

# STIMSON HALL RENOVATIONS FOR MCGRAW ENABLING

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**Project Manual & Specifications**

**February 16, 2024**

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**Owner**

**Cornell University  
Ithaca, New York 14853**

**Architect**

**SWBR Architecture, Engineering & Landscape Architecture, DPC  
387 East Main Street  
Rochester, New York 14604**



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END OF DOCUMENT





## INSTRUCTIONS TO BIDDERS

Project: Stimson Hall Renovation for McGraw Enabling

Owner: Cornell University  
Ithaca, New York 14853

Architect: SWBR Architecture, Engineering & Landscape Architecture, DPC  
387 East Main Street  
Rochester, New York 14604

### 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 eBuilder 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](mailto: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 eBuilder 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 eBuilder 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 11:00AM, March 5, 2024, in Room 101 of Humphreys Service Building or via Zoom at:

<https://cornell.zoom.us/j/93051212560?pwd=L0FqU1RSaEhjck5wVG9yOWlpZU83dz09&from=addon>

A Pre-bid walkthrough will follow and will meet at Stimson Hall, 204 Feeney Way 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.

#### 5. BID SUBMISSION

Bid Submissions must include the following:

- a. Base Bid entered into the eBuilder 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. 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 eBuilder 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.

#### 6. 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.



7. FEDERAL EXCISE TAX

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

8. 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.

9. 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.

10. 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 eBuilder 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 eBuilder 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.

11. 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 eBuilder 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.

12. 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 eBuilder 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.

13. 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 eBuilder 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.

14. METHOD OF SUBMISSION

- a. Base Bid shall be prepared and electronically submitted via the eBuilder Bid Portal. All required fields and attachments in the eBuilder Bid Portal must be completed.
- b. Bid Proposal Certification Form shall be prepared electronically submitted as an attachment via the eBuilder Bid Portal Response Form – Step 3 – Additional Required Information Custom Fields.
- c. Completed and responsive Bid Proposals shall be submitted through the eBuilder Bid Portal no later than **2:00PM on March 21, 2024**.
- 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.

15. BID OPENING

- a. Completed and responsive Bid Proposals will be opened electronically via eBuilder 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.



16. 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 eBuilder 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.

17. 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.

18. 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.

19. 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 November 15, 2024.
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.
  - ii. Furnish the Owner with safety plan related to COVID-19 pandemic.



- 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.

20. ADDENDA AND BULLETINS

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

21. 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



**STIMSON HALL RENOVATIONS  
FOR MCGRAW ENABLING**

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 February 16, 2024, as prepared by prepared by SWBR Architecture, Engineering & Landscape Architecture, DPC, 387 East Main Street, Rochester, New York 14604, 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 eBuilder Bid Portal.
2. Minority and Women's Business Enterprises (M/WBEs)

Facilities and Campus Services supports Cornell University's ongoing commitment to encourage business opportunities and diversity among its vendor community by promoting minority owned and controlled business' development as a shared responsibility. The University's intention is to create and expand opportunities for minority, women, veteran, LGBTQ, small and locally owned businesses through construction labor opportunities and the procurement of goods and services.

Positive good faith efforts to advance the University's objectives shall be made by all Contractors, engaging, and maximizing these diverse enterprise goals, and to positively drive Cornell's economic impact.

Cornell University Diversity Council Statement:

"Cultivate partnerships with the widest spectrum of Off-Campus entities and include a fully diverse range of Off-Campus participants in Cornell's events, contracts, services, and initiatives."

3. 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 November 15, 2024.





- 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:

Substantial completion of the 219 suite and scope of work in rooms 106 & 116 no later than August 9, 2024.

Substantial completion shall be achieved for rooms 105/107 (Knight Institute) and 307/309 (Landscape & Objects Lab) no later than November 15, 2024.

- 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.

4. Proposed Principal Subcontractors

- a. The undersigned agrees, if awarded the Contract, to employ subcontractors from the list submitted in the eBuilder 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.

5. Contractor Team:

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

6. Bonds

- a. Bid Bond. A Bid Bond in the amount of a minimum of 10% of Bid Amount is attached to the eBuilder 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 eBuilder Bid Portal Response Form – Step 3 – Additional Required Information Custom Fields
- d. Bonding Rate for Change Orders has been entered into the eBuilder Bid Portal Response Form – Step 3 – Additional Required Information Custom Fields

#### 7. 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 eBuilder Bid Portal.

#### 8. 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 eBuilder 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.

#### 9. 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 eBuilder 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 eBuilder Bid Portal Response Form – Step 3 – Additional Required Information Custom Fields prior to the execution of the Contract.



## 10. 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 eBuilder 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.
  - i. The undersigned acknowledges receipt of **Supplemental Conditions** to the Contract surrounding Contractor Response and Health & Safety Protocols for COVID-19, or other viral, bacterial, or microbial presence (as applicable).
  - ii. The undersigned acknowledges that no one will be permitted on the job site until the Health & Safety Plan has been submitted.
- 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 eBuilder 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 eBuilder 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

\_\_\_\_\_  
(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: \_\_\_\_\_



**GENERAL CONDITIONS**

**FOR**

**STIMSON HALL RENOVATIONS  
FOR McGRAW ENABLING**

**CORNELL UNIVERSITY  
ITHACA, NEW YORK**



## GENERAL CONDITIONS

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## **EXHIBITS**

A		Change Order Documentation Instructions
		Construction Contract Change Order Request
		Construction Contract Change Order Summary
B		Final Release
C		Guarantee
D	Form I	MWBE Utilization Plan
	Form II	Contractor's Affirmative Action Plan
	Form III	Affirmative Action 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 which is normally under the jurisdiction of one of the local unions as covered in the contract between the Tompkins-Cortland Building Trades Council, Maintenance Division and Cornell University shall be performed by Union labor.

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 eBuilder.

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.

### 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 E-Builder 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 E-Builder.

### **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 e-Builder 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 coverage's issued to and covering the liability of the Contractor for all work and operations under this Contract and all obligations assumed by the Contractor under this Contract. The Contractor shall provide Broad Form Commercial General Liability Insurance, and the Owner shall be an additional insured in the policy utilizing additional insured endorsements CG 20 10 10 01 and CG 20 37 10 01 or their equivalents and provide a Waiver of Subrogation in favor of Owner. The completed operations coverage's shall be maintained for not less than two years after acceptance of the work or until the end of the applicable Statute of Repose, whichever is greater. The limits of the Commercial General Liability policy shall be as follows:

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

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

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

<b><u>COMBINED SINGLE LIMIT</u></b>	
\$ 1,000,000	Each Accident

4. Umbrella Liability Insurance. Umbrella and/or Excess Liability policy(ies) will be provided on a following form basis subject to limits not less than \$5,000,000 per occurrence and follow-form of the primary General Liability, Automobile Liability, and Employers Liability policies. These policies shall contain an endorsement stating that any entity qualifying as an additional insured on the insurance stated in the Schedule of Underlying Insurance shall be an Additional Insured on the Umbrella/Excess liability policy and that they apply immediately upon exhaustion of the insurance stated in the Schedule of Underlying Insurance as respects to the coverage afforded to any Additional Insured. No trailing retentions on Umbrella or Excess Liability policy(ies) shall be allowed without Owner prior written consent. When approved in advance by Owner, the policies provided in this section may have policy limits lower than indicated above if the excess liability insurance policy limits provided by Contractor, when combined with the corresponding underlying policy limits, total at least the sum of all required minimum policy limits required by this section.

\$ 5,000,000

Each Occurrence/Aggregate

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

\$ 2,000,000

Each Occurrence Aggregate

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

\$ 2,000,000

Each Occurrence/Aggregate

7. 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.A.3

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

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

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

Not less than \$5,000,000 per occurrence

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

Not less than \$2,000,000 aggregate

For Subcontracts \$1,000,000 or more:

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

**BODILY INJURY AND PROPERTY  
DAMAGE LIABILITY (BROAD FORM)**

\$ 2,000,000      Each Occurrence

\$ 4,000,000      Aggregate

- Automobile Liability Insurance as per Section 10.06.A.3
- Professional Liability Insurance – if applicable to the Subcontractor’s Scope of Work – as per Section 10.06.A.5 with the following limits:

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

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

Not less than \$10,000,000 per occurrence

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

Not less than \$5,000,000 aggregate



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

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

#### Section 10.07 - Liability Insurance of the Owner

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

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

A. The Contractor shall purchase and maintain in force a builders risk insurance policy on the entire work. Such insurance shall be written on a completed value form and in an amount equal to the initial contract sum and modified by any subsequent modifications to the contract sum. The insurance shall name Cornell University and the State of New York, all subcontractors and sub- subcontractors. 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.

### **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 E-Builder 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 E-Builder 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 percent (90%) 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 E-Builder 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 E-Builder.

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 (Dustin Sutherland) shall be recognized by the Contractor.

## **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:

Facilities and Campus Services supports Cornell University's ongoing commitment to encourage business opportunities and diversity among its vendor community by promoting minority owned and controlled business' development as a shared responsibility. The University's intention is to create and expand opportunities for minority, women, veteran, LGBTQ, small and locally owned businesses through construction labor opportunities and the procurement of goods and services.

Positive good faith efforts to advance the University's objectives shall be made by all Contractors, engaging, and maximizing these diverse enterprise goals, and to positively drive Cornell's economic impact.

#### Cornell University Diversity Council Statement:

"Cultivate partnerships with the widest spectrum of Off-Campus entities and include a fully diverse range of Off-Campus participants in Cornell's events, contracts, services, and initiatives."

## 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. Affirmative Action Workforce Report

B. The Contractor shall submit an Affirmative Action Workforce Report on a monthly basis, or as requested by Owner. 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://fcs.cornell.edu/project-contractors-and-consultants>. This includes treating equally all persons and firms currently doing business with or seeking to do business with or for Cornell University, whether as contractors, subcontractors, or suppliers. Such persons and firms are respectfully reminded that Cornell University employees and their families may not personally benefit from Cornell University's business relationships by the acceptance of gifts or gratuities, defined as a gift in excess of \$75.00 given to a Cornell employee for personal use. Items not considered gifts/gratuities include occasional business meals, items of an advertising nature, and items that are generally distributed to all potential customers. In addition, it is expected that the Contractor's officers and employees shall conduct all business related to this Contract within the highest ethical standards, observing applicable policies, practices, regulations, law, and professional standards. All parties are expected to report violations of this policy to appropriate university personnel. You may file a report to on the web [https://secure.ethicspoint.com/domain/en/report\\_custom.asp?clientid=6357](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.

**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 eBuilder 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.

## 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
<b>LABOR TOTAL</b>			<b>\$0</b>

**2 MATERIAL** (Attach Supporting Documentation)

MATERIAL REQUIRED FOR CHANGE

	UNIT PRICE	UNIT OF MEASURE	REQUIRED UNITS	TOTAL COST
_____	_____	_____	_____	\$0
_____	_____	_____	_____	\$0
_____	_____	_____	_____	\$0
_____	_____	_____	_____	\$0
<b>MATERIAL TOTAL</b>				<b>\$0</b>

**3 EQUIPMENT** (Attach Supporting Documentation)

EQUIPMENT REQUIRED FOR CHANGE

	UNIT PRICE	UNIT OF MEASURE	REQUIRED UNITS	TOTAL COST
_____	_____	_____	_____	\$0
_____	_____	_____	_____	\$0
_____	_____	_____	_____	\$0
_____	_____	_____	_____	\$0
_____	_____	_____	_____	\$0
<b>EQUIPMENT TOTAL</b>				<b>\$0</b>

**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
<b>SUB-SUBCONTRACTOR TOTAL</b>			<b>\$0</b>

**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**





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

\_\_\_\_\_  
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TOTAL COST OF PROPOSED CHANGE ORDER ITEM

\$0

TOTAL CONTRACT DAYS ADDED/DELETED FROM PROJECT SCHEDULE

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**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.

Sworn to before me this

\_\_\_\_\_  
Corporation or Business Name\_\_\_\_\_  
Day of \_\_\_\_\_ 20\_\_

By: \_\_\_\_\_

\_\_\_\_\_  
Title: \_\_\_\_\_

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**GUARANTEE**

Date: \_\_\_\_\_

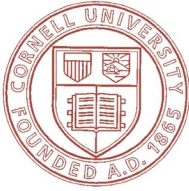
In accordance with plans and specifications and the terms and conditions of our contract with Cornell University dated \_\_\_\_\_, we hereby guarantee the \_\_\_\_\_ as found in the specifications for \_\_\_\_\_, Ithaca, New York to be free  
(Project Title)  
from defects in materials and workmanship 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

e-Builder 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 <i>(List your firm if also MBE or WBE)</i>	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:





**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.

[illegible]



**SUMMARY OF BID ACTIVITY WITH MBE AND WBE  
SUBCONTRACTORS AND VENDORS**

Please print or type all 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:		Award Status		Date of Elimination
		Date	Amount	Date	Amount	

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

OFFICER OF FIRM:

Name and Title:

\_\_\_\_\_

Date:

\_\_\_\_\_

Signature:

\_\_\_\_\_



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



## 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

\* Bodily Injury &amp; 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 &amp; 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:**

\_\_\_\_\_

**CONTRACTOR:**

\_\_\_\_\_

**SUBCONTRACTOR:**

\_\_\_\_\_

**CONTRACT NO.**

\_\_\_\_\_

**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.

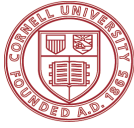
Signed:

\_\_\_\_\_

Date:

\_\_\_\_\_

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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 complete 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-Built's, 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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**HEALTH AND SAFETY PLAN REQUISITES FOR CONSTRUCTION  
ACTIVITY APPLICABLE TO HIGH IMPACT RESPIRATORY PATHOGEN  
PANDEMICS AND CONTAGIONS**

Contractors are required to protect the health and safety of employees, including the prevention and mitigation of high impact respiratory pathogen pandemics and contagions. One element of Contractor compliance with these obligations is the development and implementation of a **High Impact Respiratory Pathogen Pandemic Exposure Prevention, Preparedness and Response Plan** (Plan) for all project jobsites.

The Plan must be based upon 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). Contractor may also amend the Plan based upon and consistent with articulated operational needs and requirements.

The Plan must include the following elements:

- Responsibilities of Managers and Supervisors
  - Responsibilities of Subcontractors and Suppliers to the Jobsites
  - Responsibilities of Employees
  - Jobsite Protective Measures
  - Jobsite Visitors
  - Personal Protective Equipment and Work-Related Controls
  - Jobsite Cleaning and Disinfecting
  - Jobsite Exposure Situation and Response Protocols
  - OSHA or Other Recordkeeping Related Compliance
  - Confidentiality/Privacy Protocols
  - Other Safety Responsibilities & Protocols Related to HIRPP
- 

Contractors and businesses are further required to comply with any applicable and then current COVID mandatory, emergency or temporary directives, rules or health and safety practices issued by federal, state or local authorities.

- 1.0 Nothing contained herein shall alter or modify the Contractor's exclusive control over the job site, subcontractors, project labor, Health & Safety Plans, Protocols, Measures, or the Contractor's exclusive control over the methods and means associated with any and all of the foregoing elements.
  - 1.1 Cornell University possesses neither control nor any right of control over the job site, project labor, health & safety practices or programs, or methods and means of advancing the Contracted Work.
  - 1.2 These requirements are provided to the Contractor for the attainment of Contractor's fully compliant health and safety measures and practices communicated by applicable civil authorities as requirements, rules and/or guidance necessary to engage in qualifying construction activities.

- 2.0 Contractors, their subcontractors and suppliers, and workers are required to adhere to applicable and imposed federal, state, and/or local measures to prevent or limit the possible exposure or spread of COVID-19, pathogens, or contagions.
- 2.1 To that end, Contractor shall develop a written Health & Safety Plan related to the protective measures and protocols Contractor shall employ on the Project necessary to manage and mitigate the exposure or transmission of COVID-19, pathogens, or contagions (as applicable).
- 2.2 This Plan shall be submitted to the Owner prior to start of Construction Activity on the Campus. Owner's receipt of the subject Plan is to affirm measures and practices are in place, not for substantive review or approval.
- 2.3 Health and safety practices constitute a continuing compliance obligation, Contractors and their subcontractors and suppliers must remain current with, and immediately implement updated health and safety rules, protocols and practices as they are published. The Campus may request updated elements of the Contractor's written safety plan to address evolving best practices for measures and/or practices designed to prevent or limit the spread of COVID or other pathogen.
- 2.4 The Contractor must notify Cornell immediately upon discovery of any employees of their firm, subcontractors, or suppliers that are, or have been working on the Cornell Campus that have been confirmed to have COVID contagion.
- 2.5 In addition to the foregoing, these requirements may include Contractor compliance and implementation of then applicable federal, state, or local authorities' emergency and/or temporary safety precautions and protocols surrounding COVID *i.e., Federal EO 14042 and/or applicable OSHA COVID-19 Vaccination and Testing; Emergency Temporary Standard, as applicable.*
- 2.6 Further, Owner reserves the right to impose additional COVID or pathogen safety protocols and requirements warranted by worksite factors, including but not limited to, proximity to Cornell students, staff and faculty; activity duration; and jobsite location (*i.e., internal spaces*). These Owner health and safety requirements may be imposed without regard to the number of Contractor employees *i.e., less than 100 employees.*
- 3.0 Project Closure:
- 3.1 Where work is suspended on a project, contractors are directed to follow any additional project shut-down protocols as provided by the Owner. These protocols include but not limited to photographs, securing the work site, and a project status narrative.
- 4.0 Contractor expressly agrees to fully comply and remain exclusively responsible for the implementation of applicable Contractor Health and Safety Protocols and Measures. Contractor expressly agrees Contractor submission of the Plan is a condition precedent to engage in on-site construction activity.



## **GENERAL REQUIREMENTS**

**FOR**

**STIMSON HALL RENOVATIONS  
FOR MCGRAW ENABLING**

**CORNELL UNIVERSITY  
ITHACA, NEW YORK**

FEBRUARY 16, 2024





<b>SECTION 01 11 00</b>	<b>SUMMARY OF WORK.....</b>	<b>1</b>
<b>1.0</b>	<b>GENERAL.....</b>	<b>1</b>
1.1	DESCRIPTION.....	1
1.2	WORK UNDER OTHER CONTRACTS .....	2
1.3	CONTRACT MILESTONES .....	2
1.4	SCHEDULE OF OWNER FURNISHED ITEMS .....	2
<b>2.0</b>	<b>PRODUCTS – NOT USED .....</b>	<b>3</b>
<b>3.0</b>	<b>EXECUTION – NOT USED.....</b>	<b>3</b>
<b>SECTION 01 14 00</b>	<b>WORK RESTRICTIONS .....</b>	<b>1</b>
<b>1.0</b>	<b>GENERAL.....</b>	<b>1</b>
1.1	RELATED DOCUMENTS .....	1
1.2	CONTRACTOR USE OF PREMISES.....	1
1.3	UNIVERSITY CLOSURES .....	2
1.4	WATER USE RESTRICTION.....	2
1.5	PARKING.....	2
1.6	CHANGEOVERS AND CONTINUITY OF SERVICES .....	3
1.7	OBSTACLES, INTERFERENCE AND COORDINATION.....	4
1.8	EQUIPMENT ARRANGEMENTS.....	4
1.9	EXISTING EQUIPMENT, MATERIALS, FIXTURES, ETC. ....	5
1.10	EXAMINATION OF PREMISES, DRAWINGS, ETC.....	5
1.11	STAND DOWN DATES.....	7
1.12	WORKING HOURS.....	8
<b>2.0</b>	<b>PRODUCTS – NOT USED .....</b>	<b>8</b>
<b>3.0</b>	<b>EXECUTION – NOT USED.....</b>	<b>8</b>
<b>SECTION 01 21 00</b>	<b>ALLOWANCES.....</b>	<b>1</b>
<b>1.0</b>	<b>GENERAL.....</b>	<b>1</b>
1.1	RELATED DOCUMENTS .....	1
1.2	SUMMARY .....	1
1.3	SELECTION AND PURCHASE .....	1
1.4	SUBMITTALS .....	2
1.5	COORDINATION.....	2
1.6	LUMP SUM AND UNIT PRICE ALLOWANCES.....	2
1.7	ADJUSTMENT OF ALLOWANCES.....	3
<b>2.0</b>	<b>PRODUCTS – NOT USED .....</b>	<b>3</b>
<b>3.0</b>	<b>EXECUTION .....</b>	<b>3</b>
3.1	EXAMINATION .....	3
3.2	PREPARATION .....	3
3.3	SCHEDULE OF ALLOWANCES.....	4

<b>SECTION 01 25 00</b>	<b>SUBSTITUTIONS AND PRODUCT OPTIONS .....</b>	<b>1</b>
<b>1.0</b>	<b>GENERAL.....</b>	<b>1</b>
1.1	DESCRIPTION.....	1
1.2	DEFINITIONS.....	1
1.3	ACTION SUBMITTALS .....	2
1.4	PRODUCTS LIST .....	2
1.5	QUALITY ASSURANCE .....	2
1.6	PROCEDURES.....	3
1.7	EQUIVALENTS – APPROVED EQUAL .....	3
1.8	CONTRACTOR'S OPTIONS.....	4
1.9	SUBSTITUTIONS.....	6
1.10	COMPARABLE PRODUCTS .....	7
1.11	CONTRACTOR'S REPRESENTATION.....	8
1.12	ARCHITECT'S DUTIES .....	8
<b>2.0</b>	<b>PRODUCTS – NOT USED .....</b>	<b>8</b>
<b>3.0</b>	<b>EXECUTION – NOT USED .....</b>	<b>8</b>
<b>SECTION 01 31 19</b>	<b>PROJECT MEETINGS.....</b>	<b>1</b>
<b>1.0</b>	<b>GENERAL.....</b>	<b>1</b>
1.1	DESCRIPTION.....	1
1.2	PRE-CONSTRUCTION MEETING .....	1
1.3	PROGRESS MEETINGS .....	3
1.4	PRE-INSTALLATION CONFERENCE(S).....	4
<b>2.0</b>	<b>PRODUCTS – NOT USED .....</b>	<b>4</b>
<b>3.0</b>	<b>EXECUTION – NOT USED .....</b>	<b>4</b>
<b>SECTION 01 31 50</b>	<b>ELECTRONIC PROJECT MANAGEMENT .....</b>	<b>1</b>
<b>1.0</b>	<b>GENERAL.....</b>	<b>1</b>
1.1	SUMMARY .....	1
1.2	RELATED SECTIONS .....	1
1.3	DEFINITIONS.....	1
1.4	PROCEDURES.....	1
1.5	PROCESS OVERVIEW .....	2
1.6	ADDITIONAL INFORMATION.....	4
<b>2.0</b>	<b>PRODUCTS – NOT USED .....</b>	<b>4</b>
<b>3.0</b>	<b>EXECUTION – NOT USED .....</b>	<b>4</b>

<b>SECTION 01 32 16</b>	<b>CONSTRUCTION SCHEDULE .....</b>	<b>1</b>
<b>1.0</b>	<b>GENERAL.....</b>	<b>1</b>
1.1	SUMMARY .....	1
1.2	FORM OF SCHEDULES .....	1
1.3	CONTENT OF SCHEDULES.....	1
1.4	PROGRESS REVISIONS .....	2
1.5	SUBMISSIONS .....	2
<b>2.0</b>	<b>PRODUCTS - NOT USED.....</b>	<b>3</b>
<b>3.0</b>	<b>EXECUTION .....</b>	<b>3</b>
3.1	DISTRIBUTION.....	3
<b>SECTION 01 32 33</b>	<b>PHOTOGRAPHIC DOCUMENTATION.....</b>	<b>1</b>
<b>1.0</b>	<b>GENERAL.....</b>	<b>1</b>
1.1	DESCRIPTION.....	1
1.2	SUBMITTALS .....	1
<b>2.0</b>	<b>PRODUCTS – NOT USED .....</b>	<b>1</b>
<b>3.0</b>	<b>EXECUTION .....</b>	<b>1</b>
3.1	EXISTING CONDITION PHOTOGRAPHS.....	1
3.2	PROGRESS PHOTOGRAPHS .....	1
3.3	FINAL COMPLETION PHOTOGRAPHS .....	1
<b>SECTION 01 33 00</b>	<b>SUBMITTAL PROCEDURES .....</b>	<b>1</b>
<b>1.0</b>	<b>GENERAL.....</b>	<b>1</b>
1.1	DESCRIPTION.....	1
1.2	SUBMITTAL REGISTRY AND SCHEDULE.....	1
1.3	SHOP DRAWINGS.....	3
1.4	PRODUCT DATA.....	3
1.5	SAMPLES.....	4
1.6	QUALITY ASSURANCE AND QUALITY CONTROL SUBMITTALS.....	5
1.7	CONTRACTOR RESPONSIBILITIES .....	6
1.8	SUBMITTAL PROCEDURES.....	7
1.9	RECORD SUBMITTALS .....	8
1.10	RESUBMISSION REQUIREMENTS .....	8
1.11	ARCHITECT'S DUTIES .....	9
1.12	DISTRIBUTION.....	10
<b>2.0</b>	<b>PRODUCTS – NOT USED .....</b>	<b>10</b>
<b>3.0</b>	<b>EXECUTION – NOT USED.....</b>	<b>10</b>

<b>SECTION 01 35 29</b>	<b>GENERAL HEALTH &amp; SAFETY</b>	<b>1</b>
<b>1.0</b>	<b>GENERAL</b>	<b>1</b>
1.1	DESCRIPTION	1
1.2	CONTRACTOR'S PROJECT SITE SPECIFIC PLAN	1
1.3	ASBESTOS	3
1.4	LEAD	3
1.5	SITE VISITS	3
1.6	CONFINED SPACE	3
<b>2.0</b>	<b>PRODUCTS – NOT USED</b>	<b>3</b>
<b>3.0</b>	<b>EXECUTION – NOT USED</b>	<b>3</b>
<b>SECTION 01 35 43</b>	<b>GENERAL ENVIRONMENTAL REQUIREMENTS</b>	<b>1</b>
<b>1.0</b>	<b>GENERAL</b>	<b>1</b>
1.1	DESCRIPTION	1
1.2	RELATED SECTIONS	1
1.3	SUBMITTALS	1
1.4	JOB SITE ADMINISTRATION	1
1.5	NOISE AND VIBRATION	2
1.6	DUST CONTROL	2
1.7	PROTECTION OF THE ENVIRONMENT	2
1.8	TEMPORARY RE-ROUTING OF PIPING AND DUCTWORK	3
1.9	HAZARDOUS OR TOXIC MATERIALS	4
1.10	DISPOSAL OF WASTE MATERIAL AND TITLE	4
<b>2.0</b>	<b>PRODUCTS – NOT USED</b>	<b>4</b>
<b>3.0</b>	<b>EXECUTION – NOT USED</b>	<b>4</b>
<b>SECTION 01 35 44</b>	<b>SPILL CONTROL</b>	<b>1</b>
<b>1.0</b>	<b>GENERAL</b>	<b>1</b>
1.1	SPILL PREVENTION	1
1.2	SPILL CONTROL PROCEDURES	1
1.3	SPILL REPORTING AND DOCUMENTATION	4
<b>2.0</b>	<b>PRODUCTS – NOT USED</b>	<b>5</b>
<b>3.0</b>	<b>EXECUTION – NOT USED</b>	<b>5</b>

<b>SECTION 01 41 00</b>	<b>REGULATORY REQUIREMENTS</b>	<b>1</b>
<b>1.0</b>	<b>GENERAL</b>	<b>1</b>
1.1	PERMITS AND LICENSES	1
1.2	INSPECTIONS	1
1.3	COMPLIANCE	1
1.4	OWNER’S REQUIREMENTS	2
<b>2.0</b>	<b>PRODUCTS – NOT USED</b>	<b>2</b>
<b>3.0</b>	<b>EXECUTION – NOT USED</b>	<b>2</b>
<b>SECTION 01 42 00</b>	<b>REFERENCES</b>	<b>1</b>
<b>1.0</b>	<b>GENERAL</b>	<b>1</b>
1.1	INTENT OF CONTRACT DOCUMENTS	1
1.2	RELATED DOCUMENTS	2
1.3	DEFINITIONS	2
1.4	OWNER AGREEMENTS	4
1.5	INDUSTRY STANDARDS	4
1.6	ABBREVIATIONS AND ACRONYMS	5
<b>2.0</b>	<b>PRODUCTS - NOT USED</b>	<b>17</b>
<b>3.0</b>	<b>EXECUTION - NOT USED</b>	<b>17</b>
<b>SECTION 01 45 00</b>	<b>QUALITY CONTROL</b>	<b>1</b>
<b>1.0</b>	<b>GENERAL</b>	<b>1</b>
1.1	DESCRIPTION	1
1.2	CONTROL OF ON-SITE CONSTRUCTION	1
1.3	CONTROL OF OFF-SITE OPERATIONS	2
1.4	TESTING	3
1.5	OWNER'S REPRESENTATIVE	3
<b>2.0</b>	<b>PRODUCTS – NOT USED</b>	<b>3</b>
<b>3.0</b>	<b>EXECUTION – NOT USED</b>	<b>3</b>

<b>SECTION 01 50 00</b>	<b>TEMPORARY FACILITIES AND CONTROLS .....</b>	<b>1</b>
<b>1.0</b>	<b>GENERAL.....</b>	<b>1</b>
1.1	DESCRIPTION.....	1
1.2	REQUIREMENTS OF REGULATORY AGENCIES.....	1
<b>2.0</b>	<b>PRODUCTS.....</b>	<b>1</b>
2.1	MATERIALS, GENERAL .....	1
2.2	TEMPORARY FIRST AID FACILITIES.....	1
2.3	TEMPORARY FIRE PROTECTION .....	1
2.4	CONSTRUCTION AIDS .....	3
2.5	SUPPORTS.....	3
2.6	TEMPORARY ENCLOSURES .....	4
2.7	TEMPORARY WATER CONTROL.....	5
2.8	PERSONNEL, PUBLIC AND EMPLOYEE PROTECTION .....	5
2.9	PROJECT IDENTIFICATION AND SIGNS .....	5
2.10	SECURITY.....	5
2.11	FIELD OFFICES .....	5
<b>3.0</b>	<b>EXECUTION .....</b>	<b>5</b>
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3.2	GENERAL.....	6
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1.1	DESCRIPTION.....	1
1.2	REQUIREMENTS OF REGULATORY AGENCIES.....	1
<b>2.0</b>	<b>PRODUCTS.....</b>	<b>1</b>
2.1	MATERIALS, GENERAL .....	1
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<b>1.0</b>	<b>GENERAL.....</b>	<b>1</b>
1.1	DESCRIPTION.....	1
1.2	RESPONSIBILITY.....	1
<b>2.0</b>	<b>PRODUCTS – NOT USED .....</b>	<b>1</b>
<b>3.0</b>	<b>EXECUTION – NOT USED .....</b>	<b>1</b>

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<b>1.0</b>	<b>GENERAL</b>	<b>1</b>
1.1	DESCRIPTION	1
1.2	TRANSPORTATION AND HANDLING	1
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<b>2.0</b>	<b>PRODUCTS – NOT USED</b>	<b>4</b>
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<b>1.0</b>	<b>GENERAL</b>	<b>1</b>
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1.3	QUALITY ASSURANCE	2
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<b>2.0</b>	<b>PRODUCTS – NOT USED</b>	<b>4</b>
<b>3.0</b>	<b>EXECUTION – NOT USED</b>	<b>4</b>
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1.1	FIXED EQUIPMENT INVENTORY	1
<b>2.0</b>	<b>PRODUCTS – NOT USED</b>	<b>2</b>
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<b>SECTION 01 78 23</b>	<b>OPERATING AND MAINTENANCE DATA</b>	<b>1</b>
<b>1.0</b>	<b>GENERAL</b>	<b>1</b>
1.1	DESCRIPTION	1
1.2	FORM OF SUBMITTALS	1
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1.5	MANUAL FOR EQUIPMENT AND SYSTEMS	4
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<b>3.0</b>	<b>EXECUTION – NOT USED</b>	<b>7</b>
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<b>1.0</b>	<b>GENERAL</b>	<b>1</b>
1.1	DESCRIPTION	1
1.2	SUMMARY	1
1.3	DEFINITIONS	1
1.4	QUALITY ASSURANCE	2
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1.6	SUBMITTAL REQUIREMENTS	3
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<b>1.0</b>	<b>GENERAL</b>	<b>1</b>
1.1	DESCRIPTION	1
1.2	MAINTENANCE OF DOCUMENTS AND SAMPLES	1
1.3	RECORDING	1
1.4	SUBMITTAL	4
<b>2.0</b>	<b>PRODUCTS – NOT USED</b>	<b>4</b>
<b>3.0</b>	<b>EXECUTION – NOT USED</b>	<b>4</b>



**SECTION 01 11 00 SUMMARY OF WORK**

**1.0 GENERAL**

**1.1 DESCRIPTION**

**A. Work to be Done**

1. Reconfigure existing office and classroom spaces to be used as same function (no change of occupancy). The work area primarily consists of interior renovations on the west end of the existing building on the first and third floors and the east end on the second floor. Abatement of hazardous materials associated with the demolition scope is included based on the level of alteration within each existing space. Existing building systems shall be modified or extended to accommodate reconfiguration of interior walls and doors.

**B. The Scope of the Work**

1. The scope of the WORK in all SECTIONS of this Specification shall consist of the furnishing of all labor, materials, equipment and appliances and the performance of the Work required by the Contract Documents and/or by the conditions at the site, joining all parts of this Work with itself and the Work of others to form a complete, functioning entity.
2. Items not specifically mentioned in the Specifications or shown on the drawings, but which are inherently necessary to make a complete working installation, shall be included.
3. It is the intent and purpose of the Contract Documents to cover and include under each item all materials, machinery, apparatus, and labor necessary to properly install materials and equipment, adjust and put into perfect operation the respective portions of the installation specified and to so interconnect the various items or sections of the work as to form a complete and operating whole. Any equipment, apparatus, machinery, material and small items not mentioned in detail, and labor not hereinafter specifically mentioned, which may be found necessary to complete or perfect any portion of the installation in a substantial manner, and in compliance with the requirements stated, implied, or intended in the Contract Documents, shall be furnished without extra cost to the Owner. The Contractor shall provide the greatest quantity, highest quality, highest degree of safety, and most stringent material, equipment or Work. Should the Drawings or the Specifications disagree in themselves or with each other, the Contractor shall provide the better quality or greater quantity of work and/or materials unless otherwise directed by written addendum to the Contract.

**1.2 WORK UNDER OTHER CONTRACTS**

- A. The Contractor shall cooperate with other contracts performing related work, including providing labor, materials and other costs necessary to satisfactorily coordinate the Contract work with work performed under others contracts.
- B. New York State Electric & Gas (NYSEG):
  - 1. Contractor shall be responsible for the project management of NYSEG work including coordinating any scheduling associated with the Project.
  - 2. The Owner shall be responsible for the cost associated with the work to be performed by NYSEG. No NYSEG costs shall be carried in the Contractor's bid.

**1.3 CONTRACT MILESTONES**

- A. The work in Suite 219 and scope of work in Rooms 106 and 116 shall be substantially complete by August 9, 2024. Scope of work in Rooms 105/107 (Knight Institute) and rooms 307/309 (Landscape & Objects Lab) shall be substantially complete by November 15, 2024.

**1.4 SCHEDULE OF OWNER FURNISHED ITEMS**

- A. Owner will provide card access hardware and associated Panel Interface Modules (PIMs) and Antennas.
- B. The Contractor shall receive, unload, store and install Owner furnished equipment as shown on the plans and called for in the Specifications.
- C. Storage
  - 1. Upon written acknowledgment by Contractor of receipt in proper condition, the Contractor shall maintain responsibility for proper storage and protection of the equipment. Provide insurance for the Owner-furnished products up to the time of Final Acceptance by the Owner.
- D. Receiving and Unloading
  - 1. The Contractor shall be responsible for logging in, checking and verifying receipt of items and shall be responsible for confirming that the quantities and condition of the materials are appropriate for installation and the completion of the Work of the project.
  - 2. The Contractor shall note any damage and/or short count on the Bill of Loading for any Owner Furnished Equipment received at the storage facility, such listing of damages or short count being required to establish the Owner's potential claim against the carrier. The Contractor shall also notify the Owner directly on any such damage and/or short count.
  - 3. Unload Owner Furnished Equipment at the job site using necessary care and equipment as required to handle the equipment in a safe manner.

4. Use adequate numbers of skilled workers necessary to handle, receive and install Owner Furnished Equipment.
  5. Install Owner Furnished Equipment as called for in the Drawings or in these Specifications.
- E. Installation
1. Install products in conformance with manufacturer's installation instructions.
  2. Provide interconnecting structures, equipment, piping, electrical and instrumentation work, finish painting, and appurtenances to achieve a complete and functional system.
- F. Use of Materials
1. The Contractor shall be responsible for the use of Owner provide materials in an efficient manner in accordance with industry standards and best practices to reduce waste materials.

**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 radio communication devices, 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.
- 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 Palm Road 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 Palm Road must be registered with Transportation Services. Due to ongoing work at the Palm Road lot, parking may be limited.

### **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 be 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 1<sup>st</sup> at which point you will need to send the text **CornellAlert** to re-enlist.

### **1.4 WATER USE RESTRICTION**

- A. The Contractor shall adhere to any University issued Water Use Restrictions in place at the time of construction.

### **1.5 PARKING**

- A. The Owner may designate an area for parking of essential Contractor vehicles on the project site.
- B. The Contractor shall make all arrangements, and bear the cost, for transportation of all trade persons from the designated parking area to the construction site as necessary.

- C. It should be noted that there is a fee for all parking on the Cornell University campus. The Contractor is responsible for the payment for all parking costs imposed by the Owner. The Contractor should contact the Project Manager (Dustin Sutherland) 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 <http://finance.fs.cornell.edu/contracts/forms/contractors.cfm>.
- D. Contractor shall cooperate with Transportation Services and/or other authorities having jurisdiction, as follows:
  - 1. Ensure parking by all employees of the Contractor, subcontractors, material suppliers, and others connected with this project only within construction fence or the designated parking area.
  - 2. Prohibit employees from parking in any other areas, roads, streets, grounds, etc.
  - 3. Discharge any employee refusing to comply with these requirements.
  - 4. Ensure proper transportation of personnel between the designated parking area and the construction site.
- E. The Contractor shall remove from the parking area and staging area all temporary trailers, rubbish, unused materials, and other materials belonging to the Contractor or used under the Contractor's direction during construction or impairing the use or appearance of the property and shall restore such areas affected by the work to their original condition, and, in the event of its failure to do so, the same shall be removed by the Owner at the expense of the Contractor, and the Contractor shall be liable therefore.

**1.6 CHANGEOVERS AND CONTINUITY OF SERVICES**

- A. Make all changeovers, tie-ins and removals, etc., of any part of the Work that would affect the continuity of operation of the adjacent services at approved times that will not interfere with the Owner's operations. Secure approval of Owner before proceeding.
- B. Make all necessary temporary connections required to permit operation of the building services and/or equipment. Remove the connections after need has ceased.
- C. The Contractor may be permitted to make changeovers during normal working hours at the Owner's discretion. Should the Contractor perform this Work outside of normal working hours, no extra payment will be made for resulting overtime expenses.
- D. When connecting new facilities do not shut off any existing Mechanical/Electrical facilities or services without prior written approval of Owner's Representative.
- E. The Contractor shall not, except in an emergency condition, shutdown any utility without the express permission of the Owner's Representative. Major, affecting life safety or outside contract limit lines, shutdowns of utilities 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 Environmental Health and Safety (EH&S), and City of Ithaca Fire Department.
- G. All shutdowns to be scheduled a minimum of seven (7) calendar days in advance and requests shall be submitted via ePM system to the Owner's Representative.
- H. IN THE EVENT OF AN EMERGENCY WHERE THE OWNER'S REPRESENTATIVE IS NOT AVAILABLE, THE CONTRACTOR SHALL DIAL 911 IMMEDIATELY.

## **1.7 OBSTACLES, INTERFERENCE AND COORDINATION**

### **A. General**

- 1. Plans show general design arrangement. Install work substantially as indicated and verify exact location and elevations; DO NOT SCALE PLANS.
- 2. Due to small scale of Drawings, it is not possible to indicate all offsets, fittings, changes in elevations, interferences, etc. Make necessary changes in the Work, equipment locations, etc., after notification to the Owner's Representative and Architect. Obtain approval from same, as part of Contract, to accommodate work to obstacles and interferences encountered.
- 3. Obtain written approval for all major changes before installing. If requested, submit drawings, detailing all such deviations or changes.
- 4. Exposed to view mechanical units, ductwork, conduit, pipes or other building equipment are essential parts of the artistic effect of the building design and shall be installed in locations as shown on the drawings. Conformance to given dimensions and alignments with the structural system, walls, openings, indicated centerlines are a requirement of the Contract and the Contractor shall familiarize himself with the critical nature of proper placement of these items. The Contractor shall notify the Architect of conflicts which would cause such equipment to be installed in locations other than as indicated on the Drawings. The Contractor shall not proceed with the installation of exposed to view mechanical units, ductwork, conduit, pipes, etc. until all conflicts have been identified by the Contractor and resolutions to conflicts approved by the Architect.

### **B. Interference**

- 1. Install work so that all items are operable and serviceable and avoid interfering with removal of rails, filters, belt guards and/or operation of doors, etc. Provide easy and safe access to valves, controllers, motor starters and other equipment requiring frequent attention.

## **1.8 EQUIPMENT ARRANGEMENTS**

- A. Since all equipment of equal capacity is not necessarily of same arrangement, size of construction, these Plans are prepared on basis of one manufacturer as "basis-of-design equipment", even though other manufacturers' names are mentioned.



- B. If Contractor elects to use specified equipment other than "design equipment" which differs in arrangement, size, etc., the Contractor does so subject to following conditions:
  - 1. Submit detailed drawings indicating proposed installations of equipment and showing maintenance and service space required.
  - 2. If revised arrangement meets approval, make all required changes in the work of all trades, including but not limited to louvers, panels, structural supports, pads, etc. at no increase in Contract. Provide larger motors and any additional control devices, valves, fittings and other miscellaneous equipment required for proper operation of revised layout, and assumes responsibility for proper location of roughing in and connections by other trades.
  - 3. If revised arrangement does not meet approval because of increase in pressure loss, possibility of increase in noise, lack of space or headroom, insufficient clearance for removal of parts, or for any other reason, provide equipment which conforms to Contract Drawings and Specifications.

**1.9 EXISTING EQUIPMENT, MATERIALS, FIXTURES, ETC.**

- A. Where existing equipment, piping, fittings, etc. are to be removed, Contractor shall submit complete list to Owner. All items that Owner wishes to retain shall be carefully removed and salvaged and delivered to building storage where directed by Owner. Items that Owner does not wish to retain shall be removed from the site and legally disposed.

**1.10 EXAMINATION OF PREMISES, DRAWINGS, ETC.**

- A. Before Submitting Proposal
  - 1. Examine all Drawings and Specifications relating to Work of all trades to determine scope and relation to other work.
  - 2. Examine all existing conditions affecting compliance with Plans and Specifications, by visiting site and/or building.
  - 3. Ascertain access to site, available storage and delivery facilities.
- B. Before Commencing Work on Any Phase or in any Area
  - 1. Verify all governing dimensions at site and/or building.
  - 2. Inspect all adjacent work.

3. All work is to be conducted in such a manner as to cause a minimum degree of interference with the Campus' operation and academic schedule. Prior to the commencement of each phase, submit Shutdown / Demo action plans that clearly describe the steps required to safely shut down utilities, systems and infrastructure that are within the work area (or effecting the work area); and those outside the work area and within approximately 25 feet of the work area limits, as approved by the Owner. The Shutdown / Demo action plan shall identify the shut off point(s) for each utility, system and infrastructure as well as the secondary shut off point(s) to account if the primary points fail or are otherwise inaccessible. To identify shutoff points, trace each utility, system and infrastructure in the presence of the campus representative from the work area to the shutoff points and place clear label on same indicating what the shutoff point is and what it effects and whether it is the primary or secondary shut off. The Shutdown / Demo action plan shall describe the shutdown procedure, identify tools and material required for shutdown, sequence of activities required for proper shutdown, the name of the person(s) or trade(s) deemed competent to perform each activity in the shutdown sequence and names and telephone numbers of the campus staff required to provide access to shut off points, assist in the shut off or perform portions of the shutdown activities. Additionally, the plan will address the Contractor's plan for maintaining MEP to adjacent occupied areas, inclusive of planned tie-in points for any and all necessary, temporary infrastructure, alarming, monitoring etc. Submit the Shutdown / Demo action plan for review and approval at least two weeks prior to field work in the work area. Field work shall not begin until the Shutdown / Demo action plan is reviewed. Contractor is to assign and include a competent crew, knowledgeable of each unique system involved (i.e. Mechanic, Electrician, Sheet metal, Plumber, Controls, IT, etc.). Field investigation is to include any and all necessary ladders, scaffold, temp lighting, cutting tools, photos, labels, PPE, etc. needed to properly locate, access and label shut off points. The University is explicitly requesting heightened awareness and an earnest mitigation of impact. This requirement supplements all other contractual obligations, and requires the dedication of *no less than* an aggregate 40 hours.

**C. Tender of Proposal Confirms Agreement**

1. All items and conditions referred to herein and/or indicated on accompanying Drawings.
2. No consideration, additional monies or time extensions will be granted for alleged misunderstanding.

**D. Existing or Archived Drawings**

1. Existing or Archived drawings of impacted buildings are appended in electronic format only for reference and informational purposes. These historic drawings are not to be considered contract drawings and are provided "FOR INFORMATION ONLY". The Owner makes no representation as to the accuracy of the drawings as representing current conditions.

**1.11 STAND DOWN DATES**

A. Strict and effective enforcement by Contractor's management and supervision of the following dates and hours is required.

1. **Stand-Down Dates** (No construction work and no deliveries on site):

- a. Commencement Weekend
  - Saturday, May 25, 2024
  - Sunday, May 26, 2024
- b. Reunion Weekend
  - Thursday, June 6, 2024
  - Friday, June 7, 2024
  - Saturday, June 8, 2024
  - Sunday, June 9, 2024

2. **Restricted Work Dates** (delivery & demolition restrictions but otherwise work as usual):

Friday, May 24, 2024	Commencement weekend- deliveries and work outside fence stop at noon
Thursday, Friday June 6 - 7, 2024	Reunion guest arrivals- no work outside fence; no demo or utility work inside fence
Friday, June 7, 2024	Reunion weekend- deliveries and work outside fence stop at noon

3. **Student and Campus Life**

Residence Halls Open - August 19, 2024

- ❖ No deliveries, no hauling materials into or out of the project site.
- ❖ All work to be contained to the fenced area of the project site.

4. **Courses Study Time & Final Exams** \* See below. While future dates are unknown at this point, the Contractor shall assume these general timeframes for the duration of the project.

- May 8, 2024 through May 18, 2024

\* Contractor shall assume that the "Study Time and Final Exam" periods are accurate for the University, but that the Owner has specific exam times falling within these periods. Contractor should assume 40 hours wherein a no noise restriction applies to be used at the discretion of the Owner, but falling within the "Study Time and Final Exam" Periods noted above. Specifically, this means that absolutely no construction noise may be transmitted by virtue of this project to the lecture halls, tutorial rooms, classrooms, library, etc. during the to-be-determined 40 hour period. The Owner will provide information relative to the specific times and locations no less than two weeks in advance of scheduled exams at the Contractor's request. The 40 hours are to be included with no right to claim for additional cost or time or delays to construction schedule.

**1.12 WORKING HOURS**

- A. Normal work hours are 7AM-dusk Monday-Saturday except during above noted restrictions. This means that Contractor shall not permit any noise generating activities that could disturb campus occupants or residents to take place outside of these hours. Should any conditions necessitate work to extend beyond these hours – Contractor may submit a detailed request with reasonable advance notice to Cornell. Cornell (at its sole discretion) may issue a written relaxation of the above but Contractor is advised never to assume that it will be granted.
- B. During Construction periods, no work shall take place prior to 9AM in a Residence Hall, Fraternity, Co-Op, Sorority, or any type of Housing Unit. Residence Halls require 72 hours notification to the Student & Academic Services representative prior to entering a Residence Hall or Student Room. This does not apply to Fraternity, Co-Op or Sorority House which require 24 hours notification to the Facilities Manager.

**2.0 PRODUCTS – NOT USED**

**3.0 EXECUTION – NOT USED**

**\*\*\*END OF SECTION 01 14 00\*\*\***

**SECTION 01 21 00 ALLOWANCES**

**1.0 GENERAL**

**1.1 RELATED DOCUMENTS**

- A. This Section describes Allowances to be carried in the Base Bid by the Contractor.
- B. Drawings and general provisions of the Contract, including General Conditions and other Division 01 Specification Sections, apply to this Section.
- C. The Specification Section containing the pertinent requirements of materials and methods to achieve the Work described herein. Selected materials and equipment are specified in the Contract Documents by allowances.

**1.2 SUMMARY**

- A. Definition: An allowance is an amount determined by the Owner or calculated by the Contractor based on given quantities and stated on the Bid Proposal Submission Form.
- B. Certain items are specified in the Contract Documents by allowances. Allowances have been established in lieu of additional requirements and to defer selection of actual materials and equipment to a later date when direction will be provided to the Contractor. Items covered by these allowances shall be supplied for such amounts and by such persons as the Owner may direct. All uses of the allowances will require the prior written approval of the Owner via a Field Change Authorization.
- C. Types of Allowances may include:
  - 1. Lump Sum Allowance
  - 2. Unit Price Allowance

**1.3 SELECTION AND PURCHASE**

- A. At the earliest practical date after award of the Contract, advise the Architect of the date when final selection and purchase of each product or system described by an allowance must be completed to avoid delaying the Work. The Contractor shall provide the Owner fourteen (14) calendar days minimum notification of date.
- B. At the Owner's request, the Contractor shall obtain proposals for each allowance for use in making final selections. The Contractor shall include recommendations that are relevant to performing the work.
- C. The Contractor shall purchase products and systems selected by the Architect and Owner from the designated supplier.

**1.4     SUBMITTALS**

- A.   Submit proposals for purchase of products or systems included in allowances, in the form specified for Change Orders.
- B.   Submit invoices or delivery slips to show actual quantities of materials delivered to the site for use in fulfillment of each allowance.
- C.   Submit time sheets and other documentation to show labor hours and cost for installation of allowance items that include installation as part of the allowance.
- D.   Coordinate and process submittals for allowance items in the same manner as for other portions of the work.

**1.5     COORDINATION**

- A.   Coordinate related Work and modify or adjust adjacent Work as necessary to ensure that Work affected by each accepted allowance is complete and fully integrated into the Project.
- B.   The Contractor shall include the dollar value of each scheduled allowance number as a separate line item in the Schedule of Values and identify each allowance with Section 01 21 00.
- C.   The Owner shall provide the Contractor with a Field Change Authorization prior to proceeding with the Work of an allowance.

**1.6     LUMP SUM AND UNIT PRICE ALLOWANCES**

- A.   Allowances shall include cost to the Contractor of specific products and materials ordered by the Owner or selected by the Architect under allowance and shall include applicable taxes, freight, and delivery to the Project site.
- B.   Included as part of each allowance are miscellaneous devices, accessory objects or similar items incidental to or required for a complete installation whether or not mentioned as part of the allowance.
- C.   Unless otherwise indicated, Contractor's cost for receiving and handling at Project site, labor, installation, overhead and profit, and similar costs related to products and materials ordered by the Owner or selected by the Architect under allowance shall be included as part of the Contract Sum and not part of the allowance.
- D.   Unused Materials:   Return unused materials purchased under an allowance to the manufacturer or supplier for credit to the Owner, after installation has been completed and accepted.
  - 1.   If requested by the Owner, retain and prepare unused materials for storage by the Owner. Deliver unused material to Owner's storage space as directed.

**1.7     ADJUSTMENT OF ALLOWANCES**

- A. Allowance Adjustment: To adjust allowance amounts and scope of work, prepare a Change Order proposal based on the difference between purchase amount and the allowance, multiplied by final measurement of work-in-place where applicable. If applicable, include reasonable allowances for cutting losses, tolerances, mixing wastes, normal product imperfections, and similar margins.
  - 1. Include installation costs in purchase amount only where indicated as part of the allowance.
  - 2. Prepare explanation and documentation to substantiate distribution of overhead costs and other margins claimed.
  - 3. Submit substantiation of a change in scope of work, if any, claimed in Change Order related to unit-cost allowance.
  - 4. Owner reserves the right to establish the quantity of work-in-place by independent quantity survey, measure, or count.
- B. Submit claims for increased costs because of a change in scope or nature of the allowance described in the Contract Documents, whether for the purchase order amount or Contractor's handling, labor, installation, or overhead and profit. Submit claims in accordance with General Conditions – Changes in Work within twenty-one (21) days of receipt of Field Change Authorization authorizing work to proceed. The Owner will reject claims submitted later than twenty-one (21) days after such authorization.
  - 1. Do not include Contractor's or subcontractor's indirect expenses in the Change Order cost amount unless it is clearly shown that the nature or extent of work has changed from what could have been foreseen from information in the Contract Documents.
  - 2. No change to Contractor's indirect expenses is permitted for selection of higher or lower priced materials or systems of the same scope and nature as originally indicated.

**2.0     PRODUCTS – NOT USED**

**3.0     EXECUTION**

**3.1     EXAMINATION**

- A. Examine products covered by an allowance promptly on delivery for damage or defects. Return damaged or defective products to manufacturer for replacement.

**3.2     PREPARATION**

- A. Coordinate materials and their installation for each allowance with related materials and installations to ensure that each allowance item is completely integrated and interfaced with related work.

**3.3 SCHEDULE OF ALLOWANCES**

A. Allowance No. 1: **\$2500** – Casework investigation and repair work

Lump Sum Allowance: Include a sum of \$2,500 for the investigation and repair work associated with existing casework being relocated as part of the project. The Contractor shall repair locking hardware on wall mounted upper cabinets (qty 5) and replace hardware as necessary to make functional. Refer to Drawing 1/A-113, Room 307 – Teaching Lab. The Contractor shall provide a proposal for the value of the repair work prior to starting the work.

B. Allowance No. 2: **\$5,000** – Existing window updates investigation and repair work

Lump Sum Allowance: Include a sum of \$5,000 for the investigation and repair work associated with existing operable windows and modifications for the installation of window A/C units by the Owner. The Contractor shall repair and make functional all existing operable windows and provide insect screens in Suite 105, Suite 219, Office 215, Teaching Lab 307, and 309. Modify existing window sashes and make weathertight all locations of window A/C units and associated mounting brackets in Suite 219 (qty 2), Teaching Lab 307 (qty 1) and 309 (qty 1). Refer to Floor Plans Drawings A-111, A-112 and A-113. The Contractor shall provide a proposal for the value of the repair work prior to starting the work. Temporary protection shall be included in the base bid and will not be part of Allowance No. 1.

**\*\*\*END OF SECTION 01 21 00\*\*\***



**SECTION 01 25 00 SUBSTITUTIONS AND PRODUCT OPTIONS**

**1.0 GENERAL**

**1.1 DESCRIPTION**

- A. The Contractor shall furnish and install the products specified, under the options and conditions for substitutions stated in this Section.

**1.2 DEFINITIONS**

- A. Substitutions: Changes in products, materials, equipment, and methods of construction from those required by the Contract Documents and proposed by Contractor.
1. Substitutions for Cause: Changes proposed by Contractor that are required due to changed Project conditions that are beyond the Contractor's control, such as unavailability of product, or regulatory changes.
    - a. Products that are not available from Contractor's preferred suppliers does not constitute unavailability of product.
  2. Substitutions for Convenience: Changes proposed by Contractor or Owner that are not required in order to meet other Project requirements but may offer advantage to Contractor or Owner.
- B. Products: Items obtained for incorporating into the Work, whether purchased for Project or taken from previously purchased stock. The term "product" includes the terms "material," "equipment," "system," and terms of similar intent.
1. Named Products: Items identified by manufacturer's product name, including make or model number or other designation shown or listed in manufacturer's published product literature that is current as of date of the Contract Documents.
  2. New Products: Items that have not previously been incorporated into another project or facility. Items salvaged from other projects are not considered new products. Items that are manufactured or fabricated to include recycled content materials are considered new products, unless indicated otherwise.
  3. Comparable Product: Product that is demonstrated and approved through submittal process to have the indicated qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics that equal or exceed those of specified product.

- C. Basis-of-Design Product Specification: A specification in which a specific manufacturer's product is named and accompanied by the words "basis-of-design product," including make or model number or other designation, to establish the significant qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics for purposes of evaluating comparable products of additional manufacturers named in the specification.

### **1.3 ACTION SUBMITTALS**

- A. Substitution Requests: Submit indicated number of copies of each Substitution Request Form, attached hereto, for consideration. 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 five copies of 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 duct work, 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.
  - 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 eBuilder. 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 written notice of each meeting four days in advance of meeting date.
  - 3. Make physical arrangements for meetings.
  - 4. Preside at meetings.
  - 5. Record the minutes; include all significant proceedings and decisions.
  - 6. Duplicate and distribute copies of minutes after each meeting.
    - a. To all participants in the meeting.
    - b. To all parties affected by decisions made at the meeting.
    - c. To the Architect.
- 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

**D. Minimum Agendum:**

1. Distribution and discussion of:
  - a. List of major subcontractors and suppliers
  - b. Projected Construction Schedules
2. Critical work sequencing
  - a. Identification of major shut downs 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 utilities
10. Safety and first-aid procedures
  - a. Contractor's Project Site Specific Plan

11. Security procedures
12. Housekeeping procedures
13. Affirmative Action Plan and Reporting requirements

**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. Subcontractors as appropriate to the agenda
  6. Suppliers as appropriate to the agenda
  7. 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. Review status of all issued proposal requests and change orders

- 14. Review proposed changes for:
  - a. Effect on Construction Schedule and on completion date
  - b. Effect on other contracts of the Project
- 15. Other business
- D. All decisions, instructions, and interpretations given by the Architect/Engineer or its representative at these meetings shall be binding and conclusive on the Contractor.

**1.4 PRE-INSTALLATION CONFERENCE(S)**

- A. The Contractor to hold pre-installation conferences 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.

**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 (e-PM) system eBuilder 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 project documentation. All documentation should be communicated through the ePM system.
- B. Training
  - 1. The Owner will provide training 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 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. Color printer and plotter capable of full-size document production
  3. Scanner: capable of scanning a high volume of project documents clearly and quickly
  4. Digital Camera: (1) single lens reflex (SLR) type camera
  5. Portable Document Format (PDF) Reader/writer software
- D. Contractor shall log on to the ePM system on a daily basis, and as necessary to be kept fully apprised 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 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 system and attached to the RFI electronically.
- D. Meeting Minutes: Contractor shall enter meeting agendas, records and minutes in the 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 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 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 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 Register and Contractor shall review and update on a daily basis and shall close all approved items.

- 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 ePM 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 both pencil and official payment applications (PA) electronically via the ePM system for review by the Owner.
- 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. The Contractor shall, within fourteen (14) calendar days of Notice to Proceed, prepare and submit to the Owner estimated construction progress schedules for the entire Work, with sub-schedules of related activities which are essential to the progress of the Work.
- B. Conferences will be held with the Architect, Owner and Contractor at the start of the project to agree mutually on a progress schedule which must be diligently followed.
- C. Submit revised progress schedules periodically and when requested to do so by Owner.
- D. Submit to Owner and Architect a cash flow projection in accordance with Schedule of Values.
- E. Submit electronic versions of all schedules, including updates, as well as all back-up to the submitted schedules.

**1.2 FORM OF SCHEDULES**

- A. Prepare Network Analysis system, or prepare schedules in the form of a horizontal bar chart.
  - 1. Provide separate horizontal bar for each trade or operation.
  - 2. Horizontal time scale: Identify the first work day of each week.
  - 3. Scale and spacing: To allow space for notations and future revisions.
- B. Format of listings: The chronological order of the start of each item of work.
- C. Identification of listings: By specification section numbers.

**1.3 CONTENT OF SCHEDULES**

- A. Construction Progress Schedule:
  - 1. Show the complete sequence of construction by activity.
  - 2. Show the dates for the beginning, and completion of, each major element of construction. Specifically list:
    - a. Subcontractor work
    - b. Equipment installations

- c. Finishes
  - d. Pre-Installation meetings
- 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.
- B. Submittals Schedule for Shop Drawings, Product Data and Samples: 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.

#### **1.4 PROGRESS REVISIONS**

- A. Indicate progress of each activity to date of submission.
- B. 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
- C. Provide a narrative report as needed to define:
  - 1. Problem areas, anticipated delays, and the impact on the schedule.
  - 2. Corrective action recommended, and its effect.
  - 3. The effect of changes on schedules of other prime contractors.

#### **1.5 SUBMISSIONS**

- A. Submit initial Construction Progress Schedules within fifteen (15) calendar days after award of Contract.

1. Owner will review schedules and return review copy within ten (10) days after receipt.
2. If required, resubmit within seven (7) days after return of review copy.
- B. Submit progress revision schedules to accompany each application for payment.
- C. Submit Submittals Schedule within thirty (30) calendar days after date of commencement of work.
- D. Submit one reproducible transparency and one opaque reproduction.

**2.0 PRODUCTS - NOT USED**

**3.0 EXECUTION**

**3.1 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. Submit digital photograph electronic files, organizationally filed by week, to E-Builder within five (5) days of taking photographs.
  3. Each photograph shall be identified with project title, date, and a description of the view.

**2.0 PRODUCTS – NOT USED**

**3.0 EXECUTION**

**3.1 EXISTING CONDITION PHOTOGRAPHS**

- A. Before commencement of selective demolition, take photographs of Project area and surrounding areas, including existing items to remain during construction.

**3.2 PROGRESS PHOTOGRAPHS**

- A. Photographs shall be taken weekly in a manner which completely documents the work.
- B. The photographs shall be submitted to the Owner at the end of the first week for review.
- C. Provide photographs of any wall, ceiling or floor assembly containing MEP, A/V or any infrastructure that will thereafter become concealed-prior to closure. Note location on Key Plan.

**3.3 FINAL COMPLETION PHOTOGRAPHS**

- A. Photographs shall be taken in a manner which completely documents the completed work, for submission as project record documents.

**\*\*\*END OF SECTION 01 32 33\*\*\***



**SECTION 01 33 00 SUBMITTAL PROCEDURES**

**1.0 GENERAL**

**1.1 DESCRIPTION**

- A. Section includes administrative and procedural requirements for submittals, including the following:
  - 1. Shop Drawings
  - 2. Product Data
  - 3. Samples
  - 4. Quality Assurance and Quality Control Submittals
  - 5. Certification of Asbestos free products
  - 6. Owner audio/visual
  - 7. 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 electronic project management 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 for eBuilder importation. 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 electronic Project Management 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 draftsman 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 electronic project management 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 being 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 electronic project management system and will be reviewed and returned electronically marked with action taken.
  - b. Maintain one (1) copy as a "Record Document".

## **1.5 SAMPLES**

- 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 when directed by the Architect.
  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 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. Additionally, for electronic transmittal, photograph sample and its label and attached to the submittal item electronically via the electronic project management.

#### **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 electronic project management system and will be reviewed and returned electronically marked with action taken.
  2. Maintain one (1) additional copy as "Record Document".

**1.7 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 Contract 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. Certify that only asbestos free material is used in the execution of all work. Reference Section 01 35 39.

**1.8 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 electronic project management 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.

## **1.9 RECORD SUBMITTALS**

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

## **1.10 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.

#### **1.11 ARCHITECT'S DUTIES**

- A. Review submittals with reasonable promptness as identified in 1.8, paragraph 5 of this Section.
- B. Notations on the Submittal Review Stamp or eBuilder 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.

**1.12    DISTRIBUTION**

- A.    Distribute reviewed Shop Drawings and copies of Product Data when possible via the electronic project management 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 sub-contractors 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 e-Builder 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 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 Environmental Safety and Health Department. The OHSIP division can be contacted at (607)-255-8200 or by email at [askEHS@cornell.edu](mailto:askEHS@cornell.edu)
4. SME: The University's subject matter expert.

**1.3     ASBESTOS**

- A. All products provided for use in construction at Cornell University are to be free of asbestos. At Substantial Completion, prior to beneficial service, the Contractor shall provide a signed certification form "Exhibit AC" stating that all Contractor supplied & installed products are 100% asbestos free. The Contractor has to 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 product found to contain asbestos shall be classified as defective work. Defective work shall be corrected by the Contractor as specified in the General Conditions.
- B. Attached for the Contractor's information are asbestos reports which represent samples taken within the building.
- C. Removal and disposal of asbestos containing material shall be performed by the Contractor in accordance with Division 2 specifications.

**1.4     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.

**1.5     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.

**1.6     CONFINED SPACE**

- A. The Contractor shall be responsible for the identification of confined space in accordance with OSHA requirements.

**2.0     PRODUCTS – NOT USED**

**3.0     EXECUTION – NOT USED**

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





Cornell University

CONTRACTOR'S CERTIFICATION OF  
ASBESTOS FREE MATERIALS  
(Exhibit AC)

Distribution to:

OWNER	<input type="checkbox"/>
ARCHITECT	<input type="checkbox"/>
CONTRACTOR	<input type="checkbox"/>
FIELD	<input type="checkbox"/>
OTHER	<input type="checkbox"/>

PROJECT:

CONTRACT NUMBER:

CONTRACT FOR:

CONTRACT DATE:

DATE OF ISSUANCE:

TO OWNER: CORNELL UNIVERSITY  
(Name & Address) Facilities Contracts  
121 Humphreys Service Building  
Ithaca, New York 14853

The undersigned hereby certifies that all materials and equipment furnished for or installed in connection with all work, labor, and services provided with respect to the performance of the Contract referenced above shall be free of asbestos and any asbestos containing material. The undersigned shall provide any and all documents supporting such certification which may reasonably be required the Owner, including where applicable Safety Data Sheets and/or Material Safety Data Sheets.

SUPPORTING DOCUMENTS ATTACHED HERETO:

- Material Safety Data Sheets

CONTRACTOR:  
(Name & Address)

BY: \_\_\_\_\_  
(Signature of authorized representative)

NAME: \_\_\_\_\_  
(Printed name)

TITLE: \_\_\_\_\_

State of: \_\_\_\_\_ )  
County of: \_\_\_\_\_ ) ss.

Subscribed and sworn to before me this

\_\_\_\_\_ Day of \_\_\_\_\_ 20\_\_\_\_\_

\_\_\_\_\_



# Limited Pre-Renovation Asbestos Survey Report

Performed at  
Cornell University Stimson Hall (Bldg. 2011)

for the  
Stimson Hall Renovations for McGraw Enabling Project  
Cornell University Ithaca, New York Campus



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Delta Project No. 2016.159.019  
SWBR Project No. 23170.00

Field work performed by:  
Stephen Prislupsky - November 15, 2023  
Thomas Ferro – January 10, 2024

Report prepared by: Stephen Prislupsky, January 12, 2024

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## **1.0 INTRODUCTION:**

Delta Engineers, Architects, & Surveyors (Delta) was contracted by SWBR Architects to perform a Pre-Renovation Asbestos Survey at Stimson Hall (Building 2011) located on the Cornell University Ithaca, New York Campus. This survey is being performed in support of the upcoming "Stimson Hall Renovations for McGraw Enabling" Project. This Survey addressed accessible suspect building materials present in the project renovation areas. Rooms / areas addressed as a part of the Survey included the following:

- 1<sup>st</sup> Floor Rooms 103, 105, 106, 107 and Corridor 100CA at 105 / 107 Entry
- 2<sup>nd</sup> Floor Rooms 219, 219A, 219B, 219C, 215 and 217
- 3<sup>rd</sup> Floor Rooms 307 and 309

Reference Appendix E for drawings for survey the locations / limits.

The initial stage of the survey included a review of past Delta sample information for the building. Bulk sample results through previous Delta sampling efforts have been incorporated into this Survey and associated Survey Report where applicable.

On November 15<sup>th</sup>, 2023 and January 10<sup>th</sup>, 2024 Delta Certified Asbestos Inspectors Stephen Prislupsky and Thomas Ferro conducted walkthroughs of the renovation area spaces/rooms to identify the various accessible suspect materials present. Based on a visual inspection of the affected areas / associated suspect materials and a review of existing sample information for the building, a total of eight (8) bulk samples were collected representing four (4) suspect homogenous building material. Six (6) of the samples collected were non-friable organically bound (NOB) representing three (3) suspect homogenous materials. The remaining two (2) samples were "friable / Non-NOB's representing one (1) suspect homogenous materials. In addition to the samples collected, other suspect homogenous materials were observed in the project renovation areas but not sampled, as they were addressed through previous sampling efforts. For the previously sampled materials, the results from the previous Delta Surveys have been incorporated into this report. The suspect homogenous building materials identified and/or sampled in the affected project renovation areas included the following:

### Homogenous

Area (HA)	Suspect Building Material
01	Brown Pebble-Patterned Linoleum Flooring / Mastic Composite
02	Counter-top, Room 309
03	Counter-top Seam Epoxy, Room 309
04	Seam Epoxy from Non-Suspect Sink-top, Room 309
05*	Fume Hood and Hood Base Cabinet Transite Panels
06*	Fume Hood Counter-top
07*	9" x 9" Beige w/ Brown Streaks Floor Tile
08*	Mastic from 9" x 9" Beige w/ Brown Streaks Floor Tile
09*	12" x 12" Gray Stone Pattern Floor Tile
10*	Mastic from 12" x 12" Gray Stone Pattern Floor Tile
11*	12" x 12" Light Brown w/ Brown Streaks Floor Tile
12*	Mastic from 12" x 12" Light Brown w/ Brown Streaks Floor Tile

#### Homogenous

Area (HA)	Suspect Building Material
13*	Mastic from all colors / sizes of non-suspect vinyl cove bases
14*	Wall / Ceiling Plasters
15*	Wall System Sheetrock
16*	Wall System Joint Compound
17*	Carpet Square Mastics
18*	White End Sealant on non-suspect fiberglass pipe insulation
19**	Adhesives from Wall-mounted Boards

- \* - Materials previously sampled. Results for previously sampled materials are on file at the Offices of Delta EAS and the Cornell Asbestos Program.
- \*\* - Suspect White Board / Chalk Board / Pin Board Adhesive Material “Assumed” to be present behind all wall-mounted boards.

Specific information required by 12 NYCRR Part 56-5.1, (f) – “Building/Structure Asbestos Survey Information” to be included in this pre-renovation report is as follows:

- 1) Building Name/Address: Stimson Hall (Building 2011)  
204 Feeney Way  
Cornell University Ithaca Campus  
Ithaca, NY 14850
- 2) Owner's Name/Address: Cornell University  
Humphreys Service Building  
Ithaca, NY 14853
- 3) Owner's Agent: Mr. Steven Fernaays  
SWBR Architects
- 4) Survey Performed By: Delta Engineers, Architects, & Surveyors  
860 Hooper Road  
Endwell, NY 13760
- 5) Certified Inspectors: Stephen Prislupsky, Certificate No. 90-10891  
Thomas Ferro, Certificate No. 99-11328
- 6) Date of Survey: November 15<sup>th</sup>, 2023 and January 10<sup>th</sup>, 2024
- 7) Laboratory: America Science Team New York, Inc.  
117 East 30<sup>th</sup> Street, New York, NY 10016

## **2.0 ASBESTOS SURVEY AND SAMPLING PROCEDURES AND METHODS:**

### **2.1 Survey requirements**

Requirements to perform Pre-Demolition/Pre-Renovation Asbestos Surveys are based on the following State and Federal Regulations.

**Occupational Safety and Health Administration (OSHA):** OSHA survey requirements and sampling protocols are included in 29 CFR Part 1910.1001(j)(2) & (j)(8) and 29 CFR Part 1926.1101(k),(5):

29 CFR Part 1910.1001(j)(2), Installed Asbestos Containing Material: Employers and building owners are required to treat installed TSI and sprayed on and troweled-on surfacing materials as ACM in buildings constructed no later than 1980 for purposes of this standard. These materials are designated "presumed ACM or PACM", and are defined in paragraph (b) of this section. Asphalt and vinyl flooring material installed no later than 1980 also must be treated as asbestos-containing. The employer or building owner may demonstrate that PACM and flooring material do not contain asbestos by complying with paragraph (j)(8)(iii) of this section.

29 CFR Part 1910.1001(j)(8), Criteria to rebut the designation of installed material as PACM:

1910.1001(j)(8)(i) - At any time, an employer and/or building owner may demonstrate, for purposes of this standard, that PACM does not contain asbestos. Building owners and/or employers are not required to communicate information about the presence of building material for which such a demonstration pursuant to the requirements of paragraph (j)(8)(ii) of this section has been made. However, in all such cases, the information, data and analysis supporting the determination that PACM does not contain asbestos, shall be retained pursuant to paragraph (m) of this section.

1910.1001(j)(8)(ii) - An employer or owner may demonstrate that PACM does not contain asbestos by the following:

1910.1001(j)(8)(ii)(A) - Having a completed inspection conducted pursuant to the requirements of AHERA (40 CFR 763, Subpart E) which demonstrates that no ACM is present in the material; or

1910.1001(j)(8)(ii)(B) - Performing tests of the material containing PACM which demonstrate that no ACM is present in the material. Such tests shall include analysis of bulk samples collected in the manner described in 40 CFR 763.86. The tests, evaluation and sample collection shall be conducted by an accredited inspector or by a CIH. Analysis of samples shall be performed by persons or laboratories with proficiency demonstrated by current successful participation in a nationally recognized testing program such as the National Voluntary Laboratory Accreditation Program (NVLAP) or the National Institute for Standards and Technology (NIST) or the Round Robin for bulk samples administered by the American Industrial Hygiene Association (AIHA) or an equivalent nationally-recognized round robin testing program.

1910.1001(j)(8)(iii) - The employer and/or building owner may demonstrate that flooring material including associated mastic and backing does not contain asbestos, by a determination of an industrial hygienist based upon recognized analytical techniques showing that the material is not ACM.

29 CFR Part 1926.1101(k)(5), Criteria to rebut the designation of installed material as PACM:

1926.1101(k)(5)(i) - At any time, an employer and/or building owner may demonstrate, for purposes of this standard, that PACM does not contain asbestos. Building owners and/or employers are not required to communicate information about the presence of building material for which such a demonstration pursuant to the requirements of paragraph (k)(5)(ii) of this section has been made. However, in all such cases, the information, data and analysis supporting the determination that PACM does not contain asbestos, shall be retained pursuant to paragraph (n) of this section.

1926.1101(k)(5)(ii) - An employer or owner may demonstrate that PACM does not contain more than 1 percent asbestos by the following:

1926.1101(k)(5)(ii)(A) - Having a completed inspection conducted pursuant to the requirements of AHERA (40 CFR Part 763, Subpart E) which demonstrates that the material is not ACM; or

1926.1101(k)(5)(ii)(B) - Performing tests of the material containing PACM which demonstrate that no ACM is present in the material. Such tests shall include analysis of bulk samples collected in the manner described in 40 CFR 763.86. The tests, evaluation and sample collection shall be conducted by an accredited inspector or by a CIH. Analysis of samples shall be performed by persons or laboratories with proficiency demonstrated by current successful participation in a nationally recognized testing program such as the National Voluntary Laboratory Accreditation Program (NVLAP) or the National Institute for Standards and Technology (NIST) or the Round Robin for bulk samples administered by the American Industrial Hygiene Association (AIHA) or an equivalent nationally-recognized round robin testing program.

1926.1101(k)(5)(iii) - The employer and/or building owner may demonstrate that flooring material including associated mastic and backing does not contain asbestos, by a determination of an industrial hygienist based upon recognized analytical techniques showing that the material is not ACM.

**EPA National Emissions Standard for Hazardous Air Pollutants (NESHAPs):** (NESHAPs) regulates asbestos under “40 CFR Part 61, Subpart M - National Emission Standard for Asbestos”. Subpart M regulates demolition and/or renovation of “facilities” that may contain asbestos-containing materials (ACMs). “Facilities,” as defined by NESHAPs, includes any institutional, commercial, public, industrial, or residential structure or building, *except* residential buildings having four or fewer units. ACMs are defined in NESHAPs as materials containing more than 1 percent asbestos. Section 61.145 states:

**61.145 Standard for demolition and renovation.**

(a) *Applicability.* To determine which requirements of paragraphs (a), (b), and (c) of this section apply to the owner or operator of a demolition or renovation activity and prior to the commencement of the demolition or renovation, thoroughly inspect the affected facility or part of the facility where the demolition or renovation operation will occur for the presence of asbestos, including Category I and Category II nonfriable ACM.

It should be noted that 40 CFR Part 1 Subpart M, NESHAPS has no cut-off date exempting survey requirements.

**New York State Department of Labor (NYS DOL):** Guidelines followed for the inspection are those established by the NYS DOL’s Industrial Code Rule 56 (Cited as 12 NYCRR Part 56, as amended, adopted January 11, 2006; effective September 5, 2006). The specific survey, sampling and reporting requirements included in 12 NYCRR Part 56-5.1(e) – “Building/Structure Asbestos Survey Requirements” include:

**56-5.1 Asbestos Survey Requirements for Building/Structure Demolition, Renovation, Remodeling and Repair**

(a) **Asbestos Survey Required.** An owner or an owner’s agent, except the owner of one and two-family dwellings who contracts for, but does not direct or control the work, shall cause to be conducted, an asbestos survey completed by a licensed asbestos contractor using inspectors certified in compliance with Section 56-3.2(d), to determine whether or not the building or structure, or portion(s) thereof to be demolished, renovated, remodeled, or have repair work, contains ACM, PACM or asbestos material. This asbestos survey shall be completed and submitted as indicated in Subdivision (g) of this Section, prior to commencing work. All such asbestos surveys shall be conducted in conformance with the requirements of Subdivision (e) of this Section.

(b) **Exemptions to Asbestos Survey Requirements:** The asbestos survey required by this Subdivision (a) of this Section shall not be required for the following classes of buildings or structures:

- (1) An agricultural building;
- (2) Buildings or structures for which original construction commenced on or after January 1, 1974;
- (3) A structure certified in writing to be structurally unsound by a licensed Professional Engineer, Registered Architect, Building Inspector, Fire Inspector or other official of competent jurisdiction. (See Section 56-11.5)

(c) **Building/Structure Demolition.** If a building/structure asbestos survey is not required or performed per Subdivision (b) of this Section, and the building/structure is certified to be unsound or slated for contracted demolition, the building/structure shall be assumed to contain asbestos, and shall be demolished per this Part, unless the building/structure is adequately certified to be free of asbestos containing material. Acceptable documentation for certification shall be a previous thorough building/structure asbestos survey, abatement records or other documentation acceptable to the Commissioner or his or her representative.

(d) **Responsibility to Comply.** No exemption to the requirement to conduct an asbestos survey shall exempt any person, asbestos contractor, property owner or business entity from the inspection or asbestos survey requirements of EPA, OSHA, and any other applicable section of this Part.

(e) **Building/Structure Asbestos Survey Requirements.** The asbestos survey shall include a thorough inspection for and identification of all PACM, suspect miscellaneous ACM, or asbestos material throughout the building/structure or portion thereof to be demolished, renovated, remodeled, or to have repair work. The required inspection shall be performed by a certified asbestos inspector, and, at a minimum, shall include identification of PACM, suspect miscellaneous ACM or asbestos material by all of the following methods:

- (1) The review of building/structure plans and records, if available, for references to asbestos, ACM, PACM, suspect miscellaneous ACM or asbestos material used in construction, renovation or repair; and
- (2) A visual inspection for PACM and suspect miscellaneous ACM throughout the building/structure or portion thereof to be demolished, renovated, remodeled, or repaired. For the purpose of this Part, all PACM and suspect miscellaneous ACM visually assessed shall be treated and handled as ACM and shall be assumed to be ACM, unless bulk sampling is conducted as per this Section, standard EPA and OSHA accepted methods, including multi-layered systems sampling protocols; the subsequent analyses are performed by a laboratory that meets the requirements of Section 56-4.2 of this Part; and the analyses satisfies both ELAP and federal requirements, including multi-layered sample analyses, to document non-asbestos containing material.

(f) **Building/Structure Asbestos Survey Information.**

(1) The asbestos survey shall, at a minimum, identify and assess with due diligence, the locations, quantities, friability and conditions of all types of installations at the affected portion of the building/structure relative to the ACM, suspect miscellaneous ACM, PACM or asbestos material contained therein. The following list is not inclusive of all types of ACMs, it only summarizes typical



ACMs. The certified asbestos inspector is responsible for identification and assessment of all types ACM, PACM, suspect miscellaneous ACM and asbestos material within the affected portion of the building/structure:

**PACM**

**(i) Surfacing Treatments:**

- (a) Fireproofing;
- (b) Acoustical Plaster;
- (c) Finish Plasters; and
- (d) Skim Coats of Joint Compound.

**(ii) Thermal System Insulation:**

- (a) Equipment Insulation;
- (b) Boiler, Breeching, Boiler Rope, Duct, or Tank Insulation, Cement or Mortar Used for Boilers and Refractory Brick;
- (c) Piping and Fitting Insulations including but not limited to, Wrapped Paper, Aircell, Millboard, Rope, Cork, Preformed Plaster, Job Molded Plaster and coverings over fibrous glass insulation.

**SUSPECT MISCELLANEOUS ACM**

**(i) Roofing and Siding Miscellaneous Materials:**

- (a) Insulation Board;
- (b) Vapor Barriers;
- (c) Coatings;
- (d) Non-Metallic or Non-Wood Roof Decking
- (e) Felts;
- (f) Cementitious Board (Transite);
- (g) Flashing;
- (h) Shingles; and
- (i) Galbestos.

**(ii) Other Miscellaneous Materials:**

- (a) Dust and Debris;
- (b) Floor Tile;
- (c) Cove Base;
- (d) Floor Leveler Compound;
- (e) Ceiling Tile;
- (f) Vermiculite Insulation
- (g) Gaskets, Seals, Sealants (including for condensate control);
- (h) Vibration Isolators;
- (i) Laboratory Tables and Hoods;
- (j) Chalkboards;
- (k) Pipe Penetration Packing or Other Firestopping Materials
- (l) Cementitious Board;
- (m) Electrical Wire Insulation;
- (n) Fire Curtains;
- (o) Fire Blankets;
- (p) Fire Doors;
- (q) Brakes and Clutches;
- (r) Mastics, Adhesives and Glues;

- (s) Caulks;
- (t) Sheet Flooring (Linoleum);
- (u) Wallpaper;
- (v) Drywall;
- (w) Plasterboard
- (x) Spackling/Joint Compound;
- (y) Textured Paint;
- (z) Grout;
- (aa) Glazing Compound; and
- (ab) Terrazzo.

(2) All ACM, PACM, suspect miscellaneous ACM, or asbestos material reported under Paragraph (1) of this Subdivision shall include the location of the materials, an estimate of the quantities, types, friability and condition of the identified materials to be treated and handled as ACM. For the purpose of this Part, all PACM and suspect miscellaneous ACM visually assessed shall be treated and handled as ACM and shall be assumed to be ACM, unless bulk sampling is conducted as per this Section, standard EPA and OSHA accepted methods, including multilayered systems sampling protocols; the subsequent analyses are performed by a laboratory that meets the requirements of Section 56-4.2 of this Part; and the analyses satisfies both ELAP and federal requirements, including multi-layered sample analyses, to document non-asbestos containing material.

(3) The building/structure asbestos survey shall also include the building/structure name, address, the building/structure owner's name and address, the name and address of the owner's agent, the name of the firm performing the asbestos survey and a copy of the firm's current asbestos handling license, the names of the certified inspector(s) performing the survey and a copy of the current asbestos handling certificate for each inspector utilized, the dates of the asbestos survey, a listing of homogeneous areas identifying which ones are ACM, all laboratory analyses reports for bulk samples collected, and copies of the appropriate certifications for the laboratory used for analysis of samples taken during the asbestos survey.

**(g) Transmittal of Building/Structure Asbestos Survey Information.** One (1) copy of the results of the building/structure asbestos survey shall be immediately transmitted by the building/structure owner as follows:

- (1) One (1) copy of the completed asbestos survey shall be sent by the owner or their agent to the local government entity charged with issuing a permit for such demolition, renovation, remodeling or repair work under applicable State or local laws.
- (2) The completed asbestos survey for controlled demolition (as per Subpart 56-11.5) or pre-demolition asbestos projects shall also be submitted to the appropriate Asbestos Control Bureau district office.
- (3) The completed asbestos survey shall be kept on the construction site with the asbestos notification and variance, if required, throughout the duration of the asbestos project and any associated demolition, renovation, remodeling or repair project.

**(h) Removal Required.** If the building/structure asbestos survey finds that the portion of the building/structure to be demolished, renovated, remodeled, or have repair work contains ACM,

PACM, suspect miscellaneous ACM assumed to be ACM, or asbestos material, which is impacted by the work, the owner or the owner's agent shall conduct, or cause to have conducted, asbestos removal performed by a licensed asbestos abatement contractor in conformance with all standards set forth in this Part. All ACM, PACM, suspect miscellaneous ACM assumed to be ACM, or asbestos material impacted by the demolition, renovation, remodeling or repair project shall be removed as per this Part, prior to access or disturbance by other uncertified trades or personnel. No demolition, renovation, remodeling or repair work shall be commenced by any owner or the owner's agent prior to the completion of the asbestos abatement in accordance with the notification requirements of this Part. For multi-phased work, the access restriction for uncertified trades or personnel applies to each intermediate portion of the entire project. Upon completion of the intermediate portion of the asbestos project, other trades or personnel may access that portion of the work site.

For demolition projects that are exempt from asbestos survey requirements due to being structurally unsound, the demolition is considered an asbestos project and shall proceed as per Section 56-11.5.

(1) All building/structure owners and asbestos abatement contractors on a demolition, renovation, remodeling, or repair project, which includes work covered by this Part, shall inform all trades on the work site about PACM, ACM, asbestos material and suspect miscellaneous ACM assumed to be ACM at the work site.

(i) **Bidding.** Bids may be advertised and contracts awarded for demolition, remodeling, renovation, or repair work, but no work on the current intermediate portion of the project shall commence on the demolition, renovation, remodeling or repair work by any owner or agent prior to completion of all necessary asbestos abatement work for the current intermediate portion of the entire project, in conformance with all standards set forth in this Part.

(j) **Unidentified and Unassessed Asbestos.** When any construction activity, such as demolition, remodeling, renovation or repair work, reveals PACM or suspect miscellaneous ACM that has not been identified by the asbestos survey per this Part, or has not been identified by other inspections as per current OSHA or EPA requirements, all activities shall cease in the area where the PACM or suspect miscellaneous ACM is found and the Asbestos Control Bureau shall be notified by telephone by the building/structure owner or their representative, followed with a written notice in accordance with the notification requirements of this Part. Unassessed PACM or suspect miscellaneous ACM shall be treated and handled as ACM and assumed to be ACM, unless proven otherwise by standard EPA and OSHA accepted methods, including multi-layered systems sampling protocols; subsequent analyses performed by a laboratory that meets the requirements of Section 56-4.2 of this Part; and the analyses satisfies both NYS ELAP and federal requirements, including multi-layered sample analyses, to document non-asbestos containing material.

## **2.2 Sample Analysis**

Bulk sample analysis was performed by American Science Team New York Inc., an independent laboratory approved/accredited by the NYS Department of Health (ELAP), the American Industrial Hygiene Association (AIHA), and the National Voluntary Laboratory Accreditation Program (NVLAP).



Samples collected during the course of this survey fell into one of two categories. The first category includes non-friable organically bound (NOB) materials. These materials are those which have an organic binder in their matrix and include items such as floor tiles, sheet flooring, mastics, glazings, caulks and roofing materials. The second category includes non-NOB “friable” materials including parging, sheetrock, joint compound, wall insulations, and wallboard.

Analysis of all “NOB” materials was initially performed by Polarized Light Microscopy (PLM) following the New York State Department of Health ELAP 198.6 Gravimetric Reduction Methodology. If a given sample was reported as non-asbestos following this analysis, it was then analyzed by Transmission Electron Microscopy (TEM) following the NYS DOH ELAP 198.4 Methodology.

Analysis of all “non-NOB” materials was performed by Polarized Light Microscopy (PLM) following the EPA 600/M4/82/020 and the NYS DOH ELAP 198.1 Methodologies.

### ***2.3 Materials not sampled***

There were several materials present at the site which were not considered “suspect” by the inspector and were not sampled. These included various fiberglass, foam, vinyl, silicone, wood/cellulose products and concrete/cinder block/brick components.

### **3.0 SURVEY FINDINGS AND CONCLUSIONS**

**3.1) Stimson Hall Renovations for McGraw Enabling Project Pre-Renovation Asbestos Survey, Non-Asbestos Materials** – Based on previous sample results and results reported for samples collected during this Survey of accessible suspect materials present in the Stimson Hall Renovation Areas, the following were identified as non-asbestos:

Homogenous

Area (HA)	Non-Asbestos Material
01	Brown Pebble-Patterned Linoleum Flooring / Mastic Composite
02	Counter-top, Room 309
03	Counter-top Seam Epoxy, Room 309
04	Seam Epoxy from Non-Suspect Sink-top, Room 309
08*	Mastic from 9" x 9" Beige w/ Brown Streaks Floor Tile
10*	Mastic from 12" x 12" Gray Stone Pattern Floor Tile
12*	Mastic from 12" x 12" Light Brown w/ Brown Streaks Floor Tile
13*	Mastic from all colors / sizes of non-suspect vinyl cove bases
15*	Wall System Sheetrock
16*	Wall System Joint Compound
17*	Carpet Square Mastics
18*	White End Sealant on non-suspect fiberglass pipe insulation

- \* - Materials previously sampled. Results for previously sampled materials are on file at the Offices of Delta EAS and the Cornell Asbestos Program.

**3.2) Stimson Hall Renovations for McGraw Enabling Project Pre-Renovation Asbestos Survey, Asbestos Containing Materials** – Based on previous sample results and results reported for samples collected during this Survey of accessible suspect materials present in the Stimson Hall Renovation Areas, the following were identified as being **asbestos-containing**:

Homogenous

Area (HA)	Asbestos-Containing Material
05*	Room 309 Fume Hood and Hood Base Cabinet Transite Panels
06*	Room 309 Fume Hood Counter-top
07*	9" x 9" Beige w/ Brown Streaks Floor Tile
09*	12" x 12" Gray Stone Pattern Floor Tile
11*	12" x 12" Light Brown w/ Brown Streaks Floor Tile
14*	Wall / Ceiling Plasters
19**	Adhesives from Wall-mounted Boards

- \* - Materials previously sampled. Results for previously sampled materials are on file at the Offices of Delta EAS and the Cornell Asbestos Program.

- \*\* - Suspect White Board / Chalk Board / Pin Board Adhesive Material "Assumed" to be present behind all wall-mounted boards.

A breakdown of asbestos-containing materials by Homogeneous Area is as follows:

A) Room 309 Fume Hood & Base Cabinet Asbestos Transite Panels and Fume Hood Asbestos Transite Counter-top, HA's 05\* and 06\*: The Fume Hood and its associated base cabinet present in the south/east corner of Room 309 are lined with asbestos transite panels, with the counter-top the fume hood is mounted to also being asbestos transite:

- Transite Panels – 61 Square Feet (38 sf in fume hood / 23 sf in base cabinet)
- Transite Counter-top – 9 Square Feet

B) Asbestos Containing 9" x 9" & 12" x 12" Floor Tiles, HA's 07\*, 09\* & 11\*: The various colors / patterns of 9" x 9" and 12" x 12" floor tiles observed to be present in renovation areas were previously sampled and reported as being asbestos containing. The mastics associated with the tiles are "non-asbestos". Asbestos Floor Tile was observed to be present in the following areas:

- Room 307 – 524 Square Feet
- Room 309 – 553 Square Feet
- Room 219 – 1,120 Square Feet (under carpet squares)
- Room 219A – 105 Square Feet
- Room 219B – 130 Square Feet (under carpet squares)
- Room 219C – 149 Square Feet (under carpet squares)
- Room 103 – 135 Square Feet
- Room 106 – 410 Square Feet
- Room 107 – 778 Square Feet

The total quantity and specific locations of asbestos containing floor tile listed in the spaces above to be impacted as a part of the project was not determined at the time of this survey.

It should be noted that for Room 105 and the Corridor 100CA Section within the project renovation area, the carpet squares (105) and non-asbestos linoleum (100CA) are installed directly over a luan sub-floor. Due to building / space occupancy, it was not possible at the time of this survey to verify what was beneath the luan in these two spaces.

C) Asbestos Wall / Ceiling Plasters, HA 14\*: The Wall System and Ceiling System Plaster present in the Renovation Areas were previously sampled and reported as being asbestos containing. Asbestos ceiling plaster was observed to be present in all renovation area rooms / spaces. Asbestos containing wall plaster was also observed to be present in all renovation area rooms / spaces, with several walls for a given room also observed to be non-asbestos sheetrock / joint compound systems. Reference the Attachment F ACM Location Drawings for those walls that are ACM Plaster and those that are non-asbestos sheetrock / joint compound. The total quantity and specific locations of asbestos containing wall & ceiling plaster to be impacted as a part of the project was not determined at the time of this survey.

D) "Assumed" Asbestos Adhesives from Wall-Mounted Boards, HA 19\*\*: Wall-mounted Whiteboards, Chalk-boards and Pin-boards were observed to be present in several renovation area rooms / spaces listed below. All boards were intact so based on this, and the presence of known

Asbestos Wall Plaster, suspect adhesive associated with the wall boards could not be sampled or confirmed to be present at each location. All boards installed on asbestos plaster walls, whether mechanically fastened or fastened via suspect adhesive be removed as a part of abatement operations. For those boards installed on non-asbestos sheetrock / joint compound wall systems, they are assumed to be fastened utilizing an “assumed” asbestos adhesive for the purposes of this Survey / Survey Report.

**3.3) Stimson Hall Renovations for McGraw Enabling Project Pre-Renovation Asbestos Survey, Non-Suspect Materials** – The following accessible non-suspect materials were observed to be present in the Stimson Hall Renovation Areas:

- Fiberglass / Foam Pipe Insulation
- Vinyl / Wood Cove Base
- Luan Sub-Flooring
- Soap-Stone Sink-top (Room 309)
- Resin, Trespa & Laminated Wood Counter-tops / Table-tops (Room 309)

#### **4.0 INACCESSIBLE AREAS**

Renovation spaces and areas which were visible and accessible were inspected and sampled as a part of this survey. Inaccessible areas such as wall chases/interstitial wall space, hard ceiling plenum spaces, and enclosed pipe chases could not be inspected without select demolition. Based on the fact that the building was occupied at the time of the survey, the inaccessible areas were not included as a part of this survey. Any materials encountered in those areas not accessible shall be assumed ACM until tested.

## **APPENDIX A**

### **Asbestos Bulk Sample Report Form**



<b>Client:</b> <u>SWBR</u>	<b>Client Project No.:</b> <u>23170.00</u>	<b>Delta Proj. No.:</b> <u>2016.159.019</u>
<b>Project:</b> <u>Stimson Hall Renovations for McGraw Enabling Project - Pre-Renovation Asbestos Survey</u>	<b>Dates Sampling Performed:</b> <u>11/15/2023 &amp; 01/10/2024</u>	<b>Asbestos Inspector:</b> <u>S. Prislupsky / T. Ferro</u>
	<b>Date of Report:</b> <u>01/12/2024</u>	<b>Number of Samples Collected:</b> <u>8</u>
<b>Building Code:</b> <u>2011</u>	<b>Laboratory:</b> <u>AmeriSci Labs</u>	<b>Number of Samples Analyzed:</b> <u>PLM - 8 / TEM - 6</u>

**Asbestos Bulk Sample Report Form**

Sample Number	HA*	Floor	Bulk Sample Description / Details	Material Type	Asbestos Type	PLM Result % Asbestos	TEM Result % Asbestos
2016.159.019 - 01A	01	1	Brown Pebble Pattern Linoleum / Adhesive Composite, Rooms 105/107 entry Foyer	Misc.	ND	ND	ND
2016.159.019 - 01B	01	1	Brown Pebble Pattern Linoleum / Adhesive Composite, Rooms 105/107 entry Foyer	Misc.	ND	ND	ND
2016.159.019 - 02A	01	3	Countertop, Room 309	Misc.	ND	ND	NA
2016.159.019 - 02B	01	3	Countertop, Room 309	Misc.	ND	ND	NA
2016.159.019 - 03A	01	3	Countertop Seam Epoxy, Room 309	Misc.	ND	ND	ND
2016.159.019 - 03B	01	3	Countertop Seam Epoxy, Room 309	Misc.	ND	ND	ND
2016.159.019 - 04A	01	3	Sink Top Seam Epoxy, Room 309	Misc.	ND	ND	ND
2016.159.019 - 04B	01	3	Sink Top Seam Epoxy, Room 309	Misc.	ND	ND	ND

**HA** - Homogenous Area      **ND** - No Asbestos Detected      **NA** - Not Analyzed by Methodology      **NA/PS** - Not Analyzed, Positive Stop

**TSI** - Thermal System Insulation      **Misc** - Miscellaneous Material      **Trace / < 1%** - Non-asbestos by definition





## **APPENDIX B**

### **Laboratory Analytical Results**



**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** 11/16/23 **AmeriSci Job #** 223112318  
**Date Examined** 11/16/23 **P.O. #**  
**ELAP #** 11480 **Page** 1 of 1  
**RE:** 2016.159.019; SWBR; Stimson Hall Renovations for McGraw  
Enabling Project Asbestos Bulk Sampling - Client Project No.:  
23170.00

Client No. / HGA	Lab No.	Asbestos Present	Total % Asbestos
2016.159.019-01A 01	223112318-01	No	NAD
<b>Location:</b> 1st Fl., Rooms 105/107 Entry Foyer - Brown Pebble Pattern Linoleum / Adhesive Composite			(by NYS ELAP 198.6) by Jared C. Clarke on 11/16/23
<b>Analyst Description:</b> Brown, Homogeneous, Non-Fibrous, Bulk Material			
<b>Asbestos Types:</b>			
<b>Other Material:</b> Non-fibrous 2.1%			
2016.159.019-01B 01	223112318-02	No	NAD
<b>Location:</b> 1st Fl., Rooms 105/107 Entry Foyer - Brown Pebble Pattern Linoleum / Adhesive Composite			(by NYS ELAP 198.6) by Jared C. Clarke on 11/16/23
<b>Analyst Description:</b> Brown, Homogeneous, Non-Fibrous, Bulk Material			
<b>Asbestos Types:</b>			
<b>Other Material:</b> Non-fibrous 1.7%			

### Reporting Notes:

Analyzed by: Jared C. Clarke  
Date: 11/16/2023

Reviewed by: Karol H. Lu

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

\_\_\_\_\_END OF REPORT\_\_\_\_\_

Client Name: Delta Engineers

**Table I**  
**Summary of Bulk Asbestos Analysis Results**

2016.159.019; SWBR; Stimson Hall Renovations for McGraw Enabling Project Asbestos Bulk Sampling - Client Project No.: 23170.00

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	2016.159.019-01A	01	0.307	48.3	49.6	2.1	NAD	NAD
Location: 1st Fl., Rooms 105/107 Entry Foyer - Brown Pebble Pattern Linoleum / Adhesive Composite								
02	2016.159.019-01B	01	0.223	54.5	43.8	1.7	NAD	NAD
Location: 1st Fl., Rooms 105/107 Entry Foyer - Brown Pebble Pattern Linoleum / Adhesive Composite								

Analyzed by: Karol H. Lu

Date: 11/16/2023



Reviewed by: Karol H. Lu



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

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

## Bulk Sample Data Sheet/COC

<b>Client:</b> SWBR	<b>Delta Project No.:</b> 2016.159.019	<b>Date:</b> 11/15/2023
<b>Project:</b> Stimson Hall Renovations for McGraw Enabling Project Asbestos Bulk Sampling	<b>Client Project No.:</b> 23170.00	<b>Turnaround Time:</b> RUSH
<b>Collected By:</b> Stephen Prislupsky		

Sample Number	Material Type	Material Condition	Floor	Description / Sample Location
2016.159.019 - 01A	Misc.	Intact	1	Brown Pebble Pattern Linoleum / Adhesive Composite, Rooms 105/107 entry Foyer
2016.159.019 - 01B	Misc.	Intact	1	Brown Pebble Pattern Linoleum / Adhesive Composite, Rooms 105/107 entry Foyer

**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](mailto:wjohnson@deltaengineers.com), [sprislupsky@deltaengineers.com](mailto:sprislupsky@deltaengineers.com), [rcherevko@deltaengineers.com](mailto:rcherevko@deltaengineers.com)

**Notes:** \_\_\_\_\_

**Submitted By:** Stephen Prislupsky

(Signature)

**Date:** 11/15/2023

**Received By:** Efrain Nunez

(Signature)

**Date:** 11/16/23

223112318

**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** 01/11/24 **AmeriSci Job #** 224011670  
**Date Examined** 01/11/24 **P.O. #**  
**ELAP #** 11480 **Page** 1 of 2  
**RE:** 2016.159.019; SWBR; Stimson Hall Renovation For McGraw  
Enabling Asbestos Survey

Client No. / HGA	Lab No.	Asbestos Present	Total % Asbestos
2016.159.019-02A 02 <b>Location:</b> Floor 3 - Room 309, Countertop  <b>Analyst Description:</b> Black, Homogeneous, Non-Fibrous, Cementitious, Bulk Material <b>Asbestos Types:</b> <b>Other Material:</b> Non-fibrous 100%	224011670-01	No	NAD (by NYS ELAP 198.1) by Jared C. Clarke on 01/11/24
2016.159.019-02B 02 <b>Location:</b> Floor 3 - Room 309, Countertop  <b>Analyst Description:</b> Black, Homogeneous, Non-Fibrous, Cementitious, Bulk Material <b>Asbestos Types:</b> <b>Other Material:</b> Non-fibrous 100%	224011670-02	No	NAD (by NYS ELAP 198.1) by Jared C. Clarke on 01/11/24
2016.159.019-03A 03 <b>Location:</b> Floor 3 - Room 309, Countertop Seam Epoxy  <b>Analyst Description:</b> Black, Homogeneous, Non-Fibrous, Bulk Material <b>Asbestos Types:</b> <b>Other Material:</b> Non-fibrous 69.3%	224011670-03	No	NAD (by NYS ELAP 198.6) by Jared C. Clarke on 01/11/24
2016.159.019-03B 03 <b>Location:</b> Floor 3 - Room 309, Countertop Seam Epoxy  <b>Analyst Description:</b> Black, Homogeneous, Non-Fibrous, Bulk Material <b>Asbestos Types:</b> <b>Other Material:</b> Non-fibrous 55.7%	224011670-04	No	NAD (by NYS ELAP 198.6) by Jared C. Clarke on 01/11/24
2016.159.019-04A 04 <b>Location:</b> Floor 3 - Room 309, Sink Top Seam Epoxy  <b>Analyst Description:</b> Black, Homogeneous, Non-Fibrous, Bulk Material <b>Asbestos Types:</b> <b>Other Material:</b> Wollastonite 2%, Non-fibrous 20.8%	224011670-05	No	NAD (by NYS ELAP 198.6) by Jared C. Clarke on 01/11/24

# PLM Bulk Asbestos Report

2016.159.019; SWBR; Stimson Hall Renovation For McGraw  
Enabling Asbestos Survey

Client No. / HGA	Lab No.	Asbestos Present	Total % Asbestos
2016.159.019-04B 04	224011670-06	No	NAD
Location: Floor 3 - Room 309, Sink Top Seam Epoxy			(by NYS ELAP 198.6) by Jared C. Clarke on 01/11/24
Analyst Description: Black, Homogeneous, Non-Fibrous, Bulk Material			
Asbestos Types:			
Other Material: Wollastonite 3%, Non-fibrous 25%			

## Reporting Notes:

Analyzed by: Jared C. Clarke  
Date: 1/11/2024



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 Motic, Model BA310 Pol Scope, Microscope, Serial #: 1190000326, by Appd E to Subpt E, 40 CFR 763 quantified by either CVES or 400 pt ct as noted for each analysis (NVLAP 200546-0), ELAP PLM Method 198.1 for NY friable samples, which includes the identification and quantitation of vermiculite, or ELAP 198.6 for NOB samples, or EPA 400 pt ct by EPA 600-M4-82-020 (NY ELAP Lab 11480); Note:PLM is not consistently reliable in detecting asbestos in floor coverings and similar non-friable organically bound materials. NAD or Trace results by PLM are inconclusive, TEM is currently the only method that can be used to determine if this material can be considered or treated as non asbestos-containing in NY State (also see EPA Advisory for floor tile, FR 59,146,38970,8/1/94) National Institute of Standards and Technology Accreditation requirements mandate that this report must not be reproduced except in full without the approval of the lab.This PLM report relates ONLY to the items tested. RI Cert AAL-094, CT Cert PH-0186, Mass Cert AA000054, NJ Lab ID #NY031.

\_\_\_\_\_END OF REPORT\_\_\_\_\_

Client Name: Delta Engineers

**Table I**  
**Summary of Bulk Asbestos Analysis Results**

2016.159.019; SWBR; Stimson Hall Renovation For McGraw Enabling Asbestos Survey

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	2016.159.019-02A	02	----	----	----	----	NAD	NA
Location: Floor 3 - Room 309, Countertop								
02	2016.159.019-02B	02	----	----	----	----	NAD	NA
Location: Floor 3 - Room 309, Countertop								
03	2016.159.019-03A	03	0.117	22.6	8.1	69.3	NAD	NAD
Location: Floor 3 - Room 309, Countertop Seam Epoxy								
04	2016.159.019-03B	03	0.271	36.6	7.7	55.7	NAD	NAD
Location: Floor 3 - Room 309, Countertop Seam Epoxy								
05	2016.159.019-04A	04	0.068	65.5	11.7	22.8	NAD	NAD
Location: Floor 3 - Room 309, Sink Top Seam Epoxy								
06	2016.159.019-04B	04	0.087	28.7	43.3	28.0	NAD	NAD
Location: Floor 3 - Room 309, Sink Top Seam Epoxy								

Analyzed by: Hongyan Ran  
Date: 1/11/2024



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).



### Bulk Sample Data Sheet/COC

<b>Client:</b> <u>SWBR</u>	<b>Delta Project No.:</b> <u>2016.159.019</u>	<b>Date:</b> <u>1/10/2024</u>
<b>Project:</b> <u>Stimson Hall</u> <u>Renovation for McGraw</u> <u>Enabling Asbestos Survey</u>	<b>Client Project No.:</b>	<b>Turnaround Time:</b> <u>RUSH</u>
	<b>Collected By:</b> <u>Thomas Ferro</u>	

Sample Number	Material Type	Material Condition	Floor	Description / Sample Location
2016.159.019 - 02A	Misc.	Intact	3	Countertop, Room 309
2016.159.019 - 02B	Misc.	Intact	3	Countertop, Room 309
2016.159.019 - 03A	Misc.	Intact	3	Countertop Seam Epoxy, Room 309
2016.159.019 - 03B	Misc.	Intact	3	Countertop Seam Epoxy, Room 309
2016.159.019 - 04A	Misc.	Intact	3	Sink Top Seam Epoxy, Room 309
2016.159.019 - 04B	Misc.	Intact	3	Sink Top Seam Epoxy, Room 309

**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@delta-eas.com](mailto:wjohnson@delta-eas.com), [sprislupsky@delta-eas.com](mailto:sprislupsky@delta-eas.com), [rcherevko@delta-eas.com](mailto:rcherevko@delta-eas.com)

Notes:

RUSH T.A.T.

Submitted By: Thomas Ferro

Thomas Ferro  
(Signature)

Date: 1/10/2024

Received By: Alexa Carro

Alexa Carro  
(Signature)

Date: 1/11/24 10:21

224011670



## **APPENDIX C**

### **Delta Engineers, Architects, & Surveyors Company and Personnel Certifications**



**WE ARE YOUR DOL**



**Department  
of Labor**

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

# ASBESTOS HANDLING LICENSE

Delta Engineers, Architects, Land Surveyors, & Landscape, Architects, D.P.C.  
860 Hooper Road, Endwell, NY, 13760

License Number: 29322

License Class: RESTRICTED

Date of Issue: 10/10/2023

Expiration Date: 10/31/2024

Duly Authorized Representative: Stephen Prislupsky

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.

A handwritten signature in black ink, appearing to read "Amy Phillips".

Amy Phillips, Director  
For the Commissioner of Labor

EXCELSIOR

STATE OF NEW YORK - DEPARTMENT OF LABOR  
ASBESTOS CERTIFICATE



STEPHEN M PRISLUPSKY

CLASS(EXPIRES)

C ATEC(11/23) D INSP(11/23)

H PM (11/23) I PD (11/23)

CERT# 90-10891

DMV# 793406449

MUST BE CARRIED ON ASBESTOS PROJECTS



01213 006600376 54

EYES BRO

HAIR BRO

HGT 5' 06"

IF FOUND RETURN TO:

NYSOL - L&C UNIT

ROOM 161A BUILDING 12

STATE OFFICE CAMPUS

ALBANY NY 12240



STATE OF NEW YORK - DEPARTMENT OF LABOR  
ASBESTOS CERTIFICATE



**THOMAS P FERRO**

CLASS(EXPIRES)

C ATEC(12/23) D INSP(12/23)

H PM (12/23)

CERT# 99-11328  
DMV# 404844888

**MUST BE CARRIED ON ASBESTOS PROJECTS**

EXPIRATION DATE 12/23/23



EYES HAZ

HAIR BRO

HGT 5' 08"

IF FOUND RETURN TO:

NYSOL - L&C UNIT

ROOM 161A BUILDING 12

STATE OFFICE CAMPUS

ALBANY NY 12240





## **APPENDIX D**

### **Laboratory Certifications**



NEW YORK STATE DEPARTMENT OF HEALTH  
WADSWORTH CENTER



Expires 12:01 AM April 01, 2024  
Issued April 01, 2022  
Revised March 30, 2023

**CERTIFICATE OF APPROVAL FOR LABORATORY SERVICE**

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

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

NY Lab Id No: 11480

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

**Miscellaneous**

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



Serial No.: 66402

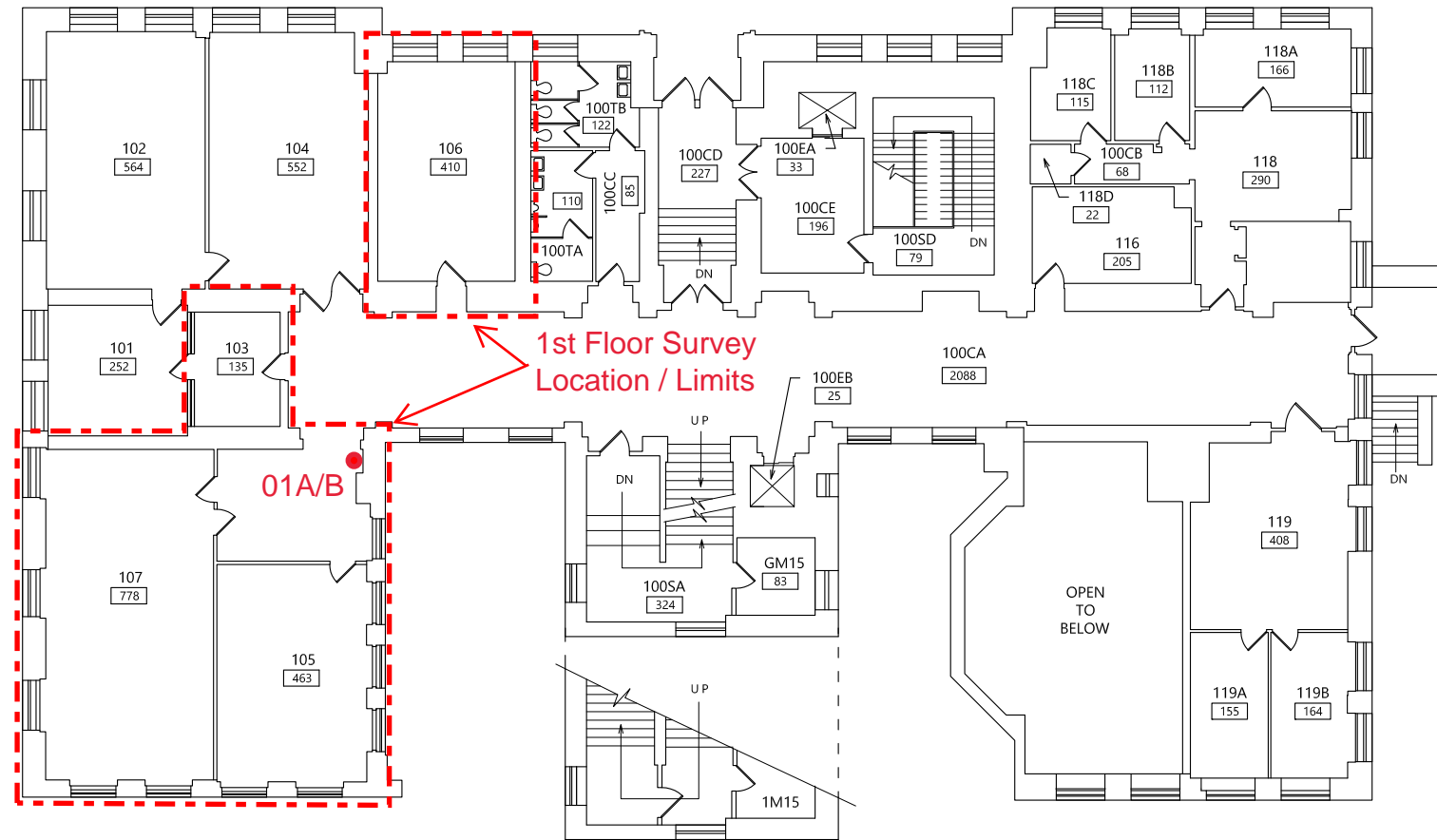
Property of the New York State Department of Health. Certificates are valid only at the address shown and must be conspicuously posted by the laboratory. Continued accreditation depends on the laboratory's successful ongoing participation in the Program. Consumers may verify a laboratory's accreditation 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](mailto:elap@health.ny.gov).



## **APPENDIX E**

### **Survey Locations / Limits and Bulk Sample Location Drawings**





N  
FIRST FLOOR PLAN  
GROSS AREA = 11,295 SQ. FT.



Cornell University

FACILITIES INVENTORY

HUMPHREY'S SERVICE BUILDING  
639 DRYDEN ROAD  
ITHACA, NEW YORK 14853-3701

DRAWING DISCLAIMER

THESE DRAWINGS, AND THEIR ASSOCIATED ELECTRONIC FILES HAVE BEEN PRODUCED FOR THE PURPOSE OF SPACE INVENTORY CAMPUS BUILDINGS. FEATURES SHOWN ARE INCIDENTAL TO THEIR PURPOSE AND DEPICT CONDITIONS AT THE TIME THE DRAWINGS WERE PRODUCED. THESE DRAWINGS SHOULD NOT BE RELIED UPON FOR ANY OTHER PURPOSE.

REVISIONS:  
IGI 1/01, 3/02 EQ, 4/03 EQ, 5/08 EQ, 4/18 SV



DRAWN BY:  
AS

CHECKED BY:  
EQ

DRAWING NO:  
3 OF 6

DATE:  
9/7/2000

PLAN LEVEL:  
1  
TOTAL BLDG GROSS SQ. FT.  
SEE SHEET 1

BLDG NAME:

STIMSON HALL

BLDG NO:

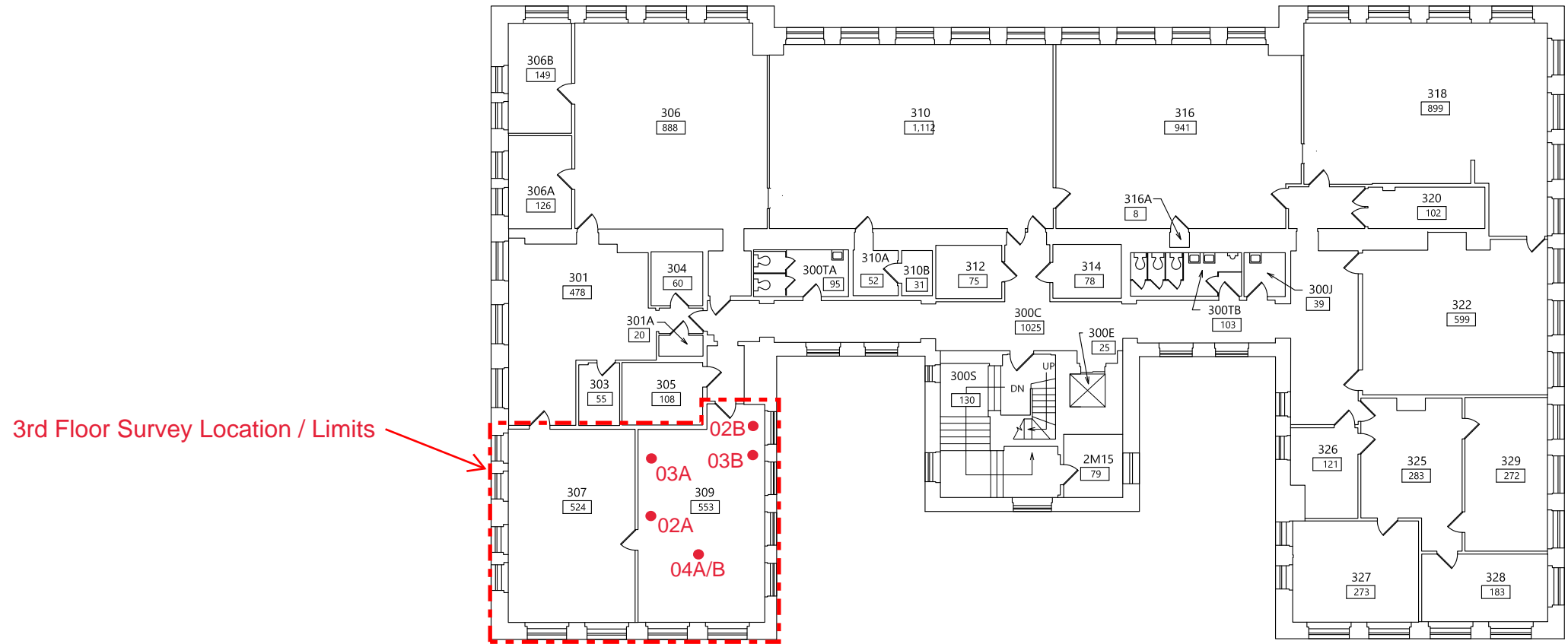
2011











**THIRD FLOOR PLAN**  
GROSS AREA = 11,968 SQ. FT.



Cornell University

**FACILITIES INVENTORY**

HUMPHREY'S SERVICE BUILDING  
639 DRYDEN ROAD  
ITHACA, NEW YORK 14853-3701

**DRAWING DISCLAIMER**

THESE DRAWINGS, AND THEIR ASSOCIATED ELECTRONIC FILES HAVE BEEN PRODUCED FOR THE PURPOSE OF SPACE INVENTORY CAMPUS BUILDINGS. FEATURES SHOWN ARE INCIDENTAL TO THEIR PURPOSE AND DEPICT CONDITIONS AT THE TIME THE DRAWINGS WERE PRODUCED. THESE DRAWINGS SHOULD NOT BE RELIED UPON FOR ANY OTHER PURPOSE.

REVISIONS:  
4/03 EQ, 4/15 SV, 4/17 SV



DRAWN BY:  
**AS**

CHECKED BY:  
**EQ**

DRAWING NO:  
**5 OF 6**

DATE:  
**9/7/2000**

PLAN LEVEL:  
**3**

TOTAL BLDG GROSS SQ. FT.  
**SEE SHEET 1**

BLDG NAME:

**STIMSON HALL**

BLDG NO:

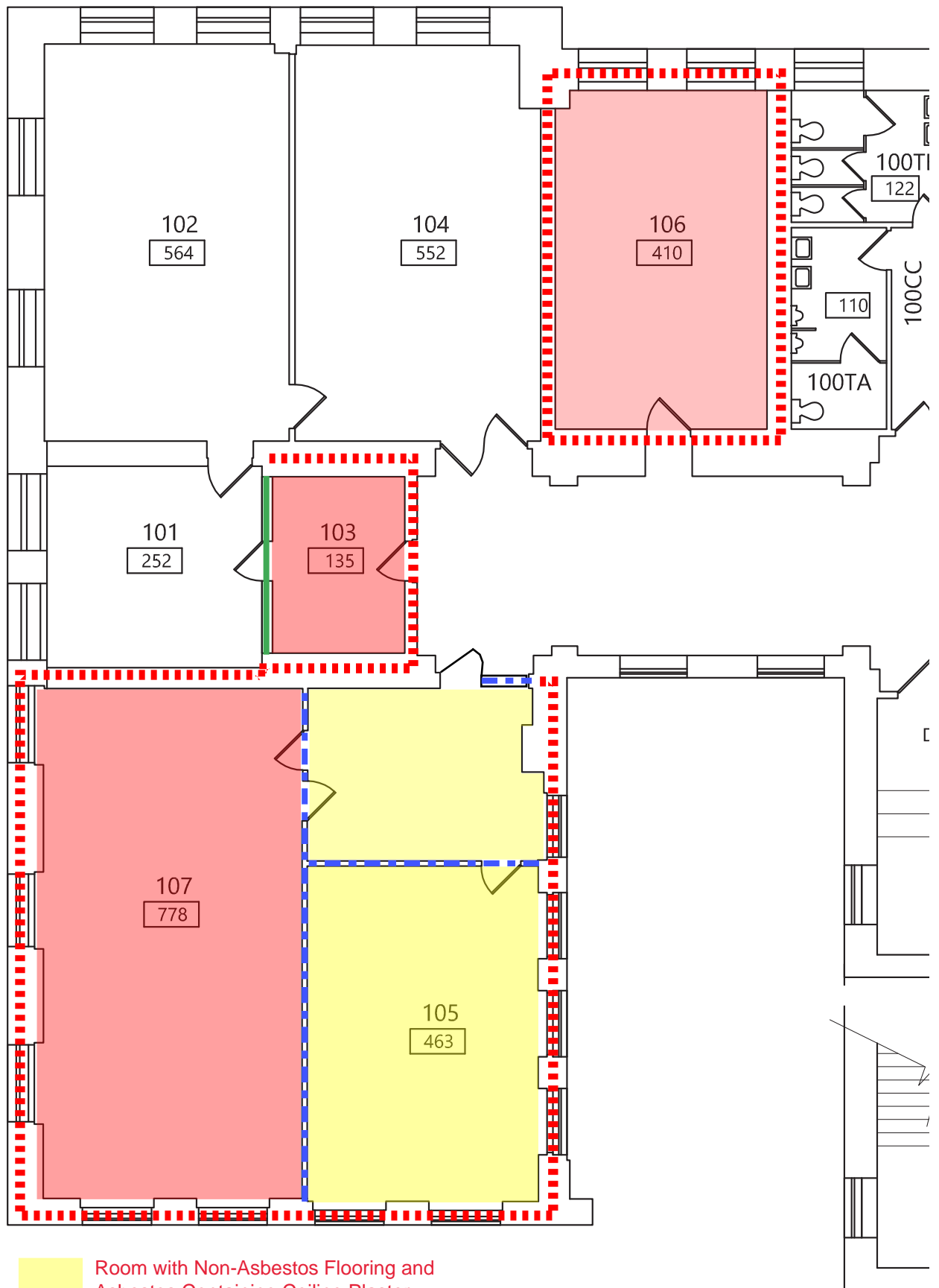
**2011**



## **APPENDIX F**

### **Asbestos Containing Material (ACM) Location Drawings**





- Room with Non-Asbestos Flooring and Asbestos Containing Ceiling Plaster
- Room with Asbestos Containing Floor Tile and Asbestos Containing Ceiling Plaster

Non-suspect Glass / Wood Wall

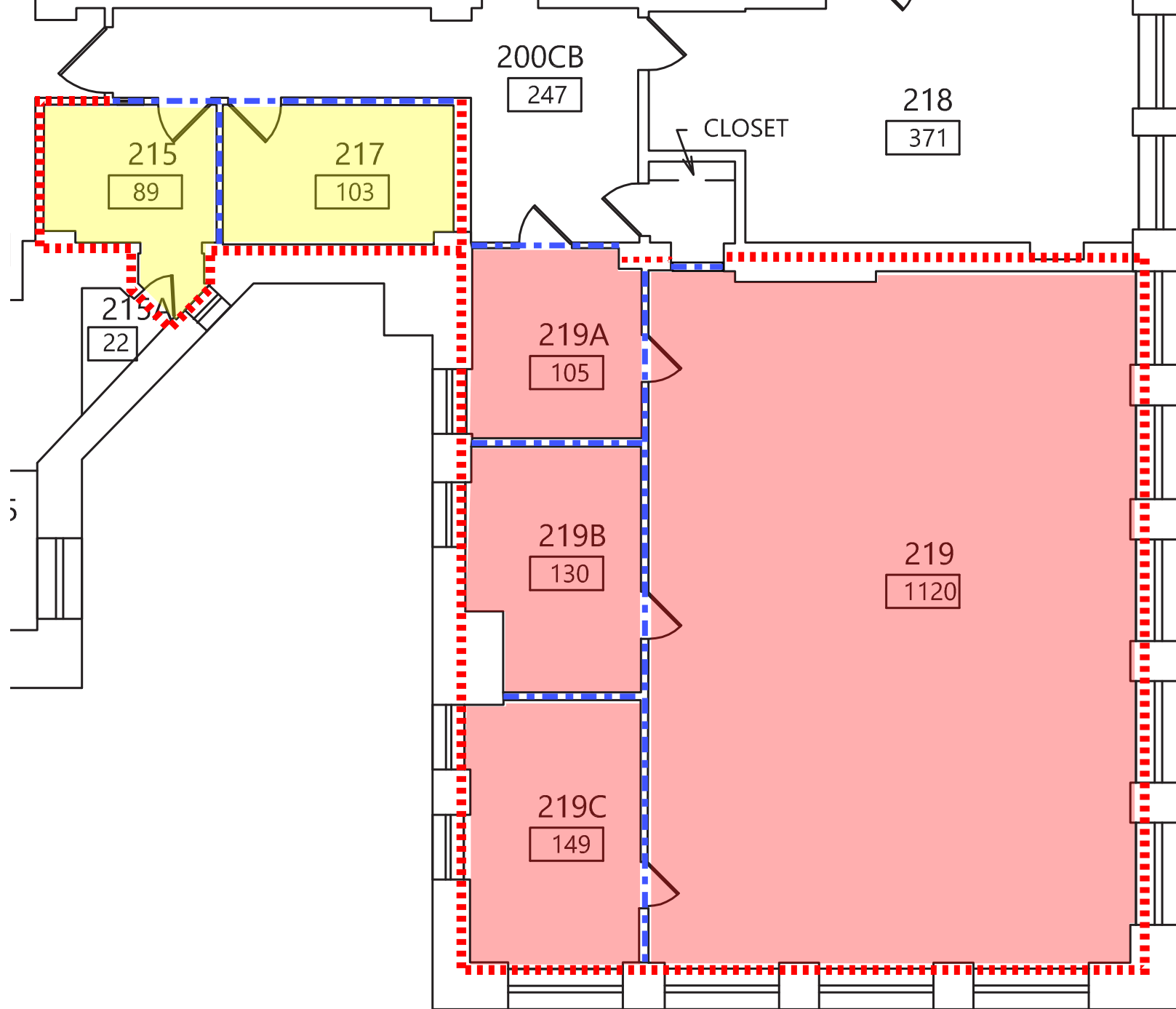
Non-Asbestos Sheetrock / Joint Compound Wall

Asbestos Containing Wall Plaster



## FIRST FLOOR PLAN

GROSS AREA = 11,295 SQ. FT.



Room with Asbestos Containing Floor Tile and Asbestos Containing Ceiling Plaster



Room with Non-Asbestos Flooring and Asbestos Containing Ceiling Plaster

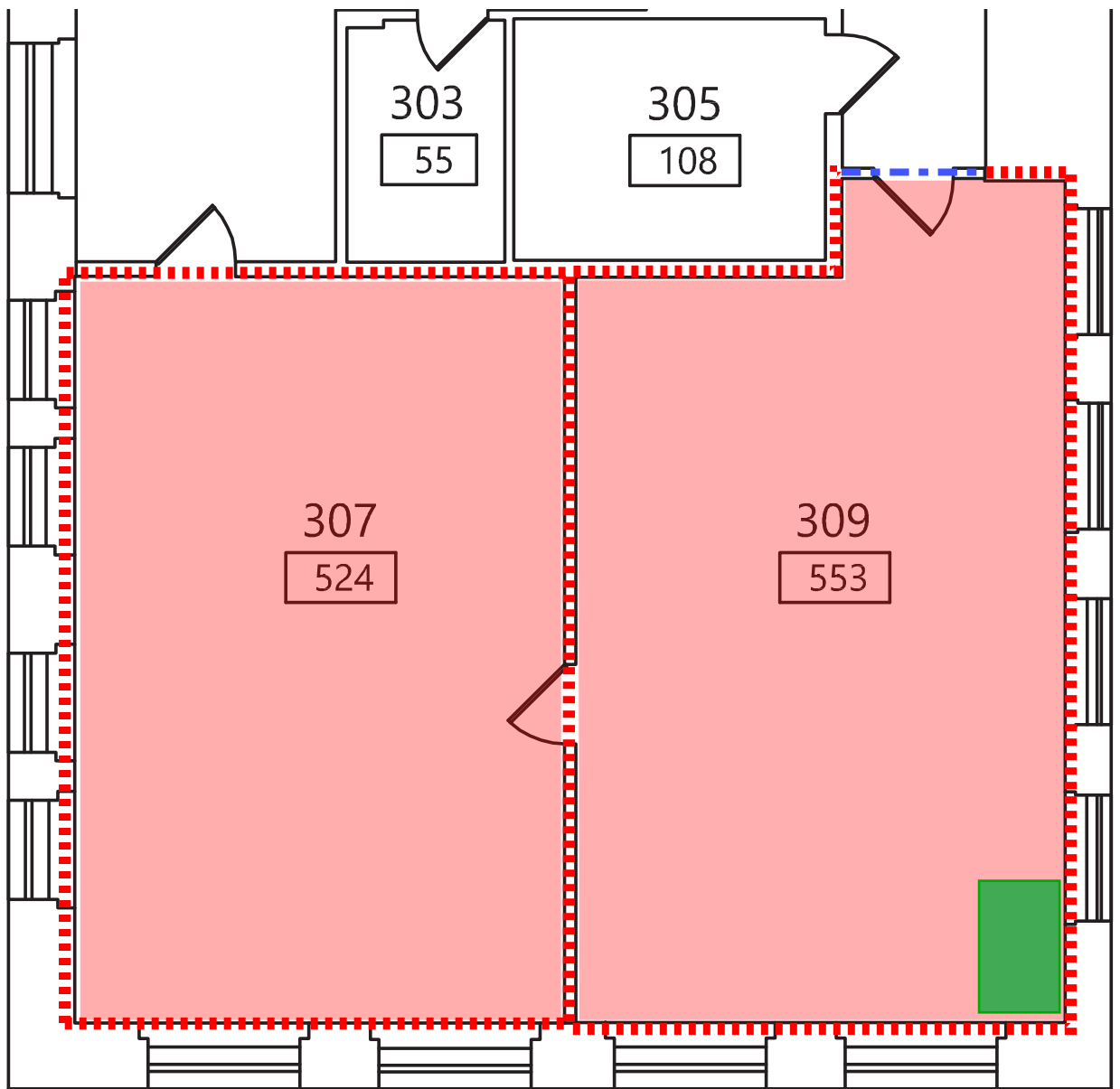


Non-Asbestos Sheetrock / Joint Compound Wall



Asbestos Containing Wall Plaster





Room with Asbestos Containing Floor Tile and Asbestos Containing Ceiling Plaster



Asbestos Containing Wall Plaster



Asbestos Transite Lined Fume Hood and Base Cabinet with Asbestos Transite Counter-top



## THIRD FLOOR PLAN

GROSS AREA = 11,968 SQ. FT.



## **APPENDIX G**

### **Photo Log**





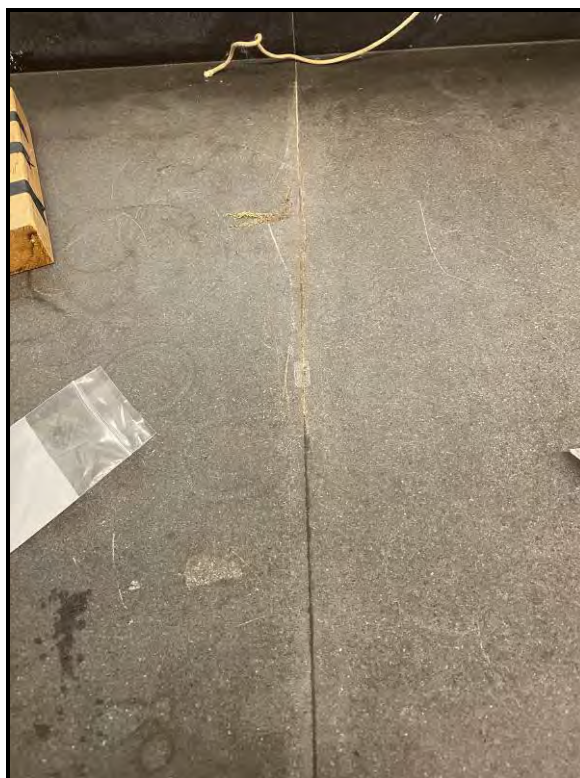
HA 01 – Brown Pebble-Pattern Linoleum, Corridor 100CA Area @ Rooms 105/107 Entry Area – “No Asbestos Detected”



HA 02 – Counter-top, Room 309, “No Asbestos Detected”



HA 03 – Counter-top Seam Epoxy, Room 309, “No Asbestos Detected”



HA 04 – Sink-top Seam Epoxy, Room 309, “No Asbestos Detected”



Room 309 asbestos transite lined fume hood / base cabinet and fume hood asbestos transite counter-top





**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 sub-contractors 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

**1.3 SUBMITTALS**

- A. Submit the following in accordance with Section 01 33 00 – Submittals:
  - 1. Analytical laboratory sample results and material Certifications for all imported soil and granular materials (“borrow”).
  - 2. Contractor's Waste Material Disposal Plan.
  - 3. Weight tickets from the Borrow Material Supplier.
  - 4. Proposed methods for dewatering and construction water management.
  - 5. Analytical laboratory sample results for all waste materials.
  - 6. Copies of manifests for all waste materials disposed of off-site.

**1.4 JOB SITE ADMINISTRATION**

- A. In accordance with Article 2 of the General Conditions, provide a competent supervisory representative with full authority to act for the Contractor at the site.

- B. If at any time operations under the representative's supervision do not comply with this Section, or the representative is otherwise unsatisfactory to the Owner, replace, if requested by the Owner, said representative with another representative satisfactory to the Owner. There shall be no change in superintendent without the Owner's approval.
- C. Remove from the Work any employee of the Contractor or any Subcontractor when so directed by the Owner. The Owner may request the removal of any employee who does not comply with these specifications.

**1.5 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

**1.6 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.

**1.7 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.

**1.8 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.

**1.9     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 Environmental Health and Safety (EH&S) 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 EH&S prior to disposal of any on-site disposal.

**1.10    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/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 EH&S 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 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 safety codes.
- 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 rope 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 by using vacuum, pump, sorbents, or shovel 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 picked up with a shovel 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 sorbents 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 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 provided in Appendix B.

**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 response personnel (e.g., ambulance, police) have been notified.
  - 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.
  - d. Ensure that fires are safely extinguished (if possible), valves closed, and other immediate actions necessary to mitigate the emergency, 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 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 Environmental Health and Safety (EH&S), 607.255.8200, within 24 hours of reporting the release. The Contractor will be expected to provide EH&S 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**

<b>CRITERIA</b>	<b>DESCRIPTION</b>
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 the soil or groundwater or onto surface water.

A release of a “reportable quantity”<sup>1</sup> 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”<sup>2</sup> of oil to navigable waters must be reported to the federal **National Response Center, 1-800-424-8802**.

**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 or 1-202-426-2675.
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.

<sup>(1)</sup>*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.

<sup>(2)</sup>*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 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 and building demolition.
  - 1. City of Ithaca building permit applications shall be presented for review at the regularly scheduled Owner's meeting with the Authority Having Jurisdiction (AHJ).
- B. For any projects which include demolition of a structure or load-bearing elements of a structure, the Contractor is required to complete a "Notification of Demolition and Renovation" and provide this notification to the United State 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 the City of Ithaca.
- 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, pavement cuts and repairs.

**1.3 COMPLIANCE**

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

**1.4     OWNER'S REQUIREMENTS**

- A.   The Contractor, Subcontractors, and employees of the Contractor and Subcontractors shall comply with all regulations governing conduct, access to the premises, operation of equipment and systems, and conduct while in or near the premises and shall perform the Work in such a manner as not to unreasonably interrupt or interfere with the conduct of business of the Owner.
- B.   Upon completion of the project, the Contractor agrees to provide the Owner with a summary of municipal permit fees paid. This shall include the name of the permits secured, the permit fees paid by the Contractor and a copy of the permit. If no permit fees were required, the Contractor shall so state, in writing, upon completion of the project.

**2.0     PRODUCTS – NOT USED**

**3.0     EXECUTION – NOT USED**

**\*\*\*END OF SECTION 01 41 00\*\*\***

**SECTION 01 42 00    REFERENCES**

**1.0    GENERAL**

**1.1    INTENT OF CONTRACT DOCUMENTS**

- A. Notes or instructions shown on any one Drawing, apply where applicable, to all other Drawings.
- B. All references to codes, specifications and standards referred to in the Specification Sections and on the Drawings shall mean, and are intended to be, the latest edition, amendment and/or revision of such reference standard in effect as of the date of these Contract Documents.
- C. Install All Work in Compliance with:
  - 1. NYS Uniform Code
    - a. International Building Code
    - b. International Residential Code
    - c. International Existing Building Code
    - d. International Fire Code
    - e. International Plumbing Code
    - f. International Mechanical Code
    - g. International Fuel Gas Code
    - h. International Property Maintenance Code
    - i. Uniform Code Supplement
  - 2. NYS Energy Code
    - a. International Energy Conservation Code
    - b. ASHRAE 90.1
    - c. Energy Code Supplement
  - 3. National Electric Code
  - 4. Occupational Safety and Health Administration (OSHA).
  - 5. Life Safety Code NFPA 101.
  - 6. All local ordinances
  - 7. Plans and Specifications in excess of code requirements and not contrary to same.

**1.2     RELATED DOCUMENTS**

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

**1.3     DEFINITIONS**

- A. “General”: Basic Contract definitions are included in the Conditions of the Contract.
- B. “Contract Documents”: The Contract Documents consist of the Agreement between Owner and Contractor, General Conditions, General Requirements, Drawings, Specifications, addenda issued before execution of the Agreement, other documents listed in the Agreement, and modifications issued after execution of the Agreement.
- C. “The Contract”: The Contract Documents form the Contract for construction and represent the entire integrated Agreement between the Owner and Contractor.
- D. “The Work”: The work comprises the completed construction required by the Contract Documents and includes all labor necessary to produce such construction and all materials and equipment incorporated in such construction.
- E. “Owner”: Cornell University a New York corporation.
- F. “Architect/Engineer”: The Architect or Engineer is the person lawfully licensed to practice architecture and/or engineering in the state of New York, identified as such in the Owner Contractor Agreement, and is referred to throughout the Contract Documents as if singular in number. The terms Architect and/or Engineer mean the Architect and/or his authorized representative.
- G. “Contractor”: The Contractor, person, firm, or corporation with whom the Construction Agreement contract is made by Owner.
- H. “Subcontractor”: A person, firm, or corporation, supplying labor and/or materials for work at site of the project for and under separate contract or agreement with Contractor.
- I. “Delegated Design” describes a collaboration between a design professional and contractor (or subcontractor) where the contractor assumes allocated responsibility for an element or portion of the Project’s design. Delegated design allocation and assignment may occur in any project delivery method and will involve a licensed professional to perform the design. The Contractor or Subcontractor allocated an element or portion of the Project’s design, will submit its engineered, stamped plans to the primary design team, who will check for any conflicts with any other aspect of the Work and make new documents to be included in the Project’s design record. Contractor or Subcontractor allocated a delegated design element of the Project shall provide professional liability insurance for the design work in such amounts and as is required by Owner.
- J. “As Approved” or “Approved”: Architect’s or Owner’s approval.
- K. “As Directed”: Owner’s direction or instruction. Other terms including "requested," "authorized," "selected," "required," and "permitted" have the same meaning as "directed."

- L. “Indicated”: Requirements expressed by graphic representations or in written form on Drawings, in Specifications, and in other Contract Documents. Other terms including "shown," "noted," "scheduled," and "specified" have the same meaning as “indicated.”
- M. “Regulations”: Laws, ordinances, statutes, and lawful orders issued by authorities having jurisdiction, and rules, conventions, and agreements within the construction industry that control performance of the Work.
- N. “Furnish”: Supply and deliver to Project site, ready for unloading, unpacking, assembly, installation, and similar operations.
- O. "Install": Operations at Project site including unloading, temporarily storing, unpacking, assembling, erecting, placing, anchoring, applying, working to dimension, finishing, curing, protecting, cleaning, and similar operations.
- P. “Reinstall”. To place back into a former position.
- Q. “Replace”. Provide a substitute for.
- R. “Provide”: Furnish and install, complete and ready for the intended use.
- S. “Concealed”: Work installed in pipe shafts, chases or recesses, behind furred walls, above ceilings, either permanent or removable.
- T. “Exposed”: All capital Work not identified as concealed.
- U. “Project Site”: Space available for performing construction activities. The extent of Project site is shown on Drawings and may or may not be identical with the description of the land on which Project is to be built.
- V. “As-Built Documents”: Drawings and other records that are maintained by the Contractor to record all conditions which exist when the building construction is completed. This includes both the elements of the project itself and existing elements that are encountered during the course of project construction.
- W. “Record Drawings”: Shows construction changes in the project and the final location of all services, lines, outlets, and connections including underground and concealed items. The “record” drawings shall be compiled by the Architect based on the working as-built drawings and revised in accordance with the marked up drawings submitted by the Contractor.
- X. “Shop Drawings”: Drawings, diagrams, illustrations, charts, brochures, and other data that are prepared by Contractor or any Subcontractor, manufacturer, supplier or distributor, for some portion of the work.
- Y. “Samples”: Physical examples furnished to illustrate materials, equipment or workmanship, and to establish standards by which the work will be judged.
- Z. “General Conditions”: The standardized contractual provisions describing the responsibilities, rights and relationships of the Owner and Contractor under the construction contract.

- AA. "Contract Limit Lines": A limit line or perimeter line established on the drawings or elsewhere in the contract documents defining the boundaries of the site available to the contractor for construction purposes.
- BB. "to do", "provide", "furnish", "install", etc., in these Specifications or on Drawings are directions given to the Contractor.

#### **1.4 OWNER AGREEMENTS**

- A. Cornell University and the Tompkins-Cortland Counties Building Trades Council, Maintenance Division have entered into an agreement. The local unions which are members of the Tompkins-Cortland Counties Building Trades Council, Maintenance Division are as follows:

Local #241 - International Brotherhood of Electrical Workers  
Local #267 - United Association of Plumbers and Steamfitters  
Local #281 - United Brotherhood of Carpenters  
Local #3NY - International Union of Bricklayers and Allied Craftworkers  
Local #178 - International Union of Painters and Allied Trades  
Local #112 - International Brotherhood of Sheetmetal Workers  
Local #785 - Laborers International Union of North America

The definition of craft maintenance as applied to this agreement shall be as follows:

All work associated with the demolition, repair, replacement, improvement to or construction of equipment, buildings, structures, utilities, and/or system or components thereof. Craft maintenance for trades assistants shall be limited to work assigned to individuals employed as building trade laborers and which directly assists the craft work performed by other employees covered by this agreement; the Employer is free to assign such work; provided, however, such assignment does not fall within the craft performed by other employees covered by this agreement.

#### **1.5 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 <a href="http://www.access-board.gov">www.access-board.gov</a>	(800) 872-2253 (202) 272-0080
CFR	Code of Federal Regulations Available from Government Printing Office <a href="http://www.gpoaccess.gov/cfr/index.html">www.gpoaccess.gov/cfr/index.html</a>	(866) 512-1800 (202) 512-1800
FS	Federal Specification Available from Department of Defense Single Stock Point <a href="http://dodssp.daps.dla.mil">http://dodssp.daps.dla.mil</a>  Available from Defense Standardization Program <a href="http://www.dps.dla.mil">www.dps.dla.mil</a>  Available from General Services Administration <a href="http://www.gsa.gov">www.gsa.gov</a>  Available from National Institute of Building Sciences <a href="http://www.nibs.org">www.nibs.org</a>	(215) 697-6257       (202) 619-8925   (202) 289-7800
UFAS	Uniform Federal Accessibility Standards Available from Access Board <a href="http://www.access-board.gov">www.access-board.gov</a>	(800) 872-2253 (202) 272-0080

## **1.6 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) <a href="http://www.aluminum.org">www.aluminum.org</a>	(703) 358-2960
AAADM	American Association of Automatic Door Manufacturers <a href="http://www.aaadm.com">www.aaadm.com</a>	(216) 241-7333
AABC	Associated Air Balance Council <a href="http://www.aabchq.com">www.aabchq.com</a>	(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.agas.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 <a href="http://www.crsi.org">www.crsi.org</a>	(847) 517-1200
CSI	Cast Stone Institute <a href="http://www.caststone.org">www.caststone.org</a>	(770) 972-3011
CSI	Construction Specifications Institute (The) <a href="http://www.csinet.org">www.csinet.org</a>	(800) 689-2900 (703) 684-0300
CSSB	Cedar Shake & Shingle Bureau <a href="http://www.cedarbureau.org">www.cedarbureau.org</a>	(604) 820-7700
CTI	Cooling Technology Institute <a href="http://www.cti.org">www.cti.org</a>	(281) 583-4087
DHI	Door and Hardware Institute <a href="http://www.dhi.org">www.dhi.org</a>	(703) 222-2010
EIA	Electronic Industries Alliance <a href="http://www.eia.org">www.eia.org</a>	(703) 907-7500
EIMA	EIFS Industry Members Association <a href="http://www.eima.com">www.eima.com</a>	(800) 294-3462 (770) 968-7945
EJCDC	Engineers Joint Contract Documents Committee <a href="http://www.ejdc.org">www.ejdc.org</a>	(703) 295-5000
EJMA	Expansion Joint Manufacturers Association, Inc. <a href="http://www.ejma.org">www.ejma.org</a>	(914) 332-0040
ESD	ESD Association <a href="http://www.esda.org">www.esda.org</a>	(315) 339-6937
FMG	FM Global <a href="http://www.fmglobal.com">www.fmglobal.com</a>	(401) 275-3000
FSA	Fluid Sealing Association <a href="http://www.fluidsealing.com">www.fluidsealing.com</a>	(610) 971-4850
FSC	Forest Stewardship Council <a href="http://www.fsc.org">www.fsc.org</a>	49 228 367 66 0
GA	Gypsum Association <a href="http://www.gypsum.org">www.gypsum.org</a>	(202) 289-5440
GANA	Glass Association of North America <a href="http://www.glasswebsite.com">www.glasswebsite.com</a>	(785) 271-0208
GS	Green Seal <a href="http://www.greenseal.org">www.greenseal.org</a>	(202) 872-6400

GSI	Geosynthetic Institute <a href="http://www.geosynthetic-institute.org">www.geosynthetic-institute.org</a>	(610) 522-8440
HI	Hydraulic Institute <a href="http://www.pumps.org">www.pumps.org</a>	(888) 786-7744 (973) 267-9700
HI	Hydronics Institute <a href="http://www.gamanet.org">www.gamanet.org</a>	(908) 464-8200
HPVA	Hardwood Plywood & Veneer Association <a href="http://www.hpva.org">www.hpva.org</a>	(703) 435-2900
HPW	H. P. White Laboratory, Inc. <a href="http://www.hpwhite.com">www.hpwhite.com</a>	(410) 838-6550
IBR	Institute of Boiler & Radiation Manufacturers	
ICEA	Insulated Cable Engineers Association, Inc. <a href="http://www.icea.net">www.icea.net</a>	(770) 830-0369
ICRI	International Concrete Repair Institute, Inc. <a href="http://www.icri.org">www.icri.org</a>	(847) 827-0830
IEC	International Electrotechnical Commission <a href="http://www.iec.ch">www.iec.ch</a>	41 22 919 02 11
IEEE	Institute of Electrical and Electronics Engineers, Inc. (The) <a href="http://www.ieee.org">www.ieee.org</a>	(212) 419-7900
IESNA	Illuminating Engineering Society of North America <a href="http://www.iesna.org">www.iesna.org</a>	(212) 248-5000
IEST	Institute of Environmental Sciences and Technology <a href="http://www.iest.org">www.iest.org</a>	(847) 255-1561
IGCC	Insulating Glass Certification Council <a href="http://www.igcc.org">www.igcc.org</a>	(315) 646-2234
IGMA	Insulating Glass Manufacturers Alliance <a href="http://www.igmaonline.org">www.igmaonline.org</a>	(613) 233-1510
ILI	Indiana Limestone Institute of America, Inc. <a href="http://www.iliai.com">www.iliai.com</a>	(812) 275-4426
ISO	International Organization for Standardization <a href="http://www.iso.ch">www.iso.ch</a>	41 22 749 01 11
	Available from ANSI <a href="http://www.ansi.org">www.ansi.org</a>	(202) 293-8020

ISSFA	International Solid Surface Fabricators Association <a href="http://www.issfa.net">www.issfa.net</a>	(877) 464-7732 (702) 567-8150
ITS	Intertek <a href="http://www.intertek.com">www.intertek.com</a>	(800) 345-3851 (713) 407-3500
ITU	International Telecommunication Union <a href="http://www.itu.int/home">www.itu.int/home</a>	41 22 730 51 11
KCMA	Kitchen Cabinet Manufacturers Association <a href="http://www.kcma.org">www.kcma.org</a>	(703) 264-1690
LMA	Laminating Materials Association (Now part of CPA)	
LPI	Lightning Protection Institute <a href="http://www.lightning.org">www.lightning.org</a>	(800) 488-6864 (804) 314-8955
MBMA	Metal Building Manufacturers Association <a href="http://www.mbma.com">www.mbma.com</a>	(216) 241-7333
MFMA	Maple Flooring Manufacturers Association, Inc. <a href="http://www.maplefloor.org">www.maplefloor.org</a>	(847) 480-9138
MFMA	Metal Framing Manufacturers Association <a href="http://www.metalframingmfg.org">www.metalframingmfg.org</a>	(312) 644-6610
MHIA	Material Handling Industry of America <a href="http://www.mhia.org">www.mhia.org</a>	(800) 345-1815 (704) 676-1190
MIA	Marble Institute of America <a href="http://www.marble-institute.com">www.marble-institute.com</a>	(440) 250-9222
MPI	Master Painters Institute <a href="http://www.paintinfo.com">www.paintinfo.com</a>	(888) 674-8937
MSS	Manufacturers Standardization Society of The Valve and Fittings Industry Inc. <a href="http://www.mss-hq.com">www.mss-hq.com</a>	(703) 281-6613
NAAMM	National Association of Architectural Metal Manufacturers <a href="http://www.naamm.org">www.naamm.org</a>	(312) 332-0405
NACE	NACE International (National Association of Corrosion Engineers International) <a href="http://www.nace.org">www.nace.org</a>	(800) 797-6623 (281) 228-6200
NADCA	National Air Duct Cleaners Association <a href="http://www.nadca.com">www.nadca.com</a>	(202) 737-2926

NAIMA	North American Insulation Manufacturers Association <a href="http://www.naima.org">www.naima.org</a>	(703) 684-0084
NBGQA	National Building Granite Quarries Association, Inc. <a href="http://www.nbgqa.com">www.nbgqa.com</a>	(800) 557-2848
NCAA	National Collegiate Athletic Association (The) <a href="http://www.ncaa.org">www.ncaa.org</a>	(317) 917-6222
NCMA	National Concrete Masonry Association <a href="http://www.ncma.org">www.ncma.org</a>	(703) 713-1900
NCPI	National Clay Pipe Institute <a href="http://www.ncpi.org">www.ncpi.org</a>	(262) 248-9094
NCTA	National Cable & Telecommunications Association <a href="http://www.ncta.com">www.ncta.com</a>	(202) 775-3550
NEBB	National Environmental Balancing Bureau <a href="http://www.nebb.org">www.nebb.org</a>	(301) 977-3698
NECA	National Electrical Contractors Association <a href="http://www.necanet.org">www.necanet.org</a>	(301) 657-3110
NeLMA	Northeastern Lumber Manufacturers' Association <a href="http://www.nelma.org">www.nelma.org</a>	(207) 829-6901
NEMA	National Electrical Manufacturers Association <a href="http://www.nema.org">www.nema.org</a>	(703) 841-3200
NETA	International Electrical Testing Association <a href="http://www.netaworld.org">www.netaworld.org</a>	(888) 300-6382 (303) 697-8441
NFHS	National Federation of State High School Associations <a href="http://www.nfhs.org">www.nfhs.org</a>	(317) 972-6900
NFPA	NFPA (National Fire Protection Association) <a href="http://www.nfpa.org">www.nfpa.org</a>	(800) 344-3555 (617) 770-3000
NFRC	National Fenestration Rating Council <a href="http://www.nfrc.org">www.nfrc.org</a>	(301) 589-1776
NGA	National Glass Association <a href="http://www.glass.org">www.glass.org</a>	(866) 342-5642 (703) 442-4890
NHLA	National Hardwood Lumber Association <a href="http://www.natlhardwood.org">www.natlhardwood.org</a>	(800) 933-0318 (901) 377-1818
NLGA	National Lumber Grades Authority <a href="http://www.nlga.org">www.nlga.org</a>	(604) 524-2393



NOFMA	NOFMA: The Wood Flooring Manufacturers Association <a href="http://www.nofma.org">www.nofma.org</a>	(901) 526-5016
NRCA	National Roofing Contractors Association <a href="http://www.nrca.net">www.nrca.net</a>	(800) 323-9545 (847) 299-9070
NRMCA	National Ready Mixed Concrete Association <a href="http://www.nrmca.org">www.nrmca.org</a>	(888) 846-7622 (301) 587-1400
NSF	NSF International (National Sanitation Foundation International) <a href="http://www.nsf.org">www.nsf.org</a>	(800) 673-6275 (734) 769-8010
NSSGA	National Stone, Sand & Gravel Association <a href="http://www.nssga.org">www.nssga.org</a>	(800) 342-1415 (703) 525-8788
NTMA	National Terrazzo & Mosaic Association, Inc. (The) <a href="http://www.ntma.com">www.ntma.com</a>	(800) 323-9736 (540) 751-0930
NYBFU	New York Board of Fire Underwriters <a href="http://www.nybfu.org">www.nybfu.org</a>	(212) 227-3700
PCI	Precast/Prestressed Concrete Institute <a href="http://www.pci.org">www.pci.org</a>	(312) 786-0300
PDCA	Painting & Decorating Contractors of America <a href="http://www.pdca.com">www.pdca.com</a>	(800) 332-7322 (314) 514-7322
PDI	Plumbing & Drainage Institute <a href="http://www.pdionline.org">www.pdionline.org</a>	(800) 589-8956 (978) 557-0720
PGI	PVC Geomembrane Institute <a href="http://pgi-tp.ce.uiuc.edu">http://pgi-tp.ce.uiuc.edu</a>	(217) 333-3929
PLANET	Professional Landcare Network <a href="http://www.landcarenetwork.org">www.landcarenetwork.org</a>	(800) 395-2522
PTI	Post-Tensioning Institute <a href="http://www.post-tensioning.org">www.post-tensioning.org</a>	(602) 870-7540
RCSC	Research Council on Structural Connections <a href="http://www.boltcouncil.org">www.boltcouncil.org</a>	(800) 644-2400 (312) 670-2400
RFCI	Resilient Floor Covering Institute <a href="http://www.rfci.com">www.rfci.com</a>	(301) 340-8580
RIS	Redwood Inspection Service <a href="http://www.calredwood.org">www.calredwood.org</a>	(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.smpete.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.tilerroofing.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 01500.
      - 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 01410.
  - 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 e-Builder to track non-conforming materials or sub-standard workmanship identified by Owner's Representative.

**2.0     PRODUCTS – NOT USED**

**3.0     EXECUTION – NOT USED**

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



**SECTION 01 50 00 TEMPORARY FACILITIES AND CONTROLS**

**1.0 GENERAL**

**1.1 DESCRIPTION**

- A. The Contractor shall furnish, install and maintain all temporary facilities and services of every kind, as required by the Contractor and by its subcontractors for their performance of the Work and compliance with the Contract Documents, and shall remove such facilities and complete such services upon the completion of all other work, or as Cornell University may direct.
- B. The Contractor shall obtain all required permits and approvals for and shall provide, construct, or install, as well as operate, maintain, service and remove temporary facilities and services.

**1.2 REQUIREMENTS OF REGULATORY AGENCIES**

- A. Comply with Federal, State and local codes and safety regulations.

**2.0 PRODUCTS**

**2.1 MATERIALS, GENERAL**

- A. Choice of materials, as suitable for the accomplishment of the intended purpose, is the Contractor's option.
- B. Materials may be new or used, but must not violate requirements of applicable codes, standards and specifications.

**2.2 TEMPORARY FIRST AID FACILITIES**

- A. Provide first aid equipment and supplies, with qualified personnel continuously available to render first aid at the site.
- B. Provide a sign, posted at the telephone, listing the telephone numbers for emergency medical services: Physicians, ambulance services and hospitals.

**2.3 TEMPORARY FIRE PROTECTION**

- A. Provide a fire protection and prevention program for employees and personnel at the site. Any fire watches as a result of construction operations are the responsibility of the Contractor. Comply with NFPA 241. Develop, manage, and supervise an overall fire-prevention and -protection program for personnel at Project site. Review needs with local fire department 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 in most cases.
    - 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 to local Authority Having Jurisdiction, FM Global, Ithaca Fire Department Officers, Building Manager, Maintenance Manager, and Customer Service.
      - Fire Watch will be required and will need the Fire Watch Person’s name and contact information. Cornell EH&S does not perform the fire watch, it is the responsibility of the Contractor.
- 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, siamese connections, standpipes, temporary fire-protection facilities, stairways, and other access routes for firefighting.
  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 placed into operation and use.

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 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 Environmental Health & Safety.
- F. Advise Cornell University Environmental Health & Safety of any items affecting Life Safety, e.g., 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 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.

**2.9 PROJECT IDENTIFICATION AND SIGNS**

- A. No Contractor signs to be displayed at the project site, unless authorized by the Owner.
- B. Owner Construction Project Sign. The Contractor shall install Owner provided project identification signage.

**2.10 SECURITY**

- A. The Contractor shall provide security services as required to protect the interests of the Owner.

**2.11 FIELD OFFICES**

- A. The Owner shall designate a space within the facility to serve as a field office for the use of the Contractor and Owner.

**3.0 EXECUTION**

**3.1 PREPARATION**

- A. Consult with Owner, review site conditions and factors which affect construction procedures and temporary facilities, including adjacent properties and public facilities which may be affected by execution of the work.
  - 1. Designate the locations and extent of temporary construction, storage, and other temporary facilities and controls required for the expeditious accomplishment of the Work.
  - 2. Allow space for use of the site by Owner and by other contractors, as required by Contract Documents.

**3.2 GENERAL**

- A. Comply with applicable requirements specified in sections of Division 02 through 40.
- B. Make work structurally, mechanically and electrically sound throughout.
- C. Install work in a neat and orderly manner.
- D. Maintain, clean, service and repair facilities to provide continuous usage, and to the quality specified for the original installation.
- E. Relocate facilities as required by progress of construction, by storage or work requirements, and to accommodate requirements of Owner and other contractors employed at the site.
- F. Keep the site, at all times during the progress of the Work, free from accumulation of waste matter or rubbish and shall confine its apparatus, materials and operations of its workers to the limits prescribed except as the latter may be extended with the approval of the Owner's Representative. Cleaning of the structure or structures must be performed daily and removal of waste matter or rubbish must be performed at least once a week.
- G. Contractor shall at all times keep access road and public roads clean of mud and construction debris and maintain dust control to the satisfaction of the Owner.

**3.3 REMOVAL**

- A. Completely remove temporary structures, materials, equipment and services:
  - 1. When construction needs can be met by use of permanent construction.
  - 2. At completion of the Project.
- B. Repair damage caused by installation or use of temporary facilities. Clean after removal.



- C. Restore existing or permanent facilities used for temporary purposes to specified, or to original condition.
  - 1. Remove foundations and underground installations for temporary construction and utilities.
  - 2. Grade the areas of the site affected by temporary installations to required elevations and slopes, and clean the area.

**\*\*\*END OF SECTION 01 50 00\*\*\***



**SECTION 01 51 00 TEMPORARY UTILITIES**

**1.0 GENERAL**

**1.1 DESCRIPTION**

- A. The Contractor shall furnish, install and maintain temporary utilities required by all trades for construction. Remove on completion of Work.
- B. The Contractor shall provide all labor and materials for temporary connections and distribution.

**1.2 REQUIREMENTS OF REGULATORY AGENCIES**

- A. Comply with National Electric Code, current edition.
- B. Comply with Federal, State and local codes and safety regulations and with utility company requirements.

**2.0 PRODUCTS**

**2.1 MATERIALS, GENERAL**

- A. Materials may be new or used, but must be adequate in capacity for the required usage, must not create unsafe conditions, and must not violate requirements of applicable codes and standards.

**2.2 TEMPORARY ELECTRICITY, LIGHTING AND WATER**

- A. The Contractor shall have access to the Owner's water and electric power for constructing the Work. Temporary utility connections shall be made by the Contractor as close to its operations as possible as long as such connections do not over-load the capacity of the Owner's utilities or interfere with its customary utilization thereof. Utility access points shall be determined in cooperation with and acceptable to the Owner.
- B. The Contractor shall be responsible for the economic use of the Owner's Water and Power. The Owner will pay for the water and power consumed in the construction of the Work as long as economical usage of these utilities is maintained. The Owner reserves the right to meter and charge for the power and water consumed if in the opinion of the Owner the usage of these utilities is not economically conducted by the Contractor. In such an event, the Owner shall give three (3) days written notice to the Contractor of its intentions to meter and charge for temporary utilities used by the Contractor.
- C. All temporary power systems including wiring shall be removed by the Contractor when no longer required.

- D. The minimum temporary lighting to be provided is at the rate of fifty foot candles, is to be maintained in each room and changed as required when interior walls are being erected. The required temporary lighting must be maintained for twenty-four (24) hours a day and seven (7) days a week at all stair levels and in all corridors below ground; in any and all egress; in all other spaces temporary lighting is to be maintained only during working hours. All temporary wiring and equipment shall be in conformity with the National Electric Code.
- E. The minimum temporary outdoor security lighting to be provided is as follows:
  - 1. Along the perimeter of the site fence, consisting of vandal-resistant light fixtures with HID lamps, located 150 foot center, mounted on the inside of the construction fence.
  - 2. Lighting for temporary pedestrian paths and roadways, to provide a minimum of 0.1 foot-candle on the path of travel.
- F. Three-phase temporary power circuits shall be installed as required to operate construction equipment of the various trades and to install and test equipment such as pumps and elevators. The Contractor shall install and maintain temporary or permanent service for the permanently installed building equipment such as sump pumps, boilers, boiler controls, fans, pumps, so that such equipment may be operated when required and so ordered by the Owner's Representative for drainage or for temporary heat.
- G. Except as otherwise provided in the Contract, the Contractor shall submit to the Owner or the Owner's Representative for approval a proposed schedule of all utility shutdowns and cutovers of all types which may be required in connection with the Work. Such schedule shall provide a minimum of four (4) weeks advance notice to the Owner prior to the time of the proposed shutdown and cutover. The Contractor shall be responsible for all charges relating to shutdowns.
- H. Discontinuance, Changes and Removal  
  
The Contractor shall:
  - 1. Discontinue all temporary services required by the Contract when so directed by the Owner or the Owner's Representative. The discontinuance of any such temporary service prior to the completion of the Work shall not render the Owner liable for any additional cost entailed thereby.
  - 2. Remove and relocate such temporary facilities as directed by the Owner or the Owner's Representative, and shall restore the Site and the Work to a condition satisfactory to the Owner.

### **2.3 TEMPORARY USE OF ELEVATOR**

- A. Use of Existing Elevator
  - 1. If the Contractor elects to use the existing elevator equipment, the Contractor shall:
    - a. Provide adequate protection for such equipment and shall operate such equipment within a capacity not to exceed that allowed by law, rule or regulation.

- b. Provide for the maintenance and cleaning of the elevator equipment as approved by the Owner's Representative.
- c. Prior to start of construction, accurately record the condition of the existing elevator. Promptly repair or replace items that are damaged as a result of Contractor's use. Service calls that arise as a result of Contractor misuse will be charged to the Contractor. At Substantial Completion, restore elevators to condition existing before initial use.
- d. Use only elevators designated by Owner's Representative at dates and times designated by Owner's Representative. Dates and times available for Contractor's use shall be scheduled with, and at the convenience of, the Owner, and may vary during the course of the Project.
- e. Owner will not provide elevator operators or other monitoring of elevator use.
- f. Do not load elevators beyond their rated weight capacity.
- g. Provide code compliant protective coverings, barriers, devices, signs, or other procedures to protect elevator car and entrance doors and frame. If, despite such protection, elevators become damaged, engage elevator maintenance contractor to restore damaged work so no evidence remains of correction work. Return items that cannot be refinished in field to the shop, make required repairs and refinish entire unit, or provide new units as required.
- h. Procure and coordinate the elevator maintenance contractor to gain access to the elevator shaft as required to complete the work

#### **2.4 TEMPORARY HEAT AND VENTILATION**

- A. The Contractor shall furnish temporary heat as may be necessary for constructing the Work.
- B. The Contractor will be permitted to use the building's permanent heating system for temporary heat. Permission to use the building's permanent heating system shall in no way constitute the Owner's acceptance of that portion of the Work.
- C. When using the permanent building systems for space conditioning, provide a written maintenance plan for acceptance by the Owner's Representative, prior to utilizing the equipment. Plan to address temporary filtering of air and water, sealing of open ducts, lubrication, operation outside of normal ranges, and controls/safeties. Return all equipment to its newly installed condition prior to acceptance testing.
  - 1. If the Contractor elects to use the building's permanent heating system for temporary heat, the Contractor shall provide filters with a minimum MERV of 8 at each return-air grille in system, maintain to keep them free of dust and debris, replace if necessary and remove at end of construction and clean HVAC system as required in Section 01 77 00 – Project Closeout.
- D. Any temporary system shall be removed when no longer required.
- E. During heating cycles the enclosures separating the interior building areas from outside shall be maintained closed to conserve heat energy.

- F. The Contractor shall provide for ventilation of all structures until Physical Completion of the Work and shall control such ventilation to avoid excessive moisture levels and rates of drying of construction materials, including but not limited to concrete and to plaster, and to prevent condensation on sensitive surfaces. The Contractor shall be responsible for any moisture intrusion that is detrimental to the Project.

**2.5 TEMPORARY CONTRACTOR TELEPHONE SERVICE**

- A. Site Superintendent or their Representative shall carry a cellular telephone at all times.
- B. Provide phone number to Cornell project representatives for communication during Work.

**2.6 TEMPORARY SANITARY FACILITIES**

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

**3.0 EXECUTION**

**3.1 REMOVAL**

- A. Completely remove temporary materials and equipment when their use is no longer required.
- B. Clean and repair damage caused by temporary installations or use of temporary facilities.
- C. Restore existing and permanent facilities used for temporary services to specified, or to original, condition.

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

**SECTION 01 51 23    HEAT DURING CONSTRUCTION**

**1.0    GENERAL**

**1.1    DESCRIPTION**

- A. The Contractor shall maintain existing or temporary building heating systems to accomplish the following:
  - 1. Protect the existing facility and facility plumbing systems against damage due to cold temperatures.
  - 2. Provide sufficient heat so that the Work can be accomplished in accordance with the Contract Documents.
  - 3. Maintain construction schedules as required by the Contract.
- B. Include in the bid price an amount necessary to provide Construction Heat as required.
- C. Existing central steam systems may be used to the extent that they do not interfere with the safe and effective completion of Work. However, any modifications to existing systems shall be corrected prior to the conclusion of work.
- D. No natural gas is available to the facility for temporary heat.
- E. At the conclusion of the project the facility heating systems shall be returned to functional order as necessary to protect the building and facility plumbing systems.

**1.2    RESPONSIBILITY**

- A. The Contractor shall include in the bid the cost of the temporary heat.
- B. The Contractor shall be responsible for repairs to the facility necessitated by the failure to provide heat during any portion of the Work.

**2.0    PRODUCTS – NOT USED**

**3.0    EXECUTION – NOT USED**

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





**SECTION 01 66 00    STORAGE AND PROTECTION**

**1.0    GENERAL**

**1.1    DESCRIPTION**

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

**1.2    TRANSPORTATION AND HANDLING**

- A.    Transport and handle products in accordance with manufacturer's instructions; using means and methods that will prevent damage, deterioration, and loss, including theft.
- B.    Schedule delivery to minimize long-term storage at Project site and to prevent overcrowding of construction space.
- C.    Coordinate delivery with installation time to ensure minimum holding time for items that are flammable, hazardous, easily damaged, or sensitive to deterioration, theft, and other losses.
- D.    Deliver products to Project site in an undamaged condition in manufacturer's original sealed container or other packaging system, complete with labels and instructions for handling, storing, unpacking, protecting, and installation.
- E.    Promptly inspect shipments to assure that products comply with requirements, quantities are correct and products are undamaged.
- F.    Provide equipment and personnel to handle products by methods to prevent soiling, disfigurement or damage.

**1.3    ON-SITE STORAGE**

- A.    Materials stored on the Site shall be neatly piled and protected, and shall be stored in a neat and orderly manner in locations that shall not interfere with the progress of the Work or with the daily functioning of the Institution.
- B.    Materials subject to weather damage shall be protected against the weather by floored weatherproof temporary storage sheds.
- C.    Comply with product manufacturer's written instructions for temperature, humidity, ventilation, and weather-protection requirements for storage.
- D.    Storage piles and sheds shall be located within the area designated as the Staging Area. The Contractor shall work to insure 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 / PALM ROAD STORAGE**

- A. All property including construction materials and equipment stored at the Palm Road 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 Palm Road 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 Palm Road 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 Palm Road 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 Palm Road 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. Signs customized for the project shall be ordered from Ithaca Plastics, Inc., 305 West Green Street, Ithaca, New York 14850, Phone - 607.272.8232, Fax - 607.277.2579, Email – db@ithacaplastics.com.

**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 window sills 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 with interior lining shall be wrapped at the factory using plastic wrap to exclude moisture and contaminants. The wrapping shall not be removed until immediately prior to installation.

- b. Ductwork shall not be exposed to moisture or contaminants at any point in the manufacturing, shipping, storage or installation process.
- c. Ductwork shall not be staged or stored outside or otherwise exposed to the weather.
- d. Ductwork shall be transported only inside of covered vehicles.
- e. Once installed, ductwork shall be protected from contamination during the construction process.

**1.6 PROTECTION AFTER INSTALLATION**

- A. Protect installed products, including Owner-provided products, and control traffic in immediate area to prevent damage from subsequent operations.
- B. Provide protective coverings at walls, projections, corners, and jambs, sills, and soffits of openings in and adjacent to traffic areas.
- C. Cover walls and floors of elevator cabins, and jambs of cab doors, when elevators are used by construction personnel.
- D. Protect finish floors and stairs from dirt, wear, and damage:
  - 1. Secure heavy sheet goods or similar protective materials in place, in areas subject to foot traffic.
  - 2. Lay planking or similar rigid materials in place, in areas subject to movement of heavy objects.
  - 3. Lay planking or similar rigid materials in place, in areas where storage of products will occur.
- E. Protect waterproofed and roofed surfaces:
  - 1. Restrict use of surfaces for traffic of any kind, and for storage of products.
  - 2. When an activity is mandatory, obtain recommendations for protection of surfaces from manufacturer. Install protection and remove on completion of activity. Restrict use of adjacent unprotected areas.
- F. Restrict traffic of any kind across planted lawn and landscape areas.

**2.0 PRODUCTS – NOT USED**

**3.0 EXECUTION – NOT USED**

**\*\*\*END OF SECTION 01 66 00\*\*\***

**SECTION 01 73 29 CUTTING, PATCHING AND REPAIRING**

**1.0 GENERAL**

**1.1 DESCRIPTION**

- A. The Contractor shall be responsible for all cutting, fitting and patching, including excavation and backfill, required to complete the Work or to:
  - 1. Make its 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 in 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. The Architect shall prepare a Certificate of Substantial Completion, on the basis of an inspection, when the Architect has determined that the work is substantially complete.
3. 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.
4. 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.
  - 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 for a fire standpipe system where a hydrostatic test is required by NFPA 14.

**B. Final Acceptance:**

1. When the items appearing on the report of inspection have been completed or corrected, the Contractor shall so advise the Architect. After receipt of this notification and Contractor's certified list of completed items, the Owner's Representative will inform the Contractor of the date and time of final inspection. A copy of the report of the final inspection containing all remaining contract exceptions, omissions and incomplete work will be furnished to the Contractor.
2. After receipt of notification of completion and all remaining contract exceptions, omissions and incomplete work from the Contractor, the Architect will make an inspection to verify completion of the exception items appearing on the report of final inspection.

**1.2 SUBMITTALS**

- A. Contractor's List of Incomplete Items: Initial punch list submittal at Substantial Completion.**
1. Organize list of spaces in sequential order, starting with exterior areas first and proceeding from lowest floor to highest floor, listing by room or space number. Organize items applying to each space by major element, including categories for individual exterior face elevations, ceilings, individual walls, floors, doors, roof levels, casework, equipment, and building systems.
- B. Contractor's Certified List of Completed Items: Final signed punch list submittal at Final Completion.**
- C. Certificates of Release: Occupancy permits from authorities having jurisdiction.**

**1.3 FINAL CLEAN UP**

- A. Upon completion of the work covered by the Contract the Contractor shall leave the completed Project ready for use and occupancy without the need of further cleaning of any kind and with all Work in new condition and in perfect order. In addition, upon completion of all Work the Contractor shall remove from the vicinity of the Work all plant, buildings, rubbish, unused materials, concrete forms and other materials belonging to him or used under its direction during construction or impairing the use or appearance of the property and shall restore such areas affected by the work to their original condition, and, in the event of its failure to do so, the same shall be removed by the Owner at the expense of the Contractor, and the Contractor and/or its surety shall be liable therefore. Final clean-up shall include but not be limited to the following:
1. All finished surfaces shall be swept, dusted, washed and polished. This includes cleaning of the Work of all finishing trades where needed, whether or not cleaning by such trades is included in their respective sections of the specifications.
  2. Roofs, utility tunnels, manholes and pipe trenches and spaces between the new and existing Work shall be left thoroughly cleaned.
  3. Finished flooring shall be thoroughly cleaned in accordance with the manufacturer's recommendations.
  4. Where the finish of floors has been marred or damaged in any space or area, the entire floor of that space or area shall be refinished as recommended by the manufacturers of the flooring.
  5. All equipment shall be in an undamaged, bright, clean, polished and new appearing condition.
  6. All new glass shall be washed and polished, both sides. The Contractor shall be responsible for all breakage of glass in the area of the Work from the commencement of its activities until the building is turned over to Owner. The Contractor shall replace all broken glass and deliver the entire building with all glazing intact and clean.
  7. Provide new filters for all fan convectors after final cleaning.
  8. Refer to exterior clean up. Remove paint and glazing compound from surfaces.
- B. Clean adjacent structures and improvements of dust, dirt, and debris caused by construction operations. Return adjacent areas to condition existing before construction operations began.
- C. Cleaning of Renovated Duct Systems and Existing Duct Systems in Renovated Areas:
1. Cleaning work shall be performed by firm which has minimum three (3) years' experience in mechanical cleaning of air systems. Work shall be done by skilled mechanics, technicians and experienced supervisors.
  2. Clean dirt, dust and debris from air units, associated equipment air ducts; sanitize same. Cleaning shall include:

- a. Cleaning of air unit's supply, return and exhaust sections including coils, fans, filter racks, outdoor air intake shaft, and interior surfaces.
  - b. Cleaning of dampers, heating coils, humidifiers, and similar devices in ductwork.
  - c. Marking of duct-mounted damper settings, prior to cleaning, and returning dampers to marked positions after cleaning. This includes fire dampers, zone dampers, balancing dampers and volume dampers.
  - d. Cleaning of terminal supply, return and exhaust grilles, registers and diffusers.
  - e. Cutting of access holes in ductwork for cleaning process, as well as sealing and patching of same.
  - f. Removal of portions of duct system which cannot otherwise be thoroughly cleaned, and replacement thereof.
  - g. Sealing of lined duct systems, upon completion.
  - h. Removal and reinstallation of ceiling panels, tiles, ceiling support tracks, and other ceiling construction, as required to facilitate cleaning.
  - i. Providing access doors required to facilitate cleaning.
3. Cleaning shall meet National Air Duct Cleaners Association (NADCA) Standards, capable of verification by NADCA Vacuum Test. Cleanliness shall be subject to Architect's visual review; provide re-cleaning as necessary to satisfy Architect
- a. Cleaning methods may include vacuuming, brushing, mechanical brushing, scraping, or air washing. Use method best suited for locations involved.
  - b. Do NOT use methods which could damage the system or the building.
  - c. Remove dirt, dust, lint and other accumulations by HEPA filtered air machine capable of minimum 6000 cfm. Air machine shall operate to obtain 1250 fpm across the work space. Use brushes, mechanical agitators or air whips to dislodge contaminants to be collected by the air machine.
  - d. Cleaning shall begin at the furthest point of the return system and at the outdoor air intake. Cleaning shall proceed toward the air handling equipment. Cleaning shall finish at the furthest point of the supply ductwork.

**1.4     MAINTENANCE STOCK**

- A. Turn over to Owner's Representative the maintenance stock specified. Contractor shall obtain signed receipt from Owner's Representative for all maintenance stock.

**2.0     PRODUCTS – NOT USED**

**3.0     EXECUTION – NOT USED**

**\*\*\*END OF SECTION 01 77 00\*\*\***



**SECTION 01 78 22    FIXED EQUIPMENT INVENTORY**

**1.0    GENERAL**

**1.1    FIXED EQUIPMENT INVENTORY**

- A. The Owner shall provide the Contractor with a list of Equipment Types to be inventoried and an Excel template.
- B. The Contractor shall populate the template (see Example Equipment List to be inventoried in Section 1.2). Once populated, the Contractor shall electronically return the list to the Owner's Representative. The initial data to be captured on each piece of equipment shall include:
  - 1. Name of Product
  - 2. Equipment Classification
  - 3. Manufacturer
  - 4. Model Number
  - 5. Serial Number
  - 6. Cost
  - 7. Location (including Building and Room Number)
  - 8. Acquisition Date (Date of Installation)
- C. The Owner shall from the Contractor provided data create a follow-up equipment Excel template that contains the MAXIMO ID for the equipment with all the name plate and specification fields for each type of equipment. This template shall then be returned to the Contractor.
- D. The Contractor shall be responsible for the initial labeling of the equipment and its' disconnects with the MAXIMO ID using an electronic label maker. ID labels shall be in close proximity to Equipment Identification information, visually locatable from the access point to the equipment and on the face of disconnects.
- E. The Contractor shall then populate the MAXIMO Equipment Specification Template with the equipment nameplate, specification information, and warranty information. The Contractor shall electronically submit the equipment data and any related documentation (i.e. - O&M manuals) to the Owner's Representative.

**F. EXAMPLE EQUIPMENT LIST**

- Building Equipment
- AC Drive/VSD
- Air Dryer
- Backflow Preventor
- Air Compressor
  - Building
  - Sprinkler
  - Control
  - Vacuum
- Pump
  - Condensate
  - Glycol
  - CWC
  - HWC
  - Potable
  - Sanitary Sewer
  - Storm Sewer
  - Sump
  - Quality Water
  - Fuel
- Fan
  - Exhaust
  - Supply
  - Return
- Fume Hood
- Furnace
- Generator
- Hot Water Heater
- Heat Exchangers
- Boiler
- Tank
- Unit Heater
- Fan Coil
- VAV Box
- Transfer Switch
- Motor
  - Pump
  - Fan
- Lift/Levelers
- Water Softener
- Reverse Osmosis

**2.0 PRODUCTS – NOT USED**

**3.0 EXECUTION – NOT USED**

**\*\*\*END OF SECTION 01 78 22\*\*\***

**SECTION 01 78 23 OPERATING AND MAINTENANCE DATA**

**1.0 GENERAL**

**1.1 DESCRIPTION**

- A. The Contractor shall compile product data and related information appropriate for Owner's maintenance and operation of products furnished under the Contract.
  - 1. Prepare operating and maintenance data as specified in this Section, as referenced in other pertinent sections of Specifications and as necessary to operate the completed work.
  - 2. Operations and maintenance data, in final format, shall be available to the Owner prior to substantial completion.
- B. Instruct Owner's personnel in the maintenance of products and in the operation of equipment and systems.

**1.2 FORM OF SUBMITTALS**

- A. Prepare data in the form of an instructional manual for use by Owner's personnel.
- B. Submit a CD with electronic .pdf files, 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 fly-leaf 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. Submit electronic .pdf files, 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. Submit electronic .pdf files, upload electronic files to ePM system.
- B. Content, for each unit of equipment and system, as appropriate:
  - 1. Description of unit and component parts.
    - a. Function, normal operating characteristics, and limiting conditions.
    - b. Performance curves, engineering data and tests.
    - c. Complete nomenclature and commercial number of all replaceable parts.
  - 2. Operating procedures:
    - a. Start-up, break-in, routine and normal operating instructions.
    - b. Regulation, control, stopping, shut-down and emergency instructions.
    - c. Summer and winter operating instructions.
    - d. Special operating instructions.
  - 3. Maintenance Procedures:
    - a. Routine operations.
    - b. Guide to "trouble-shooting".
    - c. Disassembly, repair and reassembly.
    - d. Alignment, adjusting and checking.
  - 4. Servicing and lubrication required:
    - a. List of lubricants required.
  - 5. Manufacturer's printed operating and maintenance instructions.

6. Description of sequence of operation by control manufacturer.
  7. Original manufacturer's parts list, illustrations, assembly drawings and diagrams required for maintenance.
    - a. Predicted life of parts subject to wear.
    - b. Items recommended to be stocked as spare parts.
  8. As-installed control diagrams by controls manufacturer.
  9. Each contractor's coordination drawings.
    - a. As-installed color coded piping diagrams.
  10. Charts of valve tag numbers, with the location and function of each valve.
  11. List of original manufacturer's spare parts, manufacturer's current prices, and recommended quantities to be maintained in storage.
  12. Other data as required under pertinent sections of Specifications.
- C. Content, for each electric and electronic system, as appropriate:
1. Description of system and component parts:
    - a. Function, normal operating characteristics, and limiting conditions.
    - b. Performance curves, engineering data and tests.
    - c. Complete nomenclature and commercial number of replaceable parts.
  2. Circuit directories of panel boards:
    - a. Electrical service.
    - b. Controls.
    - c. Communications.
  3. As-installed color coded wiring diagrams.
  4. Operating procedures:
    - a. Routine and normal operating instructions.
    - b. Sequences required.
    - c. Special operating instructions.

5. Maintenance procedures:
    - a. Routine operations.
    - b. Guide to "trouble-shooting".
    - c. Disassembly, repair and reassembly.
    - d. Adjustment and checking.
  6. Manufacturer's printed operating and maintenance instructions.
  7. List of original manufacturer's spare parts, manufacturer's current prices, and recommended quantities to be maintained in storage.
  8. Other data as required under pertinent sections of Specifications.
- D. Additional requirements for operations and maintenance data: See the respective sections of Specifications and General Conditions.

#### **1.6 SUBMITTAL REQUIREMENTS**

- A. Submit through ePM system preliminary draft of proposed formats and outlines of contents thirty (30) calendar days after approved submittals.
- B. Submit completed data in final form twenty (20) calendar days prior the Acceptance Phase of the Project.
- C. Submit specified number of copies of approved data in final form prior to final acceptance.

#### **1.7 INSTRUCTIONS OF OWNER'S PERSONNEL**

- A. Prior to final inspections or acceptance, fully instruct Owner's designated operating and maintenance personnel in the operation, adjustment and maintenance of all products, equipment and systems:
  1. Instruction time shall be sufficient to fully instruct all shifts of the Owner's operating and maintenance personnel.
- B. Operations and maintenance shall constitute the basis of instruction:
  1. Review contents of manual with personnel in full detail to explain all aspects of operations and maintenance.
- C. Submit typewritten statement, signed by each of 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. List under clear plastic (1/8" thick) 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 or 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 schedule listing all required warranties.

**2.0     PRODUCTS – NOT USED**

**3.0     EXECUTION**

**3.1     FORM OF SUBMITTALS**

- A.   The Warranties and Bonds shall be in electronic pdf format. Each submission shall include the title of the Project and the name of the Contractor.
- B.   Provide a series of files organized in subdirectories with a summary index with hyperlinks to the various documents and or references.
- C.   Assemble warranties, bonds and service and maintenance contracts, executed by each of the respective manufacturers, suppliers and subcontractors.
- D.   Table of Contents: Neatly typed, in orderly sequence. Provide complete information for each item.
  - 1.   Product or work item.
  - 2.   Item description.
  - 3.   Notation of what the equipment serves (e.g. – Provides perimeter heat)
  - 4.   Warranty Provider. Is the warranty provided by a manufacturer or installer?
  - 5.   Firm, with name of principal and responsible party, address and telephone number.
  - 6.   Scope.
  - 7.   Duration.
    - a.   Date of beginning of warranty, bond or service and maintenance contract
    - b.   End date of warranty, bond or service and maintenance contract.
  - 8.   Provide information for Owner's personnel:
    - a.   Proper procedure in case of failure.
    - b.   Instances which might affect the validity of warranty or bond.
  - 9.   Contractor, name of responsible principal, address and telephone number.

**3.2     TIME OF SUBMITTALS**

- A.    Make final submittals within ten (10) days after Date of Substantial Completion, prior to final request for payment.
- B.    For items of work when acceptance is delayed materially beyond the Date of Substantial Completion, provide updated submittal within ten (10) days after acceptance, listing the date of acceptance as the start of the warranty period.

**\*\*\*END OF SECTION 01 78 36\*\*\***





**SECTION 01 78 39    RECORD DOCUMENTS**

**1.0    GENERAL**

**1.1    DESCRIPTION**

- A.    The Contractor shall maintain at the site, during construction, one record copy of:
  - 1.    Drawings
  - 2.    Specifications
  - 3.    Addenda
  - 4.    Change Orders and other Modifications to the Contract
  - 5.    Architect's Field Orders or written instructions.
  - 6.    Final Shop Drawings, Product Data and Samples
  - 7.    Field Test records
  - 8.    Construction photographs

**1.2    MAINTENANCE OF DOCUMENTS AND SAMPLES**

- A.    Store documents and samples in Contractor's field office apart from documents used for construction.
  - 1.    Provide files and racks for storage of documents.
  - 2.    Provide cabinet or storage space for storage of samples.
- B.    File documents and samples in accordance with Data Filing Format of the Uniform Construction Index.
- C.    Maintain documents in a clean, dry, legible condition and in good order. Do not use record documents for construction purposes.
- D.    Make documents and samples available at all times for review by the Owner's Representative and the Architect.

**1.3    RECORDING**

- A.    Label each document "AS BUILT" in neat large printed letters.
- B.    Record information concurrently with construction progress.
  - 1.    Do not conceal any work until required information is recorded.

**C. Drawings**

As built drawings shall consist of making any changes neatly and clearly on the Contract Drawings using colored ink or pencil, shall be kept current by the contractor on a day-to-day basis in concert with the progress of the work. Where applicable, the change marked on a drawing is to carry the notation "per Change Order No. X", or similar reference which cites the reason for the change. As an alternative approach the Contractor can submit a plan for producing the "As-Built" drawings via electronic mark-up in Bluebeam, Adobe Professional, or other similar program as an alternative to colored pencil or ink mark-ups. Such plan shall be subject to approval of the Owner.

The day-to-day construction as built drawings shall be made available to the Architect or Owner's Representative for review upon request. The "As built" drawings shall show all changes to the following areas of construction:

1. Architectural:
  - a. Modifications to components dictated by the building code
  - b. Wall, door, window locations
  - c. Built in casework locations
  - d. New rated door and wall schedules/ locations
  - e. Material and products where submittals are requested
2. Civil and Structural
  - a. Dimensions for load carrying elements, both horizontal and vertical
  - b. Materials and products where submittals are requested
  - c. Load carrying elements and foundation systems
  - d. Site related elements including:
    - Building outlines, entranceways, areaways, roof overhangs, downspouts, significant architectural projections and other pertinent data.
  - e. All significant changes in foundations, columns, beams, openings, concrete reinforcing, lintels, concealed anchorages and "knock-out" panels made during construction.
  - f. Building envelope systems including roofing systems and building shell systems
  - g. Geotechnical subsurface information
  - h. Items that will require future maintenance
  - i. Life safety critical items

3. Mechanical (HVAC, Plumbing and Fire Protection)
  - a. Products where submittals are requested
  - b. Final locations of all equipment.
  - c. Final sizes and materials of piping and ductwork.
  - d. Final locations of inaccessible piping and ductwork.
  - e. Final locations of all controls equipment, including all sensors and actuators.
  - f. Final locations of all valves and dampers, including all shutoff valves, balance dampers and fire dampers.
  - g. Location of access doors for all equipment in concealed locations.
  - h. Final location and arrangement of all mechanical equipment and concealed gas, sprinkler, domestic, sanitary and drainage systems piping and other plumbing, including, but not limited to, supply and circulating mains, principal valves, meters, clean-outs, drains, pumps and controls, vent stacks, sanitary and storm water drainage.
4. Electrical
  - a. Products where submittals were requested.
  - b. Circuit (wire and raceway) size, number, and type.
  - c. Main circuit pathways for Fire Alarm, Emergency Power, and Access Control/Security systems.
  - d. Final locations of equipment and devices, interior and exterior luminaires, and power supplies.
  - e. Final location of electric signal system panels, final arrangement of all circuits and any significant changes made in electrical signal system design as a result of Change Order or job conditions.
5. Environmental
  - a. Utility related elements and supporting infrastructure

**D. Specifications and Addenda**

Legibly mark each section to record:

1. Manufacturer, trade name, catalog number, and Supplier of each product and item of equipment actually installed.
2. Changes made by Field Order or by Change Order.

**1.4     SUBMITTAL**

- A.   At Contract close-out, deliver copies of all record documents to the Owner's Representative.
- B.   Accompany submittal with transmittal letter in duplicate, containing:
  - 1.   Date
  - 2.   Project title and number
  - 3.   Contractor's name and address
  - 4.   Title and number of each record document
  - 5.   Certification that each document is complete and accurate
  - 6.   Signature of Contractor or its authorized representative.

**2.0     PRODUCTS – NOT USED**

**3.0     EXECUTION – NOT USED**

**\*\*\*END OF SECTION 01 78 39\*\*\***

**TECHNICAL SPECIFICATIONS**

**FOR**

**STIMSON HALL RENOVATIONS  
FOR MCGRAW ENABLING**

**CORNELL UNIVERSITY  
ITHACA, NEW YORK**



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SELECTIVE DEMOLITION

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SECTION 02 41 19 - SELECTIVE DEMOLITION

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
  - 1. Demolition and removal of selected portions of building or structure.
  - 2. Salvage of existing items to be reused or recycled.

1.2 DEFINITIONS

- A. Remove: Detach items from existing construction and dispose of them off-site unless indicated to be salvaged or reinstalled.
- B. Remove and Salvage: Detach items from existing construction, in a manner to prevent damage, and deliver to Owner ready for reuse.
- C. Remove and Reinstall: Detach items from existing construction, in a manner to prevent damage, prepare for reuse, and reinstall where indicated.
- D. Existing to Remain: Leave existing items that are not to be removed and that are not otherwise indicated to be salvaged or reinstalled.

1.3 MATERIALS OWNERSHIP

- A. Unless otherwise indicated, demolition waste becomes property of Contractor.

1.4 PREINSTALLATION MEETINGS

- A. Predemolition Conference: Conduct conference at Project site.
  - 1. Inspect and discuss condition of construction to be selectively demolished.
  - 2. Review structural load limitations of existing structure.
  - 3. Review and finalize selective demolition schedule and verify availability of materials, demolition personnel, equipment, and facilities needed to make progress and avoid delays.
  - 4. Review requirements of work performed by other trades that rely on substrates exposed by selective demolition operations.
  - 5. Review areas where existing construction is to remain and requires protection.

1.5 INFORMATIONAL SUBMITTALS

- A. Proposed Protection Measures: Submit report, including Drawings, that indicates the measures proposed for protecting individuals and property, for environmental protection, for dust control, and for noise control. Indicate proposed locations and construction of barriers.

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SELECTIVE DEMOLITION

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- B. Schedule of Selective Demolition Activities: Indicate the following:
  - 1. Detailed sequence of selective demolition and removal work, with starting and ending dates for each activity. Ensure Owner's on-site operations are uninterrupted.
  - 2. Interruption of utility services. Indicate how long utility services will be interrupted.
  - 3. Coordination for shutoff, capping, and continuation of utility services.
  - 4. Use of elevator and stairs.
  - 5. Coordination of Owner's continuing occupancy of portions of existing building and of Owner's partial occupancy of completed Work.
- C. Predemolition Photographs or Video: Show existing conditions of adjoining construction, including finish surfaces, that might be misconstrued as damage caused by salvage and demolition operations.

1.6 CLOSEOUT SUBMITTALS

- A. Inventory: Submit a list of items that have been removed and salvaged.

1.7 QUALITY ASSURANCE

- A. Refrigerant Recovery Technician Qualifications: Certified by an EPA-approved certification program.

1.8 FIELD CONDITIONS

- A. Owner will occupy portions of building immediately adjacent to selective demolition area. Conduct selective demolition so Owner's operations will not be disrupted.
- B. Conditions existing at time of inspection for bidding purpose will be maintained by Owner as far as practical.
- C. Notify Architect of discrepancies between existing conditions and Drawings before proceeding with selective demolition.
- D. Hazardous Materials: Present in buildings and structures to be selectively demolished. A report on the presence of hazardous materials is on file for review and use. Examine report to become aware of locations where hazardous materials are present.
  - 1. Hazardous material remediation is specified elsewhere in the Contract Documents.
  - 2. Do not disturb hazardous materials or items suspected of containing hazardous materials except under procedures specified elsewhere in the Contract Documents.
- E. Storage or sale of removed items or materials on-site is not permitted.
- F. Utility Service: Maintain existing utilities indicated to remain in service and protect them against damage during selective demolition operations.
  - 1. Maintain fire-protection facilities in service during selective demolition operations.



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SELECTIVE DEMOLITION

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1.9 COORDINATION

- A. Arrange selective demolition schedule so as not to interfere with Owner's operations.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Regulatory Requirements: Comply with governing EPA notification regulations before beginning selective demolition. Comply with hauling and disposal regulations of authorities having jurisdiction.
- B. Standards: Comply with ANSI/ASSP A10.6 and NFPA 241.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify that utilities have been disconnected and capped before starting selective demolition operations.
- B. Verify that hazardous materials have been remediated before proceeding with building demolition operations.

3.2 PREPARATION

- A. Refrigerant: Before starting demolition, remove refrigerant from mechanical equipment according to 40 CFR 82 and regulations of authorities having jurisdiction.

3.3 UTILITY SERVICES AND MECHANICAL/ELECTRICAL SYSTEMS

- A. Existing Services/Systems to Remain: Maintain services/systems indicated to remain and protect them against damage.
- B. Existing Services/Systems to Be Removed, Relocated, or Abandoned: Locate, identify, disconnect, and seal or cap off utility services and mechanical/electrical systems serving areas to be selectively demolished.
  - 1. Owner will arrange to shut off indicated services/systems when requested by Contractor.
  - 2. If services/systems are required to be removed, relocated, or abandoned, provide temporary services/systems that bypass area of selective demolition and that maintain continuity of services/systems to other parts of building.
  - 3. Disconnect, demolish, and remove fire-suppression systems, plumbing, and HVAC systems, equipment, and components indicated on Drawings to be removed.
    - a. Piping to Be Removed: Remove portion of piping indicated to be removed and cap or plug remaining piping with same or compatible piping material.
    - b. Piping to Be Abandoned in Place: Drain piping and cap or plug piping with same or compatible piping material and leave in place.

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## SELECTIVE DEMOLITION

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- c. Equipment to Be Removed: Disconnect and cap services and remove equipment.
- d. Equipment to Be Removed and Reinstalled: Disconnect and cap services and remove, clean, and store equipment; when appropriate, reinstall, reconnect, and make equipment operational.
- e. Equipment to Be Removed and Salvaged: Disconnect and cap services and remove equipment and deliver to Owner.
- f. Ducts to Be Removed: Remove portion of ducts indicated to be removed and plug remaining ducts with same or compatible ductwork material.
- g. Ducts to Be Abandoned in Place: Cap or plug ducts with same or compatible ductwork material and leave in place.

### 3.4 PROTECTION

- A. Temporary Protection: Provide temporary barricades and other protection required to prevent injury to people and damage to adjacent buildings and facilities to remain.
  - 1. Provide protection to ensure safe passage of people around selective demolition area and to and from occupied portions of building.
  - 2. Provide temporary weather protection, during interval between selective demolition of existing construction on exterior surfaces and new construction, to prevent water leakage and damage to structure and interior areas.
  - 3. Protect walls, ceilings, floors, and other existing finish work that are to remain or that are exposed during selective demolition operations.
  - 4. Cover and protect furniture, furnishings, and equipment that have not been removed.
  - 5. Comply with requirements for temporary enclosures, dust control, heating, and cooling.
- B. Temporary Shoring: Design, provide, and maintain shoring, bracing, and structural supports as required to preserve stability and prevent movement, settlement, or collapse of construction and finishes to remain, and to prevent unexpected or uncontrolled movement or collapse of construction being demolished.
  - 1. Strengthen or add new supports when required during progress of selective demolition.
- C. Remove temporary barricades and protections where hazards no longer exist.

### 3.5 SELECTIVE DEMOLITION, GENERAL

- A. General: Demolish and remove existing construction only to the extent required by new construction and as indicated. Use methods required to complete the Work within limitations of governing regulations and as follows:
  - 1. Proceed with selective demolition systematically, from higher to lower level. Complete selective demolition operations above each floor or tier before disturbing supporting members on the next lower level.
  - 2. Neatly cut openings and holes plumb, square, and true to dimensions required. Use cutting methods least likely to damage construction to remain or adjoining construction. Use hand tools or small power tools designed for sawing or grinding, not hammering and chopping. Temporarily cover openings to remain.

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## SELECTIVE DEMOLITION

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3. Cut or drill from the exposed or finished side into concealed surfaces to avoid marring existing finished surfaces.
  4. Do not use cutting torches.
  5. Remove decayed, vermin-infested, or otherwise dangerous or unsuitable materials and promptly dispose of off-site.
  6. Remove structural framing members and lower to ground by method suitable to avoid free fall and to prevent ground impact or dust generation.
  7. Locate selective demolition equipment and remove debris and materials so as not to impose excessive loads on supporting walls, floors, or framing.
  8. Dispose of demolished items and materials promptly.
- B. Site Access and Temporary Controls: Conduct selective demolition and debris-removal operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.
- C. Removed and Salvaged Items:
1. Clean salvaged items.
  2. Pack or crate items after cleaning. Identify contents of containers.
  3. Store items in a secure area until delivery to Owner.
  4. Transport items to Owner's storage area off-site designated by Owner.
  5. Protect items from damage during transport and storage.
- D. Removed and Reinstalled Items:
1. Clean and repair items to functional condition adequate for intended reuse.
  2. Pack or crate items after cleaning and repairing. Identify contents of containers.
  3. Protect items from damage during transport and storage.
  4. Reinstall items in locations indicated. Comply with installation requirements for new materials and equipment. Provide connections, supports, and miscellaneous materials necessary to make item functional for use indicated.
- E. Existing Items to Remain: Protect construction indicated to remain against damage and soiling during selective demolition. When permitted by Architect, items may be removed to a suitable, protected storage location during selective demolition and reinstalled in their original locations after selective demolition operations are complete.

### 3.6 SELECTIVE DEMOLITION PROCEDURES FOR SPECIFIC MATERIALS

- A. Concrete: Demolish in small sections. Using power-driven saw, cut concrete to a depth of at least 3/4 inch at junctures with construction to remain. Dislodge concrete from reinforcement at perimeter of areas being demolished, cut reinforcement, and then remove remainder of concrete. Neatly trim openings to dimensions indicated.
- B. Concrete: Demolish in sections. Cut concrete full depth at junctures with construction to remain and at regular intervals using power-driven saw, and then remove concrete between saw cuts.
- C. Masonry: Demolish in small sections. Cut masonry at junctures with construction to remain, using power-driven saw, and then remove masonry between saw cuts.

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SELECTIVE DEMOLITION

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- D. Resilient Floor Coverings: Remove floor coverings and adhesive according to recommendations in RFCI's "Recommended Work Practices for the Removal of Resilient Floor Coverings." Do not use methods requiring solvent-based adhesive strippers.

3.7 DISPOSAL OF DEMOLISHED MATERIALS

- A. Remove demolition waste materials from Project site and dispose of them in an EPA-approved construction and demolition waste landfill acceptable to authorities having jurisdiction.
  - 1. Do not allow demolished materials to accumulate on-site.
  - 2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.
  - 3. Remove debris from elevated portions of building by chute, hoist, or other device that will convey debris to grade level in a controlled descent.
- B. Burning: Do not burn demolished materials.

3.8 CLEANING

- A. 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 02 41 19

## **SPECIFICATION SECTION 02 82 13**

Asbestos Abatement  
at  
Cornell University's Stimson Hall  
for the  
Stimson Hall Renovations for McGraw Enabling

Prepared for:

Cornell University  
FCS Project Management  
Humphreys Service Building  
Ithaca, New York 14853

Prepared by:



860 Hooper Road  
Endwell, NY 13760  
Phone: 607-231-6600  
Fax: 607-231-6640  
Delta Project No. 2016.159.019  
SWBR Project No. 23170.00

Asbestos Design Prepared By:  
Stephen Prislupsky, Director of Environmental Services  
NYS DOL Certified Asbestos Project Designer  
Certificate No. 23-6L43B-SHAB

100% Construction Documents  
February 16, 2024

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ASBESTOS ABATEMENT

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SECTION 02 82 13 - ASBESTOS ABATEMENT

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.

1.2 SCOPE OF WORK

- A. The asbestos abatement work will consist of the removal and disposal of non-asbestos materials, asbestos containing materials and asbestos contaminated materials in the Stimson Hall Renovations for McGraw Enabling Projects Ground, 1<sup>st</sup>, 2<sup>nd</sup>, and 3<sup>rd</sup> Floor renovation areas at Stimson Hall, located at 204 Feeney Way on the Cornell Ithaca, NY Campus.
- B. Reference Drawings AR-101, AR-102 and AR-103 for asbestos abatement notes and abatement locations, quantities, and details. Reference the GR Section 01 35 29 – General Health and Safety for the Pre-Renovation Asbestos Survey Report.
- C. Non-asbestos, asbestos containing, and asbestos contaminated materials to be removed shall include the following:
  - 1. Asbestos Containing 9" x 9" and 12" x 12" Floor Tile: 9" x 9" and 12" x 12" asbestos floor tile (VAT) with non-asbestos mastic to be removed is present in rooms 107, 219, 219A, 219B and 219C. The total quantity of VAT in the referenced Rooms to be removed is approximately 2,282 square feet. The VAT is present beneath carpeting (with non-asbestos adhesive) in Rooms 219, 219B and 219C. Where VAT continues underneath walls to remain, it shall be cut-flush, and removed up to, the wall. All equipment, furniture and cabinets present in the VAT removal areas shall also be removed by the abatement contractor to access / remove the vat beneath.
  - 2. Two-coat Asbestos Containing Wall Plaster: The two-coat asbestos containing wall plaster to be removed is present in Rooms 105, 107, 105A, and the room 104 wall section above the entry door. For Rooms 105, 107, and 105A, removal shall include all wall plaster in the spaces. Removal shall be from floor to ceiling and include the two-coat plaster and associated lathe, back to the base masonry / wood framing substrate. For the Room 104 wall above the entry door, removal shall include a 2' x 2' section of two-coat plaster on both sides of the wall as necessary for new wall penetrations. The total quantity of asbestos wall plaster to be removed in the referenced rooms is approximately 1,635 square feet.
  - 3. Two-coat Asbestos Containing Ceiling Plaster: The two-coat asbestos containing ceiling plaster to be removed is present in Rooms 105, 107, 105A, and G01. For Rooms 105, 107, and 105A, removal shall include all ceiling plaster and associated lathe in the spaces. Removal shall be back to existing wood ceiling joists. For the Room G01 ceiling, removal shall include a total of six 2' x 2' locations along the east, south and west perimeters as necessary for new ceiling pipe penetrations (reference drawing M-200 for pipe penetration locations). The total quantity of two-coat asbestos ceiling plaster to be removed in the referenced rooms is approximately 1,470 square feet.

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ASBESTOS ABATEMENT

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4. Asbestos Transite-lined Fume Hood / Base Cabinet and Fume Hood Transite Counter-top: The Room 309 asbestos transite-lined fume hood, associated transite-lined base cabinet, and fume hood transite counter-top shall be removed. The total quantity of transite associated with the above items is approximately 70 square feet. Removal shall be performed "intact" as per the conditions of the Cornell Ithaca Campus-Wide Variance File No. 23-1557 for intact transite removals (see Attachment A of this specification section for the Variance).
5. The asbestos contractor shall be responsible for the removal of all light fixtures, equipment, wall boards, cabinetry, shelving, fire-protection devices, conduits / raceway, window treatments, and all other miscellaneous mechanical / electrical / plumbing / fire protection / A-V items, devices & components that are scheduled to be removed as a part of the project and are mounted on, or fastened to, asbestos containing plaster walls / ceilings and asbestos flooring. These item removals shall be performed in both areas where the asbestos containing plaster walls / ceilings and asbestos flooring are scheduled to be removed as a part of the project as well as those areas where the asbestos containing plaster walls / ceilings and asbestos flooring are to remain. Items shall be removed as a part of abatement operations and shall be cleaned / decontaminated and turned-over to the university. Reference the Architectural, Fire Protection, Plumbing, Mechanical and Electrical Demolition Drawings for the lighting fixtures, equipment, wall boards, cabinetry, shelving, fire-protection devices, conduits / raceway, and other miscellaneous mechanical / electrical / plumbing fire protection / A-V items, devices & components to be removed as a part of the project.
6. The asbestos contractor shall be responsible for the installation of any new light fixtures, equipment, wall boards, cabinetry, shelving, fire-protection devices, conduits / raceway, window treatments, and other miscellaneous mechanical / electrical / plumbing / fire protection / A-V items, devices & components that are scheduled to be installed as a part of the project and are to be mounted on, or fastened to, asbestos containing plaster walls / ceilings and asbestos flooring. Items shall be installed as a part of abatement operations. Reference the Architectural, Fire Protection, Plumbing, Mechanical and Electrical Drawings for the lighting fixtures, equipment, wall boards, cabinetry, shelving, fire-protection devices, conduits / raceway, window treatments, and all other miscellaneous mechanical / electrical / plumbing / fire protection / A-V items, devices & components to be installed as a part of the project.
7. Partial removal of the non-asbestos sheetrock / joint compound wall systems in the 1st floor renovation area may be performed by general contractor prior to abatement operations. The asbestos contractor shall remove associated wall studs / ceiling plates fastened to asbestos plaster wall / ceiling systems and base plates fastened to asbestos flooring as a part of abatement operations.
8. The asbestos contractor shall be responsible for the removal of damaged / loose / delaminating wall plaster created as a results of Items 5, 6, and 7 removal scope referenced above and for the removal of any loose / delaminating paint & plaster present in Room 116 as necessary for new painting. Removal of damaged / loose / delaminating plaster shall be down to a solid substrate, with the remaining base-coat plaster sealed with a latex encapsulant / paint.

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- D. The Contractor shall be aware of all conditions of the Project and is responsible for verifying quantities and locations of all Work to be performed. Failure to do so shall not relieve the Contractor of its obligation to furnish all labor and materials necessary to perform the Work.
- E. All Work shall be performed in strict accordance with the Project Documents and all governing codes, rules, and regulations. Where conflicts occur between the Project Documents and applicable codes, rules, and regulations, the more stringent shall apply.

### 1.3 SPECIAL JOB CONDITIONS

- A. The Contractor may submit for a Site Specific Variance to accomplish the Project. Variance petition shall be submitted to the Owners Representative for review and approval prior to submission to the New York State Department of Labor (NYS DOL).
- B. Work shifts and working hours shall be as necessary to complete the project in the required time frame and shall be submitted to the Owner's Representative for review/approval. The Contractor shall coordinate and schedule all Work with the facility, the Owner, and the Owner's representative.
- C. Contractor to submit man power and work schedule with bid.
- D. Owner will provide a tie-in location for electric and water source. The contractor will be responsible for providing GFCI electrical panel(s) and connecting to the building system as necessary for project power.
- E. Any air sampling necessary to meet OSHA requirements will be the responsibility of the Asbestos Contractor.
- F. Waste Dumpster locations shall be approved by the Facility Representative. All dumpsters receiving RACM Waste shall be lined, enclosed and lockable (i.e. no open-to dumpsters).
- G. Locations of all Airlocks and/or Decontamination Enclosure Units shall be approved by the Facility Representative.

### 1.4 PERMITS AND COMPLIANCE

- A. The Contractor shall assume full responsibility and liability for compliance with all applicable Federal, State, and local laws, rules, and regulations pertaining to Work practices, protection of Workers, authorized visitors to the site, persons, and property adjacent to the Work.
- B. Perform asbestos related Work in accordance with New York State Industrial Code Rule 56 (herein referred to as Code Rule 56), 40 CFR 61, 29 CFR 1926, and as specified herein. Where more stringent requirements are specified, adhere to the more stringent requirements.
- C. The Contractor must maintain current licenses pursuant to New York State Department of Labor and Department of Environmental Conservation for all Work related to this Project, including the removal, handling, transport, and disposal of asbestos containing materials.



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- D. The Contractor must have and submit proof upon request that any persons employed by the Contractor to engage in or supervise Work on any asbestos Project have a valid NYS asbestos handling certificate pursuant to Code Rule 56.
- E. Failure to adhere to the Project Documents shall constitute a breach of the Contract and the Owner shall have the right to and may terminate the Contract provided, however, the failure of the Owner to so terminate shall not relieve the Contractor from future compliance.
- F. The contractor shall be responsible for any waste water permits required to perform his work under this contract. Any cost associated with waste water permits shall be included in his Bid.
- G. The contractor shall be responsible for any Local City and/or State building permits required to perform his work. Any cost associated with building permits shall be included in his Bid.

## 1.5 SUBMITTALS

- A. Reference the Front-end and Division 01 documents for eBuilder submittal requirements/procedures.
- B. Pre-Work Submittals: Within 7 days prior to the pre-construction conference, the Contractor shall submit via eBuilder an electronic pdf format copy of the documents listed below for review and approval prior to the commencement of asbestos abatement activities:
  - 1. Contractor license issued by New York State Department of Labor.
  - 2. Progress Schedule:
    - a. Show the complete sequence of abatement activities and the sequencing of Work for each floor.
    - b. Show the dates for the beginning and completion of each major element of Work including substantial completion dates for each Work Area and Floor.
  - 3. Project Notifications: As required by Federal and State regulatory agencies together with proof of transmittal (i.e. certified mail return receipt).
  - 4. Building Occupant Notification: As required by regulatory agencies.
  - 5. Abatement Work Plan: Provide plans that clearly indicate the following:
    - a. All Work Areas/containments numbered sequentially.
    - b. Proposed locations and types of all decontamination enclosures.
    - c. Location of water and electrical connections to building services.
    - d. Waste transport routes through the building to the waste storage container.
  - 6. Disposal Site/Landfill Permit from applicable regulatory agency.
  - 7. NYS Department of Environmental Conservation Waste Transporter Permit.
- C. On-Site Submittals: Refer to Part 3.01.D for all submittals, documentation, and postings required to be maintained on-site during abatement activities.
- D. Project Close-out Submittals: Within 15 days of project completion, the Contractor shall submit an electronic pdf format copy of the documents listed below for review and approval prior to the Contractor's final payment.
  - 1. OSHA compliance air monitoring records conducted during the Work.
  - 2. Daily progress log, including the entry/exit log.
  - 3. A list of all Workers used in the performance of the Project, including name, NYS DOL certification number and type of certification (i.e. supervisor, asbestos handler, etc.).

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- E. Fully executed/signed Originals of all waste disposal manifests shall be submitted as per applicable State and Federal Regulations and time frame requirements.
- F. The contractor shall also be responsible for completing and submitting the Owner's "Contractor Waste Material Disposal Plan" form included in the front-end Bid Documents. This form shall be submitted and approved by the Cornell Project Manager prior to the Owner issuing any payment for the project.

1.6 PRE-BID MEETING

- A. Bidders shall attend a pre-bid meeting. Bidding Contractors will be notified in advance of the meeting.
- B. Contractors shall familiarize themselves with the Contract Documents prior to attending the conference.

1.7 APPLICABLE STANDARDS AND REGULATIONS

- A. The Contractor shall comply with the following codes and standards, except where more stringent requirements are shown or specified:
- B. Federal Regulations:
  - 1. 29 CFR 1910.1001, "Asbestos" (OSHA)
  - 2. 29 CFR 1910.1200, "Hazard Communication" (OSHA)
  - 3. 29 CFR 1910.134, "Respiratory Protection" (OSHA)
  - 4. 29 CFR 1910.145, "Specification for Accident Prevention Signs and Tags" (OSHA)
  - 5. 29 CFR 1926, "Construction Industry" (OSHA)
  - 6. 29 CFR 1926.1101, "Asbestos, Tremolite, Anthophyllite, and Actinolite" (OSHA)
  - 7. 29 CFR 1926.500 "Guardrails, Handrails and Covers" (OSHA)
  - 8. 40 CFR 61, Subpart A, "General Provisions" (EPA)
  - 9. 40 CFR 61, Subpart M, "National Emission Standard for Asbestos" (EPA)
  - 10. 49 CFR 171-172, Transportation Standards (DOT)
- C. New York State Regulations:
  - 1. 12 NYCRR, Part 56, "Asbestos", Industrial Code Rule 56 (DOL).
  - 2. 6 NYCRR, Parts 360, 364, Disposal and Transportation (DEC)
  - 3. 10 NYCRR, Part 73, "Asbestos Safety Program Requirements" (DOH)
- D. Standards and Guidance Documents:
  - 1. American National Standard Institute (ANSI) Z88.2-80, Practices for Respiratory Protection
  - 2. ANSI Z9.2-79, Fundamentals Governing the Design and Operation of Local Exhaust Systems
  - 3. EPA 560/585-024, Guidance for Controlling Asbestos Containing Materials in Buildings (Purple Book)
  - 4. EPA 530-SW-85-007, Asbestos Waste Management Guidance
  - 5. ASTM Standard E1368 "Standard Practice for Visual Inspection of Asbestos Abatement Projects."

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1.8 NOTICES

- A. The Contractor shall provide notification of intent to commence asbestos abatement activities as indicated below.

1. At least ten (10) Working days prior to beginning abatement activities, send written notification to:

U.S. Environmental Protection Agency  
National Emissions Standards for Hazardous Air Pollutants (NESHAPS) Coordinator  
26 Federal Plaza  
New York, NY 10007.

The Contractor is required to send notification via mail or package delivery service that will provide proof of delivery and receipt.

2. At least ten (10) days prior to beginning abatement activities, submit notification to:

New York State Department of Labor  
Division of Safety and Health, Asbestos Control Program.  
State Office Campus  
Building 12 - Room 454  
Albany, NY 12240

Contractor shall print copy of electronic NYS DOL Notification Notice and post onsite.

- B. The Contractor shall post and/or provide Building Occupant Notification at least 10 days prior to beginning abatement activities as required by Code Rule 56.

1.9 PROJECT MONITORING AND AIR SAMPLING

- A. The Owner shall engage the services of an Environmental Consultant (the Consultant) who shall provide Project Monitoring and Air Sampling for the project.
- B. The Contractor is required to ensure cooperation of its personnel with the Consultant for the air sampling and Project monitoring functions described in this section. The Contractor shall comply with all direction given by the Consultant during the course of the Project.
- C. The Consultant shall review and approve or disapprove all onsite submittals as required by section 3.01.
- D. The Consultant shall staff the Project with a trained and certified person(s). This individual shall be designated as the Asbestos Project Monitor (APM).
1. The APM shall be on-site at all times the Contractor is on-site. The Contractor shall not be permitted to conduct any Work unless the APM is on-site (except for inspection of barriers and negative air system during non-working days).
  2. The APM shall have the authority to direct the actions of the Contractor verbally and in writing to ensure compliance with the Project documents and all regulations. The APM shall have the authority to Stop Work when gross Work practice deficiencies or unsafe practices are observed, or when ambient fiber concentrations outside the removal area exceed .01 f/cc or background level.

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- a. Such Stop Work order shall be effective immediately and remain in effect until corrective measures have been taken and the situation has been corrected.
  - b. Standby time required to resolve the situation shall be at the Contractor's expense.
- 3. The APM shall provide the following services:
  - a. Inspection of the Contractor's Work, practices, and procedures, including temporary protection requirements, for compliance with all regulations and Project specifications.
  - b. Provide abatement Project air sampling as required by applicable regulations and the Owner's requirements. Sampling will include background, work area preparation, asbestos handling, and final cleaning and clearance air sampling.
  - c. Verify daily that all Workers used in the performance of the Project are certified by the appropriate regulatory agency.
  - d. Monitor the progress of the Contractor's Work, and report any deviations from the schedule to the Owner's Representative.
  - e. Monitor, verify, and document all waste load-out operations.
  - f. Verify that the Contractor is performing personal air monitoring daily, and that results are being returned and posted at the site as required.
  - g. The APM shall maintain a log on site that documents all project related and Consultant and Contractor actions, activities, and occurrences.
- 4. The following minimum inspections shall be conducted by the APM. Additional inspections shall be conducted as required by Project conditions. Progression from one phase of Work to the next by the Contractor is only permitted with the written approval of the APM.
  - a. Pre-Construction Inspection: The purpose of this inspection is to verify the existing conditions of the Work Areas and to document these conditions.
  - b. Pre-Abatement Inspection: The purpose of this inspection is to verify the integrity of each containment system prior to disturbance of any asbestos containing material. This inspection shall take place only after the Work Area is fully prepped for removal.
  - c. Work In-Progress Inspections: The purpose of this inspection is to monitor the Work practices and procedures employed on the Project and to monitor the continued integrity of the containment system. Inspections within the removal areas shall be conducted by the APM during all preparation, removal, and cleaning activities at least twice every Work shift. Additional inspections shall be conducted as warranted.
  - d. Visual Clearance Inspection: The purpose of this inspection is to verify that: all materials in the scope of work have been properly removed; no visible asbestos debris/residue remains; no pools of liquid or condensation remains; and all required cleanings are complete. This inspection shall be conducted before final air clearance testing.
  - e. Post-Clearance Inspection: The purpose of this inspection is to ensure the complete removal of ACM, including debris, from the Work Area after satisfactory final clearance sampling and removal of all isolation/critical barriers and equipment from the Work Area.
- E. The Consultant shall provide abatement Project air sampling and analysis as required by applicable regulations (New York State and/or AHERA). Sampling will include background, work area preparation, asbestos handling, and final cleaning and clearance air sampling.

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1. Unless otherwise directed by the Owner, the Consultant shall have samples analyzed by Phase Contrast Microscopy (PCM). If TEM clearance is required by the Owner, AHERA protocols/methodology shall be followed.
2. Samples shall be collected as required by applicable regulations (New York State and/or AHERA) and these specifications. If Transmission Electron Microscopy (TEM) clearance air sampling is utilized by the owner, the clearance criteria and sampling protocols must be in compliance with AHERA. If PCM air sample analysis results exceed the satisfactory clearance criteria, then TEM analysis of the entire set of clearance air samples may be used, provided that a standard NIOSH/ELAP accepted laboratory analysis method is utilized that shall report each air sample result in fibers per cubic centimeter.
3. If the air sampling during any phase of the abatement project reveals airborne fiber levels at or above .01 fibers/cc or the established background level, whichever is greater, outside the regulated Work Area, Work shall stop immediately and corrective measures required by Code Rule 56 shall be initiated. Notify all employers and occupants in adjacent areas. The Contractor shall bear the burden of any and all costs incurred by this delay.
4. The Environmental Consultant shall submit copies of all elevated air sampling results collected during abatement and all final air clearance results to the Commissioner of Labor.

#### 1.10 CONTRACTOR AIR SAMPLING

- A. In addition to the requirements of OSHA 1926.1101, the Contractor shall be required to perform personal air monitoring every Work shift in each Work Area during which abatement activities occur in order to determine that appropriate respiratory protection is being worn and utilized.
- B. The Contractor shall conduct air sampling that is representative of both the 8-hour time weighted average and 30-minute short-term exposures to indicate compliance with the permissible exposure and excursion limits.
- C. The Contractor's laboratory analysis of air samples shall be conducted by an NYS DOH ELAP approved laboratory, subject to approval of the Owner's Representative.
- D. Results of personnel air sample analyses shall be available, verbally, within twenty-four (24) hours of sampling and shall be posted upon receipt. Written laboratory reports shall be delivered and posted at the Work site within five (5) days. Failure to comply with these requirements may result in all work being stopped until compliance is achieved.

#### 1.11 PROJECT SUPERVISOR

- A. The Contractor shall designate a full-time Project Supervisor who shall meet the following qualifications:
  1. The Project Supervisor shall hold New York State certification as an Asbestos Supervisor.
  2. The Project Supervisor shall meet the requirements of a "Competent Person" as defined by OSHA 1926.1101 and shall have a minimum of one year experience as a supervisor.
  3. The Project Supervisor must be able to read and write English fluently, as well as communicate in the primary language of the Workers.

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- B. If the Project Supervisor is not on-site at any time whatsoever, all Work shall be stopped. The Project Supervisor shall remain on-site until the Project is complete. The Project Supervisor cannot be removed from the Project without the written consent of the Owner. The Project Supervisor shall be removed from the Project if so requested by the Owner.
- C. The Project Supervisor shall maintain the bound Daily Project Log that also includes the entry/exit logs as required by New York State Department of Labor and section 2.03 of the specifications and the Waste Disposal Log required by section 4.04 of the specifications.
- D. The Project Supervisor shall be responsible for the performance of the Work and shall represent the Contractor in all respects at the Project site. The Supervisor shall be the primary point of contact for the Asbestos Project Monitor.

#### 1.12 MEDICAL REQUIREMENTS

- A. Before exposure to airborne asbestos fibers, provide Workers with a comprehensive medical examination as required by 29 CFR 1910.1001, and 29 CFR 1926.1101.
  - 1. This examination is not required if adequate records show the employee has been examined as required by 29 CFR 1910.1001, and 29 CFR 1926.1101 within the past year.
  - 2. The same medical examination shall be given on an annual basis to employees engaged in an occupation involving asbestos fibers and within thirty (30) calendar days before or after the termination of employment in such occupations.
  - 3. Medical Examination records shall be maintained on site for each employee.

#### 1.13 TRAINING

- A. As required by applicable regulations, prior to assignment to asbestos Work instruct each employee with regard to the hazards of asbestos, safety and health precautions, and the use and requirements of protective clothing and equipment.
- B. Establish a respirator program as required by ANSI Z88.2 and 29 CFR 1910.134, and 29 CFR 1926.1101. Provide respirator training and fit testing.
- C. An onsite "tool box talk" is mandatory for all Contractor field personnel before the asbestos removal can begin. This talk will review Cornell University practices and procedures pertaining to asbestos control. Workers not complying with these specifications or Cornell University practices and procedures will be asked to leave the job.

#### 1.14 RESPIRATORY PROTECTION

- A. Select respirators from those approved by the Mine Safety and Health Administration (MSHA), and the National Institute for Occupational Safety and Health (NIOSH), Department of Health and Human Services.
- B. Respirators shall be individually fit-tested to personnel under the direction of an Industrial Hygienist on a yearly basis. Fit-tested respirators shall be permanently marked to identify the individual fitted, and use shall be limited to that individual. Fit-test records shall be maintained on site for each employee.

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- C. Where fiber levels permit, and in compliance with regulatory requirements, Powered Air Purifying Respirators (PAPR) are the minimum allowable respiratory protection permitted to be utilized during gross removal operations of OSHA Class I or OSHA Class II friable ACM.
- D. No respirators shall be issued to personnel without such personnel participating in a respirator training program.
- E. High Efficiency Particulate Air (HEPA) respirator filters shall be approved by NIOSH and shall conform to the OSHA requirements in 29 CFR 1910.134 and 29 CFR 1926.1101.
- F. A storage area for respirators shall be provided by the Contractor in the clean room side of the personnel decontamination enclosure where they will be kept in a clean environment.
- G. The Contractor shall provide and make available a sufficient quantity of respirator filters so that filter changes can be made as necessary during the work day. Filters will be removed and discarded during the decontamination process. Filters cannot be reused. Filters must be changed if breathing becomes difficult.
- H. Filters used with negative pressure air purifying respirators shall not be used any longer than one eight (8) hour work day.
- I. Any authorized visitor, Worker, or supervisor found in the Work Area not wearing the required respiratory protection shall be removed from the Project site and not be permitted to return.
- J. The Contractor shall have at least two (2) Powered Air Purifying Respirators stored on site designated for authorized visitors use. Appropriate respirator filters for authorized visitors shall be made available by the Contractor.

#### 1.15 DELIVERY AND STORAGE

- A. Deliver all materials to the job site in original packages with containers bearing manufacturer's name and label.
- B. Store all materials at the job site in a suitable and designated area.
  - 1. Store materials subject to deterioration or damage away from wet or damp surfaces and under cover.
  - 2. Protect materials from unintended contamination and theft.
  - 3. Storage areas shall be kept clean and organized.
- C. Remove damaged or deteriorated materials from the job site. Materials contaminated with asbestos shall be disposed of as asbestos debris as herein specified.

#### 1.16 TEMPORARY UTILITIES

- A. Temporary shutdown of HVAC and lock out of electric power to abatement work areas shall be the responsibility of the contractor and shall be coordinated with the owner. If electrical circuits, machinery and other electrical systems in or passing through a given regulated abatement work area must stay in operation, the contractor shall isolate/seal the live electric as per the requirements of 12 NYCRR Part 56 Subpart 56-7.7.

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- B. The Owner will provide a tie-in location to building power for the Contractor's GFCI electric panel for project power. All temporary power to the work areas shall be brought in from outside the work area through a ground-fault circuit interrupter at the source. The contractor will be responsible for all temporary power (including the power required by the owner's representative for air sampling equipment). All operations associated with electrical service work (i.e. lockout, temporary power hook-up, etc.) shall be performed by a licensed electrician.
- C. Provide temporary lighting with "weatherproof" fixtures for all Work Areas including decontamination chambers.
  - 1. The entire Work Area shall be kept illuminated at all times.
  - 2. Provide lighting as required by the Environmental Consultant for the purposes of performing required inspections.
- D. All temporary devices and wiring used in the Work Area shall be capable of decontamination procedures including HEPA vacuuming and wet-wiping.
- E. Utilize domestic water service, if available, from Owner's existing system. Provide hot water heaters with sufficient capacity to meet Project demands.

## PART 2 PRODUCTS

### 2.1 PROTECTIVE CLOTHING

- A. Provide personnel utilized during the Project with disposable protective whole body clothing, head coverings, gloves and foot coverings. Provide disposable plastic or rubber gloves to protect hands. Cloth gloves may be worn inside the plastic or rubber for comfort, but shall not be used alone. Make sleeves secure at the wrists and make foot coverings secure at the ankles by the use of tape, or provide disposable coverings with elastic wrists or tops.
- B. Provide sufficient quantities of protective clothing to assure a minimum of four (4) complete disposable outfits per day for each individual performing abatement Work.
- C. Eye protection and hard hats shall be provided and made available for all personnel entering any Work Area.
- D. Authorized visitors shall be provided with suitable protective clothing, headgear, eye protection, and footwear whenever they enter the Work Area.

### 2.2 SIGNS AND LABELS

- A. Provide warning signs and barrier tapes at all approaches to asbestos Work Areas. Locate signs at such distance that personnel may read the sign and take the necessary protective steps required before entering the area.
  - 1. Provide danger signs in vertical format conforming to 29 CFR 1926.1101, minimum 20" x 14" displaying the following legend.



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DANGER  
ASBESTOS CANCER AND LUNG DISEASE  
HAZARD  
AUTHORIZED PERSONNEL ONLY  
RESPIRATORS AND PROTECTIVE CLOTHING  
ARE REQUIRED IN THIS AREA

2. Provide 3" wide yellow barrier tape printed with black lettered, "DANGER ASBESTOS REMOVAL". Locate barrier tape across all corridors, entrances and access routes to asbestos Work Area. Install tape 3' to 4' AFF.

- B. Provide asbestos danger labels affixed to all asbestos materials, scrap, waste, debris and other products contaminated with asbestos.

1. Provide asbestos danger labels of sufficient size to be clearly legible, displaying the following legend:

DANGER  
CONTAINS ASBESTOS FIBERS  
AVOID CREATING DUST  
CANCER AND LUNG DISEASE HAZARD

2. Provide the following asbestos labels, of sufficient size to be clearly legible, for display on waste containers (bags or drums) which will be used to transport asbestos contaminated material in accordance with United States Department of Transportation 49 CFR Parts 171 and 172:

RQ HAZARDOUS  
SUBSTANCE  
SOLID, NOS  
ORM-E, NA 9188  
ASBESTOS

3. Generator identification information shall be affixed to each waste container indicating the following printed in indelible ink:

Generator Name  
Facility Name  
Facility Address

## 2.3 DAILY PROJECT LOG

- A. Provide a Daily Project Log. The log shall contain on title page the Project name, name, address and phone number of Owner; name, address and phone number of Owner's Representative; name, address and phone number of Environmental Consultant; name, address and phone number of Abatement Contractor; emergency numbers including, but not limited to local Fire/Rescue department and all other New York State Department of Labor requirements.
- B. All entries into the log shall be made in non-washable, permanent ink and such pen shall be strung to or otherwise attached to the log to prevent removal from the log-in area. Under no circumstances shall pencil entries be permitted.

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- C. All persons entering and exiting the Work Area shall sign the log and include name, social security number, and time.
- D. The Project Supervisor shall document all Work performed daily and note all inspections required by Code Rule 56, i.e. testing and inspection of barriers and enclosures.

2.4 SCAFFOLDING AND LADDERS

- A. Provide all scaffolding and/or staging as necessary to accomplish the Work of this Contract. Scaffolding may be of suspension type or standing type such as metal tube and coupler, tubular welded frame, pole or outrigger type or cantilever type. The type, erection and use of all scaffolding and ladders shall comply with all applicable OSHA construction industry standards.
- B. Provide scaffolding and ladders as required by the Environmental Consultant for the purposes of performing required inspections.

2.5 SURFACTANT (AMENDED WATER)

- A. Wet all asbestos-containing materials prior to removal with surfactant mixed and applied in accordance with manufacturer's printed instructions.
- B. Approved Manufacturer:
  - 1. International Protective Coatings Corp.: Serpiflex Shield
  - 2. American Coatings Corp.: EPA 55 Asbestos Removal Agent
  - 3. Certified Technologies: CerTane 2075 Penetrating Surfactant
- A. Wet all asbestos-containing materials prior to removal with surfactant mixed and applied in accordance with manufacturer's printed instructions.
- B. Approved Manufacturer:
  - 1. International Protective Coatings Corp.: Serpiflex Shield
  - 2. American Coatings Corp.: EPA 55 Asbestos Removal Agent
  - 3. Certified Technologies: CerTane 2075 Penetrating Surfactant

2.6 ENCAPSULANT

- A. Encapsulant shall be tinted or pigmented so that application when dry is readily discernible.

2.7 DISPOSAL BAGS, DRUMS, AND CONTAINERS

- A. Provide 6 mil polyethylene disposal bags printed with asbestos caution labels. Bags shall also be imprinted with U.S. Department of Transportation required markings.
- B. Provide 30 or 55 gallon capacity fiber, plastic, or metal drums capable of being sealed air and water tight if asbestos waste has the potential to damage or puncture disposal bags. Affix asbestos caution labels on lids and at one-third points around drum circumference to assure ready identification.

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- C. Containers and bags must be labeled in accordance with 40 CFR Part 61 NESHAPS and Code Rule 56. When the bags/containers are moved to the lockable hardtop dumpster from the waste decontamination system washroom, the bags must also be appropriately labeled with the date they are moved on the bag/container in waterproof markings.
- D. Labeled ACM waste containers or bags shall not be used for non-ACM waste or trash. Any material placed in labeled containers or bags, whether turned inside out or not shall be handled and disposed of as ACM waste.

2.8 HEPA VACUUM EQUIPMENT

- A. All dry vacuuming performed under this contract shall be performed with High Efficiency Particulate Absolute (HEPA) filter equipped industrial vacuums conforming to ANSI Z9.2.
- B. Provide tools and specialized equipment including scraping nozzles with integral vacuum hoods connected to a HEPA vacuum with flexible hose.

2.9 POWER TOOLS

- A. Any power tools used to drill, cut into, or otherwise disturb asbestos material shall be manufacturer equipped with HEPA filtered local exhaust ventilation.

2.10 POLYETHYLENE SHEETING

- A. All polyethylene (plastic) sheeting used on the Project (including but not limited to sheeting used for critical and isolation barriers, fixed objects, walls, floors, ceilings, waste container) shall be at least 6 mil fire retardant sheeting.
- B. Decontamination enclosure systems shall utilize at least 6 mil opaque fire retardant plastic sheeting. At least 2 layers of 6 mil reinforced fire retardant plastic sheeting shall be used for the flooring.

PART 3 EXECUTION

3.1 GENERAL REQUIREMENTS

- A. Should visible emissions or water leaks be observed outside the Work Area, immediately stop Work and institute emergency procedures per Code Rule 56. Should there be elevated fiber levels outside the Work Area, immediately stop Work, institute emergency procedures per Code Rule 56, and notify all employers and occupants in adjacent areas. All costs incurred in decontaminating such non-Work Areas and the contents thereof shall be borne by the Contractor, at no additional cost to the Owner.
- B. Medical approval, fit test reports, and NYS DOL certificates shall be on site prior to admittance of any Contractor's employees to the asbestos Work Area.
- C. The following submittals, documentation, and postings shall be maintained on-site by the Contractor during abatement activities at a location approved by the Abatement Project Monitor:

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1. Contractor license issued by New York State Department of Labor.
  2. Certification, Worker Training, Medical Surveillance:
    - a. New York State Asbestos Handler certification cards for each person employed in the removal, handling, or disturbance of asbestos.
    - b. Evidence that Workers have received proper training required by the regulations and the medical examinations required by OSHA 29 CFR 1926.1101.
    - c. Documentation that Workers have been fit tested specifically for respirators used on the Project.
  3. Daily OSHA personal air monitoring results.
  4. NYS Department of Health ELAP certification for the laboratory that will be analyzing the OSHA personnel air samples.
  5. NYS Department of Environmental Conservation Waste Transporter Permit.
  6. Project documents (specifications and drawings.)
  7. Notifications and variances (site specific and applicable.) Ensure that the most up-to-date notifications and variances are on-site.
  8. Applicable regulations.
  9. Material Safety Data Sheets of supplies/chemicals used on the Project.
  10. Approved Abatement Work Plan.
  11. List of emergency telephone numbers.
  12. Magnahelic manometer semi-annual calibration certification.
  13. Daily Project Log.
- D. The following documentation shall be maintained on-site by the Abatement Project Monitor during abatement activities:
1. Contractor license issued by New York State Department of Labor.
  2. Air Sample Log.
  3. Air sample results.
  4. Project Monitor Daily Log
  5. Asbestos Survey Report.
  6. A copy of ASTM Standard E1368 "Standard Practice for Visual Inspection of Asbestos Abatement Projects."
- E. The Work Area must be vacated by building occupants prior to decontamination enclosure construction and Work Area preparation.
- F. All demolition necessary to access asbestos containing materials for removal must be conducted within negative pressure enclosures by licensed asbestos handlers. Demolition debris may be disposed of as construction and demolition debris provided the Abatement Project Monitor determines that it is not contaminated with asbestos and there has been no disturbance of ACM within the enclosure. If the demolition debris is determined to be contaminated or ACM has been disturbed, it must be disposed of as asbestos waste.

### 3.2 PERSONNEL DECONTAMINATION ENCLOSURE

- A. Provide a personnel decontamination enclosure system when required. The system shall be contiguous to the Work Area unless the use of a remote unit is permitted by Code Rule 56 or a Site Specific Variance. The decontamination enclosure shall not be located within the work area unless isolation barriers are installed. If the decontamination unit is accessible to the public it shall be fully framed and sheathed to prevent unauthorized entry.

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ASBESTOS ABATEMENT

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- B. For attached Unit, access to the Work Area will be from the clean room through an air-lock to the shower and through an air lock to the equipment room. Each airlock shall be a minimum of three feet from door to door. Additional air locks shall be provided as required by Code Rule 56 for remote decontamination enclosures.
- C. The decontamination enclosure ceiling and walls shall be covered with one layer of opaque 6 mil polyethylene sheeting. Two layers of reinforced polyethylene sheeting shall be used to cover the floor.
- D. The entrance to the clean room shall have a lockable door. Provide suitable lockers for storage of Worker's street clothes. Storage for respirators along with replacement filters and disposable towels shall also be provided.
- E. Provide a temporary shower with individual hot and cold water supplies and faucets. Provide a sufficient supply of soap and shampoo. There shall be one shower for every six Workers. The shower room shall be constructed in such a way so that travel through the shower chamber shall be through the shower. The shower shall not be able to be bypassed.
- F. Shower water shall be drained, collected and filtered through a system with at least a 5.0 micron particle size collection capability containing a series of several filters with progressively smaller pore sizes to avoid rapid clogging of the system. The filtered waste water shall then be discharged in accordance with applicable codes and the contaminated filters disposed of as asbestos waste.
- G. The equipment room shall be used for the storage of tools and equipment. A walk-off pan filled with water shall be located in the Work Area outside the equipment room for Workers to clean foot coverings when leaving the Work Area. A labeled 6 mil plastic ACM waste bag for collection of contaminated clothing shall be located in this room.
- H. The personal decontamination enclosure shall be cleaned and disinfected minimally at the end of each Work shift and as otherwise directed by the Asbestos Project Monitor.

### 3.3 WASTE DECONTAMINATION ENCLOSURE

- A. Provide a waste decontamination enclosure system when required. The system shall be contiguous to the Work Area unless the use of a remote unit is permitted by Code Rule 56 or a Site Specific Variance. The decontamination enclosure shall not be located within the work area unless isolation barriers are installed. If the Unit is accessible to the public it shall be fully framed and sheathed to prevent unauthorized entry.
- B. The waste decontamination enclosure system shall consist of a holding area, air lock and washroom. The airlock shall be a minimum of three feet from door to door. The entrance to the holding area shall have a lockable door.
- C. The decontamination enclosure ceiling and walls shall be covered with one layer of opaque 6 mil polyethylene sheeting on walls and ceiling. Two layers of reinforced polyethylene sheeting shall be used to cover the floor.
- D. Where there is only one egress from the Work Area, the holding area of the waste decontamination enclosure system may branch off from the personnel decontamination enclosure equipment room, which then serves as the waste wash room.

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- E. The waste wash room water shall be drained, collected, and filtered through a system with at least a 5.0 micron particle size collection capability containing a series of several filters with progressively smaller pore sizes to avoid rapid clogging of the system. The filtered waste water shall then be discharged in accordance with applicable codes and the contaminated filters disposed of as asbestos waste.
- F. In small asbestos Projects where only one egress from the Work Area exists, the shower room may be used as a waste washroom. In this instance, the clean room shall not be used for waste storage, but shall be used for waste transfer to carts, which shall immediately be removed from this enclosure.

### 3.4 WORK AREA ENTRY AND EXIT PROCEDURES

- A. Access to and from the asbestos Work Area is permitted only through the personnel decontamination enclosure unless otherwise stipulated in a Site Specific Variance, the Cornell Ithaca Campus-Wide Variance, or 12 NYCRR Part 56 Subpart 11 Special Projects.
- B. Workers shall sign the entry/exit log upon every entry and exit.
- C. The following procedures shall be followed when entering the Work Area:
  - 1. Before entering the Work Area, Workers shall proceed to the clean room, remove all street clothes, and don protective clothing, equipment, and respirators.
  - 2. Workers shall proceed from the clean room through the shower room and the equipment room and into the Work Area.
- D. The following procedures shall be followed when exiting the Work Area:
  - 1. Before leaving the Work Area, gross asbestos contamination will be removed by brushing, wet cleaning and/or HEPA vacuuming.
  - 2. In the equipment room, Workers shall remove disposable clothing, but not respirators, and shall place clothing in plastic disposal bags for disposal as contaminated debris prior to entering the shower room.
  - 3. Workers shall shower thoroughly while wearing respirators, then wash respirator with soap and water prior to removal.
  - 4. Upon exiting the shower, Workers shall don new disposable clothing if the Work shift is to continue or street clothes to exit area. Under no circumstances shall Workers enter public non-Work Areas in disposable protective clothing.
- E. If remote decontamination enclosures are permitted by Code Rule 56 or a Site Specific Variance, workers shall wear two disposable suits for all phases of Work. Workers exiting the work area shall HEPA vacuum the outer suit, enter the airlock, remove the outer suit and then place it back into the Work Area. A clean second suit shall be donned before exiting the airlock and proceeding to the decontamination enclosure or another work area via the designated pathway required by Code Rule 56.

### 3.5 NEGATIVE AIR PRESSURE FILTRATION SYSTEM

- A. For Minor Project negative pressure tent work areas, a HEP-vacuum shall be utilized for negative air as per 12 NYCRR Part 56-11.3

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- B. For small-project and large-project work areas, provide a portable asbestos filtration system that develops a minimum pressure differential of negative 0.02 in. of water column within all full enclosure areas relative to adjacent unsealed areas and that provides a minimum of 4 air changes per hour in the Work Area during abatement and 6 air changes for non-friable flooring and/or mastic removal.
- C. Such filtration systems must be made operational after critical and isolation barriers are installed but before wall, floor, and ceilings are plasticized and shall be operated 24 hours per day during the entire Project until the final cleanup is completed and satisfactory results of the final air samples are received from the laboratory.
- D. The system shall include a series of pre-filters and filters to provide High Efficiency Particulate Air (HEPA) filtration of particles down to 0.3 microns at 100% efficiency and below 0.3 microns at 99.9% efficiency. Provide sufficient replacement filters to replace pre-filters every 2 hours, secondary pre-filters every 24 hours, and primary HEPA filters every 600 hours of operation.
- E. A minimum of one additional filtration unit of at least the same capacity as the primary unit(s) shall be installed and fully functional to be used during primary unit (s) filter changing and in case of primary failure.
- F. At no time will the unit exhaust indoors, within 15 feet of a receptor, including but not limited to windows and doors, or adversely affect the air intake of the building. Exhaust ducting shall not exceed 25' in length unless the conditions of AV-A-2 are utilized. Provide construction fencing at ground level exhaust termination locations per Code Rule 56.
- G. Upon electric power failure or shut-down of any filtration unit, all abatement activities shall stop immediately and only resume after power is restored and all filtration units are fully operating. For shut-downs longer than one hour, all openings into the Work Area, including the decontamination enclosures, shall be sealed.
- H. The Contractor shall provide a manometer to verify negative air pressure. Manometers shall be read twice daily and recorded within the Daily Project Log.
- I. There shall be at least a 4 hour settling period after the Work Area is fully prepared and the negative filtration units have been started to ensure integrity of the barriers.
- J. Once installed and operational, the Contractor's Supervisor shall conduct daily inspections of the Work Area to insure the airtight integrity of the enclosure and operation of the negative air system. Findings shall be recorded within the Daily Project Log. Inspections shall also be conducted on days when no abatement activities are in progress per Code Rule 56 (i.e. weekends).

### 3.6 REMOVAL OF ASBESTOS CONTAINING MATERIALS

- A. Asbestos-containing materials shall be removed in accordance with the Contract Documents and the approved Asbestos Work Plan. Only one type of ACM shall be abated at a time within a Work Area. Where there are multiple types of ACM requiring abatement, Code Rule 56 procedures for sequential abatement shall be followed.

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- B. Sufficiently wet asbestos materials with a low pressure, airless fine spray of surfactant to ensure full penetration prior to material removal. Re-wet material that does not display evidence of saturation.
- C. One Worker shall continuously apply amended water while ACM is being removed.
- D. Perform cutting, drilling, abrading, or any penetration or disturbance of asbestos containing material in a manner to minimize the dispersal of asbestos fibers into the air. Use equipment and methods specifically designed to limit generation of airborne asbestos particles. All power operated tools used shall be provided with HEPA equipped filtered local exhaust ventilation.
- E. Upon removal of ACM from the substrate, the newly exposed surfaces shall be HEPA vacuumed and/or wet cleaned. Surfaces must be thoroughly cleaned using necessary methods and any required solvents to completely remove any adhesive, mastic, etc.
- F. All removed material shall be placed into 6 mil plastic disposal bags or other suitable container upon detachment from the substrate. Cleanup of accumulations of loose debris or waste shall be performed whenever there is enough accumulation to fill a single bag or container and minimally at the end of each workshift.
- G. Large components shall be wrapped in two layers of 6 mil polyethylene sheeting. Sharp components likely to tear disposal bags shall be placed in fiber drums or boxes and then wrapped with sheeting.
- H. Power or pressure washers are not permitted for asbestos removal or clean-up procedures unless approved in a Site Specific Variance.
- I. All open ends of pipe and duct insulation not scheduled for removal shall be encapsulated using lag cloth.
- J. All construction and demolition debris determined by the Environmental Consultant to be contaminated with asbestos shall be handled and disposed of as asbestos waste.
- K. The use of metal shovels, metal dust pans, etc. are not permitted inside the work area.

3.7 EQUIPMENT / WASTE CONTAINER DECONTAMINATION AND REMOVAL PROCEDURES

- A. External surfaces of contaminated containers and equipment shall be cleaned by wet cleaning and/or HEPA vacuuming in the Work Area before moving such items into the waste decontamination enclosure system airlock by persons assigned to this duty. The persons in the Work Area shall not enter the airlock. No gross removal operations are permitted when waste transfer is in progress.
- B. The containers and equipment shall be removed from the airlock by persons stationed in the washroom during waste removal operations. The external surfaces of containers and equipment shall be cleaned a second time by wet cleaning.



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- C. The cleaned containers of asbestos material and equipment are to be dried of any excessive pooled or beaded liquid, placed in uncontaminated 6 mil plastic bags or sheeting, as the item's physical characteristics demand, and sealed airtight.
- D. The clean recontainerized items shall be moved into the airlock that leads to the holding area. Workers in the washroom shall not enter this airlock.
- E. Containers and equipment shall be moved from the airlock and into the holding area by persons dressed in clean personal protective equipment, who have entered from the holding area.
- F. The cleaned containers of asbestos material and equipment shall be placed in water tight carts with doors or tops that shall be closed and secured. These carts shall be held in the holding area pending removal. The carts shall be wet cleaned and/or HEPA vacuumed at least once each day.
- G. The exit from the decontamination enclosure system shall be secured to prevent unauthorized entry.
- H. Where the waste removal enclosure is part of the personnel decontamination enclosure, waste removal shall not occur during shift changes or when otherwise occupied. Precautions shall be taken to prevent short circuiting and cycling of air outward through the shower and clean room.

### 3.8 NON-FRIABLE FLOORING AND/OR MASTIC REMOVALS

- A. The following procedures may only be used for the removal of non-friable flooring and/or mastic materials using manual and chemical methods. These procedures shall not apply to beadblaster use or other abrasive abatement methods.
- B. The Contractor shall restrict access to the immediate area where tent removal procedures are taking place using barrier tape and/or construction barriers. Caution signs shall be posted.
- C. Remote personnel and waste decontamination enclosures may be utilized and shall be constructed at a location in accordance with the approved Work Plan.
- D. The Work Area shall include critical barriers and perimeter splash-guard.
- E. Negative air shall be maintained at six (6) air changes per hour.
- F. OSHA compliance air monitoring is required per section 1.10.
- G. ACM removal shall follow procedures defined in section 3.6.
- H. Waste material shall be placed in properly labeled 6 mil plastic bags or other appropriate containers. The outside of the bags or containers shall be wet wiped and/or HEPA vacuumed before being passed into the airlock for double- bagging. The bags or containers shall then be transported to the waste storage container. All transportation of waste bags and containers outside the Work Area shall be in watertight carts.

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- I. Following completion of gross abatement and after all accumulations of asbestos waste materials have been containerized, the following decontamination procedures shall be followed.
  1. All bagged asbestos waste and unnecessary equipment shall be decontaminated and removed from the Work Area.
  2. All surfaces in the Work Area shall be wet cleaned. A wet-purpose shop vacuum may be used to pick up excess liquid, and shall be decontaminated prior to removal from the Work Area.
  3. The Asbestos Project Monitor shall conduct a visual inspection of the Work Area for cleanliness and completion of abatement.
  4. The Contractor shall then apply a thin coat of encapsulant to all non-removal surfaces covered with plastic in the Work Area. In no event shall encapsulant be applied to any surface that was the subject of removal prior to obtaining satisfactory air monitoring results. Encapsulants shall be pigmented or tinted to provide an indication for completeness of coverage. The Asbestos Project Monitor shall determine adequacy of coverage.
  5. After the encapsulant has been applied and the required waiting/settling and drying time has elapsed, aggressive final clearance air sampling shall then be conducted by the Environmental Consultant.
  6. Upon receipt of satisfactory final clearance air sampling results, the isolation and critical barriers shall be removed. Following this, the decontamination enclosures shall be removed.

### 3.9 TENT ENCLOSURES FOR MINOR AND SMALL PLASTER REMOVALS / REPAIRS

- A. Tent enclosures may only be used where specifically permitted by Code Rule 56 or a Site Specific Variance issued by the NYS Department of Labor.
- B. The Contractor shall restrict access to the immediate area where tent removal procedures are taking place using barrier tape and/or construction barriers. Caution signs shall be posted.
- C. Remote personnel and waste decontamination enclosures shall be constructed when required, based on the scope of the tent work scope. Configuration shall be as required by Project size. For tent enclosures with gross abatement of friable materials, a contiguous decontamination system shall be constructed, maintained and utilized, except for minor size tent enclosure work areas where a remote decontamination enclosure is permitted by Code Rule 56.
- D. The Work Area shall be precleaned. All objects and equipment that will remain in the restricted area during abatement shall be sealed with two layers of six mil polyethylene and tape.
- E. The tent shall be a single use barrier constructed with a rigid frame and at least two layers of six mil polyethylene unless one layer of six mil polyethylene is otherwise permitted by Code Rule 56. Tents with twenty (20) square feet or less of floor space or no gross removal of friable ACM shall be constructed of one (1) layer of six mil polyethylene and shall include walls, ceilings and a floor (except portions of walls, floors and ceilings that are the removal surface) with double folded seams. All seams shall be sealed airtight using duct tape and/or spray adhesive.

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ASBESTOS ABATEMENT

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- F. The tent shall be constructed with at least one airlock for worker/waste egress.
- G. A monometer shall be used for all OSHA Class I abatement.
- H. Negative air shall be maintained at four (4) air changes per hour for non-friable and glovebag abatement tent enclosure work areas. Eight (8) air changes shall be maintained for friable gross removal tent enclosure work areas. In a Minor size abatement tent enclosure work area a HEPA vacuum may be used to maintain the required air changes.
- I. OSHA compliance air monitoring is required per section 1.09.
- J. ACM removal shall follow procedures defined in section 3.07.
- K. Waste material shall be placed in properly labeled 6 mil plastic bags or other appropriate containers. The outside of the bags or containers shall be wet wiped and/or HEPA vacuumed and shall then be placed in a second bag/container before being transported to the waste storage container. All transportation of waste bags and containers outside the Work Area shall be in watertight carts. These carts shall be held in the holding area pending removal. The carts shall be wet cleaned and/or HEPA vacuumed at least once each day.
- L. Following completion of gross abatement and after all accumulations of asbestos waste materials have been containerized, the following decontamination procedures shall be followed.
  - 1. All bagged asbestos waste and unnecessary equipment shall be decontaminated and removed from the Work Area.
  - 2. All surfaces in the Work Area shall be wet cleaned. A wet-purpose shop vacuum may be used to pick up excess liquid, and shall be decontaminated prior to removal from the Work Area.
  - 3. The Asbestos Project Monitor shall conduct a visual inspection of the Work Area for cleanliness and completion of abatement.
  - 4. After the waiting/settling and drying time requirements have elapsed, aggressive final clearance air sampling shall then be conducted by the Environmental Consultant.
  - 5. Upon receipt of satisfactory final clearance air sampling results, the tent shall be collapsed into itself, placed in suitable disposal bags, and transported to the waste decontamination enclosure. Isolation and critical barriers shall then be removed.

3.10 TRANSITE-LINED FUME HOOD \ FUME HOOD BASE CABINETS, AND FUME HOOD TRANSITE COUNTER-TOP REMOVALS

- A. Removal of the transite-line fume hood / fume hood base cabinet, and the fume hood transite counter-top shall be performed as per the associated provisions and conditions included in the Cornell University Ithaca Campus-Wide Variance File No. 22-1557. Reference Attachment A of this specification section for the Variance.

3.11 REMOVAL AND INSTALLATION OF ITEMS, DEVICES AND COMPONENTS MOUNTED ON ASBESTOS PLASTER WALLS / CEILINGS AND ASBESTOS FLOORING

- A. The removal of existing and installation of new light fixtures, equipment, wall boards, cabinetry, shelving, fire-protection devices, conduits / raceway, window treatments, and other miscellaneous mechanical / electrical / plumbing / fire protection / A-V items, devices

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& components that are scheduled to be removed / installed as a part of the project and are currently mounted on (existing) or are to be mounted on (new) asbestos containing plaster walls / ceilings and asbestos flooring shall be performed as per the associated provisions and conditions included in the Cornell University Ithaca Campus-Wide Variance File No. 22-1557. Reference Attachment A of this specification section for the Variance.

#### PART 4 DISPOSAL OF ASBESTOS WASTE

##### 4.1 TRANSPORTATION AND DISPOSAL SITE

- A. The Contractor's Hauler and Disposal Site shall be approved by the Owner's Representative.
- B. The Contractor shall give twenty-four (24) hour notification prior to removing any waste from the site. Waste shall be removed from the site only during normal working hours unless otherwise specified. No waste may be taken from the site unless the Contractor and Environmental Consultant are present and the Environmental Consultant authorizes the release of the waste as described herein.
- C. All waste generated as part of the asbestos project shall be removed from the site within ten (10) calendar days after successful completion of all asbestos abatement work.
- D. Upon arrival at the Project Site, the Hauler must possess and present to the Environmental Consultant a valid New York State Department of Environmental Conservation Part 364 Asbestos Hauler's Permit. The Environmental Consultant may verify the authenticity of the hauler's permit with the proper authority.
- E. The Hauler, with the Contractor and the Environmental Consultant, shall inspect all material in the transport container prior to taking possession and signing the Asbestos Waste Manifests.
- F. Unless specifically approved by the Owner, the Contractor shall not permit any off-site transfers of the waste or allow the waste to be transported or combined with any other off-site asbestos material. The Hauler must travel directly to the disposal site as identified on the notifications with no unauthorized stops.

##### 4.2 WASTE STORAGE CONTAINERS

- A. All waste containers shall be fully enclosed and lockable (i.e. enclosed dumpster, trailer, etc.). No open containers will be permitted on-site (i.e. open dumpster with canvas cover, etc.) unless specifically permitted by a Site Specific Variance.
- B. The Environmental Consultant shall verify that the waste storage container and/or truck tags (license plates) match that listed on the New York State Department of Environmental Conservation Part 364 permit. Any container not listed on the permit shall be removed from the site immediately.
- C. The container shall be plasticized and sealed with two (2) layers of 6 mil polyethylene. Once on site, it shall be kept locked at all times, except during load out. The waste container shall not be used for storage of equipment or contractor supplies.

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ASBESTOS ABATEMENT

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- D. While on-site, the container shall be labeled with EPA Danger signage:

DANGER  
CONTAINS ASBESTOS FIBERS  
AVOID CREATING DUST  
CANCER AND LUNG DISEASE HAZARD

- E. The New York State Department of Environmental Conservation Asbestos Hauler's Permit number shall be stenciled on both sides and back of the container.
- F. The container is not permitted to be loaded unless it is properly plasticized, has the appropriate danger signage affixed, and has the permit number appropriately stenciled on the container.

#### 4.3 ASBESTOS WASTE MANIFESTS

- A. The proposed asbestos waste manifest shall be submitted to the Owner's Representative prior to the start of the project for review and approval.
- B. The Manifest shall be completed by the Contractor and verified by the Environmental Consultant that all the information and amounts are accurate and the proper signatures are in place.
- C. The Manifests shall have the appropriate signatures prior to any waste being removed from the site.
- D. Copies of the completed Manifest shall be retained by the Environmental Consultant and the Contractor and shall remain on site for inspection.
- E. Upon arrival at the Disposal Site, the Manifest shall be signed by the Disposal Facility operator to certify receipt of ACM covered by the manifest. The Disposal Facility operator shall return the original Manifest to the Contractor.
- F. The Contractor shall forward copies of the Manifest to the Owner's Representative within 14 days of the waste container being removed from the site. Failure to do so may result in payment being withheld from the Contractor.
- G. Originals of all waste disposal manifests shall be submitted by the Contractor to the Owner's Representative with the final close-out documentation.

END OF SECTION 02 82 13

ASBESTOS ABATEMENT

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Attachment A

Cornell University Campus Wide Variance File No. 23-1557

STATE OF NEW YORK  
DEPARTMENT OF LABOR  
STATE OFFICE BUILDING CAMPUS  
ALBANY, NEW YORK 12240-0100

Variance Petition

of

Delta Engineers, Architects & Land Surveyors, PC  
Petitioner's Agent

On Behalf of

Cornell University (Dale Houseknecht)  
Petitioner

in re

Premises: Cornell University – Ithaca Campus  
Ithaca, NY 14853

**Interior Negative Pressure Unit Exhausting,  
Small Incidental Disturbance Cleanups,  
Coring Drilling Operations, Fire Door  
Removals, and Intact Transite Lab/Table Top  
and Fume Hood/Base Cabinets Removals and  
Elevated pipe Removals**

File No. 23-1557

FACILITY WIDE  
DECISION

Cases 1-35

ICR 56

The Petitioner, pursuant to Section 30 of the Labor Law, having filed Petition No. 23-1557 on December 21, 2023 with the Commissioner of Labor for a variance from the provisions of Industrial Code Rule 56 as hereinafter cited on the grounds that there are practical difficulties or unnecessary hardship in carrying out the provisions of said Rule; and the Commissioner of Labor having reviewed the submission of the petitioner dated December 21, 2023; and

Upon considering the merits of the alleged practical difficulties or unnecessary hardship and upon the record herein, the Commissioner of Labor does hereby take the following actions:

**Exhausting Negative Pressure Units**

Case No. 1	ICR 56-7.8(a)(11)
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**Small Incidental Disturbance Incidents**

Case No. 2	ICR 56-11.2(f)
Case No. 3	ICR 56-11.2(f)(4)

**Core/Drill Operations**

Case No. 4	ICR 56-6
Case No. 5	ICR 56-7.1
Case No. 6	ICR 56-7.2(o)
Case No. 7	ICR 56-7.5
Case No. 8	ICR 56-7.8
Case No. 9	ICR 56-8.1
Case No. 10	ICR 56-9.2

**Fire Door Removals**

Case No. 11	ICR 56-7.1
Case No. 12	ICR 56-7.5
Case No. 13	ICR 56-7.8
Case No. 14	ICR 56-7.11(a)(b)(c)(e)(f)
Case No. 15	ICR 56-8.1
Case No. 16	ICR 56-8.2(b)
Case No. 17	ICR 56-9.2

**Transite Lab/Table Tops and Fume Hood/Base Cabinets Removals**

Case No. 18	ICR 56-6
Case No. 19	ICR 56-7.1
Case No. 20	ICR 56-7.5
Case No. 21	ICR 56-7.8
Case No. 22	ICR 56-7.11(a)(b)(c)(e)(f)
Case No. 23	ICR 56-8.1
Case No. 24	ICR 56-8.2(b)
Case No. 25	ICR 56-9.2
Case No. 26	ICR 56-9.2(d)

**Removal of Elevated Pipe Insulation  
(Only Minor and Small Abatement Projects)**

Case No. 27	ICR 56-6
Case No. 28	ICR 56-7.1
Case No. 29	ICR 56-7.5
Case No. 30	ICR 56-7.8



Case No. 31	ICR 56-7.11(a)(b)(c)(e)(f)
Case No. 32	ICR 56-8.1
Case No. 33	ICR 56-8.2(b)
Case No. 34	ICR 56-9.2
Case No. 35	ICR 56-9.2(d)

VARIANCE GRANTED. The Petitioner's proposal is for interior negative pressure exhaust, incidental disturbance cleanups, coring/drilling operations, the removals of fire doors and transite lab/table tops and transite lined fume hoods/base cabinets and elevated pipe insulation at the subject premises in accordance with the attached 21-page stamped copy of the Petitioner's submittal, is accepted; subject to the Conditions noted below:

### **THE CONDITIONS**

#### **Building and Fire Code Requirements**

1. All other Codes shall apply, including but not limited to, "The New York State Uniform Fire Prevention and Building Code" or its successor. Following is a partial list of items required by other codes as they pertain to asbestos projects:
  - a. Accessible Means of Egress from all work areas shall be installed, marked inside and out, and shall be maintained throughout the asbestos project, as per all pertinent federal state and local regulations. In general, means of egress is a continuous and unobstructed path of vertical and horizontal egress travel from any occupied portion of a building or structure to a public way. A means of egress consisted of three separate and distinct parts: the exit access, the exit and the exit discharge.
  - b. If building is occupied, no alterations allowed to existing means of egress including exit signage and illumination. Means of egress must be maintained for the duration of the asbestos project.
  - c. For unoccupied buildings undergoing construction or preparation for demolition, that are greater than fifty (50) feet in height, or four or more stories, at least one lighted stairway with adequate exit signage including directionality, shall be provided and maintained for the duration of the asbestos project.
  - d. Maintain existing fire protection systems at building throughout asbestos project as per New York State Uniform Fire Prevention and Building Code requirements, and any local regulations. No person shall remove or modify any fire protection system installed or maintained under the provisions of the New York State Uniform Fire Prevention and Building Code without approval by the code enforcement official.

- e. Pre-demolition asbestos projects at vacant buildings with an existing standpipe, must have such standpipe maintained in an operational condition to one floor below the asbestos project work.
- f. A copy of the current pre-fire plan for the asbestos project shall be available on-site and a copy shall be provided to the Fire Chief having jurisdiction at the site. Emergency evacuation route maps for each work area shall be posted at the attached decontamination system enclosures, the ground floor lobby or comparable location, and at all exits from each work area.
- g. If variation from The New York State Uniform Fire Prevention and Building Code or local regulations is required for fire or life safety issues relating to, or resulting from the asbestos project, all appropriate permits must be obtained using New York State registered design professionals as required by pertinent state or local agency. If a permit is not required for the variation, then written approval of the variation must be obtained from the pertinent agency and made part of the project record. This documentation must be available on-site for the duration of Phase II of the asbestos project. Copies of each approved variation to pertinent regulations shall be given to the Fire Chief having jurisdiction at the site, prior to implementation of the variation.

### **Fire Protection System Devices**

- 2. All exposed fire protection system devices within the regulated abatement work area shall not be considered fixed objects subject to plasticization. The devices shall be wet-wiped and/or HEPA vacuumed during the cleaning portion of the asbestos project.

### **Exits**

- 3. Exits from the regulated abatement work area shall be maintained or alternate exits shall be established and appropriately signed according to all applicable codes. Exits shall be inspected daily by the supervisor for blockage or impediments to exiting. Signs clearly indicating the direction of exits shall be maintained and prominently displayed within the work area. Exits from the work area shall not be obstructed with sheathing and shall be constructed using two (2) layers of at least six (6) mil fire-retardant plastic sheeting sealed airtight with duct tape. Utility knives shall be taped to the work area side of each exit once the exit has been established.

**Full-Time Project Monitor:**

4. A full-time independent project monitor (PM) shall be on site and is responsible for oversight of the abatement contractor during all abatement activities to ensure compliance with ICR 56 requirements including but not limited to ICR 56-3.2(d)(8) and variance conditions.
5. In addition, the PM shall ensure that no visible emissions are generated during abatement activities. If visible emissions are observed, work practices shall be altered according to the PM's recommendations.
6. The PM shall perform the following functions during asbestos abatement projects in addition to functions already required by ICR-56:
  - a. Inspection of the interior of the asbestos project work area made at least twice every work shift accompanied by the Asbestos Supervisor.
  - b. Observe and monitor the activities of the asbestos abatement contractor to determine that proper work practices are used comply all applicable asbestos laws and regulations.
  - c. Inform the asbestos abatement contractor of work practices that, in the PM's opinion, pose a threat to public health or the environment, and are not in compliance with ICR-56 and/or approved variances or other applicable asbestos rules and/or regulations.
  - d. Document in the Project Monitor Log observations and recommendations made to the Asbestos Supervisor based upon the interior/exterior observations of the asbestos project made by the PM.
  - e. Duties specified in variances issued for the project.
7. The PM shall alert the local District Office of the NYSDOL Asbestos Control Bureau whenever, after the PM has provided recommendations to the Asbestos Supervisor, unresolved conditions remain at the asbestos project site which present a significant potential to adversely affect human health or the environment.
8. The PM is not onsite to direct the abatement workers in their work. That is the responsibility of the Contractor's designated Supervisor. The ultimate caliber of work performance and quality of the completed project is the responsibility of the contractor who performs the work.

9. The PM is not responsible for enforcing Local, State, Industry, or Federal regulations, rules or codes which are not directly applicable to the contracted asbestos abatement activities. These would include, but not limited to, fire codes, electrical codes, building codes, wage rates schedules, etc. While the PM is not responsible for enforcement of these items, the Contractor is still responsible for compliance with such requirements as applicable.
10. The PM is responsible for any duties specified in his/her contract with the Owner.

#### **Project Monitor**

11. A full time independent project monitor shall be on-site to observe the abatement contractor's work practices and to ensure that no visible emissions are generated during the removal and cleanup activities. If visible emissions are observed, work practices shall be altered according to the project monitor's recommendations.
12. The regulated work areas, decontamination units, airlocks, and dumpster areas shall be cordoned off at a distance of twenty-five feet (25') where possible, and shall remain vacated except for certified workers until the abatement project is complete. For areas where twenty-five feet isn't possible, the areas shall be cordoned off as practical, and a daily abatement air sample shall be included within ten feet (10') of the barrier.

#### **Exhausting to an Interior Space**

13. Negative pressure ventilation units that cannot be exhausted to the outside of the building or structure shall be directed to an unoccupied, controllable location within the building.
14. This location shall be accessible for the placement of air monitoring equipment as required by the applicable sections of this code.
15. A controllable area shall be defined as an existing, vacant room or an area within a larger space isolated by barrier tape and warning signs. This location shall be adequately sized to accommodate the increase in positive pressure to the area.
16. All openings within 25 feet of the Negative air machine exhaust termination shall be sealed with two layers of fire retardant polyethylene.
17. Air monitoring shall be conducted at each tube when exhausting to an interior space. Banking of tubes for air monitoring is not permitted.

18. If elevated air samples are indicated, work shall stop immediately. The faulty negative air machine shall be taken out of service and repaired. A replacement machine shall be installed to maintain the required negative air pressure differential in the work area.
19. Elevated air samples results shall be submitted to the Commissioner as required by ICR 56-4.10 (a)
20. Then all surfaces within area where the faulty negative air machine is exhausting to shall be wet wiped and HEPA vacuumed. The Project Monitor shall conduct a visual inspection of the area prior to resumption of work.
21. A summary of the cleanup activities and negative air machine repairs shall be documented in the Supervisor's daily log.

#### **Small Incidental Disturbance Incidents**

22. As written with modifications noted.

#### **HEPA-Exhausted Drilling/Saw Cutting Wall Spot Removals**

23. Each affected room/area/space shall be vacated for the duration of preparation, drilling/saw cutting/penetration, and cleaning operations and shall be considered a restricted area. Each affected space shall not be reoccupied until receipt of satisfactory air results as detailed below.
24. A Nilfisk negative pressurized drill shield shall be used in combination with a suitable HEPA vacuum for all ACM drilling operations. ACM drilling shall proceed using manufacturer's recommended operating procedures. Wet methods (i.e. shaving cream, foam or other wet method) shall be used at the cut location.
25. All power tools used to disturb ACM shall be HEPA ventilated as per ICR 56-7.2(o).
26. The interior of the power tool dust shroud is the regulated abatement work area for each ACM spot removal location. However, the room/area/space where ACM drilling operations occur is considered to be a restricted area, limited to certified personnel and authorized visitors only, until the asbestos project is complete and satisfactory air results have been obtained. The restricted area shall be cordoned off and signage posted in accordance with Subpart 56-7.4(c) of ICR 56.
27. If a ceiling, floor or wall partition is to be penetrated through, then the opposite side of the ceiling, floor or wall partition shall be considered part of the restricted area. Negative pressure controls shall be used (i.e. negative pressure tent or negative pressure glove box) during penetration operations to prevent uncontrolled disturbance at the opposite side of the ceiling or wall penetration.

28. Beneath ladders/ scaffolds, ACM drilling/penetration operations, a two-layer drop cloth of 6-mil fire retardant plastic sheeting is required.
29. Carpeting shall be protected during ACM drilling/penetration operations, if needed.
30. In addition to the requirement of Subpart 56-4, air monitoring within each room/area/space restricted area shall be conducted daily. One daily abatement air sample shall be collected within ten (10) feet of the ACM drilling location(s) during removal and cleaning operations.
31. Daily abatement air monitoring is required only on days when abatement or support activities such as ACM disturbance or cleaning activities are performed.
32. All exposed edges of drill holes and sawed areas shall be encapsulated.
33. In lieu of post-abatement clearance air monitoring in compliance with ICR-56-9.2(d), the most recent daily abatement air samples collected during drilling and cleaning operations in the restricted area, shall be used for comparison with ICR 56-4.11 clearance criteria.
34. The contractor shall observe, at a minimum, a ten (10) minute waiting (settling/drying) period after removal and cleaning is complete at each location.
35. After removal and cleanings are complete and the work area surface is dry, the Project Monitor shall determine if the area is dry and free of visible asbestos debris.
36. Upon completion of a satisfactory visual inspection and obtaining air sample results that satisfy the clearance criteria, all remaining plastic sheeting and tape will be treated as contaminated material and properly disposed of as asbestos waste. Once all remaining work area preparation has been removed, the space may be reoccupied.

### **Fire Door Removals**

37. A remote personal decontamination enclosure system that complies with 56-7.5(d) may be utilized. A waste decontamination enclosure system that fully complies with 56-7.5(f) shall be utilized.

38. The restricted area shall be considered to be the area/room/space from which the ACMs are actively being removed intact, and shall extend twenty-five (25) feet in all horizontal directions from the area of fire door removal. This restricted area shall remain vacated except for certified workers. This area will be posted with signs and barrier tape in accordance with NYCRR 56 and 29 CFR 1926.1101. For areas where twenty-five feet isn't possible, the areas shall be cordoned off as practical, and a daily abatement air sample shall be included in the vicinity of the barrier.
39. Background air sampling as per 56-6 is not required for these intact types of removals.
40. A pre-abatement waiting period as per 56-8.2(b) is not necessary for these intact types of removals.
41. Under areas where ACM fire doors are removed without tents, a dropcloth, made of six (6) mil fire retardant polyethylene sheeting, shall be placed on the ground below the work area to prevent spread of any ACM remnants.
42. All fire doors with ACM shall be removed intact without any disturbance to the ACM matrix during removal operations. If power tools are utilized to aid in unfastening the doors, the power tools shall be manufacturer equipped with HEPA-exhaust attachment, and shall be utilized as per manufacturer's instructions.
43. Fire doors shall be wrapped in two layers of 6 mil, fire retardant plastic sheeting and secured air tight prior to removal from the door frame.
44. Prior to wrapping a door, a third party Project Monitor shall inspect the door for damages or potential damage which may result in a disturbance. If damages are noted, work shall be stopped and temporary protection such as sealing the damaged area with duct tape will be done immediately.
45. Asbestos containing materials will not be allowed to accumulate on the drop cloth.
46. Refer to 56-9.1(e) for cleaning requirements. No waiting period as per 56-9.1 (f) is required.
47. Daily abatement air monitoring is required only on days when abatement or support activities such as work area preparation, fire door removal or cleaning activities are performed. One sample shall be collected within ten feet of the barrier. The second sample shall be taken inside the regulated work area. Both air samples shall be collected during all work area preparation, ACM removal and cleanup phases of the intact removal project.

48. In lieu of post-abatement clearance air monitoring in compliance with 56-9.2(d), the most recent daily abatement air samples collected shall be used for comparison with 56-4.11 clearance criteria.
49. After removal and cleanings are complete, an authorized and certified Project Monitor, independent of the Abatement Contractor, shall determine if the area is dry and free of visible asbestos debris as per 56-9.1(d) (1). If the area is determined to be acceptable and the most recent daily abatement air sample results meet 56-4.11 clearance criteria, the final dismantling of the site may begin.

#### **Transite Lab/Table Tops and Fume Hood/Base Cabinet Removal**

50. Interior ACM intact component removals can either be removed within tents or removed as part of a larger work area. Removals without tents will require plasticizing or sealing of nearby windows, placement of dropcloths and other operational safeguards as outlined below.
51. The restricted area shall be considered to be the area/room/space from which the ACMs are actively being removed intact, and shall extend twenty-five feet in all horizontal directions from the area of active component removal. This restricted area shall remain vacated except for certified workers until satisfactory clearance air monitoring results have been achieved. This area will be posted with signs and barrier tape in accordance with NYCRR 56 and 29 CFR 1926.1101.
52. At all penetrations and openings to the restricted area surfaces, critical barriers shall be installed in conformance to Subpart 56-7.11(a). All openings (critical barriers) shall be covered with two (2) two layers of (6) six-mil fire retardant polyethylene or for around pipes or similar openings an expandable foam or other sealant may be used.
53. Background air sampling is not required for these intact types of removals.
54. A pre-abatement waiting period as per 56-8.2(b) is not necessary for these intact types of removals.
55. (Applies if tents are not used.) Under areas where ACM is removed without tents, a dropcloth, made of six (6) mil fire retardant polyethylene sheeting, shall be placed on the ground below the work area to prevent spread of any ACM remnants.
56. All components with ACM shall be removed intact without any disturbance to the ACM matrix during removal operations. If power tools are utilized to aid in unfastening components, the power tools shall be manufacturer equipped with HEPA-exhaust attachment, and shall be utilized as per manufacturer's instructions.



57. Materials removed shall be containerized or immediately wrapped in two layers of 6 mil, fire retardant plastic sheeting and secured air tight prior to transport to the waste decontamination facility.
58. Asbestos containing materials will not be allowed to accumulate on the drop cloth.
59. Refer to 56-9.1(e) for cleaning requirements.
60. Daily abatement air sampling is required only on days when abatement or support activities such as ACM disturbance or cleaning activities are performed. Inside work area air samples shall be collected during abatement and cleaning activities to supplement the ICR 56 required daily abatement air sampling. The number of inside work area air samples shall be dependent on the amount of ACM to be abated within the work area (1 – minor, 3 – small, 5- large), and the air samples shall be distributed throughout the work area.
61. In lieu of post-abatement clearance air monitoring in compliance with 56-9.2(d), the most recent daily abatement air samples (both inside and outside work area samples) collected during removal and cleaning operations in the regulated abatement work area, shall be used for comparison with 56-4.11 clearance criteria.
62. After removal and cleanings are complete, an authorized and certified Project Monitor, independent of the Abatement Contractor, shall determine if the area is dry and free of visible asbestos debris as per 56-9.1(d)(1). If the area is determined to be acceptable and the most recent daily abatement air sample results meet 56-4.11 clearance criteria, the final dismantling of the site may begin.
63. Upon completion of the ACM intact component removal, all remaining waste materials shall be removed within each work area and the critical barrier caulk, tape and/or interior plastic sheeting, shall be containerized or immediately wrapped in two layers of 6 mil, fire retardant plastic sheeting or bagged and secured air tight prior to transport to the waste decontamination facility.

**Elevated Pipe Removals (Only minor and small abatement projects allowed)**

64. The full time on-site Project Monitor will be responsible to determine if pipe/fitting insulation or other thermal system insulations is too damaged to perform wrap-and-cut or glovebag operations. Any thermal system insulation that is significantly damaged and will likely be disturbed during wrapping or glovebag installation, shall require gross removal within a negative pressure enclosure as per the conditions of this variance. All failures of the abatement contractor to comply with the project monitor's

determination regarding damage shall be immediately reported by the project monitor to the local district of the asbestos control bureau.

65. The restricted areas, regulated abatement work areas, decontamination units, airlocks, and dumpster areas shall be cordoned off at a distance of twenty-five feet (25') where possible, and shall remain vacated except for certified workers until satisfactory clearance air monitoring results have been achieved or the abatement project is complete. For areas where 25-feet aren't possible, the areas shall be cordoned off as practical, and a daily abatement air sample shall be included within 10 feet of the barrier. These areas shall have Signage posted in accordance with Subpart 56-8.1(b) of this Code Rule.

#### **Pipe/Fitting Insulation Removals at or Below 15 Feet in Height**

66. All provisions of ICR 56-8.4(a) for glovebag removals completed within negative pressure enclosure shall be followed for removal of pipe and fitting insulations located at or below 15 feet in height from the ground/floor

#### **Elevated (Greater than 15 Feet in Height Pipe and Fitting Insulation Removals:**

67. Remote Decontamination Units as per ICR 56-7.5(d) **are allowed** for this portion of the project, provided glovebags are used for all insulation removals.
68. If remote decontamination units are to be used, an airlock as defined in Subpart 56-7.5(b)(11) of this Code Rule shall be constructed at the entrance to each regulated abatement work area, and shall be large enough to serve as a changing area. Within the airlock, workers shall remove their outer suit, wipe off their inner suit and don a clean outer suit prior to proceeding to another work area or to the remote personal decontamination unit over a walk way as defined above. The airlock/changing area shall not be used as a waste storage area.
69. The Remote Personal Decontamination Unit must be located as close to the abatement area as practicable. The walkway from the regulated abatement work area to the decontamination system shall have a cleared pathway. This walkway will be delineated and separated from non-certified personnel access.
70. The restricted work areas and decontamination unit shall be cordoned off as proposed and shall remain vacated except for certified workers. These areas shall have signage posted in accordance with subpart 56-8.1(b) of this Code Rule.
71. Entry/Exit of all persons and equipment shall be through one designated and secure "doorway" in the barrier or fence, which shall provide an adequate and appropriate means of egress from the work area.

72. Personal protective equipment as required by ICR 56 shall be required of and used by all persons within the work area.
73. All workers within the work area and all equipment operators accessing the work area to disturb asbestos-containing materials, shall be certified in accordance with ICR 56-3.2.
74. Critical Barriers to any vicinity structures within 25 foot of the immediate glovebag removal area shall be installed in conformance to Subpart 56-7.11(a). All openings (critical barriers) shall be covered with two (2) layers of (6) six-mil fire retardant polyethylene or for around pipes or similar openings an expandable foam or other sealant may be used.
75. Under areas where ACM is scheduled for negative pressure glovebag operations without a tent enclosure, a dropcloth, made of 6 mil fire retardant polyethylene sheeting, shall be placed below the material to be removed to prevent spread of any ACM remnants. This dropcloth shall be a minimum of 10 feet wide with an additional 10-ft. of width for every 20 feet in height above the floor/ground level where removal work will take place. This dropcloth shall be removed and containerized following removal of the glovebags or abandoned piping, prior to the cleaning stage. All remnants observed on the dropcloth shall be collected and immediately bagged or containerized for disposal as ACM.
76. If a straight scaffolding, man-lift, swing scaffolding or similar equipment is used, the lift/scaffolding unit shall be plasticized with two layers of 6 mil fire retardant polyethylene on the platform with plastic sheeting on all platform sides. While the platform/lift walking surfaces must be plasticized, the Contractor must provide proper traction surfaces or equipment to assure the safety and comfort of abatement workers while performing abatement activities on the lift/scaffold equipment. After glovebags are removed from each work location, the platform and plasticized surfaces shall be wet wiped and/or HEPA vacuumed clean before reuse. The plastic on the lift or scaffolding shall be periodically inspected during use and repaired as needed.
77. A commercially available negative pressure glovebags may be utilized for removals, in lieu of glovebag removals within negative pressure tent/shroud enclosures. Glovebag removal procedures shall be consistent with ICR 56-8.4 and OSHA 29 CFR 1926.1101, for all insulation removals.
78. If negative pressure glovebags are not available, standard glovebags placed under negative pressure using a HEPA vacuum during removal may be utilized. These glovebags shall be fitted with adequate interior support to prevent collapse while under negative pressure. The integrity of the glovebag shall not be compromised by this additional support.
79. The makeup air inlet to the glovebag shall be fitted with a HEPA filter

80. Actions that shall be taken in the event of a loss of glovebag integrity are as outlined in Subpart 56-8.4(a)(11).
81. Once ACM removal has been completed, one thorough cleaning as described in ICR 56-9.1(e) and one settling, waiting period shall suffice, except when an air test fails.
82. The contractor shall observe, at a minimum, two-hour waiting (settling/drying) periods for glovebag removals, and 20-minute waiting (settling/drying) periods for man-lift removals.
83. After removal and cleanings are complete and a minimum drying period has elapsed, Project Monitor shall determine if the area is dry and free of visible asbestos debris. For man-lift work areas, if the area is determined to be acceptable and the most recent daily abatement air sample results meet 56-4.11 clearance criteria, the final dismantling of the site may begin.
84. All pipe waste must be immediately containerized and labeled. All generated waste shall be adequately wet and transported as an asbestos-containing material by appropriate legal methods.

**Wrap and Cut Procedures:**

85. Elevated Wrap and Cut pipe removals shall be per ICR 56-11.8, the above conditions and the following:
  - a. Nylon slings shall be used to lower/move insulated pipe sections of convenient lengths. No dry disturbance or removal of asbestos material shall be permitted.
  - b. One worker shall continually wet down the pipe during wrapping and cutting operations.
  - c. Once each section of pipe is removed, a thorough cleaning of any remaining visible pipe insulation debris must be completed in the immediate area.
  - d. Any observed pipe insulation debris will be wet down and immediately containerized or immediately wrapped in two layers of 6 mil, fire retardant plastic sheeting and secured air tight prior to transport to the waste decontamination facility.
  - e. All cuts to the pipe/insulation shall be done using glovebag methods.
86. Usage of this variance is limited to those asbestos removals identified in this variance or as outlined in the Petitioner's proposal.

In addition to the conditions required by the above specific variances, the Petitioner shall also comply with the following general conditions:

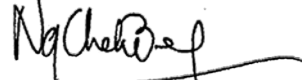
### GENERAL CONDITIONS

1. A copy of this DECISION and the Petitioner's proposals shall be conspicuously displayed at the entrance to the personal decontamination enclosure.
2. This DECISION shall apply only to the removal of asbestos-containing materials from the aforementioned areas of the subject premises.
3. The Petitioner shall comply with all other applicable provisions of Industrial Code Rule 56-1 through 56-12.
4. The NYS Department of Labor Engineering Service Unit retains full authority to interpret this variance for compliance herewith and for compliance with Labor Law Article 30. Any deviation to the conditions leading to this variance shall render this variance Null and Void pursuant to 12NYCRR 56-12.2. Any questions regarding the conditions supporting the need for this variance and/or regarding compliance hereto must be directed to the Engineering Services Unit for clarification.
5. This DECISION shall terminate on **December 22, 2025.**

Date: December 22, 2023

By

ROBERTA L. REARDON  
COMMISSIONER OF LABOR



Chek beng Ng, P.E.  
Professional Engineer 2 (Industrial)

PREPARED BY: Timothy Donlon, P.E.  
Professional Engineer 1(Industrial)

REVIEWED BY: Chek beng Ng, P.E.  
Professional Engineer 2 (Industrial)



## Petition for an Asbestos Variance

To apply for an asbestos variance, the Project Designer must:

- Complete all of the information on pages one and two of this asbestos variance request. Please type or print.
- Sign and date page two of the certification and all of the attachments.
- Send two copies of the petition and all attachments, with your \$350 fee, to the address at the top of this page.
  - Make your check or money order payable to the Commissioner of Labor
- Optional: To speed up the process you may include a self-addressed, stamped, express-mail envelope.

1a. Is this petition related to a safety or health emergency? \_\_\_\_ Yes \_\_\_\_ ☒ No

b. If yes, explain: \_\_\_\_\_

2a. **Name of Petitioner, (Property Owner):** Cornell University, Contact: Dale Houseknecht, Asbestos Coordinator

b. Street Address: 116 Humphreys Service Building

c. City: Ithaca

d. State: NY e. Zip: 14850

f. Telephone Number: (607) 327-1359

g. Fax Number: 607 255-4009

h. Petitioner's Federal Employee Identification Number (FEIN) \_\_\_\_\_

3a. **Petitioner's Agent (Asbestos Contractor) Firm Name:** Delta Engineers, Architects, & Surveyors

b. Street Address: 860 Hooper Road

c. City: Endwell

d. State: NY e. Zip: 13760

f. Telephone Number: (607) 231-6600

g. Fax Number: (607) 231-6640

4a Asbestos Contractor License No. 29322

b. Name of Firm: Delta Engineers, Architects, Land Surveyors, & Landscape, Architects, D.P.C.

### 5. Building Description:

a. Affecting premises known as: Cornell University's Ithaca, New York Campus

b. These premises are situated on the \_\_\_\_ North, \_\_\_\_ South, \_\_\_\_ East, \_\_\_\_ West side of \_\_\_\_ Street, \_\_\_\_ Ave. \_\_\_\_ Road.

c. County of Tompkins

d. Street Address: Not Applicable (N/A) - Campus Wide Variance Petition

e. City: Ithaca

d. State: NY e. Zip: 14850

h. Is building occupied? \_\_\_\_ Yes \_\_\_\_ ☒ No

i. Current function of building: Various Buildings functioning as classrooms, offices, research/labs, etc.

j. Approximate area (square feet) of building: N/A k. Number of stories or height in feet: N/A

l. What is within 25 feet of all four sides (North, South, East, West) of building? i.e. sidewalk, alley, land, another building, etc.: N/A - Campus-Wide Variance Petition

### 6. Order To Comply or Notice of Violation. Attach copy.

a. Issued to: \_\_\_\_ Owner \_\_\_\_ Asbestos Contractor \_\_\_\_ Operator \_\_\_\_ Other

b. Name on Order or Notice: \_\_\_\_\_ c. Date issued: \_\_\_\_ / \_\_\_\_ / \_\_\_\_

d. List the Industrial Code Rule (ICR) citations given on the Order to Comply or Notice of Violation: \_\_\_\_\_

### 7. If a variance has been granted previously for work closely resembling this project list:

a. Variance number: <u>20-0068 - Previous Campus-Wide Variance</u>	b. Date variance granted: <u>01 / 31 / 2020</u>
c. Variance number: <u>17-0034 - Previous Campus-Wide Variance</u>	d. Date variance granted: <u>01 / 18 / 2017</u>
e. Variance number: <u>14-0035 - Previous Campus-Wide Variance</u>	f. Date variance granted: <u>01 / 21 / 2014</u>
g. Variance number: <u>11-0024 - Previous Campus-Wide Variance</u>	h. Date variance granted: <u>01 / 21 / 2011</u>

Note: Add a separate typed or printed page for each work area and work procedure. Sign and date each page.

**8. Work Area Description table:** Attach additional tables and scale drawings of work area and pictures, as needed.

Work Area Designation	Exterior Or Interior	Work/Room Area Dimensions	Type of Asbestos Containing Material (ACM)	Quantity of ACM	Condition of ACM (level of Damage)	Friability of ACM (non-friable or friable)	Type of Containment (full, 2-layer tent, single Layer tent, open-air, etc)
Small Project Incidental Disturbance Clean-ups	Interior and Exterior	Various Buildings Campus Wide	Varies	Small Size Projects Only	Incidental Disturbance	Friable & Non-Friable Materials	Critical Barriers & Negative Pressure with Attached (Friable) and Remote ( NOB) Personal Decon Enclosure
Elevated Pipe Insulation (15' or greater)	Interior and Exterior	Various Buildings Campus Wide	Intact in-line Pipe and Pipe Fitting Insulation	Minor, Small and Large size projects	Intact	Friable	Restricted Work Area, floor level Drop Cloth, polyed lift basket, negative pressure glovebags, small-project decon
localized coring/ drilling operations	Interior	Various Buildings Campus Wide	Varies	Minor Impact (1/2" to 1-1/2" dia.) at each Drill/Core Location	Intact	Friable & Non-Friable Materials	Glovebag, Drill w/ Manufacturer equipped HEPA Drill shield and HEPA filtered Local Exhaust Ventilation
Transite Lab-tops/Transite-lined fume hoods/Base Cabinets	Interior	Various Buildings Campus Wide	Intact Transite	Small & Large size Projects	Intact	Non-Friable	Interior restricted Regulated Work Area via Barrier Tape & Drop Cloth
NPU Exhaust Relief	Interior	Various Buildings Campus Wide	Varies	Small & Large size Projects	Varies	Friable & Non-Friable Materials	For use with any type Negative Pressure Enclosure
Fire Door / Elevator Door Removals	Interior	Various Buildings Campus Wide	Sealed Fire Door / Elevator Door Core	Small Project per door location	Intact/sealed	Friable	Interior restricted Regulated Work Area via Barrier Tape & Drop Cloth
Minor Project Incidental Disturbance Clean-ups	Interior and Exterior	Various Buildings Campus Wide	Varies	Minor Size Projects Only	Incidental Disturbance	Friable & Non-Friable Materials	Critical Barriers & Negative Pressure with Attached Airlock System when no space for a small-project Decon Unit

9. **ICR 56 Relief Sought:** List the individual sections of ICR 56 for which relief is sought, for each work area or method used. Provide sufficient detail in an attachment. See Attachment A

10. **Hardship Description:** What is the hardship, (e.g. Limited room for decons, exhaust ducts must be longer than 25 feet, all Surfaces are contaminated and cannot be plasticized) for each work area or method used? Provide sufficient detail in an attachment. Include condemnation letter or EPA Approval letter if applicable. See Attachment A

11. **Proposed Abatement Method Description for each work area or method used.** Include scale drawings and pictures as necessary. Lack of sufficient detail will delay issuance of variance decision.
- a. Will proposed abatement methods render non-friable ACM material friable? \_\_\_\_\_ Yes X No
- b. What proposed abatement method, increased engineering controls and detailed procedures will be used to compensate for the relief being sought? (i.e. Increased negative air rate, negative pressure glovebag, negative pressure glovebox, high temperature glovebag, intact component removal, etc.) Include sufficiently detailed procedures to complete the proposed work. See Att. B

## Project Designer Certification

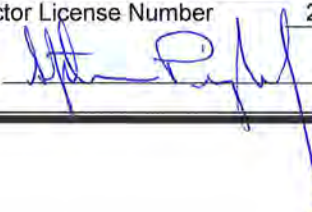
I request that the Commissioner of Labor issue a variance from the requirements of Industrial Code Rule (ICR) 56. This request is based on the information in this application and the attached documents.

**I certify that the information contained in this petition is true and accurate.**

I understand that if a variance is granted it may be withdrawn by the Commissioner if:

- Any of the information provided in this petition is found to be inaccurate
- There are violations of Article 30 of the New York State labor Law or New York State regulations.

I give the Commissioner of Labor permission to provide all of my companies records for Unemployment Insurance (U.I.) reports and contributions to employees of the New York State Department of Labor. This includes information about withholding, wage reporting, U.I. returns, U.I. registration, New Hires, and all records of U.I. delinquencies. This information may only be used for government purposes regarding the licensing and certification of this company as required by Article 30 of the New York State labor Law and the regulations of the New York State Department of Labor, and for monitoring the company's compliance with Article 30 and ICR 56.

12a. Project designer name (print): <u>Stephen Prislupsky</u> c. Project Design Asbestos Contractor firm name: <u>Delta Engineers, Architects, and Surveyors</u> d. Street: <u>860 Hooper Road</u> e. City: <u>Endwell</u> i. Design certificate number: <u>23-6L43B-SHAB</u> k. Design Firm Asbestos Contractor License Number <u>29322</u>	b. E-Mail: <u>sprislupsky@delta-eas.com</u> f. State <u>NY</u> g. Zip: <u>13760</u> h. Phone: <u>(607) 231-6600</u> j. Expiration Date: <u>11</u> / <u>30</u> / <u>2024</u> l. Expiration Date: <u>10</u> / <u>31</u> / <u>2024</u> 13a. Project designer signature:  b. Date: <u>12</u> / <u>21</u> / <u>2023</u>
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December 21, 2023

State of New York - Department of Labor  
Division of Safety and Health - Engineering Services Unit  
State Office Building Campus  
Building 12 – Room 154  
Albany, NY 12240

Re: **Petition for Multi-Site Facility (Campus) Wide Variance - Cornell University Ithaca, NY Campus**  
**Relief sought for:**

- 1) **Negative Pressure Equipment Exhaust Ventilation for Buildings with Inoperable Windows**
- 2) **Future “Small” Project Incidental Disturbance Clean-Up Episodes**
- 3) **Localized “Minor” Coring/Drilling Operations into Asbestos Containing Materials**
- 4) **Removal of Fire Doors with Asbestos Containing Cores**
- 5) **Intact Removal of Transite Lab-tops, Transite Table Tops and Transite-lined Fume Hoods**
- 6) **Removal of Elevated Pipe Insulation using Negative Pressure Glovebags**
- 7) **Future “Emergency” Minor Project Incidental Disturbance Clean-Up Episodes**

**ATTACHMENT A**

**Work Area Description, ICR 56 Relief Sought & Hardship Description**

**BACKGROUND INFORMATION**

**DELTA ENGINEERS, ARCHITECTS, & SURVEYORS** (Delta) has been hired by Cornell University to prepare and submit a Petition for a Multi-Site Facility (Campus) Wide Variance associated with relief from the 12 NYCRR Part 56 related to; 1) Engineering Controls requirements for negative air pressure exhaust location provisions; 2) the clean-up of future “small project” incidental disturbances; 3) localized “Minor” coring/drilling operations through asbestos containing floor, wall and ceiling system materials; 4) the removal of fire doors/elevator doors with asbestos containing core insulation; 5) “Intact” removal of Transite Lab-tops, Transite Table-tops & Transite-lined Fume Hoods / Base Cabinets; 6) the removal of elevated pipe insulation utilizing negative pressure glovebags, and; 7) the clean-up of future “minor project” incidental disturbances; at the Cornell University Campus in Ithaca, New York.

Multi-Facility (Campus) Wide Variances File No. 11-0024 dated January 21, 2011, File No. 14-0035 dated January 21, 2014, File No. 17-0034 dated January 18, 2017, and File No. 20-0068 dated January 31, 2020 (and their subsequent approved Variance Amendment Letters) addressing items 1 through 7 above were previously approved for the Cornell University Ithaca, NY Campus. The current Campus-Wide Variance File No. 20-0068 and its associated Variance Extension Amendment Letter expire on January 31<sup>st</sup>, 2024. This petition is requesting the same relief and work practice approval previously granted under File No.’s 11-0024, 14-0035, 17-0034 and 20-0068.

Cornell University’s Main Campus located in Ithaca, NY consists of approximately six hundred (600) individual buildings. The University has a fully staffed Environmental Health & Safety Department and Asbestos Program which oversee all internal environmental projects. All asbestos-related project monitoring, air sampling and analysis is provided by 3<sup>rd</sup> party independent consultants. All abatement work is performed by licensed Abatement Contractors using properly certified employees.

**Nature of the Work:**

**Item I – Exhausting Negative Pressure Units** - Item One of this Request for a Multi-Site Campus Wide Variance is to address relief from negative pressure unit (NPU) exhaust locations for projects being performed within buildings having either inoperable windows or where the only accessible opening to the outdoors is greater than 100' from a given regulated abatement work area. For these buildings, it is impractical to exhaust the negative pressure equipment used for interior asbestos projects directly to the exterior of the building without creating unnecessary hardships. In order to terminate the exhaust tube directly to the exterior of these buildings during interior asbestos abatement work, fire doors and/or security doors would have to remain continuously “open” during the course of a given project, which would create the potential for compromising the given buildings security and impacting fire life-safety issues. The removal of the buildings fixed inoperable window units for negative air exhaust would also compromise the building security/fire-life safety as referenced above as well as negatively impact the future integrity of the window system. Based on the fact that the Code Rule requires the negative pressure air equipment exhaust be vented directly to the outside of the building or structure, and given the existing situation/circumstances for the buildings referenced above, we are requesting relief from the following section of 12 NYCRR Part 56:

Section - Title	Reason / Proposed Plan for Protection w/o literal compliance
56-7.8, (a), (11)	We are proposing to exhaust the NPU to an unoccupied, controllable location within the building. This location shall be accessible for the placement of air monitoring equipment as required by the applicable sections of ICR-56 for “large-projects”. A controllable area shall be defined as an existing vacant room or an area within a larger space isolated by barrier tape and warning signs. This location shall be adequately sized to accommodate the increase in positive pressure in the area.

**Item II - Clean-up of “Small” Incidental Disturbance Incidents** - Item Two of this Request for a Multi-Site Campus Wide Variance is to address the clean-up of future “small” size incidental disturbance episodes and to stabilize or remove any significantly damaged material that is the cause of the given disturbance. The procedures, means and methods detailed for an incidental disturbance asbestos project in 12 NYCRR Part 56 are limited for use on “minor” projects only (as per definition and clarification in the Guidance Document). Additionally, section 11.2, (f), (4) does not allow for removal during the incidental disturbance clean-up. Based on the presence of asbestos containing materials throughout the campus buildings, the potential for future incidental disturbance episodes exists. As a pro-active measure, Cornell University is requesting a Multi-Site Campus-Wide Variance to address the clean-up of future “small” incidental disturbances. Project-Specific variance requests shall be submitted for “large” sized incidental disturbance episodes. Based on this, specific relief is requested from the following sections of 12 NYCRR Part 56:

Section - Title	Reason / Proposed Plan for Protection w/o literal compliance
56-11.2 (f)	We are proposing to utilize the conditions, procedures and methods as detailed/ outlined in “12 NYCRR Part 56 Subpart 11.2 – Emergency Project” for any future small size incidental disturbance clean-up projects.
56-11.2 (f), (4)	For those small-project incidental disturbance episodes where the material that is the source of the disturbance is in poor condition and beyond repair, we are proposing to remove the material as a part of the incidental disturbance clean-up utilizing the appropriate method for the given damaged ACM (i.e. glovebag) within the negative pressure incidental disturbance work area.

**Item III – Core/Drilling/Fastening Operations Through/Into Asbestos Containing Material** – Item Three of this Request for a Campus Wide Variance is to address localized “minor” drilling/coring/fastening operations into and/or through asbestos containing plaster or sheetrock/joint compound wall/ceiling systems and asbestos flooring systems. These coring/drilling/fastening operations are routinely required for Campus Fire and Life-Safety upgrade projects where various security devices, telecommunication devices, fire protection devices, sprinkler lines, surface mounted conduit, raceway/wire mold, and other items (i.e. new wall systems, chalk boards, bulletin boards, white boards, etc.) must be mounted onto or pass through ACM floor, wall and ceiling systems. The device, conduit, raceway, wire mold and miscellaneous item mounting operations typically require the drilling of a ½” diameter (or smaller) hole into a floor, wall or ceiling at a given location for the installation of anchors. Wall coring to accommodate the pass through of sprinkler lines, conduit, raceway and wire mold typically require a 1” to 1-1/2” core through the wall at a given location. Based on the fact that the amount of ACM impacted at each fastener, drilling and coring location is significantly less than 1 square foot (0.002 sf at each ½” diameter drill location and 0.025 sf at each 1-1/2” core location), we believe that it would create unnecessary hardships to construct a negative pressure tent enclosure at each fastening, drilling and coring location. We feel the requested relief is justified and the proposed abatement means and methods outlined in Attachment B are sufficient to minimize the potential for any airborne asbestos fiber release during the fastening, drilling and coring procedures and will sufficiently protect the Abatement Workers, Facility occupants/Employees and the General Public. Specific Relief is requested from the following sections of 12 NYCRR Part 56:

<u>Section - Title</u>	<u>Reason / Proposed Plan for Protection w/o literal compliance</u>
56-6 – Background Air Sampling 56-7.1 – Work Area Preparation Air Sampling 56-8.1 – Asbestos Abatement Air Sampling 56-9.2 – Clearance Procedures, Air Sampling	For all Coring Projects where the cumulative coring total classifies the Project as a “Small” or “Large”, or where the coring work is performed as a part of an overall Small or Large Project, we are proposing one air sample be collected in each room/area where floor, wall or ceiling fastening/drilling/coring operations are being performed and one sample “outside” on the same floor during work area preparation and fastening/ drilling/coring operations. For Projects where the cumulative total classifies the job as a “Minor”, air sampling would consist of the Contractor’s Personal OSHA sampling only.
56-7.5 – Personal and Waste Decontamination System Enclosures	As the amount of asbestos material at each individual location to be impacted is extremely limited, for all Projects where the cumulative total classifies the job as a “Small” or Large”, we are proposing to utilize a remote “small project” decontamination enclosure system. The unit will be located in a secured room within the building where these operations are being performed. The pathway from the interior restricted work area to the decontamination system or next interior restricted work area shall be cordoned off and signage installed as per Section 56-7.4(c) while in use, to delineate it from public areas while in use during Phase IIA through IID. An Airlock would be utilized for Projects where the cumulative total classifies the job as a “Minor”.
56-7.2 (o) – Materials and Equipment, Ventilation for Power Tools	Fastening, drilling and coring operations for all project sizes/classifications shall be performed using a manufacturer-equipped drill shield for “HEPA filtered local exhaust ventilation”.
56-7.8 – Engineering Controls	As the potential to impact or otherwise disturb the floor, wall and ceiling ACM materials during fastening, drilling and coring operations is minimal, we are proposing to utilize localized negative pressure via the use of HEPA vacuums as necessary during Phase IIA through IID operations.

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Section - Title	Reason / Proposed Plan for Protection w/o literal compliance
56-7.11(a), (b), (c), (e) & (f) – Regulated Abatement Work Area Enclosure	As the potential to impact or otherwise disturb the floor, wall and ceiling ACM materials during fastening, drilling and coring operations is minimal, we propose to perform the operations within an “Interior Restricted Area”. The entire room/area where fastening, drilling and/or coring operations are being performed shall be isolated/cordoned off, signage installed as per Section 56-7.4(c), and will be restricted to certified personnel only during Phase IIA through IID operations.
56-8.2 (b) – Waiting Period	Allow the commencement of fastening, drilling and coring operations immediately following completion of IIA Area Preparation and acceptance of Pre-Abatement Visual Inspection by a Project Monitor.
56-9.2 (d) – Clearance Air Sampling	For all Projects where the cumulative total classifies the job as a “Small” or “Large”, or where the coring work is performed as a part of an overall Small or Large Project, utilize the results of the “daily” 1 inside/1 outside “Interior Restricted Area” results in lieu of clearance air sampling. If the daily air samples are reported as being greater than 0.01 f/cc, then the interior restricted work area shall be re-cleaned and final clearance air sampling for the area shall be performed.

**Item IV– Removal of Door Slabs with Asbestos Containing Cores Insulation** – Item Four of this Request for a Campus Wide Variance is to address the removal of door slabs with asbestos containing core insulation. Cornell University routinely replaces Fire Doors and Elevator Doors as they become damaged or outdated. Based on the fact that the asbestos core is sealed within the door itself, and the slabs can be removed from the frames/elevator tracks without removing any hardware from the door slab itself (i.e. no potential to impact the interior core), we are requesting relief from the following sections of 12 NYCRR Part 56 for the removal of fire doors and elevator doors with confirmed/assumed ACM cores:

Section - Title	Reason / Proposed Plan for Protection w/o literal compliance
56-7.1, 8.1 & 9.2 –Phase IIA, IIB & IIC Air Sampling	We are proposing the collection of one air sample adjacent to each door removal location and one sample “outside/adjacent to” each restricted interior work area during work area preparation, door removal operations, and the wrapping/containerizing of the doors.
56-7.5 - Personal and Waste Decontamination System Enclosures	As the ACM associated with the doors is “sealed” within the door and will not be impacted or otherwise disturbed during door removal (removal from frame/track) or containerizing (wrapping), we are proposing to utilize a “remote” Small-Project Personal Decontamination System Enclosure as per 56-7.5, (d) for all fire door and elevator door removal operations.
56-7.8 – Engineering Controls	As the potential to impact or otherwise disturb the encased door core material is minimal, we are proposing to utilize localized negative pressure via the use of HEPA vacuums as necessary during Phase IIA through IID operations.
56-7.11(a), (b), (c), (e) & (f) – Regulated Abatement Work Area Enclosure	As the potential to impact or otherwise disturb the encased door core material is minimal, we are proposing to perform the interior door removal and wrapping/containerizing operations within an “Interior Restricted Area”. The location where a given door removal is being performed shall be isolated/cordoned off with barrier tape and signage installed as per Section 56-7.4(c), to restrict access and delineate it from public areas during Phase IIA through IID operations.
56-8.2 (b) – Waiting Period	Allow the commencement of IIB abatement operations immediately following completion of IIA Area Preparation and acceptance of Pre-Abatement Visual Inspection by a Project Monitor.

Section - Title	Reason / Proposed Plan for Protection w/o literal compliance
56-9.2 (d) – Clearance Air Sampling	Utilize the results of the “daily” 1 inside / 1 outside “Interior Restricted Area” air sample results in lieu of clearance air sampling. If the daily air samples are reported as being greater than 0.01 f/cc, then the interior restricted fire-door work area shall be re-cleaned and final clearance air sampling for the area shall be performed. The Owner will also employ the services a full time, third party project monitoring firm to perform a final visual inspections of each “Interior Restricted Area” as per the provisions of the current ASTM Standard E1368 “Standard Practice for Visual Inspection of Asbestos Abatement Projects.

### **Item V– Removal of Transite Lab Tops/Table Tops and Transite Lined Fume Hoods/Base Cabinets –**

Item Five of this Request for a Campus Wide Variance is to address the intact removal of Transite Lab Tops/Table Tops and Fume Hoods/Base Cabinets having an interior transite lining. Of the 600 Campus Buildings, approximately sixty (60) are involved with research & development and have laboratories equipped with transite lab tops, transite table tops and transite-lined fume hoods/Base Cabinets. Individual lab tops and table tops are generally 3’ wide and range from 3’ to approximately 15’ in length (9 sf to 45 sf). They are normally installed over either metal/wood cabinetry or other support structures (i.e. simple table legs). The interior transite panel lining present with the fume hoods are normally mechanically fastened to the fume hood’s metal framing on the 2 side walls, the back wall, and ceiling and total approximately 54 sf per hood. The interior transite panel lining present with the base cabinets are normally mechanically fastened to the cabinet walls, shelves and doors and total approximately 50 sf per hood. The University routinely either decommissions/removes these items when no longer needed or replaces the existing lab tops, table tops and fume hoods/base cabinets with new “non-asbestos” units during lab renovation projects. For those projects where the transite lab tops, table tops and interior fume hood/base cabinet transite panels must be impacted (i.e. damaged) in order to dismantle and remove the item, all work is performed within a 2-layer negative pressure tent enclosure following the provisions and conditions of 12 NYCRR Part 56 and the Guidance Document. But in numerous cases, the transite lab tops, table tops, and transite-lined fume hoods/base cabinets can be removed intact **without any impact** to the transite materials. In these instances:

- For lab tops and table tops, the entire unit (i.e. transite top and lower cabinetry/legs) is disposed of intact without any impact to the transite material.
- For fume hoods, the entire hood frame (and associated transite panels) is removed intact without removing the transite from the hood framework.
- For base cabinets, the entire cabinet (and associated transite panels) is removed intact without removing the transite from the hood framework.

As University operations performed in these labs routinely require continual University personnel occupancy to monitor the various R&D activities, the requirement to remove, handle and package those units within a small-project negative pressure enclosure where these operations can be accomplished without impacting the transite what-so-ever creates an unnecessary hard-ship to the University. Based on this, we are requesting relief from the following sections of 12 NYCRR Part 56 to address the intact removal and disposal of Lab Tops, Table Tops and Fume Hoods/base cabinets in those situations where the associated transite will not be impacted at all during the removal, handling and packaging operations:

Section - Title	Reason / Proposed Plan for Protection w/o literal compliance
56-6 – Background Air Sampling	We are proposing the collection of 1, 3, or 5 air samples within each active lab “interior restricted work area”, based on the project size, and one sample outside/adjacent to the affected work area during work area preparation, lab top / table top / fume hood / base cabinet removal operations and the wrapping/containerizing of the items.
56-7.1 – Work Area Preparation Air Sampling	
56-8.1 – Asbestos Abatement Air Sampling	
56-9.2 – Clearance Procedures, Air Sampling	



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Section - Title	Reason / Proposed Plan for Protection w/o literal compliance
56-7.5 – Personal and Waste Decontamination System Enclosures	As the intact removal of the fume hoods/base cabinets, table tops or lab tops will not impact the associated transite material, we are requesting that an impermeable drop-cloth be installed within the affected Lab adjacent to the item to be removed and this area be used for decontamination of personnel and equipment if/when necessary.
56-7.8 – Engineering Controls	As the potential to impact or otherwise disturb the transite is minimal, we are proposing to utilize localized negative pressure via the use of HEPA vacuums as necessary during Phase IIA through IID operations.
56-7.11(a), (b), (c), (e) & (f) – Regulated Abatement Work Area Enclosure	As the potential to impact or otherwise disturb the transite is minimal, we are proposing to perform the intact lab top/table top/fume hood/base cabinet removal and wrapping / containerizing operations within an “Interior Restricted Area”. The active lab where removal is being performed shall be isolated / cordoned off and signage installed as per Section 56-7.4(c), to restrict access and delineate it from public areas during Phase IIA through IID operations.
56-8.2 (b) – Waiting Period	Allow the commencement of IIB abatement operations immediately following completion of IIA Area Preparation and acceptance of Pre-Abatement Visual Inspection by a Project Monitor.
56-9.2 (d) – Clearance Air Sampling	Utilize the results of the “daily” inside / outside “Interior Restricted Area” results in lieu of clearance air sampling. If the daily air samples are reported as being greater than 0.01 f/cc, then the interior restricted Lab work area shall be re-cleaned and final clearance air sampling for the area shall be performed.

**Item VI – Removal of Elevated Pipe Insulation for Small and Minor Project Work Areas Only** – Item Six of this Request for a Campus Wide Variance is associated with the glovebag removal of elevated in-line pipe and pipe fitting insulation for Minor and Small Project Work Areas (A Project-Specific Variance will be petitioned for to address Large-Project work areas). In several of the Cornell University Ithaca Campus Buildings, including but not limited to the Central Heating Plant, the Water Treatment Plants and several other heating/treatment facilities and open-ceiling building, asbestos containing in-line pipe and pipe fitting insulation is present on elevated lines (15’ – 50’ above finished floor). The majority of these lines normally operate in excess of 160 degrees and can only be de-energized once a year for a 3-day period during the May campus-wide steam shutdown, as they service the entire campus (they must also be isolated occasionally on an emergency basis due to leaks). Based on the fact that these lines are located between 15’ and 50’ above the floor and they can only “normally” be isolated/de-energized during the 3-day steam shutdown or on an emergency basis due to leaks, it is impractical to construct scaffolding and tents for glovebag-in-tent operations during the limited 3-day time frame/emergency shutdown time frame when the lines can be isolated. Based on past experience, TSI removal which falls within the described conditions will include less than 260 linear feet each calendar year (between 3-day steam shutdown and emergency situations throughout the year).

Due to the inherent safety concerns and access limitations associated with the significantly elevated location of the insulation to be removed (15’ to 50’ above finished floor), and the fact that they can only be isolated/de-energized for a 3-day period each year as they service the entire campus (or on an emergency basis if leaking), we are requesting relief from the standard negative pressure tent enclosure requirements for the performance of glovebag abatement operations for pipe/pipe fitting insulation (TSI) located at an elevation of 15’ or greater for Minor and Small Project Work Areas.

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Section - Title	Reason / Proposed Plan for Protection w/o literal compliance
56-6 – Background Air Sampling	We are proposing to collect one air sample within the lift basket and one sample be collected on the floor level within the IRWAS directly below the active abatement location(s).
56-7.1 – Work Area Preparation Air Sampling	
56-8.1 – Asbestos Abatement Air Sampling	
56-8.1 – Asbestos Abatement Air Sampling	
56-9.2 – Clearance Procedures, Air Sampling	
56-7.5 – Personal and Waste Decontamination System Enclosures	For each individual project involving greater than 25 linear feet, we are proposing to utilize a “remote” Small-Project Personal Decontamination System Enclosure as per 56-7.5, (d).
56-7.8 – Engineering Controls	We are proposing to use negative pressure glovebags utilizing localized negative pressure via the use of HEPA vacuums.
56-7.11(a), (b), (c), (e) & (f) – Regulated Abatement Work Area Enclosure	We are proposing to use negative pressure glovebags out of lifts to access the elevated TSI. The floor area below active abatement location plus 25’ in all directions shall be considered the “Interior Restricted Work Area (IRWA)” and shall be isolated / cordoned off and signage installed as per Section 56-7.4(c), to restrict access and delineate it from public areas during Phase IIA through IID operations.
56-8.2 (b) – Waiting Period	Allow the commencement of IIB negative pressure glovebag abatement operations immediately following completion of IIA Area Preparation and acceptance of Pre-Abatement Visual Inspection by a Project Monitor.
56-9.2 (d) – Clearance Air Sampling	Utilize the results of the “daily” lift basket and “Interior Restricted Work Area” results in lieu of clearance air sampling. If the daily air samples are reported as being greater than 0.01 f/cc, then the basket and floor-level interior restricted work area shall be re-cleaned and final clearance air sampling for the area shall be performed.

**Item VII - Clean-up of “Emergency Minor” Incidental Disturbance Incidents** - Item Seven of this Request for a Multi-Site Campus Wide Variance is to address the clean-up of future “emergency minor” size incidental disturbance episodes and to stabilize or remove any significantly damaged material that is the cause of the given disturbance. The procedures, means and methods detailed for an incidental disturbance asbestos project in 12 NYCRR Part 56 are for use on “minor” projects and require the use of a small-project decontamination unit. Additionally, section 11.2, (f), (4) does not allow for removal during the incidental disturbance clean-up. Based on routinely encountered space constraints, specific relief is requested from the following sections of 12 NYCRR Part 56:

Section - Title	Reason / Proposed Plan for Protection w/o literal compliance
56-11.2 (f), (1), (i)	Where space constraints do not allow the construction of an attached small-project decontamination unit, and where building occupancy / emergency building egress does not allow a restricted path for the use of a Remote decontamination unit, we are proposing to utilize an air lock system attached to the minor-project incidental disturbance interior regulated abatement work area for access egress, in lieu of the decontamination unit for any future minor size incidental disturbance clean-up projects.
56-11.2 (f), (4)	For those minor-project incidental disturbance episodes where the material that is the source of the disturbance is in poor condition and beyond repair, we are proposing to remove the material as a part of the incidental disturbance clean-up utilizing the appropriate method for the given damaged ACM (i.e. glovebag) within the negative pressure incidental disturbance work area.

The proposed means, methods and details for exhausting negative pressure equipment for buildings with inoperable window units or limited access to the exterior, for “Minor” and “Small” sized Incidental Disturbance Clean-Up episodes, for the ACM Floor, Wall and Ceiling fastening/coring/drilling operations, for the removal of fire doors/elevator doors with asbestos containing core insulation, for the intact removal, packaging and disposal of transite lab tops, table tops and fume hoods, and for the negative pressure removal of elevated TSI on the Cornell University Ithaca Campus are presented in Attachment B.

Respectfully,

**DELTA ENGINEERS, ARCHITECTS, & SURVEYORS**



Stephen Prislupsky  
Director of Environmental Services  
Asbestos Project Designer, 23-6L43B-SHAB

Date: December 21, 2023



State of New York - Department of Labor  
Division of Safety and Health  
Engineering Services Unit  
State Office Building Campus  
Building 12 – Room 154  
Albany, NY 12240

December 21, 2023

Re: **Petition for Multi-Site Facility (Campus) Wide Variance Cornell University Ithaca, NY Campus**

**Relief sought for:**

- 1) **Negative Pressure Equipment Exhaust Ventilation for Buildings with Inoperable Windows**
- 2) **Future “Small” Project Incidental Disturbance Clean-Up Episodes**
- 3) **Localized “Minor” Coring/Drilling Operations into Asbestos Containing Materials**
- 4) **Removal of Fire Doors with Asbestos Containing Cores**
- 5) **Intact Removal of Transite Lab-tops, Transite Table Tops and Transite-lined Fume Hoods**
- 6) **Removal of Elevated Pipe Insulation using Negative Pressure Glovebags**
- 7) **Future “Emergency” Minor Project Incidental Disturbance Clean-Up Episodes**

**ATTACHMENT B**

**Proposed Abatement Method Description**

Based on the background information presented in Attachment A, in addition to the “general” requirements of 12 NYCRR Part 56, we are requesting that the following operations/procedures be used for the Interior Exhausting of Negative Pressure Equipment, for “future” minor & small size incidental disturbance episode clean-ups, for localized “Minor” coring/drilling operations into and through asbestos containing floor/wall/ceiling materials, for the removal of fire doors/elevator doors with asbestos containing core insulation, for the “Intact” removal of Transite Lab-tops/Table-tops & Transite-lined Fume Hoods/base cabinets, and for the removal of elevated pipe insulation utilizing negative pressure glovebags at the Cornell University Campus in Ithaca, New York:

**Item 1) Negative Air Pressure Equipment Exhaust Ventilation:** As stated in Attachment A, the University is requesting a Multi-Site Facility (Campus) Wide Variance to allow for the venting of negative pressure equipment utilized on an asbestos abatement project into an unoccupied controllable space within the building. This exhaust method would only be performed within those buildings where inoperable fixed window systems are present or where the nearest “feasible” building opening is greater than 100’ from the work area. Proposed procedures, means and methods for NPU exhaust are as follows:

- 1) The negative pressure air equipment exhaust set-up as proposed below would only be used for large or small projects performed within a negative pressure enclosure/regulated abatement work area at those Cornell University Ithaca Campus buildings having either inoperable fixed window systems or where the opening to the exterior is greater than 100’ from the interior regulated abatement work area.
- 2) Negative air ventilation units that cannot be exhausted to the outside of the building or structure shall be directed to an unoccupied, controllable location within the building. This location shall be accessible for the placement of air monitoring equipment as required by the applicable sections of ICR-56. A controllable area shall be defined as an existing vacant room or an area within a larger space isolated by barrier tape and warning signs. This location shall be adequately sized to accommodate the increase in positive pressure in the area.

- 3) All openings within 25 feet of the Negative air machine exhaust termination shall be sealed with two layers of fire retardant polyethylene.
- 4) Air monitoring shall be conducted at each tube for all small and large projects when exhausting to an interior space. Banking of negative air ducts terminating inside the building or structure will not be allowed and will not be permitted for air monitoring purposes.
- 5) If elevated air samples are indicated, work shall stop immediately. The faulty negative air machine shall be taken out of service and repaired. A replacement machine shall be installed to maintain the required negative air pressure differential in the work area. Elevated air samples results shall be submitted to the Commissioner as required by ICR 56-4.10 (a)
- 6) All surfaces within area where the faulty negative air machine is exhausting to shall be wet wiped and HEPA vacuumed. The Project Monitor shall conduct a visual inspection of the area prior to resumption of work.
- 7) A summary of the cleanup activities and negative air machine repairs shall be documented in the Supervisor's daily log.

**Item 2) Clean-up of “Small” Incidental Disturbance Incidents -** In order to be pro-active, Cornell University is requesting a Multi-Site Facility Wide Variance to address the clean-up of future “small” incidental disturbances following the provisions and conditions as outlined in 12 NYCRR Part 56 “Subpart 11.2 – Emergency Project” and shall include the following:

- 1) The work would apply to any “future” small size incidental disturbance clean-ups as defined by 12 NYCRR Part 56.
- 2) Air sampling and analysis shall be conducted in accordance with the requirements of Subpart 56-4. Due to the nature of this work, background air samples shall not be required. Large Project Phase IIA and Phase IIB daily air sampling shall be performed as well.
- 3) The clean-up project shall comply with the requirements of 12 NYCRR Part 56 Sections 56-3.1, 56-3.2 and 56-3.3.
- 4) Prior to the commencement of the clean-up project, the asbestos abatement contractor shall comply with the emergency asbestos project notification requirements set forth in 12 NYCRR Part 56 Sections 56-3.5 and 56-3.6.
- 5) If permission to proceed as an emergency asbestos project is granted under the conditions of the variance, as per Sections 56-3.5 and 56-11.2, all work done on the project shall be performed in a manner consistent with applicable provisions of 12 NYCRR Part 56 Subpart 11.2 and with those conditions as defined in the approved variance.
- 6) The affected area shall be cordoned off with barrier tape at a distance of twenty-five (25) feet from the outer most limit of the disturbance where feasible. If emergency egress paths are impacted by the 25’,

then the barrier distance would be reduced to allow for compliance with building code. An additional air sample shall be collected at all reduced barrier locations. This shall be considered the regulated abatement work area for the cleanup of the disturbed materials. The regulated abatement work area shall be immediately cordoned off and adequate signage shall be posted as described in 12 NYCRR Part 56 Subpart 56-7.4.

- 7) Following the emergency notification, the following shall be performed:
  - a. A small project decontamination system enclosure shall be installed and utilized for all incidental disturbance asbestos clean-up projects. For non-friable organically bound (NOB) material incidental disturbance clean-up operations, a remote small project decontamination unit will be utilized, with an airlock being attached to the NOB work area for access / egress. For friable material incidental disturbance clean-up operations, an attached small project decontamination system enclosure shall be utilized.
  - b. Critical barriers shall be installed as per 12 NYCRR Part 56 Section 56-7.11 to isolate the clean-up work area.
  - c. Negative air ventilation systems shall be established as per 12 NYCRR Part 56 Section 56-7.8(a) to maintain of 8 air changes per hour.
  - d. Wet methods shall be employed to minimize further disturbance of the affected material during cleanup activities.
  - e. No removal of undisturbed ACM, PACM or asbestos material shall be performed during the emergency asbestos project. If the ACM that is the source of the disturbance is still present and is in a damaged condition (beyond repair), the damaged material shall be removed as a part of the clean-up.
  - f. For NOB incidental disturbance projects, the worker's disposable protective clothing shall be removed and left in the work area upon exiting. After exiting the work area, workers shall immediately don clean protective clothing within the attached airlock. Workers shall then proceed immediately to the remote small project decontamination system enclosure.
  - g. For friable incidental disturbance projects, the workers shall utilize the attached decontamination system enclosure
- 8) Final clean-up procedures shall comply with 12 NYCRR Part 56 Section 56-9, except that only one (1) stage of cleaning (final) will be performed. Lockdown encapsulant shall only be used on porous contaminated surfaces subject to cleaning.
- 9) Once final cleaning is complete, a visual inspection shall be completed by the asbestos abatement contractor's supervisor to confirm that the scope of abatement work for the asbestos project is complete, and no visible debris/residue, pools of liquid, or condensation remain.
- 10) Following the observance of the required four (4) hour waiting/settling period, a final visual inspection shall be performed by an appropriately trained and certified project monitor. The project monitor visual inspection for completeness of abatement and completeness of cleanup shall be performed as per the provisions of the current ASTM Standard E1368 "Standard Practice for Visual Inspection of Asbestos Abatement Projects".
- 11) Upon passing of the final visual inspection, final clearance air sampling shall be performed as per the requirements of Subpart 56-9, (d).

**Item 3) Fastening/Coring/Drilling of Asbestos Containing Material** - For those project where localized “minor” fastening, drilling and/or coring operations are required for projects where various security devices, telecommunication devices, fire protection devices, sprinkler lines, surface mounted raceway, wire mold or new wall base-plates must be fastened to, mounted onto or pass through ACM floor, wall and ceiling systems, and the overall/cumulative amount of ACM to be impacted for a given project is greater than 10 square feet (i.e. small and large projects), we are proposing the following procedures, means and methods be allowed:

- 1) Prior to fastening/coring/drilling operations for all small-projects and large-project, a remote small project decontamination system enclosure shall be in-place and fully operational. The unit will be located in a secured room within the building where these operations are being performed. The pathway from the interior restricted work area to the decontamination system or next interior restricted work area shall be cordoned off and signage installed as per Section 56-7.4(c) while the pathway is in use, to delineate it from public areas while in use during Phase IIA through IID. For minor-project fastening/coring/drilling operations, an airlock system shall be utilized.
- 2) Each affected room/area/space shall be vacated for the duration of preparation, drilling / saw cutting / penetration, and cleaning operations and shall be considered a restricted area. Each affected space shall not be reoccupied until receipt of satisfactory air results as detailed below.
- 3) All power tools used to disturb ACM shall be HEPA ventilated as per 12 NYCRR Part 56-7.2 (0). A Nilfisk negative pressurized drill shield shall be used in combination with a suitable HEPA vacuum for all ACM drilling operations. ACM drilling shall proceed using manufacturer's recommended operating procedures. Wet methods (i.e. shaving cream, foam or other wet method) shall be used at the cut location. All power tools used to disturb ACM shall be HEPA ventilated as per ICR
- 4) The interior of the power tool dust shroud / shield is the regulated abatement work area for each ACM spot removal location. However, the room/area/space where ACM drilling operations occur shall be a restricted area, limited to certified personnel and authorized visitors only, until the asbestos project is complete and satisfactory air results have been obtained. The restricted area shall be cordoned off and signage posted in accordance with 12 NYCRR Part 56-7.4(c) of ICR 56.
- 5) With the remote decontamination system or air lock system in-place, fastening, drilling and coring operations would be performed as follows:

**A) Floor, Wall and Ceiling Fastening/Drilling Operations** – Fastening and Drilling operations would be performed for the installation of anchors to support/install surface-mounted devices, junction boxes, conduit, raceway, wire mold and other miscellaneous items (i.e. wall base-plates, Chalk boards, bulletin boards, white boards, etc.). The affected room area where fastening/drilling operations are to occur shall be isolated via barrier tape and appropriate signage. A 2-layer 6 mil fire retardant poly drop cloth shall be installed under the wall and ceiling fastening/drilling location. Carpeting shall be protected during ACM drilling/penetration operations, if needed. The size of the drop cloth shall be a minimum of 6’ out from the wall by 8’ in length. Fastening/drilling operations into the given floor/ wall/ceiling surface would then be performed utilizing a drill or Hilti fitted with a manufacturer-equipped HEPA shroud. The HEPA vacuum would operate continuously during all fastening/drilling operations. Once the holes are drilled and the anchors are installed, the device/J-box/raceway/wire mold would be fastened to the surface. Upon completion of these operations, the drop cloth shall be HEPA vacuumed and placed in an asbestos disposal bag.

B) Wall (Through-Wall) Coring Operations - For this operation, a complete core is required through a given wall for surface mounted conduit/raceway/wire mold and sprinkler line pass-through's. Coring operations at each location will be performed in two separate phases so that the asbestos containing surfacing material being impacted is isolated within the drill shroud (i.e. drill a hole into one side of the wall utilizing the proposed methods below then proceed to the other side of the wall and perform the identical operation).

- a. A 2-layer 6 mil fire retardant poly drop cloth shall be installed on both sides of the wall under the coring location. The size of the drop cloths shall be a minimum 6' out from the wall by 8' in length. The drop cloths will be disposed of as asbestos waste at the completion of operations.
  - b. As stated above, although wall coring operations will be performed in two separate phases so that the plaster or sheetrock/joint compound surface being impacted is isolated within the tool shroud/shield at all times, a commercial glovebag will be sealed to the non-drill shield side of the wall for each coring phase at a given location.
  - c. Coring operations would then be performed using drill fitted with a manufacturer-equipped HEPA shroud. The HEPA vacuum would operate continuously during all coring operations. The hole coring would be performed on one side of a given wall initially and would be to a minimal depth so as to core through the "active surface" of the wall only. Once this initial core is complete, the opposite surface of the wall would be cored following the identical set-up and coring procedure.
  - d. Once the cores on both sides of a given wall location are complete, all exposed edges of the asbestos containing material shall be encapsulated.
  - e. Upon completion of these operations at a given location, the drop cloth shall be HEPA vacuumed and placed in an asbestos disposal bag. All waste shall be double bagged within the interior restricted work area for transfer to the waste storage trailer/dumpster. The area shall then be inspected by a 3<sup>rd</sup> party independent project monitor for completeness of abatement and cleaning.
- 6) For all Coring Projects where the cumulative coring total classifies the Project as a "Small" or "Large", or where the coring work is being performed as a part of an overall Small or Large Project, we are proposing air monitoring within each room/area/space restricted be conducted daily (on days when abatement or support activities such as ACM disturbance or cleaning activities are performed). One daily abatement air sample shall be collected within ten (10) feet of the ACM drilling location(s) during removal and cleaning operations. Provided that airborne fiber concentrations remain below 0.01 fibers per cubic centimeter, clearance air sampling as described in Subpart 56-9.2, (d) will not be performed. If air sample results indicate airborne fiber concentration at or above 0.01 fibers per cubic centimeter, during device removal/installation and cleaning operations, all surfaces present within the room where the elevated sample result was reported will be re-cleaned and clearance air sampling for the given room will be performed following a two hour waiting period. For Projects where the cumulative total classifies the job as a "Minor", air sampling would consist of the Contractor's Personal OSHA sampling only.
- 7) When all drilling/coring operations are completed, and daily air samples are received and acceptable for a given restricted work area, then the signage and barrier tape shall be removed and the area shall be opened for access by follow-up trades to perform their work.

**Item 4) Fire Door/Elevator Door Removal:** Fire door and elevator door abatement operations shall include the removal, wrapping and disposal of the entire door "intact" without removing any hardware from the door slab



or otherwise impacting the interior asbestos core. As such, we are requesting that the following operations / procedures be used for the fire door removal and containerizing work:

- 1) Prior to the removal of any door units, a remote small project decontamination system enclosure shall be constructed as per the requirements of 56-7.5 and shall be utilized for door removal work. The unit will be located in a secured room within, or immediately outside, the building where these operations are being performed. The pathway from the interior restricted work area to the decontamination system or next interior restricted work area shall be cordoned off and signage installed as per Section 56-7.4(c) while the pathway is in use, to delineate it from public areas while in use during Phase IIA through IID.
- 2) With the remote decontamination system in-place and operational, removal of the interior fire doors and elevator doors would be performed as follows:
  - a. The location where an active door removal is being performed will be considered an “interior restricted work area” (IRWA). It will be isolated and cordoned off at a minimum distance of 25’, or to the greatest extent possible without impacting life/safety issues, via Caution Tape and signage installed as per Section 56-7.4(c) to restrict access during Phase IIA through IID operations. Access to the interior restricted area shall be limited to certified personnel only.
  - b. The door’s interior asbestos core would not be impacted in any manner and would remain intact within the door shell. The doors will be removed “intact” from their frames by pulling the hinge pins and at no time shall any hardware installed on the door itself be removed. At each phase of removal, a Project Monitor Visual Inspection would be required to ensure the completeness of required procedures and to verify the integrity of the door shell/casing as “intact”.
  - c. Once a door has been removed from its frame, it shall be wrapped in two layers of 6 mil fire-retardant poly and placed on a wheeled cart for transport to the waste trailer. This cart would be lined with two layers of 6-mil fire retardant poly with enough overlap remaining so as to completely cover the doors once they are placed on the cart for transport. ***As the doors are to be wrapped within the interior regulated work area and transported on a wheeled cart directly to a waste trailer, the use of Waste Decontamination System would not be needed/required.***
  - d. The pathway used to transport the door from the active regulated work area to the waste trailer shall be cordoned off and signage installed as per Section 56-7.4(c), to delineate it from public areas while in use during transport operations.
  - e. The doors shall then be placed in a lined dumpster and disposed of as RACM.
- 3) Daily “Full-Shift” Air Sampling will be performed during all interior door removal and wrapping operations. This will consist of one air sample being collected within each active interior restricted work area and one sample outside and adjacent to the area. Provided that airborne fiber concentrations remain below 0.01 fibers per cubic centimeter, clearance air sampling as described in Subpart 56-9.2, (d) will not be performed. If air sample results indicate airborne fiber concentration at or above 0.01 fibers per cubic centimeter, during door removal and wrapping operations, all surfaces present in the given work area will be re-cleaned and clearance air sampling will be performed following a two hour waiting period.
- 4) The Owner will also be employing an on-site, full time, third party project monitor/AST who in addition to collecting the daily air samples, will perform a final inspection at each area as per the provisions of the current ASTM Standard E1368 “Standard Practice for Visual Inspection of Asbestos Abatement Projects”.

- 5) Upon completion of the interior door removal and wrapping operations, the transportation of the wrapped doors to the waste trailer, and the receipt of acceptable daily air sample results for a given interior restricted work area, the interior restricted work area shall be opened to other trades for follow-up new door installation work.

**Item 5) Removal of Transite Lab Tops, Table Tops and Transite Lined Fume Hoods/Base cabinets** – For those instances where the removal of Transite Lab Tops/Table Tops and Transite-lined Fume Hoods/base cabinets can be performed without impacting / damaging the transite component, the intact removal of transite lab tops, table tops, and fume hoods/base cabinets would be performed as follows:

- 1) The Laboratory/Room where a given unit is to be removed will be considered an “interior restricted area”. It will be isolated and cordoned off at each access point (i.e. entrance doors) via Caution Tape and signage installed as per Section 56-7.4(c) to restrict access during Phase IIA through IID operations. Access to the interior restricted area shall be limited to certified personnel only.
- 2) A 2-layer 6 mil fire retardant poly drop cloth shall be installed on the floor immediately adjacent to the unit to be removed. The drop cloth will be disposed of as asbestos waste at the completion of removal and wrapping operations.
- 3) Certified workers utilizing appropriate PPE shall then wrap the lab top, table top, or fume hood/base cabinet in two layers of 6-mil fire-retardant poly without impacting the associated transite in any manner.
- 4) Once wrapped, the lab top/table top/fume hood/base cabinets shall be placed on a wheeled cart for transport to the waste trailer. This cart would be lined with two layers of 6-mil fire retardant poly with enough overlap remaining so as to completely cover the unit once it is placed on the cart for transport.
- 5) The pathway used to transport the unit from the regulated work area to the waste trailer shall be cordoned off and signage installed as per Section 56-7.4(c) while in use, to delineate it from public areas while in use during transport operations.
- 6) Daily “Full-Shift” Air Sampling will be performed during all lab top/table top/fume hood/base cabinet removal and wrapping operations. This will consist of one, three, or five air samples being collected within each active Laboratory/Room interior restricted work area (based on the project size), and one sample outside / adjacent to the Lab/Room. Provided that airborne fiber concentrations remain below 0.01 fibers per cubic centimeter, clearance air sampling as described in Subpart 56-9.2, (d) will not be performed. If air sample results indicate airborne fiber concentration at or above 0.01 fibers per cubic centimeter, during removal and wrapping operations, all surfaces present in the given lab work area will be re-cleaned and clearance air sampling will be performed following a two hour waiting period.
- 7) Upon completion of the Lab Tops/Table Tops and Transite-lined Fume Hoods/base cabinets removal and wrapping operations, the transportation of the wrapped units to the waste trailer, and the receipt of acceptable daily air sample results for a given lab work area, the lab shall be opened up for normal occupancy.

**Item 6) Removal of Elevated Pipe Insulation** – For the minor-project and small-project removal of in-line pipe and pipe fitting insulation (TSI) present at an elevation greater than 15' above floor level, we are proposing the following method be utilized. For large-project work areas, a project specific variance would be obtained:

- 1) For each individual TSI project where abatement operations are classified as a small-project (i.e. > 25 lf / < 260 lf), a remote small project decontamination system enclosure shall be constructed as per the requirements of 56-7.5. The unit will be located at the floor level within the Interior Regulated Work Area or in a secure adjacent area and will remain in-place until the proposed clearance criteria is achieved. For Minor TSI Projects (<= 25 lf), an airlock system would be utilized.
- 2) The floor level area located directly beneath the active abatement area, plus 25' in all directions where feasible, shall be considered the "Interior Restricted Work Area (IRWA)". Access to the IRWA shall be restricted to certified personnel only and it will be isolated and cordoned off via Barrier Tape and signage installed as per Section 56-7.4(c) to restrict access.
- 3) Upon establishing the IRWA, the lift man-basket utilized to access the TSI shall be plasticized with two (2) layers of six (6) mil fire retardant polyethylene on the platform, with plastic sheeting extended vertically to waist-high (as so equipped) guardrail sides and back of the lift unit. While the lift walking surfaces must be plasticized, proper traction surfaces or equipment shall be provided to assure the safety and comfort of abatement workers while performing abatement activities on the lift equipment. After removal operations are completed for a given location, the plasticized lift man-basket surfaces shall be wet wiped and/or HEPA vacuumed clean. The plasticizing on the lift shall be periodically inspected during use and repaired as needed. Upon completion of the overall abatement work, this poly shall be packaged and disposed of as RACM.
- 4) A drop cloth shall be installed on the floor area / equipment directly below each active abatement location within the IRWA. The drop cloth shall be 10' x 10' in size. Upon completion of abatement at a given location, the poly drop cloth shall be wet wiped and/or HEPA vacuumed, packaged and disposed of as RACM.
- 5) Glovebag removal of the elevated TSI shall then be performed. Commercially available negative pressure glovebags or standard glovebags placed under negative pressure using a HEPA vacuum shall be utilized, in lieu of glovebag removals within negative pressure tents. If standard glovebags are used, they shall be fitted with adequate interior support to prevent collapse while under negative pressure. The integrity of the glovebag will not be compromised by any additional support components and the makeup air inlet into the glovebag shall be fitted with a HEPA filter. Glovebag removal procedures shall be consistent with 12 NYCRR Part 56-8.4 and OSHA 29 CFR 1926.1101.
- 6) In the event of a loss of glovebag integrity, procedures as detailed in 12 NYCRR Part 56-8.2, (g) shall be followed.
- 7) For all individual projects involving greater than 25 linear feet, Daily "Full-Shift" Air Sampling will be performed during all glovebag removal operations. This will consist of one air sample being collected on the floor level within the IRWA directly below the active abatement work and one air sample being collected in the lift man-basket. Provided that airborne fiber concentrations for these abatement samples are reported as being below 0.01 fibers per cubic centimeter, clearance air sampling as described in Subpart 56-9.2, (d) will not be performed. If air sample results indicate airborne fiber concentration at or



above 0.01 fibers per cubic centimeter, the IRWA and man-basket will be re-cleaned and clearance air sampling will be performed following a two hour waiting period.

- 8) For all individual projects involving greater than 25 linear feet, a full time independent project monitor shall be on-site to observe the abatement contractor's work practices, to ensure that no visible emissions are generated during the removal activities, and to verify compliance with the conditions of the Variance, if approved.

**Item 7) Clean-up of "Emergency Minor" Incidental Disturbance Incidents -** Due to space constraints, building occupancy and compliance with building egress paths, Cornell University is requesting a Multi-Site Facility Wide Variance to address the following relief from 12 NYCRR Part 56 "Subpart 11.2 – Emergency Project":

- 1) Air sampling and analysis shall be conducted in accordance with the requirements of Subpart 56-4.
- 3) The clean-up project shall comply with the requirements of 12 NYCRR Part 56 Sections 56-3.1, 56-3.2 and 56-3.3.
- 4) Prior to the commencement of the clean-up project, the asbestos abatement contractor shall comply with the emergency asbestos project notification requirements set forth in 12 NYCRR Part 56 Sections 56-3.5 and 56-3.6.
- 5) If permission to proceed as an emergency asbestos project is granted under the conditions of the variance, as per Sections 56-3.5 and 56-11.2, all work done on the project shall be performed in a manner consistent with applicable provisions of 12 NYCRR Part 56 Subpart 11.2 with the following exceptions:
  - a. For those locations where space constraints are present or building access / egress paths must be maintained, an airlock system would be utilized in lieu of a small project decontamination system enclosure. The airlock would be attached to the minor-project incidental disturbance regulated work area and would remain in-place until receipt of acceptable final clearance air samples.<sup>1</sup>
  - b. No removal of undisturbed ACM, PACM or asbestos material shall be performed during the emergency asbestos project. If the ACM that is the source of the disturbance is still present and is in a damaged condition (beyond repair), the damaged material shall be removed as a part of the clean-up.
- 6) All other provisions / conditions of 12 NYCRR Part 56-11.2 would be followed.

The health and safety of the students, faculty and staff as well as that of the contractors working on their campus is of the utmost concern to Cornell University. By having a Multi-Site Facility (Campus) Wide Variance in-place that addresses negative pressure air equipment exhaust for those Ithaca Campus Buildings having inoperable fixed window systems and limited exterior openings, "minor" & "small" sized incidental disturbance clean-up episodes, coring/drilling through asbestos containing material, the removal of elevator and fire doors, the intact removal of transite lab tops / table tops/ fume hoods / base cabinets, and elevated pipe insulation, Cornell University can address any necessary asbestos abatement within the affected buildings in a safe and timely manner while minimizing the impact to critical operations. Based on our experience with the

previously granted Cornell Ithaca Campus-Wide Variances 11-0024, 14-0035, 17-0034, and 20-0068 (and their associated Amendment Letters), we feel that the proposed means and methods for addressing the above items would in no way compromise the security or safety of the general public, the University's student body, faculty, staff, or any workers involved with a given project.

*As per the standard conditions for a Multi-Site Facility Wide Variance, we are requesting that, if approved, the variance termination date be the maximum two years from its date of issuance.* If you have any questions or require any additional information, please feel free to contact Stephen Prislupsky of Delta Engineers (607) 231-6674.

Respectfully,

**DELTA ENGINEERS, ARCHITECTS, & SURVEYORS**



Stephen Prislupsky  
Director of Environmental Services  
Asbestos Project Designer, 23-6L43B-SHAB

Date: December 21, 2023

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ROUGH CARPENTRY

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SECTION 06 10 00 - ROUGH CARPENTRY

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
  - 1. Wood products.
  - 2. Dimension lumber framing.
  - 3. Miscellaneous lumber.

1.2 DEFINITIONS

- A. Dimension Lumber: Lumber of 2 inches nominal size or greater but less than 5 inches nominal size in least dimension.
- B. Exposed Framing: Framing not concealed by other construction.
- C. Lumber grading agencies, and abbreviations used to reference them, include the following:
  - 1. NLGA: National Lumber Grades Authority.
  - 2. SPIB: The Southern Pine Inspection Bureau.
  - 3. WCLIB: West Coast Lumber Inspection Bureau.
  - 4. WWPA: Western Wood Products Association.

1.3 DELIVERY, STORAGE, AND HANDLING

- A. Stack wood products flat with spacers beneath and between each bundle to provide air circulation. Protect wood products from weather by covering with waterproof sheeting, securely anchored. Provide for air circulation around stacks and under coverings.

PART 2 - PRODUCTS

2.1 WOOD PRODUCTS

- A. Lumber: Comply with DOC PS 20 and applicable rules of grading agencies indicated. If no grading agency is indicated, comply with the applicable rules of any rules-writing agency certified by the ALSC Board of Review. Grade lumber by an agency certified by the ALSC Board of Review to inspect and grade lumber under the rules indicated.
  - 1. Factory mark each piece of lumber with grade stamp of grading agency.
  - 2. Where nominal sizes are indicated, provide actual sizes required by DOC PS 20 for moisture content specified. Where actual sizes are indicated, they are minimum dressed sizes for dry wood products.
  - 3. Dress lumber, S4S, unless otherwise indicated.
- B. Maximum Moisture Content:
  - 1. Dimension Lumber: 19 percent unless otherwise indicated.

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ROUGH CARPENTRY

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2.2 DIMENSION LUMBER FRAMING

- A. Lumber Grade: No. 2 grade.
  - 1. Species:
    - a. Spruce-pine-fir; NLGA.
    - b. Hem-fir; WCLIB or WWPA.

2.3 MISCELLANEOUS LUMBER

- A. Provide miscellaneous lumber indicated and lumber for support or attachment of other construction, including the following:
  - 1. Blocking.
  - 2. Nailers.
  - 3. Furring.
- B. Dimension Lumber Items: Construction or No. 2 grade lumber of any of the following species:
  - 1. Spruce-pine-fir; NLGA.
  - 2. Hem-fir; WCLIB or WWPA.
- C. For blocking not used for attachment of other construction, Utility, Stud, or No. 3 grade lumber of any species may be used provided that it is cut and selected to eliminate defects that will interfere with its attachment and purpose.
- D. For furring strips for installing plywood or hardboard paneling, select boards with no knots capable of producing bent-over nails and damage to paneling.

2.4 FASTENERS

- A. General: Fasteners are to be of size and type indicated and comply with requirements specified in this article for material and manufacture. Provide nails or screws, in sufficient length, to penetrate not less than 1-1/2 inches into wood substrate.
  - 1. Where rough carpentry is exposed to weather, in ground contact, pressure-preservative treated, or in area of high relative humidity, provide fasteners with hot-dip zinc coating complying with ASTM A153/A153M or ASTM F2329.
- B. Nails, Brads, and Staples: ASTM F1667.
- C. Power-Driven Fasteners: Fastener systems with an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC70.
- D. Post-Installed Anchors: Fastener systems with an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC01, ICC-ES AC58, ICC-ES AC193 or ICC-ES AC308 as appropriate for the substrate.

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ROUGH CARPENTRY

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2.5 MISCELLANEOUS MATERIALS

- A. Adhesives for Gluing Furring and Sleepers to Concrete or Masonry: Formulation complying with ASTM D3498 that is approved for use indicated by adhesive manufacturer.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Framing Standard: Comply with AF&PA's WCD 1, "Details for Conventional Wood Frame Construction," unless otherwise indicated.
- B. Set work to required levels and lines, with members plumb, true to line, cut, and fitted. Fit rough carpentry accurately to other construction. Locate nailers, blocking, and similar supports to comply with requirements for attaching other construction.
- C. Install metal framing anchors to comply with manufacturer's written instructions. Install fasteners through each fastener hole.
- D. Do not splice structural members between supports unless otherwise indicated.
- E. Provide blocking and framing as indicated and as required to support facing materials, fixtures, specialty items, and trim.
  - 1. Provide metal clips for fastening gypsum board or lath at corners and intersections where framing or blocking does not provide a surface for fastening edges of panels. Space clips not more than 16 inches o.c.
- F. Provide fire blocking in furred spaces, stud spaces, and other concealed cavities as indicated and as follows:
  - 1. Fire block furred spaces of walls, at each floor level, at ceiling, and at not more than 96 inches o.c. with solid wood blocking or noncombustible materials accurately fitted to close furred spaces.
  - 2. Fire block concealed spaces of wood-framed walls and partitions at each floor level, at ceiling line of top story, and at not more than 96 inches o.c. Where fire blocking is not inherent in framing system used, provide closely fitted solid wood blocks of same width as framing members and 2-inch nominal thickness.
  - 3. Fire block concealed spaces between floor sleepers with same material as sleepers to limit concealed spaces to not more than 100 sq. ft. and to solidly fill space below partitions.
- G. Sort and select lumber so that natural characteristics do not interfere with installation or with fastening other materials to lumber. Do not use materials with defects that interfere with function of member or pieces that are too small to use with minimum number of joints or optimum joint arrangement.

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ROUGH CARPENTRY

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- H. Securely attach rough carpentry work to substrate by anchoring and fastening as indicated, complying with the following:
  - 1. Table 2304.10.1, "Fastening Schedule," in ICC's International Building Code (IBC).
  - 2. ICC-ES evaluation report for fastener.
- I. Use steel common nails unless otherwise indicated. Select fasteners of size that will not fully penetrate members where opposite side will be exposed to view or will receive finish materials. Make tight connections between members. Install fasteners without splitting wood. Drive nails snug but do not countersink nail heads unless otherwise indicated.

3.2 INSTALLATION OF WOOD BLOCKING AND NAILERS

- A. Install where indicated and where required for attaching other work. Form to shapes indicated and cut as required for true line and level of attached work. Coordinate locations with other work involved.
- B. Attach wood blocking to substrates to support applied loading. Recess bolts and nuts flush with surfaces unless otherwise indicated.
- C. Attach wood roofing nailers securely to substrate to resist the designed outward and upward wind loads indicated on Drawings and in accordance with ANSI/SPRI ED-1, Tables A6 and A7.

3.3 INSTALLATION OF WALL AND PARTITION FRAMING

- A. General: Provide single bottom plate and double top plates using members of 2-inch nominal thickness whose widths equal that of studs, except single top plate may be used for non-load-bearing partitions and for load-bearing partitions where framing members bearing on partition are located directly over studs. Fasten plates to supporting construction unless otherwise indicated.
  - 1. Provide continuous horizontal blocking at midheight of partitions more than 96 inches high, using members of 2-inch nominal thickness and of same width as wall or partitions.
- B. Construct corners and intersections with three or more studs.

END OF SECTION 06 10 00

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INTERIOR ARCHITECTURAL WOODWORK

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SECTION 06 40 23 - INTERIOR ARCHITECTURAL WOODWORK

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
  - 1. Interior standing and running trim for transparent finish.
  - 2. Interior standing and running trim for opaque finish.
  - 3. Interior storefront, frames, and jambs for transparent finish.
  - 4. Miscellaneous materials.
  - 5. Shop priming.
  - 6. Shop finishing.

1.2 COORDINATION

- A. Coordinate sizes and locations of framing, blocking, furring, reinforcements, and other related units of Work specified in other Sections, to ensure that interior architectural woodwork can be supported and installed as indicated.

1.3 ACTION SUBMITTALS

- A. Product Data: For the following:
  - 1. Anchors.
  - 2. Adhesives.
  - 3. Shop finishing materials.
- B. Shop Drawings:
  - 1. Include the following:
    - a. Dimensioned plans, elevations, and sections.
    - b. Attachment details.
  - 2. Show large-scale details.
  - 3. Show locations and sizes of furring, blocking, and hanging strips, including blocking and reinforcement concealed by construction and specified in other Sections.
- C. Samples for Verification: For the following:
  - 1. Lumber for Transparent Finish: Not less than 5 inches wide by 12 inches long, for each species and cut, finished on one side and one edge.

1.4 QUALITY ASSURANCE

- A. Manufacturer's Qualifications: Employs skilled workers who custom fabricate products similar to those required for this Project and whose products have a record of successful in-service performance.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Comply with the Architectural Woodwork Standards, Section 2.

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INTERIOR ARCHITECTURAL WOODWORK

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- B. Do not deliver interior architectural woodwork until painting and similar finish operations that might damage woodwork have been completed in installation areas.
- C. Store woodwork in installation areas or in areas where environmental conditions comply with requirements specified in "Field Conditions" Article.

1.6 FIELD CONDITIONS

- A. Environmental Limitations with Humidity Control: Do not deliver or install interior architectural woodwork until building is enclosed, wet-work is complete, and HVAC system is operating and maintaining temperature between 60 and 90 deg F and relative humidity between 25 and 55 percent during the remainder of the construction period.
- B. Field Measurements: Where interior architectural woodwork is indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication, and indicate measurements on Shop Drawings.
  - 1. Locate concealed framing, blocking, and reinforcements that support woodwork by field measurements before being concealed by construction, and indicate measurements on Shop Drawings.
- C. Established Dimensions: Where interior architectural woodwork is indicated to fit to other construction, establish dimensions for areas where woodwork is to fit. Provide allowance for trimming at site, and coordinate construction to ensure that actual dimensions correspond to established dimensions.

PART 2 - PRODUCTS

2.1 ARCHITECTURAL WOODWORK, GENERAL

- A. Quality Standard: Unless otherwise indicated, comply with the Architectural Woodwork Standards for grades of interior architectural woodwork indicated for construction, finishes, installation, and other requirements.
  - 1. The Contract Documents contain requirements that are more stringent than the Architectural Woodwork Standards. Comply with Contract Documents and Architectural Woodwork Standards.

2.2 INTERIOR STANDING AND RUNNING TRIM FOR TRANSPARENT FINISH

- A. Architectural Woodwork Standards Grade: Custom.
- B. Hardwood Lumber:
  - 1. Species: Red oak.
  - 2. Cut: Plain sliced/plain sawn.
  - 3. Wood Moisture Content: 5 to 10 percent.
  - 4. For trim items other than base wider than available lumber, use veneered construction. Do not glue for width.
    - a. For veneered base, use hardwood lumber core, glued for width.



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INTERIOR ARCHITECTURAL WOODWORK

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- 5. For base wider than available lumber, glue for width. Do not use veneered construction.

2.3 INTERIOR STANDING AND RUNNING TRIM FOR OPAQUE FINISH

- A. Architectural Woodwork Standards Grade: Custom.
  - 1. Wood Species: Any closed-grain hardwood.
  - 2. Wood Moisture Content: 5 to 10 percent.

2.4 INTERIOR STOREFRONT, FRAMES, AND JAMBS FOR TRANSPARENT FINISH

- A. Architectural Woodwork Standards Grade: Custom.
- B. Wood Species and Cut:
  - 1. Species: Red oak.
  - 2. Cut: Plain sliced/plain sawn.
  - 3. Wood Moisture Content: 5 to 10 percent.

2.5 HARDWOOD SHEET MATERIALS

- A. Composite Wood Products: Provide materials that comply with requirements of the Architectural Woodwork Standards for each type of interior architectural woodwork and quality grade specified unless otherwise indicated.
  - 1. Particleboard: ANSI A208.1, Grade M-2.
  - 2. Softwood Plywood: DOC PS 1, medium-density overlay.
  - 3. Veneer-Faced Panel Products (Hardwood Plywood): HPVA HP-1.

2.6 MISCELLANEOUS MATERIALS

- A. Furring, Blocking, Shims, and Nailers: Softwood or hardwood lumber, kiln-dried to less than 15 percent moisture content.
- B. Provide self-drilling screws for metal-framing supports, as recommended by metal-framing manufacturer.
- C. Anchors: Select material, type, size, and finish required for each substrate for secure anchorage.
  - 1. Provide metal expansion sleeves or expansion bolts for post-installed anchors.
  - 2. Use nonferrous-metal or hot-dip galvanized anchors and inserts at inside face of exterior walls and at floors.
- D. Installation Adhesive: Product recommended by fabricator for each substrate for secure anchorage.

2.7 FABRICATION

- A. Fabricate interior architectural woodwork to dimensions, profiles, and details indicated.
  - 1. Ease edges to radius indicated for the following:

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INTERIOR ARCHITECTURAL WOODWORK

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- a. Edges of Solid-Wood (Lumber) Members: 1/16 inch unless otherwise indicated.
  - b. Edges of Rails and Similar Members More Than 3/4 Inch (19 mm) Thick: 1/8 inch.
- B. Complete fabrication, including assembly, to maximum extent possible before shipment to Project site.
  - 1. Disassemble components only as necessary for shipment and installation.
  - 2. Where necessary for fitting at site, provide allowance for scribing, trimming, and fitting.
  - 3. Trial fit assemblies at fabrication shop that cannot be shipped completely assembled.
    - a. Install dowels, screws, bolted connectors, and other fastening devices that can be removed after trial fitting.
    - b. Verify that parts fit as intended, and check measurements of assemblies against field measurements indicated on approved Shop Drawings before disassembling for shipment.

2.8 SHOP PRIMING

- A. Preparations for Finishing: Comply with the Architectural Woodwork Standards for sanding, filling countersunk fasteners, sealing concealed surfaces, and similar preparations for finishing interior architectural woodwork, as applicable to each unit of work.
- B. Interior Architectural Woodwork for Opaque Finish: Shop prime with one coat of wood primer as specified in Section 09 91 23 "Interior Painting."
  - 1. Backpriming: Apply one coat of primer, compatible with finish coats, to concealed surfaces of woodwork.

2.9 SHOP FINISHING

- A. Finish interior architectural woodwork with transparent finish at fabrication shop. Defer only final touchup, cleaning, and polishing until after installation.
- B. Preparation for Finishing: Comply with Architectural Woodwork Standards, Section 5 for sanding, filling countersunk fasteners, sealing concealed surfaces, and similar preparations for finishing interior architectural woodwork, as applicable to each unit of work.
  - 1. Backpriming: Apply one coat of sealer or primer, compatible with finish coats, to concealed surfaces of interior architectural woodwork. Apply two coats to end-grain surfaces.
- C. Transparent Finish:
  - 1. Architectural Woodwork Standards Grade: Custom.
  - 2. Finish System:
    - a. 11: Polyurethane, Catalyzed.
  - 3. Staining: Match Architect's sample.

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INTERIOR ARCHITECTURAL WOODWORK

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4. Sheen: Satin, 31-45 gloss units measured on 60-degree gloss meter in accordance with ASTM D523.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Before installation, condition interior architectural woodwork to humidity conditions in installation areas for not less than 72 hours prior to beginning of installation.
- B. Before installing interior architectural woodwork, examine shop-fabricated work for completion and complete work as required, including removal of packing and backpriming of concealed surfaces.

3.2 INSTALLATION

- A. Grade: Install interior architectural woodwork to comply with same grade as item to be installed.
- B. Assemble interior architectural woodwork and complete fabrication at Project site to the extent that it was not completed during shop fabrication.
- C. Install interior architectural woodwork level, plumb, true in line, and without distortion.
1. Shim as required with concealed shims.
  2. Install level and plumb to a tolerance of 1/8 inch in 96 inches.
- D. Scribe and cut interior architectural woodwork to fit adjoining work, refinish cut surfaces, and repair damaged finish at cuts.
- E. Anchor interior architectural woodwork to anchors or blocking built in or directly attached to substrates.
1. Secure with countersunk, concealed fasteners and blind nailing.
  2. Use fine finishing nails or finishing screws for exposed fastening, countersunk and filled flush with interior architectural woodwork.
  3. For shop-finished items, use filler matching finish of items being installed.
- F. Standing and Running Trim:
1. Install with minimum number of joints possible, using full-length pieces (from maximum length of lumber available) to greatest extent possible.
  2. Do not use pieces less than 96 inches long, except where shorter single-length pieces are necessary.
  3. Scarf running joints and stagger in adjacent and related members.
  4. Fill gaps, if any, between top of base and wall with latex sealant, painted to match wall.
  5. Install standing and running trim with no more variation from a straight line than 1/8 inch in 96 inches.

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INTERIOR ARCHITECTURAL WOODWORK

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3.3 REPAIR

- A. Repair damaged and defective interior architectural woodwork, where possible, to eliminate functional and visual defects and to result in interior architectural woodwork being in compliance with requirements of Architectural Woodwork Standards for the specified grade.
- B. Where not possible to repair, replace defective woodwork.
- C. Shop Finish: Touch up finishing work specified in this Section after installation of interior architectural woodwork.
  - 1. Fill nail holes with matching filler where exposed.
  - 2. Apply specified finish coats, including stains and paste fillers if any, to exposed surfaces where only sealer/prime coats are shop applied.
- D. Field Finish: See Section 09 91 23 "Interior Painting" for final finishing of installed interior architectural woodwork not indicated to be shop finished.

3.4 CLEANING

- A. Clean interior architectural woodwork on exposed and semiexposed surfaces.

END OF SECTION 06 40 23

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PLASTIC-LAMINATE-CLAD ARCHITECTURAL CABINETS

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SECTION 06 41 16 - PLASTIC-LAMINATE-CLAD ARCHITECTURAL CABINETS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
  - 1. Plastic-laminate-clad architectural cabinets.
  - 2. Cabinet hardware and accessories.
  - 3. Wood furring, blocking, shims, and hanging strips for installing plastic-laminate-clad architectural cabinets that are not concealed within other construction.

1.2 COORDINATION

- A. Coordinate sizes and locations of framing, blocking, furring, reinforcements, and other related units of Work specified in other Sections to support loads imposed by installed and fully loaded cabinets.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings:
  - 1. Include plans, elevations, sections, and attachment details.
  - 2. Show large-scale details.
  - 3. Show locations and sizes of furring, blocking, and hanging strips, including concealed blocking and reinforcement specified in other Sections.
  - 4. Show locations and sizes of cutouts and holes for items installed in plastic-laminate architectural cabinets.
- C. Samples for Initial Selection: For each type of exposed finish.
- D. Samples for Verification: For the following:
  - 1. Plastic Laminates: 8 by 10 inches, for each type, color, pattern, and surface finish required.
    - a. Provide one sample applied to core material with specified edge material applied to one edge.
  - 2. Corner Pieces:
    - a. Cabinet-front frame joints between stiles and rails and at exposed end pieces, 18 inches high by 18 inches wide by 6 inches deep.
    - b. Miter joints for standing trim.
  - 3. Exposed Cabinet Hardware and Accessories: One full-size unit for each type and finish.

1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For manufacturer.

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PLASTIC-LAMINATE-CLAD ARCHITECTURAL CABINETS

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1.5 QUALITY ASSURANCE

- A. Manufacturer's Qualifications: Employs skilled workers who custom fabricate products similar to those required for this Project and whose products have a record of successful in-service performance.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Do not deliver cabinets until painting and similar finish operations that might damage architectural cabinets have been completed in installation areas. Store cabinets in installation areas or in areas where environmental conditions comply with requirements specified in "Field Conditions" Article.

1.7 FIELD CONDITIONS

- A. Environmental Limitations without Humidity Control: Do not deliver or install cabinets until building is enclosed, wet-work is complete, and HVAC system is operating and maintaining temperature and relative humidity at levels planned for building occupants during the remainder of the construction period.
- B. Field Measurements: Where cabinets are 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 cabinets by field measurements before being enclosed/concealed by construction, and indicate measurements on Shop Drawings.
- C. Established Dimensions: Where cabinets are indicated to fit to other construction, establish dimensions for areas where cabinets are to fit. Provide allowance for trimming at site, and coordinate construction to ensure that actual dimensions correspond to established dimensions.

PART 2 - PRODUCTS

2.1 PLASTIC-LAMINATE-CLAD ARCHITECTURAL CABINETS

- A. Quality Standard: Unless otherwise indicated, comply with the Architectural Woodwork Standards for grades of cabinets indicated for construction, finishes, installation, and other requirements.
  - 1. The Contract Documents contain requirements that are more stringent than the referenced quality standard. Comply with requirements of Contract Documents in addition to those of the referenced quality standard.
- B. Architectural Woodwork Standards Grade: Custom.
- C. Type of Construction: Frameless.
- D. Door and Drawer-Front Style: Flush overlay.

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PLASTIC-LAMINATE-CLAD ARCHITECTURAL CABINETS

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- E. High-Pressure Decorative Laminate: NEMA LD 3, grades as indicated or if not indicated, as required by quality standard.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Formica Corporation.
    - b. Lamin-Art, Inc.
    - c. Pionite; a Panolam Industries International, Inc. brand.
    - d. Wilsonart LLC.
- F. Laminate Cladding for Exposed Surfaces:
  - 1. Horizontal Surfaces: Grade HGS.
  - 2. Postformed Surfaces: Grade HGP.
  - 3. Vertical Surfaces: Grade HGS.
  - 4. Edges: PVC edge banding, 3.0 mm thick, matching laminate in color, pattern, and finish.
  - 5. Pattern Direction: As indicated.
- G. Materials for Semiexposed Surfaces:
  - 1. Surfaces Other Than Drawer Bodies: High-pressure decorative laminate, NEMA LD 3, Grade VGS.
    - a. Edges of Plastic-Laminate Shelves: PVC edge banding, 3.0 mm thick, matching laminate in color, pattern, and finish.
    - b. For semiexposed backs of panels with exposed plastic-laminate surfaces, provide surface of high-pressure decorative laminate, NEMA LD 3, Grade CLS.
  - 2. Drawer Sides and Backs: Solid-hardwood lumber.
  - 3. Drawer Bottoms: Hardwood plywood.
- H. Concealed Backs of Panels with Exposed Plastic-Laminate Surfaces: High-pressure decorative laminate, NEMA LD 3, Grade BKL.
- I. Drawer Construction: Fabricate with exposed fronts fastened to subfront with mounting screws from interior of body.
  - 1. Join subfronts, backs, and sides with glued rabbeted joints supplemented by mechanical fasteners or glued dovetail joints.
- J. Colors, Patterns, and Finishes: Provide materials and products that result in colors and textures of exposed laminate surfaces complying with the following requirements:
  - 1. As indicated by laminate manufacturer's designations.

## 2.2 WOOD MATERIALS

- A. Wood Products: Provide materials that comply with requirements of referenced quality standard for each type of architectural cabinet and quality grade specified unless otherwise indicated.
  - 1. Wood Moisture Content: 5 to 10 percent.

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PLASTIC-LAMINATE-CLAD ARCHITECTURAL CABINETS

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- B. Composite Wood Products: Provide materials that comply with requirements of referenced quality standard for each type of architectural cabinet and quality grade specified unless otherwise indicated.

1. Particleboard (Medium Density): ANSI A208.1, Grade M-2.

2.3 CABINET HARDWARE AND ACCESSORIES

- A. Frameless Concealed Hinges (European Type): ANSI/BHMA A156.9, B01602, 135 degrees of opening, self-closing.

- B. Wire Pulls: Back mounted, solid metal, 4 inches long, 5/16 inch in diameter.

- C. Catches: Magnetic catches, ANSI/BHMA A156.9, B03141.

- D. Shelf Rests: ANSI/BHMA A156.9, B04013; two-pin plastic with shelf hold-down clip.

- E. Drawer Slides: ANSI/BHMA A156.9.

1. Heavy-Duty (Grade 1HD-100 and Grade 1HD-200): Side mount.

a. Type: Full overtravel extension.

b. Material: Zinc-plated ball bearing slides.

c. Motion Feature: Self-closing mechanism.

2. Pencil drawers not more than 3 inches high and not more than 24 inches wide, provide 50 lb load capacity.

3. General-purpose drawers more than 3 inches high, but not more than 6 inches high and not more than 24 inches wide, provide 100 lb load capacity.

4. File drawers more than 6 inches high or more than 24 inches wide, provide 150 lb load capacity.

5. Lateral file drawers more than 6 inches high and more than 24 inches but not more than 30 inches wide, provide 200 lb load capacity.

6. Lateral file drawers more than 6 inches high and more than 30 inches wide, provide 200 lb load capacity.

7. Computer keyboard tray, provide 75 lb load capacity.

- F. Door Locks: ANSI/BHMA A156.11, E07121.

- G. Drawer Locks: ANSI/BHMA A156.11, E07041.

- H. Door and Drawer Silencers: ANSI/BHMA A156.16, L03011.

- I. Grommets for Cable Passage: 2-inch OD, molded-plastic grommets and matching plastic caps with slot for wire passage.

1. Color: Black.

- J. Exposed Hardware Finishes: For exposed hardware, provide finish that complies with ANSI/BHMA A156.18 for ANSI/BHMA finish number indicated.

1. Satin Stainless Steel: ANSI/BHMA 630.

- K. For concealed hardware, provide manufacturer's standard finish that complies with product class requirements in ANSI/BHMA A156.9.



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PLASTIC-LAMINATE-CLAD ARCHITECTURAL CABINETS

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2.4 MISCELLANEOUS MATERIALS

- A. Furring, Blocking, Shims, and Hanging Strips: Softwood or hardwood lumber, kiln-dried to less than 15 percent moisture content.
- B. Anchors: Select material, type, size, and finish required for each substrate for secure anchorage. Provide metal expansion sleeves or expansion bolts for post-installed anchors. Use nonferrous-metal or hot-dip galvanized anchors and inserts at inside face of exterior walls and at floors.

2.5 FABRICATION

- A. Fabricate architectural cabinets to dimensions, profiles, and details indicated.
- B. Complete fabrication, including assembly and hardware application, to maximum extent possible before shipment to Project site. Disassemble components only as necessary for shipment and installation. Where necessary for fitting at site, provide ample allowance for scribing, trimming, and fitting.
  - 1. Notify Architect seven days in advance of the dates and times architectural cabinet fabrication will be complete.
  - 2. Trial fit assemblies at manufacturer's shop that cannot be shipped completely assembled. Install dowels, screws, bolted connectors, and other fastening devices that can be removed after trial fitting. Verify that various parts fit as intended and check measurements of assemblies against field measurements before disassembling for shipment.
- C. Shop-cut openings to maximum extent possible to receive hardware, appliances, 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.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Before installation, condition cabinets to humidity conditions in installation areas for not less than 72 hours.

3.2 INSTALLATION

- A. Architectural Woodwork Standards Grade: Install cabinets to comply with quality standard grade of item to be installed.
- B. Assemble cabinets and complete fabrication at Project site to extent that it was not completed in the shop.
- C. Anchor cabinets to anchors or blocking built in or directly attached to substrates. Secure with wafer-head cabinet installation screws.

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PLASTIC-LAMINATE-CLAD ARCHITECTURAL CABINETS

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- D. Install cabinets level, plumb, and true in line to a tolerance of 1/8 inch in 96 inches using concealed shims.
  - 1. Scribe and cut cabinets to fit adjoining work, refinish cut surfaces, and repair damaged finish at cuts.
  - 2. Install cabinets without distortion so doors and drawers fit openings and are accurately aligned. Adjust hardware to center doors and drawers in openings and to provide unencumbered operation. Complete installation of hardware and accessory items as indicated.
  - 3. Fasten wall cabinets through back, near top and bottom, and at ends not more than 16 inches o.c. with No. 10 wafer-head screws sized for not less than 1-1/2-inch penetration into wood framing, blocking, or hanging strips.

3.3 ADJUSTING AND CLEANING

- A. Repair damaged and defective cabinets, where possible, to eliminate functional and visual defects. Where not possible to repair, replace architectural cabinets. Adjust joinery for uniform appearance.
- B. Clean, lubricate, and adjust hardware.
- C. Clean cabinets on exposed and semiexposed surfaces.

END OF SECTION 06 41 16

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THERMAL INSULATION

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SECTION 07 21 00 - THERMAL INSULATION

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
  - 1. Mineral-wool blanket insulation.

1.2 ACTION SUBMITTALS

- A. Product Data: For the following:
  - 1. Mineral-wool blanket insulation.

1.3 DELIVERY, STORAGE, AND HANDLING

- A. Protect insulation materials from physical damage and from deterioration due to moisture, soiling, and other sources. Store inside and in a dry location. Comply with manufacturer's written instructions for handling, storing, and protecting during installation.

PART 2 - PRODUCTS

2.1 MINERAL-WOOL BLANKET INSULATION

- A. Mineral-Wool Blanket Insulation, Unfaced: ASTM C665, Type I (blankets without membrane facing); consisting of fibers; passing ASTM E136 for combustion characteristics.
  - 1. Flame-Spread Index: Not more than 25 when tested in accordance with ASTM E84.
  - 2. Smoke-Developed Index: Not more than 50 when tested in accordance with ASTM E84.
  - 3. Labeling: Provide identification of mark indicating R-value of each piece of insulation 12 inches and wider in width.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Clean substrates of substances that are harmful to insulation, including removing projections capable of puncturing insulation or vapor retarders, or that interfere with insulation attachment.

3.2 INSTALLATION, GENERAL

- A. Comply with insulation manufacturer's written instructions applicable to products and applications.

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THERMAL INSULATION

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- B. Install insulation that is undamaged, dry, and unsoiled and that has not been left exposed to ice, rain, or snow at any time.
- C. Install insulation with manufacturer's R-value label exposed after insulation is installed.
- D. Extend insulation to envelop entire area to be insulated. Fit tightly around obstructions and fill voids with insulation. Remove projections that interfere with placement.
- E. Provide sizes to fit applications and selected from manufacturer's standard thicknesses, widths, and lengths. Apply single layer of insulation units unless multiple layers are otherwise shown or required to make up total thickness or to achieve R-value.

3.3 INSTALLATION OF INSULATION IN FRAMED CONSTRUCTION

- A. Blanket Insulation: Install in cavities formed by framing members according to the following requirements:
  - 1. Use insulation widths and lengths that fill the cavities formed by framing members. If more than one length is required to fill the cavities, provide lengths that will produce a snug fit between ends.
  - 2. Place insulation in cavities formed by framing members to produce a friction fit between edges of insulation and adjoining framing members.
  - 3. For metal-framed wall cavities where cavity heights exceed 96 inches, support unfaced blankets mechanically and support faced blankets by taping flanges of insulation to flanges of metal studs.

3.4 PROTECTION

- A. Protect installed insulation from damage due to harmful weather exposures, physical abuse, and other causes.
- B. Provide temporary coverings or enclosures where insulation is subject to abuse and cannot be concealed and protected by permanent construction immediately after installation.

END OF SECTION 07 21 00

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INSULATED METAL PANELS

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SECTION 07 42 13.19 - INSULATED METAL PANELS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
  - 1. Laminated-insulation-core metal panels.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product.
  - 1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type of panel and accessory.
- B. Samples for Initial Selection: For each type of metal panel indicated with factory-applied color finishes.
  - 1. Include similar Samples of trim and accessories involving color selection.

1.3 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For metal panels to include in maintenance manuals.

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Deliver components, metal panels, and other manufactured items so as not to be damaged or deformed. Package metal panels for protection during transportation and handling.
- B. Retain strippable protective covering on metal panels during installation.

1.5 FIELD CONDITIONS

- A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit assembly of metal panels to be performed according to manufacturers' written instructions and warranty requirements.

1.6 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of metal panel systems that fail in materials or workmanship within specified warranty period.
  - 1. Failures include, but are not limited to, the following:
    - a. Structural failures including rupturing, cracking, or puncturing.
    - b. Deterioration of metals and other materials beyond normal weathering.
  - 2. Warranty Period: Two years from date of Substantial Completion.

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INSULATED METAL PANELS

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- B. Special Warranty on Panel Finishes: Manufacturer's standard form in which manufacturer agrees to repair finish or replace metal panels that show evidence of deterioration of factory-applied finishes within specified warranty period.
  - 1. Exposed Panel Finish: Deterioration includes, but is not limited to, the following:
    - a. Color fading more than 5 Hunter units when tested according to ASTM D2244.
    - b. Chalking in excess of a No. 8 rating when tested according to ASTM D4214.
    - c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.
  - 2. Finish Warranty Period: 20 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes by preventing buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
  - 1. Temperature Change (Range): 120 deg F, ambient; 180 deg F, material surfaces.
- B. Fire-Test-Response Characteristics: Provide metal wall panels and system components with the following fire-test-response characteristics, as determined by testing identical panels and system components per test method indicated below by UL or another testing and inspecting agency acceptable to authorities having jurisdiction. Identify products with appropriate markings of applicable testing agency.
  - 1. Surface-Burning Characteristics: Provide wall panels with a flame-spread index of 25 or less and a smoke-developed index of 450 or less, per ASTM E84.

2.2 LAMINATED-INSULATION-CORE METAL PANELS

- A. General: Provide factory-formed and -assembled metal wall panels fabricated from two metal facing sheets and core material laminated or otherwise securely bonded to facing sheets during fabrication without use of contact adhesives, and with joints between panels designed to form weathertight seals. Include accessories required for weathertight installation.
- B. Laminated-Insulation-Core Metal Panels: Formed with flush exterior panel facing wrapped over panel edges.
  - 1. Aluminum Sheet: Fabricate panel with exterior and interior facings of same material and thickness. Provide facings of aluminum coil-coated sheet, ASTM B209, alloy as standard with manufacturer, with temper as required to suit forming operations and structural performance required.
    - a. Thickness: 0.032 inch.
    - b. Surface: Smooth, flat finish.
    - c. Exterior Finish: Two-coat fluoropolymer.
      - 1) Color: As selected by Architect from manufacturer's full range.

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## INSULATED METAL PANELS

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- d. Interior Finish: Siliconized polyester.
  - 1) Color: As selected by Architect from manufacturer's full range.
- 2. Core Material: Board insulation of the following type:
  - a. Polyisocyanurate Insulation: Closed cell, modified polyisocyanurate foam using a non-CFC blowing agent, board type, with a maximum flame-spread index of 25 and a smoke-developed index of 450.
    - 1) Closed-Cell Content: 90 percent when tested according to ASTM D6226.
- 3. Backer Board: 0.125-inch- thick hardboard behind exterior facing for increased impact resistance.
- 4. Gaskets: Extruded, dry seal silicone.
- 5. Sealant: Manufacturer's standard silicone.
- 6. Panel Thickness: As indicated on Drawings..

### 2.3 MISCELLANEOUS MATERIALS

- A. Miscellaneous Metal Subframing and Furring: ASTM C645, cold-formed, metallic-coated steel sheet, ASTM A653/A653M, G90 coating designation or ASTM A792/A792M, Class AZ50 aluminum-zinc-alloy coating designation unless otherwise indicated. Provide manufacturer's standard sections as required for support and alignment of metal panel system.
- B. Panel Accessories: Provide components required for a complete, weathertight panel system including trim, mullions, sealants, gaskets, fillers, closure strips, and similar items. Match material and finish of metal panels unless otherwise indicated.
- C. Panel Sealants: Provide sealant type recommended by manufacturer that are compatible with panel materials, are nonstaining, and do not damage panel finish.
  - 1. Sealant Tape: Pressure-sensitive, 100 percent solids, gray polyisobutylene compound sealant tape with release-paper backing. Provide permanently elastic, nonsag, nontoxic, nonstaining tape 1/2 inch wide and 1/8 inch thick.
  - 2. Joint Sealant: ASTM C920; elastomeric polyurethane or silicone sealant; of type, grade, class, and use classifications required to seal joints in metal panels and remain weathertight; and as recommended in writing by metal panel manufacturer.

### 2.4 FABRICATION

- A. General: Fabricate and finish metal panels and accessories at the factory, by manufacturer's standard procedures and processes, as necessary to fulfill indicated performance requirements demonstrated by laboratory testing. Comply with indicated profiles and with dimensional and structural requirements.

### 2.5 FINISHES

- A. Protect mechanical and painted finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

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INSULATED METAL PANELS

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- B. 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 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.
- C. Aluminum Panels and Accessories:
  - 1. Two-Coat Fluoropolymer: AAMA 2605. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
  - 2. Siliconized Polyester: Epoxy primer and silicone-modified, polyester-enamel topcoat; with a dry film thickness of not less than 0.2 mil for primer and 0.8 mil for topcoat.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, metal panel supports, and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 METAL PANEL INSTALLATION

- A. General: Install metal panels according to manufacturer's written instructions in orientation, sizes, and locations indicated. Anchor metal panels and other components of the Work securely in place, with provisions for thermal and structural movement.
  - 1. Shim or otherwise plumb substrates receiving metal panels.
- B. Fasteners:
  - 1. Aluminum Panels: Use aluminum or stainless-steel fasteners for surfaces exposed to the exterior; use aluminum or galvanized-steel fasteners for surfaces exposed to the interior.
- C. Metal Protection: Where dissimilar metals contact each other or corrosive substrates, protect against galvanic action as recommended in writing by metal panel manufacturer.
- D. Joint Sealers: Install gaskets, joint fillers, and sealants where indicated and where required for weathertight performance of metal wall panel assemblies. Provide types of gaskets, fillers, and sealants indicated by metal panel manufacturer; or, if not indicated, provide types recommended by metal wall panel manufacturer.



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INSULATED METAL PANELS

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3.3 CLEANING AND PROTECTION

- A. Remove temporary protective coverings and strippable films, if any, as metal panels are installed, unless otherwise indicated in manufacturer's written installation instructions. On completion of metal panel installation, clean finished surfaces as recommended by metal panel manufacturer. Maintain in a clean condition during construction.
- B. Replace metal panels that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION 07 42 13.19

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JOINT SEALANTS

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SECTION 07 92 00 - JOINT SEALANTS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
  - 1. Urethane joint sealants.
  - 2. Mildew-resistant joint sealants.
  - 3. Latex joint sealants.

1.2 ACTION SUBMITTALS

- A. Product Data:
  - 1. Joint-sealants.
  - 2. Joint sealant backing materials.
- B. Samples for Initial Selection: Manufacturer's standard color charts consisting of strips of cured sealants showing the full range of colors available for each product exposed to view.
- C. Joint-Sealant Schedule: Include the following information:
  - 1. Joint-sealant application, joint location, and designation.
  - 2. Joint-sealant manufacturer and product name.
  - 3. Joint-sealant formulation.
  - 4. Joint-sealant color.

1.3 CLOSEOUT SUBMITTALS

- A. Warranty Documentation:
  - 1. Manufacturers' special warranties.
  - 2. Installer's special warranties.

1.4 QUALITY ASSURANCE

- A. Qualifications:
  - 1. Installers: Authorized representative who is trained and approved by manufacturer.
  - 2. Testing Agency: Qualified in accordance with ASTM C1021 to conduct the testing indicated.

1.5 MOCKUPS

- A. Install sealant in mockups of assemblies specified in other Sections that are indicated to receive joint sealants specified in this Section. Use materials and installation methods specified in this Section.

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JOINT SEALANTS

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1.6 FIELD CONDITIONS

- A. Do not proceed with installation of joint sealants under the following conditions:
  - 1. When ambient and substrate temperature conditions are outside limits permitted by joint-sealant manufacturer or are below 40 deg F.
  - 2. When joint substrates are wet.
  - 3. Where joint widths are less than those allowed by joint-sealant manufacturer for applications indicated.
  - 4. Where contaminants capable of interfering with adhesion have not yet been removed from joint substrates.

1.7 WARRANTY

- A. Special Installer's Warranty: Installer agrees to repair or replace joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.
  - 1. Warranty Period: Two years from date of Substantial Completion.
- B. Special Manufacturer's Warranty: Manufacturer agrees to furnish joint sealants to repair or replace those joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.
  - 1. Warranty Period: Five years from date of Substantial Completion.
- C. Special warranties specified in this article exclude deterioration or failure of joint sealants from the following:
  - 1. Movement of the structure caused by stresses on the sealant exceeding sealant manufacturer's written specifications for sealant elongation and compression.
  - 2. Disintegration of joint substrates from causes exceeding design specifications.
  - 3. Mechanical damage caused by individuals, tools, or other outside agents.
  - 4. Changes in sealant appearance caused by accumulation of dirt or other atmospheric contaminants.

PART 2 - PRODUCTS

2.1 SOURCE LIMITATIONS

- A. Obtain joint sealants from single manufacturer for each sealant type.

2.2 JOINT SEALANTS, GENERAL

- A. Compatibility: Provide joint sealants, backings, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by joint-sealant manufacturer, based on testing and field experience.
- B. Colors of Exposed Joint Sealants: As selected by Architect from manufacturer's full range.

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JOINT SEALANTS

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2.3 URETHANE JOINT SEALANTS

- A. Urethane, M, NS, 25, T, NT: Multicomponent, nonsag, plus 25 percent and minus 25 percent movement capability, traffic- and nontraffic-use, urethane joint sealant; ASTM C920, Type M, Grade NS, Class 25, Uses T and NT.
  - 1. Products: Subject to compliance with requirements, provide one of the following:
    - a. Master Builders Solutions; MasterSeal NP 2 (Pre-2014: Sonolastic NP2).
    - b. Sika Corporation; Joint Sealants; Sikaflex 2c NS EZ Mix.

2.4 MILDEW-RESISTANT JOINT SEALANTS

- A. Mildew-Resistant Joint Sealants: Formulated for prolonged exposure to humidity with fungicide to prevent mold and mildew growth.
- B. Silicone, Mildew Resistant, Acid Curing, S, NS, 25, NT: Mildew-resistant, single-component, nonsag, plus 25 percent and minus 25 percent movement capability, nontraffic-use, acid-curing silicone joint sealant; ASTM C920, Type S, Grade NS, Class 25, Use NT.
  - 1. Products: Subject to compliance with requirements, provide the following:
    - a. DOWSIL 790 Silicone Building Sealant; DOW.

2.5 LATEX JOINT SEALANTS

- A. Acrylic Latex: Acrylic latex or siliconized acrylic latex, ASTM C834, Type OP, Grade NF.
  - 1. Products: Subject to compliance with requirements, provide the following:
    - a. BASF Building Systems; Sonolac.
    - b. Bostik, Inc.; Chem-Calk 600.
    - c. Tremco Incorporated; Tremflex 834.

2.6 JOINT-SEALANT BACKING

- A. Sealant Backing Material, General: Nonstaining; compatible with joint substrates, sealants, primers, and other joint fillers; and approved for applications indicated by sealant manufacturer based on field experience and laboratory testing.
- B. Cylindrical Sealant Backings: ASTM C1330, Type C (closed-cell material with a surface skin), and of size and density to control sealant depth and otherwise contribute to producing optimum sealant performance.
- C. Bond-Breaker Tape: Polyethylene tape or other plastic tape recommended by sealant manufacturer for preventing sealant from adhering to rigid, inflexible joint-filler materials or joint surfaces at back of joint. Provide self-adhesive tape where applicable.

2.7 MISCELLANEOUS MATERIALS

- A. Primer: Material recommended by joint-sealant manufacturer where required for adhesion of sealant to joint substrates indicated, as determined from preconstruction joint-sealant-substrate tests and field tests.

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JOINT SEALANTS

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- B. Cleaners for Nonporous Surfaces: Chemical cleaners acceptable to manufacturers of sealants and sealant backing materials, free of oily residues or other substances capable of staining or harming joint substrates and adjacent nonporous surfaces in any way, and formulated to promote optimum adhesion of sealants to joint substrates.
- C. Masking Tape: Nonstaining, nonabsorbent material compatible with joint sealants and surfaces adjacent to joints.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine joints indicated to receive joint sealants, with Installer present, for compliance with requirements for joint configuration, installation tolerances, and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants to comply with joint-sealant manufacturer's written instructions and the following requirements:
  - 1. Remove all foreign material from joint substrates that could interfere with adhesion of joint sealant, including dust, paints (except for permanent, protective coatings tested and approved for sealant adhesion and compatibility by sealant manufacturer), old joint sealants, oil, grease, waterproofing, water repellents, water, surface dirt, and frost.
  - 2. Clean porous joint substrate surfaces by brushing, grinding, mechanical abrading, or a combination of these methods to produce a clean, sound substrate capable of developing optimum bond with joint sealants. Remove loose particles remaining after cleaning operations above by vacuuming or blowing out joints with oil-free compressed air. Porous joint substrates include the following:
    - a. Concrete.
    - b. Masonry.
  - 3. Remove laitance and form-release agents from concrete.
  - 4. Clean nonporous joint substrate surfaces with chemical cleaners or other means that do not stain, harm substrates, or leave residues capable of interfering with adhesion of joint sealants. Nonporous joint substrates include the following:
    - a. Metal.
    - b. Glass.
    - c. Glazed surfaces of ceramic tile.
- B. Joint Priming: Prime joint substrates where recommended by joint-sealant manufacturer or as indicated by preconstruction joint-sealant-substrate tests or prior experience. Apply primer to comply with joint-sealant manufacturer's written instructions. Confine primers to areas of joint-sealant bond; do not allow spillage or migration onto adjoining surfaces.

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## JOINT SEALANTS

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- C. Masking Tape: Use masking tape where required to prevent contact of sealant or primer with adjoining surfaces that otherwise would be permanently stained or damaged by such contact or by cleaning methods required to remove sealant smears. Remove tape immediately after tooling without disturbing joint seal.

### 3.3 INSTALLATION OF JOINT SEALANTS

- A. General: Comply with joint-sealant manufacturer's written installation instructions for products and applications indicated, unless more stringent requirements apply.
- B. Sealant Installation Standard: Comply with recommendations in ASTM C1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.
- C. Install sealant backings of type indicated to support sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.
  - 1. Do not leave gaps between ends of sealant backings.
  - 2. Do not stretch, twist, puncture, or tear sealant backings.
  - 3. Remove absorbent sealant backings that have become wet before sealant application, and replace them with dry materials.
- D. Install bond-breaker tape behind sealants where sealant backings are not used between sealants and backs of joints.
- E. Install sealants using proven techniques that comply with the following and at the same time backings are installed:
  - 1. Place sealants so they directly contact and fully wet joint substrates.
  - 2. Completely fill recesses in each joint configuration.
  - 3. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.
- F. Tooling of Nonsag Sealants: Immediately after sealant application and before skinning or curing begins, tool sealants according to requirements specified in subparagraphs below to form smooth, uniform beads of configuration indicated; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint.
  - 1. Remove excess sealant from surfaces adjacent to joints.
  - 2. Use tooling agents that are approved in writing by sealant manufacturer and that do not discolor sealants or adjacent surfaces.
  - 3. Provide concave joint profile in accordance with Figure 8A in ASTM C1193 unless otherwise indicated.

### 3.4 CLEANING

- A. Clean off excess sealant or sealant smears adjacent to joints as the Work progresses by methods and with cleaning materials approved in writing by manufacturers of joint sealants and of products in which joints occur.

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JOINT SEALANTS

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3.5 PROTECTION

- A. Protect joint sealants during and after curing period from contact with contaminating substances and from damage resulting from construction operations or other causes so sealants are without deterioration or damage at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out, remove, and repair damaged or deteriorated joint sealants immediately so installations with repaired areas are indistinguishable from original work.

3.6 JOINT-SEALANT SCHEDULE

- A. Interior joints in horizontal traffic surfaces:
1. Joint Locations:
    - a. Control and expansion joints in tile flooring.
    - b. Other joints as indicated on Drawings.
  2. Joint Sealant: Urethane, M, NS, 25, T, NT.
- B. Interior joints in vertical surfaces and horizontal nontraffic surfaces not subject to significant movement:
1. Joint Locations:
    - a. Control joints on exposed interior surfaces of exterior walls.
    - b. Perimeter joints between interior wall surfaces and frames of interior doors, windows, and elevator entrances.
    - c. Other joints as indicated on Drawings.
  2. Joint Sealant: Acrylic latex.
- C. Mildew-resistant interior joints in vertical surfaces and horizontal nontraffic surfaces :
1. Joint Locations:
    - a. Joints between plumbing fixtures and adjoining walls, floors, and counters.
    - b. Tile control and expansion joints where indicated.
    - c. Other joints as indicated on Drawings.
  2. Joint Sealant: Silicone, mildew resistant, acid curing, S, NS, 25, NT.

END OF SECTION 07 92 00



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ACOUSTICAL JOINT SEALANTS

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SECTION 07 92 19 - ACOUSTICAL JOINT SEALANTS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
  - 1. Acoustical joint sealants.

1.2 ACTION SUBMITTALS

- A. Product Data:
  - 1. Acoustical joint sealants.
- B. Samples for Initial Selection: Manufacturer's color charts consisting of strips of cured sealants, showing full range of available colors for each product exposed to view.

1.3 CLOSEOUT SUBMITTALS

- A. Warranty Documentation:
  - 1. Manufacturers' special warranties.

1.4 WARRANTY

- A. Manufacturer's Special Warranty: Manufacturer agrees to furnish acoustical joint sealants to repair or replace those joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.
  - 1. Warranty Period: 5 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 ACOUSTICAL JOINT SEALANTS

- A. Acoustical joint-sealant products that effectively reduce airborne sound transmission through perimeter joints and openings in building construction, as demonstrated by testing representative assemblies in accordance with ASTM E90.
- B. Acoustical Sealant for Exposed and Concealed Joints: Manufacturer's standard nonsag, paintable, nonstaining latex acoustical sealant complying with ASTM C834.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. GE Construction Sealants; Momentive Performance Materials Inc.
    - b. Grabber Construction Products.
    - c. Hilti, Inc.
    - d. Tremco Incorporated.
  - 2. Colors of Exposed Acoustical Joint Sealants: As selected by Architect from manufacturer's full range of colors.

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ACOUSTICAL JOINT SEALANTS

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2.2 MISCELLANEOUS MATERIALS

- A. Primer: Material recommended by acoustical joint-sealant manufacturer where required for adhesion of sealant to joint substrates.
- B. Cleaners for Nonporous Surfaces: Chemical cleaners acceptable to manufacturers of sealants and sealant backing materials, free of oily residues or other substances capable of staining or harming joint substrates and adjacent nonporous surfaces in any way, and formulated to promote optimum adhesion of sealants to joint substrates.
- C. Masking Tape: Nonstaining, nonabsorbent material compatible with joint sealants and surfaces adjacent to joints.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine joints indicated to receive acoustical joint sealants, with Installer present, for compliance with requirements for joint configuration, installation tolerances, and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Surface Cleaning of Joints: Clean out joints immediately before installing acoustical joint sealants to comply with joint-sealant manufacturer's written instructions.
- B. Joint Priming: Prime joint substrates where recommended by acoustical joint-sealant manufacturer. Apply primer to comply with joint-sealant manufacturer's written instructions. Confine primers to areas of joint-sealant bond; do not allow spillage or migration onto adjoining surfaces.
- C. Masking Tape: Use masking tape where required to prevent contact of sealant or primer with adjoining surfaces that otherwise would be permanently stained or damaged by such contact or by cleaning methods required to remove sealant smears. Remove tape immediately after tooling without disturbing joint seal.

3.3 INSTALLATION OF ACOUSTICAL JOINT SEALANTS

- A. Comply with acoustical joint-sealant manufacturer's written installation instructions unless more stringent requirements apply.
- B. Seal construction at perimeters, behind control joints, and at openings and penetrations with a continuous bead of acoustical joint sealant. Install acoustical joint sealants at both faces of partitions, at perimeters, and through penetrations. Comply with ASTM C919, ASTM C1193, and manufacturer's written instructions for closing off sound-flanking paths around or through assemblies, including sealing partitions to underside of floor slabs above acoustical ceilings.

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ACOUSTICAL JOINT SEALANTS

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- C. Acoustical Ceiling Areas: Apply acoustical joint sealant at perimeter edge moldings of acoustical ceiling areas in a continuous ribbon concealed on back of vertical legs of moldings before they are installed.

3.4 CLEANING

- A. Clean off excess sealant or sealant smears adjacent to joints as the Work progresses by methods and with cleaning materials approved in writing by manufacturers of acoustical joint sealants and of products in which joints occur.

3.5 PROTECTION

- A. Protect acoustical joint sealants during and after curing period from contact with contaminating substances and from damage resulting from construction operations or other causes so sealants are without deterioration or damage at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out, remove, and repair damaged or deteriorated acoustical joint sealants immediately so installations with repaired areas are indistinguishable from original work.

END OF SECTION 07 92 19

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FLUSH WOOD DOORS

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SECTION 08 14 16 - FLUSH WOOD DOORS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
1. Solid-core five-ply flush wood veneer-faced doors and transom panels for transparent finish.
  2. Fire-rated wood door frames.
  3. Light frames and louvers.

1.2 ACTION SUBMITTALS

- A. Product Data:
1. Solid-core five-ply flush wood veneer-faced doors and transom panels for transparent finish.
  2. Fire-rated wood door frames.
  3. Light frames and louvers.
- B. Product Data Submittals: For each product, including the following:
1. Door core materials and construction.
  2. Door edge construction
  3. Door face type and characteristics.
  4. Door trim for openings.
  5. Door frame construction.
  6. Factory-machining criteria.
  7. Factory- finishing specifications.
- C. Shop Drawings: Indicate location, size, and hand of each door; elevation of each type of door; construction details not covered in Product Data; and the following:
1. Door schedule indicating door and frame location, type, size, fire protection rating, and swing.
  2. Door elevations, dimension and locations of hardware, lite and louver cutouts, and glazing thicknesses.
  3. Details of frame for each frame type, including dimensions and profile.
  4. Details of electrical raceway and preparation for electrified hardware, access control systems, and security systems.
  5. Dimensions and locations of blocking for hardware attachment.
  6. Dimensions and locations of mortises and holes for hardware.
  7. Clearances and undercuts.
  8. Requirements for veneer matching.
  9. Doors to be factory finished and application requirements.
- D. Samples for Initial Selection: For factory-finished doors and factory-finished door frames.

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FLUSH WOOD DOORS

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E. Samples for Verification:

1. Factory finishes applied to actual door face materials, approximately 8 by 10 inches, for each material and finish. For each wood species and transparent finish, provide set of three Samples showing typical range of color and grain to be expected in finished Work.
2. Corner sections of doors, approximately 8 by 10 inches, with door faces and edges representing actual materials to be used.
3. Frames for light openings, 6 inches long, for each material, type, and finish required.

1.3 INFORMATIONAL SUBMITTALS

A. Qualification Data: For door inspector.

1. Fire-Rated Door Inspector: Submit documentation of compliance with NFPA 80, Section 5.2.3.1.
2. Submit copy of DHI's Fire and Egress Door Assembly Inspector (FDAI) certificate.

B. Sample Warranty: For special warranty.

1.4 CLOSEOUT SUBMITTALS

A. Special warranties.

B. Record Documents: For fire-rated doors, list of door numbers and applicable room name and number to which door accesses.

1.5 QUALITY ASSURANCE

A. Fire-Rated Door Inspector Qualifications: Inspector for field quality-control inspections of fire-rated door assemblies complies with qualifications set forth in NFPA 80, Section 5.2.3.1 and the following:

1. DHI's Fire and Egress Door Assembly Inspector (FDAI) certification.

B. Egress Door Inspector Qualifications: Inspector for field quality-control inspections of egress door assemblies complies with qualifications set forth in NFPA 101, Section 7.2.1.15.4 and the following:

1. DHI's Fire and Egress Door Assembly Inspector (FDAI) certification.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Comply with requirements of referenced standard and manufacturer's written instructions.

B. Package doors individually in cardboard cartons, and wrap bundles of doors in plastic sheeting.

C. Mark each door on top and bottom rail with opening number used on Shop Drawings.

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FLUSH WOOD DOORS

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1.7 FIELD CONDITIONS

- A. Environmental Limitations:
1. Do not deliver or install doors until spaces are enclosed and weathertight, wet-work in spaces is complete and dry, and HVAC system is operating and maintaining temperature and relative humidity at levels designed for building occupants for the remainder of construction period.

1.8 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace doors and frames that fail in materials or workmanship within specified warranty period.
1. Failures include, but are not limited to, the following:
    - a. Delamination of veneer.
    - b. Warping (bow, cup, or twist) more than 1/4 inch in a 42-by-84-inch section.
    - c. Telegraphing of core construction in face veneers exceeding 0.01 inch in a 3-inch span.
  2. Warranty also includes installation and finishing that may be required due to repair or replacement of defective doors and frames.
  3. Warranty Period for Solid-Core Interior Doors: Life of installation.

PART 2 - PRODUCTS

2.1 SOURCE LIMITATIONS

- A. Obtain flush wood doors from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

- A. Fire-Rated Wood Door and Frame Assemblies: Assemblies complying with NFPA 80 that are listed and labeled by a qualified testing agency acceptable to authorities having jurisdiction, for fire-protection ratings and temperature-rise limits indicated on Drawings, based on testing at positive pressure in accordance with UL 10C or NFPA 252.
1. Oversize Fire-Rated Door Assemblies: For units exceeding sizes of tested assemblies, provide certification by a qualified testing agency that doors comply with standard construction requirements for tested and labeled fire-rated door assemblies except for size.
  2. Temperature-Rise Limit: At vertical exit enclosures and exit passageways, provide doors that have a maximum transmitted temperature end point of not more than 450 deg F above ambient after 30 minutes of standard fire-test exposure.
- B. Smoke- and Draft-Control Door Assemblies: Listed and labeled for smoke and draft control by a qualified testing agency acceptable to authorities having jurisdiction, based on testing in accordance with UL 1784 and installed in compliance with NFPA 105.

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FLUSH WOOD DOORS

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2.3 FLUSH WOOD DOORS AND FRAMES, GENERAL

- A. Quality Standard: In addition to requirements specified, comply with ANSI/WDMA I.S. 1A.
1. The Contract Documents contain requirements that are more stringent than the referenced quality standard. Comply with the Contract Documents in addition to those of the referenced quality standard.

2.4 SOLID-CORE FIVE-PLY FLUSH WOOD VENEER-FACED DOORS AND TRANSOM PANELS FOR TRANSPARENT FINISH

- A. Interior Doors, Solid-Core Five-Ply Veneer-Faced:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Lambton Doors.
    - b. Masonite Architectural product.
    - c. Oshkosh Door Co.
    - d. VT Industries.
  2. Performance Grade: ANSI/WDMA I.S. 1A Extra Heavy Duty.
  3. ANSI/WDMA I.S. 1A Quality Grade: Custom.
  4. Faces: Single-ply wood veneer not less than 1/50 inch thick.
    - a. Species: Red oak.
    - b. Cut: Plain sliced (flat sliced).
    - c. Match between Veneer Leaves: Book match.
    - d. Assembly of Veneer Leaves on Door Faces: Running match.
    - e. Pair and Set Match: Provide for doors hung in same opening or separated only by mullions.
    - f. Transom Match: Continuous match.
  5. Exposed Vertical and Top Edges: Same species as faces - Architectural Woodwork Standards edge Type A.
    - a. Fire-Rated Single Doors: Provide edge construction with intumescent seals concealed by outer stile. Comply with specified requirements for exposed vertical edges.
    - b. Fire-Rated Pairs of Doors:
      - 1) Provide fire-retardant stiles that are listed and labeled for applications indicated without formed-steel edges and astragals. Provide stiles with concealed intumescent seals. Comply with specified requirements for exposed edges.
    - c. Mineral-Core Doors: At hinge stiles, provide laminated-edge construction with improved screw-holding capability and split resistance. Comply with specified requirements for exposed edges.
      - 1) Screw-Holding Capability: 550 lbf in accordance with WDMA T.M. 10.
  6. Core for Non-Fire-Rated Doors:
    - a. ANSI A208.1, Grade LD-2 particleboard.
      - 1) Blocking: Provide wood blocking in particleboard-core doors as follows:
        - a) 5-inch top-rail blocking, in doors indicated to have closers.
        - b) 5-inch bottom-rail blocking, in exterior doors and doors indicated to have kick, mop, or armor plates.



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FLUSH WOOD DOORS

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- c) 5-inch midrail blocking, in doors indicated to have exit devices.
- 7. Core for Fire-Rated Doors: As required to achieve fire-protection rating indicated on Drawings.
  - a. Blocking for Mineral-Core Doors: Provide composite blocking with improved screw-holding capability approved for use in doors of fire-protection ratings indicated on Drawings as follows:
    - 1) 5-inch top-rail blocking.
    - 2) 5-inch bottom-rail blocking, in doors indicated to have protection plates.
    - 3) 5-inch midrail blocking, in doors indicated to have armor plates.
    - 4) 4-1/2-by-10-inch lock blocks, in doors indicated to have exit devices.
- 8. Construction: Five plies, hot-pressed bonded (vertical and horizontal edging is bonded to core), with entire unit abrasive planed before veneering.

2.5 FIRE-RATED WOOD DOOR FRAMES

- A. Interior Fire-Rated Door Frames:
  - 1. ANSI/WDMA I.S. 1A Quality Grade: Custom.
  - 2. Wood Species and Cut: Match species and cut indicated for wood doors unless otherwise indicated.
  - 3. Wood Moisture Content: 5 to 10 percent.
  - 4. Profile: As indicated on Drawings.
  - 5. Construction: Solid lumber, fire-retardant particleboard, or fire-retardant medium density fiberboard (MDF) with veneered exposed surfaces and listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire ratings indicated on Drawings.

2.6 LIGHT FRAMES AND LOUVERS

- A. Wood Beads for Light Openings in Wood Doors: Provide manufacturer's standard wood beads unless otherwise indicated.
  - 1. Wood Species: Same species as door faces.
  - 2. Profile: Manufacturer's standard shape.
  - 3. At wood-core doors with 20-minute fire-protection ratings, provide wood beads and metal glazing clips approved for such use.
- B. Wood-Veneered Beads for Light Openings in Fire-Rated Doors: Manufacturer's standard wood-veneered noncombustible beads matching veneer species of door faces and approved for use in doors of fire-protection rating indicated on Drawings. Include concealed metal glazing clips where required for opening size and fire-protection rating indicated.

2.7 FABRICATION

- A. Factory fit doors to suit frame-opening sizes indicated.
  - 1. Comply with clearance requirements of referenced quality standard for fitting unless otherwise indicated.
  - 2. Comply with NFPA 80 requirements for fire-rated doors.

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FLUSH WOOD DOORS

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- B. Factory machine doors for hardware that is not surface applied.
  - 1. Locate hardware to comply with DHI-WDHS-3.
  - 2. Comply with final hardware schedules, door frame Shop Drawings, ANSI/BHMA-156.115-W, and hardware templates.
  - 3. Coordinate with hardware mortises in metal frames, to verify dimensions and alignment before factory machining.
  - 4. For doors scheduled to receive electrified locksets, provide factory-installed raceway and wiring to accommodate specified hardware.
- C. Transom and Side Panels:
  - 1. Fabricate matching panels with same construction, exposed surfaces, and finish as specified for associated doors.
- D. Openings: Factory cut and trim openings through doors.
  - 1. Light Openings: Trim openings with moldings of material and profile indicated.
  - 2. Glazing: Factory install glazing in doors indicated to be factory finished. Comply with applicable requirements in Section 08 80 00 "Glazing."

## 2.8 FACTORY FINISHING

- A. Comply with referenced quality standard for factory finishing.
  - 1. Complete fabrication, including fitting doors for openings and machining for hardware that is not surface applied, before finishing.
  - 2. Finish faces, all four edges, edges of cutouts, and mortises.
  - 3. Stains and fillers may be omitted on top and bottom edges, edges of cutouts, and mortises.
- B. Factory finish doors.
- C. Transparent Finish:
  - 1. ANSI/WDMA I.S. 1A Grade: Custom.
    - a. TR-6 Catalyzed Polyurethane.
  - 2. Staining: Match adjacent existing doors..
  - 3. Sheen: Semigloss.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine doors and installed door frames, with Installer present, before hanging doors.
  - 1. Verify that installed frames comply with indicated requirements for type, size, location, and swing characteristics and have been installed with level heads and plumb jambs.
  - 2. Reject doors with defects.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

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FLUSH WOOD DOORS

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3.2 INSTALLATION

- A. Hardware: For installation, see Section 08 71 00 "Door Hardware."
- B. Install doors and frames to comply with manufacturer's written instructions and referenced quality standard, and as indicated.
- C. Install frames level, plumb, true, and straight.
  - 1. Shim as required with concealed shims. Install level and plumb to a tolerance of 1/8 inch in 96 inches.
  - 2. Anchor frames to anchors or blocking built in or directly attached to substrates.
    - a. Secure with countersunk, concealed fasteners and blind nailing.
    - b. Use fine finishing nails or finishing screws for exposed fastening, countersunk and filled flush with woodwork.
      - 1) For factory-finished items, use filler matching finish of items being installed.
  - 3. Install fire-rated doors and frames in accordance with NFPA 80.
  - 4. Install smoke- and draft-control doors in accordance with NFPA 105.
- D. Factory-Fitted Doors: Align in frames for uniform clearance at each edge.
- E. Factory-Finished Doors: Restore finish before installation if fitting or machining is required at Project site.

3.3 FIELD QUALITY CONTROL

- A. Inspection Agency: Owner will engage a qualified inspector to perform inspections and to furnish reports to Architect.
- B. Inspections:
  - 1. Fire-Rated Door Inspections: Inspect each fire-rated door in accordance with NFPA 80, Section 5.2.
  - 2. Egress Door Inspections: Inspect each door equipped with panic hardware, each door equipped with fire exit hardware, each door located in an exit enclosure, each electrically controlled egress door, and each door equipped with special locking arrangements in accordance with NFPA 101, Section 7.2.1.15.
- C. Repair or remove and replace installations where inspections indicate that they do not comply with specified requirements.
- D. Reinspect repaired or replaced installations to determine if replaced or repaired door assembly installations comply with specified requirements.
- E. Prepare and submit separate inspection report for each fire-rated door assembly indicating compliance with each item listed in NFPA 80.

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FLUSH WOOD DOORS

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3.4 ADJUSTING

- A. Operation: Rehang or replace doors that do not swing or operate freely.
- B. Finished Doors: Replace doors that are damaged or that do not comply with requirements. Doors may be repaired or refinished if Work complies with requirements and shows no evidence of repair or refinishing.

END OF SECTION 08 14 16

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STILE AND RAIL WOOD DOORS

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SECTION 08 14 33 - STILE AND RAIL WOOD DOORS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
  - 1. Interior stile and rail wood doors.

1.2 COORDINATION

1.3 ACTION SUBMITTALS

- A. Product Data:
  - 1. Interior stile and rail wood doors.
- B. Shop Drawings: Indicate location, size, and hand of each door; elevation of each type of door; construction details not covered in Product Data, including those for stiles, rails, panels, and moldings (sticking); and other pertinent data, including the following:
  - 1. Door schedule indicating door location, type, size, fire protection rating, and swing.
  - 2. Door elevations, dimensions and location of hardware, lite locations, and glazing thickness.
  - 3. Details of frame for each frame type, including dimensions and profile.
  - 4. Details of electrical raceway and preparation for electrified hardware, access control systems, and security systems.
  - 5. Dimensions and locations of mortises and holes for hardware.
  - 6. Clearances and undercuts.
  - 7. Requirements for veneer matching.
  - 8. Doors to be factory finished and application requirements.
- C. Samples for Verification:
  - 1. Factory finishes applied to actual door face materials, approximately 8 by 10 inches, for each material and finish. For each wood species and transparent finish, provide set of three Samples showing typical range of color and grain to be expected in finished Work.
  - 2. Corner sections of doors, approximately 8 by 10 inches, with door faces and edges representing actual materials to be used.

1.4 INFORMATIONAL SUBMITTALS

- A. Sample Warranty: For special warranty.

1.5 CLOSEOUT SUBMITTALS.

- A. Special warranties.
- B. Record Documents: For fire-rated doors, list of door numbers and applicable room name and number to which door accesses.

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STILE AND RAIL WOOD DOORS

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1.6 DELIVERY, STORAGE, AND HANDLING

- A. Comply with requirements of referenced standard and manufacturer's written instructions.
- B. Package doors individually in opaque plastic bags or cardboard cartons.
- C. Mark each door on top and bottom rail with opening number used on Shop Drawings.

1.7 FIELD CONDITIONS

- A. Environmental Limitations:
  - 1. Do not deliver or install doors until spaces are enclosed and weathertight, wet work in spaces is complete and dry, and HVAC system is operating and maintaining temperature and relative humidity levels designed for building occupants for the remainder of construction period.

1.8 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace doors that fail in materials or workmanship within specified warranty period.
  - 1. Failures include, but are not limited to, the following:
    - a. Delamination of veneer.
    - b. Warping (bow, cup, or twist) more than 1/4 inch in a 42-by-84-inch section.
    - c. Telegraphing of core construction in face veneers exceeding 0.01 inch in a 3-inch span.
  - 2. Warranty must also include installation and finishing that may be required due to repair or replacement of defective doors.
  - 3. Warranty must be in effect during specified period of time from date of Substantial Completion.
  - 4. Warranty Period for Interior Doors: Life of installation.

PART 2 - PRODUCTS

2.1 SOURCE LIMITATIONS

- A. Obtain stile and rail wood doors from single manufacturer.

2.2 MATERIALS

- A. Use only materials that comply with referenced standards and other requirements specified.
  - 1. Assemble interior doors, including components, with either dry-use or wet-use adhesives complying with ASTM D5572 for finger joints and with ASTM D5751 for joints other than finger joints.
- B. Panel Products: Any of the following unless otherwise indicated:
  - 1. Particleboard: ANSI A208.1, Grade M-2.
  - 2. Veneer-core plywood.

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STILE AND RAIL WOOD DOORS

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- C. Safety Glass: Provide products complying with testing requirements in 16 CFR 1201, for Category II materials, unless those of Category I are expressly indicated and permitted.

2.3 INTERIOR STILE AND RAIL WOOD DOORS

- A. Interior Stile and Rail Wood Doors: Interior custom doors complying with WDMA I.S. 6A and with other requirements specified.
1. Performance Grade: ANSI/WDMA I.S. 1A Extra Heavy Duty.
  2. ANSI/WDMA I.S. 1A Quality Grade: Custom.
  3. Panel Designs: Indicated on Drawings. Do not modify intended aesthetic effects, as judged solely by Architect, except with Architect's approval. If modifications are proposed, submit comprehensive explanatory data to Architect for review.
  4. Finish: Transparent.
  5. Wood Species and Cut for Transparent Finish: Red oak, quarter sawed/sliced stiles and rails, plain sawed/sliced panels.
  6. Door Construction for Transparent Finish:
    - a. Stile and Rail Construction:
      - 1) Clear lumber; may be edge glued for width. Select lumber for similarity of grain and color, and arrange for optimum match between adjacent pieces.
      - 2) Veneered, structural composite lumber or veneered, edge- and end-glued clear lumber. Select veneers for similarity of grain and color, and arrange for optimum match between adjacent pieces. Use veneers not less than 1/16 inch thick.
    - b. Raised-Panel Construction:
      - 1) Clear lumber; edge glued for width. Select lumber for similarity of grain and color, and arrange for optimum match between adjacent pieces.
      - 2) Veneered, wood-based panel product with mitered, raised rims made from matching clear lumber.
    - c. Flat-Panel Construction: Veneered, wood-based panel product.
  7. Stile and Rail Widths: As indicated.
  8. Raised-Panel Thickness: Manufacturer's standard, but not less than 3/4 inch.
  9. Flat-Panel Thickness: 1/2 inch.
  10. Molding Profile (Sticking): As selected by Architect from manufacturer's full range.
  11. Glass: Uncoated, clear, fully tempered float glass, 5.0 mm thick, complying with Section 08 80 00 "Glazing."
  12. Mark, label, or otherwise identify stile and rail wood doors as complying with WDMA I.S. 6A and grade specified.

2.4 STILE AND RAIL WOOD DOOR FABRICATION

- A. Factory fit doors to suit frame-opening sizes indicated, with the following uniform clearances and bevels unless otherwise indicated:
1. Clearances:
    - a. Provide 1/8 inch at heads, jambs, and between pairs of doors.

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## STILE AND RAIL WOOD DOORS

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- b. Provide 1/2 inch from bottom of door to top of decorative floor finish or covering.
  - 2. Bevel non-fire-rated doors 1/8 inch in 2 inches at lock and hinge edges.
- B. Fabricate stile and rail wood doors in sizes indicated for field fitting.
- C. Factory machine doors for hardware that is not surface applied.
  - 1. Locate hardware to comply with DHI-WDHS-3.
  - 2. Comply with final hardware schedules, door frame Shop Drawings, BHMA-156.115-W, and hardware templates.
  - 3. For doors scheduled to receive electrified locksets, provide factory-installed raceway and wiring to accommodate specified hardware.
  - 4. Coordinate measurements of hardware mortises in metal frames to verify dimensions and alignment before factory machining.
- D. Glazed Openings:
  - 1. Trim openings indicated for glazing with solid-wood moldings, with one side removable. Miter wood moldings at corner joints.
  - 2. Factory install glazing in doors, complying with Section 08 80 00 "Glazing." Install glass using manufacturer's standard elastomeric glazing sealant complying with ASTM C920. Secure glass in place with removable wood moldings. Miter wood moldings at corner joints.

### 2.5 FACTORY FINISHING

- A. Comply with referenced quality standard for factory finishing.
  - 1. Complete fabrication, including fitting doors for openings and machining for hardware that is not surface applied, before finishing.
  - 2. Finish faces, all four edges, edges of cutouts, and mortises.
  - 3. Stains and fillers may be omitted on top and bottom edges, edges of cutouts, and mortises.
- B. Factory finish doors.
- C. Transparent Finish:
  - 1. WDMA I.S. 6A Grade: Custom.
    - a. TR-6 Catalyzed Polyurethane.
  - 2. Staining: Match staining color of flush wood paneling as indicated on Drawing and as specified in Section 06 – Flush Wood Paneling.
  - 3. Sheen: Satin.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine doors and installed door frames, with Installer present, before hanging doors.
  - 1. Verify that installed frames comply with indicated requirements for type, size, location, and swing characteristics and have been installed with level heads and plumb jambs.



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STILE AND RAIL WOOD DOORS

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2. Reject doors with defects.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install hardware indicated.

B. Install doors to comply with manufacturer's written instructions and referenced quality standard, and as indicated.

C. Factory-Fitted Doors: Align in frames for uniform clearance at each edge.

D. Factory- Finished Doors: Restore finish before installation if fitting or machining is required at Project site.

3.3 ADJUSTING

A. Operation: Rehang or replace doors that do not swing or operate freely.

B. Finished Doors: Replace doors that are damaged or do not comply with requirements. Doors may be repaired or refinished if Work complies with requirements and shows no evidence of repair or refinishing.

END OF SECTION 08 14 33

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GLAZING

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SECTION 08 80 00 - GLAZING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
  - 1. Glass products.
  - 2. Laminated glass.
  - 3. Glazing sealants.
  - 4. Glazing tapes.

1.2 DEFINITIONS

- A. Glass Manufacturers: Firms that produce primary glass, fabricated glass, or both, as defined in referenced glazing publications.
- B. Glass Thicknesses: Indicated by thickness designations in millimeters in accordance with ASTM C1036.

1.3 COORDINATION

- A. Coordinate glazing channel dimensions to provide necessary bite on glass, minimum edge and face clearances, and adequate sealant thicknesses, with reasonable tolerances to achieve proper safety margins for glazing retention under each design load case, load case combination, and service condition.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer and manufacturers of fabricated glass units.
- B. Product Test Reports: For fabricated glass, for tests performed by a qualified testing agency.

1.6 QUALITY ASSURANCE

- A. Fabricated-Glass Manufacturer Qualifications: A qualified manufacturer of fabricated glass units who is approved by primary glass manufacturer.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Protect glazing materials in accordance with manufacturer's written instructions. Prevent damage to glass and glazing materials from condensation, temperature changes, direct exposure to sun, or other causes.

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GLAZING

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1.8 FIELD CONDITIONS

- A. Environmental Limitations: Do not proceed with glazing when ambient and substrate temperature conditions are outside limits permitted by glazing material manufacturers and when glazing channel substrates are wet from rain, frost, condensation, or other causes.
  - 1. Do not install glazing sealants when ambient and substrate temperature conditions are outside limits permitted by sealant manufacturer or are below 40 deg F.

1.9 WARRANTY

- A. Manufacturer's Special Warranty for Laminated Glass: Manufacturer agrees to replace laminated-glass units that deteriorate within specified warranty period. Deterioration of laminated glass is defined as defects developed from normal use that are not attributed to glass breakage or to maintaining and cleaning laminated glass contrary to manufacturer's written instructions. Defects include edge separation, delamination materially obstructing vision through glass, and blemishes exceeding those allowed by referenced laminated-glass standard.
  - 1. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Source Limitations for Glass: Obtain glass from single source from single manufacturer.
- B. Source Limitations for Glazing Accessories: For each product and installation method, obtain from single source from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

- A. Safety Glazing: Where safety glazing is indicated, provide glazing that complies with 16 CFR 1201, Category II.

2.3 GLASS PRODUCTS, GENERAL

- A. Glazing Publications: Comply with published recommendations of glass product manufacturers and organizations below unless more stringent requirements are indicated. See these publications for glazing terms not otherwise defined in this Section or in referenced standards.
  - 1. NGA Publications: "Laminated Glazing Reference Manual" and "Glazing Manual."
- B. Safety Glazing Labeling: Where safety glazing is indicated, permanently mark glazing with certification label of the SGCC. Label shall indicate manufacturer's name, type of glass, thickness, and safety glazing standard with which glass complies.

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GLAZING

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- C. Thickness: Where glass thickness is indicated, it is a minimum. Provide glass that complies with performance requirements and is not less than thickness indicated.
  - 1. Minimum Glass Thickness for Exterior Lites: 6 mm.

2.4 GLASS PRODUCTS

- A. Clear Annealed Float Glass: ASTM C1036, Type I, Class 1 (clear), Quality-Q3.
- B. Fully Tempered Float Glass: ASTM C1048, Kind FT (fully tempered), Condition A (uncoated) unless otherwise indicated, Type I, Class 1 (clear) or Class 2 (tinted) as indicated, Quality-Q3.
  - 1. Fabrication Process: By horizontal (roller-hearth) process with roll-wave distortion parallel to bottom edge of glass as installed unless otherwise indicated.

2.5 LAMINATED GLASS

- A. Laminated Glass: ASTM C1172. Use materials that have a proven record of no tendency to bubble, discolor, or lose physical and mechanical properties after fabrication and installation.
  - 1. Construction: Laminate glass with polyvinyl butyral interlayer to comply with interlayer manufacturer's written instructions.
  - 2. Interlayer Thickness: Provide thickness not less than that indicated and as needed to comply with requirements.
  - 3. Interlayer Color: Clear unless otherwise indicated.

2.6 GLAZING SEALANTS

- A. General:
  - 1. Compatibility: Compatible with one another and with other materials they contact, including glass products, seals of insulating-glass units, and glazing channel substrates, under conditions of service and application, as demonstrated by sealant manufacturer based on testing and field experience.
  - 2. Suitability: Comply with sealant and glass manufacturers' written instructions for selecting glazing sealants suitable for applications indicated and for conditions existing at time of installation.
  - 3. Colors of Exposed Glazing Sealants: As selected by Architect from manufacturer's full range of industry colors.
- B. Neutral-Curing Silicone Glazing Sealant, Class 100/50: Complying with ASTM C920, Type S, Grade NS, Use NT.

2.7 GLAZING TAPES

- A. Back-Bedding Mastic Glazing Tapes: Preformed, butyl-based, 100 percent solids elastomeric tape; nonstaining and nonmigrating in contact with nonporous surfaces; with or without spacer rod as recommended in writing by tape and glass manufacturers for application indicated; and complying with ASTM C1281 and AAMA 800 for products indicated below:

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GLAZING

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1. AAMA 806.3 tape, for glazing applications in which tape is subject to continuous pressure.
  2. AAMA 807.3 tape, for glazing applications in which tape is not subject to continuous pressure.
- B. Expanded Cellular Glazing Tapes: Closed-cell, PVC foam tapes; factory coated with adhesive on both surfaces; and complying with AAMA 800 for the following types:
1. AAMA 810.1, Type 1, for glazing applications in which tape acts as primary sealant.
  2. AAMA 810.1, Type 2, for glazing applications in which tape is used in combination with a full bead of liquid sealant.

2.8 MISCELLANEOUS GLAZING MATERIALS

- A. General: Provide products of material, size, and shape complying with referenced glazing standard, recommended in writing by manufacturers of glass and other glazing materials for application indicated, and with a proven record of compatibility with surfaces contacted in installation.
- B. Cleaners, Primers, and Sealers: Types recommended by sealant or gasket manufacturer.
- C. Setting Blocks: Type recommended in writing by sealant or glass manufacturer.
- D. Spacers: Type recommended in writing by sealant or glass manufacturer.
- E. Edge Blocks: Type recommended in writing by sealant or glass manufacturer.

2.9 FABRICATION OF GLAZING UNITS

- A. Fabricate glazing units in sizes required to fit openings indicated for Project, with edge and face clearances, edge and surface conditions, and bite complying with written instructions of product manufacturer and referenced glazing publications, to comply with system performance requirements.
1. Allow for thermal movements from ambient and surface temperature changes acting on glass framing members and glazing components.
    - a. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine framing, glazing channels, and stops, with Installer present, for compliance with the following:
1. Manufacturing and installation tolerances, including those for size, squareness, and offsets at corners.
  2. Presence and functioning of weep systems.
  3. Minimum required face and edge clearances.

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GLAZING

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- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Clean glazing channels and other framing members receiving glass immediately before glazing. Remove coatings not firmly bonded to substrates.
- B. Examine glazing units to locate exterior and interior surfaces. Label or mark units as needed so that exterior and interior surfaces are readily identifiable. Do not use materials that leave visible marks in the completed Work.

3.3 GLAZING, GENERAL

- A. Comply with combined written instructions of manufacturers of glass, sealants, gaskets, and other glazing materials, unless more stringent requirements are indicated, including those in referenced glazing publications.
- B. Protect glass edges from damage during handling and installation. Remove damaged glass from Project site and legally dispose of off Project site. Damaged glass includes glass with edge damage or other imperfections that, when installed, could weaken glass, impair performance, or impair appearance.
- C. Apply primers to joint surfaces where required for adhesion of sealants, as determined by preconstruction testing.
- D. Install setting blocks in sill rabbets, sized and located to comply with referenced glazing publications, unless otherwise required by glass manufacturer. Set blocks in thin course of compatible sealant suitable for heel bead.
- E. Do not exceed edge pressures stipulated by glass manufacturers for installing glass lites.
- F. Provide spacers for glass lites where length plus width is larger than 50 inches.
  - 1. Locate spacers directly opposite each other on both inside and outside faces of glass. Install correct size and spacing to preserve required face clearances, unless gaskets and glazing tapes are used that have demonstrated ability to maintain required face clearances and to comply with system performance requirements.
  - 2. Provide 1/8-inch- minimum bite of spacers on glass and use thickness equal to sealant width. With glazing tape, use thickness slightly less than final compressed thickness of tape.
- G. Provide edge blocking where indicated or needed to prevent glass lites from moving sideways in glazing channel, as recommended in writing by glass manufacturer and in accordance with requirements in referenced glazing publications.
- H. Set glass lites in each series with uniform pattern, draw, bow, and similar characteristics.

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GLAZING

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- I. Set glass lites with proper orientation so that coatings face exterior or interior as specified.
- J. Where wedge-shaped gaskets are driven into one side of channel to pressurize sealant or gasket on opposite side, provide adequate anchorage so gasket cannot walk out when installation is subjected to movement.
- K. Square cut wedge-shaped gaskets at corners and install gaskets in a manner recommended by gasket manufacturer to prevent corners from pulling away; seal corner joints and butt joints with sealant recommended in writing by gasket manufacturer.

3.4 CLEANING AND PROTECTION

- A. Immediately after installation, remove nonpermanent labels and clean surfaces.
- B. Protect glass from contact with contaminating substances resulting from construction operations. Examine glass surfaces adjacent to or below exterior concrete and other masonry surfaces at frequent intervals during construction, but not less than once a month, for buildup of dirt, scum, alkaline deposits, or stains.
  - 1. If, despite such protection, contaminating substances do contact with glass, remove substances immediately as recommended in writing by glass manufacturer. Remove and replace glass that cannot be cleaned without damage to coatings.
- C. Remove and replace glass that is damaged during construction period.
- D. Wash glass on both exposed surfaces not more than four days before date scheduled for inspections that establish date of Substantial Completion. Wash glass as recommended in writing by glass manufacturer.

3.5 MONOLITHIC GLASS SCHEDULE

- A. Clear Glass Type S-1 : Fully tempered float glass.
  - 1. Minimum Thickness: 6 mm.
  - 2. Safety glazing required.

3.6 LAMINATED GLASS SCHEDULE

- A. Clear Laminated Glass Type S-2 : Two plies of annealed float glass.
  - 1. Minimum Thickness of Each Glass Ply: 3 mm.
  - 2. Interlayer Thickness: 0.030 inch.
  - 3. Safety glazing required.

END OF SECTION 08 80 00



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ARCHITECTURAL GLASS FILM

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SECTION 08 87 23 - ARCHITECTURAL GLASS FILM

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
1. Glass film applied to interior surface of glass.

1.2 SUBMITTALS

- A. Product Data: Submit manufacturer's specifications, installation instructions, and general recommendations. Include data substantiating that products to be furnished comply with requirements of the contract documents.
1. Manufacturer's data sheets on each product to be used, including:
    - a. Preparation instructions and recommendations.
    - b. Storage and handling requirements and recommendations.
    - c. Installation methods.
- B. Samples for Selection: Manufacturer's standard sample sets showing the full range of colors and transparency available for each type of product indicated.
- C. Samples for Verification: 12-inch square samples of each glazing film, of each product color selected.
- D. Maintenance Data: Submit manufacturer's instructions for proper maintenance materials and procedures.

1.3 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Obtain required products from a single manufacturer.
1. Accessories: Provide accessory items only as produced or recommended by manufacturer of primary products.
- B. Installer Qualifications: All products listed in this section are to be installed by a single installer with a minimum of five (5) years demonstrated experience in installing products of the same type and scope as specified.
1. Provide documentation that the installer is authorized by the Manufacturer to perform Work specified in this section.
  2. Provide a commercial building reference list of 6 properties where the installer has applied window film. This list will include the following information:
    - a. Name of building.
    - b. The name and telephone number of a management contact.
    - c. Type of glass.
    - d. Type of film.
    - e. Amount of film installed.
    - f. Date of completion.
  3. Provide a Glass Stress Analysis of the existing glass and proposed glass/film combination as recommended by the film manufacturer.

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ARCHITECTURAL GLASS FILM

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- C. Fire Performance: Surface burning characteristics when tested in accordance ASTM E 84:
  - 1. Flame Spread: 25, maximum.
  - 2. Smoke Developed: 450, maximum.
- D. Mockups: Before applying glass film, provide mockup of glass film to demonstrate aesthetic effects and qualities of materials and execution. Build mockups to comply with the following requirements, using materials indicated for the completed Work:
  - 1. Build mockups in the location and of the size indicated or, if not indicated, as directed by Architect.
  - 2. Obtain Architect's approval of mockups before starting fabrication.
  - 3. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.
  - 4. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Store products in manufacturer's unopened packaging until ready for installation.
- B. Store and dispose of hazardous materials, and materials contaminated by hazardous materials, in accordance with requirements of local authorities having jurisdiction.

1.5 PROJECT CONDITIONS

- A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's absolute limits.

1.6 WARRANTY

- A. At project closeout, provide to Owner or Owners Representative an executed current copy of the manufacturer's standard limited warranty against manufacturing defect, outlining its terms, conditions, and exclusions from coverage.

PART 2 - PRODUCTS

2.1 WINDOW FILM

- A. Product/Manufacturer: Basis of Design.
  - 1. Fasara Glass Finishes RIKYU; 3M Window Film.
- B. Product Description: Single or multi-layered decorative film products, applied to interior glass surfaces, consisting of from outboard surface to inboard surface:
  - 1. Removable release liner.
  - 2. Pressure sensitive adhesive with integral ultraviolet absorbers.
  - 3. Clear, dyed, or printed pattern layer of polyester film.
- C. Colors and Transparency: Selected from manufacturer's full range.

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ARCHITECTURAL GLASS FILM

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2.2 GLASS FILM ACCESSORIES

- A. General: Provide products complying with requirements of glazing film manufacturer for application indicated, and with a proven record of compatibility with surfaces contacted in installation.
- B. Adhesive: Pressure Sensitive acrylic adhesive system.
- C. Cleaners, Primers, and Sealers: Types recommended by glazing film manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Inspect substrates and conditions under which the work of this section will be performed, and verify that installation properly may commence. Do not proceed with the work until unsatisfactory conditions have been resolved fully.

3.2 PREPARATION

- A. Clean substrate, removing projections and substances detrimental to the work; comply with recommendations of manufacturer of products to be installed for proper preparation procedures.
- B. Comply with manufacturer's written instructions for surface preparation.
- C. Immediately before beginning installation of films, clean glass surfaces of substances that could impair glazing film's bond, including mold, mildew, oil, grease, dirt and other foreign materials.
- D. Protect window frames and surrounding conditions from damage during installation.

3.3 APPLICATION

- A. General: Comply with manufacturer's instructions, except where more stringent requirements are shown or specified, and except where project conditions require extra precautions or provisions to ensure satisfactory performance of the work.
  - 1. Install film continuously, but not necessarily in one continuous length. Install with no gaps or overlaps.
  - 2. If seamed, install with no gaps or overlaps. Install seams vertical and plumb. No horizontal seams allowed.
  - 3. Do not remove release liner from film until just before each piece of film is cut and ready for installation.
  - 4. Install film with mounting solution and custom cut to the glass with neat, square comers and edges to within 1/8 inch of the window frame.
  - 5. Remove air bubbles, wrinkles, blisters, and other defects.

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ARCHITECTURAL GLASS FILM

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- B. After installation, view film from a distance of 10 feet against a bright uniform sky or background. Film shall appear uniform in appearance with no visible streaks, banding, thin spots or pinholes.
  - 1. If installed film does not meet these criteria, remove and replace with new film.

3.4 CLEANING

- A. Upon completion, clean all surfaces which have become soiled or coated as a result of work of this section, using proper methods which will not scratch or otherwise damage finished surfaces.
  - 1. For cleaning, use only products and techniques acceptable to manufacturer of products being cleaned.

END OF SECTION 08 87 23

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FIRE-RATED GLAZING

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SECTION 08 88 13 - FIRE-RATED GLAZING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
  - 1. Fire-protection-rated glazing.

1.2 DEFINITIONS

- A. Fire-Protection-Rated Glazing: Glazing in rated doors and openings up to 45 minutes, limited in size, and not capable of blocking radiant heat.
- B. Fire-Resistance-Rated Glazing: Glazing that prevents spread of fire and smoke and radiant heat; used in rated wall and door applications 60 minutes and above without size limitations.
- C. Glass Thicknesses: Indicated by thickness designations in millimeters in accordance with ASTM C1036.

1.3 COORDINATION

- A. Coordinate glazing channel dimensions to provide necessary bite on glass, minimum edge and face clearances, and adequate sealant thicknesses, with reasonable tolerances.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Glass Samples: For each type of glass product; 12 inches square.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: A qualified installer who employs glass installers for this Project who are certified under the NGA's Certified Glass Installer Program.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Protect glazing materials in accordance with manufacturer's written instructions. Prevent damage to glass and glazing materials from condensation, temperature changes, direct exposure to sun, or other causes.

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FIRE-RATED GLAZING

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1.7 FIELD CONDITIONS

- A. Environmental Limitations: Do not deliver or install fire-resistant glazing until spaces are enclosed and weathertight and temporary HVAC system is operating and maintaining ambient temperature conditions at occupancy levels during remainder of construction period.

1.8 WARRANTY

- A. Manufacturer's Special Warranty for Laminated Glass: Manufacturer agrees to replace laminated-glass units that deteriorate within specified warranty period. Deterioration of laminated glass is defined as defects developed from normal use that are not attributed to glass breakage or to maintaining and cleaning laminated glass contrary to manufacturer's written instructions. Defects include edge separation, delamination materially obstructing vision through glass, and blemishes exceeding those allowed by referenced laminated-glass standard.
  - 1. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Source Limitations for Glass: For each glass type, obtain from single source from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

- A. General: Installed glazing systems shall withstand normal thermal movement and impact loads (where applicable) without failure, including loss or glass breakage attributable to defective manufacture, fabrication, or installation; deterioration of glazing materials; or other defects in construction.

2.3 GLASS PRODUCTS, GENERAL

- A. Glazing Publications: Comply with published recommendations of glass product manufacturers and organization below unless more stringent requirements are indicated. See these publications for glazing terms not otherwise defined in this Section or in referenced standards.
  - 1. NGA Publications: "Laminated Glazing Reference Manual" and "Glazing Manual."
- B. Safety Glazing Labeling: Where safety glazing is indicated, permanently mark glazing with certification label of the SGCC. Label shall indicate manufacturer's name, type of glass, glass thickness, and safety glazing standard with which glass complies.

2.4 GLASS PRODUCTS

- A. Float Glass: ASTM C1036, Type I, Quality-Q3, Class I (clear) unless otherwise indicated.

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## FIRE-RATED GLAZING

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- B. Laminated Glass: ASTM C1172. Use materials that have a proven record of no tendency to bubble, discolor, or lose physical and mechanical properties after fabrication and installation.
  - 1. Construction: Laminate glass with polyvinyl butyral interlayer unless fire-protection or fire-resistance rating is based on another product.
  - 2. Interlayer Thickness: Provide thickness as needed to comply with requirements.
  - 3. Interlayer Color: Clear unless otherwise indicated.

### 2.5 FIRE-PROTECTION-RATED GLAZING

- A. Fire-Protection-Rated Glazing: Listed and labeled by a testing agency acceptable to authorities having jurisdiction, for fire-protection ratings indicated, based on positive-pressure testing in accordance with NFPA 257 or UL 9, including hose-stream test, and shall comply with NFPA 80.
  - 1. Fire-protection-rated glazing required to have a fire-protection rating of 20 minutes shall be exempt from hose-stream test.
- B. Fire-Protection-Rated Glazing Labeling: Permanently mark fire-protection-rated glazing with certification label of a testing agency acceptable to authorities having jurisdiction. Label shall indicate manufacturer's name; test standard; whether glazing is permitted to be used in doors or openings; if permitted in openings, whether glazing has passed hose-stream test; whether glazing meets 450 deg F temperature-rise limitation; and fire-resistance rating in minutes.
- C. Fire-Protection-Rated Laminated Ceramic Glazing: Laminated glass made from two plies of clear, ceramic glass; 8-mm total thickness; complying with 16 CFR 1201, Category II.
  - 1. Products: Subject to compliance with requirements, provide one of the following:
    - a. SAFTI FIRST Fire Rated Glazing Solutions; Pyran Platinum L.
    - b. Schott North America, Inc.; PYRAN Platinum fire-rated glass-ceramic.
    - c. Technical Glass Products; FireLite Plus®.
    - d. Vetrotech Saint-Gobain; Keralite Laminated.

### 2.6 GLAZING ACCESSORIES

- A. Provide glazing gaskets, glazing sealants, glazing tapes, setting blocks, spacers, edge blocks, and other glazing accessories that are compatible with glazing products and each other and are approved by testing agencies that listed and labeled fire-resistant glazing products with which products are used for applications and fire-protection ratings indicated.
- B. Glazing Sealants for Fire-Rated Glazing Products: Neutral-curing silicone glazing sealant complying with ASTM C920, Type S, Grade NS, Class 50, Use NT. Comply with sealant and glass manufacturers' written instructions for selecting glazing sealants suitable for applications indicated.

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## FIRE-RATED GLAZING

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- C. Back-Bedding Mastic Glazing Tapes: Preformed, butyl-based, 100 percent solids elastomeric tape; nonstaining and nonmigrating in contact with nonporous surfaces; with or without spacer rod as recommended in writing by tape and glass manufacturers for application indicated; and complying with ASTM C1281 and AAMA 800 for products indicated below:
  - 1. AAMA 806.3 tape, for glazing applications in which tape is subject to continuous pressure.
  - 2. AAMA 807.3 tape, for glazing applications in which tape is not subject to continuous pressure.
- D. Expanded Cellular Glazing Tapes: Closed-cell, PVC foam tapes; factory coated with adhesive on both surfaces; and complying with AAMA 800 for the following types:
  - 1. AAMA 810.1, Type 1, for glazing applications in which tape acts as primary sealant.
  - 2. AAMA 810.1, Type 2, for glazing applications in which tape is used in combination with a full bead of liquid sealant.

### 2.7 MISCELLANEOUS GLAZING MATERIALS

- A. General: Provide products of material, size, and shape complying with referenced glazing standard, recommended in writing by manufacturers of glass and other glazing materials for application indicated, and with a proven record of compatibility with surfaces contacted in installation.
- B. Perimeter Insulation for Fire-Resistance-Rated Glazing: Product that is approved by testing agency that listed and labeled fire-resistant glazing product with which it is used for application and fire-protection rating indicated.

### 2.8 FABRICATION OF GLAZING UNITS

- A. Fabricate glazing units in sizes required to fit openings indicated for Project, with edge and face clearances, edge and surface conditions, and bite complying with written instructions of product manufacturer and referenced glazing publications, to comply with system performance requirements.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine framing, glazing channels, and stops, with Installer present, for compliance with manufacturing and installation tolerances, including those for size, squareness, and offsets at corners, and for compliance with minimum required face and edge clearances.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.



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FIRE-RATED GLAZING

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3.2 PREPARATION

- A. Clean glazing channels and other framing members receiving glass immediately before glazing. Remove coatings not firmly bonded to substrates.
- B. Examine glazing units to locate fire side and protected side. Label or mark units as needed so that fire side and protected side are readily identifiable. Do not use materials that leave visible marks in the completed Work.

3.3 GLAZING, GENERAL

- A. Use methods approved by testing agencies that listed and labeled fire-resistant glazing products.
- B. Comply with combined written instructions of manufacturers of glass, sealants, gaskets, and other glazing materials unless more stringent requirements are indicated, including those in referenced glazing publications.
- C. Protect glass edges from damage during handling and installation. Remove damaged glass from Project site and legally dispose of off Project site. Damaged glass is glass with edge damage or other imperfections that, when installed, could weaken glass and impair performance and appearance.
- D. Apply primers to joint surfaces where required for adhesion of sealants, as determined by preconstruction testing.
- E. Install setting blocks in sill rabbets, sized and located to comply with referenced glazing publications unless otherwise required by glass manufacturer. Set blocks in thin course of compatible sealant suitable for heel bead.
- F. Do not exceed edge pressures stipulated by glass manufacturers for installing glass lites.
- G. Provide spacers for glass lites where length plus width is larger than 50 inches.
  - 1. Locate spacers directly opposite each other on both inside and outside faces of glass. Install correct size and spacing to preserve required face clearances unless gaskets and glazing tapes are used that have demonstrated ability to maintain required face clearances and to comply with system performance requirements.
  - 2. Provide 1/8-inch- minimum bite of spacers on glass and use thickness equal to sealant width. With glazing tape, use thickness slightly less than final compressed thickness of tape.
- H. Provide edge blocking where indicated or needed to prevent glass lites from moving sideways in glazing channel, as recommended in writing by glass manufacturer and in accordance with requirements in referenced glazing publications.
- I. Set glass lites with proper orientation so that coatings face fire side or protected side as specified.

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FIRE-RATED GLAZING

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- J. Where wedge-shaped gaskets are driven into one side of channel to pressurize sealant or gasket on opposite side, provide adequate anchorage so gasket cannot walk out when installation is subjected to movement.
- K. Square cut wedge-shaped gaskets at corners and install gaskets in a manner recommended by gasket manufacturer to prevent corners from pulling away; seal corner joints and butt joints with sealant recommended in writing by gasket manufacturer.

3.4 CLEANING AND PROTECTION

- A. Immediately after installation, remove nonpermanent labels and clean surfaces.
- B. Protect glass from contact with contaminating substances resulting from construction operations. Examine glass surfaces adjacent to or below exterior concrete and other masonry surfaces at frequent intervals during construction, but not less than once a month, for buildup of dirt, scum, alkaline deposits, or stains.
  - 1. If, despite such protection, contaminating substances do contact with glass, remove substances immediately as recommended in writing by glass manufacturer.
- C. Remove and replace glass that is damaged during construction period.
- D. Wash glass on both exposed surfaces not more than four days before date scheduled for inspections that establish date of Substantial Completion. Wash glass as recommended in writing by glass manufacturer.

3.5 FIRE-PROTECTION-RATED GLAZING SCHEDULE

- A. Glass Type S-3 : 60-minute fire-protection-rated glazing; fire-protection-rated laminated ceramic glazing .

END OF SECTION 08 88 13

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FIXED LOUVERS

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SECTION 08 91 19 - FIXED LOUVERS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Fixed extruded-aluminum louvers.
2. Fixed formed-metal acoustical louvers.
3. Blank-off panels for louvers

1.2 DEFINITIONS

- A. Louver Terminology: Definitions of terms for metal louvers contained in AMCA 501 apply to this Section unless otherwise defined in this Section or in referenced standards.
- B. Horizontal Louver: Louver with horizontal blades (i.e., the axis of the blades are horizontal).
- C. Drainable-Blade Louver: Louver with blades having gutters that collect water and drain it to channels in jambs and mullions, which carry it to bottom of unit and away from opening.
- D. Wind-Driven-Rain-Resistant Louver: Louver that provides specified wind-driven-rain performance, as determined by testing in accordance with AMCA 500-L.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. For louvers specified to bear AMCA seal, include printed catalog pages showing specified models with appropriate AMCA Certified Ratings Seals.

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FIXED LOUVERS

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- B. Shop Drawings: For louvers and accessories. Include plans, elevations, sections, details, and attachments to other work. Show frame profiles and blade profiles, angles, and spacing.
  - 1. Show weep paths, gaskets, flashings, sealants, and other means of preventing water intrusion.
  - 2. Show mullion profiles and locations.
- C. Samples: For each type of metal finish required.

1.4 INFORMATIONAL SUBMITTALS

- A. Product Test Reports: Based on evaluation of comprehensive tests performed in accordance with AMCA 500-L by a qualified testing agency or by manufacturer and witnessed by a qualified testing agency, for each type of louver and showing compliance with performance requirements specified.
- B. Sample Warranties: For manufacturer's special warranties.

1.5 FIELD CONDITIONS

- A. Field Measurements: Verify actual dimensions of openings by field measurements before fabrication.

1.6 WARRANTY

- A. Special Finish Warranty, Factory-Applied Finishes: Standard form in which manufacturer agrees to repair finishes or replace aluminum that shows evidence of deterioration of baked enamel, powder coat, or organic finishes within specified warranty period.
  - 1. Deterioration includes, but is not limited to, the following:
    - a. Color fading more than 5 Delta E units when tested in accordance with ASTM D2244.
    - b. Chalking in excess of a No. 8 rating when tested in accordance with ASTM D4214.
    - c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.

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FIXED LOUVERS

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2. Warranty Period: Five years from date of Substantial Completion.
- B. Special Finish Warranty, Anodized Finishes: Standard form in which manufacturer agrees to repair finishes or replace aluminum that shows evidence of deterioration of anodized finishes within specified warranty period.
  1. Deterioration includes, but is not limited to, the following:
    - a. Color fading more than 5 Delta E units when tested in accordance with ASTM D2244.
    - b. Chalking in excess of a No. 8 rating when tested in accordance with ASTM D4214.
    - c. Cracking, peeling, or chipping.
  2. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Source Limitations: Obtain fixed louvers from single source from a single manufacturer where indicated to be of same type, design, or factory-applied color finish.

2.2 PERFORMANCE REQUIREMENTS

- A. Structural Performance: Louvers withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated without permanent deformation of louver components, noise or metal fatigue caused by louver-blade rattle or flutter, or permanent damage to fasteners and anchors. Wind pressures are considered to act normal to the face of the building.
- B. Louver Performance Ratings: Provide louvers complying with requirements specified, as demonstrated by testing manufacturer's stock units identical to those provided, except for length and width in accordance with AMCA 500-L.
  1. Temperature Change (Range): 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.

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FIXED LOUVERS

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- C. SMACNA Standard: Comply with recommendations in SMACNA's "Architectural Sheet Metal Manual" for fabrication, construction details, and installation procedures.

2.3 FIXED EXTRUDED-ALUMINUM LOUVERS

- A. Horizontal Drainable-Blade Louver, Extruded Aluminum:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Greenheck Fan Corporation.
  - b. Industrial Louvers Inc.
  - c. Ruskin; Air Distribution Technologies, Inc.; Johnson Controls, Inc.
2. Louver Depth: 2 inches (50 mm) or 4 inches (100 mm).
3. Frame and Blade Nominal Thickness: Not less than 0.060 inch (1.52 mm) for blades and 0.080 inch (2.03 mm) for frames.
4. Mullion Type: Exposed.
5. Louver Performance Ratings:
  - a. Free Area: Not less than 50% of louver intake dimension excluding frame.
  - b. Point of Beginning Water Penetration: Not less than 900 fpm (4.6 m/s).
  - c. Air Performance:
    - 1) Not more than 0.10-inch wg (25-Pa) static pressure drop at 700-fpm (3.6-m/s) free-area intake velocity.
6. AMCA Seal: Mark units with AMCA Certified Ratings Seal.

2.4 LOUVER SCREENS

- A. General: Provide screen at each exterior louver.
1. Screen Location for Fixed Louvers: Interior face.
  2. Screening Type: Bird screening.
- B. Secure screen frames to louver frames with machine screws with heads finished to match louver, spaced a maximum of 6 inches (150 mm) from each corner and at 12 inches (300 mm) o.c.

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FIXED LOUVERS

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- C. Louver Screen Frames: Fabricate with mitered corners to louver sizes indicated.
  - 1. Metal: Same type and form of metal as indicated for louver to which screens are attached. Reinforce extruded-aluminum screen frames at corners with clips.
  - 2. Finish: Same finish as louver frames to which louver screens are attached.
  - 3. Type: Non-rewirable, U-shaped frames.
- D. Louver Screening for Aluminum Louvers:
  - 1. Bird Screening, Aluminum: 1/2-inch- (13-mm-) square mesh, 0.063-inch (1.60-mm) wire.

2.5 MATERIALS

- A. Aluminum Extrusions: ASTM B221 (ASTM B221M), Alloy 6063-T5, T-52, or T6.
- B. Aluminum Sheet: ASTM B209 (ASTM B209M), Alloy 3003 or 5005, with temper as required for forming, or as otherwise recommended by metal producer for required finish.
- C. Galvanized-Steel Sheet: ASTM A653/A653M, [**G60 (Z180)**] [**G90 (Z275)**] zinc coating, mill phosphatized.
- D. Stainless Steel Sheet: ASTM A240/A240M, Type 304, [**No. 2B finish**] [**No. 2D finish**] [**No. 4 finish, with grain running parallel to length of blades and frame members**] [**No. 4 finish, with grain running perpendicular to length of blades and frame members**] [**No. 4 finish, with grain running perpendicular to length of blades and parallel to length of frame members**] [**No. 6 finish**].
- E. Fasteners: Use types and sizes to suit unit installation conditions.
  - 1. Use hex-head or Phillips pan-head screws for exposed fasteners unless otherwise indicated.
  - 2. For fastening aluminum, use aluminum or 300 series stainless steel fasteners.
  - 3. For fastening galvanized steel, use hot-dip-galvanized-steel or 300 series stainless steel fasteners.
  - 4. For fastening stainless steel, use 300 series stainless steel fasteners.
  - 5. For color-finished louvers, use fasteners with heads that match color of louvers.
- F. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D1187/D1187M.

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FIXED LOUVERS

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2.6 FABRICATION

- A. Factory assemble louvers to minimize field splicing and assembly. Disassemble units as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation.
- B. Fabricate frames, including integral sills, to fit in openings of sizes indicated, with allowances made for fabrication and installation tolerances, adjoining material tolerances, and perimeter sealant joints.
  - 1. Frame Type: Channel unless otherwise indicated.
- C. Include supports, anchorages, and accessories required for complete assembly.
- D. Provide vertical mullions of type and at spacings indicated, but not more than is recommended by manufacturer, or 72 inches (1830 mm) o.c., whichever is less.
  - 1. Fully Recessed Mullions: Where indicated, provide mullions fully recessed behind louver blades. Where length of louver exceeds fabrication and handling limitations, fabricate with close-fitting blade splices designed to permit expansion and contraction.
  - 2. Semirecessed Mullions: Where indicated, provide mullions partly recessed behind louver blades, so louver blades appear continuous. Where length of louver exceeds fabrication and handling limitations, fabricate with interlocking split mullions and close-fitting blade splices designed to permit expansion and contraction.
  - 3. Exposed Mullions: Where indicated, provide units with exposed mullions of same width and depth as louver frame. Where length of louver exceeds fabrication and handling limitations, provide interlocking split mullions designed to permit expansion and contraction.
- E. Provide subsills made of same material as louvers or extended sills for recessed louvers.
- F. Join frame members to each other and to fixed louver blades with fillet welds concealed from view, threaded fasteners, or both, as standard with louver manufacturer unless otherwise indicated or size of louver assembly makes bolted connections between frame members necessary.



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FIXED LOUVERS

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2.7 ALUMINUM FINISHES

- A. Finish louvers after assembly.
- B. Clear Anodic Finish: AAMA 611, AA-M12C22A31, Class II, 0.010 mm or thicker.
- C. Color Anodic Finish: AAMA 611, AA-M12C22A32/A34, Class II, 0.010 mm or thicker.
  - 1. Color: As selected by Architect from full range of industry colors and color densities.
- D. Conversion-Coated Finish: AA-C12C42, nonetched, cleaned with inhibited chemicals, and chemical conversion coated with acid chromate-fluoride-phosphate.
- E. Factory-Primed Finish: AA-C12C42R1x with air-dried primer of not less than 2-mil (0.05-mm) dry film thickness.
- F. Superior-Performance Organic Finish, Three-Coat PVDF: Fluoropolymer finish complying with AAMA 2605 and containing not less than 70 percent PVDF resin by weight in both color coat and clear topcoat.
  - 1. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
  - 2. Color and Gloss: As selected by Architect from manufacturer's full range.
- G. Superior-Performance Organic Finish, Four-Coat PVDF: Fluoropolymer finish complying with AAMA 2605 and containing not less than 70 percent PVDF resin by weight in both color coat and clear topcoat.
  - 1. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
  - 2. Color and Gloss: As selected by Architect from manufacturer's full range.
- H. Superior-Performance Organic Finish, Single-Coat FEVE: Fluoropolymer finish complying with AAMA 2605.
  - 1. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
  - 2. Color and Gloss: As selected by Architect from manufacturer's full range.

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FIXED LOUVERS

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- I. Superior-Performance Organic Finish, Two-Coat FEVE: Fluoropolymer finish complying with AAMA 2605.
  - 1. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions for seacoast and severe environments.
  - 2. Color and Gloss: As selected by Architect from manufacturer's full range.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and openings, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Coordinate setting drawings, diagrams, templates, instructions, and directions for installation of anchorages that are to be embedded in concrete or masonry construction. Coordinate delivery of such items to Project site.

3.3 INSTALLATION

- A. Locate and place louvers level, plumb, and at indicated alignment with adjacent work.
- B. Use concealed anchorages where possible. Provide brass or lead washers fitted to screws where required to protect metal surfaces and to make a weathertight connection.
- C. Form closely fitted joints with exposed connections accurately located and secured.
- D. Provide perimeter reveals and openings of uniform width for sealants and joint fillers, as indicated.

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FIXED LOUVERS

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- E. Protect unpainted galvanized- and nonferrous-metal surfaces that are in contact with concrete, masonry, or dissimilar metals from corrosion and galvanic action by applying a heavy coating of bituminous paint or by separating surfaces with waterproof gaskets or nonmetallic flashing.
- F. Install concealed gaskets, flashings, joint fillers, and insulation as louver installation progresses, where weathertight louver joints are required. Comply with Section 079200 "Joint Sealants" for sealants applied during louver installation.

3.4 ADJUSTING AND CLEANING

- A. Clean exposed louver surfaces that are not protected by temporary covering, to remove fingerprints and soil during construction period. Do not let soil accumulate during construction period.
- B. Before final inspection, clean exposed surfaces with water and a mild soap or detergent not harmful to finishes. Thoroughly rinse surfaces and dry.
- C. Restore louvers damaged during installation and construction, so no evidence remains of corrective work. If results of restoration are unsuccessful, as determined by Architect, remove damaged units and replace with new units.
  - 1. Touch up minor abrasions in finishes with air-dried coating that matches color and gloss of, and is compatible with, factory-applied finish coating.

END OF SECTION 08 91 19

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GYPSUM BOARD SHAFT WALL ASSEMBLIES

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SECTION 09 21 16.23 - GYPSUM BOARD SHAFT WALL ASSEMBLIES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
  - 1. Gypsum board shaft wall assemblies.

1.2 ACTION SUBMITTALS

- A. Product Data: For each component of gypsum board shaft wall assembly.

1.3 DELIVERY, STORAGE, AND HANDLING

- A. Store materials inside under cover and keep them dry and protected against weather, condensation, direct sunlight, construction traffic, and other potential causes of damage. Stack panels flat and support them on risers on a flat platform to prevent sagging.

1.4 FIELD CONDITIONS

- A. Environmental Limitations: Comply with gypsum-shaftliner-board manufacturer's written instructions.
- B. Do not install finish panels until installation areas are enclosed and conditioned.
- C. Do not install panels that are wet, moisture damaged, or mold damaged.
  - 1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, and irregular shape.
  - 2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Fire-Resistance-Rated Assemblies: For fire-resistance-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E119 by an independent testing agency.

2.2 GYPSUM BOARD SHAFT WALL ASSEMBLIES

- A. Fire-Resistance Rating: As indicated on Drawings.
- B. Gypsum Shaftliner Board:
  - 1. Type X: ASTM C1396/C1396M; manufacturer's proprietary fire-resistive liner panels with paper faces, 1 inch thick, with double beveled long edges.

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GYPSUM BOARD SHAFT WALL ASSEMBLIES

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- C. Non-Load-Bearing Steel Framing, General: Complying with ASTM C645 requirements for metal unless otherwise indicated and complying with requirements for fire-resistance-rated assembly indicated.
  - 1. Protective Coating: ASTM A653/A653M, G60, hot-dip galvanized unless otherwise indicated.
- D. Studs: Manufacturer's standard profile for repetitive, corner, and end members as follows:
  - 1. Depth: 2-1/2 inches.
  - 2. Minimum Base-Metal Thickness: 0.030 inch.
- E. Runner Tracks: Manufacturer's standard J-profile track with manufacturer's standard long-leg length, but at least 2 inches long and matching studs in depth.
  - 1. Minimum Base-Metal Thickness: Matching steel studs.
- F. Finish Panels: Gypsum board as specified in Section 09 29 00 "Gypsum Board."

2.3 AUXILIARY MATERIALS

- A. Provide auxiliary materials that comply with shaft wall manufacturer's written instructions.
- B. Trim Accessories: Cornerbead, edge trim, and control joints of material and shapes as specified in Section 09 29 00 "Gypsum Board" that comply with gypsum board shaft wall assembly manufacturer's written instructions for application indicated.
- C. Steel Drill Screws: ASTM C1002 unless otherwise indicated.
- D. Track Fasteners: Power-driven fasteners of size and material required to withstand loading conditions imposed on shaft wall assemblies without exceeding allowable design stress of track, fasteners, or structural substrates in which anchors are embedded.
  - 1. Power-Actuated Anchors: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with allowable load capacities calculated according to ICC-ES AC70, greater than or equal to the design load, as determined by testing per ASTM E1190 conducted by a qualified testing agency.
- E. Acoustical Sealant: Section 07 92 19 "Acoustical Joint Sealants."

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

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GYPSUM BOARD SHAFT WALL ASSEMBLIES

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- B. Examine panels before installation. Reject panels that are wet, moisture damaged, or mold damaged.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. General: Install gypsum board shaft wall assemblies to comply with requirements of fire-resistance-rated assemblies indicated and manufacturer's written installation instructions.
- B. Do not bridge building expansion joints with shaft wall assemblies; frame both sides of expansion joints with furring and other support.
- C. Install supplementary framing in gypsum board shaft wall assemblies around openings and as required for blocking, bracing, and support of gravity and pullout loads of fixtures, equipment, services, heavy trim, furnishings, wall-mounted door stops, and similar items that cannot be supported directly by shaft wall assembly framing.
- D. Penetrations: At penetrations in shaft wall, maintain fire-resistance rating of shaft wall assembly by installing supplementary steel framing around perimeter of penetration and fire protection behind boxes containing wiring devices, elevator call buttons and floor indicators, and similar items.
- E. Isolate perimeter of gypsum panels from building structure to prevent cracking of panels while maintaining continuity of fire-rated construction.
- F. Control Joints: Install control joints according to ASTM C840 and in specific locations approved by Architect while maintaining fire-resistance rating of gypsum board shaft wall assemblies.
- G. Seal gypsum board shaft walls with acoustical sealant at perimeter of each assembly where it abuts other work and at joints and penetrations within each assembly.
- H. Installation Tolerance: Install each framing member so fastening surfaces vary not more than 1/8 inch from the plane formed by faces of adjacent framing.

3.3 PROTECTION

- A. Protect installed products from damage from weather, condensation, direct sunlight, construction, and other causes during remainder of the construction period.
- B. Remove and replace panels that are wet, moisture damaged, or mold damaged.
  - 1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, and irregular shape.
  - 2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

END OF SECTION 09 21 16.23

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NON-STRUCTURAL METAL FRAMING

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SECTION 09 22 16 - NON-STRUCTURAL METAL FRAMING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
  - 1. Non-load-bearing steel framing systems for interior partitions.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product.

1.3 INFORMATIONAL SUBMITTALS

- A. Evaluation Reports: For post-installed anchors and power-actuated fasteners, from ICC-ES or other qualified testing agency acceptable to authorities having jurisdiction.

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Notify manufacturer of damaged materials received prior to installation.
- B. Deliver materials in manufacturer's original, unopened, undamaged containers with identification labels intact.
- C. Protect cold-formed metal framing from corrosion, deformation, and other damage during delivery, storage, and handling as required by AISI S202, "Code of Standard Practice for Cold-Formed Steel Structural Framing."

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Fire-Test-Response Characteristics: For fire-resistance-rated assemblies that incorporate non-load-bearing steel framing, provide materials and construction identical to those tested in assembly indicated, according to ASTM E119 by an independent testing agency.
- B. STC-Rated Assemblies: For STC-rated assemblies, provide materials and construction identical to those tested in assembly indicated on Drawings, according to ASTM E90 and classified according to ASTM E413 by an independent testing agency.

2.2 FRAMING SYSTEMS

- A. Framing Members, General: Comply with AISI S220 for conditions indicated.
  - 1. Steel Sheet Components: Comply with AISI S220 requirements for metal unless otherwise indicated
  - 2. Protective Coating: Comply with AISI S220; ASTM A653/A653M, G60; or coating with equivalent corrosion resistance. Galvannealed products are unacceptable.

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NON-STRUCTURAL METAL FRAMING

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- a. Coating demonstrates equivalent corrosion resistance with an evaluation report acceptable to authorities having jurisdiction.
- B. Studs and Track: AISI S220.
  - 1. Minimum Base-Steel Thickness: 0.0296 inch.
  - 2. Depth: As indicated on Drawings.
- C. Slip-Type Head Joints: Where indicated, provide the following:
  - 1. Single Long-Leg Track System: ASTM C645 top track with 2-inch- deep flanges in thickness not less than indicated for studs, installed with studs friction fit into top track and with continuous bridging located within 12 inches of the top of studs to provide lateral bracing.
- D. Flat Strap and Backing Plate: Steel sheet for blocking and bracing in length and width indicated.
  - 1. Minimum Base-Steel Thickness: 0.042 inch.
- E. Cold-Rolled Channel Bridging: Steel, 0.0538-inch minimum base-steel thickness, with minimum 1/2-inch- wide flanges.
  - 1. Depth: 1-1/2 inches.
  - 2. Clip Angle: Not less than 1-1/2 by 1-1/2 inches, 0.068-inch- thick, galvanized steel.
- F. Hat-Shaped, Rigid Furring Channels: ASTM C645.
  - 1. Minimum Base-Steel Thickness: 0.0296 inch.
  - 2. Depth: As indicated on Drawings.
- G. Resilient Furring Channels: 1/2-inch- deep, steel sheet members designed to reduce sound transmission.
  - 1. Configuration: Asymmetrical.

## 2.3 AUXILIARY MATERIALS

- A. General: Provide auxiliary materials that comply with referenced installation standards.
  - 1. Fasteners for Steel Framing: Of type, material, size, corrosion resistance, holding power, and other properties required to fasten steel members to substrates.
- B. Isolation Strip at Exterior Walls: Provide the following:
  - 1. Foam Gasket: Adhesive-backed, closed-cell vinyl foam strips that allow fastener penetration without foam displacement, 1/8 inch thick, in width to suit steel stud size.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine areas and substrates, with Installer present, and including welded hollow-metal frames, cast-in anchors, and structural framing, for compliance with requirements and other conditions affecting performance of the Work.

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NON-STRUCTURAL METAL FRAMING

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- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

- A. Installation Standard: ASTM C754.
  - 1. Gypsum Board Assemblies: Also comply with requirements in ASTM C840 that apply to framing installation.
- B. Install framing and accessories plumb, square, and true to line, with connections securely fastened.
- C. Install supplementary framing, and blocking to support fixtures, equipment services, heavy trim, grab bars, toilet accessories, furnishings, or similar construction.
- D. Install bracing at terminations in assemblies.
- E. Do not bridge building control and expansion joints with non-load-bearing steel framing members. Frame both sides of joints independently.

3.3 INSTALLING FRAMED ASSEMBLIES

- A. Install framing system components according to spacings indicated, but not greater than spacings required by referenced installation standards for assembly types.
  - 1. Single-Layer Application: 16 inches o.c. unless otherwise indicated.
  - 2. Multilayer Application: 16 inches o.c. unless otherwise indicated.
  - 3. Tile Backing Panels: 16 inches o.c. unless otherwise indicated.
- B. Where studs are installed directly against exterior masonry walls or dissimilar metals at exterior walls, install isolation strip between studs and exterior wall.
- C. Install studs so flanges within framing system point in same direction.
- D. Install tracks at floors and overhead supports. Extend framing full height to structural supports or substrates above suspended ceilings except where partitions are indicated to terminate at suspended ceilings. Continue framing around ducts that penetrate partitions above ceiling.
  - 1. Slip-Type Head Joints: Where framing extends to overhead structural supports, install to produce joints at tops of framing systems that prevent axial loading of finished assemblies.
  - 2. Door Openings: Screw vertical studs at jambs to jamb anchor clips on door frames; install track section (for cripple studs) at head and secure to jamb studs.
    - a. Install two studs at each jamb unless otherwise indicated.
    - b. Install cripple studs at head adjacent to each jamb stud, with a minimum 1/2-inch clearance from jamb stud to allow for installation of control joint in finished assembly.
  - 3. Other Framed Openings: Frame openings other than door openings the same as required for door openings unless otherwise indicated. Install framing below sills of openings to match framing required above door heads.

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NON-STRUCTURAL METAL FRAMING

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- 4. Fire-Resistance-Rated Partitions: Install framing to comply with fire-resistance-rated assembly indicated and support closures and to make partitions continuous from floor to underside of solid structure.
- 5. Sound-Rated Partitions: Install framing to comply with sound-rated assembly indicated.
- E. Direct Furring:
  - 1. Screw to wood framing.
  - 2. Attach to concrete or masonry with stub nails, screws designed for masonry attachment, or powder-driven fasteners spaced 24 inches o.c.
- F. Installation Tolerance: Install each framing member so fastening surfaces vary not more than 1/8 inch from the plane formed by faces of adjacent framing.

END OF SECTION 09 22 16

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GYPSUM BOARD

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SECTION 09 29 00 - GYPSUM BOARD

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
  - 1. Interior gypsum board.

1.2 ACTION SUBMITTALS

- A. Product Data: For the following:
  - 1. Gypsum board, Type X.
  - 2. Gypsum board, Type C.
  - 3. Interior trim.
  - 4. Joint treatment materials.
  - 5. Sound-attenuation blankets.

1.3 QUALITY ASSURANCE

- A. Finish Mockups: Build mockups of at least 100 sq. ft. in surface area to demonstrate aesthetic effects and to set quality standards for materials and execution.
  - 1. Build mockups for the following:
    - a. Each level of gypsum board finish indicated for use in exposed locations.
  - 2. Apply or install final decoration indicated, including painting and wallcoverings, on exposed surfaces for review of mockups.
  - 3. Simulate finished lighting conditions for review of mockups.
- B. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.4 DELIVERY, STORAGE AND HANDLING

- A. Store materials inside under cover and keep them dry and protected against weather, condensation, direct sunlight, construction traffic, and other potential causes of damage. Stack panels flat and supported on risers on a flat platform to prevent sagging.

1.5 FIELD CONDITIONS

- A. Environmental Limitations: Comply with ASTM C840 requirements or gypsum board manufacturer's written instructions, whichever are more stringent.
- B. Do not install paper-faced gypsum panels until installation areas are enclosed and conditioned.
- C. Do not install panels that are wet, moisture damaged, and mold damaged.
  - 1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.

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GYPSUM BOARD

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2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Fire-Resistance-Rated Assemblies: For fire-resistance-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E119 by an independent testing agency.
- B. STC-Rated Assemblies: For STC-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E90 and classified according to ASTM E413 by an independent testing agency.

2.2 GYPSUM BOARD, GENERAL

- A. Size: Provide maximum lengths and widths available that will minimize joints in each area and that correspond with support system indicated.

2.3 INTERIOR GYPSUM BOARD

- A. Gypsum Board, Type X: ASTM C1396/C1396M.
  1. Thickness: 5/8 inch.
  2. Long Edges: Tapered.

2.4 SPECIALTY GYPSUM BOARD

- A. Gypsum Board, Type C: ASTM C1396/C1396M. Manufactured to have increased fire-resistive capability.
  1. Thickness: As required by fire-resistance-rated assembly indicated on Drawings.
  2. Long Edges: Tapered.

2.5 TRIM ACCESSORIES

- A. Interior Trim: ASTM C1047.
  1. Material: Paper-faced galvanized-steel sheet.
  2. Shapes:
    - a. Cornerbead.
    - b. LC-Bead: J-shaped; exposed long flange receives joint compound.
    - c. U-Bead: J-shaped; exposed short flange does not receive joint compound.
    - d. Expansion (control) joint.

2.6 JOINT TREATMENT MATERIALS

- A. General: Comply with ASTM C475/C475M.
- B. Joint Tape:
  1. Interior Gypsum Board: Paper.

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GYPSUM BOARD

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- C. Joint Compound for Interior Gypsum Board: For each coat, use formulation that is compatible with other compounds applied on previous or for successive coats.
  - 1. Prefilling: At open joints and damaged surface areas, use setting-type taping compound.
  - 2. Embedding and First Coat: For embedding tape and first coat on joints, fasteners, and trim flanges, use setting-type taping compound.
    - a. Use setting-type compound for installing paper-faced metal trim accessories.
  - 3. Fill Coat: For second coat, use setting-type, sandable topping compound.
  - 4. Finish Coat: For third coat, use drying-type, all-purpose compound.

2.7 AUXILIARY MATERIALS

- A. Provide auxiliary materials that comply with referenced installation standards and manufacturer's written instructions.
- B. Laminating Adhesive: Adhesive or joint compound recommended for directly adhering gypsum panels to continuous substrate.
- C. Steel Drill Screws: ASTM C1002 unless otherwise indicated.
  - 1. Use screws complying with ASTM C954 for fastening panels to steel members from 0.033 to 0.112 inch thick.
  - 2. For fastening cementitious backer units, use screws of type and size recommended by panel manufacturer.
- D. Sound-Attenuation Blankets: ASTM C665, Type I (blankets without membrane facing) produced by combining thermosetting resins with mineral fibers manufactured from glass, slag wool, or rock wool.
  - 1. Fire-Resistance-Rated Assemblies: Comply with mineral-fiber requirements of assembly.
- E. Acoustical Sealant: As specified in Section 07 92 19 "Acoustical Joint Sealants."

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas and substrates including welded hollow-metal frames and support framing, with Installer present, for compliance with requirements and other conditions affecting performance of the Work.
- B. Examine panels before installation. Reject panels that are wet, moisture damaged, and mold damaged.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION AND FINISHING OF PANELS, GENERAL

- A. Comply with ASTM C840.

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GYPSUM BOARD

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- B. Install ceiling panels across framing to minimize the number of abutting end joints and to avoid abutting end joints in central area of each ceiling. Stagger abutting end joints of adjacent panels not less than one framing member.
- C. Install panels with face side out. Butt panels together for a light contact at edges and ends with not more than 1/16 inch of open space between panels. Do not force into place.
- D. Locate edge and end joints over supports, except in ceiling applications where intermediate supports or gypsum board back-blocking is provided behind end joints. Do not place tapered edges against cut edges or ends. Stagger vertical joints on opposite sides of partitions. Do not make joints other than control joints at corners of framed openings.
- E. Form control and expansion joints with space between edges of adjoining gypsum panels.
- F. Cover both faces of support framing with gypsum panels in concealed spaces (above ceilings, etc.), except in chases braced internally.
  - 1. Unless concealed application is indicated or required for sound, fire, air, or smoke ratings, coverage may be accomplished with scraps of not less than 8 sq. ft. in area.
  - 2. Fit gypsum panels around ducts, pipes, and conduits.
  - 3. Where partitions intersect structural members projecting below underside of floor/roof slabs and decks, cut gypsum panels to fit profile formed by structural members; allow 1/4- to 3/8-inch- wide joints to install sealant.
- G. Isolate perimeter of gypsum board applied to non-load-bearing partitions at structural abutments. Provide 1/4- to 1/2-inch- wide spaces at these locations and trim edges with edge trim where edges of panels are exposed. Seal joints between edges and abutting structural surfaces with acoustical sealant.
- H. Attachment to Steel Framing: Attach panels so leading edge or end of each panel is attached to open (unsupported) edges of stud flanges first.
- I. Wood Framing: Install gypsum panels over wood framing, with floating internal corner construction. Do not attach gypsum panels across the flat grain of wide-dimension lumber, including floor joists and headers. Float gypsum panels over these members or provide control joints to counteract wood shrinkage.
- J. Seal construction at perimeters, behind control joints, and at openings and penetrations with a continuous bead of acoustical sealant. Install acoustical sealant at both faces of partitions at perimeters and through penetrations. Comply with ASTM C919 and with manufacturer's written instructions for locating edge trim and closing off sound-flanking paths around or through assemblies, including sealing partitions above acoustical ceilings.
- K. Install sound attenuation blankets before installing gypsum panels unless blankets are readily installed after panels have been installed on one side.



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GYPSUM BOARD

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3.3 INSTALLATION OF INTERIOR GYPSUM BOARD

- A. Single-Layer Application:
1. On ceilings, apply gypsum panels before wall/partition board application to greatest extent possible and at right angles to framing unless otherwise indicated.
  2. On partitions/walls, apply gypsum panels horizontally (perpendicular to framing) unless otherwise indicated or required by fire-resistance-rated assembly, and minimize end joints.
    - a. Stagger abutting end joints not less than one framing member in alternate courses of panels.
    - b. At stairwells and other high walls, install panels horizontally unless otherwise indicated or required by fire-resistance-rated assembly.
  3. Fastening Methods: Apply gypsum panels to supports with steel drill screws.
- B. Multilayer Application:
1. On ceilings, apply gypsum board indicated for base layers before applying base layers on walls/partitions; apply face layers in same sequence. Apply base layers at right angles to framing members and offset face-layer joints one framing member, 16 inches minimum, from parallel base-layer joints, unless otherwise indicated or required by fire-resistance-rated assembly.
  2. On partitions/walls, apply gypsum board indicated for base layers and face layers vertically (parallel to framing) with joints of base layers located over stud or furring member and face-layer joints offset at least one stud or furring member with base-layer joints unless otherwise indicated or required by fire-resistance-rated assembly. Stagger joints on opposite sides of partitions.
  3. Fastening Methods: Fasten base layers and face layers separately to supports with screws.
- C. Laminating to Substrate: Where gypsum panels are indicated as directly adhered to a substrate (other than studs, joists, furring members, or base layer of gypsum board), comply with gypsum board manufacturer's written instructions and temporarily brace or fasten gypsum panels until fastening adhesive has set.

3.4 INSTALLATION OF TRIM ACCESSORIES

- A. General: For trim with back flanges intended for fasteners, attach to framing with same fasteners used for panels. Otherwise, attach trim according to manufacturer's written instructions.
- B. Control Joints: Install control joints according to ASTM C840 and in specific locations approved by Architect for visual effect.
- C. Interior Trim: Install in the following locations:
1. Cornerbead: Use at outside corners unless otherwise indicated.
  2. LC-Bead: Use at exposed panel edges.
  3. U-Bead: Use where indicated.

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GYPSUM BOARD

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3.5 FINISHING GYPSUM BOARD

- A. General: Treat gypsum board joints, interior angles, edge trim, control joints, penetrations, fastener heads, surface defects, and elsewhere as required to prepare gypsum board surfaces for decoration. Promptly remove residual joint compound from adjacent surfaces.
- B. Prefill open joints and damaged surface areas.
- C. Apply joint tape over gypsum board joints, except for trim products specifically indicated as not intended to receive tape.
- D. Gypsum Board Finish Levels: Finish panels to levels indicated below and according to ASTM C840:
  - 1. Level 1: Ceiling plenum areas, concealed areas, and where indicated.
  - 2. Level 4: At panel surfaces that will be exposed to view unless otherwise indicated.
    - a. Primer and its application to surfaces are specified in Section 09 91 23 "Interior Painting."

3.6 PROTECTION

- A. Protect adjacent surfaces from drywall compound and promptly remove from floors and other non-drywall surfaces. Repair surfaces stained, marred, or otherwise damaged during drywall application.
- B. Protect installed products from damage from weather, condensation, direct sunlight, construction, and other causes during remainder of the construction period.
- C. Remove and replace panels that are wet, moisture damaged, and mold damaged.
  - 1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
  - 2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

END OF SECTION 09 29 00

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ACOUSTICAL PANEL CEILINGS

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SECTION 09 51 13 - ACOUSTICAL PANEL CEILINGS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes acoustical panels and exposed suspension systems for interior ceilings.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Samples for Verification: For each component indicated and for each exposed finish required, prepared on Samples of sizes indicated below:
  - 1. Acoustical Panels: Set of 6-inch- square Samples of each type, color, pattern, and texture.

1.3 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For finishes to include in maintenance manuals.

1.4 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials, from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
  - 1. Acoustical Ceiling Units: Full-size panels equal to 2 percent of quantity installed.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Deliver acoustical panels, suspension-system components, and accessories to Project site and store them in a fully enclosed, conditioned space where they will be protected against damage from moisture, humidity, temperature extremes, direct sunlight, surface contamination, and other causes.
- B. Before installing acoustical panels, permit them to reach room temperature and a stabilized moisture content.

1.6 FIELD CONDITIONS

- A. Environmental Limitations: Do not install acoustical panel ceilings until spaces are enclosed and weathertight, wet-work in spaces is complete and dry, work above ceilings is complete, and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.

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ACOUSTICAL PANEL CEILINGS

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PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Source Limitations: Obtain each type of acoustical ceiling panel and its supporting suspension system from single source from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

- A. Surface-Burning Characteristics: Comply with ASTM E84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
  - 1. Flame-Spread Index: Class A according to ASTM E1264.
  - 2. Smoke-Developed Index: 450 or less.

2.3 ACOUSTICAL PANELS

- A. Product/Manufacture: As indicated on Drawings.
- B. Acoustical Panel Standard: Provide manufacturer's standard panels according to ASTM E1264 and designated by type, form, pattern, acoustical rating, and light reflectance unless otherwise indicated.

2.4 METAL SUSPENSION SYSTEM

- A. Metal Suspension-System Standard: Provide manufacturer's standard, direct-hung, metal suspension system and accessories according to ASTM C635/C635M and designated by type, structural classification, and finish indicated.
- B. Wide-Face, Capped, Double-Web, Steel Suspension System: Main and cross runners roll formed from cold-rolled steel sheet; prepainted, electrolytically zinc coated, or hot-dip galvanized, G30 coating designation; with prefinished 15/16-inch- wide metal caps on flanges.
  - 1. Structural Classification: Intermediate -duty system.
  - 2. End Condition of Cross Runners: butt-edge type.
  - 3. Face Design: Flat, flush.
  - 4. Cap Material: aluminum.
  - 5. Cap Finish: Painted white.

2.5 ACCESSORIES

- A. Attachment Devices: Size for five times the design load indicated in ASTM C635/C635M, Table 1, "Direct Hung," unless otherwise indicated. Comply with seismic design requirements.
  - 1. Power-Actuated Fasteners in Concrete: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with clips or other accessory devices for attaching hangers of type indicated and with capability to sustain, without failure, a load equal to 10 times that imposed by ceiling construction, as determined by testing according to ASTM E1190, conducted by a qualified testing and inspecting agency.

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ACOUSTICAL PANEL CEILINGS

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- B. Wire Hangers, Braces, and Ties: Provide wires as follows:
  - 1. Zinc-Coated, Carbon-Steel Wire: ASTM A641/A641M, Class 1 zinc coating, soft temper.
  - 2. Size: Wire diameter sufficient for its stress at three times hanger design load (ASTM C635/C635M, Table 1, "Direct Hung") will be less than yield stress of wire, but not less than 0.106-inch- diameter wire.

2.6 METAL EDGE MOLDINGS AND TRIM

- A. Roll-Formed, Sheet-Metal Edge Moldings and Trim: Type and profile indicated or, if not indicated, manufacturer's standard moldings for edges and penetrations 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. Edge moldings shall fit acoustical panel edge details and suspension systems indicated and match width and configuration of exposed runners unless otherwise indicated.
  - 2. For lay-in panels with reveal edge details, provide.
- B. Extruded-Aluminum Edge Moldings and Trim: Where indicated, provide manufacturer's extruded-aluminum edge moldings and trim of profile indicated or referenced by manufacturer's designations, including splice plates, corner pieces, and attachment and other clips, complying with seismic design requirements.
  - 1. Baked-Enamel or Powder-Coat Finish: Minimum dry film thickness of 1.5 mils. Comply with ASTM C635/C635M and coating manufacturer's written instructions for cleaning, conversion coating, and applying and baking finish.

2.7 ACOUSTICAL SEALANT

- A. Acoustical Sealant: As specified in Section 07 92 19 "Acoustical Joint Sealants."

PART 3 - EXECUTION

3.1 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. Examine acoustical panels before installation. Reject acoustical panels that are wet, moisture damaged, or mold damaged.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

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ACOUSTICAL PANEL CEILINGS

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3.2 PREPARATION

- A. Measure each ceiling area and establish layout of acoustical panels to balance border widths at opposite edges of each ceiling. Avoid using less-than-half-width panels at borders unless otherwise indicated, and comply with layout shown on reflected ceiling plans.
- B. Layout openings for penetrations centered on the penetrating items.

3.3 INSTALLATION

- A. Install acoustical panel ceilings according to ASTM C636/C636M and manufacturer's written instructions.
- B. Suspend ceiling hangers from building's structural members and as follows:
  - 1. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structure or of ceiling suspension system.
  - 2. Splay hangers only where required to miss obstructions; offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.
  - 3. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with location of hangers at spacings required to support standard suspension-system members, install supplemental suspension members and hangers in form of trapezes or equivalent devices.
  - 4. Secure wire hangers to ceiling-suspension members and to supports above with a minimum of three tight turns. Connect hangers directly to structure or to inserts, eye screws, or other devices that are secure and appropriate for substrate and that will not deteriorate or otherwise fail due to age, corrosion, or elevated temperatures.
  - 5. Do not support ceilings directly from permanent metal forms or floor deck. Fasten hangers to cast-in-place hanger inserts, postinstalled mechanical or adhesive anchors, or power-actuated fasteners that extend through forms into concrete.
  - 6. When steel framing does not permit installation of hanger wires at spacing required, install carrying channels or other supplemental support for attachment of hanger wires.
  - 7. Do not attach hangers to steel deck tabs.
  - 8. Do not attach hangers to steel roof deck. Attach hangers to structural members.
  - 9. Space hangers not more than 48 inches o.c. along each member supported directly from hangers unless otherwise indicated; provide hangers not more than 8 inches from ends of each member.
  - 10. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced standards.
- C. Secure bracing wires to ceiling suspension members and to supports with a minimum of four tight turns. Suspend bracing from building's structural members as required for hangers, without attaching to permanent metal forms, steel deck, or steel deck tabs. Fasten bracing wires into concrete with cast-in-place or postinstalled anchors.

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ACOUSTICAL PANEL CEILINGS

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- D. Install edge moldings and trim of type indicated at perimeter of acoustical ceiling area and where necessary to conceal edges of acoustical panels.
  - 1. Apply acoustical sealant in a continuous ribbon concealed on back of vertical legs of moldings before they are installed.
  - 2. Screw attach moldings to substrate at intervals not more than 16 inches o.c. and not more than 3 inches from ends. Miter corners accurately and connect securely.
  - 3. Do not use exposed fasteners, including pop rivets, on moldings and trim.
- E. Install suspension-system runners so they are square and securely interlocked with one another. Remove and replace dented, bent, or kinked members.
- F. Install acoustical panels with undamaged edges and fit accurately into suspension-system runners and edge moldings. Scribe and cut panels at borders and penetrations to provide precise fit.
  - 1. Arrange directionally patterned acoustical panels as follows:
    - a. As indicated on reflected ceiling plans.
  - 2. For square-edged panels, install panels with edges fully hidden from view by flanges of suspension-system runners and moldings.
  - 3. For reveal-edged panels on suspension-system runners, install panels with bottom of reveal in firm contact with top surface of runner flanges.
  - 4. For reveal-edged panels on suspension-system members with box-shaped flanges, install panels with reveal surfaces in firm contact with suspension-system surfaces and panel faces flush with bottom face of runners.
  - 5. 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.

3.4 ERECTION TOLERANCES

- A. Suspended Ceilings: Install main and cross runners level to a tolerance of 1/8 inch in 12 feet, non-cumulative.
- B. Moldings and Trim: Install moldings and trim to substrate and level with ceiling suspension system to a tolerance of 1/8 inch in 12 feet, non-cumulative.

3.5 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 touchup of minor finish damage.
- B. Remove and replace ceiling components that cannot be successfully cleaned and repaired to permanently eliminate evidence of damage.

END OF SECTION 09 51 13

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RESILIENT BASE AND ACCESSORIES

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SECTION 09 65 13 - RESILIENT BASE AND ACCESSORIES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
  - 1. Thermoplastic-rubber base.
  - 2. Rubber molding accessories.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Samples for Initial Selection: For each type of product indicated.

1.3 QUALITY ASSURANCE

- A. Mockups: Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for materials and execution.
  - 1. Coordinate mockups in this Section with mockups specified in other Sections.
  - 2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
  - 3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Store resilient products and installation materials in dry spaces protected from the weather, with ambient temperatures maintained within range recommended by manufacturer, but not less than 50 deg F or more than 90 deg F.

1.5 FIELD CONDITIONS

- A. Maintain ambient temperatures within range recommended by manufacturer, but not less than 70 deg F or more than 95 deg F, in spaces to receive resilient products during the following periods:
  - 1. 48 hours before installation.
  - 2. During installation.
  - 3. 48 hours after installation.
- B. After installation and until Substantial Completion, maintain ambient temperatures within range recommended by manufacturer, but not less than 55 deg F or more than 95 deg F.
- C. Install resilient products after other finishing operations, including painting, have been completed.

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RESILIENT BASE AND ACCESSORIES

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PART 2 - PRODUCTS

2.1 THERMOPLASTIC-RUBBER BASE (RB)

- A. Product/Manufacturer: Basis of design.
  - 1. As indicated on Drawings.
- B. Product Standard: ASTM F1861, Type TP (rubber, thermoplastic).
  - 1. Group: II (layered).
  - 2. Style and Location:
    - a. Style D, Sculptured: Provide in areas indicated.
    - 1) Profile: As indicated.
- C. Height: As indicated on Drawings.
- D. Lengths: Cut lengths 48 inches long or coils in manufacturer's standard length.
- E. Outside Corners: Job formed.
- F. Inside Corners: Job formed.
- G. Colors: As indicated by manufacturer's designations.

2.2 RUBBER MOLDING ACCESSORY

- A. Profile and Dimensions: As indicated.
- B. Colors and Patterns: As selected by Architect from manufacturer's full range.

2.3 INSTALLATION MATERIALS

- A. Adhesives: Water-resistant type recommended by resilient-product manufacturer for resilient products and substrate conditions indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, with Installer present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.
  - 1. Verify that finishes of substrates comply with tolerances and other requirements specified in other Sections and that substrates are free of cracks, ridges, depressions, scale, and foreign deposits that might interfere with adhesion of resilient products.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.
  - 1. Installation of resilient products indicates acceptance of surfaces and conditions.

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RESILIENT BASE AND ACCESSORIES

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3.2 PREPARATION

- A. Prepare substrates according to manufacturer's written instructions to ensure adhesion of resilient products.
- B. Fill cracks, holes, and depressions in substrates with trowelable leveling and patching compound; remove bumps and ridges to produce a uniform and smooth substrate.
- C. Do not install resilient products until materials are the same temperature as space where they are to be installed.
  - 1. At least 48 hours in advance of installation, move resilient products and installation materials into spaces where they will be installed.
- D. Immediately before installation, sweep and vacuum clean substrates to be covered by resilient products.

3.3 RESILIENT BASE INSTALLATION

- A. Comply with manufacturer's written instructions for installing resilient base.
- B. Apply resilient base to walls, columns, pilasters, casework and cabinets in toe spaces, and other permanent fixtures in rooms and areas where base is required.
- C. Install resilient base in lengths as long as practical without gaps at seams and with tops of adjacent pieces aligned.
- D. Tightly adhere resilient base to substrate throughout length of each piece, with base in continuous contact with horizontal and vertical substrates.
- E. Do not stretch resilient base during installation.
- F. On masonry surfaces or other similar irregular substrates, fill voids along top edge of resilient base with manufacturer's recommended adhesive filler material.
- G. Job-Formed Corners:
  - 1. Outside Corners: Use straight pieces of maximum lengths possible and form with returns not less than 3 inches in length.
    - a. Form without producing discoloration (whitening) at bends.
  - 2. Inside Corners: Use straight pieces of maximum lengths possible and form with returns not less than 3 inches in length.
    - a. Miter or cope corners to minimize open joints.

3.4 RESILIENT ACCESSORY INSTALLATION

- A. Comply with manufacturer's written instructions for installing resilient accessories.
- B. Resilient Molding Accessories: Butt to adjacent materials and tightly adhere to substrates throughout length of each piece. Install reducer strips at edges of floor covering that would otherwise be exposed.

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RESILIENT BASE AND ACCESSORIES

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3.5 CLEANING AND PROTECTION

- A. Comply with manufacturer's written instructions for cleaning and protecting resilient products.
- B. Perform the following operations immediately after completing resilient-product installation:
  - 1. Remove adhesive and other blemishes from surfaces.
  - 2. Sweep and vacuum horizontal surfaces thoroughly.
- C. Protect resilient products from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period.

END OF SECTION 09 65 13

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RESILIENT TILE FLOORING

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SECTION 09 65 19 - RESILIENT TILE FLOORING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
  - 1. Vinyl composition floor tile.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: For each type of resilient floor tile.
  - 1. Include floor tile layouts, edges, columns, doorways, enclosing partitions, built-in furniture, cabinets, and cutouts.
  - 2. Show details of special patterns.
- C. Samples for Initial Selection: For each type of floor tile indicated.
- D. Samples for Verification: Full-size units of each color and pattern of floor tile required.
- E. Product Schedule: For floor tile. Use same designations indicated on Drawings.

1.3 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer.

1.4 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For each type of floor tile to include in maintenance manuals.

1.5 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials, from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
  - 1. Floor Tile: Furnish one box for every 50 boxes or fraction thereof, of each type, color, and pattern of floor tile installed.

1.6 QUALITY ASSURANCE

- A. Installer Qualifications: An entity that employs installers and supervisors who are competent in techniques required by manufacturer for floor tile installation and seaming method indicated.
  - 1. Engage an installer who employs workers for this Project who are trained or certified by floor tile manufacturer for installation techniques required.

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RESILIENT TILE FLOORING

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- B. Mockups: Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for materials and execution.
  - 1. Coordinate mockups in this Section with mockups specified in other Sections.
    - a. Size: Minimum 100 sq. ft. for each type, color, and pattern in locations directed by Architect.
  - 2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
  - 3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Store floor tile and installation materials in dry spaces protected from the weather, with ambient temperatures maintained within range recommended by manufacturer, but not less than 50 deg F or more than 90 deg F. Store floor tiles on flat surfaces.

1.8 FIELD CONDITIONS

- A. Maintain ambient temperatures within range recommended by manufacturer, but not less than 70 deg F or more than 95 deg F, in spaces to receive floor tile during the following periods:
  - 1. 48 hours before installation.
  - 2. During installation.
  - 3. 48 hours after installation.
- B. After installation and until Substantial Completion, maintain ambient temperatures within range recommended by manufacturer, but not less than 55 deg F or more than 95 deg F.
- C. Close spaces to traffic during floor tile installation.
- D. Close spaces to traffic for 48 hours after floor tile installation.
- E. Install floor tile after other finishing operations, including painting, have been completed.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Fire-Test-Response Characteristics: For resilient floor tile, as determined by testing identical products according to ASTM E648 or NFPA 253 by a qualified testing agency.
  - 1. Critical Radiant Flux Classification: Class I, not less than 0.45 W/sq. cm.

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RESILIENT TILE FLOORING

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2.2 VINYL COMPOSITION FLOOR TILE (VCT)

- A. Product/Manufacturer: Match existing.
- B. Tile Standard: ASTM F1066, Class 2, through pattern.
- C. Wearing Surface: Smooth.
- D. Thickness: 0.125 inch.
- E. Size: 12 by 12 inches.
- F. Colors and Patterns: Match existing.

2.3 INSTALLATION MATERIALS

- A. Trowelable Leveling and Patching Compounds: Latex-modified, portland-cement-based or blended hydraulic-cement-based formulation provided or approved by floor tile manufacturer for applications indicated.
- B. Adhesives: Water-resistant type recommended by floor tile and adhesive manufacturers to suit floor tile and substrate conditions indicated.
- C. Floor Polish: Provide protective, liquid floor-polish products recommended by floor tile manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, with Installer present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.
  - 1. Verify that finishes of substrates comply with tolerances and other requirements specified in other Sections and that substrates are free of cracks, ridges, depressions, scale, and foreign deposits that might interfere with adhesion of floor tile.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Prepare substrates according to floor tile manufacturer's written instructions to ensure adhesion of resilient products.
- B. Concrete Substrates: Prepare according to ASTM F710.
  - 1. Verify that substrates are dry and free of curing compounds, sealers, and hardeners.

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## RESILIENT TILE FLOORING

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2. Remove substrate coatings and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended by floor tile manufacturer. Do not use solvents.
3. Alkalinity and Adhesion Testing: Perform tests recommended by floor tile manufacturer. Proceed with installation only after substrate alkalinity falls within range on pH scale recommended by manufacturer in writing, but not less than 5 or more than 9 pH.
4. Moisture Testing: Perform tests so that each test area does not exceed 1000 sq. ft., and perform no fewer than three tests in each installation area and with test areas evenly spaced in installation areas.
  - a. Anhydrous Calcium Chloride Test: ASTM F1869. Proceed with installation only after substrates have maximum moisture-vapor-emission rate of 3 lb of water/1000 sq. ft. in 24 hours.
  - b. Relative Humidity Test: Using in-situ probes, ASTM F2170. Proceed with installation only after substrates have a maximum 75 percent relative humidity level measurement.
- C. Fill cracks, holes, and depressions in substrates with trowelable leveling and patching compound; remove bumps and ridges to produce a uniform and smooth substrate.
- D. Do not install floor tiles until materials are the same temperature as space where they are to be installed.
  1. At least 48 hours in advance of installation, move resilient floor tile and installation materials into spaces where they will be installed.
- E. Immediately before installation, sweep and vacuum clean substrates to be covered by resilient floor tile.

### 3.3 FLOOR TILE INSTALLATION

- A. Comply with manufacturer's written instructions for installing floor tile.
- B. Lay out floor tiles from center marks established with principal walls, discounting minor offsets, so tiles at opposite edges of room are of equal width. Adjust as necessary to avoid using cut widths that equal less than one-half tile at perimeter.
  1. Lay tiles in pattern indicated.
- C. Match floor tiles for color and pattern by selecting tiles from cartons in the same sequence as manufactured and packaged, if so numbered. Discard broken, cracked, chipped, or deformed tiles.
  1. Lay tiles in pattern of colors and sizes indicated.
- D. Scribe, cut, and fit floor tiles to butt neatly and tightly to vertical surfaces and permanent fixtures including built-in furniture, cabinets, pipes, outlets, and door frames.
- E. Extend floor tiles into toe spaces, door reveals, closets, and similar openings. Extend floor tiles to center of door openings.



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RESILIENT TILE FLOORING

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- F. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on floor tiles as marked on substrates. Use chalk or other nonpermanent marking device.
- G. Install floor tiles on covers for telephone and electrical ducts, building expansion-joint covers, and similar items in installation areas. Maintain overall continuity of color and pattern between pieces of tile installed on covers and adjoining tiles. Tightly adhere tile edges to substrates that abut covers and to cover perimeters.
- H. Adhere floor tiles to substrates using a full spread of adhesive applied to substrate to produce a completed installation without open cracks, voids, raising and puckering at joints, telegraphing of adhesive spreader marks, and other surface imperfections.

3.4 CLEANING AND PROTECTION

- A. Comply with manufacturer's written instructions for cleaning and protecting floor tile.
- B. Perform the following operations immediately after completing floor tile installation:
  - 1. Remove adhesive and other blemishes from surfaces.
  - 2. Sweep and vacuum surfaces thoroughly.
  - 3. Damp-mop surfaces to remove marks and soil.
- C. Protect floor tile from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period.
- D. Floor Polish: Remove soil, adhesive, and blemishes from floor tile surfaces before applying liquid floor polish.
  - 1. Apply one coat(s).
- E. Cover floor tile until Substantial Completion.

END OF SECTION 09 65 19

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TILE CARPETING

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SECTION 09 68 13 - TILE CARPETING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
1. Modular carpet tile.

1.2 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.
1. Review methods and procedures related to carpet tile installation including, but not limited to, the following:
    - a. Review delivery, storage, and handling procedures.
    - b. Review ambient conditions and ventilation procedures.
    - c. Review subfloor preparation procedures.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
1. Include manufacturer's written data on physical characteristics, durability, and fade resistance.
  2. Include manufacturer's written installation recommendations for each type of substrate.
- B. Shop Drawings: For carpet tile installation, plans showing the following:
1. Columns, doorways, enclosing walls or partitions, built-in cabinets, and locations where cutouts are required in carpet tiles.
  2. Carpet tile type, color, and dye lot.
  3. Type of subfloor.
  4. Type of installation.
  5. Pattern of installation.
  6. Pattern type, location, and direction.
  7. Pile direction.
  8. Type, color, and location of insets and borders.
  9. Type, color, and location of edge, transition, and other accessory strips.
  10. Transition details to other flooring materials.
- C. Samples for Initial Selection: For each type of carpet tile.
1. Include Samples of exposed edge, transition, and other accessory stripping involving color or finish selection.
- D. Samples for Verification: For each of the following products and for each color and texture required. Label each Sample with manufacturer's name, material description, color, pattern, and designation indicated on Drawings and in schedules.
1. Carpet Tile: Full-size Sample.
- E. Product Schedule: For carpet tile. Use same designations indicated on Drawings.

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TILE CARPETING

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1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer.
- B. Product Test Reports: For carpet tile, for tests performed by a qualified testing agency.
- C. Sample Warranty: For special warranty.

1.5 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For carpet tiles to include in maintenance manuals. Include the following:
  - 1. Methods for maintaining carpet tile, including cleaning and stain-removal products and procedures and manufacturer's recommended maintenance schedule.
  - 2. Precautions for cleaning materials and methods that could be detrimental to carpet tile.

1.6 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials, from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
  - 1. Carpet Tile: Full-size units equal to 15 percent of amount installed for each type indicated, but not less than 10 sq. yd..

1.7 QUALITY ASSURANCE

- A. Installer Qualifications: An experienced installer who is certified by the International Certified Floorcovering Installers Association at the Commercial II certification level.
- B. Mockups: Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for fabrication and installation.
  - 1. Build mockups at locations and in sizes shown on Drawings.
  - 2. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Comply with the Carpet and Rug Institute's CRI 104.

1.9 FIELD CONDITIONS

- A. Comply with the Carpet and Rug Institute's CRI 104 for temperature, humidity, and ventilation limitations.

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TILE CARPETING

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- B. Environmental Limitations: Do not deliver or install carpet tiles until spaces are enclosed and weathertight, wet-work in spaces is complete and dry, and ambient temperature and humidity conditions are maintained at levels planned for building occupants during the remainder of the construction period.
- C. Do not install carpet tiles over concrete slabs until slabs have cured and are sufficiently dry to bond with adhesive and concrete slabs have pH range recommended by carpet tile manufacturer.
- D. Where demountable partitions or other items are indicated for installation on top of carpet tiles, install carpet tiles before installing these items.

1.10 WARRANTY

- A. Special Warranty for Carpet Tiles: Manufacturer agrees to repair or replace components of carpet tile installation that fail in materials or workmanship within specified warranty period.
  - 1. Warranty does not include deterioration or failure of carpet tile due to unusual traffic, failure of substrate, vandalism, or abuse.
  - 2. Failures include, but are not limited to, the following:
    - a. Edge raveling, snags, and runs.
    - b. Dimensional instability.
    - c. Excess static discharge.
    - d. Loss of tuft-bind strength.
    - e. Loss of face fiber.
    - f. Delamination.
  - 3. Warranty Period: 20 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 CARPET TILE

- A. Product/Manufacturer: As indicated on Drawings.
- B. Color: As indicated by manufacturer's designations.
- C. Performance Characteristics:
  - 1. Critical Radiant Flux Classification: Not less than 0.45 W/sq. cm according to NFPA 253.

2.2 INSTALLATION ACCESSORIES

- A. Trowelable Leveling and Patching Compounds: Latex-modified, hydraulic-cement-based formulation provided or recommended by carpet tile manufacturer.
- B. Adhesives: Water-resistant, mildew-resistant, nonstaining, pressure-sensitive type to suit products and subfloor conditions indicated, that comply with flammability requirements for installed carpet tile, and are recommended by carpet tile manufacturer for releasable installation.

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TILE CARPETING

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PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for maximum moisture content, alkalinity range, installation tolerances, and other conditions affecting carpet tile performance.
- B. Examine carpet tile for type, color, pattern, and potential defects.
- C. Concrete Slabs: Verify that finishes comply with requirements of the carpet tile manufacturer and that surfaces are free of cracks, ridges, depressions, scale, and foreign deposits.
  - 1. Moisture Testing: Perform tests so that each test area does not exceed 1000 sq. ft., and perform no fewer than three tests in each installation area and with test areas evenly spaced in installation areas.
    - a. Relative Humidity Test: Using in situ probes, ASTM F2170. Proceed with installation only after substrates have a maximum 75 percent relative humidity level measurement.
    - b. Perform additional moisture tests recommended in writing by adhesive and carpet tile manufacturers. Proceed with installation only after substrates pass testing.
- D. Wood Subfloors: Verify the following:
  - 1. Surface is free of irregularities and substances that may interfere with adhesive bond or show through surface.
  - 2. Fasten existing wood flooring to eliminate movement causing squeaks.
- E. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. General: Comply with the Carpet and Rug Institute's CRI 104 and with carpet tile manufacturer's written installation instructions for preparing substrates indicated to receive carpet tile.
- B. Use trowelable leveling and patching compounds, according to manufacturer's written instructions, to fill cracks, holes, depressions, and protrusions in substrates. Fill or level cracks, holes and depressions 1/8 inch wide or wider, and protrusions more than 1/32 inch unless more stringent requirements are required by manufacturer's written instructions.
- C. Concrete Substrates: Remove coatings, including curing compounds, and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, without using solvents. Use mechanical methods recommended in writing by adhesive and carpet tile manufacturers.
- D. Broom and vacuum clean substrates to be covered immediately before installing carpet tile.

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TILE CARPETING

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3.3 INSTALLATION

- A. General: Comply with the Carpet and Rug Institute's CRI 104, Section 10, "Carpet Tile," and with carpet tile manufacturer's written installation instructions.
- B. Installation Method: Glue down; install every tile with full-spread, releasable, pressure-sensitive adhesive.
- C. Maintain dye-lot integrity. Do not mix dye lots in same area.
- D. Maintain pile-direction patterns recommended in writing by carpet tile manufacturer.
- E. Cut and fit carpet tile to butt tightly to vertical surfaces, permanent fixtures, and built-in furniture including cabinets, pipes, outlets, edgings, thresholds, and nosings. Bind or seal cut edges as recommended by carpet tile manufacturer.
- F. Extend carpet tile into toe spaces, door reveals, closets, open-bottomed obstructions, removable flanges, alcoves, and similar openings.
- G. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on carpet tile as marked on subfloor. Use nonpermanent, nonstaining marking device.
- H. Install pattern parallel to walls and borders.

3.4 CLEANING AND PROTECTION

- A. Perform the following operations immediately after installing carpet tile:
  - 1. Remove excess adhesive and other surface blemishes using cleaner recommended by carpet tile manufacturer.
  - 2. Remove yarns that protrude from carpet tile surface.
  - 3. Vacuum carpet tile using commercial machine with face-beater element.
- B. Protect installed carpet tile to comply with the Carpet and Rug Institute's CRI 104, Section 13.7.
- C. Protect carpet tile against damage from construction operations and placement of equipment and fixtures during the remainder of construction period. Use protection methods indicated or recommended in writing by carpet tile manufacturer.

END OF SECTION 09 68 13

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INTERIOR PAINTING

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SECTION 09 91 23 - INTERIOR PAINTING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
  - 1. Primers.
  - 2. Finish coatings.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product. Include preparation requirements and application instructions.
  - 1. Include preparation requirements and application instructions.
  - 2. Indicate VOC content.
- B. Samples for Verification: For each type of paint system and each color and gloss of topcoat.
  - 1. Submit Samples on rigid backing, 8 inches square.
  - 2. Apply coats on Samples in steps to show each coat required for system.
  - 3. Label each coat of each Sample.
  - 4. Label each Sample for location and application area.
- C. Product Schedule: Use same designations indicated on Drawings and in the Interior Painting Schedule to cross-reference paint systems specified in this Section. Include color designations.

1.3 QUALITY ASSURANCE

- A. Mockups: Apply mockups of each paint system indicated and each color and finish selected to verify preliminary selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
  - 1. Architect will select one surface to represent surfaces and conditions for application of each paint system.
    - a. Vertical and Horizontal Surfaces: Provide samples of at least 100 sq. ft..
    - b. Other Items: Architect will designate items or areas required.
  - 2. Final approval of color selections will be based on mockups.
    - a. If preliminary color selections are not approved, apply additional mockups of additional colors selected by Architect at no added cost to Owner.
  - 3. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
  - 4. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

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INTERIOR PAINTING

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1.4 DELIVERY, STORAGE, AND HANDLING

- A. Store materials not in use in tightly covered containers in well-ventilated areas with ambient temperatures continuously maintained at not less than 45 deg F.
  - 1. Maintain containers in clean condition, free of foreign materials and residue.
  - 2. Remove rags and waste from storage areas daily.

1.5 FIELD CONDITIONS

- A. Apply paints only when temperature of surfaces to be painted and ambient air temperatures are between 50 and 95 deg F.
- B. Do not apply paints when relative humidity exceeds 85 percent; at temperatures of less than 5 deg F above the dew point; or to damp or wet surfaces.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Benjamin Moore & Co.
  - 2. PPG Paints.
  - 3. Sherwin-Williams Company (The).
- B. Source Limitations: Obtain each paint product from single source from single manufacturer.

2.2 PAINT PRODUCTS, GENERAL

- A. Material Compatibility:
  - 1. Materials for use within each paint system shall be compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.
  - 2. For each coat in a paint system, products shall be recommended in writing by topcoat manufacturers for use in paint system and on substrate indicated.
- B. Colors: As indicated in a color schedule.

2.3 INTERIOR PRIMERS

- A. Interior Concrete and Masonry Primer: Factory-formulated acrylic-latex interior primer for interior application.
  - 1. Sherwin-Williams; Loxon Concrete and Masonry Primer LX02WQ050: Applied at a dry film thickness of not less than 3.2 mils.

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INTERIOR PAINTING

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- B. Interior Gypsum Board Primer: Factory-formulated latex-based primer for interior application.
  - 1. Sherwin-Williams; ProMar 200 Zero VOC Interior Latex Primer B28W2600 Series: Applied at a dry film thickness of not less than 1.1 mils.
- C. Interior Ferrous-Metal Primer: Factory-formulated quick-drying rust-inhibitive alkyd-based metal primer.
  - 1. Sherwin-Williams; Pro-Cryl Universal Metal Primer B66-310 Series: Applied at a dry film thickness of not less than 3.0 mils.
- D. Interior Zinc-Coated Metal Primer: Factory-formulated galvanized metal primer.
  - 1. Sherwin-Williams; Pro-Cryl Universal Metal Primer B66-310 Series: Applied at a dry film thickness of not less than 3.0 mils.

2.4 INTERIOR FINISH COATS

- A. Interior Flat Acrylic Paint: Factory-formulated flat latex paint for interior application.
  - 1. Sherwin-Williams; ProMar 200 Zero VOC Interior Latex Flat Wall Paint B30W12651 Series: Applied at a dry film thickness of not less than 1.4 mils.
- B. Interior Low-Luster Acrylic Enamel: Factory-formulated eggshell latex interior enamel.
  - 1. Sherwin-Williams; ProMar 200 Zero VOC Interior Latex Egg-Shell Enamel B20W12651 Series: Applied at a dry film thickness of not less than 1.6 mils.
- C. Interior Semigloss Acrylic Enamel: Factory-formulated semigloss latex enamel for interior application.
  - 1. Sherwin-Williams; ProMar 200 Zero VOC Interior Latex Semi-Gloss Enamel B31W02651 Series: Applied at a dry film thickness of not less than 1.3 mils.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.
- B. Maximum Moisture Content of Substrates: When measured with an electronic moisture meter as follows:
  - 1. Concrete: 12 percent.
  - 2. Masonry (Clay and CMUs): 12 percent.
  - 3. Wood: 15 percent.
  - 4. Gypsum Board: 12 percent.
- C. Gypsum Board Substrates: Verify that finishing compound is sanded smooth.
- D. Verify suitability of substrates, including surface conditions and compatibility, with existing finishes and primers.

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## INTERIOR PAINTING

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- E. Proceed with coating application only after unsatisfactory conditions have been corrected.
  - 1. Application of coating indicates acceptance of surfaces and conditions.

### 3.2 PREPARATION

- A. Comply with manufacturer's written instructions and recommendations applicable to substrates and paint systems indicated.
- B. Remove hardware, covers, plates, and similar items already in place that are removable and are not to be painted. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and painting.
  - 1. After completing painting operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection if any.
- C. Clean substrates of substances that could impair bond of paints, including dust, dirt, oil, grease, and incompatible paints and encapsulants.
  - 1. Remove incompatible primers and reprime substrate with compatible primers or apply tie coat as required to produce paint systems indicated.
- D. Concrete Substrates: Remove release agents, curing compounds, efflorescence, and chalk. Do not paint surfaces if moisture content or alkalinity of surfaces to be painted exceeds that permitted in manufacturer's written instructions.
- E. Masonry Substrates: Remove efflorescence and chalk. Do not paint surfaces if moisture content or alkalinity of surfaces or mortar joints exceeds that permitted in manufacturer's written instructions.
- F. Steel Substrates: Remove rust, loose mill scale, and shop primer, if any. Clean using methods recommended in writing by paint manufacturer.
- G. Shop-Primed Steel Substrates: Clean field welds, bolted connections, and areas where shop paint is abraded. Paint exposed areas with the same material as used for shop priming to comply with SSPC-PA 1 for touching up shop-primed surfaces.
- H. Galvanized-Metal Substrates: Remove grease and oil residue from galvanized sheet metal by mechanical methods to produce clean, lightly etched surfaces that promote adhesion of subsequently applied paints.

### 3.3 INSTALLATION

- A. Apply paints according to manufacturer's written instructions.
  - 1. Use applicators and techniques suited for paint and substrate indicated.
  - 2. Paint surfaces behind movable equipment and furniture same as similar exposed surfaces. Before final installation, paint surfaces behind permanently fixed equipment or furniture with prime coat only.
  - 3. Paint front and backsides of access panels, removable or hinged covers, and similar hinged items to match exposed surfaces.

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INTERIOR PAINTING

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4. Do not paint over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.
  5. Primers specified in painting schedules may be omitted on items that are factory primed or factory finished if acceptable to topcoat manufacturers.
- B. 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.
- C. If undercoats or other conditions show through topcoat, apply additional coats until cured film has a uniform paint finish, color, and appearance.
- D. 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.
- E. Painting Fire-Suppression, Plumbing, HVAC, Electrical, Communication, and Electronic Safety and Security Work:
1. Paint the following work where exposed in equipment rooms:
    - a. Equipment, including panelboards.
    - b. Uninsulated metal piping.
    - c. Uninsulated plastic piping.
    - d. Pipe hangers and supports.
    - e. Metal conduit.
    - f. Plastic conduit.
    - g. Tanks that do not have factory-applied final finishes.
    - h. Duct, equipment, and pipe insulation having cotton or canvas insulation covering or other paintable jacket material.
  2. Paint the following work where exposed in occupied spaces:
    - a. Equipment, including panelboards.
    - b. Uninsulated metal piping.
    - c. Uninsulated plastic piping.
    - d. Pipe hangers and supports.
    - e. Metal conduit.
    - f. Plastic conduit.
    - g. Duct, equipment, and pipe insulation having cotton or canvas insulation covering or other paintable jacket material.
    - h. Other items as directed by Architect.
  3. Paint portions of internal surfaces of metal ducts, without liner, behind air inlets and outlets that are visible from occupied spaces.

### 3.4 FIELD QUALITY CONTROL

- A. Dry-Film Thickness Testing: Owner may engage the services of a qualified testing and inspecting agency to inspect and test paint for dry-film thickness.
1. Contractor shall touch up and restore painted surfaces damaged by testing.
  2. If test results show that dry-film thickness of applied paint does not comply with paint manufacturer's written recommendations, Contractor shall pay for testing

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## INTERIOR PAINTING

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and apply additional coats as needed to provide dry-film thickness that complies with paint manufacturer's written recommendations.

### 3.5 CLEANING AND PROTECTION

- A. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.
  - 1. Do not clean equipment with free-draining water and prevent solvents, thinners, cleaners, and other contaminants from entering into waterways, sanitary and storm drain systems, and ground.
  - 2. Dispose of contaminants in accordance with requirements of authorities having jurisdiction.
  - 3. Allow empty paint cans to dry before disposal.
  - 4. Collect waste paint by type and deliver to recycling or collection facility.
- B. After completing paint application, clean spattered surfaces. Remove spattered paints by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.
- C. Protect work of other trades against damage from paint application. Correct damage to work of other trades by cleaning, repairing, replacing, and refinishing, as approved by Architect, and leave in an undamaged condition.
- D. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.

### 3.6 INTERIOR PAINTING SCHEDULE

- A. Concrete and Masonry (Other Than Concrete Unit Masonry): Provide the following paint systems over interior concrete and brick masonry substrates:
  - 1. Semigloss Acrylic-Enamel Finish: Two finish coats over a primer.
    - a. Primer: Interior concrete and masonry primer. Provide interior vapor barrier primer in locations indicated on Drawings.
    - b. Finish Coats: Interior semigloss acrylic enamel.
- B. Gypsum Board: Provide the following finish systems over interior gypsum board surfaces:
  - 1. Flat Acrylic Finish: Two finish coats over a primer.
    - a. Primer: Interior gypsum board primer.
    - b. Finish Coats: Interior flat acrylic paint.
  - 2. Low-Luster Acrylic-Enamel Finish: Two finish coats over a primer.
    - a. Primer: Interior gypsum board primer. Provide interior vapor barrier primer in locations indicated on Drawings.
    - b. Finish Coats: Interior low-luster acrylic enamel.
  - 3. Semigloss Acrylic-Enamel Finish: Two finish coats over a primer.
    - a. Primer: Interior gypsum board primer. Provide interior vapor barrier primer in locations indicated on Drawings.
    - b. Finish Coats: Interior semigloss acrylic enamel.

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INTERIOR PAINTING

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- C. Ferrous Metal: Provide the following finish systems over ferrous metal:
  - 1. Semigloss Acrylic-Enamel Finish: Two finish coats over a primer.
    - a. Primer: Interior ferrous-metal primer.
    - b. Finish Coats: Interior semigloss acrylic enamel.
- D. Zinc-Coated Metal: Provide the following finish systems over interior zinc-coated metal surfaces:
  - 1. Semigloss Acrylic-Enamel Finish: Two finish coats over a primer.
    - a. Primer: Interior zinc-coated metal primer.
    - b. Finish Coats: Interior semigloss acrylic enamel.

END OF SECTION 09 91 23

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VISUAL DISPLAY UNITS

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SECTION 10 11 00 - VISUAL DISPLAY UNITS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
  - 1. Glass markerboards.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product.
  - 1. Include construction details, material descriptions, dimensions of individual components and profiles, finishes, and accessories for visual display units.

1.3 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For visual display units to include in maintenance manuals.

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Deliver factory-fabricated visual display units completely assembled in one piece. If dimensions exceed maximum manufactured unit size, or if unit size is impracticable to ship in one piece, provide two or more pieces with joints in locations indicated on approved Shop Drawings.

1.5 FIELD CONDITIONS

- A. Environmental Limitations: Do not deliver or install visual display units 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.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Surface-Burning Characteristics: Comply with ASTM E84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
  - 1. Flame-Spread Index: 25 or less.
  - 2. Smoke-Developed Index: 450 or less.

2.2 GLASS MARKERBOARDS

- A. Product/Manufacturer: Basis of design.
  - 1. As indicated on Drawings.

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VISUAL DISPLAY UNITS

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- B. Glass Markerboards: Fabricated of low-iron 6-mm tempered glass with steel backing for use with magnets.
  - 1. Edge Treatment: Smooth polished edge with eased corners.
  - 2. Surface: Matte.
  - 3. Color: White.
- C. Mounting: Concealed, Z-shaped brackets.
- D. Size: As indicated on Drawings.

2.3 MATERIALS

- A. Clear Tempered Glass: ASTM C1048, Kind FT, Condition A, Type I, Class 1, Quality Q3, with exposed edges seamed before tempering.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions, with Installer present, for compliance with requirements for installation tolerances, surface conditions of wall, and other conditions affecting performance of the Work.
- B. Examine walls and partitions for proper preparation and backing for visual display units.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Comply with manufacturer's written instructions for surface preparation.
- B. Clean substrates of substances, such as dirt, mold, and mildew, that could impair the performance of and affect the smooth, finished surfaces of visual display boards.

3.3 INSTALLATION

- A. General: Install visual display surfaces in locations and at mounting heights indicated on Drawings. Keep perimeter lines straight, level, and plumb. Provide grounds, clips, backing materials, adhesives, brackets, anchors, trim, and accessories necessary for complete installation.
- B. Factory-Fabricated Visual Display Board Assemblies: Attach concealed clips, hangers, and grounds to wall surfaces and to visual display board assemblies with fasteners at not more than 16 inches o.c. Secure tops and bottoms of boards to walls.

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VISUAL DISPLAY UNITS

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3.4 CLEANING AND PROTECTION

- A. Clean visual display units in accordance with manufacturer's written instructions. Attach one removable cleaning instructions label to visual display unit in each room.
- B. Cover and protect visual display units after installation and cleaning.

END OF SECTION 10 11 00

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VINYL GRAPHIC SIGNAGE

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SECTION 10 14 19.13 - VINYL GRAPHIC SIGNAGE

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes surface applied vinyl graphic signs.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings:
  - 1. Include fabrication and installation details and attachments to other work.
  - 2. Show sign size and mounting heights.
  - 3. Show message list, tpestyles, graphic elements, and layout for each sign.
- C. Samples for Initial Selection: For each type of sign assembly, exposed component, and exposed finish.
  - 1. Include representative Samples of available tpestyles and graphic symbols.
- D. Samples for Verification: For each type of sign assembly showing all components and with the required finish(es), in manufacturer's standard size unless otherwise indicated and as follows:
  - 1. Vinyl Graphic Signs: Full-size Sample.
- E. Product Schedule: Use same designations indicated on Drawings or specified.

1.3 INFORMATIONAL SUBMITTALS

- A. Sample Warranty: For special warranty.

1.4 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For signs to include in maintenance manuals.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.

1.6 FIELD CONDITIONS

- A. Field Measurements: Verify locations of applied vinyl graphic sign applied to permanent construction by other installers by field measurements before fabrication, and indicate measurements on Shop Drawings.

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VINYL GRAPHIC SIGNAGE

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1.7 WARRANTY

- A. Special Warranty: Manufacturer agrees to replace signs that fail in materials or workmanship within specified warranty period.
  - 1. Failures include, but are not limited to, the following:
    - a. Deterioration of finishes beyond normal weathering.
    - b. Separation or delamination from substrate of sheet materials.
  - 2. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Field-Applied, Vinyl-Character Sign: Characters die cut from 3- to 3.5-mil thick, weather-resistant vinyl film with release liner on the back and carrier film on the front for on-site alignment and application.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Allen Markings.
    - b. APCO Graphics, Inc.
    - c. Inpro Corporation.
    - d. Mohawk Sign Systems.
    - e. Seton Identification Products; a Brady Corporation company.
  - 2. Size: As indicated on Drawings.
  - 3. Substrate: As indicated on Drawings.
  - 4. Text and Font: As indicated on Drawings.

2.2 ACCESSORIES

- A. Adhesive: As recommended by sign manufacturer and compatible with substrate indicated.

2.3 FABRICATION

- A. General: Provide manufacturer's sign assemblies according to requirements indicated.
- B. Surface Applied Vinyl Graphics: Product die cut to precisely formed images as indicated on Drawings. Image shall be free of rough edges.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. General: Install signs using mounting methods indicated and according to manufacturer's written instructions.
  - 1. Install signs level, plumb, true to line, and at locations and heights indicated, with sign surfaces free of distortion and other defects in appearance.
  - 2. Before installation, verify that sign surfaces are clean and free of materials or debris that would impair installation.

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VINYL GRAPHIC SIGNAGE

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B. Mounting Methods:

1. Adhesive: Clean bond-breaking materials from substrate surface and remove loose debris. Keep adhesive away from edges to prevent adhesive extrusion as sign is applied and to prevent visibility of cured adhesive at sign edges. Place sign in position, and push to engage adhesive. Temporarily support sign in position until adhesive fully sets.
2. Align vinyl film in final position and apply to surface. Firmly press film from the middle outward to obtain good bond without blisters or fishmouths.

3.2 ADJUSTING AND CLEANING

- A. Remove and replace damaged or deformed signs and signs that do not comply with specified requirements. Replace signs with damaged or deteriorated finishes or components that cannot be successfully repaired by finish touchup or similar minor repair procedures.
- B. Remove temporary protective coverings.
- C. On completion of installation, clean exposed surfaces of signs according to manufacturer's written instructions, and touch up minor nicks and abrasions in finish. Maintain signs in a clean condition during construction and protect from damage until acceptance by Owner.

END OF SECTION 10 14 19.13

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ROOM-IDENTIFICATION PANEL SIGNAGE

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SECTION 10 14 23.16 - ROOM-IDENTIFICATION PANEL SIGNAGE

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes room-identification signs that are directly attached to the building.

1.2 DEFINITIONS

- A. Accessible: In accordance with the accessibility standard.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: For room-identification signs.
  - 1. Include fabrication and installation details and attachments to other work.
  - 2. Show sign mounting heights, locations of supplementary supports to be provided by other installers, and accessories.
  - 3. Show message list, typestyles, graphic elements, including raised characters and Braille, and layout for each sign at least half size.
- C. Samples for Initial Selection: For each type of sign assembly, exposed component, and exposed finish.
  - 1. Include representative Samples of available typestyles and graphic symbols.
- D. Samples for Verification: For each type of sign assembly showing all components and with the required finish(es), in manufacturer's standard size unless otherwise indicated and as follows:
  - 1. Room-Identification Signs: Full-size Sample.
- E. Product Schedule: For room-identification signs. Use same designations indicated on Drawings or specified.

1.4 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For signs to include in maintenance manuals.

1.5 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace components of signs that fail in materials or workmanship within specified warranty period.
  - 1. Failures include, but are not limited to, the following:
    - a. Deterioration of finishes beyond normal weathering.
    - b. Deterioration of embedded graphic image.
    - c. Separation or delamination of sheet materials and components.
  - 2. Warranty Period: Five years from date of Substantial Completion.

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ROOM-IDENTIFICATION PANEL SIGNAGE

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PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Accessibility Standard: Comply with applicable provisions in the USDOJ's "2010 ADA Standards for Accessible Design" and ICC A117.1.

2.2 ROOM-IDENTIFICATION SIGNS

- A. Room-Identification Sign: Sign with smooth, uniform surfaces; with message and characters having uniform faces, sharp corners, and precisely formed lines and profiles; and as follows:
1. Product/Manufacturer: Basis of design.
    - a. As indicated on Drawings.
  2. Text and Typeface: Accessible raised characters and Braille.

2.3 SIGNS

- A. Signage System:
1. The signage shall incorporate a decorative laminate face with applied graphics including all tactile requirements in adherence to ADA specifications.
- B. Materials:
1. Sign face shall be 0.035-inch (nominal) standard grade, high pressure surface laminate. A painted sign face shall not be acceptable.
  2. The sign shall incorporate balanced construction with the core sandwiched between laminates to prevent warping. Laminate on the sign face only shall not be acceptable.
  3. Tactile lettering shall be precision machined, raised 1/32-inch, matte PETG and subsurface colored for scratch resistance.
  4. Signs shall incorporate a metal accent bar. Bars shall be anodized with a brushed satin finish. Painted bars shall not be acceptable.
- C. Standard Colors:
1. Face/background color shall be standard grade, high pressure laminate, all colors and finishes.
  2. Standard tactile colors shall match manufacturer's ADA standard color selection.
- D. Construction:
1. The signage shall, with the exception of directories and directionals, be a uniform 8-½ inches width to facilitate inserts printed on standard width paper.
  2. Insert components shall have a 0.080-inch thickness non-glare acrylic window and shall be inlaid flush to sign face for a smooth, seamless appearance.
  3. The signage shall include modules allowing for inserts. All modules shall be flush to sign face for a smooth, seamless appearance.
  4. The laminates (front and back) shall be pressure laminated and precision machined together to a 90-degree angle. Edges shall be smooth, void of chips, burrs, sharp edges and marks.

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ROOM-IDENTIFICATION PANEL SIGNAGE

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5. The signage shall utilize an acrylic sphere for Grade II Braille inserted directly into a scratch resistant, high pressure laminate sign face. Braille dots are to be pressure fit in high tolerance drilled holes.
6. Braille dots shall be half hemispherical domed and protruding a minimum 0.025-inch.
7. 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 to changes in temperature and moisture without bond failure.
8. All signs shall be provided with appropriate mounting hardware. Hardware shall be finished and architectural in appearance and suitable for the mounting surface.
9. Signs installed on glass: Blank backer is required to be placed on the opposite side of the glass to cover tape and adhesive. The backer shall match the sign in size and shape.

E. Printed Inserts:

1. The signage shall be capable of accepting paper or acetate inserts to allow changing and updating as required. Insert components shall have a 0.080-inch thickness non-glare acrylic window and shall be inlaid flush to sign face for a smooth, seamless appearance.
2. The signage contractor shall provide and install all signage inserts.
3. Manufacturer shall provide a template containing layout, font, color, artwork and trim lines to allow Owner to produce inserts on laser or ink jet printer. The template shall be in an Acrobat (.pdf) and Word format.

2.4 ACCESSORIES

- A. Adhesive: As recommended by sign manufacturer.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. General: Install signs using mounting methods indicated and according to manufacturer's written instructions.
1. Install signs level, plumb, true to line, and at locations and heights indicated, with sign surfaces free of distortion and other defects in appearance.
  2. Install signs so they do not protrude or obstruct according to the accessibility standard.
  3. Before installation, verify that sign surfaces are clean and free of materials or debris that would impair installation.
- B. Accessibility: Install signs in locations on walls as indicated on Drawings and according to the accessibility standard.
- C. Mounting Methods:
1. Adhesive: Clean bond-breaking materials from substrate surface and remove loose debris. Apply linear beads or spots of adhesive symmetrically to back of sign and of suitable quantity to support weight of sign after cure without slippage.

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ROOM-IDENTIFICATION PANEL SIGNAGE

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Keep adhesive away from edges to prevent adhesive extrusion as sign is applied and to prevent visibility of cured adhesive at sign edges. Place sign in position, and push to engage adhesive. Temporarily support sign in position until adhesive fully sets.

3.2 ADJUSTING AND CLEANING

- A. Remove and replace damaged or deformed signs and signs that do not comply with specified requirements. Replace signs with damaged or deteriorated finishes or components that cannot be successfully repaired by finish touchup or similar minor repair procedures.
- B. Remove temporary protective coverings and strippable films as signs are installed.
- C. On completion of installation, clean exposed surfaces of signs according to manufacturer's written instructions, and touch up minor nicks and abrasions in finish. Maintain signs in a clean condition during construction and protect from damage until acceptance by Owner.

END OF SECTION 10 14 23.16

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ROLLER WINDOW SHADES

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SECTION 12 24 13 - ROLLER WINDOW SHADES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
  - 1. Manually operated, single-roller shades.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product.
  - 1. Include construction details, material descriptions, dimensions of individual components and profiles, features, finishes, and operating instructions for roller shades.
- B. Shop Drawings: Show fabrication and installation details for roller shades, including shadeband materials, their orientation to rollers, and their seam and batten locations.
  - 1. Motor-Operated Shades: Include details of installation and diagrams for power, signal, and control wiring.
- C. Samples for Initial Selection: For each type and color of shadeband material.
  - 1. Include Samples of accessories involving color selection.

1.3 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For roller shades to include in maintenance manuals.

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Deliver roller shades in factory packages, marked with manufacturer, product name, and location of installation using same designations indicated on Drawings.

1.5 FIELD CONDITIONS

- A. Environmental Limitations: Do not install roller shades until construction and finish work in spaces, including painting, is complete and dry and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.
- B. Field Measurements: Where roller shades are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication and indicate measurements on Shop Drawings. Allow clearances for operating hardware of operable glazed units through entire operating range. Notify Architect of installation conditions that vary from Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

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ROLLER WINDOW SHADES

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PART 2 - PRODUCTS

2.1 SOURCE LIMITATIONS

- A. Obtain roller shades from single source from single manufacturer.

2.2 MANUALLY OPERATED, SINGLE-ROLLER SHADES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Draper, Inc.
  2. Lutron Electronics Co., Inc.
  3. MechoShade Systems, LLC.
- B. Chain-and-Clutch Operating Mechanisms: With continuous-loop bead chain and clutch that stops shade movement when bead chain is released; permanently adjusted and lubricated.
1. Bead Chains: Stainless steel.
    - a. Loop Length: Full length of roller shade.
    - b. Limit Stops: Provide upper and lower ball stops.
    - c. Chain-Retainer Type: Clip, jamb mount.
- C. Rollers: Corrosion-resistant steel or extruded-aluminum tubes of diameters and wall thicknesses required to accommodate operating mechanisms and weights and widths of shadebands indicated without deflection. Provide with permanently lubricated drive-end assemblies and idle-end assemblies designed to facilitate removal of shadebands for service.
1. Roller Drive-End Location: Right side of interior face of shade.
  2. Direction of Shadeband Roll: Regular, from back (exterior face) of roller.
  3. Shadeband-to-Roller Attachment: Manufacturer's standard method.
- D. Mounting Hardware: Brackets or endcaps, corrosion resistant and compatible with roller assembly, operating mechanism, installation accessories, and mounting location and conditions indicated.
- E. Shadebands:
1. Shadeband Material: Light-filtering fabric and Light-blocking fabric.
  2. Shadeband Bottom (Hem) Bar: Steel or extruded aluminum.
    - a. Type: Enclosed in sealed pocket of shadeband material.
- F. Installation Accessories:
1. Front Fascia: Aluminum extrusion that conceals front and underside of roller and operating mechanism and attaches to roller endcaps without exposed fasteners.
    - a. Shape: L-shaped.
    - b. Height: Manufacturer's standard height required to conceal roller and shadeband assembly when shade is fully open, but not less than 4 inches.
  2. Endcap Covers: To cover exposed endcaps.

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## ROLLER WINDOW SHADES

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3. Side Channels: With light seals and designed to eliminate light gaps at sides of shades as shades are drawn down. Provide side channels with shadeband guides or other means of aligning shadebands with channels at tops.
4. Bottom (Sill) Channel or Angle: With light seals and designed to eliminate light gaps at bottoms of shades when shades are closed.
5. Installation Accessories Color and Finish: As selected from manufacturer's full range.

### 2.3 SHADEBAND MATERIALS

- A. Shadeband Material Flame-Resistance Rating: Comply with NFPA 701. Testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
- B. Light-Filtering Fabric: Woven fabric, stain and fade resistant.
  1. Source: Roller shade manufacturer.
  2. Weave: Mesh.
  3. Openness Factor: 3 percent.
  4. Color: As indicated on Drawings.
- C. Light-Blocking Fabric: Opaque fabric, stain and fade resistant.
  1. Source: Roller shade manufacturer.
  2. Color: As indicated on Drawings.

### 2.4 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 other openings as follows, measured at 74 deg F:
  1. Between (Inside) Jamb Installation: Width equal to jamb-to-jamb dimension of opening in which shade is installed less 1/4 inch per side or 1/2-inch total, plus or minus 1/8 inch. Length equal to head-to-sill or -floor dimension of opening in which shade is installed less 1/4 inch, plus or minus 1/8 inch.
  2. Outside of Jamb Installation: Width and length as indicated, with terminations between shades of end-to-end installations at centerlines of mullion or other defined vertical separations between openings.
- C. Shadeband Fabrication: Fabricate shadebands without battens or seams to extent possible, except as follows:
  1. Skylight Shades: Provide battens and seams at uniform spacings along shadeband as required to ensure shadeband tracking and alignment through its full range of movement without distortion or sag of material.

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ROLLER WINDOW SHADES

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PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, operational clearances, and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 ROLLER SHADE INSTALLATION

- A. Install roller shades level, plumb, and aligned with adjacent units according to manufacturer's written instructions.
  - 1. Opaque Shadebands: Located so shadeband is not closer than 2 inches to interior face of glass. Allow clearances for window operation hardware.
- B. Roller Shade Locations: As indicated on Drawings.

3.3 ADJUSTING

- A. Adjust and balance roller shades to operate smoothly, easily, safely, and free from binding or malfunction throughout entire operational range.

3.4 CLEANING AND PROTECTION

- A. Clean roller shade surfaces, after installation, according to manufacturer's written instructions.
- B. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer, that ensure that roller shades are without damage or deterioration at time of Substantial Completion.
- C. Replace damaged roller shades that cannot be repaired, in a manner approved by Architect, before time of Substantial Completion.

END OF SECTION 12 24 13



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PLASTIC-LAMINATE-CLAD COUNTERTOPS

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SECTION 12 36 23.13 - PLASTIC-LAMINATE-CLAD COUNTERTOPS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
  - 1. Plastic-laminate-clad countertops.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: For plastic-laminate-clad countertops.
  - 1. Include plans, sections, details, and attachments to other work. Detail fabrication and installation, including field joints.
  - 2. Show locations and sizes of cutouts and holes for items installed in plastic-laminate-clad countertops.
- C. Samples for Initial Selection: For plastic laminates.
- D. Samples for Verification: As follows:
  - 1. Plastic Laminates: For each type, color, pattern, and surface finish required, 8 by 10 inches in size.
  - 2. Fabrication Sample: For each type and profile of countertop required, provide one sample applied to core material with specified edge material applied to one edge.

1.3 INFORMATIONAL SUBMITTALS

1.4 QUALITY ASSURANCE

- A. Fabricator Qualifications: Shop that employs skilled workers who custom fabricate products similar to those required for this Project and whose products have a record of successful in-service performance.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Deliver countertops only after casework and supports on which they will be installed have been completed in installation areas.
- B. Store countertops in areas where environmental conditions comply with requirements specified in "Field Conditions" Article.
- C. Keep surfaces of countertops covered with protective covering during handling and installation.

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PLASTIC-LAMINATE-CLAD COUNTERTOPS

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1.6 FIELD CONDITIONS

- A. Environmental Limitations without Humidity Control: Do not deliver or install countertops until building is enclosed, wet-work is complete, and HVAC system is operating and maintaining temperature and relative humidity at levels planned for building occupants during the remainder of the construction period.
- B. Field Measurements: Where countertops are 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.
- C. Established Dimensions: Where countertops are indicated to fit to other construction, establish dimensions for areas where countertops are to fit. Provide allowance for trimming at site, and coordinate construction to ensure that actual dimensions correspond to established dimensions.

PART 2 - PRODUCTS

2.1 PLASTIC-LAMINATE-CLAD COUNTERTOPS

- A. Quality Standard: Unless otherwise indicated, comply with the "Architectural Woodwork Standards" for grades of plastic-laminate-clad countertops indicated for construction, finishes, installation, and other requirements.
  - 1. The Contract Documents contain requirements that are more stringent than the referenced quality standard. Comply with requirements of Contract Documents in addition to those of the referenced quality standard.
- B. Grade: Custom.
- C. High-Pressure Decorative Laminate: NEMA LD 3, Grade HGS.
- D. Colors, Patterns, and Finishes: Provide materials and products that result in colors and textures of exposed laminate surfaces complying with the following requirements:
  - 1. As indicated by manufacturer's designations.
- E. Edge Treatment: 3.0-mm PVC edging.
- F. Core Material: Particleboard.
- G. Core Material at Sinks: Particleboard made with exterior glue.
- H. Core Thickness: 3/4 inch.
  - 1. Build up countertop thickness to 1-1/2 inches at front, back, and ends with additional layers of core material laminated to top.
- I. Backer Sheet: Provide plastic-laminate backer sheet, NEMA LD 3, Grade BKL, on underside of countertop substrate.

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PLASTIC-LAMINATE-CLAD COUNTERTOPS

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2.2 WOOD MATERIALS

- A. Composite Wood Products: Provide materials that comply with requirements of referenced quality standard for each type of countertop and quality grade specified unless otherwise indicated.
  - 1. Particleboard: ANSI A208.1, Grade M-2.

2.3 ACCESSORIES

- A. Wire-Management Grommets: Circular, molded-plastic grommets and matching plastic caps with slot for wire passage.
  - 1. Outside Diameter: 1-1/4 inch.
  - 2. Color: Black,

2.4 FABRICATION

- A. Fabricate countertops to dimensions, profiles, and details indicated. Provide front and end overhang of 1 inch over base cabinets. Ease edges to radius indicated for the following:
- B. Complete fabrication, including assembly, to maximum extent possible before shipment to Project site. Disassemble components only as necessary for shipment and installation. Where necessary for fitting at site, provide ample allowance for scribing, trimming, and fitting.
  - 1. Trial fit assemblies at fabrication shop that cannot be shipped completely assembled. Install dowels, screws, bolted connectors, and other fastening devices that can be removed after trial fitting. Verify that various parts fit as intended, and check measurements of assemblies against field measurements before disassembling for shipment.
- C. Shop cut openings to maximum extent possible to receive 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.
  - 1. Seal edges of cutouts by saturating with varnish.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Before installation, condition countertops to average prevailing humidity conditions in installation areas.
- B. Before installing countertops, examine shop-fabricated work for completion and complete work as required, including removal of packing.

3.2 INSTALLATION

- A. Grade: Install countertops to comply with same grade as item to be installed.

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PLASTIC-LAMINATE-CLAD COUNTERTOPS

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- B. Assemble countertops and complete fabrication at Project site to the extent that it was not completed in the shop.
  - 1. Provide cutouts for 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.
  - 2. Seal edges of cutouts by saturating with varnish.
- C. Field Jointing: Where possible, make in the same manner as shop jointing, using dowels, splines, adhesives, and fasteners recommended by manufacturer. Prepare edges to be joined in shop so Project-site processing of top and edge surfaces is not required. Locate field joints where shown on Shop Drawings.
  - 1. Secure field joints in countertops with concealed clamping devices located within 6 inches of front and back edges and at intervals not exceeding 24 inches. Tighten in accordance with manufacturer's written instructions to exert a constant, heavy-clamping pressure at joints.
- D. Scribe and cut countertops to fit adjoining work, refinish cut surfaces, and repair damaged finish at cuts.
- E. Countertop Installation: Anchor securely by screwing through corner blocks of base cabinets or other supports into underside of countertop.
  - 1. Install countertops level and true in line. Use concealed shims as required to maintain not more than a 1/8-inch-in-96-inches variation from a straight, level plane.
  - 2. Secure backsplashes to tops with concealed metal brackets at 16 inches o.c. and to walls with adhesive.
  - 3. Seal joints between countertop and backsplash, if any, and joints where countertop and backsplash abut walls with mildew-resistant silicone sealant or another permanently elastic sealing compound recommended by countertop material manufacturer.

### 3.3 ADJUSTING AND CLEANING

- A. Repair damaged and defective countertops, where possible, to eliminate functional and visual defects. Where not possible to repair, replace countertops. Adjust joinery for uniform appearance.
- B. Clean countertops on exposed and semiexposed surfaces.
- C. Protection: Provide Kraft paper or other suitable covering over countertop surfaces, taped to underside of countertop at a minimum of 48 inches o.c. Remove protection at Substantial Completion.

END OF SECTION 12 36 23.13

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SOLID SURFACING COUNTERTOPS

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SECTION 12 36 61.16 - SOLID SURFACING COUNTERTOPS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
  - 1. Solid surface material countertops.
  - 2. Solid surface material backsplashes.
  - 3. Solid surface material end splashes.

1.2 ACTION SUBMITTALS

- A. Product Data: For countertop materials.
- B. Shop Drawings: For countertops. Show materials, finishes, edge and backsplash profiles, methods of joining, and cutouts for plumbing fixtures.
  - 1. Show direction of directional pattern, if any.
- C. Samples for Initial Selection: For each type of material exposed to view.

1.3 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For fabricator.

1.4 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For solid surface material countertops to include in maintenance manuals. Include Product Data for care products used or recommended by Installer and names, addresses, and telephone numbers of local sources for products.

1.5 QUALITY ASSURANCE

- A. Fabricator Qualifications: Shop that employs skilled workers who custom-fabricate countertops similar to that required for this Project, and whose products have a record of successful in-service performance.

1.6 FIELD CONDITIONS

- A. Field Measurements: Verify dimensions of countertops by field measurements after base cabinets are installed but before countertop fabrication is complete.

1.7 COORDINATION

- A. Coordinate locations of utilities that will penetrate countertops or backsplashes.

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SOLID SURFACING COUNTERTOPS

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PART 2 - PRODUCTS

2.1 SOLID SURFACE COUNTERTOP MATERIALS

- A. Product/Manufacturer: Basis of design.
  - 1. As indicated on Drawings.
- B. Solid Surface Material: Homogeneous-filled plastic resin complying with ISFA 2-01.
  - 1. Type: Provide Standard type unless Special Purpose type is indicated.
  - 2. Colors and Patterns: As selected by Architect from manufacturer's full range.
- C. Particleboard: ANSI A208.1, Grade M-2.

2.2 FABRICATION

- A. Fabricate countertops according to solid surface material manufacturer's written instructions and to the AWI/AWMAC/WI's "Architectural Woodwork Standards."
  - 1. Grade: Custom.
- B. Configuration:
  - 1. Front: Straight, slightly eased at top.
  - 2. Backsplash: Straight, slightly eased at corner.
  - 3. End Splash: Matching backsplash.
- C. Countertops:
  - 1. 1/2-inch- thick, solid surface material.
- D. Backsplashes: 1/2-inch- thick, solid surface material.
- E. Fabricate tops with shop-applied edges unless otherwise indicated. Comply with solid surface material manufacturer's written instructions for adhesives, sealers, fabrication, and finishing.
  - 1. Fabricate with loose backsplashes for field assembly.
- F. Joints:
  - 1. Fabricate countertops without joints.

2.3 INSTALLATION MATERIALS

- A. Adhesive: Product recommended by solid surface material manufacturer.
- B. Sealant for Countertops: Comply with applicable requirements in Section 07 92 00 "Joint Sealants."

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SOLID SURFACING COUNTERTOPS

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PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates to receive solid surface material countertops and conditions under which countertops will be installed, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of countertops.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Install countertops level to a tolerance of 1/8 inch in 8 feet, 1/4 inch maximum. Do not exceed 1/64-inch difference between planes of adjacent units.
- B. Secure countertops to cabinets with adhesive according to solid surface material manufacturer's written instructions. Align adjacent surfaces and, using adhesive in color to match countertop, form seams to comply with manufacturer's written instructions. Carefully dress joints smooth, remove surface scratches, and clean entire surface.
- C. Install backsplashes and end splashes by adhering to wall and countertops with adhesive. Mask areas of countertops and splashes adjacent to joints to prevent adhesive smears.
- D. Apply sealant to gaps at walls; comply with Section 07 92 00 "Joint Sealants."

END OF SECTION 12 36 61.16

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QUARTZ AGGLOMERATE COUNTERTOPS

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SECTION 12 36 61.19 - QUARTZ AGGLOMERATE COUNTERTOPS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
  - 1. Quartz agglomerate countertops.
  - 2. Quartz agglomerate backsplashes.
  - 3. Quartz agglomerate end splashes.

1.2 ACTION SUBMITTALS

- A. Product Data: For countertop materials.
- B. Shop Drawings: For countertops. Show materials, finishes, edge and backsplash profiles, methods of joining, and cutouts for plumbing fixtures.
  - 1. Show locations and details of joints.
  - 2. Show direction of directional pattern, if any.
- C. Samples for Initial Selection: For each type of material exposed to view.

1.3 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For fabricator.

1.4 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For quartz agglomerate countertops to include in maintenance manuals. Include Product Data for care products used or recommended by Installer and names, addresses, and telephone numbers of local sources for products.

1.5 QUALITY ASSURANCE

- A. Fabricator Qualifications: Shop that employs skilled workers who custom-fabricate countertops similar to that required for this Project, and whose products have a record of successful in-service performance.

1.6 FIELD CONDITIONS

- A. Field Measurements: Verify dimensions of countertops by field measurements after base cabinets are installed but before countertop fabrication is complete.

1.7 COORDINATION

- A. Coordinate locations of utilities that will penetrate countertops or backsplashes.

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QUARTZ AGGLOMERATE COUNTERTOPS

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PART 2 - PRODUCTS

2.1 QUARTZ AGGLOMERATE COUNTERTOP MATERIALS

- A. Product/Manufacturer: Basis of design.
  - 1. As indicated on Drawings.
- B. Quartz Agglomerate: Solid sheets consisting of quartz aggregates bound together with a matrix of polymers, resins, and pigment and complying with ISFA 3-01.
  - 1. Colors and Patterns: As selected by Architect from manufacturer's full range.
- C. Particleboard: ANSI A208.1, Grade M-2.
- D. Countertop Brackets: As indicated on Drawings.

2.2 FABRICATION

- A. Fabricate countertops according to quartz agglomerate manufacturer's written instructions and the AWI/AWMAC/WI's "Architectural Woodwork Standards."
  - 1. Grade: Custom.
- B. Configuration:
  - 1. Front: Straight, slightly eased at top.
  - 2. Backsplash: Straight, slightly eased at corner.
  - 3. End Splash: Matching backsplash.
- C. Countertops: 1/2-inch- thick, quartz agglomerate.
- D. Backsplashes: 1/2-inch- thick, quartz agglomerate.
- E. Fabricate tops with shop-applied edges unless otherwise indicated. Comply with quartz agglomerate manufacturer's written instructions for adhesives, sealers, fabrication, and finishing.
  - 1. Fabricate with loose backsplashes for field assembly.
- F. Joints:
  - 1. Fabricate countertops without joints.

2.3 INSTALLATION MATERIALS

- A. Adhesive: Product recommended by quartz agglomerate manufacturer.
- B. Sealant for Countertops: Comply with applicable requirements in Section 07 92 00 "Joint Sealants."

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QUARTZ AGGLOMERATE COUNTERTOPS

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PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates to receive quartz agglomerate countertops and conditions under which countertops will be installed, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of countertops.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Install countertops level to a tolerance of 1/8 inch in 8 feet, 1/4 inch maximum. Do not exceed 1/64-inch difference between planes of adjacent units.
- B. Fasten subtops to cabinets by screwing through subtops into cornerblocks of base cabinets. Shim as needed to align subtops in a level plane.
- C. Secure countertops to subtops with adhesive according to quartz agglomerate manufacturer's written instructions. Align adjacent surfaces and, using adhesive in color to match countertop, form seams to comply with quartz agglomerate manufacturer's written instructions. Carefully dress joints smooth, remove surface scratches, and clean entire surface.
- D. Install backsplashes and end splashes by adhering to wall and countertops with adhesive. Mask areas of countertops and splashes adjacent to joints to prevent adhesive smears.
- E. Apply sealant to gaps at walls; comply with Section 07 92 00 "Joint Sealants."

END OF SECTION 12 36 61.19

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COMMON WORK RESULTS FOR FIRE SUPPRESSION

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SECTION 21 05 00 - COMMON WORK RESULTS FOR FIRE SUPPRESSION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 State University Construction Fund General Requirements, apply to this Section.

1.2 SUMMARY

- A. This Section includes the following:
  - 1. Piping materials and installation instructions common to most piping systems.
  - 2. Escutcheons.
  - 3. Painting and finishing.
  - 4. Supports and anchorages.

1.3 DEFINITIONS

- A. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe chases, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawlspaces, and tunnels.
- B. Exposed, Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and mechanical equipment rooms.
- C. Concealed, Interior Installations: Concealed from view and protected from physical contact by building occupants. Examples include above ceilings and in chases.
- D. The following are industry abbreviations for rubber materials:
  - 1. EPDM: Ethylene-propylene-diene terpolymer rubber.
  - 2. NBR: Acrylonitrile-butadiene rubber.

1.4 SUBMITTALS

- A. Product Data: For the following:
  - 1. Piping materials and installation instructions common to most piping systems.
  - 2. Escutcheons.
  - 3. Painting and finishing.

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COMMON WORK RESULTS FOR FIRE SUPPRESSION

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- 4. Supports and anchorages.
- B. Welding certificates.
- C. Hydraulic calculations
- D. Fully coordinated shop drawings, stamped by a professional engineer.

1.5 QUALITY ASSURANCE

- A. Steel Support Welding: Qualify processes and operators according to AWS D1.1, "Structural Welding Code--Steel."
- B. Steel Pipe Welding: Qualify processes and operators according to ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications."
  - 1. Comply with provisions in ASME B31 Series, "Code for Pressure Piping."
  - 2. Certify that each welder has passed AWS qualification tests for welding processes involved and that certification is current.
- C. Electrical Characteristics for Fire-Suppression Equipment: Equipment of higher electrical characteristics may be furnished provided such proposed equipment is approved in writing and connecting electrical services, circuit breakers, and conduit sizes are appropriately modified. If minimum energy ratings or efficiencies are specified, equipment shall comply with requirements.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver pipes and tubes with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe end damage and to prevent entrance of dirt, debris, and moisture.

1.7 COORDINATION

- A. Arrange for pipe spaces, chases, slots, and openings in building structure during progress of construction, to allow for fire-suppression installations.
- B. Coordinate requirements for access panels and doors for fire-suppression items requiring access that are concealed behind finished surfaces. Access panels and doors are specified in Division 08 Section "Access Doors and Frames."
- C. Fire Protection shall be maintained throughout the project area during all times. Coordinate with the Construction Manager, the Cornell University Project Manager, Cornell University EH&S, and the City of Ithaca Fire Department prior to disabling any existing fire suppression and/or detection systems.

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COMMON WORK RESULTS FOR FIRE SUPPRESSION

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PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. In other Part 2 articles where subparagraph titles below introduce lists, the following requirements apply for product selection:
  - 1. Manufacturers: Subject to compliance with requirements, provide products by the manufacturers specified.

2.2 PIPE, TUBE, AND FITTINGS

- A. Refer to individual Division 21 piping Sections for pipe, tube, and fitting materials and joining methods.
- B. Pipe Threads: ASME B1.20.1 for factory-threaded pipe and pipe fittings.

2.3 JOINING MATERIALS

- A. Refer to individual Division 21 piping Sections for special joining materials not listed below.
- B. Pipe-Flange Gasket Materials: Suitable for chemical and thermal conditions of piping system contents.
  - 1. ASME B16.21, nonmetallic, flat, asbestos-free, 1/8-inch (3.2-mm) maximum thickness unless thickness or specific material is indicated.
    - a. Full-Face Type: For flat-face, Class 125, cast-iron and cast-bronze flanges.
    - b. Narrow-Face Type: For raised-face, Class 250, cast-iron and steel flanges.
  - 2. AWWA C110, rubber, flat face, 1/8 inch (3.2 mm) thick, unless otherwise indicated; and full-face or ring type, unless otherwise indicated.
- C. Flange Bolts and Nuts: ASME B18.2.1, carbon steel, unless otherwise indicated.
- D. Welding Filler Metals: Comply with AWS D10.12 for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.

2.4 ESCUTCHEONS

- A. Description: Manufactured wall and ceiling escutcheons and floor plates, with an ID to closely fit around pipe, tube, and insulation of insulated piping and an OD that completely covers opening.
- B. One-Piece, Stamped-Steel Type: With set screw or spring clips and chrome-plated finish.

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COMMON WORK RESULTS FOR FIRE SUPPRESSION

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PART 3 - EXECUTION

3.1 PIPING SYSTEMS - COMMON REQUIREMENTS

- A. Install piping according to the following requirements and Division 21 Sections specifying piping systems.
- B. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.
- C. Install piping in concealed locations, unless otherwise indicated and except in equipment rooms and service areas.
- D. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
- E. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.
- F. Install piping to permit valve servicing.
- G. Install piping at indicated slopes.
- H. Install piping free of sags and bends.
- I. Install fittings for changes in direction and branch connections.
- J. Install piping to allow application of insulation.
- K. Select system components with pressure rating equal to or greater than system operating pressure.
- L. Install escutcheons for penetrations of walls, ceilings, and floors.
- M. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Refer to Division 07 Section "Penetration Firestopping" for materials.
- N. Verify final equipment locations for roughing-in.
- O. Refer to equipment specifications in other Sections of these Specifications for roughing-in requirements.



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COMMON WORK RESULTS FOR FIRE SUPPRESSION

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3.2 PIPING JOINT CONSTRUCTION

- A. Join pipe and fittings according to the following requirements and Division 21 Sections specifying piping systems.
- B. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
- C. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.
- D. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:
  - 1. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.
  - 2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.
- E. Welded Joints: Construct joints according to AWS D10.12, using qualified processes and welding operators according to Part 1 "Quality Assurance" Article.
- F. Flanged Joints: Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Use suitable lubricants on bolt threads.

3.3 PAINTING

- A. Paint all exposed sprinkler piping and fittings with one coat of primer and two coats of finish enamel. Coordinate color selection with construction manager and architect.

END OF SECTION 21 05 00

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HANGERS AND SUPPORTS FOR FIRE SUPPRESSION PIPING AND EQUIPMENT

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SECTION 21 05 29 - HANGERS AND SUPPORTS FOR FIRE SUPPRESSION PIPING AND EQUIPMENT

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. Metal pipe hangers and supports.
  - 2. Trapeze pipe hangers.
  - 3. Metal framing systems.
  - 4. Thermal hanger-shield inserts.
  - 5. Fastener systems.
  - 6. Equipment supports.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: Signed and sealed by a qualified professional engineer. Show fabrication and installation details and include calculations for the following:
  - 1. Trapeze pipe hangers.
  - 2. Metal framing systems.
  - 3. Equipment supports.
- C. Delegated-Design Submittal: For trapeze hangers indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
  - 1. Detail fabrication and assembly of trapeze hangers.
  - 2. Include design calculations for designing trapeze hangers.

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HANGERS AND SUPPORTS FOR FIRE SUPPRESSION PIPING AND EQUIPMENT

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1.4 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: Signed and sealed by a qualified professional engineer. Show fabrication and installation details and include calculations for the following; include Product Data for components:
  - 1. Trapeze pipe hangers.
  - 2. Pipe stands.
- C. Delegated-Design Submittal: For trapeze hangers indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
  - 1. Detail fabrication and assembly of trapeze hangers.
  - 2. Design Calculations: Calculate requirements for designing trapeze hangers.
- D. Welding certificates.

1.5 QUALITY ASSURANCE

- A. Structural-Steel Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M.
- B. Pipe Welding Qualifications: Qualify procedures and operators according to 2015 ASME Boiler and Pressure Vessel Code, Section IX.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Engage a qualified professional engineer, to design trapeze pipe hangers and equipment supports.
- B. Structural Performance: Hangers and supports for fire-suppression piping and equipment shall withstand the effects of gravity loads and stresses within limits and under conditions indicated according to ASCE/SEI 7.
  - 1. Design supports for multiple pipes, including pipe stands, capable of supporting combined weight of supported systems, system contents, and test water.
  - 2. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.
  - 3. Design seismic-restraint hangers and supports for piping and equipment.

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## HANGERS AND SUPPORTS FOR FIRE SUPPRESSION PIPING AND EQUIPMENT

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- C. NFPA Compliance: Comply with NFPA 13.
- D. UL Compliance: Comply with UL 203.

### 2.2 METAL PIPE HANGERS AND SUPPORTS

- A. Carbon-Steel Pipe Hangers and Supports:
  - 1. Description: Factory-fabricated components, NFPA approved, UL listed, or FM approved for fire-suppression piping support.
  - 2. Galvanized Metallic Coatings: Pre-galvanized or hot-dip galvanized.
  - 3. Hanger Rods: Continuous-thread rod, nuts, and washer made of carbon steel.

### 2.3 TRAPEZE PIPE HANGERS

- A. Description: MSS SP-58, Type 59, shop- or field-fabricated pipe-support assembly, made from structural-carbon-steel shapes, with NFPA-approved, UL-listed, or FM-approved carbon-steel hanger rods, nuts, saddles, and U-bolts.

### 2.4 METAL FRAMING SYSTEMS

- A. MFMA Manufacturer Metal Framing Systems:
  - 1. Description: Shop- or field-fabricated pipe-support assembly, made of steel channels, accessories, fittings, and other components for supporting multiple parallel pipes.
  - 2. Standard: Comply with MFMA-4, factory-fabricated components for field assembly.
  - 3. Channels: Continuous slotted carbon-steel channel with interned lips.
  - 4. Channel Width: Selected for applicable load criteria.
  - 5. Channel Nuts: Formed or stamped nuts or other devices designed to fit into channel slot and, when tightened, prevent slipping along channel.
  - 6. Hanger Rods: Continuous-thread rod, nuts, and washer made of carbon steel.
  - 7. Metallic Coating: No coating
  - 8. Paint Coating: urethane.
- B. Non-MFMA Manufacturer Metal Framing Systems:
  - 1. Description: Shop- or field-fabricated pipe-support assembly, made of steel channels, accessories, fittings, and other components for supporting multiple parallel pipes.
  - 2. Standard: Comply with MFMA-4, factory-fabricated components for field assembly.
  - 3. Channels: Continuous slotted carbon-steel channel with inturned lips.
  - 4. Channel Width: Select for applicable load criteria.

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## HANGERS AND SUPPORTS FOR FIRE SUPPRESSION PIPING AND EQUIPMENT

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5. Channel Nuts: Formed or stamped nuts or other devices designed to fit into channel slot and, when tightened, prevent slipping along channel.
6. Hanger Rods: Continuous-thread rod, nuts, and washer made of carbon steel.
7. Metallic Coating: Hot-dip galvanized.
8. Paint Coating: urethane.

### 2.5 FASTENER SYSTEMS

- A. Powder-Actuated Fasteners: NFPA-approved, UL-listed, or FM-approved threaded-steel stud, for use in hardened portland cement concrete, with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.
- B. Mechanical-Expansion Anchors: NFPA-approved, UL-listed, or FM-approved, insert-wedge-type anchors, for use in hardened portland cement concrete; with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.
  1. Indoor Applications: Zinc-coated steel.
  2. Outdoor Applications: Stainless steel.

### 2.6 EQUIPMENT SUPPORTS

- A. Description: NFPA-approved, UL-listed, or FM-approved, welded, shop- or field-fabricated equipment support, made from structural-carbon-steel shapes.

### 2.7 MATERIALS

- A. Aluminum: ASTM B221.
- B. Carbon Steel: ASTM A1011/A1011M.
- C. Structural Steel: ASTM A36/A36M, carbon-steel plates, shapes, and bars; black and galvanized.
- D. Stainless Steel: ASTM A240/A240M.
- E. Grout: ASTM C1107/C1107M, factory-mixed and -packaged, dry, hydraulic-cement, nonshrink and nonmetallic grout, suitable for interior and exterior applications.
  1. Properties: Nonstaining, noncorrosive, and nongaseous.
  2. Design Mix: 5000-psi, 28-day compressive strength.

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HANGERS AND SUPPORTS FOR FIRE SUPPRESSION PIPING AND EQUIPMENT

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PART 3 - EXECUTION

3.1 APPLICATION

- A. Comply with requirements in Division 07 section "Penetration Firestopping" for firestopping materials and installation, for penetrations through fire-rated walls, ceilings, and assemblies.
- B. Strength of Support Assemblies: Where not indicated, select sizes of components, so strength will be adequate to carry present and future static loads within specified loading limits. Minimum static design load used for strength determination shall be weight of supported components plus 200 lb.

3.2 HANGER AND SUPPORT INSTALLATION

- A. Metal Pipe-Hanger Installation: Comply with installation requirements of approvals and listings. Install hangers, supports, clamps, and attachments as required to properly support piping from building structure.
- B. Metal Trapeze Pipe-Hanger Installation: Comply with MSS SP-58. Arrange for grouping of parallel runs of horizontal piping, and support together on field-fabricated trapeze pipe hangers.
  - 1. Pipes of Various Sizes: Support together and space trapezes for smallest pipe size or install intermediate supports for smaller-diameter pipes as specified for individual pipe hangers.
  - 2. Field fabricate from ASTM A36/A36M carbon-steel shapes selected for loads being supported. Weld steel according to AWS D1.1/D1.1M.
- C. Metal Framing System Installation: Arrange for grouping of parallel runs of piping, and support together on field-assembled metal strut systems.
- D. Thermal Hanger-Shield Installation: Install in pipe hanger or shield for insulated piping.
- E. Fastener System Installation:
  - 1. Install powder-actuated fasteners for use in lightweight concrete or concrete slabs less than 4 inches thick in concrete, after concrete is placed and completely cured. Use operators that are licensed by powder-actuated tool manufacturer. Install fasteners according to powder-actuated tool manufacturer's operating manual. Install in accordance with approvals and listings.
  - 2. Install mechanical-expansion anchors in concrete, after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions. Install in accordance with approvals and listings.

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## HANGERS AND SUPPORTS FOR FIRE SUPPRESSION PIPING AND EQUIPMENT

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- F. Install hangers and supports complete with necessary attachments, inserts, bolts, rods, nuts, washers, and other accessories.
- G. Equipment Support Installation: Fabricate from welded-structural-steel shapes.
- H. Install hangers and supports to allow controlled thermal and seismic movement of piping systems, to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends, and similar units.
- I. Install lateral bracing with pipe hangers and supports to prevent swaying.
- J. Install building attachments within concrete slabs or attach to structural steel. Install additional attachments at concentrated loads, including valves, flanges, and strainers, NPS 2-1/2 and larger and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten inserts to forms, and install reinforcing bars through openings at top of inserts.
- K. Load Distribution: Install hangers and supports, so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.
- L. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and to not exceed maximum pipe deflections allowed by ASME B31.9 for building services piping.

### 3.3 EQUIPMENT SUPPORTS

- A. Fabricate structural-steel stands to suspend equipment from structure overhead or to support equipment above floor.
- B. Grouting: Place grout under supports for equipment, and make bearing surface smooth.
- C. Provide lateral bracing, to prevent swaying, for equipment supports.

### 3.4 METAL FABRICATIONS

- A. Cut, drill, and fit miscellaneous metal fabrications for trapeze pipe hangers and equipment supports.
- B. Fit exposed connections together to form hairline joints. Field weld connections that cannot be shop welded because of shipping size limitations.
- C. Field Welding: Comply with AWS D1.1/D1.1M procedures for shielded, metal arc welding; appearance and quality of welds; and methods used in correcting welding work; and with the following:



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## HANGERS AND SUPPORTS FOR FIRE SUPPRESSION PIPING AND EQUIPMENT

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1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove welding flux immediately.
4. Finish welds at exposed connections, so no roughness shows after finishing and so contours of welded surfaces match adjacent contours.

### 3.5 ADJUSTING

- A. Hanger Adjustments: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.
- B. Trim excess length of continuous-thread hanger and support rods to 1-1/2 inches.

### 3.6 PAINTING

- A. Touchup: Clean field welds and abraded, shop-painted areas. Paint exposed areas immediately after erecting hangers and supports. Use same materials as those used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.
  1. Apply paint by brush or spray to provide a minimum dry film thickness of 2.0 mils.
- B. Touchup: Cleaning and touchup painting of field welds, bolted connections, and abraded, shop-painted areas on miscellaneous metal are specified in Division 09 Section "Interior Painting".
- C. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas, and apply galvanizing-repair paint to comply with ASTM A780/A780M.

### 3.7 HANGER AND SUPPORT SCHEDULE

- A. Specific hanger and support requirements are in Sections specifying piping systems and equipment.
- B. Comply with NFPA requirements for pipe-hanger selections and applications that are not specified in piping system Sections.
- C. Use hangers and supports with galvanized metallic coatings for piping and equipment that will not have field-applied finishes.
- D. Use nonmetallic coatings on attachments for electrolytic protection where attachments are in direct contact with copper tubing.

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HANGERS AND SUPPORTS FOR FIRE SUPPRESSION PIPING AND EQUIPMENT

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- E. Use carbon-steel pipe hangers and supports and attachments for general service applications.
- F. Use stainless-steel pipe hangers and stainless-steel attachments for hostile environment applications.
- G. Use thermal hanger-shield inserts for insulated piping and tubing.
- H. Horizontal-Piping Hangers and Supports: Comply with NFPA requirements. Unless otherwise indicated and except as specified in piping system Sections, install the following types:
  - 1. Adjustable, Steel Clevis Hangers (MSS Type 1): For suspension of noninsulated or insulated, stationary pipes NPS 1/2 to NPS 30.
  - 2. Steel Pipe Clamps (MSS Type 4): For suspension of NPS 1/2 to NPS 24 if little or no insulation is required.
  - 3. Adjustable, Swivel-Ring Band Hangers (MSS Type 10): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8.
  - 4. Split Pipe Ring with or without Turnbuckle Hangers (MSS Type 11): For suspension of noninsulated, stationary pipes NPS 3/8 to NPS 8.
  - 5. Extension Hinged or Two-Bolt Split Pipe Clamps (MSS Type 12): For suspension of noninsulated, stationary pipes NPS 3/8 to NPS 3.
  - 6. U-Bolts (MSS Type 24): For support of heavy pipes NPS 1/2 to NPS 30.
  - 7. Pipe Saddle Supports (MSS Type 36): For support of pipes NPS 4 to NPS 36, with steel-pipe base stanchion support and cast-iron floor flange or carbon-steel plate.
  - 8. Pipe Stanchion Saddles (MSS Type 37): For support of pipes NPS 4 to NPS 36, with steel-pipe base stanchion support and cast-iron floor flange or carbon-steel plate, and with U-bolt to retain pipe.
  - 9. Adjustable Pipe Saddle Supports (MSS Type 38): For stanchion-type support for pipes NPS 2-1/2 to NPS 36 if vertical adjustment is required, with steel-pipe base stanchion support and cast-iron floor flange.
- I. Vertical-Piping Clamps: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
  - 1. Extension Pipe or Riser Clamps (MSS Type 8): For support of pipe risers NPS 3/4 to NPS 24.
  - 2. Carbon- or Alloy-Steel Riser Clamps (MSS Type 42): For support of pipe risers NPS 3/4 to NPS 24 if longer ends are required for riser clamps.
- J. Hanger-Rod Attachments: Comply with NFPA requirements.
- K. Building Attachments: Comply with NFPA requirements. Unless otherwise indicated and except as specified in piping system Sections, install the following types:
  - 1. Steel or Malleable-Concrete Inserts (MSS Type 18): For upper attachment to suspend pipe hangers from concrete ceiling.

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HANGERS AND SUPPORTS FOR FIRE SUPPRESSION PIPING AND EQUIPMENT

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2. C-Clamps (MSS Type 23): For structural shapes.
  3. Side-Beam Brackets (MSS Type 34): For sides of steel or wooden beams.
- L. Saddles and Shields: Comply with NFPA requirements. Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Steel-Pipe-Covering Protection Saddles (MSS Type 39): To fill interior voids with insulation that matches adjoining insulation.
  2. Protection Shields (MSS Type 40): Of length recommended in writing by manufacturer to prevent crushing insulation.
  3. Thermal Hanger-Shield Inserts: For supporting insulated pipe.
- M. Comply with NFPA requirements for trapeze pipe-hanger selections and applications that are not specified in piping system Sections.
- N. Comply with MFMA-103 for metal framing system selections and applications that are not specified in piping system Sections.
- O. Use mechanical-expansion anchors instead of building attachments where required in concrete construction.

END OF SECTION 21 05 29

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DRY-PIPE SPRINKLER SYSTEMS

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SECTION 21 13 16 - DRY-PIPE SPRINKLER SYSTEMS

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. General
  - 2. Products
  - 3. Execution

1.3 DEFINITIONS

- A. Standard-Pressure Sprinkler Piping: Dry-pipe sprinkler system piping designed to operate at working pressure of 175-psig (1200-kPa) maximum.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.
  - 1. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.
- B. Shop Drawings: For dry-pipe sprinkler systems.
  - 1. Include plans, elevations, sections, and attachment details.
  - 2. Include diagrams for power, signal, and control wiring.
- C. Delegated Design Submittal: For dry-pipe sprinkler systems indicated to comply with performance requirements and design criteria, including analysis data, signed and sealed by the qualified professional engineer responsible for their preparation.

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DRY-PIPE SPRINKLER SYSTEMS

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1.5 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For dry-pipe sprinkler systems and specialties to include in emergency, operation, and maintenance manuals.

1.6 QUALITY ASSURANCE

- A. Installer must be licensed as a fire sprinkler contractor in the jurisdiction where work is being performed.

1.7 FIELD CONDITIONS

- A. Interruption of Existing Sprinkler Service: Do not interrupt sprinkler service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary sprinkler service in accordance with requirements indicated:
  - 1. Notify Owner no fewer than two days in advance of proposed interruption of sprinkler service.
  - 2. Do not proceed with interruption of sprinkler service without Owner's written permission.

PART 2 - PRODUCTS

2.1 SYSTEM DESCRIPTIONS

- A. Dry-Pipe Sprinkler System: Automatic sprinklers are attached to piping containing compressed air or nitrogen. Opening of sprinklers releases compressed air or nitrogen and permits water pressure to open dry-pipe valve. Water then flows into piping and discharges from opened sprinklers.

2.2 PERFORMANCE 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. Sprinkler system equipment, specialties, accessories, installation, and testing shall comply with NFPA 13 and FM Global.
- C. Standard-Pressure Piping System Component: Listed for 175-psig (1200-kPa) minimum working pressure.

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DRY-PIPE SPRINKLER SYSTEMS

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- D. Sprinkler system design shall be approved by authorities having jurisdiction.

2.3 SPRINKLERS

- A. Manufacturers: Subject to compliance with requirements, provide products by the following:
  - 1. Reliable Automatic Sprinkler Co., Inc. (The).
  - 2. Victaulic Company.
  - 3. Viking Corporation.
- B. Listed in UL's "Fire Protection Equipment Directory" and FM Approvals' "Approval Guide."
- C. Pressure Rating for Automatic Sprinklers: 175-psig (1200-kPa) minimum.
- D. Automatic Sprinklers with Heat-Responsive Element:
  - 1. Nonresidential Applications: UL 199.
  - 2. Characteristics: Nominal 1/2-inch (12.7-mm) orifice with Discharge Coefficient K of 5.6, and for "Ordinary" temperature classification rating unless otherwise indicated or required by application.
- E. Sprinkler Escutcheons: Escutcheons for concealed, flush, and recessed-type sprinklers are specified with sprinklers.

PART 3 - EXECUTION

3.1 PIPING INSTALLATION

- A. Locations and Arrangements: Drawing plans, schematics, and diagrams indicate general location and arrangement of piping. Install piping as indicated on approved working plans.
  - 1. Deviations from approved working plans for piping require written approval from authorities having jurisdiction. File written approval with Architect before deviating from approved working plans.
  - 2. Coordinate layout and installation of sprinklers with other construction that penetrates ceilings, including light fixtures, HVAC equipment, and partition assemblies.
- B. Piping Standard: Comply with NFPA 13 requirements for installation of sprinkler piping.
- C. Use listed fittings to make changes in direction, branch takeoffs from mains, and reductions in pipe sizes.

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DRY-PIPE SPRINKLER SYSTEMS

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- D. Install unions adjacent to each valve in pipes NPS 2 (DN 50) and smaller.
- E. Install flanges, flange adapters, or couplings for grooved-end piping on valves, apparatus, and equipment having NPS 2-1/2 (DN 65) and larger end connections.
- F. Connect air compressor to the following piping and wiring:
  - 1. Pressure gauges and controls.
  - 2. Electrical power system.
  - 3. Fire-alarm devices, including low-pressure alarm.
- G. Install alarm devices in piping systems.
- H. Install pressure gauges on riser or feed main, at each sprinkler test connection, and at top of each standpipe. Include pressure gauges with connection not less than NPS 1/4 (DN 8) and with soft-metal seated globe valve, arranged for draining pipe between gauge and valve. Install gauges to permit removal, and install where they are not subject to freezing.
- I. Drain dry-pipe sprinkler piping.
- J. Pressurize and check dry-pipe sprinkler system piping and air-pressure maintenance devices.

3.2 JOINT CONSTRUCTION

- A. Install couplings, flanges, flanged fittings, unions, nipples, and transition and special fittings that have finish and pressure ratings same as or higher than system's pressure rating for aboveground applications unless otherwise indicated.
- B. Install unions adjacent to each valve in pipes NPS 2 (DN 50) and smaller.
- C. Install flanges, flange adapters, or couplings for grooved-end piping on valves, apparatus, and equipment having NPS 2-1/2 (DN 65) and larger end connections.
- D. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
- E. Remove scale, slag, dirt, and debris from inside and outside of pipes, tubes, and fittings before assembly.
- F. Flanged Joints: Select appropriate gasket material in size, type, and thickness suitable for water service. Join flanges with gasket and bolts in accordance with ASME B31.9.
- G. Threaded Joints: Thread pipe with tapered pipe threads in accordance with ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:



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## DRY-PIPE SPRINKLER SYSTEMS

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1. Apply appropriate tape or thread compound to external pipe threads.
  2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged.
- H. Twist-Locked Joints: Insert plain end of steel pipe into plain-end-pipe fitting. Rotate retainer lugs one-quarter turn or tighten retainer pin.
- I. Steel-Piping, Cut-Grooved Joints: Cut square-edge groove in end of pipe in accordance with AWWA C606. Assemble coupling with housing, gasket, lubricant, and bolts. Join steel pipe and grooved-end fittings in accordance with AWWA C606 for steel-pipe joints.
- J. Brazed Joints: Join copper tube and fittings in accordance with CDA's "Copper Tube Handbook," "Braze Joints" Chapter.
- K. Extruded-Tee Connections: Form tee in copper tube in accordance with ASTM F2014. Use tool designed for copper tube; drill pilot hole, form collar for outlet, dimple tube to form seating stop, and braze branch tube into collar.
- L. Dissimilar-Material Piping Joints: Make joints using adapters compatible with materials of both piping systems.

### 3.3 VALVE AND SPECIALTIES INSTALLATION

- A. Install listed fire-protection valves, trim and drain valves, specialty valves and trim, controls, and specialties in accordance with NFPA 13 and authorities having jurisdiction.

### 3.4 SPRINKLER INSTALLATION

- A. Do not install wet pendent sprinklers in areas subject to freezing.

### 3.5 IDENTIFICATION

- A. Install labeling and pipe markers on equipment and piping in accordance with requirements in NFPA 13.
- B. Identify system components, wiring, cabling, and terminals.

### 3.6 FIELD QUALITY CONTROL

- A. Perform the following tests and inspections with the assistance of a factory-authorized service representative:

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DRY-PIPE SPRINKLER SYSTEMS

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1. Leak Test: After installation, charge systems and test for leaks. Repair leaks and retest until no leaks exist.
  2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
  3. Flush, test, and inspect sprinkler systems in accordance with NFPA 13, "Systems Acceptance" Chapter.
  4. Energize circuits to electrical equipment and devices.
  5. Start and run air compressors.
  6. Coordinate with fire-alarm tests. Operate as required.
  7. Coordinate with fire-pump tests. Operate as required.
  8. Verify that equipment hose threads are same as local fire department equipment.
- B. Sprinkler piping system will be considered defective if it does not pass tests and inspections.
- C. Prepare test and inspection reports.

3.7 CLEANING

- A. Clean dirt and debris from sprinklers.
- B. Only sprinklers with their original factory finish are acceptable. Remove and replace any sprinklers that are painted or have any other finish than their original factory finish.

3.8 DEMONSTRATION

- A. Train Owner's maintenance personnel to adjust, operate, and maintain specialty valves.
- B. Engage a factory-authorized service representative to perform on-site commissioning of nitrogen generator and associated corrosion-control equipment.

3.9 PIPING SCHEDULE

- A. Piping between Fire Department Connections and Check Valves: Galvanized, standard-weight steel pipe with threaded ends, cast-iron threaded fittings, and threaded joints.
- B. Sprinkler specialty fittings may be used, downstream of control valves, instead of specified fittings.
- C. Standard-pressure, dry-pipe sprinkler system shall be the following:
1. Schedule 40 black steel piping with cast or malleable-iron threaded or ductile iron grooved-end fittings.
  2. Type E and Galvanized piping are not allowed.

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DRY-PIPE SPRINKLER SYSTEMS

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3.10 SPRINKLER SCHEDULE

- A. Use sprinkler types in subparagraphs below for the following applications:
  - 1. Rooms without Ceilings: Upright sprinklers
  - 2. Rooms with suspended Ceilings: Dry concealed sprinklers
- B. Provide sprinkler types in subparagraphs below with finishes indicated.
  - 1. Concealed Sprinklers: Rough brass, with factory-painted white cover plate.
  - 2. Upright, Pendent, and Sidewall Sprinklers: Chrome plated in finished spaces exposed to view; rough bronze in unfinished spaces not exposed to view; wax coated where exposed to acids, chemicals, or other corrosive fumes.

END OF SECTION

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BASIC HVAC REQUIREMENTS

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SECTION 23 00 10 - BASIC HVAC REQUIREMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specifications Sections, apply to this Section.
- B. Division 23 will be responsible to carry out the commissioning requirements specified in Division 1 Specifications Sections and other sections referenced therein.

1.2 PLANS AND SPECIFICATIONS

- A. All work under this title, on drawings or specified, is subject to the general and special contract conditions for the entire project, and the contractor for this portion of the work is required to refer especially thereto, and to the architectural drawings.
- B. Drawings are diagrammatic and specifications are complementary and must be so interpreted to determine the full scope of work under this heading. Wherever any material, article, operation or method is either specified or shown on the drawings, this contractor is required to provide each item and perform each prescribed operation according to the designate quality, qualification or condition, furnishing all necessary labor, equipment or incidentals.
- C. Wherever the designation "Architect" appears, it shall imply Architect or Engineer. Wherever the term "Contractor" or "HC" appears, it shall imply the Contractor responsible for Division 23, HVAC work.

1.3 CONFLICTS

- A. If, in the interpretation of contract documents, it appears that the drawings and specifications are not in agreement, the Contractor is to contact the Engineer. The Engineer shall be the final authority. Addenda supersede the provisions which they amend.
- B. In the absence of a written clarification by the engineer, the Contractor must install his work in accordance with the more stringent and/or costly condition. Contractor assumes full responsibility for any and all items furnished and installed without the written approval by the Architect or Engineer. Under no circumstances will a change order be accepted for work installed that was not approved by the Architect or Engineer.

1.4 DIMENSIONS, LAYOUTS AND OBSTACLES

- A. Verify dimensions and elevations from actual field measurements after building

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BASIC HVAC REQUIREMENTS

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construction has sufficiently progressed.

- B. Assume full and final responsibility for the accuracy of any or all work performed under this Division and make repairs and corrections as required or directed at no extra cost to the Owner.
- C. Layouts of piping, ductwork, and equipment shown on drawings are diagrammatic and shall be construed as such. DO NOT SCALE DRAWINGS. Contractor shall field verify all existing conditions prior to fabrication and installation of material. It is recommended that the contractor verify all existing conditions prior to submitting a proposal. Lack of field verification does not constitute a basis for additional monies during construction. Contractor assumes full responsibility for completeness of installation including coordination of work with other trades.
- D. Make actual installations in accord with said layouts, but with necessary deviations as directed or required by job conditions and field measurements in order to produce a thoroughly integrated and practical job upon completion but make deviations only with specific approval of the Engineer/Architect.
- E. Take particular care to coordinate all piping and ductwork under this Division to prevent conflict and remove and relocate work as may be made necessary by such conflict at no extra cost to the Owner.
- F. Unless expressly permitted by the Engineer/Architect or shown otherwise on the Drawings, all piping, ducts and similar items shall be installed so that they are concealed except as permitted by the Engineer/Architect in service rooms noted on the Drawings.
- G. The Owner or Owner's Representative reserves the right to relocate terminal equipment six (6) feet in any direction from locations indicated on plans, before roughing-in, with no change in contract price.

1.5 REVIEW OF MATERIAL

- A. Items specified have been checked by the Engineer for performance and space limitation.
- B. In order for Engineer to consider "equal", HC must certify by letter that he has checked the product for conformance to specifications and space limitations and assumes full responsibility thereafter.
- C. Engineer, not Contractor or Vendor, shall be the final judge of equal materials.
- D. Substitutions are defined as any manufacturer and/or model not indicated in drawings or specifications. Requests for substitutions must be made in writing ten (10) days prior to bid date so that an addendum may reach all contractors.
- E. If substitutions are proposed after the bids are received, the Contractor shall state amount of credit to the Owner for substitution. Substitutions that are considered equal by the Contractor and carried in bid without approval by Engineer shall be the

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## BASIC HVAC REQUIREMENTS

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responsibility of the Contractor. The Engineer and/or Owner shall not be made liable or responsible for losses incurred by the Contractor, due to the rejection of said items for installation.

- F. Where equipment requiring different arrangement or connections other than as indicated is acceptable, it shall be the responsibility of this Contractor to furnish revised layouts, and install the equipment to operate properly and in harmony with the intent of the drawings and specifications. All changes in the work required by the different arrangement shall be done at no additional cost to the Owner, including but not limited to structural steel modifications. Control and power wiring modifications required by Contractor, imposed modifications, and the additional cost of these modifications, shall be the responsibility of this Contractor.
- G. Upon review of equipment list by Engineer, copies of submittal prints shall be forwarded to Engineer within 30 days.

### 1.6 PERMITS, CODES AND ORDINANCES

- A. The Heating Contractor shall arrange and pay for all permits, inspections, etc., as required by local utilities or applicable agencies.
- B. All work and material shall be in complete accordance with the ordinances, regulations, codes, etc., of all political entities exercising jurisdictions, specifically including the 2015 International Mechanical Code, 2015 International Energy Conservation Construction Code and the 2016 New York State Uniform Code Supplement.

### 1.7 COORDINATION WITH OTHER TRADES

- A. Check Division 23 drawings with all others.
- B. Anticipate and avoid interferences with other trades.
- C. Take particular care to coordinate all piping, ductwork, plumbing and major electrical components above ceiling, to prevent conflict. Remove and relocate work as may be made necessary by such conflict, at no extra cost to the Owner. The use of coordination drawings is recommended but may not be required (refer to Division 1 for additional requirements). Lack of coordination drawings assumes contractor has verified and coordinated all work associated with installation.
- D. Obtain decision for approval from project Engineer for proposed group installation before proceeding, and for clearance in structure and finish of the building.

### 1.8 DELIVERY, STORAGE, AND HANDLING

- A. Delivery of Materials: Make provisions for delivery and safe storage of all materials. Check and properly receipt material to be "furnished by others" to contractor and assume full responsibility for all materials while in storage with full visible identification and information.

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BASIC HVAC REQUIREMENTS

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1.9 PROJECT CONDITIONS

- A. Existing Conditions: Field verify existing conditions that will determine exact locations, distances, levels, dimensions, elevations, etc. Review all drawings of other trades and report any conflicts to the Architect/Engineer which will affect the project cost. Lack of field verification does not constitute a basis for additional monies during construction. Contractor assumes full responsibility for completeness of installation including coordination of work with other trades.
- B. The existing facility will be occupied and functioning during the entire duration of construction. Care shall be taken when working in or around occupied spaces. There will be no interruption in HVAC systems or utilities without written approval from the Owner.

1.10 SUBMITTALS

- A. Shop Drawings and Product Data: Submit shop drawings, wiring diagrams and/or equipment list for the following equipment and material.
  - 1. Submit a list of the following sub-contractors
    - a. Sheet Metal
    - b. Piping
    - c. Insulation
    - d. Temperature Controls
    - e. Balancing - air and water procedures
- B. Required Shop Drawings
  - 1. Provide all submittals as required for each specification or drawing requirement.

1.11 MISCELLANEOUS SUPPORT

- A. Mechanical Contractor is responsible for providing all miscellaneous support components necessary for properly supporting equipment provided by Mechanical Contractor including hangers, rods, anchors, steel, etc.

END OF SECTION 23 00 10



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CUTTING AND PATCHING

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SECTION 23 00 15 - CUTTING AND PATCHING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SCOPE OF WORK

- A. Provide cutting and patching work required by work of this (sub) contract.
- B. Do not cut and patch in a manner that would result in a failure of the work to perform as intended, decreased structural integrity, decreased integrity of fire proofing, decreased energy performance, increased maintenance, decreased operational life or decreased safety.
- C. Requirements in this Section apply to mechanical, plumbing and electrical installations. Refer to Divisions 23 and 26 Sections for other requirements and limitations applicable to cutting and patching mechanical and electrical installations. Requirements of this section shall be coordinated with requirements of Division 1 sections. In the event of conflict, the more stringent requirements shall be used.

1.3 DEFINITIONS

- A. Cutting: Removal of existing construction necessary to permit installation or performance of other Work.
- B. Patching: Fitting and repair work required to restore surfaces to original conditions after installation of other Work.

1.4 QUALITY ASSURANCE

- A. Structural Elements: Do not cut and patch structural elements in a manner that could change their load-carrying capacity or load-deflection ratio.
- B. Operational Elements: Do not cut and patch operating elements and related components in a manner that results in reducing their capacity to perform as intended or that results in increased maintenance or decreased operational life or safety. This is to include but not be limited to the following:
  - 1. Primary operational systems and equipment.
  - 2. Air or smoke barriers.
  - 3. Fire-protection systems.
  - 4. Control systems.
  - 5. Communication systems.

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CUTTING AND PATCHING

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6. Conveying systems.
  7. Electrical wiring systems.
  8. Operating systems of special construction in Division 13 Sections.
- C. Miscellaneous Elements: Do not cut and patch the following elements or related components in a manner that could change their load-carrying capacity, that results in reducing their capacity to perform as intended, or that results in increased maintenance or decreased operational life or safety.
1. Water, moisture, or vapor barriers.
  2. Membranes and flashings.
  3. Exterior curtain-wall construction.
  4. Equipment supports.
  5. Piping, ductwork, vessels, and equipment.
  6. Noise and vibration control elements and systems.
- D. Visual Requirements: Do not cut and patch construction in a manner that results in visual evidence of cutting and patching. Do not cut and patch construction exposed on the exterior or in occupied spaces in a manner that would, in Architect's opinion, reduce the building's aesthetic qualities. Remove and replace construction that has been cut and patched in a visually unsatisfactory manner.
1. If possible, retain original Installer or fabricator to cut and patch exposed Work listed below. If it is impossible to engage original Installer or fabricator, engage another recognized, experienced, and specialized firm.
    - a. Processed concrete finishes.
    - b. Stonework and stone masonry.
    - c. Ornamental metal.
    - d. Matched-veneer woodwork.
    - e. Preformed metal panels.
    - f. Roofing.
    - g. Firestopping.
    - h. Window wall system.
    - i. Stucco and ornamental plaster.
    - j. Terrazzo.
    - k. Finished wood flooring.
    - l. Fluid-applied flooring.
    - m. Aggregate wall coating.
    - n. Wall covering.
    - o. HVAC enclosures, cabinets, or covers.
- E. Cutting and Patching Conference: Before proceeding, meet at Project site with parties involved in cutting and patching, including mechanical and electrical trades. Review areas of potential interference and conflict. Coordinate procedures and resolve potential conflicts before proceeding.

1.5 WARRANTY

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CUTTING AND PATCHING

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- A. Existing Warranties: Remove, replace, patch, and repair materials and surfaces cut or damaged during cutting and patching operations, by methods and with materials so as not to void existing warranties.

PART 2 - PRODUCTS

2.1 NON-FIRE RATED PENETRATIONS

- A. Patch and repair to match existing conditions.

2.2 FIRE RATED PENETRATIONS

- A. Patch and repair to match existing conditions.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine surfaces to be cut and patched and conditions under which cutting and patching are to be performed.
  - 1. Compatibility: Before patching, verify compatibility with and suitability of substrates, including compatibility with existing finishes or primers.
  - 2. Proceed with installation only after unsafe or unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Temporary Support: Provide temporary support of Work to be cut.
- B. Protection: Protect existing construction during cutting and patching to prevent damage. Provide protection from adverse weather conditions for portions of Project that might be exposed during cutting and patching operations.
- C. Adjoining Areas: Avoid interference with use of adjoining areas or interruption of free passage to adjoining areas.
- D. Existing Services: Where existing services are required to be removed, relocated, or abandoned, bypass such services before cutting to avoid interruption of services to occupied areas.

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.

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## CUTTING AND PATCHING

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1. Cut existing construction to provide for installation of other components or performance of other construction, and subsequently patch as required to restore surfaces to their original condition.
  2. Fit work airtight to pipes, sleeves, ducts, conduits and other penetration through surfaces.
- B. Cutting: Cut existing construction by sawing, drilling, breaking, chipping, grinding, and similar operations, including excavation, using methods least likely to damage elements retained or adjoining construction. If possible, review proposed procedures with original Installer; comply with original Installer's written recommendations.
1. In general, use hand or small power tools designed for sawing and 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. Existing Finished Surfaces: Cut or drill from the exposed or finished side into concealed surfaces.
  3. Concrete Masonry: Cut using a cutting machine, such as an abrasive saw or a diamond-core drill.
  4. Excavating and Backfilling: Comply with requirements in applicable Division 2 Sections where required by cutting and patching operations.
  5. Mechanical and Electrical Services: Cut off pipe or conduit in walls or partitions to be removed. Cap, valve, or plug and seal remaining portion of pipe or conduit to prevent entrance of moisture or other foreign matter after cutting.
  6. Proceed with patching after construction operations requiring cutting are complete.
- C. Patching: Patch construction by filling, repairing, refinishing, closing up, and similar operations following performance of other Work. Patch with durable seams that are as invisible as possible. Provide materials and comply with installation requirements specified in other Sections of these Specifications.
1. Inspection: Where feasible, test and inspect patched areas after completion to demonstrate integrity of installation.
  2. Exposed Finishes: 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.
  3. Floors and Walls: Where walls or partitions that are removed 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. Where patching occurs in a painted surface, apply primer and intermediate paint coats over the patch and apply final paint coat over entire unbroken surface containing the patch. Provide additional coats until patch blends with adjacent surfaces.

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CUTTING AND PATCHING

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4. Exterior Building Enclosure: Patch components in a manner that restores enclosure to a weathertight condition.

END OF SECTION 23 00 15

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BASIC MECHANICAL MATERIALS AND METHODS

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SECTION 23 05 00 – BASIC MECHANICAL MATERIALS AND METHODS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes the following:
  - 1. Piping materials and installation instructions common to most piping systems.
  - 2. Transition fittings.
  - 3. Dielectric fittings.
  - 4. Mechanical sleeve seals.
  - 5. Sleeves.
  - 6. Escutcheons.
  - 7. Grout.
  - 8. Mechanical demolition.
  - 9. Equipment installation requirements common to equipment sections.
  - 10. Painting and finishing.
  - 11. Concrete bases.
  - 12. Supports and anchorages.

1.3 DEFINITIONS

- A. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe and duct shafts, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawlspace, and tunnels.
- B. Exposed, Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and mechanical equipment rooms.
- C. Exposed, Exterior Installations: Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations.
- D. Concealed, Interior Installations: Concealed from view and protected from physical contact by building occupants. Examples include above ceilings and in duct shafts.

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BASIC MECHANICAL MATERIALS AND METHODS

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- E. Concealed, Exterior Installations: Concealed from view and protected from weather conditions and physical contact by building occupants but subject to outdoor ambient temperatures. Examples include installations within unheated shelters.
- F. The following are industry abbreviations for plastic materials:
  - 1. ABS: Acrylonitrile-butadiene-styrene plastic.
  - 2. CPVC: Chlorinated polyvinyl chloride plastic.
  - 3. PE: Polyethylene plastic.
  - 4. PVC: Polyvinyl chloride plastic.
- G. The following are industry abbreviations for rubber materials:
  - 1. EPDM: Ethylene-propylene-diene terpolymer rubber.
  - 2. NBR: Acrylonitrile-butadiene rubber.

1.4 SUBMITTALS

- A. Product Data: For the following:
  - 1. Transition fittings.
  - 2. Dielectric fittings.
  - 3. Mechanical sleeve seals.
  - 4. Escutcheons.
- B. Welding certificates.

1.5 QUALITY ASSURANCE

- A. Steel Support Welding: Qualify processes and operators according to AWS D1.1, "Structural Welding Code--Steel."
- B. Steel Pipe Welding: Qualify processes and operators according to ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications."
  - 1. Comply with provisions in ASME B31 Series, "Code for Pressure Piping."
  - 2. Certify that each welder has passed AWS qualification tests for welding processes involved and that certification is current.
- C. Electrical Characteristics for Mechanical Equipment: Equipment of higher electrical characteristics may be furnished provided such proposed equipment is approved in writing and connecting electrical services, circuit breakers, and conduit sizes are appropriately modified. If minimum energy ratings or efficiencies are specified, equipment shall comply with requirements.



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BASIC MECHANICAL MATERIALS AND METHODS

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1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver pipes and tubes with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe end damage and to prevent entrance of dirt, debris, and moisture.
- B. Store plastic pipes protected from direct sunlight. Support to prevent sagging and bending.

1.7 COORDINATION

- A. Arrange for pipe spaces, chases, slots, and openings in building structure during progress of construction, to allow for mechanical installations.
- B. Coordinate installation of required supporting devices and set sleeves in poured-in-place concrete and other structural components as they are constructed.
- C. Coordinate requirements for access panels and doors for mechanical items requiring access that are concealed behind finished surfaces. Access panels and doors are specified in Division 8 Section "Access Doors and Frames."

**PART 2 - PRODUCTS**

2.1 MANUFACTURERS

- A. In other Part 2 articles where subparagraph titles below introduce lists, the following requirements apply for product selection:
  - 1. Manufacturers: Subject to compliance with requirements, provide products by the manufacturers specified.

2.2 PIPE, TUBE, AND FITTINGS

- A. Refer to individual Division 23 piping Sections for pipe, tube, and fitting materials and joining methods.
- B. Pipe Threads: ASME B1.20.1 for factory-threaded pipe and pipe fittings.

2.3 JOINING MATERIALS

- A. Refer to individual Division 23 piping Sections for special joining materials not listed below.

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BASIC MECHANICAL MATERIALS AND METHODS

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- B. Pipe-Flange Gasket Materials: Suitable for chemical and thermal conditions of piping system contents.
  - 1. ASME B16.21, nonmetallic, flat, asbestos-free, 1/8-inch (3.2-mm) maximum thickness unless thickness or specific material is indicated.
    - a. Full-Face Type: For flat-face, Class 125, cast-iron and cast-bronze flanges.
    - b. Narrow-Face Type: For raised-face, Class 250, cast-iron and steel flanges.
  - 2. AWWA C110, rubber, flat face, 1/8 inch (3.2 mm) thick, unless otherwise indicated; and full-face or ring type, unless otherwise indicated.
- C. Flange Bolts and Nuts: ASME B18.2.1, carbon steel, unless otherwise indicated.
- D. Plastic, Pipe-Flange Gasket, Bolts, and Nuts: Type and material recommended by piping system manufacturer, unless otherwise indicated.
- E. Solder Filler Metals: ASTM B 32, lead-free alloys. Include water-flushable flux according to ASTM B 813.
- F. Brazing Filler Metals: AWS A5.8, BCuP Series, copper-phosphorus alloys for general-duty brazing, unless otherwise indicated; and AWS A5.8, BAg1, silver alloy for refrigerant piping, unless otherwise indicated.
- G. Welding Filler Metals: Comply with AWS D10.12 for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.
- H. Solvent Cements for Joining Plastic Piping:
  - 1. ABS Piping: ASTM D 2235.
  - 2. CPVC Piping: ASTM F 493.
  - 3. PVC Piping: ASTM D 2564. Include primer according to ASTM F 656.
  - 4. PVC to ABS Piping Transition: ASTM D 3138.
- I. Fiberglass Pipe Adhesive: As furnished or recommended by pipe manufacturer.

## 2.4 TRANSITION FITTINGS

- A. AWWA Transition Couplings: Same size as, and with pressure rating at least equal to and with ends compatible with, piping to be joined.
  - 1. Manufacturers:
    - a. Cascade Waterworks Mfg. Co.
    - b. Dresser Industries, Inc.; DMD Div.
    - c. Ford Meter Box Company, Incorporated (The); Pipe Products Div.

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BASIC MECHANICAL MATERIALS AND METHODS

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- d. JCM Industries.
  - e. Smith-Blair, Inc.
  - f. Viking Johnson.
- 2. Underground Piping NPS 1-1/2 (DN 40) and Smaller: Manufactured fitting or coupling.
  - 3. Underground Piping NPS 2 (DN 50) and Larger: AWWA C219, metal sleeve-type coupling.
  - 4. Aboveground Pressure Piping: Pipe fitting.
- B. Plastic-to-Metal Transition Fittings: CPVC and PVC one-piece fitting with manufacturer's Schedule 80 equivalent dimensions; one end with threaded brass insert, and one solvent-cement-joint end.
- 1. Manufacturers:
    - a. Eslon Thermoplastics.
- C. Plastic-to-Metal Transition Adaptors: One-piece fitting with manufacturer's SDR 11 equivalent dimensions; one end with threaded brass insert, and one solvent-cement-joint end.
- 1. Manufacturers:
    - a. Thompson Plastics, Inc.
- D. Plastic-to-Metal Transition Unions: MSS SP-107, CPVC and PVC four-part union. Include brass end, solvent-cement-joint end, rubber O-ring, and union nut.
- 1. Manufacturers:
    - a. NIBCO INC.
    - b. NIBCO, Inc.; Chemtrol Div.
- E. Flexible Transition Couplings for Underground Nonpressure Drainage Piping: ASTM C 1173 with elastomeric sleeve ends same size as piping to be joined, and corrosion-resistant metal band on each end.
- 1. Manufacturers:
    - a. Cascade Waterworks Mfg. Co.
    - b. Fernco, Inc.
    - c. Mission Rubber Company.
    - d. Plastic Oddities, Inc.

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BASIC MECHANICAL MATERIALS AND METHODS

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2.5 DIELECTRIC FITTINGS

- A. Description: Combination fitting of copper alloy and ferrous materials with threaded, solder-joint, plain, or weld-neck end connections that match piping system materials.
- B. Insulating Material: Suitable for system fluid, pressure, and temperature.
- C. Dielectric Flanges: Factory-fabricated, companion-flange assembly, for 150- or 300-psig (1035- or 2070-kPa) minimum working pressure as required to suit system pressures.
  - 1. Manufacturers:
    - a. Capitol Manufacturing Co.
    - b. Central Plastics Company.
    - c. Epco Sales, Inc.
    - d. Watts Industries, Inc.; Water Products Div.
- D. Dielectric-Flange Kits: Companion-flange assembly for field assembly. Include flanges, full-face- or ring-type neoprene or phenolic gasket, phenolic or polyethylene bolt sleeves, phenolic washers, and steel backing washers.
  - 1. Manufacturers:
    - a. Advance Products & Systems, Inc.
    - b. Calpico, Inc.
    - c. Central Plastics Company.
    - d. Pipeline Seal and Insulator, Inc.
  - 2. Separate companion flanges and steel bolts and nuts shall have 150- or 300-psig (1035- or 2070-kPa) minimum working pressure where required to suit system pressures.
- E. Dielectric Couplings: Galvanized-steel coupling with inert and noncorrosive, thermoplastic lining; threaded ends; and 300-psig (2070-kPa) minimum working pressure at 225 deg F (107 deg C).
  - 1. Manufacturers:
    - a. Calpico, Inc.
    - b. Lochinvar Corp.
- F. Dielectric Nipples: Electroplated steel nipple with inert and noncorrosive, thermoplastic lining; plain, threaded, or grooved ends; and 300-psig (2070-kPa) minimum working pressure at 225 deg F (107 deg C).
  - 1. Manufacturers:

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BASIC MECHANICAL MATERIALS AND METHODS

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- a. Perfection Corp.
- b. Precision Plumbing Products, Inc.
- c. Sioux Chief Manufacturing Co., Inc.
- d. Victaulic Co. of America.

## 2.6 MECHANICAL SLEEVE SEALS

- A. Description: Modular sealing element unit, designed for field assembly, to fill annular space between pipe and sleeve.
  - 1. Manufacturers:
    - a. Advance Products & Systems, Inc.
    - b. Calpico, Inc.
    - c. Metraflex Co.
    - d. Pipeline Seal and Insulator, Inc.
  - 2. Sealing Elements: EPDM interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
  - 3. Pressure Plates: Stainless steel. Include two for each sealing element.
  - 4. Connecting Bolts and Nuts: Stainless steel of length required to secure pressure plates to sealing elements. Include one for each sealing element.

## 2.7 SLEEVES

- A. Galvanized-Steel Sheet: 0.0239-inch (0.6-mm) minimum thickness; round tube closed with welded longitudinal joint.
- B. Steel Pipe: ASTM A 53, Type E, Grade B, Schedule 40, galvanized, plain ends.
- C. Stack Sleeve Fittings: Manufactured, cast-iron sleeve with integral clamping flange. Include clamping ring and bolts and nuts for membrane flashing.
  - 1. Underdeck Clamp: Clamping ring with set screws.
- D. Molded PVC: Permanent, with nailing flange for attaching to wooden forms.
- E. PVC Pipe: ASTM D 1785, Schedule 40.
- F. Molded PE: Reusable, PE, tapered-cup shaped, and smooth-outer surface with nailing flange for attaching to wooden forms.

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BASIC MECHANICAL MATERIALS AND METHODS

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2.8 ESCUTCHEONS

- A. Description: Manufactured wall and ceiling escutcheons and floor plates, with an ID to closely fit around pipe, tube, and insulation of insulated piping and an OD that completely covers opening.
- B. One-Piece, Deep-Pattern Type: Deep-drawn, box-shaped brass with polished chrome-plated finish.
- C. One-Piece, Cast-Brass Type: With set screw.
  - 1. Finish: Polished chrome-plated.
- D. One-Piece, Stamped-Steel Type: With set screw or spring clips and chrome-plated finish.
- E. One-Piece, Floor-Plate Type: Cast-iron floor plate.

2.9 GROUT

- A. Description: ASTM C 1107, Grade B, nonshrink and nonmetallic, dry hydraulic-cement grout.
  - 1. Characteristics: Post-hardening, volume-adjusting, nonstaining, noncorrosive, nongaseous, and recommended for interior and exterior applications.
  - 2. Design Mix: 5000-psi (34.5-MPa), 28-day compressive strength.
  - 3. Packaging: Premixed and factory packaged.

**PART 3 - EXECUTION**

3.1 MECHANICAL DEMOLITION

- A. Refer to Division 1 Sections "Cutting and Patching" and "Selective Demolition" for general demolition requirements and procedures.
- B. Disconnect, demolish, and remove mechanical systems, equipment, and components indicated to be removed.
  - 1. Piping to Be Removed: Remove portion of piping indicated to be removed and cap or plug remaining piping with same or compatible piping material.
  - 2. Piping to Be Abandoned in Place: Drain piping and cap or plug piping with same or compatible piping material.
  - 3. Ducts to Be Removed: Remove portion of ducts indicated to be removed and plug remaining ducts with same or compatible ductwork material.

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4. Ducts to Be Abandoned in Place: Cap or plug ducts with same or compatible ductwork material.
  5. Equipment to Be Removed: Disconnect and cap services and remove equipment.
  6. Equipment to Be Removed and Reinstalled: Disconnect and cap services and remove, clean, and store equipment; when appropriate, reinstall, reconnect, and make equipment operational.
  7. Equipment to Be Removed and Salvaged: Disconnect and cap services and remove equipment and deliver to Owner.
- C. If pipe, insulation, or equipment to remain is damaged in appearance or is unserviceable, remove damaged or unserviceable portions and replace with new products of equal capacity and quality.

3.2 PIPING SYSTEMS - COMMON REQUIREMENTS

- A. Install piping according to the following requirements and Division 23 Sections specifying piping systems.
- B. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.
- C. Install piping in concealed locations, unless otherwise indicated and except in equipment rooms and service areas.
- D. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
- E. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.
- F. Install piping to permit valve servicing.
- G. Install piping at indicated slopes.
- H. Install piping free of sags and bends.
- I. Install fittings for changes in direction and branch connections.
- J. Install piping to allow application of insulation.
- K. Select system components with pressure rating equal to or greater than system operating pressure.

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BASIC MECHANICAL MATERIALS AND METHODS

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- L. Install escutcheons for penetrations of walls, ceilings, and floors according to the following:
  - 1. New and Existing Piping:
    - a. Piping with Fitting or Sleeve Protruding from Wall: One-piece, deep-pattern type.
    - b. Chrome-Plated Piping: One-piece, cast-brass type with polished chrome-plated finish.
    - c. Insulated Piping: One-piece, stamped-steel type with spring clips.
    - d. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece, cast-brass type with polished chrome-plated finish.
    - e. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece, stamped-steel type.
    - f. Bare Piping at Ceiling Penetrations in Finished Spaces: One-piece, cast-brass type with polished chrome-plated finish.
    - g. Bare Piping in Unfinished Service Spaces: One-piece, cast-brass type with polished chrome-plated finish.
    - h. Bare Piping in Unfinished Service Spaces: One-piece, stamped-steel type with concealed hinge and set screw.
    - i. Bare Piping in Equipment Rooms: One-piece, cast-brass type.
    - j. Bare Piping at Floor Penetrations in Equipment Rooms: One-piece, floor-plate type.
- M. Permanent sleeves are not required for holes formed by removable PE sleeves.
- N. Install sleeves for pipes passing through concrete and masonry walls and concrete floor and roof slabs.
  - 1. Cut sleeves to length for mounting flush with both surfaces.
    - a. Exception: Extend sleeves installed in floors of mechanical equipment areas or other wet areas 2 inches (50 mm) above finished floor level. Extend cast-iron sleeve fittings below floor slab as required to secure clamping ring if ring is specified.
  - 2. Install sleeves in new walls and slabs as new walls and slabs are constructed.
  - 3. Install sleeves that are large enough to provide 1/4-inch (6.4-mm) annular clear space between sleeve and pipe or pipe insulation. Use the following sleeve materials:
    - a. Steel Pipe Sleeves: For pipes smaller than NPS 6 (DN 150).
    - b. Steel Sheet Sleeves: For pipes NPS 6 (DN 150) and larger, penetrating gypsum-board partitions.
    - c. Stack Sleeve Fittings: For pipes penetrating floors with membrane waterproofing. Secure flashing between clamping flanges. Install section of cast-iron soil pipe to extend sleeve to 2 inches (50 mm) above finished



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BASIC MECHANICAL MATERIALS AND METHODS

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floor level. Refer to Division 7 Section "Sheet Metal Flashing and Trim" for flashing.

- 1) Seal space outside of sleeve fittings with grout.
4. Except for underground wall penetrations, seal annular space between sleeve and pipe or pipe insulation, using joint sealants appropriate for size, depth, and location of joint.
- O. Aboveground, Exterior-Wall Pipe Penetrations: Seal penetrations using sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch (25-mm) annular clear space between pipe and sleeve for installing mechanical sleeve seals.
1. Install steel pipe for sleeves smaller than 6 inches (150 mm) in diameter.
  2. Install cast-iron "wall pipes" for sleeves 6 inches (150 mm) and larger in diameter.
- P. Underground, Exterior-Wall Pipe Penetrations: Install cast-iron "wall pipes" for sleeves. Seal pipe penetrations using mechanical sleeve seals. Select sleeve size to allow for 1-inch (25-mm) annular clear space between pipe and sleeve for installing mechanical sleeve seals.
1. Mechanical Sleeve Seal Installation: Select type and number of sealing elements required for pipe material and size. Position pipe in center of sleeve. Assemble mechanical sleeve seals and install in annular space between pipe and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.
- Q. Fire-Barrier Penetrations: Sealing of fire rated walls, partitions, ceilings, and floors at pipe penetrations is by the contractor making the penetration.
- R. Verify final equipment locations for roughing-in.
- S. Refer to equipment specifications in other Sections of these Specifications for roughing-in requirements.
- 3.3 PIPING JOINT CONSTRUCTION
- A. Join pipe and fittings according to the following requirements and Division 23 Sections specifying piping systems.
  - B. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
  - C. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.

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BASIC MECHANICAL MATERIALS AND METHODS

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- D. Soldered Joints: Apply ASTM B 813, water-flushable flux, unless otherwise indicated, to tube end. Construct joints according to ASTM B 828 or CDA's "Copper Tube Handbook," using lead-free solder alloy complying with ASTM B 32.
- E. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," "Pipe and Tube" Chapter, using copper-phosphorus brazing filler metal complying with AWS A5.8.
- F. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:
  - 1. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.
  - 2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.
- G. Welded Joints: Construct joints according to AWS D10.12, using qualified processes and welding operators according to Part 1 "Quality Assurance" Article.
- H. Flanged Joints: Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Use suitable lubricants on bolt threads.
- I. Plastic Piping Solvent-Cement Joints: Clean and dry joining surfaces. Join pipe and fittings according to the following:
  - 1. Comply with ASTM F 402 for safe-handling practice of cleaners, primers, and solvent cements.
  - 2. ABS Piping: Join according to ASTM D 2235 and ASTM D 2661 Appendixes.
  - 3. CPVC Piping: Join according to ASTM D 2846/D 2846M Appendix.
  - 4. PVC Pressure Piping: Join schedule number ASTM D 1785, PVC pipe and PVC socket fittings according to ASTM D 2672. Join other-than-schedule-number PVC pipe and socket fittings according to ASTM D 2855.
  - 5. PVC Nonpressure Piping: Join according to ASTM D 2855.
  - 6. PVC to ABS Nonpressure Transition Fittings: Join according to ASTM D 3138 Appendix.
- J. Plastic Pressure Piping Gasketed Joints: Join according to ASTM D 3139.
- K. Plastic Nonpressure Piping Gasketed Joints: Join according to ASTM D 3212.
- L. PE Piping Heat-Fusion Joints: Clean and dry joining surfaces by wiping with clean cloth or paper towels. Join according to ASTM D 2657.
  - 1. Plain-End Pipe and Fittings: Use butt fusion.
  - 2. Plain-End Pipe and Socket Fittings: Use socket fusion.

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BASIC MECHANICAL MATERIALS AND METHODS

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- M. Fiberglass Bonded Joints: Prepare pipe ends and fittings, apply adhesive, and join according to pipe manufacturer's written instructions.

3.4 PIPING CONNECTIONS

- A. Make connections according to the following, unless otherwise indicated:
  - 1. Install unions, in piping NPS 2 (DN 50) and smaller, adjacent to each valve and at final connection to each piece of equipment.
  - 2. Install flanges, in piping NPS 2-1/2 (DN 65) and larger, adjacent to flanged valves and at final connection to each piece of equipment.
  - 3. Dry Piping Systems: Install dielectric unions and flanges to connect piping materials of dissimilar metals.
  - 4. Wet Piping Systems: Install dielectric coupling and nipple fittings to connect piping materials of dissimilar metals.

3.5 EQUIPMENT INSTALLATION - COMMON REQUIREMENTS

- A. Install equipment to allow maximum possible headroom unless specific mounting heights are not indicated.
- B. Install equipment level and plumb, parallel and perpendicular to other building systems and components in exposed interior spaces, unless otherwise indicated.
- C. Install mechanical equipment to facilitate service, maintenance, and repair or replacement of components. Connect equipment for ease of disconnecting, with minimum interference to other installations. Extend grease fittings to accessible locations.
- D. Install equipment to allow right of way for piping installed at required slope.
- E. Install all equipment per the manufacturer's written installation instructions.

3.6 PAINTING

- A. Damage and Touchup: Repair marred and damaged factory-painted finishes with materials and procedures to match original factory finish.

3.7 CONCRETE BASES

- A. Concrete Bases: Anchor equipment to concrete base according to equipment manufacturer's written instructions and according to seismic codes at Project.

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BASIC MECHANICAL MATERIALS AND METHODS

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1. Construct concrete bases of dimensions indicated, but not less than 4 inches (100 mm) larger in both directions than supported unit.
2. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch (450-mm) centers around the full perimeter of the base.
3. Install epoxy-coated anchor bolts for supported equipment that extend through concrete base, and anchor into structural concrete floor.
4. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
5. Install anchor bolts to elevations required for proper attachment to supported equipment.
6. Install anchor bolts according to anchor-bolt manufacturer's written instructions.
7. Use 3000-psi (20.7-MPa), 28-day compressive-strength concrete and reinforcement as specified in Division 3 Section "Cast-in-Place Concrete."

3.8 ERECTION OF METAL SUPPORTS AND ANCHORAGES

- A. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor mechanical materials and equipment.
- B. Field Welding: Comply with AWS D1.1.

3.9 ERECTION OF WOOD SUPPORTS AND ANCHORAGES

- A. Cut, fit, and place wood grounds, nailers, blocking, and anchorages to support, and anchor mechanical materials and equipment.
- B. Select fastener sizes that will not penetrate members if opposite side will be exposed to view or will receive finish materials. Tighten connections between members. Install fasteners without splitting wood members.
- C. Attach to substrates as required to support applied loads.

3.10 GROUTING

- A. Mix and install grout for mechanical equipment base bearing surfaces, pump and other equipment base plates, and anchors.
- B. Clean surfaces that will come into contact with grout.
- C. Provide forms as required for placement of grout.
- D. Avoid air entrapment during placement of grout.

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BASIC MECHANICAL MATERIALS AND METHODS

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- E. Place grout, completely filling equipment bases.
- F. Place grout on concrete bases and provide smooth bearing surface for equipment.
- G. Place grout around anchors.
- H. Cure placed grout.

END OF SECTION 23 05 00

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COMMON MOTOR REQUIREMENTS FOR HVAC EQUIPMENT

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SECTION 23 05 13 - COMMON MOTOR REQUIREMENTS FOR HVAC EQUIPMENT

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 general requirements for single-phase and polyphase, general-purpose, horizontal, small and medium, squirrel-cage induction motors for use on alternating-current power systems up to 600 V and installed at equipment manufacturer's factory or shipped separately by equipment manufacturer for field installation.

1.3 COORDINATION

- A. Coordinate features of motors, installed units, and accessory devices to be compatible with the following:
  - 1. Motor controllers.
  - 2. Torque, speed, and horsepower requirements of the load.
  - 3. Ratings and characteristics of supply circuit and required control sequence.
  - 4. Ambient and environmental conditions of installation location.

PART 2 - PRODUCTS

2.1 GENERAL MOTOR REQUIREMENTS

- A. Comply with NEMA MG 1 unless otherwise indicated.

2.2 MOTOR CHARACTERISTICS

- A. Duty: Continuous duty at ambient temperature of 40 deg C and at altitude of 3300 feet (1000 m) above sea level.

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COMMON MOTOR REQUIREMENTS FOR HVAC EQUIPMENT

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- B. Capacity and Torque Characteristics: Sufficient to start, accelerate, and operate connected loads at designated speeds, at installed altitude and environment, with indicated operating sequence, and without exceeding nameplate ratings or considering service factor.
- C. Description: NEMA MG 1, Design B, medium induction motor.
- D. Efficiency: Premium efficient, as defined in NEMA MG 1.
- E. Service Factor: 1.15.
- F. Multispeed Motors: Variable torque.
  - 1. For motors with 2:1 speed ratio, consequent pole, single winding.
  - 2. For motors with other than 2:1 speed ratio, separate winding for each speed.
- G. Rotor: Random-wound, squirrel cage.
- H. Bearings: Re-greaseable, shielded, antifriction ball bearings suitable for radial and thrust loading.
- I. Temperature Rise: Match insulation rating.
- J. Insulation: Class F.
- K. Code Letter Designation:
  - 1. Motors 15 HP and Larger: NEMA starting Code F or Code G.
  - 2. Motors Smaller Than 15 HP: Manufacturer's standard starting characteristic.
- L. Enclosure Material: Cast iron for motor frame sizes 324T and larger; rolled steel for motor frame sizes smaller than 324T.

2.3 ADDITIONAL REQUIREMENTS FOR POLYPHASE MOTORS

- A. Motors Used with Reduced-Voltage and Multispeed Controllers: Match wiring connection requirements for controller with required motor leads. Provide terminals in motor terminal box, suited to control method.
- B. Motors Used with Variable-Frequency Controllers: Ratings, characteristics, and features coordinated with and approved by controller manufacturer.
  - 1. Windings: Copper magnet wire with moisture-resistant insulation varnish, designed and tested to resist transient spikes, high frequencies, and short time rise pulses produced by pulse-width-modulated inverters.
  - 2. Premium-Efficient Motors: Class B temperature rise; Class F insulation.



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COMMON MOTOR REQUIREMENTS FOR HVAC EQUIPMENT

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3. Inverter-Duty Motors: Class F temperature rise; Class H insulation.
4. Thermal Protection: Comply with NEMA MG 1 requirements for thermally protected motors.

2.4 SINGLE-PHASE MOTORS

- A. Motors larger than 1/20 hp shall be one of the following, to suit starting torque and requirements of specific motor application:
  1. Permanent-split capacitor.
  2. Split phase.
  3. Capacitor start, inductor run.
  4. Capacitor start, capacitor run.
- B. Multispeed Motors: Variable-torque, permanent-split-capacitor type.
- C. Bearings: Prelubricated, antifriction ball bearings or sleeve bearings suitable for radial and thrust loading.
- D. Motors 1/20 HP and Smaller: Shaded-pole type.
- E. Thermal Protection: Internal protection to automatically open power supply circuit to motor when winding temperature exceeds a safe value calibrated to temperature rating of motor insulation. Thermal-protection device shall automatically reset when motor temperature returns to normal range.

PART 3 - EXECUTION (Not Applicable)

END OF SECTION 23 05 13

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METERS AND GAUGES FOR HVAC PIPING

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SECTION 23 05 19 - METERS AND GAUGES FOR HVAC PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Thermometers, liquid in glass.
2. Thermometers, light activated.
3. Duct-thermometer mounting brackets.
4. Thermowells.
5. Pressure gauges, dial type.
6. Gauge attachments.
7. Test plugs.
8. Test-plug kits.
9. Sight flow indicators.
10. Flowmeters.

1.2 ACTION SUBMITTALS

A. Product Data:

1. Thermometers, liquid in glass.
2. Thermometers, light activated.
3. Duct-thermometer mounting brackets.
4. Thermowells.
5. Pressure gauges, dial type.
6. Gauge attachments.
7. Test plugs.
8. Test-plug kits.
9. Sight flow indicators.
10. Flowmeters.

B. Product Data Submittals: For each type of product.

C. Shop Drawings:

1. Include diagrams for power, signal, and control wiring.

1.3 INFORMATIONAL SUBMITTALS

A. Product Certificates: For each type of meter.

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METERS AND GAUGES FOR HVAC PIPING

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1.4 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For meters and gauges to include in operation and maintenance manuals.

PART 2 - PRODUCTS

2.1 THERMOMETERS, LIQUID IN GLASS

- A. Thermometers, Liquid in Glass - Metal Case, Industrial Style:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Terice, H. O. Co.
  - b. Weiss Instruments, Inc.
  - c. Weksler Glass Thermometer Corp.
2. Source Limitations: Provide liquid-in-glass, metal-case, industrial-style thermometers from single manufacturer.
3. Standard: ASME B40.200.
4. Case: Cast aluminum; 9-inch (229-mm) nominal size unless otherwise indicated.
5. Case Form: Locking adjustable angle unless otherwise indicated.
6. Tube: Glass with magnifying lens and blue or red organic liquid, mercury free.
7. Tube Background: Nonreflective aluminum with permanent scale markings graduated in 2 deg F.
8. Window: Glass or acrylic plastic.
9. Stem: Aluminum, brass, or stainless steel and of length to suit installation.
  - a. Design for Air-Duct Installation: With ventilated shroud.
  - b. Design for Thermowell Installation: Bare stem.
10. Connector: 1-1/4 inches (32 mm), with ASME B1.1 or ASME B1.20.1 screw threads to fit thermowell.
11. Accuracy: Plus or minus 1 percent of span range or one scale division, to a maximum of 1.5 percent of span.

- B. Thermometers, Liquid in Glass - Plastic Case, Industrial Style:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Terice, H. O. Co.
  - b. Weiss Instruments, Inc.
  - c. Weksler Glass Thermometer Corp.

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METERS AND GAUGES FOR HVAC PIPING

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2. Source Limitations: Provide liquid-in-glass, plastic-case, industrial-style thermometers from single manufacturer.
  3. Standard: ASME B40.200.
  4. Case: Plastic; 9-inch (229-mm) nominal size unless otherwise indicated.
  5. Case Form: Locking adjustable angle unless otherwise indicated.
  6. Tube: Glass with magnifying lens and blue or red organic liquid, mercury free.
  7. Tube Background: Nonreflective aluminum with permanent scale markings graduated in 2 deg F.
  8. Window: Glass or acrylic plastic.
  9. Stem: Aluminum, brass, or stainless steel and of length to suit installation.
    - a. Design for Thermowell Installation: Bare stem.
  10. Connector: 1-1/4 inches (32 mm), with ASME B1.1 or ASME B1.20.1 screw threads to fit thermowell.
- C. Accuracy: Plus or minus 1 percent of span or one scale division, to a maximum of 1.5 percent of span

## 2.2 THERMOMETERS, LIGHT ACTIVATED

### A. Thermometers, Light Activated - Direct Mounted:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Terice, H. O. Co.
  - b. Weiss Instruments, Inc.
  - c. Weksler Glass Thermometer Corp.
2. Source Limitations: Provide light-activated, direct-mounted thermometers from single manufacturer.
3. Case: High impact ABS plastic or Metal; 9-inch (229-mm) nominal size unless otherwise indicated.
4. Scale Divisions: 0.1 deg F.
5. Range: -40 to 300 deg F.
6. Case Form: Adjustable angle.
7. Connector: 1-1/4 inches (32 mm), with ASME B1.1 or ASME B1.20.1 screw threads to fit thermowell.
8. Stem: Aluminum and of length to suit installation.
  - a. Design for Thermowell Installation: Bare stem.
9. Display: LCD with digits a minimum of 0.5 inch high.
10. Accuracy: Plus or minus 1 percent.

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METERS AND GAUGES FOR HVAC PIPING

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2.3 DUCT-THERMOMETER MOUNTING BRACKETS

- A. Description: Flanged bracket with screw holes, for attachment to air duct and made to hold thermometer stem.

2.4 THERMOWELLS

- A. Thermowells:
1. Standard: ASME B40.200.
  2. Description: Pressure-tight, socket-type fitting made for insertion in piping tee fitting.
  3. Material for Use with Copper Tubing: Copper.
  4. Material for Use with Steel Piping: Type 304 stainless steel or Type 316 stainless steel.
  5. Type: Stepped shank unless straight or tapered shank is indicated.
  6. External Threads: NPS 1/2, NPS 3/4, or NPS 1 (DN 15, DN 20, or NPS 25), with ASME B1.20.1 pipe threads.
  7. Internal Threads: 1/2, 3/4, and 1 inch (13, 19, and 25 mm), with ASME B1.1 screw threads.
  8. Bore: Diameter required to match thermometer bulb or stem.
  9. Insertion Length: Length required to match thermometer bulb or stem.
  10. Lagging Extension: Include on thermowells for insulated piping and tubing.
  11. Bushings: For converting size of thermowell's internal screw thread to size of thermometer connection.
- B. Heat-Transfer Medium: Mixture of graphite and glycerin.

2.5 PRESSURE GAUGES, DIAL TYPE

- A. Pressure Gauges, Dial Type - Direct Mounted, Metal Case:
1. Source Limitations: Provide dial-type, direct-mounted, metal-case pressure gauges from single manufacturer.
  2. Standard: ASME B40.100.
  3. Case: Silicone-filled type(s); stainless steel; 3-1/2-inch nominal diameter.
  4. Pressure-Element Assembly: Bourdon tube.
  5. Pressure Connection: Brass, with NPS 1/4 or NPS 1/2 (DN 8 or DN 15), ASME B1.20.1 pipe threads and bottom-outlet type unless back-outlet type is indicated.
  6. Movement: Mechanical, with link to pressure element and connection to pointer.
  7. Dial: Nonreflective aluminum with permanent scale markings graduated in psi and kPa.
  8. Pointer: Dark-colored metal.
  9. Window: Glass or acrylic plastic.

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METERS AND GAUGES FOR HVAC PIPING

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- 10. Ring: Metal.
- 11. Accuracy: Grade A, plus or minus 1 percent of middle half of span.

2.6 GAUGE ATTACHMENTS

- A. Valves: Brass ball, with NPS 1/4 or NPS 1/2 (DN 8 or DN 15), ASME B1.20.1 pipe threads.

2.7 TEST PLUGS

- A. Source Limitations: Provide test plugs from single manufacturer.
- B. Description: Test-station fitting made for insertion in piping tee fitting.
- C. Body: Brass or stainless steel with core inserts and gasketed and threaded cap. Include extended stem on units to be installed in insulated piping.
- D. Thread Size: NPS 1/4 (DN 8) or NPS 1/2 (DN 15), ASME B1.20.1 pipe thread.
- E. Minimum Pressure and Temperature Rating: 500 psig at 200 deg F (3450 kPa at 93 deg C).
- F. Core Inserts: EPDM self-sealing rubber.

2.8 TEST-PLUG KITS

- A. Source Limitations: Provide test-plug kits from single manufacturer.
- B. Furnish one test-plug kit(s) containing one thermometer(s), one pressure gauge and adapter, and carrying case. Thermometer sensing elements, pressure gauge, and adapter probes are to be of diameter to fit test plugs and of length to project into piping.
- C. Low-Range Thermometer: Small, bimetallic insertion type with 1- to 2-inch- (25- to 51-mm-) diameter dial and tapered-end sensing element. Dial range is to be at least 25 to 125 deg F (minus 4 to plus 52 deg C).
- D. High-Range Thermometer: Small, bimetallic insertion type with 1- to 2-inch- (25- to 51-mm-) diameter dial and tapered-end sensing element. Dial range is to be at least 0 to 220 deg F (minus 18 to plus 104 deg C).
- E. Pressure Gauge: Small, Bourdon-tube insertion type with 2- to 3-inch- (51- to 76-mm-) diameter dial and probe. Dial range is to be at least 0 to 200 psig (0 to 1380 kPa).
- F. Carrying Case: Metal or plastic, with formed instrument padding.

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METERS AND GAUGES FOR HVAC PIPING

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2.9 SIGHT FLOW INDICATORS

- A. Source Limitations: Provide sight flow indicators from single manufacturer.
- B. Description: Piping inline-installation device for visual verification of flow.
- C. Construction: Bronze or stainless steel body, with sight glass and ball, flapper, or paddle wheel indicator, and threaded or flanged ends.
- D. Minimum Pressure Rating: 150 psig (1034 kPa).
- E. Minimum Temperature Rating: 200 deg F (93 deg C).
- F. End Connections for NPS 2 (DN 50) and Smaller: Threaded.
- G. End Connections for NPS 2-1/2 (DN 65) and Larger: Flanged.

2.10 FLOWMETERS

- A. Performance Requirements: Manufacturer is to certify that each flowmeter complies with specified performance requirements and characteristics.
- B. Flowmeters - Orifice:
  - 1. Source Limitations: Provide orifice flowmeters from single manufacturer.
  - 2. Description: Flowmeter with orifice plate and flanges, differential pressure sensor, hoses or tubing, fittings, valves, indicator, and conversion chart.
  - 3. Flow Range: Sensor and indicator is to cover operating range of equipment or system served.
  - 4. Orifice Plate: Wafer-orifice-type, calibrated, flow-measuring element; for installation between orifice plate pipe flanges.
    - a. Design: Differential-pressure-type measurement for water.
    - b. Construction: Cast-iron body, brass valves with integral check valves and caps, and calibrated nameplate.
    - c. Minimum Pressure Rating: 300 psig (2070 kPa).
    - d. Minimum Temperature Rating: 250 deg F (121 deg C).
  - 5. Permanent Indicators: Meter suitable for wall or bracket mounting, calibrated for connected sensor, and has 6-inch- (152-mm-) diameter, or equivalent, dial with fittings and copper tubing for connecting to sensor.
    - a. Scale Divisions: gpm (Lps).
    - b. Accuracy: Plus or minus 1 percent between 20 and 80 percent of scale range.



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METERS AND GAUGES FOR HVAC PIPING

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6. Display: Shows rate of flow, with register to indicate total volume in gallons (liters).
7. Conversion Chart: Flow rate data compatible with sensor and indicator.
8. Operating Instructions: Include complete instructions with each flowmeter.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install thermowells with socket extending a minimum of 2 inches (51 mm) into fluid and in vertical position in piping tees.
- B. Install thermowells of sizes required to match thermometer connectors. Include bushings if required to match sizes.
- C. Install thermowells with extension on insulated piping.
- D. Fill thermowells with heat-transfer medium.
- E. Install direct-mounted thermometers in thermowells and adjust vertical and tilted positions.
- F. Install remote-mounted thermometer bulbs in thermowells and install cases on panels; connect cases with tubing, and support tubing to prevent kinks. Use minimum tubing length.
- G. Install pipe-mounted thermal-energy temperature sensors in thermowells and extend wiring to indicator.
- H. Install duct-thermometer-mounting brackets in walls of ducts. Attach to duct with screws.
- I. Install direct-mounted pressure gauges in piping tees with pressure gauge located on pipe at the most readable position.
- J. Install remote-mounted pressure gauges on panel.
- K. Install valve and snubber in piping for each pressure gauge for fluids (except steam).
- L. Install valve and syphon fitting in piping for each pressure gauge for steam.
- M. Install test plugs in piping tees.
- N. Install flow indicators in piping systems in accessible positions for easy viewing.

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## METERS AND GAUGES FOR HVAC PIPING

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- O. Assemble and install connections, tubing, and accessories between flow-measuring elements and flowmeters according to manufacturer's written instructions.
- P. Install flowmeter elements in accessible positions in piping systems.
- Q. Install wafer-orifice flowmeter elements between orifice-type pipe flanges.
- R. Install all flowmeter elements, with at least minimum straight lengths of pipe, upstream and downstream from element according to manufacturer's written instructions.
- S. Install permanent indicators on walls or brackets in accessible and readable positions.
- T. Install connection fittings in accessible locations for attachment to portable indicators.
- U. Mount thermal-energy meters on wall if accessible; if not, provide brackets to support meters.
- V. Install thermometers in the following locations:
  - 1. Inlet and outlet of each hydronic zone.
  - 2. Inlet and outlet of each hydronic boiler.
  - 3. Two inlets and two outlets of each chiller.
  - 4. Inlet and outlet of each hydronic coil in air-handling units.
  - 5. Two inlets and two outlets of each hydronic heat exchanger.
  - 6. Inlet and outlet of each thermal-storage tank.
  - 7. Outside-, return-, supply-, and mixed-air ducts.
- W. Install pressure gauges in the following locations:
  - 1. Discharge of each pressure-reducing valve.
  - 2. Inlet and outlet of each chiller chilled-water and condenser-water connection.
  - 3. Suction and discharge of each pump.

### 3.2 CONNECTIONS

- A. Install meters and gauges adjacent to machines and equipment to allow space for service and maintenance of meters, gauges, machines, and equipment.
- B. Connect flowmeter-system elements to meters.
- C. Connect flowmeter transmitters to meters.
- D. Connect thermal-energy meter transmitters to meters.

### 3.3 ADJUSTING

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METERS AND GAUGES FOR HVAC PIPING

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- A. After installation, calibrate meters according to manufacturer's written instructions.
- B. Adjust faces of meters and gauges to proper angle for best visibility.

3.4 THERMOMETER SCHEDULE

- A. Thermometers at inlet and outlet of each hydronic zone are to be the following:
  - 1. Liquid-filled, bimetallic-actuated type.
  - 2. Direct-mounted, metal-case, vapor-actuated type.
  - 3. Industrial-style, liquid-in-glass type.
  - 4. Direct-mounted, light-activated type.
  - 5. Test plug with EPDM self-sealing rubber inserts.
- B. inlet and outlet of each hydronic coil in air-handling units and built-up central systems are to be the following:
  - 1. Liquid-filled, bimetallic-actuated type.
  - 2. Direct-mounted, metal-case, vapor-actuated type.
  - 3. Industrial-style, liquid-in-glass type.
  - 4. Direct-mounted, light-activated type.
  - 5. Test plug with EPDM self-sealing rubber inserts.
- C. Thermometer stems are to be of length to match thermowell insertion length.

3.5 THERMOMETER SCALE-RANGE SCHEDULE

- A. Scale Range for Chilled-Water Piping:
  - 1. 0 to 100 deg F (Minus 20 to plus 50 deg C).
- B. Scale Range for Air Ducts:
  - 1. Minus 40 to plus 110 deg F (Minus 40 to plus 45 deg C).

3.6 PRESSURE-GAUGE SCHEDULE

- A. Pressure gauges at discharge of each pressure-reducing valve are to be the following:
  - 1. Liquid-filled, direct mounted, metal case.
  - 2. Sealed, direct mounted, plastic case.
  - 3. Test plug with EPDM self-sealing rubber inserts.

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METERS AND GAUGES FOR HVAC PIPING

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3.7 PRESSURE-GAUGE SCALE-RANGE SCHEDULE

A. Scale Range for Chilled-Water Piping:

1. 30 in. Hg to 15 psi (minus 100 to 0 kPa).

3.8 FLOWMETER SCHEDULE

A. Flowmeters for Chilled-Water Piping: Orifice type.

END OF SECTION 23 05 19

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GENERAL-DUTY VALVES FOR HVAC PIPING

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SECTION 23 05 23 - GENERAL-DUTY VALVES FOR HVAC PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Ball valves.

1.2 DEFINITIONS

- A. CWP: Cold working pressure.
- B. NRS: Nonrising stem.
- C. RS: Rising stem.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
  1. Include material descriptions and dimensions of individual components.
  2. Include operating characteristics and furnished accessories.

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Prepare valves for shipping as follows:
  1. Protect internal parts against rust and corrosion.
  2. Protect threads, flange faces, grooved ends, press ends, solder ends, and weld ends.
  3. Set ball valves open to minimize exposure of functional surfaces.
  4. Set butterfly valves closed or slightly open.
  5. Block check valves in either closed or open position.
  6. Set gate valves closed to prevent rattling.
  7. Set plug valves to open to minimize exposure of functional surfaces.
- B. Use the following precautions during storage:
  1. Maintain valve end protection.

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GENERAL-DUTY VALVES FOR HVAC PIPING

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- 2. Store valves indoors and maintain at higher than ambient dew point temperature. If outdoor storage is necessary, store valves off the ground in watertight enclosures.
- C. Use sling to handle large valves; rig sling to avoid damage to exposed parts. Do not use operating handles or stems or other components as lifting or rigging points unless specifically indicated for this purpose in manufacturer's written instructions.

PART 2 - PRODUCTS

2.1 SOURCE LIMITATIONS

- A. Obtain each type of valve from single source from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

- A. ASME Compliance:
  - 1. ASME B1.20.1 for threads for threaded-end valves.
  - 2. ASME B16.1 for flanges on iron valves.
  - 3. ASME B16.5 for flanges on steel valves.
  - 4. ASME B16.10 and ASME B16.34 for ferrous valve dimensions and design criteria.
  - 5. ASME B16.18 for cast-copper solder-joint connections.
  - 6. ASME B16.22 for wrought copper and copper-alloy solder-joint connections.
  - 7. ASME B16.34 for flanged- and threaded-end connections.
  - 8. ASME B16.51 for press joint connections.
  - 9. ASME B31.1 for power piping valves.
  - 10. ASME B31.9 for building services piping valves.
- B. AWWA Compliance: Comply with AWWA C606 for grooved-end connections.
- C. Provide bronze valves made with dezincification-resistant materials. Bronze valves made with copper alloy (brass) containing more than 15 percent zinc are unacceptable.
- D. Valve Pressure-Temperature Ratings: Not less than indicated and as required for system pressures and temperatures.
- E. Valve Sizes: Same as upstream piping unless otherwise indicated.
- F. Valve Bypass and Drain Connections: MSS SP-45.
- G. Wrench: Furnish Owner with one wrench for every five plug valves, for each size square plug-valve head.

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GENERAL-DUTY VALVES FOR HVAC PIPING

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H. Valve Actuator Type:

1. Gear Actuator: For quarter-turn ball valves **NPS 4 (DN 100)** and larger.
2. Hand Lever: For quarter-turn ball valves smaller than **NPS 4 (DN 100)**.

I. Valves in Insulated Piping:

1. Provide 2-inch (50-mm) extended neck stems.
2. Provide extended operating handles with nonthermal-conductive covering material and protective sleeves that allow operation of valves without breaking vapor seals or disturbing insulation.
3. Provide memory stops that are fully adjustable after insulation is applied.

2.3 BALL VALVES

A. Ball Valves, Threaded or Soldered Ends - Bronze, Two Piece with Full Port and Stainless Steel Trim:

1. Manufacturers: Subject to compliance with requirements, provide products by the following:
  - a. Apollo Valves; a part of Aalberts Integrated Piping Systems.
2. Standard: MSS SP-110.
3. SWP Rating: 150 psig (1035 kPa).
4. CWP Rating: 600 psig (4140 kPa).
5. Body Design: Two piece.
6. Body Material: Bronze.
7. Ends: Threaded or soldered. See Part 3 ball valve schedule articles.
8. Seats: PTFE.
9. Stem: Stainless steel.
10. Ball: Stainless steel, vented.
11. Port: Full.

B. Ball Valves, Threaded Ends - Bronze, Two Piece with Regular Port and Stainless Steel Trim:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Apollo Valves; a part of Aalberts Integrated Piping Systems.
  - b. NIBCO INC.
  - c. Watts
2. Standard: MSS SP-110.
3. SWP Rating: 150 psig (1035 kPa).

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GENERAL-DUTY VALVES FOR HVAC PIPING

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4. CWP Rating: 600 psig (4140 kPa).
5. Body Design: Two piece.
6. Body Material: Bronze.
7. Ends: Threaded.
8. Seats: PTFE.
9. Stem: Stainless steel.
10. Ball: Stainless steel, vented.
11. Port: Regular.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine valve interior for cleanliness, freedom from foreign matter, and corrosion. Remove special packing materials, such as blocks, used to prevent disc movement during shipping and handling.
- B. Operate valves in positions from fully open to fully closed. Examine guides and seats made accessible by such operations.
- C. Examine threads on valve and mating pipe for form and cleanliness.
- D. Examine mating flange faces for conditions that might cause leakage. Check bolting for proper size, length, and material. Verify that gasket is of proper size, that its material composition is suitable for service, and that it is free from defects and damage.
- E. Examine press fittings to verify they have been properly pressed.
- F. Do not attempt to repair defective valves; replace with new valves. Remove defective valves from site.

3.2 INSTALLATION OF VALVES

- A. Install valves with unions or flanges at each piece of equipment arranged to allow service, maintenance, and equipment removal without system shutdown.
- B. Provide support of piping adjacent to valves such that no force is imposed upon valves.
- C. Locate valves for easy access and where not blocked by equipment, other piping, or building components.
- D. For valves in horizontal piping, install valves with stem at or above center of pipe.



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GENERAL-DUTY VALVES FOR HVAC PIPING

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- E. Install valves in position that does not project into aisles or block access to other equipment.
- F. Install valves in position to allow full stem and actuator or manual operator movement.
- G. Verify that joints of each valve have been properly installed and sealed to ensure that there is no leakage or damage.
- H. Valve Tags: Comply with requirements for valve tags and schedules in Section 230553 "Identification for HVAC Piping and Equipment."
- I. Adhere to manufacturer's written installation instructions. When soldering or brazing valves, do not heat valves above maximum permitted temperature. Do not use solder with melting point temperature above valve of manufacturer's written recommended maximum.

### 3.3 ADJUSTING

- A. Adjust or replace valve packing after piping systems have been tested and put into service, but before final adjusting and balancing. Replace valves if persistent leaking occurs.

### 3.4 GENERAL REQUIREMENTS FOR VALVE APPLICATIONS

- A. If valves with specified SWP classes or CWP ratings are unavailable, the same types of valves with higher SWP classes or CWP ratings may be substituted.
- B. Select valves with the following end connections:
  - 1. For Copper Tubing, NPS 2 (DN 50) and Smaller: Threaded ends except where solder-joint valve-end option is indicated in valve schedules.
  - 2. For Copper Tubing, NPS 2-1/2 to NPS 4 (DN 65 to DN 100): Flanged ends except where threaded valve-end option is indicated in valve schedules.
  - 3. For Copper Tubing, NPS 5 (DN 125) and Larger: Flanged ends.
  - 4. For Steel Piping, NPS 2 (DN 50) and Smaller: Threaded ends.
  - 5. For Steel Piping, NPS 2-1/2 to NPS 4 (DN 65 to DN 100): Flanged ends except where threaded valve-end option is indicated in valve schedules.
  - 6. For Steel Piping, NPS 5 (DN 125) and Larger: Flanged ends.
  - 7. For Grooved-End Copper Tubing, except Steam and Steam Condensate Piping: Valve ends may be grooved.
  - 8. For Grooved-End Steel Piping, except Steam and Steam Condensate Piping: Valve ends may be grooved.
  - 9. Wafer-Type Valves: Flanged connections.

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GENERAL-DUTY VALVES FOR HVAC PIPING

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3.5 CHILLED-WATER BALL VALVE SCHEDULE

- A. Pipe NPS 2 (DN 50) and Smaller:
  - 1. Ball valves, threaded or soldered ends - bronze, two piece with full port and stainless steel trim.
  - 2. Ball valves, threaded ends - bronze, two piece with regular port and stainless steel trim.

3.6 COOLING-COIL CONDENSATE BALL VALVE SCHEDULE

- A. Pipe NPS 2 (DN 50) and Smaller:
  - 1. Ball valves, threaded or soldered ends - bronze, two piece with full port and bronze or brass trim.
  - 2. Ball valves, threaded ends - bronze, two piece with regular port and bronze or brass trim.

3.7 HEATING-WATER BALL VALVE SCHEDULE

- A. Pipe NPS 2 (DN 50) and Smaller:
  - 1. Ball valves, threaded or soldered ends - bronze, two piece with full port and stainless steel trim.
  - 2. Ball valves, threaded ends - bronze, two piece with regular port and stainless steel trim.

END OF SECTION 23 05 23

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HANGERS AND SUPPORTS FOR HVAC PIPING AND EQUIPMENT

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SECTION 23 05 29 – HANGERS AND SUPPORTS FOR HVAC PIPING AND EQUIPMENT

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

- A. Section Includes:
  - 1. Metal pipe hangers and supports.
  - 2. Trapeze pipe hangers.
  - 3. Metal framing systems.
  - 4. Thermal-hanger shield inserts.
  - 5. Fastener systems.
  - 6. Equipment supports.

1.03 DEFINITIONS

- A. MSS: Manufacturers Standardization Society of The Valve and Fittings Industry Inc.

1.04 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Design trapeze pipe hangers and equipment supports, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.
- B. Structural Performance: Hangers and supports for HVAC piping and equipment shall withstand the effects of gravity loads and stresses within limits and under conditions indicated according to ASCE/SEI 7.
  - 1. Design supports for multiple pipes, including pipe stands, capable of supporting combined weight of supported systems, system contents, and test water.
  - 2. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.

1.05 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.

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HANGERS AND SUPPORTS FOR HVAC PIPING AND EQUIPMENT

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- B. Shop Drawings: Signed and sealed by a qualified professional engineer. Show fabrication and installation details and include calculations for the following; include Product Data for components:
  - 1. Trapeze pipe hangers.
  - 2. Metal framing systems.
  - 3. Pipe stands.
  - 4. Equipment supports.
- C. Delegated-Design Submittal: For trapeze hangers indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
  - 1. Detail fabrication and assembly of trapeze hangers.
  - 2. Design Calculations: Calculate requirements for designing trapeze hangers.

1.06 INFORMATIONAL SUBMITTALS

- A. Welding certificates.

1.07 QUALITY ASSURANCE

- A. Welding: Qualify procedures and personnel according to AWS D1.1, "Structural Welding Code--Steel." AWS D1.3, "Structural Welding Code--Sheet Steel." AWS D1.4, "Structural Welding Code--Reinforcing Steel." ASME Boiler and Pressure Vessel Code: Section IX.
- B. Welding: Qualify procedures and personnel according to the following as applicable:
  - 1. AWS D1.1, "Structural Welding Code--Steel."
  - 2. AWS D1.2, "Structural Welding Code--Aluminum."
  - 3. AWS D1.3, "Structural Welding Code--Sheet Steel."
  - 4. AWS D1.4, "Structural Welding Code--Reinforcing Steel."
  - 5. ASME Boiler and Pressure Vessel Code: Section IX.
- C. Pipe Welding Qualifications: Qualify procedures and operators according to ASME Boiler and Pressure Vessel Code.

PART 2 PRODUCTS

2.01 METAL PIPE HANGERS AND SUPPORTS

- A. Copper Pipe Hangers:
  - 1. Description: MSS SP-58, Types 1 through 58, copper-coated-steel, factory-fabricated components.
  - 2. Hanger Rods: Continuous-thread rod, nuts, and washer made of copper-coated steel.

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HANGERS AND SUPPORTS FOR HVAC PIPING AND EQUIPMENT

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2.02 TRAPEZE PIPE HANGERS

- A. Description: MSS SP-69, Type 59, shop- or field-fabricated pipe-support assembly made from structural carbon-steel shapes with MSS SP-58 carbon-steel hanger rods, nuts, saddles, and U-bolts.

2.03 METAL FRAMING SYSTEMS

- A. MFMA Manufacturer Metal Framing Systems:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Allied Tube & Conduit.
    - b. Cooper B-Line, Inc.
    - c. Flex-Strut Inc.
    - d. GS Metals Corp.
    - e. Thomas & Betts Corporation.
    - f. Unistrut Corporation; Tyco International, Ltd.
    - g. Wesanco, Inc.
  2. Description: Shop- or field-fabricated pipe-support assembly for supporting multiple parallel pipes.
  3. Standard: MFMA-4.
  4. Channels: Continuous slotted steel channel with intumed lips.
  5. Channel Nuts: Formed or stamped steel nuts or other devices designed to fit into channel slot and, when tightened, prevent slipping along channel.
  6. Hanger Rods: Continuous-thread rod, nuts, and washer made of carbon steel.
  7. Metallic Coating: Electroplated zinc.

2.04 THERMAL-HANGER SHIELD INSERTS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Carpenter & Paterson, Inc.
  2. Clement Support Services.
  3. ERICO International Corporation.
  4. National Pipe Hanger Corporation.
  5. PHS Industries, Inc.
  6. Pipe Shields, Inc.; a subsidiary of Piping Technology & Products, Inc.
  7. Piping Technology & Products, Inc.
  8. Rilco Manufacturing Co., Inc.
  9. Value Engineered Products, Inc.
- B. Description: 100-psig- (690-kPa-) minimum, compressive-strength insulation insert encased in sheet metal shield.

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HANGERS AND SUPPORTS FOR HVAC PIPING AND EQUIPMENT

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- C. Insulation-Insert Material for Cold Piping: Water-repellent treated, ASTM C 533, Type I calcium silicate or ASTM C 552, Type II cellular glass with vapor barrier.
- D. Insulation-Insert Material for Hot Piping: Water-repellent treated, ASTM C 533, Type I calcium silicate or ASTM C 552, Type II cellular glass with 100-psig minimum compressive strength.
- E. For Trapeze or Clamped Systems: Insert and shield shall cover entire circumference of pipe.
- F. For Clevis or Band Hangers: Insert and shield shall cover lower 180 degrees of pipe.
- G. Insert Length: Extend 2 inches (50 mm) beyond sheet metal shield for piping operating below ambient air temperature.

2.05 FASTENER SYSTEMS

- A. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.
- B. Mechanical-Expansion Anchors: Insert-wedge-type, stainless steel anchors, for use in hardened portland cement concrete; with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

2.06 EQUIPMENT SUPPORTS

- A. Description: Welded, shop- or field-fabricated equipment support made from structural carbon-steel shapes.

2.07 MISCELLANEOUS MATERIALS

- A. Structural Steel: ASTM A 36/A 36M, carbon-steel plates, shapes, and bars; black and galvanized.
- B. Grout: ASTM C 1107, factory-mixed and -packaged, dry, hydraulic-cement, nonshrink and nonmetallic grout; suitable for interior and exterior applications.
  - 1. Properties: Nonstaining, noncorrosive, and nongaseous.
  - 2. Design Mix: 5000-psi, 28-day compressive strength.

PART 3 EXECUTION

3.01 HANGER AND SUPPORT INSTALLATION

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HANGERS AND SUPPORTS FOR HVAC PIPING AND EQUIPMENT

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- A. Metal Pipe-Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Install hangers, supports, clamps, and attachments as required to properly support piping from the building structure.
- B. Metal Trapeze Pipe-Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Arrange for grouping of parallel runs of horizontal piping, and support together on field-fabricated trapeze pipe hangers.
  - 1. Pipes of Various Sizes: Support together and space trapezes for smallest pipe size or install intermediate supports for smaller diameter pipes as specified for individual pipe hangers.
  - 2. Field fabricate from ASTM A 36/A 36M, carbon-steel shapes selected for loads being supported. Weld steel according to AWS D1.1/D1.1M.
- C. Metal Framing System Installation: Arrange for grouping of parallel runs of piping, and support together on field-assembled metal framing systems.
- D. Thermal-Hanger Shield Installation: Install in pipe hanger or shield for insulated piping.
- E. Fastener System Installation:
  - 1. Install powder-actuated fasteners for use in lightweight concrete or concrete slabs less than 4 inches thick in concrete after concrete is placed and completely cured. Use operators that are licensed by powder-actuated tool manufacturer. Install fasteners according to powder-actuated tool manufacturer's operating manual.
  - 2. Install mechanical-expansion anchors in concrete after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions.
- F. Pipe Stand Installation:
  - 1. Pipe Stand Types except Curb-Mounted Type: Assemble components and mount on smooth roof surface. Do not penetrate roof membrane.
  - 2. Curb-Mounted-Type Pipe Stands: Assemble components or fabricate pipe stand and mount on permanent, stationary roof curb. See Division 07 Section "Roof Accessories" for curbs.
- G. Install hangers and supports complete with necessary attachments, inserts, bolts, rods, nuts, washers, and other accessories.
- H. Equipment Support Installation: Fabricate from welded-structural-steel shapes.
- I. Install hangers and supports to allow controlled thermal and seismic movement of piping systems, to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends, and similar units.
- J. Install lateral bracing with pipe hangers and supports to prevent swaying.

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## HANGERS AND SUPPORTS FOR HVAC PIPING AND EQUIPMENT

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- K. Install building attachments within concrete slabs or attach to structural steel. Install additional attachments at concentrated loads, including valves, flanges, and strainers, NPS 2-1/2 and larger and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten inserts to forms and install reinforcing bars through openings at top of inserts.
- L. Load Distribution: Install hangers and supports so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.
- M. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and to not exceed maximum pipe deflections allowed by ASME B31.9 for building services piping.
- N. Insulated Piping:
  - 1. Attach clamps and spacers to piping.
    - a. Piping Operating above Ambient Air Temperature: Clamp may project through insulation.
    - b. Piping Operating below Ambient Air Temperature: Use thermal-hanger shield insert with clamp sized to match OD of insert.
    - c. Do not exceed pipe stress limits allowed by ASME B31.9 for building services piping.
  - 2. Install MSS SP-58, Type 39, protection saddles if insulation without vapor barrier is indicated. Fill interior voids with insulation that matches adjoining insulation.
    - a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 and larger if pipe is installed on rollers.
  - 3. Install MSS SP-58, Type 40, protective shields on cold piping with vapor barrier. Shields shall span an arc of 180 degrees.
    - a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 and larger if pipe is installed on rollers.
  - 4. Shield Dimensions for Pipe: Not less than the following:
    - a. NPS 1/4 to NPS 3-1/2: 12 inches long and 0.048 inch thick.
    - b. NPS 4: 12 inches long and 0.06 inch thick.
    - c. NPS 5 and NPS 6: 18 inches long and 0.06 inch thick.
    - d. NPS 8 to NPS 14: 24 inches long and 0.075 inch thick.
    - e. NPS 16 to NPS 24: 24 inches long and 0.105 inch thick.
  - 5. Pipes NPS 8 and Larger: Include wood or reinforced calcium-silicate-insulation inserts of length at least as long as protective shield.
  - 6. Thermal-Hanger Shields: Install with insulation same thickness as piping insulation.

### 3.02 EQUIPMENT SUPPORTS

- A. Fabricate structural-steel stands to suspend equipment from structure overhead or to support equipment above floor.



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HANGERS AND SUPPORTS FOR HVAC PIPING AND EQUIPMENT

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- B. Grouting: Place grout under supports for equipment and make bearing surface smooth.
- C. Provide lateral bracing, to prevent swaying, for equipment supports.

3.03 METAL FABRICATIONS

- A. Cut, drill, and fit miscellaneous metal fabrications for trapeze pipe hangers and equipment supports.
- B. Fit exposed connections together to form hairline joints. Field weld connections that cannot be shop welded because of shipping size limitations.
- C. Field Welding: Comply with AWS D1.1/D1.1M procedures for shielded, metal arc welding; appearance and quality of welds; and methods used in correcting welding work; and with the following:
  - 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
  - 2. Obtain fusion without undercut or overlap.
  - 3. Remove welding flux immediately.
  - 4. Finish welds at exposed connections so no roughness shows after finishing and so contours of welded surfaces match adjacent contours.

3.04 ADJUSTING

- A. Hanger Adjustments: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.
- B. Trim excess length of continuous-thread hanger and support rods to 1-1/2 inches.

3.05 PAINTING

- A. Touchup: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal are specified in Division 09 section "Exterior Painting" Division 09 section "Interior Painting" and Division 09 section "High Performance Coatings."
- B. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

3.06 HANGER AND SUPPORT SCHEDULE

- A. Specific hanger and support requirements are in Sections specifying piping systems and equipment.

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HANGERS AND SUPPORTS FOR HVAC PIPING AND EQUIPMENT

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- B. Comply with MSS SP-69 for pipe-hanger selections and applications that are not specified in piping system Sections.
- C. Use hangers and supports with galvanized metallic coatings for piping and equipment that will not have field-applied finish.
- D. Use nonmetallic coatings on attachments for electrolytic protection where attachments are in direct contact with copper tubing.
- E. Use carbon-steel pipe hangers and supports metal trapeze pipe hangers and metal framing systems and attachments for general service applications.
- F. Use padded hangers for piping that is subject to scratching.
- G. Use thermal-hanger shield inserts for insulated piping and tubing.
- H. Provide vertical spring hangers, as detailed below, between pipe clamps and building attachments for all pipe risers subject to thermal expansion.
- I. Horizontal-Piping Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
  - 1. Adjustable, Steel Clevis Hangers (MSS Type 1): For suspension of noninsulated or insulated, stationary pipes NPS 1/2 to NPS 30.
  - 2. Yoke-Type Pipe Clamps (MSS Type 2): For suspension of up to 1050 deg F, pipes NPS 4 to NPS 24, requiring up to 4 inches of insulation.
  - 3. Carbon- or Alloy-Steel, Double-Bolt Pipe Clamps (MSS Type 3): For suspension of pipes NPS 3/4 to NPS 36, requiring clamp flexibility and up to 4 inches of insulation.
  - 4. Steel Pipe Clamps (MSS Type 4): For suspension of cold and hot pipes NPS 1/2 to NPS 24 if little or no insulation is required.
  - 5. Pipe Hangers (MSS Type 5): For suspension of pipes NPS 1/2 to NPS 4, to allow off-center closure for hanger installation before pipe erection.
  - 6. Adjustable, Swivel Split- or Solid-Ring Hangers (MSS Type 6): For suspension of noninsulated, stationary pipes NPS 3/4 to NPS 8.
  - 7. Adjustable, Steel Band Hangers (MSS Type 7): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8.
  - 8. Adjustable Band Hangers (MSS Type 9): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8.
  - 9. Adjustable, Swivel-Ring Band Hangers (MSS Type 10): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8.
  - 10. Split Pipe Ring with or without Turnbuckle Hangers (MSS Type 11): For suspension of noninsulated, stationary pipes NPS 3/8 to NPS 8.
  - 11. Extension Hinged or Two-Bolt Split Pipe Clamps (MSS Type 12): For suspension of noninsulated, stationary pipes NPS 3/8 to NPS 3.
  - 12. U-Bolts (MSS Type 24): For support of heavy pipes NPS 1/2 to NPS 30.

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HANGERS AND SUPPORTS FOR HVAC PIPING AND EQUIPMENT

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13. Clips (MSS Type 26): For support of insulated pipes not subject to expansion or contraction.
  14. Pipe Saddle Supports (MSS Type 36): For support of pipes NPS 4 to NPS 36, with steel-pipe base stanchion support and cast-iron floor flange or carbon-steel plate.
  15. Pipe Stanchion Saddles (MSS Type 37): For support of pipes NPS 4 to NPS 36, with steel-pipe base stanchion support and cast-iron floor flange or carbon-steel plate, and with U-bolt to retain pipe.
  16. Adjustable Pipe Saddle Supports (MSS Type 38): For stanchion-type support for pipes NPS 2-1/2 to NPS 36 if vertical adjustment is required, with steel-pipe base stanchion support and cast-iron floor flange.
  17. Single-Pipe Rolls (MSS Type 41): For suspension of pipes NPS 1 to NPS 30, from two rods if longitudinal movement caused by expansion and contraction might occur.
  18. Adjustable Roller Hangers (MSS Type 43): For suspension of pipes NPS 2-1/2 to NPS 24, from single rod if horizontal movement caused by expansion and contraction might occur.
  19. Complete Pipe Rolls (MSS Type 44): For support of pipes NPS 2 to NPS 42 if longitudinal movement caused by expansion and contraction might occur but vertical adjustment is not necessary.
  20. Pipe Roll and Plate Units (MSS Type 45): For support of pipes NPS 2 to NPS 24 if small horizontal movement caused by expansion and contraction might occur and vertical adjustment is not necessary.
  21. Adjustable Pipe Roll and Base Units (MSS Type 46): For support of pipes NPS 2 to NPS 30 if vertical and lateral adjustment during installation might be required in addition to expansion and contraction.
- J. Vertical-Piping Clamps: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Extension Pipe or Riser Clamps (MSS Type 8): For support of pipe risers NPS 3/4 to NPS 24.
  2. Carbon- or Alloy-Steel Riser Clamps (MSS Type 42): For support of pipe risers NPS 3/4 to NPS 24 if longer ends are required for riser clamps.
- K. Hanger-Rod Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Steel Turnbuckles (MSS Type 13): For adjustment up to 6 inches for heavy loads.
  2. Steel Clevises (MSS Type 14): For 120 to 450 deg F piping installations.
  3. Swivel Turnbuckles (MSS Type 15): For use with MSS Type 11, split pipe rings.
  4. Malleable-Iron Sockets (MSS Type 16): For attaching hanger rods to various types of building attachments.
  5. Steel Weldless Eye Nuts (MSS Type 17): For 120 to 450 deg F piping installations.

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HANGERS AND SUPPORTS FOR HVAC PIPING AND EQUIPMENT

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- L. Building Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Steel or Malleable Concrete Inserts (MSS Type 18): For upper attachment to suspend pipe hangers from concrete ceiling.
  2. Top-Beam C-Clamps (MSS Type 19): For use under roof installations with bar-joint construction, to attach to top flange of structural shape.
  3. Side-Beam or Channel Clamps (MSS Type 20): For attaching to bottom flange of beams, channels, or angles.
  4. Center-Beam Clamps (MSS Type 21): For attaching to center of bottom flange of beams.
  5. Welded Beam Attachments (MSS Type 22): For attaching to bottom of beams if loads are considerable and rod sizes are large.
  6. C-Clamps (MSS Type 23): For structural shapes.
  7. Top-Beam Clamps (MSS Type 25): For top of beams if hanger rod is required tangent to flange edge.
  8. Side-Beam Clamps (MSS Type 27): For bottom of steel I-beams.
  9. Steel-Beam Clamps with Eye Nuts (MSS Type 28): For attaching to bottom of steel I-beams for heavy loads.
  10. Linked-Steel Clamps with Eye Nuts (MSS Type 29): For attaching to bottom of steel I-beams for heavy loads, with link extensions.
  11. Malleable-Beam Clamps with Extension Pieces (MSS Type 30): For attaching to structural steel.
  12. Welded-Steel Brackets: For support of pipes from below or for suspending from above by using clip and rod. Use one of the following for indicated loads:
    - a. Light (MSS Type 31): 750 lb.
    - b. Medium (MSS Type 32): 1500 lb.
    - c. Heavy (MSS Type 33): 3000 lb.
  13. Side-Beam Brackets (MSS Type 34): For sides of steel or wooden beams.
  14. Plate Lugs (MSS Type 57): For attaching to steel beams if flexibility at beam is required.
  15. Horizontal Travelers (MSS Type 58): For supporting piping systems subject to linear horizontal movement where headroom is limited.
- M. Saddles and Shields: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Steel-Pipe-Covering Protection Saddles (MSS Type 39): To fill interior voids with insulation that matches adjoining insulation.
  2. Protection Shields (MSS Type 40): Of length recommended in writing by manufacturer to prevent crushing insulation.
  3. Thermal-Hanger Shield Inserts: For supporting insulated pipe.
- N. Spring Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

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HANGERS AND SUPPORTS FOR HVAC PIPING AND EQUIPMENT

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1. Restraint-Control Devices (MSS Type 47): Where indicated to control piping movement.
  2. Spring Cushions (MSS Type 48): For light loads if vertical movement does not exceed 1-1/4 inches.
  3. Spring-Cushion Roll Hangers (MSS Type 49): For equipping Type 41, roll hanger with springs.
  4. Spring Sway Braces (MSS Type 50): To retard sway, shock, vibration, or thermal expansion in piping systems.
  5. Variable-Spring Hangers (MSS Type 51): Preset to indicated load and limit variability factor to 25 percent to allow expansion and contraction of piping system from hanger.
  6. Variable-Spring Base Supports (MSS Type 52): Preset to indicated load and limit variability factor to 25 percent to allow expansion and contraction of piping system from base support.
  7. Variable-Spring Trapeze Hangers (MSS Type 53): Preset to indicated load and limit variability factor to 25 percent to allow expansion and contraction of piping system from trapeze support.
  8. Constant Supports: For critical piping stress and if necessary to avoid transfer of stress from one support to another support, critical terminal, or connected equipment. Include auxiliary stops for erection, hydrostatic test, and load-adjustment capability. These supports include the following types:
    - a. Horizontal (MSS Type 54): Mounted horizontally.
    - b. Vertical (MSS Type 55): Mounted vertically.
    - c. Trapeze (MSS Type 56): Two vertical-type supports and one trapeze member.
- O. Comply with MSS SP-69 for trapeze pipe-hanger selections and applications that are not specified in piping system Sections.
- P. Comply with MFMA-103 for metal framing system selections and applications that are not specified in piping system Sections.
- Q. Use powder-actuated fasteners or mechanical-expansion anchors instead of building attachments where required in concrete construction.

END OF SECTION 23 05 29

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VIBRATION AND SEISMIC CONTROLS FOR HVAC

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SECTION 23 05 48 – VIBRATION AND SEISMIC CONTROLS FOR HVAC

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Elastomeric isolation pads.
2. Elastomeric isolation mounts.
3. Restrained elastomeric isolation mounts.
4. Open-spring isolators.
5. Housed-spring isolators.
6. Restrained-spring isolators.
7. Housed-restrained-spring isolators.
8. Pipe-riser resilient support.
9. Resilient pipe guides.
10. Elastomeric hangers.
11. Spring hangers.
12. Snubbers.
13. Restraints - rigid type.
14. Restraints - cable type.
15. Restraint accessories.
16. Post-installed concrete anchors.
17. Concrete inserts.
18. Vibration isolation equipment bases.
19. Restrained isolation roof-curb rails.

B. Related Requirements:

1. Section 210548 "Vibration and Seismic Controls for Fire-Suppression Piping and Equipment" for devices for fire-suppression equipment and systems.
2. Section 220548 "Vibration and Seismic Controls for Plumbing Piping and Equipment" for devices for plumbing equipment and systems.

1.2 DEFINITIONS

- A. Designated Seismic System: An HVAC component that requires design in accordance with ASCE/SEI 7, Ch. 13, and for which the Component Importance Factor is greater than 1.0.
- B. IBC: International Building Code.
- C. OSHPD: Office of Statewide Health Planning and Development (State of California).

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VIBRATION AND SEISMIC CONTROLS FOR HVAC

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1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
  - 1. Include rated load, rated deflection, and overload capacity for each vibration isolation device.
  - 2. Illustrate and indicate style, material, strength, fastening provision, and finish for each type and size of vibration isolation device and seismic and wind-force restraint component.
  - 3. Annotate to indicate application of each product submitted and compliance with requirements.
  - 4. Interlocking Snubbers: Include ratings for horizontal, vertical, and combined loads.
- B. Shop Drawings:
  - 1. Detail fabrication and assembly of equipment bases.
  - 2. Vibration Isolation Base Details: Detail fabrication including anchorages and attachments to structure and to supported equipment. Include adjustable motor bases, rails, and frames for equipment mounting.

1.4 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Show coordination of vibration isolation device installation and seismic bracing for HVAC piping and equipment with other systems and equipment in the vicinity, including other supports and restraints, if any.
- B. Qualification Data: For testing agency.
- C. Welding certificates.
- D. Field quality-control reports.

1.5 QUALITY ASSURANCE

- A. Testing Agency Qualifications: An independent agency, with the experience and capability to conduct testing indicated, be an NRTL as defined by OSHA in 29 CFR 1910.7, and be acceptable to authorities having jurisdiction.
- B. Welding Qualifications: Qualify procedures and personnel in accordance with AWS D1.1/D1.1M, "Structural Welding Code - Steel."
- C. Seismic and Wind-Load-JRestraint Device Load Ratings: Devices to be tested and rated in accordance with applicable code requirements and authorities having jurisdiction. Devices to be listed by a nationally recognized third party that requires periodic follow-up inspections and has a listing directory available to the public. Provide



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VIBRATION AND SEISMIC CONTROLS FOR HVAC

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third-party listing by one or more of the following: ICC-ES product listing, UL product listing, FM Approvals, an agency acceptable to authorities having jurisdiction.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

2.2 ELASTOMERIC ISOLATION PADS

A. Elastomeric Isolation Pads:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. California Dynamics Corporation.
  - b. Kinetics Noise Control, Inc.
  - c. Vibration Eliminator Co., Inc.
2. Source Limitations: Obtain elastomeric isolation pads from single manufacturer.
3. Fabrication: Single or multiple layers of sufficient durometer stiffness for uniform loading over pad area.
4. Size: Factory or field cut to match requirements of supported equipment.
5. Pad Material: Oil and water resistant with elastomeric properties. Neoprene rubber, silicone rubber, or other elastomeric material.
6. Surface Pattern: Smooth, ribbed, or waffle pattern.
7. Load-bearing metal plates adhered to pads.

2.3 ELASTOMERIC ISOLATION MOUNTS

A. Double-Deflection, Elastomeric Isolation Mounts:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. California Dynamics Corporation.
  - b. Isolation Technology, Inc.
  - c. Kinetics Noise Control, Inc.
  - d. Vibration Eliminator Co., Inc.
2. Source Limitations: Obtain double-deflection, elastomeric isolation mounts from single manufacturer.
3. Mounting Plates:

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- a. Top Plate: Encapsulated steel load transfer top plates, factory drilled and threaded with threaded studs or bolts.
  - b. Baseplate: Encapsulated steel bottom plates with holes provided for anchoring to support structure.
4. Elastomeric Material: Molded, oil- and water-resistant neoprene rubber, silicone rubber, or other elastomeric material.

## 2.4 RESTRAINED ELASTOMERIC ISOLATION MOUNTS

### A. Restrained Elastomeric Isolation Mounts:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. CADDY; brand of nVent Electrical plc.
  - b. California Dynamics Corporation.
  - c. Isolation Technology, Inc.
  - d. Kinetics Noise Control, Inc.
2. Source Limitations: Obtain restrained elastomeric isolation mounts from single manufacturer.
3. Description: All-directional isolator with seismic restraints containing two separate and opposing elastomeric elements that prevent central threaded element and attachment hardware from contacting the housing during normal operation.
  - a. Housing: Cast-ductile iron or welded steel.
  - b. Elastomeric Material: Molded, oil-resistant rubber, neoprene, or other elastomeric material.

## 2.5 OPEN-SPRING ISOLATORS

### A. Freestanding, Laterally Stable, Open-Spring Isolators:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. California Dynamics Corporation.
  - b. Isolation Technology, Inc.
  - c. Kinetics Noise Control, Inc.
  - d. Vibration Eliminator Co., Inc.
2. Source Limitations: Obtain freestanding, laterally stable, open-spring isolators from single manufacturer.
3. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.

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4. Minimum Additional Travel: 50 percent of the required deflection at rated load.
5. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
6. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.
7. Baseplates: Factory-drilled steel plate for bolting to structure with an elastomeric isolator pad attached to the underside. Baseplates limit floor load to 500 psig.
8. Top Plate and Adjustment Bolt: Threaded top plate with adjustment bolt and cap screw to fasten and level equipment.

## 2.6 HOUSED-SPRING ISOLATORS

### A. Freestanding, Laterally Stable, Open-Spring Isolators in Two-Part Telescoping Housing:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. CADDY; brand of nVent Electrical plc.
  - b. California Dynamics Corporation.
  - c. Isolation Technology, Inc.
  - d. Kinetics Noise Control, Inc.
2. Source Limitations: Obtain freestanding, laterally stable, open-spring isolators in two-part telescoping housing from single manufacturer.
3. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
4. Minimum Additional Travel: 50 percent of the required deflection at rated load.
5. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
6. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.
7. Two-Part Telescoping Housing: A steel top and bottom frame separated by an elastomeric material and enclosing the spring isolators.
  - a. Drilled base housing for bolting to structure with an elastomeric isolator pad attached to the underside. Bases limit floor load to 500 psig.
  - b. Top housing with threaded mounting holes and internal leveling device.

## 2.7 RESTRAINED-SPRING ISOLATORS

### A. Freestanding, Laterally Stable, Open-Spring Isolators with Vertical-Limit Stop Restraint:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. CADDY; brand of nVent Electrical plc.
  - b. California Dynamics Corporation.

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- c. Isolation Technology, Inc.
- d. Kinetics Noise Control, Inc.
- 2. Source Limitations: Obtain restrained-spring isolators from single manufacturer.
- 3. Housing: Steel housing with vertical-limit stops to prevent spring extension due to weight being removed.
  - a. Base with holes for bolting to structure with an elastomeric isolator pad attached to the underside. Bases limit floor load to 500 psig.
  - b. Top plate with threaded mounting holes.
  - c. Internal leveling bolt that acts as blocking during installation.
- 4. Restraint: Limit stop as required for equipment and authorities having jurisdiction.
- 5. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
- 6. Minimum Additional Travel: 50 percent of the required deflection at rated load.
- 7. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
- 8. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.

## 2.8 HOUSED-RESTRAINED-SPRING ISOLATORS

- A. Freestanding, Steel, Open-Spring Isolators with Vertical-Limit Stop Restraint in Two-Part Telescoping Housing:
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. CADDY; brand of nVent Electrical plc.
    - b. California Dynamics Corporation.
    - c. Isolation Technology, Inc.
    - d. Kinetics Noise Control, Inc.
  - 2. Source Limitations: Obtain freestanding, open-spring isolators with vertical-limit stop restraints from single manufacturer.
  - 3. Two-Part Telescoping Housing: A steel top and bottom frame separated by an elastomeric material and enclosing the spring isolators. Housings are equipped with adjustable snubbers to limit vertical movement.
    - a. Drilled base housing for bolting to structure with an elastomeric isolator pad attached to the underside. Bases limit floor load to 500 psig.
    - b. Threaded top housing with adjustment bolt and cap screw to fasten and level equipment.
  - 4. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
  - 5. Minimum Additional Travel: 50 percent of the required deflection at rated load.

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6. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
7. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.

2.9 PIPE-RISER RESILIENT SUPPORT

- A. All-Directional, Acoustical Pipe Anchor Consisting of Two Steel Tubes Separated by a Minimum 1/2-inch Thick Neoprene:
  1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. California Dynamics Corporation.
    - b. Kinetics Noise Control, Inc.
    - c. Vibration Eliminator Co., Inc.
    - d. Vibration Management Corp.
  2. Source Limitations: Obtain all-directional, acoustical pipe anchor from single manufacturer.
  3. Vertical-Limit Stops: Steel and neoprene vertical-limit stops arranged to prevent vertical travel in both directions.
  4. Maximum Load Per Support: 500 psig on isolation material providing equal isolation in all directions.

2.10 RESILIENT PIPE GUIDES

- A. Telescopic Arrangement of Two Steel Tubes or Post and Sleeve Arrangement Separated by a Minimum 1/2-inch Thick Neoprene:
  1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. California Dynamics Corporation.
    - b. Kinetics Noise Control, Inc.
    - c. Vibration Eliminator Co., Inc.
    - d. Vibration Management Corp.
  2. Source Limitations: Obtain resilient pipe guides from single manufacturer.
  3. Factory-Set Height Guide with Shear Pin: Shear pin to be removable and reinsertable to allow for selection of pipe movement. Guides to be capable of motion to meet location requirements.

2.11 ELASTOMERIC HANGERS

- A. Elastomeric Mount in a Steel Frame with Upper and Lower Steel Hanger Rods:

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1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. CADDY; brand of nVent Electrical plc.
  - b. California Dynamics Corporation.
  - c. Kinetics Noise Control, Inc.
  - d. Vibration Management Corp.
2. Source Limitations: Obtain elastomeric hangers from a single manufacturer.
3. Frame: Steel, fabricated with a connection for an upper threaded hanger rod and an opening on the underside to allow for a maximum of 30 degrees of angular lower hanger-rod misalignment without binding or reducing isolation efficiency.
4. Damping Element: Molded, oil-resistant rubber, neoprene, or other elastomeric material with a projecting bushing for the underside opening preventing steel to steel contact.

2.12 SPRING HANGERS

- A. Combination Coil-Spring and Elastomeric-Insert Hanger with Spring and Insert in Compression:
  1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. CADDY; brand of nVent Electrical plc.
    - b. California Dynamics Corporation.
    - c. Kinetics Noise Control, Inc.
    - d. Vibration Management Corp.
  2. Source Limitations: Obtain spring hangers from single manufacturer.
  3. Frame: Steel, fabricated for connection to threaded hanger rods and to allow for a maximum of 30 degrees of angular hanger-rod misalignment without binding or reducing isolation efficiency.
  4. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
  5. Minimum Additional Travel: 50 percent of the required deflection at rated load.
  6. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
  7. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.
  8. Elastomeric Element: Molded, oil-resistant rubber or neoprene. Steel-washer-reinforced cup to support spring and bushing projecting through bottom of frame.
  9. Adjustable Vertical Stop: Steel washer with neoprene washer "up-stop" on lower threaded rod.
  10. Self-centering hanger-rod cap to ensure concentricity between hanger rod and support spring coil.

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2.13 SNUBBERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. CADDY; brand of nVent Electrical plc.
  2. Kinetics Noise Control, Inc.
  3. Vibration Management Corp.
- B. Source Limitations: Obtain snubbers from single manufacturer.
- C. Description: Factory fabricated using welded structural-steel shapes and plates, anchor bolts, and replaceable resilient isolation washers and bushings.
1. Post-Installed Concrete Anchor Bolts: Secure to concrete surface with post-installed concrete anchors. Anchors to be seismically prequalified in accordance with ACI 355.2 testing and designated in accordance with ACI 318-14 Ch. 17 for 2015 or 2018 IBC.
  2. Preset Concrete Inserts: Seismically prequalified in accordance with ICC-ES AC446 testing.
  3. Anchors in Masonry: Design in accordance with TMS 402.
  4. Resilient Isolation Washers and Bushings: Oil- and water-resistant neoprene.
  5. Resilient Cushion: Maximum 1/4-inch air gap, and minimum 1/4 inch thick.

2.14 RESTRAINTS - RIGID TYPE

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Atkore Unistrut.
  2. B-Line; a division of Eaton, Electrical Sector.
  3. CADDY; brand of nVent Electrical plc.
  4. Hilti, Inc.
- B. Source Limitations: Obtain rigid-type restraints from single manufacturer.
- C. Description: Shop- or field-fabricated bracing assembly made of AISI S110-07-S1 slotted steel channels, ANSI/ASTM A53/A53M steel pipe as per NFPA 13, or other rigid steel brace member. Includes accessories for attachment to braced component at one end and to building structure at the other end and other matching components and with corrosion-resistant coating; rated in tension, compression, and torsion forces.

2.15 RESTRAINTS - CABLE TYPE

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

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1. B-Line; a division of Eaton, Electrical Sector.
2. CADDY; brand of nVent Electrical plc.
3. Gripple Inc.

- B. Source Limitations: Obtain cable-type restraints from single manufacturer.
- C. Seismic-Restraint Cables: ASTM A603 galvanized-steel cables. End connections made of steel assemblies with thimbles, brackets, swivel, and bolts designed for seismic-restraining cable service; with fittings attached by means of poured socket, swaged socket or mechanical (Flemish eye) loop.
- D. Restraint cable assembly with cable fittings must comply with ASCE/SEI 19. All cable fittings and complete cable assembly must maintain the minimum cable breaking force. U-shaped cable clips and wedge-type end fittings do not comply and are unacceptable.

2.16 RESTRAINT ACCESSORIES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Atkore Unistrut.
  2. B-Line; a division of Eaton, Electrical Sector.
  3. Hilti, Inc.
- B. Source Limitations: Obtain restraint accessories from single manufacturer.
- C. Hinged and Swivel Brace Attachments: Multifunctional steel connectors for attaching hangers to rigid channel bracings and restraint cables.
- D. Bushings for Floor-Mounted Equipment Anchor Bolts: Neoprene bushings designed for rigid equipment mountings, and matched to type and size of anchor bolts and studs.
- E. Bushing Assemblies for Wall-Mounted Equipment Anchorage: Assemblies of neoprene elements and steel sleeves designed for rigid equipment mountings, and matched to type and size of attachment devices used.
- F. Resilient Isolation Washers and Bushings: One-piece, molded, oil- and water-resistant neoprene, with a flat washer face.

2.17 POST-INSTALLED CONCRETE ANCHORS

- A. Mechanical Anchor Bolts:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:



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- a. Atkore Unistrut.
    - b. B-Line; a division of Eaton, Electrical Sector.
    - c. Hilti, Inc.
  2. Source Limitations: Obtain mechanical anchor bolts from single manufacturer.
  3. Drilled-in and stud-wedge or female-wedge type in zinc-coated steel for interior applications and stainless steel for exterior applications. Select anchor bolts with strength for anchor and as tested according to ASTM E488/E488M.
- B. Adhesive Anchor Bolts:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Atkore Unistrut.
    - b. B-Line; a division of Eaton, Electrical Sector.
    - c. Hilti, Inc.
  2. Source Limitations: Obtain adhesive anchor bolts from single manufacturer.
  3. Drilled-in and capsule anchor system containing PVC or urethane methacrylate-based resin and accelerator, or injected polymer or hybrid mortar adhesive. Provide anchor bolts and hardware with zinc-coated steel for interior applications and stainless steel for exterior applications. Select anchor bolts with strength required for anchor and as tested according to ASTM E488/E488M.
- C. Provide post-installed concrete anchors that have been prequalified for use in wind-load applications. Post-installed concrete anchors must comply with all requirements of ASCE/SEI 7-05, Ch. 13.
1. Prequalify post-installed anchors in concrete in accordance with ACI 355.2 or other approved qualification testing procedures.
  2. Prequalify post-installed anchors in masonry in accordance with approved qualification procedures.
- D. Expansion-type anchor bolts are not permitted for equipment in excess of 10 hp that is not vibration isolated.
1. Undercut expansion anchors are permitted.

2.18 CONCRETE INSERTS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. B-Line; a division of Eaton, Electrical Sector.
  2. Hilti, Inc.
  3. Powers Fasteners.

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- B. Source Limitations: Obtain concrete inserts from single manufacturer.
- C. Provide preset concrete inserts that are seismically prequalified in accordance with ICC-ES AC466 testing.
- D. Comply with ANSI/MSS SP-58.

2.19 VIBRATION ISOLATION EQUIPMENT BASES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. California Dynamics Corporation.
  - 2. Kinetics Noise Control, Inc.
  - 3. Vibro-Acoustics.
- B. Source Limitations: Obtain vibration isolation equipment bases from single manufacturer.
- C. Steel Rails: Factory-fabricated, welded, structural-steel rails.
  - 1. Design Requirements: Lowest possible mounting height with not less than 1-inch clearance above the floor. Include equipment anchor bolts and auxiliary motor slide rails.
    - a. Include supports for suction and discharge elbows for pumps.
  - 2. Structural Steel: Steel shapes, plates, and bars complying with ASTM A36/A36M. Rails to have shape to accommodate supported equipment.
  - 3. Support Brackets: Factory-welded steel brackets on frame for outrigger isolation mountings and to provide for anchor bolts and equipment support.
- D. Steel Bases: Factory-fabricated, welded, structural-steel bases and rails.
  - 1. Design Requirements: Lowest possible mounting height with not less than 1-inch clearance above the floor. Include equipment anchor bolts and auxiliary motor slide bases or rails.
    - a. Include supports for suction and discharge elbows for pumps.
  - 2. Structural Steel: Steel shapes, plates, and bars complying with ASTM A36/A36M. Bases to have shape to accommodate supported equipment.
  - 3. Support Brackets: Factory-welded steel brackets on frame for outrigger isolation mountings and to provide for anchor bolts and equipment support.
- E. Concrete Inertia Base: Factory-fabricated, welded, structural-steel bases and rails ready for placement of cast-in-place concrete.

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1. Design Requirements: Lowest possible mounting height with not less than 1-inch clearance above the floor. Include equipment anchor bolts and auxiliary motor slide bases or rails.
  - a. Include supports for suction and discharge elbows for pumps.
2. Structural Steel: Steel shapes, plates, and bars complying with ASTM A36/A36M. Bases to have shape to accommodate supported equipment.
3. Support Brackets: Factory-welded steel brackets on frame for outrigger isolation mountings and to provide for anchor bolts and equipment support.
4. Fabrication: Fabricate steel templates to hold equipment anchor-bolt sleeves and anchors in place during placement of concrete. Obtain anchor-bolt templates from supported equipment manufacturer.

2.20 RESTRAINED ISOLATION ROOF-CURB RAILS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  1. CADDY; brand of nVent Electrical plc.
  2. California Dynamics Corporation.
  3. Kinetics Noise Control, Inc.
- B. Source Limitations: Obtain restrained isolation roof-curb rails from single manufacturer.
- C. Description: Factory-assembled, fully enclosed, insulated, air- and watertight curb rail designed to resiliently support equipment and to withstand seismic and wind forces.
- D. Upper Frame: To provide continuous support for equipment and to be captive to resiliently resist seismic and wind forces.
- E. Lower Support Assembly: To be formed sheet metal section containing adjustable and removable steel springs that support the upper frame. Lower support assembly to have a means for attaching to building structure and a wood nailer for attaching roof materials, and to be insulated with a minimum of 2 inches of rigid, glass-fiber insulation on inside of assembly. Mount adjustable, restrained-spring isolators on elastomeric vibration isolation pads and provide access ports, for level adjustment, with removable waterproof covers at all isolator locations. Locate isolators so they are accessible for adjustment at any time during the life of the installation without interfering with integrity of roof.
- F. Snubber Bushings: All-directional, elastomeric snubber bushings at least 1/4 inch thick.
- G. Water Seal: Galvanized sheet metal with EPDM seals at corners, attached to upper support frame, extending down past wood nailer of lower support assembly, and counterflashed over roof materials.

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PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas and equipment to receive vibration isolation and seismic and wind control devices for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Examine roughing-in of reinforcement and cast-in-place anchors to verify actual locations before installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 APPLICATIONS

- A. Multiple Pipe Supports: Secure pipes to trapeze member with clamps approved for application by an agency acceptable to authorities having jurisdiction.
- B. Hanger-Rod Stiffeners: Install where indicated or scheduled on Drawings to receive them and where required to prevent buckling of hanger rods due to seismic forces.
- C. Strength of Support and Seismic-Restraint Assemblies: Where not indicated, select sizes of components so strength is adequate to carry present and future static[, wind load,] and seismic loads within specified loading limits.

3.3 INSTALLATION OF VIBRATION-CONTROL AND SEISMIC-RESTRAINT DEVICES

- A. Provide vibration-control devices for systems and equipment where indicated in Equipment Schedules or Vibration-Control Devices Schedules, where indicated on Drawings, or where Specifications indicate they are to be installed on specific equipment and systems.
- B. Provide seismic-restraint devices for systems and equipment where indicated in Equipment Schedules or Seismic-Restraint Devices Schedules, where indicated on Drawings, where Specifications indicate they are to be installed on specific equipment and systems, and where required by applicable codes.
- C. Coordinate location of embedded connection hardware with supported equipment attachment and mounting points and with requirements for concrete reinforcement and formwork specified in Section 033000 "Cast-in-Place Concrete."
- D. Installation of vibration isolators must not cause any change of position of equipment, piping, or ductwork resulting in stresses or misalignment.

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- E. Comply with requirements in Section 077200 "Roof Accessories" for installation of roof curbs, equipment supports, and roof penetrations.
- F. Equipment Restraints:
  - 1. Install seismic snubbers on HVAC equipment mounted on vibration isolators. Locate snubbers as close as possible to vibration isolators and bolt to equipment base and supporting structure.
  - 2. Install resilient bolt isolation washers on equipment anchor bolts where clearance between anchor and adjacent surface exceeds 0.125 inch.
  - 3. Install seismic-restraint devices using methods approved by an agency acceptable to authorities having jurisdiction that provides required submittals for component.
- G. Piping Restraints:
  - 1. Comply with requirements in MSS SP-127.
  - 2. Space lateral supports a maximum of 40 feet o.c., and longitudinal supports a maximum of 80 feet o.c.
  - 3. Brace a change of direction longer than 12 feet.
- H. Ductwork Restraints:
  - 1. Install ducts with hangers and braces designed to support the duct and to restrain against seismic forces required by applicable building codes. Comply with SMACNA's "Seismic Restraint Manual: Guidelines for Mechanical Systems.". See Section 233113 "Metal Ducts" for Seismic Hazard Level (SHL).
  - 2. Space lateral supports a maximum of 40 feet o.c., and longitudinal supports a maximum of 80 feet o.c.
  - 3. Brace a change of direction longer than 12 feet.
  - 4. Select seismic-restraint devices with capacities adequate to carry static and seismic loads.
  - 5. Install cable restraints on ducts that are suspended with vibration isolators.
- I. Install seismic restraint cables so they do not bend across edges of adjacent equipment or building structure.
- J. Install seismic-restraint devices using methods approved by an agency acceptable to authorities having jurisdiction that provides required submittals for component.
- K. Install bushing assemblies for anchor bolts for floor-mounted equipment, arranged to provide resilient media between anchor bolt and mounting hole in concrete base.
- L. Install bushing assemblies for mounting bolts for wall-mounted equipment, arranged to provide resilient media where equipment or equipment-mounting channels are attached to wall.

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- M. Attachment to Structure: If specific attachment is not indicated, anchor bracing to structure at flanges of beams, at upper truss chords of bar joists, or at concrete members.
- N. Mechanical Anchor Bolts:
  - 1. Identify position of reinforcing steel and other embedded items prior to drilling holes for anchors. Do not damage existing reinforcing or embedded items during coring or drilling. Notify structural engineer if reinforcing steel or other embedded items are encountered during drilling. Locate and avoid prestressed tendons, electrical and telecommunications conduit, and gas lines.
  - 2. Do not drill holes in concrete or masonry until concrete, mortar, or grout has achieved full design strength.
  - 3. Wedge-Type Anchor Bolts: Protect threads from damage during anchor installation. Heavy-duty sleeve anchors to be installed with sleeve fully engaged in the structural element to which anchor is to be fastened.
  - 4. Adhesive-Type Anchor Bolts: Clean holes to remove loose material and drilling dust prior to installation of adhesive. Place adhesive in holes proceeding from the bottom of the hole and progressing toward the surface in such a manner as to avoid introduction of air pockets in the adhesive.
  - 5. Set anchors to manufacturer's recommended torque, using a torque wrench.
  - 6. Install zinc-coated steel anchors for interior and stainless steel anchors for exterior applications.

3.4 INSTALLATION OF VIBRATION ISOLATION EQUIPMENT BASES

- A. Coordinate location of embedded connection hardware with supported equipment attachment and mounting points and with requirements for concrete reinforcement and formwork specified in Section 033000 "Cast-in-Place Concrete."
- B. Coordinate dimensions of steel equipment rails and bases, concrete inertia bases, and restrained isolation roof-curb rails with requirements of isolated equipment specified in this and other Sections. Where dimensions of these bases are indicated on Drawings, dimensions may require adjustment to accommodate actual isolated equipment.

3.5 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.
- B. Tests and Inspections:
  - 1. Perform tests and inspections with the assistance of a factory-authorized service representative.

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2. Provide evidence of recent calibration of test equipment by a testing agency acceptable to authorities having jurisdiction.
  3. Schedule test with Owner, through Architect, before connecting anchorage device to restrained component (unless postconnection testing has been approved), and with at least seven days' advance notice.
  4. Obtain Architect's approval before transmitting test loads to structure. Provide temporary load-spreading members.
  5. Test no fewer than four of each type and size of installed anchors and fasteners selected by Architect.
  6. Test to 90 percent of rated proof load of device.
  7. Measure isolator restraint clearance.
  8. Measure isolator deflection.
  9. Verify snubber minimum clearances.
- C. Remove and replace malfunctioning units and retest as specified above.
- D. Units will be considered defective if they do not pass tests and inspections.
- E. Prepare test and inspection reports.

END OF SECTION 23 05 48

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IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT

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SECTION 23 05 53 – IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Equipment labels
- B. Warning signs and labels
- C. Pipe labels
- D. Duct labels
- E. Warning tags
- F. Adhesive-backed duct markers.
- G. Stencils.
- H. Pipe markers.
- I. Ceiling tacks.

1.02 SUBMITTALS

- A. See Section 013000 - Administrative Requirements for submittal procedures.
- B. Equipment Label Schedule: Include a listing of all equipment to be labeled with the proposed content for each label.
- C. Product Data: Provide manufacturers catalog literature for each product required.
- D. Samples: For color, letter style, and graphic representation required for each identification material and device.

1.03 COORDINATION

- A. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.
- B. Install identifying devices before installing acoustical ceilings and similar concealment.

PART 2 PRODUCTS

2.01 EQUIPMENT LABELS

- A. Metal Labels for Equipment:

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IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT

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1. Material and Thickness: Brass, 0.032-inch minimum thickness, and having predrilled or stamped holes for attachment hardware.
  2. Minimum Label Size: Length and width vary for required content, but not less than 2-1/2 by 3/4 inch.
  3. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
  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:
1. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/8 inch 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 160F.
  5. Minimum Label Size: Length and width vary for required content, but not less than 2-1/2 by 3/4 inch.
  6. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
  7. Fasteners: Stainless-steel rivets or self-tapping screws.
  8. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.
- C. Label Content: Include equipment's Drawing designation or unique equipment number, and Drawing numbers where equipment is indicated (plans, details, and schedules).
- D. Equipment Label Schedule: For each item of equipment to be labeled, on 8-1/2-by-11-inch 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.
- 2.02 WARNING SIGNS AND LABELS
- A. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/8 inch thick, and having predrilled holes for attachment hardware.
- B. Letter Color: White
- C. Background Color: Red
- D. Maximum Temperature: Able to withstand temperatures up to 160 deg F.

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IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT

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- E. Minimum Label Size: Length and width vary for required content, but not less than 2-1/2 by 3/4 inch.
- F. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
- G. Fasteners: Stainless-steel rivets or self-tapping screws.
- H. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.
- I. Label Content: Include caution and warning information, plus emergency notification instructions.

2.03 STENCILS

- A. Stencils: Prepared with letter sizes according to ASME A13.1 for piping; minimum letter height of 1-1/4 inches for insulated ducts and pipes; and minimum letter height of 3/4 inch for access panel and door labels, equipment labels, and similar operational instructions.
  - 1. Stencil Paint: As specified in Section 099123, acrylic enamel, colors complying with ASME A13.1 unless otherwise indicated.

2.04 PIPE LABELS

- A. General Requirements for Manufactured Pipe Labels: Preprinted, color-coded, with lettering indicated service, and showing flow direction.
- B. Self-Adhesive Pipe Labels: Printed plastic with contact-type, permanent-adhesive backing.
- C. Pipe Label Contents: Include identification of piping service using same designations or abbreviations as used on Drawings, pipe size, and an arrow indicated flow direction.
  - 1. Flow-Direction Arrows: Integral with piping system service lettering to accommodate both directions, or as separate unit on each pipe label to indicate flow direction.
  - 2. Lettering Size: At least 1-1/2 inches high.

2.05 DUCT LABELS

- A. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/8 inch thick, and having predrilled holes for attachment hardware.
- B. Letter Color: White
- C. Background Color: Blue
- D. Maximum Temperature: Able to withstand temperatures up to 160 deg F.

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IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT

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- E. Minimum Label Size: Length and width vary for required content, but not less than 2-1/2 by 3/4 inch.
- F. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
- G. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.
- H. Duct Label Contents: Include identification of duct service using same designations or abbreviations as used on Drawings, duct size, and an arrow indicated flow direction.
  - 1. Flow-Direction Arrows: Integral with duct system service lettering to accommodate both directions, or as separate unit on each duct label to indicate flow direction.
  - 2. Lettering Size: At least 1-1/2 inches high.

PART 3 EXECUTION

3.01 PREPARATION

- A. Clean piping and equipment surfaces of substances that could impair bond of identification devices, including dirt, oil, grease, release agents, and incompatible primers, paints, and encapsulants.

3.02 EQUIPMENT LABEL INSTALLATION

- A. Install or permanently fasten labels on each major item of mechanical equipment.
- B. Locate equipment labels where accessible and visible.

3.03 PIPE LABEL INSTALLATION

- A. Piping Color-Coding: Painting of Piping is specified in Section 099123 "Interior Painting".
- B. Stencil Pipe Label Option: Stenciled labels may be provided instead of manufactured pipe labels, at Installer's option. Install stenciled pipe labels with painted, color-coded bands or rectangles, complying with ASME A13.1, on each piping system.
  - 1. Identification Paint: Use for contrasting background.
  - 2. Stencil Paint: Use for pipe marking.
- C. Locate pipe labels where piping is exposed or above accessible ceilings in finished spaces; machine rooms; accessible maintenance spaces such as plenums; and exterior exposed locations as follows:
  - 1. Near each valve and control device.
  - 2. Near each branch connections, excluding short takeoffs for fixtures and terminal units. Where flow pattern is not obvious, mark each pipe at branch.

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IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT

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3. Near penetrations through walls and inaccessible enclosures.
4. Near major equipment items.
5. Spaced at maximum intervals of 50 feet along each run. Reduce intervals to 25 feet in areas of congested piping and equipment.
6. On piping above removable acoustical ceilings, omit intermediately spaced labels.

3.04 DUCT LABEL INSTALLATION

- A. Install self-adhesive duct labels with permanent adhesive on air ducts in the following color codes:
  1. Blue: For supply ducts.
  2. Yellow: For return ducts.
  3. Green: For exhaust, outside air, and relief ducts
- B. Locate labels near points where ducts enter into concealed spaces and at maximum intervals of 50 feet in each space where ducts are exposed or concealed by removable ceiling system.

3.05 WARNING-TAG INSTALLATION

- A. Write required message on, and attach warning tags to, equipment and other items where required.

END OF SECTION 23 05 53

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TESTING, ADJUSTING, AND BALANCING FOR HVAC

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SECTION 23 05 93 - TESTING, ADJUSTING, AND BALANCING FOR HVAC

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. Balancing Air Systems:
    - a. Constant-volume air systems.
  - 2. Balancing Hydronic Piping Systems:
    - a. Constant-flow hydronic systems.
    - b. Variable-flow hydronic systems.
  - 3. Testing, Adjusting, and Balancing Equipment:
    - a. Heat-transfer coils.
  - 4. Testing, adjusting, and balancing existing systems and equipment.
  - 5. Duct leakage tests.

1.3 DEFINITIONS

- A. AABC: Associated Air Balance Council.
- B. NEBB: National Environmental Balancing Bureau.
- C. TAB: Testing, adjusting, and balancing.
- D. TABB: Testing, Adjusting, and Balancing Bureau.
- E. TAB Specialist: An entity engaged to perform TAB Work.

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TESTING, ADJUSTING, AND BALANCING FOR HVAC

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1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: Within 15 days of Contractor's Notice to Proceed, submit documentation that the TAB contractor and this Project's TAB team members meet the qualifications specified in "Quality Assurance" Article.
- B. Contract Documents Examination Report: Within 15 days of Contractor's Notice to Proceed, submit the Contract Documents review report as specified in Part 3.
- C. Strategies and Procedures Plan: Within 60 days of Contractor's Notice to Proceed, submit TAB strategies and step-by-step procedures as specified in "Preparation" Article.
- D. Certified TAB reports.
- E. Sample report forms.
- F. Instrument calibration reports, to include the following:
  - 1. Instrument type and make.
  - 2. Serial number.
  - 3. Application.
  - 4. Dates of use.
  - 5. Dates of calibration.

1.5 QUALITY ASSURANCE

- A. TAB Contractor Qualifications: Engage a TAB entity certified by AABC NEBB or TABB.
  - 1. TAB Field Supervisor: Employee of the TAB contractor and certified by AABC NEBB or TABB.
  - 2. TAB Technician: Employee of the TAB contractor and who is certified by AABC NEBB or TABB as a TAB technician.
- B. Certify TAB field data reports and perform the following:
  - 1. Review field data reports to validate accuracy of data and to prepare certified TAB reports.
  - 2. Certify that the TAB team complied with the approved TAB plan and the procedures specified and referenced in this Specification.
- C. Instrumentation Type, Quantity, Accuracy, and Calibration: As described in ASHRAE 111, Section 5, "Instrumentation."



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TESTING, ADJUSTING, AND BALANCING FOR HVAC

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- D. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 7.2.2 - "Air Balancing."
- E. ASHRAE/IESNA Compliance: Applicable requirements in ASHRAE/IESNA 90.1, Section 6.7.2.3 - "System Balancing."
- F. ANSI/ASHRAE Compliance: Applicable requirements in ANSI/ASHRAE 110-2016 Standard "Methods of Testing Performance Laboratory Fume Hoods"

1.6 PROJECT CONDITIONS

- A. Partial Owner Occupancy: Owner may occupy completed areas of building before Substantial Completion. Cooperate with Owner during TAB operations to minimize conflicts with Owner's operations.

1.7 COORDINATION

- A. Notice: Provide seven days' advance notice for each test. Include scheduled test dates and times.
- B. Perform TAB after leakage and pressure tests on air and water distribution systems have been satisfactorily completed.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine the Contract Documents to become familiar with Project requirements and to discover conditions in systems' designs that may preclude proper TAB of systems and equipment.
- B. Examine systems for installed balancing devices, such as test ports, gage cocks, thermometer wells, flow-control devices, balancing valves and fittings, and manual volume dampers. Verify that locations of these balancing devices are accessible.
- C. Examine the approved submittals for HVAC systems and equipment.

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TESTING, ADJUSTING, AND BALANCING FOR HVAC

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- D. Examine design data including HVAC system descriptions, statements of design assumptions for environmental conditions and systems' output, and statements of philosophies and assumptions about HVAC system and equipment controls.
- E. Examine ceiling plenums and underfloor air plenums used for supply, return, or relief air to verify that they meet the leakage class of connected ducts as specified in Division 23 Section "Metal Ducts" and are properly separated from adjacent areas. Verify that penetrations in plenum walls are sealed and fire-stopped if required.
- F. Examine equipment performance data including fan and pump curves.
  - 1. Relate performance data to Project conditions and requirements, including system effects that can create undesired or unpredicted conditions that cause reduced capacities in all or part of a system.
  - 2. Calculate system-effect factors to reduce performance ratings of HVAC equipment when installed under conditions different from the conditions used to rate equipment performance. To calculate system effects for air systems, use tables and charts found in AMCA 201, "Fans and Systems," or in SMACNA's "HVAC Systems - Duct Design." Compare results with the design data and installed conditions.
- G. Examine system and equipment installations and verify that field quality-control testing, cleaning, and adjusting specified in individual Sections have been performed.
- H. Examine test reports specified in individual system and equipment Sections.
- I. Examine HVAC equipment and filters and verify that bearings are greased, belts are aligned and tight, and equipment with functioning controls is ready for operation.
- J. Examine terminal units, such as variable-air-volume boxes, and verify that they are accessible and their controls are connected and functioning.
- K. Examine strainers. Verify that startup screens are replaced by permanent screens with indicated perforations.
- L. Examine three-way valves for proper installation for their intended function of diverting or mixing fluid flows.
- M. Examine heat-transfer coils for correct piping connections and for clean and straight fins.
- N. Examine system pumps to ensure absence of entrained air in the suction piping.
- O. Examine operating safety interlocks and controls on HVAC equipment.

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## TESTING, ADJUSTING, AND BALANCING FOR HVAC

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- P. Report deficiencies discovered before and during performance of TAB procedures. Observe and record system reactions to changes in conditions. Record default set points if different from indicated values.

### 3.2 PREPARATION

- A. Prepare a TAB plan that includes strategies and step-by-step procedures.
- B. Complete system-readiness checks and prepare reports. Verify the following:
  - 1. Permanent electrical-power wiring is complete.
  - 2. Hydronic systems are filled, clean, and free of air.
  - 3. Automatic temperature-control systems are operational.
  - 4. Equipment and duct access doors are securely closed.
  - 5. Balance, smoke, and fire dampers are open.
  - 6. Isolating and balancing valves are open and control valves are operational.
  - 7. Ceilings are installed in critical areas where air-pattern adjustments are required and access to balancing devices is provided.
  - 8. Windows and doors can be closed so indicated conditions for system operations can be met.

### 3.3 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 Total System Balance", ASHRAE 111, NEBB's "Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems", SMACNA's "HVAC Systems - Testing, Adjusting, and Balancing" and in this Section.
  - 1. Comply with requirements in ASHRAE 62.1, Section 7.2.2 - "Air Balancing."
- B. Cut insulation, ducts, pipes, and equipment cabinets for installation of test probes to the minimum extent necessary for TAB procedures.
  - 1. After testing and balancing, patch probe holes in ducts with same material and thickness as used to construct ducts.
  - 2. After testing and balancing, install test ports and duct access doors that comply with requirements in Division 23 section "Air Duct Accessories."
  - 3. Install and join new insulation that matches removed materials. Restore insulation, coverings, vapor barrier, and finish according to division 23 section "Duct Insulation," Division 23 Section "HVAC Equipment Insulation," and Division 23 Section "HVAC Piping Insulation."

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- C. Mark equipment and balancing devices, including damper-control positions, valve position indicators, fan-speed-control levers, and similar controls and devices, with paint or other suitable, permanent identification material to show final settings.
- D. Take and report testing and balancing measurements in inch-pound (IP) units.

3.4 GENERAL PROCEDURES FOR BALANCING AIR SYSTEMS

- A. Prepare test reports for both fans and outlets. Obtain manufacturer's outlet factors and recommended testing procedures. Crosscheck the summation of required outlet volumes with required fan volumes.
- B. Prepare schematic diagrams of systems' "as-built" duct layouts.
- C. For variable-air-volume systems, develop a plan to simulate diversity.
- D. Determine the best locations in main and branch ducts for accurate duct-airflow measurements.
- E. Check airflow patterns from the outdoor-air louvers and dampers and the return- and exhaust-air dampers through the supply-fan discharge and mixing dampers.
- F. Locate start-stop and disconnect switches, electrical interlocks, and motor starters.
- G. Verify that motor starters are equipped with properly sized thermal protection.
- H. Check dampers for proper position to achieve desired airflow path.
- I. Check for airflow blockages.
- J. Check condensate drains for proper connections and functioning.
- K. Check for proper sealing of air-handling-unit components.
- L. Verify that air duct system is sealed as specified in Division 23 Section "Metal Ducts."

3.5 PROCEDURES FOR CONSTANT-VOLUME AIR SYSTEMS

- A. Adjust fans to deliver total indicated airflows within the maximum allowable fan speed listed by fan manufacturer.
  - 1. Measure total airflow.

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TESTING, ADJUSTING, AND BALANCING FOR HVAC

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- a. Where sufficient space in ducts is unavailable for Pitot-tube traverse measurements, measure airflow at terminal outlets and inlets and calculate the total airflow.
  2. Measure fan static pressures as follows to determine actual static pressure:
    - a. Measure outlet static pressure as far downstream from the fan as practical 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 fans in the inlet duct as near the fan as possible, upstream from the 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.
  3. Measure static pressure across each component that makes up an air-handling unit, rooftop unit, and other air-handling and -treating equipment.
    - a. Report the cleanliness status of filters and the time static pressures are measured.
  4. Measure static pressures entering and leaving other devices, such as sound traps, heat-recovery equipment, and air washers, under final balanced conditions.
  5. Review Record Documents to determine variations in design static pressures versus actual static pressures. Calculate actual system-effect factors. Recommend adjustments to accommodate actual conditions.
  6. Obtain approval from Architect for adjustment of fan speed higher or lower than indicated speed. Comply with requirements in HVAC Sections for air-handling units for adjustment of fans, belts, and pulley sizes to achieve indicated air-handling-unit performance.
  7. 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 mode 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 airflow of submain and branch ducts.
    - 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.

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TESTING, ADJUSTING, AND BALANCING FOR HVAC

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2. Measure static pressure at a point downstream from the balancing damper, and adjust volume dampers until the proper static pressure is achieved.
  3. Remeasure 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 air 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 air outlets and inlets for each space to indicated airflows within specified tolerances of indicated values. Make adjustments using branch 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.

3.6 GENERAL PROCEDURES FOR HYDRONIC SYSTEMS

- A. Prepare test reports with pertinent design data, and number in sequence starting at pump to end of system. Check the sum of branch-circuit flows against the approved pump flow rate. Correct variations that exceed plus or minus 5 percent.
- B. Prepare schematic diagrams of systems' "as-built" piping layouts.
- C. Prepare hydronic systems for testing and balancing according to the following, in addition to the general preparation procedures specified above:
1. Open all manual valves for maximum flow.
  2. Check liquid level in expansion tank.
  3. Check makeup water-station pressure gage for adequate pressure for highest vent.
  4. Check flow-control valves for specified sequence of operation, and set at indicated flow.
  5. Set differential-pressure control valves at the specified differential pressure. Do not set at fully closed position when pump is positive-displacement type unless several terminal valves are kept open.
  6. Set system controls so automatic valves are wide open to heat exchangers.
  7. Check pump-motor load. If motor is overloaded, throttle main flow-balancing device so motor nameplate rating is not exceeded.
  8. Check air vents for a forceful liquid flow exiting from vents when manually operated.

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3.7 PROCEDURES FOR CONSTANT-FLOW HYDRONIC SYSTEMS

- A. Measure water flow at pumps. Use the following procedures except for positive-displacement pumps:
  - 1. Verify impeller size by operating the pump with the discharge valve closed. Read pressure differential across the pump. Convert pressure to head and correct for differences in gage heights. Note the point on manufacturer's pump curve at zero flow and verify that the pump has the intended impeller size.
    - a. If impeller sizes must be adjusted to achieve pump performance, obtain approval from Architect, Construction Manager, Commissioning Authority and comply with requirements in Section 232123 "Hydronic Pumps."
  - 2. Check system resistance. With all valves open, read pressure differential across the pump and mark pump manufacturer's head-capacity curve. Adjust pump discharge valve until indicated water flow is achieved.
    - a. Monitor motor performance during procedures and do not operate motors in overload conditions.
  - 3. Verify pump-motor brake horsepower. Calculate the intended brake horsepower for the system based on pump manufacturer's performance data. Compare calculated brake horsepower with nameplate data on the pump motor. Report conditions where actual amperage exceeds motor nameplate amperage.
  - 4. Report flow rates that are not within plus or minus 10 percent of design.
- B. Measure flow at all automatic flow control valves to verify that valves are functioning as designed.
- C. Measure flow at all pressure-independent characterized control valves, with valves in fully open position, to verify that valves are functioning as designed.
- D. Set calibrated balancing valves, if installed, at calculated pre-settings.
- E. Measure flow at all stations and adjust, where necessary, to obtain first balance.
  - 1. System components that have Cv rating or an accurately cataloged flow-pressure-drop relationship may be used as a flow-indicating device.
- F. Measure flow at main balancing station and set main balancing device to achieve flow that is 5 percent greater than indicated flow.
- G. Adjust balancing stations to within specified tolerances of indicated flow rate as follows:
  - 1. Determine the balancing station with the highest percentage over indicated flow.

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2. Adjust each station in turn, beginning with the station with the highest percentage over indicated flow and proceeding to the station with the lowest percentage over indicated flow.
  3. Record settings and mark balancing devices.
- H. Measure pump flow rate and make final measurements of pump amperage, voltage, rpm, pump heads, and systems' pressures and temperatures including outdoor-air temperature.
- I. Measure the differential-pressure-control-valve settings existing at the conclusion of balancing.
- J. Check settings and operation of each safety valve. Record settings.

3.8 PROCEDURES FOR VARIABLE-FLOW HYDRONIC SYSTEMS

- A. Balance systems with automatic two- and three-way control valves by setting systems at maximum flow through heat-exchange terminals and proceed as specified above for hydronic systems.

3.9 PROCEDURES FOR HEAT-TRANSFER COILS

- A. Measure, adjust, and record the following data for each water coil:
1. Entering- and leaving-water temperature.
  2. Water flow rate.
  3. Water pressure drop.
  4. Dry-bulb temperature of entering and leaving air.
  5. Wet-bulb temperature of entering and leaving air for cooling coils.
  6. Airflow.
  7. Air pressure drop.

3.10 PROCEDURE FOR TESTING, ADJUSTING, AND BALANCING EXISTING SYSTEMS:

- A. Perform a preconstruction inspection of existing equipment that is to remain and be reused.
1. Measure and record the operating speed, airflow, and static pressure of each fan.
  2. Measure motor voltage and amperage. Compare the values to motor nameplate information.
  3. Check the condition of filters.
  4. Check bearing and other lubricated parts for proper lubrication.



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5. Report on the operating condition of the equipment and the results of the measurements taken. Report deficiencies.
- B. Perform a preconstruction inspection of existing equipment that is to be removed.
  1. Measure and record the operating speed, airflow, and static pressure of each fan.
  2. Measure the inlet and outlet static pressure of the unit.
  3. Measure motor voltage and amperage. Compare the values to motor nameplate information.
  4. Note & record the condition of and static pressure across existing filters.
  5. Measure the supply natural gas pressure at the unit, as it enters the unit's gas train.
- C. Before performing testing and balancing of existing systems, inspect existing equipment that is to remain and be reused to verify that existing equipment has been cleaned and refurbished (if specified). Verify and record the following:
  1. New filters are installed (or condition of existing).
  2. Drain pans are clean.
  3. Fans are clean.
  4. Bearings and other parts are properly lubricated.
  5. Deficiencies noted in the preconstruction report are corrected.
- D. Perform testing and balancing of existing systems to the extent that existing systems are affected by the renovation work or systems that serve the areas that served by new equipment in order to provide a complete balanced system for the area including all new and existing units as a complete system.
  1. Compare the indicated airflow of the renovated work to the measured fan airflows, and determine the new fan speed and the face velocity of filters and coils.
  2. Verify that the indicated airflows of the renovated work result in filter and coil face velocities and fan speeds that are within the acceptable limits defined by equipment manufacturer.
  3. If calculations increase or decrease the air flow rates by more than 5 percent, make equipment adjustments to achieve the calculated rates. If increase or decrease is 5 percent or less, equipment adjustments are not required unless the difference between supply and exhaust is more than 5 percent.
  4. Balance each air outlet and inlet.

### 3.11 DUCT LEAKAGE TESTS

- A. Witness the duct pressure testing performed by Installer.
- B. Verify that proper test methods are used and that leakage rates are within specified tolerances.

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- C. Report deficiencies observed.

3.12 TOLERANCES

- A. Set HVAC system's air flow rates and water flow rates within the following tolerances:
1. Supply, Return, and Exhaust Fans and Equipment with Fans: Plus or minus 5 percent.
  2. Air Outlets and Inlets: Plus or minus 5 percent.
  3. Heating-Water Flow Rate: Plus or minus 5 percent.

3.13 REPORTING

- A. Initial Construction-Phase Report: Based on examination of the Contract Documents as specified in "Examination" Article, prepare a report on the adequacy of design for systems' balancing devices. Recommend changes and additions to systems' balancing devices to facilitate proper performance measuring and balancing. Recommend changes and additions to HVAC systems and general construction to allow access for performance measuring and balancing devices.
- B. Status Reports: Prepare weekly progress reports to describe completed procedures, procedures in progress, and scheduled procedures. Include a list of deficiencies and problems found in systems being tested and balanced. Prepare a separate report for each system and each building floor for systems serving multiple floors.

3.14 FINAL REPORT

- A. General: Prepare a certified written report; tabulate and divide the report into separate sections for tested systems and balanced systems.
1. Include a certification sheet at the front of the report's binder, signed and sealed by the certified testing and balancing engineer.
  2. Include a list of instruments used for procedures, along with proof of calibration.
- B. Final Report Contents: In addition to certified field-report data, include the following:
1. Fan curves.
  2. Manufacturers' test data.
  3. Field test reports prepared by system and equipment installers.
  4. Other information relative to equipment performance; do not include Shop Drawings and product data.
- C. General Report Data: In addition to form titles and entries, include the following data:

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1. Title page.
  2. Name and address of the TAB contractor.
  3. Project name.
  4. Project location.
  5. Architect's name and address.
  6. Engineer's name and address.
  7. Contractor's name and address.
  8. Report date.
  9. Signature of TAB supervisor who certifies the report.
  10. Table of Contents with the total number of pages defined for each section of the report. Number each page in the report.
  11. Summary of contents including the following:
    - a. Indicated versus final performance.
    - b. Notable characteristics of systems.
    - c. Description of system operation sequence if it varies from the Contract Documents.
  12. Nomenclature sheets for each item of equipment.
  13. Data for terminal units, including manufacturer's name, type, size, and fittings.
  14. Notes to explain why certain final data in the body of reports vary from indicated values.
  15. Test conditions for fans and pump performance forms including the following:
    - a. Settings for outdoor-, return-, and exhaust-air dampers.
    - b. Conditions of filters.
    - c. Cooling coil, wet- and dry-bulb conditions.
    - d. Face and bypass damper settings at coils.
    - e. Fan drive settings including settings and percentage of maximum pitch diameter.
    - f. Inlet vane settings for variable-air-volume systems.
    - g. Settings for supply-air, static-pressure controller.
    - h. Other system operating conditions that affect performance.
- D. Apparatus-Coil Test Reports:
1. Coil Data:
    - a. System identification.
    - b. Location.
    - c. Coil type.
    - d. Number of rows.
    - e. Fin spacing in fins per inch o.c.
    - f. Make and model number.
    - g. Face area in sq. ft.
    - h. Tube size in NPS.

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- i. Tube and fin materials.
  - j. Circuiting arrangement.
2. Test Data (Indicated and Actual Values):
- a. Air flow rate in cfm.
  - b. Average face velocity in fpm.
  - c. Air pressure drop in inches wg.
  - d. Outdoor-air, wet- and dry-bulb temperatures in deg F.
  - e. Return-air, wet- and dry-bulb temperatures in deg F.
  - f. Entering-air, wet- and dry-bulb temperatures in deg F.
  - g. Leaving-air, wet- and dry-bulb temperatures in deg F.
  - h. Water flow rate in gpm.
  - i. Water pressure differential in feet of head or psig.
  - j. Entering-water temperature in deg F.
  - k. Leaving-water temperature in deg F.
  - l. Refrigerant expansion valve and refrigerant types.
  - m. Refrigerant suction pressure in psig.
  - n. Refrigerant suction temperature in deg F.
  - o. Inlet steam pressure in psig.
- E. Fan Test Reports: For supply, return, and exhaust fans, include the following:
- 1. Fan Data:
    - a. System identification.
    - b. Location.
    - c. Make and type.
    - d. Model number and size.
    - e. Manufacturer's serial number.
    - f. Arrangement and class.
    - g. Sheave make, size in inches, and bore.
    - h. Center-to-center dimensions of sheave, and amount of adjustments in inches.
  - 2. Motor Data:
    - a. Motor make, and frame type and size.
    - b. Horsepower and rpm.
    - c. Volts, phase, and hertz.
    - d. Full-load amperage and service factor.
    - e. Sheave make, size in inches, and bore.
    - f. Center-to-center dimensions of sheave, and amount of adjustments in inches.
    - g. Number, make, and size of belts.

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3. Test Data (Indicated and Actual Values):
  - a. Total airflow rate in cfm.
  - b. Total system static pressure in inches wg.
  - c. Fan rpm.
  - d. Discharge static pressure in inches wg.
  - e. Suction static pressure in inches wg.
- F. Round, Flat-Oval, and Rectangular Duct Traverse Reports: Include a diagram with a grid representing the duct cross-section and record the following:
  1. Report Data:
    - a. System and air-handling-unit number.
    - b. Location and zone.
    - c. Traverse air temperature in deg F.
    - d. Duct static pressure in inches wg.
    - e. Duct size in inches.
    - f. Duct area in sq. ft..
    - g. Indicated air flow rate in cfm.
    - h. Indicated velocity in fpm.
    - i. Actual air flow rate in cfm.
    - j. Actual average velocity in fpm.
    - k. Barometric pressure in psig.
- G. Air-Terminal-Device Reports:
  1. Unit Data:
    - a. System and air-handling unit identification.
    - b. Location and zone.
    - c. Apparatus used for test.
    - d. Area served.
    - e. Make.
    - f. Number from system diagram.
    - g. Type and model number.
    - h. Size.
    - i. Effective area in sq. ft.
  2. Test Data (Indicated and Actual Values):
    - a. Air flow rate in cfm.
    - b. Air velocity in fpm.
    - c. Preliminary air flow rate as needed in cfm.
    - d. Preliminary velocity as needed in fpm.
    - e. Final air flow rate in cfm.

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- f. Final velocity in fpm.
    - g. Space temperature in deg F.
- H. System-Coil Reports: For reheat coils and water coils of terminal units, include the following:
  - 1. Unit Data:
    - a. System and air-handling-unit identification.
    - b. Location and zone.
    - c. Room or riser served.
    - d. Coil make and size.
    - e. Flowmeter type.
  - 2. Test Data (Indicated and Actual Values):
    - a. Air flow rate in cfm.
    - b. Entering-water temperature in deg F.
    - c. Leaving-water temperature in deg F.
    - d. Water pressure drop in feet of head or psig.
    - e. Entering-air temperature in deg F.
    - f. Leaving-air temperature in deg F.
- I. Instrument Calibration Reports:
  - 1. Report Data:
    - a. Instrument type and make.
    - b. Serial number.
    - c. Application.
    - d. Dates of use.
    - e. Dates of calibration.

### 3.15 INSPECTIONS

- A. Initial Inspection:
  - 1. After testing and balancing are complete, operate each system and randomly check measurements to verify that the system is operating according to the final test and balance readings documented in the final report.
  - 2. Check the following for each system:
    - a. Measure airflow of at least 10 percent of air outlets.
    - b. Measure water flow of at least 5 percent of terminals.

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- c. Measure room temperature at each thermostat/temperature sensor. Compare the reading to the set point.
- d. Verify that balancing devices are marked with final balance position.
- e. Note deviations from the Contract Documents in the final report.

B. Final Inspection:

- 1. After initial inspection is complete and documentation by random checks verifies that testing and balancing are complete and accurately documented in the final report, request that a final inspection be made by Architect, Construction Manager, Commissioning Authority.
- 2. The TAB contractor's test and balance engineer shall conduct the inspection in the presence of Architect, Construction Manager, Commissioning Authority.
- 3. Architect, Construction Manager, Commissioning Authority shall randomly select measurements, documented in the final report, to be rechecked. Rechecking shall be limited to either 10 percent of the total measurements recorded or the extent of measurements that can be accomplished in a normal 8-hour business day.
- 4. If rechecks yield measurements that differ from the measurements documented in the final report by more than the tolerances allowed, the measurements shall be noted as "FAILED."
- 5. If the number of "FAILED" measurements is greater than 10 percent of the total measurements checked during the final inspection, the testing and balancing shall be considered incomplete and shall be rejected.

C. TAB Work will be considered defective if it does not pass final inspections. If TAB Work fails, proceed as follows:

- 1. Recheck all measurements and make adjustments. Revise the final report and balancing device settings to include all changes; resubmit the final report and request a second final inspection.
- 2. If the second final inspection also fails, Owner may contract the services of another TAB contractor to complete TAB Work according to the Contract Documents and deduct the cost of the services from the original TAB contractor's final payment.

D. Prepare test and inspection reports.

3.16 ADDITIONAL TESTS

- A. Within 90 days of completing TAB, perform additional TAB to verify that balanced conditions are being maintained throughout and to correct unusual conditions.

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- B. Seasonal Periods: If initial TAB procedures were not performed during near-peak summer and winter conditions, perform additional TAB during near-peak summer and winter conditions.

END OF SECTION 23 05 93



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SECTION 23 07 00 - HVAC INSULATION

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. Insulation Materials:
    - a. Mineral fiber Blanket
    - b. Mineral Fiber Preformed Pipe insulation
  - 2. Fire-Rated Insulation Systems
  - 3. Adhesives.
  - 4. Mastics.
  - 5. Sealants.
  - 6. Tapes.
  - 7. Securements.
  - 8. Corner angles.
- B. Related Sections:
  - 1. Division 23 Section "Identification for HVAC Piping"
  - 2. Division 23 Section "Metal Ducts" for duct liners.

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated. Include thermal conductivity, thickness, and jackets (both factory and field applied, if any).
- B. Shop Drawings:
  - 1. Detail application of protective shields, saddles, and inserts at hangers for each type of insulation and hanger.
  - 2. Detail insulation application at elbows, fittings, flanges, valves, and specialties for each type of insulation.
  - 3. Detail removable insulation at piping specialties, equipment connections, and access panels.
- C. Qualification Data: For qualified Installer.

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- D. Material Test Reports: From a qualified testing agency acceptable to authorities having jurisdiction indicating, interpreting, and certifying test results for compliance of insulation materials, sealers, attachments, cements, and jackets, with requirements indicated. Include dates of tests and test methods employed.
- E. Field quality-control reports.

1.4 QUALITY ASSURANCE

- A. Installer Qualifications: Skilled mechanics who have successfully completed an apprenticeship program or another craft training program certified by the Department of Labor, Bureau of Apprenticeship and Training.
- B. Fire-Test-Response Characteristics: Insulation and related materials shall have fire-test-response characteristics indicated, as determined by testing identical products per ASTM E 84, by a testing and inspecting agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers, with appropriate markings of applicable testing and inspecting agency.
  - 1. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.
  - 2. Insulation Installed Outdoors: Flame-spread index of 75 or less, and smoke-developed index of 150 or less.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Packaging: Insulation material containers shall be marked by manufacturer with appropriate ASTM standard designation, type and grade, and maximum use temperature.

1.6 COORDINATION

- A. Coordinate size and location of supports, hangers, and insulation shields specified in Division 23 Section "Hangers and Supports for HVAC Piping and Equipment."
- B. Coordinate clearance requirements with piping Installer for piping insulation application, duct Installer for duct insulation application, and equipment Installer for equipment insulation application. Before preparing piping and ductwork Shop Drawings, establish and maintain clearance requirements for installation of insulation and field-applied jackets and finishes and for space required for maintenance.
- C. Coordinate installation and testing of heat tracing.

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1.7 SCHEDULING

- A. Schedule insulation application after pressure testing systems and, where required, after installing and testing heat tracing. Insulation application may begin on segments that have satisfactory test results.
- B. Complete installation and concealment of plastic materials as rapidly as possible in each area of construction.

PART 2 - PRODUCTS

2.1 INSULATION MATERIALS

- A. Comply with requirements in Part 3 schedule articles for where insulating materials shall be applied.
- B. Products shall not contain asbestos, lead, mercury, or mercury compounds.
- C. Products that come in contact with stainless steel shall have a leachable chloride content of less than 50 ppm when tested according to ASTM C 871.
- D. Insulation materials for use on austenitic stainless steel shall be qualified as acceptable according to ASTM C 795.
- E. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.
- F. Flexible Elastomeric: Closed-cell, sponge- or expanded-rubber materials. Comply with ASTM C 534, Type I for tubular materials and Type II for sheet materials.
  - 1. Products: Subject to compliance with requirements, provide one of the following:
    - a. Aeroflex USA Inc.; Aerocel.
    - b. Armacell LLC; AP Armaflex.
    - c. RBX Corporation; Insul-Sheet 1800 and Insul-Tube 180.
- G. Mineral-Fiber Blanket Insulation: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 553, Type II and ASTM C 1290, Type III with factory-applied FSK jacket. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.
  - 1. Products: Subject to compliance with requirements, provide one of the following:
    - a. CertainTeed Corp.; Duct Wrap.
    - b. Johns Manville; Microlite.
    - c. Knauf Insulation; Duct Wrap.

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- d. Manson Insulation Inc.; Alley Wrap.
  - e. Owens Corning; All-Service Duct Wrap.
- H. Mineral-Fiber Board Insulation: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 612, Type IA or Type IB. For duct and plenum applications, provide insulation with factory-applied ASJ. For equipment applications, provide insulation with factory-applied ASJ. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.
- 1. Products: Subject to compliance with requirements, provide one of the following:
    - a. CertainTeed Corp.; Commercial Board.
    - b. Fibrex Insulations Inc.; FBX.
    - c. Johns Manville; 800 Series Spin-Glas.
    - d. Knauf Insulation; Insulation Board.
    - e. Manson Insulation Inc.; AK Board.
    - f. Owens Corning; Fiberglas 700 Series.
- I. Mineral-Fiber, Preformed Pipe Insulation:
- 1. Products: Subject to compliance with requirements, provide one of the following:
    - a. Fibrex Insulations Inc.; Coreplus 1200.
    - b. Johns Manville; Micro-Lok.
    - c. Knauf Insulation; 1000 Pipe Insulation.
    - d. Manson Insulation Inc.; Alley-K.
    - e. Owens Corning; Fiberglas Pipe Insulation.
  - 2. Type I, 850 deg F Materials: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 547, Type I, Grade A, with factory-applied ASJ. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.
  - 3. Type II, 1200 deg F Materials: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 547, Type II, Grade A, with factory-applied ASJ. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

## 2.2 FIRE-RATED INSULATION SYSTEMS

- A. Fire-Rated Blanket: High-temperature, flexible, blanket insulation with FSK jacket that is tested and certified to provide a 1-hour fire rating by an NRTL acceptable to authorities having jurisdiction.
- 1. Products: Subject to compliance with requirements, provide products by one of the following:
    - a. CertainTeed Corp.; FlameChek.

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- b. Johns Manville; Firetemp Wrap.
- c. Nelson Fire Stop Products; Nelson FSB Flameshield Blanket.
- d. 3M; Fire Barrier Wrap Products.

2.3 ADHESIVES

- A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated, unless otherwise indicated.
- B. Flexible Elastomeric and Polyolefin Adhesive: Comply with MIL-A-24179A, Type II, Class I.
  - 1. Products: Subject to compliance with requirements, provide one of the following:
    - a. Aeroflex USA Inc.; Aeroseal.
    - b. Armacell LCC; 520 Adhesive.
    - c. Foster Products Corporation, H. B. Fuller Company; 85-75.
    - d. RBX Corporation; Rubatex Contact Adhesive.
  - 2. For indoor applications, use adhesive that has a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- C. Mineral-Fiber Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.
  - 1. Products: Subject to compliance with requirements, provide one of the following:
    - a. Childers Products, Division of ITW; CP-82.
    - b. Foster Products Corporation, H. B. Fuller Company; 85-20.
    - c. ITW TACC, Division of Illinois Tool Works; S-90/80.
    - d. Marathon Industries, Inc.; 225.
    - e. Mon-Eco Industries, Inc.; 22-25.
  - 2. For indoor applications, use adhesive that has a VOC content of 80 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- D. ASJ Adhesive, and FSK and PVDC Jacket Adhesive: Comply with MIL-A-3316C, Class 2, Grade A for bonding insulation jacket lap seams and joints.
  - 1. Products: Subject to compliance with requirements, provide one of the following:
    - a. Childers Products, Division of ITW; CP-82.
    - b. Foster Products Corporation, H. B. Fuller Company; 85-20.
    - c. ITW TACC, Division of Illinois Tool Works; S-90/80.
    - d. Marathon Industries, Inc.; 225.
    - e. Mon-Eco Industries, Inc.; 22-25.

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2. For indoor applications, use adhesive that has a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- E. PVC Jacket Adhesive: Compatible with PVC jacket.
  1. Products: Subject to compliance with requirements, provide one of the following:
    - a. Dow Chemical Company (The); 739, Dow Silicone.
    - b. Johns-Manville; Zeston Perma-Weld, CEEL-TITE Solvent Welding Adhesive.
    - c. P.I.C. Plastics, Inc.; Welding Adhesive.
    - d. Speedline Corporation; Speedline Vinyl Adhesive.
  2. For indoor applications, use adhesive that has a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2.4 MASTICS

- A. Materials shall be compatible with insulation materials, jackets, and substrates; comply with MIL-C-19565C, Type II.
  1. For indoor applications, use mastics that have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- B. Vapor-Barrier Mastic: Water based; suitable for indoor and outdoor use on below ambient services.
  1. Products: Subject to compliance with requirements, provide one of the following:
    - a. Childers Products, Division of ITW; CP-35.
    - b. Foster Products Corporation, H. B. Fuller Company; 30-90.
    - c. ITW TACC, Division of Illinois Tool Works; CB-50.
    - d. Marathon Industries, Inc.; 590.
    - e. Mon-Eco Industries, Inc.; 55-40.
    - f. Vimasco Corporation; 749.
  2. Water-Vapor Permeance: ASTM E 96, Procedure B, 0.013 perm at 43-mil dry film thickness.
  3. Service Temperature Range: Minus 20 to plus 180 deg F.
  4. Solids Content: ASTM D 1644, 59 percent by volume and 71 percent by weight.
  5. Color: White.
- C. Breather Mastic: Water based; suitable for indoor and outdoor use on above ambient services.
  1. Products: Subject to compliance with requirements, provide one of the following:

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- a. Childers Products, Division of ITW; CP-10.
  - b. Foster Products Corporation, H. B. Fuller Company; 35-00.
  - c. ITW TACC, Division of Illinois Tool Works; CB-05/15.
  - d. Marathon Industries, Inc.; 550.
  - e. Mon-Eco Industries, Inc.; 55-50.
  - f. Vimasco Corporation; WC-1/WC-5.
2. Water-Vapor Permeance: ASTM F 1249, 3 perms at 0.0625-inch dry film thickness.
  3. Service Temperature Range: Minus 20 to plus 200 deg F.
  4. Solids Content: 63 percent by volume and 73 percent by weight.
  5. Color: White.

## 2.5 SEALANTS

### A. Joint Sealants:

1. Materials shall be compatible with insulation materials, jackets, and substrates.
2. Permanently flexible, elastomeric sealant.
3. Service Temperature Range: Minus 100 to plus 300 deg F.
4. Color: White or gray.
5. For indoor applications, use sealants that have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

### B. FSK and Metal Jacket Flashing Sealants:

1. Products: Subject to compliance with requirements, provide one of the following:
  - a. Childers Products, Division of ITW; CP-76-8.
  - b. Foster Products Corporation, H. B. Fuller Company; 95-44.
  - c. Marathon Industries, Inc.; 405.
  - d. Mon-Eco Industries, Inc.; 44-05.
  - e. Vimasco Corporation; 750.
2. Materials shall be compatible with insulation materials, jackets, and substrates.
3. Fire- and water-resistant, flexible, elastomeric sealant.
4. Service Temperature Range: Minus 40 to plus 250 deg F.
5. Color: Aluminum.
6. For indoor applications, use sealants that have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

### C. ASJ Flashing Sealants, and Vinyl, PVDC, and PVC Jacket Flashing Sealants:

1. Materials shall be compatible with insulation materials, jackets, and substrates.
2. Fire- and water-resistant, flexible, elastomeric sealant.
3. Service Temperature Range: Minus 40 to plus 250 deg F.
4. Color: White.

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5. For indoor applications, use sealants that have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

## 2.6 TAPES

- A. FSK Tape: Foil-face, vapor-retarder tape matching factory-applied jacket with acrylic adhesive; complying with ASTM C 1136.
  1. Products: Subject to compliance with requirements, provide one of the following:
    - a. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0827.
    - b. Compac Corp.; 110 and 111.
    - c. Ideal Tape Co., Inc., an American Biltrite Company; 491 AWF FSK.
    - d. Venture Tape; 1525 CW, 1528 CW, and 1528 CW/SQ.
  2. Width: 3 inches.
  3. Thickness: 6.5 mils.
  4. Adhesion: 90 ounces force/inch in width.
  5. Elongation: 2 percent.
  6. Tensile Strength: 40 lbf/inch in width.
  7. FSK Tape Disks and Squares: Precut disks or squares of FSK tape.
- B. PVC Tape: White vapor-retarder tape matching field-applied PVC jacket with acrylic adhesive. Suitable for indoor and outdoor applications.
  1. Products: Subject to compliance with requirements, provide one of the following:
    - a. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0555.
    - b. Compac Corp.; 130.
    - c. Ideal Tape Co., Inc., an American Biltrite Company; 370 White PVC tape.
    - d. Venture Tape; 1506 CW NS.
  2. Width: 2 inches.
  3. Thickness: 6 mils.
  4. Adhesion: 64 ounces force/inch in width.
  5. Elongation: 500 percent.
  6. Tensile Strength: 18 lbf/inch in width.
- C. Aluminum-Foil Tape: Vapor-retarder tape with acrylic adhesive.
  1. Products: Subject to compliance with requirements, provide one of the following:
    - a. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0800.
    - b. Compac Corp.; 120.
    - c. Ideal Tape Co., Inc., an American Biltrite Company; 488 AWF.
    - d. Venture Tape; 3520 CW.



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2. Width: 2 inches.
3. Thickness: 3.7 mils.
4. Adhesion: 100 ounces force/inch in width.
5. Elongation: 5 percent.
6. Tensile Strength: 34 lbf/inch in width.

## 2.7 SECUREMENTS

### A. Bands:

1. Products: Subject to compliance with requirements, provide one of the following:
  - a. Childers Products; Bands.
  - b. PABCO Metals Corporation; Bands.
  - c. RPR Products, Inc.; Bands.
2. Stainless Steel: ASTM A 167 or ASTM A 240/A 240M, Type 304; 0.015 inch thick, 1/2 inch wide with wing or closed seal.
3. Aluminum: ASTM B 209, Alloy 3003, 3005, 3105, or 5005; Temper H-14, 0.020 inch thick, 1/2 inch wide with wing or closed seal.
4. Springs: Twin spring set constructed of stainless steel with ends flat and slotted to accept metal bands. Spring size determined by manufacturer for application.

### B. Insulation Pins and Hangers:

1. Capacitor-Discharge-Weld Pins: Copper- or zinc-coated steel pin, fully annealed for capacitor-discharge welding, 0.135-inch- diameter shank, length to suit depth of insulation indicated.
  - a. Products: Subject to compliance with requirements, provide one of the following:
    - 1) AGM Industries, Inc.; CWP-1.
    - 2) GEMCO; CD.
    - 3) Midwest Fasteners, Inc.; CD.
    - 4) Nelson Stud Welding; TPA, TPC, and TPS.
2. Cupped-Head, Capacitor-Discharge-Weld Pins: Copper- or zinc-coated steel pin, fully annealed for capacitor-discharge welding, 0.135-inch- diameter shank, length to suit depth of insulation indicated with integral 1-1/2-inch galvanized carbon-steel washer.
  - a. Products: Subject to compliance with requirements, provide one of the following:
    - 1) AGM Industries, Inc.; CWP-1.
    - 2) GEMCO; Cupped Head Weld Pin.

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- 3) Midwest Fasteners, Inc.; Cupped Head.
  - 4) Nelson Stud Welding; CHP.
- 3. Metal, Adhesively Attached, Perforated-Base Insulation Hangers: Baseplate welded to projecting spindle that is capable of holding insulation, of thickness indicated, securely in position indicated when self-locking washer is in place. Comply with the following requirements:
  - a. Products: Subject to compliance with requirements, provide one of the following:
    - 1) AGM Industries, Inc.; Tactoo Insul-Hangers, Series T.
    - 2) GEMCO; Perforated Base.
    - 3) Midwest Fasteners, Inc.; Spindle.
  - b. Baseplate: Perforated, galvanized carbon-steel sheet, 0.030 inch thick by 2 inches square.
  - c. Spindle: Copper- or zinc-coated, low carbon steel, fully annealed, 0.106-inch- diameter shank, length to suit depth of insulation indicated.
  - d. Adhesive: Recommended by hanger manufacturer. Product with demonstrated capability to bond insulation hanger securely to substrates indicated without damaging insulation, hangers, and substrates.
- 4. Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch-thick, galvanized-steel sheet, with beveled edge sized as required to hold insulation securely in place but not less than 1-1/2 inches in diameter.
  - a. Products: Subject to compliance with requirements, provide one of the following:
    - 1) AGM Industries, Inc.; RC-150.
    - 2) GEMCO; R-150.
    - 3) Midwest Fasteners, Inc.; WA-150.
    - 4) Nelson Stud Welding; Speed Clips.
  - b. Protect ends with capped self-locking washers incorporating a spring steel insert to ensure permanent retention of cap in exposed locations.
- 5. Nonmetal Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch- thick nylon sheet, with beveled edge sized as required to hold insulation securely in place but not less than 1-1/2 inches in diameter.
  - a. Products: Subject to compliance with requirements, provide one of the following:
    - 1) GEMCO.
    - 2) Midwest Fasteners, Inc.

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- C. Staples: Outward-clinching insulation staples, nominal 3/4-inch- wide, stainless steel or Monel.
- D. Wire: 0.080-inch nickel-copper alloy, 0.062-inch soft-annealed, galvanized steel.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. C & F Wire.
    - b. Childers Products.
    - c. PABCO Metals Corporation.
    - d. RPR Products, Inc.

2.8 CORNER ANGLES

- A. PVC Corner Angles: 30 mils thick, minimum 1 by 1 inch, PVC according to ASTM D 1784, Class 16354-C. White or color-coded to match adjacent surface.
- B. Aluminum Corner Angles: 0.040 inch thick, minimum 1 by 1 inch, aluminum according to ASTM B 209, Alloy 3003, 3005, 3105 or 5005; Temper H-14.
- C. Stainless-Steel Corner Angles: 0.024 inch thick, minimum 1 by 1 inch, stainless steel according to ASTM A 167 or ASTM A 240/A 240M, Type 304.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions for compliance with requirements for installation and other conditions affecting performance of insulation application.
  - 1. Verify that systems and equipment to be insulated have been tested and are free of defects.
  - 2. Verify that surfaces to be insulated are clean and dry.
  - 3. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Surface Preparation: Clean and prepare surfaces to be insulated. Before insulating, apply a corrosion coating to insulated surfaces as follows:
  - 1. Stainless Steel: Coat 300 series stainless steel with an epoxy primer 5 mils thick and an epoxy finish 5 mils thick if operating in a temperature range between 140

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- and 300 deg F. Consult coating manufacturer for appropriate coating materials and application methods for operating temperature range.
- 2. Carbon Steel: Coat carbon steel operating at a service temperature between 32 and 300 deg F with an epoxy coating. Consult coating manufacturer for appropriate coating materials and application methods for operating temperature range.
- B. Coordinate insulation installation with the trade installing heat tracing. Comply with requirements for heat tracing that apply to insulation.
- C. Mix insulating cements with clean potable water; if insulating cements are to be in contact with stainless-steel surfaces, use demineralized water.

### 3.3 GENERAL INSTALLATION REQUIREMENTS

- A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of equipment, ducts and fittings, and piping including fittings, valves, and specialties.
  - B. Install insulation materials, forms, vapor barriers or retarders, jackets, and thicknesses required for each item of equipment, duct system, and pipe system as specified in insulation system schedules.
  - C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.
  - D. Install insulation with longitudinal seams at top and bottom of horizontal runs.
  - E. Install multiple layers of insulation with longitudinal and end seams staggered.
  - F. Do not weld brackets, clips, or other attachment devices to piping, fittings, and specialties.
  - G. Keep insulation materials dry during application and finishing.
  - H. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.
  - I. Install insulation with least number of joints practical.
  - J. Where vapor barrier is indicated, and for all insulated piping systems carrying below ambient fluid, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.
- 1. Install insulation continuously through hangers and around anchor attachments.

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2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends at attachment to structure with vapor-barrier mastic.
  3. Install insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.
  4. Cover inserts with jacket material matching adjacent pipe insulation. Install shields over jacket, arranged to protect jacket from tear or puncture by hanger, support, and shield.
- K. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.
- L. Install insulation with factory-applied jackets as follows:
1. Draw jacket tight and smooth.
  2. Cover circumferential joints with 3-inch- wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip, spaced 4 inches o.c.
  3. Overlap jacket longitudinal seams at least 1-1/2 inches. Install insulation with longitudinal seams at bottom of pipe. Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at 2 inches o.c.
    - a. For below ambient services, apply vapor-barrier mastic over staples.
  4. Cover joints and seams with tape as recommended by insulation material manufacturer to maintain vapor seal.
  5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to duct and pipe flanges and fittings.
- M. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.
- N. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.
- O. 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 similar to butt joints.
- P. 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.
  4. Manholes.

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5. Handholes.
6. Cleanouts.

### 3.4 PENETRATIONS

- A. Insulation Installation at Roof Penetrations: Install insulation continuously through roof penetrations.
  1. Seal penetrations with flashing sealant.
  2. For applications requiring only indoor insulation, terminate insulation above roof surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
  3. Extend jacket of outdoor insulation outside roof flashing at least 2 inches below top of roof flashing.
  4. Seal jacket to roof flashing with flashing sealant.
- B. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.
- C. Insulation Installation at Fire-Rated Wall and Partition Penetrations: Terminate insulation at fire damper sleeves for fire-rated wall and partition penetrations. Externally insulate damper sleeves to match adjacent insulation and overlap duct insulation at least 2 inches.
  1. Comply with requirements in Division 07 Section "Penetration Firestopping" firestopping and fire-resistive joint sealers.

### 3.5 GENERAL PIPE INSULATION INSTALLATION

- A. Requirements in this article generally apply to all insulation materials except where more specific requirements are specified in various pipe insulation material installation articles.
- B. Insulation Installation on Fittings, Valves, Strainers, Flanges, and Unions:
  1. Install insulation over fittings, valves, strainers, flanges, unions, and other specialties with continuous thermal and vapor barrier (for below ambient services) integrity, unless otherwise indicated.
  2. Insulate pipe elbows using preformed fitting insulation or mitered fittings made from same material and density as adjacent pipe insulation. Each piece shall be butted tightly against adjoining piece and bonded with adhesive. Fill joints, seams, voids, and irregular surfaces with insulating cement finished to a smooth, hard, and uniform contour that is uniform with adjoining pipe insulation.
  3. Insulate tee fittings with preformed fitting insulation or sectional pipe insulation of same material and thickness as used for adjacent pipe. Cut sectional pipe

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- insulation to fit. Butt each section closely to the next and hold in place with tie wire. Bond pieces with adhesive.
4. Insulate valves using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. For valves, insulate up to and including the bonnets, valve stuffing-box studs, bolts, and nuts. Fill joints, seams, and irregular surfaces with insulating cement. Do not cover valve handles/actuators or install insulation in a fashion that operation of valves is compromised.
  5. Insulate strainers using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. Fill joints, seams, and irregular surfaces with insulating cement. Insulate strainers so strainer basket flange or plug can be easily removed and replaced without damaging the insulation and jacket. Provide a removable reusable insulation cover. For below ambient services, provide a design that maintains vapor barrier.
  6. Insulate flanges and unions using a section of oversized preformed pipe insulation. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker.
  7. Cover segmented insulated surfaces with a layer of finishing cement and coat with a mastic. Install vapor-barrier mastic for below ambient services and a breather mastic for above ambient services. Reinforce the mastic with fabric-reinforcing mesh. Trowel the mastic to a smooth and well-shaped contour.
  8. For services not specified to receive a field-applied jacket except for flexible elastomeric and polyolefin, install fitted PVC cover over elbows, tees, strainers, valves, flanges, and unions. Terminate ends with PVC end caps. Tape PVC covers to adjoining insulation facing using PVC tape.
  9. Stencil or label the outside insulation jacket of each union with the word "UNION." Match size and color of pipe labels.
- C. Insulate instrument connections for thermometers, pressure gages, pressure temperature taps, test connections, flow meters, sensors, switches, and transmitters on insulated pipes, vessels, and equipment. Shape insulation at these connections by tapering it to and around the connection with insulating cement and finish with finishing cement, mastic, and flashing sealant.
- D. Install removable insulation covers at locations indicated. Installation shall conform to the following:
1. Make removable flange and union insulation from sectional pipe insulation of same thickness as that on adjoining pipe. Install same insulation jacket as adjoining pipe insulation.
  2. When flange and union covers are made from sectional pipe insulation, extend insulation from flanges or union long at least two times the insulation thickness over adjacent pipe insulation on each side of flange or union. Secure flange

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- cover in place with stainless-steel or aluminum bands. Select band material compatible with insulation and jacket.
3. Construct removable valve insulation covers in same manner as for flanges except divide the two-part section on the vertical center line of valve body.
  4. When covers are made from block insulation, make two halves, each consisting of mitered blocks wired to stainless-steel fabric. Secure this wire frame, with its attached insulation, to flanges with tie wire. Extend insulation at least 2 inches over adjacent pipe insulation on each side of valve. Fill space between flange or union cover and pipe insulation with insulating cement. Finish cover assembly with insulating cement applied in two coats. After first coat is dry, apply and trowel second coat to a smooth finish.
  5. Unless a PVC jacket is indicated in field-applied jacket schedules, finish exposed surfaces with a metal jacket.

### 3.6 MINERAL-FIBER INSULATION INSTALLATION

#### A. Insulation Installation on Straight Pipes and Tubes:

1. Secure each layer of preformed pipe insulation to pipe with wire or bands and tighten bands without deforming insulation materials.
2. Where vapor barriers are indicated, seal longitudinal seams, end joints, and protrusions with vapor-barrier mastic and joint sealant.
3. For insulation with factory-applied jackets on above ambient surfaces, secure laps with outward clinched staples at 6 inches o.c.
4. For insulation with factory-applied jackets on below ambient surfaces, do not staple longitudinal tabs but secure tabs with additional adhesive as recommended by insulation material manufacturer and seal with vapor-barrier mastic and flashing sealant.

#### B. Insulation Installation on Pipe, Fittings and Elbows:

1. Install preformed sections of same material as straight segments of pipe insulation when available.
2. When preformed insulation elbows and fittings are not available, install mitered sections of pipe insulation, to a thickness equal to adjoining pipe insulation. Secure insulation materials with wire or bands.

#### C. Insulation Installation on Valves, Control Valves, Drains, Vents, and Pipe Specialties:

1. Install preformed sections of same material as straight segments of pipe insulation when available.
2. When preformed sections are not available, install mitered sections of pipe insulation to valve body.
3. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
4. Install insulation to flanges as specified for flange insulation application.



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- D. Blanket Insulation Installation on Ducts and Plenums: Secure with adhesive and insulation pins.
1. Apply adhesives according to manufacturer's recommended coverage rates per unit area, for 100 percent coverage of duct and plenum surfaces.
  2. Apply adhesive to entire circumference of ducts and to all surfaces of fittings and transitions.
  3. Install either capacitor-discharge-weld pins and speed washers or cupped-head, capacitor-discharge-weld pins on sides and bottom of horizontal ducts and sides of vertical ducts as follows:
    - a. On duct sides with dimensions 18 inches and smaller, place pins along longitudinal centerline of duct. Space 3 inches maximum from insulation end joints, and 16 inches o.c.
    - b. On duct sides with dimensions larger than 18 inches, place pins 16 inches o.c. each way, and 3 inches maximum from insulation joints. Install additional pins to hold insulation tightly against surface at cross bracing.
    - c. Pins may be omitted from top surface of horizontal, rectangular ducts and plenums.
    - d. Do not over compress insulation during installation.
    - e. Impale insulation over pins and attach speed washers.
    - f. Cut excess portion of pins extending beyond speed washers or bend parallel with insulation surface. Cover exposed pins and washers with tape matching insulation facing.
  4. For ducts and plenums with surface temperatures below ambient, install a continuous unbroken vapor barrier. Create a facing lap for longitudinal seams and end joints with insulation by removing 2 inches from 1 edge and 1 end of insulation segment. Secure laps to adjacent insulation section with 1/2-inch outward-clinching staples, 1 inch o.c. Install vapor barrier consisting of factory- or field-applied jacket, adhesive, vapor-barrier mastic, and sealant at joints, seams, and protrusions.
    - a. Repair punctures, tears, and penetrations with tape or mastic to maintain vapor-barrier seal.
    - b. Install vapor stops for ductwork and plenums operating below 50 deg F at 18-foot intervals. Vapor stops shall consist of vapor-barrier mastic applied in a Z-shaped pattern over insulation face, along butt end of insulation, and over the surface. Cover insulation face and surface to be insulated a width equal to 2 times the insulation thickness but not less than 3 inches.
  5. Overlap unfaced blankets a minimum of 2 inches on longitudinal seams and end joints. At end joints, secure with steel bands spaced a maximum of 18 inches o.c.
  6. Install insulation on rectangular duct elbows and transitions with a full insulation section for each surface. Install insulation on round and flat-oval duct elbows with individually mitered gores cut to fit the elbow.

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7. Insulate duct stiffeners, hangers, and flanges that protrude beyond insulation surface with 6-inch- wide strips of same material used to insulate duct. Secure on alternating sides of stiffener, hanger, and flange with pins spaced 6 inches o.c.
- E. Board Insulation Installation on Ducts and Plenums: Secure with adhesive and insulation pins.
1. Apply adhesives according to manufacturer's recommended coverage rates per unit area, for 100 percent coverage of duct and plenum surfaces.
  2. Apply adhesive to entire circumference of ducts and to all surfaces of fittings and transitions.
  3. Install either capacitor-discharge-weld pins and speed washers or cupped-head, capacitor-discharge-weld pins on sides and bottom of horizontal ducts and sides of vertical ducts as follows:
    - a. On duct sides with dimensions 18 inches and smaller, place pins along longitudinal centerline of duct. Space 3 inches maximum from insulation end joints, and 16 inches o.c.
    - b. On duct sides with dimensions larger than 18 inches, space pins 16 inches o.c. each way, and 3 inches maximum from insulation joints. Install additional pins to hold insulation tightly against surface at cross bracing.
    - c. Pins may be omitted from top surface of horizontal, rectangular ducts and plenums.
    - d. Do not over compress insulation during installation.
    - e. Cut excess portion of pins extending beyond speed washers or bend parallel with insulation surface. Cover exposed pins and washers with tape matching insulation facing.
  4. For ducts and plenums with surface temperatures below ambient, install a continuous unbroken vapor barrier. Create a facing lap for longitudinal seams and end joints with insulation by removing 2 inches from 1 edge and 1 end of insulation segment. Secure laps to adjacent insulation section with 1/2-inch outward-clinching staples, 1 inch o.c. Install vapor barrier consisting of factory- or field-applied jacket, adhesive, vapor-barrier mastic, and sealant at joints, seams, and protrusions.
    - a. Repair punctures, tears, and penetrations with tape or mastic to maintain vapor-barrier seal.
    - b. Install vapor stops for ductwork and plenums operating below 50 deg F at 18-foot intervals. Vapor stops shall consist of vapor-barrier mastic applied in a Z-shaped pattern over insulation face, along butt end of insulation, and over the surface. Cover insulation face and surface to be insulated a width equal to 2 times the insulation thickness but not less than 3 inches.
  5. Install insulation on rectangular duct elbows and transitions with a full insulation section for each surface. Groove and score insulation to fit as closely as

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possible to outside and inside radius of elbows. Install insulation on round and flat-oval duct elbows with individually mitered gores cut to fit the elbow.

6. Insulate duct stiffeners, hangers, and flanges that protrude beyond insulation surface with 6-inch- wide strips of same material used to insulate duct. Secure on alternating sides of stiffener, hanger, and flange with pins spaced 6 inches o.c.

### 3.7 FIELD-APPLIED JACKET INSTALLATION

- A. Where PVC jackets are indicated, install with 1-inch overlap at longitudinal seams and end joints; for horizontal applications, install with longitudinal seams along top and bottom of tanks and vessels. Seal with manufacturer's recommended adhesive.
- B. Where metal jackets are indicated, install with 2-inch overlap at longitudinal seams and end joints. Overlap longitudinal seams arranged to shed water. Seal end joints with weatherproof sealant recommended by insulation manufacturer. Secure jacket with stainless-steel bands 12 inches o.c. and at end joints.

### 3.8 FIRE-RATED INSULATION SYSTEM INSTALLATION

- A. Where fire-rated insulation system is indicated, secure system to ducts and duct hangers and supports to maintain a continuous fire rating.
- B. Insulate duct access panels and doors to achieve same fire rating as duct.
- C. Install firestopping at penetrations through fire-rated assemblies. Fire-stop systems are specified in Division 07 Section "Penetration Firestopping."

### 3.9 FIELD QUALITY CONTROL

- A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.
- B. Perform tests and inspections.
- C. Tests and Inspections:
  1. Inspect ductwork, randomly selected by Architect, by removing field-applied jacket and insulation in layers in reverse order of their installation. Extent of inspection shall be limited to one location(s) for each duct system defined in the "Duct Insulation Schedule, General" Article.
  2. Inspect field-insulated pipe, fittings, strainers, valves and equipment, randomly selected by Architect, by removing field-applied jacket and insulation in layers in reverse order of their installation. Extent of inspection shall be limited to one location(s) for each type of equipment defined in the "Equipment Insulation

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Schedule" Article. For large equipment, remove only a portion adequate to determine compliance.

- D. All insulation applications will be considered defective Work if sample inspection reveals noncompliance with requirements.

3.10 DUCT INSULATION SCHEDULE, GENERAL

A. Plenums and Ducts Requiring Insulation:

1. Indoor, concealed supply and outdoor air located in unconditioned space.
2. Indoor, exposed supply and outdoor air located in unconditioned space.
3. Indoor, concealed return located in unconditioned space.
4. Indoor, exposed return located in unconditioned space.

B. Items Not Insulated:

1. Indoor, exposed supply and return air duct located in conditioned space.
2. Exhaust duct unless otherwise indicated.
3. Factory-insulated flexible ducts.
4. Factory-insulated plenums and casings.
5. Flexible connectors.
6. Vibration-control devices.
7. Factory-insulated access panels and doors.

3.11 INDOOR DUCT AND PLENUM INSULATION SCHEDULE

A.

TYPE	SERVICE	STYLE	MATERIAL	THICKNESS	DENSITY	MIN R-VALUE INSTALLED
Rectangular	Supply, Return	Duct Wrap	Fiberglass	2"	0.75 lbs/ft <sup>3</sup>	6
Concealed Round/Oval	Supply, Return	Duct Wrap	Fiberglass	2"	0.75 lbs/ft <sup>3</sup>	6
Rectangular	Outside Air	Duct Board	Fiberglass	2"	3 lbs/ft <sup>3</sup>	12
Exposed Round/Oval	Supply, Return, Outside Air	Duct Wrap	Fiberglass	2"	1.5 lbs/ft <sup>3</sup>	6

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3.12 PIPING INSULATION SCHEDULE, GENERAL

- A. Acceptable preformed pipe and tubular insulation materials and thicknesses are identified for each piping system and pipe size range. If more than one material is listed for a piping system, selection from materials listed is Contractor's option.
- B. Items Not Insulated: Unless otherwise indicated, do not install insulation on the following:
  - 1. No exceptions.

3.13 INDOOR PIPING INSULATION SCHEDULE

- A. Condensate and Equipment Drain Water below 60 Deg F:
  - 1. All Pipe Sizes: Insulation shall be one of the following:
    - a. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1" inch thick.
- B. Chilled Water and Brine, above 40 Deg F:
  - 1. Insulation shall be the following:
    - a. Mineral-Fiber, Preformed Pipe, Type I:
    - b. 1 inch thick for piping 1 ½ inches or less in diameter
    - c. 1-1/2 inches thick for piping greater than 1 ½ inches.
- C. Heating-Hot-Water Supply and Return, 200 Deg F and Below:
  - 1. Insulation shall be the following:
    - a. Mineral-Fiber, Preformed Pipe, Type I:
    - b. 1-1/2 inch thick for piping 1 inches or less in diameter
    - c. 2 inches thick for piping greater than 1-1/2 inches in diameter.

END OF SECTION 23 07 00

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INSTRUMENTATION AND CONTROL FOR HVAC

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SECTION 23 09 00 - INSTRUMENTATION AND CONTROL FOR HVAC

PART 1 – GENERAL

1.1 WORK INCLUDED

Scope of work: Refer to dwgs.

Project Description:

The following is a general description of the project for the purpose of providing an overview of the work scope. It is not intended to be all inclusive and does not limit the scope in any way. All work shown on the project documents is included in the work scope, including but not limited to all controls, electrical work and accessories. This project will be bid as a single prime contract with subcontractors for electrical work, controls and other trades as the contractor determines are needed.

1. Expand the existing Automated Logic BACS system in the building to implement the control strategy and functionality shown on the controls drawings. ALC was used as the basis of design for this project.

Summary:

Provide labor, materials, equipment, services and warranty for complete installation, startup and commissioning of controls for fan coil and finned-tube radiators as required in the Contract Documents.

Provide all control wiring (green jacketing) and the conduit (green) as required to connect devices furnished as a part of, or integral to the HVAC control system. Control wiring includes the 120 volt and lower voltage wiring as needed to utilize control signals directing the equipment operation.

Unless specially required otherwise by the BACS equipment manufacturer, all I/O wiring shall be twisted shielded cable. For communications, the BACS equipment manufacturer's installation guidelines and recommendations shall apply.

All control wiring installed above accessible ceiling spaces which are not laboratories or AHU's shall be plenum type, not installed in conduit, but neatly run with generous use of rings or ties.

Exposed conduit shall be painted to match wall/ceiling. Confirm color with architect.

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Control circuits shall be 24VAC in general, and no more than 120 VAC where required, Voltage higher than 30V shall not be directly connected to a control module, but rather through a low voltage interface relay.

Provide wiring in coordination and accordance with the requirements specified in Division 26, "Electrical" of this document, and the National Electrical Code.

Provide all devices required for proper system's operation including electrical switches, transformers, disconnect switches, relays, device controllers and control modules, actuators, transducers, sensors, safety devices, power supplies, mode selecting switches, enclosures, circuit breakers and the control software with graphics.

Provide complete wiring, wiring terminations, pneumatic tubing with accessories and cross-flow sensors where required. Provide all assembly, programming and testing of all items as necessary to create a coherent system, encompassing all combined intents of the design, drawings, specifications, addenda, and completed in a true professional quality of work.

- A. Coordinate with Cornell IT department for any necessary connections to the buildings LAN or VLAN systems.
- B. Coordinate all work with Division 26, "Electrical".

### 1.2 WORK NOT INCLUDED

- A. Power wiring for motors, motor starters and associated with it power starting and control hardware, as well as the motor starters, (except in the case of equipment specified to have packaged controls/starters) are included in Division 26, "Electrical," unless otherwise called for in the Project Specific Documentations.

### 1.3 QUALIFICATIONS

- A. Wiring installed in compliance with all requirements of Division 26, "Electrical."
- B. Control wiring installed in compliance with the NEC, Automated Logic and Cornell requirements.
- C. All control wiring within high voltage cabinets to conform to Class 2 wiring standards.



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1.4 ACCEPTABLE MANUFACTURERS

- A. Subject to compliance with this specification the Automated Logic is the only acceptable product. Additionally, all installed modules, software and control components must be comparable with the most recent version of Automated Logic Control System in use at Cornell.
- B. All HVAC equipment provided with the factory-mounted controls will have such controls installed in accordance with this specification, unless such installation would violate basic standards of safety.

1.5 BID CLARIFICATIONS

- A. Along with the bid package all Contractors are required to submit minimum scope letter with:
  - 1. Detailed Points Lists as were provided with the bid invitation; those should be filled out with details of control modules types showing clearly the relationships and particular points allocations to each controller including clearly identified spare I/O.
  - 2. Specification Conformance: State by individual paragraph where your system cannot meet the requirements.
  - 3. Network Diagrams: Provide a block diagram on how any new controller will fit into the existing network.
  - 4. Statement summarizing the warranty period for all control components that are part of this project – including any components that carry a warranty beyond the required 2 year minimum.

1.6 QUALITY ASSURANCE

- A. Acceptable Products: All products shall be proven to be functional and suitable in accordance with this specification for a period of warranty commencing on the day of transfer of the completed. Demonstration of such warranty may be required prior to the submittal approval.
- B. Contractor Qualifications: The Controls Contractor *called thereafter the TC* shall be factory-authorized by the respective manufacturer to provide pertinent installation and service.

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- C. Field Representation: The TC shall staff the project with a field representative project manager that has been factory-trained in the installation, programming and commissioning of the equipment specified. This representative must be in the direct employ of the TC.
- D. Any subcontractors in employ of TC on this project must receive prior approval of Cornell to be permitted work on this project.
- E. Coordination of Work During Construction:
  - 1. The TC shall protect work installed by other trades.
  - 2. The TC is to coordinate its work with parallel projects.
  - 3. The TC shall repair any damage caused by his/her work.
  - 4. The TC shall promptly correct all the new work that Cornell finds as defective or not conforming to Contract Documents.
  - 5. The TC shall bear all costs required to correct the new work found defective as described above, or cost of any restitutions caused in result of the TC performance proven faulty of thereof.
  - 6. The TC Contractor shall bear all actual, as charged to Cornell incidentals; costs resulted from setting the Building Fire Alarm, which afterwards required an unscheduled intervention of Fire Department, where such setting was initiated in direct result of the TC Contractor activities. The cost is defined as one-per-accident charge incurred by Cornell.
- F. Satisfaction of User's Needs: The TC shall deliver a complete project, which shall include all the instrumentation added by this project and integral to its control elements and components. The deliverables shall be presented to Cornell as a singular graphical\_system with any and all listed below functions, and shall be able to achieve as listed below:
  - 1. Project completed according to all current control standards and construction practices published by Automated Logic.
  - 2. WebCTRL Graphical Interface (GI) based on the Windows Platform running on campus (currently XP).
  - 3. GI depicting all added instrumentation by this project allowing its

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monitoring and control.

4. GI equipped to navigate to any and all added equipment, integral to, and matching the central navigation system already in place, including matching existing system's nomenclature, object names, file names, directory structures, etc.
5. Local access to GI from the multiple locations communicating with a dedicated central server, networked to each group of control devices utilizing Cornell-owned IP network.
6. Prior to commissioning the system server shall commence an automated, 24 hour/day monitoring and trending of the entire system added by this project.
7. Automated Alarm Monitoring allowing alarm Acknowledgment and Logging to file.
8. Event Alarms generated with multiple classes of importance.
9. Operator Generated Change (or adjustment) recorded and stored in the GI Event Logging.
10. Global Scheduling of equipment, available from each viewing location.
11. Calendar Functions supporting holiday, day-of-the-week and special time-triggered schedule exemptions.
12. Group Scheduling of Equipment S/S.
13. User's Log on Screen.
14. GI Control System accessible exclusively on recognition of authorized user, his individual password and assigned level of privileges.
15. System shall recognize Multiple Levels of User Privileges.
16. System shall include Graphical Data Trending, capable to be updated at operator-defined intervals and capable to zoom-in of trend sections for more detailed examination.
17. Tuning trend package integrated with system to adjust all PID parameters

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of analog outputs.

18. Global Data Base Updates, where a change of parameter entered through any authorized viewing station is instantly projected to the rest of the authorized viewing stations that may be on line at the same time.
19. On-line programming, download, upload and automated error correction of field control devices from each authorized Windows Station, where a change of program can be entered remotely through any authorized station, with effect on designated controller, and without a need to manually connect in the field to such controller.
20. Server-based data collection, error corrections and distribution of data to terminal devices.
21. Multi-level Secure Access to server.
22. Encryption between the server and client for Web transmission.
23. Errors-free system operation and its communication free of system timeouts.
24. Navigation to each controlled device from multiple viewing stations in real time.
25. Logic represented in a real-time, interactive diagram of graphical logic blocks.

#### 1.7 SHOP DRAWINGS AND SUBMITTALS

- A. Product Data: Submit for approval the manufacturer's technical product data for each component furnished as part of control system. Data shall include dimensions, capacities, performance characteristics, electrical requirements, and material finishes. Data shall also include installation, start-up requirements and operational instructions.
- B. Shop Drawings: Submit for approval control drawings detailing the following:
  1. Network Block Diagrams and System Riser Diagrams: Provide an upgraded network block diagram to show controls added to the existing controls network.

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2. Point-to-point Termination Detail: These drawings shall be created for each unique control application type. Drawings that are typical for similar application shall state the application and quantity of that what they represent and the specifics for each. All wiring and piping required to install and operate the system shall be represented in these details. For terminations that are unknown at the time of submittal, or introduced over the course of project, properly designate these as "Field Determined Terminations," and include in the As-built Drawings after completion. All wiring and piping shall be either number or color-coded on the drawings.
  3. Provide individual details for each control type, as described in the Sequence of Operation.
  4. Provide spreadsheets of schedules for dampers, valves, wiring, fans and other miscellaneous components if they are part of this control contract showing sizes, characteristics, model numbers and specific locations.
  5. For prefabricated control panels, provide panel's interior and exterior layout details. These details shall depict the equipment layout and shall detail the panel wiring and piping.
- C. Database Information: The submittal package shall contain detailed information on the point naming convention that is to be used. Consult Cornell for currently used nomenclature for equipment and database points and utilize it in the project.
- D. Provide documentation for all sequences of operation of any equipment added by this project.
- E. Provide documentation for all sequences of operation that cannot be performed by stand-alone controllers and require non-controller-resident programs, or programs requiring retransmission to be effective on the controller's output.
- F. Provide a schedule of module allocations for each segment of control equipment to be approved by the Cornell. Provide specifics for equipment that will be served by multiple modules.
- G. Provide the Project Points List in the standard FMS spreadsheet form, annotated with assignment of control modules as appropriate to execute the required control function.

1.8 OPERATION AND MAINTENANCE MANUALS PROVIDED AT PROJECT

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COMPLETION

- A. Upon completion of installation and prior to the training, provide manuals containing the following information:
1. Installation O&M and Service Manuals for all products and components.
  2. Calibration and Troubleshooting Procedures for all installed equipment and components that have build in calibration futures.
  3. List of location of all control enclosures, controllers, sensors, transformers and other components as specified above.
  4. As built control floorplan(s) clearly showing the equipment on the mechanical floorplan. Drawing must show the exact location of all controls including panels, modules, thermostats, field located sensors, network devices, field located power supplies, etc. Drawings must also accurately show the exact and correct location of the network and thermostat wiring (along with any other field wiring).
  5. As-built Control Drawings as specified above with all modifications, changes and wiring details that depict actual installation.
  6. Sequence of operation – Describing in detail the operation of every piece of equipment subject to control by the DDC system. Each section of the sequence should contain the following:
    - a) Overview – describes what the intent is, what components are involved and provides a concise description of the piece of equipment to be described.
    - b) Occupied Mode – Describes the operation of this system during occupied periods.
    - c) Unoccupied Mode – Describes the operation of this system during unoccupied periods.
    - d) Alarm Mode - Describes operation of the system in the event of alarm condition and steps to restore system to normal operation. List all anticipated alarm conditions.
    - e) Each Component's individual Sequence - Describes the detailed

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operation of each component and how it interacts with the entire system.

- f) List of all external interlocks and condition of their response and reset.
  - g) List of all tests required to check interlock responses.
- 7. Listing of all DDC controllers with details of points, point's functions and controlled equipment.
- 8. Provide spreadsheets of schedules for enclosures, control modules, dampers, valves, wiring, fans, well, tap and other miscellaneous components if they are part of this control contract showing sizes, characteristics, model numbers and specific locations.
- B. Provide laminated control diagrams and points list in each control panel showing wiring details of each piece of equipment whose controller(s) resides in the enclosure.
- C. CD backup disk(s) to be left on-site that will allow Cornell to fully restore the entire ALC System, including programming point database, configuration, graphic screens and all libraries of typically composed objects, and details supporting the navigation, screens and graphics.
- D. Within five working days from the time of the final system commissioning, (x) sets of Operation and Maintenance Manuals shall be turned directly to Cornell – coordinate with mechanical contract for exact number also provide electronic copies.
  - 1. A Programmer's Manual shall be provided with graphic and text descriptions of all functions required for software modifications and developments. This can be provided in the form of the CD received from the factory, containing latest release of help manuals and other technical bulletins.
  - 2. Section for each Major Piece of equipment – Contains the cut-sheets for the controllers, custom programs, and relevant information pertaining to that piece of equipment. (IE: schedules for AHUs showing Cornell specific Equipment Tag, Controller address, serial #, airflow, and pertinent engineering units like MBH, GPM, etc.).

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3. Wiring Details – Contains 8-1/2" x 11" drawings of all the wiring details shown throughout the set of drawings.
  4. Instrumentation Cut Sheets – Contains the Manufacturer's original cut sheets for all the instrumentation used on the job. (IE: Well sensor, transformers, enclosures, pressure sensors, etc.).
  5. Equipment Cut Sheets – Contains the Manufacturer's original cut sheets for all the equipment that was supplied for this job. (IE: Control valves, etc.).
  6. AutoCAD Drawings – All drawings shall be provided in Auto CAD format (IE: each file format should have the "dwg" extension), made as set of both, a set 11"x17" black and white and a set of 24"x36" (1 color set and 3 black and white sets). Drawing Sets consists of the following:
    - a) System Description Drawing – Shows the overview of the job and what is being controlled.
    - b) Network Riser Drawings – Shows how the network is connected between all the devices on the job. This drawing is to show the network connections in the order they are installed in the field.
    - c) Detail Drawing(s) – Shows all the wiring and piping details for the entire job – all other drawings refer to these drawings.
    - d) Individual Control panel drawings & Schematics (1 or 2 drawings per piece of equipment) Shows the *exact* wiring and layout of each control panel. Also shows the schematic representation of the system that is being controlled. (IE: AHU, HW Plant, CHW Plant, etc.).
    - e) Controls Floor Plan page for entire building showing thermo graphic status of building zone temperatures.
    - f) Controls Floor Plans (at least 1 for each floor) – Shows the exact location of the control panels, equipment, network wiring and any specific controls required for the job. All this information is overlaid on top of the mechanical floor plan showing the architectural layout (wall and room numbers).
- E. All above should be copied to a CD and released to Cornell. Provide Cornell with



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a CD containing all the documentation shown in paper format in the O&M, plus any relevant information or tools used during commissioning

1.9 SYSTEM COMMISSIONING

- A. The Owner will provide to the TC Contractor a Commissioning Check List Form according to which the Commissioning process will be completed.
- B. The Owner will conduct a commissioning according to the Commissioning Check List Form. No final payment can be approved prior to a successful completion of the commissioning.
- C. TC shall complete Pre-Commissioning to assure operational readiness of equipment prior to conducting of commissioning.
- D. All points connected to the EMS shall operate fully in accordance with this specification before the final completion is determined.
- E. Equipment Start-up: Upon completion of installation, all equipment being controlled shall be initially started and tested on site, using the contractor-provided temporary PC or Laptop; upon completion of this process whole content of the temporary PC should be reloaded to the Cornell owned Windows Server, which thereafter should continue to operate in a manner required by this specification. Such reload shall be done by insertion rather than by override of entire existing database. Additionally perform the following:
  - 1. Measure, calibrate and adjust all analog inputs.
  - 2. Stroke all analog outputs at 5 different points 0%, 25%, 50%, 75%, 100% and verify that all linkage adjustments are set properly, valves travel full stroke, VSDs control a full range, etc.
  - 3. Valves shall fully close and provide reasonably tight shut-off.
  - 4. Verify that all digital outputs are properly energizing the controlled device.
  - 5. Adjust setpoints so that equipment operates properly. Tune all PID control loops to avoid unnecessary cycling of control equipment, overheating, sub-cooling, and other limit switches and safeties. Create the trends and print trend results to verify a correct tuning operation.
  - 6. Adjust all alarm parameters so that nuisance alarms are eliminated.

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7. Provide reasonable control and operational assistance to the balancing personnel as needed to achieve reliable and energy-efficient system operation.
8. Cornell personnel will conduct its own commissioning to which the TC shall provide reasonable assistance;
  - a) Cornell Project Coordinator will complete Project Ready Checklist and TC shall assure that all items on the list are completed.
  - b) All questions arising in a course of either commissioning shall be answered by TC as part of this project.
- F. Communication Network Start-up: Verify from a host computer that all configured controllers are engaged in proper communication passing all configured points to viewing stations without time-outs.
  1. Monitor and review all network alarms during the commissioning process for dead module and COV alarms. Take correction action to eliminate any nuisance alarms.
- G. Software Verification: All programs and software functions shall be verified for proper sequence of operation.
- H. TC shall, during the ensuing four seasons (one year), conduct periodical inspections to fine-tune all dynamic elements of the system.
- I. TC shall --at no additional cost to Cornell-- dedicate one full day in each of the four subsequent seasons (total of 4 days), during which all necessary tuning of dynamic parameters shall be conducted in the field. Coordinate with Cornell the dates for this activity.
- J. Coordination: Work with the air-balancing contractor, ventilation contractor, piping contractor and electrical contractor to provide proper and obstruction-free component location, and a complete system commissioning.
- K. As built Drawings: All drawings shall be reviewed after the final installation is completed and corrected to provide accurate, as-built representation of the complete system.
- L. Commissioning Report: This report shall detail who and when performed the individual startups mentioned above.

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- M. Project commissioning is considered completed only if a physical walk-through of the project, together by TC and Cornell was concluded and the complete set of required documentation and software has been transferred to Cornell. Cornell has no right to refuse or delay a reasonably scheduled walk through, during which time every major components should be inspected if Cornell wishes so.
- N. Contractor shall provide detailed spreadsheet of all added points to match the existing point summary archived at Cornell Control Room.

1.10 TRAINING

After commissioning is completed, the TC shall provide on-site session detailing the layout of the EMS. This shall include network wiring routes, control panel locations, transformer locations, etc., and;

- A. The TC shall then provide on-site session to review the entire Operations and Maintenance manual(s) with Cornell. This session shall also include but not be limited to:
  - 1. Fundamental operation of the system
  - 2. Training on set points adjustment and scheduling modifications
  - 3. Operation and sequencing of control loops for all mechanical equipment being controlled
  - 4. Understanding of interlocks and the test routine to verify them.
- B. Throughout the warranty period provide the telephone support to answer system related questions and concerns.

1.11 WARRANTY

- A. Except as otherwise specified, the Contractor shall warrant and guarantee all work against defects in materials, equipment, and workmanship for a period of one (1) year from the date of acceptance of the work as evidenced by a resolution to that effect by the Owner, and for that period of time noted in special or extended warranties.
- B. The period of one (1) year shall be extended with respect to portions of the work first performed after substantial completion by the period of time between substantial completion and the actual performance of the work.

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- 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 airflow, 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 after acceptance, and during the subsequent six month period, the BACS contractor shall update the equipment and any controllers, servers, workstations, and HMI web servers with the latest modification and improvements in software, firmware, and hardware that the manufacturer may have incorporated in the furnished equipment.
- E. Disclose to Cornell and accommodate longer warranty periods if such are provided by components manufactured at the time of purchasing.

## PART 2 – PRODUCTS

### 2.1 SYSTEM DESCRIPTION

- A. General Requirements
  - 1. A distributed logic control system, complete with Direct Digital Control (DDC) and Direct Analog Control (DAC) software shall be provided. System shall be based on ANSI/ASHRAE Standard 135-1995, BACnet. This system is to control all mechanical equipment specified in the contract documents and any other listed equipment using native BAC

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BACnet-compliant components.

2. The system shall use BACnet protocols and LAN types throughout and exclusively.
3. The TC shall provide system software based on server-client architecture, designed around the open standards of web technology. The TC server shall communicate using ASHRAE BACnet/IP protocol. Server shall be accessed using a web browser over Cornell's intranet and remotely over the Internet.
4. The TC shall assume complete responsibility for the entire controls system as a single source, providing installation, program debugging and service of all portions of logic control system. This shall include designated server, operator's terminal, global controllers, routers, terminal unit controllers, sensors and all other sections of the system.
5. The web browser GUI shall provide a completely interactive user interface and must offer the following features as a minimum:
  - a) Trending
  - b) Scheduling
  - c) Real time 'live' Graphic Programs
  - d) Tree Navigation
  - e) Parameter display, change and change of properties
  - f) Setpoints adjustments
  - g) Alarm / Event information
  - h) Configuration of control mode including HOA manipulation with display of current HOA state
  - i) Execution of global commands
  - j) All standard functions provided by WebCTRL.

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- k) Graphical representation of program with life data display in pertinent nodes of program

B. Basic System Features

1. Operator's terminal software shall run under Microsoft Windows platform operating system. The HVAC controls application program shall be written to communicate utilizing BACnet protocols. Software shall be multi-tasking, capable of executing and displaying multiple instances in individual windows while running concurrently with other Windows programs such as word processors or database programs. Software shall support Windows Active X interface. Software shall strictly follow Microsoft Windows API guidelines. Systems using proprietary software or operating systems other than that described above are strictly prohibited. Operation of the terminal software shall be simple and intuitive.
2. Operator's terminal software shall contain capability to allow configuration of system-wide BACnet native controllers, including management and display of the controller programming.
3. During construction, if needed, at least one terminal shall be equipped to act as a system server. This system server shall store copies of all installed software for all field components and shall be capable of automatic or manual reloading of such software into the field components as required. The system server shall also gather and archive system-operating data, such as trends, energy logs, and other historical operating data.
4. Complete energy management firmware, including self-adjusting optimum start, demand limiting, global control strategies and logging routines for use with total control systems shall be supplied. All energy management firmware shall be resident in field hardware and shall not be dependent on the operator's terminal for operation. Operator's terminal software is to be used for access to field-based energy management control firmware only. All schedules shall be module resident and shall not be affected in case of interruption network transport between the module and the host station.
5. Upon completion of the project, the Contractor shall integrate new field controllers into an existing server used by Cornell.

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6. Priority password security systems shall prevent unauthorized use. Each user shall have an individual password. The user shall only be given access to the system functions required for individual job performance.
7. Equipment monitoring, alarm functions and help files including information for diagnosing equipment problems shall be included with the system.
8. The complete system, including, but not limited to terminal unit controllers, higher level controllers and operator's terminals shall auto-restart, without operator intervention, on resumption of power after a power failure. Database stored in any controller's memory shall reside error free for a minimum of 1 year.
9. System design shall be modular and have proven reliability.
10. All software and/or firmware interface equipment for connection to remote monitoring station from field hardware or the operator's terminal shall be provided.
11. System shall be capable of equipment runtime totalization of fans, heaters, boilers, etc. and capable of alarm generation and alarm dial-out.
12. System shall be able to respond to Cornell energy demand input and adjust the setpoints accordingly, or provide a total unit shutdown as centrally commanded.
13. *System shall be linked to and shall provide the Emergency Shutdown when OA Warning is executed.*
14. All controllers shall communicate using protocol as recommended by Automated Logic Control System as described in ALC documentations.
15. All hardware shall be Listed Underwriters Laboratory for Open Energy Management Equipment (PAZX) under the UL Standard for Safety 916 in both the US and Canada, with integral labels showing rating.
16. All hardware shall be in compliance with FCC Part 15, Subpart J, Class A.

C. Graphical Interface (GI)

Each GI page depicting the floor in a building shall, in addition to the scaled down floor plan and the North Arrow, have the following minimum features: thermo graphic zone scales and statuses, zone equipment and sensor distribution, the

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list of all room numbers on the floorplans, where each zone serves as a link to its zone equipment, and the links to other floors, sub floors, and if applicable, the roof of the same building.

Each GI page depicting particular piece of equipment shall have, in addition to the schematic of the equipment, the following data points linked to and representing actual state of the equipment, and possessing all futures as listed below:

1. Complete set of graphical representation of all associated with the depicted equipment points, such as Analog Inputs, Analog Outputs, Digital Inputs and Digital Outputs, including each respective current State or Value, Units of State or Value, the Hand-Off-Auto Manipulation Block, the State of the Schedule, Alarm State for all alarms requiring manual reset, Alarm Reset for all software resets, and other pertinent information as applicable.
2. Positioning of above elements shall be easily identified with particular control component.
3. Each page shall have adequate number of Manipulation Blocks functioning as overrides for each Outputs. Such Manipulation Blocks shall be designed to execute the operator-entered Change of the State Requests such as the Hand-Off-Auto, On/Off, Start/Stop, Open/Closed, etc., or other specific requests like Change of Speed, Percent of Open Valve or Damper, etc. Coordinate with Manager of Controls for current examples.
4. There are cases when installing such graphical controls may increase possibility of damage to the unit due to an unacceptable violation of sequence. Such cases should be identified, coordinated and approved for installation, or removed from the main operating graphic pages in accordance with approval of Cornell.
5. While it is desired to have a maximum of information on the same page, it may be practical to add additional pages, especially, if should such information would be difficult to fit on a singular page.
6. Complete set of Navigation Buttons, which, without the need to use the Navigation Tree, shall link the equipment to its sources of Heating, Cooling, Refrigeration, Heat Rejection Equipment, Pumps, Water Loops Control, Filtering Stations, Fire Alarm Controllers, Condensing Units, Heat



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Exchangers, Fire Suppression Systems, light controls and other supporting equipment.

7. Provide dedicated chilled water page for systems that have more than one chilled water equipment entries. This page will show the accurate schematic of the entire chilled water system for the building and tie in to the campus chilled water loop. The schematic will include piping, valves, pumps, sensors and associated equipment. The page will have links to each piece of equipment shown on the page. This page is not required on projects that do not involve the chilled water system.
8. Provide dedicated hot water page for systems that have more than one hot water equipment entries. This page will show the accurate schematic of the entire hot water system for the building and tie in to the campus hot water loop. The schematic will include piping, valves, pumps, sensors and associated equipment. The page will have links to each piece of equipment shown on the page. This page is not required on projects that do not involve the hot water system.
9. Information on current Outside Temperature, Humidity and the Enthalpy. Such information shall be placed consistently in the upper left corner of the page.
10. Provide Emergency Load Shed page(s) representing installed equipment with graphical blocks permitting global manipulation of Start/Stop commands to be used for the emergency shutdowns, when requested by power providing Utilities. Such page shall also contain proof status of all affected equipment.
11. Provide navigation tree linking to all controlled equipment. Such tree should be presented in logical structure of unit allocations in the building, building's floor, mechanical room, roof, etc.

### D. Reference Standards

The latest edition of the following standards and codes in effect and amended as of supplier's proposal date and any applicable subsections thereof, shall govern design and selection of equipment and material supplied:

1. American Society of Heating, Refrigerating and Air Conditioning Engineers (ASHRAE)

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2. ANSI/ASHRAE Standard 135-1995, BACnet
3. UL 916 Underwriters Laboratories Standard for Energy Management Equipment. Canada and the US
4. National Electrical Code (NEC)
5. FCC Part 15, Subpart B, Class A
6. EMC Directive 89/336/EEC
7. City, county, state, and federal regulations and codes in effect as of contract date
8. Occupational Safety and Health Act (OSHA)
9. National Fire Code
10. Uniform Plumbing Code
11. Except as otherwise indicated the system supplier shall secure and pay for all permits, inspections, and certifications required for his work and arrange for necessary approvals by the governing authorities.

2.2 TEMPERATURE SENSORS

- A. General Use Temperature Sensors shall be Thermistor 10,000 ohm at 77°F with Precon type-2 material. Accuracy shall be +/-0.36°F.
  1. Duct Sensors
    - a) Approved Manufacturer: Automated Logic, Precon Corp.
  2. Well Sensors
    - a) Liquid immersion sensors shall have a stainless steel probe and stainless steel well. Length of the sensor well shall be selected based on the diameter of the pipe to provide accurate, reliable sensing of the liquid temperature. Temperature range: 10 to 230°F.
    - b) All liquid immersion sensors shall be installed with thermal

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compound appropriate for selected sensor and the temperature conditions.

- c) Approved manufacture: Automated Logic, Precon Corp, BAPI.

B. Utility Temperature Sensors

1. Utility temperature sensors include any sensor that is to be used in conjunction with a flow meter with the intent of metering the amount of thermal usage.

- a) Typical examples include, but are not limited to:

- (1) Heat Exchanger MTHW supply and temperatures
- (2) Chiller loop supply and return temperatures

2. Medium Temperature Hot Water Temperature

- a) Any immersion temperature sensor that is connected to the Medium Temperature Hot Water (MTHW) system is considered to be a MTHW sensor.

- b) These sensors shall have the following characteristics:

- (1) 1K  $\Omega$  Platinum @ 0 °C, 3.85  $\Omega$ /°C temp. coeff.
- (2) Designed to accommodate 250°F temperature water media continuously.
- (3) Come with integrated calibrated transmitter with range: 50-250°F
- (4) Transmitter is to be calibrated at 3 points 125°F, 200°F and 240°F
- (5) Come with CE Declaration of Conformity letter
- (6) Acceptable models
  - (a) Sensor – BAPI - BA/1K[2]-I-4"-WP

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- (b) Transmitter – BAPI - BA/T1K[50 TO 250F]-XOR-BB-TS
    - (c) Enclosure – BAPI Box (BB)
- 3. Chilled Water Temperature
  - a) Any immersion temperature connected to chilled water piping with an associated flow meter is considered to be a Chilled Water Utility Temperature sensor.
  - b) These sensors shall have the following characteristics:
    - (1) Precon Type II Thermister, 10,000 Ohms at 77°F
    - (2) accuracy of  $\pm 0.1$  °C throughout the commercial temperature range of 0 to 70 °C
    - (3) Acceptable models:
      - (a) BA/10K-2[XP]-I-4"-BB
      - (b) Enclosure – BAPI Box (BB)

## 2.3 PRESSURE TRANSMITTERS

- A. Pressure transmitters shall be of 2-wire, 4-20 mA output type with a capacitance element having an accuracy of +/- 1% over the entire range. Transmitter shall include protection against reverse polarity and supply voltage transients. Accuracy and zero span adjustment shall be provided with each transmitter to allow for recalibration as necessary.
  - 1. Liquid Differential Pressure
    - a) The operating range shall be -40.0 to 176.0 Deg F.
    - b) Maximum safe overpressure shall be 150% of the rated pressure.
    - c) Shall be contained in an aluminum NEMA-1 enclosure.

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- d) Shall be provided with the appropriate factory manifold with the ability to bleed air from the system without disconnecting fittings.
- b) LCD Display indicating live pressure reading.
- c) Approved Manufacturer: Setra 231G-MSX-3V-D with manifold.
- d) Be sure to take into account total system pressure when selecting the differential pressure range.

2. Liquid or Steam Pressure

- a) Stainless steel pressure transmitter housing.
- b) 316 Stainless Steel wetted parts.
- c) Wide range of pressure ranges: 0 to 30, 0 to 50, 0 to 100, and 0 to 200 psig.
- d) High overpressure capability: 3 to 5 times range.
- e) Approved Manufacturer: Johnson Model PSS2 series or equivalent.

3. Air Differential Pressure, General and Static Pressure

- a. Acceptable Manufacturers: Mamac, Setra, Veris
- b. Provide zero and span adjustments.
- c. Accuracy  $\pm 1\%$  of full scale

2.4 FLOW TRANSMITTERS

A. Liquid Flow

- 1. The sensor shall be a 4-20 mA output type with the repeatability of  $\pm 0.1\%$  of value.
- 2. Temperature limits: -20.0 to 850.0 Deg F.
- 3. LCD Display indicating live flow value.

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4. Material is dependent upon that of the size and type of pipe material.
  - a) Approved manufacturer: GE Ultrasonic At868.
  - b) Provide dual fit transmitter (2 channel).

2.5 PNEUMATIC TRANSDUCERS

- A. I/P transducers shall not be used without prior approval from Manager of Controls.

2.6 ACTUATORS

- A. Pneumatic: (not to be used without prior approval from Manager of Controls).
- B. Electronic:
  1. Electronic actuators shall be driven directly by 0-10 VDC, Supply power: 24 VAC, as acceptable to its controller, and provide adequate torque to meet the application.
    - a) Electronic actuators shall be direct-coupled type.
    - b) Actuators to have a memory return to a designated position (spring return as required by application).
    - c) Approved Manufacturer: Belimo
    - d) Provide actuator with necessary torque to assure fail safe position.

2.7 ENCLOSURES

- A. Each controller shall be housed in the Enclosure.
- B. Enclosures shall be NEMA-12 rated steel, painted gray, finished to control oxidation in a highly humid atmosphere.
- C. Each enclosure shall have a hinged door with latch handle. Shall be Johnson Controls M8100 series or better.
- D. Shall provide 40% of free space for future expansion of the system.

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- E. Shall be equipped with laminated wiring diagram showing all terminations, modules, relays, switches, reset and push buttons, indicating lights, inputs and outputs, power supplies, network connections, etc.
- F. Each enclosure shall be equipped with internal 120VAC dual receptacle and ON/OFF switch to terminate power to the panel for the service repairs.
- G. All penetrations shall be sealed with mechanical bushing or knockout filler, protected with water sealing compound.
- H. All exterior enclosures shall be equipped with adequate thermostatically controlled fan and drip and insect screen protected vents, if internal temperature could increase in excess of permitted operating range of equipment housed in the enclosure.
- I. Each enclosure shall be equipped with a back plate firmly secured and grounded to the enclosure.
- J. Each enclosure shall be fitted with the Emergency Power (EM) fed from the nearest EM panel; TC is responsible for providing the EM power, unless this requirement was specifically excluded from the bid by the TC, Cornell or design engineer by including it in the Division 26 of the specification. On all new construction projects this requirement shall be included in and coordinated with the Division 26.
- K. All metal filings and derbies shall be vacuumed from each enclosure prior to mounting the hardware.

## 2.8 CONTROL VALVES

- A. Provide factory fabricated control valves with operators as required by this specification. Provide selection as determined by manufacturer for installation requirements and pressure class, based on maximum pressure and temperature in piping system. Provide valve size in accordance with specified maximum pressure drop across control valve. Equipment control valves with heavy duty actuators, with proper shut off rating for each individual application.
  - 1. Type: Two-Way V-port Ball Valves with Characterized Disk 1/4 turn:
  - 2. Manufacturers: Subject to compliance with requirements, provide products by the following:
    - a) Belimo Aircontrols (USA), Inc.
  - 3. Pressure Rating for NPS 1 and Smaller: Nominal 600 WOG.

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4. Pressure Rating for NPS 1-1/2 through NPS 2: Nominal 400 WOG.
5. Close-off Pressure: 200 psig.
6. Process Temperature Range: Zero to 212 deg F.
7. Body and Tail Piece: Cast bronze ASTM B 61, ASTM B 62, ASTM B 584, or forged brass with nickel plating.
8. End Connections: Threaded (NPT) ends.
9. Ball: Stainless Steel.
10. Stem and Stem Extension:
  - a) Material – Stainless Steel.
  - b) Blowout-proof design.
  - c) Sleeve or other approved means to allow valve to be opened and closed without damaging the insulation or the vapor barrier seal.
11. Ball Seats: Reinforced PTFE.
12. Stem Seal: Reinforced PTFE packing ring with a threaded packing ring follower to retain the packing ring under design pressure with the linkage removed. Alternative means, such as EPDM O-rings, are acceptable if an equivalent cycle endurance can be demonstrated by testing.
13. Flow Characteristic: Equal percentage.
14. Actuator: Electric, one motor only, valves 4 inches and larger shall have single operator.
15. Modulation control valves for steam humidification units shall be factory installed and factory piped by the humidifier equipment manufacturer. Steam control valves shall be VSI manufacture.

PART 3 - EXECUTION

3.1 WIRING

- A. Unless noted otherwise, all electrical wiring required to interconnect the components of the control system, including all terminations, splices, shield management, proper sizing and tests shall be furnished and installed by the TC. Perform all wiring in accordance with the requirements listed below, code requirements and Division 26.
- B. Power wiring required for controllers and control panels shall be furnished and installed by Division 26. Power for these components shall be dedicated power circuits for the express use of the individual controller or control panel. Circuits shall be furnished and selected by the Electrical Contractor. All circuit breakers and other electrical components required providing this dedicated circuit shall be



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the responsibility of the Electrical Contractor. Refer to Project Specific Requirements for additional information.

- C. Power wiring required for the Area Controller shall also be dedicated as specified above, and if available in the building, shall be on the emergency power circuit.
- D. All line voltage wiring shall be installed within EMT conduit. Conduit shall be adequately supported in accordance with local codes and Division 26.
- E. All low voltage (Class 2) wiring shall be installed within EMT conduit, except when ran in ceiling spaces. Low voltage wiring installed in ceiling spaces must be plenum rated wiring in accordance with all local codes. All wiring in ceiling spaces must be properly supported in ring runs, on 3 foot centers, and fastened to the building so as not to droop on the suspended ceiling and other appliances installed nearby. Install wiring as close to the deck as possible to avoid damage from other trades, materials, construction and service activities.
- F. All low voltage wiring shall be installed with additional lengths formed in organized loops to allow moving large objects in and out of the wire vicinity. Identification of such object is done by examination of construction drawings. Contractor should make a reasonable effort to comply with this requirement.
- G. All conduit and wiring shall be installed in parallel lines to the building structure, its corridors, and hallways.
- H. Communication network wiring shall be clearly marked with a specific color code. Communication wiring shall not be installed near a noise producing equipment, such as ballasts, magnetic starters, etc. Communication wiring shall comply with the optimum requirements necessary to assure good communication of the control system.
  - 1. All communications wiring shall follow standard best practices for the manufacturer.
  - 2. Exceptions:
    - a) In addition Cornell has a design standard that is more stringent than the manufacturer's best practice. Reference Cornell Design Standards on the Cornell FMS website.
    - b) Do not use repeaters.

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- c) When using Arcnet to Arcnet Routers (AARs) the equipment associated with the AAR should be related to each other.
    - (1) Example: An AHU and its associated VAVs
    - (2) Example: A floor of heat pumps.
  - d) Network devices, such as AARs shall be located in easily accessible areas, such as a control panel in a mechanical room. They shall not be located above a ceiling or other difficult to access area.
- I. All controls input and output wiring shall be done by a single and continuous set of shielded twisted wire with plenum rated jacket, foil shield and the drain. Such wire should be connected in the manner where:
- 1. Only one splice of the pair between the input or output and the termination on the control module were included.
  - 2. Where going through the compartments and walls, no additional transitions of pin connectors or pin bushings, etc. are permitted.
  - 3. All analog input and output wire shall be connected using individually separated and individually shielded (with drain) pairs of wires. Exception: All control wire connected to a dedicated piece of hardware can utilize a multi conductor cable with a common shield and drain wire; examples of the above rules are VSDs and actuators.
  - 4. The shield should have only one ground at the terminal board ground receiving fastener, and network one ground connection at designated communication device, unless specified otherwise by manufacturer of the equipment.
- J. Unless stated otherwise, all signals shall be wired using 18 gauge stranded wire as follows:
- 1. Comtran, 4859, Plenum rated, White Jacket wire, Foil shield with drain wire, 8 conductors, or
  - 2. Comtran, 4857, Plenum rated, White Jacket wire, Foil shield with drain wire, 6 conductors, or

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3. Comtran, 4855, Plenum rated, White Jacket wire, Foil shield with drain wire, 4 conductors, or
  4. Comtran, 4853, Plenum rated, White Jacket wire, Foil shield with drain wire, 2 conductors.
- K. All control wire shall be protected from pulling by utilizing fastening bushings at all knockouts crossed by the wire.
- L. No control wire should be directly fastened to the threaded rod or other sharp objects.
- M. All wiring in mechanical rooms or occupied spaces shall be installed in EMT conduit. The conduit should be sized to allow no more than 60% fill factor measured with all wiring installed in such conduit.
- N. In addition to the above requirements, Cornell has established the following standards for wiring:
1. DDC Control Panels – (Class 2 wiring)  
  
Stranded Hookup wire (MTW), 18 AWG (Simcona or Kele):  
  
Red – 24VAC power  
Blue – 24VAC common  
White – Analog Inputs / Outputs  
Black – Common  
Orange – 24VDC power  
Misc. – Misc. wiring connections (Digital Outputs, etc.)
  2. Cabling – Plenum Rated Stranded Shielded (run separately from all high voltage wiring). All single pair black and white shall be wired with the white as positive.  
  
18/2 (Black/White) – Duct, Well, Status  
18/2 (Red/White) – 24VAC Power (VAV boxes, etc)  
18/3 (Red/Black/White) – 3 wire devices and devices w/ switched 24VAC power  
18/4 (Red/Green/Black/White) – Actuators & Control Valves,  
18/6 (Brn/Blu/Red/Green/Black/White) – Zone Sensors  
18/12  
(Brn/Org/Blu/Yel/Red/Green/Black/White/Pur/Grey/Pink/Tan) –

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VFD Drives.

Variable Speed Drive DDC wiring color allocations:

Red/Green – Speed Feedback

Blue/Yellow – Start/Stop

Orange/Brown – Proof

Black/White – Speed Command

Purple/Grey – KW feedback

Pink/Tan – Alarm (fault)

The TC shall submit their wire requirements for approval.

3. Terminal Blocks

- a) No wires shall land directly on controller but rather shall be connected controller through DIN rail mounted termination strip.
- b) All terminals shall be identified with a terminal number corresponding to the same termination number posted on control drawing.
- c) All terminal blocks shall be provided with a removable fuse for any power wiring landing on terminal block.
- d) All wires leaving the terminals to the field devices must be labeled with descriptive text generated by a professional quality wire label maker.
- e) Provide spare terminal blocks corresponding to spare controller I/O.

4. Groups of terminals shall be separated as necessary utilizing the following color scheme: (inputs / interlocks / outputs)

Grey – Inputs / Network

Blue – Outputs

Red – Power (24VAC, 24vdc)

Yellow – Interlocks

Black – 120VAC Hot

White – 120VAC Neutral

Green – 120VAC Ground

5. Power Supply

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- a) Each new panel shall be equipped with its own 24 VAC Power Source with On/Off Switch, Convenience Outlet and Circuit Breaker. To achieve all above use Kele T-PB 303-0 Panel Mount, Class 3 Power Source.
  - b) Transformers – Each of the following w/ low voltage fuse holder/disconnect.
    - (1) DDC controller & DC power supply
    - (2) All field wiring (24VAC leaving panel – switched in field)
    - (3) Valves
    - (4) Dampers
  - c) DC Power Supply for 4-20ma devices must meet Class 2 wiring standards.
6. Convenience Outlet
- a) 120VAC combination outlet w/ switch to turn off 120VAC to panel.
  - b) Switched 120VAC to panel is fused before transformers (after outlet).
7. Din Rail (the following devices are din rail mounted)
- a) Terminal strips (inputs, outputs, network, and power).
  - b) Fuse Holders.
  - c) Interface Relays.
8. Wiring Panduit
- a) Wire ducts around exterior of panel for cables entering panel to be 3" to allow for wiring to be neatly run.
  - b) Wire ducts as necessary on interior of panel to route hookup wires from terminals to controllers and other devices.

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9. Panel Construction (sized to provide 40% future expansion w/ removable back panel)
  - a) Indoors – Johnson M8100 series or Hoffman (Nema 12 or better)
  - b) Outdoors – Hoffman fiberglass Nema 4x
10. Relays
  - a) Din Rail mounted
  - b) Track mounted
11. Panel lights for local annunciation
  - a) Provide LED type push to test all panel lights, 24VAC as needed.
  - b) Provide selector switches and pushbuttons as required.
  - c) Provide mechanically engraved descriptive panel labels for each device mounted on the face of the panel (light, switch & button) utilizing white letters on the black background.
12. All panels shall be named and labeled
  - a) Each panel shall have a reference name on the face of the panel describing its association with the services. Example: ## - *Hot Water Plant-##*, ## - *Chiller Plant-##*, ##-*Hot Water Pumps-##*, ##-*Air Handler 01*, *Corridor Lights- A. Level*, etc. The face plate should also include the panel number. Contact Manager HVAC Controls for official panel name and number.
  - b) Each panel shall be clearly labeled with the breaker panel and breaker number. This may be part of the front label or it may be labeled on the panel power supply.
  - c) Panel's reference name shall be reflected on the drawings.
  - d) All panel-controlled equipment shall be listed on labels on face of the panel near the reference name or near a cluster of controls related to particular equipment.

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- e) Face mounted control knobs, switches and monitoring lights shall be coordinated with the labeling system so that there is no ambiguity of controls association with the equipment. Such coordination shall result in creating clearly distinct control clusters, separated from each other by adequate space, or by including embracing frames, plates, etc, bearing the common labeling engravings.
- f) Labels should be made on black plastic material with white-engraved letters. Labels shall be neatly mounted with adhesive material providing strong bond with the face of panel.
- g) Each individual panel labeling scheme shall be approved by Cornell.

3.2 DDC EQUIPMENT

- A. All components shall be installed in protective enclosures. All wiring within the DDC enclosure shall be either number coded or color-coded. Both the enclosure and the controller shall be properly grounded in accordance with manufacturer's recommendation.
- B. Documentation shall be firmly attached to the enclosure within a plastic envelope. Documentation shall state point-to-point termination detail, description of each individual point, location of power source for the controller and ID number or address within the network. Examples of drawings are included at the end of the specification.
- C. All DDC Controllers shall be mounted in enclosures installed on walls within equipment rooms, custodial closets or electrical rooms. Only application-specific controllers for VAV boxes, heat pumps, unit ventilators, rooftop units or package units may be mounted on the equipment.
- D. Stand-alone Controllers shall be microprocessor-based with a minimum word size of 16 bits. They shall also be multi-tasking, multi-user, real-time digital control processors consisting of modular hardware with plug-in enclosed processors, communication controllers, power supplies and input/output point modules. Controller size shall be sufficient to fully meet the requirements of this specification.
- E. Each DDC Controller shall have sufficient memory, a minimum of 1 megabyte, to support its own operating system and databases, including:

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1. Control processes
  2. Energy management applications
  3. Alarm management applications including custom alarm messages for each level alarm for each point in the system.
  4. Historical/trend data for points specified
  5. Maintenance support applications
  6. Custom processes
  7. Operator I/O
  8. Dial-up communications
  9. Manual override monitoring
- F. Each DDC Controller shall support:
1. Monitoring of the following types of inputs, without the addition of equipment outside the DDC Controller cabinet:
    - a) Analog inputs
      - (1) 4-20 mA
      - (2) 0-5 or 0-10 VDC
      - (3) Thermistor
    - b) Digital inputs
      - (1) Dry contact closure
      - (2) Pulse Accumulator
      - (3) Voltage Sensing
  2. Direct control of pneumatic and electronic actuators and control devices. Each DDC Controller shall be capable of providing the following control outputs without the addition of equipment outside the DDC Controller cabinet:
    - a) Digital outputs
      - (1) Contact closure
    - b) Analog outputs
      - (1) 0-20 psi
      - (2) 4-20 mA
      - (3) 0-10 VDC
- G. Each DDC Controller shall have a minimum of 10 per cent spare capacity for future point connection. The type of spares shall be in the same proportion as the implemented I/O functions of the panel, but in no case shall there be less than two spares of each implemented I/O type. Provide all processors, power supplies and



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communication controllers complete so that the implementation of a point only requires the addition of the appropriate point input/output termination module and wiring.

1. Provide sufficient internal memory for the specified control sequences and have at least 25% of the memory available for future use.
- H. DDC Controller types shall be approved by Cornell. Whenever the number of required points exceeds capacity of basic controller, expanders should be utilized.
- I. Utilization of multiple modules for the same equipment -- where equal functionality can be achieved by a singular module with expanders-- is not permitted, unless specifically approved by Cornell.
- J. Each DDC Controller shall continuously perform self-diagnostics, communication diagnosis and diagnosis of all panel components. The DDC Controller shall provide both local and remote annunciation of any detected component failures, low battery conditions or repeated failure to establish communication.
- K. Isolation shall be provided at all peer-to-peer network terminations, as well as all field point terminations to suppress induced voltage transients consistent with IEEE Standards 587-1980.
- L. In the event of the loss of normal power, there shall be an orderly shutdown of all DDC Controllers to prevent the loss of database or operating system software. Non-volatile memory shall be incorporated for all critical controller configuration data and battery backup shall be provided to support the real-time clock and all volatile memory for a minimum of 72 hours.
1. Upon restoration of normal power, the DDC Controller shall automatically resume full operation without manual intervention.
  2. Should DDC Controller memory be lost for any reason, the user shall have the capability of reloading the DDC Controller via a network or local laptop PC.
- M. Provide a separate DDC Controller for each AHU, RTU or other HVAC system. It is intended that each unique system be provided with its own DDC Controller.

### 3.3 CONTROL WIRE PROTECTION

- A. Provide conduit protection for all control wiring between the floor and the ceiling

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space. Where there is no ceiling installed, provide conduit to protect wiring up to 9 feet AFF.

- B. The end, unsupported section of conduit connecting to field hardware shall be made of seal-tight flexible conduit with vinyl jacket and the drip proof fittings.
- C. Provide reasonable wire protection from all sharp elements that may get in contact with the wire jacket. This includes conduit outlets, junction boxes and devices supporting the wire.
- D. Run wire clear of any access doors, removable components, the space expected to be used for lifting suspended objects, hot pipe, pipe hangers, threaded rods, objects in motion, sharp edges, etc.
- E. All control wiring shall be protected and neatly bundled with plastic tie wraps and properly supported and fastened to solid objects. Supporting the wire on the ceiling, ceiling's light fixtures, etc. is not permitted.
- F. Control wiring shall comply with its class of insulation as per NEC code. Control wiring entering objects where higher class is enforced shall be protected accordingly. If change of wiring class require termination of two different wires, such termination shall be done in a separate enclosure or junction box, complete with a removable cover or access door.
- G. Provide Initial Resistance Test for all installed Control and Network Wiring, including resistance between each member of cable set and the ground with identification of tested parts.

### 3.4 DDC CONTROLLER RESIDENT SOFTWARE FEATURES

- A. General:
  - 1. All necessary software to form a complete operating system as described in this specification shall be provided.
  - 2. The software programs specified in this Section shall be provided as an integral part of DDC Controllers and shall not be dependent upon any higher level computer for execution.
- B. Control Software Description:
  - 1. The DDC Controllers shall have the ability to perform the following pre-tested control algorithms:

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- a) Two-position control
  - b) Proportional control
  - c) Proportional plus integral control
  - d) Proportional, integral, plus derivative control
  - e) PID Deadband
  - f) Control loop tuning
  - g) Input selections
  - h) Load shed offset of control setpoint
  - i) Intuitive learning
  - j) Control from remote input connected via the network
  - k) Controlling remote points via the network
  - l) Value broadcast via the network
- 2. Control software shall include a provision for limiting the number of times each piece of equipment may be cycled within any one-hour period.
  - 3. The system shall provide protection against excessive demand situations during start-up periods by automatically introducing time delays between successive start commands to heavy electrical loads.
  - 4. Upon the resumption of normal power, each DDC Controller shall analyze the status of all controlled equipment, compare it with normal occupancy scheduling and turn equipment on or off as necessary to resume normal operations.
- C. DDC Controllers shall have the ability to perform any or all the following energy management routines:
- 1. Time-of-day scheduling
  - 2. Calendar-based scheduling
  - 3. Holiday scheduling
  - 4. Temporary schedule overrides
  - 5. Start-Stop Time Optimization
  - 6. Automatic Daylight Savings Time Switchover
  - 7. Night setback control
  - 8. Enthalpy switchover (economizer)
  - 9. Peak demand limiting
  - 10. Temperature-compensated duty cycling
  - 11. Fan speed/CFM control
  - 12. Heating/cooling interlock
  - 13. Hot water reset
  - 14. Chilled water reset
  - 15. Condenser water reset
  - 16. Chiller sequencing
  - 17. Adaptive learning sequencer of multi stages

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- D. All programs shall be executed automatically without the need for operator intervention and shall be flexible enough to allow user customization. Programs shall be applied to building equipment as described in the Sequence of Operations.
- E. As much as possible use the same program for similar types of equipment in the same building and across campus.
  - 1. In cases where one piece of equipment requires an extra control routine, but is otherwise similar to other equipment in the project, then create one program that has the ability to turn that feature on and off, so the same program can be used on equipment with that feature and on equipment without that feature.
- F. If possible use one of the standardized Cornell programs.
  - 1. This library is continually expanding. Check with Manager HVAC Controls to see if there is a program in the library to meet the needs of the project.
- G. Refer to Cornell Design Standards located on the Cornell FMS website for program names and other program features.
- H. DDC Controllers shall be able to execute custom, job-specific processes defined by the user, to automatically perform calculations and special control routines.
  - 1. A single process shall be able to incorporate measured or calculated data from any and all other DDC Controllers on the network. In addition, a single process shall be able to issue commands to points in any and all other DDC Controllers on the network.
  - 2. Processes shall be able to generate operator messages and advisories to operator I/O devices. A process shall be able to directly send a message to a specified device or cause the execution of a dial-up connection to a remote device such as a printer or pager.
  - 3. The custom control programming feature shall be documented via English language descriptors.
  - 4. Process shall synchronize values entered locally from remote access pad and project new value on all access sites.
- I. Alarm management shall be provided to monitor and direct alarm information to operator devices. Each DDC Controller shall perform distributed, independent alarm analysis and filtering to minimize operator interruptions due to non-critical alarms, minimize network traffic and prevent alarms from being lost. At no time

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shall the DDC Controllers ability to report alarms be affected by either operator or activity at a PC workstation, local I/O device or communications with other panels on the network.

1. All alarm or point change reports shall include the point's English language description and the time and date of occurrence.
  2. Each alarm shall have the event-alarm message followed by the event-restore message when the alarm conditions has restored to normal operation.
  3. Alarm set and restore setpoints should be easily accessible.
  4. The user shall be able to define the specific system reaction for each point. Alarms shall be prioritized to minimize nuisance reporting and to speed operator response to critical alarms. A minimum of six priority levels shall be provided for each point. Point priority levels shall be combined with user definable destination categories (PC, printer, DDC Controller, etc.) to provide full flexibility in defining the handling of system alarms. Each DDC Controller shall automatically inhibit the reporting of selected alarms during system shutdown and start-up. Users shall have the ability to manually inhibit alarm reporting for each point.
  5. Alarm reports and messages will be directed to a user-defined list of operator devices or PCs.
  6. In addition to the point's descriptor and the time and date, the user shall be able to print, display or store a 200 character alarm message to more fully describe the alarm condition or direct operator response.
    - a) Each DDC Controller shall be capable of storing a library of at least 50 alarm messages. Each message may be assignable to any number of points in the Controller.
  7. In dial-up applications, operator-selected alarms shall initiate a call to a remote operator device.
- J. A variety of historical data collection utilities shall be provided too manually or automatically sample, store and display system data for points as specified in the I/O summary.
1. DDC Controllers shall store point history data for selected analog and digital inputs and outputs:
    - a) Any point, physical or calculated may be designated for trending. Any point, regardless of physical location in the network, may be collected and stored in each DDC Controllers point group. Two

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methods of collection shall be allowed: either by a pre-defined time interval or upon a pre-defined change of value. Sample intervals of 1 minute to 7 days shall be provided.

2. Trend data shall be stored at the DDC Controllers and uploaded to the workstation when retrieval is desired. Uploads shall occur based upon either user-defined interval, manual command or when the trend buffers are full. All trend data shall be available for use in 3rd party personal computer applications.
  3. DDC Controllers shall also provide high resolution sampling capability for verification of control loop performance. Operator-initiated automatic and manual loop tuning algorithms shall be provided for operator-selected PID control loops as identified in the point I/O summary. Provide capability to view or print trend and tuning reports.
- K. DDC Controllers shall automatically accumulate and store run-time hours for digital input and output points as specified in the point I/O summary.
1. The totalization routine shall have a sampling resolution of one minute or less.
  2. The user shall have the ability to define a warning limit for run-time totalization. Unique, user-specified messages shall be generated when the limit is reached.
- L. DDC Controllers shall automatically sample, calculate and store consumption totals on a daily, weekly or monthly basis for user-selected analog and digital pulse input type points as specified in the point I/O summary.
1. Totalization shall provide calculation and storage of accumulations of up to 99,999.9 units (e.g., KWH, gallons, BTU, tons, etc.).
  2. The totalization routine shall have a sampling resolution of one minute or less.
  3. The user shall have the ability to define a warning limit. Unique, user-specified messages shall be generated when the limit is reached.
- M. DDC Controllers shall have the ability to count events such as the number of times a pump or fan system is cycled on and off. Event totalization shall be performed on a daily, weekly or monthly basis for points as specified in the point I/O summary.
1. The event totalization feature shall be able to store the records associated with a minimum of 9,999.9 events before reset.
  2. The user shall have the ability to define a warning limit. Unique, user-specified messages shall be generated when the limit is reached.
- N. When applicable, the DDC Controllers shall provide recalculation of percentage of

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Outside Air entering the air handler, base on the algorithm, taking into consideration current OA, RA and MA condition. The computed result shall be distinctly posted on the Graphical Page alongside with the OA Damper position value.

3.5 SERVER/PC WORKSTATION

- A. The permanent Server assigned to Automated Logic Control System is in place at Cornell;
- B. Provide fully configured database, graphics, reports, alarm/events trend and scheduling management and merge it with existing in server control system and provide matching navigation system to all added elements, pages, etc.
- C. Provide daily management of all alarms generated as result of the construction cycle; Excessive alarms shall be maintained as needed without affecting other alarms on the server.
- D. All control systems provided in this contract shall be connected to the existing campus-wide Ethernet system.

3.6 COLOR GRAPHIC SOFTWARE (CGS)

- A. Provide graphic screens depicting the actual layout for all major equipment, including but not limited to:
  - 1. Air Handling Equipment
  - 2. VAV Boxes, Unit Heaters and other Zone Terminal Equipment
  - 3. Central Plant Equipment
- B. Provide graphic representation of the building, including building floor plans. Provide common information and status within these screens, such as zone temperature, equipment status, etc. Graphics shall use non-intrusive colors and close proximity color associations.
- C. Graphics shall allow manipulation of adjustable setpoints and show all pertinent dynamic data reasonably required to accurately representing system status and

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its functionality.

- D. Coordinate with the Engineer and Cornell prior to loading and testing.
- E. All graphic pages shall allow for the direct manipulation of all digital and analog outputs directly from the graphic screen through Hand-Off-Auto operators.
- F. As much as possible use the same graphic for similar types of equipment in the same building and across campus.
  - 1. In cases where one piece of equipment requires an graphic element, but is otherwise similar to other equipment in the project, then create one graphic that has the ability to turn that feature on and off, so the same graphic can be used on equipment with that feature and on equipment without that feature.
- G. If possible use one of the standardized Cornell programs.
  - 1. This library is continually expanding. Check with Manager HVAC Controls to see if there is a graphic in the library to meet the needs of the project.
- H. Refer to Cornell Design Standards located on the Cornell FMS website for graphic names, locations and other graphic features.

### 3.7 SENSING DEVICE INSTALLATION

- A. Liquid Immersion Sensor/Transmitter: Provide as required by the contract documents. The piping contractor shall provide and install all thread-o-lets for wells and other liquid sensors. Coordinate locations so that sensors are properly installed in an acceptable location. Actual sensors shall be provided and installed by the TC using thermal conductive compound. Strap on sensors are not acceptable, except for aqua-stats, or if specifically approved by Cornell.
- B. The building outside air station program will read the outside air conditions from the campus outside air program through the network and use the campus outside air values for its status values. In the event that the building outside air program cannot communicate with the campus outside air program then the building outside air program will use the average of the outside air sensors inside the buildings network.

### 3.8 CONTROLLED DEVICES



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- A. Valves: Provide as required by the contract documents – installed by the piping contractor. Coordinate locations so that valves are piped properly and installed in an acceptable location. Valves shall provide proper shut-off as specified in this section. Valves shall be wired by the control contractor.
- B. Actuators: TC shall install all actuators, unless specified otherwise. All wiring to the devices shall be the responsibility of the TC.

PART 4 – TYPICAL PROJECT REQUIREMENTS

1. The purpose of this section is to clarify and highlight those parts of contract requirements that may require additional clarifications, or are slightly different or in contrast with the rest of the specification, or needs to be purposely emphasized because of additional importance or safety considerations.
  - A. Provide all control points as listed in the Building Bid Request Points list.
  - B. Provide new control panels as per schedule in the points list.
  - C. For each piece of equipment provide singular panel. If multiple panels are required, this should be approved by the Owner.
  - D. Provide new control modules to operate each controlled unit as per schedule (separate module for each piece of equipment).
  - E. Provide schedule of new module assignments for approval.
  - F. Control panels shall be either Johnson Style M8100-xx-xx Extruded aluminum type or Hoffman metal enclosures with back panel. All controls panels to have a minimum rating of Nema-12. Any panels mounted outdoors shall be a NEMA-4X fiberglass.
  - G. All control panels shall be sized to provide 40% extra space for future expansion. Cornell shall approve type, size and location of each enclosure. Please, note that some enclosures shall be furnished with surface mounted indicator lights and switches as called for in the sequence of operation.
  - H. In order to minimize negative impact on building environment during the system transition, switchover needs to be coordinated with Cornell
  - I. The switchover shall be done in such a way, that no interruptions of building services should be required. If needed, the TC will provide manual control of the equipment and will provide adequate labor to complete this task.
  - J. TC Contractor shall assume liability for and provide adequate protection of the points which, when triggered in result of the TC Contractor's activities, may result in setting off the fire alarm.
  - K. Should wire damage cause internal short resulting in a loss of power supply to the existing Rosemount Control system, the TC will expedite the system transfer process without additional cost to Cornell.

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- L. Mount new enclosures as directed by the Owner.
- M. Replace all field temperature sensors with Precon type II. Provide factory calibration data for all installed sensors. (Exception: MTHW sensors shall be RTD with transmitter, Plant MTHW sensors shall be RTD with integrated factory calibrated and certified transmitter)
- N. Provide averaging temperature sensors for all MA & coil locations. Provide adequate sensor's length to assure reasonable averaging of MA temperature.
- O. For all air handlers provide Freezestat Alarm indicating light.
- P. For all air handlers provide Fire Alarm Relay and Fire Alarm indicating light.
- Q. Fire Alarm Contact Received shall be a separate command for each unit controlled.
- R. All safety devices shall be tied in series through the terminal strips within the ALC control panel. Examples of safeties wired in series that can shutdown the Fans are Fire alarm, Freezestat, Smoke Dampers and BAS Safety; Each safety that can shutdown a VFD should also generate a corresponding input to the ALC system, and also be indicated on the "push-to-test" light on the face of the control panel.
- S. All lighted pushbuttons shall be low voltage (24 VAC) and incorporate 2 sets of contacts (1 N.O. and 1 N.C.) wired such, that the "push to test" function is incorporated to test integrity of the light and the system. The N.C. contact shall be wired to the control point (freeze stat, high limit, etc.) and the N.O. contact shall be wired to a constant power source such, that when the lighted pushbutton is depressed the light will come on, independent of the control source. Bulbs will be LED.
- T. VFD Shutdown or interlock circuit shall be initiated from ALC control panel, rather than having individual cables tied together inside the VFD control section; even though the interlock circuit comes from the ALC control panel, it shall not be ALC controlled; *all safety devices shall be hardwired through relays within the control panel, and work independently of the ALC controller.* The interlock circuit should also fail off with no power to the control panel.
- U. All low voltage transformers shall be mounted within an enclosure (same or adjacent) and have a DIN rail mounted combination fused disconnect for fuse protection and means of disconnect. (see Kele Catalog #M10/16SFL or approved equal)
- V. Control panels shall have transformer dedicated for individual usage – (Examples include 1 for DDC controllers, 1 for all 24VAC power leaving the control panel, 1 for valves, 1 for dampers, 1 for all panel equipment (DC power supplies, panel lights) etc. Size each transformer as to allow 20% margin of safety in total VA load of each.

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- W. Within each control enclosure, the modules shall have a minimum of 10% spare I/O (of the total) with no less than 2 spare inputs of any type on each module. All bids shall include a list of the free I/O per panel & module.
- X. Each control panel will contain spare terminal blocks corresponding to the required 10% (minimum 2 each type) spare IO.
- Y. Within each enclosure provide convenience outlet with a light toggle switch (double gang box with cover) so that the control components and transformers can be independently de-energized separate from the outlet. To achieve all above use Kele T-PB 303-0 Panel Mount, Class 3 Power Source.
- Z. Control panels shall be designed with power entering on the bottom portion of the panel and control terminations in the top and sides unless obstructions prevent doing so.
- AA. Control panels shall be designed using wiring duct to section off different sections of the panel. Example: (transformers, relays, AHU-1, AHU-2, HW plant, terminals would all have their own section. The outside duct shall be oversized to allow for future expansion and to provide for a neat appearance without being cramped. Recommend using 3" duct on perimeter of panel. Kele T1-3030 or Horizon Fduct Wh6.
- BB. Panel relays shall be Idec blade style relays with DIN rail sockets. Kele: RH-2B or RH-4B with SH2B-05 or SH-4B-05
- CC. All control signal wiring should be plenum rated and provided with foil shield and drain. Analog inputs and outputs shall be additionally composed of separately shielded pairs of wires, complete with shield and drain wire. The drain wire shall be grounded in the control panel. Wiring not confirming to those criteria shall not be approved as completed, until corrected to meet above requirements.
- DD. Provide requested sequence of operation and test its performance including test of all interlocks and safeties. Consult with Cornell before proceeding with any test involving the MTHW or Steam.
- EE. Provide for approval two submittals for equipment and hardware utilized on this project.
- FF. Provide functional commissioning of system including testing all active inputs and outputs. Include system testing, PID tuning and safety testing. Support your work with actual trend data.
- GG. Demonstrate to Cornell effect of commissioning by conducting this process with the presence of authorized representative of Cornell.
- HH. Provide standard Cornell documentation, CAD drawings, wiring details, equipment cut sheets and Point Summaries, detailed sequence of operation for each piece of installed equipment controls; this should be provided both, in text version and block of program drawing. All drawings shall be provided additionally on a CD disk. Simulated CAD drawings completed using the Visio software is not an acceptable substitute for a professional quality CAD drawings.

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INSTRUMENTATION AND CONTROL FOR HVAC

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- II. Merge this project's work with the existing WebCTRL system, update all links and tree directory. Test completeness of WebCTRL graphical interface and correct all errors and inconsistency of equipment operation resulting from faulty programming, incomplete sequence of operation, etc.
- JJ. Provide 3-hour training seminar for Staff.
- KK. Provide 2-year warranty on labor and materials installed in this project.
- LL. In addition to the above, TC shall implement all applicable requirements from the generic specification developed and presented for project of Rosemount conversion in Building 01.
- MM. It is expected that during the warranty period, the TC will occasionally review all equipment added by this projects with the intent of system improvements, tuning, adjustments and corrections, as needed to provide most efficient and accurate operation of equipment. In each case such corrections shall have a prior approval of Cornell. Such activity shall be done in the best interest of project outcome and will not require additional compensation from Cornell.
- NN. All graphics shall conform to the Cornell standard and retain consistency with other buildings on campus. They should contain H-O-A operators for all equipment, Room numbers & zone numbers on floor plans.
- OO. Contractor Rules. Contractors shall follow all Cornell regulations concerning but not limited to:
  - a) Parking
  - b) Keys
  - c) Shutdowns
  - d) Fire alarms
  - e) Safety
  - f) Lock and Tag
- PP. Contractor shall be fully responsible for implementing and adhering to the above regulations including reimbursement of Cornell with required compensations for fees and fines resulting from his or her, or their team and, or their subcontractors performances at Cornell.
- QQ. Refer to Cornell Design Standards located on the Cornell FMS website for:
  - 1. Program Standards
  - 2. Graphic Standards
  - 3. Preferred Network topology
  - 4. Preferred Webctrl configuration

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INSTRUMENTATION AND CONTROL FOR HVAC

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HYDRONIC PIPING

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SECTION 23 21 13 - HYDRONIC PIPING

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. This Section includes pipe and fitting general materials, joining methods, special-duty valves, and specialties for the following:
  - 1. Hot-water heating piping.
  - 2. Air Control Devices
  - 3. Hydronic Specialties
  - 4. Air-vent piping
  - 5. Safety-valve-inlet and -outlet piping.
- B. Related Sections include the following:
  - 1. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.3 DEFINITIONS

- A. PTFE: Polytetrafluoroethylene.

1.4 PERFORMANCE REQUIREMENTS

- A. Hydronic piping components and installation shall be capable of withstanding the following minimum working pressure and temperature:
  - 1. Hot-water heating piping: 125 psig at 200 deg F.
  - 2. Air-Vent Piping: 200 deg F.

1.5 SUBMITTALS

- A. Product Data: For each type of the following:

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## HYDRONIC PIPING

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1. Pressure-seal fittings.
  2. Valves. Include flow and pressure drop curves based on manufacturer's testing for calibrated-orifice balancing valves.
  3. Air control devices.
  4. Hydronic specialties.
  5. Strainers
  6. Flexible Connectors.
- B. Shop Drawings: Detail, at 1/4 scale, the piping layout, fabrication of pipe anchors, hangers, supports for multiple pipes, alignment guides, expansion joints and loops, and attachments of the same to the building structure. Detail location of valves, devices, equipment, anchors, alignment guides, and expansion joints and loops.
- C. Welding certificates.
- D. Qualification Data: For Installer.
- E. Submit matrix indicating branch connection standards for all hydronic piping systems.
- F. Field quality-control test reports.
- G. Operation and Maintenance Data: For air control devices, hydronic specialties, and special-duty valves to include in emergency, operation, and maintenance manuals.
- H. Water Analysis: Submit a copy of the water analysis to illustrate water quality available at Project site.

### 1.6 QUALITY ASSURANCE

- A. Steel Support Welding: Qualify processes and operators according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."
- B. Welding: Qualify processes and operators according to ASME Boiler and Pressure Vessel Code: Section IX.
1. Comply with provisions in ASME B31 Series, "Code for Pressure Piping."
  2. Certify that each welder has passed AWS qualification tests for welding processes involved and that certification is current.
- C. ASME Compliance: Comply with ASME B31.9, "Building Services Piping," for materials, products, and installation. Safety valves and pressure vessels shall bear the appropriate ASME label. Fabricate and stamp air separators and expansion tanks to comply with ASME Boiler and Pressure Vessel Code: Section VIII, Division 01.



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HYDRONIC PIPING

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1.7 EXTRA MATERIALS

- A. Water-Treatment Chemicals: Furnish enough chemicals for initial system startup and for preventive maintenance for one year from date of Substantial Completion.
- B. Differential Pressure Meter: For each type of balancing valve and automatic flow control valve, include flowmeter, probes, hoses, flow charts, and carrying case.

PART 2 - PRODUCTS

2.1 COPPER TUBE AND FITTINGS

- A. Drawn-Temper Copper Tubing: ASTM B 88, Type L.
- B. Annealed-Temper Copper Tubing: ASTM B 88, Type K.
- C. DWV Copper Tubing: ASTM B 306, Type DWV.
- D. Wrought-Copper Unions: ASME B16.22.

2.2 JOINING MATERIALS

- A. Solder Filler Metals: ASTM B 32, lead-free alloys. Include water-flushable flux according to ASTM B 813.
- B. Brazing Filler Metals: AWS A5.8, BCuP Series, copper-phosphorus alloys for joining copper with copper; or BAg-1, silver alloy for joining copper with bronze or steel.

2.3 VALVES

- A. Check, Ball, and Butterfly Valves: Comply with requirements specified in Division 23 Section "General-Duty Valves for HVAC Piping."
- B. Bronze, Calibrated-Orifice, Balancing Valves:
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Armstrong Pumps, Inc.
    - b. Bell & Gossett Domestic Pump; a division of ITT Industries.
    - c. Flow Design Inc.
    - d. Gerand Engineering Co.
    - e. Griswold Controls.
    - f. Tour and Anderson

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HYDRONIC PIPING

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g. Sarco

2. Body: Bronze, ball or plug type with calibrated orifice or venturi.
3. Ball: Brass or stainless steel.
4. Plug: Resin.
5. Seat: PTFE.
6. End Connections: Threaded or socket.
7. Pressure Gage Connections: Integral seals for portable differential pressure meter.
8. Handle Style: Lever, with memory stop to retain set position.
9. CWP Rating: Minimum 125 psig.
10. Maximum Operating Temperature: 250 deg F.

2.4 AIR CONTROL DEVICES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Amtrol, Inc.
2. Armstrong Pumps, Inc.
3. Bell & Gossett Domestic Pump; a division of ITT Industries.
4. Taco.
5. Spirotherm

B. Manual Air Vents:

1. Body: Bronze.
2. Internal Parts: Nonferrous.
3. Operator: Screwdriver or thumbscrew.
4. Inlet Connection: NPS 1/2.
5. Discharge Connection: NPS 1/8.
6. CWP Rating: 150 psig.
7. Maximum Operating Temperature: 225 deg F.

C. Automatic Air Vents:

1. Body: Bronze or cast iron.
2. Internal Parts: Nonferrous.
3. Operator: Noncorrosive metal float.
4. Inlet Connection: NPS 1/2.
5. Discharge Connection: NPS 1/4.
6. CWP Rating: 150 psig.
7. Maximum Operating Temperature: 240 deg F.

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HYDRONIC PIPING

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2.5 STRAINERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Mueller
  - 2. Spirax Sarco
- B. Y-Pattern Strainers:
  - 1. Body: ASTM A 126, Class B, cast iron with bolted cover and bottom drain connection.
  - 2. End Connections: Threaded ends for NPS 2 and smaller; flanged ends for NPS 2-1/2 and larger.
  - 3. Strainer Screen: 40-mesh startup strainer, and perforated stainless-steel basket with 50 percent free area.
  - 4. CWP Rating: 125 psig.
- C. Basket Strainers:
  - 1. Body: ASTM A 126, Class B, high-tensile cast iron with bolted cover and bottom drain connection.
  - 2. End Connections: Threaded ends for NPS 2 and smaller; flanged ends for NPS 2-1/2 and larger.
  - 3. Strainer Screen: 40-mesh startup strainer, and perforated stainless-steel basket with 50 percent free area.
  - 4. CWP Rating: 125 psig.

2.6 Stainless-Steel Bellow, Flexible Connectors:

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Metraflex
  - 2. Flex Weld Incorporated
- B. Stainless-Steel Bellow, Flexible Connectors:
  - 1. Body: Stainless-steel bellows with woven, flexible, bronze, wire-reinforcing protective jacket.
  - 2. End Connections: Threaded or flanged to match equipment connected.
  - 3. Performance: Capable of 3/4-inch misalignment.
  - 4. CWP Rating: 150 psig.
  - 5. Maximum Operating Temperature: 250 deg F.
- C. Expansion fittings are specified in Division 23 Section "Expansion Fittings and Loops for HVAC Piping."

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## HYDRONIC PIPING

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### 2.7 HYDRONIC PIPING SPECIALTIES

#### A. Y-Pattern Strainers:

1. Body: ASTM A 126, Class B, cast iron with bolted cover and bottom drain connection.
2. End Connections: Threaded ends for NPS 2 and smaller; flanged or grooved ends for NPS 2-1/2 and larger.
3. Strainer Screen: 60-mesh startup strainer, and perforated stainless-steel basket with 50 percent free area.
4. CWP Rating: 125 psig.

#### B. Stainless-Steel Bellow, Flexible Connectors:

1. Body: Stainless-steel bellows with woven, flexible, bronze, wire-reinforcing protective jacket.
2. End Connections: Threaded or flanged to match equipment connected.
3. Performance: Capable of 3/4-inch misalignment.
4. CWP Rating: 150 psig.
5. Maximum Operating Temperature: 250 deg F.

#### C. Expansion fittings are specified in Division 23 Section "Expansion Fittings and Loops for HVAC Piping."

## PART 3 - EXECUTION

### 3.1 PIPING APPLICATIONS

#### A. Hot-water heating piping, aboveground, NPS 2 and smaller, shall be any of the following:

1. Type L, drawn-temper copper tubing, wrought-copper fittings, and soldered joints.

#### B. Hot-water heating heating piping, aboveground, NPS 2-1/2 and larger, shall be any of the following:

1. Type L, drawn-temper copper tubing, wrought-copper fittings, and soldered joints.
2. Schedule 40, ERW, Type B steel pipe, forged-steel flanges and flange fittings, and welded and flanged joints.

#### C. Air-Vent Piping:

1. Inlet: Same as service where installed.
2. Outlet: Type K, annealed-temper copper tubing with soldered or flared joints.

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HYDRONIC PIPING

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3.2 VALVE APPLICATIONS

- A. Install shutoff-duty valves at each branch connection to supply mains, and at supply connection to each piece of equipment.
- B. Install calibrated-orifice, balancing valves at each branch connection to return main.
- C. Install calibrated-orifice, balancing valves in the return pipe of each heating or cooling terminal.
- D. Install check valves where shown and as required to control flow direction.

3.3 PIPING INSTALLATIONS

- A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.
- B. Install piping in concealed locations, unless otherwise indicated and except in equipment rooms and service areas.
- C. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
- D. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.
- E. Install piping to permit valve servicing.
- F. Install piping at indicated slopes.
- G. Install piping free of sags and bends.
- H. Install fittings for changes in direction.
- I. Branch connections:
  - 1. Tees shall be used for branch connections that are same size as the mains, and for branch pipe sizes 1 and 2 pipe sizes smaller than the main.
  - 2. Shop fabricated connections may be used for branch connections that are more than 2 pipe sizes smaller than the main. Connections must comply with the procedures and requirements as defined in ASME B31.1.
  - 3. Weld-o-lets, welding saddles, thread-o-lets or Anvilets may be used.
- J. Install piping to allow application of insulation.

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HYDRONIC PIPING

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- K. Select system components with pressure rating equal to or greater than system operating pressure.
- L. Install groups of pipes parallel to each other, spaced to permit applying insulation and servicing of valves.
- M. Install drains, consisting of a tee fitting, NPS 3/4 ball valve, and short NPS 3/4 threaded nipple with cap, at low points in piping system mains and elsewhere as required for system drainage.
- N. Install manual air vents at all high points in hydronic systems, or wherever air can become trapped in the piping distribution.
- O. Install piping at a uniform grade of 0.2 percent upward in direction of flow.
- P. Reduce pipe sizes using eccentric reducer fitting installed with level side up.
- Q. Install branch connections to mains using wrought tee fittings in main pipe, with the branch connected to the bottom of the main pipe. For up-feed risers, connect the branch to the top of the main pipe.
- R. Install valves according to Division 23 Section "General-Duty Valves for HVAC Piping."
- S. Install unions in piping, NPS 2 and smaller, adjacent to valves, at final connections of equipment, and elsewhere as indicated.
- T. Install flanges or grooved fittings in piping, NPS 2-1/2 and larger, at final connections of equipment and elsewhere as indicated.
- U. Install strainers on inlet side of each control valve, pressure-reducing valve, solenoid valve, in-line pump, and elsewhere as indicated. Install NPS 3/4 nipple and ball valve in blowdown connection of strainers NPS 2 and larger. Match size of strainer blowoff connection for strainers smaller than NPS 2.
- V. Install expansion loops, expansion joints, anchors, and pipe alignment guides as specified in Division 23 Section "Expansion Fittings and Loops for HVAC Piping."
- W. Identify piping as specified in Division 23 Section "Identification for HVAC Piping and Equipment."

3.4 HANGERS AND SUPPORTS

- A. Hanger, support, and anchor devices are specified in Division 23 Section "Hangers and Supports for HVAC Piping and Equipment." Comply with the following requirements for maximum spacing of supports.
- B. Install the following pipe attachments:

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HYDRONIC PIPING

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1. Adjustable steel clevis hangers, high density thermal inserts or wood blocks, and 180 degree pipe shields for suspended piping systems below ambient room temperature.
  2. Adjustable clevis hangers, pipe clamps, or split rings for above ambient piping systems; pipe diameters at or below 2" diameter and continuous horizontal runs less than 50'. Pipe hangers may be in direct contact with this pipe providing the hangers are covered by insulation to the pivot point, the hanger pivot is able to move freely after installation, and the hangers are copper clad if in direct contact with copper pipe.
  3. Adjustable roller hangers, high density inserts and shields for above ambient piping; pipe diameters at or below 2" diameter and continuous horizontal runs greater than, or equal to, 50'.
  4. Adjustable roller hangers, saddles and shields for above ambient piping systems 2 1/2" in diameter and above.
  5. Spring hangers for individual horizontal piping within 50' of any equipment supported with vibration isolation measures.
  6. Pipe Roller: MSS SP-58, Type 44 for multiple horizontal piping 20 feet or longer, supported on a trapeze.
  7. Spring hangers to support vertical risers. Above ambient piping riser clamps may directly connect to pipe. Below ambient piping riser clamps must employ a high density insert to provide a thermal break and maintain continuous vapor barrier.
  8. Provide copper-clad hangers and supports for hangers and supports in direct contact with copper pipe.
  9. On plastic pipe, install pads or cushions on bearing surfaces to prevent hanger from scratching pipe. Provide "V-Channel" support for pipe support to prevent pipe sagging between hangers
- C. Install hangers for steel piping with the following maximum spacing and minimum rod sizes:
1. NPS 3/4: Maximum span, 7 feet; minimum rod size, 3/8 inch.
  2. NPS 1: Maximum span, 7 feet; minimum rod size, 3/8 inch.
  3. NPS 1-1/4: Maximum span, 7 feet; minimum rod size, 3/8 inch.
  4. NPS 1-1/2: Maximum span, 9 feet; minimum rod size, 3/8 inch.
  5. NPS 2: Maximum span, 10 feet; minimum rod size, 3/8 inch.
  6. NPS 2-1/2: Maximum span, 11 feet; minimum rod size, 1/2 inch.
  7. NPS 3: Maximum span, 12 feet; minimum rod size, 1/2 inch.
- D. Install hangers for drawn-temper copper tubing with the following maximum spacing and minimum rod sizes:
1. NPS 3/4: Maximum span, 5 feet; minimum rod size, 3/8 inch.
  2. NPS 1: Maximum span, 6 feet; minimum rod size, 3/8 inch.
  3. NPS 1-1/4: Maximum span, 7 feet; minimum rod size, 3/8 inch.
  4. NPS 1-1/2: Maximum span, 8 feet; minimum rod size, 3/8 inch.
  5. NPS 2: Maximum span, 8 feet; minimum rod size, 3/8 inch.
  6. NPS 2-1/2: Maximum span, 9 feet; minimum rod size, 1/2 inch.

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HYDRONIC PIPING

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7. NPS 3: Maximum span, 10 feet; minimum rod size, 1/2 inch.

E. Support vertical runs at roof, at each floor, and at 10-foot intervals between floors.

3.5 PIPE JOINT CONSTRUCTION

A. Join pipe and fittings according to the following requirements and Division 23 Sections specifying piping systems.

B. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.

C. Soldered Joints: Apply ASTM B 813, water-flushable flux, unless otherwise indicated, to tube end. Construct joints according to ASTM B 828 or CDA's "Copper Tube Handbook," using lead-free solder alloy complying with ASTM B 32.

D. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," "Pipe and Tube" Chapter, using copper-phosphorus brazing filler metal complying with AWS A5.8.

E. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:

1. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.
2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.

3.6 HYDRONIC SPECIALTIES INSTALLATION

A. Install manual air vents at high points in piping, at heat-transfer coils, and elsewhere as required for system air venting.

B. Install automatic air vents at high points of system piping in mechanical equipment rooms only. Manual vents at heat-transfer coils and elsewhere as required for air venting.

3.7 TERMINAL EQUIPMENT CONNECTIONS

A. Sizes for supply and return piping connections shall be the same as pipe branches serving the equipment and may be larger than equipment connections. Provide reducing fittings at the connections if needed.

B. Install control valves in accessible locations close to connected equipment. Provide reducing fittings as needed.



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HYDRONIC PIPING

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- C. Install ports for pressure gauges and thermometers at coil inlet and outlet connections according to Division 23 Section "Meters and Gauges for HVAC Piping."

3.8 FIELD QUALITY CONTROL

- A. Prepare hydronic piping according to ASME B31.9 and as follows:
  - 1. Leave joints, including welds, uninsulated and exposed for examination during test.
  - 2. Provide temporary restraints for expansion joints that cannot sustain reactions due to test pressure. If temporary restraints are impractical, isolate expansion joints from testing.
  - 3. Flush hydronic piping systems with clean water; then remove and clean or replace strainer screens.
  - 4. Isolate equipment from piping. If a valve is used to isolate equipment, its closure shall be capable of sealing against test pressure without damage to valve. Install blinds in flanged joints to isolate equipment.
- B. Perform the following tests on hydronic piping:
  - 1. Use ambient temperature water as a testing medium unless there is risk of damage due to freezing. Another liquid that is safe for workers and compatible with piping may be used.
  - 2. While filling system, use vents installed at high points of system to release air. Use drains installed at low points for complete draining of test liquid.
  - 3. Isolate expansion tanks and determine that hydronic system is full of water.
  - 4. Subject piping system to hydrostatic test pressure that is not less than 1.5 times the system's working pressure. Test pressure shall not exceed maximum pressure for any vessel, pump, valve, or other component in system under test. Verify that stress due to pressure at bottom of vertical runs does not exceed 90 percent of specified minimum yield strength or 1.7 times "SE" value in Appendix A in ASME B31.9, "Building Services Piping."
  - 5. After hydrostatic test pressure has been applied for at least 10 minutes, examine piping, joints, and connections for leakage. Eliminate leaks by tightening, repairing, or replacing components, and repeat hydrostatic test until there are no leaks.
  - 6. Prepare written report of testing.
- C. Perform the following before operating the system:
  - 1. Open manual valves fully.
  - 2. Inspect pumps for proper rotation.
  - 3. Set makeup pressure-reducing valves for required system pressure.
  - 4. Inspect air vents at high points of system and determine if all are installed and operating freely (automatic type), or bleed air completely (manual type).
  - 5. Set temperature controls so all coils are calling for full flow.
  - 6. Inspect and set operating temperatures of hydronic equipment, such as boilers, chillers, cooling towers, to specified values.

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HYDRONIC PIPING

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7. Verify lubrication of motors and bearings.

END OF SECTION 23 21 13

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METAL DUCTS

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SECTION 23 31 13 - METAL DUCTS

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. Single-wall rectangular ducts and fittings.
  - 2. Single-wall round and flat oval ducts and fittings.
  - 3. Sheet metal materials.
  - 4. Duct liner.
  - 5. Sealants and gaskets.
  - 6. Hangers and supports.
- B. Related Sections:
  - 1. Division 23 Section "Testing, Adjusting, and Balancing for HVAC" for testing, adjusting, and balancing requirements for metal ducts.
  - 2. Division 23 Section "Air Duct Accessories" for dampers, sound-control devices, duct-mounting access doors and panels, turning vanes, and flexible ducts.

1.3 PERFORMANCE REQUIREMENTS

- A. Delegated Duct Design: Duct construction, including sheet metal thicknesses, seam and joint construction, reinforcements, and hangers and supports, shall comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" and performance requirements and design criteria indicated in "Duct Schedule" Article.
- B. Structural Performance: Duct hangers and supports shall withstand the effects of gravity loads and stresses within limits and under conditions described in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible".
- C. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.

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METAL DUCTS

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1.4 ACTION SUBMITTALS

A. Product Data: For each type of the following products:

1. Liners and adhesives.
2. Sealants and gaskets.

B. Shop Drawings:

1. Fabrication, assembly, and installation, including plans, elevations, sections, components, and attachments to other work.
2. Factory- and shop-fabricated ducts and fittings.
3. Duct layout indicating sizes, configuration, liner material, and static-pressure classes.
4. Elevation of top of ducts.
5. Dimensions of main duct runs from building grid lines.
6. Fittings.
7. Reinforcement and spacing.
8. Seam and joint construction.
9. Penetrations through fire-rated and other partitions.
10. Equipment installation based on equipment being used on Project.
11. Locations for duct accessories, including dampers, turning vanes, and access doors and panels.
12. Hangers and supports, including methods for duct and building attachment and vibration isolation.

C. Delegated-Design Submittal:

1. Sheet metal thicknesses.
2. Joint and seam construction and sealing.
3. Reinforcement details and spacing.
4. Materials, fabrication, assembly, and spacing of hangers and supports.

1.5 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:

1. Duct installation in congested spaces, indicating coordination with general construction, building components, and other building services. Indicate proposed changes to duct layout.
2. Suspended ceiling components.
3. Structural members to which duct will be attached.
4. Size and location of initial access modules for acoustical tile.
5. Penetrations of smoke barriers and fire-rated construction.
6. Items penetrating finished ceiling including the following:
  - a. Lighting fixtures.

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METAL DUCTS

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- b. Air outlets and inlets.
  - c. Speakers.
  - d. Sprinklers.
  - e. Access panels.
  - f. Perimeter moldings.
- B. Welding certificates.
- C. Field quality-control reports.

1.6 QUALITY ASSURANCE

- A. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel," for hangers and supports. AWS D1.2/D1.2M, "Structural Welding Code - Aluminum," for aluminum supports. AWS D9.1M/D9.1, "Sheet Metal Welding Code," for duct joint and seam welding.
- B. Welding Qualifications: Qualify procedures and personnel according to the following:
- 1. AWS D1.1/D1.1M, "Structural Welding Code - Steel," for hangers and supports.
  - 2. AWS D1.2/D1.2M, "Structural Welding Code - Aluminum," for aluminum supports.
  - 3. AWS D9.1M/D9.1, "Sheet Metal Welding Code," for duct joint and seam welding.
- C. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 5 - "Systems and Equipment" and Section 7 - "Construction and System Start-up."
- D. ASHRAE/IESNA Compliance: Applicable requirements in ASHRAE/IESNA 90.1, Section 6.4.4 - "HVAC System Construction and Insulation."

PART 2 - PRODUCTS

2.1 SINGLE-WALL RECTANGULAR DUCTS AND FITTINGS

- A. General Fabrication Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" based on indicated static-pressure class unless otherwise indicated.
- B. Transverse Joints: Select joint types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-1, "Rectangular Duct/Transverse Joints," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

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METAL DUCTS

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- C. Longitudinal Seams: Select seam types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-2, "Rectangular Duct/Longitudinal Seams," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
- D. Elbows, Transitions, Offsets, Branch Connections, and Other Duct Construction: Select types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 4, "Fittings and Other Construction," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

## 2.2 SINGLE-WALL ROUND and FLAT OVAL DUCTS AND FITTINGS

- A. General Fabrication Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 3, "Round, Oval, and Flexible Duct," based on indicated static-pressure class unless otherwise indicated.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. McGill AirFlow LLC.
    - b. SEMCO Incorporated.
    - c. Sheet Metal Connectors, Inc.
    - d. Spiral Manufacturing Co., Inc.
- B. Transverse Joints: Select joint types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-1, "Round Duct Transverse Joints," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
  - 1. Transverse Joints in Ducts Larger Than 60 Inches in Diameter: Flanged.
- C. Longitudinal Seams: Select seam types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-2, "Round Duct Longitudinal Seams," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
  - 1. Fabricate round ducts larger than 90 inches in diameter with butt-welded longitudinal seams.
  - 2. Fabricate flat-oval ducts larger than 72 inches in width (major dimension) with butt-welded longitudinal seams.
- D. Tees and Laterals: Select types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-5, "90 Degree Tees and

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Laterals," and Figure 3-6, "Conical Tees," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

2.3 SHEET METAL MATERIALS

- A. General Material Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods unless otherwise indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.
- B. Galvanized Sheet Steel: Comply with ASTM A 653/A 653M.
  - 1. Galvanized Coating Designation: G90 (Z275).
  - 2. Finishes for Surfaces Exposed to View: Mill phosphatized.
- C. Carbon-Steel Sheets: Comply with ASTM A 1008/A 1008M, with oiled, matte finish for exposed ducts.
- D. Stainless-Steel Sheets: Comply with ASTM A 480/A 480M, Type 304 or 316, as indicated in the "Duct Schedule" Article; cold rolled, annealed, sheet. Exposed surface finish shall be No. 2B, No. 2D, No. 3, or No. 4 as indicated in the "Duct Schedule" Article.
- E. 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.
- F. Reinforcement Shapes and Plates: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.
  - 1. Where black- and galvanized-steel shapes and plates are used to reinforce aluminum ducts, isolate the different metals with butyl rubber, neoprene, or EPDM gasket materials.
- G. Tie Rods: Galvanized steel, 1/4-inch minimum diameter for lengths 36 inches or less; 3/8-inch minimum diameter for lengths longer than 36 inches.

2.4 DUCT LINER

- A. Fibrous-Glass Duct Liner: Comply with ASTM C 1071, NFPA 90A, or NFPA 90B; and with NAIMA AH124, "Fibrous Glass Duct Liner Standard."
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

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- a. CertainTeed Corporation; Insulation Group.
  - b. Johns Manville.
  - c. Knauf Insulation.
  - d. Owens Corning.
  - e. Maximum Thermal Conductivity:
    - 1) Type I, Flexible: 0.27 Btu x in./h x sq. ft. x deg F at 75 deg F mean temperature.
    - 2) Type II, Rigid: 0.23 Btu x in./h x sq. ft. x deg F at 75 deg F mean temperature.
2. Antimicrobial Erosion-Resistant Coating: Apply to the surface of the liner that will form the interior surface of the duct to act as a moisture repellent and erosion-resistant coating. Antimicrobial compound shall be tested for efficacy by an NRTL and registered by the EPA for use in HVAC systems.
  3. Water-Based Liner Adhesive: Comply with NFPA 90A or NFPA 90B and with ASTM C 916.
    - a. For indoor applications, adhesive shall have a VOC content of 80 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
    - b. Adhesive shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."
- B. Insulation Pins and Washers:
1. Cupped-Head, Capacitor-Discharge-Weld Pins: Copper- or zinc-coated steel pin, fully annealed for capacitor-discharge welding, 0.135-inch diameter shank, length to suit depth of insulation indicated with integral 1-1/2-inch galvanized carbon-steel washer.
  2. Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch thick galvanized steel; with beveled edge sized as required to hold insulation securely in place but not less than 1-1/2 inches in diameter.
- C. Shop Application of Duct Liner: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 7-11, "Flexible Duct Liner Installation."
1. Adhere a single layer of indicated thickness of duct liner with at least 90 percent adhesive coverage at liner contact surface area. Attaining indicated thickness with multiple layers of duct liner is prohibited.
  2. Apply adhesive to transverse edges of liner facing upstream that do not receive metal nosing.
  3. Butt transverse joints without gaps, and coat joint with adhesive.
  4. Fold and compress liner in corners of rectangular ducts or cut and fit to ensure butted-edge overlapping.



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5. Do not apply liner in rectangular ducts with longitudinal joints, except at corners of ducts, unless duct size and dimensions of standard liner make longitudinal joints necessary.
6. Apply adhesive coating on longitudinal seams in ducts with air velocity of 1500 fpm.
7. Secure liner with mechanical fasteners 4 inches from corners and at intervals not exceeding 12 inches transversely; at 3 inches from transverse joints and at intervals not exceeding 18 inches longitudinally.
8. Secure transversely oriented liner edges facing the airstream with metal nosings that have either channel or "Z" profiles or are integrally formed from duct wall. Fabricate edge facings at the following locations:
  - a. Fan discharges.
  - b. Intervals of lined duct preceding unlined duct.
  - c. Upstream edges of transverse joints in ducts where air velocities are higher than 1500 fpm or where indicated.
9. Terminate inner ducts with buildouts attached to fire-damper sleeves, dampers, turning vane assemblies, or other devices. Fabricated buildouts (metal hat sections) or other buildout means are optional; when used, secure buildouts to duct walls with bolts, screws, rivets, or welds.

## 2.5 SEALANT AND GASKETS

- A. General Sealant and Gasket Requirements: Surface-burning characteristics for sealants and gaskets shall be a maximum flame-spread index of 25 and a maximum smoke-developed index of 50 when tested according to UL 723; certified by an NRTL.
- B. Water-Based Joint and Seam Sealant:
  1. Application Method: Brush on BEFORE assembly of joints to insure sealant is applied inside the joint and not over it.
  2. Solids Content: Minimum 65 percent.
  3. Shore A Hardness: Minimum 20.
  4. Water resistant.
  5. Mold and mildew resistant.
  6. VOC: Maximum 75 g/L (less water).
  7. Maximum Static-Pressure Class: 10-inch wg, positive and negative.
  8. Service: Indoor or outdoor.
  9. Substrate: Compatible with galvanized sheet steel (both PVC coated and bare), stainless steel, or aluminum sheets.
  10. Color: Duct sealants shall be similar in color to the duct or system to which they will be applied.
- C. Flanged Joint Sealant: Comply with ASTM C 920.
  1. General: Single-component, acid-curing, silicone, elastomeric.

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2. Type: S.
  3. Grade: NS.
  4. Class: 25.
  5. Use: O.
  6. For indoor applications, sealant shall have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
  7. Sealant shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."
- D. Flange Gaskets: Butyl rubber, neoprene, or EPDM polymer with polyisobutylene plasticizer.
- E. Round Duct Joint O-Ring Seals:
1. Seal shall provide maximum leakage class of 3 cfm/100 sq. ft. at 1-inch wg and shall be rated for 10-inch wg static-pressure class, positive or negative.
  2. EPDM O-ring to seal in concave bead in coupling or fitting spigot.
  3. Double-lipped, EPDM O-ring seal, mechanically fastened to factory-fabricated couplings and fitting spigots.

## 2.6 HANGERS AND SUPPORTS

- A. Hanger Rods for Noncorrosive Environments: Cadmium-plated steel rods and nuts.
- B. Hanger Rods for Corrosive Environments: Electrogalvanized, all-thread rods or galvanized rods with threads painted with zinc-chromate primer after installation.
- C. Strap and Rod Sizes: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 5-1, "Rectangular Duct Hangers Minimum Size," and Table 5-2, "Minimum Hanger Sizes for Round Duct."
- D. Steel Cables for Galvanized-Steel Ducts: Galvanized steel complying with ASTM A 603.
- E. Steel Cables for Stainless-Steel Ducts: Stainless steel complying with ASTM A 492.
- F. Steel Cable End Connections: Cadmium-plated steel assemblies with brackets, swivel, and bolts designed for duct hanger service; with an automatic-locking and clamping device.
- G. Duct Attachments: Sheet metal screws, blind rivets, or self-tapping metal screws; compatible with duct materials.
- H. Trapeze and Riser Supports:

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1. Supports for Galvanized-Steel Ducts: Galvanized-steel shapes and plates.
2. Supports for Stainless-Steel Ducts: Stainless-steel shapes and plates.
3. Supports for Aluminum Ducts: Aluminum or galvanized steel coated with zinc chromate.

PART 3 - EXECUTION

3.1 DUCT INSTALLATION

- A. Drawing plans, schematics, and diagrams indicate general location and arrangement of duct system. Indicated duct locations, configurations, and arrangements were used to size ducts and calculate friction loss for air-handling equipment sizing and for other design considerations. Install duct systems as indicated unless deviations to layout are approved on Shop Drawings and Coordination Drawings.
- B. Install ducts according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" unless otherwise indicated.
- C. Install round ducts in maximum practical lengths.
- D. Install ducts with fewest possible joints.
- E. Install factory- or shop-fabricated fittings for changes in direction, size, and shape and for branch connections.
- F. Unless otherwise indicated, install ducts vertically and horizontally, and parallel and perpendicular to building lines.
- G. Install ducts close to walls, overhead construction, columns, and other structural and permanent enclosure elements of building.
- H. Install ducts with a clearance of 1 inch, plus allowance for insulation thickness.
- I. Route ducts to avoid passing through transformer vaults and electrical equipment rooms and enclosures.
- J. Where ducts pass through non-fire-rated interior partitions and exterior walls and are exposed to view, cover the opening between the partition and duct or duct insulation with sheet metal flanges of same metal thickness as the duct. Overlap openings on four sides by at least 1-1/2 inches.
- K. Where ducts pass through fire-rated interior partitions and exterior walls, install fire dampers. Comply with requirements in Division 23 Section "Air Duct Accessories" for fire and combination fire/smoke dampers.

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- L. Protect duct interiors from moisture, construction debris and dust, and other foreign materials. Comply with SMACNA's "IAQ Guidelines for Occupied Buildings Under Construction," Appendix G, "Duct Cleanliness for New Construction Guidelines."

3.2 INSTALLATION OF EXPOSED DUCTWORK

- A. Protect ducts exposed in finished spaces from being dented, scratched, or damaged.
- B. Trim duct sealants flush with metal. Create a smooth and uniform exposed bead. Do not use two-part tape sealing system.
- C. Grind welds to provide smooth surface free of burrs, sharp edges, and weld splatter. When welding stainless steel with a No. 3 or 4 finish, grind the welds flush, polish the exposed welds, and treat the welds to remove discoloration caused by welding.
- D. Maintain consistency, symmetry, and uniformity in the arrangement and fabrication of fittings, hangers and supports, duct accessories, and air outlets.
- E. Repair or replace damaged sections and finished work that does not comply with these requirements.

3.3 DUCT SEALING

- A. Seal ducts for duct static-pressure, seal classes, and leakage classes specified in "Duct Schedule" Article according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
- B. Seal all ducts to Seal Class A according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible".
- C. Sealants shall be installed inside the joints, not over the joints. Most ductwork will be visible or partially visible. Duct sealants shall be installed carefully and neatly to avoid a sloppy looking appearance.

3.4 HANGER AND SUPPORT INSTALLATION

- A. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 5, "Hangers and Supports."
- B. Building Attachments: Concrete inserts, powder-actuated fasteners, or structural-steel fasteners appropriate for construction materials to which hangers are being attached.
  - 1. Where practical, install concrete inserts before placing concrete.
  - 2. Install powder-actuated concrete fasteners after concrete is placed and completely cured.

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- 3. Use powder-actuated concrete fasteners for standard-weight aggregate concretes or for slabs more than 4 inches thick.
- 4. Do not use powder-actuated concrete fasteners for lightweight-aggregate concretes or for slabs less than 4 inches thick.
- C. Hanger Spacing: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 5-1, "Rectangular Duct Hangers Minimum Size," and Table 5-2, "Minimum Hanger Sizes for Round Duct," for maximum hanger spacing; install hangers and supports within 24 inches of each elbow and within 48 inches of each branch intersection.
- D. Hangers Exposed to View: Threaded rod and angle or channel supports.
- E. Support vertical ducts with steel angles or channel secured to the sides of the duct with welds, bolts, sheet metal screws, or blind rivets; support at each floor and at a maximum interval of 16 feet.
- F. Install upper attachments to structures. Select and size upper attachments with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

3.5 CONNECTIONS

- A. Make connections to equipment with flexible connectors complying with Division 23 Section "Air Duct Accessories."
- B. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for branch, outlet and inlet, and terminal unit connections.

3.6 PAINTING

- A. Paint interior of metal ducts that are visible through registers and grilles and that do not have duct liner. Apply one coat of flat, black, latex paint over a compatible galvanized-steel primer. Paint materials and application requirements shall be coordinated with Division 09 Painting Sections.
- B. Paint all welded joints on ductwork after grinding smooth the welded joint.

3.7 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
- B. Leakage Tests:

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1. Testing shall be performed in accordance with SMACNA's "HVAC Air Duct Leakage Test Manual." Leakage testing shall be witnessed by representatives from Cornell University, and the Project Engineer of Record.
  2. Test the following systems:
    - a. Systems designed to operate at 3-inches w.c. and below: 25% percent of the duct system shall be leak tested. The Consultant/Owner shall randomly choose the sections of ductwork to be tested during the Construction Phase. If any of the original sections fail the leakage test, another 25% of the duct shall be chosen to be tested. If any section of the second 25% fails, the entire system shall be leakage tested.
    - b. Systems designed to operate in excess of 3-inches w.c.: The entire system shall be leak tested.
    - c. Testing shall be performed in accordance with the SMACNA Air Duct Leakage Test Manual. Leakage testing shall be witnessed by representatives from Cornell University and the Project Engineer of Record.
  3. Test for leaks before applying external insulation.
  4. Conduct tests at static pressures equal to maximum design pressure of system or section being tested. If static-pressure classes are not indicated, test system at maximum system design pressure. Do not pressurize systems above maximum design operating pressure.
  5. Give ten business days' advance notice for testing.
- C. Acceptance criteria for leakage tests:
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.
- D. Duct System Cleanliness Tests:
1. Visually inspect duct system to ensure that no visible contaminants are present.
  2. Test sections of metal duct system, chosen randomly by Owner, for cleanliness according to "Vacuum Test" in NADCA ACR, "Assessment, Cleaning and Restoration of HVAC Systems."
    - a. Acceptable Cleanliness Level: Net weight of debris collected on the filter media shall not exceed 0.75 mg/100 sq. cm.
- E. Duct system will be considered defective if it does not pass tests and inspections.
- F. Prepare test and inspection reports.
- 3.8 DUCT CLEANING
- A. Clean new duct system(s) before testing, adjusting, and balancing.

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- B. Use service openings for entry and inspection.
1. Create new openings and install access panels appropriate for duct static-pressure class if required for cleaning access. Provide insulated panels for insulated or lined duct. Patch insulation and liner as recommended by duct liner manufacturer. Comply with Division 23 Section "Air Duct Accessories" for access panels and doors.
  2. Disconnect and reconnect flexible ducts as needed for cleaning and inspection.
  3. Remove and reinstall ceiling to gain access during the cleaning process.
- C. Particulate Collection and Odor Control:
1. When venting vacuuming system inside the building, use HEPA filtration with 99.97 percent collection efficiency for 0.3-micron-size (or larger) particles.
  2. When venting vacuuming system to outdoors, use filter to collect debris removed from HVAC system, and locate exhaust downwind and away from air intakes and other points of entry into building.
- D. Clean the following components by removing surface contaminants and deposits:
1. Air outlets and inlets (registers, grilles, and diffusers).
  2. Supply, return, and exhaust fans including fan housings, plenums (except ceiling supply and return plenums), scrolls, blades or vanes, shafts, baffles, dampers, and drive assemblies.
  3. Air-handling unit internal surfaces and components including mixing box, coil section, air wash systems, spray eliminators, condensate drain pans, humidifiers and dehumidifiers, filters and filter sections, and condensate collectors and drains.
  4. Coils and related components.
  5. Return-air ducts, dampers, actuators, and turning vanes except in ceiling plenums and mechanical equipment rooms.
  6. Supply-air ducts, dampers, actuators, and turning vanes.
  7. Dedicated exhaust and ventilation components and makeup air systems.
- E. Mechanical Cleaning Methodology:
1. Clean metal duct systems using mechanical cleaning methods that extract contaminants from within duct systems and remove contaminants from building.
  2. Use vacuum-collection devices that are operated continuously during cleaning. Connect vacuum device to downstream end of duct sections so areas being cleaned are under negative pressure.
  3. Use mechanical agitation to dislodge debris adhered to interior duct surfaces without damaging integrity of metal ducts, duct liner, or duct accessories.
  4. Clean fibrous-glass duct liner with HEPA vacuuming equipment; do not permit duct liner to get wet. Replace fibrous-glass duct liner that is damaged, deteriorated, or delaminated or that has friable material, mold, or fungus growth.

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5. Clean coils and coil drain pans according to NADCA 1992. Keep drain pan operational. Rinse coils with clean water to remove latent residues and cleaning materials; comb and straighten fins.
6. Provide drainage and cleanup for wash-down procedures.
7. Antimicrobial Agents and Coatings: Apply EPA-registered antimicrobial agents if fungus is present. Apply antimicrobial agents according to manufacturer's written instructions after removal of surface deposits and debris.

3.9 START UP

- A. Air Balance: Comply with requirements in Division 23 Section "Testing, Adjusting, and Balancing for HVAC."

3.10 DUCT SCHEDULE

- A. Supply Ducts:

1. Ducts Connected to Constant Air Volume Boxes and Variable Air Volume Boxes:

- a. Galvanized Steel
- b. Pressure Class: Positive 1-inch wg.
- c. Minimum SMACNA Seal Class: A.
- d. SMACNA Leakage Class for Rectangular: 6.
- e. SMACNA Leakage Class for Round and Flat Oval: 3.

2. Ducts Connected to Variable-Air-Volume Air-Handling Units:

- a. Galvanized Steel
- b. Pressure Class: Positive 4-inch wg.
- c. Minimum SMACNA Seal Class: A.
- d. SMACNA Leakage Class for Rectangular: 6.
- e. SMACNA Leakage Class for Round and Flat Oval: 3.

3. Supply Ducts Downstream of Terminal Units:

- a. Galvanized Steel
- b. Pressure Class: Positive 1-inch wg.
- c. Minimum SMACNA Seal Class: A.
- d. SMACNA Leakage Class for Rectangular: 6.
- e. SMACNA Leakage Class for Round: 3.

4. Supply Ducts Upstream of Terminal Units:

- a. Galvanized Steel
- b. Pressure Class: Positive 4-inch wg.
- c. Minimum SMACNA Seal Class: A.



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- d. SMACNA Leakage Class for Rectangular: 6.
- e. SMACNA Leakage Class for Round: 3.

B. Return / General Exhaust Ducts:

- 1. Ducts Connected to Constant Air Volume Boxes and Variable Air Volume Boxes:
  - a. Galvanized Steel
  - b. Pressure Class: Positive or negative 1-inch wg.
  - c. Minimum SMACNA Seal Class: A.
  - d. SMACNA Leakage Class for Rectangular: 6.
  - e. SMACNA Leakage Class for Round and Flat Oval: 3.
- 2. Ducts Connected to Air-Handling Units:
  - a. Galvanized Steel
  - b. Pressure Class: Positive or negative 2-inch wg.
  - c. Minimum SMACNA Seal Class: A.
  - d. SMACNA Leakage Class for Rectangular: 6.
  - e. SMACNA Leakage Class for Round and Flat Oval: 3.
- 3. Ducts Connected to Fans Exhausting Laboratory and Process (ASHRAE 62.1, Class 3 and 4) Air, including Laboratory Exhaust Air Valves:
  - a. Type 316 stainless steel sheet.
  - b. Pressure Class: Negative 4-inch wg (1000 Pa).
  - c. Minimum SMACNA Seal Class: A.
  - d. SMACNA Leakage Class for Rectangular: 3
  - e. SMACNA Leakage Class for Round and Flat Oval: 3

C. Laboratory Hood Exhaust Ducts:

- 1. Ducts Connected to Laboratory Fume Hoods:
  - a. Type 316 stainless steel sheet.
    - 1) Exposed to View: No. 4 finish.
    - 2) Concealed: No. 2B finish.
  - b. Pressure Class: Negative 4-inch wg.
  - c. Minimum SMACNA Seal Class: A, Welded seams, joints, and penetrations.
  - d. SMACNA Leakage Class: 3.

D. Intermediate Reinforcement:

- 1. Galvanized-Steel Ducts: Galvanized steel or carbon steel coated with zinc-chromate primer.
- 2. Stainless-Steel Ducts:

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- a. Exposed to Airstream: Match duct material.
  - b. Not Exposed to Airstream: Match duct material.
- E. Liner:
  - 1. Transfer Ducts: Fibrous glass, Type I, 1 inch thick.
- F. Elbow Configuration:
  - 1. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-2, "Rectangular Elbows."
    - a. Velocity 1000 fpm or Lower:
      - 1) Radius Type RE 1 with minimum 0.5 radius-to-diameter ratio.
      - 2) Mitered Type RE 4 without vanes.
    - b. Velocity 1000 to 1500 fpm:
      - 1) Radius Type RE 1 with minimum 1.0 radius-to-diameter ratio.
      - 2) Radius Type RE 3 with minimum 0.5 radius-to-diameter ratio and two vanes.
      - 3) Mitered Type RE 2 with vanes complying with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-3, "Vanes and Vane Runners," and Figure 4-4, "Vane Support in Elbows."
    - c. Velocity 1500 fpm or Higher:
      - 1) Radius Type RE 1 with minimum 1.5 radius-to-diameter ratio.
      - 2) Radius Type RE 3 with minimum 1.0 radius-to-diameter ratio and two vanes.
      - 3) Mitered Type RE 2 with vanes complying with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-3, "Vanes and Vane Runners," and Figure 4-4, "Vane Support in Elbows."
  - 2. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-2, "Rectangular Elbows."
    - a. Radius Type RE 1 with minimum 1.5 radius-to-diameter ratio.
    - b. Radius Type RE 3 with minimum 1.0 radius-to-diameter ratio and two vanes.
    - c. Mitered Type RE 2 with vanes complying with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-3, "Vanes and Vane Runners," and Figure 4-4, "Vane Support in Elbows."
  - 3. Round Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-4, "Round Duct Elbows."

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- a. Minimum Radius-to-Diameter Ratio and Elbow Segments: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 3-1, "Mitered Elbows." Elbows with less than 90-degree change of direction have proportionately fewer segments.
    - 1) Velocity 1000 fpm or Lower: 0.5 radius-to-diameter ratio and three segments for 90-degree elbow.
    - 2) Velocity 1000 to 1500 fpm: 1.0 radius-to-diameter ratio and four segments for 90-degree elbow.
    - 3) Velocity 1500 fpm or Higher: 1.5 radius-to-diameter ratio and five segments for 90-degree elbow.
    - 4) Radius-to Diameter Ratio: 1.5.
  - b. Round Elbows, 12 Inches and Smaller in Diameter: Stamped or pleated.
  - c. Round Elbows, 14 Inches and Larger in Diameter: Welded.
- G. Branch Configuration:
- 1. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-6, "Branch Connection."
    - a. Rectangular Main to Rectangular Branch: 45-degree entry.
    - b. Rectangular Main to Round Branch: Spin in.
  - 2. Round and Flat Oval: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-5, "90 Degree Tees and Laterals," and Figure 3-6, "Conical Tees." Saddle taps are permitted in existing duct.
    - a. Velocity 1000 fpm or Lower: 90-degree tap.
    - b. Velocity 1000 to 1500 fpm: Conical tap.
    - c. Velocity 1500 fpm or Higher: 45-degree lateral.

END OF SECTION 23 31 13

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AIR DUCT ACCESSORIES

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SECTION 23 33 00 – AIR DUCT ACCESSORIES

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

- A. Section Includes:
  - 1. Manual volume dampers.
  - 2. Combination fire and smoke dampers.
  - 3. Flange connectors.
  - 4. Turning vanes.
  - 5. Duct-mounted access doors.
  - 6. Flexible connectors.
  - 7. Duct accessory hardware.

1.03 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: For duct accessories. Include plans, elevations, sections, details and attachments to other work.
  - 1. Detail duct accessories fabrication and installation in ducts and other construction. Include dimensions, weights, loads, and required clearances; and method of field assembly into duct systems and other construction. Include the following:
    - a. Special fittings.
    - b. Manual volume damper installations.
    - c. Control-damper installations.
    - d. Wiring Diagrams: For power, signal, and control wiring.

1.04 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Reflected ceiling plans, drawn to scale, on which ceiling-mounted access panels and access doors required for access to duct accessories are shown and coordinated with each other, using input from Installers of the items involved.
- B. Source quality-control reports.

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1.05 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For air duct accessories to include in operation and maintenance manuals.

PART 1 PRODUCTS

2.01 ASSEMBLY DESCRIPTION

- A. Comply with NFPA 90A, "Installation of Air Conditioning and Ventilating Systems," and with NFPA 90B, "Installation of Warm Air Heating and Air Conditioning Systems."
- B. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods unless otherwise indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.

2.02 MATERIALS

- A. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods unless otherwise indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.
- B. Galvanized Sheet Steel: Comply with ASTM A 653/A 653M.
  - 1. Galvanized Coating Designation: G90 (Z275).
  - 2. Exposed-Surface Finish: Mill phosphatized.
- C. Stainless-Steel Sheets: Comply with ASTM A 480/A 480M, Type 304, and having a No. 2 finish for concealed ducts and No. 4 finish for exposed ducts.
- D. Aluminum Sheets: Comply with ASTM B 209, Alloy 3003, Temper H14; with mill finish for concealed ducts and standard, 1-side bright finish for exposed ducts.
- E. Extruded Aluminum: Comply with ASTM B 221, Alloy 6063, Temper T6.
- F. Reinforcement Shapes and Plates: Galvanized-steel reinforcement where installed on galvanized sheet metal ducts; compatible materials for aluminum and stainless-steel ducts.
- G. Tie Rods: Galvanized steel, 1/4-inch minimum diameter for lengths 36 inches or less; 3/8-inch minimum diameter for lengths longer than 36 inches.

2.03 MANUAL VOLUME DAMPERS

- A. Standard, Steel, Manual Volume Dampers:
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

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- a. Air Balance Inc.; a division of Mestek, Inc.
    - b. American Warming and Ventilating; a division of Mestek, Inc.
    - c. Flexmaster U.S.A., Inc.
    - d. McGill AirFlow LLC.
    - e. METALAIRE, Inc.
    - f. Nailor Industries Inc.
    - g. Pottorff; a division of PCI Industries, Inc.
    - h. Ruskin Company.
    - i. Trox USA Inc.
    - j. Vent Products Company, Inc.
  2. Standard leakage rating, with linkage outside airstream.
  3. Suitable for horizontal or vertical applications.
  4. Frames:
    - a. Hat-shaped, galvanized-steel channels, 0.064-inch (1.62-mm) minimum thickness.
    - b. Mitered and welded corners.
    - c. Flanges for attaching to walls and flangeless frames for installing in ducts.
  5. Blades:
    - a. Multiple or single blade.
    - b. Opposed-blade design.
    - c. Stiffen damper blades for stability.
    - d. Galvanized-steel, 0.064 inch (1.62 mm) thick.
  6. Blade Axles: Galvanized steel.
  7. Bearings:
    - a. Stainless-steel sleeve.
    - b. Dampers in ducts with pressure classes of 3-inch wg (750 Pa) or less shall have axles full length of damper blades and bearings at both ends of operating shaft.
  8. Tie Bars and Brackets: Galvanized steel.
- B. Low-Leakage, Steel, Manual Volume Dampers:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Air Balance Inc.; a division of Mestek, Inc.
    - b. American Warming and Ventilating; a division of Mestek, Inc.
    - c. Flexmaster U.S.A., Inc.
    - d. McGill AirFlow LLC.
    - e. METALAIRE, Inc.
    - f. Nailor Industries Inc.
    - g. Pottorff; a division of PCI Industries, Inc.
    - h. Ruskin Company.
    - i. Trox USA Inc.
    - j. Vent Products Company, Inc.
  2. Low-leakage rating, with linkage outside airstream, and bearing AMCA's Certified Ratings Seal for both air performance and air leakage.

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3. Suitable for horizontal or vertical applications.
4. Frames:
  - a. Hat shaped.
  - b. Galvanized-steel channels, 0.064 inch (1.62 mm) thick.
  - c. Mitered and welded corners.
  - d. Flanges for attaching to walls and flangeless frames for installing in ducts.
5. Blades:
  - a. Multiple or single blade.
  - b. Opposed-blade design.
  - c. Stiffen damper blades for stability.
  - d. Galvanized, roll-formed steel, 0.064 inch (1.62 mm) thick.
6. Blade Axles: Galvanized steel.
7. Bearings:
  - a. Stainless-steel sleeve.
  - b. Dampers in ducts with pressure classes of 3-inch wg (750 Pa) or less shall have axles full length of damper blades and bearings at both ends of operating shaft.
8. Blade Seals: Neoprene.
9. Jamb Seals: Cambered aluminum.
10. Tie Bars and Brackets: Galvanized steel.
11. Accessories:
  - a. Include locking device to hold single-blade dampers in a fixed position without vibration.

C. Jackshaft:

1. Size: 0.5-inch diameter.
2. Material: Galvanized-steel pipe rotating within pipe-bearing assembly mounted on supports at each mullion and at each end of multiple-damper assemblies.
3. Length and Number of Mountings: As required to connect linkage of each damper in multiple-damper assembly.

D. Damper Hardware:

1. Zinc-plated, die-cast core with dial and handle made of 3/32-inch thick zinc-plated steel, and a 3/4-inch hexagon locking nut.
2. Include center hole to suit damper operating-rod size.
3. Include elevated platform for insulated duct mounting.

2.04 COMBINATION FIRE AND SMOKE DAMPERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  1. Greenheck Fan Corporation.
  2. Ruskin Company.
- B. The assemblies shall be UL and FM specification tested. The assembly shall be provided with an integral UL-approved sleeve. Jackshaft penetrations shall be provided



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with a factory shaft seal; providing sealing in field of this penetration is unacceptable. Sleeve seams shall be continuously welded or sealed, and the transverse joint should be a sealed UL-approved flanged duct sleeve connection. Damper actuator shall use 120 VAC power. The mechanical consultant shall include accessories that allow for remote damper test/reset and damper position indication. The remote test/reset/position accessory shall be located next to the smoke detector remote test/reset/status accessory.

- C. The duct smoke detectors associated with these devices shall be specified by the electrical engineer to be provided by the fire alarm contractor so they coordinate with the building fire alarm system. A standard photoelectric, addressable, sampling type detector shall be used; the use of no-flow detectors is NOT acceptable. Options for remote LED annunciator and remote test/reset shall also be specified. See Cornell Design and Construction Standard Section 283100 - Fire Alarm System & Detection Systems.
- D. The smoke damper shall be designed to close whenever the associated air distribution system fan is shutdown. This shall be initiated via the fire alarm system via appropriate addressable relay modules, addressable monitor modules, and relay contacts that interface directly with the 120 VAC fire/smoke damper actuator. The electrical consultant shall provide for this in the design and the fire alarm contractor shall be responsible for the installation. See Cornell Design and Construction Standard Section 283100 - Fire Alarm System & Detection Systems for additional information.

2.05 FLANGE CONNECTORS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Ductmate Industries, Inc.
  - 2. Nexus PDQ; Division of Shilco Holdings Inc.
  - 3. Ward Industries, Inc.; a division of Hart & Cooley, Inc.
- B. Description: Roll-formed, factory-fabricated, slide-on transverse flange connectors, gaskets, and components.
- C. Material: Galvanized steel.
- D. Gage and Shape: Match connecting ductwork.

2.06 TURNING VANES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Ductmate Industries, Inc.
  - 2. Duro Dyne Inc.
  - 3. METALAIRE, Inc.
  - 4. SEMCO Incorporated.
  - 5. Ward Industries, Inc.; a division of Hart & Cooley, Inc.

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- B. Manufactured Turning Vanes for Metal Ducts: Curved blades of galvanized sheet steel; support with bars perpendicular to blades set or set into vane runners suitable for duct mounting.
  - 1. Acoustic Turning Vanes: Fabricate airfoil-shaped aluminum extrusions with perforated faces and fibrous-glass fill.
- C. General Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible"; Figures 2-3, "Vanes and Vane Runners," and 2-4, "Vane Support in Elbows."
- D. Vane Construction: Single wall for vanes to 24 inches long and double wall for larger dimensions.

2.07 DUCT-MOUNTED ACCESS DOORS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. American Warming and Ventilating; a division of Mestek, Inc.
  - 2. Cesco Products; a division of Mestek, Inc.
  - 3. Ductmate Industries, Inc.
  - 4. Flexmaster U.S.A., Inc.
  - 5. Greenheck Fan Corporation.
  - 6. McGill AirFlow LLC.
  - 7. Nailor Industries Inc.
  - 8. Pottorff; a division of PCI Industries, Inc.
  - 9. Ventfabrics, Inc.
  - 10. Ward Industries, Inc.; a division of Hart & Cooley, Inc.
- B. Duct-Mounted Access Doors: Fabricate access panels according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible"; Figures 2-10, "Duct Access Doors and Panels," and 2-11, "Access Panels - Round Duct."
  - 1. Door:
    - a. Double wall, rectangular.
    - b. Galvanized sheet metal with insulation fill and thickness as indicated for duct pressure class.
    - c. Vision panel.
    - d. Hinges and Latches: 1-by-1-inch (25-by-25-mm) butt or piano hinge and cam latches.
    - e. Fabricate doors airtight and suitable for duct pressure class.
  - 2. Frame: Galvanized sheet steel, with bend-over tabs and foam gaskets.
  - 3. Number of Hinges and Locks:
    - a. Access Doors Less Than 12 Inches (300 mm) Square: No hinges and two sash locks.
    - b. Access Doors up to 18 Inches (460 mm) Square: Two hinges and two sash locks.
    - c. Access Doors up to 24 by 48 Inches (600 by 1200 mm): Three hinges and two compression latches with outside and inside handles.

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- d. Access Doors Larger Than 24 by 48 Inches (600 by 1200 mm): Four hinges and two compression latches with outside and inside handles.

2.08 FLEXIBLE CONNECTORS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Ductmate Industries, Inc.
  - 2. Duro Dyne Inc.
  - 3. Ventfabrics, Inc.
  - 4. Ward Industries, Inc.; a division of Hart & Cooley, Inc.
- B. Materials: Flame-retardant or noncombustible fabrics.
- C. Coatings and Adhesives: Comply with UL 181, Class 1.
- D. Metal-Edged Connectors: Factory fabricated with a fabric strip 3-1/2 inches wide attached to 2 strips of 2-3/4-inch wide, 0.028-inch thick, galvanized sheet steel or 0.032-inch thick aluminum sheets. Provide metal compatible with connected ducts.
- E. Indoor System, Flexible Connector Fabric: Glass fabric double coated with neoprene.
  - 1. Minimum Weight: 26 oz./sq. yd.
  - 2. Tensile Strength: 480 lbf/inch the warp and 360 lbf/inch in the filling.
  - 3. Service Temperature: Minus 40 to plus 200 deg F.
- F. Outdoor System, Flexible Connector Fabric: Glass fabric double coated with weatherproof, synthetic rubber resistant to UV rays and ozone.
  - 1. Minimum Weight: 24 oz./sq. yd.
  - 2. Minimum Tensile Strength: 500 lbf/inch the warp and 440 lbf/inch in the filling.
  - 3. Service Temperature: Minus 50 to plus 250 deg F.

2.09 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. Adhesives: High strength, quick setting, neoprene based, waterproof, and resistant to gasoline and grease.

PART 1 EXECUTION

3.01 INSTALLATION

- A. Install duct accessories according to applicable details in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for metal ducts and in NAIMA AH116, "Fibrous Glass Duct Construction Standards," for fibrous-glass ducts.

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- B. Install duct accessories of materials suited to duct materials; use galvanized-steel accessories in galvanized-steel and fibrous-glass ducts, stainless-steel accessories in stainless-steel ducts, and aluminum accessories in aluminum ducts.
- C. Install volume dampers at points on supply, return, and exhaust systems where branches extend from larger ducts. Where dampers are installed in ducts having duct liner, install dampers with hat channels of same depth as liner, and terminate liner with nosing at hat channel.
  - 1. Install steel volume dampers in steel ducts.
- D. Set dampers to fully open position before testing, adjusting, and balancing.
- E. Install test holes at fan inlets and outlets and elsewhere as indicated.
- F. Install fire dampers according to UL listing.
- G. Install duct access doors on sides of ducts to allow for inspecting, adjusting, and maintaining accessories and equipment at the following locations:
  - 1. At outdoor-air intakes and mixed-air plenums (head and hand access size).
  - 2. Downstream from control dampers and equipment (head and shoulders access size).
  - 3. Adjacent to and close enough to fire/smoke dampers to reset or reinstall fusible links. Access doors for access to fire dampers having fusible links shall be pressure relief access doors and shall be outward operation for access doors installed upstream from dampers and inward operation for access doors installed downstream from dampers (body access size).
  - 4. Upstream from turning vanes (head and hand access size).
  - 5. Control devices requiring inspection (head and hand access size).
  - 6. Elsewhere as indicated.
- H. Install access doors with swing against duct static pressure.
- I. Access Door Sizes:
  - 1. One-Hand or Inspection Access: 8 by 5 inches.
  - 2. Two-Hand Access: 12 by 6 inches.
  - 3. Head and Hand Access: 18 by 10 inches.
  - 4. Head and Shoulders Access: 21 by 14 inches.
  - 5. Body Access: 25 by 14 inches.
  - 6. Body plus Ladder Access: 25 by 17 inches.
- J. Label access doors according to Section 230553 "Identification for HVAC Piping and Equipment" to indicate the purpose of access door.
- K. Install flexible connectors to connect ducts to equipment.
- L. Provide turning vanes at all rectangular square throat elbows and SMACNA Type 2 divided flow branches.

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AIR DUCT ACCESSORIES

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- M. For fans developing static pressures of 5-inch wg (1250 Pa) and more, cover flexible connectors with loaded vinyl sheet held in place with metal straps.
- N. Connect diffusers or linear diffuser boots to ducts directly or with maximum 60-inch (1500-mm) lengths of flexible duct clamped or strapped in place.
- O. Connect flexible ducts to metal ducts with draw bands.
- P. Install duct test holes where required for testing and balancing purposes.

3.02 FIELD QUALITY CONTROL

- A. Tests and Inspections:
  - 1. Operate dampers to verify full range of movement.
  - 2. Inspect locations of access doors and verify that the purpose of access door can be performed.
  - 3. Operate fire/smoke dampers to verify full range of movement and verify that proper heat-response device is installed.
  - 4. Inspect turning vanes for proper and secure installation.
  - 5. Operate remote damper operators to verify full range of movement of operator and damper.

END OF SECTION 23 33 00

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DIFFUSERS, REGISTERS, AND GRILLES

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SECTION 23 37 13 – DIFFUSERS, REGISTERS, AND GRILLES

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

- A. Section Includes:
  - 1. Adjustable bar registers and grilles.
  - 2. Fixed face registers and grilles.
- B. Related Sections:
  - 1. Division 23 section "Air Duct Accessories" for fire and smoke dampers and volume-control dampers not integral to diffusers, registers, and grilles.

1.03 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated, include the following:
  - 1. Data Sheet: Indicate materials of construction, finish, and mounting details; and performance data including throw and drop, static-pressure drop, and noise ratings.
  - 2. Diffuser, Register, and Grille Schedule: Indicate drawing designation, room location, quantity, model number, size, and accessories furnished.
- B. Samples for Initial Selection: For diffusers, registers, and grilles with factory-applied color finishes.
- C. Samples for Verification: For diffusers, registers, and grilles, in manufacturer's standard sizes to verify color selected.

1.04 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Reflected ceiling plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from Installers of the items involved:
  - 1. Ceiling suspension assembly members.
  - 2. Method of attaching hangers to building structure.
  - 3. Size and location of initial access modules for acoustical tile.
  - 4. Ceiling-mounted items including lighting fixtures, diffusers, grilles, speakers, sprinklers, access panels, and special moldings.
  - 5. Duct access panels.

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DIFFUSERS, REGISTERS, AND GRILLES

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- B. Source quality-control reports.

PART 1 PRODUCTS

2.01 REGISTERS AND GRILLES

- A. Adjustable Bar Register:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Nailor Industries Inc.
    - b. Krueger
    - c. Price Industries.
    - d. Titus.
  2. Material: Steel or aluminum as scheduled.
  3. Finish: Baked enamel, color selected by Architect.
  4. See equipment schedules on drawings for performance criteria.
- B. Adjustable Bar Grille:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Nailor Industries Inc.
    - b. Krueger
    - c. Price Industries.
    - d. Titus.
  2. Material: Steel or aluminum as scheduled.
  3. Finish: Baked enamel, color selected by Architect.
  4. See equipment schedules on drawings for performance criteria.
- C. Fixed Face Register:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Nailor Industries Inc.
    - b. Price Industries.
    - c. Titus.
  2. Material: Steel or aluminum as scheduled.
  3. Finish: Baked enamel, color selected by Architect.
  4. Provide integral volume damper.
  5. See equipment schedules on drawings for performance criteria.
- D. Fixed Face Grille:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Nailor Industries Inc.
    - b. Price Industries.
    - c. Titus.
  2. Material: Steel or aluminum as scheduled.



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DIFFUSERS, REGISTERS, AND GRILLES

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- 3. Finish: Baked enamel, color selected by Architect.
- 4. See equipment schedules on drawings for performance criteria.

2.02 SOURCE QUALITY CONTROL

- A. Verification of Performance: Rate diffusers, registers, and grilles according to ASHRAE 70, "Method of Testing for Rating the Performance of Air Outlets and Inlets."

PART 1 EXECUTION

3.01 EXAMINATION

- A. Examine areas where diffusers, registers, and grilles are to be installed for compliance with requirements for installation tolerances and other conditions affecting performance of equipment.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

- A. Install diffusers, registers, and grilles level and plumb.
- B. 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. Make final locations where indicated, as much as practical. 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.
- C. Install diffusers, registers, and grilles with airtight connections to ducts and to allow service and maintenance of dampers, air extractors, and fire dampers.
- D. Install at correct angle to provide air flow direction intended.

3.03 ADJUSTING

- A. After installation, adjust diffusers, registers, and grilles to air patterns indicated, or as directed, before starting air balancing.
- B. Adjust face blades as needed to provide air flow direction where needed and as directed by the commissioning authority or the owner's representative.

END OF SECTION 23 37 13

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FAN COIL UNITS

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SECTION 23 82 19 – FAN COIL UNITS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Ductless fan coil units.
2. Ducted fan coil units.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include rated capacities, operating characteristics, and furnished specialties and accessories.

B. Shop Drawings:

1. Include details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
2. Include diagrams for power, signal, and control wiring.

C. Samples for Initial Selection: For units with factory-applied color finishes.

D. Samples for Verification: For each type of fan coil unit indicated.

1.3 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Floor plans, reflected ceiling plans, and other details, drawn to scale, on which the following items are shown and coordinated with each other, based on input from installers of the items involved:

1. Suspended ceiling components.
2. Structural members to which fan coil units will be attached.

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FAN COIL UNITS

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3. Method of attaching hangers to building structure.
  4. Size and location of initial access modules for acoustical tile.
  5. Items penetrating finished ceiling, including the following:
    - a. Lighting fixtures.
    - b. Air outlets and inlets.
    - c. Speakers.
    - d. Sprinklers.
    - e. Access panels.
  6. \Perimeter moldings.
- B. Seismic Qualification Certificates: For fan coil units, accessories, and components, from manufacturer.
1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
  2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
  3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.
- C. Field quality-control reports.
- D. Sample Warranty: For special warranty.

1.4 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For fan coil units to include in emergency, operation, and maintenance manuals.
1. In addition to items specified in Section 017823 "Operation and Maintenance Data," include the following:
    - a. Maintenance schedules and repair part lists for motors, coils, integral controls, and filters.

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FAN COIL UNITS

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1.5 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
  - 1. Fan Coil Unit Filters: Furnish one (1) set spare filters for each filter installed.

1.6 QUALITY ASSURANCE

- A. Comply with NFPA 70.
- B. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 5 - "Systems and Equipment" and Section 7 - "Construction and Startup."
- C. ASHRAE/IES 90.1 Compliance: Applicable requirements in ASHRAE/IES 90.1, Section 6 - "Heating, Ventilating, and Air-Conditioning."

1.7 COORDINATION

- A. Coordinate layout and installation of fan coil units and suspension system components with other construction that penetrates or is supported by ceilings, including light fixtures, HVAC equipment, fire-suppression-system components, and partition assemblies.
- B. Coordinate size and location of wall sleeves for outdoor-air intake.

PART 2 - PRODUCTS

2.1 SYSTEM DESCRIPTION

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. Factory-packaged and -tested units rated according to AHRI 440, ASHRAE 33, and UL 1995.

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FAN COIL UNITS

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2.2 DUCTLESS FAN COIL UNITS

- A. Acceptable Manufacturers:
  - 1. Trane
  - 2. Carrier
  - 3. York/JCI
- B. Coil Section Insulation:
  - 1. 1/2-inch thick, coated glass fiber complying with ASTM C1071 and attached with adhesive complying with ASTM C916.
  - 2. Surface-Burning Characteristics: Insulation and adhesive shall have a combined maximum flame-spread index of 25 and smoke-developed index of 50 when tested according to ASTM E84 by a qualified testing agency.
  - 3. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.
- C. Drain Pans: Main and Auxiliary Insulated galvanized steel with plastic liner. Fabricate pans and drain connections to comply with ASHRAE 62.1. Drain pans shall be removable.
- D. Chassis: Galvanized steel where exposed to moisture, with baked-enamel finish and removable access panel. Floor-mounting units shall have leveling screws.
- E. Cabinet: Steel with baked-enamel finish in manufacturer's standard paint color as selected by Architect.
  - 1. Vertical Unit Front Panels: Removable, steel, with integral stamped steel discharge grille and channel-formed edges, cam fasteners, and insulation on back of panel.
  - 2. Horizontal Unit Bottom Panels: Fastened to unit with cam fasteners and hinge and attached with safety chain; with integral stamped cast-aluminum discharge grilles.
  - 3. Steel recessing flanges for recessing fan coil units into ceiling or wall.
- F. Filters: Minimum arrestance and a minimum efficiency reporting value (MERV) according to ASHRAE 52.2 and all addendums.
  - 1. MERV Rating: 6 when tested according to ASHRAE 52.2.
  - 2. Pleated Cotton-Polyester Media: 90 percent arrestance and MERV 7.

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FAN COIL UNITS

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- G. Hydronic Coils: Copper tube, with mechanically bonded aluminum fins spaced no closer than 0.1 inch, rated for a minimum working pressure of 200 psig and a maximum entering-water temperature of 220 deg F. Include manual air vent and drain valve.
- H. Fan and Motor Board: Removable.
  - 1. Fan: Forward curved, double width, centrifugal; directly connected to motor. Thermoplastic or painted-steel wheels, and aluminum, painted-steel, or galvanized-steel fan scrolls.
  - 2. Motor:
    - a. Permanently lubricated, multispeed, electronically commutated;
    - b. resiliently mounted on motor board;
    - c. Comply with requirements in Section 230500 "Common Work Results for HVAC."
  - 3. Wiring Termination: Connect motor to chassis wiring with plug connection.
- I. Control devices and operational sequences are specified in Section 230900 "Instrumentation and Control for HVAC" and on the Drawings.
- J. Electrical Connection: Factory wire motors and controls for a single electrical connection.

2.3 DUCTED FAN COIL UNITS

- A. Acceptable Manufacturers:
  - 1. Trane
  - 2. Carrier
  - 3. York/JCI
- B. Coil Section Insulation:
  - 1. 1/2-inch thick, coated glass fiber complying with ASTM C1071 and attached with adhesive complying with ASTM C916.
  - 2. Surface-Burning Characteristics: Insulation and adhesive shall have a combined maximum flame-spread index of 25 and smoke-developed index of 50 when tested according to ASTM E84 by a qualified testing agency.
  - 3. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.

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FAN COIL UNITS

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- A. Drain Pans: Main and Auxiliary Insulated galvanized steel with plastic liner. Fabricate pans and drain connections to comply with ASHRAE 62.1. Drain pans shall be removable.
- B. Chassis: Galvanized steel where exposed to moisture, with baked-enamel finish and removable access panel. Floor-mounting units shall have leveling screws.
- C. Cabinet: Steel with baked-enamel finish in manufacturer's standard paint color as selected by Architect.
  - 1. Vertical Unit Front Panels: Removable, steel, with integral stamped steel discharge grille and channel-formed edges, cam fasteners, and insulation on back of panel.
  - 2. Horizontal Unit Bottom Panels: Fastened to unit with cam fasteners and hinge and attached with safety chain; with integral stamped cast-aluminum discharge grilles.
  - 3. Steel recessing flanges for recessing fan coil units into ceiling or wall.
- D. Filters: Minimum arrestance and a minimum efficiency reporting value (MERV) according to ASHRAE 52.2 and all addendums.
  - 1. MERV Rating: 6 when tested according to ASHRAE 52.2.
  - 2. Pleated Cotton-Polyester Media: 90 percent arrestance and MERV 7.
- E. Hydronic Coils: Copper tube, with mechanically bonded aluminum fins spaced no closer than 0.1 inch, rated for a minimum working pressure of 200 psig and a maximum entering-water temperature of 220 deg F. Include manual air vent and drain valve.
- F. Fan and Motor Board: Removable.
  - 1. Fan: Forward curved, double width, centrifugal; directly connected to motor. Thermoplastic or painted-steel wheels, and aluminum, painted-steel, or galvanized-steel fan scrolls.
  - 2. Motor:
    - a. Permanently lubricated, multispeed, electronically commutated;
    - b. resiliently mounted on motor board;
    - c. Comply with requirements in Section 230500 "Common Work Results for HVAC."
  - 3. Wiring Termination: Connect motor to chassis wiring with plug connection.



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FAN COIL UNITS

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- G. Control devices and operational sequences are specified in Section 230900 "Instrumentation and Control for HVAC" and on the Drawings.
- H. Electrical Connection: Factory wire motors and controls for a single electrical connection.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas, with Installer present, to receive fan coil units for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Examine roughing-in for piping and electrical connections to verify actual locations before fan coil unit installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION OF FAN COIL UNITS

- A. Install fan coil units level and plumb.
- B. Install fan coil units to comply with NFPA 90A.
- C. Suspend fan coil units from structure with elastomeric hangers. Vibration isolators are specified in Section 230548 "Vibration and Seismic Controls for HVAC Piping and Equipment."
- D. Install new filters in each fan coil unit within two weeks after Substantial Completion.

3.3 CONNECTIONS

- A. Piping installation requirements are specified in other Sections. Drawings indicate general arrangement of piping, fittings, and specialties. Specific connection requirements are as follows:

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FAN COIL UNITS

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1. Install piping adjacent to machine to allow service and maintenance.
2. Connect piping to fan coil unit factory hydronic piping package. Install piping package if shipped loose.
3. Connect condensate drain to indirect waste.
  - a. Install condensate trap of adequate depth to seal against fan pressure. Install cleanouts in piping at changes of direction.
- B. Connect supply-air and return-air ducts to fan coil units with flexible duct connectors specified in Section 233300 "Air Duct Accessories." Comply with safety requirements in UL 1995 for duct connections.
- C. Ground equipment according to Section 260526 "Grounding and Bonding for Electrical Systems."
- D. Connect wiring according to Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

3.4 FIELD QUALITY CONTROL

- A. Perform the following tests and inspections with the assistance of a factory-authorized service representative:
  1. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
  2. Operate electric heating elements through each stage to verify proper operation and electrical connections.
  3. Test and adjust controls and safety devices. Replace damaged and malfunctioning controls and equipment.
- B. Remove and replace malfunctioning units and retest as specified above.
- C. Prepare test and inspection reports.

3.5 DEMONSTRATION

- A. Train Owner's maintenance personnel to adjust, operate, and maintain fan coil units.

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FAN COIL UNITS

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END OF SECTION 23 82 19

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SUPPLEMENTAL REQUIREMENTS FOR ELECTRICAL

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SECTION 26 00 10 - SUPPLEMENTAL REQUIREMENTS FOR ELECTRICAL

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Supplemental requirements generally applicable to the Work specified in Division 26. This Section is also referenced by related Work specified in other Divisions.

1.2 REFERENCES

A. Abbreviations and Acronyms for Electrical Terms and Units of Measure:

1. 8P8C: An 8-position 8-contact modular jack.
2. A: Ampere, unit of electrical current.
3. AC or ac: Alternating current.
4. AFCI: Arc-fault circuit interrupter.
5. AIC: Ampere interrupting capacity.
6. AL, Al, or ALUM: Aluminum.
7. ASD: Adjustable-speed drive.
8. ATS: Automatic transfer switch.
9. AWG: American wire gauge; see ASTM B258.
10. BAS: Building automation system.
11. BIL: Basic impulse insulation level.
12. BIM: Building information modeling.
13. CAD: Computer-aided design or drafting.
14. CATV: Community antenna television.
15. CB: Circuit breaker.
16. cd: Candela, the SI fundamental unit of luminous intensity.
17. CO/ALR: Copper-aluminum, revised.
18. COPS: Critical operations power system.
19. CU or Cu: Copper.
20. CU-AL or AL-CU: Copper-aluminum.
21. dB: Decibel, a unitless logarithmic ratio of two electrical, acoustical, or optical power values.

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- 22. dB(A-weighted) or dB(A): Decibel acoustical sound pressure level with A-weighting applied in accordance with IEC 61672-1.
- 23. dB(adjusted) or dBa: Decibel weighted absolute noise power with respect to 3.16 pW (minus 85 dBm).
- 24. dBm: Decibel absolute power with respect to 1 mW.
- 25. DC or dc: Direct current.
- 26. DCOA: Designated critical operations area.
- 27. DDC: Direct digital control (HVAC).
- 28. EGC: Equipment grounding conductor.
- 29. ELV: Extra-low voltage.
- 30. EMF: Electromotive force.
- 31. EMI: Electromagnetic interference.
- 32. EPM: Electrical preventive maintenance.
- 33. EPS: Emergency power supply.
- 34. EPSS: Emergency power supply system.
- 35. ESS: Energy storage system.
- 36. EV: Electric vehicle.
- 37. EVPE: Electric vehicle power export equipment.
- 38. EVSE: Electric vehicle supply equipment.
- 39. fc: Footcandle, an internationally recognized unit of illuminance equal to one lumen per square foot or 10.76 lx. The simplified conversion 1 fc = 10 lx in the Specifications is common practice and considered adequate precision for building construction activities. When there are conflicts, lux is the primary unit; footcandle is specified for convenience.
- 40. FLC: Full-load current.
- 41. ft: Foot.
- 42. ft-cd: Foot-candle, the antiquated U.S. Standard unit of illuminance, equal to one international candle measured at a distance of one foot, that was superseded in 1948 by the unit "footcandle" after the SI unit candela (cd) replaced the international candle; see "fc,"
- 43. GEC: Grounding electrode conductor.
- 44. GFCI: Ground-fault circuit interrupter.
- 45. GFPE: Ground-fault protection of equipment.
- 46. GND: Ground.
- 47. HACR: Heating, air conditioning, and refrigeration.
- 48. HDPE: High-density polyethylene.
- 49. HID: High-intensity discharge.
- 50. HP or hp: Horsepower.
- 51. HVAC: Heating, ventilating, and air conditioning.
- 52. Hz: Hertz.
- 53. IBT: Intersystem bonding termination.
- 54. inch: Inch. To avoid confusion, the abbreviation "in." is not used.

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- 55. IP: Ingress protection rating (enclosures); Internet protocol (communications).
- 56. IR: Infrared.
- 57. IS: Intrinsically safe.
- 58. IT&R: Inspecting, testing, and repair.
- 59. ITE: Information technology equipment.
- 60. kAIC: Kiloampere interrupting capacity.
- 61. kcmil or MCM: One thousand circular mils.
- 62. kV: Kilovolt.
- 63. kVA: Kilovolt-ampere.
- 64. kVA<sub>r</sub> or kVAR: Kilovolt-ampere reactive.
- 65. kW: Kilowatt.
- 66. kWh: Kilowatt-hour.
- 67. LAN: Local area network.
- 68. lb: Pound (weight).
- 69. lbf: Pound (force).
- 70. LCD: Liquid-crystal display.
- 71. LCDI: Leakage-current detector-interrupter.
- 72. LED: Light-emitting diode.
- 73. Li-ion: Lithium-ion.
- 74. lm: Lumen, the SI derived unit of luminous flux.
- 75. LNG: Liquefied natural gas.
- 76. LP-Gas: Liquefied petroleum gas.
- 77. LRC: Locked-rotor current.
- 78. LV: Low voltage.
- 79. lx: Lux, the SI derived unit of illuminance equal to one lumen per square meter.
- 80. m: Meter.
- 81. MCC: Motor-control center.
- 82. MDC: Modular data center.
- 83. MG set: Motor-generator set.
- 84. MIDI: Musical instrument digital interface.
- 85. MLO: Main lugs only.
- 86. MV: Medium voltage.
- 87. MVA: Megavolt-ampere.
- 88. mW: Milliwatt.
- 89. MW: Megawatt.
- 90. MWh: Megawatt-hour.
- 91. NC: Normally closed.
- 92. Ni-Cd: Nickel-cadmium.
- 93. Ni-MH: Nickel-metal hydride.
- 94. NIU: Network interface unit.
- 95. NO: Normally open.
- 96. NPT: National (American) standard pipe taper.

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- 97. OCPD: Overcurrent protective device.
- 98. ONT: Optical network terminal.
- 99. PC: Personal computer.
- 100. PCS: Power conversion system.
- 101. PCU: Power-conditioning unit.
- 102. PF or pf: Power factor.
- 103. PHEV: Plug-in hybrid electric vehicle.
- 104. PLC: Programmable logic controller.
- 105. PLFA: Power-limited fire alarm.
- 106. PoE: Power over Ethernet.
- 107. PV: Photovoltaic.
- 108. PVC: Polyvinyl chloride.
- 109. pW: Picowatt.
- 110. RFI: (electrical) Radio-frequency interference; (contract) Request for interpretation.
- 111. RMS or rms: Root-mean-square.
- 112. RPM or rpm: Revolutions per minute.
- 113. SCADA: Supervisory control and data acquisition.
- 114. SCR: Silicon-controlled rectifier.
- 115. SPD: Surge protective device.
- 116. sq.: Square.
- 117. SWD: Switching duty.
- 118. TCP/IP: Transmission control protocol/Internet protocol.
- 119. TEFC: Totally enclosed fan-cooled.
- 120. TR: Tamper resistant.
- 121. TVSS: Transient voltage surge suppressor.
- 122. UL: (standards) Underwriters Laboratories, Inc.; (product categories) UL, LLC.
- 123. UL CCN: UL Category Control Number.
- 124. UPS: Uninterruptible power supply.
- 125. USB: Universal serial bus.
- 126. UV: Ultraviolet.
- 127. V: Volt, unit of electromotive force.
- 128. V(ac): Volt, alternating current.
- 129. V(dc): Volt, direct current.
- 130. VA: Volt-ampere, unit of complex electrical power.
- 131. VAR: Volt-ampere reactive, unit of reactive electrical power.
- 132. VFC: Variable-frequency controller.
- 133. VOM: Volt-ohm-multimeter.
- 134. VPN: Virtual private network.
- 135. VRLA: Valve regulated lead acid; also called "sealed lead acid (SLA)" or "valve regulated sealed lead acid."
- 136. W: Watt, unit of real electrical power.



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- 137. Wh: Watt-hour, unit of electrical energy usage.
- 138. WPT: Wireless power transfer.
- 139. WPTE: Wireless power transfer equipment.
- 140. WR: Weather resistant.

B. Abbreviations and Acronyms for Electrical Raceway Types:

- 1. EMT: Electrical metallic tubing.
- 2. EMT-A: Aluminum electrical metallic tubing.
- 3. EMT-S: Steel electrical metallic tubing.
- 4. EMT-SS: Stainless steel electrical metallic tubing.
- 5. ENT: Electrical nonmetallic tubing.
- 6. EPEC: Electrical HDPE underground conduit (thin wall).
- 7. EPEC-A: Type A electrical HDPE underground conduit.
- 8. EPEC-B: Type B electrical HDPE underground conduit.
- 9. ERMC: Electrical rigid metal conduit.
- 10. ERMC-A: Aluminum electrical rigid metal conduit.
- 11. ERMC-S: Steel electrical rigid metal conduit.
- 12. ERMC-S-G: Galvanized-steel electrical rigid metal conduit.
- 13. ERMC-S-PVC: PVC-coated-steel electrical rigid metal conduit.
- 14. ERMC-SS: Stainless steel electrical rigid metal conduit.
- 15. FMC: Flexible metal conduit.
- 16. FMC-A: Aluminum flexible metal conduit.
- 17. FMC-S: Steel flexible metal conduit.
- 18. FMT: Steel flexible metallic tubing.
- 19. FNMC: Flexible nonmetallic conduit. See "LFNC."
- 20. HDPE: HDPE underground conduit (thick wall).
- 21. HDPE-40: Schedule 40 HDPE underground conduit.
- 22. HDPE-80: Schedule 80 HDPE underground conduit.
- 23. IMC: Steel electrical intermediate metal conduit.
- 24. LFMC: Liquidtight flexible metal conduit.
- 25. LFMC-A: Aluminum liquidtight flexible metal conduit.
- 26. LFMC-S: Steel liquidtight flexible metal conduit.
- 27. LFMC-SS: Stainless steel liquidtight flexible metal conduit.
- 28. LFNC: Liquidtight flexible nonmetallic conduit.
- 29. LFNC-A: Layered (Type A) liquidtight flexible nonmetallic conduit.
- 30. LFNC-B: Integral (Type B) liquidtight flexible nonmetallic conduit.
- 31. LFNC-C: Corrugated (Type C) liquidtight flexible nonmetallic conduit.
- 32. PVC: Rigid PVC conduit.
- 33. PVC-40: Schedule 40 rigid PVC conduit.
- 34. PVC-80: Schedule 80 rigid PVC Conduit.
- 35. PVC-A: Type A rigid PVC concrete-encased conduit.

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36. PVC-EB: Type EB rigid PVC concrete-encased underground conduit.
37. RGS: See ERM-C-S-G.
38. RMC: See ERM-C.
39. RTRC: Reinforced thermosetting resin conduit.
40. RTRC-AG: Low-halogen, aboveground reinforced thermosetting resin conduit.
41. RTRC-AG-HW: Heavy wall, low-halogen, aboveground reinforced thermosetting resin conduit.
42. RTRC-AG-SW: Standard wall, low-halogen, aboveground reinforced thermosetting resin conduit.
43. RTRC-AG-XW: Extra heavy wall, low-halogen, aboveground reinforced thermosetting resin conduit.
44. RTRC-BG: Low-halogen, belowground reinforced thermosetting resin conduit.

C. Abbreviations and Acronyms for Electrical Single-Conductor and Multiple-Conductor Cable Types:

1. AC: Armored cable.
2. CATV: Coaxial general-purpose cable.
3. CATVP: Coaxial plenum cable.
4. CATVR: Coaxial riser cable.
5. CI: Circuit integrity cable.
6. CL2: Class 2 cable.
7. CL2P: Class 2 plenum cable.
8. CL2R: Class 2 riser cable.
9. CL2X: Class 2 cable, limited use.
10. CL3: Class 3 cable.
11. CL3P: Class 3 plenum cable.
12. CL3R: Class 3 riser cable.
13. CL3X: Class 3 cable, limited use.
14. CM: Communications general-purpose cable.
15. CMG: Communications general-purpose cable.
16. CMP: Communications plenum cable.
17. CMR: Communications riser cable.
18. CMUC: Under-carpet communications wire and cable.
19. CMX: Communications cable, limited use.
20. DG: Distributed generation cable.
21. FC: Flat cable.
22. FCC: Flat conductor cable.
23. FPL: Power-limited fire-alarm cable.
24. FPLP: Power-limited fire-alarm plenum cable.
25. FPLR: Power-limited fire-alarm riser cable.
26. IGS: Integrated gas spacer cable.

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- 27. ITC: Instrumentation tray cable.
- 28. ITC-ER: Instrumentation tray cable, exposed run.
- 29. MC: Metal-clad cable.
- 30. MC-HL: Metal-clad cable, hazardous location.
- 31. MI: Mineral-insulated, metal-sheathed cable.
- 32. MTW: (machine tool wiring) Moisture-, heat-, and oil-resistant thermoplastic cable.
- 33. MV: Medium-voltage cable.
- 34. NM: Nonmetallic sheathed cable.
- 35. NMC: Nonmetallic sheathed cable with corrosion-resistant nonmetallic jacket.
- 36. NMS: Nonmetallic sheathed cable with signaling, data, and communications conductors, plus power or control conductors.
- 37. NPLF: Non-power-limited fire-alarm circuit cable.
- 38. NPLFP: Non-power-limited fire-alarm circuit cable for environmental air spaces.
- 39. NPLFR: Non-power-limited fire-alarm circuit riser cable.
- 40. NUCC: Nonmetallic underground conduit with conductors.
- 41. OFC: Conductive optical fiber general-purpose cable.
- 42. OFCG: Conductive optical fiber general-purpose cable.
- 43. OFCP: Conductive optical fiber plenum cable.
- 44. OFCR: Conductive optical fiber riser cable.
- 45. OFN: Nonconductive optical fiber general-purpose cable.
- 46. OFNG: Nonconductive optical fiber general-purpose cable.
- 47. OFNP: Nonconductive optical fiber plenum cable.
- 48. OFNR: Nonconductive optical fiber riser cable.
- 49. P: Marine shipboard cable.
- 50. PLTC: Power-limited tray cable.
- 51. PLTC-ER: Power-limited tray cable, exposed run.
- 52. PV: Photovoltaic cable.
- 53. RHH: (high heat) Thermoset rubber, heat-resistant cable.
- 54. RHW: Thermoset rubber, moisture-resistant cable.
- 55. SA: Silicone rubber cable.
- 56. SE: Service-entrance cable.
- 57. SER: Service-entrance cable, round.
- 58. SEU: Service-entrance cable, flat.
- 59. SIS: Thermoset cable for switchboard and switchgear wiring.
- 60. TBS: Thermoplastic cable with outer braid.
- 61. TC: Tray cable.
- 62. TC-ER: Tray cable, exposed run.
- 63. TC-ER-HL: Tray cable, exposed run, hazardous location.
- 64. THW: Thermoplastic, heat- and moisture-resistant cable.
- 65. THHN: Thermoplastic, heat-resistant cable with nylon jacket outer sheath.
- 66. THHW: Thermoplastic, heat- and moisture-resistant cable.

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- 67. THWN: Thermoplastic, moisture- and heat-resistant cable with nylon jacket outer sheath.
- 68. TW: Thermoplastic, moisture-resistant cable.
- 69. UF: Underground feeder and branch-circuit cable.
- 70. USE: Underground service-entrance cable.
- 71. XHH: Cross-linked polyethylene, heat-resistant cable.
- 72. XHHW: Cross-linked polyethylene, heat- and moisture-resistant cable.

D. Abbreviations and Acronyms for Electrical Flexible Cord Types:

- 1. SEO: 600 V extra-hard-usage, hard-service cord with thermoplastic elastomer insulation and oil-resistant thermoplastic elastomer outer covering for damp locations.
- 2. SEOW: 600 V extra-hard-usage, hard-service cord with thermoplastic elastomer insulation and oil-resistant thermoplastic elastomer outer covering for damp or wet locations.
- 3. SEOO: 600 V extra-hard-usage, hard-service cord with oil-resistant thermoplastic elastomer insulation and oil-resistant thermoplastic elastomer outer covering for damp locations.
- 4. SEOOW: 600 V extra-hard-usage, hard-service cord with oil-resistant thermoplastic elastomer insulation and oil-resistant thermoplastic elastomer outer covering for damp or wet locations.
- 5. SJEO: 300 V hard-usage, junior hard-service cord with thermoplastic elastomer insulation and oil-resistant thermoplastic elastomer outer cover for damp locations.
- 6. SJEOW: 300 V hard-usage, junior hard-service cord with thermoplastic elastomer insulation and oil-resistant thermoplastic elastomer outer cover for damp or wet locations.
- 7. SJEOO: 300 V hard-usage, junior hard-service cord with oil-resistant thermoplastic elastomer insulation and oil-resistant thermoplastic elastomer outer cover for damp locations.
- 8. SJEOOW: 300 V hard-usage, junior hard-service cord with oil-resistant thermoplastic elastomer insulation and oil-resistant thermoplastic elastomer outer cover for damp or wet locations.
- 9. SJO: 300 V hard-usage, junior hard-service cord with thermoset insulation and oil-resistant thermoset outer cover for damp locations.
- 10. SJOW: 300 V hard-usage, junior hard-service cord with thermoset insulation and oil-resistant thermoset outer cover for damp or wet locations.
- 11. SJOO: 300 V hard-usage, junior hard-service cord with oil-resistant thermoset insulation and oil-resistant thermoset outer cover for damp locations.
- 12. SJOOW: 300 V hard-usage, junior hard-service cord with oil-resistant thermoset insulation and oil-resistant thermoset outer cover for damp or wet locations.

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13. SJTO: 300 V hard-usage, junior hard-service cord with thermoplastic insulation and oil-resistant thermoplastic outer cover for damp locations.
14. SJTOW: 300 V hard-usage, junior hard-service cord with thermoplastic insulation and oil-resistant thermoplastic outer cover for damp or wet locations.
15. SJTOO: 300 V hard-usage, junior hard-service cord with oil-resistant thermoplastic insulation and oil-resistant thermoplastic outer cover for damp locations.
16. SJTOOW: 300 V hard-usage, junior hard-service cord with oil-resistant thermoplastic insulation and oil-resistant thermoplastic outer cover for damp or wet locations.
17. SO: 600 V extra-hard-usage, hard-service cord with thermoset insulation and oil-resistant thermoset outer covering for damp locations.
18. SOW: 600 V extra-hard-usage, hard-service cord with thermoset insulation and oil-resistant thermoset outer covering for damp or wet locations.
19. SOO: 600 V extra-hard-usage, hard-service cord with oil-resistant thermoset insulation and oil-resistant thermoset outer covering for damp locations.
20. SOOW: 600 V extra-hard-usage, hard-service cord with oil-resistant thermoset insulation and oil-resistant thermoset outer covering for damp or wet locations.
21. STO: 600 V extra-hard-usage, hard-service cord with thermoplastic insulation and oil-resistant thermoplastic outer covering for damp locations.
22. STOW: 600 V extra-hard-usage, hard-service cord with thermoplastic insulation and oil-resistant thermoplastic outer covering for damp or wet locations.
23. STOO: 600 V extra-hard-usage, hard-service cord with oil-resistant thermoplastic insulation and oil-resistant thermoplastic outer covering for damp locations.
24. STOOOW: 600 V extra-hard-usage, hard-service cord with oil-resistant thermoplastic insulation and oil-resistant thermoplastic outer covering for damp or wet locations.

E. Definitions:

1. 8-Position 8-Contact (8P8C) Modular Jack: An unkeyed jack with up to eight contacts commonly used to terminate twisted-pair and multiconductor Ethernet cable. Also called a "TIA-1096 miniature 8-position series jack" (8PSJ), or an "IEC 8877 8-pole jack."
  - a. Be careful when suppliers use "RJ45" generically. Obsolete RJ45 jacks used for analog telephone cables have rejection keys. 8P8C jacks used for digital telephone cables and Ethernet cables do not have rejection keys.
2. Basic Impulse Insulation Level (BIL): Reference insulation level expressed in impulse crest voltage with a standard wave not longer than 1.5 times 50 microseconds and 1.5 times 40 microseconds.

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3. Cable: In accordance with NIST NBS Circular 37 and IEEE standards, in the United States for the purpose of interstate commerce, the definition of "cable" is (1) a conductor with insulation, or a stranded conductor with or without insulation (single-conductor cable); or (2) a combination of conductors insulated from one another (multiple-conductor cable).
4. Communications Jack: A fixed connecting device designed for insertion of a communications cable plug.
5. Communications Outlet: One or more communications jacks, or cables and plugs, mounted in a box or ring, with a suitable protective cover.
6. Conductor: In accordance with NIST NBS Circular 37 and IEEE standards, in the United States for the purpose of interstate commerce, the definition of "conductor" is (1) a wire or combination of wires not insulated from one another, suitable for carrying an electric current; (2) (National Electrical Safety Code) a material, usually in the form of wire, cable, or bar, suitable for carrying an electric current; or (3) (general) a substance or body that allows a current of electricity to pass continuously along it.
7. Designated Seismic System: A system component that requires design in accordance with Ch. 13 of ASCE/SEI 7 and for which the Component Importance Factor is greater than 1.0.
8. Direct Buried: Installed underground without encasement in concrete or other protective material.
9. Enclosure: The case or housing of an apparatus, or the fence or wall(s) surrounding an installation, to prevent personnel from accidentally contacting energized parts or to protect the equipment from physical damage. Types of enclosures and enclosure covers include the following:
  - a. Cabinet: An enclosure that is designed for either surface mounting or flush mounting and is provided with a frame, mat, or trim in which a swinging door or doors are or can be hung.
  - b. Concrete Box: A box intended for use in poured concrete.
  - c. Conduit Body: A means for providing access to the interior of a conduit or tubing system through one or more removable covers at a junction or terminal point. In the United States, conduit bodies are listed in accordance with outlet box requirements.
  - d. Conduit Box: A box having threaded openings or knockouts for conduit, EMT, or fittings.
  - e. Cutout Box: An enclosure designed for surface mounting that has swinging doors or covers secured directly to and telescoping with the walls of the enclosure.
  - f. Device Box: A box with provisions for mounting a wiring device directly to the box.

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- g. Extension Ring: A ring intended to extend the sides of an outlet box or device box to increase the box depth, volume, or both.
- h. Floor Box: A box mounted in the floor intended for use with a floor box cover and other components to complete the floor box enclosure.
- i. Floor-Mounted Enclosure: A floor box and floor box cover assembly with means to mount in the floor that is sealed against the entrance of scrub water at the floor level.
- j. Floor Nozzle: An enclosure used on a wiring system, intended primarily as a housing for a receptacle, provided with a means, such as a collar, for surface-mounting on a floor, which may or may not include a stem to support it above the floor level, and is sealed against the entrance of scrub water at the floor level.
- k. Junction Box: A box with a blank cover that joins different runs of raceway or cable and provides space for connection and branching of the enclosed conductors.
- l. Outlet Box: A box that provides access to a wiring system having pryout openings, knockouts, threaded entries, or hubs in either the sides or the back, or both, for the entrance of conduit, conduit or cable fittings, or cables, with provisions for mounting an outlet box cover, but without provisions for mounting a wiring device directly to the box.
- m. Pedestal Floor Box Cover: A floor box cover that, when installed as intended, provides a means for typically vertical or near-vertical mounting of receptacle outlets above the floor's finished surface.
- n. Pull Box: A box with a blank cover that joins different runs of raceway and provides access for pulling or replacing the enclosed cables or conductors.
- o. Raised-Floor Box: A floor box intended for use in raised floors.
- p. Recessed Access Floor Box: A floor box with provisions for mounting wiring devices below the floor surface.
- q. Recessed Access Floor Box Cover: A floor box cover with provisions for passage of cords to recessed wiring devices mounted within a recessed floor box.
- r. Ring: A sleeve, which is not necessarily round, used for positioning a recessed wiring device flush with the plaster, concrete, drywall, or other wall surface.
- s. Ring Cover: A box cover, with raised center portion to accommodate a specific wall or ceiling thickness, for mounting wiring devices or luminaires flush with the surface.
- t. Termination Box: An enclosure designed for installation of termination base assemblies consisting of bus bars, terminal strips, or terminal blocks with provision for wire connectors to accommodate incoming or outgoing conductors, or both.

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10. Emergency Systems: Those systems legally required and classed as emergency by municipal, state, federal, or other codes, or by any governmental agency having jurisdiction that are designed to ensure continuity of lighting, electrical power, or both, to designated areas and equipment in the event of failure of the normal supply for safety to human life.
11. Essential Electrical Systems: (healthcare facilities) Those systems designed to ensure continuity of electrical power to designated areas and functions of a healthcare facility during disruption of normal power sources, and also to minimize disruption within the internal wiring system.
12. Fault Limited: Providing or being served by a source of electrical power that is limited to not more than 100 W when tested in accordance with UL 62368-1.
  - a. The term "fault limited" is intended to encompass most Class 1, 2, and 3 power-limited sources complying with Article 725 of NFPA 70; Class ES1 and ES2 electrical energy sources that are Class PS1 electrical power sources (e.g., USB); and Class ES3 electrical energy sources that are Class PS1 and PS2 electrical power sources (e.g., PoE). See UL 62368-1 for discussion of classes of electrical energy sources and classes of electrical power sources.
13. High-Performance Building: A building that integrates and optimizes on a life-cycle basis all major high-performance attributes, including energy conservation, environment, safety, security, durability, accessibility, cost-benefit, productivity, sustainability, functionality, and operational considerations.
14. Jacket: A continuous nonmetallic outer covering for conductors or cables.
15. Luminaire: A complete lighting unit consisting of a light source such as a lamp, together with the parts designed to position the light source and connect it to the power supply. It may also include parts to protect the light source or the ballast or to distribute the light.
16. Mode: The terms "Active Mode," "Off Mode," and "Standby Mode" are used as defined in the Energy Independence and Security Act (EISA) of 2007.
17. Multi-Outlet Assembly: A type of surface, flush, or freestanding raceway designed to hold conductors, receptacles, and switches, assembled in the field or at the factory.
18. Plenum: A compartment or chamber to which one or more air ducts are connected and that forms part of the air distribution system.
19. Receptacle: A fixed connecting device arranged for insertion of a power cord plug. Also called a power jack.
20. Receptacle Outlet: One or more receptacles mounted in a box with a suitable protective cover.
21. Sheath: A continuous metallic covering for conductors or cables.



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SUPPLEMENTAL REQUIREMENTS FOR ELECTRICAL

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- 22. UL Category Control Number (CCN): An alphabetic or alphanumeric code used to identify product categories covered by UL's Listing, Classification, and Recognition Services.
- 23. Voltage Class: For specified circuits and equipment, voltage classes are defined as follows:
  - a. Control Voltage: Having electromotive force between any two conductors, or between a single conductor and ground, that is supplied from a battery or other Class 2 or Class 3 power-limited source.
  - b. Line Voltage: (1) (controls) Designed to operate using the supplied low-voltage power without transformation. (2) (transmission lines, transformers, SPDs) The line-to-line voltage of the supplying power system.
  - c. Extra-Low Voltage (ELV): Not having electromotive force between any two conductors, or between a single conductor and ground, exceeding 30 V(ac rms), 42 V(ac peak), or 60 V(dc).
  - d. Low Voltage (LV): Having electromotive force between any two conductors, or between a single conductor and ground, that is rated above 30 V but not exceeding 1000 V.
  - e. Medium Voltage (MV): Having electromotive force between any two conductors, or between a single conductor and ground, that is rated about 1 kV but not exceeding 69 kV.
  - f. High Voltage: (1) (circuits) Having electromotive force between any two conductors, or between a single conductor and ground, that is rated above 69 kV but not exceeding 230 kV. (2) (safety) Having sufficient electromotive force to inflict bodily harm or injury.
- 24. Wire: In accordance with NIST NBS Circular 37 and IEEE standards, in the United States for the purpose of interstate commerce, the definition of "wire" is a slender rod or filament of drawn metal. A group of small wires used as a single wire is properly called a "stranded wire." A wire or stranded wire covered with insulation is properly called an "insulated wire" or a "single-conductor cable." Nevertheless, when the context indicates that the wire is insulated, the term "wire" will be understood to include the insulation.

### 1.3 COORDINATION

- A. Interruption of Existing Electrical Service: Do not interrupt electrical service to facilities occupied by Owner or others unless permitted under the following conditions:
  - 1. Notify Owner no fewer than seven days in advance of proposed interruption of electrical service.

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SUPPLEMENTAL REQUIREMENTS FOR ELECTRICAL

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2. Do not proceed with interruption of electrical service without Owner's written permission.
  3. Coordinate interruption with systems impacted by outage including, but not limited to, the following:
    - a. Exercising generators.
    - b. Emergency lighting.
    - c. Elevators.
    - d. Fire-alarm systems.
- B. Arrange to provide temporary electrical service or power in accordance with requirements specified in Division 01.

1.4 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data:
1. Provide emergency operation, normal operation, and preventive maintenance manuals for each system, equipment, and device provided as part of this project.
  2. Include the following information:
    - a. Manufacturer's operating specifications.
    - b. User's guides for software and hardware.
    - c. Schedule of maintenance material items recommended to be stored at Project site.
    - d. Detailed instructions covering operation under both normal and abnormal conditions.
    - e. Time-current curves for overcurrent protective devices and manufacturer's written instructions for testing and adjusting their settings.
    - f. List of load-current and overload-relay heaters with related motor nameplate data.
    - g. List of lamp types and photoelectric relays used on Project, with ANSI and manufacturers' codes.
    - h. Manufacturer's instructions for setting field-adjustable components.
    - i. Manufacturer's instructions for testing, adjusting, and reprogramming microprocessor controls.
- B. Software and Firmware Operational Documentation: Provide software and firmware operational documentation, including the following:
1. Software operating and upgrade manuals.

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SUPPLEMENTAL REQUIREMENTS FOR ELECTRICAL

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2. Names, versions, and website addresses for locations of installed software.
3. Device address list.
4. Printout of software application and graphic screens.
5. Testing and adjusting of panic and emergency power features.
6. For lighting controls, include the following:
  - a. Adjustments of scene preset controls, adjustable fade rates, and fade overrides.
  - b. Operation of adjustable zone controls.

PART 2 - PRODUCTS

2.1 SUBSTITUTION LIMITATIONS FOR ELECTRICAL EQUIPMENT

- A. Substitution requests for electrical equipment will be entertained under the following conditions:
  1. Substitution requests may be submitted for consideration prior to the Electrical Preconstruction Conference if accompanied by value analysis data indicating that substitution will comply with Project performance requirements while significantly increasing value for Owner throughout life of facility.
  2. Substitution requests may be submitted for consideration concurrently with submission of power system study reports when those reports indicate that substitution is necessary for safety of maintenance personnel and facility occupants.
  3. Contractor is responsible for sequencing and scheduling power system studies and electrical equipment procurement. After the Electrical Preconstruction Conference, insufficient lead time for electrical equipment delivery will not be considered a valid reason for substitution.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verification of Conditions:
  1. Prior to all work of this Division, carefully inspect the installed work of all other trades and verify that all such work is complete to the point where this installation may properly commence.

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SUPPLEMENTAL REQUIREMENTS FOR ELECTRICAL

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2. Verify that the electrical installation may be made in complete accordance with all pertinent codes and regulations and the original design.

B. Evaluation and Assessment:

1. In the event of discrepancy, immediately notify the Engineer.
2. Do not proceed with installation in areas of discrepancy until all such discrepancies have been fully resolved.

3.2 PREPARATION

A. Coordination:

1. Coordinate the installation of electrical items with the schedules for work of other trades and building components to prevent unnecessary delays in the total Work. Coordinate specific equipment connections and requirements with the trade providing the equipment.
2. Any changes due to improper coordination shall be done at the Contractor's expense.
3. Where luminaires and other electrical items are shown in conflict with locations of structural members and mechanical or other equipment, furnish and install all required supports and wiring to clear the encroachment.
4. Any Work installed contrary to or without approval of the Engineer shall be subject to change as directed by the Engineer, and no extra compensation will be allowed the Contractor for making these changes.

B. Accuracy of Data:

1. The Drawings are diagrammatic and functional only, and are not intended to show exact layouts, number of fittings, or other installation details. The Contractor shall furnish all labor and materials necessary to install and place in satisfactory operation all power, lighting, and other electrical systems shown. The Contractor shall install additional circuits wherever needed to conform to the specific requirements of the equipment.
2. The locations of equipment, materials, outlets, and similar devices shown on the Drawings are approximate only. Exact locations shall be verified during construction so that they shall coordinate with all other work, equipment and trades. The Contractor shall obtain in the field all information relevant to the

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SUPPLEMENTAL REQUIREMENTS FOR ELECTRICAL

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placing of electrical work and, in case of any interference with other work, shall proceed as directed by the Engineer and shall furnish all labor and materials necessary to complete the Work in an approved manner.

3. The ratings of motors and other electrically operated devices, together with the size shown for their branch circuit conductors and conduits, are approximate only, and are indicative of the probable power requirements insofar as they can be determined in advance of the purchase of equipment. Equipment sizes may vary from sizes indicated on the drawings and must be verified with actual equipment to be furnished and coordinated with all other equipment and material sizes.

### 3.3 DIMENSIONS, ELEVATIONS, AND LAYOUTS

- A. It shall be the responsibility of the Contractor to verify dimensions and elevations shown or scaled on Drawings by actual field measurements after building construction has progressed to the point where such measurements may be taken.
- B. Advise Engineer in writing regarding those critical dimensions that must be held by other Trades as they perform their work.
- C. Assume full responsibility for accuracy of all work under this Division and make corrections as required.
- D. It shall be this Division's responsibility to coordinate with all other Trades and separate equipment contracts regarding mechanical equipment layouts, space requirements, mounting details, "roughing-in" dimensions, and for items substituted for those specified herein to avoid conflict.
- E. Arrange for disassembling large pieces of equipment for entry into buildings as necessary to pass through available openings. Disassembly shall not void UL Listing or manufacturer's warranty.
- F. Layouts of feeders and wiring shown on Drawings are diagrammatic, and shall be constructed as such, intended to show scope of work and general arrangement, unless otherwise noted.
- G. Equipment locations shall be as indicated unless prohibited by equipment dimensions, codes or the manufacturer's recommendations. In such an event, contact the Engineer.

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SUPPLEMENTAL REQUIREMENTS FOR ELECTRICAL

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3.4 EQUIPMENT CLEANING

- A. Thoroughly inspect all equipment and any items dented, scratched or otherwise damaged in any manner shall be replaced or repaired and painted to match original finish.
  - 1. All items so repaired and refinished shall be brought to the attention of the Engineer for inspection and approval.
- B. Upon completion of all installation, lamping, and testing, thoroughly inspect all exposed portions of the electrical installation and completely remove all exposed labels, soil, markings and foreign material.

3.5 INSTALLATION OF ELECTRICAL WORK

- A. Unless more stringent requirements are specified in the Contract Documents or manufacturers' written instructions, comply with NFPA 70 and NECA NEIS 1 for installation of Work specified in Division 26. Consult Architect for resolution of conflicting requirements.
- B. General: Sequence, coordinate, and integrate the various elements of electrical systems, materials, and equipment. Comply with the following requirements:
  - 1. Coordinate electrical systems, equipment, and materials installation with other building components.
  - 2. Verify all dimensions by field measurements.
  - 3. Arrange for chases, slots, and openings in other building components during progress of construction, to allow for electrical installations.
  - 4. Coordinate the installation of required supporting devices and sleeves to be set in poured-in-place concrete and other structural components, as they are constructed.
  - 5. Sequence, coordinate, and integrate installations of electrical materials and equipment for efficient flow of the Work. Give particular attention to large equipment requiring positioning prior to closing in the building.
  - 6. Where mounting heights are not detailed or dimensioned, install systems, materials, and equipment to provide the maximum headroom possible.
  - 7. Coordinate connection of electrical systems with exterior underground utilities and services. Comply with requirements of governing regulations, franchised service companies, and controlling agencies. Provide required connection for each service.
  - 8. Install systems, materials, and equipment to conform with approved submittal data, including coordination drawings, to greatest extent possible. Conform to

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SUPPLEMENTAL REQUIREMENTS FOR ELECTRICAL

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arrangements indicated by the Contract Documents, recognizing that portions of the Work are shown only in diagrammatic form. Where coordination requirements conflict with individual system requirements, refer conflict to the Engineer.

9. Install systems, materials, and equipment level and plumb, parallel and perpendicular to other building systems and components, where installed exposed in finished spaces.
  10. Install electrical equipment to facilitate servicing, maintenance, and repair or replacement of equipment components. As much as practical, connect equipment for ease of disconnecting, with minimum of interference with other installations.
  11. Install access panels or doors where splices, junctions, pull points, etc. are concealed behind finished surfaces.
  12. Install systems, materials, and equipment giving right-of-way priority to systems required to be installed at a specified slope.
- C. Coordinate with the Engineer, architectural drawings, etc for the locations of the expansion joints, fire walls and smoke walls/partitions. Suitable expansion/deflection fittings shall be provided at all expansion joints and at recommended lengths of raceway. Fire/gas stopping shall be provided at all walls/floor/partitions penetrations. Fire stopping rating shall match or exceed the walls/floor/partitions rating.
- D. Cutting and Patching:
1. Perform cutting, fitting, and patching of electrical equipment and materials required to:
    - a. Uncover Work to provide for installation of ill-timed Work.
    - b. Remove and replace defective Work.
    - c. Remove and replace Work not conforming to requirements of the Contract Documents.
    - d. Remove samples of installed Work as specified for testing.
    - e. Install equipment and materials in existing structures.
  2. Upon written instructions from the Engineer, uncover and restore Work to provide for Engineer's observation of concealed Work.
  3. Cut, remove, and legally dispose of selected electrical equipment, components, and materials as indicated, including but not limited to removal of electrical items indicated to be removed and items made obsolete by the new Work.
  4. Protect the structure, furnishings, finishes, and adjacent materials not indicated or scheduled to be removed.
  5. Provide and maintain temporary partitions or dust barriers adequate to prevent the spread of dust and dirt to adjacent areas.

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SUPPLEMENTAL REQUIREMENTS FOR ELECTRICAL

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6. Protection of Installed Work: During cutting and patching operations, protect adjacent installations.
7. Patch existing finished surfaces and building components using new materials matching existing materials and experienced Installers. Installers' qualifications refer to the materials and methods required for the surface and building components being patched.

3.6 CLOSEOUT ACTIVITIES

- A. Demonstration: Demonstrate to Owner's maintenance and clerical personnel and building occupants how to operate the following systems and equipment:
  1. Lighting control devices specified in Section 260923 "Lighting Control Devices."
- B. Provide video recordings of demonstrations to Owner.
- C. Training: Train Owner's maintenance personnel on the following topics:
  1. How to adjust, operate, and maintain devices specified in Section 260923 "Lighting Control Devices."
  2. How to adjust, operate, and maintain equipment specified in Section 262913.03 "Manual and Magnetic Motor Controllers."
- D. Provide video recordings of training sessions to Owner.

END OF SECTION 26 00 10



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LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

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SECTION 26 05 19 - LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

- A. Section Includes:
  - 1. Building wires and cables rated 600 V and less.
  - 2. Connectors, splices, and terminations rated 600 V and less.
- B. Related Requirements:
  - 1. Section 260523 "Control-Voltage Electrical Power Cables" for control systems communications cables and Classes 1, 2 and 3 control cables.

1.03 ACTION SUBMITTALS

- A. Product Data: For each type of product.

PART 2 PRODUCTS

2.01 CONDUCTORS AND CABLES

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
  - 1. Alpha Wire Company.
  - 2. Belden Inc.
  - 3. General Cable; General Cable Corporation.
  - 4. Southwire Company.
- B. Copper Conductors: Comply with NEMA WC 70/ICEA S-95-658.
- C. Conductor Insulation: Comply with NEMA WC 70/ICEA S-95-658 for Type THHN/THWN-2.
- D. Multiconductor Cable: Comply with NEMA WC 70/ICEA S-95-658 for metal-clad cable, Type MC with ground wire.

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LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

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2.02 CONNECTORS AND SPLICES

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
  - 1. AFC Cable Systems, Inc.
  - 2. Ideal Industries, Inc.
  - 3. ILSCO.
  - 4. O-Z/Gedney; a brand of Emerson Industrial Automation.
- B. Description: Factory-fabricated connectors and splices of size, ampacity rating, material, type, and class for application and service indicated.

2.03 SYSTEM DESCRIPTION

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. Comply with NFPA 70.

PART 3 EXECUTION

3.01 CONDUCTOR MATERIAL APPLICATIONS

- A. Feeders: Copper. Stranded (all sizes).
- B. Branch Circuits: Copper. Stranded (all sizes).

3.02 CONDUCTOR INSULATION AND MULTICONDUCTOR CABLE APPLICATIONS AND WIRING METHODS

- A. Exposed Feeder and Branch Circuits, Including in Crawlspace: Type THHN/THWN-2, single conductors in raceway.
- B. Feeder and Branch Circuits Concealed in Ceilings, Walls, and Partitions: Type THHN/THWN-2, single conductors in raceway or Metal-clad cable, Type MC.
- C. Cord Drops and Portable Appliance Connections: Type SO, hard service cord with stainless-steel, wire-mesh, strain relief device at terminations to suit application.

3.03 INSTALLATION OF CONDUCTORS AND CABLES

- A. Conceal cables in finished walls, ceilings, and floors unless otherwise indicated.

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LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

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- B. Complete raceway installation between conductor and cable termination points according to Section 260533 "Raceways and Boxes for Electrical Systems" prior to pulling conductors and cables.
- C. Use manufacturer-approved pulling compound or lubricant where necessary; compound used must not deteriorate conductor or insulation. Do not exceed manufacturer's recommended maximum pulling tensions and sidewall pressure values.
- D. Use pulling means, including fish tape, cable, rope, and basket-weave wire/cable grips; that will not damage cables or raceway.
- E. Install exposed cables parallel and perpendicular to surfaces of exposed structural members, and follow surface contours where possible.
- F. Support cables according to Section 260529 "Hangers and Supports for Electrical Systems."

3.04 CONNECTIONS

- A. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A-486B.
- B. Make splices, terminations, and taps that are compatible with conductor material and that possess equivalent or better mechanical strength and insulation ratings than unspliced conductors.
- C. Wiring at Outlets: Install conductor at each outlet, with at least 6 inches (150 mm) of slack.

3.05 IDENTIFICATION

- A. Identify and color-code conductors and cables according to Section 260553 "Identification for Electrical Systems."
- B. Identify each spare conductor at each end with identity number and location of other end of conductor, and identify as spare conductor.

3.06 SLEEVE AND SLEEVE-SEAL INSTALLATION FOR ELECTRICAL PENETRATIONS

- A. Install sleeves and sleeve seals at penetrations of exterior floor and wall assemblies. Comply with requirements in Section 260544 "Sleeves and Sleeve Seals for Electrical Raceways and Cabling."

3.07 FIRESTOPPING

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LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

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- A. Apply firestopping to electrical penetrations of fire-rated floor and wall assemblies to restore original fire-resistance rating of assembly according to Section "Penetration Firestopping."

3.08 FIELD QUALITY CONTROL

- A. Perform the following tests and inspections:
  - 1. After installing conductors and cables and before electrical circuitry has been energized, test for continuity and inspect for visual damage.
- B. Cables will be considered defective if they do not pass tests and inspections.

END OF SECTION 26 05 19

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CONTROL-VOLTAGE ELECTRICAL POWER CABLES

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SECTION 26 05 23 - CONTROL-VOLTAGE ELECTRICAL POWER CABLES

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

- A. Section Includes:
  - 1. Low-voltage control cabling.
  - 2. Control-circuit conductors.
  - 3. Identification products.

1.03 DEFINITIONS

- A. EMI: Electromagnetic interference.
- B. Low Voltage: As defined in NFPA 70 for circuits and equipment operating at less than 50 V or for remote-control and signaling power-limited circuits.
- C. Plenum: A space forming part of the air distribution system to which one or more air ducts are connected. An air duct is a passageway, other than a plenum, for transporting air to or from heating, ventilating, or air-conditioning equipment.

1.04 ACTION SUBMITTALS

- A. Product Data: For each type of product.

1.05 QUALITY ASSURANCE

- A. Testing Agency Qualifications: Member company of NETA or an NRTL.
  - 1. Testing Agency's Field Supervisor: Currently certified by BICSI as an RCDD to supervise on-site testing.

PART 1 PRODUCTS

2.01 SYSTEM DESCRIPTION

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CONTROL-VOLTAGE ELECTRICAL POWER CABLES

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- 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.

2.02 PERFORMANCE REQUIREMENTS

- A. Flame Travel and Smoke Density in Plenums: As determined by testing identical products according to NFPA 262 by a qualified testing agency. Identify products for installation in plenums with appropriate markings of applicable testing agency.
  - 1. Flame Travel Distance: 60 inches (1520 mm) or less.
  - 2. Peak Optical Smoke Density: 0.5 or less.
  - 3. Average Optical Smoke Density: 0.15 or less.
- B. Flame Travel and Smoke Density for Cables in Non-Riser Applications and Non-Plenum Building Spaces: As determined by testing identical products according to UL 1685.

2.03 LOW-VOLTAGE CONTROL CABLE

- A. Plenum-Rated, Paired Cable: NFPA 70, Type CMP.
  - 1. One or multi-pair, twisted, No. 16 AWG, stranded (19x29) tinned-copper conductors.
  - 2. PVC insulation.
  - 3. Unshielded.
  - 4. PVC jacket.
  - 5. Flame Resistance: Comply with NFPA 262.

2.04 CONTROL-CIRCUIT CONDUCTORS

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
  - 1. Encore Wire Corporation.
  - 2. General Cable; General Cable Corporation.
  - 3. Southwire Company.
- B. Class 1 Control Circuits: Stranded copper, Type THHN-2-THWN-2, in raceway, complying with UL 44.
- C. Class 2 Control Circuits: Stranded copper, Type THHN-2-THWN-2, in raceway, complying with UL 44.
- D. Class 3 Remote-Control and Signal Circuits: Stranded copper, Type THHN-2-THWN-2, in raceway, complying with UL 44.

PART 1 EXECUTION

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CONTROL-VOLTAGE ELECTRICAL POWER CABLES

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3.01 INSTALLATION OF RACEWAYS AND BOXES

- A. Comply with requirements in Section 260533 "Raceways and Boxes for Electrical Systems" for raceway selection and installation requirements for boxes, conduits, and wireways as supplemented or modified in this Section.
  - 1. Outlet boxes shall be no smaller than 2 inches (50 mm) wide, 3 inches (75 mm) high, and 2-1/2 inches (64 mm) deep.
  - 2. Flexible metal conduit shall not be used.
- B. Comply with TIA-569-B for pull-box sizing and length of conduit and number of bends between pull points.
- C. Install manufactured conduit sweeps and long-radius elbows if possible.
- D. Raceway Installation in Equipment Rooms:
  - 1. Position conduit ends adjacent to a corner on backboard if a single piece of plywood is installed, or in the corner of the room if multiple sheets of plywood are installed around perimeter walls of the room.
  - 2. Install metal conduits with grounding bushings and connect with grounding conductor to grounding system.

3.02 INSTALLATION OF CONDUCTORS AND CABLES

- A. Comply with NECA 1 and NFPA 70.
- B. General Requirements for Cabling:
  - 1. Comply with TIA-568-C Series of standards.
  - 2. Terminate all conductors; no cable shall contain unterminated elements. Make terminations only at indicated outlets and terminals.
  - 3. Cables may not be spliced.
  - 4. Secure and support cables at intervals not exceeding 30 inches (760 mm) and not more than 6 inches (150 mm) from cabinets, boxes, fittings, outlets, racks, frames, and terminals.
  - 5. Bundle, lace, and train conductors to terminal points without exceeding manufacturer's limitations on bending radii, but not less than radii specified in BICSI ITSIMM, Ch. 5, "Copper Structured Cabling Systems". Install lacing bars and distribution spools.
  - 6. Do not install bruised, kinked, scored, deformed, or abraded cable. Do not splice cable between termination, tap, or junction points. Remove and discard cable if damaged during installation and replace it with new cable.
  - 7. Cold-Weather Installation: Bring cable to room temperature before dereeling. Do not use heat lamps for heating.
  - 8. Pulling Cable: Comply with BICSI ITSIMM, Ch. 5, "Copper Structured Cabling Systems". Monitor cable pull tensions.
  - 9. Support: Do not allow cables to lay on removable ceiling tiles.
  - 10. Secure: Fasten securely in place with hardware specifically designed and installed so as to not damage cables.

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CONTROL-VOLTAGE ELECTRICAL POWER CABLES

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- C. Installation of Control-Circuit Conductors:
  - 1. Install wiring in raceways. Comply with requirements specified in Section 260533 "Raceways and Boxes for Electrical Systems."
- D. Open-Cable Installation:
  - 1. Install cabling with horizontal and vertical cable guides in telecommunications spaces with terminating hardware and interconnection equipment.
  - 2. Suspend copper cable not in a wireway or pathway a minimum of 8 inches (200 mm) above ceilings by cable supports not more than 30 inches (760 mm) apart.
  - 3. Cable shall not be run through or on structural members or in contact with pipes, ducts, or other potentially damaging items. Do not run cables between structural members and corrugated panels.
- E. Installation of Cable Routed Exposed under Raised Floors:
  - 1. Install plenum-rated cable only.
  - 2. Install cabling after the flooring system has been installed in raised floor areas.

3.03 REMOVAL OF CONDUCTORS AND CABLES

- A. Remove abandoned conductors and cables. Abandoned conductors and cables are those installed that are not terminated at equipment and are not identified for future use with a tag.

3.04 CONTROL-CIRCUIT CONDUCTORS

- A. Minimum Conductor Sizes:
  - 1. Class 1 remote-control and signal circuits; No 14 AWG.
  - 2. Class 2 low-energy, remote-control, and signal circuits; No. 16 AWG.
  - 3. Class 3 low-energy, remote-control, alarm, and signal circuits; No 12 AWG.

3.05 FIRESTOPPING

- A. Comply with requirements in Section "Penetration Firestopping."

3.06 GROUNDING

- A. For low-voltage control wiring and cabling, comply with requirements in Section 260526 "Grounding and Bonding for Electrical Systems."

3.07 IDENTIFICATION

- A. Comply with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

END OF SECTION 26 05 23



## GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

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### SECTION 26 05 26 - GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

#### PART 1 GENERAL

##### 1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

##### 1.02 SUMMARY

- A. Section includes grounding and bonding systems and equipment.

##### 1.03 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.

#### PART 1 PRODUCTS

##### 2.01 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
  1. Burndy; Part of Hubbell Electrical Systems.
  2. ERICO International Corporation.
  3. ILSCO.
  4. O-Z/Gedney; a brand of Emerson Industrial Automation.

##### 2.02 SYSTEM DESCRIPTION

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. Comply with UL 467 for grounding and bonding materials and equipment.

##### 2.03 CONDUCTORS

- A. Insulated Conductors: Copper wire or cable insulated for 600 V unless otherwise required by applicable Code or authorities having jurisdiction.
- B. Bare Copper Conductors:

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GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

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1. Solid Conductors: ASTM B 3.
2. Stranded Conductors: ASTM B 8.
3. Bonding Cable: 28 kcmil, 14 strands of No. 17 AWG conductor, 1/4 inch (6 mm) in diameter.
4. Bonding Conductor: No. 4 or No. 6 AWG, stranded conductor.
5. Bonding Jumper: Copper tape, braided conductors terminated with copper ferrules; 1-5/8 inches (41 mm) wide and 1/16 inch (1.6 mm) thick.

2.04 CONNECTORS

- A. Listed and labeled by an NRTL acceptable to authorities having jurisdiction for applications in which used and for specific types, sizes, and combinations of conductors and other items connected.
- B. Bolted Connectors for Conductors and Pipes: Copper or copper alloy.

PART 1 EXECUTION

3.01 APPLICATIONS

- A. Conductors: Install solid or stranded conductor for No. 10 AWG and smaller, and stranded conductors for No. 8 AWG and larger unless otherwise indicated.
- B. Isolated Grounding Conductors: Green-colored insulation with continuous yellow stripe. On feeders with isolated ground, identify grounding conductor where visible to normal inspection, with alternating bands of green and yellow tape, with at least three bands of green and two bands of yellow.
- C. Conductor Terminations and Connections:
  1. Pipe and Equipment Grounding Conductor Terminations: Bolted connectors.
  2. Underground Connections: Welded connectors except at test wells and as otherwise indicated.
  3. Connections to Ground Rods at Test Wells: Bolted connectors.
  4. Connections to Structural Steel: Welded connectors.

3.02 EQUIPMENT GROUNDING

- A. Install insulated equipment grounding conductors with all feeders and branch circuits.
- B. Install insulated equipment grounding conductors with the following items, in addition to those required by NFPA 70:
  1. Feeders and branch circuits.
  2. Lighting circuits.
  3. Receptacle circuits.
  4. Single-phase motor and appliance branch circuits.
  5. Three-phase motor and appliance branch circuits.
  6. Flexible raceway runs.

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GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

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7. Metal-clad cable runs.

- C. Air-Duct Equipment Circuits: Install insulated equipment grounding conductor to duct-mounted electrical devices operating at 120 V and more, including air cleaners, heaters, dampers, humidifiers, and other duct electrical equipment. Bond conductor to each unit and to air duct and connected metallic piping.
- D. Isolated Grounding Receptacle Circuits: Install an insulated equipment grounding conductor connected to the receptacle grounding terminal. Isolate conductor from raceway and from panelboard grounding terminals. Terminate at equipment grounding conductor terminal of the applicable derived system or service unless otherwise indicated.
- E. Isolated Equipment Enclosure Circuits: For designated equipment supplied by a branch circuit or feeder, isolate equipment enclosure from supply circuit raceway with a nonmetallic raceway fitting listed for the purpose. Install fitting where raceway enters enclosure, and install a separate insulated equipment grounding conductor. Isolate conductor from raceway and from panelboard grounding terminals. Terminate at equipment grounding conductor terminal of the applicable derived system or service unless otherwise indicated.

3.03 INSTALLATION

- A. Grounding Conductors: Route along shortest and straightest paths possible unless otherwise indicated or required by Code. Avoid obstructing access or placing conductors where they may be subjected to strain, impact, or damage.
- B. Bonding Straps and Jumpers: Install in locations accessible for inspection and maintenance except where routed through short lengths of conduit.
  - 1. Bonding to Structure: Bond straps directly to basic structure, taking care not to penetrate any adjacent parts.
  - 2. Bonding to Equipment Mounted on Vibration Isolation Hangers and Supports: Install bonding so vibration is not transmitted to rigidly mounted equipment.
- C. Bonding Interior Metal Ducts: Bond metal air ducts to equipment grounding conductors of associated fans, blowers, electric heaters, and air cleaners. Install bonding jumper to bond across flexible duct connections to achieve continuity.

END OF SECTION 26 05 26

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HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

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SECTION 26 05 29 - HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

- A. Section Includes:
  - 1. Hangers and supports for electrical equipment and systems.

1.03 ACTION SUBMITTALS

- A. Product Data: For each type of product.
  - 1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for the following:
    - a. Hangers.
    - b. Steel slotted support systems.
  - 2. Include rated capacities and furnished specialties and accessories.

PART 1 PRODUCTS

2.01 SUPPORT, ANCHORAGE, AND ATTACHMENT COMPONENTS

- A. Steel Slotted Support Systems: Comply with MFMA-4 factory-fabricated components for field assembly.
  - 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
    - a. Allied Tube & Conduit; a part of Atkore International.
    - b. Cooper B-Line, Inc.; a division of Cooper Industries.
    - c. ERICO International Corporation.
    - d. Flex-Strut Inc.
    - e. GS Metals Corp.
    - f. Thomas & Betts Corporation, A Member of the ABB Group.
    - g. Unistrut; an Atkore International company.
  - 2. Material: Galvanized steel.
  - 3. Channel Width: 1-5/8 inches (41.25 mm) min.

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HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

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4. Metallic Coatings: Hot-dip galvanized after fabrication and applied according to MFMA-4.
5. Protect finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
6. Channel Dimensions: Selected for applicable load criteria.
- B. Conduit and Cable Support Devices: Steel hangers, clamps, and associated fittings, designed for types and sizes of raceway or cable to be supported.
- C. Support for Conductors in Vertical Conduit: Factory-fabricated assembly consisting of threaded body and insulating wedging plug or plugs for nonarmored electrical conductors or cables in riser conduits. Plugs shall have number, size, and shape of conductor gripping pieces as required to suit individual conductors or cables supported. Body shall be made of malleable iron.
- D. Structural Steel for Fabricated Supports and Restraints: ASTM A 36/A 36M steel plates, shapes, and bars; black and galvanized.
- E. Mounting, Anchoring, and Attachment Components: Items for fastening electrical items or their supports to building surfaces include the following:
  1. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete, steel, or wood, with tension, shear, and pullout capacities appropriate for supported loads and building materials where used.
    - a. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
      - 1) Hilti, Inc.
      - 2) ITW Ramset/Red Head; Illinois Tool Works, Inc.
  2. Mechanical-Expansion Anchors: Insert-wedge-type, [zinc-coated steel] [stainless steel], for use in hardened portland cement concrete, with tension, shear, and pullout capacities appropriate for supported loads and building materials where used.
    - a. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
      - 1) Cooper B-Line, Inc.; a division of Cooper Industries.
      - 2) Empire Tool and Manufacturing Co., Inc.
      - 3) Hilti, Inc.
  3. Concrete Inserts: Steel or malleable-iron, slotted support system units are similar to MSS Type 18 units and comply with MFMA-4 or MSS SP-58.
  4. Clamps for Attachment to Steel Structural Elements: MSS SP-58 units are suitable for attached structural element.
  5. Through Bolts: Structural type, hex head, and high strength. Comply with ASTM A 325.
  6. Toggle Bolts: All-steel springhead type.
  7. Hanger Rods: Threaded steel.

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HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

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2.02 FABRICATED METAL EQUIPMENT SUPPORT ASSEMBLIES

- A. Description: Welded or bolted structural-steel shapes, shop or field fabricated to fit dimensions of supported equipment.
- B. Materials: Comply with requirements in Section 055000 "Metal Fabrications" for steel shapes and plates.

PART 1 EXECUTION

3.01 APPLICATION

- A. Comply with NECA 1 and NECA 101 for application of hangers and supports for electrical equipment and systems unless requirements in this Section are stricter.
- B. Comply with requirements for raceways and boxes specified in Section 260533 "Raceways and Boxes for Electrical Systems."
- C. Maximum Support Spacing and Minimum Hanger Rod Size for Raceway: Space supports for EMTs and RMCs as required by NFPA 70. Minimum rod size shall be 1/4 inch (6 mm) in diameter.
- D. Multiple Raceways or Cables: Install trapeze-type supports fabricated with steel slotted or other support system, sized so capacity can be increased by at least 25 percent in future without exceeding specified design load limits.
  - 1. Secure raceways and cables to these supports with two-bolt conduit clamps.
- E. Spring-steel clamps designed for supporting single conduits without bolts may be used for 1-1/2-inch (38-mm) and smaller raceways serving branch circuits and communication systems above suspended ceilings and for fastening raceways to trapeze supports.

3.02 SUPPORT INSTALLATION

- A. Comply with NECA 1 and NECA 101 for installation requirements except as specified in this article.
- B. Raceway Support Methods: In addition to methods described in NECA 1, EMTs and RMCs may be supported by openings through structure members, according to NFPA 70.
- C. Strength of Support Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static loads within specified loading limits. Minimum static design load used for strength determination shall be weight of supported components plus 200 lb (90 kg).
- D. Mounting and Anchorage of Surface-Mounted Equipment and Components: Anchor and fasten electrical items and their supports to building structural elements by the following methods unless otherwise indicated by code:

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HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

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1. To Wood: Fasten with lag screws or through bolts.
  2. To New Concrete: Bolt to concrete inserts.
  3. To Masonry: Approved toggle-type bolts on hollow masonry units and expansion anchor fasteners on solid masonry units.
  4. To Existing Concrete: Expansion anchor fasteners.
  5. Instead of expansion anchors, powder-actuated driven threaded studs provided with lock washers and nuts may be used in existing standard-weight concrete 4 inches (100 mm) thick or greater. Do not use for anchorage to lightweight-aggregate concrete or for slabs less than 4 inches (100 mm) thick.
  6. To Steel: Beam clamps (MSS SP-58, Type 19, 21, 23, 25, or 27), complying with MSS SP-69.
  7. To Light Steel: Sheet metal screws.
  8. Items Mounted on Hollow Walls and Nonstructural Building Surfaces: Mount cabinets, panelboards, disconnect switches, control enclosures, pull and junction boxes, transformers, and other devices on slotted-channel racks attached to substrate.
- E. Drill holes for expansion anchors in concrete at locations and to depths that avoid the need for reinforcing bars.

3.03 INSTALLATION OF FABRICATED METAL SUPPORTS

- A. Comply with installation requirements in Section "Metal Fabrications" for site-fabricated metal supports.
- B. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor electrical materials and equipment.
- C. Field Welding: Comply with AWS D1.1/D1.1M.

3.04 PAINTING

- A. Touchup: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces. Apply paint by brush or spray to provide minimum dry film thickness of 2.0 mils (0.05 mm).
- B. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

END OF SECTION 26 05 29



## RACEWAYS AND BOXES FOR ELECTRICAL SYSTEMS

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### SECTION 26 05 33 - RACEWAYS AND BOXES FOR ELECTRICAL SYSTEMS

#### PART 1 GENERAL

##### 1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

##### 1.02 SUMMARY

- A. Section Includes:
  - 1. Metal conduits, tubing, and fittings.
  - 2. Metal wireways and auxiliary gutters.
  - 3. Surface raceways.
  - 4. Boxes, enclosures, and cabinets.
- B. Related Requirements:
  - 1. Section 270528 "Pathways for Communications Systems" for conduits, surface pathways, innerduct, boxes, and faceplate adapters serving communications, electronic safety and security.

##### 1.03 DEFINITIONS

- A. GRC: Galvanized rigid steel conduit.

##### 1.04 ACTION SUBMITTALS

- A. Product Data: For surface raceways, wireways and fittings, floor boxes, hinged-cover enclosures, and cabinets.

#### PART 1 PRODUCTS

##### 2.01 METAL CONDUITS, TUBING, AND FITTINGS

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
  - 1. Allied Tube & Conduit; a part of Atkore International.
  - 2. O-Z/Gedney; a brand of Emerson Industrial Automation.
  - 3. Southwire Company.
  - 4. Thomas & Betts Corporation, A Member of the ABB Group.

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RACEWAYS AND BOXES FOR ELECTRICAL SYSTEMS

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- 5. Wheatland Tube Company.
- B. Listing and Labeling: Metal conduits, tubing, and fittings shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- C. GRC: Comply with ANSI C80.1 and UL 6.
- D. EMT: Comply with ANSI C80.3 and UL 797.
- E. FMC: Comply with UL 1; zinc-coated steel.
- F. LFMC: Flexible steel conduit with PVC jacket and complying with UL 360.
- G. Fittings for Metal Conduit: Comply with NEMA FB 1 and UL 514B.
  - 1. Fittings for EMT:
    - a. Material: Steel.
    - b. Type: Setscrew or compression.
  - 2. Expansion Fittings: PVC or steel to match conduit type, complying with UL 651, rated for environmental conditions where installed, and including flexible external bonding jumper.
- H. Joint Compound for GRC: Approved, as defined in NFPA 70, by authorities having jurisdiction for use in conduit assemblies, and compounded for use to lubricate and protect threaded conduit joints from corrosion and to enhance their conductivity.

2.02 METAL WIREWAYS AND AUXILIARY GUTTERS

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
  - 1. Cooper B-Line, Inc.; a division of Cooper Industries.
  - 2. Hoffman; a brand of Pentair Equipment Protection.
  - 3. MonoSystems, Inc.
- B. Description: Sheet metal, complying with UL 870 and NEMA 250, Type 1 unless otherwise indicated, and sized according to NFPA 70.
  - 1. Metal wireways installed outdoors shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- C. Fittings and Accessories: Include covers, couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings to match and mate with wireways as required for complete system.
- D. Wireway Covers: Hinged type or Screw-cover type unless otherwise indicated.
- E. Finish: Manufacturer's standard enamel finish.

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RACEWAYS AND BOXES FOR ELECTRICAL SYSTEMS

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2.03 NONMETALLIC CONDUITS AND FITTINGS

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
  - 1. Cantex
  - 2. Carlon.
  - 3. JM Eagle.
- B. Description: NFPA 70, Schedule 40 & 80 Type PVC rigid polyvinyl chloride conduit complying with NEMA TC 2 and listed and labeled as complying with UL 651; rated for use with conductors rated 90-degrees C.
- C. Fittings:
  - 1. Manufacturer: Same as manufacturer of conduit to be connected.
  - 2. Description: Fittings complying with NEMA TC 3 and listed and labeled as complying with UL 651; material to match conduit.

2.04 SURFACE RACEWAYS

- A. Listing and Labeling: Surface raceways shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. Surface Metal Raceways: Aluminum with snap-on cover complying with UL 5. Electrically pre-wired in the factory with pre-punched activation openings, pre-finished and cut to job site lengths. Color shall be selected by Architect.
  - 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
    - a. Hubbell Incorporated; Wiring Device-Kellems.
    - b. Panduit Corp.
    - c. Wiremold / Legrand.

2.05 BOXES, ENCLOSURES, AND CABINETS

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
  - 1. EGS/Appleton Electric.
  - 2. FSR Inc.
  - 3. Hoffman; a brand of Pentair Equipment Protection.
  - 4. Hubbell Incorporated.
  - 5. Oldcastle Enclosure Solutions.
  - 6. RACO; Hubbell.
  - 7. Thomas & Betts Corporation, A Member of the ABB Group.

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RACEWAYS AND BOXES FOR ELECTRICAL SYSTEMS

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- B. Die-Cast Metal Boxes: Shall be weatherproof, NEMA 3R rated, with gray powder coat finish and internal hub threads.
- C. PVC Boxes: Shall be weatherproof, NEMA 3R rated, with gasketed covers and stainless steel mounting screws.
- D. Sheet Metal Outlet and Device Boxes: Comply with NEMA OS 1 and UL 514A.
- E. Luminaire Outlet Boxes: Nonadjustable, designed for attachment of luminaire weighing 50 lb (23 kg). Outlet boxes designed for attachment of luminaires weighing more than 50 lb (23 kg) shall be listed and marked for the maximum allowable weight.
- F. Small Sheet Metal Pull and Junction Boxes: NEMA OS 1.
- G. Box extensions used to accommodate new building finishes shall be of same material as recessed box.
- H. Device Box Dimensions: 4 inches square by 2-1/8 inches deep (100 mm square by 60 mm deep).
- I. Gangable boxes are not allowed.
- J. Hinged-Cover Enclosures: Comply with UL 50 and NEMA 250, Type 1 with continuous-hinge cover with flush latch unless otherwise indicated.
  - 1. Metal Enclosures: Steel, finished inside and out with manufacturer's standard enamel.
  - 2. Interior Panels: Steel; all sides finished with manufacturer's standard enamel.
- K. Cabinets:
  - 1. NEMA 250, Type 1 galvanized-steel box with removable interior panel and removable front, finished inside and out with manufacturer's standard enamel.
  - 2. Hinged door in front cover with flush latch and concealed hinge.
  - 3. Key latch to match panelboards.
  - 4. Metal barriers to separate wiring of different systems and voltage.
  - 5. Accessory feet where required for freestanding equipment.

PART 1 EXECUTION

3.01 RACEWAY APPLICATION

- A. Apply raceway products as specified below unless otherwise indicated:
  - 1. Exposed, Not Subject to Physical Damage: EMT.
  - 2. Exposed and Subject to Severe Physical Damage: GRC. Raceway locations include the following:
    - a. Mechanical rooms.
  - 3. Concealed in Ceilings and Interior Walls and Partitions: EMT.

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RACEWAYS AND BOXES FOR ELECTRICAL SYSTEMS

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- 4. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): FMC, except use LFMC in damp or wet locations.
  - 5. Damp or Wet Locations: GRC.
  - 6. Boxes and Enclosures: NEMA 250, Type 1, except use NEMA 250, Type 4 stainless steel in institutional and commercial kitchens and damp or wet locations.
- B. Minimum Raceway Size: 3/4-inch trade size.
- C. Raceway Fittings: Compatible with raceways and suitable for use and location.
- 1. Rigid and Intermediate Steel Conduit: Use threaded rigid steel conduit fittings unless otherwise indicated. Comply with NEMA FB 2.10.
  - 2. EMT: Use setscrew or compression, steel fittings. Comply with NEMA FB 2.10.
  - 3. Flexible Conduit: Use only fittings listed for use with flexible conduit. Comply with NEMA FB 2.20.
- D. Install surface raceways only where indicated on Drawings.

3.02 INSTALLATION

- A. Comply with NECA 1 and NECA 101 for installation requirements except where requirements on Drawings or in this article are stricter. Comply with NECA 102 for aluminum conduits. Comply with NFPA 70 limitations for types of raceways allowed in specific occupancies and number of floors.
- B. Keep raceways at least 6 inches (150 mm) away from parallel runs of flues and steam or hot-water pipes. Install horizontal raceway runs above water and steam piping.
- C. Complete raceway installation before starting conductor installation.
- D. Comply with requirements in Section 260529 "Hangers and Supports for Electrical Systems" for hangers and supports.
- E. Arrange stub-ups so curved portions of bends are not visible above finished slab.
- F. Install no more than the equivalent of three 90-degree bends in any conduit run except for control wiring conduits, for which fewer bends are allowed. Support within 12 inches (300 mm) of changes in direction.
- G. Conceal conduit and EMT within finished walls, ceilings, and floors unless otherwise indicated. Install conduits parallel or perpendicular to building lines.
- H. Support conduit within 12 inches (300 mm) of enclosures to which attached.
- I. Stub-ups to Above Recessed Ceilings:
  - 1. Use EMT for raceways.
  - 2. Use a conduit bushing or insulated fitting to terminate stub-ups not terminated in hubs or in an enclosure.

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RACEWAYS AND BOXES FOR ELECTRICAL SYSTEMS

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- J. Threaded Conduit Joints, Exposed to Wet, Damp, Corrosive, or Outdoor Conditions: Apply listed compound to threads of raceway and fittings before making up joints. Follow compound manufacturer's written instructions.
- K. Raceway Terminations at Locations Subject to Moisture or Vibration: Use insulating bushings to protect conductors including conductors smaller than No. 4 AWG.
- L. 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 (35mm) trade size and insulated throat metal bushings on 1-1/2-inch (41-mm) trade size and larger conduits terminated with locknuts. Install insulated throat metal grounding bushings on service conduits.
- M. Install raceways square to the enclosure and terminate at enclosures with locknuts. Install locknuts hand tight plus 1/4 turn more.
- N. Do not rely on locknuts to penetrate nonconductive coatings on enclosures. Remove coatings in the locknut area prior to assembling conduit to enclosure to assure a continuous ground path.
- O. Cut conduit perpendicular to the length. For conduits 2-inch (53-mm) trade size and larger, use roll cutter or a guide to make cut straight and perpendicular to the length.
- P. Install pull wires in empty raceways. Use polypropylene or monofilament plastic line with not less than 200-lb (90-kg) tensile strength. Leave at least 12 inches (300 mm) of slack at each end of pull wire. Cap underground raceways designated as spare above grade alongside raceways in use.
- Q. Surface Raceways:
  - 1. Install surface raceway with a minimum 2-inch (50-mm) radius control at bend points.
  - 2. Secure surface raceway with screws or other anchor-type devices at intervals not exceeding 48 inches (1200 mm) and with no less than two supports per straight raceway section. Support surface raceway according to manufacturer's written instructions. Tape and glue are not acceptable support methods.
- R. Flexible Conduit Connections: Comply with NEMA RV 3. Use a maximum of 72 inches (1830 mm) of flexible conduit for recessed and semirecessed luminaires, equipment subject to vibration, noise transmission, or movement; and for transformers and motors.
  - 1. Use LFMC in damp or wet locations subject to severe physical damage.
  - 2. Use LFMC in damp or wet locations not subject to severe physical damage.
- S. Mount boxes at heights indicated on Drawings. If mounting heights of boxes are not individually indicated, give priority to ADA requirements. Install boxes with height measured to center of box unless otherwise indicated.
- T. Horizontally separate boxes mounted on opposite sides of walls so they are not in the same vertical channel.

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RACEWAYS AND BOXES FOR ELECTRICAL SYSTEMS

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- U. Locate boxes so that cover or plate will not span different building finishes.
- V. Support boxes of three gangs or more from more than one side by spanning two framing members or mounting on brackets specifically designed for the purpose.
- W. Fasten junction and pull boxes to or support from building structure. Do not support boxes by conduits.

3.03 SLEEVE AND SLEEVE-SEAL INSTALLATION FOR ELECTRICAL PENETRATIONS

- A. Install sleeves and sleeve seals at penetrations of exterior floor and wall assemblies. Comply with requirements in Section 260544 "Sleeves and Sleeve Seals for Electrical Raceways and Cabling."

3.04 FIRESTOPPING

- A. Install firestopping at penetrations of fire-rated floor and wall assemblies. Comply with requirements in Section "Penetration Firestopping."

3.05 PROTECTION

- A. Protect coatings, finishes, and cabinets from damage and deterioration.
  - 1. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.

END OF SECTION 26 05 33

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SURFACE RACEWAYS FOR ELECTRICAL SYSTEMS

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SECTION 26 05 33.23 - SURFACE RACEWAYS FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Surface raceway systems.
- B. Dual-compartment raceway systems.
- C. Wireways.
- D. Under-carpet tile raceway systems.
- E. Overfloor raceway systems.

1.02 RELATED REQUIREMENTS

- A. Section 260526 - Grounding and Bonding for Electrical Systems.
- B. Section 260529 - Hangers and Supports for Electrical Systems.
- C. Section 260533.13 - Conduit for Electrical Systems.
- D. Section 260533.16 - Boxes for Electrical Systems.
- E. Section 260553 - Identification for Electrical Systems: Identification products and requirements.

1.03 REFERENCE STANDARDS

- A. NECA 1 - Standard for Good Workmanship in Electrical Construction 2015.
- B. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- C. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum) 2020.
- D. NEMA PRP 5 - Installation Guidelines for Surface Nonmetallic Raceway 2021.
- E. UL 5 - Surface Metal Raceways and Fittings Current Edition, Including All Revisions.
- F. UL 5A - Nonmetallic Surface Raceways and Fittings Current Edition, Including All Revisions.
- G. UL 111 - Outline of Investigation for Multioutlet Assemblies Current Edition, Including All Revisions.

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SURFACE RACEWAYS FOR ELECTRICAL SYSTEMS

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- H. UL 870 - Wireways, Auxiliary Gutters, and Associated Fittings Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
1. Coordinate the placement of raceways with millwork, furniture, equipment, etc. installed under other sections or by others.
  2. Coordinate rough-in locations of outlet boxes provided under Section 260533.16 and conduit provided under Section 260533.13 as required for installation of raceways provided under this section.
  3. Verify minimum sizes of raceways with the actual conductors and components to be installed.
  4. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.
- B. Sequencing:
1. Do not install raceways until final surface finishes and painting are complete.
  2. Do not begin installation of conductors and cables until installation of raceways is complete between outlet, junction and splicing points.

1.05 SUBMITTALS

- A. Product Data: Provide manufacturer's standard catalog pages and data sheets including dimensions, knockout sizes and locations, materials, fabrication details, finishes, service condition requirements, and accessories.
1. Surface Raceway Systems: Include information on fill capacities for conductors and cables.
- B. Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

1.06 QUALITY ASSURANCE

- A. Comply with requirements of NFPA 70.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Receive, inspect, handle, and store products in accordance with manufacturer's instructions.

PART 2 PRODUCTS

2.01 RACEWAY REQUIREMENTS

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SURFACE RACEWAYS FOR ELECTRICAL SYSTEMS

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- A. Provide all components, fittings, supports, and accessories required for a complete raceway system.
- B. Provide products listed, classified, and labeled as suitable for the purpose intended.
- C. Do not use raceways for applications other than as permitted by NFPA 70 and product listing.

2.02 SURFACE RACEWAY SYSTEMS

- A. Manufacturers:
  - 1. Wiremold, a brand of Legrand North America, Inc: [www.legrand.us/#sle](http://www.legrand.us/#sle).
  - 2. Hubbell Incorporated: [www.hubbell.com/#sle](http://www.hubbell.com/#sle).
  - 3. MonoSystems, Inc: [www.monosystems.com/#sle](http://www.monosystems.com/#sle).
- B. Surface Metal Raceways: Listed and labeled as complying with UL 5.
- C. Surface Nonmetallic Raceways: Listed and labeled as complying with UL 5A.
- D. Multioutlet Assemblies: Listed and labeled as complying with UL 111.

2.03 DUAL-COMPARTMENT SURFACE RACEWAY SYSTEMS

- A. Manufacturers:
  - 1. Wiremold, a brand of Legrand North America, Inc: [www.legrand.us/#sle](http://www.legrand.us/#sle). (4000 Series)
  - 2. Hubbell Incorporated: [www.hubbell.com/#sle](http://www.hubbell.com/#sle).
  - 3. MonoSystems, Inc: [www.monosystems.com/#sle](http://www.monosystems.com/#sle).
- B. Galvanized steel base with snap-on covers.
- C. Manufacturer's standard enamel finish in color selected by Architect.
- D. Wiring Channels: Dual. Multiple channels must be capable of housing a standard 20A device flush within the raceway.

2.04 WIREWAYS

- A. Manufacturers:
  - 1. Cooper B-Line, a division of Cooper Industries: [www.cooperindustries.com/#sle](http://www.cooperindustries.com/#sle).
  - 2. Hoffman, a brand of Pentair Technical Products: [www.hoffmanonline.com/#sle](http://www.hoffmanonline.com/#sle).
  - 3. Schneider Electric; Square D Products: [www.schneider-electric.us/#sle](http://www.schneider-electric.us/#sle).
- B. Description: Lay-in wireways and wiring troughs with removable covers; listed and labeled as complying with UL 870.
- C. Wireway Type, Unless Otherwise Indicated:
  - 1. Indoor Clean, Dry Locations: NEMA 250, Type 1, painted steel with screw-cover.

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SURFACE RACEWAYS FOR ELECTRICAL SYSTEMS

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- 2. Outdoor Locations: NEMA 250, Type 3R, painted steel with screw-cover; include provision for padlocking.
- D. Finish for Painted Steel Wireways: Manufacturer's standard grey unless otherwise indicated.
- E. Minimum Wireway Size: 4 by 4 inches (100 by 100 mm) unless otherwise indicated.
- F. Where wireway size is not indicated, size to comply with NFPA 70 but not less than applicable minimum size requirements specified.

2.05 UNDER-CARPET TILE RACEWAY SYSTEMS

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
  - 1. Legrand (Connectrac) - Flex System.
- B. Description: Modular under-carpet tile power, data and audio/visual distribution system.
- C. Source Limitations: Obtain under-carpet tile raceway components for each system through single source from single manufacturer.
- D. Material: Galvanized steel raceway with polycarbonate plastic components.
- E. Number of Longitudinal Channels: Three (communication, pre-wired power, communication) separated by steel wall(s).
- F. Service Raceways: Fitted with modular inserts.
  - 1. Nominal Multichannel Underfloor Raceway Dimensions:
    - a. Overall Depth: 0.66-inch.
    - b. Overall Width: 4-inch.
    - c. Interior Pre-wired Power Service Channel (approx.): 2.8-inch (width) x 0.43-inch (depth)
    - d. Interior Communication Service Channel (typical of each channel): 0.6-inch (width) x 0.43-inch (depth). Sized for two (2) CAT 6 data cables.
  - 2. Modular Inserts: Rectangular.
    - a. Receptacle Module
      - 1) Four (4) NEMA 5-20R receptacles
        - a) Single-Circuit
    - b. Data Module
      - 1) Sized to accommodate up to eight (8) keystone modules.
    - c. A/V Module
      - 1) Sized to hold any standard double-gang faceplate.
  - 3. Surface-Mounted Entrance Fitting

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SURFACE RACEWAYS FOR ELECTRICAL SYSTEMS

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- 1) Provide with 3-foot pre-wired power whip, 2-foot surface mounted extruded aluminum wall channel kit and transition adapter.
4. In-Wall Entrance Fitting
  - 1) Provide with 15-foot pre-wired power whip and base trim.
5. Furnish and install all power extenders, under-carpet raceway covers, under-carpet transition ramps and under-carpet end ramps as required by manufacturer for layout shown on Drawings.

2.06 OVERFLOOR RACEWAY SYSTEMS

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
  1. Legrand – OFR Series Raceway
- B. Description: Low profile, surface mounted, multi-channel raceway. Raceway must meet ADA Accessibility Guidelines (ADA Standard 4.5).
- C. Source Limitations: Obtain overfloor raceway components for each system through single source from single manufacturer.
- D. Material:
  1. Base: Aluminum.
  2. Cover: Aluminum.
- E. Finish: Black powder coat
- F. Number of Longitudinal Channels: Four separated by aluminum wall(s).
- G. Additional System Components:
  1. 4-Gang Device Box: Divided four-gang device box allowing multiple services at a single-point-of-use. Divider shall be removable and capable of being repositioned.
  2. Raceway Transition Box: Shall allow for transition from overfloor raceway system to dual-compartment raceway. Divider shall be removable and capable of being repositioned.

2.07 SOURCE QUALITY CONTROL

- A. Factory test each production unit for pre-wired surface raceway systems to verify proper wiring.

PART 3 EXECUTION

3.01 EXAMINATION

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SURFACE RACEWAYS FOR ELECTRICAL SYSTEMS

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- A. Verify that field measurements are as indicated.
- B. Verify that outlet boxes and conduit terminations are installed in proper locations and are properly sized in accordance with NFPA 70 to accommodate raceways.
- C. Verify that mounting surfaces are ready to receive raceways and that final surface finishes are complete, including painting.
- D. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

- A. Install products in accordance with manufacturer's instructions.
- B. Perform work in accordance with NECA 1 (general workmanship).
- C. Surface Nonmetallic Raceways: Install in accordance with NEMA PRP 5.
- D. Install raceways plumb and level.
- E. Arrange wireways and associated raceway connections to comply with NFPA 70, including but not limited to requirements for deflected conductors and wireways used as pullboxes. Increase size of wireway where necessary.
- F. Secure and support raceways in accordance with Section 260529 at intervals complying with NFPA 70 and manufacturer's requirements.
- G. Close unused raceway openings.
- H. Provide grounding and bonding in accordance with Section 260526.
- I. Identify raceways in accordance with Section 260553.

3.03 FIELD QUALITY CONTROL

- A. Inspect raceways for damage and defects.
- B. Surface Raceway Systems with Integrated Devices: Test each wiring device to verify operation and proper polarity.
- C. Correct wiring deficiencies and replace damaged or defective raceways.

3.04 CLEANING

- A. Clean exposed surfaces to remove dirt, paint, or other foreign material and restore to match original factory finish.

3.05 PROTECTION

- A. Protect installed raceways from subsequent construction operations.

SURFACE RACEWAYS FOR ELECTRICAL SYSTEMS

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END OF SECTION 26 05 33.23

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SLEEVES AND SLEEVE SEALS FOR ELECTRICAL RACEWAYS AND CABLING

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SECTION 26 05 44 - SLEEVES AND SLEEVE SEALS FOR ELECTRICAL RACEWAYS AND CABLING

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

- A. Section Includes:
  - 1. Sleeves for raceway and cable penetration of non-fire-rated construction walls and floors.
  - 2. Grout.
  - 3. Silicone sealants.
- B. Related Requirements:
  - 1. Section "Penetration Firestopping" for penetration firestopping installed in fire-resistance-rated walls, horizontal assemblies, and smoke barriers, with and without penetrating items.

PART 1 PRODUCTS

2.01 SLEEVES

- A. Wall Sleeves:
  - 1. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, zinc coated, plain ends.
  - 2. Cast-Iron Pipe Sleeves: Cast or fabricated "wall pipe," equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop unless otherwise indicated.
- B. Sleeves for Conduits Penetrating Non-Fire-Rated Gypsum Board Assemblies: Galvanized-steel sheet; 0.0239-inch (0.6-mm) minimum thickness; round tube closed with welded longitudinal joint, with tabs for screw-fastening the sleeve to the board.
- C. Sleeves for Rectangular Openings:
  - 1. Material: Galvanized sheet steel.
  - 2. Minimum Metal Thickness:

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SLEEVES AND SLEEVE SEALS FOR ELECTRICAL RACEWAYS AND CABLING

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- a. For sleeve cross-section rectangle perimeter less than 50 inches (1270 mm) and with no side larger than 16 inches (400 mm), thickness shall be 0.052 inch (1.3 mm).
- b. For sleeve cross-section rectangle perimeter 50 inches (1270 mm) or more and one or more sides larger than 16 inches (400 mm), thickness shall be 0.138 inch (3.5 mm).

2.02 GROUT

- A. Description: Nonshrink; recommended for interior and exterior sealing openings in non-fire-rated walls or floors.
- B. Standard: ASTM C 1107/C 1107M, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.
- C. Design Mix: 5000-psi (34.5-MPa), 28-day compressive strength.
- D. Packaging: Premixed and factory packaged.

2.03 SILICONE SEALANTS

- A. Silicone Sealants: Single-component, silicone-based, neutral-curing elastomeric sealants of grade indicated below.
  - 1. Grade: Pourable (self-leveling) formulation for openings in floors and other horizontal surfaces that are not fire rated.
  - 2. Sealant shall have VOC content as calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- B. Silicone Foams: Multicomponent, silicone-based liquid elastomers that, when mixed, expand and cure in place to produce a flexible, nonshrinking foam.

PART 1 EXECUTION

3.01 SLEEVE INSTALLATION FOR NON-FIRE-RATED ELECTRICAL PENETRATIONS

- A. Comply with NECA 1.
- B. Comply with NEMA VE 2 for cable tray and cable penetrations.
- C. Sleeves for Conduits Penetrating Above-Grade Non-Fire-Rated Concrete and Masonry-Unit Floors and Walls:
  - 1. Interior Penetrations of Non-Fire-Rated Walls and Floors:
    - a. Seal annular space between sleeve and raceway or cable, using joint sealant appropriate for size, depth, and location of joint. Comply with requirements in Section "Joint Sealants."

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SLEEVES AND SLEEVE SEALS FOR ELECTRICAL RACEWAYS AND CABLING

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- b. Seal space outside of sleeves with mortar or grout. Pack sealing material solidly between sleeve and wall so no voids remain. Tool exposed surfaces smooth; protect material while curing.
  - 2. Use pipe sleeves unless penetration arrangement requires rectangular sleeved opening.
  - 3. Size pipe sleeves to provide 1/4-inch (6.4-mm) annular clear space between sleeve and raceway or cable unless sleeve seal is to be installed.
  - 4. Install sleeves for wall penetrations unless core-drilled holes or formed openings are used. Install sleeves during erection of walls. Cut sleeves to length for mounting flush with both surfaces of walls. Deburr after cutting.
  - 5. Install sleeves for floor penetrations. Extend sleeves installed in floors 2 inches (50 mm) above finished floor level. Install sleeves during erection of floors.
- D. Sleeves for Conduits Penetrating Non-Fire-Rated Gypsum Board Assemblies:
- 1. Use circular metal sleeves unless penetration arrangement requires rectangular sleeved opening.
  - 2. Seal space outside of sleeves with approved joint compound for gypsum board assemblies.

END OF SECTION 26 05 44

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## IDENTIFICATION FOR ELECTRICAL SYSTEMS

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### SECTION 26 05 53 - IDENTIFICATION FOR ELECTRICAL SYSTEMS

#### PART 1 GENERAL

##### 1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

##### 1.02 SUMMARY

- A. Section Includes:
  - 1. Identification for raceways.
  - 2. Identification of power and control cables.
  - 3. Identification for conductors.
  - 4. Warning labels and signs.
  - 5. Instruction signs.
  - 6. Equipment identification labels, including arc-flash warning labels.
  - 7. Miscellaneous identification products.

##### 1.03 ACTION SUBMITTALS

- A. Product Data: For each type of product.
  - 1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for electrical identification products.

#### PART 1 PRODUCTS

##### 2.01 PERFORMANCE REQUIREMENTS

- A. Comply with ASME A13.1.
- B. Comply with NFPA 70.
- C. Comply with 29 CFR 1910.144 and 29 CFR 1910.145.
- D. Comply with ANSI Z535.4 for safety signs and labels.
- E. Adhesive-attached labeling materials, including label stocks, laminating adhesives, and inks used by label printers, shall comply with UL 969.
- F. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes.

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IDENTIFICATION FOR ELECTRICAL SYSTEMS

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1. Temperature Change: 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.

2.02 COLOR AND LEGEND REQUIREMENTS

- A. Raceways and Cables Carrying Circuits at 600 V or Less:
  1. Black letters on an orange field.
  2. Legend: Indicate voltage and system or service type.
- B. Warning labels and signs shall include, but are not limited to, the following legends:
  1. Multiple Power Source Warning: "DANGER - ELECTRICAL SHOCK HAZARD - EQUIPMENT HAS MULTIPLE POWER SOURCES."
  2. Workspace Clearance Warning: "WARNING - OSHA REGULATION - AREA IN FRONT OF ELECTRICAL EQUIPMENT MUST BE KEPT CLEAR FOR MIN OF 36 INCHES (915 MM)."

2.03 LABELS

- A. Self-Adhesive Labels:
  1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
    - a. Brady Corporation.
    - b. Ideal Industries, Inc.
    - c. Marking Services, Inc.
    - d. Panduit Corp.
    - e. Seton Identification Products.
  2. Preprinted, 3-mil- (0.08-mm-) thick, polyester flexible label with acrylic pressure-sensitive adhesive.
    - a. Self-Lamination: Clear; UV-, weather- and chemical-resistant; self-laminating, protective shield over the legend. Labels sized to fit the raceway diameter, such that the clear shield overlaps the entire printed legend.
  3. Vinyl, thermal, transfer-printed, 3-mil- (0.08-mm-) thick, multicolor, weather- and UV-resistant, pressure-sensitive adhesive labels, configured for display on front cover, door, or other access to equipment unless otherwise indicated.
    - a. Nominal Size: 3.5-by-5-inch (76-by-127-mm).
  4. Marker for Tags: Machine-printed, permanent, waterproof, black ink recommended by printer manufacturer.

2.04 TAPES:

- A. Marker Tapes: Vinyl or vinyl-cloth, self-adhesive wraparound type, with circuit identification legend machine printed by thermal transfer or equivalent process.

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IDENTIFICATION FOR ELECTRICAL SYSTEMS

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1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
  - a. Carlton Industries, LP.
  - b. Ideal Industries, Inc.
  - c. Panduit Corp.
- B. Self-Adhesive Vinyl Tape: Colored, heavy duty, waterproof, fade resistant; not less than 3 mils (0.08 mm) thick by 1 to 2 inches (25 to 50 mm) wide; compounded for outdoor use.
  1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
    - a. Brady Corporation.
    - b. Carlton Industries, LP.
    - c. Marking Services, Inc.
- C. Floor Marking Tape: 2-inch- (50-mm-) wide, 5-mil (0.125-mm) pressure-sensitive vinyl tape, with yellow and black stripes and clear vinyl overlay.
  1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
    - a. Carlton Industries, LP.
    - b. Seton Identification Products.
  2. Color and Printing:
    - a. Comply with ANSI Z535.1, ANSI Z535.2, ANSI Z535.3, ANSI Z535.4, and ANSI Z535.5.
    - b. Inscriptions for Red-Colored Tapes: "ELECTRIC LINE, HIGH VOLTAGE".

2.05 Tags

- A. Nonmetallic Preprinted Tags: Polyethylene tags, 0.015 inch (0.38 mm) thick, color-coded for phase and voltage level, with factory printed permanent designations; punched for use with self-locking cable tie fastener.
  1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
    - a. Brady Corporation.
    - b. Carlton Industries, LP.
    - c. Panduit Corp.

2.06 Signs

- A. Laminated Acrylic or Melamine Plastic Signs:
  1. Engraved legend.
  2. Thickness:

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IDENTIFICATION FOR ELECTRICAL SYSTEMS

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- a. For signs up to 20 sq. inches (129 sq. cm), minimum 1/16-inch- (1.6-mm-).
  - b. For signs larger than 20 sq. inches (129 sq. cm), 1/8 inch (3.2 mm) thick.
  - c. Engraved legend with black letters on white face.
  - d. Self-adhesive.
  - e. Framed with mitered acrylic molding and arranged for attachment at applicable equipment.
3. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
- a. Brady Corporation.
  - b. Carlton Industries, LP.
  - c. emedco.
  - d. Marking Services, Inc.

2.07 CABLE TIES

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
1. Ideal Industries, Inc.
  2. Marking Services, Inc.
  3. Panduit Corp.
- B. General-Purpose Cable Ties: Fungus inert, self-extinguishing, one piece, self-locking, Type 6/6 nylon.
1. Minimum Width: 3/16 inch (5 mm).
  2. Tensile Strength at 73 deg F (23 deg C) according to ASTM D 638: 12,000 psi (82.7 MPa).
  3. Temperature Range: Minus 40 to plus 185 deg F (Minus 40 to plus 85 deg C).
  4. Color: Black, except where used for color-coding.
- C. UV-Stabilized Cable Ties: Fungus inert, designed for continuous exposure to exterior sunlight, self-extinguishing, one piece, self-locking, Type 6/6 nylon.
1. Minimum Width: 3/16 inch (5 mm).
  2. Tensile Strength at 73 deg F (23 deg C) according to ASTM D 638: 12,000 psi (82.7 MPa).
  3. Temperature Range: Minus 40 to plus 185 deg F (Minus 40 to plus 85 deg C).
  4. Color: Black.
- D. Plenum-Rated Cable Ties: Self-extinguishing, UV stabilized, one piece, self-locking.
1. Minimum Width: 3/16 inch (5 mm).
  2. Tensile Strength at 73 deg F (23 deg C) according to ASTM D 638: 7000 psi (48.2 MPa).
  3. UL 94 Flame Rating: 94V-0.
  4. Temperature Range: Minus 50 to plus 284 deg F (Minus 46 to plus 140 deg C).
  5. Color: Black.



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IDENTIFICATION FOR ELECTRICAL SYSTEMS

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2.08 MISCELLANEOUS IDENTIFICATION PRODUCTS

- A. Paint: Comply with requirements in painting Sections for paint materials and application requirements. Retain paint system applicable for surface material and location (exterior or interior).
- B. Fasteners for Labels and Signs: Self-tapping, stainless-steel screws or stainless-steel machine screws with nuts and flat and lock washers.

PART 1 EXECUTION

3.01 PREPARATION

- A. Self-Adhesive Identification Products: Before applying electrical identification products, clean substrates of substances that could impair bond, using materials and methods recommended by manufacturer of identification product.

3.02 INSTALLATION

- A. Verify and coordinate identification names, abbreviations, colors, and other features with requirements in other Sections requiring identification applications, Drawings, Shop Drawings, manufacturer's wiring diagrams, and operation and maintenance manual. Use consistent designations throughout Project.
- B. Install identifying devices before installing acoustical ceilings and similar concealment.
- C. Verify identity of each item before installing identification products.
- D. Install identification materials and devices at locations for most convenient viewing without interference with operation and maintenance of equipment. Install access doors or panels to provide view of identifying devices.
- E. Apply identification devices to surfaces that require finish after completing finish work.
- F. Attach signs and plastic labels that are not self-adhesive type with mechanical fasteners appropriate to the location and substrate.
- G. Attach plastic raceway and cable labels that are not self-adhesive type with clear vinyl tape, with adhesive appropriate to the location and substrate.
- H. Cable Ties: For attaching tags. Use general-purpose type, except as listed below:
  - 1. Outdoors: UV-stabilized nylon.
  - 2. In Spaces Handling Environmental Air: Plenum rated.
- I. Painted Identification: Comply with requirements in painting Sections for surface preparation and paint application.
- J. System Identification Color-Coding Bands for Raceways and Cables: Each color-coding band shall completely encircle cable or conduit. Place adjacent bands of two-

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IDENTIFICATION FOR ELECTRICAL SYSTEMS

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color markings in contact, side by side. Locate bands at changes in direction, at penetrations of walls and floors, at 50-foot (15-m) maximum intervals in straight runs, and at 25-foot (7.6-m) maximum intervals in congested areas.

3.03 IDENTIFICATION SCHEDULE

- A. Accessible Raceways and Metal-Clad Cables, 600 V or Less, for Service, Feeder, and Branch Circuits, More Than 30A and 120V to Ground: Identify with self-adhesive vinyl label. Install labels at 30-foot (10-m) maximum intervals.
- B. Accessible Raceways and Cables within Buildings: Identify the covers of each junction and pull box of the following systems with self-adhesive vinyl labels containing the wiring system legend and system voltage. System legends shall be as follows:
  - 1. "EMERGENCY POWER."
  - 2. "POWER."
- C. Power-Circuit Conductor Identification, 600 V or Less: For conductors in pull and junction boxes, use color-coding conductor tape to identify the phase.
  - 1. Color-Coding for Phase- and Voltage-Level Identification, 600 V or Less: Use colors listed below for ungrounded feeder and branch-circuit conductors.
    - a. Color shall be factory applied or field applied for sizes larger than No. 8 AWG if authorities having jurisdiction permit.
    - b. Colors for 208/120-V Circuits:
      - 1) Phase A: Black.
      - 2) Phase B: Red.
      - 3) Phase C: Blue.
    - c. Colors for 480/277-V Circuits:
      - 1) Phase A: Brown.
      - 2) Phase B: Orange.
      - 3) Phase C: Yellow.
    - d. Field-Applied, Color-Coding Conductor Tape: Apply in half-lapped turns for a minimum distance of 6 inches (150 mm) from terminal points and in boxes where splices or taps are made. Apply last two turns of tape with no tension to prevent possible unwinding. Locate bands to avoid obscuring factory cable markings.
- D. Install instructional sign, including the color code for grounded and ungrounded conductors using adhesive-film-type labels.
- E. Control-Circuit Conductor Identification: For conductors and cables in pull and junction boxes, manholes, and handholes, use self-adhesive, self-laminating polyester labels with the conductor or cable designation, origin, and destination.
- F. Control-Circuit Conductor Termination Identification: For identification at terminations, provide self-adhesive, self-laminating polyester labels with the conductor designation.
- G. Conductors To Be Extended in the Future: Attach marker tape to conductors and list source.

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IDENTIFICATION FOR ELECTRICAL SYSTEMS

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- H. Auxiliary Electrical Systems Conductor Identification: Identify field-installed alarm, control, and signal connections.
  - 1. Identify conductors, cables, and terminals in enclosures and at junctions, terminals, and pull points. Identify by system and circuit designation.
  - 2. Use system of marker-tape designations that is uniform and consistent with system used by manufacturer for factory-installed connections.
  - 3. Coordinate identification with Project Drawings, manufacturer's wiring diagrams, and operation and maintenance manual.
- I. Workspace Indication: Install floor marking tape to show working clearances in the direction of access to live parts. Workspace shall comply with NFPA 70 and 29 CFR 1926.403 unless otherwise indicated. Do not install at flush-mounted panelboards and similar equipment in finished spaces.
- J. Warning Labels for Indoor Cabinets, Boxes, and Enclosures for Power and Lighting: Self-adhesive warning labels.
  - 1. Comply with 29 CFR 1910.145.
  - 2. Identify system voltage with black letters on an orange background.
  - 3. Apply to exterior of door, cover, or other access.
  - 4. For equipment with multiple power or control sources, apply to door or cover of equipment, including, but not limited to, the following:
    - a. Power-transfer switches.
    - b. Controls with external control power connections.
- K. Arc Flash Warning Labeling: Self-adhesive thermal transfer vinyl labels.
  - 1. Comply with NFPA 70E and ANSI Z535.4.
  - 2. Comply with Section 260574 "Overcurrent Protective Device Arc-Flash Study" requirements for arc-flash warning labels.
- L. Operating Instruction Signs: Install instruction signs to facilitate proper operation and maintenance of electrical systems and items to which they connect. Install instruction signs with approved legend where instructions are needed for system or equipment operation.
- M. Equipment Identification Labels: On each unit of equipment, install unique designation label that is consistent with wiring diagrams, schedules, and operation and maintenance manual. Apply labels to disconnect switches and protection equipment, central or master units, control panels, control stations, terminal cabinets, and racks of each system. Systems include power, lighting, control, communication, signal, monitoring, and alarm unless equipment is provided with its own identification.
  - 1. Labeling Instructions:
    - a. Indoor Equipment: Engraved, laminated acrylic or melamine plastic label, punched or drilled for mechanical fasteners. Unless otherwise indicated, provide a single line of text with 1/2-inch- (13-mm-) high letters on 1-1/2-inch- (38-mm-) high label; where two lines of text are required, use labels 2 inches (50 mm) high.
    - b. Outdoor Equipment: Engraved, laminated acrylic or melamine label.

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IDENTIFICATION FOR ELECTRICAL SYSTEMS

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- c. Elevated Components: Increase sizes of labels and letters to those appropriate for viewing from the floor.
  - d. Unless labels are provided with self-adhesive means of attachment, fasten them with appropriate mechanical fasteners that do not change the NEMA or NRTL rating of the enclosure.
  - e. Receptacles: Provide vinyl self-adhesive labels (clear with black labeling) on the front covers of all receptacles identifying panel and circuit designation.
2. Equipment To Be Labeled:
- a. Panelboards: Typewritten directory of circuits in the location provided by panelboard manufacturer. Panelboard identification shall be in the form of a self-adhesive, engraved, laminated acrylic or melamine label.
  - b. Enclosures and electrical cabinets.
  - c. Access doors and panels for concealed electrical items.
  - d. Switchgear.
  - e. Switchboards.
  - f. Transformers: Label that includes tag designation shown on Drawings for the transformer, feeder, and panelboards or equipment supplied by the secondary.
  - g. Substations.
  - h. Emergency system boxes and enclosures.
  - i. Enclosed switches.
  - j. Enclosed circuit breakers.
  - k. Enclosed controllers.
  - l. Variable-speed controllers.
  - m. Remote-controlled switches, dimmer modules, and control devices.
  - n. Monitoring and control equipment.
  - o. UPS equipment.

END OF SECTION 26 05 53

## LIGHTING CONTROL DEVICES

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### SECTION 26 09 23 - LIGHTING CONTROL DEVICES

#### PART 1 GENERAL

##### 1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

##### 1.02 SUMMARY

- A. Section Includes:
  - 1. Indoor ceiling sensors.
  - 2. Switchbox-mounted sensors.
  - 3. Emergency shunt relays.
- B. Related Requirements:
  - 1. Section 262726 "Wiring Devices" for wall-box dimmers and manual light switches.

##### 1.03 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: Show installation details for occupancy and light-level sensors.
  - 1. Interconnection diagrams showing field-installed wiring.
  - 2. Include diagrams for power, signal, and control wiring.

##### 1.04 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For each type of lighting control device to include in emergency, operation, and maintenance manuals.

#### PART 1 PRODUCTS

##### 2.01 INDOOR CEILING SENSORS

- A. Manufacturers:
  - 1. Acuity SensorSwitch
  - 2. Legrand Wattstopper
  - 3. Steinel

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LIGHTING CONTROL DEVICES

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4. Sensorworx

- B. General Requirements for Sensors: Ceiling-mounted, solid-state indoor sensors.
1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
  2. Shall be capable of being used as either a vacancy sensor (manual-on) or occupancy sensor.
    - a. Occupancy Mode: Turn lights on when coverage area is occupied, and turn them off when unoccupied; with a time delay for turning lights off, adjustable over a minimum range of 1 to 15 minutes.
    - b. Vacancy Mode: Requires occupant to manually turn lights on when they enter the coverage area, however sensor shall automatically turn them off when coverage area becomes unoccupied; with a time delay for turning lights off, adjustable over a minimum range of 1 to 15 minutes.
  3. Sensor Output: Contacts rated to operate the connected relay, complying with UL 773A. Sensor is powered from the power pack.
  4. Power Pack:
    - a. Dry contacts rated for 20-A ballast load at 120- and 277-V ac, for 13-A tungsten at 120-V ac, and for 1 hp at 120-V ac. Sensor has 24-V dc, 150-mA, Class 2 power source, as defined by NFPA 70.
    - b. Capable of 0-10V dimming.
  5. Mounting:
    - a. Sensor: Suitable for mounting in any position on a standard outlet box.
    - b. Relay: Externally mounted through a 1/2-inch (13-mm) knockout in a standard electrical enclosure.
    - c. Time-Delay and Sensitivity Adjustments: Recessed and concealed behind hinged door.
  6. Indicator: LED light, to show when motion is detected during testing and normal operation of sensor.
  7. Bypass Switch: Override the "on" function in case of sensor failure.
  8. Automatic Light-Level Sensor: Adjustable from 2 to 200 fc (21.5 to 2152 lux); turn lights off when selected lighting level is present.
- C. PIR Type: Ceiling mounted; detect occupants in coverage area by their heat and movement.
1. Detector Sensitivity: Detect occurrences of 6-inch- (150-mm-) minimum movement of any portion of a human body that presents a target of not less than 36 sq. in. (232 sq. cm).
  2. Detection Coverage (Room): Detect occupancy anywhere in a circular area of 1000 sq. ft. (93 sq. m) when mounted on a 96-inch- (2440-mm-) high ceiling.
  3. Detection Coverage (Corridor): Detect occupancy within 90 feet (27.4 m) when mounted on a 10-foot- (3-m-) high ceiling.

2.02 SWITCHBOX-MOUNTED SENSORS

A. Manufacturers:

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LIGHTING CONTROL DEVICES

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1. Acuity Sensorswitch
  2. Legrand Wattstopper
  3. Steinel
  4. Sensorworx
- B. General Requirements for Sensors: Automatic-wall-switch occupancy sensor, suitable for mounting in a single gang switchbox.
1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application[, and shall comply with California Title 24].
  2. Operating Ambient Conditions: Dry interior conditions, 32 to 120 deg F (0 to 49 deg C).
  3. Switch Rating: Not less than 800-VA fluorescent at 120 V, 1200-VA fluorescent at 277 V, and 800-W incandescent.
- C. Wall-Switch Sensor:
1. Standard Range: 180-degree field of view, field adjustable from 180 to 40 degrees; with a minimum coverage area of 900 sq. ft. (84 sq. m).
  2. Sensing Technology: PIR.
  3. Switch Type: SP, field selectable automatic "on," or manual "on" automatic "off."
  4. Voltage: Dual voltage, 120 and 277 V; passive-infrared type.
  5. Ambient-Light Override: Concealed, field-adjustable, light-level sensor from 10 to 150 fc (108 to 1600 lux). The switch prevents the lights from turning on when the light level is higher than the set point of the sensor.
  6. Concealed, field-adjustable, "off" time-delay selector at up to 30 minutes.
  7. Concealed "off" time-delay selector at 30 seconds, and 5, 10, and 20 minutes.
  8. Adaptive Technology: Self-adjusting circuitry detects and memorizes usage patterns of the space and helps eliminate false "off" switching.
  9. Provide with integral 0-10V dimmer where called for.

## 2.03 EMERGENCY SHUNT RELAY

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
1. Lighting Control and Design.
  2. Watt Stopper.
- B. Description: Normally closed, electrically held relay, arranged for wiring in parallel with manual or automatic switching contacts; complying with UL 924.
1. Coil Rating: 120 V.

## 2.04 CONDUCTORS AND CABLES

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LIGHTING CONTROL DEVICES

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- A. Power Wiring to Supply Side of Remote-Control Power Sources: Not smaller than No. 12 AWG. Comply with requirements in Section 260519 "Low-Voltage Electrical Power Conductors and Cables."
- B. Classes 2 and 3 Control Cable: Multiconductor cable with stranded-copper conductors not smaller than No. 18 AWG. Comply with requirements in Section 260519 "Low-Voltage Electrical Power Conductors and Cables."
- C. Class 1 Control Cable: Multiconductor cable with stranded-copper conductors not smaller than No. 14 AWG. Comply with requirements in Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

PART 1 EXECUTION

3.01 SENSOR INSTALLATION

- A. Coordinate layout and installation of ceiling-mounted devices with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, smoke detectors, fire-suppression systems, and partition assemblies.
- B. Install and aim sensors in locations to achieve not less than 90 percent coverage of areas indicated. Do not exceed coverage limits specified in manufacturer's written instructions.

3.02 CONTACTOR INSTALLATION

- A. Mount electrically held lighting contactors with elastomeric isolator pads to eliminate structure-borne vibration, unless contactors are installed in an enclosure with factory-installed vibration isolators.

3.03 WIRING INSTALLATION

- A. Wiring Method: Comply with Section 260519 "Low-Voltage Electrical Power Conductors and Cables." Minimum conduit size is 1/2 inch (13 mm).
- B. Wiring within Enclosures: Comply with NECA 1. Separate power-limited and nonpower-limited conductors according to conductor manufacturer's written instructions.
- C. Size conductors according to lighting control device manufacturer's written instructions unless otherwise indicated.
- D. Splices, Taps, and Terminations: Make connections only on numbered terminal strips in junction, pull, and outlet boxes; terminal cabinets; and equipment enclosures.

3.04 IDENTIFICATION



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LIGHTING CONTROL DEVICES

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- A. Identify components and power and control wiring according to Section 260553 "Identification for Electrical Systems."
  - 1. Identify controlled circuits in lighting contactors.
  - 2. Identify circuits or luminaires controlled by photoelectric and occupancy sensors at each sensor.
- B. Label time switches and contactors with a unique designation.

3.05 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.
- B. Perform the following tests and inspections with the assistance of a factory-authorized service representative:
  - 1. Operational Test: After installing time switches and sensors, and after electrical circuitry has been energized, start units to confirm proper unit operation.
  - 2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- C. Lighting control devices will be considered defective if they do not pass tests and inspections.

3.06 ADJUSTING

- A. Occupancy Adjustments: When requested within 12 months from date of Substantial Completion, provide on-site assistance in adjusting sensors to suit actual occupied conditions. Provide up to two visits to Project during other-than-normal occupancy hours for this purpose.
  - 1. For occupancy and motion sensors, verify operation at outer limits of detector range. Set time delay to suit Owner's operations.
  - 2. For daylighting controls, adjust set points and deadband controls to suit Owner's operations.

3.07 DEMONSTRATION

- A. Coordinate demonstration of products specified in this Section with demonstration requirements for low-voltage and programmable lighting control systems.
- B. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain lighting control devices.

END OF SECTION 26 09 23

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## PANELBOARDS

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### SECTION 26 24 16 - PANELBOARDS

#### PART 1 GENERAL

##### 1.01 SECTION INCLUDES

- A. Power distribution panelboards.
- B. Lighting and appliance panelboards.
- C. Overcurrent protective devices for panelboards.

##### 1.02 RELATED REQUIREMENTS

- A. Section 260526 - Grounding and Bonding for Electrical Systems.
- B. Section 260529 - Hangers and Supports for Electrical Systems.
- C. Section 260553 - Identification for Electrical Systems: Identification products and requirements.
- D. Section 260573 - Power System Studies: Additional criteria for the selection and adjustment of equipment and associated protective devices specified in this section.

##### 1.03 REFERENCE STANDARDS

- A. FS W-C-375 - Circuit Breakers, Molded Case; Branch Circuit and Service 2013e (Amended 2017).
- B. NECA 1 - Standard for Good Workmanship in Electrical Construction 2015.
- C. NECA 407 - Standard for Installing and Maintaining Panelboards 2015.
- D. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum) 2020.
- E. NEMA ICS 2 - Industrial Control and Systems Controllers, Contactors and Overload Relays Rated 600 Volts 2008 (Reaffirmed 2020).
- F. NEMA PB 1 - Panelboards 2011.
- G. NEMA PB 1.1 - General Instructions for Proper Installation, Operation and Maintenance of Panelboards Rated 600 Volts or Less 2013.
- H. NETA ATS - Acceptance Testing Specifications for Electrical Power Equipment and Systems 2017.
- I. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

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PANELBOARDS

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- J. UL 50 - Enclosures for Electrical Equipment, Non-Environmental Considerations Current Edition, Including All Revisions.
- K. UL 50E - Enclosures for Electrical Equipment, Environmental Considerations Current Edition, Including All Revisions.
- L. UL 67 - Panelboards Current Edition, Including All Revisions.
- M. UL 489 - Molded-Case Circuit Breakers, Molded-Case Switches and Circuit Breaker Enclosures Current Edition, Including All Revisions.
- N. UL 869A - Reference Standard for Service Equipment Current Edition, Including All Revisions.
- O. UL 943 - Ground-Fault Circuit-Interrupters Current Edition, Including All Revisions.
- P. UL 1053 - Ground-Fault Sensing and Relaying Equipment Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
  - 1. Coordinate the work with other trades to avoid placement of ductwork, piping, equipment, or other potential obstructions within the dedicated equipment spaces and working clearances for electrical equipment required by NFPA 70.
  - 2. Coordinate arrangement of electrical equipment with the dimensions and clearance requirements of the actual equipment to be installed.
  - 3. Coordinate the work with other trades to provide walls suitable for installation of flush-mounted panelboards where indicated.
  - 4. Verify with manufacturer that conductor terminations are suitable for use with the conductors to be installed.
  - 5. Notify Engineer of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

1.05 SUBMITTALS

- A. Product Data: Provide manufacturer's standard catalog pages and data sheets for panelboards, enclosures, overcurrent protective devices, and other installed components and accessories.
- B. Shop Drawings: Indicate outline and support point dimensions, voltage, main bus ampacity, overcurrent protective device arrangement and sizes, short circuit current ratings, conduit entry locations, conductor terminal information, and installed features and accessories.
  - 1. Include dimensioned plan and elevation views of panelboards and adjacent equipment with all required clearances indicated.
  - 2. Include wiring diagrams showing all factory and field connections.

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PANELBOARDS

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- 3. Clearly indicate whether proposed short circuit current ratings are fully rated or, where acceptable, series rated systems.
  - C. Field Quality Control Test Reports.
  - D. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.
  - E. Project Record Documents: Record actual installed locations of panelboards and actual installed circuiting arrangements.
  - F. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
    - 1. Panelboard Keys: Two of each different key.
- 1.06 QUALITY ASSURANCE
- A. Comply with requirements of NFPA 70.
  - B. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.
- 1.07 DELIVERY, STORAGE, AND HANDLING
- A. Receive, inspect, handle, and store panelboards in accordance with manufacturer's instructions and NECA 407.
  - B. Store in a clean, dry space. Maintain factory wrapping or provide an additional heavy canvas or heavy plastic cover to protect units from dirt, water, construction debris, and traffic.
  - C. Handle carefully in accordance with manufacturer's written instructions to avoid damage to panelboard internal components, enclosure, and finish.
- 1.08 FIELD CONDITIONS
- A. Maintain ambient temperature within the following limits during and after installation of panelboards:
    - 1. Panelboards Containing Circuit Breakers: Between 23 degrees F (-5 degrees C) and 104 degrees F (40 degrees C).

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Schneider Electric; Square D Products[<>]: [www.schneider-electric.us/#sle](http://www.schneider-electric.us/#sle).

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PANELBOARDS

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- B. ABB/GE: [www.geindustrial.com/#sle](http://www.geindustrial.com/#sle).
- C. Eaton Corporation: [www.eaton.com/#sle](http://www.eaton.com/#sle).
- D. Source Limitations: Furnish panelboards and associated components produced by the same manufacturer as the other electrical distribution equipment used for this project and obtained from a single supplier.

2.02 PANELBOARDS - GENERAL REQUIREMENTS

- A. Provide products listed, classified, and labeled as suitable for the purpose intended.
- B. Unless otherwise indicated, provide products suitable for continuous operation under the following service conditions:
  - 1. Altitude: Less than 6,600 feet (2,000 m).
  - 2. Ambient Temperature:
    - a. Panelboards Containing Circuit Breakers: Between 23 degrees F (-5 degrees C) and 104 degrees F (40 degrees C).
- C. Short Circuit Current Rating:
  - 1. Provide panelboards with listed short circuit current rating not less than the available fault current at the installed location as determined by short circuit study performed in accordance with Section 260573.
- D. Panelboards Used for Service Entrance: Listed and labeled as suitable for use as service equipment according to UL 869A.
- E. Mains: Configure for top or bottom incoming feed as indicated or as required for the installation.
- F. Branch Overcurrent Protective Devices: Replaceable without disturbing adjacent devices.
- G. Bussing: Sized in accordance with UL 67 temperature rise requirements.
  - 1. Provide fully rated neutral bus unless otherwise indicated, with a suitable lug for each feeder or branch circuit requiring a neutral connection.
  - 2. Provide 200 percent rated neutral bus and lugs where indicated, where oversized neutral conductors are provided, or where panelboards are fed from K-rated transformers.
  - 3. Provide solidly bonded equipment ground bus in each panelboard, with a suitable lug for each feeder and branch circuit equipment grounding conductor.
  - 4. Provide separate isolated/insulated ground bus where indicated or where isolated grounding conductors are provided.
- H. Conductor Terminations: Suitable for use with the conductors to be installed.
- I. Enclosures: Comply with NEMA 250, and list and label as complying with UL 50 and UL 50E.

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PANELBOARDS

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1. Environment Type per NEMA 250: Unless otherwise indicated, as specified for the following installation locations:
    - a. Indoor Clean, Dry Locations: Type 1.
    - b. Outdoor Locations: Type 3R.
  2. Boxes: Galvanized steel unless otherwise indicated.
    - a. Provide wiring gutters sized to accommodate the conductors to be installed.
    - b. Increase gutter space as required where sub-feed lugs, feed-through lugs, gutter taps, or oversized lugs are provided.
  3. Fronts:
    - a. Fronts for Surface-Mounted Enclosures: Same dimensions as boxes.
    - b. Fronts for Flush-Mounted Enclosures: Overlap boxes on all sides to conceal rough opening.
    - c. Finish for Painted Steel Fronts: Manufacturer's standard grey unless otherwise indicated.
  4. Lockable Doors: All locks keyed alike unless otherwise indicated.
- J. Future Provisions: Prepare all unused spaces for future installation of devices including bussing, connectors, mounting hardware and all other required provisions.
- K. Panelboard Contactors: Where panelboard contactors are indicated, provide electrically operated, mechanically held magnetic contactor complying with NEMA ICS 2.
  1. Ampere Rating: Not less than ampere rating of panelboard bus.
  2. Short Circuit Current Rating: Not less than the panelboard short circuit current rating.
  3. Coil Voltage: As required for connection to control system indicated.
- L. Ground Fault Protection: Where ground-fault protection is indicated, provide system listed and labeled as complying with UL 1053.
  1. Where electronic circuit breakers equipped with integral ground fault protection are used, provide separate neutral current sensor where applicable.
- M. Selectivity: Where the requirement for selectivity is indicated, furnish products as required to achieve selective coordination.
- N. Provide the following features and accessories where indicated or where required to complete installation:
  1. Feed-through lugs.
  2. Sub-feed lugs.
- 2.03 POWER DISTRIBUTION PANELBOARDS
- A. Description: Panelboards complying with NEMA PB 1, power and feeder distribution type, circuit breaker type, and listed and labeled as complying with UL 67; ratings, configurations and features as indicated on the drawings.
- B. Conductor Terminations:

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PANELBOARDS

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1. Main and Neutral Lug Material: Copper, suitable for terminating copper conductors only.
  2. Main and Neutral Lug Type: Compression.
- C. Bussing:
1. Phase and Neutral Bus Material: Copper.
  2. Ground Bus Material: Copper.
- D. Circuit Breakers:
1. Provide bolt-on type or plug-in type secured with locking mechanical restraints.
  2. Provide thermal magnetic circuit breakers for circuit breaker frame sizes less than 250 amperes.
  3. Provide electronic trip circuit breakers for circuit breaker frame sizes 250 amperes and above.
- E. Enclosures:
1. Provide surface-mounted enclosures unless otherwise indicated.
  2. Fronts: Provide door-in-door trim with hinged cover for access to load terminals and wiring gutters, and separate lockable hinged door with concealed hinges for access to overcurrent protective device handles without exposing live parts.
  3. Provide clear plastic circuit directory holder mounted on inside of door.

2.04 LIGHTING AND APPLIANCE PANELBOARDS

- A. Description: Panelboards complying with NEMA PB 1, lighting and appliance branch circuit type, circuit breaker type, and listed and labeled as complying with UL 67; ratings, configurations and features as indicated on the drawings.
- B. Conductor Terminations:
1. Main and Neutral Lug Material: Copper, suitable for terminating copper conductors only.
  2. Main and Neutral Lug Type: Compression.
- C. Bussing:
1. Phase Bus Connections: Arranged for sequential phasing of overcurrent protective devices.
  2. Phase and Neutral Bus Material: Copper.
  3. Ground Bus Material: Copper.
- D. Circuit Breakers: Thermal magnetic bolt-on type unless otherwise indicated.
- E. Enclosures:
1. Provide surface-mounted or flush-mounted enclosures as indicated.
  2. Fronts: Provide door-in-door trim with hinged cover for access to load terminals and wiring gutters, and separate lockable hinged door with concealed hinges for access to overcurrent protective device handles without exposing live parts.
  3. Provide clear plastic circuit directory holder mounted on inside of door.



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PANELBOARDS

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2.05 LOAD CENTERS

- A. Shall only be used where indicated on drawings.
- B. Description: Circuit breaker type load centers listed and labeled as complying with UL 67; ratings, configurations, and features as indicated on the drawings.
- C. Bussing:
  - 1. Phase Bus Connections: Arranged for sequential phasing of overcurrent protective devices.
  - 2. Bus Material: Copper.
- D. Circuit Breakers: Thermal magnetic plug-in type.
- E. Enclosures:
  - 1. Provide surface-mounted enclosures unless otherwise indicated.
  - 2. Fronts: Provide lockable hinged door with concealed hinges for access to overcurrent protective device handles without exposing live parts.
  - 3. Provide circuit directory label on inside of door or individual circuit labels adjacent to circuit breakers.

2.06 OVERCURRENT PROTECTIVE DEVICES

- A. Molded Case Circuit Breakers:
  - 1. Description: Quick-make, quick-break, over center toggle, trip-free, trip-indicating circuit breakers listed and labeled as complying with UL 489, and complying with FS W-C-375 where applicable; ratings, configurations, and features as indicated on the drawings.
  - 2. Interrupting Capacity:
    - a. Provide circuit breakers with interrupting capacity as required to provide the short circuit current rating indicated, but not less than:
      - 1) 10,000 rms symmetrical amperes at 240 VAC or 208 VAC.
      - 2) 14,000 rms symmetrical amperes at 480 VAC.
    - b. Fully Rated Systems: Provide circuit breakers with interrupting capacity not less than the short circuit current rating indicated.
  - 3. Conductor Terminations:
    - a. Provide mechanical lugs for circuit breaker frame sizes less than 250 amperes.
    - b. Provide compression lugs for circuit breaker frame sizes 250 amperes and above.
    - c. Lug Material: Copper, suitable for terminating copper conductors only.
  - 4. Thermal Magnetic Circuit Breakers: For each pole, furnish thermal inverse time tripping element for overload protection and magnetic instantaneous tripping element for short circuit protection.
    - a. Provide field-adjustable magnetic instantaneous trip setting for circuit breaker frame sizes 225 amperes and larger.
    - b. Provide interchangeable trip units where indicated.

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PANELBOARDS

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5. Electronic Trip Circuit Breakers: Furnish solid state, microprocessor-based, true rms sensing trip units.
  - a. Provide the following field-adjustable trip response settings:
    - 1) Long time pickup, adjustable by replacing interchangeable trip unit or by setting dial.
    - 2) Long time delay.
    - 3) Short time pickup and delay.
    - 4) Instantaneous pickup.
6. Multi-Pole Circuit Breakers: Furnish with common trip for all poles.
7. Provide the following circuit breaker types where indicated:
  - a. Ground Fault Circuit Interrupter (GFCI) Circuit Breakers: Listed as complying with UL 943, class A for protection of personnel.
  - b. Ground Fault Equipment Protection Circuit Breakers: Designed to trip at 30 mA for protection of equipment.
  - c. 100 Percent Rated Circuit Breakers: Listed for application within the panelboard where installed at 100 percent of the continuous current rating.
8. Provide listed switching duty rated circuit breakers with SWD marking where indicated.
9. Provide listed high intensity discharge lighting rated circuit breakers with HID marking for all branch circuits serving HID lighting.
10. Do not use tandem circuit breakers.
11. Do not use handle ties in lieu of multi-pole circuit breakers.
12. Provide multi-pole circuit breakers for multi-wire branch circuits as required by NFPA 70.
13. Provide the following features and accessories where indicated or where required to complete installation:
  - a. Shunt Trip: Provide coil voltage as required for connection to indicated trip actuator.
  - b. Handle Pad-Lock Provision: For locking circuit breaker handle in OFF position.

2.07 SOURCE QUALITY CONTROL

- A. Factory test panelboards according to NEMA PB 1.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that field measurements are as indicated.
- B. Verify that the ratings and configurations of the panelboards and associated components are consistent with the indicated requirements.
- C. Verify that mounting surfaces are ready to receive panelboards.

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PANELBOARDS

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- D. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

- A. Perform work in accordance with NECA 1 (general workmanship).
- B. Install products in accordance with manufacturer's instructions.
- C. Install panelboards in accordance with NECA 407 and NEMA PB 1.1.
- D. Arrange equipment to provide minimum clearances in accordance with manufacturer's instructions and NFPA 70.
- E. Provide required support and attachment in accordance with Section 260529.
- F. Install panelboards plumb.
- G. Install flush-mounted panelboards so that trims fit completely flush to wall with no gaps and rough opening completely covered.
- H. Mount panelboards such that the highest position of any operating handle for circuit breakers or switches does not exceed 78" above the floor or working platform.
- I. Mount floor-mounted power distribution panelboards on properly sized 3 inch (80 mm) high concrete pad.
- J. Provide grounding and bonding in accordance with Section 260526.
  - 1. Terminate branch circuit equipment grounding conductors on solidly bonded equipment ground bus only. Do not terminate on isolated/insulated ground bus.
  - 2. Terminate branch circuit isolated grounding conductors on isolated/insulated ground bus only. Do not terminate on solidly bonded equipment ground bus.
- K. Install all field-installed branch devices, components, and accessories.
- L. Where accessories are not self-powered, provide control power source as required to complete installation.
- M. Multi-Wire Branch Circuits: Group grounded and ungrounded conductors together in the panelboard as required by NFPA 70.
- N. Set field-adjustable ground fault protection pickup and time delay settings as indicated.
- O. Provide filler plates to cover unused spaces in panelboards.
- P. Provide circuit breaker lock-on devices to prevent unauthorized personnel from de-energizing essential loads where indicated. Also provide for the following:
  - 1. Fire detection and alarm circuits.
  - 2. Communications equipment circuits.
  - 3. Intrusion detection and access control system circuits.
  - 4. Video surveillance system circuits.

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PANELBOARDS

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- Q. Identify panelboards in accordance with Section 260553.
- R. Provide and affix typewritten circuit directory card with a clear plastic cover to the inside of each panelboard door. Directory shall include the Panel ID, voltage rating and current rating of the panel, as well as identify the type and location of every load and all spares in accordance with NEC. Also, note all available spaces on the directory. Include copy of final panelboard directory in O&M manual.

3.03 FIELD QUALITY CONTROL

- A. Inspect and test in accordance with NETA ATS, except Section 4.
- B. Molded Case Circuit Breakers: Perform inspections and tests listed in NETA ATS, Section 7.6.1.1 for circuit breakers larger than 400 amperes. Tests listed as optional are not required.
- C. Ground Fault Protection Systems: Test in accordance with manufacturer's instructions as required by NFPA 70.
- D. Test GFCI circuit breakers to verify proper operation.
- E. Test shunt trips to verify proper operation.
- F. Correct deficiencies and replace damaged or defective panelboards or associated components.

3.04 ADJUSTING

- A. Adjust tightness of mechanical and electrical connections to manufacturer's recommended torque settings.
- B. Adjust alignment of panelboard fronts.
- C. Load Balancing: For each panelboard, rearrange circuits such that the difference between each measured steady state phase load does not exceed 20 percent and adjust circuit directories accordingly. Maintain proper phasing for multi-wire branch circuits.

3.05 CLEANING

- A. Clean dirt and debris from panelboard enclosures and components according to manufacturer's instructions.
- B. Repair scratched or marred exterior surfaces to match original factory finish.

END OF SECTION 26 24 16

## WIRING DEVICES

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### SECTION 26 27 26 - WIRING DEVICES

#### PART 1 GENERAL

##### 1.01 SECTION INCLUDES

- A. Wall switches.
- B. Receptacles.
- C. Wall plates.
- D. Cord Reels.

##### 1.02 RELATED REQUIREMENTS

- A. Section 260519 - Low-Voltage Electrical Power Conductors and Cables: Manufactured wiring systems for use with access floor boxes with compatible pre-wired connectors.
- B. Section 260526 - Grounding and Bonding for Electrical Systems.
- C. Section 260533.16 - Boxes for Electrical Systems.
- D. Section 260553 - Identification for Electrical Systems: Identification products and requirements.
- E. Section 260583 - Wiring Connections: Cords and plugs for equipment.
- F. Section 260923 - Lighting Control Devices: Devices for automatic control of lighting, including occupancy sensors, in-wall time switches, and in-wall interval timers.

##### 1.03 REFERENCE STANDARDS

- A. FS W-C-596 - Connector, Electrical, Power, General Specification for 2017h.
- B. FS W-S-896 - Switches, Toggle (Toggle and Lock), Flush-mounted (General Specification) 2014g, with Amendment (2017).
- C. NECA 1 - Standard for Good Workmanship in Electrical Construction 2015.
- D. NECA 130 - Standard for Installing and Maintaining Wiring Devices 2016.
- E. NEMA WD 1 - General Color Requirements for Wiring Devices 1999 (Reaffirmed 2020).
- F. NEMA WD 6 - Wiring Devices - Dimensional Specifications 2016.

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WIRING DEVICES

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- G. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- H. UL 20 - General-Use Snap Switches Current Edition, Including All Revisions.
- I. UL 498 - Attachment Plugs and Receptacles Current Edition, Including All Revisions.
- J. UL 514D - Cover Plates for Flush-Mounted Wiring Devices Current Edition, Including All Revisions.
- K. UL 943 - Ground-Fault Circuit-Interrupters Current Edition, Including All Revisions.
- L. UL 1310 - Class 2 Power Units Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
  - 1. Coordinate the placement of outlet boxes with millwork, furniture, equipment, etc. installed under other sections or by others.
  - 2. Coordinate wiring device ratings and configurations with the electrical requirements of actual equipment to be installed.
  - 3. Coordinate the placement of outlet boxes for wall switches with actual installed door swings.
  - 4. Coordinate the installation and preparation of uneven surfaces, such as split face block, to provide suitable surface for installation of wiring devices.
  - 5. Notify Engineer of any conflicts or deviations from Contract Documents to obtain direction prior to proceeding with work.
- B. Sequencing:
  - 1. Do not install wiring devices until final surface finishes and painting are complete.

1.05 SUBMITTALS

- A. Product Data: Provide manufacturer's catalog information showing dimensions, colors, and configurations.

1.06 QUALITY ASSURANCE

- A. Comply with requirements of NFPA 70.
- B. Maintain at the project site a copy of each referenced document that prescribes execution requirements.
- C. Products: Listed, classified, and labeled as suitable for the purpose intended.
- D. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

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WIRING DEVICES

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1.07 DELIVERY, STORAGE, AND PROTECTION

- A. Store in a clean, dry space in original manufacturer's packaging until ready for installation.

PART 2 PRODUCTS

2.01 WIRING DEVICE APPLICATIONS

- A. Provide wiring devices suitable for intended use and with ratings adequate for load served.
- B. For single receptacles installed on an individual branch circuit, provide receptacle with ampere rating not less than that of the branch circuit.
- C. Provide weather resistant GFCI receptacles with specified weatherproof covers for receptacles installed outdoors or in damp or wet locations.
- D. Provide GFCI protection for receptacles installed within 6 feet (1.8 m) of sinks.
- E. Provide GFCI protection for receptacles installed in kitchens.
- F. Provide GFCI protection for receptacles serving electric drinking fountains.
- G. Provide isolated ground receptacles for receptacles serving computers and electronic cash registers.
- H. Unless noted otherwise, do not use combination switch/receptacle devices.

2.02 WIRING DEVICE FINISHES

- A. Provide wiring device finishes as described below unless otherwise indicated.
- B. Wiring Devices Installed in Finished Spaces: Standard color to be selected by Architect with stainless steel wall plate.
- C. Wiring Devices Installed in Unfinished Spaces: Gray with galvanized steel wall plate.
- D. Wiring Devices Installed in Wet or Damp Locations: Standard color to be selected by Architect with specified weatherproof cover.
- E. Automatically Controlled Receptacles: Green.

2.03 WALL SWITCHES

- A. Manufacturers:
  - 1. Hubbell Incorporated: [www.hubbell.com/#sle](http://www.hubbell.com/#sle).
  - 2. Leviton Manufacturing Company, Inc: [www.leviton.com/#sle](http://www.leviton.com/#sle).
  - 3. Pass & Seymour, a brand of Legrand North America, Inc: [www.legrand.us/#sle](http://www.legrand.us/#sle).

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WIRING DEVICES

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- B. Wall Switches - General Requirements: AC only, quiet operating, general-use snap switches with silver alloy contacts, complying with NEMA WD 1 and NEMA WD 6, and listed as complying with UL 20 and where applicable, FS W-S-896; types as indicated on the drawings.
  - 1. Wiring Provisions: Terminal screws for side wiring and screw actuated binding clamp for back wiring with separate ground terminal screw.
- C. Standard Wall Switches: Industrial specification grade, 20 A, 120/277 V with standard toggle type switch actuator and maintained contacts; single pole single throw, double pole single throw, three way, or four way as indicated on the drawings.
- D. Momentary Contact Wall Switches: Industrial specification grade, 20 A, 120/277 V with toggle type three position switch actuator and momentary contacts; single pole double throw, off with switch actuator in center position.

2.04 RECEPTACLES

- A. Manufacturers:
  - 1. Hubbell Incorporated: [www.hubbell.com/#sle](http://www.hubbell.com/#sle).
  - 2. Leviton Manufacturing Company, Inc: [www.leviton.com/#sle](http://www.leviton.com/#sle).
  - 3. Lutron Electronics Company, Inc; Designer Style: [www.lutron.com/#sle](http://www.lutron.com/#sle).
  - 4. Pass & Seymour, a brand of Legrand North America, Inc: [www.legrand.us/#sle](http://www.legrand.us/#sle).
  - 5. Source Limitations: Where wall controls are furnished as part of lighting control system, provide accessory matching receptacles and wallplates by the same manufacturer in locations indicated.
- B. Receptacles - General Requirements: Self-grounding, complying with NEMA WD 1 and NEMA WD 6, and listed as complying with UL 498, and where applicable, FS W-C-596; types as indicated on the drawings.
  - 1. Wiring Provisions: Terminal screws for side wiring or screw actuated binding clamp for back wiring with separate ground terminal screw.
  - 2. NEMA configurations specified are according to NEMA WD 6.
- C. Convenience Receptacles:
  - 1. Standard Convenience Receptacles: Industrial specification grade, 20A, 125V, NEMA 5-20R; single or duplex as indicated on the drawings.
  - 2. Automatically Controlled Convenience Receptacles: Industrial specification grade, 20A, 125V, NEMA 5-20R; controlled receptacle marking on device face per NFPA 70; single or duplex as indicated on the drawings.
  - 3. Weather Resistant Convenience Receptacles: Industrial specification grade, 20A, 125V, NEMA 5-20R, listed and labeled as weather resistant type complying with UL 498 Supplement SE suitable for installation in damp or wet locations; single or duplex as indicated on the drawings.
- D. GFCI Receptacles:
  - 1. GFCI Receptacles - General Requirements: Self-testing, with feed-through protection and light to indicate ground fault tripped condition and loss of protection; listed as complying with UL 943, class A.



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WIRING DEVICES

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- a. Provide test and reset buttons of same color as device.
- 2. Standard GFCI Receptacles: Industrial specification grade, duplex, 20A, 125V, NEMA 5-20R, rectangular decorator style.
- 3. Weather Resistant GFCI Receptacles: Industrial specification grade, duplex, 20A, 125V, NEMA 5-20R, rectangular decorator style, listed and labeled as weather resistant type complying with UL 498 Supplement SE suitable for installation in damp or wet locations.
- E. USB Charging Devices:
  - 1. USB Charging Devices - General Requirements: Listed as complying with UL 1310.
    - a. Charging Capacity - Two-Port Devices: 2.1 A, minimum.
  - 2. USB Charging/Tamper Resistant Receptacle Combination Devices: Two-port (Type A) USB charging device and receptacle, commercial specification grade, duplex, 20A, 125V, NEMA 5-20R, listed and labeled as tamper resistant type; rectangular decorator style.
- F. Locking Receptacles: Industrial specification grade, configuration as indicated on the drawings.

2.05 WALL PLATES

- A. Manufacturers:
  - 1. Hubbell Incorporated: [www.hubbell-wiring.com/#sle](http://www.hubbell-wiring.com/#sle).
  - 2. Leviton Manufacturing Company, Inc: [www.leviton.com/#sle](http://www.leviton.com/#sle).
  - 3. Lutron Electronics Company, Inc: [www.lutron.com/#sle](http://www.lutron.com/#sle).
  - 4. Pass & Seymour, a brand of Legrand North America, Inc: [www.legrand.us/#sle](http://www.legrand.us/#sle).
  - 5. Intermatic
  - 6. Source Limitations: Where wall controls are furnished as part of lighting control system, provide accessory matching receptacles and wallplates by the same manufacturer in locations indicated.
- B. Wall Plates: Comply with UL 514D.
  - 1. Configuration: One piece cover as required for quantity and types of corresponding wiring devices.
  - 2. Size: Standard.
  - 3. Screws: Metal with slotted heads finished to match wall plate finish.
- C. Nylon Wall Plates: Smooth finish, high-impact thermoplastic.
- D. Stainless Steel Wall Plates: Brushed satin finish, Type 302 stainless steel.
- E. Galvanized Steel Wall Plates: Rounded corners and edges, with corrosion resistant screws.
- F. Weatherproof Covers (Hinged Type) : Gasketed, cast aluminum, with self-closing hinged cover and corrosion-resistant screws; listed as suitable for use in wet locations with cover closed.

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WIRING DEVICES

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- G. Weatherproof Covers (While-in-Use Type): Gasketed, cast aluminum, with hinged lockable cover and corrosion-resistant screws; listed as suitable for use in wet locations while in use with attachment plugs connected and identified as extra-duty type (Intermatic #WP Extra-Duty Die-Cast Series or Approved Equal). Provide two-gang covers where indicated on drawings.

2.06 CORD REELS

- A. Manufacturers:
1. Hubbell Incorporated: [www.hubbell.com/#sle](http://www.hubbell.com/#sle). (inReach Series)
  2. Leviton Manufacturing Company, Inc: [www.leviton.com/#sle](http://www.leviton.com/#sle).
  3. Lutron Electronics Company, Inc; Designer Style: [www.lutron.com/#sle](http://www.lutron.com/#sle).
  4. Pass & Seymour, a brand of Legrand North America, Inc: [www.legrand.us/#sle](http://www.legrand.us/#sle).
- B. Industrial Grade.
- C. Material: Corrosion resistant cast aluminum.
- D. Finish:
1. Cord Reel: White
  2. Cord & Outlet Box: Black
- E. Multi-position guide arm capable of being mounted in two positions.
- F. Cable: 12/3 SJO
- G. Cable Length: 25-feet
- H. Connector End: Two (2) 20A duplex receptacles.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that field measurements are as indicated.
- B. Verify that outlet boxes are installed in proper locations and at proper mounting heights and are properly sized to accommodate devices and conductors in accordance with NFPA 70.
- C. Verify that wall openings are neatly cut and will be completely covered by wall plates.
- D. Verify that final surface finishes are complete, including painting.
- E. Verify that branch circuit wiring installation is completed, tested, and ready for connection to wiring devices.
- F. Verify that conditions are satisfactory for installation prior to starting work.

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WIRING DEVICES

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3.02 PREPARATION

- A. Provide extension rings to bring outlet boxes flush with finished surface.
- B. Clean dirt, debris, plaster, and other foreign materials from outlet boxes.

3.03 INSTALLATION

- A. Perform work in accordance with NECA 1 (general workmanship) and, where applicable, NECA 130, including mounting heights specified in those standards unless otherwise indicated.
- B. Coordinate locations of outlet boxes provided under Section 260533.16 as required for installation of wiring devices provided under this section.
  - 1. Mounting Heights: Unless otherwise indicated, as follows:
    - a. Wall Switches: 48 inches (1200 mm) above finished floor.
    - b. Receptacles: 18 inches (450 mm) above finished floor or 6 inches (150 mm) above counter.
  - 2. Orient outlet boxes for vertical installation of wiring devices unless otherwise indicated.
  - 3. Where multiple receptacles, wall switches, or wall dimmers are installed at the same location and at the same mounting height, gang devices together under a common wall plate.
  - 4. Locate wall switches on strike side of door with edge of wall plate 3 inches (80 mm) from edge of door frame. Where locations are indicated otherwise, notify Architect to obtain direction prior to proceeding with work.
  - 5. Locate receptacles for electric drinking fountains concealed behind drinking fountain according to manufacturer's instructions.
- C. Install wiring devices in accordance with manufacturer's instructions.
- D. Install permanent barrier between ganged wiring devices when voltage between adjacent devices exceeds 300 V.
- E. Where required, connect wiring devices using pigtails not less than 6 inches (150 mm) long. Do not connect more than one conductor to wiring device terminals.
- F. Connect wiring devices by wrapping conductor clockwise 3/4 turn around screw terminal and tightening to proper torque specified by the manufacturer. Where present, do not use push-in pressure terminals that do not rely on screw-actuated binding.
- G. Unless otherwise indicated, connect wiring device grounding terminal to branch circuit equipment grounding conductor and to outlet box with bonding jumper.
- H. For isolated ground receptacles, connect wiring device grounding terminal only to identified branch circuit isolated equipment grounding conductor. Do not connect grounding terminal to outlet box or normal branch circuit equipment grounding conductor.

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WIRING DEVICES

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- I. Provide GFCI receptacles with integral GFCI protection at each location indicated. Do not use feed-through wiring to protect downstream devices.
- J. Install wiring devices plumb and level with mounting yoke held rigidly in place.
- K. Install wall switches with OFF position down.
- L. Install vertically mounted receptacles with grounding pole on top and horizontally mounted receptacles with grounding pole on left.
- M. Install wall plates to fit completely flush to wall with no gaps and rough opening completely covered without strain on wall plate. Repair or reinstall improperly installed outlet boxes or improperly sized rough openings. Do not use oversized wall plates in lieu of meeting this requirement.
- N. Install blank wall plates on junction boxes and on outlet boxes with no wiring devices installed or designated for future use.
- O. Identify wiring devices in accordance with Section 260553.

3.04 FIELD QUALITY CONTROL

- A. Inspect each wiring device for damage and defects.
- B. Operate each wall switch, wall dimmer, and fan speed controller with circuit energized to verify proper operation.
- C. Test each receptacle to verify operation and proper polarity.
- D. Test each GFCI receptacle for proper tripping operation according to manufacturer's instructions.
- E. Correct wiring deficiencies and replace damaged or defective wiring devices.

3.05 ADJUSTING

- A. Adjust devices and wall plates to be flush and level.

3.06 CLEANING

- A. Clean exposed surfaces to remove dirt, paint, or other foreign material and restore to match original factory finish.

END OF SECTION 26 27 26

## LED INTERIOR LIGHTING

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### SECTION 26 51 19 - LED INTERIOR LIGHTING

#### PART 1 GENERAL

##### 1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

##### 1.02 SUMMARY

- A. Section Includes:
  - 1. Interior solid-state luminaires that use LED technology.
  - 2. Lighting fixture supports.
  - 3. Exit Signs
  - 4. Central Inverter
- B. Related Requirements:
  - 1. Section 260923 "Lighting Control Devices" for automatic control of lighting, including time switches, photoelectric relays, occupancy sensors, and multipole lighting relays and contactors.

##### 1.03 DEFINITIONS

- A. CCT: Correlated color temperature.
- B. CRI: Color Rendering Index.
- C. Fixture: See "Luminaire."
- D. IP: International Protection or Ingress Protection Rating.
- E. LED: Light-emitting diode.
- F. Lumen: Measured output of lamp and luminaire, or both.
- G. Luminaire: Complete lighting unit, including lamp, reflector, and housing.

##### 1.04 ACTION SUBMITTALS

- A. Product Data: For each type of product.
  - 1. Arrange in order of luminaire designation.
  - 2. Include data on features, accessories, and finishes.
  - 3. Include physical description and dimensions of luminaires.

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LED INTERIOR LIGHTING

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4. Include emergency lighting units, including batteries and chargers.
5. Include life, output (lumens, CCT, and CRI), and energy efficiency data.
6. Photometric data and adjustment factors based on laboratory tests, complying with IESNA Lighting Measurements Testing and Calculation Guides, of each lighting fixture type. The adjustment factors shall be for lamps and accessories identical to those indicated for the lighting fixture as applied in this Project.
  - a. Manufacturers' Certified Data: Photometric data certified by manufacturer's laboratory with a current accreditation under the National Voluntary Laboratory Accreditation Program for Energy Efficient Lighting Products.
  - b. Testing Agency Certified Data: For indicated luminaires, photometric data certified by a qualified independent testing agency. Photometric data for remaining luminaires shall be certified by manufacturer.
- B. Shop Drawings: For nonstandard or custom luminaires.
  1. Include plans, elevations, sections, and mounting and attachment details.
  2. Include details of luminaire assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
  3. Include diagrams for power, signal, and control wiring.
- C. Samples: For each luminaire and for each color and texture with standard factory-applied finish.
- D. Samples for Initial Selection: For each type of luminaire with custom factory-applied finishes.
  1. Include Samples of luminaires and accessories involving color and finish selection.
- E. Samples for Verification: For each type of luminaire.
  1. Include Samples of luminaires and accessories to verify finish selection.
- F. Product Schedule: For luminaires and lamps. Use same designations indicated on Drawings.

1.05 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: 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. Lighting luminaires.
  2. Suspended ceiling components.
  3. Partitions and millwork that penetrate the ceiling or extend to within 12 inches (300 mm) of the plane of the luminaires.
  4. Structural members to which equipment and luminaires will be attached.
  5. Initial access modules for acoustical tile, including size and locations.
  6. Items penetrating finished ceiling, including the following:
    - a. Other luminaires.

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LED INTERIOR LIGHTING

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- b. Air outlets and inlets.
- c. Speakers.
- d. Sprinklers.
- e. Access panels.
- f. Ceiling-mounted projectors.
- 7. Moldings.

- B. Qualification Data: For testing laboratory providing photometric data for luminaires.
- C. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.
- D. Product Certificates: For each type of luminaire.
- E. Product Test Reports: For each luminaire, for tests performed by manufacturer and witnessed by a qualified testing agency.
- F. Sample warranty.

1.06 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For luminaires and lighting systems to include in operation and maintenance manuals.
  - 1. Provide a list of all lamp types used on Project; use ANSI and manufacturers' codes.

1.07 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
  - 1. Lamps: Ten for every 100 of each type and rating installed. Furnish at least one of each type.
  - 2. Diffusers and Lenses: One for every 100 of each type and rating installed. Furnish at least one of each type.
  - 3. LED Drivers: Ten for every 100 of each type and rating installed. Furnish at least one of each type.

1.08 QUALITY ASSURANCE

- A. Luminaire Photometric Data Testing Laboratory Qualifications: Luminaire manufacturer's laboratory that is accredited under the NVLAP for Energy Efficient Lighting Products.
- B. Luminaire Photometric Data Testing Laboratory Qualifications: Provided by an independent agency, with the experience and capability to conduct the testing indicated, that is an NRTL as defined by OSHA in 29 CFR 1910.7, accredited under the NVLAP for Energy Efficient Lighting Products, and complying with the applicable IES testing standards.

## LED INTERIOR LIGHTING

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- C. Provide luminaires from a single manufacturer for each luminaire type.
- D. Each luminaire type shall be binned within a three-step MacAdam Ellipse to ensure color consistency among luminaires.
- E. Mockups: For interior lighting luminaires in room or module mockups, complete with power and control connections.
  - 1. Obtain Architect's approval of luminaires in mockups before starting installations.
  - 2. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.
  - 3. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
  - 4. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

### 1.09 DELIVERY, STORAGE, AND HANDLING

- A. Protect finishes of exposed surfaces by applying a strippable, temporary protective covering before shipping.

### 1.10 WARRANTY

- A. Warranty: Manufacturer and Installer agree to repair or replace components of luminaires that fail in materials or workmanship within specified warranty period.
- B. Warranty Period: Five year(s) from date of Substantial Completion.

## PART 1 PRODUCTS

### 2.01 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. Recessed Fixtures: Comply with NEMA LE 4.
- C. Bulb shape complying with ANSI C79.1.
- D. CRI of 80. CCT of 3500 K.
- E. Rated lamp life of 50,000 hours.
- F. Lamps dimmable from 100 percent to 0 percent of maximum light output.
- G. Internal driver.
- H. Nominal Operating Voltage: 120 V ac or 277 V ac as noted on drawings.



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LED INTERIOR LIGHTING

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1. Lens Thickness: At least 0.125 inch (3.175 mm) minimum unless otherwise indicated.

2.02 MATERIALS

- 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, and designed to permit relamping without use of tools. Designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally during relamping and when secured in operating position.
- C. Diffusers and Globes:
  1. Acrylic Diffusers: One hundred percent virgin acrylic plastic, with high resistance to yellowing and other changes due to aging, exposure to heat, and UV radiation.
  2. Glass: Annealed crystal glass unless otherwise indicated.
  3. Lens Thickness: At least 0.125 inch (3.175 mm) minimum unless otherwise indicated.
- D. Housings:
  1. Extruded-aluminum housing and heat sink.
  2. Powder-coat finish.
- E. Factory-Applied Labels: Comply with UL 1598. Include recommended lamps. Locate labels where they will be readily visible to service personnel, but not seen from normal viewing angles when lamps are in place.
  1. Label shall include the following lamp characteristics:
    - a. "USE ONLY" and include specific lamp type.
    - b. Lamp diameter, shape, size, wattage, and coating.
    - c. CCT and CRI for all luminaires.

2.03 METAL FINISHES

- A. Variations in finishes are unacceptable in the same piece. Variations in finishes of adjoining components are acceptable if they are within the range of approved Samples and if they can be and are assembled or installed to minimize contrast.

2.04 LUMINAIRE FIXTURE SUPPORT COMPONENTS

- A. Comply with requirements in Section 260529 "Hangers and Supports for Electrical Systems" for channel and angle iron supports and nonmetallic channel and angle supports.

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LED INTERIOR LIGHTING

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- B. Single-Stem Hangers: 1/2-inch (13-mm) steel tubing with swivel ball fittings and ceiling canopy. Finish same as luminaire.
- C. Wires: ASTM A 641/A 641 M, Class 3, soft temper, zinc-coated steel, 12 gage (2.68 mm).
- D. Rod Hangers: 3/16-inch (5-mm) minimum diameter, cadmium-plated, threaded steel rod.
- E. Hook Hangers: Integrated assembly matched to luminaire, line voltage, and equipment with threaded attachment, cord, and locking-type plug.

PART 1 EXECUTION

3.01 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Examine roughing-in for luminaire to verify actual locations of luminaire and electrical connections before fixture installation. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 TEMPORARY LIGHTING

- A. If approved by the Architect, use selected permanent luminaires for temporary lighting. When construction is sufficiently complete, clean luminaires used for temporary lighting and install new lamps.

3.03 INSTALLATION

- A. Comply with NECA 1.
- B. Install luminaires level, plumb, and square with ceilings and walls unless otherwise indicated.
- C. Install lamps in each luminaire.
- D. Supports:
  - 1. Sized and rated for luminaire weight.
  - 2. Able to maintain luminaire position after cleaning and relamping.
  - 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 vertical force of 400 percent of luminaire weight.
- E. Flush-Mounted Luminaire Support:

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LED INTERIOR LIGHTING

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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.
- F. Wall-Mounted Luminaire Support:
1. Attached to structural members in walls.
  2. Do not attach luminaires directly to gypsum board.
- G. Ceiling-Mounted Luminaire Support:
1. Ceiling mount with two 5/32-inch- (4-mm-) diameter aircraft cable supports adjustable to 120 inches (6 m) in length.
  2. Ceiling mount with pendant mount with 5/32-inch- (4-mm-) diameter aircraft cable supports adjustable to 120 inches (6 m) in length.
  3. Ceiling mount with hook mount.
- H. Suspended Luminaire Support:
1. Pendants and Rods: Where longer than 48 inches (1200 mm), brace to limit swinging.
  2. Stem-Mounted, Single-Unit Luminaires: Suspend with twin-stem hangers. Support with approved outlet box and accessories that hold stem and provide damping of luminaire oscillations. Support outlet box vertically to building structure using approved devices.
  3. Continuous Rows of Luminaires: Use tubing or stem for wiring at one point and wire support for suspension for each unit length of luminaire chassis, including one at each end.
  4. Do not use ceiling grid as support for pendant luminaires. Connect support wires or rods to building structure.
- I. Ceiling-Grid-Mounted Luminaires:
1. Secure to any required outlet box.
  2. Secure luminaire to the luminaire opening using approved fasteners in a minimum of four locations, spaced near corners of luminaire.
  3. Use approved devices and support components to connect luminaire to ceiling grid and building structure in a minimum of four locations, spaced near corners of luminaire.
- J. Comply with requirements in Section 260519 "Low-Voltage Electrical Power Conductors and Cables" for wiring connections.

3.04 IDENTIFICATION

- A. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

3.05 FIELD QUALITY CONTROL

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LED INTERIOR LIGHTING

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- A. Perform the following tests and inspections:
  - 1. Operational Test: After installing luminaires, switches, and accessories, and after electrical circuitry has been energized, test units to confirm proper operation.
  - 2. Test for Emergency Lighting: Interrupt power supply to demonstrate proper operation. Verify transfer from normal power to emergency power and retransfer to normal.
- B. Luminaire will be considered defective if it does not pass operation tests and inspections.

3.06 ADJUSTING

- A. Occupancy Adjustments: When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting the direction of aim of luminaires to suit occupied conditions. Make up to two visits to Project during other-than-normal hours for this purpose. Some of this work may be required during hours of darkness.
  - 1. During adjustment visits, inspect all luminaires. Replace lamps or luminaires that are defective.
  - 2. Parts and supplies shall be manufacturer's authorized replacement parts and supplies.
  - 3. Adjust the aim of luminaires in the presence of the Architect.

END OF SECTION 26 51 19

## COMMUNICATIONS HORIZONTAL CABLING

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### SECTION 27 15 00 - COMMUNICATIONS HORIZONTAL CABLING

#### PART 1 GENERAL

##### 1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- B. Cornell University Design and Construction Standards 270000 Communications

##### 1.02 SUMMARY

- A. Section Includes:
  - 1. UTP cabling
  - 2. Multiuser telecommunications outlet assemblies.
  - 3. Telecommunications outlet/connectors.
  - 4. Cabling system identification products.
- B. Related Requirements:
  - 1. Section 271501.11 "Conductors and Cables for Electronic Safety and Security" for voice and data cabling associated with system panels and devices.

##### 1.03 DEFINITIONS

- A. BICSI: Building Industry Consulting Service International.
- B. Consolidation Point: A location for interconnection between horizontal cables extending from building pathways and horizontal cables extending into furniture pathways.
- C. Cross-Connect: A facility enabling the termination of cable elements and their interconnection or cross-connection.
- D. EMI: Electromagnetic interference.
- E. IDC: Insulation displacement connector.
- F. LAN: Local area network.
- G. MUTOA: Multiuser telecommunications outlet assembly, a grouping in one location of several telecommunications outlet/connectors.
- H. Outlet/Connectors: A connecting device in the work area on which horizontal cable or outlet cable terminates.
- I. RCDD: Registered Communications Distribution Designer.

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COMMUNICATIONS HORIZONTAL CABLING

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- J. UTP: Unshielded twisted pair.

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Coordinate layout and installation of telecommunications cabling with Owner's telecommunications and LAN equipment and service suppliers.
- B. Coordinate telecommunications outlet/connector locations with location of power receptacles at each work area.

1.05 ACTION SUBMITTALS

- A. Product Data: For each type of product.

1.06 INFORMATIONAL SUBMITTALS

- A. Qualification Data: Submit documentation showing Contractor is certified through the Panduit One Partner Program. This is required to provide system warranty.
- B. Field quality-control reports.

1.07 PRIOR TO CLOSEOUT SUBMITTALS

- A. A cable schedule in MS Excel format identifying TR room number, racks, patch panels and IT outlet designations.

1.08 CLOSEOUT SUBMITTALS

- A. Record drawings with as-built notations showing telecomm rooms (TR), major pathways, pullboxes, and outlet designations.
- B. A copy of the AutoCAD and MS Excel files listed above delivered on a thumb drive or by electronic delivery to CIT.
- C. Cable manufacturer's warranty naming CIT/Infrastructure Engineering as the Owner.

1.09 QUALITY ASSURANCE

- A. Installer Qualifications: Cabling Installer must have personnel on staff certified by BICSI (INSTC or TECH) and/or Panduit.
  - 1. Layout Responsibility: Preparation of Shop Drawings and Cabling Administration Drawings
  - 2. Installation Supervision: Installation shall be under the direct supervision of Registered Technician, who shall be present at all times when Work of this Section is performed at Project site.
  - 3. Testing Supervisor: Currently certified by BICSI and/or Panduit to supervise on-site testing.

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COMMUNICATIONS HORIZONTAL CABLING

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- B. Testing Agency Qualifications: An NRTL.
  - 1. Testing Agency's Field Supervisor: Currently certified by BICSI and/or Panduit to supervise on-site testing.

PART 1 PRODUCTS

2.01 HORIZONTAL CABLING DESCRIPTION

- A. Horizontal cable and its connecting hardware provide the means of transporting signals between the telecommunications outlet/connector and the horizontal cross-connect located in the communications equipment room. This cabling and its connecting hardware are called a "permanent link," a term that is used in the testing protocols.
- B. Bridged taps and splices shall not be installed in the horizontal cabling.
- C. The maximum allowable horizontal cable length is 295 feet (90 m). This maximum allowable length does not include an allowance for the length of 16 feet (4.9 m) to the workstation equipment or in the horizontal cross-connect.

2.02 PERFORMANCE REQUIREMENTS

- A. General Performance: Horizontal cabling system shall comply with transmission standards in TIA/EIA-568-C when tested according to test procedures of this standard.
- B. Surface-Burning Characteristics: Comply with ASTM E 84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
  - 1. Flame-Spread Index: 25 or less.
  - 2. Smoke-Developed Index: 50 or less.
- C. 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.
- D. Grounding: Comply with J-STD-607-A.

2.03 CAT 6A UTP CABLE

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. SYSTIMAX Solutions; a CommScope Inc. brand.
  - 2. Panduit
  - 3. General Cable
- B. Description: 100-ohm, four-pair UTP, covered with a thermoplastic jacket.
  - 1. Comply with ICEA S-90-661 for mechanical properties.
  - 2. Comply with TIA/EIA-568-C for performance specifications.

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COMMUNICATIONS HORIZONTAL CABLING

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3. Comply with TIA/EIA-568-C Category 6A.
4. Listed and labeled by an NRTL acceptable to authorities having jurisdiction as complying with UL 444 and NFPA 70 for the following types:
  - a. Communications, General Purpose: Type CM or CMG.
  - b. Communications, Plenum Rated: Type CMP, complying with NFPA 262.
5. Cable shall have an outside diameter of 0.24-inches or less.
6. Cable shall have green jacket.

2.04 UTP CABLE TERMINATION HARDWARE

- A. Manufacturer: Substitutions are not allowed.
  1. Panduit Corp.
- B. General Requirements for Cable Connecting Hardware: Comply with TIA/EIA-568-C, IDC type, with modules designed for punch-down caps or tools. Cables shall be terminated with connecting hardware of same category or higher.
- C. Jacks and Jack Assemblies:
  1. Category 6A, color-coded, eight-position, eight wire T568A modular receptacle units with integral IDC-type terminals. Category 6A links shall be terminated using Panduit CJ6X88TG jack modules. Coordinate color with Section 262726 "Wiring Devices." Jack color shall match receptacle color within the space.

2.05 TELECOMMUNICATION UTP OUTLETS

- A. Workstation Outlets: Four-port-connector assemblies mounted in single faceplate.
  1. Plastic Faceplate: High-impact plastic. Color shall match jacks.
  2. For use with snap-in jacks accommodating any combination of UTP cables.
    - a. Flush mounting jacks.
    - b. Outlets shall be from the same manufacturer as jack modules and be the mini-com executive series single gang (Panduit CFPE4).
  3. Legend: Machine printed, in the field, using adhesive-tape label.
  4. Legend: Snap-in, clear-label covers and machine-printed paper inserts.
- B. Wireless Access Points: Provide two (2) terminated Category 6A cables to each wireless access point location.

2.06 GROUNDING

- A. Bonding and Grounding shall conform to ANSI/TIA-607-B Generic Telecommunications Grounding and Bonding (Earthing) for Customer Premises, NEC Articles 250 & 800, as well as any hardware manufacturer grounding requirements.

2.07 IDENTIFICATION PRODUCTS

- A. Comply with TIA/EIA-606-B and UL 969 for labeling materials, including label stocks, laminating adhesives, and inks used by label printers.



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COMMUNICATIONS HORIZONTAL CABLING

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- B. Comply with requirements in Section 260553 "Identification for Electrical Systems."

2.08 SOURCE QUALITY CONTROL

- A. Testing Agency: Engage a qualified testing agency to evaluate cables.
- B. Factory test UTP on reels according to TIA/EIA-568-C.
- C. Factory test UTP cables according to TIA/EIA-568-C.
- D. Cable will be considered defective if it does not pass tests and inspections.
- E. Prepare test and inspection reports.

PART 1 EXECUTION

3.01 WIRING METHODS

- A. Install cables in pathways and cable trays except within consoles, cabinets, desks, and counters. Conceal pathways and cables except in unfinished spaces.
  - 1. Comply with requirements in Section 270528 "Pathways for Communications Systems."
- B. Conceal conductors and cables in accessible ceilings, walls, and floors where possible.
- C. Wiring within Enclosures:
  - 1. Bundle and train conductors to terminal points with no excess and without exceeding manufacturer's limitations on bending radii. Velco straps may be used to loosely bundle cables.
  - 2. Install conductors parallel with or at right angles to sides and back of enclosure.

3.02 INSTALLATION OF CABLES

- A. Comply with NECA 1.
- B. General Requirements for Cabling:
  - 1. Comply with TIA/EIA-568-C
  - 2. Comply with BICSI ITSIM, Ch. 6, "Cable Termination Practices."
  - 3. Install modular termination hardware unless otherwise indicated.
  - 4. Consolidation points shall not be used.
  - 5. Terminate conductors; no cable shall contain unterminated elements. Make terminations only at indicated outlets, terminals, cross-connects, and patch panels.
  - 6. Cables may not be spliced. Secure and support cables at intervals not exceeding 60 inches (1520 mm) and not more than 6 inches (150 mm) from cabinets, boxes, fittings, outlets, racks, frames, and terminals.

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COMMUNICATIONS HORIZONTAL CABLING

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7. Install Velcro tie wraps to restrain cables, to prevent straining connections, and to prevent bending cables to smaller radii than minimums recommended by manufacturer.
  8. Bundle and train conductors to terminal points without exceeding manufacturer's limitations on bending radii, but not less than radii specified in BICSI ITSIM, "Cabling Termination Practices" Chapter. Install lacing bars and distribution spools.
  9. Do not install bruised, kinked, scored, deformed, or abraded cable. Do not splice cable between termination, tap, or junction points. Remove and discard cable if damaged during installation and replace it with new cable.
  10. Cold-Weather Installation: Bring cable to room temperature before dereeling. Heat lamps shall not be used for heating.
  11. Pulling Cable: Comply with BICSI ITSIM, Ch. 4, "Pulling Cable." Monitor cable pull tensions.
  12. Cables should not be coiled in cable trays, raceways or pull boxes.
  13. Within the Telecommunication Room, some cable slack may be worked into routing of cables on ladder racks and in wire management but should not result in coils or slack loops laying on top of ladder rack.
- C. UTP Cable Installation:
1. Comply with TIA/EIA-568-C
  2. Do not untwist UTP cables more than 1/2 inch (12 mm) from the point of termination to maintain cable geometry.
- D. Jack Installation: Wiring shall be T568A.
- E. Group connecting hardware for cables into separate logical fields.
- F. Separation from EMI Sources:
1. Comply with BICSI TDMM and TIA-569-B for separating unshielded copper voice and data communication cable from potential EMI sources, including electrical power lines and equipment.
  2. Separation between open communications cables or cables in nonmetallic raceways and unshielded power conductors and electrical equipment shall be as follows:
    - a. Electrical Equipment Rating Less Than 2 kVA: A minimum of 5 inches (127 mm).
    - b. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 12 inches (300 mm).
    - c. Electrical Equipment Rating More Than 5 kVA: A minimum of 24 inches (610 mm).
  3. Separation between communications cables in grounded metallic raceways and unshielded power lines or electrical equipment shall be as follows:
    - a. Electrical Equipment Rating Less Than 2 kVA: A minimum of 2-1/2 inches (64 mm).
    - b. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 6 inches (150 mm).

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COMMUNICATIONS HORIZONTAL CABLING

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- c. Electrical Equipment Rating More Than 5 kVA: A minimum of 12 inches (300 mm).
- 4. Separation between communications cables in grounded metallic raceways and power lines and electrical equipment located in grounded metallic conduits or enclosures shall be as follows:
  - a. Electrical Equipment Rating Less Than 2 kVA: No requirement.
  - b. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 3 inches (76 mm).
  - c. Electrical Equipment Rating More Than 5 kVA: A minimum of 6 inches (150 mm).
- 5. Separation between Communications Cables and Electrical Motors and Transformers, 5 kVA or HP and Larger: A minimum of 48 inches (1200 mm).
- 6. Separation between Communications Cables and Fluorescent Fixtures: A minimum of 5 inches (127 mm).

3.03 FIRESTOPPING

- A. Comply with requirements in Section "Penetration Firestopping."
- B. Comply with TIA-569-B, Annex A, "Firestopping."
- C. Comply with BICSI TDMM, "Firestopping Systems" Article.

3.04 GROUNDING

- A. Install grounding according to BICSI TDMM, "Grounding, Bonding, and Electrical Protection" Chapter.
- B. Comply with J-STD-607-A.

3.05 IDENTIFICATION

- A. Identify system components, wiring, and cabling complying with TIA/EIA-606-B. Comply with requirements for identification specified in Section 260553 "Identification for Electrical Systems."
  - 1. Administration Class: 1.
  - 2. Color-code cross-connect fields. Apply colors to voice and data service backboards, connections, covers, and labels.
- B. Cable Schedule: Post in prominent location in each equipment room and wiring closet. List incoming and outgoing cables and their designations, origins, and destinations. Protect with rigid frame and clear plastic cover. Furnish an electronic copy of final comprehensive schedules for Project.
- C. Cabling Administration Drawings: Show building floor plans with cabling administration-point labeling. Identify labeling convention and show labels for telecommunications closets, terminal hardware and positions, horizontal cables, work areas and workstation terminal positions, grounding buses and pathways, and equipment

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COMMUNICATIONS HORIZONTAL CABLING

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grounding conductors. Follow convention of TIA/EIA-606-B. Furnish electronic record of all drawings, in software and format selected by Owner.

D. Cable and Wire Identification:

1. Label each cable within 4 inches (100 mm) of each termination and tap, where it is accessible in a cabinet or junction or outlet box, and elsewhere as indicated.
2. Each wire connected to building-mounted devices is not required to be numbered at device if color of wire is consistent with associated wire connected and numbered within panel or cabinet.
3. Exposed Cables and Cables in Cable Trays and Wire Troughs: Label each cable at intervals not exceeding 15 feet (4.5 m).
4. Label each terminal strip and screw terminal in each cabinet, rack, or panel.
  - a. Individually number wiring conductors connected to terminal strips, and identify each cable or wiring group being extended from a panel or cabinet to a building-mounted device shall be identified with name and number of particular device as shown.
  - b. Label each unit and field within distribution racks and frames.
5. Identification within Connector Fields in Equipment Rooms and Wiring Closets: Label each connector and each discrete unit of cable-terminating and connecting hardware. Where similar jacks and plugs are used for both voice and data communication cabling, use a different color for jacks and plugs of each service.
6. Installer shall obtain outlet number configuration for room layouts from the CIT/Infrastructure Engineer. The outlet designations are assigned using the CIT alpha numeric system which consists of the room number followed by letters A-Z in a clock-wise orientation from the left of the primary entrance into the room (e.g. 101-A1,2).

E. Labels shall be preprinted or computer-printed type with printing area and font color that contrasts with cable jacket color but still complies with requirements in TIA/EIA-606-B.

1. Cables use flexible vinyl or polyester that flex as cables are bent.

F. Contractor shall submit completed "Line Card Template" to Cornell CIT, prior to completion of work, to allow for voice, network and Wi-Fi jack activations by Cornell CIT. Refer to Appendix A for sample template.

3.06 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

B. Perform the following tests and inspections (Typical for CAT 6A outlets and cables):

1. Visually inspect UTP cable jacket materials for NRTL certification markings. Inspect cabling terminations in communications equipment rooms for compliance with color-coding for pin assignments, and inspect cabling connections for compliance with TIA/EIA-568-C.
2. Visually confirm correct Category marking of outlets, cover plates, outlet/connectors, and patch panels.

## COMMUNICATIONS HORIZONTAL CABLING

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3. Visually inspect cable placement, cable termination, grounding and bonding, equipment and patch cords, and labeling of all components.
  4. UTP Performance Tests:
    - a. Test for each outlet. Perform the following tests according to TIA/EIA-568-C:
      - 1) Wire map.
      - 2) Length (physical vs. electrical, and length requirements).
      - 3) Insertion loss.
      - 4) Near-end crosstalk (NEXT) loss.
      - 5) Power sum near-end crosstalk (PSNEXT) loss.
      - 6) Equal-level far-end crosstalk (ELFEXT).
      - 7) Power sum equal-level far-end crosstalk (PSELFEXT).
      - 8) Return loss.
      - 9) Propagation delay.
      - 10) Delay skew.
    - b. Horizontal cabling shall be permanent link tested with a Level IIIe tester for full Category 6 or Category 6A compliance.
    - c. The dB loss for a horizontal segment must not exceed 2.0dB.
    - d.
  5. Final Verification Tests: Perform verification tests for UTP systems after the complete communications cabling and workstation outlet/connectors are installed.
    - a. Voice Tests: These tests assume that dial tone service has been installed. Connect to the network interface device at the demarcation point. Go off-hook and listen and receive a dial tone. If a test number is available, make and receive a local, long distance, and digital subscription line telephone call.
    - b. Data Tests: These tests assume the Information Technology Staff has a network installed and is available to assist with testing. Connect to the network interface device at the demarcation point. Log onto the network to ensure proper connection to the network.
- C. Document data for each measurement. Data for submittals shall be printed in a summary report that is formatted similar to Table 10.1 in BICSI TDMM, or transferred from the instrument to the computer, saved as text files, and printed and submitted.
- D. End-to-end cabling will be considered defective if it does not pass tests and inspections.
- E. Prepare test and inspection reports. Test results shall be provided in MS-Windows Word or Excel format and submitted on a thumb drive or by electronic delivery to CIT.
- a) END OF SECTION 27 15 00

### APPENDIX A: LINE CARD TEMPLATE

JACK BUILD	DEVICE PORT	JACK FIX	JACK NUMBER	JACK TYPE	CABLE TYPE	ROOM NUMBER	TR BUILD	TR ROOM	COMMENT	PROB JACK
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## COMMUNICATIONS HORIZONTAL CABLING

END OF SECTION 27 15 00





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CONDUCTORS AND CABLES FOR ELECTRONIC SAFETY AND SECURITY

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SECTION 27 15 01.11 - CONDUCTORS AND CABLES FOR ELECTRONIC SAFETY AND SECURITY

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

- A. Section Includes:
  - 1. Fire alarm wire and cable.
  - 2. Identification products.

1.03 DEFINITIONS

- A. EMI: Electromagnetic interference.
- B. IDC: Insulation displacement connector.
- C. Low Voltage: As defined in NFPA 70 for circuits and equipment operating at less than 50 V or for remote-control and signaling power-limited circuits.
- D. Open Cabling: Passing telecommunications cabling through open space (e.g., between the studs of a wall cavity).

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Coordinate layout and installation of electronic safety and security cabling with Owner's telecommunications and LAN equipment and service suppliers.
- B. Coordinate telecommunications outlet/connector locations with location of power receptacles at each work area.

1.05 ACTION SUBMITTALS

- A. Product Data: For each type of product.
  - 1. For Fire Alarm cable, include the following installation data for each type used:
    - a. Nominal OD.
    - b. Minimum bending radius.
    - c. Maximum pulling tension.

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CONDUCTORS AND CABLES FOR ELECTRONIC SAFETY AND SECURITY

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PART 1 PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

- A. Surface-Burning Characteristics: Comply with ASTM E 84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
  - 1. Flame-Spread Index: 25
  - 2. Smoke-Developed Index: 50 or less.
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

2.02 FIRE ALARM WIRE AND CABLE

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
  - 1. Allied Wire & Cable Inc.
  - 2. Draka Cableteq USA; a Prysmian Group company.
  - 3. Genesis Cable Products; Honeywell International, Inc.
  - 4. West Penn Wire.
- B. General Wire and Cable Requirements: NRTL listed and labeled as complying with NFPA 70, Article 760.
- C. Signaling Line Circuits: Twisted, shielded pair, not less than No. 18 AWG or size as recommended by system manufacturer.
  - 1. Circuit Integrity Cable: Twisted shielded pair, NFPA 70, Article 760, Classification CI, for power-limited fire alarm signal service Type FPL. NRTL listed and labeled as complying with UL 1424 and UL 2196 for a two-hour rating.
- D. Non-Power-Limited Circuits: Solid-copper conductors with 600-V rated, 75 deg C, color-coded insulation, and complying with requirements in UL 2196 for a two-hour rating.
  - 1. Low-Voltage Circuits: No. 16 AWG, minimum, in pathway.
  - 2. Line-Voltage Circuits: No. 12 AWG, minimum, in pathway.
  - 3. Multiconductor Armored Cable: NFPA 70, Type MC, copper conductors, Type TFN/THHN conductor insulation, copper drain wire, copper armor with outer jacket with red identifier stripe, NTRL listed for fire alarm and cable tray installation, plenum rated.

2.03 IDENTIFICATION PRODUCTS

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

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CONDUCTORS AND CABLES FOR ELECTRONIC SAFETY AND SECURITY

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1. Brady Corporation.
  2. Kroy LLC.
  3. Panduit Corp.
- B. Comply with TIA-606-B and UL 969 for a system of labeling materials, including label stocks, laminating adhesives, and inks used by label printers.
- C. Comply with requirements in Section 260553 "Identification for Electrical Systems."

PART 1 EXECUTION

3.01 INSTALLATION OF HANGERS AND SUPPORTS

- A. Comply with requirements in Section 260529 "Hangers and Supports for Electrical Systems" for installation of supports for cables.

3.02 WIRING METHOD

- A. Install all wiring in metal pathways and wireways.
1. Minimum conduit size shall be 3/4 inch (21 mm). Control and data-transmission wiring shall not share conduits with other building wiring systems.
  2. Comply with requirements in Section 270528 "Pathways for Communications Systems."
- B. Install cable, concealed in accessible ceilings, walls, and floors when possible.
- C. Wiring on Racks and within Enclosures:
1. Bundle, lace, and train conductors to terminal points with no excess and without exceeding manufacturer's limitations on bending radii, but not less than radii specified in BICSI ITSIM's "Cabling Termination Practices" chapter. Cable ties shall not be excessively tightened such that the transmission characteristics of the cable are altered.
  2. Install lacing bars and distribution spools.
  3. Separate power-limited and non-power-limited conductors as recommended in writing by manufacturer.
  4. Install conductors parallel with or at right angles to sides and back of enclosure.
  5. Connect conductors associated with intrusion system that are terminated, spliced, or interrupted in any enclosure onto terminal blocks.
  6. Mark each terminal according to system's wiring diagrams.
  7. Make all connections with approved crimp-on terminal spade lugs, pressure-type terminal blocks, or plug connectors.

3.03 INSTALLATION OF CONDUCTORS AND CABLES

- A. Comply with NECA 1 and NFPA 70.

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CONDUCTORS AND CABLES FOR ELECTRONIC SAFETY AND SECURITY

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- B. Conductors: Size according to system manufacturer's written instructions unless otherwise indicated.
- C. Do not install conductors and cables that are wet, moisture damaged, or mold damaged.
- D. General Requirements for Cabling:
  - 1. Comply with TIA-568-C.1.
  - 2. Comply with BICSI ITSIM, Ch. 6, "Cable Termination Practices."
  - 3. Terminate all conductors; no cable shall contain unterminated elements. Make terminations only at indicated outlets, terminals, and cross-connect and patch panels. Leave a minimum of 6 inches (150 mm) of slack at outlet terminations and coil loosely into box after termination on outlet fitting.
  - 4. Cables may not be spliced. Secure and support cables at intervals not exceeding 30 inches (760 mm) and not more than 6 inches (150 mm) from cabinets, boxes, fittings, outlets, racks, frames, and terminals.
  - 5. Maintain minimum cable bending radius during installation and termination of cables.
  - 6. Do not install bruised, kinked, scored, deformed, or abraded cable. Do not splice cable between termination, tap, or junction points. Remove and discard cable if damaged during installation and replace it with new cable.
  - 7. Cold-Weather Installation: Bring cable to room temperature before dereeling. Heat lamps shall not be used for heating.
  - 8. Pulling Cable: Comply with BICSI ITSIM, Ch. 4, "Pulling Cable." Monitor cable pull tensions. Do not exceed manufacturer's rated cable-pulling tension.

### 3.04 FIRE ALARM WIRING INSTALLATION

- A. Comply with NECA 1 and NFPA 72.
- B. Wiring Method: Install wiring in metal pathway according to Section 270528 "Pathways for Communications Systems."
  - 1. Fire alarm circuits and equipment control wiring associated with the fire alarm system shall be installed in a dedicated pathway system. This system shall not be used for any other wire or cable.
- C. Wiring Method:
  - 1. Cables and pathways used for fire alarm circuits, and equipment control wiring associated with the fire alarm system, may not contain any other wire or cable.
  - 2. Fire-Rated Cables: Use of two-hour, fire-rated fire alarm cables, NFPA 70, Types MI and CI, is permitted.
  - 3. Signaling Line Circuits: Power-limited fire alarm cables may be installed in the same cable or pathway as signaling line circuits.
- D. Wiring within Enclosures: Separate power-limited and non-power-limited conductors as recommended by manufacturer. Install conductors parallel with or at right angles to sides and back of the enclosure. Bundle, lace, and train conductors to terminal points with no excess. Connect conductors that are terminated, spliced, or interrupted in any

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## CONDUCTORS AND CABLES FOR ELECTRONIC SAFETY AND SECURITY

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enclosure associated with the fire alarm system to terminal blocks. Mark each terminal according to the system's wiring diagrams. Make all connections with approved crimp-on terminal spade lugs, pressure-type terminal blocks, or plug connectors.

- E. Cable Taps: Use numbered terminal strips in junction, pull, and outlet boxes, cabinets, or equipment enclosures where circuit connections are made.
- F. Color Coding: Color code fire alarm conductors differently from the normal building power wiring. Use one color code for alarm circuit wiring and another for supervisory circuits. Color code audible alarm-indicating circuits differently from alarm-initiating circuits. Use different colors for visible alarm-indicating devices. Paint fire alarm system junction boxes and covers red.

### 3.05 POWER AND CONTROL-CIRCUIT CONDUCTORS

- A. 120-V Power Wiring: Install according to Section 260519 "Low-Voltage Electrical Power Conductors and Cables" unless otherwise indicated.
- B. Minimum Conductor Sizes:
  - 1. Class 1 remote-control and signal circuits, No. 14 AWG.
  - 2. Class 2 low-energy, remote-control and signal circuits, No. 16 AWG.
  - 3. Class 3 low-energy, remote-control, alarm and signal circuits, No. 12 AWG.

### 3.06 CONNECTIONS

- A. Comply with requirements in Section 281643 "Perimeter Security Systems" for connecting, terminating, and identifying wires and cables.
- B. Comply with requirements in Section 283111 "Digital, Addressable Fire-Alarm System" for connecting, terminating, and identifying wires and cables.

### 3.07 FIRESTOPPING

- A. Comply with requirements in Section "Penetration Firestopping."
- B. Comply with TIA-569-C, "Firestopping" Annex A.
- C. Comply with BICSI TDMM, "Firestopping Systems" Article.

### 3.08 GROUNDING

- A. For communication wiring, comply with J-STD-607-A and with BICSI TDMM's "Grounding, Bonding, and Electrical Protection" chapter.
- B. For low-voltage wiring and cabling, comply with requirements in Section 260526 "Grounding and Bonding for Electronic Safety and Security."

### 3.09 IDENTIFICATION

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CONDUCTORS AND CABLES FOR ELECTRONIC SAFETY AND SECURITY

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- A. Identify system components, wiring, and cabling complying with TIA-606-B. Comply with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

3.10 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.
- B. Perform the following tests and inspections:
  - 1. Visually inspect cable placement, cable termination, grounding and bonding, equipment and patch cords, and labeling of all components.
- C. End-to-end cabling will be considered defective if it does not pass tests and inspections.

END OF SECTION 27 15 01.11

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DIGITAL, ADDRESSABLE FIRE-ALARM SYSTEM

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SECTION 28 31 11 - DIGITAL, ADDRESSABLE FIRE-ALARM SYSTEM

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

- A. Section Includes:
  - 1. Fire Alarm Control Panel
  - 2. System Smoke Detectors.
  - 3. Heat detectors
  - 4. Notification appliances.
  - 5. Fire Alarm System Cabling
- B. Related Requirements:
  - 1. Section 271501.11 "Conductors and Cables for Electronic Safety and Security" for cables and conductors for fire-alarm systems.

1.03 DEFINITIONS

- A. EMT: Electrical Metallic Tubing.
- B. FACP: Fire Alarm Control Panel.
- C. HLI: High Level Interface.
- D. NICET: National Institute for Certification in Engineering Technologies.

1.04 ACTION SUBMITTALS

- A. Product Data: For each type of product, including furnished options and accessories.
  - 1. Include construction details, material descriptions, dimensions, profiles, and finishes.
  - 2. Include rated capacities, operating characteristics, and electrical characteristics.
- B. Shop Drawings: For fire-alarm system.
  - 1. Comply with recommendations and requirements in the "Documentation" section of the "Fundamentals" chapter in NFPA 72.
  - 2. Include voltage drop calculations for notification-appliance circuits.
  - 3. Include battery-size calculations.
  - 4. Include input/output matrix.

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DIGITAL, ADDRESSABLE FIRE-ALARM SYSTEM

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5. Include statement from manufacturer that all equipment and components have been tested as a system and meet all requirements in this Specification and in NFPA 72.
6. Include floor plans to indicate final outlet locations showing address of each addressable device. Show size and route of cable and conduits and point-to-point wiring diagrams.

C. General Submittal Requirements:

1. Submittals shall be approved by authorities having jurisdiction prior to submitting them to Architect.
2. Shop Drawings shall be prepared by persons with the following qualifications:
  - a. Trained and certified by manufacturer in fire-alarm system design.
  - b. NICET-certified, fire-alarm technician; Level IV minimum.
  - c. Licensed or certified by authorities having jurisdiction.
3. Submittals shall also be submitted to Cornell EHS & CU Facilities Electrical Engineer (Mark Scholeno) for review and approval.

1.05 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer.
- B. Field quality-control reports.

1.06 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For fire-alarm systems and components to include in emergency, operation, and maintenance manuals.
  1. In addition to items specified in Section 017823 "Operation and Maintenance Data," include the following and deliver copies to authorities having jurisdiction:
    - a. Comply with the "Records" section of the "Inspection, Testing and Maintenance" chapter in NFPA 72.
    - b. Provide "Fire Alarm and Emergency Communications System Record of Completion Documents" according to the "Completion Documents" Article in the "Documentation" section of the "Fundamentals" chapter in NFPA 72.
    - c. Provide "Inspection and Testing Form" according to the "Inspection, Testing and Maintenance" chapter in NFPA 72, and include the following:
      - 1) Equipment tested.
      - 2) Frequency of testing of installed components.
      - 3) Frequency of inspection of installed components.
      - 4) Requirements and recommendations related to results of maintenance.
      - 5) Manufacturer's user training manuals.
    - d. Manufacturer's required maintenance related to system warranty requirements.
    - e. Abbreviated operating instructions for mounting at fire-alarm control unit and each annunciator unit.



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DIGITAL, ADDRESSABLE FIRE-ALARM SYSTEM

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1.07 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
  - 1. Lamps for Strobe Units: Quantity equal to 10 percent of amount installed, but no fewer than one unit.
  - 2. Keys and Tools: One extra set for access to locked or tamperproofed components.
  - 3. Audible and Visual Notification Appliances: One of each type installed.

1.08 QUALITY ASSURANCE

- A. Installer Qualifications: Personnel shall be trained and certified by manufacturer for installation of units required for this Project.
- B. Installer Qualifications: Installation shall be by personnel certified by NICET as fire-alarm Level IV technician.
- C. NFPA Certification: Obtain certification according to NFPA 72 by an NRTL (nationally recognized testing laboratory).
- D. NFPA Certification: Obtain certification according to NFPA 72 by a UL-listed alarm company.

1.09 PROJECT CONDITIONS

- A. Perform a full test of the existing system prior to starting work. Document any equipment or components not functioning as designed.
- B. Interruption of Existing Fire-Alarm Service: Do not interrupt fire-alarm service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary guard service according to requirements indicated:
  - 1. Notify Construction Manager no fewer than seven days in advance of proposed interruption of fire-alarm service.
  - 2. Do not proceed with interruption of fire-alarm service without Construction Manager's written permission.
- C. Use of Devices during Construction: Protect devices during construction unless devices are placed in service to protect the facility during construction.

1.10 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace fire-alarm system equipment and components that fail in materials or workmanship within specified warranty period.
  - 1. Warranty Extent: All equipment and components not covered in the Maintenance Service Agreement.
  - 2. Warranty Period: Five years from date of Substantial Completion.

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PART 1 PRODUCTS

2.01 SYSTEM DESCRIPTION

- A. Noncoded, UL-certified addressable system, with multiplexed signal transmission and horn/strobe evacuation.
- B. Automatic sensitivity control of certain smoke detectors.
- C. All components provided shall be listed for use with the selected system.
- D. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

2.02 SYSTEMS OPERATIONAL DESCRIPTION

- A. Fire-alarm system shall operate per present programming. New devices shall be added to existing zones and function the same as other devices in the same zone.

2.03 EXISTING FIRE-ALARM CONTROL PANEL (FACP)

- A. Make: FCI 7200.

2.04 SYSTEM SMOKE DETECTORS

- A. Provide units compatible and listed with building addressable fire alarm system.
- B. General Requirements for System Smoke Detectors:
  - 1. Comply with UL 268; operating at 24-V dc, nominal.
  - 2. Detectors shall be two-wire type.
  - 3. Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to fire-alarm control unit.
  - 4. Base Mounting: Detector and associated electronic components shall be mounted in a twist-lock module that connects to a fixed base. Provide terminals in the fixed base for connection to building wiring.
  - 5. Self-Restoring: Detectors do not require resetting or readjustment after actuation to restore them to normal operation.
  - 6. Integral Visual-Indicating Light: LED type, indicating detector has operated and power-on status.
  - 7. Remote Control: Unless otherwise indicated, detectors shall be digital-addressable type, individually monitored at fire-alarm control unit for calibration, sensitivity, and alarm condition.
  - 8. Rate-of-rise temperature characteristic of combination smoke- and heat-detection units shall be selectable at fire-alarm control unit for 15 or 20 deg F (8 or 11 deg C) per minute.

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9. Fixed-temperature sensing characteristic of combination smoke- and heat-detection units shall be independent of rate-of-rise sensing and shall be settable at fire-alarm control unit to operate at 135 or 155 deg F (57 or 68 deg C).
10. Multiple levels of detection sensitivity for each sensor.
11. Sensitivity levels based on time of day.
12. Photoelectric Smoke Detectors:
13. Detector address shall be accessible from fire-alarm control unit and shall be able to identify the detector's location within the system and its sensitivity setting.
14. An operator at fire-alarm control unit, having the designated access level, shall be able to manually access the following for each detector:
15. Primary status.
16. Device type.
17. Present average value.
18. Present sensitivity selected.
19. Sensor range (normal, dirty, etc.).

2.05 HEAT DETECTORS

- A. Provide units compatible and listed with building addressable fire alarm system.
- B. General Requirements for Heat Detectors: Comply with UL 521.
  1. Temperature sensors shall test for and communicate the sensitivity range of the device.
- C. Heat Detector, Fixed-Temperature Type: Actuated by temperature that exceeds a fixed temperature of 135 deg F (57 deg C).
  1. Mounting: Twist-lock base interchangeable with smoke-detector bases.
  2. Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to fire-alarm control unit.

2.06 NOTIFICATION APPLIANCES

- A. Provide units compatible and listed with building addressable fire alarm system.
- B. General Requirements for Notification Appliances: Connected to notification-appliance signal circuits, zoned as indicated, equipped for mounting as indicated, and with screw terminals for system connections.
  1. Combination Devices: Factory-integrated audible and visible devices in a single-mounting assembly, equipped for mounting as indicated, and with screw terminals for system connections.
  2. Provide weatherproof type devices where indicated on drawings.
- C. Visible Notification Appliances: Xenon strobe lights complying with UL 1971, with clear or nominal white polycarbonate lens mounted on an aluminum faceplate. The word "FIRE" is engraved in minimum 1-inch- (25-mm-) high letters on the lens.
  1. Rated Light Output:
    - a. 15/30/75/110 cd, selectable in the field.
  2. Mounting: Wall mounted unless otherwise indicated.

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- 3. For units with guards to prevent physical damage, light output ratings shall be determined with guards in place.
  - 4. Flashing shall be in a temporal pattern, synchronized with other units.
  - 5. Strobe Leads: Factory connected to screw terminals.
  - 6. Mounting Faceplate: Factory finished, white.
- D. Horns: Electric-vibrating-polarized type, 24-V dc; with provision for housing the operating mechanism behind a grille. Comply with UL 464. Horns shall produce a sound-pressure level of 90 dBA, measured 10 feet (3 m) from the horn, using the coded signal prescribed in UL 464 test protocol. Mounting faceplate shall be white factory finished.

2.07 FIRE-ALARM ADDRESSABLE INTERFACE DEVICES

- A. Provide units compatible and listed with building addressable fire alarm system.
- B. Performance Criteria:
  - 1. Regulatory Requirements:
    - a. NFPA 72.
  - 2. General Characteristics:
    - a. Include address-setting means on module.
    - b. Store internal identifying code for control panel use to identify module type.
    - c. Listed for controlling HVAC fan motor controllers.
    - d. Monitor Module: Microelectronic module providing system address for alarm-initiating devices for wired applications with normally open contacts.
    - e. Control Module: Addressable microelectronic module with minimum of two normally open and two normally closed contacts available for field wiring.

2.08 FIRE-ALARM NOTIFICATION APPLIANCE CIRCUIT (NAC) PANEL

- A. Provide units compatible and listed with building addressable fire alarm system.
- B. Performance Criteria:
  - 1. Regulatory Requirements:
    - a. NFPA 72.
  - 2. General Characteristics:
    - a. Batteries shall be sized to accommodate devices indicated in Contract Documents as well as minimum 20% spare capacity for future use.

2.09 MANUAL FIRE-ALARM BOXES

- A. Provide units compatible and listed with building addressable fire alarm system.
- B. General Requirements for Manual Fire-Alarm Boxes: Comply with UL 38. Boxes must be finished in red with molded, raised-letter operating instructions in contrasting color; must show visible indication of operation; and must be mounted on recessed outlet box. If indicated as surface mounted, provide manufacturer's surface back box.

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1. Double-action mechanism requiring two actions to initiate alarm, push-pull lever type; with attached addressable module arranged to communicate manual-station status (normal, alarm, or trouble) to FACP.
2. Station Reset: Key- or wrench-operated switch.
3. Able to perform at up to 90 percent relative humidity at 90 deg F.
4. Material: Manual stations made of Lexan polycarbonate.
5. Able to be used in indoor areas.
6. Provide weatherproof type devices where indicated on drawings.

PART 1 EXECUTION

3.01 EXAMINATION

- A. Examine areas and conditions for compliance with requirements for ventilation, temperature, humidity, and other conditions affecting performance of the Work.
  1. Verify that manufacturer's written instructions for environmental conditions have been permanently established in spaces where equipment and wiring are installed, before installation begins.
- B. Examine roughing-in for electrical connections to verify actual locations of connections before installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 EQUIPMENT INSTALLATION

- A. Comply with NFPA 72, NFPA 101, and requirements of authorities having jurisdiction for installation and testing of fire-alarm equipment. Install all electrical wiring to comply with requirements in NFPA 70 including, but not limited to, Article 760, "Fire Alarm Systems."
  1. Devices placed in service before all other trades have completed cleanup shall be replaced.
  2. Devices installed but not yet placed in service shall be protected from construction dust, debris, dirt, moisture, and damage according to manufacturer's written storage instructions.
- B. Connecting to Existing Equipment: Verify that existing fire-alarm system is operational before making changes or connections.
  1. Connect new equipment to existing control panel in existing part of the building.
  2. Connect new equipment to existing monitoring equipment at the supervising station.
  3. Expand, modify, and supplement existing control equipment as necessary to extend existing control functions to the new points. New components shall be capable of merging with existing configuration without degrading the performance of either system.
- C. Audible Alarm-Indicating Devices: Install not less than 6 inches (150 mm) below the ceiling. Install bells and horns on flush-mounted back boxes with the device-operating

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mechanism concealed behind a grille. Install all devices at the same height unless otherwise indicated.

- D. Visible Alarm-Indicating Devices: Install adjacent to each alarm bell or alarm horn and at least 6 inches (150 mm) below the ceiling. Install all devices at the same height unless otherwise indicated.

3.03 PATHWAYS

- A. All wiring shall be installed in conduit. EMT conduit shall be used in conditioned portion of building. Schedule 80 PVC shall be used in unconditioned portion of building.
- B. EMT shall be painted red enamel.

3.04 IDENTIFICATION

- A. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Section 260553 "Identification for Electrical Systems."
- B. Install framed instructions in a location visible from fire-alarm control unit
- C. All fire alarm devices and panels shall be labeled per Cornell Design Standard 283100.

3.05 GROUNDING

- A. Ground fire-alarm control unit and associated circuits; comply with IEEE 1100. Install a ground wire from main service ground to fire-alarm control unit.
- B. Ground shielded cables at the control panel location only. Insulate shield at device location.

3.06 FIELD QUALITY CONTROL

- A. Field tests shall be witnessed by authorities having jurisdiction.
- B. Manufacturer's Field Service: Engage a factory-authorized service representative to pre-test and inspect components, assemblies, and equipment installations, including connections prior to scheduling final test. A final test shall be scheduled with EH&S and the factory-authorized service representative shall complete the final test with EH&S and Contract Colleges AHJ present to witness.
- C. Perform the following tests and inspections with the assistance of a factory-authorized service representative:
  - 1. Visual Inspection: Conduct visual inspection prior to testing.
    - a. Inspection shall be based on completed record Drawings and system documentation that is required by the "Completion Documents, Preparation" table in the "Documentation" section of the "Fundamentals" chapter in NFPA 72.

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- b. Comply with the "Visual Inspection Frequencies" table in the "Inspection" section of the "Inspection, Testing and Maintenance" chapter in NFPA 72; retain the "Initial/Reacceptance" column and list only the installed components.
  - 2. System Testing: Comply with the "Test Methods" table in the "Testing" section of the "Inspection, Testing and Maintenance" chapter in NFPA 72.
  - 3. Test audible appliances for the public operating mode according to manufacturer's written instructions. Perform the test using a portable sound-level meter complying with Type 2 requirements in ANSI S1.4.
  - 4. Test audible appliances for the private operating mode according to manufacturer's written instructions.
  - 5. Test visible appliances for the public operating mode according to manufacturer's written instructions.
  - 6. Factory-authorized service representative shall prepare the "Fire Alarm System Record of Completion" in the "Documentation" section of the "Fundamentals" chapter in NFPA 72 and the "Inspection and Testing Form" in the "Records" section of the "Inspection, Testing and Maintenance" chapter in NFPA 72.
- D. Reacceptance Testing: Perform reacceptance testing to verify the proper operation of added or replaced devices and appliances.
- E. Fire-alarm system will be considered defective if it does not pass tests and inspections.
- F. Prepare test and inspection reports.

END OF SECTION 28 31 11

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