INFORMATION FOR BIDDERS, AGREEMENT, GENERAL CONDITIONS & TECHNICAL SPECIFICATIONS

FOR

MDF & DATA CLOSET UPGRADE

PHASE 1

HARLEM HOSPITAL CENTER

506 LENOX AVE @ 135TH STREET
NEW YORK, N.Y. 10037

CONSECUTIVE CALENDAR DAYS: (180)

ALL BIDS SHALL BE IN ACCORDANCE WITH THE TERMS OF THE NYC HEALTH & HOSPITALS (HHC) PROJECT LABOR AGREEMENT

CONSULTANT: KALLEN & LEMELSON, LLP
520 Eighth Ave, 17th Fl.
New York, NY 10018

ELECTRICAL CONTRACTOR SHALL FILE FORM BEC-166 WITH THE BUREAU OF ELECTRICAL CONTROL. DEPARTMENT OF BUILDINGS CERTIFICATE FOR WORK PERFORMED SHALL BE SUBMITTED WITH INVOICES
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PART 1 - GENERAL

1.01 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.

1.02 SUMMARY

A. This Section includes the following:
1. Work covered by the Contract Documents.
2. Type of the Contract.
3. Use of premises.
4. Work restrictions.
5. Work phases.

B. Related Sections include the following:
1. Division 01 Section "Temporary Facilities and Controls" for limitations and procedures governing temporary use of Owner's facilities.

1.03 WORK COVERED BY CONTRACT DOCUMENTS

A. Project Identification: MDF and Data Closet Upgrade – Phase I
   1. Project Location: 506 Lenox Avenue, New York, NY 10037

B. Owner: Harlem Hospital

C. Architect: Gertler & Wente Architects

D. The Work consists of the following:
   1. The Architectural Work includes removal and re-install/replacement of existing ceilings in kind (depending on conditions of removed material and ability to re-install), removal and re-install of existing lighting in kind, supplementing existing partitions to achieve ratings indicated at electrical closet(s), removal of existing doors/frames/hardware and replacement with new rated doors/frames/hardware, and patching/repair of existing finishes as required to complete the work. Coordinate with MEP drawings. Construct new MDF room, new UPS room and new electrical closets
   2. The Owner desires to have a minimal impact on the environment resulting from this Work, and therefore has established a goal of recycling 50-percent of the demolition and construction waste that is removed from the site.

1.04 EXISTING CONDITIONS

A. Information contained in the Contract Documents regarding existing facilities and conditions is taken from drawings, other forms of documentation, verbal and written representations furnished by the Owner, and observations in the field without extensive exploration or dimensional verification. Contractor is required to check and verify all
information in the field prior to ordering materials and prior to proceeding with construction. Contractor shall notify the Architect in writing of differences between what is indicated in the Contract Documents and the actual conditions that will materially affect the project.

1.05 TYPE OF CONTRACT

A. Project will be constructed under a single prime contract.

1.06 WORK UNDER OTHER CONTRACTS

A. General: Cooperate fully with separate contractors so work on those contracts may be carried out smoothly, without interfering with or delaying work under this Contract. Coordinate the Work of this Contract with work performed under separate contracts.

B. Concurrent Work: Owner will award separate contract(s) for some construction operations at Project site. Those operations will be conducted simultaneously with work under this Contract.

C. Owner-Furnished Equipment: Owner will purchase some equipment to be delivered to the Project site which will then be installed under this Contract. This equipment is enumerated in a separate equipment list or is noted on Drawings as “OFCI” or “Owner-Furnished, Contractor-Installed.” The work to be done by each contractor to unload, store, and install the equipment will be determined by the Construction Manager and assigned by contract. Each contractor is responsible for completing the assigned portions of the Work and for coordinating with the Construction Manager and other contractors to complete the Work.

D. Certain medical equipment and other types of equipment will be purchased directly by the Owner and will be installed by the Owner in the building being built under this Contract. Receiving, storing, and protecting equipment on site, installation of supporting structure, and providing final connections are part of the Work of this Contract. In some cases the equipment provided by the Owner shall be installed by the Contractor as part of the Work of this Contract. An equipment list is shown on the Drawings. Contractor’s Work for each group of equipment is as follows:

1. Ref. 1, Contractor-furnished, contractor-installed equipment: Provide specified equipment complete, including installation and connection to proper utilities, ready for use.
2. Ref. 2, Owner-furnished, Contractor-installed equipment: Coordinate with Owner for delivery of equipment. Receive, unload, store, unpack, install, and connect utilities to equipment, ready for use.
3. Ref 3, Owner-furnished, Owner-installed equipment, utilities by Contractor: Coordinate with Owner’s delivery and installation of equipment. Provide utilities required by equipment to connection location and then connect equipment to utilities.
4. Ref 4, Owner-furnished, Owner-installed equipment, no utilities required. Coordinate with Owner’s delivery and installation of equipment.

1.07 USE OF PREMISES

A. General: Contractor shall have limited use of premises for construction operations as indicated on Drawings by the Contract limits.
1. Contractor shall be subject to the requirements of the Owner.
B. Building Owner Restrictions: Work is subject to the “Contractor’s Building Rules” published by the owner of [building name or address, a copy of which is available through the Owner.

C. Use of Existing Building: Maintain existing building in a weather tight condition throughout construction period. Repair damage caused by construction operations. Protect building and its occupants during construction period.

1.08 WORK RESTRICTIONS

A. On-Site Work Hours: Work shall be generally performed inside the existing building during normal business working hours of 6:00 a.m. to 6:00 p.m., Monday through Friday, except otherwise indicated.
   1. Weekend Hours: Subject to approval of the building owner.
   2. Early Morning Hours: Subject to approval of the building owner and to local authorities having jurisdiction.
   3. Hours for Utility Shutdowns: Subject to approval and assistance of building owner.

B. Existing Utility Interruptions: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary utility services according to requirements indicated:
   1. Notify Owner and building owner not less than two days in advance of proposed utility interruptions.
   2. Do not proceed with utility interruptions without Owner's written permission.

1.09 SPECIFICATION FORMATS AND CONVENTIONS

A. Specification Format: The Specifications are organized into Divisions and Sections using the 50-division format and CSI's "Master Format 2010 Update" numbering system.
   1. Division 01: Sections in Division 01 govern the execution of the Work of all Sections in the Specifications and that shown on Drawings.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION 01 12 00
PART 1 - GENERAL

1.01 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.

1.02 SUMMARY
A. This Section includes administrative and procedural requirements governing allowances.
   1. 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 additional information is available for evaluation. If necessary, additional requirements will be issued by Change Order.

B. Types of allowances include the following:
   1. Lump-sum allowances.
   2. Calculated lump sum allowances, derived by the Bidder by taking quantities that the Bidder has determined from the Contract Documents and multiplying them by the unit price given in this Section. Calculated lump sum allowances include materials, only. Installation, taxes, delivery, and all other costs associated with providing the item, except the material itself, are included in the Base Bid outside the allowance.

C. Related Sections include the following:
   1. Division 01 Section "Contract Modification Procedures" for procedures for submitting and handling Change Orders for allowances.
   2. Divisions 02 through 49 Sections for items of Work covered by allowances.

1.03 SELECTION AND PURCHASE
A. At the earliest practical date after award of the Contract, advise 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.

B. At Architect's request, obtain proposals for each allowance for use in making final selections. Include recommendations that are relevant to performing the Work.

C. Purchase products and systems selected by Architect from the designated supplier.

1.04 SUBMITTALS
A. Submit invoices or delivery slips to show actual quantities of materials delivered to the site for use in fulfillment of each allowance.

B. Coordinate and process submittals for allowance items in same manner as for other portions of the Work.
1.05 COORDINATION
   A. Coordinate allowance items with other portions of the Work. Furnish templates as required to coordinate installation.

1.06 LUMP-SUM ALLOWANCES
   A. Allowance shall include cost to Contractor of specific products and materials ordered by Owner under allowance and shall include taxes, freight, and delivery to Project site.
   B. Contractor's costs for receiving and handling at Project site, labor, installation, overhead and profit, and similar costs related to products and materials ordered by Owner under allowance shall be included as part of the Contract Sum and not part of the allowance.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

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

3.02 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.

3.03 SCHEDULE OF ALLOWANCES
   A. Allowance No. 1: TBD

END OF SECTION 01 21 00
PART 1 - GENERAL

1.01 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.

1.02 SUMMARY

A. This Section includes administrative and procedural requirements for unit prices.

B. Related Sections include the following:
   1. Division 01 Section "Allowances" for procedures for using unit prices to adjust quantity allowances.
   2. Division 01 Section "Contract Modification Procedures" for procedures for submitting and handling Change Orders.
   3. Division 01 Section "Payment Procedures" for procedures for measurement and payment for each unit price item.

1.03 DEFINITIONS

A. Unit price is an amount proposed by bidders, stated on the FORM OF PROPOSAL, as a price per unit of measurement for materials or services added to or deducted from the Contract Sum by appropriate modification, if estimated quantities of Work required by the Contract Documents are increased or decreased. The unit price on the FORM OF PROPOSAL is the price for a single unit.

B. Pricing Basis is the quantity upon which a per-unit price is to be established by the bidder. The quantity given as the Pricing Basis for each item is arbitrary, but establishes a baseline for unit pricing with the understanding that often materials are not purchased nor installed on the basis of the units requested.

1.04 PROCEDURES

A. Unit prices include all necessary material, plus cost for delivery, installation, insurance, applicable taxes, overhead, and profit. Unit prices include the normal amount of waste and overage required to complete the amount of work included in the Pricing Basis.

B. Measurement and Payment: Contractor shall provide a measurement of the additional work in place or of the work to be removed from the scope of the Project. Documentation of quantities, calculations, and component costs shall be provided to the Owner upon request.

C. Owner reserves the right to reject Contractor's measurement of work-in-place that involves use of established unit prices and to have this work measured, at Owner's expense, by an independent surveyor acceptable to Contractor.
PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.01 LIST OF UNIT PRICES

END OF SECTION 01 22 00
PART 1 - GENERAL

1.01 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.

1.02 SUMMARY
A. This Section includes administrative and procedural requirements for alternates.

1.03 DEFINITIONS
A. Alternate: An amount proposed by bidders and stated on the Bid Form for certain work defined in the Bidding Requirements that may be added to or deducted from the Base Bid amount if Owner decides to accept a corresponding change either in the amount of construction to be completed or in the products, materials, equipment, systems, or installation methods described in the Contract Documents.
1. The cost or credit for each alternate is the net addition to or deduction from the Contract Sum to incorporate alternate into the Work. No other adjustments are made to the Contract Sum.

1.04 PROCEDURES
A. Coordination: Modify or adjust affected adjacent work as necessary to completely integrate work of the alternate into Project.
1. Include as part of each alternate, miscellaneous devices, accessory objects, and similar items incidental to or required for a complete installation whether or not indicated as part of alternate.

B. Notification: Immediately following award of the Contract, notify each party involved, in writing, of the status of each alternate. Indicate if alternates have been accepted, rejected, or deferred for later consideration. Include a complete description of negotiated modifications to alternates.

C. Execute accepted alternates under the same conditions as other work of the Contract.

D. Schedule: A Schedule of Alternates is included at the end of this Section. Specification Sections referenced in schedule contain requirements for materials necessary to achieve the work described under each alternate.
PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.01 SCHEDULE OF ALTERNATES

A. Alternate No. 1: TBD

END OF SECTION 01 23 00
PART 1 - GENERAL

1.01 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.

1.02 SUMMARY

A. This Section specifies administrative and procedural requirements for handling and processing Contract modifications.

B. Related Sections include the following:
   1. Division 01 Section "Product Requirements" for administrative procedures for handling requests for substitutions made after Contract award.

1.03 MINOR CHANGES IN THE WORK

A. Architect will issue supplemental instructions authorizing Minor Changes in the Work, not involving adjustment to the Contract Sum or the Contract Time, on CSI Form 13.4A, “Field Order”.

1.04 CHANGE ORDER REQUESTS

A. Owner-Initiated Change Order Requests: Architect will issue a detailed description of proposed changes in the Work that may require adjustment to the Contract Sum or the Contract Time. If necessary, the description will include supplemental or revised Drawings and Specifications.
   1. Proposal Requests issued by Architect are for information only. Do not consider them instructions either to stop work in progress or to execute the proposed change.
   2. Within 10 days after receipt of Change Order Request, submit a quotation estimating cost adjustments to the Contract Sum and the Contract Time necessary to execute the change.
      a. Include a list of quantities of products required or eliminated and unit costs, with total amount of purchases and credits to be made. If requested, furnish survey data to substantiate quantities.
      b. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.
      c. Include costs of labor and supervision directly attributable to the change.
      d. Include an updated Contractor's Construction Schedule that indicates the effect of the change, including, but not limited to, changes in activity duration, start and finish times, and activity relationship. Use available total float before requesting an extension of the Contract Time.

B. Contractor-Initiated Proposals: If latent or unforeseen conditions require modifications to the Contract, Contractor may propose changes by submitting a Change Order Request to Architect.
1. Include a statement outlining reasons for the change and the effect of the change on the Work. Provide a complete description of the proposed change. Indicate the effect of the proposed change on the Contract Sum and the Contract Time.

2. Include a list of quantities of products required or eliminated and unit costs, with total amount of purchases and credits to be made. If requested, furnish survey data to substantiate quantities.

3. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.

4. Include costs of labor and supervision directly attributable to the change.

5. Include an updated Contractor's Construction Schedule that indicates the effect of the change, including, but not limited to, changes in activity duration, start and finish times, and activity relationship. Use available total float before requesting an extension of the Contract Time.

6. Comply with requirements in Division 01 Section "Product Requirements" if the proposed change requires substitution of one product or system for product or system specified.

C. Proposal Request Form: Use CSI Form 13.6.A, “Change Order Request”.

1.05 CHANGE ORDER PROCEDURES

A. On Owner's approval of a Change Order Request, Architect will issue a Change Order for signatures of Owner and Contractor on AIA Document G701. Change Orders may only be approved if the Architect agrees and signs the Change Order form.

1.06 CONSTRUCTION CHANGE DIRECTIVE


1. Construction Change Directive contains a complete description of change in the Work. It also designates method to be followed to determine change in the Contract Sum or the Contract Time.

B. Documentation: Maintain detailed records on a time and material basis of work required by the Construction Change Directive.

1. After completion of change, submit an itemized account and supporting data necessary to substantiate cost and time adjustments to the Contract.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)
PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specifications Sections, apply to this Section.

1.02 SUMMARY

A. This Section includes administrative and procedural requirements for requests for interpretation before and during construction.

B. The form for Requests for Interpretation is included immediately following this Section.

C. Related Work specified in other Sections includes:
   1. Submittals of RFIs by electronic means, Division 01 Section “Project Management and Coordination.”
   2. Submittals of Applications for Payment are described in Division 01 Section “Payment Procedures.”
   3. Submittals of test reports and certifications are specified in Division 01 Section “Quality Requirements.”
   4. Requirements regarding substitutions, product options, and color selections are described in Division 01 Section “Product Requirements.”
   5. Submittals for project closeout are specified in Division 01 Section “Closeout Procedures.”
   6. Requirements regarding shop drawings, product data, and samples are described in the various sections of these Specifications.

1.03 REQUESTS FOR INTERPRETATION PRIOR TO START OF CONSTRUCTION

A. Submit Requests for Interpretation (RFIs) to the Architect in specified written format when information is missing from the Contract Documents and other data available to the Contractor, or such information is ambiguous or in apparent conflict with other portions of the Contract Documents.

B. Responses to RFIs prior to executing a Contract shall be distributed in the form of an Addendum and made available to all who are bidding or negotiating for the work.

1.04 REQUESTS FOR INTERPRETATION DURING CONSTRUCTION

A. Requests for Interpretation (RFIs): Submit requests for interpretation to the Architect in writing when information is missing from the Contract Documents and other data available to the Contractor, or such information is ambiguous or in apparent conflict with other portions of the Contract Documents.
1.05 PROCEDURES FOR REQUESTS FOR INTERPRETATION

A. No extension of Contract Time will be authorized because of failure to transmit
requests for interpretation to the Architect sufficiently in advance of the Work to
permit processing.

B. Requests for Interpretation shall be submitted only after the Contractor has thoroughly
reviewed the Contract Documents and other data available to the Contractor, as
required in the GENERAL CONDITIONS.

C. RFIs shall be submitted in writing on the form “Request for Interpretation” and shall
indicate which drawings, details, and specifications need clarification and exactly what
interpretation or information is required. RFIs shall be sequentially numbered. If
supplemental information is required, the Contractor shall clearly articulate the
requirement.
   1. RFIs submitted electronically shall be in a file separate from an e-mail or other
delivery method. Requests for interpretation in the text of e-mail will be returned
unanswered.

D. If appropriate, RFIs shall include proposed solutions. When proposed solutions could
result in additional cost to the Owner the RFI shall indicate the estimated amount. An
RFI shall not constitute a formal request for change order.

E. RFIs shall be submitted in the same format throughout the project. In addition to the
information required above, each RFI shall indicate:
   1. Project Name.
   2. Sequential number of RFI.
   3. Date request is made.
   4. Name of the person or subcontractor who is making the request.

F. RFIs shall be submitted at least 14 calendar days before the answer is required in the
field. If, on rare occasion, an RFI requires a shorter response time it shall be specially
marked as “Urgent” and shall, in addition to the information required in all RFIs, state
the reason for providing a response sooner than 14 calendar days. The Contractor is
responsible for reviewing Contract Documents and field conditions sufficiently in
advance to avoid the use of Urgent RFIs.

1.06 ARCHITECT’S ACTION ON REQUESTS FOR INTERPRETATION

A. The Architect shall review each RFI to determine whether it qualifies as an actual RFI
within the meaning of this term. If the Architect determines that it is not a properly
constituted RFI, it will be returned to the Contractor, unreviewed for content, and the
Contractor shall immediately close the item. The Contractor may reconsider the
inquiry, re-state or supplement it to meet the definition of a proper RFI and resubmit
same for consideration as a new item. The Architect shall be the sole arbiter of the
legitimacy of RFIs as submitted and the Contractor must abide by the Architect’s
decision. RFIs which request information which is available on drawings, details,
specifications, and other Contract Documents or other data available to the Contractor
shall be returned with a written response: “Not an RFI. No response necessary.”

B. The Architect will respond to RFIs in writing.

C. RFIs marked “Urgent” will be reviewed by the Architect within the time period
requested. If, in the Architect’s determination, the reason given for urgent review is
insufficient or could have been avoided by the Contractor, the Architect will so state in
a separate response, and will respond to the RFI within the usual 14 calendar days.
D. A response to an RFI does not authorize changes from the Contract Documents nor does it authorize changes in the Contract Amount unless so stated separately and in writing. In the event that a Contractor believes that a response to an RFI will cause a change to the requirements of the Contract Documents in terms of cost or schedule, the Contractor shall make immediate notice to the Architect and Owner stating same, in accordance with the notice provisions of the Contract Documents. Failure to give immediate notice will waive the Contractor’s right to make claim for additional time or cost.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION 01 26 13
PART 1 - GENERAL

1.01 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.

1.02 SUMMARY

A. This Section specifies administrative and procedural requirements necessary to prepare and process Applications for Payment.

B. Related Sections include the following:
   1. Division 01 Section "Allowances" for procedural requirements governing handling and processing of allowances.
   2. Submittals of payment requests by electronic means, Division 01 Section “Project Management and Coordination.”
   3. Division 01 Section "Contract Modification Procedures" for administrative procedures for handling changes to the Contract.
   4. Division 01 Section "Construction Progress Documentation" for administrative requirements governing preparation and submittal of Contractor's Construction Schedule and Submittals Schedule.

1.03 DEFINITIONS

A. Schedule of Values: A statement furnished by Contractor allocating portions of the Contract Sum to various portions of the Work and used as the basis for reviewing Contractor's Applications for Payment.

1.04 SCHEDULE OF VALUES

A. Coordination:
   1. Correlate line items in the Schedule of Values with other required administrative forms and schedules, including the following:
      a. Application for Payment forms with Continuation Sheets.
      b. Submittals Schedule.
      c. Contractor's Construction Schedule.
   2. Submit the Schedule of Values to Architect at earliest possible date but no later than 14 days before the date scheduled for submittal of initial Applications for Payment.

B. Format and Content:
   1. Identification:
      a. Project name and location.
      b. Contractor's name and address.
c. Date of submittal.
2. Submit draft of AIA Document G703 Continuation Sheets.
3. Provide a breakdown of the Contract Sum in enough detail to facilitate continued evaluation of Applications for Payment and progress reports. Coordinate with the Project Manual table of contents. Provide several line items for principal subcontract amounts, where appropriate.
4. Round amounts to nearest whole dollar; total shall equal the Contract Sum.
5. Provide a separate line item in the Schedule of Values for each part of the Work where Applications for Payment may include materials or equipment purchased or fabricated and stored, but not yet installed.
   a. Differentiate between items stored on-site and items stored off-site. If specified, include evidence of insurance or bonded warehousing.
6. Provide separate line items in the Schedule of Values for initial cost of materials, for each subsequent stage of completion, and for total installed value of that part of the Work.
7. Each item in the Schedule of Values and Applications for Payment shall be complete. Include total cost and proportionate share of general overhead and profit for each item.
   a. Temporary facilities and other major cost items that are not direct cost of actual work-in-place may be shown either as separate line items in the Schedule of Values or distributed as general overhead expense, at Contractor's option.
8. Schedule Updating: Update and resubmit the Schedule of Values before the next Applications for Payment when Change Orders or Construction Change Directives result in a change in the Contract Sum.

1.05 APPLICATIONS FOR PAYMENT

A. Each Application for Payment shall be consistent with previous applications and payments as certified by Architect and paid for by Owner.
   1. Initial Application for Payment, Application for Payment at time of Substantial Completion, and final Application for Payment involve additional requirements.

B. Payment Application Times: The date for each progress payment is indicated in the Agreement between Owner and Contractor. The period of construction Work covered by each Application for Payment is the period indicated in the Agreement.

C. Payment Application Forms: Use AIA Document G702 and AIA Document G703 Continuation Sheets as form for Applications for Payment.

D. Application Preparation: Complete every entry on form. Notarize and execute by a person authorized to sign legal documents on behalf of Contractor. Architect will return incomplete applications without action.
   1. Entries shall match data on the Schedule of Values and Contractor's Construction Schedule. Use updated schedules if revisions were made.
   2. Include amounts of Change Orders and Construction Change Directives issued before last day of construction period covered by application.

E. Transmittal: Submit 3 signed and notarized original copies of each Application for Payment to Architect by a method ensuring receipt. One copy shall include waivers of lien and similar attachments if required.
   1. Transmit each copy with a transmittal form listing attachments and recording appropriate information about application.

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F. Waivers of Mechanic's Lien: With each Application for Payment, submit waivers of mechanic's lien from every entity who is lawfully entitled to file a mechanic's lien arising out of the Contract and related to the Work covered by the payment.
1. Submit partial waivers on each item for amount requested in previous application, after deduction for retainage, on each item.
2. When an application shows completion of an item, submit final or full waivers.
3. Owner reserves the right to designate which entities involved in the Work must submit waivers.
4. Waiver Forms: Submit waivers of lien on forms, executed in a manner acceptable to Owner.

G. Initial Application for Payment: Administrative actions and submittals that must precede or coincide with submittal of first Application for Payment include the following:
1. List of subcontractors.
2. Schedule of Values.
3. Contractor's Construction Schedule (preliminary if not final).
4. Products list.
5. Copies of building permits.
7. Certificates of insurance and insurance policies.
8. Performance and payment bonds.
9. Construction waste management plan

H. Application for Payment at Substantial Completion: After issuing the Certificate of Substantial Completion, submit an Application for Payment showing 100 percent completion for portion of the Work claimed as substantially complete.
1. Include documentation supporting claim that the Work is substantially complete and a statement showing an accounting of changes to the Contract Sum.
2. This application shall reflect Certificates of Partial Substantial Completion issued previously for Owner occupancy of designated portions of the Work.

I. Final Payment Application: Submit final Application for Payment with releases and supporting documentation not previously submitted and accepted, including, but not limited, to the following:
1. Evidence of completion of Project closeout requirements.
2. Updated final statement, accounting for final changes to the Contract Sum.
4. Evidence that claims have been settled.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION 01 29 00
PART 1 - GENERAL

1.01 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.

1.02 SUMMARY

A. This Section includes administrative provisions for coordinating construction operations on Project including, but not limited to, the following:
   1. Administrative and supervisory personnel.
   2. Coordination of the Work and coordination documents.
   3. Project meetings.
   4. Electronic documentation requirements.

B. Related Sections include the following:
   1. Division 01 Section "Construction Progress Documentation" for preparing and submitting Contractor's Construction Schedule.
   2. Division 01 Section “Submittal Procedures” for administrative and procedural requirements for submitting Coordination Drawings.
   3. Division 01 Section "Requests for Interpretation" for preparing and submitting requests for clarification and information with regard to the Contract Documents.
   4. Division 01 Section "Execution Requirements" for procedures for coordinating general installation and field-engineering services, including establishment of benchmarks and control points.
   5. Division 01 Section "Closeout Procedures" for coordinating Contract closeout.
   6. Division 01 Section "Record Documents" for documentation of electronic communications and construction administration documents at the conclusion of construction.

1.03 COORDINATION

A. Coordination: Coordinate construction operations included in different Sections of the Specifications to ensure efficient and orderly installation of each part of the Work. Coordinate construction operations included in different Sections that depend on each other for proper installation, connection, and operation.
   1. Schedule construction operations in sequence required to obtain the best results where installation of one part of the Work depends on installation of other components, before or after its own installation.
   2. Coordinate installation of different components with other contractors to ensure maximum accessibility for required maintenance, service, and repair.
   3. Make adequate provisions to accommodate items scheduled for later installation.
   4. Where availability of space is limited, coordinate installation of different components to ensure maximum performance and accessibility for required maintenance, service, and repair of all components, including mechanical and electrical.
B. Prepare memoranda for distribution to each party involved, outlining special procedures required for coordination. Include such items as required notices, reports, and list of attendees at meetings.
   1. Prepare similar memoranda for Owner and separate contractors if coordination of their Work is required.

C. Coordination Drawings: Prepare coordination drawings where careful coordination is needed for installation of products and materials fabricated by separate entities. Prepare coordination drawings where limited space availability necessitates maximum utilization of space for efficient installation of different components.
   1. Show the relationship of components shown on separate Shop Drawings.
   2. Indicate required installation sequences.
   3. Comply with requirements of Division 01 Section "Submittal Procedures."
   4. Provide a building information model file with conflict-detection showing where conflicts occur.

D. Prepare coordination drawings for distribution to each party involved, showing coordination of major systems and building elements. Include such systems and building elements as mechanical and electrical systems, plumbing and fire protection systems, vertical and horizontal conveyance systems, structural systems, openings and penetrations, and temporary construction.
   1. Submit 3 copies of coordination drawings to the Architect for confirmation of their having been done.
   2. Show the relationship of components shown on separate Shop Drawings.
   3. Indicate required installation sequences.
   4. Comply with requirements of Division 01 Section "Submittal Procedures."

E. Administrative Procedures: Coordinate scheduling and timing of required administrative procedures with other construction activities and activities of other contractors to avoid conflicts and to ensure orderly progress of the Work. Such administrative activities include, but are not limited to, the following:
   1. Preparation of Contractor's Construction Schedule.
   2. Preparation of the Schedule of Values.
   3. Installation and removal of temporary facilities and controls.
   4. Delivery and processing of submittals.
   5. Progress meetings.
   6. Preinstallation conferences.
   7. Project closeout activities.
   8. Startup and adjustment of systems.
   9. Project closeout activities.

F. Conservation: Coordinate construction activities to ensure that operations are carried out with consideration given to conservation of energy, water, and materials.
   1. Salvage materials and equipment involved in performance of, but not actually incorporated into, the Work. Refer to other Sections for disposition of salvaged materials that are designated as Owner's property.

1.04 PROJECT MEETINGS

A. General: Schedule and conduct meetings and conferences at Project site, unless otherwise indicated.
   1. Attendees: Inform participants and others involved, and individuals whose presence is required, of date and time of each meeting. Notify Owner and Architect of scheduled meeting dates and times.
2. Agenda: Prepare the meeting agenda. Distribute the agenda to all invited attendees.

3. Minutes: Record significant discussions and agreements achieved. Distribute the meeting minutes to everyone concerned, including Owner and Architect, within three days of the meeting.

B. Initial Project Meeting: Conduct a project kick-off meeting prior to start of Work.
1. Attendees: In addition to representatives of Owner and Architect, the Construction Manager, every Contractor and every subcontractor shall be represented at these meetings. All participants at the conference shall be familiar with Project and authorized to conclude matters relating to the Work.
2. Agenda:
   a. Review the general roles of all the parties and the routes of communication.
   b. Review process and requirements for payment requests.
   c. Review process and requirements for requests for interpretation.
   d. Review process and requirements for submittals.

C. Progress Meetings: Conduct progress meetings at semi-monthly intervals. Coordinate dates of meetings with preparation of payment requests.
1. Attendees: In addition to representatives of Owner and Architect, other entities concerned with current progress or involved in planning, coordination, or performance of future activities shall be represented at these meetings. All participants at the conference shall be familiar with Project and authorized to conclude matters relating to the Work.
2. Agenda: Review and correct or approve minutes of previous progress meeting. Review other items of significance that could affect progress. Include topics for discussion as appropriate to status of Project.
   a. Contractor's Construction Schedule: Review progress since the last meeting. Determine whether each activity is on time, ahead of schedule, or behind schedule, in relation to Contractor's Construction Schedule. Determine how construction behind schedule will be expedited; secure commitments from parties involved to do so. Discuss whether schedule revisions are required to ensure that current and subsequent activities will be completed within the Contract Time.
      1) Review schedule for next period.
   b. Review present and future needs of each entity present, including the following:
      1) Status of submittals.
      2) Status of correction of deficient items.
      3) Field observations.
      4) Requests for interpretations (RFIs).
      5) Status of proposal requests.
      6) Pending changes.
      7) Status of Change Orders.
      8) Pending claims and disputes.
      9) Documentation of information for payment requests.
3. Reporting: Distribute minutes of the meeting to each party present and to parties who should have been present.
   a. Schedule Updating: Revise Contractor's Construction Schedule after each progress meeting where revisions to the schedule have been made or recognized. Issue revised schedule concurrently with the report of each meeting.
1.05 ELECTRONIC PROJECT DOCUMENTATION

A. General: Provide a system for the creation and transmission of construction contract administration documents using electronic systems.

B. Software Writers: Compatible with ISO 32000-1:2008 Document Management, software that can save to or write a Portable Document File (PDF) including allowing for encryption and signature. Non-branded and non-publicly-supported software is not acceptable.
   1. Where electronic files are created using software such as building information modeling software, provide the entire file in the original software format with instructions on which software and the version that was used to create it.
   2. Provide PDFs of construction progress schedules and charts.
   3. Convert e-mail to PDF.

C. Scanned Copies: Legible scanned PDF files of paper originals are acceptable; scanned submittals and other documents that are not legible will be rejected.

D. Sheet Orientation: Assemble PDF sheets in a single file; unless resulting file is larger than 10 MB, rotated to a “Ready-to-Read” orientation with majority of text horizontal to the sheet with no additional adjustments or formatting required by the viewer.

E. File Size: E-Mail Delivery, 5 megabytes (MB); FTP site or Web site delivery, 100 MB
   1. Split Delivery: Break large PDF files into smaller packages where necessary to meet delivery restrictions; identify split packages as “1 of 2” and “2 of 2” in the Subject Line of submission.

F. File Security: Do not set any permissions on the file; protected documents will not be accepted.

G. File Identification: File name must contain Project Number, Name of Submission, Date of Submission, Name of Fabricator and Submittal Number with underscore between each item; do not use periods except immediately prior to document type.

H. Transmission Requirements: Send non-compressed files as an attachment to e-mail or upload to FTP site; zipped files will be rejected (This prevents and potential problems with regards to non-supported file compression utilities).

I. Provide electronically submitted documents with an encrypted signature attached; indicating reviewer and location of original PDF documents on server. Any changes made subsequent to the signature and comments added to documents will identified by the PDF software used during review.

J. Electronic documents posted or sent after 3:00 P.M. local time on a Friday or last day prior to a holiday will not be considered as having been received until 9:00 A.M. of the first business day following the date sent.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION 01 31 00

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PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. This Section is to be coordinated with and complementary to the General Conditions and General Requirements, wherever applicable to the Work.

B. Where items of the General Conditions and General Requirements are repeated in this Section of the Specifications, it is intended to qualify or to call particular attention to them; it is not intended that any other parts of the General Conditions and General Requirements shall be assumed to be omitted if not repeated herein.

C. This Section applies equally and specifically to all Contractors and Subcontractors supplying labor and/or equipment and/or materials as required for the project.

1.02 DEFINITIONS

A. "The Contractor" or "Each Contractor" means specifically, the Contractor or Subcontractor working under his respective Section of this Specification.

B. "Provide" means to supply, erect, install, and connect up in complete readiness for regular operation, the particular work referred to.

C. "Furnish" means to supply and deliver to the job.

D. "Piping" includes, in addition to pipe, all fittings, valves, hangers, and other accessories related to such piping.

E. "Concealed" means hidden from sight as in chases, furred spaces, shafts, hung ceilings, or embedded in construction.

F. "Exposed" means "not concealed" as defined above. Work in trenches, crawl spaces, and tunnels shall be considered "exposed" unless otherwise specifically noted. Work located in mechanical rooms, accessible attics, open storage rooms, janitor’s closets, on the roof or anywhere outdoors shall be considered “exposed”.

G. "Approved equal" means any equipment or material which, in the opinion of the Engineer, is equal in quality, durability, appearance, strength, design, performance, physical dimensions, and arrangement to the equipment or material specified, and will function adequately in accordance with the general design.

H. "Governmental” means all municipal, state and federal governmental agencies.

I. “Architect” and “Engineer” means Kallen & Lemelson LLP, Engineers

J. Where any device or part of equipment is herein referred to in the singular number (such as "the pump"), such reference shall be deemed to apply to as many such devices as are required to complete the installation as shown on the Drawings.

K. "HVAC” means Heating, Ventilating and Air Conditioning.
L. "Plumbing Contractor" means the Contractor doing Plumbing and Fire Protection Work including Sprinkler Work.

1.03 CODES AND STANDARDS

B. NFPA National Fire Protection Association
C. ASME American Society of Mechanical Engineers
D. ANSI American National Standards Institute
E. ASTM American Society for Testing Materials
F. NEMA National Electrical Manufacturers Association
G. ASHRAE American Society of Heating, Refrigeration and Air Conditioning Engineers
H. SMACNA Sheet Metal and Air Conditioning Contractors National Association, Inc.
I. ARI Air Conditioning and Refrigeration Institute
J. UL Underwriters' Laboratories
K. AMCA Air Movement Control Association
L. ADC Air Diffusion Council
M. AABC Associated Air Balance Council
N. NFPA-90A Air Conditioning and Ventilation Systems
O. NY City Electric Code

1.04 INTENT

A. It is the intention of the Specifications and Drawings to call for finished work, tested, and ready for operation. All materials, equipment, and apparatus shall be new and of first-class quality.

B. Any apparatus, appliance, material, or work not shown on Drawings, but mentioned in the Specifications, or vice versa, or any incidental accessories, or minor details not shown but necessary to make the work complete and perfect in all respects and ready for operation, even if not particularly specified, shall be provided without additional expense to the Owner.

1.05 DRAWINGS

A. The Drawings are generally diagrammatic and are intended to convey the scope of work and indicate general arrangement of equipment; ducts, conduits, piping, and fixtures.

B. The locations of all items shown on the Drawings or called for in the Specifications that are not definitely fixed by dimensions are approximate only. The exact locations necessary to secure the
best conditions and results must be determined at the project and shall have the approval of the
Engineer before being installed. Do not scale Drawings.

C. Follow Drawings in laying out work and check Drawings of other trades to verify spaces in which
work will be installed. Maintain maximum headroom and space conditions at all points. Where
headroom and space conditions appear inadequate, Engineer shall be notified before proceeding
with installation.

D. If directed by the Engineer, without extra charge, make reasonable modifications in the layout as
needed to prevent conflict with work of other trades, new and existing, or for proper execution of
the work.

E. Piping or ductwork connected to equipment may require different size connection than indicated
on the Drawings. The Contractor shall provide transition pieces as required at the equipment.

1.06 INTERPRETATION OF DRAWINGS AND SPECIFICATIONS

A. Any questions or disagreements arising as to the true intent of this Specification or the Drawings
or the kind and quality of work required thereby shall be decided by the Engineer, whose
interpretations thereof shall be final, conclusive, and binding on all parties.

B. In case of disagreement between Drawings and Specifications, or within either document itself,
the better quality, greater quantity or more costly work shall be included in the Bid Price and the
matter referred to the Engineer's attention for decision and/or adjustment prior to the Contractor’s
submission of their Bid. If such ambiguity is identified by the Contractor during construction
(after bid period), then the Engineer shall be consulted merely to decide on the proper technical
approach; the more costly work’s value shall be included.

C. Maintain an awareness to avoid space conflict with other trades.

D. Purchase the equipment and material required in accordance with field measurements taken at the
proper time during the construction progress.

1.07 VISITING THE SITE

A. Before submitting the final proposal, examine the site of the proposed work to determine the
existing conditions that may affect the work, as the Contractor will be held responsible for any
assumptions in regard.

1.08 EQUIPMENT AND MATERIALS

A. All pipe, fittings and valves shall be manufactured in the United States of America.

B. Within twenty (20) working days after the acceptance of the proposal, and prior to the submission
of any shop drawings for review, a complete list of manufacturers shall be submitted to the
Engineer of all equipment and materials proposed for the work. No reviews will be rendered on
shop drawings submitted before the complete list of manufacturers is reviewed.

C. If material or equipment is installed before the Contractor obtained "No Objections" comment
from Engineer, and/or in the opinion of the Engineer the material or equipment does not meet the
intent of the Drawings and Specifications, the removal and replacement shall be made at no extra
cost to the Owner.
D. The materials, workmanship, design, and arrangement of all work installed under the Contract shall be subject to the approval of the Engineer.

E. If material or equipment is installed before the Contractor obtained "No Objections" comment from the Engineer, trade installing same shall be liable for the removal and replacement at no extra charge to the Owner if, in the opinion of the Engineer, the material or equipment does not meet the intent of the Drawings and Specifications.

F. The words "or approved equal" are understood to follow:
   1. The name of any manufacturer, vendor, equipment or materials;
   2. Any trade name, plate number, or catalog number;
   3. Any detailed description used to define equipment or material; except where otherwise indicated on the Drawings or in the Specifications.
   4. It is the intent of these Specifications that wherever a manufacturer of a product is specified, and the terms "other approved" or "or approved equal" are used, the substituted item must conform in all respects to the specified item. Consideration will not be given to claim that the substituted item meets the performance requirements with lesser construction (such as lesser heat exchange surface, etc.) Performance as delineated in schedules and in the Specifications shall be interpreted as minimum performance.

G. All equipment and materials required for installation under these Specifications shall be new and without blemish or defect. All electrical equipment shall bear labels attesting to Underwriters' Laboratories approval. Where no specific indication as to the type or quality of the material or equipment is indicated, a first class standard article shall be furnished.

H. Where it is proposed to use an item of equipment other than that specified or detailed on the Drawings which requires any redesign of the structure, partitions, foundations, piping, wiring, or of any other part of the mechanical, electrical, or architectural layout, all such redesign, and all new drawings and detailing required therefore shall, with the review of the Engineer and subsequent comments by the Engineer "No Exception" or "Exception as Noted" on the shop drawings, be prepared at no additional cost to the Owner.

I. Where such deviation from contract documents requires a different quantity and arrangement of general construction work, ductwork, piping, wiring, conduit, and equipment from that specified or indicated on the Drawings, furnish and install any such general construction work, ductwork, piping, structural supports, insulation, controllers, motors, starters, electrical wiring, and conduit, and any other additional equipment required by the system, at no additional cost to the Owner.

J. All equipment of one type (such as fan, coils, etc.) shall be the product of the same manufacturer.

K. Note that the comments "No Exception" or "Exception as Noted" marked on the shop drawings or other information submitted in accordance with the requirements herein before specified does not assure that the Engineer, or any other Owner's representative attests to the dimensional accuracy or dimensional suitability of the material or equipment involved or the mechanical performance of equipment. Comments on the shop drawings does not invalidate the Plans and Specifications if the shop drawings are in conflict with the Plans and Specifications.

1.09 SHOP DRAWINGS AND SUBMITTALS

A. Prior to delivery to job site, but sufficiently in advance of requirements necessary to allow Engineer ample time for review, submit copies (as stated in "General Conditions") of shop
drawings of all equipment, materials, piping, sleeves, conduit, ductwork, and wiring diagrams, and further obtain written comments "No Exception" or "Exception as Noted" for same from the Engineer, before installing any of these items.

B. All shop drawings shall be prepared using AutoCAD. Manually drafted shop drawings are prohibited. If a Contractor is incapable of developing CAD drawings in-house, then they shall engage the services of an external drafting service in order to do so. The cost for such service shall be borne by the Contractor and included as part of their bid. Shop drawing submittals shall be on paper as described herein. While shop drawings are being developed and revised throughout the construction process, the Contractor shall continually update the CAD files. As construction approaches completion, these shop drawing CAD files will develop into “As-Built” drawings. As part of standard project close-out documents, in addition to providing conventional paper copies of As-Built Shop Drawings, the Contractor must also provide CD’s containing electronic AutoCAD versions of same.

C. Shop drawings shall consist of manufacturer’s certified scale drawings, cuts, or catalogs, including descriptive literature and complete certified characteristics of equipment, showing dimensions, capacity, code requirements, motor and drive testing, as indicated on the Drawings or Specifications.

D. Certified performance curves for all pumping and fan equipment shall be submitted for review.

E. Shop drawings submitted with insufficient information shall be rejected without review.

F. All shop drawings and submittals shall be sent via email in PDF format. Other electronic file formats will be rejected without review. Additionally, large format prints (larger than 18” x 24”) shall also be sent in paper (hard copy) form, either mailed or hand delivered. If and where such hard copies are sent, the Contractor shall send a sufficient quantity of prints of each, knowing that one (1) copy will each be required for the Engineer’s record, the Owner and various subcontractors.

G. Samples of materials or equipment, when requested by the Engineer, shall be submitted for review.

H. Provide a detailed Transmittal with all shop drawings, via email. Any Transmittal, Shop drawing, sample, specification, etc. which is not labeled with all of the following information shall be rejected without review:
   1. Project name
   2. Project location
   3. Contractor’s name and address, Subcontractor’s name and address
   4. Applicable section and article number of specifications
   5. Contractor’s approval stamp and signature
   6. Submission number
   7. Specific service for which material is to be used.

I. Catalogs, pamphlets, or other documents submitted to describe items on which review is being requested, shall be specific and identification in catalog, pamphlet, etc., of item submitted shall be clearly made in ink. Data of a general nature such as tabulated charts will not be accepted.

J. Shop drawings indicating an unsuitable manufacturer shall be rejected without review.
K. The HVAC Subcontractor shall prepare ductwork shop drawings at \(\frac{3}{4}"=1\text{-}0"\) scale and submit to the Engineer for their approval to prepare the coordination drawings as called for in paragraph below. Ductwork shop drawings shall be drawn with double line ductwork and shall indicate the elevation above finished floor of all ducts, location and height of building structure (beams, etc.), lengths of fabrication pieces and fittings. Show new and existing work. Shop drawings submitted shall be ready for sheet metal fabrication.

L. The comments "No Exception" or "Exceptions as Noted" rendered on shop drawings shall not be considered as a guarantee of measurements or building conditions. Where drawings are reviewed, said review does not in any way relieve responsibility, or necessity, of furnishing material or performing work as required by the Contract Drawings and Specifications.

M. "EXCEPTIONS, AS NOTED" means, unless otherwise noted on the drawings to approved for construction, fabrication and/or manufacture subject to the provision that the work shall be carried out in compliance with all annotations and/or corrections indicated on the shop drawings and in accordance with the requirements of the Contract Documents. If also marked "RESUBMIT", "EXCEPTIONS AS NOTED" is invalid and a corrected submittal of the drawing is required.

N. If a shop drawing is resubmitted and does not comply with all of the comments indicated on the previous submission(s), and does not reflect specific reasons for such non-compliance, it shall be rejected without review.

O. Label resubmitted shop drawings with a stamp indicating the submittal number, for example: SECOND SUBMISSION; THIRD SUBMISSION, etc. and send separate transmittals for each item being submitted so that one transmittal does not cover more than one specific item or group of items from one manufacturer.

P. Failure to submit shop drawings in ample time for checking shall not entitle an extension of Contract time, and no claim for extension by reason of such default will be allowed.

Q. Prior to submission of shop drawings, thoroughly check each shop drawing, reject those not conforming to the Specifications, and indicate (by signature) that the shop drawings submitted meet Contract requirements. Deviations and/or exceptions to the contract documents should be clearly noted as being deviations and/or exceptions. The Contractor will later be required to correct such deviation and/or exceptions at his own expense, if they have not been noted and approved on the shop drawing.

R. All shop drawings showing routing of ductwork, piping and conduit, shall be not less than \(\frac{3}{4}"=1\text{-}0"\) scale.

S. Shop drawings requiring resubmission should bear the number of the original submission and bear a suffix indicating the resubmission sequence.

T. Before request for acceptance and final payment for the work, write a letter to the Engineer stating that all shop drawings are brought to a condition "No Exception" or "Exception as Noted". Any outstanding shop drawings must be cleared with the Engineer.

1.10 RECORD DRAWINGS

A. The Contractor shall furnish, coordinate, produce and distribute record drawings as stated within the General Conditions of the Contract.
B. During construction keep an accurate record of all deviations between the work as shown on the Drawings and that which is actually installed.

C. Record drawings shall be CAD type, provide CD’s containing AutoCAD files of these drawings to the Engineer and the Owner.

1.11 LAWS, ORDINANCES, PERMITS AND FEES

A. Give all necessary notices, obtain all permits and pay all governmental taxes, fees, and other costs in connection with the work; file all necessary plans, prepare all documents, and obtain all necessary approvals of all governmental departments having jurisdiction; obtain all required Certificates of Inspection for the work and deliver to the Engineer before request for acceptance and final payment for the work. File for and obtain all required equipment use permits, controlled inspections, submission of fire alarm as-built drawings and all other required filings.

B. Include in the work, without extra cost to the Owner, any labor, materials, services, apparatus, drawings, (in addition to Contract Drawings and Documents) in order to comply with all applicable laws, ordinances, rules and regulations, whether or not shown on Drawings and/or specified.

C. All materials furnished and all work installed shall comply with the rules and recommendations of the National Fire Protection Association, with all requirements of local utility companies, with the recommendations of the fire insurance rating organization having jurisdiction, and with the requirements of all governmental departments having jurisdiction.

D. Include in the bid, without extra cost to the Owner, retaining the service of a licensed professional engineer to obtain equipment use permits, filing of sprinkler drawings with hydraulic calculations, preparation of fire alarm as-built drawings, testing of all fire and fire smoke dampers, and approvals and all other required filings.

1.12 INDEMNIFICATION

A. Pay all royalties and defend all suits or claims for infringement of any patent rights and save the Owner harmless from loss on account thereof.

B. If process or article specified is an infringement of a patent, promptly notify the Engineer in writing, and any necessary changes shall be as provided in the Contract for changes in the work. If the Contractor performs any work specified knowing it to be an infringement of patent, he shall bear all costs arising therefrom.

C. Take out all necessary insurance, free of extra charge, and agree to indemnify and save harmless the party contracting for services against loss or expense, by reason of the liability imposed by law upon such party for damages because of bodily injuries, including death at any time resulting therefrom, accidentally sustained by any person or persons or on account of damage to property arising out of or in consequence of the performance of this Contract, whether such injuries to persons or damage to property are due or claimed to be due to any negligence in the performance of the Contract, the party contracting for services, employees or agents, or any other person.
1.13 ORGANIZATION OF WORK

A. The work throughout shall be executed in the best and most thorough manner under the direction of and to the satisfaction of the Engineers, Owners and Architects, who will jointly interpret the meaning of the Drawings and Specifications, and shall have the power to reject any work and materials which, in their judgment, are not in full accordance therewith.

B. The work called for under this Contract shall be carried on simultaneously with the work of other trades in a manner such as not to delay the overall progress of the work. Furnish promptly to other trades involved at the project, all information and measurements relating to the work which they may require. Cooperate with them in order to secure the harmony necessary in the interest of the project as a whole.

C. Furnish and install all work as expeditiously as possible in order to meet all construction schedules.

D. Keep a competent superintendent in charge of the work at all times. Such superintendent shall be replaced if deemed unsatisfactory to the Owner.

E. Upon award of contract, consult with the Engineer and negotiate with subcontractors and manufacturers, and within thirty (30) days submit five (5) copies of a preliminary list of major equipment, for approval, complete with name of manufacturer, dates of purchase orders, and delivery dates to the site. Also submit within thirty (30) days, five (5) copies of a preliminary schedule of installation of the various systems. This list shall be revised monthly and five (5) copies shall be submitted. The second submittal shall contain the names of manufacturers of scheduled equipment (with names, addresses, and telephone numbers of local representatives).

F. Maintain a complete file of shop drawings at all times available to the Owner's representative.

G. Every facility shall be provided to permit inspection of the work by the Owner's representative during the course of construction.

H. Where items of equipment and/or materials are indicated in the Specifications as being furnished by other trades for installation, assume responsibility for the unloading of such equipment and/or materials from the delivery trucks, and for providing safe storage for same as required pending installation.

I. Where the work is to be installed in close proximity to work of other trades, or where there is evidence that the work is to interfere with work of other trades, assist in working out space conditions to make a satisfactory adjustment.

J. If so directed by the Engineer, at no additional cost to the Owner, prepare composite working drawings and sections at a suitable scale not less than \( \frac{3}{8}'' = 1'-0'' \) clearly showing how the work is to be installed in relation to the work of other trades. If the installation is made before coordinating with other trades, make all necessary changes in the work without extra charge to the Owner.

K. Before submitting shop drawings for sleeves, conduit, piping and ductwork, the Contractor shall prepare a combined \( \frac{3}{8}'' = 1'-0'' \) scale shop drawing for conduit, piping and ductwork indicating location of piping and ductwork with dimensions for each floor, the MDF room and the roofs.
L. The Contractor shall arrange a Coordination Meeting for each floor, MDF room and roofs with all sub-contractors and trades working in each area. The Contractor shall submit these drawings to the Engineer for review and he shall call any conflicts that could not be resolved in the coordination meetings, and/or deviation from original design, to the Engineer’s attention. After receiving written review from the Engineer, each Contractor shall prepare the shop drawings as required under the paragraph "Shop Drawings" in the Specifications.

1.14 PROTECTION OF WORK AND PROPERTY

A. Maintain and protect all equipment, materials and tools from loss or damage from all causes until final acceptance by the Owner.

B. Assume responsibility for the protection of existing work, any finished work or other trades from damage or defacement by the operations and remedy any such injury or damages.

1.15 TEMPORARY OPENINGS

A. Ascertain from examination of the Drawings whether any special temporary openings in the building will be required for the admission of apparatus provided under the Contract. Assume all costs of providing such openings thereafter.

1.16 SHUTDOWNS

A. When installation of a new system requires the temporary shutdown of an existing operating system, the connection of the new system shall be performed at such regular time or at overtime when designated by the Owner at no additional cost to the Owner.

B. The Owner shall be notified of the estimated duration of the shutdown period at least ten (10) days in advance of the date the work is to be performed.

C. Work shall be arranged for continuous performance, including overtime, when approved by the Owner, if required, to assure that existing operating services will be shut down only during the time actually required to make necessary connections.

1.17 ACCESS DOORS IN FINISHED CONSTRUCTION

A. Install all work so that all parts required are readily accessible for inspection, operation, maintenance and repair. Minor deviations from the Drawings may be made to accomplish this, but changes of magnitude shall not be made without prior written review from the Engineer.

B. Wherever mechanisms requiring access for maintenance, reading of instruments, or for operation are concealed in the structure and wherever else indicated on the Drawings, supply access doors of sizes necessary to provide ready access to the concealed items. Group together valves, controls, dampers, pull boxes, cleanouts, gauges, switches, and other equipment requiring access in walls and furred spaces to reduce the number of access doors.

C. Access doors shall be Milcor Style A, B or K, L or M, as manufactured by Inland Steel Products Co. or approved equal. Minimum access door shall be 12" x 12". For installation in plastered wall or ceiling, provide Style "K" or "L" as required. For installation in masonry walls, provide Style "M". For installation in acoustical tile surfaces, provide Style "AT". For installation in acoustical plaster surfaces provide Style "AP". Fire resistive access doors for suspended dry wall
ceiling shall be Style ATC’s. Provide fire rated access doors at fire rated shafts, stairwells, corridors and at all other walls with Fire Rating.

D. All access doors shall be provided with master keyed cylinder locks. These locks shall be supplied and installed by the Contractor. These cylinder locks shall be purchased for hardware after submission and review of the panel schedule as hereinafter specified.

E. Prepare a schedule showing location of all panels, cabinets, etc. to receive the locks. This schedule shall designate, by building and room number, the panel or cabinet location and shall be submitted to the Engineer. This schedule is required for use in preparation of keying information. Locks shall not be purchased prior to review of this schedule.

1.18 PIPE EXPANSION

A. All pipe connections shall be installed to allow for freedom of movement of the pipe during the expansion and contraction without proper anchors and guides shall be provided where necessary and/or when shown on the Drawings. Anchors and guides shall be subject to the review of the Engineer.

1.19 SCAFFOLDING, RIGGING, HOISTING

A. Provide all scaffolding, rigging, hoisting and services necessary for erection and delivery into the premises of all equipment and materials furnished under this Section of the Specifications, and remove same from premises when no longer required.

B. In the event that supplementary bracing of the basic building structure is required to assure a secure rigging procedure and a secure route for the equipment being handled, assume full responsibility for such supplementary bracing.

1.20 BASES AND SUPPORTS

A. Provide all bases and supports not part of the building structure of required size, type and strength, as approved by the Engineer, for all equipment and materials furnished by him. All equipment, bases, and supports shall be adequately anchored to the building structure to prevent shifting of position under operating conditions.

B. The Section furnishing the equipment shall provide not less than six-inch high concrete bases for all transformers, distribution panels, fans, air handlers, etc. Bases shall extend six inches beyond machinery base in all directions, with top edge chamfered. Provide ½" x 6" steel dowels into floors to anchor bases. Provide anchor bolts set in pipe sleeves, two sizes larger than anchor bolts for securing machinery. After anchor bolts are aligned with equipment bases, fill sleeves with concrete and allow to set.

C. Concrete pads shall also be provided below any floor-mounted duct support, pipe support and electrical panel support (including switchboards, power panels, starters, VFDs, pull boxes, etc.). Provide six inch high concrete pads below the mounting feet of any of the above duct, pipe or equipment support legs. Provide connection hardware (anchor bolts) as described above for rotating equipment.
D. New concrete pads shall be doweled into the existing concrete with ½" rods at corners, drilled 6" deep and grouted. An epoxy bonding agent shall be applied between the old and new concrete. Concrete shall be 3000 psi reinforced with one middle layer 4 x 4 - w2.9 x w2.9.

1.21 SEISMIC RESTRAINT

A. All mechanical and electrical systems including equipment, conduit, piping and ductwork shall be installed so as to resist seismic loading as indicated in Section 01 35 48 of the specification.

B. The section installing the equipment shall provide required seismic restraints.

1.22 SLEEVES, PIPE AND CONDUIT INSERTS AND ANCHOR BOLTS

A. Provide and assume responsibility for the location and maintenance in proper position of all sleeves, inserts, and anchor bolts required for the work. Provide cutting and patching of existing and finished work, as required, without additional cost to the Owner.

B. All pipes and conduits passing through all walls or partitions shall be provided with sleeves having an internal diameter larger than the outside diameter of the pipe or insulation enclosing the pipe or conduit. Sleeves shall be Schedule 40 black steel pipe. Sleeves through non-masonry partitions shall be 22 gauge sheet steel, set flush with finished surfaces of partitions.

C. Sleeves through concrete floors or interior masonry walls shall be Schedule 40 black steel pipe, set flush with finished wall surfaces, but extending 1" above finished floors. The open sleeve space shall be packed with non-combustible materials.

D. In general, all piping and conduit shall be supported from structural steel building members only or approved malleable steel inserts imbedded in concrete pours. Inserts shall not be located in the same deck flute as ceiling tabs nor within 2 feet in any direction from ceiling tabs. Inserts shall not be spaced closer than 4 feet on center in all directions.

E. For existing concrete decks, piping and conduit 3" and smaller may be supported at Intermediate Points by Phillips' ¾" expansion bolts with lead shields, provided main supports are welded to structural steel and are not more than twenty feet on centers.

F. The Contractor shall have the option of providing 18 gauge sheet metal sleeves in lieu of Schedule 40 steel pipe.

G. Piping and conduit 3" and smaller shall be supported from existing slab by "Phillips" ¾ expansion bolts with lead shields. Piping 4" and larger shall be supported by means of 4” x 4” x ¾” clip knee angle with ¾” expansion bolt in shear and supporting rod at 90 from another bolt or using two expansion bolts per hanging post - pipes 8’ and larger shall be supported from steel building members. In concrete buildings, add supplementary steel tied into the concrete structural members. Support such piping, conduits and ductwork from the supplementary steel.

H. Provide sleeves for conduits and pipes passing through roofs. Sleeves passing through roofs shall be as detailed on drawings extending min. 12" above finished roof. All pipes passing through roof shall be minimum of 10" from walls or other construction to permit proper flashing. Provide counter flashing.
I. Where sleeves pass through waterproofed floors, they shall be IPS brass pipe sleeves of the required diameter, brazed at the bottom to 18" x 18", 16-ounce copper flashing for bond with waterproofing. The tops of the sleeves shall extend 1" above finished floor.

J. No ductwork, piping, conduit or equipment shall be supported from corrugated decking construction. For this area provide supplementary steel to support ductwork, piping, conduit or equipment. Supplemental steel members shall be welded to building structural steel.

K. Repair structural fireproofing where new supports are connected.

L. The required fire resistance rating of floor or floor/ceiling assemblies and walls shall be maintained where a penetration is made for electrical, mechanical, plumbing pipes, conduits, ducts and systems. Fire stopping shall be provided at openings around vents, pipes, ducts, conduits at floor levels and walls with non-combustible materials. For openings around pipes and conduits and/or sleeves, 3M product Caulk CP 25 and Putty 303 or approved equal shall be provided.

M. Owner shall retain the services of a NYS Licensed Professional Engineer and under his direction shall inspect the existing spray or fire proofing of existing structural members exposed during the renovation. Provide a report of deficiencies.

1.23 ESCUTCHEONS

A. Provide escutcheons on pipes wherever they pass through ceilings, walls, or partitions.

B. Escutcheons or pipes passing through outside walls shall be Ritter Pattern and Casting Co., № 1, solid, cast brass, flat type secured to pipe with set screw.

C. Escutcheons for pipes passing through floors shall be Ritter Pattern and Casting Co., № 36A, split-hinged, cast brass type, designed to fit pipe on one end and cover sleeve projecting through floor on the other end.

D. Escutcheons for pipes passing through interior walls, partitions, and ceilings shall be Ritter Pattern and Casting Co., № 3A, split-hinged, cast brass chromium plated type.

1.24 MANUFACTURERS' IDENTIFICATION

A. Manufacturer's nameplate, name or trademark, shall be permanently affixed to all equipment and material furnished under this Specification. Where such equipment is in a finished occupied space, the nameplate shall be in a concealed but accessible location. The nameplate of a Subcontractor or Distributor will not be acceptable.

1.25 EQUIPMENT NAMEPLATES

A. Provide for each item of equipment, including panelboards, disconnects, breakers, starters, switches, and all control devices, fans, etc., a permanently attached nameplate made of black surface, white core laminated bakelite with incised letters. Subcontractor furnishing equipment shall provide nameplate. Nameplates shall be a minimum of 3" long by 1½" wide and shall bear the equipment name and item number (tag number) in ½" high white letters as designated in the equipment schedule. Nameplates shall be attached to their respective equipment by screws or rivets.
B. Provide nameplates on emergency power equipment (panelboards, circuit breaker panels, ATS, etc.) identifying the branch (life safety, critical or equipment) to which devices they belong.

1.26 TAGS AND CHARTS

A. Furnish and attach to each valve as hereinafter specified, a 1½" diameter brass tag with ½" indented numerals filled with durable black compound. Tags shall be securely attached to stems of valves with wire and "S" hooks.

B. Valve charts shall consist of schematic drawings of piping layouts, showing and identifying each valve and describing the function. Upon completion of the work, one (1) copy of each chart, sealed to rigid backboard with clear lacquer placed under glass and framed, shall be hung in a conspicuous location in the main equipment room, unless otherwise directed by the Engineer. Two (2) additional unmounted copies in 8½" x 11" leather ring binders shall be delivered to the Engineer. Also furnish three (3) copies of schematic flow chart with corresponding valve numbers noted on chart.

C. Provide tags for the following valves:
   1. Zone control, bypass, shut-off, check and balancing valves.
   2. Building and area shut-off and balancing valves.
   3. Control, by-pass, shut-off, balancing and drain valves for major pieces of equipment such as boilers, domestic hot water heaters, heat exchangers, refrigeration machines, pumps, heating, ventilating and air conditioning units, cooling towers, etc.

D. Tags on control valves shall bear the valve tag numbers shown on the ATC shop drawings. These shall be brass 1¼" diameter tags, with ½" indented numerals filled with durable black compound. Tags shall be securely attached to steams of valves with wire and “S” hooks.

1.27 IDENTIFICATION

A. Identification shall be in accordance with "Scheme for Identification of Piping System ANSI A13.1" and OSHA safety color regulation.

B. Markers shall be snap-on type as manufactured by Craftmark, Fort Worth, TX or Seton Nameplate Corp., New Haven, CT (Setmark System), or Bunting Stamp Co. Inc., Pittsburgh, PA or approved equal. Markers shall completely encircle the pipe with a substantial overlap. No adhesive shall be used. They shall be manufactured of U.L. approved, self-extinguishing plastic. When the pipe, including insulation (if any), is larger than 4 inches diameter, markers shall be strap-on type. For piping located outdoors, all markers shall be strap-on type for all pipe diameters. Markers for medical gas piping shall be by means of metal tags, stenciling, stamping or with adhesive markers, in a manner which is not readily removable.

C. Provide identification for piping, ductwork and electrical conduits.

D. All piping and ductwork shall be labeled, whether concealed above ceilings or exposed. Labels shall be installed at intervals no greater than 15 feet (unless noted otherwise) and shall be installed after every turn or elbow. Where concealed above ceilings, a minimum of one (1) label shall occur above each room. Due to various above ceiling visual obstructions, the Engineer reserves the right to request additional labels in order to ensure visibility, at no additional cost to the Owner.
E. Pipe shall be lettered and valves tagged in accordance with the schedule below. Lettering shall be located near each valve and branch connection and at intervals of not over 20 feet (10 feet on fire lines, and at least once in each room and in each story traversed for medical gas piping) on straight runs of pipe. Provide flow arrows for all piping at each marker. Adjacent to the legend, stencil the size of the pipe, conduit or ductwork. Letter Colors are as follows: Yellow with black letters, green with white letters, blue with white letters and red with white letters.

<table>
<thead>
<tr>
<th>Service</th>
<th>Label Designation</th>
<th>Color</th>
<th>Tag Designation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cold Water</td>
<td>Cold Water</td>
<td>Green</td>
<td>C.W.</td>
</tr>
<tr>
<td>Fire Standpipe</td>
<td>Fire Standpipe</td>
<td>Red</td>
<td>FSP</td>
</tr>
<tr>
<td>Sprinkler</td>
<td>Sprinkler</td>
<td>Red</td>
<td>SP</td>
</tr>
<tr>
<td>Condenser Water Supply</td>
<td>Condenser Water</td>
<td>Green</td>
<td>C.W.S.</td>
</tr>
<tr>
<td>Condenser Water Return</td>
<td>Condenser Water Ret.</td>
<td>Green</td>
<td>C.W.R.</td>
</tr>
<tr>
<td>Refrigerant Suction</td>
<td>Refrigerant Suction</td>
<td>Green</td>
<td>RS</td>
</tr>
<tr>
<td>Refrigerant Liquid</td>
<td>Refrigerant Liquid</td>
<td>Green</td>
<td>RL</td>
</tr>
<tr>
<td>Refrigerant Hot Gas</td>
<td>Refrigerant Hot Gas</td>
<td>Green</td>
<td>RHG</td>
</tr>
<tr>
<td>Sanitary Sewer</td>
<td>San. Sewer</td>
<td>Green</td>
<td>----</td>
</tr>
<tr>
<td>Storm Sewer</td>
<td>Storm Sewer</td>
<td>Green</td>
<td>----</td>
</tr>
<tr>
<td>Vent Piping</td>
<td>Vent</td>
<td>Green</td>
<td>----</td>
</tr>
<tr>
<td>Air Conditioning Drain</td>
<td>Air Conditioning Drain</td>
<td>Green</td>
<td>----</td>
</tr>
<tr>
<td>Safety Valve Discharge</td>
<td>Safety V. Disch.</td>
<td>Yellow</td>
<td>S.V.D.</td>
</tr>
<tr>
<td>Relief Vent</td>
<td>Relief V.</td>
<td>Yellow</td>
<td>----</td>
</tr>
</tbody>
</table>

F. Tanks, pumps, fans and other equipment shall be labeled to show the number, if any, and service.

G. Exposed conduits for alarm and communication systems shall be banded at intervals of not over 10 feet. Bands shall be of the following colors:
1. Fire Alarm System .......................................................... Red
2. Waterflow and Sprinkler Supervisory System .................................. Red & Yellow
3. Security System ........................................................................... Blue & Yellow
4. Mechanical and Electrical Supervisory System ................................... Green & Blue
5. IT and Telephone System .............................................................. Green & Yellow

H. Except where other means of identification are specified, electric cabinets, switchboards, motor control centers, transformers, system control boards, disconnecting switches, remote control switches, individual motor starters and motor control pushbutton stations shall be stenciled to show the service and number, if any, of the equipment controlled, as appropriate. Panelboards
and other electrical equipment located in finished areas, such as offices, shall have the identification placed on the inside of the cabinet doors.

I. Cabinets housing 460 volt/208 volt panelboards shall have "460/208 volt" stenciled in 2-inch high yellow letters on the inside of the cabinet doors.

J. Cabinet housing emergency panelboards shall have the words "LIFE SAFETY", “CRITICAL” or “EQUIPMENT” and “EMERGENCY” stenciled in 2-inch high red letters on the outside of the cabinet, in addition to other lettering required above.

K. The bolted covers of housings for disconnecting switches or links in bus ducts between network transformers and switchboards shall be lettered to identify the equipment within.

L. Serial numbers shall be stenciled on the tanks and covers of transformers having their nameplates attached to the high voltage switch chamber covers.

M. Signs for Equipment Controlled through the BAS: For all fans, pumps and other motor driven equipment with start/stop control through the BAS provide a red surface, white core laminated bakelite sign with incised letters, permanently mounted on the equipment indicating, “Warning. This Equipment Is Started and Stopped Automatically from the Building Automation System.”

1.28 COORDINATION OF MECHANICAL AND ELECTRICAL EQUIPMENT LOCATIONS

A. The space equal to the width and depth plus 6” on either side of the electrical equipment and extending to a height of 6 feet above the equipment or the structural ceiling, whichever is lower, shall be dedicated to the electrical installation and shall not contain piping ducts or other equipment foreign to the electrical installation. Electrical equipment shall include switchboards, panelboards and motor control centers.

B. Examine the existing conditions and the drawings, and in cooperation with the Electrical Work confirm the final location of all electrical equipment to be installed in the vicinity of piping and ductwork. Plan and arrange all overhead piping no closer than three feet, and ductwork no closer than one foot from a vertical line to electric switchboards, panelboards, motor control centers or similar equipment.

C. Where the existing and/or installation of piping or ductwork does not comply with the requirements of foregoing paragraphs, where feasible, the piping and ductwork shall be relocated. Installation of a barrier between piping and ductwork and electrical equipment below will be considered if located more than six feet above the electrical equipment. Refer to NEC Article 110. If piping ductwork and foreign equipment cannot be located outside of the space dedicated to electrical installation, a drip pan as described below can be considered to protect the electrical equipment from condensation, leaks or breaks, but shall be approved by the Engineer after the Contractor has demonstrated that piping, ductwork and/or equipment cannot be installed to avoid this space.

D. Provide galvanized steel gutters as follows:
   1. Provide a gutter of 18 gauge galvanized steel under every pipe and roof drain which is within 2'-0” (two feet) of being vertically over any motor, transformer, electrical controllers, switchboards, panelboards, generator or the like.
   2. Also provide drip pans below any drain piping located above the ceiling in food preparation or storage areas. In such areas, if piping also runs vertical through the floor slab above,
then fully enclose the vertical portion with an extension of said drip pan and fully seal this enclosure to the underside of the floor slab above.

3. Each gutter shall be made watertight, properly suspended; and carefully pitched to a convenient point for draining. Provide a ¾ inch drain, to nearest floor drain or slopsink.

4. In lieu of such separate gutters, a continuous protecting sheet of similar construction, adequately supported and braced, properly rimmed, pitched and drained, may be provided over any such motor, and extending 3'-0" in all directions beyond the motor, over which such piping has to run.

1.29 CONDENSATE DISPOSAL

A. Evaporators and Cooling Coils: Condensate drain systems shall be provided for equipment and appliances containing evaporators or cooling coils. Condensate drain systems shall be designed, constructed and installed with the following:

1. Condensate Disposal: Condensate from all cooling coils and evaporators shall be conveyed from the drain pan outlet to an approved place of disposal. Such piping shall maintain a minimum horizontal slope in the direction of discharge of to less than ¼ unit vertical in 12 units horizontal (1% slope). Condensate shall not discharge into a street, alley or other areas so as to cause a nuisance.

2. Drain Pipe Materials and Sizes: Components of the condensate disposal system shall be copper pipe or tubing as specified in the piping section of this specification. All components shall be selected for the pressure and temperature rating of the installation. Condensate waste and drain line size shall be not less than ¾” (19 mm) internal diameter and shall not decrease in size from the drain pan connection to the place of condensate disposal. Where the drain pipes from more than one unit are manifolded together for condensate drainage, the pipe or tubing shall be sized in accordance with the following:

<table>
<thead>
<tr>
<th>Equipment Capacity</th>
<th>Minimum Condensate Per Diameter</th>
</tr>
</thead>
<tbody>
<tr>
<td>Up to 20 tons of refrigeration</td>
<td>¾”</td>
</tr>
<tr>
<td>Over 20 tons to 40 tons of refrigeration</td>
<td>1”</td>
</tr>
<tr>
<td>Over 40 tons to 90 tons of refrigeration</td>
<td>1¼”</td>
</tr>
<tr>
<td>Over 90 tons to 125 tons of refrigeration</td>
<td>1½”</td>
</tr>
<tr>
<td>Over 125 tons to 250 tons of refrigeration</td>
<td>2”</td>
</tr>
</tbody>
</table>

3. Auxiliary and Secondary Drain Systems: Where damage to any building components could occur as a result of overflow from the equipment primary condensate removal system, the following auxiliary protection methods shall be provided for each cooling coil: A water-level detection device shall be provided that will shut off the equipment served in the event that the primary drain is blocked. The device shall be installed in the primary drain line, the overflow drain line, or in the equipment-supplied drain pan, located at a point higher than the primary drain line connection and below the overflow rim of such pan.

a. Water-Level Monitoring Devices: On down-flow units and all other coils that do not have a secondary drain or provisions to install a secondary or auxiliary drain pan, a water-level monitoring device shall be installed inside the primary drain pan. This device shall shut off the equipment served in the event that the primary drain becomes restricted. Devices installed in the drain line shall not be permitted.

4. Traps: Condensate drains shall be trapped as required by the equipment or appliance manufacturer.
1.30 TOOLS
   A. All special tools for proper operation and maintenance of the equipment shall be delivered to the Owner's representative and a receipt requested for same at no additional cost to the Owner.

1.31 QUIET OPERATION
   A. All equipment and material shall operate under all conditions of load without any sound or vibration which in the opinion of the Engineer is objectionable. Where sound or vibration conditions arise which are considered objectionable by the Engineer, eliminate same in a manner reviewed by the Engineer.

1.32 RUBBISH REMOVAL
   A. See to it that the project is at all times maintained free of all rubbish, rubble, waste material, packaging materials, etc. accumulating as a result of his work. Assume responsibility for the cleaning up of packaging removed from materials and equipment furnished by other trades for the installation. Note that final acceptance of the work is contingent upon the project being free of all excess and waste materials resulting from the work.

   B. Clean all parts of the building exterior spaces and adjacent roads, sidewalks, and pavement, free from material and debris resulting from the execution of the work. Debris resulting from interior construction shall be neatly stacked on each floor near elevators, material hoists and rubbish chutes, as directed by the Engineer or his representative. Debris resulting from exterior construction shall be similarly stacked. All debris so stacked will be removed under other Sections. Excess material will not be permitted to accumulate either on the interior, exterior or on sidewalk.

1.33 CLEANING, PIPING, DUCTS AND EQUIPMENT
   A. Clean all piping, ducts, and equipment of all foreign substances inside and out before being placed in operation.

   B. If any part of a system should be stopped by foreign matter after being placed in operation, the system shall be disconnected, cleaned, and reconnected wherever necessary to locate and remove obstructions. Any work damaged in the course of removing obstructions shall be repaired when the system is reconnected at no additional cost to the Owner.

   C. During construction, properly cap all pipes and equipment nozzles so as to prevent the entrance of sand, dirt, etc.

1.34 DELIVERY OF MATERIAL
   A. Deliver the material and store same in spaces indicated by the Engineer and assume full responsibility for damage to structure caused by any overloading of the material.

1.35 CUTTING AND PATCHING (IN EXISTING CONSTRUCTION)
   A. Any cutting and patching required for the project work, shall be done at no extra cost to Owner. Such cutting and patching shall be done under Division One, as approved by the Engineer.
B. Where existing piping or ductwork insulation are damaged by the requirements of the work, replace all damaged insulation to match existing.

C. Refer to Paragraph: "Sleeves, Inserts and Anchor Bolts" for additional requirements.

D. Prior to performing any core drilling or cutting of existing floor or roof slabs, Contractor shall perform a scan of the slab using ground penetrating radar (GPR) to confirm that there are no existing conduits or pipes in area of core drill or cutting of slab.

1.36 ALTERATIONS

A. When new work and alterations render equipment, piping and ductwork useless, such equipment, piping and ductwork when exposed to view, shall be removed and connections thereof to lines or ducts remaining shall be properly capped or plugged and left in construction. If construction, such as hung ceiling, furred beam, chase, etc., is opened up and removed during the course of the construction, the useless pipe and ducts therein shall be treated as though exposed to view. When required to accommodate new work, useless piping and ductwork concealed in construction shall be treated as though exposed to view.

B. When existing piping and duct systems, at points of connection to new work or in rerouting are found defective, such defective portions shall be removed and replaced with new materials without cost to the Owner.

C. Provide temporary supports where required.

D. Where alterations reveal piping, ductwork, conduit circuits, wiring, and accessories that must necessarily remain in service, same shall be rerouted, replaced or altered as required to make same completely concealed in the new work at no additional cost to the Owner.

E. Where existing piping or ductwork insulation is damaged by the requirements of the work, replace all damaged insulation to match existing.

F. Cutting in existing building shall be done by each Contractor as reviewed by the Engineer. Rough patching shall be done by each Contractor. Finish patching, ceiling construction removal, new ceiling in existing building shall be provided.

1.37 PAINTING

A. Painting Schedule
   1. No on-site painting is required on the following items unless specifically indicated otherwise:
      a. Stainless steel or monel sheet metal.
      b. Stainless steel or monel piping.
      c. Piping or ductwork to be insulated.
      d. Insulation on piping or ductwork in unfinished spaces or concealed.
      e. Insulated piping covered with stainless steel, aluminum or all service jacketing, unless otherwise specified.
      f. Insulated piping in walk-in and non-walk-in tunnels.
      g. Mechanical equipment with a factory applied baked-on enamel finish, not specified to be insulated or provided with an enameled steel insulated jacket.
h. Insulated equipment or smoke stacks specified or noted on the Drawings to be covered with stainless steel or aluminum sheet metal jacketing.

i. Factory fabricated multi-wall metal smoke flue piping.

j. Concealed piping.

2. Paint the following:

a. Uninsulated Black Steel Piping:
   1) Exposed in Finished Rooms or Finished Spaces: 1 coat of primer and 2 coats of latex semi-gloss enamel.
   2) Exposed in Unfinished Rooms, or Unfinished Spaces, or in Pipe Shafts: 1 coat of primer and 2 coats of finish.
   3) Exposed Exterior to a Building: 1 coat of primer and 2 coats of exterior acrylic latex gloss enamel.

b. Uninsulated Galvanized, Cast Iron, Brass or Copper Piping:
   1) Exposed in Finished Rooms or Finished Spaces: 1 coat of primer and 2 coats of latex semi-gloss enamel.
   2) Exposed Exterior to a Building: 1 coat of primer and 2 coats of exterior acrylic latex gloss enamel.
   3) Exposed in Unfinished Rooms or Unfinished Spaces: 1 coat of primer and 2 coats of finish.

c. Piping in floor trenches after fabrication: primer and finish.

d. Uninsulated Mechanical Equipment:

e. Vessels, Tanks, and Like Equipment Specified to be Insulated: 1 coat of corrosion resistant paint, prior to the application of insulation.

f. Uninsulated Exposed Iron and Steel Surfaces of Boilers, Including the Steel Casing, Buck Stays, Boiler Fronts, Castings, Smoke Pipes, Breeching and the Exposed Surfaces of all Other Iron or Steel Installed in Conjunction with Boiler Work: 1 coat of primer and 2 coats of heat resistant enamel.

g. Hangers, Supports and Accessories:
   1) Exposed: Paint to match adjacent piping, pipe insulation or ductwork insulation.
   2) All black steel or iron pipe hangers, rods, inserts, brackets and accessories for supporting piping systems and duct systems: 1 coat of primer and 2 coats of latex semi-gloss enamel. Paint black steel hanger rods, threaded on the job site, with a primer immediately after installation.
   3) Metal Fabrications in Finished Spaces: Paint over shop coat with 2 coats of alkyd gloss enamel.

h. Sheet Metal Work:
   1) Exposed Black Iron, Galvanized Iron, and Aluminum, including Hangers for Insulated and Uninsulated Ductwork, in Finished Rooms, Finished Spaces or Exterior to a Building: 1 coat of primer and 2 coats of latex semi-gloss enamel.
   2) Jacketing on Exposed Insulated Ductwork in Finished Rooms and Finished Spaces: 2 coats of latex semi-gloss enamel. No primer required.

i. Uninsulated Exposed Valves, Flanges, Unions and Irregular Surfaces in Piping Systems Installed in Finished Rooms or Finished Spaces: 1 coat of primer and 1 coat of black heat resistant enamel.

j. Convectors enclosures shall be painted at the factory as specified.

k. Underground pipe, ducts and conduits - two coats of black asphaltum paint.
B. Color Coding:
1. Apply finish paints of colors indicated opposite the various items listed below where such items are installed in Mechanical Equipment Rooms, Machine Rooms, Boiler Rooms, Penthouse Mechanical Equipment Rooms:

2. Piping, Exposed - Bare and Insulated on Unfinished Spaces and Rooms:
   a. Fuel Oils................................................................. Yellow
   b. Pneumatic Tube Systems................................................. Green
   c. Steam Supply (all pressures)............................................ Yellow
   d. Steam Condensate Returns............................................. Orange
   e. Water - Boiler Make Up ................................................ Light Green
   f. Water - Boiler Feed....................................................... Orange
   g. Water - Blow Off......................................................... Orange

3. Piping Not Listed Above: Color code by classification as follows:
   a. Fire Protection............................................................. Red
   b. Dangerous Materials.................................................... Yellow or Orange
   c. Safe Materials............................................................... Green
   d. Valuable Materials ....................................................... Purple

4. Ductwork: Grey.
5. Equipment - Bare and Insulated (Except Factory Painted): Grey.

C. The inside of all ductwork where visible through openings shall be painted with two prime coats of flat black paint.

D. Nameplates on all equipment shall be cleaned and left free of paint. Where equipment is to be painted, the Contractor shall carefully mask all equipment nameplates and data tags prior to application of paint. Such masking shall be removed after paint has dried.

E. All lead bends and lead safes and flashing shall be painted with two coats of waterproof black asphaltum varnish.

1.38 LUBRICATION
A. Assume responsibility that all rotating equipment is properly lubricated as soon as it is electrically connected before operation of this equipment is started. Assume responsibility for any damage to any equipment that is turned on without previously having been oiled or greased when connected up.

1.39 TESTS
A. All piping, wiring, and equipment shall be tested as specified under the various sections of the work. Labor, materials, instruments and power required for testing shall be furnished under the particular Section of the Specifications.

B. Tests shall be performed satisfaction of the Engineer. The Engineer will be present at such test, when he deems necessary and such other parties as may have legal jurisdiction.

C. Pressure tests shall be applied to piping only before connection of equipment and installation of insulation. In no case shall piping, equipment, or accessories be subjected to pressure exceeding their rating.
D. All defective work shall be promptly repaired or replaced and the tests shall be repeated until the particular system and component parts thereof receive the review of the Engineer.

E. Any damages resulting from tests shall be repaired or replaced and the tests shall be repeated until the particular system and component parts thereof receive the approval of the Engineer.

F. The duration of tests shall be as determined by all authorities having jurisdiction, but in no case less than the time prescribed in each Section of the Specifications.

G. Equipment and systems which normally operate during certain seasons of the year shall be tested during the appropriate season. Tests shall be performed on individual equipment, systems, and their controls. Whenever the equipment or system under test is interrelated with and depends upon the operation of other equipment, systems and controls for proper operation, functioning, and performance, the latter shall be operated simultaneously with the equipment or system being tested.

H. The electrical work shall include providing any assistance (such as removal of switchboard and panelboard trims and covers, pull and junction box covers, etc.) deemed necessary by the Engineer to check compliance with the Drawings and Specifications.

1.40 OPERATING INSTRUCTIONS

A. Two months prior to the completion of all work and the final inspection of the installation by the Owner, five (5) copies of a complete Instruction Manual, bound in booklet form and suitably indexed, shall be submitted to the Engineer for review. All written material contained in the manual shall be typewritten or printed.

B. The Manual shall contain the following items:

Table of Contents (Plumbing, HVAC and Electrical)


II. **Description of Systems**

1. Complete schematic drawings of all systems.
2. Functional and sequential description of all systems.
3. Relationship of system where applicable to the supervisory data system.

III. **Systems Operation**

1. Start-up procedures.
2. Shut-down procedures.
3. Reset and adjustment and balancing procedures.
4. Seasonal operation.
5. All posted instruction charts.

IV. **Maintenance**

1. Cleaning and replacement - lines, components, filters, strainers, ducts, fans, etc.
2. Lubrication.
3. Charging and filling.
4. Purging and draining.
5. Systems trouble shooting charts.
6. Instruments checking and calibration.
7. Procedures for checking out functions with remote (Supervisory Data Console) indication and control.
8. Recommended list of spare parts.

V. Listing of Manufacturers

VI. Manufacturer's Data (Where multiple model, type and size listings are included, clearly and conspicuously indicate those that are pertinent to this installation).
1. Description - Literature, drawings, illustrations, certified performance charts, technical data, etc.
2. Operation.
3. Maintenance - including complete trouble-shooting charts.
4. Parts List.
5. Names, addresses and telephone numbers of local recommended repair and service companies.
7. Model No. and Serial No. of all equipment.

1.41 INSTRUCTION OF OWNER'S PERSONNEL

A. After completion of all work and all tests and at such time as designated by the Engineer, provide the necessary skilled personnel to operate the entire installation for a period of three (3) consecutive days eight (8) hours each.

B. During the operating period, fully instruct the Owner's representative in the complete operation, adjustment and maintenance of the entire installation.

C. Provide training on the operation and maintenance for equipment, as indicated within the equipment specification. If not indicated within the equipment specification section, provide the following training:
   1. Automatic Temperature Controls: Three (3) non-consecutive days within one (1) year of the Owner's acceptance.
   2. Packaged AC Units: One (1) day.
      a. Where more than one (1) day is required, the Contractor shall schedule the first day and the Owner shall schedule all other days.
      b. All training shall be by factory authorized representatives, fully trained in the systems and the equipment operation and maintenance.

1.42 GUARANTEE

A. The Contractor guarantees by his acceptance of the Contract that all work installed will be free from any and all defects and that all apparatus will develop capacities and characteristics specified, and that if during a period of one year from date of completion and acceptance of work, one (1) entire heating and cooling season or eighteen (18) months from date of shipment, whichever is later, any such defects in workmanship, material or performance. He shall immediately replace, repair, or otherwise correct the defect or deficiency, including parts, labor and travel time, without cost to the Owner within a reasonable time. Notify the Engineer in writing of the time required to do work. For heating systems the guarantee period must include
one continuous heating season from November 1st to April 1st. For cooling systems the guarantee period must include one continuous cooling season from May 1st to October 1st.

B. Replace or repair to the satisfaction of the Owner any and all damage done to the building or its contents or to the work of other trades in consequence of work performed in fulfilling guarantee.

C. This Article is general in nature and will not waive stipulations of other claims which specify guarantee periods in excess of one (1) year.

D. In the event default on this Guarantee, the Owner may have such work done as required & charge the cost to the Contractor.

E. The date of acceptance shall be the date of final payment by the Owner or notice of acceptance by the Owner, whichever is later.

1.43 OPERATION PRIOR TO COMPLETION

A. The Owner may require operation of parts or all of the installation for the beneficial occupancy prior to final completion and acceptance of the building.

B. The operation shall not be construed to mean acceptance of the work by the Engineer for the Owner. The Owner will furnish supervisory personnel to direct operation of the entire system and the Contractor shall continue to assume this responsibility until final acceptance.

1.44 INSTALLATION OF MOTORS AND CONTROL EQUIPMENT

A. The Electrical Work shall include furnishing and installing power wiring for all electrical devices, individual motor starters and MCC's, furnished to him at the job site by other trades.

B. The HVAC Work shall provide all wiring for the Automatic Temperature Controls, Combustion Control, Burner and Boiler Control, and condenser water treatment controls, except as otherwise specified herein. This shall include low voltage wiring and 120 VAC power wiring unless electrical drawings show 120 VAC feed for the ATC panels.

C. The Electrical Work shall, except where otherwise noted, provide wiring for all Plumbing and Sprinkler Control and Alarm Systems. The Plumbing Work shall provide all devices in connection with same.

D. The Electrical Work shall provide all low voltage wiring and 120 VAC power to all auto smoke and combination fire/smoke dampers, which shall be controlled from the Fire Alarm Panel.

E. For single phase motors which are not interlocked with other motors and which have temperature control or motor control devices in the power circuit, furnishing of control devices, installation and wiring shall be by the Electrical Work.

F. For all HVAC 3-phase motors or HVAC equipment, temperature control wiring, motor control wiring and associated interlocks shall be provided under the HVAC Work, including the installation of all control devices. For all plumbing and sprinkler 3-phase motors, equipment control wiring, motor control wiring and associated interlocks shall be provided by the electrical Work, including the installation of all control devices.
G. All wiring between fire/smoke dampers and fire alarm panel shall be under the Electrical Work. All wiring between the fire alarm panel and air handling equipment for automatic fire alarm shutdown shall be under the Electrical Work. All wiring for operation of smoke purge fan and associated floor dampers shall be under the Electrical Work.

H. Whether or not shown on the drawings, the Electrical Work shall furnish and install a local disconnect switch at each motor which is not in sight from the controller location.

I. Electrically operated equipment supplied by other trades, which are to be installed and wired under the Electrical Work, shall be delivered with detailed instructions for their installation and wiring in sufficient time and proper sequence to meet the work schedule.

J. Each contractor shall furnish all electrical motors, starters and other motor control devices for motor driven equipment required for the work. The Electrical Work shall include providing the code required disconnect switches for all motors, except where otherwise noted. The setting of all motors, required for mechanical equipment, including unmounted motors, shall be done as part of the mechanical work.

K. If a motor is replaced (even with the same horsepower) a new starter shall be provided for that motor.

L. Equipment which includes a group of electrical control devices mounted in a single enclosure or on a common base with equipment, shall be supplied completely wired as a unit with terminal boxes or leads ready for external wiring.

M. All electrical items furnished and/or installed as part of the mechanical work shall conform to NEMA Standards, to the requirements of the National Fire Protection Association, and to the requirements of any local authority having jurisdiction. Any field modifications required to insure such conformance shall be included as part of the mechanical work.

N. The furnishing of floor mounted motor starting equipment shall include the purchase and delivery of channel sills for mounting.

O. Whether or not shown on the drawings, the Electrical Work shall include furnishing and installing a local disconnect switch at each motor which is not in sight from the controller location.

P. The supplying of any and all "field instruction" diagrams deemed necessary by the Engineer for the complete delineation of electrical wiring for mechanical equipment shall be included as part of the mechanical work.

Q. The drawings describing the electrical or the mechanical work may include explanatory wiring diagrams indicating the function intended for the motor control circuits of certain motors. The "field instructions" wiring diagrams required as part of the mechanical work shall conform to these intended functions.

R. Electric power required for control circuits shall be taken under the HVAC Work from the electric circuits in the junction boxes left by the Electrical Work for ATC use as indicated on the electrical drawings. Where junction boxes are not indicated on the electrical drawings, the HVAC Work shall run power wiring to the nearest electrical panel with spare circuits and provide required circuit breaker. The ATC Work shall provide and wire all required transformers for the ATC system.
S. The HVAC Work shall include coordinating the control systems with unit ventilator and VAV terminal box manufacturers. Provide all necessary control equipment which is not provided by the unit manufacturer to complete the sequence of operation as specified herein. Provide all field wiring.

1.45 ELECTRIC MOTORS

A. Each Contractor shall provide all electric motors required for driving all motor driven equipment required to be furnished under his Section of the Specification.

B. All motors shall be designed for 3 phase, 60 cycle alternating current operation at voltage indicated on the drawings across the motor terminals, except that, unless otherwise specified herein, all motors ½ HP and smaller shall be designed for single phase, 60 cycle alternating current at 120 volts across the terminals. Before ordering motors, ascertain the actual voltages and other current characteristics that will be available and permissible for each motor. Report the same in writing to the Engineer and obtain approval before ordering motors. The designation of current characteristics in these Specifications does not relieve the responsibility for ascertaining the actual conditions of electric service available for each motor or for the proper operation of all motors under the actual conditions.

C. The speed, horsepower, type and other essential data for each motor, if not given under paragraphs describing the various motor driven apparatus, or in schedules on the drawings shall be obtained from the manufacturer of the respective apparatus and shall be submitted to the Engineer for his review. All two speed motors shall be single winding type.

D. Provide oversized motor junction box for 2 speed motors.

E. All motors shall be built in accordance with the latest rules of the National Electrical Manufacturers Assn., and of the Institute of Electrical and Electronic Engineers and also as hereinafter specified.

F. Motors ½ HP and larger shall have Class B insulation. All motors shall be rated for continuous duty and shall be designed for temperature rises not to exceed 55°C for fully enclosed type, 55°C for splashproof types and 40°C for all other motors excepting as otherwise specified herein. Motors shall be capable of withstanding momentary overloads of fifty (50%) without injurious heating. They shall operate without excessive heating, flashing or sparking under any conditions within the specified capacity of load and speed. All motors shall operate quietly and shall be replaced if, in the Engineer's opinion, they do not do so. All motors which are in the airstream of air conditioning units, shall be totally enclosed type.

G. Motors ½ HP and larger shall have ball or roller bearings with pressure grease lubrication, except where otherwise noted.

H. Direct connected motors shall be furnished without an adjustable base. All motors connected to driven equipment by belt shall be furnished with adjustable sliding bases, except fractional motors with slotted mounting holes.

I. All motor leads shall be permanently identified and supplied with connectors.

J. Motors shall have nameplates giving manufacturer's name, serial number, horsepower, speed, voltage, phase and current characteristics.
K. The insulation resistance between stator conductors and frames of motors at the time of final inspection shall be not less than one-half megohm.

L. All motors shall be of the proper type for the duty and shall have sufficient torque to start and run the equipment to which they are connected and starting currents and running currents shall not exceed the limits imposed by the laws or rules and regulations of the public authorities having jurisdiction or of the electrical utility company. All motors shall have sufficient horsepower capacity and rated duty to operate the apparatus to which they are connected so as to give the speeds and performances specified, but the horsepower shall be in no case less than that stated herein or shown on the drawings. A schedule giving the characteristics of the motors proposed for each type of service shall be submitted to the Engineer for approval.

M. The maximum full load speed of each direct connected motor shall be suitable for the equipment it drives.

N. Except where V-belt drive is specified, the fan wheels for ventilating fans shall be mounted on the motor shafts, which shall be designed for this duty.

O. All motors except motors furnished as an integral part of equipment and factory installed on the equipment, shall be of same manufacture.

P. Polyphase motors shall be squirrel cage induction high efficiency energy saver type, suitable for the starting torque and current requirements.

Q. Single phase motors shall be of the capacitor start induction run or split phase type as required for proper operation of the driven equipment.

R. Where used with VFD equipment, motor shall be rated for inverter service without excessive noise, vibration, hum or damage.

S. All motors, except water pump motors, operated on variable frequency drives (VFD) shall be equipped with a maintenance-free, conductive microfiber, shaft grounding ring with a minimum of two rows of circumferential micro fibers to discharge electric shaft currents within the motor and/or its bearings. Motors up to 100 HP shall be provided with a minimum of one shaft grounding ring installed either on the drive end or non-drive end. Motors over 100 HP shall be provided with an insulated bearing on the non-drive end and a shaft grounding ring on the drive end of the motor. Grounding rings shall be provided and installed by the motor pump manufacturer or contractor and shall be installed in accordance with the manufacturer’s recommendations.

T. The efficiency of energy efficient motors shall be verified in accordance with NEMA standard MG1-12.53a. Submittals and shop drawings for all equipment shall state the motor efficiency and shall meet or exceed that listed in the table below. Minimum acceptable efficiency shall be as follows:
### Minimum Electric Motor Efficiencies

<table>
<thead>
<tr>
<th>Motor Size (hp)</th>
<th>Speed (rpm)</th>
<th>Open Drip-Proof (ODP)</th>
<th>Totally Enclosed Fan Cooled (TEFC)</th>
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<tr>
<td></td>
<td>1200</td>
<td>1800</td>
<td>3600</td>
</tr>
<tr>
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<td>82.5%</td>
<td>85.5%</td>
<td>77.0%</td>
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<td>85.5%</td>
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<td>89.5%</td>
<td>86.5%</td>
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<td>88.5%</td>
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<tr>
<td>200</td>
<td>95.4%</td>
<td>95.8%</td>
<td>95.0%</td>
</tr>
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</table>

1.46 **INDIVIDUAL MOTOR STARTERS**

A. For single-phase motors ½ HP or smaller, starters shall be manual, 120 volts, single-pole or 240 volts, 2-pole with thermal overload protection and pilot light. Where interlocking or automatic control (other than for unit and cabinet heaters) is required, starters shall be combination circuit breaker and magnetic starter with pilot light.

B. For 3-phase motors ½ HP and over, starters shall be full-voltage combination circuit breaker and magnetic across-the-line contactor, rated 208 or 480 volts, 3-pole. All magnetic starters shall have three thermal overloads.

C. Unless otherwise specified, motors 25 HP and over, rated 200 volts and motors 50 HP and over, rated 460 volts shall be furnished with reduced voltage starters of the autotransformer closed transition type.

D. For motors requiring electric interlocks, or automatic control features, starters shall be equipped with the necessary auxiliary relays and contacts to provide the control features desired. All starters shall be provided with "hand-off-auto" twist type switches mounted in cover. For two-speed motors, provide "high-low-off-auto" four position selector switch. Furnish adjustable 20-second time delay between high and low speeds for motors 10 HP and above.
E. Electrical Control Devices
   1. Allen-Bradley® Electrical Control Devices are the basis of design,
   2. The electrical control devices shall include:
      a. Pilot Devices
      b. Relays and Timers
      c. Miniature Circuit Breakers
      d. Terminal Blocks and Fuse Blocks
      e. Alarms and Signals
      f. Power Supplies
      g. Panel-mounted disconnect switches
   3. The electrical control devices shall be interoperable with standard electrical equipment.

F. Pilot Devices
   1. 30.5 MM Push Buttons, Selector Switches and Pilot Lights
      a. 30.5 mm push buttons, selector switches and pilot lights shall be Allen-Bradley heavy industrial Type 4/13 watertight/oiltight metal [Bulletin 800T].
      b. 30.5 mm push buttons, selector switches and pilot lights shall provide EN/IEC 60529 IP66/65 degree of protection.
      c. 30.5 mm push buttons, selector switches and pilot lights shall have electrical ratings of:
         1) Dielectric strength – 2200V for 1 minute [or 300V for 1 minute (Logic Reed)]
         2) Electrical design life cycles – 10,000,000 at max. rated load [200,000 at max rated load (Logic Reed)]
      d. 30.5 mm push buttons, selector switches and pilot lights shall have an operating range of -40 to 131°F (-40 to 55°C).
      e. Illuminated devices shall offer universal LED that accepts 12 to 130 VAC/VDC voltage input.
      f. 30.5 mm push buttons shall have a diaphragm seal for protection from liquids, particles and corrosive agents.
      g. 30.5 mm selector switches shall incorporate a positive detent to prevent the switch from hanging up between positions.
   2. Potentiometer Devices
      a. 30.5 mm potentiometer devices shall be Allen-Bradley heavy industrial Type 4/13 watertight/oiltight metal [Bulletin 800T].
      b. Potentiometer devices shall be rated for 300 VAC/VDC, 2 W maximum (6 VDC minimum):
         1) Mechanical design life – Min. 25,000 cycles
         2) Rotational torque – 3 to 12 in-oz
         3) Stopping torque – Min. 12 in-lb
      c. Potentiometer devices shall have single-turn operation, 312 degree rotation.
      d. Potentiometer devices shall be finger-safe.
   3. Control Stations
      a. Control stations shall provide Allen-Bradley heavy industrial 30.5 mm push button(s) or selector switch with appropriate contact action, button/lever type and color/legend marking. Devices shall be Type 4/13 watertight/oiltight metal [Bulletin 800T].
      b. Control stations shall be constructed of die-cast aluminum

G. Relays And Timers
   1. Relays – Time Delay
b. Time delay relays shall have 10A, B300, DPDT contact ratings and coil voltages as shown on drawings.
c. Time delay relays shall have adjustable timing ranges [or fixed timing ranges to avoid tampering]. Timing ranges shall be as shown on drawings.

2. Relays – General Purpose
   b. General purpose relay contacts shall be silver nickel [or silver nickel bifurcated or gold-plated bifurcated] and have 10A, B300, DPDT [or 3PDT] ratings. Coil voltages shall be as shown on drawings.
   c. General purpose relays shall have an electrical schematic on the faceplate, a clear cover for visual inspection and snap-in marker ability.
   d. General purpose relays shall have LED status indicators, push-to-test and manual override.

3. Relays – Miniature
   a. Allen-Bradley miniature relays [Bulletin 700-HC] shall be square-base, 4-pole, plug-in type with blade-style terminals and ON/OFF flag indicators.
   b. Miniature relay contacts shall be silver nickel [or gold-plated silver nickel] and have 7A [or 10A], DPDT [or 4PDT] ratings. Coil voltages shall be as shown on drawings.
   c. Miniature relays shall have an electrical schematic on the faceplate and a clear cover for visual inspection.
   d. Miniature relays shall have LED status indicators and push-to-test button with incorporated manual override lever.

4. Relays – Industrial-Type
   a. Allen-Bradley industrial-type relays [Bulletin 700-P] shall be ruggedly constructed (10 million operation mechanical life), 2-pole [or 4-pole, 8-pole, 12-pole], configured N.O./N.C. as shown on drawings, and panel- [or strip-, DIN rail-] mounted.
   b. Industrial-type relays shall be finger-safe.
   c. Industrial-type relay contacts shall be silver nickel with a double-break and bifurcated design and 10A, A600 rating for AC [5A, P600 rating for DC].
   d. Accessories shall include adder decks, time delay, latching, surge suppressors and/or mounting strip.

5. Timers – Solid-State
   b. The solid-state timer contacts shall be available as SPDT or DPDT, 8A.
   c. Solid-state timers shall be available with On-Delay, Off-Delay, On- and Off-Delay, One-Shot and Flasher operating modes as required on the drawings.
   d. Solid-state timers shall have coil surge protection and adjustable timing ranges of 0.05 seconds to 60 hours as shown on drawings.

6. Timers – Programmable
   a. Allen-Bradley programmable timers [Bulletin 700-HX] shall be digital timing relays with LCD display and shall be socket- [or panel-] mounted.
   b. Programmable timer contacts shall be SPDT, rated 5A, B300.
   c. Programmable timer panel surface shall offer Type 4X/IP66 protection.
   d. Programmable timers shall be configurable for Signal On-Delay, Power On-Delay, Off-Delay, Repeat Cycle, One-Shot and Cumulative operating modes as required on the drawings.
H. Miniature Circuit Breakers
2. Miniature circuit breakers shall be thermal-magnetic, current-limiting type, sized as specified on the drawings:
   a. 0.5A to 63A current rating
   b. 1-, 2- or 3-pole
   c. Type C or Type D tripping characteristic
3. Miniature circuit breakers shall be UL Listed (E197878), CSA Certified (259391), CE Marked, VDE and CCC Certified and RoHS Compliant. Standards compliances shall include:
   a. UL 489
   b. CSA C22.2, No. 5.1
   c. EN 60947-2
   d. GB 14048.2
4. Miniature circuit breakers shall be rated for:
   a. Voltage – Max. 480Y/277 VAC (UL/CSA); Ue 230/400 VAC (IEC)
   b. Interrupting capacity – 10 kA (UL/CSA); 15 kA (IEC)
5. Housing shall satisfy Insulation Group II/RAL 7035, shall have IP20 finger-safe design, shall be suitable for DIN rail mounting and shall include status indicator window and scratch- and solvent-resistant printing.
6. Miniature circuit breakers shall support reversible line and load connections and shall have dual terminals that:
   a. Connect up to 4 wires, or 2 wires and a bus bar.
   b. Clamp from both sides.
   c. Have a unique design that directs wires into openings to prevent wiring misses.
7. Miniature circuit breakers shall be compatible with UL 508 Listed bus bars, auxiliary contacts, signal contacts, shunt trips and toggle-mount lockout attachments.

I. Terminal Blocks And Fuse Blocks
1. Terminal Blocks – Control, #22 to #8 AWG
   a. Control terminal blocks shall be Allen-Bradley screw-type, feed-through [Bulletin 1492-J].
   b. Control terminal blocks shall be certified:
      1) UR/CSA – #22 to #8 AWG wire range, 50A maximum current, 600 VAC/VDC voltage rating
      2) IEC – 6 mm² wire range, 41A maximum current, 800 VAC/VDC voltage rating
      3) ATEX – 6 mm² (#20 to #10 AWG) wire range, 36A maximum current, 550 VAC/VDC voltage rating
   c. Control terminal blocks shall have a snap-in card marking system.
2. Terminal Blocks – Power
   a. Power terminal blocks shall be Allen-Bradley [Bulletin 1492-PD]:
      1) Open-style power distribution block with aluminum or copper connectors – 3-pole [or 1-pole], rated at 600 VAC/VDC, 175 to 760A
   b. Power terminal blocks shall be certified by UR, CSA and CE.
   c. Wire ranges and tightening torques shall be labeled on the block.
d. Power terminal blocks shall have a write-on marking surface or marker retention feature.

3. Fuse Blocks
   a. Allen-Bradley fuse block kits [Bulletin 1491] shall be used for protection of transformers and control circuits capable of delivering no more than 200,000 RMS symmetrical amps, 600V maximum.
   b. Fuse block kits shall be 1-pole, 2-pole or 3-pole.
   c. Each pole shall have a fuse cover.

J. Alarms and Signals
   1. Alarm Horn
      a. The alarm horn shall be an Allen-Bradley High Performance Electronic Horn [Bulletin 855H] and shall have up to 4 stages and low current consumption.
      b. The alarm horn shall have a UV-stable plastic housing and non-moving parts.
      c. The alarm horn shall have an on-board microphone, 45 alarm tones selectable by DIP switch and fine volume control via potentiometer.
      d. The alarm horn shall allow synchronized output in multi-horn installations and shall have the ability to replicate content to other devices (master/slave).

   2. Alarm Beacon
      a. The alarm beacon shall be an Allen-Bradley [Bulletin 855B] with high-intensity, minimum 5-Joule Xenon, minimum 20-Watt Halogen or LED illumination as required on the drawings.
      b. The alarm beacon shall have polycarbonate housing and lens, available in square or round configuration, and Type 4/4X/13, IP65/IP66 ingress rating as required on the drawings.
      c. Flashing frequency shall be 1 Hz.
      d. Alarm beacon lens colors shall be red, green, amber, blue, yellow or clear as required on the drawings.

   3. Alarm Light Tower
      a. The alarm light tower shall consist of Allen-Bradley Control Tower™ Stack Lights [Bulletin 854J or K], stacked 1 [or 2, 3, 4, 5] module(s) high and shall be surface- [or vertical-, quick-release-, pole-] mounted.
      b. The alarm light tower shall be 40 mm [or 60 mm] size and the terminal block shall be top-mounted on the base.
      c. The light modules shall be Type 4/4X/13, IP65 and are:
         1) LED (steady, flashing or strobe)
      d. The alarm light tower shall include a continuous (or pulsing) piezo [or transducer] sound module.
      e. The alarm light tower shall have a DeviceNet base.

   4. Signal Alarm (Panel Mount)
      a. The signal alarm shall be an Allen-Bradley Panel Mount Signaling Alarm [Bulletin 855P] in a 30 mm [or 45 mm, 65 mm] size, that mounts in a standard 22.5 mm hole.
      b. The signal alarm shall have polycarbonate base and lens.
      c. The signal alarm shall be combination sounder and LED
      d. The signal alarm shall be rear-securing and finger-safe.

K. Power Supplies
   1. Control Power Transformer
      a. The control power transformer shall be an Allen-Bradley Global Control Transformer [Bulletin 1497], single-phase and sized as shown on drawings.
SPECIAL REQUIREMENTS FOR THE WORK

b. The control power transformer shall be epoxy encapsulated and shall offer EN 60-529 finger-safe protection.
c. The control transformer shall have a dual primary and secondary fuse block, pre-wired and top-mounted.

2. 24 VDC Power Supplies
   a. 24 VDC power supplies shall be Allen-Bradley [Bulletin 1606-XL] with active or passive PFC choke and input as shown in drawings [or auto-select input].
   b. 24 VDC power supplies shall have low inrush current, and power supplies with greater than 100-Watt output shall incorporate a minimum 120% Power Burst design.
   c. 24 VDC power supplies shall have NEC Class 2 “Limited Power” output.

3. UPS
   a. The UPS shall be an Allen-Bradley Industrial Uninterruptible Power Supply [Bulletin 1609-B/D] with 120 VAC input voltage and output power as shown on drawings.
   b. The UPS shall be back-of-panel- [or DIN rail-] mounted.
   c. The UPS shall provide:
      1) Surge protection to 380 Joules
      2) Overload protection, resulting in delayed shutdown at 110 to 130% and immediate shutdown at 130%
      3) Protection against output short on line – over-current protection from premises branch circuit
      4) Protection against output short on battery, resulting in shutdown
      5) Thermal protection
   d. The UPS shall have USB communications and software, integrated remote on/off and dry I/O contacts.
   e. The UPS shall have EtherNet/IP communications, expandable battery capacity and/or pure sine wave output.
   f. The UPS shall perform to 40°C [50°C, with hi-temp battery].

L. Disconnect/breakers shall be external flange mounted type, all metal construction with painted handle, lockable, similar to Allen Bradley Model 1494F-M1-412. Plastic switches, disconnects and breakers and twist types shall not be used.

M. In addition to any auxiliary contacts required for interlocking purposes, each magnetic starter shall be equipped with one normally open auxiliary control circuit contact either for "sealing in" or as a spare for future use.

N. Indicating lights shall be transformer or series resistor type. There shall be one red light for each single speed motor to indicate when motor is running. For multiple speed motors one indicating light for each speed shall be provided.

O. The starter disconnecting means shall be circuit breakers. The external operating handle shall clearly indicate "ON" or "OFF" position of the switch and shall be interlocked with the door to require throwing the handle to the "OFF" position to open the door. The handle shall be arranged for locking both the door closed and the disconnect in the "OFF" position with up to 3 padlocks. Provide defeat device in cover to permit opening door in "ON" position.

P. Circuit breakers in combination starter units shall be of the magnetic trip type with an adjustable trip setting for selecting instantaneous trip points of fault protection (motor circuit protector).
Field adjustment of the instantaneous trip shall be performed by the Electrical Contractor. Select the trip setting at approximately 10 times the motor nameplate full-load current. If the circuit breaker trips on starting, incrementally increase the settings. In no case shall the trip setting exceed 13 times the motor full-load current.

Q. Overload heaters shall be furnished for all starters and shall be sized in range of 115 to 125 percent of full load current. The motor starters shall be shipped with the overload heaters inside the compartment but not installed. The Electrical Contractor shall verify the ratings of the heater coils based on the motor nameplate data before installing the overloads. The Contractor supplying the starter shall replace any improperly selected heaters.

R. A transformer shall be supplied in each starter unit for 120 volt control voltage. Transformer capacity shall be adequate to supply the holding coil requirements plus the solenoids, e-p switches, relays and other devices required to be controlled from the starter. A fuse shall be supplied in one secondary terminal of the control transformer. The other terminal shall be grounded to the housing of the starter. Fuses shall be also provided in the transformer primary leads per the National Electrical Code.

S. All enclosures shall be NEMA Type 1 steel with hinged cover for general purpose indoor application, unless otherwise indicated. Enclosures shall be arranged for equipment or wall mounting. Weather resistant NEMA 3R steel enclosures shall be provided for all outdoor starters. All devices mounted on the outside of all enclosures shall be NEMA 4.

T. Each starters shall be clearly identified by engraved nameplates after installation. The nameplates shall be bakelite black plates with ½" high white letters and shall be securely fastened to starter with mounting screws made of non-corrosive metals.

U. Stainless steel flush mounted starter and enclosures shall be provided for all starters located in the kitchen and dishwasher areas.

V. All starters, except those furnished as an integral part of equipment and factory installed on the equipment, shall be of the same manufacturer.

W. Starters shall be as manufactured by Westinghouse, General Electric, Square D, Eaton/Cutler-Hammer, or Allen-Bradley.

X. Shop drawings shall be provided with dimensions, ratings, wiring diagrams and schedule of nameplates for approval prior to fabrication.

Y. If a motor is replaced (even with the same horsepower), a new starter shall be provided for that motor.

1.47 SEMI-FINAL AND FINAL SITE VISITS FOR OBSERVATION

A. As the project approaches completion, the Engineer, at their discretion shall determine a period of time in which they shall perform a Semi-Final Site Visit to observe the Mechanical and Electrical installation. At the conclusion of this Semi-Final Site Visit, a Semi-Final Punchlist shall be issued to the appropriate Contractor for the deficiencies in the work of his trade. Complete all work and perform all corrective measures as required by the Semi-Final Punchlist. After this corrective and completion work has been accomplished, in writing, advise the Engineer that every item on the Semi-Final Punchlist has been completed. After the Engineer make a Final
Site Visit to observe the Mechanical and Electrical installation and make a Punchlist, a similar letter of Compliance shall be forwarded through the appropriate channels.

PART 2 - PRODUCTS - (NOT USED)

PART 3 - EXECUTION

3.01 INSTALLATION OF EQUIPMENT

A. The Contractor shall be responsible for the installation of all equipment in accordance with the Manufacturer’s Installation/Operation & Maintenance Manuals and instructions. If other requirements of this Specification contradict what is stated in the Manufacturer’s instructions, the matter shall be brought to the attention of the Engineer for clarification. Any and all of the Manufacturer’s requirements for utilities (electrical power and control wiring, piped water, drain, gas, fuel oil, steam, condensate, etc.), ducted supply or exhaust air, mounting and support shall be provided by the Contractor, regardless of how, or whether or not stated elsewhere in the Contract/Bid Documents.

END OF SECTION 01 31 46
PART 1 - GENERAL

1.01 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.

1.02 SUMMARY

A. This Section includes administrative and procedural requirements for documenting the
   progress of construction during performance of the Work, including the following:
   1. Contractor's Construction Schedule.

B. Related Sections include the following:
   1. Division 01 Section "Summary" for phases of the Work.
   2. Division 01 Section "Payment Procedures" for submitting the Schedule of
      Values.
   3. Division 01 Section "Project Management and Coordination" for submitting and
      distributing meeting and conference minutes.
   4. Division 01 Section "Project Management and Coordination" for submitting and
      distributing construction progress documents electronically.
   5. Division 01 Section "Submittal Procedures" for submitting schedules and reports.
   6. Division 01 Section "Quality Requirements" for submitting a schedule of tests
      and inspections.

1.03 CONSTRUCTION SCHEDULE

A. Fifteen calendar days after the award of the Contract, the Contractor shall prepare a
   composite Critical Path Construction Schedule Gantt chart which shall indicate
   graphically and chronologically the times the various parts of the work of the Contract
   shall commence and be completed. The Schedule shall be in a reproducible format.

B. The Schedule shall show the sequence and interrelationship of each operation of all
   trades, including dates of shop drawing submissions.

C. The Schedule shall show the estimated time for fabrication and delivery of all material
   and equipment required for the Work.

D. The Contractor shall meet with subcontractors and with the Owner to review and make
   necessary adjustments to the composite Construction Schedule, and to coordinate the
   Work indicated thereon.

E. Upon acceptance by the Architect and Owner, the Construction Schedule shall be
   signed and dated by the Contractor or his official representative.

F. Master Bar Chart Schedule shall be updated twice monthly.
1.04 COORDINATION

A. Coordinate preparation and processing of schedules and reports with performance of construction activities and with scheduling and reporting of separate contractors.

B. Subcontractors shall consult the approved Construction Schedule and install their work within the time limits indicated on the Schedule. Each subcontractor shall report any inability to comply and provide detailed explanation with suggested remedies.

C. Coordinate Contractor's Construction Schedule with the Schedule of Values, list of subcontracts, Submittals Schedule, progress reports, payment requests, and other required schedules and reports.
   1. Secure time commitments for performing critical elements of the Work from parties involved.
   2. Coordinate each construction activity in the network with other activities and schedule them in proper sequence.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.01 CONTRACTOR'S CONSTRUCTION SCHEDULE

A. Contractor's Construction Schedule Updating: At semi-monthly intervals, update schedule to reflect actual construction progress and activities. Issue schedule 2 days before each regularly scheduled progress meeting.
   1. Revise schedule immediately after each meeting or other activity where revisions have been recognized or made. Issue updated schedule concurrently with the report of each such meeting.
   2. Include a report with updated schedule that indicates every change, including, but not limited to, changes in logic, durations, actual starts and finishes, and activity durations.
   3. As the Work progresses, indicate Actual Completion percentage for each activity.

B. Distribution: Distribute copies of approved schedule to Architect, Owner, separate contractors, testing and inspecting agencies, and other parties identified by Contractor with a need-to-know schedule responsibility. The Architect shall receive 1 copy and the Owner shall receive 2 copies.
   1. Post copies in Project meeting rooms and temporary field offices.
   2. When revisions are made, distribute updated schedules to the same parties and post in the same locations. Delete parties from distribution when they have completed their assigned portion of the Work and are no longer involved in performance of construction activities.

END OF SECTION 01 32 00
PART 1 - GENERAL

1.01 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.

1.02 SUMMARY

A. This Section includes administrative and procedural requirements for the following:
   1. Preconstruction photographs.
   2. Periodic construction photographs.

B. See Division 01 Section "Closeout Procedures" for submitting digital media as Project Record Documents at Project closeout.

C. See Division 01 Section "Demonstration and Training" for submitting videotapes of demonstration of equipment and training of Owner's personnel.

1.03 SUBMITTALS

A. Key Plan: Submit key plan of Project site and building with notation of vantage points marked for location and direction of each photograph. Indicate elevation or story of construction. Include same label information as corresponding set of photographs.

B. Construction Photographs: Submit two prints of each photographic view within three days of taking photographs.
   1. Format: 8-by-10-inch (203-by-254-mm) smooth-surface matte prints on single-weight commercial-grade photographic paper, enclosed back to back in clear plastic sleeves that are punched for standard 3-ring binder.
   2. Identification: On back of each print, provide an applied label or rubber-stamped impression with the following information:
      a. Name of Project.
      b. Name and address of photographer.
      c. Name of Architect.
      d. Name of Contractor.
      e. Date photograph was taken if not date stamped by camera.
      f. Description of vantage point, indicating location, direction (by compass point), and elevation or story of construction.
      g. Unique sequential identifier.
   3. Digital Images: Submit a complete set of digital image electronic files with each submittal of prints on CD-ROM. Identify electronic media with date photographs were taken. Submit images that have same aspect ratio as the sensor, uncropped.

1.04 QUALITY ASSURANCE

A. Photographer Qualifications: An individual who has been regularly engaged as a professional photographer of construction projects for not less than three years.
1.05 COORDINATION

A. Auxiliary Services: Cooperate with photographer and provide auxiliary services requested, including access to Project site and use of temporary facilities, including temporary lighting required to produce clear, well-lit photographs without obscuring shadows.

1.06 USAGE RIGHTS

A. Obtain and transfer copyright usage rights from photographer to Owner for unlimited reproduction of photographic documentation.

PART 2 - PRODUCTS

2.01 PHOTOGRAPHIC MEDIA

A. Digital Images: Provide images in uncompressed TIFF format, produced by a digital camera with minimum sensor size of 4.0 megapixels, and at an image resolution of not less than 1024 by 768 pixels.

PART 3 - EXECUTION

3.01 CONSTRUCTION PHOTOGRAPHS

A. Photographer: Engage a qualified commercial photographer to take construction photographs.

B. General: Take photographs using the maximum range of depth of field, and that are in focus, to clearly show the Work. Photographs with blurry or out-of-focus areas will not be accepted.
   1. Maintain key plan with each set of construction photographs that identifies each photographic location.

C. Digital Images: Submit digital images exactly as originally recorded in the digital camera, without alteration, manipulation, editing, or modifications using image-editing software.
   1. Date and Time: Include date and time in filename for each image.
   2. Field Office Images: Maintain one set of images on CD-ROM in the field office at Project site, available at all times for reference. Identify images same as for those submitted to Architect.

D. Preconstruction Photographs: Before commencement of demolition, take digital photographs of Project site and surrounding properties, including existing items to remain during construction, from different vantage points, as directed by Architect.
   1. Flag construction limits before taking construction photographs.
   2. Take eight photographs to show existing conditions adjacent to property before starting the Work.
   3. Take eight photographs of existing buildings either on or adjoining property to accurately record physical conditions at start of construction.

E. Periodic Construction Photographs: Take 12 digital photographs monthly, coinciding with the cutoff date associated with each Application for Payment. Select vantage points to show status of construction and progress since last photographs were taken.
F. Provide photos to highlight the implemented construction IAQ practices in accordance with the submittal requirements in Division 01 Section “Indoor Air Quality (IAQ) Management.”

G. Additional Photographs: Architect may issue requests for additional photographs, in addition to periodic photographs specified. Additional photographs will be paid for by Change Order and are not included in the Contract Sum.
   1. Three days' notice will be given, where feasible.
   2. In emergency situations, take additional photographs within 24 hours of request.
   3. Circumstances that could require additional photographs include, but are not limited to, the following:
      a. Special events planned at Project site.
      b. Immediate follow-up when on-site events result in construction damage or losses.
      c. Photographs to be taken at fabrication locations away from Project site. These photographs are not subject to unit prices or unit-cost allowances.
      d. Substantial Completion of a major phase or component of the Work.
      e. Extra record photographs at time of final acceptance.
      f. Owner's request for special publicity photographs.
PART 1 - GENERAL

1.01 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.

1.02 SUMMARY

A. This Section includes administrative and procedural requirements for submitting Shop Drawings, Product Data, Samples, and other submittals.

B. Related Sections include the following:
   1. Division 01 Section "Payment Procedures" for submitting Applications for Payment and the Schedule of Values.
   2. Division 01 Section “Project Management and Coordination.” For submittals by electronic means,
   3. Division 01 Section "Project Management and Coordination" for submitting and distributing meeting and conference minutes and for submitting Coordination Drawings.
   4. Division 01 Section "Construction Progress Documentation" for submitting schedules and reports, including Contractor's Construction Schedule and the Submittals Schedule.
   5. Division 01 Section "Requests for Interpretation" for submitting requests for clarification of the Contract Documents during construction.
   6. Division 01 Section "Quality Requirements" for submitting test and inspection reports and for mockup requirements.
   7. Division 01 Section "Closeout Procedures" for submitting warranties.
   8. Division 01 Section "Project Record Documents" for submitting Record Drawings, Record Specifications, and Record Product Data.
   9. Division 01 Section "Operation and Maintenance Data" for submitting operation and maintenance manuals.
   10. Divisions 02 through 49 Sections for specific requirements for submittals in those Sections.

1.03 DEFINITIONS

A. Action Submittals: Written and graphic information that requires Architect's responsive action.

B. Informational Submittals: Written information that does not require Architect's responsive action. Submittals may be rejected for not complying with requirements.

1.04 SUBMITTAL PROCEDURES

A. General: Electronic copies of CAD Drawings of the Contract Drawings will be provided by Architect for Contractor's use in preparing submittals. The Contractor will
be required to complete and sign the Electronic File Release Form found at the end of this Section.

1. Transmit one electronic copy of each submittal in Adobe .pdf or Autodesk .dwg format to each concurrent reviewer. At minimum transmit copies concurrently to Architect, Owner, consultants, and contractors who have any responsibility for the design or construction of the construction activity being reviewed. Retain one copy of original.

2. Convert submittal material to required electronic submittal format. Provide clear and readable scans, extending fully to original submittal margins, including Contractor’s original stamp and label information.

B. Coordination: Coordinate preparation and processing of submittals with performance of construction activities.

1. Coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals, and related activities that require sequential activity.

2. Coordinate transmittal of different types of submittals for related parts of the Work so processing will not be delayed because of need to review submittals concurrently for coordination.
   a. Architect reserves the right to withhold action on a submittal requiring coordination with other submittals until related submittals are received.

C. Submittals Schedule: Comply with requirements in Division 01 Section "Construction Progress Documentation" for list of submittals and time requirements for scheduled performance of related construction activities, including the listing of all submittals required in Sections in Divisions 02 through 49.

D. Processing Time: Allow enough time for submittal review, including time for resubmittals, as follows. Time for review shall commence on Architect's receipt of submittal. No extension of the Contract Time will be authorized because of failure to transmit submittals enough in advance of the Work to permit processing, including resubmittals.

1. Initial Review: Allow 15 days for initial review of each submittal. Allow additional time if coordination with subsequent submittals is required. Architect will advise Contractor when a submittal being processed must be delayed for coordination.

2. Intermediate Review: If intermediate submittal is necessary, process it in same manner as initial submittal.

3. Resubmittal Review: Allow 15 days for review of each resubmittal.

4. Sequential Review: Where sequential review of submittals by Architect's consultants, Owner, or other parties is indicated, allow 21 days for initial review of each submittal.
   a. All submittals for Division 21, Fire Suppression, Division 22, Plumbing, Division 23, Heating, Ventilating and Air Conditioning, Division 25, Integrated Automation, Division 26, Electrical, and Division 27, Electronic Safety and Security, require sequential review.

E. Identification: Place a permanent label or title block on each submittal for identification.

1. Indicate name of firm or entity that prepared each submittal on label or title block.

2. Provide a space approximately 6 by 8 inches (152 by 203 mm) on label or beside title block to record Contractor's review and approval markings and action taken by Architect.
3. Include the following information on label for processing and recording action taken:
   a. Project name.
   b. Date.
   c. Name and address of Contractor.
   d. Name and address of subcontractor.
   e. Name of manufacturer.
   f. Drawing number and detail references, and Specification Section and paragraph as appropriate.
   g. Location(s) where product is to be installed, as appropriate.
   h. Other necessary identification.

F. Deviations: Highlight or otherwise specifically identify deviations from the Contract Documents on submittals.

G. Additional Copies: Unless additional copies are required for final submittal, and unless Architect observes noncompliance with provisions in the Contract Documents, initial submittal may serve as final submittal.
   1. Submit one copy of submittal file to concurrent reviewer in addition to specified number of copies to Architect.
   2. Additional copies submitted for maintenance manuals will not be marked with action taken and will be returned.

H. Transmittal: Package each submittal individually and appropriately for transmittal and handling. Transmit each submittal using a transmittal form. Architect will return submittals, without review, received from sources other than Contractor.
   1. Transmittal Form: Provide locations on form for the following information:
      a. Project name.
      b. Date.
      c. Destination (To:).
      d. Source (From:).
      e. Names of subcontractor, manufacturer, and supplier.
      f. Category and type of submittal.
      g. Drawing number and detail references, and Specification Section and paragraph as appropriate.
      h. Transmittal number, numbered consecutively.
      i. Submittal and transmittal distribution record.
      j. Remarks.
      k. Signature of transmitter.
   2. On an attached separate document transmittal form, prepared on Contractor's letterhead, record relevant information, requests for data, revisions other than those requested by Architect on previous submittals, and deviations from requirements in the Contract Documents, including minor variations and limitations. Include same label information as related submittal.

I. Resubmittals: Make resubmittals in same form and number of copies as initial submittal.
   1. Note date and content of previous submittal.
   2. Note date and content of revision in label or title block and clearly indicate extent of revision.
   3. Resubmit submittals until they are marked "No exceptions taken." or “Make corrections noted.”
J. Distribution: Furnish copies of final submittals to manufacturers, subcontractors, suppliers, fabricators, installers, authorities having jurisdiction, and others as necessary for performance of construction activities. Show distribution on transmittal forms.

K. Use for Construction: Use only final submittals with mark indicating "No exceptions taken." or “Make corrections noted.”

PART 2 - PRODUCTS

2.01 ACTION SUBMITTALS

A. General: Prepare and submit Action Submittals required by individual Specification Sections.

B. Product Data: Collect information into a single submittal for each element of construction and type of product or equipment.
1. If information must be specially prepared for submittal because standard printed data are not suitable for use, submit as Shop Drawings, not as Product Data.
2. Mark each copy of each submittal to show which products and options are applicable.
3. Include the following information, as applicable:
   a. Manufacturer's written recommendations.
   b. Manufacturer's product specifications.
   c. Standard color charts.
   d. Manufacturer's catalog cuts.
   e. Standard product operation and maintenance manuals.
   f. Compliance with specified referenced standards.
   g. Testing by recognized testing agency.
   h. Application of testing agency labels and seals.
   i. Notation of coordination requirements.
4. Submit Product Data before or concurrent with Samples.
5. Distribution: Submit product data and associated shop drawings in a single transmittal with transmittal form.

C. Shop Drawings: Prepare Project-specific information, drawn accurately to scale. Do not base Shop Drawings on reproductions of the Contract Documents or standard printed data.
1. Preparation: Fully illustrate requirements in the Contract Documents. Include the following information, as applicable:
   a. Dimensions.
   b. Wiring diagrams showing field-installed wiring, including power, signal, and control wiring.
   c. Schedules.
   d. Compliance with specified standards.
   e. Notation of coordination requirements.
   f. Notation of dimensions established by field measurement.
   g. Relationship to adjoining construction clearly indicated.
   h. Wiring Diagrams: Differentiate between manufacturer-installed and field-installed wiring.
2. Sheet Size: Except for templates, patterns, and similar full-size drawings, submit Shop Drawings on sheets at least 8-1/2 by 11 inches (216 by 280 mm) but no larger than 30 by 40 inches (762 by 1016 mm).
3. Distribution: Submit shop drawings in a single transmittal with transmittal form.

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D. Samples: Submit Samples for review of kind, color, pattern, and texture for a check of these characteristics with other elements and for a comparison of these characteristics between submittal and actual component as delivered and installed.
1. Transmit Samples that contain multiple, related components such as accessories together in one submittal package.
2. Identification: Attach label on unexposed side of Samples that includes the following:
   a. Generic description of Sample.
   b. Product name and name of manufacturer.
   c. Sample source.
   d. Number and title of appropriate Specification Section.
3. Disposition: Maintain sets of approved Samples at Project site, available for quality-control comparisons throughout the course of construction activity. Sample sets may be used to determine final acceptance of construction associated with each set.
   a. Samples not incorporated into the Work, or otherwise designated as Owner's property, are the property of Contractor.
4. Samples for Initial Selection: Submit manufacturer's color charts consisting of units or sections of units showing the full range of colors, textures, and patterns available.
   a. Number of Samples: Submit one full set of available choices where color, pattern, texture, or similar characteristics are required to be selected from manufacturer's product line. Architect will return submittal with options selected.

E. Product Schedule or List: As required in individual Specification Sections, prepare a written summary indicating types of products required for the Work and their intended location. Include the following information in tabular form:
1. Type of product. Include unique identifier for each product.
2. Number and name of room or space.
3. Location within room or space.
4. Number of Copies: Submit an electronic record in Adobe .pdf or Microsoft .doc format of product schedule or list, unless otherwise indicated.
5. Mark up and retain one returned copy as a Project Record Document.

F. Application for Payment: Comply with requirements specified in Division 01 Section "Payment Procedures."

G. Schedule of Values: Comply with requirements specified in Division 01 Section "Payment Procedures."

H. Subcontract List: Prepare a written summary identifying individuals or firms proposed for each portion of the Work, including those who are to furnish products or equipment fabricated to a special design. Use CSI Form 1.5A. Include the following information in tabular form:
1. Name, address, and telephone number of entity performing subcontract or supplying products.
2. Number and title of related Specification Section(s) covered by subcontract.
3. Drawing number and detail references, as appropriate, covered by subcontract.
4. Number of Copies: Submit three copies of subcontractor list, unless otherwise indicated. Architect will return two copies.
   a. Mark up and retain one returned copy as a Project Record Document.
### 2.02 INFORMATIONAL SUBMITTALS

A. General: Prepare and submit Informational Submittals required by other Specification Sections.

1. Number of Copies: Submit an electronic record in Adobe .pdf or Microsoft .doc format of informational submittals, unless otherwise indicated. Architect will not return copies.

2. Certificates and Certifications: Provide a notarized statement that includes signature of entity responsible for preparing certification. Certificates and certifications shall be signed by an officer or other individual authorized to sign documents on behalf of that entity.

3. Test and Inspection Reports: Comply with requirements specified in Division 01 Section "Quality Requirements."

B. Contractor's Construction Schedule: Comply with requirements specified in Division 01 Section "Construction Progress Documentation."

C. Installer Certificates: Prepare written statements on manufacturer's letterhead certifying that Installer complies with requirements in the Contract Documents and, where required, is authorized by manufacturer for this specific Project.

D. Manufacturer Certificates: Prepare written statements on manufacturer's letterhead certifying that manufacturer complies with requirements in the Contract Documents. Include evidence of manufacturing experience where required.

E. Product Certificates: Prepare written statements on manufacturer's letterhead certifying that product complies with requirements in the Contract Documents.

F. Product Test Reports: Prepare written reports indicating current product produced by manufacturer complies with requirements in the Contract Documents. Base reports on evaluation of tests performed by manufacturer and witnessed by a qualified testing agency, or on comprehensive tests performed by a qualified testing agency.

G. Field Test Reports: Prepare reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of field tests performed either during installation of product or after product is installed in its final location, for compliance with requirements in the Contract Documents.

H. Maintenance Data: Prepare written and graphic instructions and procedures for operation and normal maintenance of products and equipment. Comply with requirements specified in Division 01 Section "Operation and Maintenance Data."

I. Manufacturer's Instructions: Prepare written or published information that documents manufacturer's recommendations, guidelines, and procedures for installing or operating a product or equipment. Include name of product and name, address, and telephone number of manufacturer. Include the following, as applicable:

1. Preparation of substrates.
2. Required substrate tolerances.
3. Sequence of installation or erection.
4. Required installation tolerances.
5. Required adjustments.
6. Recommendations for cleaning and protection.
J. Insurance Certificates and Bonds: Prepare written information indicating current status of insurance or bonding coverage. Include name of entity covered by insurance or bond, limits of coverage, amounts of deductibles, if any, and term of the coverage.

K. Material Safety Data Sheets (MSDSs): Submit information directly to Owner; do not submit to Architect.
1. Architect will not review submittals that include MSDSs and will return the entire submittal for resubmittal.

2.03 DELEGATED DESIGN

A. Performance and Design Criteria: Where professional design services or certifications by a design professional are specifically required of Contractor by the Contract Documents, provide products and systems complying with specific performance and design criteria indicated.
1. If criteria indicated are not sufficient to perform services or certification required, submit a written request for additional information to Architect.

B. Delegated-Design Submittal: In addition to Shop Drawings, Product Data, and other required submittals, submit three copies of a statement, signed and sealed by the responsible design professional, for each product and system specifically assigned to Contractor to be designed or certified by a design professional.
1. Indicate that products and systems comply with performance and design criteria in the Contract Documents. Include list of codes, loads, and other factors used in performing these services.
2. Design professionals preparing, signing, and sealing design documents shall be licensed in the state in which the Work is to be installed.

PART 3 - EXECUTION

3.01 CONTRACTOR'S SUBMITTAL LOG

A. Log in each submittal and assign it a sequential number before submitting to Architect. Numbering system shall include a 2-digit reference to the Specification Division in which the requirement for the submittal is specified.

B. Track the dates and recipients when transmitting each submittal.

C. The submittal log shall be distributed at each Progress Meeting.

3.02 CONTRACTOR'S REVIEW

A. Review each submittal and check for coordination with other Work of the Contract and for compliance with the Contract Documents. Note corrections and field dimensions. Mark with approval stamp before submitting to Architect.

B. Approval Stamp: Stamp each submittal with a uniform, approval stamp. Include Project name and location, submittal number, Specification Section title and number, name of reviewer, date of Contractor's approval, and statement certifying that submittal has been reviewed, checked, and approved for compliance with the Contract Documents.
3.03 ARCHITECT'S ACTION

A. General: Architect will not review submittals that do not bear Contractor's approval stamp and will return them without action.

Spec. Section: File No.:
Job No.: Submittal No.:

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| Corrections or comments made on the shop drawings during this review do not relieve contractor from compliance with requirements of the drawings and specifications. This check is only for review of general conformance with the design concept of the project and general compliance with the information given in the contract documents. The contractor is responsible for: confirming and correlating all quantities and dimensions; selecting fabrication processes and techniques of construction; coordinating his work with that of all other trades; and performing his work in a safe and satisfactory manner. By: Date: |
| No exceptions taken |
| Make corrections noted |
| Revise and resubmit |
| Rejected |
| No Action Taken |

B. Action Submittals: Architect will review each submittal, make marks to indicate corrections or modifications required, and return it. Architect will stamp each submittal with an action stamp and will mark stamp appropriately to indicate action taken, as follows:

1. Final Release: When the Architect marks a submittal “No Exceptions Taken”, the Work covered by the submittal may proceed provided it complies with requirements of the Contract Documents. Final payment depends on that compliance.

2. Final-But-Restricted Release: When the Architect marks a submittal “Make Corrections Noted”, the Work covered by the submittal may proceed provided it complies with notations or corrections on the submittal and requirements of the Contract Documents. Final payment depends on that compliance.

3. Returned for Resubmittal: When the Architect marks a submittal “Revise and Resubmit” or “Rejected. See Remarks”, do not proceed with Work covered by the submittal, including purchasing, fabrication, delivery, or other activity. Revise or prepare a new submittal according to the notations; resubmit without delay. Repeat if necessary to obtain different action mark.
   a. Do not use, or allow others to use, submittals marked “Revise and Resubmit.” or “Rejected. See Remarks.” at the project site or elsewhere where Work is in progress.

4. No Action Taken: When the Architect marks a submittal “No Action Taken”, it implies that the submitted materials are not required by the Contract Documents and that they have been returned to the Contractor without review, notice or action.

C. Informational Submittals: Architect will review each submittal and will not return it, or will return it if it does not comply with requirements. Architect will forward each submittal to appropriate party.

D. Partial submittals are not acceptable, will be considered non-responsive, and will be returned without review.

E. Submittals not required by the Contract Documents may not be reviewed and may be discarded.
January 11, 2019

GW #18031
LINCOLN HOSPITAL
Type 1 EES Distribution

DISCLAIMER FOR THE USE OF DATA BASES IN SHOP DRAWING PREPARATION

Data contained in electronic files are considered to be part of Gertler & Wente Architects LLP instruments of service and shall not be used for any purpose other than a convenience in preparation of shop drawings for the referenced project. In the event of any conflicts between the electronic files and the signed or sealed hard-copy construction documents prepared by Gertler & Wente Architects LLP, the signed or sealed hard-copy construction documents shall govern.

The data bases (electronic files) will be provided “as is” and Gertler & Wente Architects, LLP expressly disclaims all representations and warranties of any kind, expressed or implied, including the implied warranties of title, merchantability and fitness for a particular purpose, in connection with the data base or such translation. Gertler & Wente Architects, LLP shall not be liable to anyone for any direct or indirect damages arising from any errors in our computer systems, in the software used therewith or in the translated data bases (electronic files) or for any lost profits, special or consequential damages for any claim, whether in contract, tort (including negligence and strict liability) or otherwise, arising out of your use of, or inability to use, the data bases (electronic files), even if an authorized representative has been advised of the possibility of same.

Gertler & Wente Architects, LLP (including our partners, officers, employees and agents) shall be indemnified and held harmless from all costs, liabilities, damages and expenses (including attorneys fees and defense costs) arising out of any claim related to the use of the data bases (electronic files).

Please acknowledge the terms and conditions of this disclaimer by signing in the space provided below.

Construction Manager / GC

__________________________________________________________________________  __________
Name and Title (Print)                                         Sign and Date

Subcontractor

__________________________________________________________________________  __________
Name and Title (Print)                                         Sign and Date

Files requested: ___________________________________________________________
PART 1 - GENERAL

1.01 GENERAL REQUIREMENTS

A. This Section is coordinated and complementary to the General Conditions and Supplementary General Conditions of the Work, wherever applicable.

B. Section 01 31 46 – Special Requirements for Mechanical and Electrical Work shall apply.

C. This section specifies required vibration control and seismic restraints for all equipment, with consideration for wind and snow load requirements for all equipment in outdoor locations. Additionally, included are provisions for flood control as stated herein. Section 1.4, General Design and Performance Requirements, will elaborate on these loading requirements and include specifics pertaining to a facility’s “continued operation.” Section 1.1, Part C is a partial list of components covered herein. This specification is part of the general conditions for the HVAC, Plumbing, Electrical and Fire Protection contracts.

D. This Specification is based on minimum code requirements for nonstructural building components affected from seismic, wind, snow or flood loads outlined in IBC 2012 and ASCE 7-10.

1.02 SUMMARY

A. This section includes the following:
   1. All equipment, piping, ductwork and conduit as noted on the drawing’s schedule or in the specification shall be restrained if the building is so classified under the design loads in the structural engineer’s notes. Vibration control shall apply as described in all cases herein.
   2. All outdoor equipment, including roof-mounted components, shall comply with Section 1609, Wind Load, IBC-2012, and ASCE 7-10, Chapters 29 and 30. There shall be no decrease of the effects of wind load on a component due to other structures or components acting as a shield. (ASCE 7-10 Chapter 29)
   3. All below, at grade or above grade locations located in a flood hazard area as defined and located herein.
   4. Seismic, wind, flood load and isolation materials shall be the products of the same manufacturing group and shall be certified by that group.
   5. It is the intent of the seismic and wind load portion of this specification to keep all mechanical, electrical, plumbing and fire protection building system components in place during a seismic or wind event, and additionally operational, where the designated Risk Category so requires or as assigned by the building owner.
   6. This specification is considered to be minimum requirements for seismic, wind, flood and vibration control considerations.
   7. Any variation, which results in non-compliance with the specification requirements, shall be corrected by the contractor in an approved manner.

B. The work in this section includes, but is not limited to, the following:
1. Vibration isolation for piping, ductwork, bus duct, cable tray conduit and equipment, all referred to as components.
2. Component isolation bases.
4. Wind restraints for isolated and non-isolated components.
5. Flood protection for components.
6. Certification of seismic, wind, snow or flood restraint designs.
7. Installation supervision.
8. Design of reinforcement and attachment of housekeeping pads.
9. All components requiring IBC compliance and certification and as listed herein.
10. All inspection and test procedures for components and installation of components.
11. Any variation, which results in non-compliance with the specification requirements, shall be corrected by the contractor in an approved manner.

C. All mechanical, electrical, plumbing or fire protection equipment, pipe and ductwork, within, attached to, located on or outdoors of the building supporting operation of the building. Entry of services to the building, up to but not including, the utility connection, is part of this specification.

D. Components referred to below are typical. (Components not listed are still included in this specification.) All systems that are part of the building in any way are referred to as components, including:
1. AC Units
2. Adapter Curb
3. Air Separators
4. Battery Chargers
5. Battery Racks
6. Bus Ducts
7. Cabinet Unit Heaters
8. Cable Trays
9. Compressor
10. Computer Room Units
11. Condensing Units
12. Curbs
13. Dry Coolers
14. Ductwork
15. Electrical Panels
16. Equipment Supports
17. Fans (all types)
18. Fan Coil Units
19. Fire Alarm Panels
20. Light Fixtures
21. Motor Control Centers
22. Pipe
23. Pumps (all types)
24. Risers
25. Supports
26. Switch Gear
27. Tanks (all types)
28. Transformers
29. Variable Frequency Drives
30. VAV Boxes
31. Vibration Isolators

1.03 RELATED DOCUMENTS

A. Drawings and general conditions of the contract, including General Supplementary Conditions and Division 1 Specification Section, apply to this section. In the event that this section conflicts with the requirements of other sections, the more stringent criteria stated herein shall apply.

1.04 DEFINITIONS (BUILDING AND COMPONENTS, ALL CODES)

A. ESSENTIAL FACILITIES, (Occupancy Category, IBC-2012)
1. Buildings and other structures that are intended to remain operational in the event of extreme environmental loading from flood, wind, snow or earthquakes.

B. LIFE SAFETY AND HIGH HAZARD
1. All systems involved with fire protection, including sprinkler piping, jockey pumps, fire pumps, control panels, service water supply piping, water tanks, fire dampers, smoke exhaust systems and fire alarm panels. (Life Safety)
2. All mechanical, electrical, plumbing or fire protection systems that support the operation of, or are connected to, emergency power equipment, including all lighting, generators, transfer switches and transformers. (Life Safety)
3. All medical and life support systems. (Life Safety)
4. Hospital heating systems and air conditioning systems for maintaining normal ambient temperature. (Life Safety)
5. Automated supply, exhaust, fresh air and relief air systems on emergency control sequence, including air handlers, duct, dampers, etc., or manually-operated systems used for smoke evacuation, purge or fresh air relief by the fire department. (Life Safety)
6. All gases or fluids that must be contained in a closed system which are flammable or combustible. Any gas that poses a health hazard if released into the environment and vented Fuel Cells. (High Hazard)

C. General
1. Anchor: A device, such as an expansion bolt, for connecting equipment bracing members to the structure of a building.
2. Approved Agency: An established and recognized agency regularly engaged in conducting tests or furnishing analytical or inspection services, when such agency has been approved.
3. Attachment: See Positive Attachment below.
4. Authority Having Jurisdiction: the organization, political subdivision, office, or individual charged with the responsibility of administering and enforcing the provisions of the standard.
5. Basic Wind Speed: The ultimate design wind speed, in mph, for determination of the wind loads shall be determined using Figures 1609A, 1609B, and 1609C of IBC-2012 based on the Risk Category of the building (unless local code determinations are more severe). Local jurisdictions shall determine wind speeds for indicated special wind regions located near gorges or mountainous terrain. Section 26.5.1 of ASCE 7-10 shall be used after determination of basic wind speed by the local jurisdiction. In nonhurricane-prone regions, when the ultimate design wind speed is estimated from regional climatic data, the ultimate design wind speed shall be determined in accordance with Section 26.5.3 of ASCE 7.
6. **Bracing**: Structural supports that prevent components from displacing or breaking away from the structure due to earthquake, wind or other environmental loading. See also **Longitudinal Bracing** and **Transverse Bracing**.

7. **Certified Seismic Qualification Agency**: A certified listing and pre-approval service for manufacturer’s requiring Special Seismic Certification for their components as outlined in the International Building Code Chapters 16 & 17, ASCE 7-10 Section 13.2.2 and ICC-ES AC156.

8. **Certificate of Compliance**: A certificate stating that materials and products meet specified standards or that work was done in compliance with approved construction documents, provided by an approved agency. (Certificate to be supplied by equipment component manufacturer.)

9. **Component**: A non-structural part or element of an architectural, electrical, mechanical, plumbing or fire protection system within or without of a building system.

10. **Component Importance Factor**: Factor applied to a component that defines the criticality of that component. This factor can be 1.0 or 1.5.

11. **Consequential Damage**: The functional and physical interrelationship of components, their supports and their effect on each other shall be considered so that the failure of an essential or non-essential architectural, mechanical or electrical component shall not cause the failure of an essential architectural, mechanical or electrical component.

12. **Essential Facility**: Buildings and other structures that are intended to remain operational in the event of extreme environmental loading from flood, wind, snow or earthquake.

13. **Equipment**: Systems associated with ducts, pipes and conduits also called components.

14. **Flood or Flooding**: A general and temporary condition or partial and complete inundation of normally dry land from:
   a. The overflow of inland or tidal waters.
   b. The unusual and rapid accumulation of runoff of surface waters from any source.

15. **Flood Hazard Area**: The greater of the following of two areas:
   a. The area within a flood plain subject to a 1 percent or greater chance of flooding in any year.
   b. The area designated as a flood hazard area on a community’s flood hazard map, or otherwise legally designated.

16. **Special Flood Hazard Area Subject to High Velocity Wave Action**: Area within the flood hazard area that is subject to high velocity wave action and shown on a Flood Insurance Rate Map (FIRM) or other flood hazard map as zone V, VO, VE or VI-30.

17. **Flood Insurance Rate Map (FIRM)**: An official map of a community on which the Federal Emergency Management Agency (FEMA) has delineated both the special flood hazard areas and the risk premium zones applicable to the community.

18. **Hazardous Material**: Those chemicals or substances that are physical hazards or health hazards as classified in Section 307 of IBC 2012 and the International Fire Code, whether the materials are in usable or waste condition.

19. **Hurricane Prone Regions**: Areas vulnerable to hurricanes defined as:
   a. The U.S. Atlantic Ocean and Gulf of Mexico coasts where the ultimate design wind speed $V_{ult}$ for Risk Category buildings is greater than 115mph (51.4m/s); and
   b. Hawaii, Puerto Rico, Guam, Virgin islands and American Samoa.

20. **Importance Factor I**: A factor that accounts for the degree of risk to human life, health and welfare associated with damage to property or loss or use of functionality.

21. **Inspection Certificate**: An identification applied on a product by an approved agency containing the name of the manufacturer, the function and performance characteristics, and the name and identification of an approved agency that indicates that the product or
material has been inspected and evaluated by an approved agency (see Section 1703.5 and "Label," and "Manufacturer’s Designation" and "Mark").

22. **Label:** An identification applied on a product by the manufacturer that contains the name of the manufacturer, the function and performance characteristics, and the name and identification of an approved agency that indicates that the representative sample of the product or material has been tested and evaluated by an approved agency (see Section 1703.5 and “Inspection Certificate,” “Manufacturer’s Designation” and “Mark”).

23. **Longitudinal bracing:** Bracing that prevents a component from moving in the direction of its run.

24. **Mark:** An identification applied on a product by the manufacturer indicating the name of the manufacturer and the function of a product or material (see also “Inspection Certificate,” “Label” and “Manufacturer’s Designation”).

25. **Manufacturer’s Designation:** An identification applied on a product by the manufacturer indicating that a product or material complies with a specified standard or set of rules (see also “Inspection Certificate,” “Label” and “Mark”).

26. **Occupancy Category:** Reclassified to Risk Category in IBC 2012, see below.

27. **Positive Attachment:** A mechanical device, designed to resist seismic forces, which connects a non-structural building component or support, to a structural element. Bolts and welding are examples of positive attachments. Friction anchorage does not constitute positive attachment.

28. **Risk Category:** A categorization of buildings and other structures for determination of flood, wind, snow, ice and earthquake loads based on the risk associated with unacceptable performance.

29. **Seismic Design Category:** A classification assigned to a structure based on its Seismic Use Group or Occupancy Category and the severity of the design earthquake ground motion at the site.

30. **Seismic Forces:** The assumed forces prescribed herein, related to the response of the structure to earthquake motions, to be used in the design of the structure and its components.

31. **Site Class:** A classification assigned to a site based on the types of soils present and their engineering properties as defined in Table 1613.3.2 (IBC-2012).

32. **Special Inspection:** Inspection of construction requiring the expertise of an approved special inspector in order to ensure compliance with IBC-2012 and the approved construction documents.

33. **Special Inspector:** A qualified person employed or retained by an approved agency and approved by the building official as having the competence necessary to inspect a particular type of construction requiring special inspection.

34. **Special Inspection, Continuous:** Special inspection by the special inspector who is present when and where the work to be inspected is being performed.

35. **Special Inspection, Periodic:** Special inspection by the special inspector who is intermittently present where the work to be inspected has been or is being performed.

36. **Structure:** Load carrying building elements as designed for environmental loading by the building structural engineer of record.

37. **Transverse bracing:** Bracing that prevents a component from moving from side to side.

38. **Wind-Borne Debris Region.** Area within hurricane prone regions located:
   a. Within 1 mile (1.61km) of the coastal mean high water line where the ultimate design wind speed \( V_{uh} \) is 130 mph (58 m/s) or greater or
   b. In areas where the ultimate design wind speed is 140 mph (63.6 m/s) or greater; or Hawaii
For Risk Category II buildings and structures and Risk Category III buildings and structures except health care facilities, the wind borne debris region shall be based on figure 1609A. For Risk Category IV buildings and structures and risk Category III health care facilities, the windborne debris region shall be based on Figure 1609B.

1.05 GENERAL DESIGN AND PERFORMANCE REQUIREMENTS

A. General Design Requirements.

1. **SEISMIC CONSIDERATIONS:** This project has the following seismic design requirements:
   a. Seismic Design Category C (Risk Category IV)
      All MEP Components are required to be addressed for seismic restraint.
      Component Certifications shall be provided for designated seismic systems assigned to Seismic Design Category C through F facilities as specified in Section 13.2.2 of ASCE 7–10. Certified components must be listed by a Certified Seismic Qualification Agency.

2. **WIND CONSIDERATIONS:** For the MEP components installed on the exterior of the building, wind restraint design requirements are as follows:
   a. The unit must be secured to the structural slab or housekeeping pad to resist the design wind force determined in accordance with Equation 29.5-1 of ASCE 7-10 for equipment and/or components installed at grade.
   b. The unit must be secured to the structure to resist the design wind force determined in accordance with Equation 29.5-1 of ASCE 7-10 for rooftop equipment and/or components on buildings with a roof height greater than 60 feet.
   c. The unit must be secured to the structure to resist the design wind force determined in accordance with Equation 29.5-2 of ASCE 7-10 for rooftop equipment and/or components on buildings with a roof height less than or equal to 60.

3. **FLOOD CONSIDERATIONS:** This project has design requirements in accordance with FEMA and/or FIRM as follows:
   a. None

4. **SNOW CONSIDERATIONS:** Design snow loads determined in accordance with Figure 7.1 of ASCE 7-10 to be used in the design of supports for rooftop equipment. Snow loads to be used within the basic load combinations recognized in Chapter 2 of ASCE 7-10.

B. General Design Performance Requirements

1. Seismic and Wind Load Certification and Analysis:
   a. Attachment calculations by the Seismic Restraint Manufacturer’s licensed Engineer substantiating the mounting system, seismic or wind restraints, fasteners or ICC evaluated Concrete Anchors shall be submitted for approval along with the submittal drawings. Seismic loads shall have their calculations based on seismic loads as established in Specification Section 1.4, Paragraph B, article 6 Design Seismic Loads. Wind loads shall have their calculations based on Section 1.4, Paragraph B, article 7 Design Wind Loads. A registered professional engineer having a PE from the same state as the project, or state of restraint manufacturer shall stamp all analysis, or as required by local building codes.
   b. Unless otherwise specified, all equipment, piping and ductwork shall be restrained to resist seismic forces. Restraints shall maintain equipment, piping or ductwork in a captive position. Restraint devices shall be designed and selected to meet seismic requirements as defined in the latest issue of:
      1) International Building Code, IBC and ASCE applicable state and local codes
      2) NFPA (fire protection only)
2. Importance Factor, Ip = 1.5 Components:
   a. In addition to all of the above provisions, for components having an Ip of 1.5, all trades shall comply with Sections 16 and 17 of the International Building Code using, when available, vendors that comply with the provisions stated herein and submitting the special inspections listed within these specifications. Where compliance is not possible, each contractor shall submit a vendor report (form CVC-1 at end of this specification) clearly indicating that none of the specified, listed or other vendors known to the contractor meets the compliance, testing and certification portions of the IBC specification’s Sections 16 and 17. Special inspections of the component installation shall still be conducted (Section 1.4, Paragraph B, Article 4) even if no vendors meet the following requirements. All non-isolated and isolated equipment (components) shall be secured to the structure in accordance with that code.

3. All component manufacturers shall submit for approval the Certified Seismic Qualification Agency's listing for their equipment for the required conditions below:
   a. For all life safety system components noted in this specification shall be submitted with the Certified Seismic Qualification Agency's listing of the manufacturer's Certificate of Compliance for the specific equipment on this project when the Seismic Design Category is C through F. Analytical or Shaker Test certification through the component’s load path to structure at its center of gravity shall include anchorage, structural and on-line capability. Use of seismic experience data shall be permitted if evidence confirms that the historical based component has the same construction and weight and accompanying center of gravity as submitted unit and basis of experience claim conforms to loads derived in testing with accompanying accelerations based on AC-156. Seismic qualification by seismic experience data based upon nationally recognized procedures acceptable to the authority having jurisdiction shall be deemed to satisfy the design and evaluation requirements provided that the substantiated seismic capacities equal or exceed the seismic demands determined in accordance with Sections 13.3.1 and 13.3.2 of ASCE 7-10.
   b. In addition, all components needed for the continued operation of the facility or that have an Ip of 1.5 in the above stated categories will have the manufacturer of that component submit the Certified Seismic Qualification Agency's listing of their Certificate of Compliance for their equipment when the Seismic Design Category is C through F. Analytical or Shaker Test certification through the component’s load path to structure at its center of gravity shall include on line capability for all essential and life safety components. This requirement also pertains to projects that combine an emergency preparedness center within a structure of another Use Group. Where components do not effect the facility’s functional operation but could affect the performance of other components should they dislodge, only anchorage of that component requires compliance. Components needed for continued operation of the building require Analytical or Shaker Test certification through the total component’s load path to structure calculated at its center of gravity. Certification shall prove anchorage, structural and on line capability for all essential and life safety components and for all components in Essential Facilities. For use of seismic experience data, see (a) above.
   c. All components containing hazardous or flammable materials will have the manufacturer of the component submit the Certified Seismic Qualification Agency's listing of their Certificate of Compliance for their equipment when used on any project having a minimum Seismic Design Category of C through F. Testing shall be conducted by Analytical or Shaker Test through the total component’s load path to structure calculated at its center of gravity.
to structure at its center of gravity and shall prove anchorage, structural capability and hazardous material containment. Testing shall prove that no internal component will rupture to insure against loss of hazardous or flammable (explosive) material that could support combustion, ignite or contaminate in Non Essential Facilities. In Essential Facilities, compliance shall demonstrate on line and functional after an event.

d. All components requiring anchorage compliance only, not listed in the above categories, shall have the manufacturer of each component submit a PE stamped calculation package stating that their project specific equipment will accept anchorage by calculating its reactions through the component’s load path to structure at its center of gravity at the designated anchorage locations. This requirement is for all projects having a Seismic Design Category of C through F.

e. Component Testing for IBC Compliance must be by an approved agency or Certified Seismic Qualification Agency listed on an accredited listing site.

4. Special and Periodic Inspection: (Occupancy Category II, III, IV Projects)
The following systems shall require Special Inspection and Periodic Special Inspection for seismic installation and anchorage during the course of construction shall be as follows:

a. Periodic special inspection is required during the anchorage of electrical equipment for emergency or standby power systems in structures assigned to Seismic Design Categories C through F

b. Periodic Special inspection is required during the anchorage of other electrical equipment in structures assigned to Seismic Design Categories C through F

c. Periodic Special Inspection is required during the installation and anchorage of piping systems designed to carry hazardous materials and their associated mechanical units in structures assigned to Seismic Design Category C, D, E or F.

d. Periodic special Inspection is required during the installation and anchorage of ductwork designed to carry hazardous materials in structures assigned to Seismic Design Category C, D, E or F.

e. Periodic Special inspection is required during the installation and anchorage of vibration isolation systems in structures assigned to Seismic Design Category C, D, E or F where the construction documents require a nominal clearance of ¼” (6.4mm) or less between the equipment support frame and restraint.

5. Contractor Responsibilities and Approvals: (Occupancy Category II, III, IV Projects)
a. Each contractor responsible for the construction of a designated seismic system listed in the statement of special inspections shall submit a written statement of responsibility to the building official and the owner prior to the commencement of work on the system or component. The contractor’s statement of responsibility shall contain acknowledgement of awareness of the special requirements contained in the statement of special inspections.

b. As part of contractor’s submission, each designated seismic system listed in the statement of special inspections shall have all components of that system requiring such inspection listed on form DSS-1 at the end of this specification.

6. Design Seismic Loads:
a. Analysis for anchorage must indicate calculated dead loads, static seismic loads and capacity of materials utilized for connections to equipment and structure. Analysis must detail anchoring methods, bolt diameter, embedment depth and/or welded length. All seismic restraint devices shall be designed to accept, without failure, the forces detailed in this section, acting through the equipment center of gravity.

b. Vertical load shall be calculated as 0.2 times Sds and shall be applied per the loads combination from IBC 1613 & ASCE 7-10.
c. Failure is defined as the discontinuance of any attachment point or load path between component and structure. Permanent deformation of the component is acceptable as long as the component continues to operate without failure and, if permanent, it is within acceptable manufacturing or structural tolerances.

7. Design Wind Loads:
   a. All outdoor mounted components shall be positively fastened to their supporting structure as discussed below. Fastening to metal deck is unacceptable.
      1) If component is curb mounted, Section 1.8, Quality Assurance, paragraph F, shall be followed for all roof-mounted components. Curbs shall be as described in Base type B-3 if isolated, Base type B-4 if non-isolated.
      2) If component is support mounted, Section 1.8 Quality Assurance paragraph F, shall be followed for all roof-mounted components requiring waterproofed rail supports. Equipment supports shall be Base type B-5 if isolated, Base type B-6 if non-isolated.
      3) If equipment is dunnage mounted, positive attachment shall occur through welding or bolting of equipment to dunnage steel.
   b. Loads and calculations shall be based on IBC-2012, figure 1609 and related sections in ASCE 7-10.
   c. Where buildings are less than or equal to 60 feet in height to the top of the roof slab (not parapet walls), the force on roof-mounted components shall be based on Section 29.5 ASCE 7-12.
   d. Calculated wind loads shall not be diminished from the effects of shielding by other structures. IBC 2012 Section 1609.1

8. Design Flood Loads:
   a. When a building or structure is located in a flood hazard area, anchorage for all components subjected to those locations shall follow Section 1.4 article 7, Design Wind Load paragraph a for their proper fastening to structure.
   b. Components used for anchorage purposes shall be hot dipped galvanized, cadmium-plated or powder-coated for the purpose of anti-corrosion.

9. Design Snow Load:
   a. When a building or structure is located in an area subject to snow loads, anchorage for all outdoor components shall follow Section 1.4 article 7, Design Wind Load paragraph a, for their proper fastening to structure.
   b. Components used for anchorage purposes shall be hot dipped galvanized, cadmium-plated, or powder coated for the purpose of anti-corrosion.

10. Additional Seismic Design Requirements for Fire Protection Components
    Fire protection piping systems must be protected against horizontal seismic loads and must be installed to prevent vertical motion resulting from seismic loads following section 13.6.8.2 of ASCE 7-10 and the most recent adopted edition of NFPA 13.
    Provisions to protect the piping must address the following:
    a. Couplings – Listed flexible couplings shall be provided as flexure joints at locations within the piping system following Section 9.3.2 of NFPA 13.
    b. Seismic Separation Assembly – An approved seismic separation assembly shall be installed where sprinkler piping crosses building seismic separation as specified in Section 9.3.3 of NFPA 13.
    c. Clearance – All piping extending through walls, floors, platforms, and foundations must be provided with adequate clearances around the pipe as specified in Section 9.3.4 of NFPA 13.
    d. Sway Bracing – System piping must be braced to resist both lateral and longitudinal horizontal seismic loads and installed in a manner to prevent vertical motion
VIBRATION ISOLATION, SEISMIC, WIND AND FLOOD LOAD RESTRAINTS FOR HVAC, PLUMBING, ELECTRICAL AND FIRE PROTECTION COMPONENTS 01 35 48 - 10
manufacturer’s submittals must include spacing and maximum seismic/wind loads at the restraint points.

d. Provide specific details of restraints and anchors, include number, size and locations for each piece of equipment. Restraint and anchor allowables shall be by structural testing, shake testing, analysis or third party certification. Test and/or analysis data to substantiate restraint allowables shall be available if requested.

e. Calculations shall be submitted as required in Section 1.4, General Design and Performance Requirements.

1.07 RELATED WORK

A. Housekeeping pad structural design, including its attachment to building structure, shall be by the structural engineer of record or as shown on the contract drawings. Attachment of all components and restraints to the pad and size of the pad shall be designed and certified according to this section by the seismic/isolation supplier. Material and labor required for attachment and construction shall be by the concrete section contractor, or by the contractor where specified. Housekeeping pads shall be sized to accommodate a minimum 6” of clearance all around the equipment; or 12 times the outermost anchor bolt diameter, whichever is greater. Where exterior isolators are used, this distance shall be as measured from the outermost holes in the isolator base plate to the edge of the housekeeping pad.

B. The project’s structural engineer shall design all roof and interior steel to support and make connections to all components, including roof-mounted equipment specified in other sections. Design shall comply with IBC requirements including load path to structure.

C. Roof steel supporting roof-mounted equipment shall be designed for all seismic and wind forces including, but not limited to, tension, compression and moment loads.

D. Chimneys, stacks and boiler breeching passing through floors are to be attached at each floor level with a riser guide.

E. Where ceilings are not braced, lay-in lighting fixtures, weighing more than 20 lbs, shall have at least 2 independent corner diagonal wire ties to structure.

F. Lay-in ceilings in compliance with seismic code requirements may use earthquake clips or other approved means of positive attachment to brace fixtures such as panel lights and diffusers less than 40 lbs to T-bar structures. Local codes dictate fixture support requirements.

1.08 CODE AND STANDARDS REQUIREMENTS

A. Typical Applicable Codes and Standards

1. All City, State and Local Codes (Code)
   a. NFPA 13 and 14 for Fire Protection System (Standard)
   b. American Society For Testing and Materials (ASTM) (Standard)
   c. International Conference of Building Officials (ICBO) (Standard)
   d. International Building Code (Code)
   e. ASHRAE (Standard reference, to be used for design purposes only, not code).
   f. VISCMA (Vibration Isolation and Seismic Controls Manufacturers Association) (Standard reference, to be used for design purposes only, not code).
B. In cases where requirements vary, the guideline for the most stringent shall be utilized.

C. Use IBC-2012 as reference code standard unless otherwise designated.

1.09 QUALITY ASSURANCE

A. Manufacturer of vibration isolation, seismic and wind load control equipment or manufacturer’s approved representative shall have the following responsibilities:
   1. Determine vibration isolation and restraint sizes and locations.
   2. Provide vibration isolation and restraints as scheduled or specified.
   3. Provide calculations and materials, if required, for restraint of non-isolated equipment.
   4. Provide installation instructions in writing, drawings and trained field supervision, where necessary, to insure proper installation and performance.
   5. Certify correctness of installation upon completion, in writing.
   6. All provisions of Section 1.4, General Design and Performance Requirements including the listing of the isolated or non-isolated component by the Certified Seismic Qualification Agency.

B. All manufacturers of vibration control, seismic, wind or flood restraining systems must provide a Seismic Design Error and Omissions Insurance Certificate for their firm or their design consultant to certify their ability to provide engineering and design as required by this section. This document shall be provided at the time of first submittal from the seismic restraint provider.

C. All manufacturers of any type of equipment including OEM are responsible for Section 1.4.

D. Equipment manufacturer’s substitution of internally or externally isolated and/or restrained equipment supplied by the equipment vendor, in lieu of the isolation and restraints specified in this section, is acceptable provided all conditions of this section are met. The equipment manufacturer shall provide a letter of guarantee from their engineering department, PE stamped and certified per the section on the Seismic Restraint Design (see Section 1.4B, article 3), stating that the seismic restraints are in full compliance with these specifications. Where used on an Essential or High Hazard Facility, manufacturer’s certification proving on line capability shall be required in addition to all requirements stated in Section 1.4 B. Letters from field offices or representatives are unacceptable.

E. All costs for converting to the specified vibration isolation and/or restraints shall be borne by the component vendor in the event of non-compliance with the preceding. Substitution of internal isolation is unacceptable for:
   1. Indoor or outdoor mounted equipment over or adjacent to:
      a. Patient or operating areas
      b. Theatre space
      c. Office locations
      d. Assembly areas

F. Whether the equipment is internally or externally isolated and restrained, the entire unit assembly must be seismically attached to the structure. Curb or roof rail mounted equipment must not only have seismic or wind attachment of the equipment to the roof but also attachment to the curb or rails. The attachment and certification thereof shall be by this section. Sheet metal screw attachment is acceptable provided that the following five conditions are met and verified.
G. Calculations support sufficient quantity and size of sheet metal screws to handle all loads including shear.

H. Shear and tension allowables are obtained from an accredited third party source, such as ICC or NDS, not from the fastening manufacturer.

I. Space or gap between the inside overhang of the rooftop unit and the curb at each of the screw locations is closed with structural material, tapered to contour to both the curb and the components’ inside edge structure.

J. Attachment points of the roof-mounted unit to curb and the curb to structure demonstrates structural load path.

K. The method of attachment does not violate the NRCA rating of the curb by violating the roof member’s waterproofing.

1.10 RELATED WORK

A. Housekeeping pad structural design, including its attachment to building structure, shall be by the structural engineer of record or as shown on the contract drawings. Attachment of all components and restraints to the pad and size of the pad shall be designed and certified according to this section by the seismic/isolation supplier. Material and labor required for attachment and construction shall be by the concrete section contractor, or by the contractor where specified. Housekeeping pads shall be sized to accommodate a minimum 6” of clearance all around the equipment; or 12 times the outermost anchor bolt diameter, whichever is greater. Where exterior isolators are used, this distance shall be as measured from the outermost holes in the isolator base plate to the edge of the housekeeping pad.

B. The project’s structural engineer shall design all roof and interior steel to support and make connections to all components, including roof-mounted equipment specified in other sections. Design shall comply with IBC requirements including load path to structure.

C. Roof steel supporting roof-mounted equipment shall be designed for all seismic and wind forces including, but not limited to, tension, compression and moment loads.

D. Chimneys, stacks and boiler breeching passing through floors are to be attached at each floor level with a riser guide.

E. Where ceilings are not braced, lay-in lighting fixtures, weighing more than 20 lbs, shall have at least 2 independent corner diagonal wire ties to structure.

F. Lay-in ceilings in compliance with seismic code requirements may use earthquake clips or other approved means of positive attachment to brace fixtures such as panel lights and diffusers less than 40 lbs to T-bar structures. Local codes dictate fixture support requirements.

1.11 CODE AND STANDARDS REQUIREMENTS

A. Typical Applicable Codes and Standards
   1. All City, State and Local Codes (Code)
      a. NFPA 13 and 14 for Fire Protection System (Standard)
b. American Society For Testing and Materials (ASTM) (Standard)
c. International Conference of Building Officials (ICBO) (Standard)
d. International Building Code (Code)
e. ASHRAE (Standard reference, to be used for design purposes only, not code).
f. VISCMA (Vibration Isolation and Seismic Controls Manufacturers Association) (Standard reference, to be used for design purposes only, not code).

B. In cases where requirements vary, the guideline for the most stringent shall be utilized.

C. International Fire Code

D. Use IBC-2012 as reference code standard unless otherwise designated.

PART 2 - PRODUCTS & SERVICES

2.01 DESCRIPTION

A. All vibration isolators and seismic restraints described in this Section shall be the product of a single manufacturer. The basis of this specification is The VMC Group, including Vibration Mountings & Controls, Amber/Booth or Korfund Dynamics.

B. Products from other nationally recognized manufacturers are acceptable provided their systems strictly comply with these specifications and have the approval of the specifying engineer. Manufacturer shall be a regular member of VISCMA (Vibration Isolation and Seismic Controls Manufacturers Association).

C. IBC compliant manufacturers for isolated and non-isolated components shall be listed on a Certified Seismic Qualification Agency site similar to that of the VMC GROUP or approved equal.

2.02 VIBRATION ISOLATION TYPES

A. Type A: Spring Isolator – Free Standing

1. Spring isolators shall be free standing and laterally stable without any housing and complete with a molded elastomeric cup or ¼” elastomeric acoustical friction pad between the bottom of isolator and the support.
2. All mountings shall have leveling bolts that must be rigidly bolted to the equipment.
3. Spring diameters shall be no less than 0.8” of the compressed height of the spring at rated load.
4. Springs shall have a minimum additional travel to solid equal to 50% of the operating deflection.

B. Type 4: Seismic and Wind Restrained Spring Isolator

MS, MSS, AEQM, ASCM, AMSR

1. Restrained spring mountings shall have a Type A spring isolator within a rigid housing that includes vertical limit stops to prevent spring extension if weight is removed. The housing shall serve as blocking during erection. A maximum clearance of ¼” shall be maintained around restraining bolts and internal elastomeric deceleration bushings. Limit stops shall
be out of contact during normal operation. If housings are to be bolted or welded in position there must be an internal isolation pad or elastomeric cup. Housing shall be designed to resist all seismic forces.

C. Type C: Combination Spring/Elastomer Hanger Isolator (30° Type)
   HRSA
   1. Hangers shall consist of rigid steel frames containing minimum 1 ¼" thick elastomeric elements at the top and a steel spring with general characteristics as in Type A. The elastomeric element shall have resilient bushings projecting through the steel box.
   2. Spring diameters and hanger box lower hole sizes shall be large enough to permit the hanger rod to swing through a 30° arc from side to side before contacting the rod bushing and short-circuiting the spring.
   3. Submittals shall include a hanger drawing showing the 30° capability.
   4. Hanger locations requiring pre-compression for holding piping at fixed elevation shall be type pre-compressed or pre-positioning for all manufacturers.

D. Type D: Elastomer Double Deflection Hanger Isolator
   HR
   1. Molded (minimum 1 ¼” thick) elastomeric element with projecting bushing lining the rod clearance hole. Static deflection at rated load shall be a minimum of 0.35.”
   2. Steel retainer box encasing elastomeric mounting capable of supporting equipment up to two times the rated capacity of the element.

E. Type E: Combination Spring/Elastomer Hanger Isolator
   HRS
   1. Spring and elastomeric elements in a steel retainer box with the features as described for Type C and D isolators.
   2. Hanger locations requiring pre-compression for holding piping at fixed elevation shall be type pre-compressed or pre-positioning for all manufacturers.
   3. 30° angularity feature is not required.

F. Type F: Seismic Restrained Elastomer Floor Isolator
   RSM, MB, RUD
   1. Bridge-bearing elastomeric mountings shall have a minimum static deflection of 0.2” and all-directional seismic capability. The mount shall consist of a ductile iron or aluminum casting containing molded elastomeric elements. The elements shall prevent the central threaded sleeve and attachment bolt from contacting the casting during normal operation. The shock-absorbing elastomeric materials shall be compounded to bridge-bearing or Durulene™ specifications.

G. Type G: Pad Type Elastomer Isolator (Standard)
   Maxiflex
   1. One layer of 3/8” thick elastomeric pad consisting of 2” square modules for size required.
   2. Load distribution plates shall be used as required.
   3. Bolting required for seismic compliance. Elastomeric and duck washers and bushings shall be provided to prevent short-circuiting.

H. Type H: Pad Type Elastomer Isolator (High Density)
   Fabri-Flex, NDB, NRC
   1. Laminated canvas duck and neoprene, maximum loading 1000 psi, minimum ½” thick.
2. Load distribution plate shall be used as required.
3. Bolting required for seismic compliance. Elastomeric and duck washers and bushings shall be provided to prevent short-circuiting.

I. Type I: Thrust Restraints
   RSHTR, TRK
   1. A spring element similar to Type A isolator shall be combined with steel angles, backup plates, threaded rod, washers and nuts to produce a pair of devices capable of limiting movement of air handling equipment to \( \frac{1}{4}" \) due to thrust forces. Contractor shall supply hardware.
   2. Thrust restraints shall be installed on all cabinet fan heads, axial or centrifugal fans whose thrust exceeds 10% of unit weight.

J. Type J: Pipe Anchors
   MDPA, AG
   1. All-directional acoustical pipe anchor, consisting of two sizes of steel tubing or piping separated by a minimum \( \frac{1}{2}" \) thick 60 durometer elastomer.
   2. Vertical restraint shall be provided by similar material arranged to prevent vertical travel in either direction.
   3. Applied loads on the isolation material shall not exceed 500 psi and the design shall be balanced for equal resistance in any direction.

K. Type K: Pipe Guides
   PG/AG/SWP/SWX
   1. Pipe guides shall consist of a telescopic arrangement of two sizes of steel tubing or piping separated by a minimum \( \frac{1}{2}" \) thickness of 60 durometer elastomer.
   2. The height of the guides shall be preset with a shear pin to allow vertical motion due to pipe expansion or contraction. Shear pin shall be removable and replaceable to allow for selection of pipe movement.
   3. Guides shall be capable of \( \pm 1 5/8" \) motion, or to meet location requirements.

L. Type L: Isolated Pipe Hanger System
   CIH, CIR, TIH, PIH
   1. Pre-compressed spring and elastomer isolation hanger combined with pipe support into one assembly. Replaces standard clevis, single or double rod roller, or double rod fixed support.
   2. Spring element (same as Type A) with steel lower spring retainer and an upper elastomer retainer cup with an integral bushing to insulate support rod from the isolation hanger.
   3. The elastomeric element under the lower steel spring retainer shall have an integral bushing to insulate the support rod from the steel spring retainer.
   4. Hangers shall be designed and constructed to support loads over three times the rated load without failure.
   5. Systems shall be pre-compressed to allow for rod insertion and standard leveling.

2.03 SEISMIC RESTRAINT TYPES

A. Type I: Spring Isolator, Restrained
   MS, MSS, AEQM, ASCM, AMRS
   1. Refer to vibration isolation Type B.

B. Type II: Seismic Restrained Elastomer Floor Isolator
C. Refer to vibration isolation Type F.

D. Type III: All-Directional Seismic Snubber SR, ER
   1. All-directional seismic snubbers shall consist of interlocking steel members restrained by an elastomeric bushing. Bushing shall be replaceable and a minimum of ¼” thick. Applied loading shall not exceed 1000 psi. A minimum air gap of 1/8” shall be incorporated in the snubber design in all directions before contact is made between the rigid and resilient surfaces. Snubber end caps shall be removable to allow inspection of internal clearances. Elastomeric bushings shall be rotated to insure no short circuits exist before systems are activated.

E. Type IV: Floor or Roof Anchorage Cast-In Plates
   1. Rigid attachment to structure utilizing wedge type anchor bolts, anchored plates, machine screw, bolting or welding. Power shots are unacceptable.

F. Type V: Seismic Cable Restraints SB, LRC
   1. Seismic Cable Restraints shall consist of galvanized steel aircraft cables sized to resist seismic loads with a minimum safety factor of two and arranged to provide all-directional restraint. Cable end connections shall be steel assemblies that swivel to final installation angle and utilize two clamping bolts to provide proper cable engagement. Cables must not be allowed to bend across sharp edges.

G. Type VI: Rigid Arm Brace SAB
   1. Seismic solid braces shall consist of steel angles or channels to resist seismic loads with a minimum safety factor of two and arranged to provide all-directional restraint. Seismic solid brace end connectors shall be steel assemblies that swivel to the final installation angle and utilize two anchor bolts to provide proper attachment spaced to ICBO standards for attachment to concrete.

H. Type VII: Internal Clevis Cross Brace ICB
   1. Internal clevis cross braces at seismic locations shall be pre-cut pipe or other approved device sized for internal dimensions.

I. Type VIII: Seismic Waterproof Foundation Wall Sleeve SWFWS
   1. Seismic waterproof foundation wall sleeves shall consist of two elastomeric sleeves that shall be mounted both inside and out of the vertical foundation wall. The conical design shall have a suitably waterproof means of fastening to both concrete and to its concentric utility pipe. Allowable vertical drift shall be ± 2” from the installed neutral point along the vertical “y” axis. All fittings shall be stainless steel or galvanized.
2.04 EQUIPMENT BASES

A. General
1. All curbs and roof rails are to be bolted or welded to the building steel or anchored to the concrete deck (minimum thickness shall be 4”) for resisting wind and seismic forces in accordance with the project location. (Fastening to metal deck is unacceptable.)

B. Base Types
1. Type B-1: Integral Structural Steel Base
   WFB, SFB, WSB
   a. Rectangular bases are preferred for all equipment.
   b. Centrifugal refrigeration machines and pump bases may be T or L shaped where space is a problem. Pump bases for split case and end suction pumps shall include supports for suction and discharge elbows.
   c. All perimeter members shall be structural steel beams with a minimum depth equal to 1/12 of the longest dimension between isolators.
   d. Base depth need not exceed 12” provided that the deflection and misalignment is kept within acceptable limits as determined by the manufacturer.
   e. Height saving brackets shall be employed in all mounting locations to provide a minimum base clearance of 2.”

2. Type B-2: Concrete Inertia Base
   MPF, WPF, CPF
   a. Vibration isolation manufacturer shall furnish rectangular welded or bolted modular steel concrete pouring forms for floating and inertia foundations.
   b. Bases for split case and end suction pumps shall be large enough to provide for suction and discharge elbows.
   c. Bases shall be a minimum of 1/12 of the longest dimension between isolators but not less than 6.”
   d. The base depth need not exceed 12” unless specifically recommended by the base manufacturer for mass or rigidity.
   e. Forms shall include a minimum concrete reinforcing consisting of 3/8” bars welded in place a maximum of 16” on centers running both ways in a layer 1 to 1½” above the bottom.
   f. Forms shall be furnished with steel templates to hold the component anchor bolts sleeves and anchors while concrete is being poured.
   g. Height saving brackets shall be employed in all mounting locations to maintain a 2” minimum operational clearance below the base.

3. Type B-3: Seismic Isolation Curb
   P6200, P6300, TELECURB
   Option: Sound Package 1 & 2 VMC/AB-RPFMA/SRPFMA
   a. Curb-mounted rooftop equipment shown on isolation schedule shall be mounted on structural seismic spring isolation curbs. The upper frame must provide continuous support for the equipment and must be captive so as to resiliently resist wind and seismic forces. The lower frame must accept point support for both seismic attachment and leveling. The upper frame must be designed with positive fastening provisions (welding or bolting), to anchor the rooftop unit to the curb, which will not violate the National Roofing Contractors Association (NRCA) ratings of the membrane waterproofing. Sheet metal screws are only acceptable if all provisions in Section 1.4, Article B, paragraph 7, Design Seismic Loads, are met. Contact points
between the rooftop unit, the curb and the building’s structure shall show load path through those locations only.

b. All-directional elastomeric snubber bushings shall be minimum of ¼” thick. Steel springs shall be laterally stable and rest on ¼” thick elastomeric acoustical pads or cups.

c. Hardware must be plated and the springs shall be powder-coated or cadmium-plated.

d. The curb’s waterproofing shall be designed to meet all NRCA requirements.

e. All spring locations shall have full spring view access ports with removable waterproof covers and all isolators shall be adjustable, removable and interchangeable.

f. Isolated curbs shall be supplied with a continuous air seal between the upper floating member and the stationary wood nailer.

Option #1 Where sound barrier package is required, curb shall have full size lay in attenuation panels having a minimum STC rating of 60 when combined with the roof deck’s rating. Attenuation system shall add a full sound attenuation structural floor to the curb capable of spanning the curb’s width and designed for live loads of 20 psf. Panels shall not weigh more than 6 psf. The 4” nominal galvanized panel shall be joined to allow for airtight construction and additionally shall have a support system where the panels are used below an outside condenser section. Panels shall be waterproof for both outdoor and indoor application. The space below the curb panels and the roof deck shall have 4” of insulation contractor furnished and installed.

Option #2 When curb type SRPFMA (Supply Return Plenum Construction) is required, in addition to Option #1 the walls of the supply section will use 2” sound attenuating panels as well as a continuous inner elastomeric air seal and isolated plenum divider. Both supply and return ducts shall seal directly to curb base floor attenuation panels.

4. Type B-4: Seismic Non-Isolated Curb

P6000, TELEECURB (non-isolated)

Option: Sound Package VMC-RPFMA/SRPFMA System

a. Seismic curbs shall have all provisions as Type B-3 curbs with the exception of spring isolation.

b. System shall be designed for positive anchorage or welding of equipment to supports and welding of supports to the building steel, capable of carrying the design seismic loads.

5. Type B-5: Isolated Equipment Supports

R7200/R7300

a. Continuous structural equipment support rails that combine equipment support and isolation mounting into one unitized roof flashed assembly with all features as described for Type B-3.

b. System shall be designed for positive anchorage or welding of equipment to supports and welding of supports to the building steel, capable of carrying the design seismic loads.

6. Type B-6: Non-Isolated Equipment Supports

R7000

a. This shall have the same provisions as Type B-5 without the spring isolation.

7. Type B-7: Computer Room Unit Base
SFS
a. Computer Room air conditioning units shall be welded or bolted to welded structural steel stands having a minimum 0.5 “G” certified lateral acceleration capabilities, but no less than the design seismic loads.

b. Elastomeric isolated stands shall have 1” of adjustment to accommodate floor irregularities and 0.25” of nominal static deflection.

c. Spring isolated stands shall have 1” of adjustment to accommodate floor irregularities and 2” of nominal static deflection.

d. Bolting or welding is required to meet seismic criteria.

e. Stands to have positive fastening provisions for bolting of computer room unit to seismic floor stand and fastening of seismic isolated floor stand to structure, capable of carrying the design seismic loads.

8. Type B-8 AHU / AC unit Structural Base Frames
a. Where roof mounted Air Conditioning or Air Handling Units are placed on steel platforms and are incapable of being point loaded or supported, structural frames shall be furnished which will either match the centerline dimensions of the unit’s base frame rail or its curb dimensions. The structural frame shall have provisions to be welded or bolted to the unit’s base frame and shall be supported on type “B” wind/seismic restrained isolation system.

b. Isolator deflection shall be either 1.5” or 2.5” depending on the tonnage of the roof mounted component as shown in Isolation Table “A”. Structural Base Frame shall be type RTSBF as manufactured by The VMC Group.

9. Type B-9: Structural Adapter Curbs
a. Structural Adapter Curbs will be designed to match the replacement unit’s curb dimensions to the existing unit’s curb dimensions, matching both supply and return air delivery systems of both components or creating a plenum to accommodate airflow of both components.

b. The new adapter curb will be structurally designed to rest on the existing curb only and carry the new unit’s load directly to building steel or concrete thru stanchions that are welded or bolted to both within the confines of the existing curb. Additionally, the new roof mounted unit will be welded or bolted to the structural adapter and shall demonstrate load path of all loads from all components into the building structure.

c. Where the installed unit component’s height to the unit’s electrical disconnect box is in excess of 78”, a service platform or other suitable staging shall be utilized.

d. Structural Adapter Curbs shall be Type PSAC-6000 as manufactured by The VMC Group.

10. Type B-10 Structural Isolated Adapter Curbs:
a. Where isolation is required to be incorporated into the adapter curb, isolation and restraining system shall be similar to the requirements highlighted under Base Type B-3. Isolator deflection shall be either 2” or 3” deflection as required by Isolation Table “A”.

b. Structural Isolated Adapter Curbs shall be Type PSAC-6200 or PSAC-6300 as manufactured by The VMC Group.

2.05 Flexible Connectors

A. Type FC-2: Flexible Stainless Steel Hose
   SS-FP, SS-FW, SS-PM, SS-WE
1. Flexible stainless steel hose shall have stainless steel braid and carbon steel fittings. Sizes 3” and larger shall be flanged. Smaller sizes shall have male nipples.

B. Type BC-2 connector shall be braided bronze for Freon connections.
   1. Minimum lengths shall be as tabulated:

<table>
<thead>
<tr>
<th>Flanged</th>
<th>Male Nipples</th>
</tr>
</thead>
<tbody>
<tr>
<td>3 x 14</td>
<td>10 x 26</td>
</tr>
<tr>
<td>4 x 15</td>
<td>12 x 28</td>
</tr>
<tr>
<td>5 x 19</td>
<td>14 x 30</td>
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<td>6 x 20</td>
<td>16 x 32</td>
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<td>8 x 22</td>
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<td>½ x 9</td>
<td>1 ½ x 13</td>
</tr>
<tr>
<td>¾ x 10</td>
<td>2 x 14</td>
</tr>
<tr>
<td>1 x 11</td>
<td>2 ½ x 18</td>
</tr>
<tr>
<td>1 ¼ x 12</td>
<td></td>
</tr>
</tbody>
</table>

2. Hoses shall be installed on the equipment side of the shut-off valves horizontally and parallel to the equipment shafts wherever possible.

C. Type GC-2: Flexible Groove Couplings
   1. For use in locations where vibration attenuation and stress relief are required, and for the elimination of flexible connectors; 3 flexible grooved type couplings shall be installed on the equipment supply & return sides.
   2. Basis of Design Product: Subject to compliance with requirements, provide Victaulic Company; Style 107 or 77 couplings. The manufacturer will support with design and installation if needed.

PART 3 - EXECUTION

3.01 EXAMINATION
   A. All areas that will receive components requiring vibration control, seismic or wind load bracing shall be thoroughly examined for deficiencies that will affect their installation or performance. Such deficiencies shall be corrected prior to the installation of any such system.
   
   B. Examine all “rough ins” including anchors and reinforcing prior to placement.

3.02 APPLICATIONS
   A. All vibration isolators and seismic, wind restraint systems must be installed in strict accordance with the manufacturer’s written instructions and all certified submittal data.
   
   B. Installation of vibration isolators and seismic, wind restraints must not cause any change of position of equipment, piping or ductwork resulting in stresses or misalignment.
   
   C. No rigid connections between equipment and the building structure shall be made that degrades the noise and vibration control system specified herein.
   
   D. The contractor shall not install any isolated components in a manner that makes rigid connections with the building unless isolation is not specified. “Building” includes, but is not limited to, slabs, beams, columns, studs and walls.
   
   E. Coordinate work with other trades to avoid rigid contact with the building.
VIBRATION ISOLATION, SEISMIC, WIND AND FLOOD LOAD RESTRAINTS FOR HVAC, PLUMBING, ELECTRICAL AND FIRE PROTECTION COMPONENTS

F. Overstressing of the building structure must not occur due to overhead support of equipment. Contractor must submit loads to the structural engineer of record for approval. General bracing may occur from flanges of structural beams, upper truss cords in bar joist construction and cast in place inserts or wedge type drill-in concrete anchors.

G. Seismic cable restraints shall be installed slightly slack to avoid short circuiting the isolated suspended equipment or piping.

H. Seismic cable assemblies are installed taut on non-isolated systems. Seismic rigid braces may be used in place of cables on rigidly attached systems.

I. At locations where seismic cable restraints or seismic single arm braces are located, the support rods must be braced when necessary to accept compressive loads. See Table “E.”

J. At all locations where seismic cable braces and seismic cable restraints are attached to the pipe clevis, the clevis bolt must be reinforced with pipe clevis cross bolt braces or double inside nuts if required by seismic acceleration levels.

K. Vibration isolation manufacturer shall furnish integral structural steel bases as required. Independent steel rails are not permitted.

L. Air handling equipment and centrifugal fans shall be protected against excessive displacement which results from high air thrust in relation to the equipment weight. Horizontal thrust restraints shall be those described in the specification when horizontal motion exceeds 3/8.”

M. Special and Periodic Inspections for items listed in Section 1.5, Article B, Paragraph 4 shall be conducted and submitted on a timely basis.

3.03 EQUIPMENT INSTALLATION

A. Equipment shall be isolated and/or restrained as per Tables A-E at the end of this section.

B. Place floor mounted equipment on 4” actual height concrete housekeeping pads properly sized and doweled or expansion shielded to the structural deck to meet acceleration criteria (see Section 1.5). Anchor isolators and/or bases to housekeeping pads. Concrete work is specified under that section of the contract documents.

C. Additional Requirements:
   1. The minimum operating clearance under all isolated components bases shall be 2.”
   2. All bases shall be placed in position and supported temporarily by blocks or shims, as appropriate, prior to the installation of the equipment, isolators and restraints.
   3. All components shall be installed on blocks to the operating height of the isolators. After the entire installation is complete and under full load, including water, the isolators shall be adjusted so that the load is transferred from the blocks to the isolators. Remove all debris from beneath the equipment and verify that there are no short circuits of the isolation. The equipment shall be free to move in all directions, within the limits of the restraints.
   4. Ceilings containing diffusers or lighting fixtures must meet seismic requirements by using earthquake clips of other approved means of positive attachment to secure diffuser and fixtures to T-bar structure.
   5. All floor or wall-mounted equipment and tanks shall be restrained with Type V restraints.
3.04 PIPING AND DUCTWORK ISOLATION

A. Vibration Isolation of Piping:

1. HVAC Water Piping: All spring type isolation hangers shall be pre-compressed or pre-positioned if isolators are installed prior to fluid charge. If installed afterwards, field pre-compressed isolators can be used. All HVAC piping in the machine room shall be isolated as well as pressurized runs in other locations of the building 6” and larger. Type E hangers shall isolate horizontal pressurized runs in all other locations of the building. Floor supported piping shall rest on Type B isolators. Heat exchangers and expansion tanks are considered part of the piping run. The first 3 isolators from the isolated equipment shall have at least the same static deflection as specified for the mountings under the connected equipment. If piping is connected to equipment located in basements and hangs from ceilings under occupied spaces, the first 3 hangers shall have 0.75” nominal deflection or greater for pipe sizes up to and including 3,” 1 3/8” nominal deflection or greater for pipe sizes greater than 3.” Where column spacing exceeds 35’, isolation hanger deflection shall be 2½” for pipes exceeding 3” diameter. Type L hangers may be substituted for the above where isolation hangers are required.

2. Steam and Condensate Piping: All ceiling suspended piping in the mechanical equipment room shall be isolated with Type D hangers. All floor supported piping shall be supported with Type F isolators. At locations where supports are either acting as anchors or guides, Type D and F isolators shall be deleted and anchor or guide shall be resiliently attached to the structure utilizing isolation washers and bushings to prevent metal to metal contact. Isolation washers and bushings shall be molded from Type “H” material.

3. Plumbing Water Lines: Plumbing water lines in the machine room shall only be isolated if connected to isolated equipment. (See Table B.) Isolator type shall be as listed in Article 1, above.

4. Riser Location: All risers shall be supported on Type J or K anchors or guide restraints positively attached to both the riser and structure. Spiders welded to the pipe can substitute for Type K guides using J Type anchors.

5. Control Air Piping: Where control air piping is connected to isolated components, all piping shall be isolated and equipment shall be flexibly connected in horizontal and vertical plane with Type FC-2 flexible connectors.

6. Gas lines shall not be isolated.

7. Fire protection lines shall not be isolated.

B. Seismic Restraint of Piping, Conduit, Bus Duct and Cable Tray:

1. All high hazard and life safety pipe regardless of size such as fuel oil piping, fire protection mains, gas piping, medical gas piping and compressed air piping and piping with an Ip=1.5 shall be seismically restrained or braced. Type V seismic cable restraints or resilient single arm braces shall be used if piping is isolated. Type V seismic cable restraints or Type VI single arm braces may be used on non-isolated piping. There are no exclusions for size or distance in this category.

2. Seismically restrain piping, with an Ip = 1.0, located in boiler rooms, mechanical equipment rooms and refrigeration equipment rooms that is 1¼” I.D. and larger. In projects having a Seismic Design Category of D, E or F., or when Consequential Damages will affect other components having an Ip of 1.5 below, Seismic Category C, Type V seismic cable restraints or resilient single arm braces shall be used if piping is isolated. Type V seismic cable restraints or Type VI single arm braces may be used on non-isolated piping.
3. Seismically restrain all other piping 2½” diameter and larger. Type V seismic cable restraints or resilient single arm braces shall be used if piping is isolated. Type VI seismic cable restraints or single arm braces may be used on non-isolated piping.

4. See Table D for maximum seismic bracing distances.

5. Multiple runs of pipe on the same support shall have distance determined by calculation.

6. Rod braces shall be used for all rod lengths as listed in Table E.

7. Clevis hangers shall be used to place inside of hanger at seismic brace locations.

8. Where thermal expansion is a consideration, guides and anchors may be used as transverse and longitudinal restraints provided they have a capacity equal to or greater than the restraint loads in addition to the loads induced by expansion or contraction.

9. For fuel oil and all gas piping, transverse restraints must be at 20’ maximum and longitudinal restraints at 40’ maximum spacing.

10. Transverse restraint for one pipe section may also act as longitudinal restraint for a pipe section of the same or smaller size connected perpendicular to it if the restraint is installed within 24” of the centerline of the smaller pipe or combined stresses are within allowable limits at longer distances.

11. Hold down clamps must be used to attach pipe to all trapeze members before applying restraints. Use Type V or VI restraint, if trapeze is smaller than 48” long.

12. Branch lines may not be used to restrain main lines or cross mains.

13. All fire protection branch lines shall be end tied.

14. Where pipe passes through a fire-rated, seismic gypsum wall, the wall can act as a lateral/transverse brace for pipe sizes up to and including 6,” provided fire stopping material is tight to the pipe.

15. Where pipe passes through a seismic block or concrete wall, the wall can act as a lateral/transverse brace.

16. Where horizontal pipe crosses a building’s drift expansion joint, allowance shall be part of the design to accommodate differential motion.

17. Vertical pipe and conduit risers between floors shall have their differential movement part of the seismic design for building drift. Risers shall be anchored as required.

18. For horizontal passage of all underground utilities through building’s foundation wall, all pipes shall pass freely through an oversized opening and waterproofed accordingly to accommodate maximum allowable building drift. (Seismic Restraint Type VIII)

C. Vibration Isolation of Ductwork:

1. All discharge runs for a distance of 50’ from the connected equipment shall be isolated from the building structure by means of Type A or Type E isolators. Actual spring deflection shall be a minimum of 0.75.”

2. All duct runs having air velocity of 1500 feet per minute (fpm) or more shall be isolated from the building structure by Type E combination spring elastomer hangers or Type A floor spring supports. Spring deflection shall be a minimum of 0.75.”

D. Seismic Restraint of Ductwork:

1. Restrain rectangular ductwork with cross sectional area of 6 square feet or larger. Type V seismic cable restraints or Type VI single arm braces shall be used on this duct. Duct that serves a life safety function or carries toxic materials in an “Essential or High Hazard Facility” must be braced with no exceptions regardless of size or distance requirements.

2. Restrain round ducts with diameters of 28” or larger. Type V seismic cable restraints or Type VI single arm braces.

3. Restrain flat oval ducts the same as rectangular ducts of the same nominal size.

4. See Table D for maximum seismic bracing distances.
5. Duct must be reinforced at the restraint locations. Reinforcement shall consist of an additional angle on top of the ductwork that is attached to the support hanger rods. Ductwork is to be attached to both upper angle and lower trapeze. Additional reinforcing is not required if duct sections are mechanically fastened together with frame bolts and positively fastened to the duct support suspension system.

6. A group of ducts may be combined in a larger frame so that the combined weights and dimensions of the ducts are less than or equal to the maximum weight and dimensions of the duct for which bracing details are selected.

7. Walls, including gypsum board non-bearing partitions, which have ducts running through them, may replace a typical transverse brace. Provide channel framing around ducts and solid blocking between the duct and frame.

8. If ducts are supported by angles, channels or struts, ducts shall be fastened to it at seismic brace locations in lieu of duct reinforcement.

3.05 EXEMPTIONS

A. EQUIPMENT:
   1. Floor or curb-mounted equipment weighing less than 400 lbs and not resiliently mounted, where the Importance Factor, Ip = 1.0 and there is no possibility of consequential damage.
   2. Equipment weighing less than 20 lbs and distribution systems weighing less than 5 lbs/lineal foot, with an Ip = 1.0 and where flexible connections exist between the component and associated ductwork, piping or conduit.
   3. Chain supported lighting fixtures as described in Section 13.6.1 (ASCE 7-10).

B. DUCT (Applies to Ip = 1.0 only)
   1. Rectangular, square, and oval air handling ducts less than six square feet in cross sectional area.
   2. Duct runs supported at locations by two rods less than 12 inches in length from the structural support to the structural connection to the ductwork.

C. PIPING and CONDUIT
   1. All high deformability pipe or conduit 3” or less in diameter suspended by individual hanger rods where Ip = 1.0.
   2. High deformability pipe or conduit in Seismic Design Category C, 2” or less in diameter suspended by individual hanger rods where Ip = 1.0.
   3. Ip = 1.5.
   4. High deformability pipe or conduit in Seismic Design Category D, E or F, 1” or less in diameter suspended by individual hanger rods where Ip = 1.5.
   5. All clevis supported pipe or conduit runs installed less than 12” from the top of the pipe to the underside of the support point and trapeze supported pipe suspended by hanger rods having a distance less than 12” in length from the underside of the pipe support to the support point of the structure.
   6. Piping systems, including their supports, designed and constructed in accordance with ASME B31.
   7. Piping systems, including their supports, designed and constructed in accordance with NFPA, provided they meet the force and displacement requirements of Section 13.3.1 and 13.3.2 (ASCE 7-10).
3.06 **EXEMPTIONS DO NOT APPLY FOR:**

A. LIFE SAFETY or HIGH HAZARD COMPONENTS

1. Including gas, fire protection, medical gas, fuel oil and compressed air needed for the continued operation of the facility or whose failure could impair the facility’s continued operation, Occupancy Category IV, IBC-2012 as listed in Section 1.3 B regardless of governing code for HVAC, Plumbing, Electrical piping or equipment. *(A partial list is illustrated.)* High Hazard is additionally classified as any system handling flammable, combustible or toxic material. **Typical systems not excluded are additionally listed below.**

   a. ELECTRICAL
      1) Includes critical, standby or emergency power components including conduit (1” nominal diameter and larger) cable tray or bus duct, lighting, panels, communication lines involving 911, etc.

   b. PIPING
      1) Fuel oil, gasoline, natural gas, medical gas, steam, compressed air or any piping containing hazardous, flammable, combustible, toxic or corrosive materials. Fire protection standpipe, risers and mains. Fire Sprinkler Branch Lines must be end tied.

   c. DUCT
      1) Smoke evacuation duct or fresh air make up connected to emergency system, emergency generator exhaust, boiler breeching or as used by the fire department on manual override.

   d. EQUIPMENT
      1) Previously excluded non life safety duct mounted systems such as fans, variable air volume boxes, heat exchangers and humidifiers having a weight greater than 75 lbs require independent seismic bracing.

3.07 **FIELD QUALITY CONTROL, INSPECTION**

A. All Independent Special and Periodic Inspections must be performed and submitted on components as outlined in Section 1.5 B, Paragraph 4. *(See also Contractor Responsibility, Section 1.5B, Paragraph 5.)* **Note: Special Inspection services are to be supplied by the owner.**

B. Upon completion of installation of all vibration isolation devices, the manufacturer’s chosen representative shall inspect the completed project and certify in writing to the Contractor that all systems are installed properly, or list any that require correction. The contractor shall submit a report to the Architect, including the representative’s report, certifying correctness of the installation or detailing corrective work to be done.

**PART 4 - SELECTION GUIDE FOR VIBRATION ISOLATION AND SEISMIC RESTRAINT**

<table>
<thead>
<tr>
<th>TABLE “A” HVAC EQUIPMENT</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>ON GRADE, BASEMENT OR SLAB ON GRADE</strong></td>
</tr>
<tr>
<td>EQUIPMENT (See Notes)</td>
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<tr>
<td>Absorption Machine</td>
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<tr>
<td>Air Handling Units Indoor</td>
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VIBRATION ISOLATION, SEISMIC, WIND AND FLOOD LOAD RESTRAINTS FOR HVAC, PLUMBING, ELECTRICAL AND FIRE PROTECTION COMPONENTS 01 35 48 - 26
<table>
<thead>
<tr>
<th>Equipment Type</th>
<th>HP</th>
<th>Floor</th>
<th>Ceiling</th>
<th>Minimum Deflection</th>
<th>Maximum Deflection</th>
</tr>
</thead>
<tbody>
<tr>
<td>Air Compressor, Tank or Floor Mounted</td>
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<td></td>
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<td></td>
<td></td>
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<tr>
<td>To 10 HP</td>
<td></td>
<td>B</td>
<td></td>
<td>IV</td>
<td>B 1.50</td>
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<tr>
<td>&gt;10 HP</td>
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<td>B</td>
<td></td>
<td>B-2 IV</td>
<td>B-2 IV</td>
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<tr>
<td>Dry Coolers</td>
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<td>B</td>
<td></td>
<td>IV</td>
<td>B 1.50</td>
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<tr>
<td>Outdoor Condensing Units/Condensers</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>To 1 HP</td>
<td></td>
<td>F</td>
<td></td>
<td>IV</td>
<td>B 0.75</td>
</tr>
<tr>
<td>&gt;1 HP</td>
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<td>B</td>
<td></td>
<td>IV</td>
<td>B 0.75</td>
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<tr>
<td>Axial Fans (Inline Type)</td>
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<tr>
<td>Base Mounted Pumps</td>
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<tr>
<td>To 15 HP</td>
<td></td>
<td>B</td>
<td></td>
<td>IV</td>
<td>B 0.75</td>
</tr>
<tr>
<td>&gt;15 HP</td>
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<td>B</td>
<td></td>
<td>IV</td>
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<td>Boilers</td>
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<td></td>
<td>IV</td>
<td>B 0.75</td>
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<tr>
<td>&gt;1 HP</td>
<td></td>
<td>B</td>
<td></td>
<td>IV</td>
<td>B 0.75</td>
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<tr>
<td>Centrifugal Chiller</td>
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<td>B</td>
<td></td>
<td>IV</td>
<td>B 1.50</td>
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<tr>
<td>Centrifugal Fans Arr. 1 &amp; 3</td>
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<td></td>
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<tr>
<td>Class 1</td>
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<td>B</td>
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<td>Class 2 &amp; 3</td>
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<td>IV</td>
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<td>IV</td>
<td>B See Guide See Note 4 IV</td>
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<tr>
<td>Class 2 &amp; 3</td>
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<td>Computer Room Units</td>
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<tr>
<td>Condensate Pumps</td>
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<td></td>
<td>IV</td>
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<td>Cooling Towers</td>
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<td>IV</td>
<td>B 0.75</td>
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<tr>
<td>Curb Mtd. Equip. (Non-Isol.)</td>
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<td>Fan Coil Units</td>
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<tr>
<td>Outdoor Reciprocating, Rotary or Screw Chillers</td>
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<tr>
<td>Roof</td>
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<tr>
<td>Roof</td>
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<td>B-6</td>
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<tr>
<td>Ceiling</td>
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<tr>
<td>Rooftop AHU/AC (curb mounted)</td>
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<tr>
<td>&lt; 10 Ton</td>
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<td></td>
<td>IV</td>
<td>B 1.50</td>
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<tr>
<td>&gt; 10 Ton</td>
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<td>---</td>
<td></td>
<td>IV</td>
<td>B 2.50</td>
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<tr>
<td>Rooftop AHU/AC (dunnage mounted)</td>
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<td></td>
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<tr>
<td>&lt; 10 Ton</td>
<td></td>
<td>---</td>
<td></td>
<td>IV</td>
<td>B 1.50</td>
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<tr>
<td>&gt; 10 Ton</td>
<td></td>
<td>---</td>
<td></td>
<td>IV</td>
<td>B 2.50</td>
</tr>
</tbody>
</table>

*See Minimum Deflection Guide for Equipment with Low RPM*
### Table “B” Plumbing Equipment

<table>
<thead>
<tr>
<th>Equipment (See Notes)</th>
<th>On Grade, Basement or Slab on Grade</th>
<th>Above Grade</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>HP</td>
<td>Mtg</td>
</tr>
<tr>
<td>Air Compressors &amp; Vacuum Pumps</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Up to 10</td>
<td></td>
<td>Floor</td>
</tr>
<tr>
<td>Over 10</td>
<td></td>
<td>Floor</td>
</tr>
<tr>
<td>Base Mounted Pumps</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Up to 15</td>
<td></td>
<td>Floor</td>
</tr>
<tr>
<td>Over 15</td>
<td></td>
<td>Floor</td>
</tr>
</tbody>
</table>

*Where Component cannot be point supported, Base Type B-1 shall be used.

### Table “C” Electrical Equipment

<table>
<thead>
<tr>
<th>Equipment (See Notes)</th>
<th>On Grade, Basement or Slab on Grade</th>
<th>Above Grade</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Size</td>
<td>Mtg</td>
</tr>
<tr>
<td>Transformers (Dry Type)</td>
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</tr>
<tr>
<td>All</td>
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<td>Floor</td>
</tr>
<tr>
<td>All</td>
<td></td>
<td>Ceiling</td>
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<td>Generators</td>
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<tr>
<td>Generators</td>
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<td>Over Occupied Space</td>
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<tr>
<td>UPS Systems</td>
<td>M</td>
<td>All</td>
</tr>
</tbody>
</table>

*Where Component cannot be point supported, Base Type B-1 shall be used.

Minimum Deflection Guide for Equipment with Low RPM

<table>
<thead>
<tr>
<th>Lowest RPM of Rotating Equipment</th>
<th>Minimum Actual Deflection</th>
</tr>
</thead>
<tbody>
<tr>
<td>Less Than 400</td>
<td>3.5”</td>
</tr>
<tr>
<td>401 thru 600</td>
<td>2.5”</td>
</tr>
<tr>
<td>601 thru 900</td>
<td>1.5”</td>
</tr>
<tr>
<td>Greater than 900</td>
<td>0.75”</td>
</tr>
</tbody>
</table>
General Notes for All Tables:

1. Abbreviations:
   (1) Mtg = Mounting
   (2) ol = Vibration Isolator Type per Section 2.2, Vibration Isolation Types
   (3) Defl = Minimum Deflection of Vibration Isolator
   (4) Base = Base Type per Section 2.4, Equipment Bases
   (5) Restr = Seismic Restraint Type per Section 2.3 Seismic Restraint Types

2. All deflections indicated are in inches.

3. For equipment with variable speed driven components having driving operating speed below 600 rpm, select isolation deflection from minimum deflection guide.

4. For roof applications, use base Type B-5.

5. Specification Option #1 called out on equipment schedule in curb Type B-3 shall use sound barrier RPFMA when there is no concrete under rooftop units and this option is selected. Curbs can be used for return plenums. (See Option #1 under curb type B-3.)

6. Specification Option #2, called out on equipment schedule in curb Type B-3 shall be used where curbs require supply and return sound attenuation package type SPFMA shall be used. (See Option #2 under curb type B-3.)

7. Units may not be capable of point support. Refer to separate air handling unit specification section. If that section does not provide base and external isolation is required, provide Type B-1 base by this section for entire unit.

8. Static deflection shall be determined based on the deflection guide for Table “A.”

9. Deflections indicated are minimums at actual load and shall be selected for manufacturer’s nominal 5”, 4”, 3”, 2” and 1” deflection spring series; RPM is defined as the lowest operating speed of the equipment.

10. Single stroke compressors may require inertia bases with thicknesses greater than 14” maximum as described for base B-2. Inertia base mass shall be sufficient to maintain double amplitude for 1/8.”

11. Floor mounted fans, substitute base Type B-2 for class 2 or 3 or any fan having static pressure over 5.”

12. Indoor utility sets with wheel diameters less than 24” need not have deflections greater than .75.”

13. Curb-mounted fans with curb area less than 9 square feet are excluded.

14. For equipment with multiple motors, Horsepower classification applies to largest single motor.

15. **Engineer’s Note:** When either note #s 3 or 4 apply to the project, type RPFMA option #1, or type SPFMA option #2 sound attenuation systems, the use of options #1 or #2 shall appear as a note clearly called out on the equipment schedule for either of these options to apply.
## Table “D” Seismic Bracing
(Maximum Allowable Spacing Shown- Actual Spacing to Be Determined by Calculation)

<table>
<thead>
<tr>
<th>Equipment</th>
<th>On Center Transverse</th>
<th>On Center Longitudinal</th>
<th>Change Of Direction</th>
</tr>
</thead>
<tbody>
<tr>
<td>Duct</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>All Sizes</td>
<td>30 Feet</td>
<td>60 Feet</td>
<td>4 Feet</td>
</tr>
<tr>
<td>Pipe Threaded, Welded, Soldered Or Grooved; Conduit and Conduit Racks</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>To 16”</td>
<td>40 Feet</td>
<td>80 Feet</td>
<td>4 Feet</td>
</tr>
<tr>
<td>18” – 28”</td>
<td>30 Feet</td>
<td>60 Feet</td>
<td>4 Feet</td>
</tr>
<tr>
<td>30” – 40”</td>
<td>20 Feet</td>
<td>60 Feet</td>
<td>4 Feet</td>
</tr>
<tr>
<td>42” &amp; Larger</td>
<td>10 Feet</td>
<td>30 Feet</td>
<td>4 Feet</td>
</tr>
<tr>
<td>Pipe - No Hub Or Bell And Spigot</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.5” &amp; Larger</td>
<td>10 Feet</td>
<td>20 Feet</td>
<td>4 Feet</td>
</tr>
<tr>
<td>Boiler Breeching</td>
<td>30 Feet</td>
<td>60 Feet</td>
<td>4 Feet</td>
</tr>
<tr>
<td>Chimneys &amp; Stacks</td>
<td>30 Feet</td>
<td>60 Feet</td>
<td>4 Feet</td>
</tr>
<tr>
<td>Conduit</td>
<td>40 Feet</td>
<td>80 Feet</td>
<td>4 Feet</td>
</tr>
<tr>
<td>Bus Duct</td>
<td>20 Feet</td>
<td>40 Feet</td>
<td>4 Feet</td>
</tr>
<tr>
<td>Cable Tray</td>
<td>40 Feet</td>
<td>80 Feet</td>
<td>4 Feet</td>
</tr>
</tbody>
</table>

## Table “E” Hanger Rod Bracing Schedule
(Stiffener to be maximum 6” from end of rod)

<table>
<thead>
<tr>
<th>Rod Dia.</th>
<th>Clamp Size</th>
<th>Maximum Un-braced Rod Length</th>
<th>Steel Angle Size</th>
<th>Clamp Spacing</th>
<th>Min # of Clamps per Stiffener</th>
</tr>
</thead>
<tbody>
<tr>
<td>3/8”</td>
<td>SRBC-1-1/4</td>
<td>19”</td>
<td>1 x 1 x ¼”</td>
<td>16”</td>
<td>2</td>
</tr>
<tr>
<td>1/2”</td>
<td>SRBC-1-1/4</td>
<td>25”</td>
<td>1 x 1 x ¼”</td>
<td>20”</td>
<td>2</td>
</tr>
<tr>
<td>5/8”</td>
<td>SRBC-1-1/4</td>
<td>31”</td>
<td>1 x 1 x ¼”</td>
<td>24”</td>
<td>2</td>
</tr>
<tr>
<td>3/4”</td>
<td>SRBC-1-1/2</td>
<td>37”</td>
<td>1 ½ x 1 ½ x ¼”</td>
<td>28”</td>
<td>2</td>
</tr>
<tr>
<td>7/8”</td>
<td>SRBC-1-1/2</td>
<td>43”</td>
<td>1 ½ x 1 ½ x ¼”</td>
<td>33”</td>
<td>2</td>
</tr>
<tr>
<td>1”</td>
<td>SRBC-1-1/2</td>
<td>50”</td>
<td>1 ½ x 1 ½ x ¼”</td>
<td>40”</td>
<td>2</td>
</tr>
<tr>
<td>1 1/8”</td>
<td>SRBC-1-1/2</td>
<td>62”</td>
<td>1 ½ x 1 ½ x ¼”</td>
<td>50”</td>
<td>2</td>
</tr>
</tbody>
</table>

VIBRATION ISOLATION, SEISMIC, WIND AND FLOOD LOAD RESTRAINTS FOR HVAC, PLUMBING, ELECTRICAL AND FIRE PROTECTION COMPONENTS 01 35 48 - 30
Contractor’s Statement of Responsibility for Designated Seismic Systems & Inspection

IBC 2012, Section 1704.4
Form DSS-1

Section 230548
Vibration Isolation and Seismic Restraints
Contractor Name: __________________________

Date: ________________________________

Project: ______________________________

Specification Section: ____________________

Contractor IBC Designated Seismic System Inspections

This form is to be filled out by the installing contractor to acknowledge his responsibility to implement the special inspections program outline in the contract documents prior to the first submission in any vendor group. All components listed herein shall be part of that program subject to the special inspections program.

Contractor to submit this document acknowledging receipt and program implementation.

_______________________ Signature

_______________________ Print Name
FORM CVC-1

OCCUPANCY CATEGORY II, III, IV
COMPONENTS HAVING AN Ip OF 1.5 IBC 2012

Section 230548

Vibration Isolation and Seismic Restraints

Contractor Name: ____________________________________

Date: _______________________________________________

Project: _____________________________________________

Specification Section: __________________________________

Notes to the installing contractor

The purpose of this form is for you, the contractor to fill in all vendors that are IBC compliant as part of your initial submission for any group of equipment, i.e., fans, ac units, pumps, etc. It is acceptable to submit vendors that will be compliant as long as a factory letter is issued stating full compliance will occur at time of shipment. Only IBC compliant vendors can participate on this project. In the event that no vendor in any group is IBC compliant, this information must be submitted to the project’s consulting engineer for approval.

<table>
<thead>
<tr>
<th>Manufacturer</th>
<th>IBC Compliant</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Yes</td>
</tr>
</tbody>
</table>

______________________        ______________________
Signature                Print Name

Revision History

VIBRATION ISOLATION, SEISMIC, WIND AND FLOOD LOAD RESTRAINTS FOR HVAC, PLUMBING, ELECTRICAL AND FIRE PROTECTION COMPONENTS 01 35 48 - 32
VIBRATION ISOLATION, SEISMIC, WIND AND FLOOD LOAD RESTRAINTS FOR HVAC, PLUMBING, ELECTRICAL AND FIRE PROTECTION COMPONENTS
PART 1 - GENERAL

1.01 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.

1.02 SUMMARY

A. This Section includes administrative and procedural requirements for quality assurance and quality control. This Section also includes the requirements for the Contractor to arrange for and contract with an independent testing laboratory.

B. This Section also includes requirements construction and testing of full-scale mock-ups for quality assurance and quality control.

C. Testing and inspecting services are required to verify compliance with requirements specified or indicated. These services do not relieve Contractor of responsibility for compliance with the Contract Document requirements.

1. Specific quality-assurance and -control requirements for individual construction activities are specified in the Sections that specify those activities. Requirements in those Sections may also cover production of standard products.

2. Specified tests, inspections, and related actions do not limit Contractor's other quality-assurance and -control procedures that facilitate compliance with the Contract Document requirements.

3. Requirements for Contractor to provide quality-assurance and -control services required by Architect, Owner, or authorities having jurisdiction are not limited by provisions of this Section.

D. Related Sections include the following:

1. Division 01 Section "Construction Progress Documentation" for developing a schedule of required tests and inspections.

2. Division 01 Section "Cutting and Patching" for repair and restoration of construction disturbed by testing and inspecting activities.

3. Divisions 02 through 49 Sections for specific test and inspection requirements.

1.03 DEFINITIONS

A. Quality-Assurance Services: Activities, actions, and procedures performed before and during execution of the Work to guard against defects and deficiencies and substantiate that proposed construction will comply with requirements.

B. Quality-Control Services: Tests, inspections, procedures, and related actions during and after execution of the Work to evaluate that actual products incorporated into the Work and completed construction comply with requirements. Services do not include contract enforcement activities performed by Architect.

C. Mockups: Full-size, physical assemblies that are constructed on-site. Mockups are used to verify selections made under sample submittals, to demonstrate aesthetic effects...
and, where indicated, qualities of materials and execution, and to review construction, coordination, testing, or operation; they are not Samples. Approved mockups establish the standard by which the Work will be judged.

D. Laboratory Mockups: Full-size, physical assemblies that are constructed at testing facility to verify performance characteristics.

E. Preconstruction Testing: Tests and inspections that are performed specifically for the Project before products and materials are incorporated into the Work to verify performance or compliance with specified criteria.

F. Product Testing: Tests and inspections that are performed by an NRTL, an NVLAP, or a testing agency qualified to conduct product testing and acceptable to authorities having jurisdiction, to establish product performance and compliance with industry standards.

G. Source Quality-Control Testing: Tests and inspections that are performed at the source, i.e., plant, mill, factory, or shop.

H. Field Quality-Control Testing: Tests and inspections that are performed on-site for installation of the Work and for completed Work.

I. Testing Agency: An entity engaged to perform specific tests, inspections, or both. Testing laboratory shall mean the same as testing agency.

J. Installer/Applicator/Erector: Contractor or another entity engaged by Contractor as an employee, Subcontractor, or Sub-subcontractor, to perform a particular construction operation, including installation, erection, application, and similar operations.

1. Using a term such as "carpentry" does not imply that certain construction activities must be performed by accredited or unionized individuals of a corresponding generic name, such as "carpenter." It also does not imply that requirements specified apply exclusively to tradespeople of the corresponding generic name.

K. Experienced: When used with an entity, "experienced" means having successfully completed a minimum of five previous projects similar in size and scope to this Project; being familiar with special requirements indicated; and having complied with requirements of authorities having jurisdiction.

L. Special Inspections: Inspections required by local building code enforcement authority to confirm conformance of installed building systems to health and safety requirements. These inspections are in addition to Quality Control tests and inspections required in individual specification sections.

1.04 CONFLICTING REQUIREMENTS

A. General: If compliance with two or more standards is specified and the standards establish different or conflicting requirements for minimum quantities or quality levels, comply with the most stringent requirement. Refer uncertainties and requirements that are different, but apparently equal, to Architect for a decision before proceeding.

B. Minimum Quantity or Quality Levels: The quantity or quality level shown or specified shall be the minimum provided or performed. The actual installation may comply exactly with the minimum quantity or quality specified, or it may exceed the minimum within reasonable limits. To comply with these requirements, indicated numeric values
are minimum or maximum, as appropriate, for the context of requirements. Refer uncertainties to Architect for a decision before proceeding.

C. Where special inspections are indicated on a matrix or form provided as part of the Drawings, those requirements supersede the requirements that may appear in a specification section in Divisions 02 through 49.

1.05 SUBMITTALS

A. Qualification Data: For testing agencies specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include proof of qualifications in the form of a recent report on the inspection of the testing agency by a recognized authority.

B. Schedule of Tests and Inspections: Prepare in tabular form and include the following:
   1. Specification Section number and title.
   2. Description of test and inspection.
   3. Identification of applicable standards.
   4. Identification of test and inspection methods.
   5. Number of tests and inspections required.
   6. Time schedule or time span for tests and inspections.

C. Reports: Prepare and submit certified written reports that include the following:
   1. Date of issue.
   2. Project title and number.
   3. Name, address, and telephone number of testing agency.
   4. Dates and locations of samples and tests or inspections.
   5. Identification of product and Specification Section.
   6. Test and inspection results and an interpretation of test results.
   7. Record of temperature and weather conditions at time of sample taking and testing and inspecting.
   8. Comments or professional opinion on whether tested or inspected Work complies with the Contract Document requirements.
   9. Name and signature of laboratory inspector.
   10. Recommendations on retesting and reinspecting.

1.06 QUALITY ASSURANCE

A. General: Qualifications paragraphs in this Article establish the minimum qualification levels required; individual Specification Sections specify additional requirements.

B. Installer Qualifications: A firm or individual experienced in installing, erecting, or assembling work similar in material, design, and extent to that indicated for this Project, whose work has resulted in construction with a record of successful in-service performance.

C. Manufacturer Qualifications: A firm experienced in manufacturing products or systems similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.

D. Fabricator Qualifications: A firm experienced in producing products similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.
E. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of the system, assembly, or product that are similar to those indicated for this Project in material, design, and extent.

F. Specialists: Certain sections of the Specifications require that specific construction activities shall be performed by entities who are recognized experts in those operations. Specialists shall satisfy qualification requirements indicated and shall be engaged for the activities indicated.
1. Requirement for specialists shall not supersede building codes and regulations governing the Work.

G. Testing Agency Qualifications: An NRTL, an NVLAP, or an independent agency with the experience and capability to conduct testing and inspecting indicated, as documented according to ASTM E 548; and with additional qualifications specified in individual Sections; and where required by authorities having jurisdiction, that is acceptable to authorities.
1. NRTL: A nationally recognized testing laboratory according to 29 CFR 1910.7.
2. NVLAP: A testing agency accredited according to NIST's National Voluntary Laboratory Accreditation Program.

H. Factory-Authorized Service Representative Qualifications: An authorized representative of manufacturer who is trained and approved by manufacturer to inspect installation of manufacturer's products that are similar in material, design, and extent to those indicated for this Project.

I. Mockups: Before installing portions of the Work requiring mockups, build mockups for each form of construction and finish required to comply with the following requirements, using materials indicated for the completed Work:
1. Build mockups in locations and of sizes indicated or, if not indicated, as directed by Architect.
2. Provide mock-ups of other products and systems as required in specification sections in Divisions 03 through 14. Provide each mockup using the exact materials to be used in the Work, including adjacent materials and substrates.
3. Notify Architect seven (7) days in advance of dates and times when mockups will be constructed.
4. Demonstrate the proposed range of aesthetic effects and workmanship.
   a. Approval of mockups is for material and construction qualities specifically approved by Architect in writing.
   b. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups, unless such deviations are specifically approved by Architect in writing.
5. Obtain Architect's approval of mockups, in writing, before starting work, fabrication or construction.
   a. Allow seven (7) days for initial review and each re-review of each mockup.
6. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.
7. Protect accepted mockups from the elements with weather-resistant membrane.
8. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.
1.07 QUALITY CONTROL

A. Owner Responsibilities: Where quality-control services are indicated as Owner's responsibility, Owner will engage a qualified testing agency to perform these services.  
1. Costs for retesting and reinspecting construction that replaces or is necessitated by work that failed to comply with the Contract Documents will be charged to Contractor, and the Contract Sum will be adjusted by Change Order.

B. Tests and inspections not explicitly assigned to Owner are Contractor's responsibility. Unless otherwise indicated, provide quality-control services specified and those required by authorities having jurisdiction. Perform quality-control services required of Contractor by authorities having jurisdiction, whether specified or not.  
1. Where services are indicated as Contractor's responsibility, engage a qualified testing agency to perform these quality-control services.  
   a. Contractor shall not employ same entity engaged by Owner, unless agreed to in writing by Owner.  
2. Notify testing agencies at least 24 hours in advance of time when Work that requires testing or inspecting will be performed.  
3. Where quality-control services are indicated as Contractor's responsibility, submit a certified written report, in duplicate, of each quality-control service.  
4. Testing and inspecting requested by Contractor and not required by the Contract Documents are Contractor's responsibility.  
5. Submit additional copies of each written report directly to authorities having jurisdiction, when they so direct.

C. Manufacturer's Field Services: Where indicated, engage a factory-authorized service representative to inspect field-assembled components and equipment installation, including service connections. Report results in writing as specified in Division 01 Section "Submittal Procedures."

D. Retesting/Reinspecting: Regardless of whether original tests or inspections were Contractor's responsibility, provide quality-control services, including retesting and reinspecting, for construction that replaced Work that failed to comply with the Contract Documents.

1. Notify Architect and Contractor promptly of irregularities or deficiencies observed in the Work during performance of its services.  
2. Determine the location from which test samples will be taken and in which in-situ tests are conducted.  
3. Conduct and interpret tests and inspections and state in each report whether tested and inspected work complies with or deviates from requirements.  
4. Submit a certified written report, in duplicate, of each test, inspection, and similar quality-control service through Contractor.  
5. Do not release, revoke, alter, or increase the Contract Document requirements or approve or accept any portion of the Work.  
6. Do not perform any duties of Contractor.

F. Associated Services: Cooperate with agencies performing required tests, inspections, and similar quality-control services, and provide reasonable auxiliary services as requested. Notify agency sufficiently in advance of operations to permit assignment of personnel. Provide the following:  
1. Access to the Work.
2. Incidental labor and facilities necessary to facilitate tests and inspections.
3. Adequate quantities of representative samples of materials that require testing and inspecting. Assist agency in obtaining samples.
4. Facilities for storage and field curing of test samples.
5. Delivery of samples to testing agencies.
6. Preliminary design mix proposed for use for material mixes that require control by testing agency.
7. Security and protection for samples and for testing and inspecting equipment at Project site.

G. Coordination: Coordinate sequence of activities to accommodate required quality-assurance and -control services with a minimum of delay and to avoid necessity of removing and replacing construction to accommodate testing and inspecting.
   1. Schedule times for tests, inspections, obtaining samples, and similar activities.

H. Schedule of Tests and Inspections: Prepare a schedule of tests, inspections, and similar quality-control services required by the Contract Documents. Submit schedule at the same time as the Contractor’s Schedule of Work.
   1. Distribution: Distribute schedule to Owner, Architect, testing agencies, and each party involved in performance of portions of the Work where tests and inspections are required.

1.08 SPECIAL TESTS AND INSPECTIONS

A. Special Tests and Inspections: Owner will engage a qualified testing agency or special inspector to conduct special tests and inspections required by the Building Code of the City of New York, and as follows:
   1. Testing and Inspection Agency shall have been listed in New York City Form TR-1 containing authorization by the Architect for each required test or inspection.
   2. Verify that manufacturer maintains detailed fabrication and quality-control procedures and reviewing the completeness and adequacy of those procedures to perform the Work.
   3. Interpret tests and inspections and stating in each report whether tested and inspected work complies with or deviates from the Contract Documents.
   4. Testing and Inspection Agency shall inform Owner, Contractor, and Architect of irregularities and deficiencies observed in the Work during performance of its services.
   5. Upon completion of tests and inspections, Testing and Inspection Agency shall file all required forms with local authorities, providing a certified written report of each test, inspection, and similar quality-control service to Architect with copy to Contractor and to authorities having jurisdiction.
   6. Submit a final report of special tests and inspections at Substantial Completion, which includes a list of unresolved deficiencies.
   7. Testing and Inspection Agency shall be responsible for retesting and reinspecting corrected work where required by local authorities.

B. Certain tests are to be paid for by the Contractor. Those are marked on the form or matrix and are to be included in the Contract Amount.
PART 3 - EXECUTION

3.01 TEST AND INSPECTION LOG

A. Prepare a record of tests and inspections. Include the following:
   1. Date test or inspection was conducted.
   2. Description of the Work tested or inspected.
   3. Date test or inspection results were transmitted to Architect.
   4. Identification of testing agency or special inspector conducting test or inspection.

B. Maintain log at Project site. Post changes and modifications as they occur. Provide access to test and inspection log for Architect's reference during normal working hours.

3.02 REPAIR AND PROTECTION

A. General: On completion of testing, inspecting, sample taking, and similar services, repair damaged construction and restore substrates and finishes.
   1. Comply with the Contract Document requirements for Division 01 Section "Cutting and Patching”.

B. Protect construction exposed by or for quality-control service activities.

C. Repair and protection are Contractor's responsibility, regardless of the assignment of responsibility for quality-control services.

END OF SECTION 01 40 00
PART 1 - GENERAL

1.01 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.

1.02 SUMMARY

A. This Section includes definitions of terms used throughout the specifications and on the drawings, and general standards that are referred to in Specifications in Divisions 01 through 49.

B. Related Work
1. The building codes under which the Work is designed and is to be constructed are noted on the Drawings.
2. Requirements for copies of references at the project site are specified in Division 01 Section “Temporary Facilities and Controls”.

1.03 DEFINITIONS

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

B. “Agreement” and “Contract” are synonymous.

C. "Approved": When used to convey Architect's or Project Manager’s action on Contractor's submittals, applications, and requests, "approved" is limited to the duties and responsibilities of the Architect or the Project Manager as stated in the Conditions of the Contract.

D. “Contractor” and “General Contractor” are synonymous.

E. "Directed": A command or instruction by Architect or Project Manager. Other terms including "requested," "authorized," "selected," "approved," "required," and "permitted" have the same meaning as "directed."

F. “Drawings” and “plans” are synonymous.

G. "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."

H. "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.

I. "Furnish": Supply and deliver to Project site, ready for unloading, unpacking, assembly, installation, and similar operations.
J. "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, including coordinating with other Contractors.

K. "Owner’s Representative" (sometimes referred to as “Owner’s Construction Manager”): The individual named by the Owner whose responsibility it is to convey decisions of the Owner to the Contractor and otherwise facilitate communications among the Project team members.

L. "Provide": Furnish and install, complete and ready for the intended use.

M. "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.

N. "Engineer" as noted in these Contract Documents refers to Engineers listed in the Project Directory.

O. "Relocate": Move from the existing location to a new location and installed complete and ready for use.

P. "Coordinate": Cooperate with related trades to provide the components of the Work in correct sequence, size, and location to create a complete system ready for intended use.

Q. "Verify": Measure, investigate, review, test, check the accuracy or correctness of and prove by demonstration, evidence, or testimony, the location, size dimension, and condition of an item.

R. "Regulations": Includes laws, statutes, ordinances and lawful orders issued by authorities having jurisdiction, as well as rules, conventions and agreements within the construction industry that control performance of the Work, whether they are lawfully imposed by authorities having jurisdiction or not.

S. "Installer": An entity engaged by the Contractor, either as an employee or Sub-Contractor for performance of a particular construction activity, including installation, erection, application and similar operations. Installers are required to be experienced in the operations they are engaged to perform. The term "experienced" when used with the term "Installer" means having a minimum of five years of experience on projects similar in size and scope to this project and familiar with the precautions required, and has complied with requirements of the authority having jurisdiction.

T. "Governing Authorities", "Authorities Having Jurisdiction", "Town", “City”, "Municipality", or "Public Authority" shall include Federal, State, County or Municipal government and bureaus and subdivisions thereof, to the extent of the jurisdiction of any of them.

U. “Typical”: Provide the item in every situation and location where such items are indicated or in every repeated element of the facility, unless another item is specifically indicated in the Contract Documents.

1.04 STANDARDS

A. Various standards are referenced in the Specifications and notes on the Drawings. Reference standards shall be the current edition, as of the date of these specifications, of the document indicated.
B. In addition to sources identified in individual sections of the Specifications, standards of the following organizations are referenced by initials only.
   4. UL: Underwriters Laboratories Inc.

C. Measurements in these Specifications are shown in English inch-pound-second system and in International System of Units (SI) within parentheses ( ) in accordance with ASTM E380. Where products are described using nominal dimensions, these remain in the English system. The Contractor shall provide products which fit together and products shall form complete and working assemblies.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION 01 42 00
PART 1 - GENERAL

1.01 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.

1.02 SUMMARY

A. This Section includes requirements for temporary utilities, support facilities, and security and protection facilities.
   1. Provide engineering design of temporary facilities and controls.
   2. Pay permits and fees related to temporary facilities and controls.

1.03 USE CHARGES

A. General: Cost or use charges for temporary facilities shall be included in the Contract Sum. Allow other entities to use temporary services and facilities without cost, including, but not limited to, Architect, Project Manager, Owner’s representative, testing agencies, and authorities having jurisdiction.

B. Sewer Service: Pay sewer service use charges for sewer usage, by all parties engaged in construction, at Project site. Provide connections and extensions of services as required for construction operations.

C. Water Service: Water from Owner's existing water system is available for use with or without metering and with payment of use charges. Provide connections and extensions of services as required for construction operations.

D. Electric Power Service: Pay electric power service use charges, whether metered or otherwise, for electricity used by all entities engaged in construction activities at Project site. Provide connections and extensions of services as required for construction operations.

1.04 SUBMITTALS

A. Temporary Utility Reports: Submit reports of tests, inspections, meter readings, and similar procedures performed on temporary utilities.

1.05 QUALITY ASSURANCE

A. Standards:

B. Tests and Inspections: Arrange for authorities having jurisdiction to test and inspect each temporary construction before use. Obtain required certifications and permits.
1.06 PROJECT CONDITIONS

A. Temporary Utilities: At earliest feasible time, when acceptable to Owner, change over from use of temporary service to use of permanent service.
1. Temporary Use of Permanent Facilities: Installer of each permanent service shall assume responsibility for operation, maintenance, and protection of each permanent service during its use as a construction facility before Owner's acceptance, regardless of previously assigned responsibilities.

B. Conditions of Use: The following conditions apply to use of temporary services and facilities by all parties engaged in the Work:
1. Keep temporary services and facilities clean and neat.
2. Relocate temporary services and facilities as required by progress of the Work

PART 2 - PRODUCTS

2.01 MATERIALS

A. General: Provide new materials. Undamaged, previously used materials in serviceable condition may be used if approved by Architect. Provide materials suitable for use intended.

B. Chain-Link Fencing: Minimum 2-inch, 0.148-inch-thick, galvanized steel, chain-link fabric fencing; minimum 6 feet high with galvanized steel pipe posts; minimum 2-3/8-inch OD line posts and 2-7/8-inch OD corner and pull posts, with 1-5/8-inch OD top rails, with galvanized barbed-wire top strand.

C. Wood Enclosure Fence: Plywood, 6 feet high, framed with four 2-by-4-inch rails, with preservative-treated wood posts spaced not more than 8 feet apart.

D. Lumber and Plywood: Comply with requirements in Division 06 Section "Rough Carpentry".

E. Gypsum Board: Minimum 1/2 inch thick by 48 inches wide by maximum available lengths; regular-type panels with tapered edges. Comply with ASTM C 36.

F. Tarpaulins: Fire-resistive labeled with flame-spread rating of 15 or less.

G. Insulation: Unfaced mineral-fiber blanket, manufactured from glass, slag wool, or rock wool; with maximum flame-spread and smoke-developed indices of 25 and 50, respectively.

H. Paint: Comply with requirements in Division 09 Section "Painting."

I. Water: Potable.

2.02 EQUIPMENT

A. Field Offices: Job-built construction with lockable entrances serviceable finishes; heated and air conditioned.

B. Fire Extinguishers: Hand carried, portable, UL rated. Provide class and extinguishing agent as indicated or a combination of extinguishers of NFPA-recommended classes for exposures.
1. Comply with NFPA 10 and NFPA 241 for classification, extinguishing agent, and size required by location and class of fire exposure.

C. Drinking-Water Fixtures: Containerized, tap-dispenser, bottled-water, drinking-water units, including paper cup supply.
   1. Where power is accessible, provide electric water coolers to maintain dispensed water temperature at 45 to 55 deg F.

D. Electrical Outlets: Properly configured, NEMA-polarized outlets to prevent insertion of 110- to 120-V plugs into higher-voltage outlets; equipped with ground-fault circuit interrupters, reset button, and pilot light.

E. Power Distribution System Circuits: Where permitted and overhead and exposed for surveillance, wiring circuits, not exceeding 125-V ac, 20-A rating, and lighting circuits may be nonmetallic sheathed cable.

F. Dust Control and Infection Containment: Provide portable entrance containment booths and walk-off mats where entrances and exits to work areas abut hospital operations. At each entrance containment booth and at other areas where dust control is needed, provide replaceable walk-off mats.
   2. Replaceable Walk-Off Mats: Cole Static Control, Inc., Sticky-Mats, or approved equal, adhesive-coated film at least 18-inches wide by 36-inches long. Provide mats in quantity such that used mats are replaced when they are determined to be ineffective, at a minimum of once each day.

2.03 REFERENCE MATERIALS

A. Field Office shall have at least one copy of each of the following:
   1. Local building code as of the date that the Contract Documents were approved by the local building authority.
   2. Building code referenced standards.

PART 3 - EXECUTION

3.01 INSTALLATION, GENERAL

A. Locate facilities where they will serve Project adequately and result in minimum interference with performance of the Work. Relocate and modify facilities as required by progress of the Work.

B. Provide each facility ready for use when needed to avoid delay. Do not remove until facilities are no longer needed or are replaced by authorized use of completed permanent facilities.

3.02 TEMPORARY UTILITY INSTALLATION

A. General: Install temporary service or connect to existing service.
1. Arrange with utility company, Owner, and existing users for time when service can be interrupted, if necessary, to make connections for temporary services.

2. Provide adequate capacity at each stage of construction. Before temporary utility is available, provide trucked-in services.

3. Obtain easements to bring temporary utilities to Project site where Owner's easements cannot be used for that purpose.

B. Sewers and Drainage: Provide temporary connections to remove effluent that can be discharged lawfully. If neither sewers nor drainage facilities can be lawfully used for discharge of effluent, provide containers to remove and dispose of effluent off-site in a lawful manner.

1. Filter out excessive soil, construction debris, chemicals, oils, and similar contaminants that might clog sewers or pollute waterways before discharge.

C. Water Service: Use of Owner's existing water service facilities will be permitted, as long as facilities are cleaned and maintained in a condition acceptable to Owner. At Substantial Completion, restore these facilities to condition existing before initial use.

1. Where installations below an outlet might be damaged by spillage or leakage, provide a drip pan of suitable size to minimize water damage. Drain accumulated water promptly from pans.

D. Heating and Cooling: Provide temporary heating required by construction activities for curing or drying of completed installations or for protecting installed construction from adverse effects of low temperatures or high humidity. Select equipment that will not have a harmful effect on completed installations or elements being installed.

1. Maintain a minimum temperature of 50 deg F in permanently enclosed portions of building for normal construction activities, and 65 deg F for finishing activities and areas where finished Work has been installed.

E. Ventilation and Humidity Control: Provide temporary ventilation required by construction activities for curing or drying of completed installations or for protecting installed construction from adverse effects of high humidity. Select equipment that will not have a harmful effect on completed installations or elements being installed. Coordinate ventilation requirements to produce ambient condition required and minimize energy consumption.

F. Electric Power Service: Provide weatherproof, grounded electric power service and distribution system of sufficient size, capacity, and power characteristics during construction period. Include meters, transformers, overload-protected disconnecting means, automatic ground-fault interrupters, and main distribution switchgear.

G. Electric Distribution: Provide receptacle outlets adequate for connection of power tools and equipment.

1. Provide waterproof connectors to connect separate lengths of electrical power cords if single lengths will not reach areas where construction activities are in progress. Do not exceed safe length-voltage ratio.

H. Lighting: Provide temporary lighting with local switching that provides adequate illumination for construction operations, observations, inspections, and traffic conditions.

1. Install and operate temporary lighting that fulfills security and protection requirements without operating entire system.

I. Telephone Service: Provide temporary telephone service in common-use facilities for use by all construction personnel. Install one telephone line.
1. Provide additional telephone lines for the following:
   a. Provide a dedicated telephone line for each facsimile machine.
   b. Provide a dedicated telephone line or digital subscriber line for computers.
2. At each telephone, post a list of important telephone numbers.
   a. Police and fire departments.
   b. Ambulance service.
   c. Contractor's home office.
3. Provide superintendent with cellular telephone or portable two-way radio for use when away from field office.

3.03 SUPPORT FACILITIES INSTALLATION

A. General: Comply with the following:
1. Locate field offices, storage sheds, sanitary facilities, and other temporary construction and support facilities for easy access. Coordinate with Architect on location.
2. Provide incombustible construction for offices, shops, and sheds located within construction area or within 30 feet of building lines. Comply with NFPA 241.
3. Maintain support facilities until near Substantial Completion. Remove before Substantial Completion. Personnel remaining after Substantial Completion will be permitted to use permanent facilities, under conditions acceptable to Owner.

B. Traffic Controls: Provide temporary traffic controls at junction of temporary roads with public roads. Include warning signs for public traffic and "STOP" signs for entrance onto public roads. Comply with requirements of authorities having jurisdiction.

C. Common-Use Field Office: Of sufficient size to accommodate needs of construction personnel. Keep office clean and orderly. Furnish and equip offices as follows:
1. Furniture required for Project-site documents including file cabinets, plan tables, plan racks, and bookcases.
2. One full set of the building code.
3. Facsimile machine.
5. At least one computer with software and connections for high-speed (DSL 384Kbps or greater) Internet access and electronic mail.
   a. Provide at least one digital camera on site, with connection to computer.
6. Conference room of sufficient size to accommodate meetings of 10 individuals. Provide electrical power service and 120-V ac duplex receptacles, with not less than 1 receptacle on each wall. Furnish room with conference table, chairs, and 4-foot- (1.2-m-) square tack board.
7. Drinking water and private toilet.
8. Coffee machine and supplies.
9. Heating and cooling equipment necessary to maintain a uniform indoor temperature of 68 to 72 deg F (20 to 22 deg C).
10. Lighting fixtures capable of maintaining average illumination of 20 fc (215 lx) at desk height.

D. Waste Disposal Facilities: Provide waste-collection containers in sizes adequate to handle waste from construction operations. Containerize and clearly label hazardous, dangerous, or unsanitary waste materials separately from other waste. Comply with Division 01 Section "Execution Requirements" for progress cleaning requirements.
1. Provide separate containers, clearly labeled, for each type of waste material to be deposited in accordance with Division 01 Section “Construction Waste Management.”
E. Lifts and Hoists: Provide facilities necessary for hoisting materials and personnel.
1. Truck cranes and similar devices used for hoisting materials are considered "tools and equipment" and not temporary facilities.

3.04 SECURITY AND PROTECTION FACILITIES INSTALLATION

A. Environmental Protection: Provide protection, operate temporary facilities, and conduct construction in ways and by methods that comply with environmental regulations and that minimize possible air, waterway, and subsoil contamination or pollution or other undesirable effects.
1. Comply with work restrictions specified in Division 01 Section "Summary".

B. Security Enclosure and Lockup: Install substantial temporary enclosure around material storage areas and partially completed areas of construction. Provide lockable entrances to prevent unauthorized entrance, vandalism, theft, and similar violations of security.

C. Temporary Enclosures: Provide temporary enclosures for protection of construction, in progress and completed, from exposure, other construction operations, and similar activities. Provide temporary weathertight enclosure for building exterior.
1. Where heating or cooling is needed and permanent enclosure is not complete, provide insulated temporary enclosures. Coordinate enclosure with ventilating and material drying or curing requirements to avoid dangerous conditions and effects.
2. Vertical Openings: Close openings of 25 sq. ft. or less with plywood or similar materials.
3. Horizontal Openings: Close openings in floor or roof decks and horizontal surfaces with load-bearing, wood-framed construction.
4. Install tarpaulins securely using fire-retardant-treated wood framing and other materials.
5. Seal joints and perimeter. Equip partitions with dustproof doors and security locks.
6. Protect air-handling equipment.
7. Weatherstrip openings.

D. Temporary Fire Protection: Install and maintain temporary fire-protection facilities of types needed to protect against reasonably predictable and controllable fire losses. Comply with NFPA 241.
1. Prohibit smoking in construction areas.
2. Supervise welding operations, combustion-type temporary heating units, and similar sources of fire ignition according to requirements of authorities having jurisdiction.
3. Develop 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.
4. Provide temporary standpipes and hoses for fire protection. 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.

3.05 OPERATION, TERMINATION AND REMOVAL

A. Supervision: Enforce strict discipline in use of temporary facilities. To minimize waste and abuse, limit availability of temporary facilities to essential and intended uses.
B. Maintenance: Maintain facilities in good operating condition until removal.
   1. Maintain operation of temporary enclosures, heating, cooling, humidity control,
      ventilation, and similar facilities on a 24-hour basis where required to achieve
      indicated results and to avoid possibility of damage.
   2. Prevent accumulation of graffiti, removing that which occurs within 12 hours of
      discovery.

C. Temporary Facility Changeover: Do not change over from using temporary security
   and protection facilities to permanent facilities until Substantial Completion.

D. Termination and Removal: Remove each temporary facility when need for its service
   has ended, when it has been replaced by authorized use of a permanent facility, or no
   later than Substantial Completion. Complete or, if necessary, restore permanent
   construction that may have been delayed because of interference with temporary
   facility. Repair damaged Work, clean exposed surfaces, and replace construction that
   cannot be satisfactorily repaired.
   1. Materials and facilities that constitute temporary facilities are property of
      Contractor. Owner reserves right to take possession of Project identification
      signs.
   2. At Substantial Completion, clean and renovate permanent facilities used during
      construction period. Comply with final cleaning requirements specified in
      Division 01 Section "Closeout Procedures."

END OF SECTION 01 50 00
PART 1 - GENERAL

1.01 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.

1.02 SUMMARY

A. Section includes requirements for indoor air quality (IAQ) management during construction operations, including:
   1. Control of emissions during construction.
   2. Moisture control during construction.
   3. Procedures for testing baseline IAQ. Baseline IAQ requirements specify maximum indoor pollutant concentrations for acceptance of the facility.

B. Related Sections include:
   1. Division 01 Section “Project Management and Coordination.”
   2. Division 01 Section “Quality Requirements.”
   3. Divisions 02 through 13 sections for:
      a. Product data for adhesives and sealants used inside the weatherproofing system indicating VOC content of each product used.
      b. Product data for paints and coatings used inside the weatherproofing system indicating VOC content of each product used.
      c. Product data for products containing composite wood or agrifiber products or wood glues indicating that they do not contain urea-formaldehyde resin.

1.03 DEFINITIONS

A. Definitions pertaining to sustainable development: As defined in ASTM E2114.

B. Adequate ventilation: Ventilation, including air circulation and air changes, required to cure materials, dissipate humidity, and prevent accumulation of particulates, dust, fumes, vapors, or gases.

C. Hazardous Materials: Any material that is regulated as a hazardous material in accordance with 49 CFR 173, requires a Material Safety Data Sheet (MSDS) in accordance with 29 CFR 1910.1200, or which during end use, treatment, handling, storage, transportation or disposal meets or has components which meet or have the potential to meet the definition of a Hazardous Waste in accordance with 40 CFR 261. Throughout this specification, hazardous material includes hazardous chemicals.
   1. Hazardous materials include: pesticides, biocides, and carcinogens as listed by recognized authorities, such as the Environmental Protection Agency (EPA) and the International Agency for Research on Cancer (IARC).

D. Indoor Air Quality (IAQ): The composition and characteristics of the air in an enclosed space that affect the occupants of that space. The indoor air quality of a space refers to the relative quality of air in a building with respect to contaminants and hazards and is determined by the level of indoor air pollution and other characteristics of the air,
including those that impact thermal comfort such as air temperature, relative humidity and air speed.

E. Interior final finishes: Materials and products that will be exposed at interior, occupied spaces; including flooring, wallcovering, finish carpentry, and ceilings.

F. Packaged dry products: Materials and products that are installed in dry form and are delivered to the site in manufacturer's packaging; including carpets, resilient flooring, ceiling tiles, and insulation.

G. Wet products: Materials and products installed in wet form, including paints, sealants, adhesives, special coatings, and other materials which require curing.

1.04 QUALITY ASSURANCE

A. Inspection and Testing Lab Qualifications: Minimum of 5 years experience in performing the types of testing specified herein.

1.05 PRECONSTRUCTION MEETING

A. After award of Contract and prior to the commencement of the Work, schedule and conduct meeting with Owner and Architect to discuss the proposed IAQ Management Plan and to develop mutual understanding relative to details of environmental protection.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.01 IAQ MANAGEMENT OF EMISSIONS

A. During construction operations, follow the recommendations in SMACNA IAQ Guidelines for Occupied Buildings under Construction.

B. HVAC Protection:
   1. Seal return registers during construction operations.
   2. Provide temporary exhaust during construction operations
   3. To the greatest extent possible, isolate and/or shut down the return side of the HVAC system during construction. When ventilation system must be operational during construction activities, provide temporary filters.

C. Source Control: Provide low and zero VOC materials as specified.

D. Pathway Interruption: Isolate areas of work as necessary to prevent contamination of clean or occupied spaces. Provide pressure differentials and/or physical barriers to protect clean or occupied spaces.

E. Housekeeping: During construction, maintain project and building products and systems to prevent contamination of building spaces.

F. Temporary Ventilation: Provide an ACH (air changes per hour) of [1.5] [xxxx] or more and as follows:
   1. Provide minimum 48 hour pre-ventilation of packaged dry products prior to installation. Remove from packaging and ventilate in a secure, dry, well-
ventilated space free from strong contaminant sources and residues. Provide a temperature range of 60 degrees F minimum to 90 degree F maximum continuously during the ventilation period. Do not ventilate within limits of Work unless otherwise approved by Architect.

2. Provide adequate ventilation during and after installation of interior wet products and interior final finishes.

3. Provide filtration media with a Minimum Efficiency Reporting Value (MERV) of 8 as determined by ASHRAE 52.2 during construction and during Owner occupancy. Coordinate with work of Division 23, Heating Ventilating and Air Conditioning (HVAC).

G. Scheduling: Schedule construction operations involving wet products prior to packaged dry products to the greatest extent possible.

H. Flush-Out: After construction ends, prior to occupancy and with all interior finishes installed, perform a building flush-out by supplying a total air volume of 14,000 cu.ft. of outdoor air per sq. ft. of floor area while maintaining an internal temperature of at least 60 degrees F and relative humidity no higher than 60%.

3.02 IAQ MOISTURE MANAGEMENT

A. Housekeeping:
1. Keep materials dry. Protect stored on-site and installed absorptive materials from moisture damage.
2. Verify that installed materials and products are dry prior to sealing and weatherproofing the building envelope.
3. Install interior absorptive materials only after building envelope is sealed and weatherproofed.

B. Inspections: Document and report results of inspections; state whether or not inspections indicate satisfactory conditions.
1. Examine materials for dampness as they arrive. If acceptable to Architect/Owner, dry damp materials completely prior to installation; otherwise, reject materials that arrive damp.
2. Examine materials for mold as they arrive and reject materials that arrive contaminated with mold.
3. Inspect stored and installed absorptive materials regularly for dampness and mold growth. Inspect after each rain event.
   a. Where stored on-site or installed absorptive materials become wet, notify [Architect][Owner]. Inspect for damage. If acceptable to Architect/Owner, dry completely prior to closing in assemblies; otherwise, remove and replace with new materials.
4. Basement: Monitor basement and crawlspace humidity, and dehumidify when relative humidity is greater than 85 percent for more than 2 weeks or at the first sign of mold growth.
5. Site drainage: Verify that final grades of site work and landscaping drain surface water and ground water away from the building.
6. Weather-proofing: Inspect moisture control materials as they are being installed. Include the following:
   a. Air barrier: Verify air barrier is installed without punctures and/or other damage. Verify air barrier is sealed completely.
   b. Flashing: Verify correct shingling of the flashing for roof, walls, windows, doors, and other penetrations.
   c. Insulation layer: Verify insulation is installed without voids.
d. Roofing: In accordance with ASTM D7186 Standard Practice for Quality Assurance Observation of Roof Construction and Repair

7. Plumbing: Verify satisfactory pressure test of pipes and drains is performed before closing in and insulating lines.

8. HVAC: Inspect HVAC system to verify:
   a. condensate pans are sloped and plumbed correctly;
   b. access panels are installed to allow for inspection and cleaning of coils and ductwork downstream of coils;
   c. ductwork and return plenums are air sealed;
   d. duct insulation is installed and sealed; and
   e. chilled water line and refrigerant line insulation are installed and sealed.]

C. Schedule:
1. Schedule work such that absorptive materials, including but not limited to porous insulations, paper-faced gypsum board, ceiling tile, and finish flooring, are not installed until they can be protected from rain and construction-related water.
2. Weather-proof as quickly as possible. Schedule installation of moisture-control materials, including but not limited to air barriers, flashing, exterior sealants and roofing, at the earliest possible time.

D. Testing for Moisture Content: Test moisture content of porous materials and absorptive materials to ensure that they are dry before sealing them into an assembly. Document and report results of testing. Where tests are not satisfactory, dry materials and retest. If satisfactory results cannot be obtained with retest, remove and replace with new materials.
1. Concrete: Moisture test prior to finish flooring application as specified in Division 09.
2. Wood: Moisture test as per ASTM D4444 - Standard Test Methods for Use and Calibration of Hand-Held Moisture Meters; unless otherwise indicated acceptable upper limits for wood products are < 20% at center of piece; < 15% at surface.
3. Gypsum Board, Gypsum Plaster, Insulation, and other absorptive materials: Moisture test with a Pinless Moisture Meter to assess patterns of moisture, if any.

E. Testing for Moisture Penetration:
1. Windows: Test as per ASTM E1105 Test Method for Field Determination of Water Penetration of Installed Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform or Cyclic Static Air Pressure Difference; unless otherwise indicated acceptable upper limits are [no leakage for 15 minutes] [xxxx].
2. Horizontal Waterproofing (not roofing): Test as per ASTM D5957 Standard Guide for Flood Testing Horizontal Waterproofing Installations; acceptable upper limits are [no leakage for 15 minutes].
3. Masonry: Test as per ASTM C1601 Standard Test Method for Field Determination of Water Penetration of Masonry Wall Surfaces; acceptable upper limits are [no leakage for 15 minutes].
4. Exterior Walls:
F. Testing for Support of Microbial Growth: Test and report in accordance with ASTM D6329 Standard Guide for Developing Methodology for Evaluating the Ability of Indoor Materials to Support Microbial Growth Using Static Environmental Chambers. Indicate susceptibility of product or material to colonization and amplification of microorganisms. Identify microorganisms and conditions of testing.

1. Normal conditions: Perform testing at 35 degrees Centigrade and 50 percent relative humidity.

2. Extreme conditions: Perform worst case scenarios screening tests by providing an atmosphere where environmental conditions may be favorable for microbial growth.

3. Perform testing for the following:
   a. Fireproofing material on appropriate substrate.
   b. Ceiling tile.
   c. Wallcovering.
PART 1 - GENERAL

1.01 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.

1.02 SUMMARY

A. This Section includes administrative and procedural requirements for selection of products for use in Project; product delivery, storage, and handling; manufacturers' standard warranties on products; special warranties; product substitutions; and comparable products.

B. The Substitution Request Form follows this Section.

C. Related Sections include the following:
   1. Division 01 Section "Alternates" for products selected under an alternate.
   2. Division 01 Section "Closeout Procedures" for submitting warranties for Contract closeout.
   3. Divisions 02 through 49 Sections for specific requirements for warranties on products and installations specified to be warranted.

1.03 DEFINITIONS

A. Products: Items purchased 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, except that products consisting of recycled-content materials are allowed, unless explicitly stated otherwise. Products salvaged or recycled from other projects are not considered new products.
   3. Comparable Product: Product that is demonstrated and approved through submittal process, or where indicated as a product substitution, 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.

B. Substitutions: Changes in products, materials, equipment, and methods of construction from those required by the Contract Documents and proposed by Contractor.

C. Basis-of-Design Product Specification: Where a specific manufacturer's product is named and accompanied by the words "basis of design," 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 that equal or exceed those of specified product.
characteristics for purposes of evaluating comparable products of other named manufacturers.

1.04 SUBMITTALS

A. Substitution Requests: Submit three copies of each request for consideration. Identify product or fabrication or installation method to be replaced. Include Specification Section number and title and Drawing numbers and titles.

1. Substitution Request Form: Use Substitution Request Form.

2. Documentation: Show compliance with requirements for substitutions and the following, as applicable:
   a. Statement indicating why specified material or product cannot be provided.
   b. Coordination information, including a list of changes or modifications needed to other parts of the Work and to construction performed by Owner and separate contractors, that will be necessary to accommodate proposed substitution.
   c. Detailed comparison of significant qualities of proposed substitution with those of the Work specified. Significant qualities may include attributes such as performance, weight, size, durability, visual effect, and specific features and requirements indicated.
   d. Product Data, including drawings and descriptions of products and fabrication and installation procedures.
   e. Samples, where applicable or requested.
   f. List of similar installations for completed projects with project names and addresses and names and addresses of architects and owners.
   g. Material test reports from a qualified testing agency indicating and interpreting test results for compliance with requirements indicated.
   h. Research/evaluation reports evidencing compliance with building code in effect for Project, from a model code organization acceptable to authorities having jurisdiction.
   i. Detailed comparison of Contractor's Construction Schedule using proposed substitution with products specified for the Work, including effect on the overall Contract Time. If specified product or method of construction cannot be provided within the Contract Time, include letter from manufacturer, on manufacturer's letterhead, stating lack of availability or delays in delivery.
   j. Cost information, including a proposal of change, if any, in the Contract Sum.
   k. Contractor's certification that proposed substitution complies with requirements in the Contract Documents and is appropriate for applications indicated.
   l. Contractor's waiver of rights to additional payment or time that may subsequently become necessary because of failure of proposed substitution to produce indicated results.

3. Architect's Action: If necessary, Architect will request additional information or documentation for evaluation within 7 days of receipt of a request for substitution. Architect will notify Contractor of acceptance or rejection of proposed substitution within 15 days of receipt of request, or 7 days of receipt of additional information or documentation, whichever is later.
   a. Form of Acceptance: Change Order.
   b. Use product specified if Architect cannot make a decision on use of a proposed substitution within time allocated.
B. Comparable Product Requests: Submit three copies of each request for consideration. Identify product or fabrication or installation method to be replaced. Include Specification Section number and title and Drawing numbers and titles.

1. Architect's Action: If necessary, Architect will request additional information or documentation for evaluation within one week of receipt of a comparable product request. Architect will notify Contractor of approval or rejection of proposed comparable product request within 15 days of receipt of request, or 7 days of receipt of additional information or documentation, whichever is later.
   a. Form of Approval: As specified in Division 01 Section "Submittal Procedures."
   b. Use product specified if Architect cannot make a decision on use of a comparable product request within time allocated.

C. Basis-of-Design Product Specification Submittal: Comply with requirements in Division 01 Section "Submittal Procedures." Show compliance with requirements.

1.05 QUALITY ASSURANCE

A. Compatibility of Options: If Contractor is given option of selecting between two or more products for use on Project, product selected shall be compatible with products previously selected, even if previously selected products were also options.

1.06 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Deliver, store, and handle products using means and methods that will prevent damage, deterioration, and loss, including theft. Comply with manufacturer's written instructions.

B. Delivery and Handling:
   1. Schedule delivery to minimize long-term storage at Project site and to prevent overcrowding of construction spaces.
   2. 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.
   3. 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 installing.
   4. Inspect products on delivery to ensure compliance with the Contract Documents and to ensure that products are undamaged and properly protected.

C. Storage:
   1. Store materials in a manner that will not endanger Project structure.
   2. Comply with product manufacturer's written instructions for temperature, humidity, ventilation, and weather-protection requirements for storage.

1.07 PRODUCT WARRANTIES

A. Warranties specified in other Sections shall be in addition to, and run concurrent with, other warranties required by the Contract Documents. Manufacturer's disclaimers and limitations on product warranties do not relieve Contractor of obligations under requirements of the Contract Documents.
   1. Manufacturer's Warranty: Preprinted written warranty published by individual manufacturer for a particular product and specifically endorsed by manufacturer to Owner.
2. Special Warranty: Written warranty required by or incorporated into the Contract Documents, either to extend time limit provided by manufacturer's warranty or to provide more rights for Owner.

B. Special Warranties: Prepare a written document that contains appropriate terms and identification, ready for execution. Submit a draft for approval before final execution.
1. Manufacturer's Standard Form: Modified to include Project-specific information and properly executed.
2. Refer to Divisions 02 through 49 Sections for specific content requirements and particular requirements for submitting special warranties.

C. Submittal Time: Comply with requirements in Division 01 Section "Closeout Procedures."

PART 2 - PRODUCTS
2.01 PRODUCT SELECTION PROCEDURES

A. General Product Requirements: Provide products that comply with the Contract Documents, that are undamaged and, unless otherwise indicated, that are new at time of installation.
1. Provide products complete with accessories, trim, finish, fasteners, and other items needed for a complete installation and indicated use and effect.
2. Standard Products: If available, and unless custom products or nonstandard options are specified, provide standard products of types that have been produced and used successfully in similar situations on other projects.
3. Owner reserves the right to limit selection to products with warranties not in conflict with requirements of the Contract Documents.
4. Where products are accompanied by the term "as selected," Architect will make selection.
5. Where products are accompanied by the term "match sample," sample to be matched is Architect's.

B. Product Selection Procedures:
1. Product: Where Specifications name a single product and manufacturer, provide the named product that complies with requirements.
2. Manufacturer/Source: Where Specifications name a single manufacturer or source, provide a product by the named manufacturer or source that complies with requirements.
3. Products: Where Specifications include a list of names of both products and manufacturers, provide one of the products listed that complies with requirements.
4. Manufacturers: Where Specifications include a list of manufacturers' names, provide a product by one of the manufacturers listed that complies with requirements.
5. Available Manufacturers: Where Specifications include a list of manufacturers, provide a product by one of the manufacturers listed, or an unnamed manufacturer, that complies with requirements. Comply with provisions in Part 2 "Comparable Products" Article for consideration of an unnamed product.
6. Visual Matching Specification: Where Specifications require matching an established Sample, select a product that complies with requirements and
matches Architect's sample. Architect's decision will be final on whether a proposed product matches.

a. If no product available within specified category matches and complies with other specified requirements, comply with provisions in Part 2 "Product Substitutions" Article for proposal of product.

7. Visual Selection Specification: Where Specifications include the phrase "as selected from manufacturer's colors, patterns, textures" or a similar phrase, select a product that complies with other specified requirements.

a. Standard Range: Where Specifications include the phrase "standard range of colors, patterns, textures" or similar phrase, Architect will select color, pattern, density, or texture from manufacturer's product line that does not include premium items.

b. Full Range: Where Specifications include the phrase "full range of colors, patterns, textures" or similar phrase, Architect will select color, pattern, density, or texture from manufacturer's product line that includes both standard and premium items.

2.02 PRODUCT SUBSTITUTIONS

A. Timing: Architect will consider requests for substitution if received within 21 days after the Notice of Award. Requests received after that time may be considered or rejected at discretion of Architect.

B. Conditions: Architect will consider Contractor's request for substitution when the following conditions are satisfied. If the following conditions are not satisfied, Architect will return requests without action, except to record noncompliance with these requirements:

1. Requested substitution offers Owner a substantial advantage in cost, time, energy conservation, or other considerations, after deducting additional responsibilities Owner must assume. Owner's additional responsibilities may include compensation to Architect for redesign and evaluation services, increased cost of other construction by Owner, and similar considerations.

2. Requested substitution is consistent with the Contract Documents and will produce indicated results.

3. Substitution request is fully documented and properly submitted.

4. Requested substitution will not adversely affect Contractor's Construction Schedule.

5. Requested substitution has received necessary approvals of authorities having jurisdiction.

6. Requested substitution is compatible with other portions of the Work.

7. Requested substitution has been coordinated with other portions of the Work.

8. Requested substitution provides specified warranty.

2.03 COMPARABLE PRODUCTS

A. Conditions: Architect will consider Contractor's request for comparable product when the following conditions are satisfied. If the following conditions are not satisfied, Architect will return requests without action, except to record noncompliance with these requirements:

1. Evidence that the proposed product does not require extensive 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, and specific features and requirements indicated.
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.

PART 3 - EXECUTION (NOT USED)

END OF SECTION 01 60 00
PART 1 - GENERAL

1.01 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.

1.02 SUMMARY

A. Section includes general administrative and procedural requirements governing execution of the Work including, but not limited to, the following:
   2. Installation of the Work.
   3. Coordination of Owner-installed products.
   4. Progress cleaning.
   5. Starting and adjusting.
   6. Protection of installed construction.
   7. Correction of the Work.

B. Unless noted otherwise in writing, each Contractor is responsible for all of the items specified in this Section as they pertain to the Work of that prime contractor’s Contract. The Construction Manager may assign certain aspects of the Work specified in this Section to a single contractor.

C. Related Requirements:
   1. Division 01 Section "Cutting and Patching" for cutting and patching of building elements during construction.
   2. Division 02 Section "Selective Structure Demolition" for demolition and removal of selected portions of the building.
   3. Division 07 Section "Penetration Firestopping" for patching penetrations in fire-rated construction.

1.03 DEFINITIONS

A. Cutting: Removal of in-place construction necessary to permit installation or performance of other work.

B. Patching: Fitting and repair work required to restore construction to original conditions after installation of other work.

1.04 INFORMATIONAL SUBMITTALS

A. Qualification Data: For professional engineer.

B. Certificates: Submit certificate signed by professional engineer certifying that location of improvements comply with requirements.

C. Landfill Receipts: Submit copy of receipts issued by a landfill facility, licensed to accept hazardous materials, for hazardous waste disposal.
1.05 QUALITY ASSURANCE

A. Manufacturer's Installation Instructions: Obtain and maintain on-site manufacturer's written recommendations and instructions for installation of products and equipment.

PART 2 - PRODUCTS

2.01 MATERIALS

A. General: Comply with requirements specified in other Sections.
   1. For projects requiring compliance with sustainable design and construction practices and procedures, use products for patching that comply with requirements in Division 01 sustainable design requirements Section.

B. In-Place Materials: Use materials for patching identical to in-place materials. For exposed surfaces, use materials that visually match in-place adjacent surfaces to the fullest extent possible.
   1. If identical materials are unavailable or cannot be used, use materials that, when installed, will provide a match acceptable to Architect for the visual and functional performance of in-place materials.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Existing Conditions: The existence and location of underground and other utilities and construction indicated as existing are not guaranteed. Investigate and verify the existence and location of mechanical and electrical systems and other construction affecting the Work.
   1. Furnish location data for work related to Project that must be performed by public utilities serving Project site.

B. Examination and Acceptance of Conditions: Before proceeding with each component of the Work, examine substrates, areas, and conditions, with Installer or Applicator present where indicated, for compliance with requirements for installation tolerances and other conditions affecting performance. Record observations.
   1. Examine roughing-in for mechanical and electrical systems to verify actual locations of connections before equipment and fixture installation.
   2. Examine walls, floors, and roofs for suitable conditions where products and systems are to be installed.
   3. Verify compatibility with and suitability of substrates, including compatibility with existing finishes or primers.

C. Written Report: Where a written report listing conditions detrimental to performance of the Work is required by other Sections, include the following:
   1. Description of the Work.
   2. List of detrimental conditions, including substrates.
   3. List of unacceptable installation tolerances.
   4. Recommended corrections.

D. Proceed with installation only after unsatisfactory conditions have been corrected. Proceeding with the Work indicates acceptance of surfaces and conditions.
3.02 PREPARATION

A. Existing Utility Information: Furnish information to local utility and Owner that is necessary to adjust, move, or relocate existing utility structures, utility poles, lines, services, or other utility appurtenances located in or affected by construction. Coordinate with authorities having jurisdiction.

B. Field Measurements: Take field measurements as required to fit the Work properly. Recheck measurements before installing each product. Where portions of the Work are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

C. Space Requirements: Verify space requirements and dimensions of items shown diagrammatically on Drawings.

D. Review of Contract Documents and Field Conditions: Immediately on discovery of the need for clarification of the Contract Documents caused by differing field conditions outside the control of Contractor, submit a request for information to Architect according to requirements in Division 01 Section "Project Management and Coordination."

3.03 CONSTRUCTION LAYOUT

A. Verification: Before proceeding to lay out the Work, verify layout information shown on Drawings. If discrepancies are discovered, notify Architect promptly.

B. General: Engage a professional engineer to lay out the Work using accepted surveying practices.
   1. Establish benchmarks and control points to set lines and levels to locate each element of Project.
   2. Establish limits on use of Project site.
   3. Establish dimensions within tolerances indicated. Do not scale Drawings to obtain required dimensions.
   4. Inform installers of lines and levels to which they must comply.
   5. Check the location, level and plumb, of every major element as the Work progresses.
   6. Notify Architect when deviations from required lines and levels exceed allowable tolerances.

3.04 INSTALLATION

A. General: Locate the Work and components of the Work accurately, in correct alignment and elevation, as indicated.
   1. Make vertical work plumb and make horizontal work level.
   2. Where space is limited, install components to maximize space available for maintenance and ease of removal for replacement.
   3. Conceal pipes, ducts, and wiring in finished areas unless otherwise indicated.
   4. Maintain minimum headroom clearance of 96 inches (2440 mm) in occupied spaces and 90 inches (2300 mm) in unoccupied spaces.

B. Comply with manufacturer's written instructions and recommendations for installing products in applications indicated.
C. Install products at the time and under conditions that will ensure the best possible results. Maintain conditions required for product performance until Substantial Completion.

D. Conduct construction operations so no part of the Work is subjected to damaging operations or loading in excess of that expected during normal conditions of occupancy.

E. Sequence the Work and allow adequate clearances to accommodate movement of construction items on site and placement in permanent locations.

F. Tools and Equipment: Do not use tools or equipment that produce harmful noise levels.

G. Templates: Obtain and distribute to the parties involved templates for work specified to be factory prepared and field installed. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing products to comply with indicated requirements.

H. Attachment: Provide blocking and attachment plates and anchors and fasteners of adequate size and number to securely anchor each component in place, accurately located and aligned with other portions of the Work. Where size and type of attachments are not indicated, verify size and type required for load conditions.
   1. Mounting Heights: Where mounting heights are not indicated, mount components at heights directed by Architect.
   2. Allow for building movement, including thermal expansion and contraction.
   3. Coordinate installation of anchorages. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

I. Joints: Make joints of uniform width. Where joint locations in exposed work are not indicated, arrange joints for the best visual effect. Fit exposed connections together to form hairline joints.

J. Hazardous Materials: Use products, cleaners, and installation materials that are not considered hazardous.

3.05 OWNER-INSTALLED PRODUCTS

A. Site Access: Provide access to Project site for Owner's construction personnel.

B. Coordination: Coordinate construction and operations of the Work with work performed by Owner's construction personnel.
   1. Construction Schedule: Inform Owner of Contractor's preferred construction schedule for Owner's portion of the Work. Adjust construction schedule based on a mutually agreeable timetable. Notify Owner if changes to schedule are required due to differences in actual construction progress.
   2. Preinstallation Conferences: Include Owner's construction personnel at preinstallation conferences covering portions of the Work that are to receive Owner's work. Attend preinstallation conferences conducted by Owner's construction personnel if portions of the Work depend on Owner's construction.

3.06 PROGRESS CLEANING

A. General: Clean Project site and work areas daily, including common areas. Enforce requirements strictly. Dispose of materials lawfully.
2. Do not hold waste materials more than seven days during normal weather or three days if the temperature is expected to rise above 80 deg F (27 deg C).
3. Containerize hazardous and unsanitary waste materials separately from other waste. Mark containers appropriately and dispose of legally, according to regulations.
   a. Use containers intended for holding waste materials of type to be stored.
4. Coordinate progress cleaning for joint-use areas where Contractor and other contractors are working concurrently.

B. Site: Maintain Project site free of waste materials and debris.

C. Work Areas: Clean areas where work is in progress to the level of cleanliness necessary for proper execution of the Work.
   1. Remove liquid spills promptly.
   2. Where dust would impair proper execution of the Work, broom-clean or vacuum the entire work area, as appropriate.

D. Installed Work: Keep installed work clean. Clean installed surfaces according to written instructions of manufacturer or fabricator of product installed, using only cleaning materials specifically recommended. If specific cleaning materials are not recommended, use cleaning materials that are not hazardous to health or property and that will not damage exposed surfaces.

E. Concealed Spaces: Remove debris from concealed spaces before enclosing the space.

F. Exposed Surfaces in Finished Areas: Clean exposed surfaces and protect as necessary to ensure freedom from damage and deterioration at time of Substantial Completion.

G. Waste Disposal: Do not bury or burn waste materials on-site. Do not wash waste materials down sewers or into waterways. Comply with waste disposal requirements in Division 01 Section "Temporary Facilities and Controls" and Division 01 Section "Construction Waste Management and Disposal."

H. During handling and installation, clean and protect construction in progress and adjoining materials already in place. Apply protective covering where required to ensure protection from damage or deterioration at Substantial Completion.

I. Clean and provide maintenance on completed construction as frequently as necessary through the remainder of the construction period. Adjust and lubricate operable components to ensure operability without damaging effects.

J. Limiting Exposures: Supervise construction operations to assure that no part of the construction, completed or in progress, is subject to harmful, dangerous, damaging, or otherwise deleterious exposure during the construction period.

3.07 STARTING AND ADJUSTING

A. Start equipment and operating components to confirm proper operation. Remove malfunctioning units, replace with new units, and retest.

B. Adjust equipment for proper operation. Adjust operating components for proper operation without binding.
C. Test each piece of equipment to verify proper operation. Test and adjust controls and safety. Replace damaged and malfunctioning controls and equipment.

D. Manufacturer's Field Service: Comply with qualification requirements in Division 01 Section "Quality Requirements."

3.08 PROTECTION OF INSTALLED CONSTRUCTION

A. Provide final protection and maintain conditions that ensure installed Work is without damage or deterioration at time of Substantial Completion.

B. Comply with manufacturer's written instructions for temperature and relative humidity.

3.09 CORRECTION OF THE WORK

A. Repair or remove and replace defective construction. Restore damaged substrates and finishes. Comply with requirements in Division 01 Section "Cutting and Patching".
   1. Repairing includes replacing defective parts, refinishing damaged surfaces, touching up with matching materials, and properly adjusting operating equipment.

B. Restore permanent facilities used during construction to their specified condition.

C. Remove and replace damaged surfaces that are exposed to view if surfaces cannot be repaired without visible evidence of repair.

D. Repair components that do not operate properly. Remove and replace operating components that cannot be repaired.

E. Remove and replace chipped, scratched, and broken glass or reflective surfaces.

END OF SECTION 01 73 00
PART 1 - GENERAL

1.01 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.

1.02 SUMMARY

A. This Section includes procedural requirements for cutting and patching.

B. Related Sections include the following:
   1. Division 02 Section "Selective Structure Demolition" for demolition of selected portions of the building.
   2. Divisions 02 through 49 Sections for specific requirements and limitations applicable to cutting and patching individual parts of the Work.
   3. Division 07 Section "Penetration Firestopping" for patching fire-rated construction.

1.03 DEFINITIONS

A. Cutting: Removal of in-place 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.

1.04 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.
   1. Primary operational systems and equipment.
   2. Air or smoke barriers.
   3. Fire-suppression systems.
   4. Mechanical systems piping and ducts.
   5. Control systems.
   6. Communication systems.
   7. Conveying systems.
   8. Electrical wiring systems.

C. Miscellaneous Elements: Do not cut and patch miscellaneous 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.
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.

PART 2 - PRODUCTS

2.01 MATERIALS

A. General: Comply with requirements specified in other Sections.

B. In-Place Materials: Use materials identical to in-place materials. For exposed surfaces, use materials that visually match in-place adjacent surfaces to the fullest extent possible.
   1. If identical materials are unavailable or cannot be used, use materials that, when installed, will match the visual and functional performance of in-place materials.

PART 3 - EXECUTION

3.01 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 in-place finishes or primers.
   2. Proceed with installation only after unsafe or unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Temporary Support: Provide temporary support of Work to be cut.

B. Protection: Protect in-place 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.

3.03 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 in-place 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.

B. Existing Warranties: Remove, replace, patch, and repair materials and surfaces cut or damaged during installation or cutting and patching operations, by methods and with materials so as not to void existing warranties.

C. Temporary Support: Provide temporary support of work to be cut.
D. Protection: Protect in-place 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.

E. Adjacent Occupied Areas: Where interference with use of adjoining areas or interruption of free passage to adjoining areas is unavoidable, coordinate cutting and patching according to requirements in Division 01 Section "Summary."

F. Existing Utility Services and Mechanical/Electrical Systems: Where existing services/systems are required to be removed, relocated, or abandoned, bypass such services/systems before cutting to prevent interruption to occupied areas.

G. Cutting: Cut in-place 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. Finished Surfaces: Cut or drill from the exposed or finished side into concealed surfaces.
3. Concrete: Cut using a cutting machine, such as an abrasive saw or a diamond-core drill.
4. 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.
5. Proceed with patching after construction operations requiring cutting are complete.

H. 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.
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.
   a. Clean piping, conduit, and similar features before applying paint or other finishing materials.
   b. Restore damaged pipe covering to its original condition.
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 in-place 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.
4. Ceilings: Patch, repair, or rehang in-place ceilings as necessary to provide an even-plane surface of uniform appearance.
I. Cleaning: Clean areas and spaces where cutting and patching are performed. Remove paint, mortar, oils, putty, and similar materials from adjacent finished surfaces.

END OF SECTION 01 73 29
PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplemental General Conditions and other Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. This Section includes administrative and procedural requirements for the following:
   1. Salvaging nonhazardous demolition and construction waste.
   2. Recycling nonhazardous demolition and construction waste.
   3. Disposing of nonhazardous demolition and construction waste.

B. Related Sections include the following:
   1. Division 01 Section "Temporary Facilities and Controls" for environmental-protection measures during construction, and location of waste containers at Project site.
   2. Division 02 Section "Selective Structure Demolition" for disposition of hazardous waste.

1.03 DEFINITIONS

A. Construction Waste: Building and site improvement materials and other solid waste resulting from construction, remodeling, renovation, or repair operations. Construction waste includes packaging.

B. Demolition Waste: Building and site improvement materials resulting from demolition or selective demolition operations.

C. Disposal: Removal off-site of demolition and construction waste and subsequent sale, recycling, reuse, or deposit in landfill or incinerator acceptable to authorities having jurisdiction.

D. Recycle: Recovery of demolition or construction waste for subsequent processing in preparation for reuse.

E. Salvage: Recovery of demolition or construction waste and subsequent sale or reuse in another facility.

F. Salvage and Reuse: Recovery of demolition or construction waste and subsequent incorporation into the Work.

1.04 PERFORMANCE GOALS

A. General: Manage waste disposal that results in end-of-Project rates for salvage/recycling of 50 percent by weight of total waste generated by the Work.
1.05 QUALITY ASSURANCE

A. Regulatory Requirements: Comply with hauling and disposal regulations of authorities having jurisdiction.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.01 GENERAL WASTE MANAGEMENT

A. General: Provide handling, containers, storage, signage, transportation, and other items during the entire duration of the Contract.
   1. Comply with Division 01 Section "Construction Facilities and Temporary Controls" for operation, termination, and removal requirements.

B. Site Access and Temporary Controls: Manage waste operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.
   1. Designate and label specific areas on Project site necessary for separating materials that are to be salvaged, recycled, reused, donated, and sold.
   2. Comply with Division 01 Section "Construction Facilities and Temporary Controls" for controlling dust and dirt, environmental protection, and noise control.

3.02 SALVAGING DEMOLITION WASTE

A. Salvaged Items for Reuse in the Work:
   1. Clean salvaged items.
   2. Pack or crate items after cleaning. Identify contents of containers.
   3. Store items in a secure area until installation.
   4. Protect items from damage during transport and storage.
   5. Install salvaged items to comply with installation requirements for new materials and equipment. Provide connections, supports, and miscellaneous materials necessary to make items functional for use indicated.

B. Salvaged Items for Sale and Donation: Not permitted on Project site.

C. Salvaged Items for Owner's Use:
   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.
   5. Protect items from damage during transport and storage.

D. Doors and Hardware: Brace open end of door frames. Except for removing door closers, leave door hardware attached to doors.

3.03 RECYCLING DEMOLITION AND CONSTRUCTION WASTE, GENERAL

A. General: Recycle paper and beverage containers used by on-site workers.

B. Recycling Incentives: Revenues, savings, rebates, tax credits, and other incentives received for recycling waste materials shall accrue to Contractor.
C. Procedures: Separate recyclable waste from other waste materials, trash, and debris. Separate recyclable waste by type at Project site to the maximum extent practical.
1. Provide appropriately marked containers or bins for controlling recyclable waste until they are removed from Project site. Include list of acceptable and unacceptable materials at each container and bin.
   a. Inspect containers and bins for contamination and remove contaminated materials if found.
2. Stockpile processed materials on-site without intermixing with other materials. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust.
3. Stockpile materials away from construction area. Do not store within drip line of remaining trees.
4. Store components off the ground and protect from the weather.
5. Remove recyclable waste off Owner's property and transport to recycling receiver or processor.

3.04 RECYCLING DEMOLITION WASTE
A. Metals: Separate metals by type.

3.05 DISPOSAL OF WASTE
A. General: Except for items or materials to be salvaged, recycled, or otherwise reused, remove waste materials from Project site and legally dispose of them in a landfill or incinerator acceptable to authorities having jurisdiction.
1. Except as otherwise specified, do not allow waste materials that are to be disposed of accumulate on-site.
2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.
B. Burning: Do not burn waste materials.
C. Disposal: Transport waste materials off Owner's property and legally dispose of them.

3.06 RECYCLING DEMOLITION AND CONSTRUCTION WASTE, GENERAL
A. General: Recycle paper and beverage containers used by on-site workers.

   Recycling Receivers and Processors: List below is provided for information only; available recycling receivers and processors include, but are not limited to, the following:

1. AAA Polymer, Inc.
   Tel: (718) 389-2498
   Fax: (718) 389-8775
   68 Freeman St.
   Brooklyn, NY 11222

   Tel: (718) 721-8885
   Fax: (718) 721-8885
   18-50 43rd Street
   Astoria, NY 11105

3. AERC/MTI
   Tel: (610) 797-7608
   Fax: (610) 797-7696
   2591 Mitchell Ave.
   Allentown, PA 18103

4. Allocco Recycling Corp.
   Tel: (718) 349-3094
   Fax: (718) 349-3097
   540 Kingsland Avenue
   Brooklyn, NY 11222
5. Armstrong Industries  
Tel: (877) 276-7876  
Fax: (800) 233-5598  
2500 Columbia Ave.  
Lancaster, PA  17603

6. American Wood Recyclers  
Tel: (609) 386-5200  
Fax: (609) 386-8300  
445 Neck Rd.  
Burlington, NJ  08016

7. Astoria Carting  
Tel: (718) 387-2077  
Fax: (718) 387-0011  
538-545 Stewart Ave.  
Brooklyn, NY  11237

Tel: (718) 345-6451  
Fax: (718) 345-0086  
889 Essex St.  
Brooklyn, NY  11208

Tel: (212) 563-0222  
Fax: (212) 239-3209  
507 W. 27th St.  
New York, NY  10001

10. C&C Recycled Hardwoods  
Tel: (860) 535-9192  
Fax: N/A  
22 Bayview Dr.  
Stonington, CT  06359

11. Cardella Trucking, Co  
Tel: (201) 867-7276  
Fax: (201) 867-9047  
2400 Tonnelle Ave.  
North Bergen, NJ  07047

12. CarpetCycle, L.L.C.  
Tel: (908) 353-5900  
Fax: (908) 353-8801  
447 Schiller St.  
Elizabeth, NJ  07206

Tel: (212) 947-2985  
Fax: (212) 239-3209  
505 W. 22nd St.  
New York, NY  10001

14. Chambers Paper Fibers  
Tel: (718) 624-8181  
Fax: (718) 624-8153  
139 Plymouth St.  
Brooklyn, NY  11201

15. Charles J. King, Inc.  
Tel: (718) 497-1950  
Fax: (718) 456-7274  
1301 Grand St.  
Brooklyn, NY  11211

16. Cousins Metal Industries  
Tel: (516) 536-7755  
Fax: (516) 536-7490  
P.O. Box 547  
Oceanside, NY  11572

17. Delisa Pallet Corp.  
Tel: (973) 344-8600  
Fax: (973) 344-8600  
91 Blanchard St.  
Newark, NJ  07105

18. Dupont Co.  
Tel: (212) 376-5355  
Fax: (212) 376-5356  
95 Madison Ave.  
New York, NY  10016

19. Eastern Environmental Technologies  
Tel: (800) 808-7227  
Fax: (914) 934-9659  
47 Purdy Avenue.  
Port Chester, NY  10573

20. Emerson Recycling Corp.  
Tel: (718) 622-1799  
Fax: (718) 783-1981  
65 Emerson Pl.  
Brooklyn, NY  11205

21. EWG Glass Recovery  
Tel: (718) 739-7270  
Fax: (718) 297-4101  
145-11 Liberty Ave.  
Queens, NY  11433

22. Flag Container Services  
Tel: (718) 720-4650  
Fax: (718) 720-0137  
11 Ferry St.  
Staten Island, NY  10302

23. Fortune Metals  
Tel: (718) 389-3000  
Fax: (718) 389-3921  
55 Provost St.  
Brooklyn, NY  11222

24. Full Circle, Inc.  
Tel: (800) 775-1516  
Fax: (718) 328-4462  
509 Manida St.  
Bronx, NY  10474

Harlem Hospital  
MDF & Data Closet Upgrade Phase 1  
GW #18011  
CONSTRUCTION WASTE MANAGEMENT  
01 74 19 - 4  
January 11, 2019
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<thead>
<tr>
<th>No.</th>
<th>Company Name</th>
<th>Tel</th>
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<tr>
<td>25</td>
<td>Gaeta Demolition</td>
<td>(718) 720-7220</td>
<td>(718) 720-3025</td>
<td>25 Van St. Staten Island, NY 10310</td>
<td></td>
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<tr>
<td>26</td>
<td>Garfield Iron &amp; Metal</td>
<td>(973) 777-0666</td>
<td>(973) 777-4627</td>
<td>770 Patterson Ave. East Rutherford, NJ 07073</td>
<td></td>
</tr>
<tr>
<td>27</td>
<td>Galnz Iron &amp; Metals, Inc.</td>
<td>(516) 504-0001</td>
<td>(516) 504-0504</td>
<td>98 Cuttermill Rd. #218N Great Neck, NY 11201</td>
<td></td>
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<tr>
<td>28</td>
<td>Grace Associates</td>
<td>(718) 767-6500</td>
<td>(718) 767-9000</td>
<td>151-17 6th Rd. Queens, NY 11357</td>
<td></td>
</tr>
<tr>
<td>29</td>
<td>IESI</td>
<td>(212) 268-1322</td>
<td>(212) 268-1326</td>
<td>330 Seventh Ave. New York, NY 10001</td>
<td></td>
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<tr>
<td>30</td>
<td>IESI</td>
<td>(718) 388-2183</td>
<td>(718) 388-2180</td>
<td>548 Varick St. Brooklyn, NY 11237</td>
<td></td>
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<tr>
<td>31</td>
<td>J. Bass &amp; Son, Inc.</td>
<td>(914) 667-1442</td>
<td>(914) 667-9647</td>
<td>9-11 Carelton Ave. Mount Vernon, NY 10550</td>
<td></td>
</tr>
<tr>
<td>32</td>
<td>Justus Recycling</td>
<td>(718) 324-1111</td>
<td>(718) 325-9662</td>
<td>P.O. Box 1346 Bronx, NY 10475</td>
<td></td>
</tr>
<tr>
<td>33</td>
<td>Kids Waterfront Corp.</td>
<td>(718) 991-7700</td>
<td>(718) 991-1733</td>
<td>1264 Viele Ave. Bronx, NY 10474</td>
<td></td>
</tr>
<tr>
<td>34</td>
<td>Kings County Scrap Iron</td>
<td>(718) 251-5800</td>
<td>(718) 251-3967</td>
<td>37 Preston Court Brooklyn, NY 11234</td>
<td></td>
</tr>
<tr>
<td>35</td>
<td>Lori Contracting</td>
<td>(718) 991-7700</td>
<td>(718) 991-1733</td>
<td>1264 Viele Ave. Bronx, NY 10474</td>
<td></td>
</tr>
<tr>
<td>36</td>
<td>M. Fine Lumber</td>
<td>(718) 381-5200</td>
<td>(718) 366-8907</td>
<td>1301 Metropolitan Ave. Brooklyn, NY 11237</td>
<td></td>
</tr>
<tr>
<td>37</td>
<td>Mak Metal Corp.</td>
<td>(718) 278-7500</td>
<td>(718) 267-0229</td>
<td>12-01 Broadway Long Island City, NY 11106</td>
<td></td>
</tr>
<tr>
<td>38</td>
<td>Manhattan Recycling Ctr.</td>
<td>(212) 567-7400</td>
<td>(212) 567-3647</td>
<td>332 W. 207th St. New York, NY 10034</td>
<td></td>
</tr>
<tr>
<td>39</td>
<td>Mercer Group Int'l</td>
<td>(609) 394-9494</td>
<td>(609) 631-8218</td>
<td>853 Nottingham Way Trenton, NJ 08638</td>
<td></td>
</tr>
<tr>
<td>40</td>
<td>National Scrap I&amp;M Corp</td>
<td>(718) 784-7233</td>
<td>N/A</td>
<td>42-36 Crescent St. Long Island City, NY 11101</td>
<td></td>
</tr>
<tr>
<td>41</td>
<td>Nationwide Recycling Ctr.</td>
<td>(718) 545-1966</td>
<td>(718) 545-1830</td>
<td>154-20 South Rd. Queens, NY 11433</td>
<td></td>
</tr>
<tr>
<td>42</td>
<td>New Style Recycling</td>
<td>(860) 292-1992</td>
<td>(860) 292-1114</td>
<td>250 Main Street East Windsor, Ct 06088</td>
<td></td>
</tr>
<tr>
<td>43</td>
<td>Northeast Lamp Recycling, Inc.</td>
<td>(718) 326-4175</td>
<td>(718) 416-1913</td>
<td>3 Railroad Pl. Maspeth, NY 11378</td>
<td></td>
</tr>
<tr>
<td>44</td>
<td>P.K. Metals</td>
<td>(516) 732-6403</td>
<td>(516) 732-6917</td>
<td>3542 Route 112 Coram, NY 11727</td>
<td></td>
</tr>
</tbody>
</table>
45. Pace Glass, Inc.
   Tel: (201) 432-7983
   Fax: (201) 432-7476
   73-75 Cornelison Ave.
   Jersey City, NJ 07304

46. Paper Fibers, Inc
   Tel: (718) 991-3842
   Fax: (718) 991-3842
   960 Bronx River Ave.
   Bronx, NY 10473

47. Pascap Company, Inc.
   Tel: (718) 325-7200
   Fax: (718) 325-7595
   4250 Boston Rd.
   Bronx, NY 10475

48. Pinz Metals Co.
   Tel: (718) 389-1470
   Fax: (718) 389-9285
   208 Frost St.
   Brooklyn, NY 11211

49. Recycling Technology Ctr.
   Tel: (732) 922-9292
   Fax: (732) 918-9328
   3230 Shafto Rd.
   Tinton Falls, NJ 07753

50. Red Hook Crushers
   Tel: (718) 855-9442
   Fax: (718) 330-0301
   186 3rd St.
   Brooklyn, NY 11215

51. Russo Recycling Co.
   Tel: (718) 723--1111
   Fax: (516) 239-9324
   248-12 Brookville Rd.
   Queens, NY 11422

52. Sanzo Enterprises
   Tel: (718) 991-7700
   Fax: (718) 991-1733
   1264 Viele Ave.
   Bronx, NY 10474

53. Sarro Salvage
   Tel: (516) 334-2499
   Fax: (718) 334-2946
   69 Sylvester St.
   Westbury, NY 11590

54. Season’s Contracting Corp
   Tel: (201) 939-4000
   Fax: (201) 861-1118
   2531 94th St.
   North Bergen, NJ 07047

55. Sola Metal Co., Inc.
   Tel: (212) 569-5000
   Fax: (212) 567-3437
   333 W. 206th St.
   New York, NY 10034

56. Solid Waste Transfer, Inc.
   Tel: (973) 565-0181
   Fax: (973) 623-9047
   442 Frelinghuysen Ave.
   Newark, NJ 07114

57. Supino Scrap Iron & Metal
   Tel: (718) 447-1500
   Fax: (718) 447-5369
   2604 Richmond Ter.
   Staten Island, NY 10303

58. Taylor Recycling
   Tel: (845) 457-4021
   Fax: (845) 457-4003
   315 Neely Town Rd.
   Montgomery, NY 12549

59. Vanbro Corp.
   Tel: (718) 698-1100
   Fax: (718) 698-1107
   1900 South Ave.
   Staten Island, NY 10314

60. Waste Management Inc.
   Tel: (718) 386-7900
   Fax: (718) 386-1931
   101 Varick St.
   Brooklyn, NY 11237

61. Waste Management Inc.
   Tel: (718) 533-5200
   Fax: (718) 533-5271
   123 Varick St.
   Brooklyn, NY 11237

62. Waste Management Inc.
   Tel: (914) 423-2092
   Fax: (914) 969-4674
   325 Yonkers Ave.
   Yonkers, NY 10701

D. Materials Recycling: Index below is provided for information only; contact information for recycling receivers and processors is noted above.

1. Cardboard Chambers Paper Fibers; Emerson Recycling; Paper Fibers; Waste Management
2. Carpet CarpetCycle; Dupont

Harlem Hospital
MDF & Data Closet Upgrade Phase 1
GW #18011

CONSTRUCTION WASTE MANAGEMENT
01 74 19 - 6
January 11, 2019
3. Ceiling Tile  Armstrong Industries
4. Concrete  Allocco Recycling; Grace Associates; Justus Recycling; Mercer Group Int’l; Recycling Technology Center; Red Hook Crushers; Russo Recycling; Season’s; Vanbro; Waste Management
5. Film Plastic  AAA Polymer; Emerson Recycling
6. Fluorescent Lamps  AERC/MTI; Eastern Environmental Technologies; Full Circle Recyclers; Northeast Lamp Recycling
7. Glass  EWG Glass Recovery; Pace Glass; Waste Management
8. Gypsum  Taylor Recycling (only gypsum outlet in NY, located 75 miles from NYC)
9. Metal  A&A Scrap; Boulder Resources; Central Iron; Charles J. King; Cousins Metals; Fortune Metals, Garfield Iron; Glantz Iron; J. Bass; Kings County Scrap; Mak Metal; Manhattan Recycling; National Scrap; P.K. Metals; Pascap; Pinz; Sola; Supino Scrap
10. Mixed C&D  Astoria Carting; Atlas Roll-off; Cardella Trucking; Flag Container; Gaeta Demolition; IESI; Kids Waterfront; Lori Contracting, Nationwide Recycling; New Style Recycling; Paper Fibers; Solid Waste Transfer; Waste Management
11. Pallets  American Wood Recyclers; Delisa Pallet; Fortune Metals; Recycling Technology Center; Waste Management
12. Rubble  Allocco Recycling; Red Hook Crushers; Russo Recycling; Waste Management
13. Salvage  Sarro Salvage
14. Wood  C&C Recycled Hardwoods; M. Fine Lumber; Mercer Group Int’l; Recycling Technology Center; Waste Management

END OF SECTION 01 74 19
PART 1 - GENERAL

1.01 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.

1.02 SUMMARY

A. This Section includes administrative and procedural requirements for contract closeout, including, but not limited to, the following:
1. Inspection procedures.
2. Warranties.
3. Final cleaning.

B. Related Sections include the following:
1. Division 01 Section "Payment Procedures" for requirements for Applications for Payment for Substantial and Final Completion.
2. Division 01 Section "Execution Requirements" for progress cleaning of Project site.
3. Divisions 02 through 49 Sections for specific closeout and special cleaning requirements for the Work in those Sections.

1.03 SUBSTANTIAL COMPLETION

A. Preliminary Procedures: Before requesting inspection for determining date of Substantial Completion, complete the following. List items below that are incomplete in request.
1. Prepare a list of items to be completed and corrected (punch list), the value of items on the list, and reasons why the Work is not complete.
2. Advise Owner of pending insurance changeover requirements.
3. Submit specific warranties, workmanship bonds, maintenance service agreements, final certifications, and similar documents.
4. Obtain and submit releases permitting Owner unrestricted use of the Work and access to services and utilities. Include occupancy permits, operating certificates, and similar releases.
5. Make final changeover of permanent locks and deliver keys to Owner. Advise Owner's personnel of changeover in security provisions.
6. Complete startup testing of systems.
7. Submit test/adjust/balance records.
8. Terminate and remove temporary facilities from Project site, along with mockups, construction tools, and similar elements.
9. Submit changeover information related to Owner's occupancy, use, operation, and maintenance.
10. Complete final cleaning requirements, including touchup painting.
11. Touch up and otherwise repair and restore marred exposed finishes to eliminate visual defects.
B. Inspection: Submit a written request for inspection for Substantial Completion. On receipt of request, Architect will either proceed with inspection or notify Contractor of unfulfilled requirements. Architect will prepare the Certificate of Substantial Completion after inspection or will notify Contractor of items, either on Contractor's list or additional items identified by Architect, that must be completed or corrected before certificate will be issued.
1. Re-inspection: Request re-inspection when the Work identified in previous inspections as incomplete is completed or corrected.
2. Results of completed inspection will form the basis of requirements for Final Completion.

1.04 FINAL COMPLETION

A. Preliminary Procedures: Before requesting final inspection for determining date of Final Completion, complete the following:
1. Submit a final Application for Payment according to Division 01 Section "Payment Procedures".
2. Submit certified copy of Architect's Substantial Completion inspection list of items to be completed or corrected (punch list), endorsed and dated by Architect. The certified copy of the list shall state that each item has been completed or otherwise resolved for acceptance.
3. Instruct Owner's personnel in operation, adjustment, and maintenance of products, equipment, and systems. Submit demonstration and training videotapes.

B. Inspection: Submit a written request for final inspection for acceptance. On receipt of request, Architect will either proceed with inspection or notify Contractor of unfulfilled requirements. Architect will prepare a final Certificate for Payment after inspection or will notify Contractor of construction that must be completed or corrected before certificate will be issued.
1. Reinspection: Request reinspection when the Work identified in previous inspections as incomplete is completed or corrected.

1.05 LIST OF INCOMPLETE ITEMS (PUNCH LIST)

A. Preparation: Submit three copies of list. Include name and identification of each space and area affected by construction operations for incomplete items and items needing correction including, if necessary, areas disturbed by Contractor that are outside the limits of construction.
1. Organize list of spaces in sequential order, starting with exterior areas first and proceeding from lowest floor to highest floor.
2. Organize items applying to each space by major element, including categories for ceiling, individual walls, floors, equipment, and building systems.
3. Include the following information at the top of each page:
   a. Project name.
   b. Date.
   c. Name of Contractor.
   d. Page number.

1.06 WARRANTIES

A. Submittal Time: Submit written warranties on request of Architect for designated portions of the Work where commencement of warranties other than date of Substantial Completion is indicated.
B. Partial Occupancy: Submit properly executed warranties within 15 days of completion of designated portions of the Work that are completed and occupied or used by Owner during construction period by separate agreement with Contractor.

C. Organize warranty documents into an orderly sequence based on the table of contents of the Project Manual.
1. Bind warranties and bonds in heavy-duty, 3-ring, vinyl-covered, loose-leaf binders, thickness as necessary to accommodate contents, and sized to receive 8-1/2-by-11-inch (216-by-279-mm) paper.
2. Provide heavy paper dividers with plastic-covered tabs for each separate warranty. Mark tab to identify the product or installation. Provide a typed description of the product or installation, including the name of the product and the name, address, and telephone number of Installer.
3. Identify each binder on the front and spine with the typed or printed title "WARRANTIES," Project name, and name of Contractor.

D. Provide additional copies of each warranty to include in operation and maintenance manuals.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Cleaning Agents: Use cleaning materials and agents recommended by manufacturer or fabricator of the surface to be cleaned. Do not use cleaning agents that are potentially hazardous to health or property or that might damage finished surfaces.

PART 3 - EXECUTION

3.01 FINAL CLEANING

A. General: Provide final cleaning. Conduct cleaning and waste-removal operations to comply with local laws and ordinances and Federal and local environmental and antipollution regulations.

B. Cleaning: Employ experienced workers or professional cleaners for final cleaning. Clean each surface or unit to condition expected in an average commercial building cleaning and maintenance program. Comply with manufacturer's written instructions.
1. Complete the following cleaning operations before requesting inspection for certification of Substantial Completion for entire Project or for a portion of Project:
   a. Remove tools, construction equipment, machinery, and surplus material from Project site.
   b. Clean exposed hard-surfaced finishes to a dirt-free condition, free of stains, films, and similar foreign substances. Restore reflective surfaces to their original condition.
   c. Remove debris and surface dust from limited access spaces, including plenums, shafts, equipment vaults, manholes, attics, and similar spaces.
   d. Vacuum carpet and similar soft surfaces, removing debris and excess nap; shampoo if visible soil or stains remain.
   e. Clean transparent materials, including mirrors and glass in doors and windows. Remove glazing compounds and other noticeable, vision-obscuring materials. Replace chipped or broken glass and other damaged
transparent materials. Polish mirrors and glass, taking care not to scratch surfaces.

f. Remove labels that are not permanent.

g. Touch up and otherwise repair and restore marred, exposed finishes and surfaces. Replace finishes and surfaces that cannot be satisfactorily repaired or restored or that already show evidence of repair or restoration.

1) Do not paint over "UL" and similar labels, including mechanical and electrical nameplates.

h. Wipe surfaces of mechanical and electrical equipment and similar equipment. Remove excess lubrication, paint and mortar droppings, and other foreign substances.

i. Clean plumbing fixtures to a sanitary condition, free of stains, including stains resulting from water exposure.

j. Replace disposable air filters and clean permanent air filters. Clean exposed surfaces of diffusers, registers, and grills.

k. Clean light fixtures, lamps, globes, and reflectors to function with full efficiency. Replace burned-out bulbs, and those noticeably dimmed by hours of use, and defective and noisy starters in fluorescent and mercury vapor fixtures to comply with requirements for new fixtures.

l. Leave Project clean and ready for occupancy.

C. Comply with safety standards for cleaning. Do not burn waste materials. Do not bury debris or excess materials on Owner's property. Do not discharge volatile, harmful, or dangerous materials into drainage systems. Remove waste materials from Project site and dispose of lawfully.

END OF SECTION 01 77 00
PART 1 - GENERAL

1.01 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.

1.02 SUMMARY

A. This Section includes administrative and procedural requirements for preparing operation and maintenance manuals, including the following:
   1. Operation manuals for systems, subsystems, and equipment.
   2. Maintenance manuals for the care and maintenance of products, materials, and finishes, and systems and equipment.

B. Related Sections include the following:
   1. Division 01 Section "Submittal Procedures" for submitting copies of submittals for operation and maintenance manuals.
   2. Division 01 Section "Closeout Procedures" for submitting operation and maintenance manuals.
   3. Divisions 02 through 49 Sections for specific operation and maintenance manual requirements for the Work in those Sections.

1.03 DEFINITIONS

A. System: An organized collection of parts, equipment, or subsystems united by regular interaction.

B. Subsystem: A portion of a system with characteristics similar to a system.

1.04 SUBMITTALS

A. Final Submittal: Submit one copy of each manual in final form at least 15 days before final inspection. Architect will return copy with comments within 15 days after final inspection.
   1. Correct or modify each manual to comply with Architect's comments. Submit 3 copies of each corrected manual within 15 days of receipt of Architect's comments.

1.05 COORDINATION

A. Where operation and maintenance documentation includes information on installations by more than one factory-authorized service representative, assemble and coordinate information furnished by representatives and prepare manuals.
PART 2 - PRODUCTS

2.01 MANUALS, GENERAL

A. Organization: Unless otherwise indicated, organize each manual into a separate section for each system and subsystem, and a separate section for each piece of equipment not part of a system. Each manual shall contain the following materials, in the order listed:
   1. Title page.
   2. Table of contents.

B. Title Page: Enclose title page in transparent plastic sleeve. Include the following information:
   1. Subject matter included in manual.
   2. Name and address of Project.
   3. Name, address, and telephone number of Contractor.
   4. Cross-reference to related systems in other operation and maintenance manuals.

C. Table of Contents: List each product included in manual, identified by product name, indexed to the content of the volume, and cross-referenced to Specification Section number in Project Manual.
   1. If operation or maintenance documentation requires more than one volume to accommodate data, include comprehensive table of contents for all volumes in each volume of the set.

D. Manual Contents: Organize into sets of manageable size. Arrange contents alphabetically by system, subsystem, and equipment. If possible, assemble instructions for subsystems, equipment, and components of one system into a single binder.
   1. Binders: Heavy-duty, 3-ring, vinyl-covered, loose-leaf binders, in thickness necessary to accommodate contents, sized to hold 8-1/2-by-11-inch (216-by-279-mm) paper; with clear plastic sleeve on spine to hold label describing contents and with pockets inside covers to hold folded oversize sheets.
      a. If two or more binders are necessary to accommodate data of a system, organize data in each binder into groupings by subsystem and related components. Cross-reference other binders if necessary to provide essential information for proper operation or maintenance of equipment or system.
      b. Identify each binder on front and spine, with printed title "OPERATION AND MAINTENANCE MANUAL," Project title or name, and subject matter of contents. Indicate volume number for multiple-volume sets.
   2. Dividers: Heavy-paper dividers with plastic-covered tabs for each section. Mark each tab to indicate contents. Include typed list of products and major components of equipment included in the section on each divider, cross-referenced to Specification Section number and title of Project Manual.
   3. Protective Plastic Sleeves: Transparent plastic sleeves designed to enclose diagnostic software diskettes for computerized electronic equipment.
   5. Drawings: Attach reinforced, punched binder tabs on drawings and bind with text.
      a. If oversize drawings are necessary, fold drawings to same size as text pages and use as foldouts.
      b. If drawings are too large to be used as foldouts, fold and place drawings in labeled envelopes and bind envelopes in rear of manual. At appropriate
2.02 OPERATION MANUALS

A. Content: In addition to requirements in this Section, include operation data required in individual Specification Sections and the following information:
1. System, subsystem, and equipment descriptions.
2. Performance and design criteria if Contractor is delegated design responsibility.
3. Operating standards.
4. Operating procedures.
5. Wiring diagrams.
6. Control diagrams.
7. Piped system diagrams.
8. Precautions against improper use.
9. License requirements including inspection and renewal dates.

B. Descriptions: Include the following:
1. Product name and model number.
2. Manufacturer's name.
3. Equipment identification with serial number of each component.
4. Equipment function.
5. Operating characteristics.
6. Limiting conditions.
7. Complete nomenclature and number of replacement parts.

C. Operating Procedures: Include the following, as applicable:
1. Startup procedures.
2. Routine and normal operating instructions.
3. Regulation and control procedures.
4. Instructions on stopping.
5. Normal shutdown instructions.
6. Seasonal and weekend operating instructions.
7. Required sequences for electric or electronic systems.
8. Special operating instructions and procedures.

D. Systems and Equipment Controls: Describe the sequence of operation, and diagram controls as installed.

E. Piped Systems: Diagram piping as installed, and identify color-coding where required for identification.

2.03 PRODUCT MAINTENANCE MANUAL

A. Content: Organize manual into a separate section for each product, material, and finish. Include source information, product information, maintenance procedures, repair materials and sources, and warranties and bonds, as described below.

B. Source Information: List each product included in manual, identified by product name and arranged to match manual's table of contents. For each product, list name, address, and telephone number of Installer or supplier and maintenance service agent, and cross-reference Specification Section number and title in Project Manual.

C. Product Information: Include the following, as applicable:
1. Product name and model number.
2. Manufacturer's name.
3. Color, pattern, and texture.
4. Reordering information for specially manufactured products.

D. Maintenance Procedures: Include manufacturer's written recommendations and the following:
1. Inspection procedures.
2. Types of cleaning agents to be used and methods of cleaning.
3. List of cleaning agents and methods of cleaning detrimental to product.
4. Schedule for routine cleaning and maintenance.
5. Repair instructions.

E. Repair Materials and Sources: Include lists of materials and local sources of materials and related services.

F. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.
1. Include procedures to follow and required notifications for warranty claims.

2.04 SYSTEMS AND EQUIPMENT MAINTENANCE MANUAL

A. Content: For each system, subsystem, and piece of equipment not part of a system, include source information, manufacturers' maintenance documentation, maintenance procedures, maintenance and service schedules, spare parts list and source information, maintenance service contracts, and warranty and bond information, as described below.

B. Source Information: List each system, subsystem, and piece of equipment included in manual, identified by product name and arranged to match manual's table of contents. For each product, list name, address, and telephone number of Installer or supplier and maintenance service agent, and cross-reference Specification Section number and title in Project Manual.

C. Manufacturers' Maintenance Documentation: Manufacturers' maintenance documentation including the following information for each component part or piece of equipment:
1. Standard printed maintenance instructions and bulletins.
2. Drawings, diagrams, and instructions required for maintenance, including disassembly and component removal, replacement, and assembly.
3. Identification and nomenclature of parts and components.
4. List of items recommended to be stocked as spare parts.

D. Maintenance Procedures: Include the following information and items that detail essential maintenance procedures:
1. Troubleshooting guide.
2. Precautions against improper maintenance.
3. Demonstration and training videotape, if available.

E. Maintenance and Service Schedules: Include service and lubrication requirements, list of required lubricants for equipment, and separate schedules for preventive and routine maintenance and service with standard time allotment.
1. Scheduled Maintenance and Service: Tabulate actions for daily, weekly, monthly, quarterly, semiannual, and annual frequencies.
2. Maintenance and Service Record: Include manufacturers' forms for recording maintenance.
F. Spare Parts List and Source Information: Include lists of replacement and repair parts, with parts identified and cross-referenced to manufacturers' maintenance documentation and local sources of maintenance materials and related services.

G. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.
   1. Include procedures to follow and required notifications for warranty claims.

PART 3 - EXECUTION

3.01 MANUAL PREPARATION

A. Product Maintenance Manual: Assemble a complete set of maintenance data indicating care and maintenance of each product, material, and finish incorporated into the Work.

B. Operation and Maintenance Manuals: Assemble a complete set of operation and maintenance data indicating operation and maintenance of each system, subsystem, and piece of equipment not part of a system.
   1. Engage a factory-authorized service representative to assemble and prepare information for each system, subsystem, and piece of equipment not part of a system.
   2. Prepare a separate manual for each system and subsystem, in the form of an instructional manual for use by Owner's operating personnel.

C. Manufacturers' Data: Where manuals contain manufacturers' standard printed data, include only sheets pertinent to product or component installed. Mark each sheet to identify each product or component incorporated into the Work. If data include more than one item in a tabular format, identify each item using appropriate references from the Contract Documents. Identify data applicable to the Work and delete references to information not applicable.
   1. Prepare supplementary text if manufacturers' standard printed data are not available and where the information is necessary for proper operation and maintenance of equipment or systems.

D. Drawings: Prepare drawings supplementing manufacturers' printed data to illustrate the relationship of component parts of equipment and systems and to illustrate control sequence and flow diagrams. Coordinate these drawings with information contained in Record Drawings to ensure correct illustration of completed installation.
   1. Do not use original Project Record Documents as part of operation and maintenance manuals.
   2. Comply with requirements of newly prepared Record Drawings in Division 01 Section "Project Record Documents".

E. Comply with Division 01 Section "Closeout Procedures" for schedule for submitting operation and maintenance documentation.
PART 1 - GENERAL

1.01 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.

1.02 SUMMARY

A. This Section includes administrative and procedural requirements for Project Record Documents, including the following:
   1. Record Drawings.
   2. Record Specifications.

B. Related Sections include the following:
   1. Division 01 Section "Project Management and Coordination" for submitting and distributing electronic project record documents.
   2. Electronic Data Release Form, following Division 01 Section "Submittal Procedures" for the form that must be completed before CAD files will be released to the Contractor.
   3. Division 01 Section "Closeout Procedures" for general closeout procedures.
   4. Division 01 Section "Operation and Maintenance Data" for operation and maintenance manual requirements.
   5. Divisions 02 through 49 Sections for specific requirements for Project Record Documents of the Work in those Sections.

1.03 SUBMITTALS

A. Record Drawings: Comply with the following:
   1. Number of Copies: Submit copies of Record Drawings as follows:
      a. Initial Submittal: Submit one set of marked-up Record Prints. Architect will initial and date each drawing and mark whether general scope of changes, additional information recorded, and quality of drafting are acceptable. Architect will return prints for organizing into sets, printing, binding, and final submittal.
      b. Final Submittal: Submit three sets of marked-up Record Prints. Print each Drawing, whether or not changes and additional information were recorded.
      c. Final Submittal: Submit one set of marked-up Record Prints, one set of Record CAD Drawing files, one set of Record CAD Drawing plots, and three copies printed from record plots. Plot and print each Drawing, whether or not changes and additional information were recorded.
      1) Electronic Media: CD-R.

B. Record Specifications: Submit one copy of Project's Specifications, including addenda and contract modifications.
PART 2 - PRODUCTS

2.01 RECORD DRAWINGS

A. Record Prints: Maintain one set of blue- or black-line white prints of the Contract Drawings and Shop Drawings.

1. Preparation: Mark Record Prints to show the actual installation where installation varies from that shown originally. Require individual or entity who obtained record data, whether individual or entity is Installer, subcontractor, or similar entity, to prepare the marked-up Record Prints.
   a. Give particular attention to information on concealed elements that would be difficult to identify or measure and record later.
   b. Accurately record information in an understandable drawing technique.
   c. Record data as soon as possible after obtaining it. Record and check the markup before enclosing concealed installations.

2. Content: Types of items requiring marking include, but are not limited to, the following:
   a. Dimensional changes to Drawings.
   b. Revisions to details shown on Drawings.
   c. Depths of foundations below first floor.
   d. Locations and depths of underground utilities.
   e. Revisions to routing of piping and conduits.
   f. Revisions to electrical circuitry.
   g. Actual equipment locations.
   h. Duct size and routing.
   i. Locations of concealed internal utilities.
   j. Changes made by Change Order or Construction Change Directive.
   k. Changes made following Architect's written orders.

3. Mark the Contract Drawings or Shop Drawings, whichever is most capable of showing actual physical conditions, completely and accurately. If Shop Drawings are marked, show cross-reference on the Contract Drawings.

4. Mark record sets with erasable, red-colored pencil. Use other colors to distinguish between changes for different categories of the Work at same location.

5. Mark important additional information that was either shown schematically or omitted from original Drawings.

6. Note Construction Change Directive numbers, alternate numbers, Change Order numbers, and similar identification, where applicable.

B. Newly-Prepared Record Drawings: Prepare new Drawings instead of preparing Record Drawings where Architect determines that neither the original Contract Drawings nor Shop Drawings are suitable to show actual installation.

1. New Drawings may be required when a Change Order is issued as a result of accepting an alternate, substitution, or other modification.

2. Consult Architect for proper scale and scope of detailing and notations required to record the actual physical installation and its relation to other construction. Integrate newly prepared Record Drawings into Record Drawing sets; comply with procedures for formatting, organizing, copying, binding, and submitting.

C. Format: Identify and date each Record Drawing; include the designation "PROJECT RECORD DRAWING" in a prominent location.

1. Record Prints: Organize Record Prints and newly prepared Record Drawings into manageable sets. Bind each set with durable paper cover sheets. Include identification on cover sheets.
2. Record Transparencies: Organize into unbound sets matching Record Prints. Place transparencies in durable tube-type drawing containers with end caps. Mark end cap of each container with identification. If container does not include a complete set, identify Drawings included.

3. Identification: As follows:
   a. Project name.
   b. Date.
   c. Designation "PROJECT RECORD DRAWINGS."
   d. Name of Architect.
   e. Name of Contractor.

2.02 RECORD SPECIFICATIONS

A. Preparation: Mark Specifications to indicate the actual product installation where installation varies from that indicated in Specifications, addenda, and contract modifications.
   1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
   2. Mark copy with the proprietary name and model number of products, materials, and equipment furnished, including substitutions and product options selected.
   3. Record the name of manufacturer, supplier, Installer, and other information necessary to provide a record of selections made.
   4. For each principal product, indicate whether Record Product Data has been submitted in operation and maintenance manuals instead of submitted as Record Product Data.
   5. Note related Change Orders and Record Drawings where applicable.

2.03 ELECTRONIC DOCUMENTS RECORD SUBMITTALS

A. Provide 2 copies of all electronic documents issued or transmitted during the course of construction, recorded on DVD-ROM. These documents shall include all submittals, RFIs, payment requests, progress schedules and charts, coordination drawings and models, minutes of meetings, records of telephone calls, e-mails, letters, and transmittals generated by the Construction Manager, all of the contractors, subcontractors, and suppliers, the Architect and the Architect’s consultants, and the Owner and the Owner’s consultants and other advisors. Only those documents that were distributed using the Construction Manager’s project management software or project-specific web site need be provided on DVD-ROM.

2.04 MISCELLANEOUS RECORD SUBMITTALS

A. Assemble miscellaneous records required by other Specification Sections for miscellaneous record keeping and submittal in connection with actual performance of the Work. Bind or file miscellaneous records and identify each, ready for continued use and reference.

PART 3 - EXECUTION

3.01 RECORDING AND MAINTENANCE

A. Recording: Maintain one copy of each submittal during the construction period for Project Record Document purposes. Post changes and modifications to Project Record Documents as they occur; do not wait until the end of Project.
B. Maintenance of Record Documents and Samples: Store Record Documents and Samples in the field office apart from the Contract Documents used for construction. Do not use Project Record Documents for construction purposes. Maintain Record Documents in good order and in a clean, dry, legible condition, protected from deterioration and loss. Provide access to Project Record Documents for Architect's reference during normal working hours.

END OF SECTION 01 78 39
PART 1 - GENERAL

1.01 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.

1.02 SUMMARY

A. This Section includes administrative and procedural requirements for instructing Owner's personnel, including the following:
   1. Demonstration of operation of systems, subsystems, and equipment.
   2. Training in operation and maintenance of systems, subsystems, and equipment.
   3. Demonstration and training videos.

B. See Divisions 02 through 49 Sections for specific requirements for demonstration and training for products in those Sections.

1.03 SUBMITTALS

A. Instruction Program: Submit two copies of outline of instructional program for demonstration and training, including a schedule of proposed dates, times, length of instruction time, and instructors' names for each training module. Include learning objective and outline for each training module.

B. Demonstration and Training Videos: Submit DVD file or two copies within seven days of end of each training module.

1.04 QUALITY ASSURANCE

A. Facilitator Qualifications: A firm or individual experienced in training or educating maintenance personnel in a training program similar in content and extent to that indicated for this Project, and whose work has resulted in training or education with a record of successful learning performance.

B. Instructor Qualifications: A factory-authorized service representative, complying with requirements in Division 01 Section "Quality Requirements," experienced in operation and maintenance procedures and training.

C. Coordinate content of training modules with content of approved emergency, operation, and maintenance manuals. Do not submit instruction program until operation and maintenance data has been reviewed and approved by Architect.
PART 2 - PRODUCTS

2.01 INSTRUCTION PROGRAM

A. Program Structure: Develop an instruction program that includes individual training modules for each system and equipment not part of a system, as required by individual Specification Sections.

B. Training Modules: Develop a learning objective and teaching outline for each module. Include a description of specific skills and knowledge that participant is expected to master. For each module, include instruction for the following:
1. Basis of System Design, Operational Requirements, and Criteria: Include system and equipment descriptions, operating standards, regulatory requirements, equipment function, operating characteristics, limiting conditions, and performance curves.
2. Documentation: Review emergency, operations, and maintenance manuals; Project Record Documents; identification systems; warranties and bonds; and maintenance service agreements.
3. Emergencies: Include instructions on stopping; shutdown instructions; operating instructions for conditions outside normal operating limits; instructions on meaning of warnings, trouble indications, and error messages; and required sequences for electric or electronic systems.
4. Operations: Include startup, break-in, control, and safety procedures; stopping and normal shutdown instructions; routine, normal, seasonal, and weekend operating instructions; operating procedures for emergencies and equipment failure; and required sequences for electric or electronic systems.
5. Adjustments: Include alignments and checking, noise, vibration, economy, and efficiency adjustments.
6. Troubleshooting: Include diagnostic instructions and test and inspection procedures.
7. Maintenance: Include inspection procedures, types of cleaning agents, methods of cleaning, procedures for preventive and routine maintenance, and instruction on use of special tools.
8. Repairs: Include diagnosis, repair, and disassembly instructions; instructions for identifying parts; and review of spare parts needed for operation and maintenance.

PART 3 - EXECUTION

3.01 INSTRUCTION

A. Facilitator: Engage a qualified facilitator to prepare instruction program and training modules, to coordinate instructors, and to coordinate between Contractor and Owner for number of participants, instruction times, and location.

B. Engage qualified instructors to instruct Owner's personnel to adjust, operate, and maintain systems, subsystems, and equipment not part of a system.
1. Owner will furnish an instructor to describe Owner's operational philosophy.

C. Scheduling: Provide instruction at mutually agreed on times. For equipment that requires seasonal operation, provide similar instruction at start of each season.
1. Schedule training with Owner with at least seven days' advance notice.
D. Evaluation: At conclusion of each training module, assess and document each participant's mastery of module by use of a demonstration performance-based test.

3.02 DEMONSTRATION AND TRAINING VIDEOS

A. General: Engage a qualified commercial photographer to record demonstration and training videos. Record each training module separately. Include classroom instructions and demonstrations, board diagrams, and other visual aids, but not student practice.
   1. At beginning of each training module, record each chart containing learning objective and lesson outline.

B. Video Format: For DVD format, provide high-quality color DVDs in full-size DVD cases with descriptive labels on both the discs and the cases.

C. Narration: Describe scenes on video by dubbing audio narration off-site after video is recorded. Include description of items being viewed. Describe vantage point, indicating location, direction (by compass point), and elevation or story of construction.

END OF SECTION 01 79 00
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. This Section defines the volatile organic compound (VOC) content limits for the adhesives, sealants, paints and architectural coatings used in the project. Chemical component limitations are also defined for some categories of paint and primer.

1.03 RELATED SECTIONS

A. Division 01 Section “Sustainable Design Requirements”.

B. Specifications in Divisions 02 through 49 with field-applied adhesive, sealant coating or paint used in interior applications.

1.04 REFERENCE STANDARDS AND REGULATORY REQUIREMENTS

A. General: Rules and regulations of other jurisdictions are cited as the reference standard for certain types of pollutants. These reference standards are fully applicable to the Work even though the project is not located in those jurisdictions.


D. “Green Seal Standard for Architectural Coating” (GS-11), plus “Green Seal Standard for Anti-Corrosive Paints” (GC-03).


1.05 GREEN BUILDING GENERAL REQUIREMENTS

A. Specific project goals which may impact this and the other sections of this specification include: use of recycled-content materials; use of locally-manufactured materials; use of low-emitting materials; use of certified wood products; construction waste recycling; and the implementation of a construction indoor air quality management plan. The Contractor shall ensure that the requirements related to these goals, as defined in the sections below and in related sections of the contract documents, are implemented to the fullest extent.
Substitutions, or other changes to the work proposed by the Contractor or their Subcontractors, shall not be allowed if such changes compromise the stated GREEN BUILDING Performance Criteria.

1.06 VOC REQUIREMENTS FOR ADHESIVES

A. The volatile organic compound (VOC) content of adhesives, adhesive bonding primers, or adhesive primers used in this project shall not exceed the limits defined in Rule 1168 – “Adhesive and Sealant Applications” of the South Coast Air Quality Management District (SCAQMD), of the State of California.

B. VOC content of aerosol adhesives shall not exceed the limits defined in the Green Seal Standard for Commercial Adhesives GS-36, requirements in effect October 19, 2000.

C. The VOC limits defined by SCAQMD (based on 1/7/05 amendments) are as follows. All VOC limits are defined in grams per liter, less water and less exempt compounds.

D. General: Unless otherwise specified below, the VOC content of all adhesives, adhesive bonding primers, or adhesive primers shall not be in excess of 250 grams per liter.

E. For specified applications, the allowable VOC content is as follows:

1. Architectural Applications:

   a. Indoor carpet adhesive 50
   b. Carpet pad adhesive 50
   c. Outdoor carpet adhesive 150
   d. Wood flooring adhesive 100
   e. Rubber floor adhesive 60
   f. Sub-floor adhesive 50
   g. Ceramic tile adhesive 65
   h. VCT and asphalt tile adhesive 50
   i. Drywall and panel adhesive 50
   j. Cove base adhesive 50
   k. Multipurpose construction adhesive 70
   l. Structural glazing adhesive 100
   m. Single ply roof membrane adhesives 250

2. Specialty Applications:

   a. PVC welding 150
   b. CPVC welding 490
   c. ABS welding 325
   d. Plastic cement welding 250
   e. Adhesive primer for plastic 550
   f. Contact Adhesive 80
   g. Special Purpose Contact Adhesive 250
   h. Adhesive Primer for Traffic Marking Tape 150
   i. Structural Wood Member Adhesive 140
   j. Sheet Applied Rubber Lining Operations 850

3. Substrate Specific Applications:

   a. Metal to metal 30
   b. Plastic foams 50
   c. Porous material (except wood) 50
   d. Wood 30
   e. Fiberglass 80

F. If an adhesive is used to bond dissimilar substrates together, the adhesive with the highest VOC content shall be allowed.
G. VOC limits for Aerosol Adhesives (defined as percentage of VOC weight in grams per liter less water)
1. General purpose mist spray  65% VOCs by weight
2. General purpose web spray  55% VOCs by weight
3. Special purpose aerosol adhesives (all types)  70% VOCs by weight

1.07 REQUIREMENTS FOR SEALANTS

A. The VOC content of sealants or sealant primers used in this project shall not exceed the limits defined in Rule 1168 – “Adhesives and Sealant Applications” of the South Coast Air Quality Management District (SCAQMD).

B. The VOC limits defined by SCAQMD Rule 1168. All VOC limits are defined in grams per liter, less exempt compounds.

1. Sealants:
   a. Architectural  250
   b. Marine Deck  760
   c. Roadways  250
   d. Single Ply Roof Material Installation/Repair  450
   e. Non-membrane Roof Installation/Repair  300
   f. Other  420

2. Sealant Primer:
   a. Architectural – Nonporous  250
   b. Architectural – Porous  775
   c. Other  750

1.08 VOC LIMIT REQUIREMENTS FOR PAINTS

A. Paints and Primers (Non-specialized applications): Paints and primers used in non-specialized interior and exterior applications shall meet the VOC and chemical component limitations of the Green Seal Paint Standard GS-11, and anti-corrosive paints (those used in preventing the corrosion of ferrous metal substrates) shall meet the VOC and chemical component limitations of Green Seal Standard GC-03 of Green Seal, Inc., Washington, DC. Product-specific environmental requirements are as follows:

1. VOC concentrations (in grams per liter) of the product shall not exceed those listed below as determined by U. S. Environmental Protection Agency (EPA) Reference Test Method 24.

2. Interior Coatings:
   a. Non-flat:  150
   b. Flat:  50

3. Interior Anti-Corrosive Paints:
   a. Gloss  250
   b. Semi-gloss  250
   c. Flat  250

4. Exterior Coatings:
   a. Non-flat:  200
   b. Flat  100

5. The calculation of VOC shall exclude water and tinting color added at the point of sale.

6. Chemical Component Limitations - Aromatic Compounds: the product must contain no more than 1.0% by weight of the sum total of aromatic compounds. Testing for the concentration of these compounds will be performed if they are determined to be present in the product during a materials audit.
7. Chemical Component Limitations - Other Chemicals: the manufacturer shall demonstrate that the following chemical compounds are not used as ingredients in the manufacture of the product.
   a. Halomethanes: methylene chloride
   b. Chlorinated ethanes: 1,1,1-trichloroethane
   c. Aromatic solvents: benzene, toluene (methylbenzene), ethylbenzene
   d. Chlorinated ethylenes: vinyl chloride
   e. Polynuclear aromatics: naphthalene
   f. Chlorobenzenes: 1,2-dichlorobenzene
   g. Phthalate esters: di (2-ethylhexyl) phthalate, butyl benzyl phthalate, di-n-butyl phthalate, di-n-octyl phthalate, diethyl phthalate, dimethyl phthalate
   h. Miscellaneous semi-volatile organics: isophorone
   i. Metals and their compounds: antimony, cadmium, hexavalent chromium, lead, mercury
   j. Preservatives (antifouling agents): formaldehyde
   k. Ketones: methyl ethyl ketone, methyl isobutyl ketone
   l. Miscellaneous volatile organics: acrolein, acrylonitrile

B. Paints and other Architectural Coatings (Specialized applications): Paints and other architectural coatings used in specialized interior and exterior applications (as defined below) shall meet the VOC limitations defined in Rule 1113, “Architectural Coatings” of SCAQMD, of the State of California. The VOC limits defined by SCAQMD, based on 7/9/04 amendments, are as follows. VOC limits are defined in grams per liter, less water and less exempt compounds.
   1. Bond Breakers: 350
   2. Clear Wood Finishes
      a. Varnish 275
      b. Sanding Sealers: 275
      c. Lacquer: 275
   3. Clear Brushing Lacquer: 275
   4. Concrete-Curing Compounds: 350
   5. Dry-Fog Coatings: 400
   6. Fire-Proofing Exterior Coatings: 350
   7. Fire-Retardant Coatings
      a. Clear: 650
      b. Pigmented: 350
   8. Floor Coatings: 50
   9. Graphic Arts (Sign) Coatings: 500
   10. Industrial Maintenance (IM) Coatings: 100
       a. High Temperature IM Coatings: 420
       b. Zinc-Rich IM Primers: 100
   12. Low-solids Coatings: 120
   13. Magnesite Cement Coatings: 450
   14. Mastic Coatings: 300
   15. Metallic Pigmented Coatings: 500
   16. Multi-Color Coatings: 250
   17. Pigmented Lacquer: 275
   18. Pre-Treatment Wash Primers: 420
   19. Primers, Sealers, and Undercoaters: 100
   20. Quick-Dry Enamels: 250 (50 after 7/1/06)
   21. Quick-Dry Primers, Sealers, and Undercoaters: 100
   22. Recycled Coatings: 250

Harlem Hospital
MDF & Data Closet Upgrade Phase 1
GW #18011
LIMITS ON VOCs
01 81 15 - 4
January 11, 2019
23. Roof Coatings: 50
24. Roof Coatings, Aluminum: 100
25. Roof Primers, Bituminous: 350
26. Exterior Rust Preventative Coatings: 100
27. Shellac
   a. Clear: 730
   b. Pigmented: 550
28. Specialty Primers: 100
29. Stains: 100
30. Stains, Interior: 250
31. Swimming Pool Coatings
   a. Repair: 340
   b. Other: 340
32. Traffic Coatings: 150
33. Waterproofing Sealers: 100
34. Waterproofing Concrete/Masonry Sealers: 100
35. Wood Preservatives
   a. Below-Ground: 350
   b. Other: 350
36. Other Coating Types (not included in above): 250

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION 01 81 15
SECTION 061000 – MINOR ROUGH CARPENTRY

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. This Section includes the following:
   1. Wood blocking and nailers.
   2. Plywood backing panels.

B. Related Sections include Division 06 Section "Finish Carpentry" for nonstructural carpentry items exposed to view and not specified in another Section.

1.03 DEFINITIONS

A. Rough Carpentry: Carpentry work not specified in other Sections and not exposed, unless otherwise indicated.

B. Lumber grading agencies, and the abbreviations used to reference them, include the following:
   1. NELMA - Northeastern Lumber Manufacturers Association.
   2. NLGA - National Lumber Grades Authority.

1.04 SUBMITTALS

A. Product Data: For each type of process and factory-fabricated product. Indicate component materials and dimensions and include construction and application details.
   1. Include data for wood-preservative treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements. Indicate type of preservative used, net amount of preservative retained, and chemical treatment manufacturer's written instructions for handling, storing, installing, and finishing treated material.
   2. Include data for fire-retardant treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements. Include physical properties of treated materials, both before and after exposure to elevated temperatures when tested according to ASTM D 5516 and ASTM D 5664.
   3. For products receiving a waterborne treatment, include statement that moisture content of treated materials was reduced to levels specified before shipment to Project site.
   4. Include copies of warranties from chemical treatment manufacturers for each type of treatment.
1.05 QUALITY ASSURANCE

A. Testing Agency Qualifications: An independent testing agency, acceptable to authorities having jurisdiction, with the experience and capability to conduct the testing indicated, as documented according to ASTM E 548.

B. Source Limitations for Fire-Retardant-Treated Wood: Obtain each type of fire-retardant-treated wood product through one source from a single producer.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Stack lumber, plywood, and other panels; place spacers between each bundle to provide air circulation. Provide for air circulation around stacks and under coverings.

PART 2 - PRODUCTS

2.01 WOOD PRODUCTS, GENERAL

A. Lumber: DOC PS 20 and applicable rules of lumber grading agencies certified by the American Lumber Standards Committee Board of Review.
   1. Factory mark each piece of lumber with grade stamp of grading agency.
   2. For exposed lumber indicated to receive a stained or natural finish, mark grade stamp on end or back of each piece.
   3. 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 lumber.
   4. Provide dressed lumber, S4S, unless otherwise indicated.
   5. Provide dry lumber with 19 percent maximum moisture content at time of dressing for 2-inch nominal (38-mm actual) thickness or less, unless otherwise indicated.

B. Wood Structural Panels:
   1. Plywood: DOC PS 1.
   2. Oriented Strand Board: DOC PS 2.
   3. Thickness: As needed to comply with requirements specified but not less than thickness indicated.
   5. Factory mark panels according to indicated standard.

2.02 WOOD-PRESERVATIVE-TREATED MATERIALS

A. Preservative Treatment by Pressure Process: AWPA C2 (lumber) and AWPA C9 (plywood), except that lumber that is not in contact with the ground and is continuously protected from liquid water may be treated according to AWPA C31 with inorganic boron (SBX).
   1. Preservative Chemicals: Acceptable to authorities having jurisdiction and one of the following:
      a. Ammoniacal, or amine, copper quat (ACQ).
      b. Copper bis (dimethylthiocarbamate) (CDDC).
      c. Ammoniacal copper citrate (CC).
      d. Copper azole, Type A (CBA-A).
2. For exposed items indicated to receive a stained or natural finish, use chemical formulations that do not require incising, contain colorants, bleed through, or otherwise adversely affect finishes.

B. Kiln-dry material after treatment to a maximum moisture content of 19 percent for lumber and 15 percent for plywood. Do not use material that is warped or does not comply with requirements for untreated material.

C. Mark each treated item with the treatment quality mark of an inspection agency approved by the American Lumber Standards Committee Board of Review.
   1. For exposed lumber indicated to receive a stained or natural finish, mark end or back of each piece.

D. Application:
   1. Wood cants, nailers, curbs, equipment support bases, blocking, stripping, and similar members in connection with roofing, flashing, vapor barriers, and waterproofing.
   2. Wood sills, sleepers, blocking, furring, stripping, and similar concealed members in contact with masonry or concrete.

2.03 FIRE-RETARDANT-TREATED MATERIALS

A. General: Where fire-retardant-treated materials are indicated, provide materials that comply with performance requirements in AWPA C20 (lumber) and AWPA C27 (plywood). Identify fire-retardant-treated wood with appropriate classification marking of UL, U.S. Testing, Timber Products Inspection, or another testing and inspecting agency acceptable to authorities having jurisdiction.
   1. Use treatment for which chemical manufacturer publishes physical properties of treated wood after exposure to elevated temperatures, when tested by a qualified independent testing agency according to ASTM D 5664, for lumber and ASTM D 5516, for plywood.
   2. Use treatment that does not promote corrosion of metal fasteners.
   3. Use Exterior type for exterior locations and where indicated.
   4. Use Interior Type A High Temperature (HT), unless otherwise indicated.

B. For exposed items indicated to receive a stained or natural finish, use chemical formulations that do not bleed through, contain colorants, or otherwise adversely affect finishes.

2.04 DIMENSION LUMBER

A. General: Provide dimension lumber of grades indicated according to the American Lumber Standards Committee National Grading Rule provisions of the grading agency indicated.

2.05 MISCELLANEOUS LUMBER

A. General: Provide lumber for support or attachment of other construction, including the following:
   1. Blocking.
   2. Cants.
   4. Furring.
B. For items of dimension lumber size, provide Construction, Stud, or No. 2 grade lumber with 19 percent maximum moisture content and any of the following species:
   1. Hem-fir or Hem-fir (north); NLGA, WCLIB, or WWPA.
   2. Spruce-pine-fir (south) or Spruce-pine-fir; NELMA, NLGA, WCLIB, or WWPA.

C. For concealed boards, provide lumber with 19 percent maximum moisture content and the following species and grades:
   1. Northern species, No. 2 Common grade; NLGA.

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.

2.06 PLYWOOD BACKING PANELS

A. Telephone and Electrical Equipment Backing Panels: DOC PS 1, Exposure 1, C-D Plugged, fire-retardant treated, in thickness indicated or, if not indicated, not less than 1/2 inch(12.7 mm) thick.

2.07 FASTENERS

A. General: Provide fasteners of size and type indicated that comply with requirements specified in this Article for material and manufacture.
   1. Where rough carpentry is exposed to weather, in ground contact, or in area of high relative humidity, provide fasteners with hot-dip zinc coating complying with ASTM A 153/A 153M.
   2. For fasteners used with preservative-treated wood provide fasteners galvanized to meet requirements of ASTM A 653/A 653M, G90.

B. Nails, Brads, and Staples: ASTM F 1667.

C. Power-Driven Fasteners: CABO NER-272.

D. Wood Screws: ASME B18.6.1.

E. Screws for Fastening to Cold-Formed Metal Framing: ASTM C 954, except with wafer heads and reamer wings, length as recommended by screw manufacturer for material being fastened.

F. Lag Bolts: ASME B18.2.1. (ASME B18.2.3.8M).

G. Bolts: Steel bolts complying with ASTM A 307, Grade A (ASTM F 568M, Property Class 4.6); with ASTM A 563 (ASTM A 563M) hex nuts and, where indicated, flat washers.

H. Expansion Anchors: Anchor bolt and sleeve assembly of material indicated below with capability to sustain, without failure, a load equal to 6 times the load imposed when installed in unit masonry assemblies and equal to 4 times the load imposed when installed in concrete as determined by testing per ASTM E 488 conducted by a qualified independent testing and inspecting agency.
2.08 MISCELLANEOUS MATERIALS

A. Adhesives for Field Gluing Panels to Framing: Formulation complying with APA AFG-01 that is approved for use with type of construction panel indicated by both adhesive and panel manufacturers.
   1. Use adhesives that have a VOC content of 70 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

PART 3 - EXECUTION

3.01 INSTALLATION, GENERAL

A. Set rough carpentry to required levels and lines, with members plumb, true to line, cut, and fitted. Fit rough carpentry to other construction; scribe and cope as needed for accurate fit. Locate furring, nailers, blocking, and similar supports to comply with requirements for attaching other construction.

B. Do not use materials with defects that impair quality of rough carpentry or pieces that are too small to use with minimum number of joints or optimum joint arrangement.

C. Apply field treatment complying with AWPA M4 to cut surfaces of preservative-treated lumber and plywood.

D. Securely attach rough carpentry work to substrate by anchoring and fastening as indicated, complying with the following:
   1. CABO NER-272 for power-driven fasteners.
   2. Published requirements of metal framing anchor manufacturer.

E. Use common wire 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; predrill as required.

3.02 WOOD SLEEPER, BLOCKING, AND NAILER INSTALLATION

A. Install where indicated and where required for attaching other work. Form to shapes indicated and cut as required for true line and level of attached work. Coordinate locations with other work involved.

B. Attach items to substrates to support applied loading. Recess bolts and nuts flush with surfaces, unless otherwise indicated. Build anchor bolts into masonry during installation of masonry work. Where possible, secure anchor bolts to formwork before concrete placement.

END OF SECTION 06 10 00
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. Penetrations in fire-resistance-rated walls.
2. Penetrations in horizontal assemblies.
3. Penetrations in smoke barriers.
4. Design of penetration firestopping systems.

1.03 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

B. Product Schedule: For each penetration firestopping system. Include location and design designation of qualified testing and inspecting agency.
1. Where Project conditions require modification to a qualified testing and inspecting agency's illustration for a particular penetration firestopping condition, submit illustration, with modifications marked, approved by penetration firestopping manufacturer's fire-protection engineer as an engineering judgment or equivalent fire-resistance-rated assembly.

1.04 INFORMATIONAL SUBMITTALS

A. Installer Certificates: From Installer indicating penetration firestopping has been installed in compliance with requirements and manufacturer's written recommendations.

B. Product test reports.

1.05 QUALITY ASSURANCE

A. Installer Qualifications: A firm that has been approved by FM Global according to FM Global 4991, "Approval of Firestop Contractors," or been evaluated by UL and found to comply with its "Qualified Firestop Contractor Program Requirements."

B. Fire-Test-Response Characteristics: Penetration firestopping shall comply with the following requirements:
1. Penetration firestopping tests are performed by a qualified testing agency acceptable to authorities having jurisdiction.
2. Penetration firestopping is identical to those tested per testing standard referenced in "Penetration Firestopping" Article. Provide rated systems bearing marking of qualified testing and inspection agency.

C. Preinstallation Conference: Conduct conference at Project site.
2.01 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   2. Grace Construction Products.
   3. Hilti, Inc.
   6. NUCO Inc.
   8. RectorSeal Corporation.
   9. Specified Technologies Inc.
   10. Thermafiber, Inc.
   11. 3M Fire Protection Products.
   13. USG Corporation.

2.02 PENETRATION FIRESTOPPING

A. Provide penetration firestopping that is produced and installed to resist spread of fire according to requirements indicated, resist passage of smoke and other gases, and maintain original fire-resistance rating of construction penetrated. Penetration firestopping systems shall be compatible with one another, with the substrates forming openings, and with penetrating items if any.

B. Penetrations in Fire-Resistance-Rated Walls: Ratings determined per ASTM E 814 or UL 1479, based on testing at a positive pressure differential of 0.01-inch wg (2.49 Pa).
   1. F-Rating: Not less than the fire-resistance rating of constructions penetrated.

C. Penetrations in Horizontal Assemblies: Ratings determined per ASTM E 814 or UL 1479, based on testing at a positive pressure differential of 0.01-inch wg (2.49 Pa).
   1. F-Rating: At least 1 hour, but not less than the fire-resistance rating of constructions penetrated.
   2. T-Rating: At least 1 hour, but not less than the fire-resistance rating of constructions penetrated except for floor penetrations within the cavity of a wall.

D. Penetrations in Smoke Barriers: Provide penetration firestopping with ratings determined per UL 1479.
   1. L-Rating: Not exceeding 5.0 cfm/sq. ft. (0.025 cu. m/s per sq. m) of penetration opening at 0.30-inch wg (74.7 Pa) at both ambient and elevated temperatures.

E. Exposed Penetration Firestopping: Provide products with flame-spread and smoke-developed indexes of less than 25 and 450, respectively, as determined per ASTM E 84.

F. VOC Content: Penetration firestopping sealants and sealant primers shall comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24):
   1. Sealants: 250 g/L.
   2. Sealant Primers for Nonporous Substrates: 250 g/L.
   3. Sealant Primers for Porous Substrates: 775 g/L.
G. Low-Emitting Materials: Penetration firestopping sealants and sealant primers 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."

H. Accessories: Provide components for each penetration firestopping system that are needed to install fill materials and to maintain ratings required. Use only those components specified by penetration firestopping manufacturer and approved by qualified testing and inspecting agency for firestopping indicated.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Examine substrates and conditions, with Installer present, for compliance with requirements for opening configurations, penetrating items, substrates, and other conditions affecting performance of the Work.

B. Install penetration firestopping to comply with manufacturer's written installation instructions and published drawings for products and applications indicated.

C. Install forming materials and other accessories of types required to support fill materials during their application and in the position needed to produce cross-sectional shapes and depths required to achieve fire ratings indicated.
   1. After installing fill materials and allowing them to fully cure, remove combustible forming materials and other accessories not indicated as permanent components of firestopping.

D. Install fill materials for firestopping by proven techniques to produce the following results:
   1. Fill voids and cavities formed by openings, forming materials, accessories, and penetrating items as required to achieve fire-resistance ratings indicated.
   2. Apply materials so they contact and adhere to substrates formed by openings and penetrating items.
   3. For fill materials that will remain exposed after completing the Work, finish to produce smooth, uniform surfaces that are flush with adjoining finishes.

3.02 IDENTIFICATION

A. Identify penetration firestopping with preprinted metal or plastic labels. Attach labels permanently to surfaces adjacent to and within 6 inches (150 mm) of firestopping edge so labels will be visible to anyone seeking to remove penetrating items or firestopping. Use mechanical fasteners or self-adhering-type labels with adhesives capable of permanently bonding labels to surfaces on which labels are placed. Include the following information on labels:
   1. The words "Warning - Penetration Firestopping - Do Not Disturb. Notify Building Management of Any Damage."
   2. Contractor's name, address, and phone number.
   3. Designation of applicable testing and inspecting agency.
   4. Date of installation.
   5. Manufacturer's name.
   6. Installer's name.
A. Owner will engage a qualified testing agency to perform tests and inspections.

B. Where deficiencies are found or penetration firestopping is damaged or removed because of testing, repair or replace penetration firestopping to comply with requirements.

C. Proceed with enclosing penetration firestopping with other construction only after inspection reports are issued and installations comply with requirements.

END OF SECTION 07 84 13
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. Concealed building insulation.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated.
B. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for insulation products.
C. Research/Evaluation Reports: For foam-plastic insulation.

1.4 QUALITY ASSURANCE

A. Source Limitations: Obtain each type of building insulation through one source.
B. Fire-Test-Response Characteristics: Provide insulation and related materials with the fire-test-response characteristics indicated, as determined by testing identical products per test method indicated below by UL or another testing and inspecting agency acceptable to authorities having jurisdiction. Identify materials with appropriate markings of applicable testing and inspecting agency.


1.5 DELIVERY, STORAGE, AND HANDLING

A. Protect insulation materials from physical damage and from deterioration by 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.
B. Protect plastic insulation as follows:
   1. Do not expose to sunlight, except to extent necessary for period of installation and concealment.
2. Protect against ignition at all times. Do not deliver plastic insulating materials to Project site before installation time.
3. Complete installation and concealment of plastic materials as rapidly as possible in each area of construction.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

   a. Owens Corning

2.2 INSULATING MATERIALS

A. General: Provide insulating materials that comply with requirements and with referenced standards.

1. Preformed Units: Sizes to fit applications indicated; selected from manufacturer's standard thicknesses, widths, and lengths.

B. Extruded-Polystyrene Board Insulation: Build-up for concrete topping slab ASTM C 578, of type and density indicated below, with maximum flame-spread and smoke-developed indices of 75 and 450, respectively:

   1. Type VII, 2.20 lb/cu. ft. (35 kg/cu. m). minimum

C. Faced Mineral-Fiber Blanket Insulation(for install at metal stud furring partitions and other interior partitions where THERMAL INSULATION is specifically called for: ASTM C 665, Type III (blankets with reflective membrane facing), Class A (membrane-faced surface with a flame spread of 25 or less); Category 1 (membrane is a vapor barrier), faced with foil-scrim-kraft, foil-scrim, or foil-scrim-polyethylene vapor-retarder membrane on one face; consisting of fibers manufactured from glass.

2.3 AUXILIARY INSULATING MATERIALS

A. Adhesive for Bonding Insulation: Product with demonstrated capability to bond insulation securely to substrates indicated without damaging insulation and substrates.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Installer present, for compliance with requirements for Sections in which substrates and related work are specified and other conditions affecting performance.
B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Clean substrates of substances harmful to insulations or vapor retarders, including removing projections capable of puncturing vapor retarders or of interfering with insulation attachment.

B. Close off openings in cavities receiving poured-in-place insulation to prevent escape of insulation. Provide bronze or stainless-steel screens (inside) where openings must be maintained for drainage or ventilation.

3.3 INSTALLATION, GENERAL

A. Comply with insulation manufacturer's written instructions applicable to products and application indicated.

B. Install insulation that is undamaged, dry, and unsoiled and that has not been left exposed at any time to ice and snow.

C. Extend insulation in thickness indicated to envelop entire area to be insulated. Cut and fit tightly around obstructions and fill voids with insulation. Remove projections that interfere with placement.

D. Apply single layer of insulation to produce thickness indicated, unless multiple layers are otherwise shown or required to make up total thickness.

3.4 INSTALLATION OF INSULATION

A. On vertical surfaces, set units in adhesive applied according to manufacturer's written instructions. Use adhesive recommended by insulation manufacturer.

3.5 INSTALLATION OF GENERAL BUILDING INSULATION

A. Apply insulation units to substrates by method indicated, complying with manufacturer's written instructions. If no specific method is indicated, bond units to substrate with adhesive or use mechanical anchorage to provide permanent placement and support of units.

3.6 PROTECTION

A. Protect installed insulation from damage due to harmful weather exposures, physical abuse, and other causes. 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 07210
SECTION 081113 – HOLLOW METAL DOORS AND FRAMES

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. This Section includes hollow-metal steel doors and frames and hollow metal windows.

B. Related Sections include the following:
   1. Division 08 Sections “Flush Wood Doors” for doors to be pre-hung in hollow metal frames.
   2. Division 08 Section “Finish Hardware” for door hardware for hollow metal doors.
   3. Division 08 Section “Glazing” for glass in hollow metal doors and windows.
   4. Division 09 painting Sections for field painting hollow metal doors and frames.

1.03 DEFINITIONS

A. Minimum Thickness: Minimum thickness of base metal without coatings.

1.04 SUBMITTALS

A. Product Data: Include construction details, material descriptions, core descriptions, label compliance, and finishes for each type of hollow metal door and frame specified.

B. Shop Drawings: In addition to requirements below, provide a schedule of hollow metal doors and frames using same reference numbers for details and openings as those on Drawings:
   1. Elevations of each door design.
   2. Details of doors, including vertical and horizontal edge details.
   3. Frame details for each frame type, including dimensioned profiles.
   4. Details and locations of reinforcement and preparations for hardware.
   5. Details of each different wall opening condition.
   6. Details of anchorages, accessories, joints, and connections.
   7. Details of conduit and preparations for electrified door hardware and controls.

1.05 QUALITY ASSURANCE

A. Installer Qualifications: An employer of workers trained and approved by manufacturer.

B. Source Limitations: Obtain hollow metal doors and frames through one source from a single manufacturer.

C. Labels: Each fire rated frame and door shall bear applied label of Underwriters Laboratories (UL), Warnock Hersey International (WHI), or other approved
independent testing laboratory and inspection service. Approvals shall not be stamped directly into metal frames or doors.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver doors and frames palletized, wrapped, or crated to provide protection during transit and Project-site storage. Do not use non-vented plastic.
   1. Provide additional protection to prevent damage to finish of factory-finished doors and frames.

B. Deliver welded frames with two removable spreader bars across bottom of frames, tack welded to jambs and mullions.

C. Store doors and frames under cover at Project site. Place units in a vertical position with heads up, spaced by blocking, on minimum 4-inch- (100-mm-) high, wood blocking. Avoid using non-vented plastic or canvas shelters that could create a humidity chamber.
   1. If wrappers on doors become wet, remove cartons immediately. Provide minimum 1/4-inch (6-mm) space between each stacked door to permit air circulation.

1.07 PROJECT CONDITIONS

A. Field Measurements: Verify openings by field measurements before fabrication and indicate measurements on Shop Drawings.
   1. Established Dimensions: Where field measurements cannot be made without delaying the Work, establish opening dimensions and proceed with fabricating hollow metal frames without field measurements. Coordinate wall construction to ensure that actual opening dimensions correspond to established dimensions.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

Frames:
1. CURRIES Company; an ASSA ABLOY Group Company(M Series-M/MK/DEM Profile for interior / M for exterior)
2. CECO (SU Series)

Hollow Metal Doors:
3. CURRIES Company; an ASSA ABLOY Group Company(707 Series or 777 Series)
4. CECO (CECO Legions Series or CECO Trio-E series)

2.02 MATERIALS

A. Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, Commercial Steel (CS), Type B; suitable for exposed applications.
B. Hot-Rolled Steel Sheet: ASTM A 1011/A 1011M, Commercial Steel (CS), Type B; free of scale, pitting, or surface defects; pickled and oiled.

C. Supports and Anchors: After fabricating, galvanize units to be built into exterior walls according to ASTM A 153/A 153M, Class B.

D. Inserts, Bolts, and Fasteners: Provide items to be built into exterior walls, hot-dip galvanized according to ASTM A 153/A 153M.

E. Powder-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 hollow metal door frames of type indicated.

F. Mineral-Fiber Insulation: ASTM C 665, Type I (blankets without membrane facing); consisting of fibers manufactured from slag or rock wool with 6- to 12-lb/cu. ft. (96- to 192-kg/cu. m) density; with maximum flame-spread and smoke-developed indexes of 25 and 50 respectively; passing ASTM E 136 for combustion characteristics.

2.03 HOLLOW METAL DOORS

A. General: Provide flush panel doors, not less than 1-3/4 inches (44 mm) thick, of seamless hollow construction, unless otherwise indicated. Construct doors with smooth surfaces without visible joints or seams on exposed faces. 18 Gauge(interior), 16 Gauge(external).

B. Interior Door Face Sheets: Fabricated from minimum 0.053-inch- (1.3-mm-) thick, cold-rolled steel sheet (18 Gauge), unless otherwise indicated to comply with exterior door face sheet requirements. Continuous face welded, dressed and ground smooth; prime paint.

C. Exterior Door Face Sheets: A60 galvanized with continuous face welded, dressed and ground smooth; prime paint.

D. Core Construction: Fabricate doors with core indicated.
   1. Laminated Honeycomb Core: Resin-impregnated kraft paper with maximum 1-inch (25.4-mm) cells; fastened to face sheets with waterproof adhesive.
   2. Internal Reinforcement: Provide additional reinforcement inside hollow doors as required to achieve scheduled fire rating.

E. Top and Bottom Channels: Minimum 0.053-inch- (1.3-mm-) thick, steel channel spot welded, not more than 6 inches (152 mm) o.c., to face sheets.
   1. Tops and bottoms of doors reinforced with inverted horizontal channels, continuous across full width of door, of same material as face sheets so flanges of channels are even with bottom and top edges of face sheets.

F. Hardware Reinforcement: Fabricate reinforcement plates from same material as door face sheets to comply with the following minimum sizes:
   1. Hinges: Minimum 0.167 inch (4.2 mm) thick by 1-1/2 inches (38 mm) wide by 6 inches (152 mm) longer than hinge, secured by not less than 6 spot welds.
   2. Lock Face, Flush Bolts, Closers, and Concealed Holders: Minimum 0.093 inch (2.3 mm) thick.
   3. All Other Surface-Mounted Hardware: Minimum 0.067 inch (1.7 mm) thick.
4. General: All doors to be internally reinforced for surface mounted hardware and cut-out, drilled and tapped to receive mortised hardware.

G. Hardware Enclosures: Provide enclosures and junction boxes within doors for electrically operated door hardware, interconnected with UL-approved, 1/2-inch- (12.7-mm-) diameter conduit and connectors.
   1. Where indicated for installation of wiring, provide access plates to junction boxes, fabricated from same material and thickness as face sheet and fastened with at least 4 security fasteners spaced not more than 6 inches (152 mm) o.c.

2.04 HOLLOW METAL FRAMES

A. General: Fabricate frames of construction indicated, with faces of corners mitered and contact edges closed tight.
   1. Frames for Doors: Fully welded and ground smooth.

B. Interior Frames: Formed from cold-rolled steel sheet, unless otherwise indicated to comply with exterior frame requirements.
   1. Door Frames for Openings 48 Inches (1219 mm) Wide or Less: Fabricated from 0.053-inch- (1.3-mm-) thick steel sheet(16 Gauge).
   2. Door Frames for Openings More Than 48 Inches (1219 mm) Wide: Fabricated from 0.067-inch- (1.7-mm-) thick steel sheet(14 Gauge).
   3. Door Frames for “Trimless” Appearance: Studco “EZY-Jamb” or approved equal fabricated from 0.053-inch- (1.3-mm-) thick steel sheet with perforated edge strips for receiving gypsum board joint compound, fully galvanized.

C. Hardware Reinforcement: Fabricate reinforcement plates from same material as frames to comply with the following minimum sizes:
   1. Hinges: Minimum 0.167 inch (4.2 mm) thick by 1-1/4 inches (32 mm) wide by 10 inches (254 mm) long, secured by not less than 6 spot welds.
   2. Strikes, Flush Bolts, and Closers: Minimum 0.093 inch (2.3 mm) thick.
   3. Surface-Mounted Hardware: Minimum 0.093 inch (2.3 mm) thick.
   4. All frames to be reinforced for surface mounted hardware and cut-out, drilled and tapped to receive mortised hardware.

D. Head Reinforcement: Minimum 0.093-inch- (2.3-mm-) thick, steel channel or angle stiffener.

E. Jamb Anchors:
   1. Masonry Type: Adjustable strap-and-stirrup or T-shaped anchors to suit frame size, not less than 0.042 inch (1.0 mm) thick, with corrugated or perforated straps not less than 2 inches (50 mm) wide by 10 inches (250 mm) long; or wire anchors not less than 0.177 inch (4.5 mm) thick.
   2. Stud-Wall Type: Designed to engage stud, welded to back of frames; not less than 0.042 inch (1.0 mm) thick.

F. Floor Anchors: Formed from same material as frames, not less than 0.067 inch (1.7 mm) thick, and as follows:
   1. Monolithic Concrete Slabs: Clip-type anchors, with two holes to receive fasteners.
2. Separate Topping Concrete Slabs: Adjustable-type anchors with extension clips, allowing not less than 2-inch (50-mm) height adjustment. Terminate bottom of frames at finish floor surface.

2.05 STOPS AND MOLDINGS

A. Fixed Frame Moldings: Formed integral with hollow metal frames, minimum 5/8 inch (16 mm) high, unless otherwise indicated.

B. Provide hospital stops at interior door frames, with angled closed end at 12-inches above the finished floor.

C. Provide inverted-V blade louvers at indicated doors.

2.06 FABRICATION

A. General: Fabricate hollow metal doors and frames to be rigid and free of defects, warp, or buckle. Accurately form metal to required sizes and profiles, with minimum radius for thickness of metal. Where practical, fit and assemble units in manufacturer's plant. To ensure proper assembly at Project site, clearly identify work that cannot be permanently factory assembled before shipment.

B. Hollow Metal Doors: Comply with ANSI A250.4, Level A.

1. Single-Acting Doors: Bevel both vertical edges 1/8 inch in 2 inches (3 mm in 50 mm).

2. Edges: Door face sheets joined at vertical edges by continuous weld extending full height of door; with edges ground and polished, providing smooth, flush surfaces with no visible seams.

C. Hollow Metal Frames: Weld joints continuously; grind, fill, dress, and make smooth, flush, and invisible. Where frames are fabricated in sections due to shipping or handling limitations, provide alignment plates or angles at each joint, fabricated of same thickness metal as frames.

1. Frames: Provide closed tubular members with no visible seams or joints. Fasten members at crossings and to jambs by butt welding according to joint designs in HMMA 820.
   a. Provide false head member to receive lower ceiling where frames extend to finish ceilings of different heights.

2. Provide countersunk, flat- or oval-head exposed screws and bolts for exposed fasteners, unless otherwise indicated.

3. Floor Anchors: Weld anchors to bottom of jambs and mullions with at least four spot welds per anchor.

4. Jamb Anchors: Provide number and spacing of anchors as follows:
   a. Stud-Wall Type: Locate anchors not more than 18 inches (457 mm) from top and bottom of frame. Space anchors not more than 32 inches (813 mm) o.c. and as follows:
      1) Three anchors per jamb up to 60 inches (1524 mm) in height.
      2) Four anchors per jamb from 60 to 90 inches (1524 to 2286 mm) in height.
      3) Five anchors per jamb from 90 to 96 inches (2286 to 2438 mm) in height.
4) Five anchors per jamb plus 1 additional anchor per jamb for each 24 inches (610 mm) or fraction thereof more than 96 inches (2438 mm) in height.

5) Two anchors per head for frames more than 42 inches (1066 mm) wide and mounted in metal-stud partitions.

5. Head Reinforcement: For frames more than 48 inches (1219 mm) wide, provide continuous head reinforcement for full width of opening, welded to back of frame at head.

6. Door Silencers: Except on weather-stripped doors, drill stops to receive door silencers as follows. Provide plastic plugs to keep holes clear during construction.
   a. Single-Door Frames: Drill stop in strike jamb to receive three door silencers.
   b. Double-Door Frames: Drill stop in head jamb to receive two door silencers.

D. Hardware Preparation: Factory prepare hollow metal doors and frames to receive templated mortised hardware; include cutouts, reinforcement, mortising, drilling, and tapping, according to the Door Hardware Schedule and templates furnished as specified in Division 08 Section "Door Hardware."
   1. Reinforce doors and frames to receive non-templated mortised and surface-mounted door hardware.
   2. Locate door hardware as indicated, or if not indicated, according to HMMA 831, "Recommended Hardware Locations for Custom Hollow Metal Doors and Frames."

2.07 STEEL FINISHES

A. General: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
   1. Finish hollow metal door and frames after assembly.

B. Steel Surface Preparation: Clean surfaces to comply with SSPC-SP 1, "Solvent Cleaning"; remove dirt, oil, grease, or other contaminants that could impair paint bond. Remove mill scale and rust, if present, from uncoated steel; comply with SSPC-SP 3, "Power Tool Cleaning," or SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."

C. Factory Priming for Field-Painted Finish: Apply shop primer specified below immediately after surface preparation and pretreatment. Apply a smooth coat of even consistency to provide a uniform dry film thickness of not less than 0.7 mils (0.018 mm).
   1. Shop Primer: Manufacturer's standard, fast-curing, lead- and chromate-free primer complying with ANSI A250.10 acceptance criteria; recommended by primer manufacturer for substrate; compatible with substrate and field-applied finish paint system indicated; and providing a sound foundation for field-applied topcoats despite prolonged exposure.
PART 3 - EXECUTION

3.01 EXAMINATION
A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of hollow metal doors and frames.
   1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION
A. Remove welded-in shipping spreaders installed at factory.
B. Prior to installation and with installation spreaders in place, adjust and securely brace hollow metal door frames for squareness, alignment, twist, and plumb to the following tolerances:
   1. Squareness: Plus or minus 1/16 inch (1.6 mm), measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.
   2. Alignment: Plus or minus 1/16 inch (1.6 mm), measured at jambs on a horizontal line parallel to plane of wall.
   3. Twist: Plus or minus 1/16 inch (1.6 mm), measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.
   4. Plumbness: Plus or minus 1/16 inch (1.6 mm), measured at jambs on a perpendicular line from head to floor.
C. Drill and tap doors and frames to receive non-templated mortised and surface-mounted door hardware.

3.03 INSTALLATION
A. General: Provide doors of sizes, thicknesses, and designs indicated. Install hollow metal doors and frames plumb, rigid, properly aligned, and securely fastened in place; comply with Drawings and manufacturer's written instructions.
B. Hollow Metal Frames: Install hollow metal frames for doors and other openings, of size and profile indicated.
   1. Set frames accurately in position; plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is complete, remove temporary braces, leaving surfaces smooth and undamaged.
      a. Where frames are fabricated in sections due to shipping or handling limitations, field splice at approved locations by welding face joint continuously; grind, fill, dress, and make splice smooth, flush, and invisible on exposed faces.
      b. Install door silencers in frames before grouting.
      c. Remove temporary braces necessary for installation only after frames have been properly set and secured.
      d. Check plumb, squareness, and twist of frames as walls are constructed. Shim as necessary to comply with installation tolerances.
      e. Apply bituminous coating to backs of frames that are filled with mortar, grout, and plaster containing anti-freezing agents.
   2. Floor Anchors: Provide floor anchors for each jamb and mullion that extends to floor and secure with post-installed expansion anchors.
a. Floor anchors may be set with powder-actuated fasteners instead of post-installed expansion anchors, if so indicated and approved on Shop Drawings.


4. Installation Tolerances: Adjust hollow metal door frames for squareness, alignment, twist, and plumb to the following tolerances:
   a. Squareness: Plus or minus 1/16 inch (1.6 mm), measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.
   b. Alignment: Plus or minus 1/16 inch (1.6 mm), measured at jambs on a horizontal line parallel to plane of wall.
   c. Twist: Plus or minus 1/16 inch (1.6 mm), measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.
   d. Plumbness: Plus or minus 1/16 inch (1.6 mm), measured at jambs at floor.

C. Hollow Metal Doors: Fit hollow-metal doors accurately in frames, within clearances indicated below. Shim as necessary.
   1. Non-Fire-Rated Doors:
      a. Jambs and Head: 1/8 inch (3 mm) plus or minus 1/16 inch (1.6 mm).
      b. Between Edges of Pairs of Doors: 1/8 inch (3 mm) plus or minus 1/16 inch (1.6 mm).
      c. Between Bottom of Door and Top of Threshold: Maximum 3/8 inch (9.5 mm).
      d. Between Bottom of Door and Top of Finish Floor (No Threshold): Maximum 3/4 inch (19 mm).
   2. Fire-Rated Doors: Install doors with clearances according to NFPA 80.

3.04 ADJUSTING AND CLEANING

A. Final Adjustments: Check and readjust operating hardware items immediately before final inspection. Leave work in complete and proper operating condition. Remove and replace defective work including hollow metal doors or frames that are warped, bowed, or otherwise unacceptable.

B. Clean grout and other bonding material off hollow metal doors and frames immediately after installation.

C. Prime-Coat Touchup: Immediately after erection, sand smooth rusted or damaged areas of prime coat and apply touchup of compatible air-drying primer.

END OF SECTION 08 11 13
SECTION 087100 – DOOR HARDWARE

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. This Section includes commercial door hardware for the following:
   1. Cylinders for doors specified in other Sections.

B. Related Sections include the following:
   1. Division 8 Section "Steel Doors and Frames" for astragals provided as part of a fire-rated labeled assembly and for door silencers provided as part of the frame.
   2. Division 8 Section "Flush Wood Doors" for astragals provided as part of a fire-rated labeled assembly.
   3. Division 8 Section "Aluminum Entrances and Storefronts" for entrance door hardware, except cylinders.
   4. Division 8 Section "Sliding Automatic Entrance Doors" for entrance door hardware, except cylinders.

C. Work in this Section is subject to an Alternate. Refer to Division 01 Section “Alternates.”

D. Other: Prior to installation of hardware, manufacturer’s representatives shall arrange and hold a jobsite meeting to instruct the installing contractor’s personnel on the proper installation of their respective products. The Architect shall also be invited to these meetings. Seminar(s) shall be attended by installers of hardware (including electrical hardware) for aluminum, hollow metal and wood doors. Training will include the use of installation manuals, hardware schedule, templates and physical product samples.

The manufacturer’s representative(s) for the life safety and security products shall inspect and approve the installation of the products they represent. Any identified installation of product issues shall be directed to the attention of the Architect for the purpose of generating the final punch list.

1.03 SUBMITTALS

A. Product Data: Include installation details, material descriptions, dimensions of individual components and profiles, and finishes.

B. Samples for Initial Selection: Manufacturer's color charts consisting of units or sections of units showing the full range of colors, textures, and patterns available for each type of door hardware indicated.
C. Samples: If required by the architect, furnish door hardware of required type indicated below, in specified finish, full size. Tag with full description for coordination with the Door Hardware Schedule. Submit samples before, or concurrent with, submission of the final Door Hardware Schedule.

1. Door Hardware: As follows:
   a. Hinges (Butts)
   b. Locks and latches.
   c. Exit devices.
   d. Cylinders and keys.
   e. Closers.
   f. Stops and holders.
   g. Door gasketing.
   h. Coat Hooks
   i. Thresholds

2. Samples will be returned to Contractor. Units that are acceptable and remain undamaged through submittal, review, and field comparison process may, after final check of operation, be incorporated into the Work, within limitations of keying requirements.

D. Door Hardware Schedule: Prepared by or under the supervision of supplier, detailing fabrication and assembly of door hardware, as well as procedures and diagrams. Coordinate the final Door Hardware Schedule with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of door hardware.

1. Format: Comply with scheduling sequence and vertical format in DHI's "Sequence and Format for the Hardware Schedule."

2. Content: Include the following information:
   a. Type, style, function, size, label, hand, and finish of each door hardware item.
   b. Manufacturer of each item.
   c. Fastenings and other pertinent information.
   d. Location of each door hardware set, cross-referenced to Drawings, both on floor plans and in door and frame schedule.
   e. Explanation of abbreviations, symbols, and codes contained in schedule.
   f. Mounting locations for door hardware.
   g. Door and frame sizes and materials.

3. Submittal Sequence: Submit the final Door Hardware Schedule at earliest possible date, particularly where approval of the Door Hardware Schedule must precede fabrication of other work that is critical in the Project construction schedule. Include Product Data, Samples, Shop Drawings of other work affected by door hardware, and other information essential to the coordinated review of the Door Hardware Schedule.

E. Keying Schedule: Prepared by or under the supervision of supplier, detailing Owner's final keying instructions for locks. Include schematic keying diagram and index each key set to unique door designations.

F. Product Certificates: Signed by manufacturers of electrified door hardware certifying that products furnished comply with requirements.

1. Certify that door hardware approved for use on types and sizes of labeled fire doors complies with listed fire door assemblies.
G. Qualification Data: For firms and persons specified in "Quality Assurance" Article.
   1. Include lists of completed projects with project names and addresses of architects and owners, and other information specified.

H. Product Test Reports: Based on evaluation of comprehensive tests performed by manufacturer and witnessed by a qualified testing agency, indicating current products comply with requirements.

I. Maintenance Data: For each type of door hardware to include in maintenance manuals specified in Division 1.

J. Warranties: Special warranties specified in this Section.

1.04 QUALITY ASSURANCE

A. Installer Qualifications: An experienced installer who has completed door hardware similar in material, design, and extent to that indicated for this Project and whose work has resulted in construction with a record of successful in-service performance.

B. Supplier Qualifications: Door hardware supplier with warehousing facilities in Project's vicinity and who is or employs a qualified Architectural Hardware Consultant, available during the course of the Work to consult with Contractor, Architect, and Owner about door hardware and keying.
   1. Scheduling Responsibility: Preparation of door hardware and keying schedules.

C. Architectural Hardware Consultant Qualifications: A person who is currently certified by the Door and Hardware Institute as an Architectural Hardware Consultant and who is experienced in providing consulting services for door hardware installations that are comparable in material, design, and extent to that indicated for this Project.

D. Source Limitations: Obtain each type and variety of door hardware from a single manufacturer, unless otherwise indicated.

E. Regulatory Requirements: Comply with provisions of the following:
   1. Where indicated to comply with accessibility requirements, comply with Americans with Disabilities Act (ADA), "Accessibility Guidelines for Buildings and Facilities (ADAAG),"
      a. Handles, Pulls, Latches, Locks, and other Operating Devices: Shape that is easy to grasp with one hand and does not require tight grasping, tight pinching, or twisting of the wrist.
      b. Door Closers: Comply with the following maximum opening-force requirements indicated:
         1) Interior Hinged Doors: 5 lbf (22.2 N) applied perpendicular to door.
         2) Sliding or Folding Doors: 5 lbf (22.2 N) applied parallel to door at latch.
         3) Fire Doors: Minimum opening force allowable by authorities having jurisdiction.
      c. Thresholds: Not more than 1/2 inch (13 mm) high.
   2. NFPA 101: Comply with the following for means of egress doors:
a. Latches, Locks, and Exit Devices: Not more than 15 lbf (67 N) to release the latch. Locks shall not require the use of a key, tool, or special knowledge for operation.
b. Delayed-Egress Locks: Lock releases within 15 seconds after applying a force not more than 15 lbf (67 N) for not more than 3 seconds.
c. Door Closers: Not more than 30 lbf (133 N) to set door in motion and not more than 15 lbf (67 N) to open door to minimum required width.
d. Thresholds: Not more than 1/2 inch (13 mm) high.

F. Fire-Rated Door Assemblies: Provide door hardware for assemblies complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire ratings indicated, based on testing according to NFPA 252.
1. Test Pressure: Test at atmospheric pressure.

G. Keying Conference: Conduct conference at Project site to comply with requirements in Division 1 Section "Project Meetings." Incorporate keying conference decisions into final keying schedule after reviewing door hardware keying system including, but not limited to, the following:
1. Function of building, flow of traffic, purpose of each area, degree of security required, and plans for future expansion.
2. Preliminary key system schematic diagram.
3. Requirements for key control system.
4. Address for delivery of keys.
5. Existing building key system.

H. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 1 Section "Project Meetings." Review methods and procedures related to electrified door hardware including, but not limited to, the following:
1. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
2. Review required testing, inspecting, and certifying procedures.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Inventory door hardware on receipt and provide secure lock-up for door hardware delivered to Project site.

B. Tag each item or package separately with identification related to the final Door Hardware Schedule, and include basic installation instructions with each item or package.

C. Deliver keys to manufacturer of key control system.

D. Deliver keys to Owner by registered mail or overnight package service.

1.06 COORDINATION

A. Templates: Obtain and distribute to the parties involved templates for doors, frames, and other work specified to be factory prepared for installing door hardware. Check Shop Drawings of
other work to confirm that adequate provisions are made for locating and installing door hardware to comply with indicated requirements.

1.07 WARRANTY

A. General Warranty: Special warranties specified in this Article shall not deprive Owner of other rights Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by Contractor under requirements of the Contract Documents.

B. Special Warranty: Written warranty, executed by manufacturer agreeing to repair or replace components of door hardware that fail in materials or workmanship within specified warranty period. Failures include, but are not limited to, the following:
   1. Structural failures including excessive deflection, cracking, or breakage.
   2. Faulty operation of operators and door hardware.
   3. Deterioration of metals, metal finishes, and other materials beyond normal weathering.

C. Warranty Period: Three years from date of Substantial Completion, unless otherwise indicated.

D. Warranty Period for Manual Closers: 10 years from date of Substantial Completion.

1.08 MAINTENANCE SERVICE

A. Maintenance Tools and Instructions: Furnish a complete set of specialized tools and maintenance instructions as needed for Owner's continued adjustment, maintenance, and removal and replacement of door hardware.

B. Maintenance Service: Beginning at Substantial Completion, provide six months' full maintenance by skilled employees of door hardware Installer. Include quarterly preventive maintenance, repair or replacement of worn or defective components, lubrication, cleaning, and adjusting as required for proper door hardware operation. Provide parts and supplies as used in the manufacture and installation of original products.

PART 2 - PRODUCTS

2.01 SCHEDULED DOOR HARDWARE

A. General: Provide door hardware for each door to comply with requirements in this Section, door hardware sets indicated in door and frame schedule] [, and the Door Hardware Schedule at the end of Part 3.
   1. Door Hardware Sets: Provide quantity, item, size, finish or color indicated, and named manufacturer's products and products complying with BHMA standard referenced.

B. Designations: Requirements for design, grade, function, finish, size, and other distinctive qualities of each type of door hardware are indicated in the Door Hardware Schedule at the end of Part 3. Products are identified by using door hardware designations, as follows:
   1. Named Manufacturer's Products: Product designation and manufacturer are listed for each door hardware type required for the purpose of establishing minimum requirements. Manufacturers' names are abbreviated in the Door Hardware Schedule.
2. References to BHMA Standards: Provide products complying with these standards and requirements for description, quality, and function.

2.02 HINGES (BUTTS)

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   1. Hinges (Butts):
      a. PBB: Standard Duty BB81/51 series and Heavy Duty 4B81/51 series
      b. McKinney Products Company; Div. of ASSA Abloy, Inc. (MCK).
         Standard Duty TA2714/2713 series and Heavy Duty T4A3786/T4A386.
      c. Stanley: Standard Duty CB1900 and Heavy Duty CB1901 series (ST)

B. Standards: Comply with the following:
   2. Template Hinge Dimensions: BHMA A156.7.

C. Quantity: Provide the following, unless otherwise indicated:
   1. Three Hinges (1 1/2 pair): For doors with heights 61 to 90 inches
   2. Four Hinges (2 pair): For doors with heights 91 to 120 inches
   3. Four Hinges (2 pair): For doors with width 48 inches and more.

D. Size: Provide the following, unless otherwise indicated, with hinge widths sized for door thickness and clearances required:
   1. Hinges (butts) 4 1/2 x 4 “ at new hinges in new frames.
   2. Field measure where new hinges indicated at existing frames
   3. Hinges(continuous) heavy duty at lead lined doors

E. Template Requirements: Except for hinges and pivots to be installed entirely (both leaves) into wood doors and frames, provide only template-produced units.

F. Hinge Type: Unless otherwise indicated, provide the following:
   1. H.M. Doors 40 inches and less: Antifriction, standard to medium weight, five knuckle full mortise ball-bearing hinges
   2. H.M. Doors over 40 inches: Antifriction, heavy duty weight, five knuckle full mortise ball-bearing hinges.
   3. H.M. Doors(Swing Clear): Standard to medium weight or heavy duty(see above), five knuckle full mortise ball-bearing hinges, swing clear function.
   4. Wood Doors: Same as above except thru door bolted face fastened type butts at wood doors over 36 inches wide.
   5. Continuous: Standard to medium weight for doors 36 inches and less or heavy duty for doors over 36 inches.

G. Hinge Base Metal: Unless otherwise indicated, provide the following:
   1. Hinges: Stainless steel, with stainless-steel pin.

H. Hinge Options: Comply with the following where indicated in the Door Hardware Schedule or on Drawings:
   1. Hospital Tips: Slope ends of hinge barrel all interior doors, u.n.o. in schedule.
2. Nonremovable Pins: Provide set screw in hinge barrel that, when tightened into a groove in hinge pin, prevents removal of pin while door is closed; for the following applications:
   a. Outswinging exterior doors.

I. Fasteners: Comply with the following:
2. Wood Screws: For wood doors and frames.
3. Threaded-to-the-Head Wood Screws: For fire-rated wood doors.
4. Screws: Phillips flat-head screws; machine screws (drilled and tapped holes) for metal doors wood screws for wood doors and frames. Finish screw heads to match surface of hinges.

2.03 LOCKS AND LATCHES
A. Mortise Locksets: Mortise Locksets to be used as standard of quality for all projects—Best 45H Series x 15H lever and rose design.
B. Electric Locks: Unless otherwise noted, electric locks shall be specified at all card access doors. Electric locks shall be as required by the Owner to match Owner standards. Electric locks shall be specified to have a built in request to exit switch.
   1. Typical locks to be fail secure type, unless otherwise noted.
   2. When a door is required to unlock in a fire condition or loss of power, it will be specifically called out as a fail safe electric lock.
C. Lock Functions: Function numbers and descriptions (Office, Classroom Storage, Passage, etc.) as indicated in the Door Hardware Schedule.
D. Lock Throw: Comply with testing requirements for length of bolts to comply with labeled fire door requirements, and as follows:
E. Backset: 2-3/4 inches (70 mm), unless otherwise indicated.
F. Push/Pull Type Latch (Hospital paddle type latch):
   1. Lever: Paddle type.
   2. As manufactured by Glyn-Johnson model #HL-6

2.04 DOOR BOLTS
A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   1. Flush Bolts:
      a. Hager Companies (HAG).
      c. Trimco: (TR).
B. Flush Bolts: BHMA Grade 1, unless Grade 2 is indicated, designed for mortising into door edge. – (for use at pairs of low frequency use doors to secure the imperative leaf)
1. Lever Type Manual Flush Bolts – flat plate (6-3/4” x 1-1/4” exposed, provide Dust-proof strike for floor condition:
   a. Ives Model 262
   b. Trimco – 3917 for metal doors.
   c. Glyn-Johnson – FB6 for metal doors

2.05 EXIT DEVICES

A. Exit devices as manufactured by the following:
   1. Corbin-Russwin #5400 or #5800, or #6300 Rim Series with “Newport” #N4M trim.
   2. Von Duprin #99 Series with #06 standard lever trim.
   3. Monarch #18 Series with “LE” trim and “Saxon” lever.
   4. Precision Apex series with “A” lever trim.

B. Standard: BHMA A156.3.
   1. BHMA Grade: Grade 1, unless Grade 2 is indicated.

C. Certified Products: Provide exit devices listed in BHMA's "Directory of Certified Exit Devices."

D. Panic Exit Devices: Listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for panic protection, based on testing according to UL 305.

E. Fire Exit Devices: Complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire and panic protection, based on testing according to UL 305 and NFPA 252.

F. Outside Trim: Pull with cylinder; material and finish to match locksets, unless otherwise indicated.
   1. Match design for locksets and latchsets, unless otherwise indicated.

G. Through Bolts: For exit devices and trim on metal doors non-fire-rated wood doors and fire-rated wood doors.

H. Mounting Style:
   1. Hollow Metal Doors: Concealed Vertical Rod Device
   2. Wood Doors: Surface Mounted Vertical Rod Device

2.06 CYLINDERS AND KEYING

A. Unless otherwise noted, all cylinders shall be keyed to the existing ASSA large format interchangeable core keying system. The hardware supplier shall furnish all cylinders and temporary brass construction cores. The NYULMC Lock Shop will furnish and install all permanent cores. The hardware supplier shall furnish 5 control keys and 5 construction keys to be used during construction. It shall be the GC/Hardware supplier’s responsibility to return the temporary cores to the manufacturer.

B. Contractor shall provide and install temporary cores as work requires. NYULMC locksmith shall provide all permanent ASSA cylinders upon completion of the work.
2.07 STRIKES

A. Standards: Comply with the following:
1. Strikes for Bored Locks and Latches: BHMA A156.2.

2.08 ACCESSORIES FOR PAIRS OF DOORS

2.09 CLOSERS

A. SURFACE MOUNTED DOOR CLOSERS:

1. Unless otherwise noted, all surface mounted door closers shall meet ANSI A156.4 Grade 1 requirements. All closers shall be barrier free with a delayed action feature. Furnish all required brackets, filler plates and any others items required to insure proper installation and operation.

2. All surface mounted door closers shall be installed so that closer bodies are positioned on room side of doors to and from corridors, i.e., in-swing doors shall be regular arm. Out-swing doors shall have a parallel arm. Regular arm shall be used in connecting doors between rooms.

   a. Approved Manufacturers: NO SUBSTITUTIONS.
      Dorma: 8916 series x Alum

   b. Surface Mounted Door Closers shall be specified as follows:

      Regular Arm Mount: used on doors that swing into a space. The door closer will mount on the pull side of the door, 8916DA-AF89 x Alum.

      Parallel Arm Mount: used on doors that swing out of a space. The door closer will mount on the push side of the door, 8916DA-89P x Alum.

      Regular Arm Mount with built in stop: used on doors that swing into a space, where an auxiliary stop cannot be used. The door closer will mount on the pull side of the door, 8916DA-IS x Alum.

      Parallel Arm Mount with built in stop: used on doors that swing out of a space, where an auxiliary stop cannot be used. The door closer will mount on the push side of the door, 8916DA-DS x Alum.

2.10 STOPS AND HOLDERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

   2. Hager Companies (HAG).
B. Standards: Comply with the following:
   1. Stops and Bumpers: BHMA A156.16.
   2. Electromagnetic Door Holders: BHMA A156.15.
   3. Combination Overhead Holders and Stops: BHMA A156.8.
   4. Door Silencers: BHMA A156.16.

C. Stops and Bumpers: BHMA Grade 1, unless Grade 2 is indicated.

D. Combination Overhead Stop Arms and Holders: BHMA Grade 1, unless Grade 2 is indicated. Standard function to be “friction”. Only provide Hold Open Function (H.O.) where specified in hardware schedule.

E. Wall Stops: For doors, unless floor or other type stops are scheduled or indicated. Do not mount floor stops where they will impede traffic.
   1. Where floor or wall stops are not appropriate, provide overhead holders.
   2. All wall stops to be Concave Type. Provide full blocking in wall for mounting.
   3. Trimco 1270WV or Trimco W1211 floor stops
   4. Approved manufacturers-Trimco, Rockwood, Ives

F. Silencers for Wood Door Frames: BHMA Grade 1; neoprene or rubber, minimum 5/8 by 3/4 inch (16 by 19 mm); fabricated for drilled-in application to frame. Color to be grey.

G. Silencers for Metal Door Frames: BHMA Grade 1; neoprene or rubber, minimum diameter 1/2 inch (13 mm); fabricated for drilled-in application to frame. Color to be grey.

2.11 DOOR GASKETING

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   1. Door Gasketing:
      a. Hager Companies (HAG).
      b. Pemko Manufacturing Co., Inc. (PEM).
      c. National Guard Products (NA).
   2. Door Bottoms:
      a. Hager Companies (HAG).
      b. Pemko Manufacturing Co., Inc. (PEM).
      c. Reese Enterprises, Inc. (RE).

B. Standard: Comply with BHMA A156.22.

C. General: Provide continuous weather-strip gasketing on exterior doors and provide smoke, light, or sound gasketing on interior doors where indicated or scheduled. Provide noncorrosive fasteners for exterior applications and elsewhere as indicated.
   1. Perimeter Gasketing: Apply to head and jamb, forming seal between door and frame.
   2. Door Bottoms: Apply to bottom of door, forming seal with floor or threshold when door is closed.
D. Air Leakage: Not to exceed 0.50 cfm per foot (0.000774 cu. m/s per m) of crack length for gasketing other than for smoke control, as tested according to ASTM E 283.

E. Sound-Rated Gasketing: Assemblies that are listed and labeled by a testing and inspecting agency, for sound ratings indicated, based on testing according to ASTM E 1408.

F. Replaceable Seal Strips: Provide only those units where resilient or flexible seal strips are easily replaceable and readily available from stocks maintained by manufacturer.


2.12 THRESHOLDS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   1. Hager Companies (HAG).
   2. Pemko Manufacturing Co., Inc. (PEM).

B. Standard: Comply with BHMA A156.21.

C. For exterior swinging doors only.

2.13 SLIDING DOOR HARDWARE

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   1. Hager Companies (HAG).
   2. Lawrence Brothers, Inc. (LB).
   3. Stanley Commercial Hardware; Div. of The Stanley Works (STH).

B. Standard: Comply with BHMA A156.14.

C. Pocket Sliding Door Hardware: Rated for doors weighing up to 250 lb

2.14 COAT HOOKS:

A. Coat hooks (as manufactured by Peter Pepper) shall be installed at all typical toilet, exam and office type doors (1 minimum).

B. Install room side, u.n.o.

C. For specific coat hook model numbers see the Hardware Schedule.

2.15 KICK/MOP/ARMOR PLATES:

A. Typical plates shall be as manufactured Trimco, Rockwood and Ives or equal manufacturer.
   1. Color: Stainless Steel
B. Plates shall extend 2" less than full width of door height as shown, both sides of the door.

C. Fabrication: Full contact adhesive applied

D. Dimensions:
   1. Kick plates: 10" high unless otherwise noted on drawings.
   2. Mop plates: 6" high unless otherwise noted on drawings.
   3. Armor plates to be 34” high unless otherwise noted on drawings.

2.16 FLUSH BOLTS:

A. MANUAL FLUSH BOLTS:
   1. Unless otherwise noted, furnish manual flush bolts to secure the inactive leaf on pairs of doors leading to spaces that are considered as being non occupied spaces (Mechanical Rooms, Electrical Rooms, Closets, and Boiler Rooms etc. Furnish Trimco W3917 for all metal doors. Top bolts shall be furnished with proper extensions to allow for easy operation. Furnish Trimco W3913 for all wood doors. A dustproof strike Trimco 3910 must be used.
      a. Approved Manufacturers:
         Trimco, Rockwood and Ives.

B. AUTOMATIC FLUSH BOLTS:
   1. Automatic Flush Bolts shall be installed on all other pairs of doors where manual flush bolts cannot be installed per appropriate building codes. Furnish Trimco 3810 x 3810 for all metal doors and Trimco 3815 x 3815 for all wood or composite doors. A dustproof strike Trimco 3910 must be used.
      a. Approved Manufacturers:
         Trimco, Rockwood and Ives.

2.17 2.23 FABRICATION

A. Manufacturer's Nameplate: Do not provide manufacturers' products that have manufacturer's name or trade name displayed in a visible location (omit removable nameplates) except in conjunction with required fire-rated labels and as otherwise approved by Architect.
   1. Manufacturer's identification will be permitted on rim of lock cylinders only.

B. Base Metals: Produce door hardware units of base metal, fabricated by forming method indicated, using manufacturer's standard metal alloy, composition, temper, and hardness. Furnish metals of a quality equal to or greater than that of specified door hardware units and BHMA A156.18 for finishes. Do not furnish manufacturer's standard materials or forming methods if different from specified standard.

C. Fasteners: Provide door hardware manufactured to comply with published templates generally prepared for machine, wood, and sheet metal screws. Provide screws according to
commercially recognized industry standards for application intended. Provide Phillips flat-head screws with finished heads to match surface of door hardware, unless otherwise indicated.

1. **Concealed Fasteners:** For door hardware units that are exposed when door is closed, except for units already specified with concealed fasteners. Do not use through bolts for installation where bolt head or nut on opposite face is exposed unless it is the only means of securely attaching the door hardware. Where through bolts are used on hollow door and frame construction, provide sleeves for each through bolt.

2. **Steel Machine or Wood Screws:** For the following fire-rated applications:
   a. Strike plates to frames.
   b. Closers to doors and frames.

3. **Steel Through Bolts:** For the following fire-rated applications, unless door blocking is provided:
   a. Closers to doors and frames.

4. **Spacers or Sex Bolts:** For through bolting of hollow metal doors.

5. **Fasteners for Wood Doors:** Comply with requirements of DHI WDHS.2, "Recommended Fasteners for Wood Doors."

### 2.18 FINISHES

- **A. Standard:** Comply with BHMA A156.18.
- **B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.**
- **C. Appearance of Finished Work:** Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.
- **D. BHMA Designations:** Comply with base material and finish requirements indicated by the following:
  1. BHMA 630: Satin stainless steel, over stainless-steel base metal.
  2. BHMA 689: Aluminum painted, over any base metal.

## PART 3 - EXECUTION

### 3.01 EXAMINATION

- **A.** Examine doors and frames, with Installer present, for compliance with requirements for installation tolerances, labeled fire door assembly construction, wall and floor construction, and other conditions affecting performance.

- **B.** Examine roughing-in for electrical power systems to verify actual locations of wiring connections before electrified door hardware installation.

- **C.** Proceed with installation only after unsatisfactory conditions have been corrected.
3.02 PREPARATION

A. Steel Doors and Frames: Comply with DHI A115 series.
   1. Surface-Applied Door Hardware: Drill and tap doors and frames according to SDI 107.

B. Wood Doors: Comply with DHI A115-W series.

3.03 INSTALLATION

A. Mounting Heights: Mount door hardware units at heights indicated in following applicable publications, unless specifically indicated or required to comply with governing regulations:
   2. Wood Doors: DHI WDHS.3, "Recommended Locations for Architectural Hardware for Wood Flush Doors."

B. Install each door hardware item to comply with manufacturer's written instructions. Where cutting and fitting are required to install door hardware onto or into surfaces that are later to be painted or finished in another way, coordinate removal, storage, and reinstallation of surface protective trim units with finishing work specified in Division 9 Sections. Do not install surface-mounted items until finishes have been completed on substrates involved.
   1. Set units level, plumb, and true to line and location. Adjust and reinforce attachment substrates as necessary for proper installation and operation.
   2. Drill and countersink units that are not factory prepared for anchorage fasteners. Space fasteners and anchors according to industry standards.

C. Key Control System: Place keys on markers and hooks in key control system cabinet, as determined by final keying schedule.

D. Thresholds: Set thresholds for exterior and acoustical doors in full bed of sealant complying with requirements specified in Division 7 Section "Joint Sealants."

3.04 FIELD QUALITY CONTROL

A. Independent Architectural Hardware Consultant: Owner will engage a qualified independent Architectural Hardware Consultant to perform inspections and to prepare inspection reports.
   1. Independent Architectural Hardware Consultant will inspect door hardware and state in each report whether installed work complies with or deviates from requirements, including whether door hardware is properly installed and adjusted.

3.05 ADJUSTING

A. Initial Adjustment: Adjust and check each operating item of door hardware and each door to ensure proper operation or function of every unit. Replace units that cannot be adjusted to operate as intended. Adjust door control devices to compensate for final operation of heating and ventilating equipment and to comply with referenced accessibility requirements.
   1. Door Closers: Adjust sweep period so that, from an open position of 70 degrees, the door will take at least 3 seconds to move to a point 3 inches (75 mm) from the latch, measured to the leading edge of the door.
B. Six-Month Adjustment: Approximately six months after date of Substantial Completion, Installer shall perform the following:
   1. Examine and readjust each item of door hardware as necessary to ensure function of doors, door hardware, and electrified door hardware.
   2. Consult with and instruct Owner's personnel on recommended maintenance procedures.
   3. Replace door hardware items that have deteriorated or failed due to faulty design, materials, or installation of door hardware units.

3.06 CLEANING AND PROTECTION
A. Clean adjacent surfaces soiled by door hardware installation.
B. Clean operating items as necessary to restore proper function and finish.
C. Provide final protection and maintain conditions that ensure door hardware is without damage or deterioration at time of Substantial Completion.

3.07 DEMONSTRATION
A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain door hardware and door hardware finishes.
SECTION 002116 – GYPSUM BOARD ASSEMBLIES

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. This Section includes the following:
   1. Interior gypsum wallboard and ceiling board with applied finishes.
   2. Tile backing panels.
      a. Sheet steel backing plates for equipment and accessories.
   4. Load-bearing steel framing for interior gypsum board walls and ceilings.
      a. Structural engineering design for load-bearing interior partitions.
   5. Shaft wall assemblies.
   7. Labeling of fire- and smoke-separation partitions.
   8. Lead Lined wallboard panels

B. Related Sections include the following:
   1. Division 05 Section "Cold-Formed Metal Framing" for metal framing at exterior walls, and for gypsum sheathing at exterior walls.
   2. Division 06 Section "Rough Carpentry" for wood framing and furring, and for gypsum sheathing at exterior walls.

1.03 DEFINITIONS

A. Gypsum Board Terminology: Refer to ASTM C 11 for definitions of terms for gypsum board assemblies not defined in this Section or in other referenced standards.

1.04 PERFORMANCE REQUIREMENTS

A. Structural Performance: Provide metal framing capable of withstanding design loads within limits and under conditions indicated.
   1. Deflection Limits: Design framing systems to withstand design loads without deflections greater than the following:
      a. Interior Non-Load-Bearing Framing: Horizontal deflection of 1/360 of the wall height.

1.05 SUBMITTALS

A. Product Data: For each type of product indicated.

1.06 QUALITY ASSURANCE

A. Fire-Test-Response Characteristics: For gypsum board assemblies with fire-resistance ratings, provide materials and construction identical to those tested in assembly
indicated according to ASTM E 119 by an independent testing and inspecting agency acceptable to authorities having jurisdiction.


B. Mold Resistance: Provide materials tested according to ASTM D3273.

C. Sound Transmission Characteristics: For gypsum board assemblies with STC ratings, provide materials and construction identical to those tested in assembly indicated according to ASTM E 90 and classified according to ASTM E 413 by a qualified independent testing agency.

1. STC-Rated Assemblies: Indicated by design designations from GA-600, "Fire Resistance Design Manual."

D. Marking of Framing Members: Provide factory-applied marking and identification on each steel member, including roll-former’s identification, steel thickness in mils or inches exclusive of protective coating, yield strength in ksi, coating weight using standard coating designator, and color-coating as required by Building Code.

E. Gypsum Board Finish Mockups: Before finishing gypsum board assemblies, install mockups of at least 100 sq. ft. (9 sq. m) in surface area to demonstrate aesthetic effects and qualities of materials and execution.

1. Install mockups for the following applications:
   a. Surfaces with texture finishes.
   b. Surfaces indicated to receive nontextured paint finishes.
   c. Surfaces indicated to receive textured paint finishes.
2. Simulate finished lighting conditions for review of mockups.
3. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials in original packages, containers, or bundles bearing brand name and identification of manufacturer or supplier.

B. Store materials inside under cover and keep them dry and protected against damage from weather, direct sunlight, surface contamination, corrosion, construction traffic, and other causes. Stack gypsum panels flat to prevent sagging.

1.08 PROJECT CONDITIONS

A. Environmental Limitations: Comply with ASTM C 840 requirements or gypsum board manufacturer's written recommendations, whichever are more stringent.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
1. Steel Framing and Furring:
   a. ClarkWestern Building Systems.
   b. Dietrich Industries, Inc.
   c. MarinoWare; Division of Ware Ind.
   d. NoFlex, Inc. (for partial-height partition supports).
   e. Scafco Corporation.
   f. Super Stud Building Products, Inc.

2. Gypsum Board and Related Products:
   a. American Gypsum Co.
   b. Certainteed Corporation.
   c. G-P Gypsum Corp.
   d. LaFarge North America.
   e. National Gypsum Company.
   f. United States Gypsum Co.

3. Signs for Posting Partition Rating:

        B. Recycled Content of Steel Products: Provide products with average recycled content of steel products such that postconsumer recycled content plus one-half of preconsumer recycled content is not less than 25 percent.

2.02 STEEL SUSPENDED CEILING AND SOFFIT FRAMING

A. Components, General: Comply with ASTM C 754 for conditions indicated.

B. Hanger Attachments to Structure: As follows:
   1. Powder-Actuated at Concrete Structure and Screw Fasteners at Wood Structure: Suitable for application indicated, fabricated from corrosion-resistant materials, with clips or other devices for attaching hangers of type indicated, and capable of sustaining, without failure, a load equal to 10 times that imposed by construction as determined by testing according to ASTM E 1190 by a qualified independent testing agency.

C. Hangers: As follows:
   1. Wire Hangers: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.162-inch (4.12-mm) diameter.

D. Carrying Channels: Cold-rolled, commercial-steel sheet with a base metal thickness of 0.0538 inch (1.37 mm), a minimum 1/2-inch- (12.7-mm-) wide flange, with ASTM A 653/A 653M, G40 (Z120), hot-dip galvanized zinc coating.
   1. Depth: 1-1/2 inches (38.1 mm).

E. Furring Channels (Furring Members): Commercial-steel sheet with manufacturer's standard corrosion-resistant zinc coating.
   1. Hat-Shaped, Rigid Furring Channels: ASTM C 645, 7/8 inch (22.2 mm) deep.

F. Grid Suspension System for Interior Ceilings: ASTM C 645, direct-hung system composed of main beams and cross-furring members that interlock.
   1. Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
      b. BPB America Inc., Celotex Brand Drywall Grid System.
      c. Chicago Metallic Corporation; Drywall Furring 660 System.
      d. USG Interiors, Inc.; Drywall Suspension System.
2.03 STEEL PARTITION AND SOFFIT FRAMING

A. Components, General: As follows:
   1. Comply with ASTM C 754 for conditions indicated.
   2. Steel Sheet Components: Complying with ASTM C 645 requirements for metal
      and with manufacturer's standard corrosion-resistant zinc coating.

B. Steel Studs and Runners: ASTM C 645.
   1. Minimum Base Metal Thickness: 0.033 inch (0.84 mm).
   2. Depth: 3-5/8 inches (92.1 mm), unless indicated otherwise.
   3. Where extra height or other special design requires additional strength, provide
      steel studs of additional thickness.

C. Dimpled Steel Studs and Runners:
   1. Minimum Base-Metal Thickness: 0.025 inch (0.64 mm).
   2. Depth: 3-5/8 inches (92 mm), unless indicated otherwise.
   3. Where extra height or other special design requires additional strength, provide
      steel studs of additional thickness.

D. Steel Structural Supports for Partial-Height Walls:
   1. NoFlex, Inc., heavy-gauge steel base plate and tube steel support, fully welded.
   2. Spacing: 48-inches on center.
   3. Attachment: Through-bolts into structural floor or blocking below floor.

E. Hat-Shaped, Rigid Furring Channels: ASTM C 645.
   1. Minimum Base Metal Thickness: 0.0312 inch (0.79 mm).
   2. Depth: 7/8 inch (22.2 mm).

F. Resilient Furring Channels: 1/2-inch- (12.7-mm-) deep, steel sheet members designed
   to reduce sound transmission.
   1. Configuration: Asymmetrical, with face attached to single flange by a slotted leg
      (web).

G. Z-Shaped Furring: With slotted or nonslotted web, face flange of 1-1/4 inches (31.8
   mm), wall attachment flange of 7/8 inch (22.2 mm), minimum bare metal thickness of
   0.0179 inch (0.45 mm), and depth required to fit insulation thickness indicated.

H. Firestop Tracks: Top runner manufactured to allow partition heads to expand and
   contract with movement of structure while maintaining continuity of fire-resistance-
   rated assembly indicated; in thickness not less than indicated for studs and in width to
   accommodate depth of studs.
   1. Products: Subject to compliance with requirements, provide one of the
      following:
      a. Dietrich Metal Framing; The System by Metal-Lite, Inc.
      b. Fire Trak Corp.; Fire Trak attached to studs with Fire Trak Slip Clip.

I. Sheet Steel Backing Plates: Galvanized steel sheet, 0.0538-inch (16-gauge) extending
   to nearest stud beyond each end of device being attached.

J. Fasteners for Metal Framing: Of type, material, size, corrosion resistance, holding
   power, and other properties required to fasten steel members to substrates.
2.04 INTERIOR GYPSUM WALLBOARD

A. Panel Size: Provide in maximum lengths and widths available that will minimize joints in each area and correspond with support system indicated.

B. Recycled Content: Provide gypsum panel products with recycled content such that postconsumer recycled content plus one-half of preconsumer recycled content constitutes a minimum of 25 percent by weight.

C. Gypsum Wallboard: ASTM C 1396/C 1396M.
   1. Regular Type:
      a. Thickness: As indicated.
      b. Long Edges: Tapered.
      c. Location: Vertical surfaces, unless otherwise indicated.
   2. Regular Mold-Resistant Type:
      a. Thickness: As indicated.
      b. Long Edges: Tapered.
      c. Location: Vertical surfaces, unless otherwise indicated.
   3. Type X:
      a. Thickness: As indicated.
      b. Long Edges: Tapered.
      c. Location: As indicated, and where required for fire-resistance-rated assembly.
   4. “Level 5” Type X:
      a. Thickness: As indicated.
      b. Long Edges: Tapered.
      c. Location: As indicated, and where required for fire-resistance-rated assembly and also requiring a Level 5 finish as specified under gypsum board finishes, below.
   5. Moisture- and Mold-Resistant Type X: mold resistance score of 10 as tested in accordance with ASTM D 3273 and water absorption of less than 5-percent by weight as tested in accordance with ASTM C 473
      a. Thickness: As indicated.
      b. Long Edges: Tapered.
      c. Location: As indicated, and where required for fire-resistance-rated assembly.

D. Special Type X: Having improved fire resistance over standard Type X, and complying with requirements of fire-resistance-rated assemblies indicated on Drawings, sometimes referred to as “Type C”.
   1. Thickness: As required by fire-resistance-rated assembly indicated on Drawings.
   2. Long Edges: Tapered.

E. Abuse-Resistant Type: Manufactured to produce greater resistance to surface indentation and through-penetration (impact resistance) than standard, regular-type and Type X gypsum board.
   1. Core: 5/8 inch (15.9 mm), Type X.
   2. Long Edges: Tapered.
F. High-Abuse-Resistant Type at Typical Walls: Manufactured with glass fiber reinforcement to produce greater resistance to surface indentation and through-penetration (impact resistance) than standard, regular-type and Type X gypsum board.  
1. Core: 5/8 inch (15.9 mm), Type X.  
2. Long Edges: Tapered.  

G. High-Abuse- and Mold-Resistant Type at Toilets, Showers, Housekeeping, Laundry, and Soiled Utility Room Walls: Manufactured with glass fiber reinforcement to produce greater resistance to surface indentation and through-penetration (impact resistance) than standard, regular-type and Type X gypsum board. Manufactured with resistance to moisture and water.  
1. Core: 5/8 inch (15.9 mm), Type X.  
2. Long Edges: Tapered.  

H. Gypsum Liner Panels: Comply with ASTM C 1396/C 1396M.  
1. Type X: Manufacturer's proprietary liner panels with moisture-resistant paper faces.  
   a. Core: 1 inch (25.4 mm) thick.  
   b. Long Edges: Double bevel.  
2. Moisture- and Mold-Resistant Type X: Manufacturer's proprietary liner panels and with moisture- and mold-resistant core and surfaces; mold resistance score of 10 as tested in accordance with ASTM D 3273 and water absorption of less than 5-percent by weight as tested in accordance with ASTM C 473.  
   a. Core: 1 inch (25.4 mm) thick.  
   b. Long Edges: Double bevel.

2.05 TILE BACKING PANELS

A. Panel Size: Provide in maximum lengths and widths available that will minimize joints in each area and correspond with support system indicated.

B. Glass-Mat, Water-Resistant Backing Board at Damp Areas:  
1. Complying with ASTM C 1178/C 1178M.  
   a. Product: Subject to compliance with requirements, provide one of the following:  
      1) "DensShield Tile Guard" by G-P Gypsum.  
      2) "GlasRoc Tile Backer" by Certainteed Corporation.  
2. Complying with ASTM C1177/C 1177M.  
   a. Product: Subject to compliance with requirements, provide one of the following:  
      1) "DensArmor Plus Interior Guard" by G-P Gypsum.  
      2) "GlasRoc Sheathing" by Certainteed Corporation.  
      3) "E2XP Sheathing" by National Gypsum.  
3. Core: 5/8 inch (15.9 mm), Type X.

C. Cementitious Backer Units at Wet Areas, Shower Walls, and at Walls Behind and Next to Toilets in Toilet Rooms: ANSI A118.9.
1. Products: Subject to compliance with requirements, provide one of the following:
   a. C-Cure; C-Cure Board 990.
   b. Custom Building Products; Wonderboard.
   c. FinPan, Inc.; Util-A-Crete Concrete Backer Board.
   d. USG Corporation; DUROCK Cement Board.

2. Thickness: 1/2 inch (12.7 mm).

3. Width and Length: Manufacturer's standard width, but not less than 32 inches (813 mm). Provide cementitious backer units in maximum lengths available to minimize end-to-end butt joints.

2.06 TRIM ACCESSORIES

A. Interior Trim: ASTM C 1047.
   1. Material: Galvanized or aluminum-coated steel sheet or rolled zinc.
   2. Shapes:
      a. Cornerbead: Use at outside corners, unless otherwise indicated.
      b. L-Bead: L-shaped; exposed long leg receives joint compound; use where indicated.
      c. U-Bead: J-shaped; exposed short flange does not receive joint compound; use at exposed panel edges.

   1. Types:
      b. Edge Trim: “L” Trim.
      c. Inside or Outside Corner Trim, Any Degree: UltraFlex.
      d. Inside or Outside Corner Trim, Any Degree, Small Areas: UltraFlex 325.

2.07 JOINT TREATMENT MATERIALS

A. General: Comply with ASTM C 475.

B. Joint Tape:
   1. Interior Gypsum Wallboard: Paper.
   2. Tile Backing Panels: As recommended by panel manufacturer.

C. Joint Compound for Interior Gypsum Wallboard: 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.
   3. Fill Coat: For second coat, use setting-type, sandable topping compound.
   4. Finish Coat: For third coat, use setting-type, sandable topping compound.
   5. Skim Coat: For final coat of Level 5 finish, use setting-type, sandable topping compound.

D. Joint Compound for Tile Backing Panels:
   1. Glass-Mat, Water-Resistant Backing Panel: As recommended by backing panel manufacturer.
   2. Cementitious Backer Units: As recommended by backer unit manufacturer.
2.08 SOUND ATTENUATION

A. Sound Attenuation Blankets: ASTM C 665, Type I (blankets without membrane facing) produced by combining thermosetting resins with mineral fibers manufactured from glass, slag wool, or rock wool.
   1. Fire-Resistance-Rated Assemblies: Comply with mineral-fiber requirements of assembly.
   2. Formaldehyde-Free: Provide sound attenuation blankets containing no formaldehyde.
   3. Recycled Content: Provide blankets with recycled content such that postconsumer recycled content plus one-half of preconsumer recycled content constitutes a minimum of 20 percent by weight.

B. Where sound attenuation insulation is indicated, provide blankets in batt or roll form in thicknesses that most closely fill the entire void of the wall, without crushing.

C. Sound Attenuation Board: ASTM C 612, Type standard with manufacturer; nominal density of 6 to 7 lb/cu. ft. (96 to 112 kg/cu. m), unfaced, and dimensionally stable, molded rigid glass fiber board; and with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively.
   1. Formaldehyde-Free: Provide sound attenuation board containing no formaldehyde.
   2. Recycled Content: Provide blankets with recycled content such that postconsumer recycled content plus one-half of preconsumer recycled content constitutes a minimum of 20 percent by weight.
   3. Provide black faced insulation where insulation is visible, including when insulation is installed behind another finish material.

D. Acoustic Sheet Caulking: Lowry's "Electrical Box Pads" resilient, self-adhesive sound sealer.

E. Acoustical Sealant for Exposed and Concealed Joints: Nonsag, paintable, nonstaining, latex sealant, with a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24), complying with ASTM C 834 that effectively reduces airborne sound transmission through perimeter joints and openings in building construction as demonstrated by testing representative assemblies according to ASTM E 90.
   1. Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
      a. Acoustical Sealant for Exposed and Concealed Joints:
         1) Pecora Corp.; AC-20 FTR Acoustical and Insulation Sealant.
         2) United States Gypsum Co.; SHEETROCK Acoustical Sealant.
         3) W.W. Henry #313

2.09 AUXILIARY MATERIALS

A. General: Provide auxiliary materials that comply with referenced installation standards and manufacturer's written recommendations.

B. Laminating Adhesive: Adhesive or joint compound recommended for directly adhering gypsum panels to continuous substrate.
   1. Use adhesives that have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
C. Steel Drill Screws: ASTM C 1002, Type S-12, unless otherwise indicated.

D. Thermal Insulation and Sound Attenuation: As specified in Division 07 Section "Building Insulation."

E. Signs for Posting Partition Ratings: Provide signs in size and with wording as required by code, appropriate for each partition on which sign is affixed.
   2. At Contractor’s option, provide signs as required by code for each partition using contrasting-color spray paint.

2.10 TEXTURE FINISHES

A. Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
   1. Acoustical Finish:
      a. International Cellulose Corp.; SonaSpray "fc."

B. Primer: As recommended by textured finish manufacturer.

C. Acoustical Finish: Water-based, chemical-setting or drying-type, job-mixed texture finish for spray application.
   1. Application Thickness: 1/2 inch (12.7 mm).
   2. Fire-Test-Response Characteristics: Indices when tested according to ASTM E 84 as follows:
      b. Smoke Developed: Less than 450.
   3. NRC: 0.55 according to ASTM C 423.

PART 3 - EXECUTION

3.01 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. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLING STEEL FRAMING, GENERAL

A. Installation Standards: ASTM C 754, and ASTM C 840 requirements that apply to framing installation.

B. Install supplementary framing, blocking, and bracing at terminations in gypsum board assemblies to support fixtures, equipment services, heavy trim, grab bars, toilet accessories, furnishings, or similar construction. Comply with details indicated and with gypsum board manufacturer's written recommendations or, if none available, with United States Gypsum's "Gypsum Construction Handbook."

C. Isolate steel framing from building structure at locations indicated to prevent transfer of loading imposed by structural movement.
1. Isolate ceiling assemblies where they abut or are penetrated by building structure.

D. Do not bridge building control and expansion joints with steel framing or furring members. Frame both sides of joints independently.

3.03 INSTALLING STEEL SUSPENDED CEILING AND SOFFIT FRAMING

A. Suspend ceiling hangers from building structure as follows:
1. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structural or ceiling suspension system. Splay hangers only where required to miss obstructions and offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.
2. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with the location of hangers required to support standard suspension system members, install supplemental suspension members and hangers in form of trapezes or equivalent devices. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced standards.
3. Secure wire hangers by looping and wire-tying, either directly to structures or to inserts, eyescrews, or other devices and fasteners that are secure and appropriate for substrate, and in a manner that will not cause them to deteriorate or otherwise fail.
4. Secure hangers to structure, including intermediate framing members, by attaching to inserts, eyescrews, or other devices and fasteners that are secure and appropriate for structure and hanger, and in a manner that will not cause hangers to deteriorate or otherwise fail.
5. Do not support ceilings directly from permanent metal forms.
6. Do not connect or suspend steel framing from ducts, pipes, or conduit.

B. Installation Tolerances: Install steel framing components for suspended ceilings so members for panel attachment are level to within 1/8 inch in 12 feet (3 mm in 3.6 m) measured lengthwise on each member and transversely between parallel members.

C. Sway-brace suspended steel framing with hangers used for support.

D. Wire-tie or clip furring channels to supports, as required to comply with requirements for assemblies indicated.

E. Install suspended steel framing components in sizes and spacings indicated, but not less than that required by the referenced steel framing and installation standards.
1. Hangers: 48 inches (1219 mm) o.c.
2. Carrying Channels (Main Runners): 48 inches (1219 mm) o.c.
3. Furring Channels (Furring Members): 16 inches (406 mm) o.c.

F. Grid Suspension System: Attach perimeter wall track or angle where grid suspension system meets vertical surfaces. Mechanically join main beam and cross-furring members to each other and butt-cut to fit into wall track.

3.04 INSTALLING STEEL PARTITION AND SOFFIT FRAMING

A. Install tracks (runners) at floors, ceilings, and structural walls and columns where gypsum board assemblies abut other construction.
1. Where studs are installed directly against exterior walls, install asphalt-felt isolation strip between studs and wall.

B. Installation Tolerance: Install each steel framing and furring member so fastening surfaces vary not more than 1/8 inch (3 mm) from the plane formed by the faces of adjacent framing.

C. Extend partition framing full height to structural supports or substrates above suspended ceilings, except where partitions are indicated to terminate at suspended ceilings. Continue framing over frames for doors and openings and frame around ducts penetrating partitions above ceiling to provide support for gypsum board.
   1. For fire-resistance-rated and STC-rated partitions that extend to the underside of floor/roof slabs and decks or other continuous solid-structure surfaces to obtain ratings, install framing around structural and other members extending below floor/roof slabs and decks, as needed to support gypsum board closures and to make partitions continuous from floor to underside of solid structure.
      a. Terminate partition framing at suspended ceilings where indicated.

D. Install steel studs and furring at the following spacings:
   1. Single-Layer Construction: 16 inches (406 mm) o.c., unless otherwise indicated.
   2. At interior walls where electrical outlet and switch boxes are indicated to be back-to-back, provide additional studs as required to locate boxes in separate stud spaces on each side of the wall.

E. Install steel studs so flanges point in the same direction and leading edge or end of each panel can be attached to open (unsupported) edges of stud flanges first.

F. Install backing plates for wall-hung equipment and accessories, using a minimum of 2 screws per stud. Install backing plates for wall cabinets, toilet accessories, bulletin boards, handrails, wall bumpers, headwalls, and other equipment to be attached to walls.

G. Frame door openings to comply with GA-600 and with gypsum board manufacturer's applicable written recommendations, unless otherwise indicated. Screw vertical studs at jambs to jamb anchor clips on door frames; install runner track section (for cripple studs) at head and secure to jamb studs.
   1. Install two studs at each jamb, unless otherwise indicated.
   2. Install cripple studs at head adjacent to each jamb stud, with a minimum 1/2-inch (13-mm) clearance from jamb stud to allow for installation of control joint.
   3. Extend jamb studs through suspended ceilings and attach to underside of floor or roof structure above.

H. 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.

I. Z-Furring Members:
   1. Erect insulation vertically and hold in place with Z-furring members spaced 24 inches (610 mm) o.c.
   2. Except at exterior corners, securely attach narrow flanges of furring members to wall with concrete stub nails, screws designed for masonry attachment, or powder-driven fasteners spaced 24 inches (600 mm) o.c.
   3. At exterior corners, attach wide flange of furring members to wall with short flange extending beyond corner; on adjacent wall surface, screw-attach short
3.05 APPLYING AND FINISHING PANELS, GENERAL

A. Gypsum Board Application and Finishing Standards: ASTM C 840 and GA-216.

B. Install sound attenuation blankets before installing gypsum panels, unless blankets are readily installed after panels have been installed on one side.

C. Install ceiling board panels across framing to minimize the number of abutting end joints and to avoid abutting end joints in the central area of each ceiling. Stagger abutting end joints of adjacent panels not less than one framing member.

D. Install gypsum panels with face side out. Butt panels together for a light contact at edges and ends with not more than 1/16 inch (1.5 mm) of open space between panels. Do not force into place.

E. 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.

F. Attach gypsum panels to steel studs so leading edge or end of each panel is attached to open (unsupported) edges of stud flanges first.

G. Attach gypsum panels to framing provided at openings and cutouts.

H. Form control and expansion joints with space between edges of adjoining gypsum panels.

I. Cover both faces of steel stud partition 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. (0.7 sq. m) in area.
   2. Fit gypsum panels around ducts, pipes, and conduits.
   3. Where partitions intersect open concrete coffers, concrete joists, and other structural members projecting below underside of floor/roof slabs and decks, cut gypsum panels to fit profile formed by coffers, joists, and other structural members; allow 1/4- to 3/8-inch- (6.4- to 9.5-mm-) wide joints to install sealant.

K. STC-Rated Assemblies: Seal construction at perimeters, behind control and expansion 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 C 919 and manufacturer's written recommendations for locating edge trim and closing off sound-flanking paths around or through gypsum board assemblies, including sealing partitions above acoustical ceilings.
L. Space fasteners in gypsum panels according to referenced gypsum board application and finishing standard and manufacturer's written recommendations.
   1. Space screws a maximum of 12 inches (304.8 mm) o.c. for vertical applications.

M. Space fasteners in panels that are tile substrates a maximum of 8 inches (203.2 mm) o.c.

N. Apply signs indicating fire- and smoke-separation rating for each rated partition, located 8-inches above suspended and dropped framed ceilings and at top of wall at unfinished spaces. Place signs at 12-foot intervals horizontally on straight and curved walls, with no fewer than one sign at each turn in each wall. Place signs on both sides of each rated partition.

3.06 PANEL APPLICATION METHODS

A. Single-Layer Application:
   1. On ceilings, apply gypsum panels before wall/partition board application to the 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. Stagger abutting end joints not less than one framing member in alternate courses of board.
   3. On Z-furring members, apply gypsum panels vertically (parallel to framing) with no end joints. Locate edge joints over furring members.

B. Single-Layer Fastening Methods: Apply gypsum panels to supports with steel drill 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 recommendations and temporarily brace or fasten gypsum panels until fastening adhesive has set.

D. Tile Backing Panels:
   1. Cementitious Backing Board: Install at showers, tubs, and where indicated. Install with 1/4-inch (6.4-mm) gap where panels abut other construction or penetrations.
   2. Areas Not Subject to Wetting: Install glass mat gypsum wallboard panels to produce a flat surface except at showers, tubs, and other locations indicated to receive cementitious panels.
   3. Where tile backing panels abut other types of panels in the same plane, shim surfaces to produce a uniform plane across panel surfaces.

3.07 INSTALLING 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 C 840 and in specific locations approved by Architect for visual effect.
3.08 FINISHING GYPSUM BOARD ASSEMBLIES

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 those with trim having flanges not intended for tape.

D. Gypsum Board Finish Levels: Finish panels to levels indicated below, according to ASTM C 840, for locations indicated:
   1. Level 1: Embed tape at joints in ceiling plenum areas, concealed areas, and where indicated, unless a higher level of finish is required for fire-resistance-rated assemblies and sound-rated assemblies.
      a. Locations: Ceiling plenum areas, concealed areas, and where indicated.
   2. Level 2: Embed tape and apply separate first coat of joint compound to tape, fasteners, and trim flanges where panels are substrate for tile or wood paneling and where indicated.
      a. Locations: Panels that are substrate for tile and panels that are substrate for acoustical tile.
   3. Level 3: Embed tape and apply separate first and finish coats of joint compound to tape, fasteners, and trim flanges at panel surfaces that will be exposed to view, unless otherwise indicated.
      a. Locations: Walls in mechanical rooms, storage rooms, janitor closets, electrical and data closets, and other spaces not occupied by building users on a day-to-day basis.
   4. Level 4: Embed tape and apply separate first, fill, and finish coats of joint compound to tape, fasteners, and trim flanges at panel surfaces that will be exposed to view, unless otherwise indicated.
      a. Locations: Walls and ceilings in public areas including offices and other normally occupied locations except those noted for Level 5 finish.
      b. Primer and its application to surfaces are specified in other Division 09 Sections.
   5. Level 5: Embed tape and apply separate first, fill, and finish coats of joint compound to tape, fasteners, and trim flanges, and apply skim coat of joint compound over entire surface where indicated. Contractor’s Option: Use “Level 5” gypsum board and follow manufacturer’s installation and finishing instructions to obtain the same finish as described in the referenced standard.
      a. Locations: Walls and ceilings in corridors, lobbies, and assembly rooms.
      b. Primer and its application to surfaces are specified in other Division 09 Sections.

3.09 APPLYING TEXTURE FINISHES

A. Surface Preparation and Primer: Prepare and apply primer to gypsum panels and other surfaces receiving texture finishes. Apply primer to surfaces that are clean, dry, and smooth.

B. Texture Finish Application: Mix and apply finish using powered spray equipment, to produce a uniform texture matching approved mockup and free of starved spots or other evidence of thin application or of application patterns.
1. Texture: Medium orange peel, as approved by the Architect.

C. Prevent texture finishes from coming into contact with surfaces not indicated to receive texture finish by covering them with masking agents, polyethylene film, or other means. If, despite these precautions, texture finishes contact these surfaces, immediately remove droppings and overspray to prevent damage according to texture finish manufacturer's written recommendations.

END OF SECTION 09 21 16
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. This Section includes ceilings consisting of acoustical panels and exposed suspension systems.

B. Work of this Section shall also include patching and repairs, and where required, replacement of existing acoustical panel ceilings damaged or otherwise required to be replaced, due to the Work of this Contract.

C. Related Sections: The following Sections contain requirements that relate to this Section:
   1. Division 09 Section “Metal Suspension Systems” for hanger rods and channel supports for suspended acoustical panel ceilings.
   2. Division 09 Section "Gypsum Board Assemblies" for gypsum board ceilings and soffits.

1.03 SUBMITTALS

A. Product Data: For each type of product specified.

B. Coordination Drawings: Reflected ceiling plans drawn to scale and coordinating penetrations and ceiling-mounted items. Show the following:
   1. Ceiling suspension system members.
   2. Method of attaching suspension system to hanger assemblies.
   3. Ceiling-mounted items including light fixtures; air outlets and inlets; speakers; sprinklers; and special moldings at walls, column penetrations, and other junctures of acoustical ceilings with adjoining construction.

C. Samples for Verification: Full-size units of each type of ceiling assembly indicated; in sets for color, texture, and pattern specified, showing the full range of variations expected in these characteristics.
   1. Full-size samples of each acoustical panel type, pattern, and color.
   2. Set of 12-inch- (300-mm-) long samples of exposed suspension system members, including moldings, for color and system type required.

D. Qualification Data: For firms and persons specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names and addresses of architects and owners, and other information specified.
E. Product Test Reports: Indicate compliance of acoustical panel ceilings and components with requirements based on comprehensive testing of current products.

F. Research/Evaluation Reports: Evidence of acoustical panel ceiling's and components' compliance with building code in effect for Project, from a model code organization acceptable to authorities having jurisdiction.

1.04 QUALITY ASSURANCE

A. Installer Qualifications: Engage an experienced installer who has completed acoustical panel ceilings similar in material, design, and extent to that indicated for this Project and with a record of successful in-service performance.

B. Source Limitations: Obtain each type of acoustical ceiling panel and supporting suspension system through one source from a single manufacturer.

C. Fire-Test-Response Characteristics: Provide acoustical panel ceilings that comply with the following requirements:
1. Surface-burning characteristics of acoustical panels comply with ASTM E 1264 for Class A materials as determined by testing identical products per ASTM E 84.

D. Control Samples: Before installing acoustical panel ceilings, construct control samples for each form of construction and finish required to verify selections made under sample Submittals and to demonstrate aesthetic effects and qualities of materials and execution. Build control samples to comply with the following requirements, using materials indicated for completed work:
1. Locate control samples in the location and of the size indicated or, if not indicated, as directed by Architect.
2. Notify Architect seven days in advance of the dates and times when control samples will be constructed.
3. Demonstrate the proposed range of aesthetic effects and workmanship.
4. Obtain Architect's approval of control samples before starting construction of acoustical panel ceilings.
5. Maintain control samples during construction in an undisturbed condition as a standard for judging the completed Work.
   a. Approved control samples in an undisturbed condition at the time of Substantial Completion may become part of the completed Work.

E. Preinstallation Conference: Conduct conference at Project site to comply with requirements of Division 01 Section "Project Management and Coordination."

1.05 DELIVERY, STORAGE, AND HANDLING

A. Deliver acoustical panels and suspension system components to Project site in original, unopened packages and store them in a fully enclosed space where they will be protected against damage from moisture, direct sunlight, surface contamination, and other causes.

B. Before installing acoustical panels, permit them to reach room temperature and a stabilized moisture content.
C. Handle acoustical panels carefully to avoid chipping edges or damaging units in any way.

1.06 PROJECT CONDITIONS

A. Environmental Limitations: Do not install acoustical panel ceilings until spaces are enclosed and weatherproof, 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.

1.07 COORDINATION

A. Coordinate layout and installation of acoustical panels and suspension system with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, fire-suppression system, and partition assemblies.

1.08 MAINTENANCE MATERIALS

A. Furnish materials described below that match products installed, packaged with protective covering for storage and identified with labels describing contents.
   1. Acoustical Ceiling Units: Full-size units equal to 2.0 percent of each type amount installed.
   2. Suspension System Components: Quantity of each exposed component equal to 2.0 percent of amount installed.

PART 2 - PRODUCTS

2.01 ACOUSTICAL PANELS

A. Acoustical Panel Standard: Provide manufacturer's standard size panels of configuration indicated that comply with ASTM E 1264 classifications as designated by types, patterns, acoustical ratings, and light reflectances, unless otherwise indicated.
   1. Mounting Method for Measuring Noise Reduction Coefficient: Type E-400; plenum mounting in which face of test specimen is 15-3/4 inches (400 mm) away from test surface per ASTM E 795.
   2. Coordinate to match existing sizes/types of acoustical panel systems when replacing removed ACT or other ceiling systems to complete the work.

2.02 METAL SUSPENSION SYSTEMS, GENERAL

A. Metal Suspension System Standard: Provide manufacturer's standard indirect-hung metal suspension systems of types, structural classifications, and finishes indicated that comply with applicable ASTM C 635 requirements.

B. Seismic Standard: Provide acoustical panel ceilings designed and installed to withstand the effects of earthquake motions according to the following:
   1. International Building Code requirements for Seismic Design Category C.

C. Manufacturers:
   1. Armstrong World Industries, Inc.
   2. Celotex Corporation; Architectural Ceilings Marketing Dept.
SECTION 095113 – ACOUSTICAL PANEL CEILINGS

3. Certainteed Corporation.
5. Fry Reglet Corporation.
7. MM Systems, Inc.
8. USG Interiors, Inc.

D. Systems: Subject to compliance with requirements and as scheduled, provide:
1. “Prelude XL” 15/16-inch.exposed tee system as manufactured by Armstrong Ceiling Systems, or equal products of one of the specified manufacturers.
2. Coordinate to match existing conditions & types of grids when completing the work.

E. Double-Web, Steel Suspension System: Main and cross runners roll formed from cold-rolled steel sheet, prepainted, electrolytically zinc coated, or hot-dip galvanized according to ASTM A 653/653M, not less than G30 (Z90) coating designation, with prefinished 9/16-inch- (15-mm-) wide metal caps on flanges.
1. Structural Classification: Heavy-duty system.
2. End Condition of Cross Runners: Override (stepped) type.
3. Face Design: Flat, flush.

F. Attachment Devices: Size for five times design load indicated in ASTM C 635, Table 1, Indirect Hung, unless otherwise indicated.

G. Direct Clip: BSA #548-58 SM.

H. Sheet-Metal Edge Moldings and Trim: Type and profile indicated or, if not indicated, manufacturer's standard moldings for edges and penetrations that fit acoustical panel edge details and suspension systems indicated; formed from sheet metal of same material and finish as that used for exposed flanges of suspension system runners.
1. For circular penetrations of ceiling, provide edge moldings fabricated to diameter required to fit penetration exactly.
2. For each suspension system, provide suspension system and manufacturer's standard edge moldings that match width and configuration of exposed runners.

2.03 ACOUSTICAL SEALANT

A. Acoustical Sealant for Exposed and Concealed Joints: Manufacturer's standard nonsag, paintable, non staining latex sealant complying with ASTM C 834 and the following requirements:
1. Product is effective in reducing airborne sound transmission through perimeter joints and openings in building construction as demonstrated by testing representative assemblies according to ASTM E 90.

B. Acoustical Sealant for Concealed Joints: Manufacturer's standard nondrying, nonhardening, nonskinning, nonstaining, gunnable, synthetic-rubber sealant recommended for sealing interior concealed joints to reduce airborne sound transmission.

C. Products: Subject to compliance with requirements, provide one of the following:
1. Acoustical Sealant for Exposed and Concealed Joints:
 PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine substrates and 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 other conditions affecting performance of acoustical panel ceilings.

1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Coordination: Furnish layouts for clips, and other ceiling anchors whose installation is specified in other Sections.

B. 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, and comply with layout shown on reflected ceiling plans.

3.03 INSTALLATION

A. General: Install acoustical panel ceilings to comply with publications referenced below per manufacturer's written instructions and CISCA's "Ceiling Systems Handbook."


3. Direct clip to metal suspension members.

4. Space clips not more than 48 inches (1200 mm) o.c. along each member supported directly from metal suspension members, unless otherwise indicated; and provide direct clips not more than 8 inches (200 mm) from ends of each member.

B. 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 (400 mm) o.c. and not more than 3 inches (75 mm) from ends, leveling with ceiling suspension system to a tolerance of 1/8 inch in 12 feet (3 mm in 3.6 m). Miter corners accurately and connect securely.

3. Do not use exposed fasteners, including pop rivets, on moldings and trim.
SECTION 095113 – ACOUSTICAL PANEL CEILINGS

C. Install suspension system runners so they are square and securely interlocked with one another. Remove and replace dented, bent, or kinked members.

D. Install acoustical panels with undamaged edges and fitted accurately into suspension system runners and edge moldings. Scribe and cut panels at borders and penetrations to provide a neat, precise fit.
   1. Arrange directionally patterned acoustical panels as follows:
      a. As indicated on reflected ceiling plans.
   2. Paint cut panel edges remaining exposed after installation; match color of exposed panel surfaces using coating recommended in writing for this purpose by acoustical panel manufacturer.

3.04 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. Remove and replace ceiling components that cannot be successfully cleaned and repaired to permanently eliminate evidence of damage.

END OF SECTION 09 51 13
SECTION 096500 – RESILIENT FLOORING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specifications Sections, apply to this Section.

1.02 SUMMARY

A. Section Includes:
1. Vinyl sheet or plank flooring (VS).
2. Vinyl composition floor tile (VCT).
3. Transition strips between flooring types.
4. Resilient base (RB/WB).
5. Floor substrate preparation.

B. Related Sections:
1. Metal transition strips between ceramic tile and other flooring types, specified in Division 09 Section “Tiling”.

1.03 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings: For each type of resilient flooring. Include flooring layouts, edges, columns, doorways, enclosing partitions, built-in furniture, cabinets, and cutouts.
1. Show details of special patterns.

C. Samples for Initial Selection: For each type of flooring indicated.

D. Samples for Verification: Full-size units of each color and pattern of flooring required.
1. For heat-welding bead, manufacturer's standard-size Samples, but not less than 9 inches (230 mm) long, of each color required.

E. Seam Samples: For seamless-installation technique indicated and for each flooring product, color, and pattern required; with seam running lengthwise and in center of 6-by-9-inch (150-by-230-mm) Sample applied to a rigid backing and prepared by Installer for this Project.

F. Written moisture test report.

G. Product Schedule: For resilient flooring. Use same designations indicated on Drawings.

1.04 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified Installer.
1.05 CLOSEOUT SUBMITTALS
A. Maintenance Data: For each type of floor to include in maintenance manuals.

1.06 MATERIALS MAINTENANCE 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. Sheet Flooring: One (1) piece of each type installed, 12 x 24-feet (3657 x 7315-mm), color as directed.
   2. Floor Tile: Furnish 1 box for every 50 boxes or fraction thereof, of each type, color, and pattern of floor tile installed.
   3. Resilient Bases: Colors assorted in proportion to those installed.
      a. Twelve (12) preformed outside corners and ten (10) 48-inch (1219-mm) pieces of 6-inch (152-mm) topset cove type.
      b. Twelve (12) preformed outside corners and ten (10) 48-inch (1219-mm) pieces of 4-inch (102-mm) topset cove type.

1.07 QUALITY ASSURANCE
A. Installer Qualifications: A qualified installer who employs workers for this Project who are competent in techniques required by manufacturer for resilient flooring installation and seaming method indicated.
   1. Engage an installer who employs workers for this Project who are trained or certified by manufacturer for installation techniques required.

B. Fire-Test-Response Characteristics: As determined by testing identical products according to ASTM E 648 or NFPA 253 by a qualified testing agency.
   1. Critical Radiant Flux Classification: Class I, not less than 0.45 W/sq. cm.

C. Mockups: Build mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
   1. Build mockups for resilient flooring including resilient base and accessories.
      a. Size: Minimum 100 sq. ft. (9.3 sq. m) for each type, color, and pattern in locations directed by Architect.
   2. Approved mock-up shall be used as a standard for the remaining installation. Areas found to be deficient by the standard set by the approved mock-up and by these specifications shall be repaired or replaced at the Contractor’s expense.

1.08 DELIVERY, STORAGE, AND HANDLING
A. Store resilient flooring 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 (10 deg C) or more than 90 deg F (32 deg C). Store floor tiles on flat surfaces.

1.09 PROJECT CONDITIONS
A. Maintain ambient temperatures within range recommended by manufacturer, but not less than 70 deg F (21 deg C) or more than 95 deg F (35 deg C), in spaces to receive floor tile during the following time periods:
   1. 48 hours before installation.
   2. During installation.
   3. 48 hours after installation.
B. Until Substantial Completion, maintain ambient temperatures within range recommended by manufacturer, but not less than 55 deg F (13 deg C) or more than 95 deg F (35 deg C).

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

2.01 PERFORMANCE REQUIREMENTS

A. Flooring materials shall have a slip resistance coefficient of friction not less than 0.60 tested in accordance with ASTM D 2047.

2.02 VINYL TILE FLOORING MATERIALS

A. Vinyl Composition Tiles:
   1. Tile Standard: ASTM F 1066, Class as indicated by product designations.
   2. Installation Pattern: As indicated.

2.03 VINYL SHEET FLOORING MATERIALS

A. Sheet Vinyl Planking Basis of Design: Lonseal - Loneco; colors selected from full range of patterns and colors. Flooring material shall meet the requirements of ASTM F1303, Type II, Grade 1, Class A backing.

2.04 RESILIENT BASE AND MOLDING MATERIALS

A. Basis-of-Design Resilient Base: Johnsonite, or equal product from one of the specified manufacturers, commercial series rubber, minimum of 5 colors as scheduled, 1/8-inch (3.175-mm) gauge, height 4-inches (102-mm), unless otherwise indicated.
   1. Outside corners shall be factory molded.
   2. Exposed ends of cove base shall be molded end stops.
   3. Cove base shall be topset type; base at carpet shall be toeless type.
   4. Other acceptable manufacturers:
      a. Roppe Rubber Corporation.
      b. Burke Flooring Products.
      c. Allstate.
      d. Flexco.
   5. Color: As scheduled on Drawings.

2.05 INSTALLATION MATERIALS

A. Trowelable Leveling and Patching Compounds: Latex-modified, portland cement based or blended hydraulic-cement-based formulation provided or approved by manufacturer for applications indicated.

B. Concrete Seal: VAPI I 2000 as manufactured by Koester American Corporation, or Dramatic Surface Products DSP 508 as manufactured by Specialty Construction Brands, Inc.; or approved equal.
C. Adhesives: Water-resistant type recommended by manufacturer to suit floor tile and substrate conditions indicated.
   1. Adhesives shall comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24):
      a. Vinyl Tile Adhesives: Not more than 50 g/L.
      b. Rubber Floor Adhesives: Not more than 60 g/L.
   2. Adhesives 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."
   3. Spray Adhesive: Use Tarkett Inc. “SpraySmart” 121- or 123-SG Platinum. No substitutions will be accepted for sprayed adhesive.

D. Seamless-Installation Accessories:
      a. Color: As selected by Architect from manufacturer's full range to contrast with flooring.
   2. Chemical-Bonding Compound: Manufacturer's product for chemically bonding seams.
      a. Chemical-bonding compound shall have a VOC content of 350 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
      b. Chemical-bonding compound 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."

A. Wax: Hillyard Chemical Company "Super Hil-Brite", or equal, water emulsion, slip-resistant wax achieving coefficient of friction greater than 0.60 when tested in accordance with ASTM D 2047.

B. Cove Strips: Mercer Products Co., No. 725, or first recommendation of flooring manufacturer.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine existing vinyl composition tile in place, with Installer present, for match. If the exact product line has been discontinued or the product is not available, notify the Architect before substituting.

B. Examine substrates, with Installer present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.

C. 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.

D. Proceed with installation only after unsatisfactory conditions have been corrected.
3.02 PREPARATION

A. Prepare substrates according to manufacturer's written instructions to ensure adhesion of resilient products.

B. Concrete Substrates: Prepare according to ASTM F 710.
   1. Verify that substrates are dry and free of curing compounds, sealers, and hardeners.
   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 manufacturer. Do not use solvents.
   3. Alkalinity and Adhesion Testing: Perform tests recommended by manufacturer. Proceed with installation only after substrates pass testing.
   4. Moisture Testing: Perform tests recommended by manufacturer and as follows. Proceed with installation only after substrates pass testing.
      a. Perform anhydrous calcium chloride test, ASTM F 1869. Proceed with installation only after substrates have maximum moisture-vapor-emission rate of 3 lb of water/1000 sq. ft. (1.36 kg of water/92.9 sq. m) or rate equal to or less than flooring manufacturer’s written recommendation.
      b. Perform relative humidity test using in situ probes, ASTM F 2170. Proceed with installation only after substrates have a maximum 75 percent relative humidity level measurement or percentage equal to or less than flooring manufacturer’s written recommendation.
   5. Provide concrete seal equivalent to VAP I 2000 at 100 square feet per gallon, or Vi-Tex “Level 3”, as required to provide substrate moisture level within the flooring manufacturer’s acceptable limits.

C. Fill cracks, holes, and depressions in substrates with trowelable leveling and patching compound and remove bumps and ridges to produce a uniform and smooth substrate.

D. Do not install flooring materials until they are same temperature as space where they are to be installed.
   1. Move resilient products and installation materials into spaces where they will be installed at least 48 hours in advance of installation.

E. Sweep and vacuum clean substrates to be covered by resilient products immediately before installation.

3.03 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 square with room axis unless otherwise 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 with grain direction alternating in adjacent tiles (basket-weave pattern) unless otherwise 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.

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, nonstaining marking device.

G. Install floor tiles on covers for telephone and electrical ducts, building expansion-joint covers, and similar items in finished floor 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 flooring 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. Where spray adhesive is used, follow manufacturer’s instructions.

I. Seamless Installation:
   1. Heat-Welded Seams: Comply with ASTM F 1516. Rout joints and heat weld with welding bead to permanently fuse sections into a seamless floor covering. Prepare, weld, and finish seams to produce surfaces flush with adjoining floor covering surfaces.
   2. Chemically Bonded Seams: Bond seams with chemical-bonding compound to permanently fuse sections into a seamless floor covering. Prepare seams and apply compound to produce tightly fitted seams without gaps, overlays, or excess bonding compound on floor covering surfaces.

3.04 SHEET FLOOR COVERING INSTALLATION

A. Comply with manufacturer's written instructions for installing floor coverings.

B. Unroll floor coverings and allow them to stabilize before cutting and fitting.

C. Lay out floor coverings as follows:
   1. Maintain uniformity of floor covering direction.
   2. Minimize number of seams; place seams in inconspicuous and low-traffic areas, at least 6 inches (152 mm) away from parallel joints in floor covering substrates.
   3. Match edges of floor coverings for color shading at seams.
   4. Avoid cross seams.

D. Scribe and cut floor coverings to butt neatly and tightly to vertical surfaces, permanent fixtures, and built-in furniture including cabinets, pipes, outlets, and door frames.

E. Extend floor coverings into toe spaces, door reveals, closets, and similar openings. Extend floor covering under open base cabinets and work surfaces and at cabinets without floor panels, such as roll-in/roll-out storage cabinets.

F. Maintain reference markers, holes, or openings that are in place or marked for future cutting by repeating on floor coverings as marked on substrates. Use chalk or other nonpermanent marking device.
G. Install floor coverings on covers for telephone and electrical ducts and similar items in installation areas. Maintain overall continuity of color and pattern between pieces of floor coverings installed on covers and adjoining floor covering. Tightly adhere floor covering edges to substrates that abut covers and to cover perimeters.

H. Adhere floor coverings 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.

I. Seamless Installation:
   1. Heat-Welded Seams: Comply with ASTM F 1516. Rout joints and use welding bead to permanently fuse sections into a seamless floor covering. Prepare, weld, and finish seams to produce surfaces flush with adjoining floor covering surfaces.
   2. Chemically-Bonded Seams: Bond seams with chemical-bonding compound to permanently fuse sections into a seamless floor covering. Prepare seams and apply compound to produce tightly-fitted seams without gaps, overlays, or excess bonding compound on floor covering surfaces.

J. Integral-Flash-Cove Base: Cove floor coverings 6 inches (152 mm) up vertical surfaces, including cabinets. Support floor coverings at horizontal and vertical junction by cove strip. Butt at top against cap strip.

3.05 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 practicable 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. Preformed Corners: Install preformed corners before installing straight pieces.

3.06 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 resilient floor covering that would otherwise be exposed.

3.07 CLEANING AND PROTECTION

A. Comply with manufacturer's written instructions for cleaning and protection of floor tile.
B. Perform the following operations immediately after completing floor tile installation:
   1. Remove adhesive and other blemishes from exposed surfaces.
   2. Sweep and vacuum surfaces thoroughly.
   3. Damp-mop surfaces to remove marks and soil.

C. Protect floor tile products 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, visible adhesive, and surface blemishes from floor tile surfaces before applying liquid floor polish.
   1. Apply two coat(s).

E. Joint Sealant: Apply sealant to resilient terrazzo floor tile perimeter and around columns, at door frames, and at other joints and penetrations.

F. Sealers and Finish Coats: Remove soil, visible adhesive, and surface blemishes from resilient terrazzo floor tile surfaces before applying liquid cleaners, sealers, and finish products.
   1. Sealer: Apply two base coats of liquid sealer.
   2. Finish: Apply two coats of liquid floor finish.

G. Cover floor tile until Substantial Completion.

END OF SECTION 09 65 00
SECTION 09 65 13
RUBBER BASE AND ACCESSORIES

PART 1 GENERAL

1.1 GENERAL REQUIREMENTS
A. Work of this Section, as shown or specified, shall be in accordance with the requirements of the Contract Documents.

1.2 SECTION INCLUDES
A. Work of this Section includes all labor, materials, equipment, and services necessary to complete the resilient tile flooring, as shown on the drawings and/or specified herein, including, but not limited to, the following:
   1. Rubber base.
   2. Transition strips.
   3. Accessories.

1.3 RELATED SECTIONS
A. Gypsum board partitions - Section 09250.

1.4 QUALITY ASSURANCE
A. Qualifications of Installers: Use only personnel who are thoroughly trained and experienced in the skills required and completely familiar with the requirements established for this work.

1.5 SUBMITTALS
A. Manufacturer's Data: For information only, submit manufacturer's technical information and installation instructions for type of base and transition strips.
   B. Samples
      1. Submit six (6) inch long samples of base and strips.

1.6 DELIVERY AND STORAGE
A. Deliver materials to the project site in the manufacturer's original unopened containers, clearly marked to indicate pattern, gauge, lot number and sequence of materials.
   B. Carefully handle all materials and store in original containers at not less than seventy (70) degrees F. for at least forty-eight (48) hours before start of installation.
1.7 JOB CONDITIONS

A. Continuously heat spaces to receive base and strips to a temperature of seventy (70) degrees F. for at least forty-eight (48) hours prior to installation, whenever project conditions are such that heating is required. Maintain seventy (70) degrees F. temperature continuously during and after installation as recommended by the tile manufacturer, but for not less than forty-eight (48) hours. Maintain a temperature of not less than fifty-five (55) degrees F. in areas where work is completed.

PART 2 PRODUCTS

2.1 BASE

A. Provide 1/8" thick, continuous rubber, top set cove base with pre-formed internal and external corner pieces, color as selected by the Architect. Base shall conform to ASTM F 1861, Type TS, Group 1 as manufactured by AFCO Rubber Corp., Johnsonite, Roppe, or approved equal.

1. Height: Four inches, unless otherwise noted.

2. In laboratory spaces with casework, base height shall match casework.

2.2 ACCESSORIES

A. Adhesives: Waterproof, stabilized type, as recommended by the tile manufacturer for the type of service indicated.

B. Edging Strips: 1/8" thick, homogeneous vinyl or rubber composition, tapered or bullnose edge, color as selected by the Architect from manufacturer's standards.

C. Finish: Type recommended by manufacturer.

PART 3 EXECUTION

3.1 INSPECTION

A. Examine the areas and conditions where base and transition strip is to be installed and correct any conditions detrimental to the proper and timely completion of the work. Do not proceed with the work until unsatisfactory conditions are corrected to permit proper installation of the work.

3.2 PREPARATION

A. Etch concrete substrate as may be required to remove curing compounds or other substances that would interfere with proper bond of adhesive for tile. Rinse with water to remove all traces of treatment.

B. Perform moisture tests on concrete slabs to determine that concrete surfaces are sufficiently cured and are ready to receive flooring installation.
3.3 INSTALLATION

A. Install base after all finishing operations, including painting, have been completed and permanent heating system is operating. Moisture content of concrete slabs, building air temperature and relative humidity must be within limits recommended by manufacturer.

B. Bases: In all spaces where base is indicated, install bases tight to walls, partitions, columns, built-in cabinets, etc., without gaps at top or bulges at bottom, with tight joints and flush edges, with molded corner pieces at internal and external corners. Provide end stops adjacent to flush type door frames and where base does not terminate against an adjacent surface. Keep base in full contact with walls until adhesive sets.

3.4 CLEANING AND PROTECTION

A. Remove any excess adhesive or other surface blemishes, using neutral type cleaners as recommended by the manufacturer. Protect installed flooring from damage by use of heavy Kraft paper or other covering.

B. Finishing: After completion of the project and just prior to the final inspection of the work, thoroughly clean floors and accessories.

END OF SECTION
SECTION 09912 - PAINTING

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. This Section includes surface preparation and field painting of the following:
   1. Exposed interior items and surfaces.
   2. Prime coat only on all wall surfaces scheduled to receive vinyl wall covering.
   3. Surface preparation, priming, and finish coats specified in this Section are in addition to shop priming and surface treatment specified in other Sections.

B. Paint exposed surfaces, except where the paint schedules indicate that a surface or material is not to be painted or is to remain natural. If the paint schedules do not specifically mention an item or a surface, paint the item or surface the same as similar adjacent materials or surfaces whether or not schedules indicate colors. If the schedules do not indicate color or finish, the Architect will select from standard colors and finishes available.
   1. Painting includes field painting of exposed bare and covered pipes and ducts (including color coding), hangers, and primed metal surfaces of mechanical and electrical equipment.

C. Do not paint prefinished items, concealed surfaces, finished metal surfaces, operating parts, and labels.
   1. Prefinished items include the following factory-finished components:
      a. Architectural woodwork and casework.
      b. Flush wood doors including lead-lined wood doors.
      c. Interior pre-finished aluminum trim.
      d. Finished mechanical and electrical equipment.
      e. Light fixtures.
      f. Distribution cabinets.
   2. Concealed surfaces include walls or ceilings in the following generally inaccessible spaces:
      a. Furred areas.
      b. Ceiling plenums.
      c. Pipe spaces.
      d. Duct shafts.
   3. Finished metal surfaces include the following:
      a. Anodized aluminum.
      b. Stainless steel.
      c. Chromium plate.
   4. Operating parts include moving parts of operating equipment and the following:
      a. Valve and damper operators.
      b. Linkages.
c. Sensing devices.
d. Motor and fan shafts.

5. Labels: Do not paint over Underwriters Laboratories (UL), Factory Mutual (FM), or other code-required labels or equipment name, identification, performance rating, or nomenclature plates.

D. Related Sections: The following Sections contain requirements that relate to this Section:
   1. Division 05 Section "Metal Fabrications" for shop priming ferrous metal.
   2. Division 06 Section "Interior Architectural Woodwork" for shop priming interior architectural woodwork.
   3. Division 08 Section "Steel Doors and Frames" for shop priming steel doors and frames.
   4. Division 09 Section "Gypsum Board Assemblies" for surface preparation for gypsum board including lead lined gypsum board as specified in Division 13 Section “Radiation Protection”.
   5. Division 09 Section “Vinyl Wall Covering”.

1.03 DEFINITIONS

A. General: Standard coating terms defined in ASTM D 16 apply to this Section.
   1. Flat refers to a lusterless or matte finish with a gloss range below 15 when measured at an 85-degree meter.
   2. Eggshell refers to low-sheen finish with a gloss range between 5 and 20 when measured at a 60-degree meter.
   3. Satin refers to low-sheen finish with a gloss range between 15 and 35 when measured at a 60-degree meter.
   4. Semigloss refers to medium-sheen finish with a gloss range between 30 and 65 when measured at a 60-degree meter.

1.04 SUBMITTALS

A. Product Data: For each paint system specified. Include block fillers and primers.
   1. Material List: Provide an inclusive list of required coating materials. Indicate each material and cross-reference specific coating, finish system, and application. Identify each material by manufacturer's catalog number and general classification.
   2. Manufacturer's Information: Provide manufacturer's technical information, including label analysis and instructions for handling, storing, and applying each coating material proposed for use.
   3. Certification by the manufacturer that products supplied comply with local regulations controlling use of volatile organic compounds (VOCs).

B. Samples for Initial Selection: Manufacturer's color charts showing the full range of colors available for each type of finish-coat material indicated.
   1. After color selection, the Architect will furnish color chips for surfaces to be coated.

C. Qualification Data: For firms and persons specified in the "Quality Assurance" Article to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names and addresses of architects and owners, and other information specified.
1.05 QUALITY ASSURANCE

A. Applicator Qualifications: Engage an experienced applicator who has completed painting system applications similar in material and extent to that indicated for this Project with a record of successful in-service performance.

B. Source Limitations: Obtain primers and undercoat materials for each coating system from the same manufacturer as the finish coats.

C. Benchmark Samples (Mockups): Provide a full-coat benchmark finish sample of each type of coating and substrate required on the Project. Comply with procedures specified in PDCA P5.
   1. The Architect will select one room or surface to represent surfaces and conditions for each type of coating and substrate to be painted.
      a. Wall Surfaces: Provide samples on at least 100 sq. ft. (9 sq. m) of wall surface.
      b. Small Areas and Items: The Architect will designate an item or area as required.
   2. After permanent lighting and other environmental services have been activated, apply coatings in this room or to each surface according to the Schedule or as specified. Provide required sheen, color, and texture on each surface.
      a. After finishes are accepted, the Architect will use the room or surface to evaluate coating systems of a similar nature.
   3. Final approval of colors will be from job-applied samples.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to the Project Site in manufacturer's original, unopened packages and containers bearing manufacturer's name and label, and the following information:
   1. Product name or title of material.
   2. Product description (generic classification or binder type).
   3. Manufacturer's stock number and date of manufacture.
   4. Contents by volume, for pigment and vehicle constituents.
   5. Thinning instructions.
   6. Application instructions.
   7. Color name and number.
   8. VOC content.

B. Store materials not in use in tightly covered containers in a well-ventilated area at a minimum ambient temperature of 45 deg F (7 deg C). Maintain containers used in storage in a clean condition, free of foreign materials and residue.
   1. Keep storage area neat and orderly. Remove oily rags and waste daily. Take necessary measures to ensure that workers and work areas are protected from fire and health hazards resulting from handling, mixing, and application.

1.07 EXTRA MATERIALS

A. Furnish extra paint materials from the same production run as the materials applied in the quantities described below. Package paint materials in unopened, factory-sealed containers for storage and identify with labels describing contents. Deliver extra materials to the Owner.
   1. Quantity: Furnish the Owner with extra paint materials in the quantities indicated below:
      a. Interior, Flat Acrylic Paint: One case of each color applied.
b. Interior, Low-Luster Acrylic Finish: One case of each color applied.
c. Interior, Semigloss Acrylic Enamel: 2 gal. (7.57 L) of each color applied.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Products: Subject to compliance with requirements, provide products in the paint schedules.

B. Manufacturers Name: The following manufacturer is referred to in the paint schedules by use of shortened version of it’s names, which is shown in parentheses:
2. Sherwin Williams
3. Tnemec Company (Tnemec).

2.02 PAINT MATERIALS, GENERAL

A. Material Compatibility: Provide block fillers, primers, undercoats, and finish-coat materials that are compatible with one another and the substrates indicated under conditions of service and application, as demonstrated by manufacturer based on testing and field experience.

B. Material Quality: Provide manufacturer's best-quality paint material of the various coating types specified. Paint-material containers not displaying manufacturer's product identification will not be acceptable.

1. Proprietary Names: Use of manufacturer's proprietary product names to designate colors or materials is not intended to imply that products named are required to be used to the exclusion of equivalent products of other manufacturers. Furnish manufacturer's material data and certificates of performance for proposed substitutions.

C. Colors: Provide color selections indicated.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine substrates, areas, and conditions, with the Applicator present, under which painting will be performed for compliance with paint application requirements.
1. Do not begin to apply paint until unsatisfactory conditions have been corrected and surfaces receiving paint are thoroughly dry.
2. Start of painting will be construed as the Applicator's acceptance of surfaces and conditions within a particular area.

B. Coordination of Work: Review other Sections in which primers are provided to ensure compatibility of the total system for various substrates. On request, furnish information on characteristics of finish materials to ensure use of compatible primers.
1. Notify the Architect about anticipated problems using the materials specified over substrates primed by others.
3.02 PREPARATION

A. General: Remove hardware and hardware accessories, plates, machined surfaces, lighting fixtures, and similar items already installed that are not to be painted. If removal is impractical or impossible because of the size or weight of the item, provide surface-applied protection before surface preparation and painting.
   1. After completing painting operations in each space or area, reinstall items removed using workers skilled in the trades involved.

B. Cleaning: Before applying paint or other surface treatments, clean the substrates of substances that could impair the bond of the various coatings. Remove oil and grease before cleaning.
   1. Schedule cleaning and painting so dust and other contaminants from the cleaning process will not fall on wet, newly painted surfaces.

C. Surface Preparation: Clean and prepare surfaces to be painted according to manufacturer's written instructions for each particular substrate condition and as specified.
   1. Provide barrier coats over incompatible primers or remove and reprime.
   2. Ferrous Metals: Clean ungalvanized ferrous-metal surfaces that have not been shop coated; remove oil, grease, dirt, loose mill scale, and other foreign substances. Use solvent or mechanical cleaning methods that comply with the Steel Structures Painting Council's (SSPC) recommendations.
      a. Blast steel surfaces clean as recommended by paint system manufacturer and according to requirements of SSPC-SP 10.
      b. Treat bare and sandblasted or pickled clean metal with a metal treatment wash coat before priming.
      c. Touch up bare areas and shop-applied prime coats that have been damaged. Wire-brush, clean with solvents recommended by paint manufacturer, and touch up with the same primer as the shop coat.

D. Materials Preparation: Mix and prepare paint materials according to manufacturer's written instructions.
   1. Maintain containers used in mixing and applying paint in a clean condition, free of foreign materials and residue.
   2. Stir material before application to produce a mixture of uniform density. Stir as required during application. Do not stir surface film into material. If necessary, remove surface film and strain material before using.
   3. Use only thinners approved by paint manufacturer and only within recommended limits.

E. Tinting: Tint each undercoat a lighter shade to simplify identification of each coat when multiple coats of the same material are applied. Tint undercoats to match the color of the finish coat, but provide sufficient differences in shade of undercoats to distinguish each separate coat.

3.03 APPLICATION

A. General: Apply paint according to manufacturer's written instructions. Use applicators and techniques best suited for substrate and type of material being applied.
   1. Paint colors, surface treatments, and finishes are indicated in the schedules.
   2. Do not paint over dirt, rust, scale, grease, moisture, scuffed surfaces, or conditions detrimental to formation of a durable paint film.
   3. Provide finish coats that are compatible with primers used.
4. The term "exposed surfaces" includes areas visible when permanent or built-in fixtures, convector covers for finned-tube radiation, grilles, and similar components are in place. Extend coatings in these areas, as required, to maintain the system integrity and provide desired protection.

5. Paint surfaces behind movable equipment and furniture the same as similar exposed surfaces. Before the final installation of equipment, paint surfaces behind permanently fixed equipment or furniture with prime coat only.

6. Paint interior surfaces of ducts with a flat, nonspecular black paint where visible through registers or grilles.

7. Paint back sides of access panels and removable or hinged covers to match exposed surfaces.

8. Sand lightly between each succeeding enamel coat.

B. Scheduling Painting: Apply first coat to surfaces that have been cleaned, pretreated, or otherwise prepared for painting as soon as practicable after preparation and before subsequent surface deterioration.

1. The number of coats and the film thickness required are the same regardless of application method. Do not apply succeeding coats until the previous coat has cured as recommended by the manufacturer. If sanding is required to produce a smooth, even surface according to manufacturer's written instructions, sand between applications.

2. Omit primer on metal surfaces that have been previously painted, shop primed and touchup painted.

3. If undercoats or other conditions show through final coat of paint, apply additional coats until paint film is of uniform finish, color, and appearance. Give special attention to ensure edges, corners, crevices, welds, and exposed fasteners receive a dry film thickness equivalent to that of flat surfaces.

4. Allow sufficient time between successive coats to permit proper drying. Do not recoat surfaces until paint has dried to where it feels firm, does not deform or feel sticky under moderate thumb pressure, and where application of another coat of paint does not cause the undercoat to lift or lose adhesion.

C. Application Procedures: Apply paints and coatings by brush, roller, spray, or other applicators according to manufacturer's written instructions.

1. Brushes: Use brushes best suited for the type of material applied. Use brush of appropriate size for the surface or item being painted.

2. Rollers: Use rollers of carpet, velvet back, or high-pile sheep's wool as recommended by the manufacturer for the material and texture required.

3. Spray Equipment: Use airless spray equipment with orifice size as recommended by the manufacturer for the material and texture required.

D. Minimum Coating Thickness: Apply paint materials no thinner than manufacturer's recommended spreading rate. Provide the total dry film thickness of the entire system as recommended by the manufacturer.

E. Mechanical and Electrical Work: Painting of mechanical and electrical work is limited to items exposed in equipment rooms and in occupied spaces.

F. Mechanical items to be painted include, but are not limited to, the following:

1. Piping, pipe hangers, and supports.
2. Ductwork.
3. Insulation.
4. Motors and mechanical equipment.
5. Accessory items.

G. Electrical items to be painted include, but are not limited to, the following:
   1. Conduit and fittings.
   2. Panelboards.

H. Prime Coats: Before applying finish coats, apply a prime coat of material, as recommended by the manufacturer, to material that is required to be painted or finished and that has not been prime coated by others. Recoat primed and sealed surfaces where evidence of suction spots or unsealed areas in first coat appears, to ensure a finish coat with no burn through or other defects due to insufficient sealing.

I. Pigmented (Opaque) Finishes: Completely cover surfaces as necessary to provide a smooth, opaque surface of uniform finish, color, appearance, and coverage. Cloudiness, spotting, holidays, laps, brush marks, runs, sags, ropiness, or other surface imperfections will not be acceptable.

J. Completed Work: Match approved samples for color, texture, and coverage. Remove, refinish, or repaint work not complying with requirements.

3.04 FIELD QUALITY CONTROL

A. The Owner reserves the right to invoke the following test procedure at any time and as often as the Owner deems necessary during the period when paint is being applied:
   1. The Owner will engage the services of an independent testing agency to sample the paint material being used. Samples of material delivered to the Project will be taken, identified, sealed, and certified in the presence of the Contractor.
   2. The testing agency will perform appropriate tests for the following characteristics as required by the Owner:
      a. Quantitative material analysis.
      b. Abrasion resistance.
      c. Apparent reflectivity.
      d. Flexibility.
      e. Washability.
      f. Absorption.
      g. Dry opacity.
      h. Accelerated yellowness.
      i. Recoating.
      j. Skinning.
      k. Color retention.
      l. Alkali and mildew resistance.
   3. The Owner may direct the Construction Manager to stop painting if test results show material being used does not comply with specified requirements. The Contractor shall remove non-complying paint from the site, pay for testing, and repaint surfaces previously coated with the rejected paint. If necessary, the Contractor may be required to remove rejected paint from previously painted surfaces if, on repainting with specified paint, the 2 coatings are incompatible.

3.05 CLEANING

A. Cleanup: At the end of each workday, remove empty cans, rags, rubbish, and other discarded paint materials from the site.
1. After completing painting, clean glass and paint-spattered surfaces including existing surfaces. Remove spattered paint by washing and scraping. Be careful not to scratch or damage adjacent finished surfaces.

3.06 PROTECTION

A. Protect work of other trades, whether being painted or not, against damage by painting. Correct damage by cleaning, repairing or replacing, and repainting, as approved by Architect.

B. Provide "Wet Paint" signs to protect newly painted finishes. Remove temporary protective wrappings provided by others to protect their work after completing painting operations.

1. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces. Comply with procedures specified in PDCA P1.

3.07 INTERIOR PAINT SCHEDULE

A. Gypsum Board: Provide the following finish systems over interior gypsum board surfaces including existing gypsum board and existing plaster surfaces:

1. Semigloss Acrylic-Enamel Finish:
      1) Benjamin Moore; IronClad Latex Low Lustre Metal and Wood Enamel No. 363: Applied at a dry film thickness of not less than 1.6 mils.
      3) Sherwin-Williams; primer not required over this substrate.
   b. Two Finish Coats: Interior semigloss acrylic enamel.
      1) Benjamin Moore; Regal AquaGlo No. 333 Premium Interior Finishes Latex Semi-Gloss: Applied at a dry film thickness of not less than 1.3 mils.
      2) Pittsburgh Paints; 88-110 Satinhide Interior Enamel Wall & Trim Lo-Lustre Semi-Gloss Latex: Applied at a dry film thickness of not less than 1.1 mils.
      3) Sherwin-Williams; SuperPaint Interior Latex Semi-Gloss Enamel A88 Series: Applied at a dry film thickness of not less than 1.6 mils.

2. Low-Luster, Acrylic-Enamel Finish: For walls and soffits in offices, Reading Rooms, Patient Rooms, Control Rooms, Staff/Conference Room, Locker Rooms, and Toilet Rooms: 2 finish coats over a primer. Primer not required on existing painted surfaces.
   a. Primer: Latex-based, interior primer applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 1.2 mils (0.031 mm).
      1) Moore: Regal First Coat Interior Latex Primer & Underbody #216. (White)
   b. First and Second Coats: Low-luster (eggshell), acrylic-latex, interior enamel applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 2.8 mils (0.071 mm).
      1) Moore: Moore's #2143-70 “Simply White”.
3. Flat Acrylic Finish: For walls in Storage Rooms: 2 finish coats over a primer.
   a. Primer: Latex-based, interior primer applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 1.2 mils (0.031 mm).
      1) Moore: Regal First Coat Interior Latex Primer & Underbody #216. (White)
   b. First and Second Coats: Flat, acrylic-latex-based, interior paint applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 2.5 mils (0.064 mm).
      1) Moore: Regal Wall Satin #215. (White)

4. Low-Luster, Acrylic-Enamel Finish: For walls and soffits in offices, Reading Rooms, Patient Rooms, Control Rooms, Staff/Conference Room, Locker Rooms, and Toilet Rooms: 2 finish coats over a primer. Primer not required on existing painted surfaces.
   a. Primer: Latex-based, interior primer applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 1.2 mils (0.031 mm).
      1) Moore: Regal First Coat Interior Latex Primer & Underbody #216. (White)
   b. First and Second Coats: Low-luster (eggshell), acrylic-latex, interior enamel applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 2.8 mils (0.071 mm).
      1) Moore: Moore's #2143-70 “Simply White”.

5. Flat Acrylic Finish: For walls in Storage Rooms: 2 finish coats over a primer.
   a. Primer: Latex-based, interior primer applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 1.2 mils (0.031 mm).
      1) Moore: Regal First Coat Interior Latex Primer & Underbody #216. (White)
   b. First and Second Coats: Flat, acrylic-latex-based, interior paint applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 2.5 mils (0.064 mm).
      1) Moore: Regal Wall Satin #215. (White)

B. Interior Semigloss Epoxy Enamel on Gypsum Board in Moderate Environment: For walls and soffits in Operating Rooms and Soiled Laundry Rooms:
   1. Factory-formulated semigloss polyamide epoxy enamel for interior application. Typical for Walls and Soffits: Two finish coats over a primer.
      a. Interior Primer for Gypsum Board in Moderate Environment: Acrylic or epoxy primer, as recommended by manufacturer for this substrate, applied at spreading rate recommended by manufacturer.
      b. Intermediate Coat: Epoxy applied at spreading rate recommended by manufacturer to achieve a dry film thickness of 1.5 to 6.0 mils (0.038 to 0.152 mm).
         1) Tnemec: Series 29 Tuf-Cryl Water Based Acrylic Emulsion.
      c. Topcoat: Semigloss acrylic enamel applied at spreading rate recommended by manufacturer to achieve a dry film thickness of 2.0 to 6.0 mils (0.051 to 0.152 mm), unless otherwise indicated.
         1) Tnemec: Series 29 Tuf-Cryl Water Based Acrylic Emulsion.

C. Ferrous Metal: Provide the following finish systems over ferrous metal and existing ferrous metal:
      1) Tnemec; Tnemec 90-97: Applied at a dry film thickness of not less than 2.5 mils (0.064 mm).
   b. First and Second Coats: Factory-formulated semigloss polyamide epoxy enamel for interior application.
      1) Tnemec; Series 66 Epoxoline: Applied at a dry film thickness of not less than 2.0 mils (0.051 mm).

2. Semi-Gloss, Alkyd-Enamel Finish: Typical at locations other than doors and frames: 2 finish coats over a primer. Primer not required on shop primed ferrous metal or previously painted ferrous metal.
   a. Primer: Alkali-resistant, alkyd or latex based, interior primer, as recommended by the manufacturer for this substrate, applied at a spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 1.0 mil (0.025 mm).
      1) Moore: Regal First Coat Interior Latex Primer & underbody #216. (Red)
   b. First and Second Coats: Odorless, semigloss, alkyd, interior enamel, applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 2.6 mils (0.066 mm).
      1) Moore: Alkyd Dulamel #HC-82 “Bennington Gray”.

D. Cotton or Canvas Covering over Insulation: Provide the following finish system on cotton or canvas insulation covering:
   1. Flat Acrylic Finish: 2 finish coats. Add fungicidal agent to render fabric mildewproof.
      a. First and Second Coats: Flat, latex-based, interior paint applied at spreading rate recommended by the manufacturer.
         1) Moore: Regal Wall Satin #215. (White)

E. Gypsum Board to receive vinyl wall covering finish:
   1. Primer: One coat pigmented vinyl acrylic latex based sealer, Moore’s “Wall-Grip 2 (203-02).

3.08 EPOXY PAINT

A. Basis-of-Design: The design for epoxy paint systems is based on Sherwin-Williams Co. (Sherwin-Williams). Subject to compliance with aesthetic and specified requirements, manufacturers offering comparable products that may be incorporated into the Work include the following:
   1. Benjamin Moore (Benjamin Moore)
   2. PPG Industries, Inc. (Pittsburgh Paints).

B. Provide the following finish system in where scheduled at the thicknesses indicated:
   1. Concrete and Masonry (Other Than Concrete Unit Masonry): Provide the following water based epoxy semigloss paint finish systems over interior concrete and brick masonry substrates:
      a. 1st Coat: S-W Water Based Catalyzed Epoxy B70/B60V25
      b. 2nd Coat: S-W Water Based Catalyzed Epoxy B70/B60V25 (6.5 mils wet, 2.5 mils dry per coat)
   2. Concrete Unit Masonry: Provide the following water based epoxy semigloss paint finish systems over interior concrete masonry:
a. 1st Coat: S-W Heavy Duty Block Filler, B42W46 (18 mils wet, 10 mils wet)
b. 2nd Coat: S-W Water Based Catalyzed Epoxy B70/B60V25
c. 3rd Coat: S-W Water Based Catalyzed Epoxy B70/B60V25 (8 mils wet, 3 mils wet per coat)

3. Zinc-Coated Metal: Provide the following water based epoxy semigloss paint finish systems over interior zinc-coated metal surfaces:
a. 1st Coat: S-W Water Based Catalyzed Epoxy, B70/B60V25
b. 2nd Coat: S-W Water Based Catalyzed Epoxy, B70/B60V25 (6.5 mils wet, 2.5 mils dry per coat)

c. 3rd Coat: S-W Water Based Catalyzed Epoxy, B70/B60V25 (6.5 mils wet, 2.5 mils dry per coat)

4. Ferrous Metal: Provide the following water based epoxy semigloss paint finish systems over ferrous metal:
a. 1st Coat: S-W Water-Based Catalyzed Epoxy Primer, B70W100 (8 mils wet, 3 mils dry)
b. 2nd Coat: S-W Water Based Catalyzed Epoxy, B70/B60V25
c. 3rd Coat: S-W Water Based Catalyzed Epoxy, B70/B60V25 (6.5 mils wet, 2.5 mils dry per coat)

5. Gypsum Board: Provide the following water based epoxy semigloss paint finish systems over interior gypsum board surfaces:
a. 1st Coat: S-W PrepRite Classic Latex Primer, B28W101 (4 mils wet, 1.2 mils dry)
b. 2nd Coat: S-W Water Based Catalyzed Epoxy, B70/B60V25
c. 3rd Coat: S-W Water Based Catalyzed Epoxy, B70/B60V25 (6.5 mils wet, 2.5 mils dry per coat)
SECTION 21 05 02
GENERAL PROVISIONS FOR FIRE PROTECTION WORK

PART 1 - GENERAL

1.01 DESCRIPTION

A. This Section is coordinated with and complementary to the General Conditions and Special Conditions of the Work wherever applicable to Mechanical and Electrical Work.

B. Section 01 31 46 - Special Requirements for Mechanical and Electrical Work shall apply.

C. Section 01 35 48 - Vibration Isolation, Seismic, Wind and Flood Load Restraints for HVAC, Plumbing, Electrical and Fire Protection Components.

1.02 SCOPE OF WORK

A. The work of this Contract consists of supplying all labor, materials, equipment and appliances necessary and required for clean agent FM-200 fire suppression system, as indicated on the drawings or described or referred to in the Specifications, including, but not limited to the following:

1. Complete preaction sprinkler system including deluge valves, pressure switch, solenoid valves, air compressor, sprinkler heads, control valves, alarms, all required accessories, etc.

2. Sleeves, hangers and supports.

3. Apply for, obtain and pay for all permits, certificates, inspections and approvals required in connection with the fire standpipe and sprinkler systems.

4. Shop drawings, samples, instructional manuals, tests and adjustments.

5. Color coding and stenciling of piping system.

6. Cutting and rough patching.

7. Cap flashing and prime painting.

8. Tests for all systems provided under this Section of the Specifications.

9. Where, due to Union regulations or trade agreements, if any of the work shown on the Drawings or specified herein is not considered Fire Protection Contractor's Work, this Contractor shall subcontract this work in question, but this Contractor shall be held responsible for the complete installation.

10. It is not the intention of these Specifications to describe, nor the Contract Drawings to show in detail, all the various pieces of apparatus and appurtenances and their connections. This Contractor shall, as part of the Contract, furnish and install all incidentals, such as piping, fittings, valves, etc., required to complete the installation of the equipment. This Contractor shall refer to Architectural Drawings and Fire Protection Drawings for exact location of fixtures including type and quantities. This Contractor shall be responsible for providing and connecting all fixtures and equipment.

11. All work described in these Specifications and not shown on the Drawings, or vice versa, shall be installed in a manner similar to the work shown or described.

1.03 RELATED WORK SPECIFIED ELSEWHERE

A. Finished painting.
B. All electrical power and interconnecting control wiring including raceways.

C. All control panels, detectors, bells, pull stations for a pre-action sprinkler system.

1.04 LIST OF SHOP DRAWINGS

A. Submit shop drawings prior to installation covering the following items:
   1. Sprinkler equipment to include pre-action valves, sprinkler heads, drain connections, etc.
   2. Valve tags, color coding and valve charts.
   3. Hangers and inserts.
   4. Wiring diagrams and equipment.
   5. Gauges and thermometers.
   6. All types of piping, fittings, valves, etc.
   7. Detailed pre-action fire protection piping layout.
   8. Detailed coordinated sleeves and insert drawings for approval by Structural Engineer. In addition, the Contractor shall indicate all piping sleeved through beams.
   9. Hydraulic calculations based on the design criteria stated in this specification.

B. The above listed items are to be considered major equipment and do not limit the Contractor's responsibility from submitting shop drawings for all equipment and accessories which are to be provided under this Section of the Contract.

1.05 VISITING THE PREMISES

A. This Contractor, before submitting his bid on the work, shall visit the site and familiarize himself with all visible existing conditions. As a result of having visited the premises, this Contractor shall be responsible for the installation of the work as it relates to such visible existing conditions.

B. The submission of a bid will be considered an acknowledgment on the part of the bidder of his visitation to the site.

1.06 SPACE CONDITIONS

A. Before starting any Work, consult Architect's detailed drawings and structural drawings, for spaces and headroom allowed for the installation of all piping, equipment, etc. Should any piping or equipment require more space than allowed for, or encroach upon hung ceilings or available headroom as planned, the contractor shall call the Architect's attention to same and obtain his approval before installing the Work.

1.07 INTENT OF SPECIFICATIONS

A. The Specification is neither intended to describe, nor the Drawings to show, in detail the various items of equipment, or the connection thereto. Furnish and install all equipment, accessories, supports, pipe connections, fittings valves, controls, insulation, testing, etc., as herein specified or required to make the various systems complete and ready for proper operation.

B. The Drawings are diagrammatic and indicate the general arrangement and location of equipment, piping, fixtures, etc. Make all responsible modifications in the layout work that may be required to suit actual job conditions without extra compensation.
1.08 ACCESSIBILITY

A. The Contractor shall fully inform himself regarding any special characteristics and limitations of the space available for the installation of all materials under Fire Protection Work.

B. The location of equipment on the Fire Protection Drawings may conflict with the building construction and may disclose the fact that the location of this Work does not make its position easily and quickly accessible. The Contractor shall call the Architect's attention to this fact before installing this Work, and shall be guided by his instructions.

1.09 PERMITS AND CERTIFICATES

A. The Contractor shall give necessary notices, file drawings and Specifications with the departments having jurisdiction, obtain permits or licenses necessary to carry out this work and pay all fees therefore.

1.10 DISCREPANCIES

A. The Drawings and Specifications are intended to cooperate. Any materials, equipment, or systems related to this Section and exhibited on the Architectural and Fire Protection Drawings but not mentioned in the Specifications are to be executed to the intent and meaning thereof, as if it were both mentioned in the Specifications and set forth on the Drawings.

B. In case of differences between the Drawings and Specifications, the Specifications shall govern first, and then the Drawings. Large scale details shall take precedence over smaller scale Drawings as to shape and details of construction. Specifications shall govern as to materials.

C. Drawings and Specifications are intended to be fully cooperative and to agree, but should any discrepancy or apparent difference occur between Drawings and Specifications or should occur in the Work of others affecting the work, the Contractor shall notify the Architect at once. If the Contractor proceeds with the Work affected without instructions from the Architect, he shall make good any resultant damage or defect. All misunderstandings of Drawings and Specifications shall be clarified by the Architect.

1.11 QUALITY ASSURANCE

A. Manufacturer's Instructions
1. In addition to the requirements of these Specifications, comply with the manufacturer's instructions and recommendations for all phases of the work.

B. Standards and Codes
3. New York City Fire Department Requirements.
5. FM Regulations.

C. In addition to the requirements of these specifications, comply with the manufacturer’s instructions and recommendations for all phases of work.
D. All work and material not specifically described, but required for a complete and proper installation of the work of this Section, shall be provided by the Contractor and shall be new, first quality of their respective kinds, and subject to approval of the Architect.

1.12 COOPERATION WITH OTHERS

A. The Contractor shall cooperate with other trades whose work is to be correlated with his work, and with the work of each other, in order to avoid field interference, improper elevations, or inaccessibility to equipment. Any extra expense occasioned by lack of cooperation by this Contractor shall be borne by him.

1.13 EXAMINATION AND COORDINATION

A. The Drawings are diagrammatic and indicate the general arrangement of systems and work indicated under this Section. (Do not scale the Drawings). The Contractor shall consult the Architectural Drawings and Details for exact locations of fixtures, and equipment; where same are not definitely located, he shall obtain this information from the Architect.

B. The Contractor shall follow the Drawings in laying out work and check Drawings of other trades to verify spaces in which work will be installed and maintain maximum headroom and space conditions at all points. Where headroom or space conditions appear inadequate, the Architect shall be notified in writing. The installation shall not proceed before receiving the Architect’s written instructions.

C. If directed by the Architect, the Contractor shall, without extra charge, make reasonable modifications in the layout as needed to prevent conflict with work of other trades, maintain required headroom and space conditions, or for proper execution of the work.

D. Where variances occur between the Drawings and the Specifications, or within either document itself, the item or arrangement of better quality, greater quantity, or higher cost shall be included in the Contract. Architect will decide on the item and manner in which the Work shall be installed and his decision shall be final.

E. It shall be the responsibility of the Contractor to closely schedule his work so that his work will be installed at the proper time and without delaying the completion of the entire Project.

F. Study the Drawings and Specifications in order to insure completeness of the Work required under this Section. Supplementary items normal and necessary to complete the Work, though not definitely shown or specified shall be included.

G. Verify all measurements and conditions in the field before starting work.

H. Examine all surfaces to which Work under this Section is to be applied and notify the Architect in writing if any conditions exist which are detrimental to the proper and expeditious installation of Work. Starting of Work shall be construed as acceptance of surfaces.

1.14 CLEANING, PROTECTION AND ADJUSTING

A. The Contractor shall be responsible for the protection of all fire protection systems equipment against breakage or damage at all times until final acceptance of the job.
B. All openings left in floor for passage of supply pipes shall be covered and protected. All pipes shall be protected with suitable coverings as soon as set. All open of pipes shall be closed by a plug fitting to prevent obstruction and damage.

C. The Contractor shall frequently clean up and remove from the Site all rubbish, scrap materials and debris caused by his Work, and upon completion of the Work and before final payment is made, he shall remove from the site all surplus material, temporary structures, tools and all debris resulting from his operation.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION 21 05 02
SECTION 21 05 03
APPROVED MANUFACTURERS FOR FIRE PROTECTION WORK

PART 1 - GENERAL

1.01 DESCRIPTION

A. This Section is coordinated with and complementary to the General Conditions and Special Conditions of the Work, wherever applicable to Mechanical and Electrical Work.

B. Section 01 31 46 - Special Requirements for Mechanical and Electrical Work shall apply.

C. Section 21 05 02 - General Provisions for Fire Protection Work shall apply.

PART 2 - PRODUCTS

2.01 APPROVED MANUFACTURERS

A. The manufacturers’ names and models hereinafter specified represent a standard of materials, appearance, finishes, performance, etc.

B. The Contractor has the option of submitting other manufacturers for approval in lieu of the manufacturers hereafter specified, provided their respective products conform in all respects to the manufacturers hereafter specified.

C. The following is a list of approved manufacturers:

1. Gauges
   a. U.S. Gauge Co.
   b. Ashton
   c. Ashcroft
   d. Mueller
   e. Taylor

2. Hangers and Supports
   a. Carpenter & Paterson, Inc.
   b. Fee and Mason
   c. Grinnell

3. Escutcheons
   a. Fee and Mason Mfg. Co.
   b. Ritter Pattern and Casting Co.

4. Sprinkler Heads
   a. Viking Corp.
   b. Reliable Inc.
   c. Central Sprinkler, Inc.

5. Pipe (Steel)
   a. Youngstown Sheet and Tube Co.
   b. Republic Steel Co.

6. Pre-Action System Valve Assembly
   a. Viking
b. Reliable Sprinkler

7. Couplings and Fittings
   a. Stockham
   b. Victaulic
   c. Gustin-Bacon

8. Alarm Actuating Devices
   a. Acme Fire Alarm Co.
   b. Edwards Co.
   c. Potter Electric Signal, Inc.

9. Gate Valves
   a. Stockham
   b. Kennedy Valve Co.

PART 3 - EXECUTION (NOT USED)

END OF SECTION 21 05 03
SECTION 21 05 12
SPRINKLER SYSTEM EQUIPMENT, SPECIALTIES, ACCESSORIES

PART 1 - GENERAL

1.01 DESCRIPTION

A. This Section is coordinated with and complementary to the General Conditions and Special Conditions of the Work, wherever applicable to Mechanical and Electrical Work.

B. Section 01 31 46 - Special Requirements for Mechanical and Electrical Work shall apply.

C. Section 01 35 48 -

D. Section 21 05 02 - General Provisions for Fire Protection Work shall apply.

1.02 SCOPE OF WORK

A. The Work of this Contract includes providing all labor, materials, accessories, services, and tests necessary to install complete and make ready for operation by the Owner, all Work as shown on Drawings and as specified herein.

B. The work of this section includes, but is not limited to the following:

1. Wet automatic sprinkler systems, each including:
   a. system's control valve with tamper switch,
   b. waterflow switch,
   c. drain valve,
   d. inspector's test connection,
   e. sprinkler heads.

2. Pre-action sprinkler systems, each including:
   a. system's control valve with tamper switch,
   b. deluge valve with all standard trimming,
   c. rubber seat check valve,
   d. pressure switch,
   e. solenoid valve,
   f. air compressor with all standard trimming,
   g. sprinkler heads.

3. Hangers, brackets and supports for all piping.

4. Signs, valve tags and charts.

5. Sleeves and escutcheons for all piping.

6. Pressure gauges.

7. Obtain approval of all applicable local authorities, I.S.O. or Owner's insurance carrier. Shop drawings shall be approved by these authorities before submission to the Architect.

8. Submit all calculations, programs and other data required to substantiate design changes, due to field conditions. Information submitted will be reviewed for acceptance as per layout intent. Submit same to authorities having jurisdiction and obtain their written approval.
1.03 RELATED WORK SPECIFIED ELSEWHERE

A. The following principal items of work shall be provided under Electrical Work.
   1. Central alarm panels and alarm wiring.
   2. Smoke detectors - as part of pre-action system.
   3. Release control panels for pre-action systems.
   4. All bells, pull stations, etc., for pre-action systems.
   5. All wiring between smoke detectors, bells, pull stations, release control panels, etc. for pre-action system.
   6. All wiring between waterflow switches, tamper switches, pressure switches and fire alarm panel.

1.04 QUALITY ASSURANCE

A. All work under this Section of the Specifications shall conform to the standards of the National Fire Protection Association Pamphlets No. 13, New York City Building and Fire Protection Codes, Local Fire Department and Factory Mutual requirements.

1.05 HYDRAULIC CALCULATION CRITERIA

A. The Contractor shall provide sprinkler system hydraulic calculations and submit them as part of the shop drawings. The calculations shall be prepared in accordance with N.F.P.A., Chapter 13, Factory Mutual Specifications and requirements herein indicated. Calculations shall be prepared for as many area of application as necessary to demonstrate to the satisfaction of the Insurance Carrier and Architect that the system meets the herein outlined criteria.

B. Sprinkler system shall meet the following (but not limited to) design criteria:
   1. Occupancy Classification: Mixed - Light and Ordinary hazard.
   3. Hydraulic calculations shall be based on the FM requirements and shall be as follows:
      a. Wet systems:
         1) Light hazard - density of 0.10 gpm/sq. ft. over the most hydraulically remote area of 1500 sq. ft.
            Example: Offices, etc.
         2) Ordinary hazard - 0.15 gpm/sq. ft. over the most hydraulically remote area of 2500 sq. ft.
   4. Hose stream demand of 250 gpm shall be added to all hydraulic calculations.
   5. Maximum water flow velocity should be limited to 20 ft. per second.
   6. If roll grooved connections are to be made, then excess friction loss associated with roll grooved pipe connections shall be include in the hydraulic calculations and shall be as follow:
      a. For straight-through-flow through each coupling joining roll grooved pipe, regardless of size, add 1 equivalent foot of pipe.
      b. For straight-through-flow through each tee or cross joining roll grooved pipe, regardless of size, add 2 equivalent feet of pipe.
      c. For each coupling joining a grooved fitting (elbow, tee or cross with flow turned 90°) to roll grooved pipe add 2 equivalent feet to the equivalent length of the fitting.
PART 2 - PRODUCTS

2.01 SPRINKLER HEADS

A. Sprinkler heads shall be Underwriters’ Laboratories approved cast brass closed fusible link wet type (unless otherwise noted) with 1/2 inch discharge orifice.

B. Sprinkler heads shall be as manufactured by Reliable Automatic Sprinkler Co., Inc. or approved equal, and shall be as follows:
   1. Hung Ceiling Areas: Fully recessed, concealed type, model to match existing heads.
   2. Finished Areas without Hung Ceiling: Standard upright or pendant type chrome plated, Model G.
   3. Unfinished Areas Without Hung Ceiling: Standard upright or pendant rough brass type, Model G.

C. All sprinkler heads shall be UL and BS&A listed and FM approved.

2.02 SPRINKLER CABINET

A. Provide an enameled steel sprinkler cabinet with approved number of sprinkler heads (of all types and rating installed) with two sprinkler wrenches and installed where directed by the Architect. Quantity of sprinkler heads shall be in accordance with NFPA Standards.

2.03 TAMPER SWITCHES

A. Tamper switches shall be installed on all valves controlling water supply to the sprinkler system.

B. Switches shall be mounted so not to interfere with the normal operation of the valve and shall be adjusted to operate when the stem of the valve has moved no more than one-fifth of the distance from its normal position.

C. The switch mechanism shall be contained in a weatherproof die cast aluminum housing which shall provide a 3/4" tapped conduit entrance and incorporate the necessary facilities for attachment to the valve. Switch housing shall be finished in red baked enamel.

D. The entire installed assembly shall be tamperproof and arranged to cause a switch operation if the housing cover is removed or if the unit is removed from its mounting.

E. Tamper switch shall be ACME Type 441 or equivalent model of other acceptable manufacturer.

2.04 WATER FLOW DETECTORS

A. Water flow detectors shall be installed on the sprinkler system piping where indicated on the drawings.

B. Detectors shall be designed for mounting on either vertical or horizontal piping, but shall not be mounted in a fitting or within 12” of any fitting that changes the direction of water flow.

C. Flow switch shall have a sensitivity setting to signal any flow of water that equals or exceeds the discharge from one sprinkler head.
D. Water flow alarms shall be equal to Acme Type 430, paddle type with adjustable pneumatic retard device as part of the water flow alarm to prevent false alarms due to water surges.

2.05 PRESSURE GAUGES

A. Pressure gauges shall be of a type approved by all authorities having jurisdiction and shall have 3-1/2” dials, cast brass cases and shall be graduated to twice the working pressure.

B. Each gauge shall have a shut-off cock or valve together with a plugged outlet for the connection of an inspector's test gauge.

C. All gauges shall be double spring gauges.

D. Pressure gauges shall be installed at all locations as required by New York City Building Code, FM and National Fire Protection Association Codes, Pamphlets 13 and 20.

2.06 DRAIN CONNECTIONS

A. Arrange the installation of piping so that all or any part of the work may be completely drained. Piping shall be pitched so as to drain to the main drain or to auxiliary drains.

B. The main drain shall be arranged so a 2” drain test can be made without flooding the receptacle.

C. The drain/test unit for wet pipe system shall be as manufactured by Victaulic Model No. 718 or approved equal.

D. Provide ¾” drain valves with threaded connection at low points of sprinkler systems for drainage.

2.07 PRE-ACTION SYSTEM VALVE ASSEMBLY

A. The pre-action system valve assemblies with all required trimming and accessories shall be as manufactured by Reliable Sprinkler Corp.
   1. The pre-action system shall be a double interlock dry type system using a deluge valve controlled by an electric release system and pneumatic system pressure to allow maximum protection against an accidental filling of the system with water. The electric detection system must actuate and a sprinkler must fuse before water will enter the system. Activation of one without the other shall only sound an alarm.
   2. A valve assembly shall include:
      a. Deluge valve
      b. Pressure operated relief valve
      c. Pneumatic actuator
      d. A standard trim package shall include pressure switch, all fittings, nipples, gauges, drains cup, etc., as specified for pre-action valve assembly.
   3. The release control panels, battery chargers, pull stations, smoke detectors, electric bells, lights, wiring, etc. shall be provided under this Contract.

2.08 AIR COMPRESSOR FOR PRE-ACTION SYSTEM

A. An air compressor unit shall be provided for pre-action system and shall be manufactured by Reliable Sprinkler Corp. or approved equal.
B. The unit shall consist of an electric motor driven, air-cooled, single-stage, oil-less compressor equipped with check valve, centrifugal pressure and moisture unloader and pressure switch.

C. The compressor unit shall be mounted on sprinkler system riser using the mounting bracket.

D. All power wiring to air compressors shall be under Division 26.

E. All control and alarm wiring shall be under this Contract.

2.09 ESCUTCHEONS

A. In addition to escutcheons previously specified, exposed pendent sprinklers on concealed piping shall be furnished with escutcheons of a type designed for use with automatic sprinklers.

B. Samples shall be submitted to the Architect for review and acceptance.

2.10 SEALS, SIGNS, TAGS AND CHARTS

A. Seals: Provide brass crosslink chain, all brass padlock, 2 keys, or copper wire and approved seal, as required by all authorities having jurisdiction for each manually operated shut-off valve required to be sealed in open position.

B. Signs: Provide identification signs of standard design, fastened securely at the base of each riser as required by NFPA 13, 14 and Factory Mutual.

C. Tags: Provide brass tags 2” in diameter, stamped with designating numbers and secured with 12 gauge copper wire to spindle of all control valves.

D. Chart: Provide 2 copies of approved sprinkler system diagram and valve chart, giving designation number, function, location of each valve, and mount in painted, glazed frames and hang where directed.

2.11 PIPE AND FITTINGS, ETC..

A. See other Sections of these Specifications for piping, valves, hangers, testing, etc. requirements related to sprinkler and fire standpipe work.

PART 3 - EXECUTION

3.01 INSTALLATION REQUIREMENTS

A. Piping shall be installed to be clear of any and all conduits, lighting fixtures, ductwork and heating piping. This Contractor shall consult with the Contractors of other trades to facilitate the erection of the system.

B. After cutting, all pipes shall be reamed out to full bore and before erection, the inside of all pipes shall be thoroughly cleaned.

C. In erecting pipe, friction wrenches and vises shall be used exclusively and any pipe cut, dented or otherwise damaged shall be replaced by this Contractor.
D. Pipe threads shall be made with the best dies and tools available. During threading, the pipes shall be saturated with solvent to assure sharp threads free of burns and notches.

E. All screwed joints shall be made with the best quality with pure red lead carefully placed on threads of pipe and not in fittings.

F. Any and all sprinkler heads placed in location where they are liable to be accidentally hit in the normal course of events shall be provided with heavy wire guards.

G. Sprinkler heads, in general, shall have ordinary degree temperature rating, but any and all heads subject to abnormal heating conditions, as those in vicinity of heating units, boilers, or very close to hot piping, shall be of sufficiently high temperature rating to prevent their accidental discharge when no fire is present.

H. The sprinkler heads in all areas are to be installed on a true axis line in both directions with a tolerance of ±1/2". At the completion of the installation, if any heads are found to exceed the above, any adjoining work that may be disturbed in reinstating said heads shall be repaired or reinstated at no additional cost to the Owner.

I. Piping and fittings shall be erected so that the entire system may be thoroughly drained. On dry-pipe systems, branch lines shall be pitched 1/2" in 10'; cross and feed mains shall be pitched 1/4" in 10' minimum.

J. See Architectural, Structural, Mechanical and Electrical Drawings for construction and interference details. Any changes that may be necessary because of physical conditions or compliance with the standards shall be made by this Contractor without additional cost to the Owner.

K. Specific references in this Section or on the Drawings to any article, device, product or material, fixtures or equipment by name, make, or catalog number shall be interpreted as establishing a basis of cost and a standard quality. All the devices shall be of the make and type listed by the Underwriter's Laboratories, Inc. No consideration will be granted for any alleged misunderstanding of the materials to be furnished or work to be done due to a lack of information on the Drawings or in the Specifications.

L. This Contractor shall make notifications in respect to location of sprinkler heads, as may be required by field conditions or as may be found necessary by the Architect at the time of installation. Valves, fittings, hangers, means of draining system, alarm and connections thereto and all necessary appurtenances shall be installed as required. Any changes that may be necessary because of physical conditions or compliance with the standards and requirements of any agency having jurisdiction shall be made by this Contractor without additional cost to the Owner.

M. The riser and branch assemblies and trimmings shall be installed inside of the building at locations as directed. Approved devices shall be installed for the automatic annunciation of the flow or water. Each wet pipe assembly and its appurtenances shall be so arranged and equipped in an approved manner that the transmission of accidental water flow alarms (due to surges or related conditions) will positively be prevented.
N. The system shall be so installed that no part thereof will interfere with doors, windows, heating, plumbing or electrical equipment, and sprinkler heads shall not be located closer than one foot from lighting fixtures or other obstructions. In connecting therewith, this Contractor shall coordinate his Work with the other trades as to avoid any interference with the potential effectiveness of the automatic sprinkler system and shall prepare and incorporate in composite working drawings the location of sprinkler heads in relation to other reflected ceiling equipment, elevations and inverts of piping, duct work equipment, electrical appurtenances of other Sections in conflict.

O. Provide all required drains. Inspector's test valve to be installed, supplied from the highest and most remote part of each system in relation to the riser or main branch assembly, and be conveniently accessible. Test pipes to be valved and piped to discharge through proper orifice to floor drains or sinks and/or as indicated on the Drawings.

P. After the piping installation has passed a satisfactory hydrostatic test and/or air test for at least two hours duration at a pressure at least 200 psi, all iron and steel parts shall be thoroughly cleaned ready for painting.

Q. All piping shall be accurately cut to measurements established by the Contractor and shall be installed without springing or forcing.

R. Drips and drains shall be installed at low points and where required and shall discharge to open sight drains or to standard interior floor drains or service sinks.

S. Direct connection from any drain to any component of the sanitary drainage system shall be prohibited.

T. This Contractor shall furnish and set sleeves in walls and floors as required. Escutcheons shall be provided at all penetrations through finish/exposed areas.

U. All pipe openings shall be capped or plugged during construction and all piping shall be flushed out before closing system.

V. Pipe compound shall be applied to male threads only.

W. Sprinkler heads installed in fittings before piping is erected shall be prohibited.

X. A drain connection shall be provided near the base of each riser and at lowest point of each horizontal main.

Y. The use of bushings to reduce the size of openings of fittings is prohibited.

Z. Before ordering any material or doing any work, this Contractor shall verify all measurements, ceiling heights and conditions at the site and shall be held responsible for the correctness of same. Extra charges or compensation will not be allowed on account of differences between actual measurements and the dimensions shown on the Drawings, but any such differences which may be found shall be submitted to the Architect for adjustment before proceeding with the work.

AA. Contractor shall provide flushing connections for flushing scale and foreign material from sprinkler system in accordance with NFPA.
BB. The complete sprinkler installation shall be made by an approved subcontractor specializing in sprinkler and fire protection work having not less than ten years’ experience in installing systems of comparable size.

CC. See Architectural, Structural, Mechanical and Electrical Drawings for construction details of the new and alteration work. Any changes that may be necessary because of physical conditions or compliance with the standards shall be made by the Sprinkler Contractor without additional cost to the Owner.

END OF SECTION 21 05 12
SECTION 21 05 28
PIPE, TUBE AND FITTINGS FOR FIRE PROTECTION WORK

PART 1 - GENERAL

1.01 DESCRIPTION

A. This Section is coordinated with and complementary to the General Conditions and Special Conditions of the Work, wherever applicable to Mechanical and Electrical Work.

B. Section 01 31 46 - Special Requirements for Mechanical and Electrical Work shall apply.

C. Section 01 35 48 – Vibration Isolation, Seismic, Wind & Flood Load Restraints for HVAC, Plumbing, Electrical and Fire Protection Components.

D. Section 21 05 02 - General Provisions for Fire Protection Work shall apply.

1.02 SCOPE OF WORK

A. The work of this Contract includes the providing of all labor, materials, accessories, services and tests necessary to install, complete and make ready for operation by the Owner, all work as shown on the Drawings and as specified herein.

1.03 SPECIFIC REQUIREMENTS

A. Pipe and fittings shall conform to the latest USASI, ASTM, ANSI and/or F.S. Standards.

B. All pipes, fittings, materials and/or other devices used in the fire protection systems shall have cast, stamped, or indelibly marked on it the maker's name or mark, weight, and quality of the product when such marking is required by the approved standard.

C. All materials used on sprinkler systems shall be approved by UL and FM and shall have New York City BS&A approval number.

PART 2 - PRODUCTS

2.01 INTERIOR PIPING MATERIAL:

A. Sprinkler system pipe shall be suitable for 175 PSI working pressure, in accordance with ANCI B36.10-1979 and any subsequent revisions thereof and shall be Schedule 40 black steel pipe.

B. All piping on pre-action systems shall be galvanized steel Schedule 40.

C. Fittings shall UL listed and/or FM approved and be of a type specifically approved for use in sprinkler systems suitable for 175 psi working pressure and made of carbon steel, cast iron, ductile iron, or malleable iron, screwed fittings.

D. Reducing coupling similar to Victaulic Fig. 750 will not be permitted.
E. Fittings and couplings for plain end pipe similar to Victaulic FIT type fittings and Roust-A-Bout and Plainlock coupling will not be permitted.

2.02 ESCUTCHEONS

A. Where instructed by the Architect, provide escutcheons on pipes passing through walls, floors, ceiling or partitions.

B. Provide set screw escutcheons to properly fasten same in place.

C. Escutcheons shall be of sufficient diameter to cover the sleeve. They shall be: chrome plated at floors and factory applied matte white enamel at the ceiling.

2.03 NIPPLES

A. No close nipples will be permitted. Short or shoulder nipples with the unthreaded section of the pipe no less than 2" long shall be of extra heavy pipe.

PART 3 - EXECUTION

3.01 INSTALLATION NOTES FOR INTERIOR PIPING SYSTEMS

A. It is the intent that each part of the Fire Protection Systems shall be complete in all details and all lines provided with all control valves as indicated on Drawings, or as may be required for the proper control of the pipe lines under this Section so that any fixture, line or piece of apparatus may be cut out for repair without interference or interruption of the service to the rest of the building.

B. The Contractor shall examine carefully the architectural plans and details and familiarize himself with all conditions relative to the installation of piping, particularly where same is concealed behind furring or in hung ceilings.

C. Piping shall be installed, whether indicated or not, so as to rise and/or drop to clear any and all conduits larger than 1", lighting fixtures, ductwork and heating mains, to maintain the desired clear heights. The Contractor shall consult with the other trades and facilitate the erection of the equipment and piping.

D. Run piping straight and as direct as possible. In general, form right angles with or parallel to walls or other piping. Risers shall be erected plumb and true.

E. After cutting, all pipes shall be reamed out to full bore and before erection the inside of all pipes shall be thoroughly cleaned.

F. No piping or work shall be concealed until all required tests have been satisfactorily completed and work has been approved by the Architect and all other authorities having jurisdiction.
G. All piping installed in finished areas shall be completely concealed within hung ceilings, furrings, soffits, pipe spaces, etc.

H. Where complete concealment is impossible because of obstructions such as beams, ducts, lights, piping, etc., the Contractor shall not install any work before first consulting with the Architect and his instructions (written or revised Drawings) shall be followed.

I. Grooved ends shall be clean and free from indentations, projections, and roll marks in the area from pipe end to groove.

END OF SECTION 21 05 28
PART 1 - GENERAL

1.01 DESCRIPTION

A. This Section is coordinated with and complementary to the General Conditions and Special Conditions of the Work, wherever applicable to Mechanical and Electrical Work.

B. Section 01 31 46 - Special Requirements for Mechanical and Electrical Work shall apply.

C. Section 01 35 48 - Vibration Isolation, Seismic, Wind and Flood Load Restraints for HVAC, Plumbing, Electrical and Fire Protection Components.

D. Section 21 05 02 - General Provisions for Fire Protection Work shall apply.

1.02 SCOPE OF WORK

A. The work of this Contract includes providing all labor, materials, accessories, services and tests necessary to install complete and make ready for operation by the Owner, all Hangers and Supports for Fire Protection Systems as shown on the Drawings and as specified hereinafter.

1.03 SPECIFIC REQUIREMENTS

A. Provide products which are Underwriters Laboratories and BS&A of New York listed FM approved wherever possible. Contractor shall indicate on his shop drawings submittals all items which are not UL listed and FM approved.

B. Provide pipe hangers and supports of which materials, design, and manufacture comply with ANSI/MSS SP-58, MSS SP-69, MSS SP-89.

C. Assume the responsibility for the proper transfer of the loads of the piping system to the structure. No additional cost to the Owner should be expected for any corrective work during construction.

D. Supports and hangers shall be provided for all horizontal and vertical piping. The hanger design shall conform to the ASA Code for Pressure Piping.

E. All bracket clamps and rod sizes indicated in these Specifications are minimum size only. This Contractor shall be responsible for structural integrity of all supports. All structural hanging material shall have a safety factor of five (5) built in.

F. All pipe supports shall be of type and arrangement as hereinafter specified. They shall be so arranged as to prevent excessive deflection and avoid excessive bending stresses between supports.

G. All auxiliary steel for pipe supports shall be furnished and installed by the Contractor, where overhead construction does not permit fastening of hanger rods in required locations.
PART 2 - PRODUCTS

2.01 HANGERS AND SUPPORTS

A. Pipe supports shall be of the following type and figure number as manufactured by B-Line Systems. Equal materials manufactured by Grinnell, Carpenter & Patterson may be submitted for approval.

B. Pipe Hanger Schedule:

<table>
<thead>
<tr>
<th>Item</th>
<th>B-Line Fig. #</th>
<th>Grinnell Fig. #</th>
<th>Piping Sizes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Beam Clamp</td>
<td>B3055</td>
<td>61</td>
<td>All</td>
</tr>
<tr>
<td>Beam Clamp w/Retaining Clip</td>
<td>B3036</td>
<td>87</td>
<td>All</td>
</tr>
<tr>
<td></td>
<td>w/B3363</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Clevis Hanger</td>
<td>B3100</td>
<td>260</td>
<td>8&quot; &amp; smaller</td>
</tr>
<tr>
<td>Pipe Saddle</td>
<td>B3093</td>
<td>264</td>
<td>4&quot; &amp; larger</td>
</tr>
<tr>
<td></td>
<td>B3093</td>
<td>192</td>
<td>2&quot;,2½&quot;,3&quot;</td>
</tr>
<tr>
<td>Riser Clamp</td>
<td>B3373</td>
<td>261</td>
<td>All</td>
</tr>
<tr>
<td>Stand Off Pipe Clamp</td>
<td>B3148</td>
<td>103</td>
<td>All</td>
</tr>
<tr>
<td>Brackets</td>
<td>B3066, B3067</td>
<td>105, 199</td>
<td>All</td>
</tr>
<tr>
<td>Steel Washer Plates</td>
<td>B3248</td>
<td>60</td>
<td>All</td>
</tr>
<tr>
<td>Concrete Insert</td>
<td>B3014</td>
<td>CB 282</td>
<td>All</td>
</tr>
</tbody>
</table>

PART 3 - EXECUTION

3.01 INSTALLATION REQUIREMENTS

A. Provide necessary structural members, hangers and supports of approved design to keep piping in proper alignment and prevent transmission of injurious thrusts and vibrations. In all cases where hangers, brackets, etc., are supported from concrete construction, care shall be taken not to weaken concrete or penetrate waterproofing. All hangers and supports shall be capable of screw adjustment after piping is erected. Hangers supporting piping expanding into loops, bends and offsets shall be secured to the building structure in such a manner that horizontal adjustment perpendicular to the run of piping supported may be made to accommodate displacement due to expansion. All such hangers shall be finally adjusted, both in the vertical and horizontal direction.

B. Pipe hangers shall be of the clevis type, except where otherwise noted.

C. Except where otherwise noted, piping shall be supported from structural steel only. Provide supplementary steel where required.

D. Piping shall not be hung from other piping, ducts, conduits or from equipment of other trades.

E. Lateral bracing of horizontal pipe shall be provided where required to prevent side sway or vibration. The lateral bracing shall be of a type approved by the Architect and shall be installed where directed by the Architect.
F. Where additional steel is required for the support of the hangers furnish and install same, subject to approval of the Architect.

G. All anchors shall be separate and independent of all hangers, guides and supports. Anchors shall be of heavy blacksmith construction suitable in every way for the work approved by the Architect. Anchors shall be welded to the pipe and fastened to the structure with anchor type bolts.

H. All horizontal steel pipe shall be supported at maximum intervals as follows: Steel pipe - up to 1½" - 12'-0". Provide at least one hanger between each two branch lines on the cross mains.

I. Trapeze type hangers shall be made up of angles bolted back-to-back or channels for supporting parallel lines of piping. Trapeze type hangers shall be supported with suspension rods having double nuts, and securely attached to construction with inserts, beam clamps, steel fishplates, cantilever brackets, lag screws or other approved means. Use approved type brackets for supporting piping attached along walls. Non-insulated piping (sprinkler system, fire standpipe) supported by trapeze hangers shall be provided with hold down clamps at the trapeze hangers.

J. Maximum weights on hanger rods shall be such that stress in tension shall not exceed 9,000 psi, using root area of threaded portion. In no case shall hanger rod sizes be less than 3/8" for pipe up to 4", 1/2" for pipe 5", 6" and 8". The use of rods over 2 to 3 feet long (depending on their diameters) to support or cross mains should be avoided, as excessive pipe oscillation can result under system operating conditions. Where rods exceed these lengths, the feed or cross mains should be adequately restrained.

K. Supports for vertical piping shall be double bolt riser clamps, with each end having equal bearing on the building structure located at alternate floors but it shall be no more than 25 feet between supports.

L. All auxiliary steel for pipe supports shall be furnished and installed under this Section.

M. All hangers, rods, inserts, clamps, stanchions, brackets, etc., shall be dipped in zinc chromate primer before installation and provided with one (1) coat of approved type paint after installation.

N. Chains, straps, perforated iron or wire hangers are not permitted.

O. The Architect must approve method of supporting pipes from building structure before work is started. The Contractor shall bear all responsibility for materials and workmanship as described in this Section, and shall make sure that all hangers and supports are properly and permanently connected to building structure.

P. All pipe supports shall be installed to avoid interference with other piping, hangers, electrical conduits and supports, building structures and equipment.

END OF SECTION 21 05 29
PART 1 - GENERAL

1.01 DESCRIPTION

A. This Section is coordinated with and complementary to the General Conditions and Special Conditions of the Work, wherever applicable to Mechanical and Electrical Work.

B. Section 01 31 46 - Special Requirements for Mechanical and Electrical Work shall apply.

C. Section 21 05 02 - General Provisions for Fire Protection Work shall apply.

1.02 SCOPE OF WORK

A. The Work of this Contract includes providing all labor, materials, accessories, services and tests necessary to install, complete and make ready for operation by the Owner, all work as shown on the Drawings and as specified hereinafter.

1.03 REQUIREMENTS

A. All tests shall be made in the presence of the Architect or their representatives, and the local authorities having jurisdiction of the work to be tested, as may be directed; and at least 72 hours notice shall be given in advance of all tests.

B. The Work of this Contractor shall include the furnishing of all testing instruments, gauges, pumps, smoke machines, and other equipment required or necessary for tests, required by laws, rules and regulations and as specified.

C. Provide all other tests required by local inspectors and all other authorities having jurisdiction.

D. All appurtenances shall be operated after installation to determine whether or not they meet the requirements of the Specifications.

E. All defects disclosed in the work by tests and otherwise shall be made good or the Work replaced without additional cost to the Owner. No caulking on screwed joints, cracks or holes will be acceptable.

F. Tests shall be repeated after any defects disclosed thereby have been made good or the work replaced if it is deemed necessary.

G. All tests shall be made at the expense of the Contractor.

H. Tests are not permitted to be made with air except as noted.

I. Contractor to provide required test plug tee fittings during erection of pipe system.

J. If the pipe installation fails to meet testing requirements, the Contractor shall determine at his own expense the source or sources of leakage, and he shall repair or replace all defective materials.
or workmanship. The completed pipe installation shall meet the requirements of the tests after the leaks have been corrected.

K. All piping which is to be enclosed in partitions or hung ceilings shall be tested and made tight when directed by the Construction Supervisor and in adequate time to permit the installation of partitions and ceilings. When necessary, the Contractor shall drain the piping and/or take over such precautions as required to prevent damage by freezing.

L. The Contractor shall also be responsible for the Work of other trades that may be damaged or disturbed by the tests, or the repair or replacement of his Work, and he shall, without extra charges, restore to its original condition any Work so damaged or disturbed.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.01 SPRINKLER SYSTEMS

A. Before any paint is applied, all sprinkler systems shall be tested hydrostatically at not less than 200 psi pressure for one (1) hour minimum, and in accordance with all requirements of the authorities having jurisdiction and NFPA latest edition.

B. The test shall be made in the presence of the Building and Fire Department Inspectors, and all other authorities having jurisdiction and to their satisfaction.

END OF SECTION 21 08 00
SECTION 22 05 02
GENERAL PROVISIONS FOR PLUMBING WORK

PART 1 - GENERAL

1.01 DESCRIPTION
A. This Section is coordinated with and complementary to the General Conditions and Special Conditions of the Work wherever applicable to Mechanical and Electrical Work.

B. Section 01 31 46 - Special Requirements for Mechanical and Electrical Work shall apply.


1.02 SCOPE OF WORK
A. Except as otherwise specified under "Related Work Not Included", the work of this Contract consists of furnishing all labor, materials, and appliances necessary and required to completely do all Plumbing Work as indicated on the Drawings or described or referred to in the Specifications, including, but not limited to the following:
   1. Complete interior sanitary, soil, waste and vent piping systems.
   2. Disconnecting and re-routing existing waste and storm water piping in renovated area as indicated on the drawings.
   3. Sleeves, hangers and supports.
   4. Apply for, obtain and pay for all permits, certificates, inspections and approvals required in connection with all Plumbing Work.
   5. Shop drawings, samples, tests and adjustments.
   6. Color coding and stenciling of all piping systems.
   7. Cutting and rough patching.
   8. Cap flashing and prime painting.
   9. Tests for all systems provided under this Section of the Specifications.
   10. Where due to Union regulations or trade agreements, if any of the work shown on the Drawings or specified herein is not considered Plumber's Work, this Contractor shall sub-contract the work in question, but this Contractor shall be held responsible for the complete installation.
   11. It is not the intention of these Specifications to describe, nor the Contract Drawings to show in detail, all the various pieces of apparatus and appurtenances and their connections. This Contractor shall, as part of the Contract, furnish and install all incidentals, such as piping, fittings, valves, etc., required to complete the installation.
   12. All work described in these Specifications and not shown on the Drawings, or vice versa, shall be installed in a manner similar to the work shown or described.

1.03 RELATED WORK NOT INCLUDED
A. The following principal items of work shall be provided under other Sections:
   1. Finish patching and finish painting.
1.04 LIST OF SHOP DRAWINGS

A. Submit shop drawings prior to installation covering the following items:
   1. All drains including floor, funnel, roof and area drains.
   2. Sleeves, escutcheons, hangers and inserts.
   3. All types of piping, fittings, etc. with description of intended uses.
   4. Detailed piping layout for all plumbing systems, coordinated with all other trades.
   5. Detailed coordinated sleeves and insert drawings for approval by Structural Engineer. In addition, the Contractor shall indicate all piping sleeved through beams.

B. The above listed items are to be considered major equipment and do not limit the Contractor's responsibility from submitting shop drawings for all equipment and accessories which are to be provided under this Section of the Contract.

1.05 VISITING THE PREMISES

A. This Contractor, before submitting his bid on the work, shall visit the site and familiarize himself with all visible existing conditions. As a result of having visited the premises, this Contractor shall be responsible for the installation of the work as it relates to such visible existing conditions.

B. The submission of a bid will be considered an acknowledgment on the part of the bidder of his visitation to the site.

1.06 QUALITY ASSURANCE

A. Manufacturer's Instructions: In addition to the requirements of these Specifications, comply with the manufacturer's instructions and recommendations for all phases of the work.

B. Standards and Codes
   1. NYC Plumbing Code.
   3. Local Municipal Rules and Regulations.
   4. Local Fire Department Requirements.
   5. NYC DEP Rules and Regulations.

C. All work and material not specifically described, but required for a complete and proper installation of the work of this Section, shall be provided by the Contractor and shall be new, first quality of their respective kinds, and subject to approval of the Architect.

1.07 ALTERATION WORK

A. All piping to be removed shall be disposed of, turned over to the Owner or salvaged as directed by the Owner. They shall not be removed from the premises without the Owner's approval.

B. All piping to be removed shall be properly plugged or capped so that upon completion of all new work, all abandoned piping shall be concealed in finished areas.

C. No dead ends shall be left on any piping upon completion of job.
D. Existing exposed piping not to be reused and not specifically noted or shown on Drawings to be abandoned shall be completely encased.

E. The existing system shall be left in perfect working order upon completion of all new work.

F. Locations and sizes of existing piping are approximate. Exact sizes and locations of all existing piping shall be verified at the site.

G. No removed existing piping, etc. shall be reused.

H. This Contractor shall not interrupt any of the services of the existing Hospital, nor interfere with the services in any way without the express permission of the Owner. Such interruptions and interferences shall be made as brief as possible and only at the time stated by the Owner.

I. Under no circumstances shall this Contractor or his workmen be permitted to use any part of the Hospital as a shop, except parts designated by the Hospital for such purposes.

J. Reroute or remove all existing piping where necessary to avoid structural or masonry work as required by the proposed alteration.

1.08 COOPERATION WITH OTHERS

A. The Plumbing Contractor shall cooperate with other trades whose work is to be correlated with his work in order to avoid field interference, improper elevations, or inaccessibility to equipment. Any extra expense occasioned by lack of cooperation by this Contractor shall be borne by him.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION 22 05 02
SECTION 22 05 03
APPROVED MANUFACTURERS FOR PLUMBING WORK

PART 1 - GENERAL

1.01 DESCRIPTION

A. This Section is coordinated with and complementary to the General Conditions and Special Conditions of the Work, wherever applicable to Mechanical and Electrical Work.

B. Section 01 31 46 - Special Requirements for Mechanical and Electrical Work shall apply.

C. Section 22 05 02 - General Provisions for Plumbing and Fire Protection Work shall apply.

PART 2 - PRODUCTS

2.01 APPROVED MANUFACTURERS

A. The manufacturers’ names and models hereinafter specified represent a standard of materials, appearance, finishes, performance, etc.

B. The Contractor has the option of submitting other manufacturers for approval in lieu of the manufacturers hereafter specified, provided their respective products conform in all respects to the manufacturers hereafter specified.

C. The following is a list of approved manufacturers:

1. Hangers and Supports
   a. Carpenter & Paterson, Inc.
   b. Fee and Mason
   c. Grinnell

2. Escutcheons
   a. Fee and Mason Mfg. Co.
   b. Ritter Pattern and Casting Co.

3. Piping and Fittings (Cast Iron)
   a. American Cast Iron Pipe Co.
   b. Alabama Pipe Co.
   c. Central Foundry Co.
   d. United States Pipe and Foundry

4. Pipe (Steel)
   a. Youngstown Sheet and Tube Co.
   b. Republic Steel Co.

5. Insulation
   a. Owens Corning Fiberglass Co.
   c. Pittsburgh Plate Glass Co.
PART 3 - EXECUTION (NOT USED)

END OF SECTION 22 05 03
SECTION 22 07 00
INSULATION FOR PLUMBING WORK

PART 1 - GENERAL

1.01 DESCRIPTION

A. This Section is to coordinate with and be complementary to the General Conditions and Special
Conditions of the work, wherever applicable to Mechanical and Electrical Work.

B. Section 01 31 46 - Special Requirements for Plumbing Work shall apply. 

C. Section 22 05 02 - General Provisions for Plumbing Work shall apply.

1.02 SCOPE OF WORK

A. The Work of this Contract includes providing all labor, materials, accessories, services and tests
necessary to install complete and make ready for operation by the Owner, all work as shown on
Drawings and as specified hereinafter.

B. The piping systems and equipment to be insulated shall include, but not be limited to the
following:
   1. Horizontal storm drainage piping as indicated.

PART 2 - PRODUCTS

2.01 INSULATING MATERIALS

A. All insulation shall have a composite (insulation, jacket facing and adhesive used to adhere jacket
or facing to the insulation) fire and smoke hazard ratings as tested by Procedure ASTM E-84,
NFPA 255 and UL 73, not exceeding flame spread of 25, fuel contributed of 50, and smoke
developed of 50. Accessories such as adhesives, mastics, cements, tapes and cloths for fittings
shall have component ratings as listed above. Insulation shall be glass fiber with a maximum K
factor 0.23 at 75°F. mean temperature. Density shall not be not less than 3 lbs. per cu. ft.

B. The materials as specified below have been selected from the catalog of Owens-Corning
Fiberglass Corp. and are representative of the quality, design and finish desired. Insulation as
manufactured by other manufacturers may be submitted for approval, provided the products meet
fully in all respects (such as density, moisture absorption, alkalinity, thermal-conductivity, jacket,
etc.) the materials as designated below.
   1. Fiberglass Pipe Insulation: ASJ/SSL-II. Molded fibrous glass pipe insulation shall
      comply with the requirements of ASTM C.547.
      a. Provide Class 12 for hot and cold plumbing piping.
   2. Fiberglass Pipe Fitting Insulation: FS HH-I-558, Form E, Class as indicated.
      a. Provide Class 16 for use with Class 12 pipe insulation, where temperature does not
         exceed 450°F.
3. Vapor Barrier Materials: ASTM 1136, Type I, paper-backed aluminum foil, except as otherwise indicated, strength and permeability rating equivalent to adjoining pipe insulation jacketing.
4. Bends shall be 0.016 inch thick, ½” aluminum spaced 18” on center, by Insulation Industries, Inc.
5. Wires shall be 20 gage galvanized annealed steel, sealer shall be layer of J-M Duramesh 207 or equal.
6. Adhesives and Protection Finish shall be Foster 30-36 or Childers CP-50AMV1.
7. For all Fittings and Valves: Provide Zeston 25/50 rated -20 mil P.V.C. covers over all insulation. The use of mitered elbows and fittings is prohibited.

2.02 RELATED MATERIALS AND REQUIREMENTS
A. At pipe supports Insul-Shield pipe saddles and matching hanger shall be used. Joints of insulation abutting Insul-Shielding pipe saddles shall be butted with IC-405, and the joints firmly pressed together.
B. All concealed and exposed piping shall be provided with factory ASJ (Owens/Corning Fiberglass) secured in place with vapor barrier adhesive Foster 85-50 or IC-225. Provide ½” aluminum bands spaced 18” on centers.

2.03 INSULATION REQUIREMENTS
A. Cold Water Piping
   1. Storm drainage piping and drain body - minimum ½” insulation, A.S. jacket SSL II.
B. Insulation shall be glass fiber complying with ASTM C547, Type I with a maximum K factor of 0.23 BTU in/hr ft² F at 75 degrees F. mean temperature with factory-applied all service vapor barrier jacket with self seal lap meeting the requirement of ASTM C-1136 Type I.
C. Insulation shall be heavy density fiberglass sectional pipe insulation as made by Owens-Corning Fiberglass Corp. or Johns-Manville Micro-Lok fiberglass insulation.
D. Ends of pipe insulation shall be sealed off at all flanges, fittings, valves and at intervals of 21 feet on continuous runs of pipe, with Foster fire-resistant vapor barrier coating Foster 30-65 or Childers CP-34 or equal.
E. All fittings, valves and flanges for pipe sizes smaller than 4” shall be insulated with molded fiberglass fittings of same thickness as the adjoining pipe insulation, secured with No. 20 gauge galvanized annealed steel wire and covered with Zeston 2000 25/50 PVC as made by Johns Manville, applied per manufacturer’s recommendation.
F. All horizontal storm drainage piping (except in service/utility corridor) under roofs, exposed and above hung ceiling, and roof drain bodies shall be insulated (sweat-proofing) as specified for water piping, but nested larger diameter covering over hubs and drain bodies.
G. Direct contact between pipe and hanger shall be avoided. Hanger shall pass outside of a metal saddle which cover a section of high density insulation (such as calcium silicate) of sufficient length to support pipe without crushing insulation. Hangers shall not pierce insulation and all vapor barriers shall be unbroken and continuous.
PART 3 - EXECUTION

3.01 GENERAL REQUIREMENTS

A. Maintain integrity of vapor-barrier jackets on pipe insulation, and protect to prevent puncture or other damage. Staples shall not be used on vapor barrier.

B. Cover valves, flanges, fittings and similar items in each piping system with equivalent thickness and composition of insulation as applied to adjoining pipe run. Install factory, precut or job fabricated units (at Installer's option) except where a specific form or type is indicated.

C. Extend piping insulation without interruption through walls, floors and similar piping penetrations, except where otherwise indicated.

D. Install protective metal shields and insulated inserts at each hanger and support to prevent compression of insulation.

E. Apply insulation using the staggered joint method for both single and double layer construction, where feasible. Apply each layer of insulation separately.

F. All horizontal storm drainage piping (except in service/utility corridor) under roofs, exposed and above hung ceiling, and roof drain bodies shall be insulated (sweat-proofing) as specified for water piping, but nested larger diameter covering over hubs and drain bodies.

G. Direct contact between pipe and hanger shall be avoided. Hanger shall pass outside of metal saddle which cover a section of high density insulation (such as calcium silicate) of sufficient length to support pipe without crushing insulation. Hangers or saddles shall not pierce insulation and vapor barriers.

3.02 INSTALLATION REQUIREMENTS

A. Install insulation products in accordance with the manufacturer's written instructions, and in accordance with recognized industry practices to ensure that the insulation serves its intended purpose.

B. Install insulation on pipe systems subsequent to testing and acceptance of tests.

C. Install insulation materials with smooth and even surfaces. Insulate each continuous run of piping with full-length units of insulation, with a single cut piece to complete the run. Do not use cut pieces of scraps abutting each other.

D. Clean and dry pipe surfaces prior to insulating. Butt insulation joints firmly together to ensure a complete and tight fit over surfaces to be covered.

E. The Contractor shall take every precaution necessary to ensure that the covering material is in satisfactory condition to receive painting.

F. In all cases where new piping connects to existing piping that is insulated, the existing insulation that is removed to make the new connection shall be replaced with new insulation as hereinafter specified.
G. Do not insulate hand holes, cleanouts, ASME stamp, or the manufacturer's nameplate. Provide neatly beveled edge at interruptions of insulation.

H. Replace damaged insulation which cannot be repaired satisfactorily, including units with vapor barrier damage and moisture saturated units.

I. The installer of the piping insulation shall advise this Contractor of required protection for the insulation work during the remainder of the construction period, to avoid damage and deterioration.

END OF SECTION 22 07 00
SECTION 22 08 00
TESTING AND ADJUSTMENTS FOR PLUMBING WORK

PART 1 - GENERAL

1.01 DESCRIPTION

A. This Section is coordinated with and complementary to the General Conditions and Special Conditions of the Work, wherever applicable to Plumbing Work.

B. Section 01 31 46 - Special Requirements for Mechanical Work shall apply.


D. Section 22 05 02 - General Provisions for Plumbing Work shall apply.

1.02 SCOPE OF WORK

A. The Work of this Contract includes providing all labor, materials, accessories, services to provide all necessary tests and adjustments of all plumbing systems and make ready for operation by the Owner, all work as shown on the Drawings and as specified hereinafter.

1.03 REQUIREMENTS

A. The persons providing the specified work and their supervisors shall be personally experienced in the work; and shall have been regularly employed by a firm engaged in the installation of similar work for this project in scope for a minimum of five (5) years.

B. All tests shall be made in the presence of the Architect or his representatives, and the local authorities having jurisdiction of the work to be tested, as may be directed; and at least 72 hours notice shall be given in advance of all tests.

C. The Work of this Contractor shall include the furnishing of all labor and testing instruments, gauges, pumps, smoke machines, and other equipment required or necessary for tests, required by laws, rules and regulations and as specified.

D. Provide all other tests required by local inspectors and all other authorities having jurisdiction.

E. All appurtenances shall be operated after installation to determine whether or not they meet the requirements of the Specifications.

F. All defects disclosed in the work by tests and otherwise shall be made good or the Work replaced without additional cost to the Owner. No caulking on screwed joints, cracks or holes will be acceptable.

G. Tests shall be repeated after any defects disclosed thereby have been made good or the work replaced if it is deemed necessary.
H. All tests shall be made at the expense of the Contractor.

I. Tests are not permitted to be made with air except as noted.

J. It shall be the responsibility of the Contractor to keep records on all testing of systems.

K. Contractor to provide required test plug tee fittings during erection of pipe system.

L. If the pipe installation fails to meet testing requirements, the Contractor shall determine at his own expense the source or sources of leakage, and he shall repair or replace all defective materials or workmanship. The completed pipe installation shall meet the requirements of the tests after the leaks have been corrected.

M. All piping which is to be enclosed in partitions or drip pans shall be tested and made tight when directed by the Construction Supervisor and in adequate time to permit the installation of partitions and drip pans. When necessary, the Contractor shall drain the piping and/or take over such precautions as required to prevent damage by freezing.

N. The Contractor shall also be responsible for the Work of other trades that may be damaged or disturbed by the tests, or the repair or replacement of his Work, and he shall, without extra charges, restore to its original condition any Work so damaged or disturbed.

O. The testing procedures listed are the minimum required. Any jurisdictional codes that call for additional requirements shall naturally be done.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.01 INTERIOR PLUMBING SYSTEMS

A. All plumbing systems shall be tested in accordance with NYC code as described below.

B. Rough Piping Installations:
   1. Drainage piping, except exposed short fixture connecting drain pipes, shall be tested and proven watertight upon completion of the rough piping installation prior to covering or concealment.
   2. Where the developed length of continuous drainage pipe installation is less than 10 feet, a water flow test shall be applied to the drainage piping. Water flow through the drainage piping shall be provided at rates similar to the service conditions under which the piping is to function. This test method may be applied in testing existing buried building drains when permission is granted by the enforcement officer.
   3. Where the developed length of continuous drainage and vent pipe installation is 10’ or more, a water pressure test shall be applied to the drainage and vent piping. Test pressure shall be equal to at least a 10’ column of water at all points, except that the uppermost 10’ of the system, measured downward from the highest roof vent terminal, need be subjected only to the pressure produced when water overflows from that terminal. The piping may be tested in sections when approved test fittings are provided at appropriate locations. Test
pressure at any point in the system shall not be allowed to exceed the equivalent of a 100' column of water. This test shall be applied to all building drains except those for which a water flow test is specially permitted.

4. An air pressure test, at five pounds per square inch gauge pressure, may be applied instead of the water pressure test when special permission is granted by the enforcement officer.

END OF SECTION 22 08 00
SECTION 22 10 01

PIPING, TUBE AND FITTINGS FOR PLUMBING WORK

PART 1 - GENERAL

1.01  DESCRIPTION

A. This Section is coordinated with and complementary to the General Conditions and Special Conditions of the Work wherever applicable to Mechanical and Electrical Work.

B. Section 01 31 46 - Special Requirements for Mechanical and Electrical Work shall apply.


D. Section 22 05 02 - General Provisions for Plumbing Work shall apply.

1.02  SCOPE OF WORK

A. The work of this Contract includes the providing of all labor, materials, accessories, services and tests necessary to install, complete and make ready for operation by the Owner, all work as shown on the Drawings and as specified herein.

1.03  SPECIFIC REQUIREMENTS

A. Pipe and fittings shall conform to the latest USASI, ASTM, ANSI and/or F.S. Standards, and/or Cast Iron Soil Pipe Institute Standards No. 301 and 310.

B. All pipes, fittings, traps, materials and/or other devices used in the plumbing system shall have cast, stamped, or indelibly marked on it the maker's name or mark, weight, and quality of the product when such marking is required by the approved standard.

PART 2 - PRODUCTS

2.01  INTERIOR PIPING

A. Interior sanitary drainage and storm water piping above ground shall be No-Hub, cast iron soil pipe and fittings or galvanized steel threaded pipe with galvanized cast iron recessed drainage fittings conforming to ASTM A126 Class B.

1. Service weight cast iron No-Hub pipe fittings shall be made up to comply with CISPI Standard 301 and ASTM A888. No-Hub coupling gaskets shall conform with ASTM C564 and ASTM C1563. Each approved coupling shall be permanently marked on its external surface with manufacturer's name or trade mark, nominal pipe size and rated pressure in PSI.

2. Stainless steel couplings shall be constructed of 24 gauge type 304 stainless steel incorporating a neoprene gasket and stainless steel bolts and bands as manufactured by Clamp-All Co. Or approved equal.
3. Heavy duty couplings shall conform to requirements of ASTM C1540 mid-range heavy duty couplings. Comparative coupling: Husky HD 2000, Clamp All 80, Mission Heavyweight or Ideal MD/HD.

PART 3 - EXECUTION

3.01 INSTALLATION NOTES FOR INTERIOR PIPING

A. It is the intent that each part of the plumbing systems shall be complete in all details and all lines provided with all control valves as indicated on Drawings, or as may be required for the proper control of the pipe lines under this Section so that any line or piece of apparatus may be cut out for repair without interference or interruption of the service to the rest of the building.

B. The Contractor shall examine carefully the architectural plans and details and familiarize himself with all conditions relative to the installation of piping, particularly where same is concealed behind furring or in hung ceilings.

C. In no case shall the Contractor permit his pipes to be exposed beyond finished plaster lines unless specifically shown on Drawings. He shall consult with the other trades in the building and install his piping in such a way as to least interfere with the installation of other trades.

D. Run piping straight and as direct as possible. In general, form right angles with or parallel to walls or other piping. Risers shall be erected plumb and true.

E. After cutting, all pipes shall be reamed out to full bore and before erection the inside of all pipes shall be thoroughly cleaned.

F. No piping or work shall be concealed or insulated until all required tests have been satisfactorily completed and work has been approved by the Architect and all other authorities having jurisdiction.

G. Branch connections of the drainage systems shall be made with "Wye" and long "Tee-Wye" fittings. Short ¼" bends, common offsets and double hubs will not be permitted. Short "Tee-Wye" fittings are to be used in a vertical position only.

H. Cleanouts shall be provided at all changes of directions, at the ends of branch runs where shown.

I. All piping installed in finished areas shall be completely concealed within hung ceilings, furrings, soffits, pipe spaces, etc.

J. Where complete concealment is impossible because of obstructions such as beams, ducts, lights, piping, etc., the Contractor shall not install any work before first consulting with the Architect and his instructions (written or revised Drawings) shall be followed.

K. Grooved ends shall be clean and free from indentations, projections, and roll marks in the area from pipe end to groove.

3.02 NO-HUB PIPING - ADDITIONAL REQUIREMENTS

A. Pipe hanger shall be provided at each coupling for horizontal piping.
B. Stacks shall be supported at their bases and at each floor, by floor clamps.

C. Horizontal piping 5" and larger shall be braced at each branch and at every change in direction.

END OF SECTION 22 10 01
SECTION 22 10 03
HANGERS AND SUPPORTS FOR PLUMBING WORK

PART 1 - GENERAL

1.01 DESCRIPTION

A. This Section is coordinate with and complementary to the General Conditions and Special Conditions of the Work wherever applicable to Mechanical and Electrical Work.

B. Section 01 31 46 - Special Requirements for Mechanical and Electrical Work shall apply.


D. Section 22 05 02 - General Provisions for Plumbing Work shall apply.

1.02 SCOPE OF WORK

A. The work of this Contract includes providing all labor, materials, accessories, services and tests necessary to install complete and make ready for operation by the Owner, all Hangers and Supports for Plumbing and Fire Protection Systems as shown on the Drawings and as specified hereinafter.

1.03 SPECIFIC REQUIREMENTS

A. Provide products which are Underwriters Laboratories listed and Factory Mutual approved.

B. Provide pipe hangers and supports of which materials, design, and manufacture comply with ANSI/MSS SP-58.

C. Select and apply pipe hangers and supports, complying with MSS SP-69.

D. Fabricate and install pipe hangers and supports complying with MSS SP-89.

E. Assume the responsibility for the proper transfer of the loads of the piping system to the structure. No additional cost to the Owner should be expected for any corrective work during construction.

F. Supports and hangers shall be provided for all horizontal and vertical piping. The hanger design shall conform to the ASA Code for Pressure Piping. Hangers shall be kept outside of pipe insulation.

G. All bracket clamps and rod sizes indicated in these Specifications are minimum size only. This Contractor shall be responsible for structural integrity of all supports. All structural hanging material shall have a safety factor of five (5) built in.

H. All horizontal cast iron pipe shall be supported every five (5) feet and at each hub and/or "no-hub" clamping assembly. When a concentration of fittings occur, additional support shall be installed.
consistent with good trade practices. "No-hub" system must be supported in accordance with Standard CISPI-310-78.

PART 2 - PRODUCTS

2.01 HANGERS AND SUPPORTS

A. Pipe supports shall be of the following type and figure number, manufactured by C&P, B-Line, Grinnell, or equal as approved:

B. Pipe Hanger Schedule

<table>
<thead>
<tr>
<th>Hanger Type</th>
<th>C&amp;P</th>
<th>B-Line</th>
<th>Grinnell</th>
</tr>
</thead>
<tbody>
<tr>
<td>Beam Clamp</td>
<td>268</td>
<td>B3055</td>
<td>-</td>
</tr>
<tr>
<td>Clevis Hanger</td>
<td>100</td>
<td>B3100</td>
<td>260</td>
</tr>
<tr>
<td>180 Degree Shield</td>
<td>-</td>
<td>B3152</td>
<td>-</td>
</tr>
<tr>
<td>Pipe Saddle</td>
<td>351</td>
<td>B3160</td>
<td>180 Series</td>
</tr>
<tr>
<td>Rigid Trapeze</td>
<td>371</td>
<td>Std. 45</td>
<td></td>
</tr>
<tr>
<td>U-Bolt</td>
<td>283</td>
<td>B3188</td>
<td>137</td>
</tr>
<tr>
<td>Riser Clamp</td>
<td>89 or</td>
<td>B3373</td>
<td>261</td>
</tr>
<tr>
<td>Double Bolt</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Pipe Clamp</td>
<td>304</td>
<td>B3144</td>
<td>295</td>
</tr>
<tr>
<td>Welding Beam</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Insert</td>
<td>113B</td>
<td>B3083</td>
<td>66</td>
</tr>
<tr>
<td>Continuous</td>
<td>650</td>
<td>B2505</td>
<td>280</td>
</tr>
<tr>
<td>Slotted Insert</td>
<td>1480</td>
<td>B321</td>
<td>-</td>
</tr>
</tbody>
</table>

C. Insulation Protection

1. For all insulated pipe furnish clevis hangers with welded shields and equal to B-Line Fig. B3100 w/B3151.

PART 3 - EXECUTION

3.01 INSTALLATION REQUIREMENTS

A. Provide necessary structural members, hangers and supports of approved design to keep piping in proper alignment and prevent transmission of injurious thrusts and vibrations. In all cases where hangers, brackets, etc., are supported from concrete construction, care shall be taken not to weaken concrete or penetrate waterproofing. All hangers and supports shall be capable of screw adjustment after piping is erected. Hangers supporting piping expanding into loops, bends and offsets shall be secured to the building structure in such a manner that horizontal adjustment perpendicular to the run of piping supported may be made to accommodate displacement due to expansion. All such hangers shall be finally adjusted, both in the vertical and horizontal direction. Hangers in contact with copper or brass pipe shall be copper plated steel.

B. Pipe hangers shall be of the clevis and pipe roller types, except where otherwise noted.
C. Except where otherwise noted, piping shall be supported from structural steel only. Provide supplementary steel where required.

D. Piping shall not be hung from other piping, ducts, conduits or from equipment of other trades.

E. Where additional steel is required for the support of hangers, furnish and install same subject to the approval of the Architect. Piping shall not be supported from the metal deck slab construction.

F. All piping running on walls shall be supported by means of hanger suspended from heavy angle iron wall brackets. No wall hooks will be permitted.

G. Lateral bracing of horizontal pipe shall be provided where required to prevent side sway or vibration. The lateral bracing shall be of a type approved by the Architect and shall be installed where directed by the Architect.

H. All anchors shall be separate and independent of all hangers, guides and supports. Anchors shall be of heavy blacksmith construction suitable in every way for the work approved by the Architect. Anchors shall be welded to the pipe and fastened to the structure with anchor type bolts.

I. Anchors shall be fabricated and assembled in such a form as to secure the piping in a fixed position. They shall permit the line to take up its expansion and contraction freely in opposite directions away from the anchored points; and shall be so arranged as to be structurally suitable for particular location and line loading. Submit details for approval.

J. All horizontal steel pipe shall be supported at maximum intervals as follows: Steel pipe - up to 1¼" - 8'-0"; 1½" to 2½" - 10'-0"; 3" and larger - 12'-0". There shall be no metal-to-metal contact at supports for non-ferrous pipes. Provide ⅛" thick lead strips or Summer Inc. pipe clamps under uninsulated piping at supports. Hangers and supports shall be installed outside of insulation or insulated piping.

K. Trapeze type hangers shall be made up of angles bolted back-to-back or channels for supporting parallel lines of piping. Trapeze type hangers shall be supported with suspension rods having double nuts, and securely attached to construction with inserts, beam clamps, steel fishplates, cantilever brackets, lag screws or other approved means. Use approved type brackets for supporting piping attached along walls. Non-insulated piping (compressed air, gas, etc.) supported by trapeze hangers shall be provided with hold down clamps at the trapeze hangers. If only non-ferrous piping (copper, etc.) is supported on the trapeze hangers, the trapeze and hold down clamps shall be epoxy painted.

L. Maximum weights on hanger rods shall be such that stress in tension shall not exceed 9,000 psi, using root area of threaded portion. In no case shall hanger sizes be less than ⅜" for pipe up to 2", ⅝" for pipe 1½" to 3½", ⅞" for pipe 4" to 5", ¾" for pipe 6", ⅞" for pipe 8" to 12".

M. All auxiliary steel for pipe supports shall be furnished and installed under this Section.

N. All hangers, rods, inserts, clamps, stanchions, brackets, etc., shall be dipped in zinc chromate primer before installation and provided with one (1) coat of approved type paint after installation. (Refer to Section 01 31 46.)
O. Chains, straps, perforated iron or wire hangers are not permitted.

P. The Architect must approve method of supporting pipes from building structure before work is started. The Contractor shall bear all responsibility for materials and workmanship as described in this Section, and shall make sure that all hangers and supports are properly and permanently connected to building structure. No piping shall be hung from metal deck; auxiliary steel shall be provided.

Q. All pipe support shall be installed to avoid interference with other piping, hangers, electrical conduits and supports, building structures and equipment.

END OF SECTION 22 10 03
SECTION 22 30 01
PLUMBING EQUIPMENT, SPECIALTIES AND ACCESSORIES

PART 1 - GENERAL

1.01 DESCRIPTION

A. This Section is coordinate with and complementary to the General Conditions and Special Conditions of the Work, wherever applicable to Mechanical and Electrical Work.

B. Section 01 31 46 - Special Requirements for Mechanical and Electrical Work shall apply.

C. Section 22 05 02 - General Provisions for Plumbing Work shall apply.

1.02 SCOPE OF WORK

A. The Work of this Contract includes providing all labor, material, equipment, accessories, services, and tests necessary to complete and make ready for operation by the Owner, all work as shown on the Drawings and hereinafter specified.

PART 2 - PRODUCTS

2.01 ESCUTCHEONS

A. This Contractor shall provide escutcheons on all exposed pipe wherever they pass through floors, ceilings, walls or partitions.

B. Escutcheons for pipes passing through interior walls, partitions, and ceilings shall be Ritter Pattern and Casting Co., No. 1, solid, cast brass chromium plated type, secured to pipe with set screws.

C. Escutcheons for pipes in unfinished areas shall be cast iron, secured with set screws.

2.02 DISSIMILAR METALS

A. Connections between pipe, fittings, hangers of dissimilar metals shall be avoided.

B. Dielectric unions or insulated couplings shall be installed between copper or brass piping material and steel piping material or steel tanks. Unions or insulated couplings shall be used for pipe sizes 2” and smaller, and use dielectric gaskets on flanges and sleeves for pipes 2-1/2” and larger.

C. Pipes, fittings, hangers, etc., of dissimilar metals shall be insulated against direct contact with each other by using a high quality or grade of dielectric insulating material.

2.03 PIPE SLEEVES

A. Any pipe required in walls and floors shall be provided with a pipe sleeve.
B. Except where indicated or specified otherwise, provide and install Schedule 40 galvanized steel sleeves for all piping passing through concrete walls or floor slabs. Sleeves shall be securely set in the framework and where not specified otherwise shall be of such length as to extend flush with each face of the wall in which they are installed. Sleeves shall be securely set in floors 3" above unfinished floor and 2" above the finished floor or tile, as applicable.

C. Sleeves shall have an internal diameter of at least 1" larger than the outside pipe size diameter of the pipe passing through them. Sleeves in exterior foundation walls shall be James B. Clow and Sons, No. F-1430 or F-1435, or approved equal, extra-heavy cast iron wall sleeves with intermediate integral flange. Cast iron sleeves shall be set with ends flush with wall faces.

D. Where sleeves penetrate waterproofing, install caulking between pipes and pipe sleeves as follows:
   1. Pack oakum to a depth of 1" between pipe and pipe sleeve at a location permitting 3" of sealant to be installed above the oakum.
   2. Fill space above oakum to a depth of 3" with sealant similar and equal to Igas Joint Sealer as manufactured by Silka Chemical Corporation.

E. Sleeves in waterproof floors shall be as manufactured by Zurn Inc. or equal, cast iron sleeve with integrally cast flange and flashing device.

2.04 CLEANOUTS

A. Provide easily accessible cleanouts where indicated; at each change of direction, and where indicated to make entire drainage system accessible for rodding. Provide at least 18 inch clearance to permit access to cleanout plugs.

B. Cleanouts for cast iron pipe shall consist of tapped extra heavy cast iron ferrule caulked into cast iron fittings, and extra heavy brass screw plug with solid hexagonal nut.

PART 3 - EXECUTION (NOT USED)

END OF SECTION 22 30 01
SECTION 23 05 12
GENERAL PROVISIONS FOR HVAC WORK

PART 1 - GENERAL

1.01 GENERAL REQUIREMENTS

A. This Section is coordinated with and complementary to the General Conditions and Supplementary General Conditions of the Work, wherever applicable to Mechanical Work.

B. Section 01 31 46 - Special Requirements for Mechanical and Electrical Work shall apply.

1.02 DESCRIPTION OF WORK INCLUDED

A. Work Included:
   1. The work includes providing all labor, materials, equipment, accessories, services and tests necessary to complete and make ready for operation by the Owner, all Heating, Ventilating and Air Conditioning Work as shown on the Drawings and hereinafter specified, including, but not limited to the following:
      a. All motor starters and controllers for equipment furnished by this Contractor. Packaged type units shall be furnished completely prewired with panels mounted on the units as specified. All other motor starters and controllers will be turned over to the Electrical Contractor for installation and wiring.
      b. Condensate pumps.
      c. Piping, fittings, and valves.
      d. Sheet metal ductwork and accessories such as dampers, access doors, etc.
      e. Duct Terminal Units
      f. Registers, grilles and diffusers.
      g. Fire dampers and smoke dampers.
      h. Pipe, duct and equipment insulation.
      i. DX Split Air conditioning systems – Air Cooled Condensers & In-row Air Conditioning Units.
      j. DX Split Air conditioning systems – Air Cooled Condensers & UPS Room Air Conditioning Units.
      k. Temperature Control: A complete system of temperature control shall be installed in connection with the HVAC systems, including all thermostats, control valves, damper motors and dampers for the outdoor air intakes and fan discharges. All control wiring for automatic temperature controls, including interlocking wiring for fans, chillers, pumps, etc. by this Contractor.
      l. Painting and pipe, duct and equipment identification for all work by this Contractor is previously specified under "Special Requirements for Mechanical and Electrical Work".
      m. Test and balancing.
      n. Sleeves, pipe inserts and anchor bolts, escutcheons, prefabricated roof curbs, etc., as hereinafter specified.
      o. Identification, name plates, tags and charts.
      p. Cutting and rough patching.
      q. All demolition work associated with HVAC systems.
1.03 WORK INCLUDED UNDER OTHER SECTIONS OF THE SPECIFICATIONS

A. The following work is included under other Sections of the Specifications:
1. Framed openings as shown on the Drawings.
2. Power wiring for all motors except where otherwise noted.
3. Setting of access doors furnished by this Contractor.
4. All motor disconnect switches, except where in combination starters and where otherwise noted.
5. Finish painting.
6. Access doors in ceiling and walls.
7. Finish patching.

1.04 QUALITY ASSURANCE

A. Perform work in accordance with quality established in Section 01 31 46 "Special Requirements for Mechanical and Electrical Work", and hereinafter specified. All work performed shall comply with local codes.

1.05 SUBMITTALS

A. Submit shop drawings covering the following items:
1. Coordination drawings.
2. Sleeve and ductwork penetration drawings.
3. Identification schedule and samples.
4. Air diffusers, registers and grilles.
5. Schedule of ductwork, joints, gauges, supports, flexible connections, fire dampers, access doors, etc.
7. Schedule of piping and fitting materials.
8. Piping shop drawings.
10. Thermometers and pressure gauges.
11. In-Row MDF-Room - DX Split Air Conditioning System
12. UPS Room - DX Split Air Conditioning Systems
13. Dry Coolers & Air Conditioning Units
14. Pumps, Expansion Tanks and Air Separators
15. Schedule of pipe and ductwork supports, including inserts, escutcheons, etc.
16. Schedule of insulation types and samples of each type.
17. Vibration isolation schedule
18. VAV Duct Terminal Units.
19. Automatic Temperature Control System.

B. All shop drawings being submitted that include electrical work shall be submitted with all internal and external wiring diagrams.

C. The previously listed items are major equipment and do not limit this Division's responsibility to submit shop drawings for all equipment and accessories which are to be provided under this Division of the Specifications.
PART 2 - PRODUCTS

2.01 SPARE PARTS

A. Filters:
   1. The Contractor shall furnish a minimum of two complete spare filter sets for the filters for
      AC units. Provide 40 spare filters for fan coil units.

B. Spare Lamps:
   1. Furnish ten (10) spare lamps for each size and type of lamp on instrument panels.

C. Miscellaneous Spare Parts:
   1. Water column glasses shall be provided for each tank utilizing one.
   2. One complete set of gaskets shall be provided for each of the following pieces of
      equipment:
      a. All manhole and handhole openings for the expansion tank and blow-down tank.
   3. Furnish one complete set of V-belts for each belt driven unit installed.
   4. Electrical equipment - two spare starter fuses identified for each type and size for all starters
      including pumps, supply, return and exhaust fan.
   5. One set of bearings properly identified for each type and size supply, return and exhaust
      fan.
   6. For each type and size pump furnished under this section of the contract, furnish as
      applicable for each type and size of pump, one set of wearing rings, one set of mechanical
      seals, one set of bearings, one set of shaft sleeves, one set of stuffing box bushings, one set
      of packing glands with rings, nuts and bolts and sufficient stuffing box packing for four
      packings.

D. Furnish tools required for equipment as follows:
   1. One set of high grade tools as recommended and approved by the respective manufacturer
      for pumps, fans, refrigeration equipment and other equipment. Tools shall be furnished
      in a suitable hardwood or other approved container with lock and two (2) keys. Pasted on
      the inside cover shall be a list of all tools provided in container.
   2. One pressure grease gun of approved design and size, complete with necessary adaptors to
      fit all lubricating fittings on installed equipment.
   3. One pitot tube, complete with required manometers, to read static pressure and velocity
      pressure simultaneously. Provide 6’-0” of rubber tubing.

2.02 LIST OF MANUFACTURERS

A. The manufacturer's name appearing first on this list is the manufacturer the project design was
   based upon. However, the additional manufacturers listed herein are also acceptable with the
   provision that they meet the requirements of these Specifications, ratings, and/or space allocations
   listed in the Specifications or shown on the Drawings.
   1. In-Row DX Air Conditioning Units (MDF Room AC-A)
      a. Schneider Electric
      b. Stulz
      c. Liebert
   2. Air-Cooled DX Split Air Conditioning Units (UPS Room AC-B)
      a. Schneider Electric
      b. Stulz
c. Liebert

3. Air Cooled Condenser Units (ACCU-A & ACCU-B)
   a. Stulz
   b. Liebert
   c. Schneider Electric

4. Duct Terminal Units
   a. Titus
   b. Price
   c. Anemostat

5. Draft Gauges
   a. Dwyer
   b. Ashcroft
   c. Weiss Instruments Inc.
   d. Noshok
   e. Winters Instruments

6. Louvers & Dampers
   a. Arlan Damper Corp. (631-589-7431)
   b. Ruskin
   c. Titus
   d. Greenheck

7. Flow Measuring Devices
   a. Barco Division; Aeroquip Corp.
   b. Pres O Ind.
   c. Hyspan

8. Thermometers & Pressure Gauges
   a. Ashcroft
   b. Weiss Instruments
   c. Miljoco Corp.
   d. Noshok
   e. H.O. Trerice Company

9. Motors & Variable Frequency Drives
   a. Toshiba
   b. Yaskawa
   c. Allen Bradley – Rockwell Automation

10. Starters, Motor Control Centers, Switches
    a. Toshiba
    b. Yaskawa
    c. Allen Bradley – Rockwell Automation

11. Diffusers, Registers & Grilles
    a. Titus
    b. Price
    c. Anemostat

12. Insulation and Acoustic Lining
    a. Owens-Corning Fiberglass Corp.
    b. CSG Snap-on
    c. Johns Manville
    d. Armacell LLC
    e. K-flex USA
    f. Aeroflex USA
    g. Knauf Insulation
13. Vibration Isolation  
   a. VMC East  
   b. Mason Industries  
   c. Korfund Corp  
14. Automatic Temperature Controls  
   a. Johnson Controls  

PART 3 - EXECUTION  

END OF SECTION 23 05 12
SECTION 23 05 93
TESTING AND BALANCING

PART 1 - GENERAL

1.01 GENERAL REQUIREMENTS

A. This Section is coordinate with and complementary to the General Conditions and Supplementary General Conditions of the Work, wherever applicable to Mechanical Work.

B. Section 01 31 46 - Special Requirements for Mechanical and Electrical Work shall apply.

1.02 DESCRIPTION OF WORK

A. All piping and equipment shall be tested. Labor including standby electrician, materials, instruments and power required for testing shall be furnished unless otherwise indicated under the particular Section of the Specification.

B. Tests shall be performed in the presence of and to the satisfaction of the Architect and such other parties as may have legal jurisdiction.

C. In no case shall piping, equipment, or accessories be subjected to pressure exceeding their ratings.

D. All defective work shall be promptly repaired or replaced and the tests shall be repeated until the particular system and component parts thereof receive the approval of the Architects.

E. Any damage resulting from tests to any and all trades shall be repaired and damaged materials replaced, all to the satisfaction of the Architect.

F. The duration of tests shall be as determined by all authorities having jurisdiction, but in no case less than the time prescribed below.

G. Equipment and systems which normally operate during certain seasons of the year shall be tested during the appropriate season. Tests shall be performed on individual equipment, systems, and their controls. Whenever the equipment or system under test is interrelated and depends upon the operation of other equipment, systems and controls for proper operation, functioning and performance, the latter shall be operated simultaneously with the equipment or system being tested.

H. All fans and duct systems shall be completely balanced by the adjustment of sheaves, dampers, registers and other volume and diverting control devices, to obtain the air quantities indicated on the design drawings. Replace sheaves if required to meet design conditions.

I. All pumps and piping systems shall be completely balanced by the adjustment of plug cocks, globe valves or other control devices, to obtain flow quantities indicated on the design drawings.

J. Upon completion of the work, a test shall be conducted in the presence and under the direction of a NYS Licensed Professional Engineer, retained by the Contractor, and qualified to conduct such tests. The tests shall show compliance with the code requirements for ventilation and the proper
functioning of operating devices, before the system is approved. Tests shall also be conducted under the direction of the same Licensed Professional Engineer to demonstrate that all installed fire and fire smoke dampers operate properly. The Contractor shall submit a letter signed and sealed by the Licensed Professional Engineer indicating that such testing has been successfully conducted and shall make all associated controlled Special Inspections and other submissions to the Authority Having Jurisdiction (AHJ).

1.03 QUALITY ASSURANCE

A. Prior to installation of the mechanical systems, engage the services of an independent air and water balancing firm that shall be subject to the approval of the Architect. The firm shall have no affiliation with a mechanical contracting or sheetmetal company. Balancing and testing company shall be a member of the Associated Air Balance Council (AABC), National Environmental Balance Bureau (NEBB) or Testing, Adjusting and Balancing Bureau (TABB). The balancing firm shall have at least one member of its full time staff who is a licensed professional engineer who shall supervise the balancing work. Prior to balancing, a list of instruments to be used shall be submitted to the Architect. All instruments shall be calibrated within six months before tests.

B. When all specified testing and balancing procedures have been completed, a written report shall be submitted to the Architect for review. The report shall be tabulated in standard AABC/TABB format. As part of the Architect's review process, the accuracy of the balancing report shall be field spot checked on a random basis, with the assistance of the balancing firm's project supervisor. The HVAC Contractor shall reimburse the Architect for all time spent in excess of eight working hours, to demonstrate the accuracy of the balancing report.

1.04 SUBMITTALS

A. Refer to Section 01 31 46 "Special Requirements for Mechanical and Electrical Work". Submit all test and balancing reports as described hereinafter.

PART 2 - PRODUCTS (NOT APPLICABLE)

PART 3 - EXECUTION

3.01 FIELD TEST OF PIPING

A. During construction properly cap or plug all lines to prevent the entrance of sand, dirt, etc. The system of piping shall be blown through wherever necessary after completion (for the purpose of removing grit, dirt, sand, etc., from all equipment and piping), for as long a time as is required to thoroughly clean the apparatus.

B. Use anti-freeze solution for piping to be tested in winter.

C. All piping shall be tested as hereinafter specified. Tests shall be made after erection and before covering is applied or piping painted or concealed, and as sections of mains and groups of risers are completed. The extent of the work completed before pressure tests are made shall be determined by the Architect.
D. All piping, unless otherwise specified, shall be tested to a hydrostatic pressure at least 1-1/2 times the maximum designed working pressure (but not less than 50 lbs. per square inch) for a sufficiently long time to detect all leaks and defects; and after testing shall be made tight in the most approved manner. Tests shall be repeated once after leaks and defects have been repaired. When automatic control valves, equipment and similar devices which are incapable of withstanding test pressures applied to piping, such devices shall be removed, or otherwise protected during tests. After approval of such tests, devices shall be installed and tested with operating medium to operating pressures. The following shall be tested for four consecutive hours and proved tight. Leaks shall be remedied by replacing defective work.

<table>
<thead>
<tr>
<th>Hydrostatic Item</th>
<th>Field Test</th>
</tr>
</thead>
<tbody>
<tr>
<td>Instrument</td>
<td>Same as System</td>
</tr>
</tbody>
</table>

E. Leaks appearing during the various pressure tests shall be corrected by replacing all defective materials or welds and subsequent tests shall be made until the piping is found perfect. Caulking of screwed joints or pending of welds is prohibited. Wherever it is necessary to cut out a weld and the ends of the pipe cannot be conveniently brought together, then a short piece of pipe shall be fitted in and welded as approved by the Architect.

F. Provide all other tests required by the Building Department, Fire Department and all other Authorities Having Jurisdiction (AHJ).

3.02 RUNNING TEST OF PIPING SYSTEMS

A. When directed, any section of the work, after it has been completed and otherwise satisfactorily tested, shall be put in actual operation and operated for a period of two (2) days of 24 hours each, during which time any defects which may appear shall be remedied and any adjustment which may be necessary shall be made.

B. During the time of the tests, repack all valves, make all adjustments and otherwise put the apparatus in perfect condition for operation, and instruct the Owner's representative in the use and management of the apparatus.

3.03 TESTING, EVACUATION AND CHARGING OF REFRIGERATION PIPING

A. The Contractor shall notify the owner 24 hours in advance of any test so that the owner and/or manufacturer's representative may be present for the test if desired.

B. When the refrigeration connections have been completed, the system shall be tested at 240 psig on the low pressure side and 430 psig on the high pressure side or in accordance with the recommendation of the refrigerant equipment manufacturer. Liquid refrigerant shall be charged into the system to raise the pressure to 35 psig, and dry nitrogen added to obtain the desired test pressure. Leak testing shall be performed with an electronic leak detector. Refrigeration piping will not be acceptable unless it is gas tight. If any leaks are found, isolate the defective area, discharge the gas and repair the leaks, and then repeat the test.

C. The system shall be evacuated with a vacuum pump specifically manufactured for vacuum duty, having a capability of pulling a vacuum of 50 microns or less. The pump should be connected to both the low and the high side evacuation valves with copper or high vacuum hoses. The
compressor service valves should remain closed. A high vacuum gauge capable of registering pressure in microns should be attached to the system for pressure readings. To check the system pressure, a hand valve must be provided between the pressure gauge and the vacuum pump which can be closed to isolate the system and check the pressure.

D. Evacuate each system to an absolute pressure not exceeding 1,500 microns. Break the vacuum to 2 psig with the refrigerant to be used in the system. Repeat the evacuation process, again breaking the vacuum with refrigerant. Install a drier of the required size in the liquid line, open the compressor suction and discharge valves, and evacuate to an absolute pressure not exceeding 500 microns. Leave the vacuum pump running for not less than two hours without interruption. Raise the system pressure to 2 psig with refrigerant, and remove the vacuum pump.

E. Refrigerant shall be charged directly from the original drums through a combination filter-drier each drier may be used for a maximum of three cylinders of refrigerant, and then must be replaced with a fresh drier charge the system by means of a charging fitting in the liquid line. Weight the refrigerant drum before charging so that an accurate record can be kept of the weight of refrigerant put in the system. If refrigerant is added to the system through the suction side of the compressor charge in vapor form only.

F. Condensing units will be delivered to the job with sufficient oil for the average installation. Check all compressors for proper oil level, and if necessary add sufficient oil to bring the level to the center of the crankcase sight glass. Use only the refrigeration oil recommended by the condensing unit manufacturer all oil must be delivered to the job in factory sealed, unopened containers.

G. Refrigeration piping shall be tested in accordance with the recommendations of the refrigeration equipment manufacturer or in the following sequence in the absence of manufacturer requirements, for a period of 24 hours.

- High Side: Nitrogen at 300 psi
- Low Side: Nitrogen at 150 psi
- Entire System: Refrigerant at 5 psi

H. No visible leaks, losses in pressure or increase in vacuum occur during test period.

3.04 EQUIPMENT TEST

A. Demonstrate that all equipment and apparatus fulfill the requirements of the Specifications and that all equipment shall be operated and tested for rated capacities and specified characteristics. Voltage and amperage readings shall be taken on all electric motors.

B. Operate air handlers and fans for 40 hours and demonstrate fans operating at maximum capacity, with all variable volume dampers to be at the full open position.

3.05 FIRE DAMPER AND FIRE SMOKE DAMPER TEST

A. Under this section test each and every fire damper by removing the fusible link to demonstrate that the damper properly closed.

B. Under this section test each and every fire smoke damper by removing the fusible link or alternately applying heat to the heat detector for dampers utilizing het detectors) to demonstrate
full closure. Also demonstrate that the damper opens and closes properly under automatic control through the operator.

C. After the successful completion of such tests reinstall fusible links and reset heat detectors.

D. All such tests shall be conducted under direction of a NYS Professional Engineer retain by the Contractor.

3.06 TEST PREPARATION AND PROCEDURE

A. On initial startup, prior to any tests, check the rotation and running amperage of all fan and pump motors to prevent damage to equipment by overload.

B. Final balancing must be done with all systems completely installed and operating, and after the automatic temperature controls have had their final adjustment.

C. New, clean filters must be installed in all supply systems prior to balancing.

D. All water systems shall be completely filled and vented, and all strainers cleaned prior to balancing. Inspect expansion tanks for proper water level and operating of makeup water valves.

E. All main supply air ducts shall be traversed, using a pitot tube and manometer. The manometer shall be calibrated to read two significant figures in all velocity pressure ranges. Duct traverses shall be conducted using the log-Tchebycheff method. The equal area method is not acceptable.

F. A main duct is defined as either of the following:
   1. A duct serving five or more outlets.
   2. A duct serving two or more branch ducts.
   3. A duct serving a reheat coil.
   4. A zone duct from a multi-zone unit.
   5. A duct emanating from a fan discharge or plenum and terminating at one or more outlets.

G. The intent of this operation is to measure by traverse the total air quantity supplied by the fan and to verify the distribution of air to zones.

H. Submit data in support of all supply fan deliveries by the following four methods:
   1. By summation of the air quantity readings at all outlets.
   2. By duct traverse of main supply ducts and directly at the air handler or fan discharge.
   3. By a rotating vane traverse across a filter or coil bank.
   4. By plotting RPM and static pressure readings on the fan curve. Air density corrections must be indicated.

I. For return air and exhaust fans, the rotating vane traverse is not required.

J. Inspect all fan scrolls and remove objects or debris. Inspect all coils and remove debris or obstructions. Verify that all fire dampers are open.

K. The supply air systems shall be completely balanced prior to the final balancing of the water systems.
L. Upon completion of all air and water balancing, all duct dampers, plug valves and other throttling devices shall be permanently marked in the final adjusted position.

3.07 AIR BALANCE

A. Record the following design requirements for all fans and fan motors from the approved shop drawings.
   1. Air quantities - CFM
   2. Approximate fan speed - RPM
   3. Fan static pressure (total or external) - inches of water.
   4. Maximum tip speed - FPM
   5. Outlet velocity - FPM
   6. Fan brake horsepower
   7. Motor horsepower
   8. Volts, phases, cycles and amps at design conditions.

B. Record the following data from all fans and fan motors installed at the project:
   1. Manufacturer, model and size
   2. Motor horsepower, service factor and RPM
   3. Volts, phases, cycles and full load amps
   4. Motor starter and heaters size
   5. Equipment location

C. All fans and duct systems shall be completely balanced by the adjustment of sheaves, dampers, registers and other volume and diverting control devices, to obtain the air quantities indicated on the Drawings. Outside air and return air modulating dampers shall be adjusted to admit the specified quantities of air under all cycles of operation. All final adjusted air quantities shall be within 10% of the design requirements. Replace sheaves if required to meet design conditions.

D. Record the following test data for all fans and motors installed at the Project at final balanced conditions:
   1. Fan speed RPM.
   2. Fan static pressure (external and total) inches of water.
   3. Static pressure drop across all filters, dampers, coils and other items in the supply fan casings.
   4. Motor operating amps. (Measure, record and report all motor amps at minimum outside air volume and at maximum outside air volume.) This requirement applies to both constant volume and variable air volume systems where economizers are present.
   5. Actual voltage
   6. Fan CFM
   7. Calculated brake horsepower.

E. Submit single line diagrams of all duct systems indicating all terminal outlets identified by number. Data sheets shall list all such outlets denoted by the same numbers, including the outlet's size, "K" factor, location, CFM and jet velocity.

F. Submit this data for all supply, return and exhaust air systems.
G. Adjust the outside air, relief air and return air dampers to admit the required amounts of outside air. Record and submit outside air flow measurement and the outside, return and mixed air temperatures for both cycles after final adjustments.

H. Air balancing shall be performed with filters partially blocked to simulate a pressure drop across the filters equal to that midway between the clean and the dirty condition.

3.08 VARIABLE AIR VOLUME SYSTEM

A. Check and record the following items on the supply and return fans:
   1. Correct fan rotation.
   2. Filter condition (clean or dirty).
   3. Cooling coil condition (dry or wet).

B. Set the controls for the supply and return fans to operate at maximum capacity and for all variable volume dampers to be at the full open position.

C. Set the system up to operate with maximum return air and minimum outside air.

D. The following preliminary data should be obtained and recorded at the supply and return fans:
   1. Fan and motor RPM.
   2. Motor and current voltage.
   3. Fan, coils and filter statics.
   4. Nameplate data on the fans and motors.
   5. Motor sheave, fan pulley and belt sizes.

E. Traverse the main supply ducts and return ducts to determine CFM deliveries of the fans.

F. Set the system to operate at 100% outside air and check the motor amperage. The motor amperage should remain relatively constant indicating no change in total air flow. If a change in flow does occur, adjust outside air, return air, and relief air dampers accordingly. Set enough variable volume controllers throughout the building to maximum in order to simulate a maximum load on the fan.

G. Measure the system duct static pressure at selected points throughout the system. Monitoring points shall be in those duct runs which are of the longest equivalent length (greatest friction loss). Monitor these points during the adjusting and balancing procedures to assure proper inlet static pressure is being maintained to the variable volume units.

H. Adjust the return fan to approximately 5% above design CFM and the supply fan to either 5% above design or to the point where the static pressure at the end of each branch is at required static pressure, whichever condition is reached first.
   1. If the fan is adjusted to obtain the minimum static pressure, then it may be necessary to readjust the fan during the balancing as the static pressure will decrease as the constant volume controller deliveries are increased.

I. Make preliminary outlet readings and balance the outlets to design CFM and record all readings.

J. Individually set the controls for each variable volume damper to comply with correct sequence of operation.
K. Check the variable volume controller for design delivery.
   1. Check all the units, but make no adjustments. Report the results.
   2. If check passes, then proceed with balancing.
   3. Do all setting and adjusting required.
   4. When necessary corrections have been made, a verification test will be required.

L. Adjust the outlets for design delivery.

M. The following final data should be obtained and recorded at the supply and return fans:
   1. Fan and motor RPM.
   2. Motor current and voltage.
   3. Fans, coils and filter statics
   4. Approximate motor sheave setting

N. Check the following controls:
   1. Economizer system function, calibration and damper synchronization.
   2. Face and bypass dampers function and calibration, if any.
   3. High temperature limit shutoff function and calibration, if any.
   4. Low temperature limit shutoff function and calibration, if any.

O. Set all controls to their normal set points and allow all controllers to reach a satisfied state.

P. Measure the mixed air plenum static pressure to verify that the return fan capacity controller is functioning properly. The static pressure in the plenum should be within .05" W.C. of the final balance condition.

Q. Walk through the building and listen for noise generated by the air distribution system. Excessive noise should be reported.

R. All above recorded items and readings shall be submitted to the Architect.

S. Adjust and test all terminal boxes, mixing boxes and their controls to deliver the required air quantities. Record the following data in addition to the design requirements for each unit:
   1. Box size and location.
   2. Air temperatures in the hot duct and cold duct inlets for cooling and full heating.
   3. Static, velocity and total pressures in hot duct and cold duct inlets for full cooling and full heating.

3.09 ADDITIONAL REQUIREMENTS

A. Replacement of adjustable pulleys, additional balancing dampers, additional fan belts, pressure taps and fittings, hydronic balancing valves and any other devices or equipment required to effect proper testing, adjusting and balancing shall be provided at no additional cost to the Owner.
PART 1 - GENERAL

1.01 GENERAL REQUIREMENTS

A. This Section is coordinate with and complementary to the General Conditions and Supplementary General Conditions of the Work, wherever applicable to Mechanical Work.

B. Section 01 31 46 - Special Requirements for Mechanical and Electrical Work shall apply.

1.02 DESCRIPTION OF WORK

A. The work includes furnishing and installing all labor, materials, equipment, accessories and services necessary to provide Piping, Ductwork and Equipment Insulation installation, which is complete in every respect and of the composition and quality as shown on the Drawings and hereinafter specified.

1.03 PIPE INSULATION

A. The following pipes shall not be insulated. Insulate all other piping:
   1. Instrument air piping.
   2. Condenser water chemical treatment piping.
   3. Refrigerant liquid and outdoor portions of refrigerant hot gas piping except where otherwise noted.

1.04 DUCTWORK INSULATION

A. Insulate all ductwork except the following portions of ductwork:
   1. Ducts provided with sound absorptive lining (except where humidifier is installed and except where located outdoors) may have external insulation thickness decreased provided overall insulation R-value internal plus external complies with R-value specified herein.
   2. All exhaust ductwork, except where otherwise noted.
   3. Exposed supply and return air ducts in air conditioned spaces if same supply air duct serves that area only.

1.05 QUALITY ASSURANCE

A. "Installer": A firm with at least ten 10 years successful installation experience on projects with piping and ductwork insulation similar to that required for this project.

B. All insulation shall have composite (including insulation jacket or facing and adhesive) fire and smoke hazard ratings as tested by procedure ASTM E-84, NFPA 255 and UL 723 not exceeding:
   1. Flame Spread 25
   2. Smoke Developed 50
   3. Fuel Contributed 50
C. Accessories such as adhesives, mastics, cements, tapes and cloths for fittings shall have component ratings as listed above. All products shall bear UL labels indicating the above are not exceeded.

D. Provide certifications or other data as necessary to show compliance with these Specifications and governing regulations. Include proof of compliance for test of products for fire rating, corrosiveness, and compressive strength.

E. Provide products produced by the manufacturers which are listed in Section 23 05 12, "Approved Manufacturers List"

F. Insulation Materials: Insulating materials manufacturing facilities must be certified and registered with an approved registrar for conformance with ISO9000 quality standard.

1.06 SUBMITTALS

A. Refer to Section 01 31 46 - "Special Requirements for Mechanical and Electrical Work", and submit shop drawings and samples.

1.07 GUARANTEE

A. Refer to Section 01 31 46 - "Special Requirements for Mechanical and Electrical Work".

1.08 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Protect insulation against dirt, water, chemical and mechanical damage. Do not install damaged insulation; remove from project site.

B. Deliver insulation, coverings, cements, adhesives and coatings to the site in factory-fabricated containers with the manufacturer's stamp, or label, affixed showing fire hazard ratings of the products.

C. Store insulation in original wrappings and protect from weather and construction traffic.

PART 2 - PRODUCTS

2.01 COLD AND DUAL TEMPERATURE PIPING INSULATION

A. The following piping shall be covered with fiberglass insulation with vapor barrier:

<table>
<thead>
<tr>
<th>Service</th>
<th>Thickness</th>
</tr>
</thead>
<tbody>
<tr>
<td>Refrigerant</td>
<td>1½&quot;</td>
</tr>
<tr>
<td>All pipe diameters</td>
<td></td>
</tr>
<tr>
<td>Cold Water Make-Up and Air Conditioning</td>
<td></td>
</tr>
<tr>
<td>Condensate Drain Piping from Cooling Coil Drain Pans</td>
<td></td>
</tr>
<tr>
<td>All sizes</td>
<td>1&quot;</td>
</tr>
<tr>
<td>Glycol Supply and Return</td>
<td></td>
</tr>
<tr>
<td>Outside Building</td>
<td>2&quot;</td>
</tr>
<tr>
<td>Glycol Water Supply and Return</td>
<td></td>
</tr>
<tr>
<td>Inside Building</td>
<td>1½&quot;</td>
</tr>
</tbody>
</table>

INSULATION FOR HVAC WORK 23 07 00-2
B. Insulation shall be glass fiber complying with ASTM C547, Type I with a maximum K factor of 0.23 BTU in/hr ft² F at 75 degrees F. mean temperature with factory-applied all service vapor barrier jacket with self seal lap meeting the requirement of ASTM C-1136 Type I.

C. Insulation shall be heavy density fiberglass sectional pipe insulation as made by Owens-Corning Fiberglass Corp. or Johns-Manville Micro-Lok fiberglass insulation.

D. Ends of pipe insulation shall be sealed off at all flanges, fittings, valves and at intervals of 21 feet on continuous runs of pipe, with Foster fire-resistant vapor barrier coating Foster 30-65 or Childers CP-34 or equal.

E. All fittings, valves and flanges for pipe sizes smaller than 4” shall be insulated with molded fiberglass fittings of same thickness as the adjoining pipe insulation, secured with No. 20 gauge galvanized annealed steel wire and covered with Zeston 2000 25/50 PVC as made by Johns Manville, applied per manufacturer's recommendation.

F. All fittings, valves and flanges for pipe sizes 4” and larger shall be insulated with fabricated mitered segments of pipe insulation of same thickness as the adjoining pipe insulation, secured with No. 20 gauge galvanized annealed steel wire and covered with Zeston 2000 25/50 PVC fitting covers as made by Johns Manville installed per manufacturer’s recommendation.

G. Finish for Exposed Pipe Insulation:
   1. The term “exposed” is hereby defined as any place outdoors, as well as any place indoors in Mechanical Rooms, Storage Rooms, Janitor’s Closets, etc., where located within 7 feet of floor or access platforms.
   2. All exposed outdoor pipe, valve and fittings insulation shall have 0.016 inch thick corrugated aluminum jacket banded with ½” s.s. bands spaced 12” o.c. Piping, fittings and valves exposed in building, within seven feet of the floor or access platform, shall have 0.016” thick aluminum jacket banded with ½” aluminum bands spaced 12” o.c. or two bands per section. Joints and jacket shall provide complete weatherproof protection either by mechanical contact or by use of Foster 95-44 or Childers CP-76 metal jacketing sealant (gallon cans only; no tubes).
   3. All calcium silicate pipe insulation, all insulated condenser water piping exposed to weather and all other insulated pipe exposed to weather shall have 0.016 inch thick aluminum jacket banded with ½” s.s. bands spaced 12” o.c. This shall include pipe, fittings and valves.

H. All below ambient, coated molded fittings and mitered segments shall be vapor sealed with a layer of open weave glass fabric embedded between two 1/16" thick coats of Foster 30-65 or Childers CP-34 vapor barrier coating and lap seal at least 1" for molded type and 2" for mitered type on itself and adjoining insulation.

I. Direct contact between pipe and hanger shall be avoided. Hanger shall pass outside of a metal saddle which shall support a section of high density insulation equal thickness to adjacent insulation (such as calcium silicate) and of sufficient length to support pipe without crushing insulation. (See table below.) Hangers shall not pierce insulation and all vapor barriers shall be unbroken and continuous.
INSULATION FOR HVAC WORK

<table>
<thead>
<tr>
<th>Pipe Size</th>
<th>Saddle &amp; Insert Length</th>
</tr>
</thead>
<tbody>
<tr>
<td>1½”- 2”</td>
<td>10” Long</td>
</tr>
<tr>
<td>3”-6”</td>
<td>12” Long</td>
</tr>
<tr>
<td>8”-10”</td>
<td>16” Long</td>
</tr>
<tr>
<td>12” &amp; Over</td>
<td>22” Long</td>
</tr>
</tbody>
</table>

J. At pipe supports, insulation shield protection saddles and matching hanger shall be used.

K. All strainers for chilled water and insulated condenser water piping shall be insulated and boxed in with galvanized sheet metal cover. The insulated metal covers shall be segmented and shall be made removable.

L. As an alternative to fiberglass insulation, on cold pipes, elastomeric closed-cell insulation may be used.

1. Insulation material shall be a flexible, closed-cell elastomeric insulation in tubular or sheet form: AP Armaflex, AP Armaflex W, AP Armaflex SS, or AP Armaflex SA. These products meet the requirements as defined in ASTM C 534, “Specification for preformed elastomeric cellular thermal insulation in sheet and tubular form.”

2. Insulation materials shall have a closed-cell structure to prevent moisture from wicking which makes it an efficient insulation.

3. Insulation material shall be manufactured without the use of CFC’s, HFC’s or HCFC’s. It is also formaldehyde free, low VOC’s, fiber free, dust free and resists mold and mildew.

4. The insulation material shall contain MICOBAN Antimicrobial additive to aid in the prevention of mold and mildew.

5. Materials shall have a flame spread index of less than 25 and a smoke-developed index of less than 50 when tested in accordance with ASTM E 84, latest revision. In addition, the product, when tested, shall not melt or drip flaming particles, the flame shall not be progressive and all materials shall pass simulated end-use fire tests.

6. Materials shall have a maximum thermal conductivity of 0.25 Btu-in./h-ft²- °F at a 75°F mean temperature when tested in accordance with ASTM C 177 or ASTM C 518, latest revisions.

7. Materials shall have a maximum water vapor transmission of 0.05 perm-inches when tested in accordance with ASTM E 96, Procedure A, latest revision.

8. The material shall be manufactured under an independent third party supervision testing program covering the properties of fire performance, thermal conductivity and water vapor transmission.

9. Valves, Flanges and Fittings:
   a. Armacell Fabricated Fittings can be used on all fittings. 2 and 3 Pieces 90s, 45s, Ts, P traps and couplings along with grooved fittings are available.
   b. All fittings shall be insulated with the same insulation thickness as the adjacent piping. All seam and mitered joints shall be adhered with Armaflex 520, 520 BLV or 520 Black Adhesive. Screwed fittings shall be sleeved and adhered with a minimum 1” overlap onto the adjacent insulation. Armaflex HT 625 Adhesive shall be used with UT Solaflex.
   c. Valves, flanges, strainers, and Grooved couplings shall be insulated using Armaflex donuts that shall then be covered with sheet or oversized tubular insulation.

10. Adhesives and Finishes
a. Adhesive shall be the insulation manufacturer's recommended contact adhesive: Armoflex 520, Armoflex 520 BLV, Armoflex 520 Black, Low VOC Spray Adhesive or Armoflex HT 625 Adhesive.
b. Insulation finish shall be the insulation manufacturer's recommended finish: Armoflex WB Finish.
c. Accessories such as adhesives, mastics and cements shall have the same properties as listed above and shall not detract from any of the system ratings as specified above.

2.02 FIRE STOPPING

A. Packing of openings, where ducts and pipes penetrate fire barriers, shall be done with Rockwool insulation as made by United States Gypsum, Co.

B. Insulation shall comply with Fed. Spec. HH-1-558, Form A, Class 4, K=0.24, melting point 2000 degrees F.

C. An acceptable alternative to rockwool insulation shall be 3M Product Caulk CP25 or approved equal.

2.03 DUCTWORK INSULATION

A. Insulation for all Duct
   1. Except where otherwise noted, all rectangular and round ductwork shall be covered with flexible duct insulation with or without vapor barrier complying with ASTM C553, Types I and II and of the thickness and densities indicated below.

<table>
<thead>
<tr>
<th>Service</th>
<th>R Value</th>
<th>With</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cold and Hot Air Supply Ducts</td>
<td>6</td>
<td>Vapor Barrier</td>
</tr>
<tr>
<td>Return Air Ducts (only where required)</td>
<td>6</td>
<td>Vapor Barrier</td>
</tr>
</tbody>
</table>

B. Flexible duct insulation with vapor barrier shall be 1 lb. per cu. ft. density glass fiber with a maximum K factor of 0.29 at 75 deg. F. mean temperature, with reinforced foil-faced, flame resistant kraft vapor barrier (facing to comply with ASTM C1136, Type II).

C. Insulation with vapor barrier shall be duct wrap insulation FRK-25, type 100 as made by Owens-Corning or Johns Manville Microlite Type 100 with FSK vapor barrier facing or standard 1 lb./cf duct insulation as made by CGG with FSK facing.

D. Flexible duct insulation without vapor barrier shall be 1 lb. per cu. ft. density glass fiber with a maximum K factor of 0.29 at 75 deg. F. mean temperature and shall be Owens Corning Fiberglass Type 75P, Johns Manville Microlite Type 100 or approved equal.

E. Adhere insulation to duct with Foster fire resistant adhesive 85-60 or Childers CP-127 or approved equal, applied in 4 inch wide transverse strips at 8 inch intervals. Insulation shall be butted with facing overlapping all joints at least 2 inches and sealed with Foster fire resistant adhesive 85-60 or Childers CP-127 or equal. For insulation with vapor barrier use Foster fire resistant vapor barrier adhesive or approved equal and joints without tabs shall be firmly sealed with aluminum foil tape adhered with same adhesive. Secure insulation with 18 gauge corrosion
resistant wire spaced not more than 18 inches on center. Coat all duct taped seams, punctures and breaks with Foster 30-65 or Childers CP-34 vapor barrier coating.

F. Additionally, secure insulation to bottom of rectangular ducts over 24” wide with welded pins or stick clips on 18” centers. Cut off excess pins and seal as above.

G. As an alternative to fiberglass insulation on ducts, elastomeric closed-cell insulation may be used.
   1. Insulation material shall be a flexible, closed-cell or conformable elastomeric insulation in sheet form: AP Armaflex, and AP Armaflex SA. These products meet the requirements as defined in ASTM C 534, “Specification for preformed elastomeric cellular thermal insulation in sheet and tubular form.”
   2. Insulation material shall be manufactured without the use of CFC’s, HFC’s or HCFC’s. It is also formaldehyde free, low VOC’s, fiber free, dust free and resists mold and mildew.
   3. The insulation material shall contain MICOBAN Antimicrobial additive to aid in the prevention of mold and mildew.
   4. Materials shall have a flame spread index of less than 25 and a smoke-developed index of less than 50 when tested in accordance with ASTM E 84, latest revision. In addition, the product, when tested, shall not melt or drip flaming particles, the flame shall not be progressive and all materials shall pass simulated end-use fire tests.
   5. Materials shall have a maximum thermal conductivity of 0.25 Btu-in./h-ft2- °F at a 75°F mean temperature when tested in accordance with ASTM C 177 or ASTM C 518, latest revisions.
   6. Materials shall have a maximum water vapor transmission of 0.05 perm-inches when tested in accordance with ASTM E 96, Procedure A, latest revision. (other than conformable elastomeric)
   7. The material shall be manufactured under an independent third party supervision testing program covering the properties of fire performance, thermal conductivity and water vapor transmission.
   8. Adhesives and Finishes
      a. Adhesive shall be the insulation manufacturer's recommended contact adhesive: Armaflex 520, Armaflex 520 BLV, Armaflex 520 Black, Low VOC Spray Adhesive or Armaflex HT 625 Adhesive.
      b. Insulation finish shall be the insulation manufacturer's recommended finish: Armaflex WB Finish.
      c. Accessories such as adhesives, mastics and cements shall have the same properties as listed above and shall not detract from any of the system ratings as specified above.

PART 3 - EXECUTION

3.01 INSPECTION

A. Contractor shall examine location where this insulation is to be installed and determine space conditions and notify Architect in writing of conditions detrimental to proper and timely completion of the work.

B. Do not proceed with the work until unsatisfactory conditions have been corrected.
3.02 INSTALLATION

A. Install insulation in accordance with manufacturer's written instructions, and with recognized industry practices, to ensure that insulation complies with requirements and serves intended purposes.

B. Coordinate with other work as necessary to interface installation of insulation with other components of systems.

C. All insulating materials shall be applied only by experienced workmen, in accordance with the best covering practice. All piping, duct or equipment shall be blown out, cleaned, tested and painted prior to the application of any covering. Adhesives, sealers and mastics shall not be applied, when the ambient temperature is below 40°F, or surfaces that are wet.

D. Insulation for factory-fabricated air handling units, furnished as part of units.

E. At all openings in insulation and acoustical duct lining, insulate edges neatly and protect with sheet metal nosing. Use sealant as well.

F. All items described in general indicate the type of covering required, however, all piping, ductwork or equipment that transmits heat or will form condensation shall be insulated.

G. Finish for Concealed Pipe Insulation:
   1. Factory ASJ (All service jacket) secured in place with Bostich staples 4" o.c. or ASJ with self sealing lap as made by Johns Manville, Owens-Corning or approved equal. All fittings shall be covered with Zeston PVC covers.

H. All piping and ductwork insulation shall be continuous through non-fire rated ceiling openings and sleeves passing through non-fire rated walls or floors. Sleeves shall be packed with mineral wool or thermofiber. Discontinue insulation as it passes through fire-rated wall or floor and use mineral wool or thermofiber packing instead. Specific mastics, adhesives and coating shall be applied in strict accordance with Manufacturer's instruction, including recommended coverages.

I. Where packaged type units are called for in the Specifications, or as scheduled on the Drawings, the insulation shall be as herein specified for the specific system.

J. All valved and capped outlets left for future work shall be insulated as herein specified for the specific systems with a removable section of insulation over caps.

K. Where insulation on existing piping, equipment, etc., has been cut, removed or damaged, this Contractor shall reinsulate as herein specified.

L. All insulation of access doors shall be set in sheet metal double-pan construction.

M. All ductwork shall be insulated in the field, following complete installation of the ductwork. Installation of insulation on the ductwork in the shop (prior to delivery and installation of the ductwork) is prohibited.

N. For installation of elastomeric closed-cell insulation:
   1. Piping:
a. Install pipe insulation by slitting tubular sections and applying onto piping or tubing. Alternately, whenever possible, slide unslit sections over the open ends of piping or tubing. All seams and butt joints shall be adhered and sealed using Armaflex 520, 520 BLV or 520 Black Adhesive. When using AP Armaflex SS, only the butt joints shall be adhered using Armaflex 520, 520 BLV or 520 Black Adhesive. Armaflex HT 625 Adhesive shall be used with UT Solaflex.

b. Insulation shall be pushed onto the pipe, never pulled. Stretching of insulation may result in open seams and joints.

c. Tape the ends of the copper tubing before slipping the Armaflex insulation over the new pipes to prevent dust from entering the pipe.

d. All edges shall be clean cut. Rough or jagged edges of the insulation shall not be permitted. Proper tools such as sharp non-serrated knives must be used.

e. On cold piping, insulation shall be adhered directly to the piping at the high end of the run and every 18 feet, using a two-inch strip of Armaflex 520, 520 BLV or 520 Black Adhesive on the ID of the insulation and on the pipe. All exposed end cuts of the insulation shall be coated with Armaflex 520, 520 BLV, or 520 Black Adhesive. All penetrations through the insulation and termination points must be adhered to the substrate to prevent condensation migration.

f. Sheet insulation shall be used on all pipes larger than 8” IPS. Insulation shall not be stretched around the pipe. On pipes larger than 12” IPS, adhere insulation directly to the pipe on the lower 1/3 of the pipe. On pipes greater than 24” IPS, complete adhesion is recommended.

g. Seams shall be staggered when applying multiple layers of insulation.

2. Hangers:

a. Support piping system using high density inserts with sufficient compressive strength. The pipe support insulation shall be elastomeric foam with the same or greater thickness than the pipe insulation. All joints shall be sealed with Armaflex 520, 520 BLV or 520 Black adhesive.

b. Standard and split hangers -- Piping supported by ring hangers shall have hangers insulated with the same insulation thickness as the adjacent pipe. All seams and butt joints shall be sealed with Armaflex 520, 520 BLV or 520 Black Adhesive. Armaflex HT 625 Adhesive shall be used with UT Solaflex. Ring hangers may be sleeved using oversized tubular insulation. On cold piping, insulation shall extend up the hanger rod a distance equal to four times the insulation thickness. Insulation tape may be used to a thickness equal to the adjacent insulation thickness.

c. Clevis hangers or other pipe support systems -- Saddles shall be installed under all insulated lines at unistrut clamps, clevis hangers, or locations where the insulation may be compressed due to the weight of the pipe. All piping shall have wooden dowels or blocks of a thickness equal to the insulation inserted and adhered to the insulation between the pipe and the saddle. It is highly recommended for continuous insulation protection to use hanger sizes equal to the outer diameter of the pipe plus insulation thickness.

d. Armafix IPH or Armafix NPH can be used to prevent compression of insulation at standard split, clevis hangers or other pipe support systems. To minimize the movement of Armafix, it is recommended that a pair of non-skid pads be adhered to the clamps. In addition, to prevent loosening of the clamps, use of an anti-vibratory fastener, such as a nylon-locking nut, is also recommended.

3. Square and Rectangular Ductwork:

a. The top of the ductwork must be sloped to prevent “ponding” of water. The recommendation is at least a 2° angle to the outer side.
b. Armaflex Sheet Insulation shall be adhered directly to clean, oil-free surfaces with a full coverage of Armaflex 520, 520 Black or Low VOC Spray Adhesive. Armaflex HT 625 Adhesive shall be used with UT Solaflex. AP Armaflex SA shall be adhered directly to clean, oil-free surfaces.

c. The duct insulation shall be constructed from the bottom up, with the top insulation sized to extend over the side insulation. This will form a watershed.

d. Butt-edge seams shall be adhered using Armaflex 520, 520 Black, or HT 625 Adhesive by the compression fit method to allow for expansion/contraction. Leave a 1/2”-wide uncoated border at the butt-edge seams on the duct surface and the insulation surface. Overlap the insulation 1/4” at the butt-edges and compress the edges into place. Apply Armaflex 520, 520 Black or HT 625 Adhesive to the butt-edges of the insulation.

e. Standing metal duct seams shall be insulated with the same insulation thickness as installed on the duct surface. Seams may be covered using strips of Armaflex Sheet Insulation or half sections of tubular pipe insulation with miter-cut ends. Standing seams shall be adhered using Armaflex 520, 520 Black or HT 625 Adhesive.

f. Insulation seams shall be staggered when applying multiple layers of insulation.

4. Round Ductwork:

a. AP Armaflex Sheet and Roll Insulation, UT Solaflex Roll Insulation, or NH Armaflex Sheet and Roll Insulation shall be used on all round ductwork. Insulation shall be wrapped not stretched around the duct. On ductwork larger than 12” in diameter, the insulation shall be adhered to the duct surface on the lower one third. On ductwork greater than 24” in diameter, the insulation shall be completely adhered to the duct surface. Longitudinal seams shall be located on the lower half of any round ductwork.

b. Butt-edge seams shall be adhered using Armaflex 520, 520 Black or HT 625 Adhesive by the compression fit method to allow for expansion/contraction. Leave a 1/2” wide uncoated border at the butt-edge seams on the duct surface and the insulation surface. Overlap the insulation 1/4” at the butt-edges and compress the edges into place. Apply Armaflex 520, 520 Black, or HT 625 Adhesive to the butt-edges of the insulation.

c. Insulation seams shall be staggered when applying multiple layers of insulation.

5. Armaflex WB Finish

a. All outdoor ductwork shall be finished with a minimum requirement of two coats of Armaflex WB Finish.

1) Rectangular ductwork

a) The surface of the insulation must be clean and dry.

b) Apply first coat of Armaflex WB Finish at a rate of 400 square feet per gallon.

c) Allow to dry at least four hours.

d) Apply second coat at a rate of 400 square feet per gallon.

O. Finish for Exposed Insulation:

1. The term “exposed” is hereby defined as any place outdoors, as well as any place indoors in Mechanical Rooms, Storage Rooms, Janitor’s Closets, etc., where located within 7 feet of floor or access platforms.

2. All exposed outdoor pipe, valve and fittings insulation shall have 0.016 inch thick corrugated aluminum jacket banded with ½” s.s. bands spaced 12” o.c. Piping, fittings and valves exposed in building, within seven feet of the floor or access platform, shall have 0.016” thick aluminum jacket banded with ½” aluminum bands spaced 12” o.c. or two
bands per section. Joints and jacket shall provide complete weatherproof protection either by mechanical contact or by use of Foster 95-44 or Childers CP-76 metal jacketing sealant (gallon cans only; no tubes).

3. All calcium silicate pipe insulation, all insulated condenser water piping exposed to weather and all other insulated pipe exposed to weather shall have 0.016 inch thick aluminum jacket banded with ½" s.s. bands spaced 12" o.c. This shall include pipe, fittings and valves.

4. As an alternative to the use of 0.016” aluminum cladding on outdoor duct insulation, if AP Armaflex insulation is used, the ArmaTuff laminated sheet and roll insulation may be used. ArmaTuff laminated Armaflex sheet and roll insulations may be used for insulating exterior applications such as duct, tanks, vessels and large pipes. Refer to section 3.06 for further installation details. ArmaTuff is a laminate of white polymeric material on Armaflex insulations, which offers durability and resistance to weathering, ultraviolet, acid rain and chemicals. The laminate is 0.013 inches (13 mils) thick. The seams must be installed in compression and sealed with Armaflex 520, or 520 Black contact adhesive. Cover the seams using ArmaTuff 6” Seal Tape.

3.03 PROTECTION

A. The installer of the insulation shall advise the Contractor of required protection for the insulation work during the remainder of the construction period, to avoid damage and deterioration.

END OF SECTION 23 07 00
PART 1 - GENERAL

1.01 GENERAL REQUIREMENTS

A. This Section is coordinate with and complementary to the General Conditions and Supplementary General Conditions of the Work, wherever applicable to Mechanical Work.

B. Section 01 31 46 - Special Requirements for Mechanical and Electrical Work shall apply.

1.02 DESCRIPTION OF WORK

A. The Work includes providing of all labor, materials, equipment, accessories, services and tests necessary to complete and make ready for operation by the Owner, all piping as shown on the Drawings and hereinafter specified.

1.03 QUALITY ASSURANCE

A. "Manufacturers"-Firms regularly engaged in manufacture of pipe whose products have been in satisfactory use in similar service for not less than ten (10) years.

B. Provide pipe whose performance, under specified conditions, is certified by the manufacturer.

C. Piping systems and installation of piping shall comply with ANSI/ASME B31.9, Building Service Piping (B31.1, Power Piping).

Refrigerant piping systems shall comply with ANSI/ASME (B31.5, Refrigeration Piping).

D. All piping and fittings shall be made in the USA and shall be labeled as such. Piping shall also be labeled with ASTM number for easy identification/verification at the site.

1.04 SUBMITTALS

A. Refer to Section 01 31 46, "Special Requirements for Mechanical and Electrical Work", and submit shop drawings.

1.05 COORDINATION

A. Refer to Section 01 31 46, "Special Requirements for Mechanical and Electrical Work".

B. Furnish fabrication detail drawings for all pipe hangers and supports for piping 2½ inches nominal size and larger.

C. Furnish hanger and support location drawings for piping 2½ inches nominal size and larger.

D. Perform calculations necessary for the design and selection of hangers, supports, anchors, guides, restraints, snubbers, and supplementary supporting steel for piping 2½ inches nominal size and larger.
E. Perform weight distribution, expansion and movement calculations for all piping.

F. Shop Drawings and Data: Contractor shall prepare the following drawings:
1. Fabrication Detail Shop Drawings: These drawings shall show each pipe hanger or support for piping 2½ inches nominal size and larger and shall include location of hanger with reference to nearest building columns or beams, arrangements and detail of hanger, detail of concrete anchor or detail of welded or bolted attachment to structural steel, bill of materials for all components with ASTM specification numbers and direction and magnitude of movement and thrusts and weight at hanger point. Provide the load at each concrete anchor.
2. Piping Erection Detail and Layout Drawings: Provide scaled detailed piping arrangement drawings showing all piping systems and connected components. Indicate piping in double line detail for all piping 2” and larger. Show piping with insulation thicknesses. Indicate all valves and valve handles, automatic actuators, strainers and access space, reducers, instruments, anchors/guides and supports, seismic components (if applicable) and all equipment to which piping is connected.
3. Hanger and Support Location Shop Drawings: Contractor shall mark all pipe hanger and support locations for piping 2½ inches nominal size and larger on Piping Erection Detail and Layout drawings. Contractor shall also show all structural grids and support points on these drawings.

1.06 WARRANTY
A. Refer to Section 01 31 46, "Special Requirements for Mechanical and Electrical Work".

PART 2 - PRODUCTS
2.01 PIPE
A. All pipe shall be new, free from scale or rust, of the material and weight specified under the various services. Each length of pipe shall be properly marked at the mill for proper identification with name or symbol of manufacturer.
B. All steel piping, except where otherwise rated, shall be standard or extra strong weight, in conformance with the ASTM A-53 Grade B seamless, for piping 2” and larger, as manufactured by National Tube Division, Republic Steel Corp., or approved equal. Piping shall be ASTM A-53 Type F continuous butt weld, for piping less than 2”.
C. High temperature hot water supply and return piping shall be ASTM A-106 Grade B.
D. All brass piping shall be standard or extra heavy weight 85% red brass semi-annealed seamless-drawn, in conformance with the ASTM B-43, as manufactured by Anaconda, American Brass Co., Chase Brass and Copper Co., or Revere Copper and Brass, Inc.
E. All copper tubing shall be of weight as required for service specified, with conformance with ASTM B-88 for Types "L" and "K" tubing, as manufactured by Chase, Anaconda, Revere, or approved equal. Tubing and fittings shall be thoroughly cleaned with sand cloth and treated with an approved non-corrosive flux before solder is applied.
F. All galvanized steel piping shall be standard or extra strong weight, as specified, in conformance with the ASTM A-53 Grade B. Pipe shall be hot-dripped zinc-coated with Prime Western smelter and not wiped.

G. Generally, unless otherwise specified, joints in steel piping of sizes 2 inches and under shall be screwed, and all sized 2½ inches and over shall be welded or flanged. Brass pipe shall be screwed 2 inches and smaller and flanged 2½ inches and over. Copper tubing shall be silver-soldered or 95-5 solder as herein specified.

H. Screwed Piping
1. All connections to apparatus with screwed piping shall be made with 250 pound brass seat unions.
2. All screwed nipples shall be Schedule 80 nipples.

I. Threaded joints in glycol filled systems shall be made by Radiator Specialty Co. Submit sample and obtain approval.

J. Welding Piping
1. All fittings for welded piping shall be as manufactured by Tube Turn, Grinnell, Bonney Forge or equal as approved by the Architect. The fittings shall be of the same weight and material as the piping to which they are attached.
2. For piping 2½” or 4” and larger, full size branch connection shall be made with manufactured welding tees, branch connections for less than full size, shall be made with welding tees or with Weldolet forged branch outlet fittings. Fishmouthing, shaped nipples, and stubbing not permitted.

K. Welding outlet fittings shall be Weldolets as manufactured by Bonney Forge, Inc., or approved equal 2 or 3 and smaller branches shall be made with thredolets as made by Bonney Forge or approved equal.

L. Weld ells shall have a center line radius not less than diameter of the pipes.

M. All flanges shall be welding neck flanges ANSI B16.5 ASTM 181 Grade I. All systems, except where otherwise noted - 150 lbs. Class, forged steel.

N. Instrumentation connections ¾” and smaller on all systems shall be provided by welding threaded 2000# forged steel half couplings to the pipe.

O. All pipe to be welded shall be cut off clean and beveled. All welding shot shall be removed.

P. Composition of welding electrodes shall be in accordance with manufacturer's recommendations.

Q. Backing rings shall be used for all welded piping for high temperature hot water. High temperature hot water piping to be butt welded in sizes 2” and larger, socket welded in sizes 1½” and smaller. Rings shall be carbon steel with knock off spacer pins, for Schedule 40 and/or Schedule 80 pipe dimensions, as manufactured by Tube Turn, Inc. or Robven Backing Ring Co. Smaller branches on high temperature hot water shall be made by using "Weldolets" or approved equal fittings. Ells for high temperature hot water system shall be long radius. All flanges shall be welding neck flanges ASA B16.5 ASTM 181 Grade L,300 lbs. Class, forged steel.
R. Pipe welding shall comply with the provisions of the latest revision of the applicable code, whether ASME Boiler and Pressure Vessel Code, ANSI Code for Pressure Piping B31, or such state or local requirements as may supersede codes mentioned above.

S. Before any pipe welding is performed, submit a copy of the welding procedure specifications together with proof of its qualification as outlined and required by the most recent issue of the code having jurisdiction. Submittal shall comply with ANSI/ASME B31.1/B31.9.

T. Before any operator shall perform any pipe welding, also submit the operator's qualification record in conformance with provisions of the code having jurisdiction, showing that the operator was tested and certified under the Procedure Specification as before mentioned. Submittal shall comply with ANSI/ASME B31.1/B31.9.

U. Assume responsibility for the quality of welding done and repair or replace any work not in accordance with these specifications.

V. In addition, all pipe welding procedures and procedures for qualification of pipe welding operators shall comply with the requirements of the American Welding Society.

W. Cut weld test plugs at locations selected at random by the Architect. The test plugs shall be tested by the testing agency approved for this project. Failure of the test plugs to meet the standards of the specified codes and agencies shall result in the complete removal and replacement of the joint and retesting of the operator who performed the welding. The removal and replacement of the joints shall be at no additional cost to the Owner.

X. Pipe Schedule: Pipe for the various services shall be as follows:

<table>
<thead>
<tr>
<th>Service</th>
<th>Material</th>
<th>Schedule</th>
</tr>
</thead>
<tbody>
<tr>
<td>Overflow &amp; Drain</td>
<td>Copper Type K</td>
<td></td>
</tr>
<tr>
<td>Cold Water</td>
<td>Copper Type &quot;TP&quot;</td>
<td></td>
</tr>
<tr>
<td>Glycol Water</td>
<td>Steel 40 or standard</td>
<td></td>
</tr>
<tr>
<td>Refrigerant</td>
<td>Copper Tubing</td>
<td>ACR Type</td>
</tr>
<tr>
<td>Vent (water discharge) above ground</td>
<td>Copper Tubing</td>
<td>¼&quot; Type &quot;L&quot; (soft)</td>
</tr>
</tbody>
</table>

Y. The Contractor shall have the option to use Type K copper for hot water and chilled water piping up to and including 2”, and brazed Type L copper for glycol water piping up to and including 2”.

2.02 MECHANICAL PIPE COUPLINGS

A. Rigid Mechanical pipe couplings similar to Victaulic QuickVic™ 107H may be used at this sections option for the following above ground services.

1. Mechanical couplings are permitted only in chilled water and condenser water systems where exposed (such as in mechanical equipment rooms) and outdoors.

B. Grooved couplings with reverse angle pads shall engage and lock in place the grooved or shouldered pipe, pipe fittings and grooved end valves in a positive watertight couple. QuickVic™ couplings shall be “Installation Ready” stab-on design, for direct “stab” installation onto roll grooved pipe without prior field disassembly and no loose parts.
C. Grooved couplings shall consist of two places of ASTM A395 and A536 ductile iron with reverse angle pads. Coupling gaskets shall be a Grade “EHP” or “E” EPDM synthetic rubber, red or green color coded with a central cavity pressure responsive design, or other grades suitable for the intended service.
   1. Flexible type couplings shall be used in seismic areas and locations stress relief and vibration attenuation are required. Flexible couplings shall be Victaulic Style 177 QuickVic™ or Style 77 standard.

D. Coupling assembly shall be securely held together by two track-head, oval-neck, steel bolts. Bolts and nuts shall be heat-treated carbon steel and shall be in accordance with ASTM A-183-60 and A-449. Coupling on outdoor piping shall have galvanized bolts and nuts.

E. AGS grooved mechanical couplings 14" through 60' shall consist of two ASTM A536 ductile iron housings cast with a wide key profile and flat bolt pads for metal-to-metal contact, designed to fit into a deeper, wedge-shaped groove; wide-width synthetic rubber Grade “E” EPDM gasket of a FlushSeal® design, and plated steel bolts and nuts. Victaulic Style W07 (rigid) and Style W77 (flexible).

F. All pipe fittings used in connection with pipe couplings shall have grooved or shouldered ends and shall be cast of ductile iron conforming to ASTM A-395 Grade 65-45-15, and ASTM A-536 Grade 65-45-12, forged carbon steel conforming to ASTM A-234 Grade WPB, or fabricated carbon steel from ASTM-A-53 standard wall.

G. Grooved couplings and fittings for copper tubing shall be used on hard drawn ASTM B-88 copper tubing. Grooved couplings and fittings shall be copper tubing sized. Flaring of pipe ends to IPS dimensions will not be permitted.
   1. Grooved fittings shall be wrought copper per ASTM B75 or B152 and ANSI B16.22, or bronze sand casting per ASTM B584-87 copper alloy CDA 836 per ANSI B16.18. Fittings shall be copper tubing sized. (Flaring of pipe ends to IPS dimensions will not be permitted.
   2. Grooved couplings shall be ASTM A395 and A536 ductile iron, coated with copper colored alkyd enamel. Coupling housings shall be angle-pattern bolt pad type to provide system rigidity. Couplings shall be copper tubing sized. Coupling gaskets shall be grade “EMP” EPDM, UL classified in accordance with ANSI/NSF 61 for potable water service. Couplings shall be “Installation Ready” stab-on design, for direct “stab” installation onto roll grooved copper tube without prior field disassembly and no loose parts. Victaulic Style 607 QuickVic™.

H. Before assembly of couplings, lubricate the gasket exterior including the lips and/or pipe ends housing interiors, to prevent pinching the gasket. Lubrication shall assist proper gasket seating and alignment while easing installation. Petroleum based lubricants must not be used on Grade "E" or Grade "M" gaskets. Lubricant shall be supplied by, or approved for use with the gasket, by the coupling manufacturer.

I. Pipe grooving shall be in accordance with the manufacturer's specifications.

J. Pipes, fittings, BFV’s, check valves, plug valves and strainers shall be provided with groove or shouldered ends in accordance with coupling manufacturers latest published literature. Flanged or threaded end valves may be used with grooved adapters.
K. Couplings and fitting shall be designed for a system pressure specified elsewhere and in conformance with manufacturer's published data.

L. Entire coupling installation shall be done in accordance with manufacturer's latest published literature.

M. After completion of pipe coupling installation, Contractor shall furnish to the Owner's representative a signed certificate of compliance with the manufacturer's installation instructions.

N. Couplings shall be standard weight as a minimum requirement.

O. All grooved couplings, fittings, valves and specialties shall be the products of a single, ISO 9001 certified, manufacturer. Grooving tools shall be of the same manufacturer as the grooved components.

P. Install the Victaulic AGS piping system in accordance with the latest Victaulic installation instructions. Use Victaulic grooving tools with AGS roll sets to groove the pipe. Follow Victaulic guidelines for tool selection and operation. Coupling installation shall be complete when visual metal-to-metal contact is reached. AGS products shall not be installed with standard grooved end pipe or components. Installing AGS products in combination with standard grooved end products could result in joint separation and/or leakage.

Q. A Victaulic factory-trained field representative shall provide on-site training to contractor's field personnel in the proper use of grooving tools and installation of grooved piping products. Factory-trained field representative shall periodically review product installation. Contractor shall remove and replace any improperly installed products.

2.03 FITTINGS

A. Fittings shall be specified under "Fitting Schedule" for various services.

B. Welding fittings shall be of the same material and schedule as the pipe to which they are welded. Welding elbows shall be long radius pattern unless clearance conditions necessitate the use of standard radius pattern. Welding fittings shall be as made by Tube-Turn.

C. Fittings shall be of material conforming to the following schedule:
   Steel Welding Fittings       ASTM A-106
   Forged Steel Fittings       ASTM A-234
   Malleable Iron Fittings     ASTM A-197
   Ductile Iron Fittings       ASTM A-395 & A-536
   Cast-Iron Fittings          ASTM A-126
   Brass Fittings              ASTM B-62
   Wrought Copper Fittings     ASTM B-75 & B-152
   Bronze Cast Fittings        ASTM B-584
   Solder Fittings             ASTM B-88

D. All fittings used at expansion loops or bends shall be extra heavy.

E. Cast-iron, malleable-iron and bronze fittings shall be of Crane manufacturer or approved equal.
F. Flanges shall be raised face, of the same weight as the fittings in each service category. All flanges shall be drilled to "US Standard" hex nuts and washers. Bolting shall conform to ASTM 193 Grade B-7, threads Class 7 fit. Nuts shall be semi-finished hexagonal, ANSI B18.2 ASTM A194 Grade 2H.

1. Flange Adapters for grooved end pipe shall be ASTM A-395 and A-536 ductile iron, with synthetic rubber gasket. (Grade to suit the intended service.) Flange Adapters shall be CL 150, Victaulic Style 741.

G. Unions - Unions 2 inches and smaller shall be screwed. Unions 2½ inches and larger shall be flanged. Screwed unions on steel pipe, unless otherwise specified, shall be of malleable iron with bronze ground seats suitable for 300 pounds W.S.P. Screwed unions on copper or brass pipe shall be brass, ground joint suitable for 300 pounds W.S.P. Flanged unions shall be malleable iron for steel pipe, and brass for copper or brass pipe, gasket type suitable for 150 pounds W.S.P. If grooved mechanical pipe couplings are used, additional unions are not required. Couplings shall serve as unions. Unions shall be as manufactured by Crane or approved equal.

H. Brass pipe threads shall be cut with special brass treading dies, and the joints shall be made up with lubricant. Strap wrenches, or equivalent, shall be used in making up brass pipe. Wrenches which gouge or scar the pipe will not be used.

I. Solder for each solder-type fitting shall be of 95% tin and 5% antimony or silver solder, as specified herein. Refrigerant piping joints shall be made with silver solder.

J. Unless otherwise specified, all flanged joints shall be fitted with Manville or equal ring gaskets designed for the intended service.

K. Fitting Schedule: Fittings for the various services shall be as follows:

<table>
<thead>
<tr>
<th>Service</th>
<th>Size</th>
<th>Material</th>
<th>Weight</th>
<th>Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pumped Condensate Returns (discharge)</td>
<td>ALL</td>
<td>C.I.</td>
<td>250#</td>
<td>Screwed</td>
</tr>
<tr>
<td>Overflow and Drain</td>
<td>ALL</td>
<td>Galv. M.I.</td>
<td>150#</td>
<td>Screwed</td>
</tr>
<tr>
<td>Cold Water</td>
<td>ALL</td>
<td>Bronze Wrought Copper</td>
<td>125#</td>
<td>Brazed Solder</td>
</tr>
<tr>
<td>Overflow and Drain</td>
<td>ALL</td>
<td>Wrought Copper</td>
<td>125#</td>
<td>Solder Grooved</td>
</tr>
<tr>
<td>Cold Water</td>
<td>ALL</td>
<td>Bronze Wrought Copper</td>
<td>125#</td>
<td>Brazed Solder</td>
</tr>
<tr>
<td>Glycol Water</td>
<td>2” &amp; Below 2½” &amp; Above</td>
<td>CI Steel DI</td>
<td>125#</td>
<td>Screwed Welding Grooved</td>
</tr>
<tr>
<td>Refrigerant</td>
<td>ALL</td>
<td>Wrought Copper</td>
<td>300#</td>
<td>15% Silver Solder</td>
</tr>
<tr>
<td>Vent (Water Discharge)</td>
<td>ALL</td>
<td>Wrought Copper</td>
<td>125#</td>
<td>Solder</td>
</tr>
</tbody>
</table>
2.04 PIPE HANGERS AND SUPPORTS

A. Provide necessary structural members, hangers and supports of approved design to keep piping in proper alignment and prevent transmission of injurious thrusts and vibrations. In all cases where hangers, brackets, etc., are supported from metal decking and/or concrete construction, care shall be taken not to weaken decking and/or concrete or penetrate waterproofing. All hangers and supports shall be capable of screw adjustment after piping is erected. Hangers supporting piping expanding into loops, bends and offsets shall be secured to the building structure in such a manner that horizontal adjustment perpendicular to the run of piping supported may be made to accommodate displacement due to expansion. All such hangers shall be finally adjusted, both in the vertical and horizontal direction, when the supported piping is hot, or chilled, as required. Hangers in direct contact with copper or brass pipe shall be solid copper.

B. Pipe hangers shall be the clevis and pipe roll types, except where otherwise noted.

<table>
<thead>
<tr>
<th>Pipe</th>
<th>Type of Hanger</th>
<th>Make and Model</th>
</tr>
</thead>
<tbody>
<tr>
<td>2&quot; &amp; smaller (steel)</td>
<td>Clevis Hanger</td>
<td>Grinnell Fig. N° 260</td>
</tr>
<tr>
<td>2&quot; &amp; smaller (copper)</td>
<td>Adjustable Wrought Iron</td>
<td>CT-65</td>
</tr>
<tr>
<td>2½&quot; to 4&quot; (steel)</td>
<td>Adjustable Steel Yoke Pipe Roll</td>
<td>181</td>
</tr>
<tr>
<td>2½&quot; to 4&quot; (copper)</td>
<td>Adjustable Swivel Ring</td>
<td>CT-69</td>
</tr>
<tr>
<td>5&quot; &amp; above</td>
<td>Two Rod Roller Hanger</td>
<td>171</td>
</tr>
</tbody>
</table>

C. Beam clamps - Hangers supported from floor steel shall be approved I beam clamps. I beam clamps for hangers shall be wrought steel. B-Line Fig. B3055 (C&P Fig. N° 268) or equal.

D. Where piping is run near the floor and not hung from the ceiling construction but is supported from the floor, such supports shall be of pipe standards with base flange and adjustable top yoke similar to B-Line Fig. B3091 (C&P Fig. 247) or equal.

E. All vertical piping shall be anchored by means of heavy steel clamps securely bolted or welded to the piping, and with end extension bearing on the building.

F. All vertical piping shall be guided at each floor by use of clamps fastened to building structure. Provide 360° protective saddle at guides. Saddles shall be fastened to pipe or insulation.

G. Vertical runs of pipe not over 15 feet long shall be supported by hangers placed not over one foot from the elbows on the connecting horizontal runs.

H. Vertical runs of pipe over 15 feet long but not over 60 feet long and not over 6 inches in size, or not over 30 feet long and not over 12 inches in size, shall be supported on heavy steel clamps. Clamps shall be bolted tightly around the pipes and shall reset securely on the building structure without blocking. Clamps shall be welded to the pipes or placed below couplings. Clamps shall be B-Line Fig. B3373 or equal.
I. For all chilled water, dual temperature water, makeup water and insulated refrigerant piping, provide "Insulshield" as made by Insulcoustic Corp. or pipe covering protection shield B-Line Fig. B3151 (C&P Fig. 265P) with steel shield min. 9 inches long, with vapor barrier jacket. For steam, condensate, hot fuel oil and hot-water heating piping 2 inches and smaller, same as above. For steam, condensate and hot-water heating and high temperature hot water piping 2½ inches and larger, provide steel pipe covering protection saddles B-Line Fig. B3160 (C&P Fig. 353 series).

J. Piping in trenches shall reset or hang from angle iron cross supports provided by the Contractor with two coatings of red primer and final coat for black asphaltum paint.

K. Hanger rods shall be of the following diameters:

<table>
<thead>
<tr>
<th>Pipe Size</th>
<th>Rod Diameter</th>
<th>Max. Spacing</th>
</tr>
</thead>
<tbody>
<tr>
<td>1¼ inch &amp; below</td>
<td>¾ inch</td>
<td>6'-0&quot;</td>
</tr>
<tr>
<td>1½ and 2 inch</td>
<td>¾ inch</td>
<td>10'-0&quot; (copper 8'-0&quot;)</td>
</tr>
<tr>
<td>2½ inch 3 inch</td>
<td>½ inch</td>
<td>10'-0&quot; (copper 8'-0&quot;)</td>
</tr>
<tr>
<td>4 inch 5 inch</td>
<td>¾ inch</td>
<td>12'-0&quot;</td>
</tr>
<tr>
<td>6 inch</td>
<td>¾ inch</td>
<td>12'-0&quot;</td>
</tr>
<tr>
<td>8 inch &amp; above</td>
<td>¾ inch</td>
<td>12'-0&quot;</td>
</tr>
</tbody>
</table>

L. Hanger rods shall be attached to preset concrete inserts with steel reinforcing rod through the insert and both ends hooked over the reinforcing mesh. For pipes 4 inches and larger, rods shall extend through concrete slab above where they shall be attached to steel bearing plates 6" x 6" x ¾".

M. All trapeze pipe supports shall be constructed of angle iron or C-channel. Uni-strut type supports are prohibited for use on HVAC piping, except insulated refrigerant piping may be supported using strut type supports as long as AP Armaflex insulation is used and the strut clamp is a Series 72 "Klo-Shure" by Hydra-Zorb which is intentionally oversized to match the O.D. of the insulation and includes a plastic clamp collar insert. All angle iron supports located outdoors (trapeze supports or vertical components) shall be of galvanized or stainless steel, including all related support rods and hardware.

N. Piping shall not be hung from other piping, ducts, conduits or from equipment of other trades and no vertical expansion shields will be permitted. Hanger rods shall not pierce ducts.

O. All water piping connected to rotating equipment within all mechanical spaces shall be isolated from the building structure by means of vibration hangers inserted in the hanger rods. The vibration hangers shall consist of a steel spring in combination with a double deflection neoprene element within a rectangular steel housing. Combined static deflection shall be 1.375" minimum. Hangers shall have capability of supporting the piping at a fixed elevation during installation and shall incorporate an adjusting device to transfer the load to the spring. Deflection shall be indicated by means of scale. Vibration hangers shall be type PCDNHS made by Mason Industries. Provide flexible pipe connectors at all pump suction and discharge piping.
P. Where additional steel is required for the support of hangers, furnish and install same subject to the approval of the Architect. Piping and ductwork shall not be supported from concrete slab construction at ceiling.

Q. All piping running on walls shall be supported by means of hanger suspended from heavy angle iron wall brackets. No wall hooks will be permitted.

R. Lateral bracing of horizontal pipe shall be provided where required to prevent side sway or vibration. The lateral bracing shall be of a type approved by the Architect and shall be installed where directed by the Architect.

S. All heavy piping is defined as follows:
   1. individual pipes having a nom. dia. greater than 12 inches.
   2. groups of pipes consisting of more than three 8 inch, or more than two 10 inch nom. 1 dia. pipes,
   3. Any combination of closely spaced pipes weighing more than the equivalent of above or 15 lb. per lin. ft., shall be supported at all cross points with overhead floor beams by fastening to the flange of such beams with steel clamps or other suitable means.

T. Where such heavy piping runs parallel with the floor beams properly designed auxiliary steel must be provided. The spacing of such auxiliary steel supports shall in no case be greater than the spacing of the floor beams running perpendicular to the corrugations of the permanent slab steel forms.

U. Assume the responsibility for the proper transfer of the loads of the piping systems to the structure. No additional cost to the Owner should be expected for any corrective work during construction.

V. Rigid type grooved mechanical couplings shall be complete with reverse-angle bolt pads to meet support and hanging requirements corresponding to ANSI B31.1, B31.9, and NFPA 13.

2.05 ANCHORS

A. All anchors shall be separate and independent of all hangers, guides, and supports. Anchors shall be of heavy blacksmith construction suitable in every way for the work approved by the Architect. Anchors shall be welded to the pipe and fastened to the structure with bolts.

B. Anchors shall be fabricated and assembled in such a form as to secure the piping in a fixed position. They shall permit the line to take up its expansion and contraction freely in opposite directions away from the anchored points; and shall be so arranged as to be structurally suitable for particular location, and line loading. Submit calculations and details for approval.

PART 3 - EXECUTION

3.01 INSPECTION

A. Contractor shall examine location where the piping is to be installed and determine space conditions and notify Architect in writing of conditions detrimental to proper and timely
completion of the work. Do not proceed with the work until unsatisfactory conditions have been corrected.

3.02 INSTALLATION

A. Coordinate with other work as necessary to interface installation of piping with other components of systems.

B. Provide and erect in a workmanlike manner, according to the best practices of the trade, all piping shown on the Drawings or required to complete the installation intended by these Specifications.

C. The Drawings indicate schematically the size and location of piping. Piping shall be set up and down and offset to meet field conditions and to provide adequate maintenance room and headroom in the Mechanical Rooms.

D. Study the General Construction Specifications and Plans, of the exact dimension of finished work and of the height of finished ceilings in all rooms where radiation, units, equipment or pipes are to be placed and arrange the work in accordance with the Schedule of Interior Finishes, as indicated on the Architectural Drawings.

E. All piping shall be run perpendicular and/or parallel to floors, interior walls, etc. Piping and valves shall be grouped neatly and shall be run so as to avoid reducing headroom or passage clearance. Provide min. 7'-6" headroom under passageway in mechanical equipment room. All valves, controls and accessories concealed in furred spaces and requiring access for operation and maintenance shall be arranged to assure the use of a minimum number of access doors.

F. All pipe lines made with screwed fittings must be provided with sufficient number of flanges or unions to enable the removal of piping without breakage of fittings.

G. All piping shall be erected as to insure a perfect and noiseless circulation throughout the system. No bull head tees will be permitted.

H. All valves and specialties shall be placed so as to permit easy operation and access.

I. Provide proper provision for expansion and contraction in all portions of pipe work, to prevent undue strains on piping or apparatus connected therewith. Provide signed and sealed pipe expansion calculations by an independent, licensed NYS Professional Engineer to substantiate all such provisions for said expansion and contraction. These calculations shall be based on the piping shop drawings. Provide double swings at riser transfers and other offsets wherever possible, to take up expansion. Arrange riser branches to take up motion of riser.

J. Approved bolted, gasketed, flanges (screwed or welded) shall be installed at all apparatus and appurtenances, and wherever else required to permit easy connection and disconnection. Screwed unions shall be used on piping 2" or less.

K. All piping connections to coils and equipment shall be made with offsets provided with screwed or welded bolted flanges arranged so that the equipment can be serviced or removed without dismantling the piping.
L. If, after plant is in operation, any coils or other apparatus are stratified or air bound (by vacuum or pressure), they shall be repiped with new approved and necessary fittings, air vents, or vacuum breakers at no extra cost. If connections are concealed in furring, floors, or ceilings, the Contractor shall bear all expenses of tearing up and refinishing construction and finish, leaving same in as good condition as before it was disturbed.

M. Fittings shall be of the eccentric reducing type, where changes of size occur in horizontal piping to provide for proper drainage or venting. Steel pipe bends shall be made of the very best grade open hearth, low carbon steel, leaving a smooth uniform exterior and interior surface. Pipe bends shall be made with seamless steel pipe, having a minimum radius of not less than five (5) pipe diameters.

N. Tubing shall be erected neatly in a workmanlike manner. Bends in soft copper tubing benders to prevent deformation of the tubing in the bends. Approved seat-to-pipe threaded adapters shall be provided for junctions with valves and other equipment having threaded connections.

O. Vertical sections of main risers shall be constructed of pipe lengths welded together. No couplings shall be used.

P. The ends of all pipe and nipples shall be thoroughly reamed to the full inside diameter of the pipe and all burrs formed in the cutting of the pipes shall be removed.

Q. Piping shall be installed in accordance with the latest edition of the ASME Code for Pressure Piping.

R. All piping shall be concealed above furred ceilings in rooms where such ceilings are provided (except where specifically indicated otherwise on the drawings, or in walls or partitions, except as otherwise indicated).

S. Piping, fittings or valves of dissimilar materials shall be connected with dielectric connectors as made by Ebco Company or approved equal.

T. Piping at all equipment and valves shall be supported to prevent strains or distortions in the connected equipment and valves. Piping shall be sufficiently supported to allow for removal of equipment, valves and accessories with a minimum of dismantling and without causing excessive stress or damage to the remaining piping, valves or equipment, without requiring additional supports after these items are removed.

U. Pipe nipples - Any piece of pipe 3” in length and less shall be considered a nipple. All nipples with unthreaded portion 1 1/2” and less shall be extra heavy. Only shoulder nipples shall be used. No close nipples will be permitted.

V. Screw threads shall be cut clean and true; screw joints made tight without caulking. No caulking will be permitted. A non-hardening lubricant shall be used. No bushings shall be used. Reductions, otherwise causing objectionable water or air pockets, to be made with eccentric reducers or eccentric fittings.

W. Pitch water piping upward one inch per 100 feet in direction of flow to ensure adequate flow without air binding, and to prevent noise and water hammer. Pitch drain piping 1/8 inch per foot in the direction of flow. Branch connections to mains are to be made in such a manner as to
prevent air trapping and permit free passage of air. To meet job conditions, mains shall set up to maintain headroom, and clear other trades. Provide oversized float operated automatic air vent (with valve). Avoid 90° lift set-ups in supply lines by using 45 degree ells. Where 90° lifts exceed 12” install automatic air vent in supply lines. All lifts in return lines shall be installed with automatic air vents. Pipe outlet of all automatic air vents to an open sight drain if the vent is concealed, or to within two feet of the floor within machine rooms. All water piping shall pitch back to low points for drainage. Low points shall be provided with capped ¾ inch hose cocks.

X. Provide drain valves at the heel of all interior main water risers. Provide capped drain valves at the heel of all perimeter water risers.

Y. Miscellaneous drains, vents, reliefs, and overflows from tanks, equipment, piping, relief valves, pumps, etc., shall be run to the nearest open sight drain or roof drain. Provide capped drain valves whenever required for complete drainage of piping, including the system side of all pumps.

Z. Provide domestic water connections from valved outlets to any equipment requiring same.

AA. All drain piping from condensate drain pans shall be properly trapped in accordance with the static pressures involved. Provide cleanout at first change in direction or before the trap. Condensate drain piping sizes shall be not less than 1½” except that fan coil unit drains may be 1”.

BB. Grooved ends shall be clean and free from indentations, projections, and roll marks in the area from pipe end to groove.

CC. Contractor shall utilize a Smog-Hog (or similar) type local exhaust system vented to the outdoors, when welding steel pipe and/or soldering pipe inside the building.

3.03 FIELD QUALITY CONTROL

A. Upon completion of installation of piping (partial or complete) test piping to demonstrate compliance with requirements. Where possible, field correct malfunctioning piping, then retest to demonstrate compliance. Replace piping which cannot be satisfactorily corrected. Refer to Section 23 05 93 - Testing and Balancing.

END OF SECTION 23 20 00
PART 1 - GENERAL

1.01 GENERAL REQUIREMENTS

A. This Section is coordinate with and complementary to the General Conditions and Supplementary General Conditions of the work, wherever applicable to Mechanical Work.

B. Section 01 31 46 - Special Requirements for Mechanical and Electrical work shall apply.

1.02 DESCRIPTION OF WORK

A. The work includes the providing of all labor, materials, equipment, accessories, services and tests necessary to complete and make ready for operation by the Owner, all Sheet Metal Ductwork as shown on the drawings and hereinafter specified.

1.03 QUALITY ASSURANCE

A. Fabrication and installation shall be by a single firm specializing and experience in metal ductwork for not less than 10 years.

B. Comply with SMACNA's (Sheet Metal and Air Conditioning Contractors National Association) 2005 "HVAC Duct Construction Standards, Metal and Flexible", Third Edition recommendations for fabrication, construction and details and installation procedures, except as otherwise indicated.

C. Comply with ASHRAE (American Society of Heating Refrigeration and Air Conditioning Engineers) recommendations, except as otherwise indicated.

D. Compliance to SMACNA and ASHRAE is a minimum requirement. In case of disagreement between sheet metal work described in this Section and SMACNA or ASHRAE, the specification shall govern.

1.04 SUBMITTALS

A. Refer to Section 01 31 46 - Special Requirements for Mechanical and Electrical work and submit shop drawings and coordinate drawings.

B. Before submitting any sheet metal drawings, submit a complete set of shop standards for review and approval. Sheet metal shop drawings may be submitted only after approval of the shop standards.

1.05 COORDINATION

A. Refer to Section 01 31 46 - Special Requirements for Mechanical and Electrical work.

1.06 GUARANTEE

A. Refer to Section 01 31 46 - Special Requirements for Mechanical and Electrical work.
B. Contractor will guarantee all work for one year from the date of acceptance against all defect in material, equipment and workmanship. This guarantee shall include repair of damage to any part of the premises resulting from leaks or other defects in material, equipment or workmanship.

1.07 PRODUCT HANDLING

A. Protect shop fabricated ductwork, accessories and purchased products from damage during shipping, storage and handling. Protect ends of ductwork and prevent dirt and moisture from entering ducts and fittings.

B. Where possible, store ductwork inside and protect from weather. Where necessary to store outside, store above grade and enclosed with waterproof wrapping.

PART 2 - PRODUCTS

2.01 GENERAL REQUIREMENTS FOR DUCTWORK

A. Furnish and install the size, connections and run of ducts as indicated on the drawings.

B. While the Drawings shall be adhered to as closely as possible, the Architect's right is reserved to vary the run and size of ducts during the progress of the work if required to meet structural conditions.

C. Install all ductwork in strict adherence to the ceiling height schedule indicated on the Architect's Drawings. Consult with the Plumbing, Fire Protection and Electrical Contractors and, in conjunction with the above Contractors, establish the necessary space requirements for each trade.

D. The sheet metal ductwork shall, whether indicated or not, rise and/or drop and/or change in shape to clear any and all conduits, lighting fixtures, piping and equipment to maintain the desired ceiling heights and to provide adequate maintenance room and headroom in mechanical equipment rooms.

E. The ductwork shall be continuous, with airtight joints and seams presenting a smooth surface on the inside and neatly finished on the outside. Ducts shall be constructed with curves and bends so as to affect an easy flow of air. Unless otherwise shown on the Drawings, the inside radius of all curves and bends shall be not less than width of ducts in plane of bend.

F. All rectangular ductwork, unless otherwise noted, shall be built from galvanized sheet steel and thoroughly braced and stiffened.

2.02 AUXILIARY AND SECONDARY DRAINS

A. A secondary/auxiliary drain pan shall be provided below air handling and fan coil units providing cooling which are suspended above a hung ceiling or hung from the slab or building structure above with no hung ceiling.

B. Requirement for secondary/auxiliary drain pans shall not apply to units hung in mechanical equipment rooms.

C. The secondary/auxiliary drain pan shall comply with the following:
   1. Shall have a separate drain line from the primary drain pan in the unit
2. The drain line shall be piped to the nearest floor drain or slop sink, if not, specifically routed and shown on the drawings.

3. Drain pan shall have a minimum depth of 1.5 inches and shall be not less than 3 inches larger than the unit or coil dimension width and length.

4. Pan shall be galvanized steel minimum thickness 0.0276 inches.

2.03 INSTALLATION OF HVAC DEVICES

A. Installation of Duct Smoke Detectors: Duct smoke detectors shall be furnished by the Electrical Contractor and shall be installed in the ductwork under this Section. Provide an access door to each smoke detector.

B. Installation of Dampers: Refer to Drawings and temperature control specification for smoke dampers and other automatic dampers and install them in ductwork.

C. Installation of variable air volume system control devices: Install in sheet metal ductwork all control devices furnished by the manufacturer of the variable air volume system controls. Provide an access door at each location.

2.04 DUCT FABRICATION

A. Ducts shall be neatly finished on the outside with all sharp edges removed.

B. Inside surfaces shall be smooth with no projections into the air stream except where otherwise indicated.

C. Longitudinal joints shall be Pittsburgh lock at corners or Acme lock on flat surfaces double seams hammered tight and shall be located above the horizontal axis of the duct. A snap lock seam shall not be permitted as a substitute for the Pittsburgh lock at corners of ducts.

D. Transverse joints shall be made airtight with all laps in the directions of air flow.

E. All fasteners and attachments shall be made of the same material as the ducts.

F. Furnish test wells 12" on the center horizontally and vertically in the suction and discharge duct of each fan. Test wells shall consist of a 1" x ¼", 125 lb., bronze, screwed hex bushing, secured to the duct with a bronze hex locknut on the inside of the duct. A ¾" x 2" long standard weight bronze, screwed nipple and cap shall be fitted to the housing on the outside of the duct. Test wells shall be No. 699 as made by Ventlok or approved equal.

G. All turns in ductwork shall be accomplished using radius elbows rather than square elbows. Square elbows will only be permitted in instances where the Contractor, through depiction on their sheet metal shop drawings, proves that only a square elbow may be installed due to such limited space availability. All radius elbows shall have a minimum centerline radius of 1½ times the width of the duct.

H. All square elbows shall have factory-designed and built single thick turning vanes. Shop fabricated vanes will not be approved. Where turning vanes are in conflict with the access doors to fire dampers, they shall be made movable so that fire dampers shall be accessible.
I. Dissimilar metals shall be connected with flanged joints made up with fiber or neoprene gaskets to prevent contact between dissimilar metals. Flanges shall be fastened with bolts protected by ferrules and washers made of the same materials as the gaskets. Where an aluminum duct is to be connected to a galvanized steel duct, the end of the galvanized steel duct shall be coated with heavy black asphaltum paint before connecting it to the aluminum duct.

J. Changes in shape and dimension shall conform to the following: Except where otherwise noted, for increases in cross-sectional area, the shape of the transformation shall not exceed 1" in 7". Except where otherwise noted, for reductions in area, the slope shall not be less than 1" in 4" but 1" in 7" preferred.

K. Wherever it may be necessary to make provisions for vertical hangers of the ceiling construction passing through ducts, provide streamlined shaped sleeves around such ceiling construction hangers as to fully protect the duct from being penetrated with holes for the passage of such hangers. Any such streamlined sleeves shall be made air tight at top and bottom of ducts. In no case shall there be more than two rods in any 9 sq. ft. area. No rods shall pierce ducts smaller than 12" in horizontal area.

L. The construction for low pressure rectangular sheet metal ducts shall be made in accordance with recommendations of ASHRAE Guide, Latest Edition, or as per SMACNA Manual but not less than the following weights and construction:

<table>
<thead>
<tr>
<th>Dimension Longest Side Inches</th>
<th>Sheet Metal Gauge All Four Sides</th>
<th>Transverse Reinforcing at Joints and Between Joints</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Steel Gauge</td>
<td>Aluminum Thickness In.</td>
</tr>
<tr>
<td>Up thru 12</td>
<td>26</td>
<td>0.020</td>
</tr>
<tr>
<td>13 thru 18</td>
<td>24</td>
<td>0.025</td>
</tr>
<tr>
<td>19 thru 30</td>
<td>24</td>
<td>0.025</td>
</tr>
<tr>
<td>31 thru 42</td>
<td>22</td>
<td>0.032</td>
</tr>
<tr>
<td>43 thru 54</td>
<td>22</td>
<td>0.032</td>
</tr>
<tr>
<td>55 thru 60</td>
<td>20</td>
<td>0.040</td>
</tr>
<tr>
<td>61 thru 84</td>
<td>20</td>
<td>0.040</td>
</tr>
</tbody>
</table>
LOW PRESSURE - RECTANGULAR DUCTWORK

<table>
<thead>
<tr>
<th>Dimension Longest Side Inches</th>
<th>Sheet Metal Gauge All Four Sides</th>
<th>Transverse Reinforcing at Joints and Between Joints</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Steel Gauge</td>
<td>Aluminum Thickness In.</td>
</tr>
<tr>
<td>85 thru 96</td>
<td>18</td>
<td>0.050</td>
</tr>
<tr>
<td>over 96</td>
<td>18</td>
<td>0.050</td>
</tr>
</tbody>
</table>

1. Flat areas of duct over 18 in. wide shall be stiffened by cross breaking of beading.
2. All joints to have corner closures.
3. All joints (longitudinal and transverse) shall be sealed with Foster 32-19, Childers CP-146 or 3M EC-800 mastic or equal UL181A approved mastic, to provide sealing equivalent to SMACNA Seal Class A.

M. The construction for low pressure round sheet metal ducts and fittings shall be as follows:

<table>
<thead>
<tr>
<th>Duct Diameter Inches</th>
<th>Steel-Galv Sheet Gage</th>
<th>Minimum Reinforcing Angle Size &amp; Maximum Longitudinal Spacing</th>
<th>Girth Joints (Continuously Welded or as Below)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Up thru 8</td>
<td>26</td>
<td>None required</td>
<td>Crimped and beaded joint</td>
</tr>
<tr>
<td>9 thru 13</td>
<td>26</td>
<td>None required</td>
<td>Crimped and beaded joint</td>
</tr>
<tr>
<td>14 thru 22</td>
<td>24</td>
<td>None required</td>
<td>Crimped and beaded joint</td>
</tr>
<tr>
<td>23 thru 36</td>
<td>22</td>
<td>None required</td>
<td>--</td>
</tr>
<tr>
<td>37 thru 50</td>
<td>20</td>
<td>1(\frac{1}{4}) x 1(\frac{1}{4}) x (\frac{1}{8}) @ 72 in.</td>
<td>--</td>
</tr>
<tr>
<td>51 thru 60</td>
<td>18</td>
<td>1(\frac{1}{4}) x 1(\frac{1}{4}) x (\frac{1}{8}) @ 72 in.</td>
<td>--</td>
</tr>
<tr>
<td>61 thru 84</td>
<td>16</td>
<td>1(\frac{1}{2}) x 1(\frac{1}{2}) x (\frac{1}{8}) @ 72 in.</td>
<td>--</td>
</tr>
</tbody>
</table>

NOTE: Flanged joints may be considered as girth reinforcing.

1. Ductwork up to 36 in. diameter shall be spiral lockseam construction and it shall be assembled with prefabricated fittings made up of 20 gauge galvanized iron.
2. All joints (longitudinal and transverse) shall be sealed tight with EC-800 to provide sealing equivalent to SMACNA Seal Class A. Joints shall, in addition, be fastened with self-tapping screws.

2.05 DAMPERS

A. At each main branch take-off and in such other locations where required to properly balance the system, provide volume dampers of the opposed blade, multi-louvered type, which shall be operated by indicating locable quadrants and set screws, for adjusting the system.

B. Volume dampers shall be constructed as follows: Damper blades shall not be wider than 12\"., shall be complete with heavy angle iron frames, connecting and operating links, brass trunnions, and
bronze bearings. Dampers, unless otherwise noted, shall be fabricated with not less than No. 16 gauge sheet steel. Blades shall overlap and shall be provided with continuous stops on all four sides of dampers to prevent leakage. Blades shall be galvanized. Blades of dampers shall be set into a flat steel frame with frame securely bolted to the duct. All dampers shall be fitted with a hexagonal brass spindle which shall extend through the exterior of duct and be fitted with an indicating self-locking regulator. Regulator shall be similar to Ventlok 641 or approved equal. All hardware shall be Ventlok or approved equal. For insulated ductwork provide No. 644 self-locking regulator as made by Ventlok or approved equal.

C. All automatic dampers shall be furnished as a part of the automatic temperature control system by the automatic temperature control manufacturer. Install dampers and provide safing in ductwork for automatic dampers smaller than duct size.

D. All dampers shall be made accessible from building construction. Access doors in building structure shall be furnished or provided as herein before specified.

2.06 FLEXIBLE RUN-OUTS

A. Flexible duct shall not be used under any circumstance.

2.07 SMOKE DAMPERS

A. Smoke dampers shall be classified and labeled in accordance with UL 555S, "Standard for Leakage Rated Dampers for Use in Smoke Control System." Smoke dampers shall be of UL 555 S leakage class I, 4 cfm/ft² at 1" w.g.; 8 cfm/ft² at 4" w.g.

B. Smoke dampers installed at smoke barriers shall be installed no more than 2 ft. from the barrier and between any branch takeoff or duct inlet and outlets and the smoke barrier.

C. Smoke dampers shall be automatically return to closed position in the event of loss of electricity. All wiring required to interconnect the dampers with fire detection, fire alarm and fire alarm supervisory control systems shall be provided under the Division 16000 of the Specification. Pneumatic control system for damper actuators shall be provided under Section 23 09 00, as specified hereinafter. All combination fire/smoke dampers and smoke dampers shall be provided with 120 VAC actuators. Power wiring for all combination fire/smoke dampers and all smoke dampers shall be through the fire alarm system control relay and through a BAS relay and control module. The Electrical Contractor shall provide all such wiring; the ATC Sub-Contractor shall provide a BAS relay which must be installed for each combination fire/smoke damper and each smoke damper. If the air handling system is shut down, all associated combination fire/smoke dampers and all smoke dampers shall close. The fire alarm relay shall, if necessary, override the BAS relay. Each damper shall be individually powered and controlled.

D. Smoke dampers shall be constructed as described above for dampers.

E. Damper actuators shall be as specified in Section 23 09 00.

F. For fire/smoke dampers, provide two (2) damper end switches that are blade actuated to signal the fire alarm system when dampers are in the open and closed position. For smoke and fire/smoke dampers which can isolate a fan from its distribution ductwork or as otherwise required by the Sequence of Operation, provide an additional end switch which shall be wired to the fan starter (VFD) control wiring to prevent the fan from operating unless the damper is open.
G. Apply a bead of sealant between damper and sleeve and between dampers for multiple damper assemblies, as defined below for combination smoke and fire dampers.

2.08 FIRE DAMPERS

A. Fire dampers and sleeve installation shall be in accordance with NFPA-90A recommendations and shall bear U.L. Label in compliance with U.L. 555.

B. Clearly indicate fire damper location on shop drawings. Provide access doors in the ducts and supply access doors or panels at building construction at each damper of sufficient size and type to permit inspection and replacement of linkage. Assume responsibility to coordinate all locations of duct access doors with the other Contractors to conform with whatever architectural access openings may be necessary and supply access doors or panels in building construction. Provide shop drawings indicating location of access panels or doors for Architect's approval.

C. It is the intention of these plans and specifications to be complete. However, it is the responsibility of the Contractor, as being completely cognizant of local regulations, to determine where fire dampers are required and to advise the Architect prior to construction as to any discrepancies or questions in the plans or specifications.

D. Fire dampers shall be enclosed in sleeve of fourteen gage metal. Sleeve shall be secured at both sides of fire partitions with $\frac{1}{2} \times \frac{1}{2} \times 14$ ga. mounting angles secured to sleeves only: retaining angles must lap structural opening 1” minimum and cover corners of opening. Provide duct breakaway connections, see detail on drawings. Breakaway connections shall be located within 6 inches of the fire wall on both sides of the fire wall.

E. Dampers shall be steel plate, mounted to turn freely, in steel plate frame inserted in duct. Dampers shall be proportioned and weighted to close at once, if released from link with spring catches to hold closed, until manually reset. Dampers and frames to have suitable standard fusible-links, normally holding them open, but releasing upon contact with fire. Damper blades shall be mounted on corrosion resisting bearings. Damper shall close by gravity, moving with the air stream to full closed position against one-eighth (\%$)$ inch angle stop. Steel spring catch shall hold damper closed. Radius arm on shaft shall show position of damper. Submit details for approval.

F. Fire dampers shall be as made by Ruskin, Lau, Arlan Damper Corp. (631-589-7431) or Greenheck, U.L. labeled.

G. Damper shall be fully out of the air stream (type B) U.O.I.

H. In stainless steel and aluminum ductwork, provide stainless steel construction fire dampers.

2.09 COMBINATION SMOKE AND FIRE DAMPERS

A. In lieu installing separate fire and smoke dampers in fire walls with a rating of two hours or less, a combination fire/smoke damper can be installed. Fire walls with a rating exceeding two hours must use separate fire and smoke dampers.

B. Combination fire/smoke dampers shall be model FSD36 as manufactured by Ruskin, Lau, Arlan Damper Corp. (631-589-7431) or Greenheck.
C. Combination fire/smoke dampers shall be installed in sleeves in accordance with NFPA-90A, UL555 and manufacturer's installation instructions. Dampers shall be UL rated, UL555S, leakage class II, 4 cfm/ft² at 1 inch w.g.; 8 cfm/ft² at 4" w.g., and UL555 1½ hour fire rated. Each damper shall bear a UL label attesting to these qualifications, in accordance with established UL labeling procedure.

D. Damper manufacturer shall have tested and qualified with UL, a complete range of damper sizes covering all combination smoke and fire dampers required for this project.

E. Damper actuators shall be electric as specified in Section 23 09 00. Damper actuators shall be installed by the damper manufacturer at the time of damper fabrication; damper and actuator shall be supplied as a single entity which meets all applicable UL555S qualifications for both dampers and operators. Damper and actuator shall be qualified under UL555S and UL555 to an elevated temperature of 250°F.

F. Each combination fire/smoke damper shall be equipped with a fusible link which shall melt at 165°F causing the damper to close and lock in the closed position.

G. Dampers shall automatically return to closed position in the event of loss of electric power.

H. Each combination fire/smoke damper shall have a factory installed sleeve of length and gauge required for satisfactory installation and with the damper actuator factory installed on the exterior of the sleeve and properly linked to the damper operating shaft. Contractor shall coordinate space requirements where dampers are located, providing required service clearance for actuators.

I. All wiring required to interconnect the dampers with fire detection, fire alarm and fire alarm supervisory control systems shall be provided under the Division 16000 of the Specification. Pneumatic control system for damper actuators shall be provided under Section 23 09 00, as specified hereinafter. All combination fire/smoke dampers and all smoke dampers shall be provided with 120 VAC actuators. Power wiring for all combination fire/smoke dampers and all smoke dampers shall be through the fire alarm system control relay and through a BAS relay and control module. The Electrical Contractor shall provide all such wiring; the ATC Sub-Contractor shall provide a BAS relay which must be installed for each combination fire/smoke damper and each smoke damper. If the air handling system is shut down, all associated combination fire/smoke dampers and all smoke dampers shall close. The fire alarm relay shall, if necessary, override the BAS relay. Each damper shall be individually powered and controlled.

J. For fire/smoke dampers, provide two (2) damper end switches that are blade actuated to signal the fire alarm system when dampers are in the open and closed position. For smoke and fire/smoke dampers which can isolate a fan from its distribution ductwork or as otherwise required by the Sequence of Operation, provide an additional end switch which shall be wired to the fan starter (VFD) control wiring to prevent the fan from operating unless the damper is open.

K. Clearly indicate fire damper location on shop drawings. Provide access doors in the duct and supply access doors for installation at building construction, at each damper, of sufficient type to permit inspection and replacement of damper actuators and linkage. Assume responsibility to coordinate all locations of access doors with other contractors. Provide shop drawings indicating locations of access doors, both duct and building construction, for Architect's approval.

L. It is the intention of these plans and specifications to be complete. However, it is the responsibility of the Contractor, as being completely cognizant of local regulations, to determine where
combination fire/smoke dampers are required and to advise the Architect prior to construction as to any discrepancies or questions in the plans or specifications.

M. Combination fire/smoke dampers shall be enclosed in a sleeve of fourteen gauge metal set and grouted into the fire partition. The sleeve shall be secured on both sides of the fire partition with 1½ x 1½ x 14 gauge mounting angles secured to the sleeves only. Retaining angles must lap structural opening 1 inch minimum and cover corners of the opening.

N. Multiple damper assemblies shall be installed and fastened together per manufacturers instructions. Unless the manufacturer's instructions indicate otherwise multiple damper assemblies shall be fastened together with ¼"-20 bolts, No. 10 screws or ½" long welds staggered intermittently on both sides. Fasteners shall be spaced 6" on center and a maximum of 2" from the ends of the joining sections or from the corner. A continuous ½" bead of Dow-Corning 100% silicon rubber, Dow-Corning Selastic 732 or GE RTV 108 sealant shall be applied on the mullion joint. Press the surface of the sealant in place to disel any air.

O. A bead of sealant, as described above, shall be applied between the damper and the sleeve.

P. Fire/smoke dampers shall be provided with end switches (Ruskin SP100 or equal) for status indication.

Q. In stainless steel and aluminum ductwork, provide stainless steel construction combination fire/smoke dampers.

2.10 ACCESS DOORS IN SHEET METAL WORK

A. Wherever necessary in ductwork, casings or sheet metal partitions, provide suitable access doors and frames to permit inspections, operation and maintenance of all valves, coils, humidifiers, controls, smoke dampers, smoke detectors, fire dampers, filters, bearings, traps, or other apparatus concealed behind the sheet metal work. All such doors shall be of double construction of not less than No. 20 gauge sheet metal and shall have sponge rubber gaskets around their entire perimeter. Doors in insulated ducts of insulated casings shall have rigid insulation between the metal panels.

B. All access doors in sheet metal ducts shall be hung on heavy flat hinges and shall be secured in the closed position by means of cast zinc clinching type latches. Where space conditions preclude hinges, use four heavy window type latches. Doors into ducts shall in general not be smaller than 24" x 24" except for access door to fire dampers which will depend on size of fire damper.

C. In no case shall access to any items of equipment requiring inspection, adjustment, or servicing require the removal of nuts, bolts, screws, wing nuts, wedges, or any other screwed or loose device.

D. Each sheet metal chamber or plenum shall have access doors for access to all parts of the system (outside air intake, exhaust and return air). Doors shall be fitted with cast zinc door latches, two per door. Latches shall be operable from both sides of casing. Hinges shall be extra heavy, zinc plated hinges, minimum of two per door. The doors shall be felted or provided with rubber gaskets so as to make them airtight. The doors shall be made with inner and outer shells 2 inches apart so that they may be properly insulated and properly operated. Doors shall be a minimum size of 20" x 48".
E. Hinges shall be Ventlok No. 150 or 260 with or without screw holes or approved equal. Latch for walk-in access doors shall be No. 260 as made by Ventlok Co. or approved equal. Latch for access door in ductwork shall be Ventlok No. 100 or approved equal.

F. Where reheat coils are installed in ductwork, provide two (2) access doors; one on the upstream side of the coil and one on the downstream side of the coil, both within 2'-0" of the coil.

G. Provide access doors of adequate size to allow easy access to the equipment that will require maintenance. Provide insulated or acoustically lined doors to prevent condensation where applicable.

H. Manufacturer to provide an installed neoprene gasket around perimeter of access door for airtight seal.

I. Systems 3” w.g. or less shall utilize a hinged, cam, or hinged & cam square-framed access door.

2.11 FLEXIBLE CONNECTIONS

A. All fan and air supply unit connections, both at inlet and discharge shall be made with material as hereinafter specified, so as to prohibit the transfer of vibration from fans to ductwork connecting thereto.

B. The flexible connections shall be a minimum of 6” long including bands using extra wide fabric as specified and held in place with heavy metal bands, securely attached, to prevent any leakage at the connection points.

C. Flexible connections shall be fabricated from the following materials unless otherwise required by Local Authorities.

D. Flexible connections shall not be painted.

E. Flexible air connectors shall be listed and labeled to the requirements of UL 181 for class 0 or class 1 flexible air connectors and shall be so identified.

2.12 GRILLES, REGISTERS AND DIFFUSERS

A. Basis of design for all air outlets and air inlets is Titus, see specification section 23 05 12 “General Provisions for HVAC work” for the approved manufacturer’s list.

B. Furnish and install where shown on the drawings all metal diffusers, grilles and registers of the sizes and capacities indicated.

C. Ceiling diffusers shall be selected to diffuse the air uniformly throughout the occupied space. The air shall be introduced at a temperature differential of 20 deg. F and shall be diffused at the five (5) foot level to a velocity of not greater than 50 FPM and a temperature differential of not greater than 2 deg. F. when compared with mean room temperature. The sound power level of air distribution equipment devices shall not exceed ratings as shown by Titus, Anemostat Corp., or Price data.

D. Equipment manufacturer shall submit engineering data in a manner to facilitate convenient review of the following factors:
1. Aspiration ability, including temperature and velocity traverses, throw and drop of each unit, noise criteria ratings for each unit, sizes, free area and quality of construction.

E. All ceiling diffusers shall be furnished with a device or devices equalize the air flow and control the volume.

F. Location of ceiling diffusers and registers shown on the drawings are approximate. Coordinate with the acoustic tile ceiling Sub-Contractor for exact locations of ceiling diffusers and registers. They shall be in accordance with approved ceiling layout shop drawings.

G. All registers, grilles and diffusers shall be coated with baked aluminum enamel, baked flat white, unless otherwise indicated. All supply registers and grilles shall have a \( \frac{3}{4} \)" sponge rubber gasket around the grille frame.

H. All grilles, registers and diffusers shall be provided without an integral shut-off damper.

I. Exceptions to foregoing types of grilles, registers and diffusers shall be as indicated on the plans.

J. Each air supply outlet shall have the required capacity and shall be guaranteed to give the required draft with draftless diffusion. Where manufacturer's recommendations require duct sizes differing from those on the drawings, the same shall be provided at no additional cost to the Owner.

K. All grilles, registers and diffusers must be tested under ADC standards and carry and ADC seal of approval.

L. All registers and grilles located at face of partitions or plaster line of ceilings or soffits, etc. shall have plaster frames supplied by the same manufacturer of the air outlet or the air inlet.

M. Relocations of ceiling diffusers or registers in order to match the ceiling tile layout shall be made at no additional cost to Owner.

2.13 SOUND REDUCTION

A. Furnish and install all soundproofing material specified, indicated or necessary to that all systems will comply with requirement of quiet operation. In general, noise level in any part of building (except in machinery rooms), due to air conditioning or ventilating equipment, ducts, and outlets, shall not exceed 40 decibels at 1200-2400 cycles per second, except as otherwise hereinafter specified.

B. Furnish and install sound-absorptive lining in ductwork for locations and lengths as indicated and/or hereinafter specified. All soundproofing material, installation and arrangement, shall be as approved. Where ducts are acoustically lined and insulation is required per 15850 (23 07 00), external insulation may be omitted provided a minimum R value 6 is maintained for indoor ducts. Dimensions noted for lined ducts are inside clear dimensions. Duct sizes shall be increased for liner.

C. Sound Absorbent Duct Lining for Low Pressure Ductwork: Furnish and install as herein specified and/or shown on the drawings (except where otherwise noted), 2" thick, closed cell liner, K-Flex LS sheet with PSA as manufactured by Nomaco, K-Flex, AP Armaflex, AP Armaflex SA or approved equal, meeting ASTM C-534, ASTM D-1056-00-2C1 and ASTM C-1534-02 and shall have an anti-microbial ingredient. Lining shall meet the requirements of NFA 90A with a FHC
of 25/50 and flammability UL 94-5V and ASTM E-84 foam core 25/50 at 1" and below, psa 0/10, R value 3.8 (1"").

D. Liner shall be applied to clean, dry ductwork by peeling the release liner away and applying uniform pressure to the sheet. Compression joints with adhesive applied should be used on all butt edges. Seal all final edges with a heavy coat of adhesive to seal off air between lining and duct, unless the material has a factory applied edge coating. Follow manufacturer's installation instructions. All exposed edges of lining shall be installed with sheet metal nosing 1½" wide, two gauges heavier than duct.

E. Duct sizes indicated on drawings are clear inside dimensions. Increase sheet metal sizes as required to install acoustic lining.

2.14 ACOUSTICAL PERFORMANCE SPECIFICATIONS - GENERAL

A. It is the intent of this Specification that noise levels due to air conditioning and/or ventilating equipment, ducts, grilles and registers, diffusers and air light fixtures, will permit attaining sound pressure levels in occupied spaces conforming to the following NC curves as explained in the ASHRAE Guide and Data Book.

<table>
<thead>
<tr>
<th>Room Type</th>
<th>NC Level</th>
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</thead>
<tbody>
<tr>
<td>Patient and Exam Rooms</td>
<td>NC 30-40</td>
</tr>
<tr>
<td>Offices and Conference Rooms</td>
<td>NC 25-35</td>
</tr>
<tr>
<td>Teleconference Rooms</td>
<td>NC 25 (max)</td>
</tr>
<tr>
<td>Corridors and Public Spaces</td>
<td>NC 35-45</td>
</tr>
</tbody>
</table>

B. Grilles, Registers, Diffusers

1. The maximum permissible sound power levels of air terminal devices when installed and operating per plans and specifications shall be as follows:

<table>
<thead>
<tr>
<th>Octave Band</th>
<th>NC-30</th>
<th>NC-35</th>
<th>NC-40</th>
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<tbody>
<tr>
<td>1</td>
<td>62</td>
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<td>8</td>
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<td>42</td>
<td>47</td>
</tr>
</tbody>
</table>

C. Sound Power Levels for air outlets and inlets shall be tested in accordance with ASHRAE Standard 70-1991.
2.15 ACoustical Performance within equipment spaces

A. Equipment room noise levels and noise transmission to adjacent buildings shall comply with all Federal, State, and City Noise Ordinances.

B. Motor acoustical performance:
   1. Motor drives for pumps and refrigerator machine when installed per plans and specifications shall operate with noise levels not to exceed 80 dbA.
   2. Noise levels shall be determined in accordance with IEEE Standard #85 test "Procedure for Air-Borne Noise Measurements on Rotating Electric Equipment".

Part 3 - Execution

3.01 Inspection

A. Contractor shall examine location where ductwork is to be installed and determine space conditions and notify Architect in writing of conditions detrimental to proper and timely completion of the work.

B. Do not proceed with the work until unsatisfactory conditions have been corrected.

3.02 Installation of Ductwork

A. Install ductwork in accordance with recognized industry practices, to ensure that ductwork complies with requirements and serve intended purposes.

B. Coordinate with other work as necessary to interface installation or ductwork with other components of systems.

C. Duct sizes shown on the drawings at connection to fans or other equipment may vary in actual installation. Contractor shall provide transition pieces as required.

D. Ducts, casings and hangers shall be installed straight and level and shall be free of vibration and noise when fans are operating.

E. Ducts at ceilings shall be suspended from inserts in concrete slabs except where otherwise indicated. Inserts shall be Grinnell Fig. 279, 282, or 152 as required. Ducts at floor shall be supported by steel angles suitably anchored to floor construction. Each duct shall be independently supported and shall not be hung from or supported by another duct, pipe, conduit or equipment of any trade.

F. Supports shall be placed at each joint and change in direction up to a maximum spacing of 8 feet on centers. Prevent buckling of ductwork.

G. All fastenings to building structure shall be adequate to insure permanent stability of sheet metal work and shall be capable of resisting all applied forces.

H. Vertical ducts in shafts or passing through floors shall be supported by steel angles or channels, welded, riveted, screwed or bolted to ducts and fastened to building structural members at each floor level. Provide safing to close all floor openings around ductwork - pack annular space with
rockwool and 18 gauge sheet metal safing. Floor openings in plenums shall have ½ inch diameter steel bars.

I. Rigid connections between ductwork and non-rotating equipment shall be made with flanged joints, sealed with fireproof material (Fiber or Neoprene gaskets).

J. It is the intent to obtain low pressure ductwork construction with minimum leakage. The construction noted in Specifications can produce low or high leakage rates, depending upon the workmanship, particularly with regard to the connection at the top of the ducts. Guarantee that total diffuser volume, measured by means of velocimeter, shall be at least 95% of actual fan supply (measured by means of a duct traverse taken with a Pitot tube and water manometer). Seal the ductwork at all joints (longitudinal & transverse and duct wall penetrations) with suitable sealers Foster 32-19, Childers CP-146 or 3M EC-800 and tape equivalent to SMACNA seal class A. Use of "HARDCAST" or any other material is subject to Architect's approval.

3.03 DUCT HANGERS

A. Low pressure ducts up to 24” on a side or up to 20” diameter shall be suspended with 16 gauge, galvanized strap hangers, 1” wide.

B. Low pressure ducts 25” to 40” on a side or 21” to 42” diameter shall be suspended with galvanized strap hangers 1” wide by ⅛” thick.

C. Strap hangers shall be bent 90°, extended down sides of ducts and turned under bottom of ducts a minimum of 2”. Strap hangers shall be fastened at ceiling with nuts, bolts and lock washers and to sides and bottom of ducts with sheet metal screws.

D. All ductwork 43” and larger on a side or diameter shall be suspended with steel angle type hangers with rod and angle steel trapeze. The use of strut for support of any HVAC work (ducts, piping or equipment) is prohibited.

E. No screws shall penetrate medium and high pressure ductwork.

F. For any ducts which require seismic bracing, provide trapeze and rod type hangers regardless of duct size.

G. Trapeze type hangers shall have steel rods threaded at both ends and bottom bracing angles on ducts, with nuts and lock washers. Threaded rod diameter shall be as scheduled on the drawings based on the size of the duct supported.

H. Angle type hangers shall be extensions of side bracing angles on ducts, bent 90° at ceiling and fastened with nuts, bolts and lock washers.

I. The minimum spacing intervals for all duct supports shall be as scheduled on the drawings based on the size of the duct supported.

J. Hangers for vertical ducts shall be as per SMACNA Duct Manual.

K. Stainless steel ductwork shall be supported with rod or angle type hangers, so that there will be no penetration of the stainless steel ducts.
3.04 CLEANING AND PROTECTION

A. Clean ductwork internally, unit by unit as it is installed of dust and debris. Clean external surfaces of foreign substances, which might cause corrosion, deterioration of metal or interfere with painting.

B. At end of ducts which are not connected to equipment or air distribution devices at the time of ductwork installation, provide temporary closure of polyethylene film or other covering.

END OF SECTION 23 31 13
PART 1 - GENERAL

1.01 GENERAL REQUIREMENTS

A. This Section is coordinate with and complementary to the General Conditions and Supplementary General Conditions of the Work, wherever applicable to Mechanical Work.

B. Section 01 31 46 - Special Requirements for Mechanical and Electrical Work shall apply.

1.02 DESCRIPTION OF WORK

A. The work includes the providing of all labor, materials, equipment, accessories, services and tests necessary to complete and made ready for operation by the Owner, all Duct Terminal Units as shown on the drawings and hereinafter specified.

1.03 QUALITY ASSURANCE

A. Firms regularly engaged in manufacture of this material with characteristics and capacities required, whose products have been in satisfactory use in similar service for not less than 10 years.

B. Provide product produced by the manufacturers, which are listed in Section 23 05 12 "Approved Manufacturer's List".

C. Provide equipment whose performance, under specified conditions, is certified by the manufacturer.

1.04 SUBMITTALS

A. Refer to Section 01 31 46 - Special Requirements for Mechanical and Electrical Work and submit shop drawings.

1.05 COORDINATION

A. Refer to Section 01 31 46 - Special Requirements for Mechanical and Electrical Work.

1.06 GUARANTEE

A. Refer to Section 01 31 46 - Special Requirements for Mechanical and Electrical Work.

PART 2 - PRODUCTS

2.01 VARIABLE VOLUME AIR TERMINAL UNITS (VAV’S)

A. Furnish and install pressure independent constant and variable air volume terminal units of size and capacities as shown on Drawings. Units shall be DESV as manufactured by Titus or approved equal.
B. Unit casings shall be 22 gauge galvanized steel and be fully lined with 1 inch, 1½ lb. density, neoprene coated fiberglass. The fiberglass shall comply with U.L.-181 for erosion, and NFPA 90A for fire resistivity. There shall be no cut edges of fiberglass exposed to the moving air stream.

C. Unit inlets shall be round or rectangular. Rectangular inlets shall have S and Drive connections. Attenuation section where called for in the Schedule shall be integral to the basic unit casing to minimize casing leakage and eliminate all field assembly.

D. Damper to be heavy gauge metal with Delrin self-lubricating bearings. Tight close-off. Damper leakage is less than 2% of nominal cfm at 3 inches sp. Terminals shall be certified under the ARI Standard 880 Certification Program and must carry the ARI Seal.

For optimum control, the inlet duct must be of the same size as the assembly inlet.

E. A section of straight duct 1½ diameters long shall be installed between the duct and the assembly inlet.

F. Units shall be tested in accordance with ARI Standard 880. Unit sound power levels (second thru seventh octave band) and minimize pressure drop ratings shall not exceed those in the schedules.

G. Pressure independent air terminal units shall operate over an inlet velocity range of 0 to 3000 fpm. Terminals shall incorporate a multipoint center averaging sensor. Measuring ports in series are not acceptable. Sensors must provide control signal accuracy within ± 5%. Cfm delivery shall be in accordance with (maximum-minimum) settings and/or as required by thermostat to satisfy space-served conditions. Adjustable minimum and maximum cfm limits gauge tee for flow measurement and balancing.

H. All actuators, controls, and circuitry shall be factory furnished and installed. Control and CFM settings must be easily accessible. Access shall also be provided to inspect, clean, and remove the velocity sensing device.

PART 3 - EXECUTION

3.01 INSPECTION

A. Contractor shall examine location where this equipment is to be installed and determine space conditions and notify architect in writing of conditions detrimental to proper and timely completion of the work.

B. Do not proceed with the work until unsatisfactory conditions have been corrected.

3.02 INSTALLATION

A. Install equipment where shown, in accordance with manufacturer's written instructions, and with recognized industry practices, to ensure that equipment comply with requirements and serve intended purposes.
B. Coordinate with other work as necessary to interface installation of equipment with other components of systems.

C. Check alignment and, where necessary (and possible), realign shafts or motors and equipment within tolerances recommended by manufacturer.

3.03 FIELD QUALITY CONTROL

A. Upon completion of installation of equipment, test equipment to demonstrate compliance with requirement. When possible, field correct malfunctioning units, then retest to demonstrate compliance. Replace units which cannot be satisfactorily corrected. Refer to Section 23 05 93 - Testing and Balancing.

END OF SECTION 23 36 00
SECTION 23 63 13
AIR-COOLED REFRIGERANT CONDENSERS

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 packaged, air-cooled refrigerant condensers for outdoor installation.

1.03 PERFORMANCE REQUIREMENTS

A. Seismic Performance: Air-cooled refrigerant condensers shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.

1. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."

1.04 ACTION SUBMITTALS

A. Product Data: For each air-cooled refrigerant condenser. Include rated capacities, operating characteristics, furnished specialties, and accessories. Include equipment dimensions, weights and structural loads, required clearances, method of field assembly, components, and location and size of each field connection.

B. LEED Submittals:

1. Product Data for Prerequisite EA 2: Documentation indicating that units comply with applicable requirements in ASHRAE/IESNA 90.1.
2. Product Data for Credit EA 4: Documentation indicating that air-cooled refrigerant condensers and refrigerants comply.

C. Shop Drawings: For air-cooled refrigerant condensers. Include plans, elevations, sections, details, and attachments to other work.

1. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
2. Wiring Diagrams: For power, signal, and control wiring.

1.05 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Plans, drawn to scale, on which the following items are shown and coordinated with each other, based on input from installers of the items involved:

1. Structural members to which air-cooled refrigerant condensers will be attached.
2. Liquid and vapor pipe sizes.
3. Refrigerant specialties.
4. Piping including connections, oil traps, and double risers.
5. Evaporators.
B. Seismic Qualification Certificates: For air-cooled refrigerant condensers, accessories, and components, from manufacturer.

C. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
   1. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
   2. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

D. Field quality-control reports.

E. Warranty: Special warranty specified in this Section.

1.06 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For air-cooled refrigerant condensers to include in emergency, operation, and maintenance manuals.

1.07 QUALITY ASSURANCE

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. Fabricate and label refrigeration system according to ASHRAE 15, "Safety Standard for Refrigeration Systems."

C. ASHRAE/IESNA 90.1 Compliance: Applicable requirements in ASHRAE/IESNA 90.1, Section 6 - "Heating, Ventilating, and Air-Conditioning."

1.08 COORDINATION

A. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in Section 033000 "Cast-in-Place Concrete."

B. Coordinate location of refrigerant piping and electrical rough-ins.

1.09 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace units that fail in materials or workmanship within specified warranty period.
   1. Warranty Period: The equipment shall be covered by a full parts and labor warranty from the manufacturer for a period of 12 months from the date of installation or acceptance by the owner, or 18 months from date of shipment, whichever occurs first.

1.10 ADDITIONAL SITE SERVICES

A. Trade management services by Skae Power Solutions, LLC shall be provided by the manufacturer to ensure the equipment is installed to the client and manufacturer requirements.
PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Manufacturers: Products specified are “APC InRow and Uniflair Direct Expansion Air Cooled Condensers” as manufactured by Schneider Electric, reference solution numbers “ISX0001554166”, and “ISX0001570855”. No alternate solutions or manufacturers shall be accepted.

2.02 MANUFACTURED UNITS

A. Description: Factory assembled and tested; consisting of casing, condenser coils, condenser fans and motors, and unit controls.

B. Refrigerant: R-410A.

C. Condenser Coil: Factory tested at 425 psig (2930 kPa).
   1. Tube: 1/2-inch- (13-mm-) diameter seamless copper.
   2. Coil Fin: Aluminum.
   4. Circuit: To match compressors with liquid subcooling coil.

D. Condenser Fans and Drives: Propeller fans with aluminum or galvanized-steel fan blades, for vertical air discharge; directly driven with permanently lubricated ball-bearing motors with integral current- and thermal-overload protection.
   1. Weather-proof motors with rain shield and shaft slinger.
   2. Extend grease lines to outside of casing.

E. Operating and Safety Controls: Include condenser fan motor thermal and overload cutouts; 115-V control transformer, if required; magnetic contactors for condenser fan motors and a nonfused factory-mounted and -wired disconnect switch for single external electrical power connection.
   1. Fan Cycling Control: Head pressure switches.

F. Casings: Galvanized or zinc-coated steel treated and finished with manufacturer's standard paint coating, designed for outdoor installation with weather protection for components and controls, and with the following:
   1. Removable panels for access to controls, condenser fans, motors, and drives.
   2. Plated-steel fan guards.
   3. Lifting eyes.

2.03 CAPACITIES AND CHARACTERISTICS

A. See Equipment Schedules on drawing for specific capacities and characteristics.

2.04 MOTORS

A. Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements for motors specified in Section 230513 "Common Motor Requirements for HVAC Equipment."
   1. Enclosure Type: Totally enclosed, fan cooled.
2. Motor Sizes: Minimum size as indicated. If not indicated, large enough so driven load will not require motor to operate in service factor range above 1.0.

2.05 SOURCE QUALITY CONTROL

A. Verification of Performance: Rate air-cooled refrigerant condensers according to ARI 460.

B. Testing Requirements: Factory test sound-power-level ratings according to ARI 270.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of air-cooled refrigerant condensers.

B. Examine roughing-in for refrigerant piping systems to verify actual locations of piping connections before equipment installation.

C. Examine walls, floors, and roofs for suitable conditions where air-cooled condensers will be installed.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

A. Install units level and plumb, firmly anchored in locations indicated; maintain manufacturer's recommended clearances.

B. Equipment Mounting:
   1. Install air-cooled condenser refrigerant condensers on cast-in-place concrete equipment bases. Comply with requirements for equipment bases and foundations specified in [Section 033000 "Cast-in-Place Concrete."

   2. Comply with requirements for vibration isolation and seismic control devices specified in Section 230548 "Vibration and Seismic Controls for HVAC."

C. Maintain manufacturer's recommended clearances for service and maintenance.

D. Loose Components: Install electrical components, devices, and accessories that are not factory mounted.

3.03 CONNECTIONS

A. Piping installation requirements are specified in Section 232300 "Refrigerant Piping." Drawings indicate general arrangement of piping, fittings, and specialties.

B. Install piping adjacent to machine to allow service and maintenance.
C. Refrigerant Piping: Connect piping to unit with pressure relief, service valve, filter-dryer, and moisture indicator on each refrigerant-circuit liquid line. Refrigerant piping and specialties are specified in Section 232300 "Refrigerant Piping."

3.04 FIELD QUALITY CONTROL

A. Perform tests and inspections.
   1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections, and to assist in testing.

B. Tests and Inspections:
   1. Perform electrical test and visual and mechanical inspection.
   2. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
   3. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation. Complete manufacturer's starting checklist.
   4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
   5. Verify proper airflow over coils.

C. Verify that vibration isolation and flexible connections properly dampen vibration transmission to structure.

D. Air-cooled refrigerant condensers will be considered defective if they do not pass tests and inspections.

E. Prepare test and inspection reports.

3.05 STARTUP SERVICE

A. Perform startup service.
   1. Complete installation and startup checks according to manufacturer's written instructions and perform the following:
      a. Inspect for physical damage to unit casing.
      b. Verify that access doors move freely and are weather-tight.
      c. Clean units and inspect for construction debris.
      d. Verify that all bolts and screws are tight.
      e. Adjust vibration isolation and flexible connections.
      f. Verify that controls are connected and operational.
   2. Lubricate bearings on fan motors.
   3. Verify that fan wheel is rotating in the correct direction and is not vibrating or binding.
   4. Adjust fan belts to proper alignment and tension.
   5. Start unit according to manufacturer's written instructions and complete manufacturer's startup checklist.
   6. Measure and record airflow and air temperature rise over coils.
   7. Verify proper operation of capacity control device.
   8. Verify that vibration isolation and flexible connections properly dampen vibration transmission to structure.
   9. After startup and performance test, lubricate bearings.
3.06 DEMONSTRATION

A. Train Owner’s maintenance personnel to adjust, operate, and maintain air-cooled refrigerant condensers.

END OF SECTION 23 63 13
SECTION 23 63 13
AIR-COOLED REFRIGERANT CONDENSER UNITS (ACCU-A & ACCU-B)

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 packaged, air-cooled refrigerant condensers for outdoor installation.

1.03 PERFORMANCE REQUIREMENTS

A. Seismic Performance: Air-cooled refrigerant condensers shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.

1. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."

1.04 ACTION SUBMITTALS

A. Product Data: For each air-cooled refrigerant condenser. Include rated capacities, operating characteristics, furnished specialties, and accessories. Include equipment dimensions, weights and structural loads, required clearances, method of field assembly, components, and location and size of each field connection.

B. LEED Submittals:

1. Product Data for Prerequisite EA 2: Documentation indicating that units comply with applicable requirements in ASHRAE/IESNA 90.1.
2. Product Data for Credit EA 4: Documentation indicating that air-cooled refrigerant condensers and refrigerants comply.

C. Shop Drawings: For air-cooled refrigerant condensers. Include plans, elevations, sections, details, and attachments to other work.

1. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
2. Wiring Diagrams: For power, signal, and control wiring.

1.05 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Plans, drawn to scale, on which the following items are shown and coordinated with each other, based on input from installers of the items involved:

1. Structural members to which air-cooled refrigerant condensers will be attached.
2. Liquid and vapor pipe sizes.
3. Refrigerant specialties.
4. Piping including connections, oil traps, and double risers.
5. Evaporators.
B. Seismic Qualification Certificates: For air-cooled refrigerant condensers, accessories, and components, from manufacturer.

C. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
   1. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
   2. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

D. Field quality-control reports.

E. Warranty: Special warranty specified in this Section.

1.06 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For air-cooled refrigerant condensers to include in emergency, operation, and maintenance manuals.

1.07 QUALITY ASSURANCE

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. Fabricate and label refrigeration system according to ASHRAE 15, "Safety Standard for Refrigeration Systems."

C. ASHRAE/IESNA 90.1 Compliance: Applicable requirements in ASHRAE/IESNA 90.1, Section 6 - "Heating, Ventilating, and Air-Conditioning."

1.08 COORDINATION

A. Coordinate size and location of roof curb. See details on Mechanical drawings.

B. Coordinate location of refrigerant piping and electrical rough-ins.

1.09 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace units that fail in materials or workmanship within specified warranty period.
   1. Warranty Period: The equipment shall be covered by a full parts and labor warranty from the manufacturer for a period of 12 months from the date of installation or acceptance by the owner, or 18 months from date of shipment, whichever occurs first.

1.10 ADDITIONAL SITE SERVICES

A. Trade management services by Skae Power Solutions, LLC shall be provided by the manufacturer to ensure the equipment is installed to the client and manufacturer requirements.
PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Manufacturers: Products specified are “APC InRow and Uniflair Direct Expansion Air Cooled Condensers” as manufactured by Schneider Electric, reference solution numbers “ISX0001554166”, and “ISX0001570855”.

2.02 MANUFACTURED UNITS

A. Description: Factory assembled and tested; consisting of casing, condenser coils, condenser fans and motors, and unit controls.

B. Refrigerant: R-410A.

C. Remote Air-Cooled Condensers
   1. Shall be designed for standard ambient temperature operations of 95°F with optional high ambient temperatures operations of 105°F and 115°F.
   2. Shall be a single or dual refrigerant circuit with copper tubes and aluminum fins, complete with low speed axial fan(s) to reduce the sound pressure level.
   3. Frame shall be made of galvanized steel with epoxy powder coat with weather-resistant capabilities.
   4. Electrical enclosure shall be weatherproof with a main disconnect mechanically interlocks with the electrical panel.
   5. Axial fans shall be fused and have heavy gauge, vinyl-coated, steel wire fan guards.
   6. Axial fan management shall be standard modulating type with phase cutting regulation, for correct operation during winter months down to temperature of 0°F.

D. Low Ambient Kits
   1. Air-cooled condensers with optional low ambient kit shall be designed for lowest allowable ambient temperature -40°F.
   2. Shall consist of either 18 lbs, 26 lbs or 60 lbs receiver based on the condenser refrigerant volume. Shall have a fusible plug, head pressure control valve, check valve, rotalock valves, heater with thermostat, wire harness, and fully insulated

E. Condenser Coil: Factory tested at 425 psig.
   1. Tube: 1/2-inch- diameter seamless copper.
   2. Coil Fin: Aluminum.
   4. Circuit: To match compressors with liquid subcooling coil.

F. Condenser Fans and Drives: Propeller fans with aluminum or galvanized-steel fan blades, for vertical air discharge; directly driven with permanently lubricated ball-bearing motors with integral current- and thermal-overload protection.
   1. Weather-proof motors with rain shield and shaft slinger.
   2. Extend grease lines to outside of casing.

G. Operating and Safety Controls: Include condenser fan motor thermal and overload cutouts; 115-V control transformer, if required; magnetic contactors for condenser fan motors and a nonfused factory-mounted and -wired disconnect switch for single external electrical power connection.
   1. Fan Cycling Control: Head pressure switches.
H. Casings: Galvanized or zinc-coated steel treated and finished with manufacturer’s standard paint coating, designed for outdoor installation with weather protection for components and controls, and with the following:
   1. Removable panels for access to controls, condenser fans, motors, and drives.
   2. Plated-steel fan guards.
   3. Lifting eyes.

2.03 CAPACITIES AND CHARACTERISTICS
   A. See Equipment Schedules on drawing for specific capacities and characteristics.

2.04 MOTORS
   A. Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements for motors specified in Section 230513 "Common Motor Requirements for HVAC Equipment."
      1. Enclosure Type: Totally enclosed, fan cooled.
      2. Motor Sizes: Minimum size as indicated. If not indicated, large enough so driven load will not require motor to operate in service factor range above 1.0.

2.05 SOURCE QUALITY CONTROL
   A. Verification of Performance: Rate air-cooled refrigerant condensers according to ARI 460.
   B. Testing Requirements: Factory test sound-power-level ratings according to ARI 270.

PART 3 - EXECUTION

3.01 EXAMINATION
   A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of air-cooled refrigerant condensers.
   B. Examine roughing-in for refrigerant piping systems to verify actual locations of piping connections before equipment installation.
   C. Examine walls, floors, and roofs for suitable conditions where air-cooled condensers will be installed.
   D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION
   A. Install units level and plumb, firmly anchored in locations indicated; maintain manufacturer’s recommended clearances.
   B. Equipment Mounting:
      1. Install air-cooled condenser refrigerant condensers on cast-in-place concrete equipment bases. Comply with requirements for equipment bases and foundations specified in [Section 033000 "Cast-in-Place Concrete."
2. Comply with requirements for vibration isolation and seismic control devices specified in Section 230548 "Vibration and Seismic Controls for HVAC."

C. Maintain manufacturer's recommended clearances for service and maintenance.

D. Loose Components: Install electrical components, devices, and accessories that are not factory mounted.

3.03 CONNECTIONS

A. Piping installation requirements are specified in Section 232300 "Refrigerant Piping." Drawings indicate general arrangement of piping, fittings, and specialties.

B. Install piping adjacent to machine to allow service and maintenance.

C. Refrigerant Piping: Connect piping to unit with pressure relief, service valve, filter-dryer, and moisture indicator on each refrigerant-circuit liquid line. Refrigerant piping and specialties are specified in Section 232300 "Refrigerant Piping."

3.04 FIELD QUALITY CONTROL

A. Perform tests and inspections.
   1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections, and to assist in testing.

B. Tests and Inspections:
   1. Perform electrical test and visual and mechanical inspection.
   2. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
   3. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation. Complete manufacturer's starting checklist.
   4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
   5. Verify proper airflow over coils.

C. Verify that vibration isolation and flexible connections properly dampen vibration transmission to structure.

D. Air-cooled refrigerant condensers will be considered defective if they do not pass tests and inspections.

E. Prepare test and inspection reports.

3.05 STARTUP SERVICE

A. Perform startup service.
   1. Complete installation and startup checks according to manufacturer's written instructions and perform the following:
      a. Inspect for physical damage to unit casing.
      b. Verify that access doors move freely and are weather-tight.
c. Clean units and inspect for construction debris.
d. Verify that all bolts and screws are tight.
e. Adjust vibration isolation and flexible connections.
f. Verify that controls are connected and operational.

2. Lubricate bearings on fan motors.
3. Verify that fan wheel is rotating in the correct direction and is not vibrating or binding.
4. Adjust fan belts to proper alignment and tension.
5. Start unit according to manufacturer's written instructions and complete manufacturer's startup checklist.
6. Measure and record airflow and air temperature rise over coils.
7. Verify proper operation of capacity control device.
8. Verify that vibration isolation and flexible connections properly dampen vibration transmission to structure.
9. After startup and performance test, lubricate bearings.

3.06 DEMONSTRATION

A. Train Owner's maintenance personnel to adjust, operate, and maintain air-cooled refrigerant condensers.

END OF SECTION 23 63 13
SECTION 23 81 26

INROW DIRECT EXPANSION (DX) SPLIT AIR CONDITIONING UNITS (AC-A)

PART 1 - GENERAL

1.01 SUMMARY

A. The environmental control system shall be designed specifically for precision temperature and humidity control applications. It will automatically monitor and control heating, cooling, humidifying, dehumidifying, and filtering functions for the conditioned space. The system shall be built to the highest quality engineering and manufacturing standards, and shall be floor mounted and configured for horizontal airflow, with draw-through air pattern, to provide uniform air distribution over the entire face of the coil.

1.02 DESIGN REQUIREMENTS

A. The system shall be as described in the following specification as manufactured by Schneider Electric.
   1. Model: ACRD100
   2. Total net cooling capacity: 31 MBH
   3. Sensible net cooling capacity: 34 MBH
   4. Return air dry bulb temperature: 72 - 110 °F DB.
   5. Return air wet bulb temperature: 60 - 72 °F WB.
   6. Humidity: 0 - 95% RH.
   7. Air Volume: 2290 CFM
   8. Electrical supply: 208 V, 60 Hz.

1.03 SUBMITTALS

A. Submittals shall be provided with the proposal and shall include: capacity data, electrical data, physical data, electrical connection drawing, and piping connection drawing.

1.04 QUALITY ASSURANCE

A. The system shall be completely factory-tested prior to shipment. Testing shall include, but not be limited to: complete pressure and leak testing to ensure system integrity, “Hi-Pot” test, and controls calibration and settings. Each system shall ship with a completed test report to verify completion of factory testing procedure. The system shall be NTRL listed, MCA, and electrical system shall be UL Listed to UL 1995 and CSA 22.2 No. 236.

B. 1.5 WARRANTY

C. The equipment shall be covered by a full parts and labor warranty from the manufacturer for a period of 12 months from the date of installation or acceptance by the owner, or 18 months from date of shipment, whichever occurs first.

D. 1.6 ADDITIONAL SITE SERVICES

E. Trade management services by Skae Power Solutions, LLC shall be provided by the manufacturer to ensure the equipment is installed to the client and manufacturer requirements.
PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Product specified is “APC InRow Direct Expansion Air Conditioner” as manufactured by Schneider Electric, reference solution number “ISX0001554166”.

2.02 2.2 STANDARD COMPONENTS

A. CABINET CONSTRUCTION

1. Exterior panels shall be 18 gauge steel with 3.7 lb/ft³ (60 kg/m³) density foam insulation. Insulation complies with UL94. Front and rear exterior panels shall be 18 gauge perforated steel with 80% open free area, and equipped with a keyed lock to provide a means of securing access to the internal components of the unit.

2. The frame shall be constructed of 16 gauge formed steel welded for maximum strength. All units shall provide maintenance from the front and rear, allowing units to be placed within a row of racks.

3. All exterior panels and frame shall be powder coated for durability and attractive finish. Exterior frame and panel color shall have color values: L = 13.44, a = 0.43, b = -2.63.

4. Units shall include casters and leveling feet to allow ease of installation in the row and provide a means to level the equipment with adjacent IT racks.

B. FANS

1. Variable speed direct drive mixed flow DC fan assembly (ACRD100 series):
   a. The unit shall be configured for draw-through air pattern to provide uniform air flow over the entire face of the coil. Each unit shall include six 200 mm mixed flow direct drive DC axial fans. Each fan assembly should be designed to provide 180.1 l/s (381.7 CFM) for total unit airflow of 1080.76 l/s (2290 CFM).
   b. Variable speed fans: Fans shall be variable speed capable of modulating from 30-100%. Fans shall soft start to minimize in-rush current.
   c. Fan protection: Each fan assembly shall consist of a plastic injection molded bezel with integral fan discharge finger guard. Inlet of the fan should include a cage type finger guard.
   d. Operation and service: The unit should be capable of operation in the event of a fan failure. Fans shall be replaceable while the unit is in operation.

C. MICROPROCESSOR CONTROLLER

1. Monitoring and Configuration: The master display shall allow monitoring and configuration of the air conditioning unit through a menu-based control. Functions include status reporting, set-up, and temperature set points. Three LEDs report the operational status of the connected air conditioning unit.

2. Controls: The microprocessor controller shall come equipped with control keys to allow the user to navigate between menus, select items, and input alpha numeric information.

3. Alarms: The microprocessor controller shall activate a visible and audible alarm in the occurrence of the following events:
   a. All series:
      1) Cool Fail
      2) Air filter clogged
      3) Return air sensor fault
      4) Supply air sensor fault
      5) Rack temperature sensor fault
      6) High discharge pressure
      7) Low suction pressure
      8) Fan fault
      9) Water detected (if optional leak detector used)
10) Check condensate management system  
11) Air filter run hours violation  
12) Group communication fault  
13) Supply air high temperature violation  
14) Return air high temperature violation  
15) Filter DP sensor failure  
16) Suction pressure sensor failure  
17) Discharge pressure sensor failure  
18) Persistent high discharge pressure fault  
19) Rack inlet temperature high violation  
20) External communication fault  
21) Internal communication fault  
22) On standby input contact fault  
23) A-link isolation relay fault  
24) Condensate pan full  
25) Upper fan power supply fault  
26) Lower fan power supply fault  
27) Suction temperature sensor failure  
28) Persistent low suction pressure fault  
29) Factory configuration not completed  
30) Liquid refrigerant sensor failure  

4. Logging: The microprocessor controller shall log and display all available events. Each alarm log shall contain time/date stamp as well as operating conditions at the time of occurrence. Controller shall display the run time hours for major components.

D. NETWORK MANAGEMENT CARD – PROVIDE EITHER 1 OR 2  
1. TCP/IP serial adapter: This field-installed serial adapter card shall plug directly into the microprocessor and allow communication between the microprocessor and the customer network or supervision system via a single Ethernet connection in BACNet IP (pCoWeb), SNMP, Modbus IP, and TCP/IP simultaneously. 
2. RS485 serial adapter: Field-installed serial adapter card that shall plug directly into the microprocessor to allow communication via an RS485 connection between the microprocessor and the supervision system of the customer using modus RTU or Johnson Controls Metasys protocol.

E. COOLING COIL AND CONDENSATE PAN  
1. ACRD100 series Direct Expansion: The cooling coil shall use corrugated aluminum fin and copper tube coils. The coil header is equipped with a drip plate in the bottom to capture and direct the condensation accumulating on the suction header tube to the drain pan.

F. COMPRESSORS  
1. Scroll Compressor (ACRD100 series and ACRD200 series only)  
   a. The high EER and few moving parts of scroll compressors shall provide efficient and reliable operation. Scroll technology has unparalleled ability to withstand liquid refrigerant “slugging,” which is a major cause of compressor failure.

G. CONDENSATE PUMP  
1. ACRD100 series: factory installed and wired condensate pumps shall pump at 9 g/hr at 16 ft of head. Each pump shall have dual internal floats.

H. CONDENSATE RESERVOIR  
1. Each pump shall have a condensate reservoir made of polymeric materials to prevent corrosion.
I. FILTERS
   1. ACRD100 series:
      a. The filter shall be high capacity 2 in. pleated, UL 900 Class 2, moisture resistant,
         with average atmospheric dust spot efficiency of 30%, per AHRAE Standard 52.1,
         MERV 8 per ASHRAE 52.2.

J. TEMPERATURE AND HUMIDITY SENSORS
   1. Internal Temperature Sensors: Thermistor temperature sensors shall be mounted behind
      the front and rear doors to provide control inputs based on supply and return air
      temperature. Sensor accuracy shall be within +/- 1 degree F accuracy.
   2. Remote Temperature Sensors
      a. ACRD100 series: One remote rack inlet temperature sensor shall be shipped with
         the unit to provide control input based on rack inlet temperature.

K. AMBIENT PROTECTION
   1. InRow DX AC (ACRD100) systems shall be equipped with a recommended outdoor
      flooded receiver package suitable for ambient temperatures down to -40C/-40F.

L. CABLE WATER DETECTOR
   1. A leak detection sensing cable shall be shipped loose with the unit. If water or other
      conductive liquids contact the cable anywhere along its length, the main controller visually
      and audibly annunciates the leak.
   2. The detector shall be provided with a 20 ft of cable. Cable may be cascaded up to 80 ft.

M. BRIDGE POWER CABLE TROUGH
   1. An overhead power distribution bridge, that sits between adjacent NetShelter racks and
      allows for removal of the unit without disrupting the overhead power cabling, is available
      as an accessory.
   2. Cable trough shall be constructed of 16 gauge cold rolled steel with a black powder finish.

N. BRIDGE DATA PARTITION
   1. An overhead cable distribution, that sits between adjacent NetShelter racks and allows for
      removal of the unit without disrupting overhead cabling, is available as an accessory.
   2. Data partition shall be constructed of 16-gauge cold rolled steel with a black powder finish.

PART 3 - EXECUTION

   A. See 23 63 13 “Air-Cooled Refrigerant Condensers Specifications.”

END OF SECTION 23 81 26
PART 1 - GENERAL

1.01 SUMMARY

A. The environmental control system shall be designed specifically for precision temperature and humidity control applications. It shall automatically monitor and control cooling and dehumidifying, as well as filtering functions for the conditioned space. The system shall be built to the highest quality engineering and manufacturing standards and shall be floor mounted and configured for either downflow discharge of conditioned airflow with either front return airflow. The draw through air pattern shall provide uniform air distribution over the entire face of the cooling coil.

1.02 DESIGN REQUIREMENTS

A. The system shall be described in the following specification as manufactured by Schneider Electric
1. Model: TDAV0511G
2. Total cooling capacity: 15.9 kW / 60 MBH
3. Sensible cooling capacity: 15.9 kW / 60 MBH
4. Return air temperature: 75 ºF-DB
5. Return air temperature: 61 ºF-WB
6. Humidity: 45% RH
7. Air quantity: 3500 CFM
8. External Static Pressure: 0.2 in. WC
9. Electrical supply: 480V, 3ph, 60 Hz

1.03 SUBMITTAL

A. Submittal are provided with the proposal and shall include the following: capacity data, electrical data, physical data, and electrical and mechanical piping connections

1.04 ADDITIONAL SITE SERVICES

A. Trade management services by Skae Power Solutions, LLC shall be provided by the manufacturer to ensure the equipment is installed to the client and manufacturer requirements.

PART 2 - PRODUCTS

2.01 CABINET AND FRAME CONSTRUCTION

A. The structure of the unit shall be characterized by a metal framework and internal parts made from hot zinc plated sheet steel.

B. These profiles are connected together by structural rivets designed to ensure sturdy assembly and which are capable of withstanding severe transportation and handling conditions. The units are
also equipped with internal panels for shutting off the compartments affected by airflow; these internal panels are made from hot zinc plated sheet metal and ensure the following:
1. Reduction in the noise transmitted through the paneling
2. Air tightness even without external panels so that the units can also operate with the doors open during servicing
3. The possibility of inspecting the internal elements without interfering with the operation of the unit and, more importantly, with the unit in operation

C. The external panels shall be 1-mm thick, coated on the external side with RAL 9003 epoxy-polyester paint, which guarantees long-term durability. The front panels are attached to the framework by means of rapid coupling fasteners. The external panels are double-walled, lined with fiberglass heat-insulating material 15 mm (0.59 in.) in thickness and 20 kg/m³ (.00073 lbs/in.³) of density.

2.02 FAN/BLOWER SECTION

A. Electronically Commutated Fans
1. Shall be plug/type, single inlet, and are dynamically balanced. The drive package is direct drive, electronically commutated (EC), and variable speed. The fans shall be located to draw air over the coil to ensure even air distribution and maximum coil performance.
   a. TDAV0511: The single fan motor shall be 3.8 hp being able to generate a nominal 5946 CMH (3500 CFM) at 50.0 Pa (0.20 in. WC) external static pressure.

2.03 RETURN AIR FILTERS

A. The standard return air filters shall be MERV 8 per ASHRAE Standard 52.2.
1. Return air filter shall be 95-mm (3.7-in.), deep, pleated, and replaceable from the front of the unit.

2.04 UNIFLAIR LE CONTROLLER WITH 7-IN. LCD TOUCH SCREEN DISPLAY

A. The microprocessor controller shall utilize proportional/integral/derivative (PID) logic as a precision control method, allowing for custom tuning of control variables to achieve desired system response.
1. Shall manage unit operation
2. The controls shall be composed of the following components.
   a. Microprocessor control board housed inside the electrical cabinet.
   b. Seven-inch LCD touch screen display (color) externally mounted and viewed from the front of the unit.
3. The microprocessor control board shall contain the settings and programs of all the stored operating parameters which can be used, viewed, and set on the user display interface (touch screen display).
4. The user interface (7-in. LCD touch screen display) shall be externally mounted, password protected, and menu driven.
5. The user interface (touch screen display) shall allow modification of adjustable parameters.

B. Network Management Card
1. The unit shall include a network management card embedded in the touch screen display (user interface) to provide management through a computer network TCP/IP (MODBUS, SNMP, StruxureWare, or Web).
2. Management through the network shall include the ability to change setpoints and view and clear alarms.

C. User Interface (LCD Touch Screen Display)
1. The user interface shall consist of the following:
   a. Seven-inch LCD touch screen display to move between screens and change parameters.
   b. Network Management Card
2. The microprocessor board is connected to the user interface (display) by a mini-HDMI cable.

D. Controller System Functions
1. Temperature and Humidity Control based on adjustable setpoints.
2. Alarm signaling local or via remote
3. Alarm History, logs 100 recent events with date and time stamp
4. Alarm signal contacts configured on the User Interface (Touch Screen Display)
5. "Automatic Restart" after power is restored
6. Remote unit on/off
7. Two levels of password protection
   a. Settings Menu
   b. Service Menu
8. Clock/date functionality
9. Hour Meter calculates operating hours and start up cycles of major components
10. View status of all unit components and sensors connected to the control board.
11. Manage LAN Network with the potential of programming (one (1) unit) rotating or (two (2) stand-by) units and operating these units "Setback Mode" settings based on average temperature.
12. "Manual Override" function shall allow manual control of the main components without excluding possible remote control.
13. Communication with a supervision system using the RS485 serial board, LON FFT10 by TREND and PCOWEB.
14. Symbols appear on the user interface (touch screen display) to show status of unit and components.
15. Potential of setting a dual setpoint for temperature (in both cooling and heating) and humidity (both when dehumidifying and humidifying), which can be modified from a remote terminal.

E. User Interface (Touch Screen Display) Menu
1. Language Selection: The user interface (touch screen display) shall display the language that has been defined by the regulation program selected in the flash memory options (EN = English, SP = Spanish, FR = French).
2. Imperial Measurement Selection: Shall display options for conversion of the following parameters:
   a. Celsius to Fahrenheit
   b. Bar to PSI
   c. Pascal to inches H2O
3. Program Identification: Shall display the firmware configuration of the system.
   a. Firmware revision number
   b. Firmware revision date
   c. Product family
4. Status Screen(s): The user interface (touch screen display) shall display essential information of the system state.
   a. Overview Screen
      1) Displays room temperature and the percentage of humidity.
      2) Displays the information regarding unit status.
      3) Displays active alarms.
   b. Home Screen: Used to navigate to other screens.
   c. Alarms Screen: Used to display active alarms.
   d. About Screens: Used to display software version, bios, boot, and unit serial number.
   e. On/Standby Screen: Used to put the system into operation or standby mode.
   f. Set Points Screen: Used to adjust the setpoint values
   g. Configuration Screen: Used to configure (cooling unit is pre-set in the factory: any changes will require a pass code).
      1) The unit parameters
      2) Display (Imperial or Metric)
      3) Factory system defaults
      4) Network connectivity
   h. Logs Screen: Used to display the event log and export log data.

F. Setpoints
1. Temperature and humidity setpoints shall be pre-set at the factory so the control functions correctly, maintaining standard conditions in the room. This screen shall display the following:
   a. Return Air Setpoint
   b. Return Air Temperature Sensitivity
   c. Dehumidification Setpoint, Relative Humidity
   d. Dehumidification Proportional Band Relative Humidity
   e. Setpoint External Offset Temperature Range Start
   f. Setpoint External Offset Temperature Range End Delta
   g. Supply Air High Temperature Alarm
   h. Setpoint External Offset Voltage Range Start
   i. Setpoint External Offset Voltage Range End
   j. Offset Setpoint Anti-Hunt Time
2. Sleep Mode Settings: Shall allow a standby unit to activate and take control of the room conditions. The activation from "Sleep Mode" shall be programmed according to desired environmental conditions. This "Sleep Mode" shall be used in a "Cooling Assist Mode" in conjunction with grouping to allow a standby unit in the group to activate when the following is not met:
   a. Cooling Setpoint
   b. Fan Cycle
   c. Fan Cycle Time
   d. Dehumidification Setpoint
3. Counter/Run Hour Meter Settings: Shall enable setting the maintenance intervals for the components of the unit, establishing a threshold for operation hours. When a component reaches the limit, the microprocessor shall signal the maintenance request on the user interface (touch screen display).
4. Alarm Relay Settings: Shall enable a status change of the alarm signal contact type (N.C. or N.O) for Alarm "A" and "B".
5. LAN (Grouping) Settings: Uniflair LE microprocessor shall enable through the user interface (touch screen display) the automatic management of a local network (LAN)
connected to more than one (1) unit, (up to maximum of ten (10)), of which some are in primary operation and other units are in standby mode, (up to maximum of two (2) units can be in standby mode.

6. Stand-by Rotation Alarms: This screen shall be displayed if the local network is configured and is used to manage the start-up of the stand-by unit when an alarm is activated.

7. Network Settings: Shall enable the setting the network information for the NMC (Network Management Card).
   a. TCP/IPv4
   b. TCP/IPv6

8. Manual Control: Shall assist maintenance and checks or in cases of emergency; the following individual components can be activated manually and independently of the control process:
   a. Unit Fan (Unit Start-up)
   b. Compressor(s) 1/2/3/4
   c. Dehumidification Function
   d. Activate 0/1 analog output
   e. Alarms/Events
      1) Event Log: Shall save status information and a message with a date and time stamp for each alarm, event, or system configuration change.
      2) Syslog: Shall be used to export event logs from the unit to a connected server.
      3) Description of Alarm Events: Shall be displayed on the user interface (LCD touch screen Display).
         • High/Low Temperature Threshold Exceeded
         • High/Low Humidity Threshold Exceeded
         • Supply Air Temperature Threshold Exceeded
         • Return Air Sensor Error Detected
         • High/Low Airflow
         • Smoke/Fire Detected
         • Electronic Expansion Valve Error
         • High/Low Refrigerant Pressure
         • Primary/Secondary Power Source Unavailable
         • Dual Circuit Expansion Board Error Detected
         • Digital 2/4/6 Input
         • Supply Air Sensor Error Detected
         • Air Filter Clogged
         • Water Detected
         • Humidity Sensor Error Detected
         • EEPROM Error Detected
         • Wrong Password Error

2.05 SCROLL COMPRESSORS

A. The Schneider Electric Uniflair LE Direct Expansion (DX) systems shall utilize scroll compressors. The scroll compressors shall be mounted with anti-vibration support inside a dedicated mechanical space, which shall be separated from the air flow of the system, (exception shall be TU models) to ensure ease of maintenance inspection during operation.

1. Scroll compressor shall have the following standard features:
   a. Crankcase Heaters (Factory Mounted)
   b. Integrated Overheat Protection
c. High Pressure Switch Protection

2.06 REFRIGERANT (R-410A)
   A. The refrigeration system shall be designed to use R-410A.

2.07 ELECTRONIC EXPANSION VALVE (EEV)
   A. Direct Expansion (DX) systems shall electronic expansion valves.

2.08 EVAPORATOR COIL
   A. The evaporator coil shall be designed with a large front surface area in order to have an elevated SHR and a low air-velocity speed to prevent condensation carryover issues. The evaporator coil shall be made from copper tubes mechanically expanded on aluminum fins, complete with a hydrophilic coating to reduce the surface tension between the water and the metal fin surface promoting sheeting of the condensation and avoiding the risk of condensation carryover.
   B. The evaporator coil shall be built with two circuits, which are linked together to maximize the surface area of the coil regardless of which circuit is operating.
   C. The evaporator condensate drain pan shall be constructed of stainless steel.

2.09 AIR COOLED
   A. Air-Cooled Systems
      1. The indoor unit shall consist of an evaporator section including evaporator coil, blower package, controls, electrical section, and refrigerant piping internal to the evaporator coil and compressor will be sealed with a positive pressure of dry nitrogen.
      2. Refrigerant piping required for interconnecting the evaporator and condenser sections shall be field supplied and installed to include the refrigerant R-410A required to charge the system.
   B. Remote Air-Cooled Condensers
      1. Shall be designed for standard ambient temperature operations of 95°F with optional high ambient temperatures operations of 105°F and 115°F.
      2. Shall be a single or dual refrigerant circuit with copper tubes and aluminum fins, complete with low speed axial fan(s) to reduce the sound pressure level.
      3. Frame shall be made of galvanized steel with epoxy powder coat with weather-resistant capabilities.
      4. Electrical enclosure shall be weatherproof with a main disconnect mechanically interlocks with the electrical panel.
      5. Axial fans shall be fused and have heavy gauge, vinyl-coated, steel wire fan guards.
      6. Axial fan management shall be standard modulating type with phase cutting regulation, for correct operation during winter months down to temperature of 0°F.
   C. Low Ambient Kits
      1. Air-cooled condensers with optional low ambient kit shall be designed for lowest allowable ambient temperature -40°F.
2. Shall consist of either 18 lbs, 26 lbs or 60 lbs receiver based on the condenser refrigerant volume. Shall have a fusible plug, head pressure control valve, check valve, rotolock valves, heater with thermostat, wire harness, and fully insulated.

2.10 PROVIDE ADDITIONAL COMPONENTS

A. Condensate Pump
   1. High Temperature Condensate Pump
      a. Shall be available for applications which include a humidifier and have a capacity of 306 GPH at 48 ft. with a maximum lift of 60 ft..
      b. The pump shall be designed with an integral dual float switch, pump, motor assembly, and a one-gallon reservoir. The secondary float shall generate a signal to the local alarm and shut the unit down upon a high-water condition.
      c. The pump shall be rated for 230/460VAC with a 3/8 in. ID discharge line size at an entering water temperature of 212°F.
      d. The condensate pump shall be shipped loose for field installations.
      e. The condensate pump shall be powered from within the unit via a terminal block located in a junction box inside the unit.

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B. Water Detection Options (Tape or Spot)
   1. Spot Water Detection Sensor: Shall include a control module to be installed inside the electrical panel and an external water sensor to be field installed. The maximum wiring distance is 1640 ft. The water detector sensors can be configured to stop the unit from running upon activating a water detection alarm.

C. Smoke Detector / Firestat Factory Installed
   1. Smoke/Firestat Option: Shall have a Smoke and Fire Sensor comprising a control module to be installed inside the electrical panel and an external sensor. The smoke/fire stat shuts the unit down and provides a visual and audible alarm at the user interface (LCD touch screen display).
   2. Remote Fire and Smoke Relay - Shall provide a 24V relay for external connection of the smoke or fire sensor. The fire stat shuts the unit down and provides a visual and audible alarm at the user interface (LCD touch screen display).

D. Communication Options – Provide Either 1 or 2
   1. TCP/IP serial adapter: This field-installed serial adapter card shall plug directly into the microprocessor and allow communication between the microprocessor and the customer network or supervision system via a single Ethernet connection in BACNet IP (pCoWeb), SNMP, Modbus IP, and TCP/IP simultaneously.
   2. RS485 serial adapter: Field-installed serial adapter card that shall plug directly into the microprocessor to allow communication via an RS485 connection between the microprocessor and the supervision system of the customer using modus RTU or Johnson Controls Metasys protocol.

E. Floor Stands
   1. Seismic Floor Stands
      a. Shall be in fixed heights of 12 in., 18 in., 24 in. and 36 in..
      b. Shall be seismically tested and rated to a force of Sds = 2.5 g. Anchorage to the structure was assumed to be 2.5 in. HILTI kwikbolt TZ expansion anchors with 2
in. embedment into a 4-in. thick, nominal weight concrete slab with the strength of $f_{c'} = 4000$ psi.

F. Dampers
1. Motorized Dampers
   a. The motorized damper shall be 5.95 in. in height.
   b. The damper shall have a motorized actuator that receives a 0-10V signal from the microprocessor.
   c. The motorized damper shall be factory mounted and wired on top of the cooling unit.

G. Sub-bases
1. Sub-base(s) shall be 200-mm (8-in.) high for piping and cable entry under the unit. The external panels are 1-mm (0.039-in.) thick and are coated on the external side with RAL 9003 epoxy-polyester paint for long-term durability. The side panels shall have knockouts for piping and electrical control wiring entry connections.

H. Front Supply Plenums
1. Front Supply Plenum shall be 20-in. in height and provide air discharge in the room using adjustable grills.
   a. The external panels shall be 0.039-in. thick and are coated on the external side with RAL 9003 epoxy-polyester paint for long-term durability. The external panels shall be double walled and lined internally with 0.59-in. thick, 0.00072 lb/in.\(^3\) of density, fiberglass, heat-insulating material.

I. Top Return Plenums
1. Return Plenum shall be 20-in. in height installed on the top of the unit. The external panels shall be 0.039-in. thick and are coated on the external side with RAL 9003 epoxy-polyester paint for long-term durability. The external panels shall be double walled and lined internally with fiberglass heat-insulating material 0.59-in. thick, 0.00072 lb/in.\(^3\) of density.

PART 3 - EXECUTION

3.01 INSTALLING COOLING UNITS

A. General
1. End user shall install cooling units in accordance with the manufacturer unpacking and installation instructions and guidelines. Install units plumb and level and securely attached in locations indicated. Maintain manufacturers recommended service clearances.

B. Electrical
1. End user shall install and connect electrical devices furnished by manufacturer that are field installed per installation instructions and wiring diagrams supplied with the equipment. Ensure the electrical schematic of the system is submitted to electrical contractor for reference.

C. Piping Connections
1. Equipment mechanical connections shall be installed per installation documentation provided by the manufacturer. Ensure the mechanical piping schematic of the system is
submitted to the mechanical contractor for reference. All equipment piping and connections shall meet local code requirements as well as field leak-checking procedures.

3.02 FIELD QUALITY CONTROL

A. End user shall start-up cooling units per guidance provided with manufacturer operation and maintenance documentation. Test controls and operation of the system to demonstrate compliance with the site requirements and specifications.

END OF SECTION 23 81 27
SECTION 26 05 00 – GENERAL PROVISIONS FOR ELECTRICAL WORK

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. This Section is to coordinate with and be complementary to the General Conditions and Supplementary General Conditions of the work, and Division 01 Specification Sections wherever applicable to Mechanical and Electrical Work.

B. Section 01 31 46 – Special Requirements for Mechanical and Electrical Work shall apply.

C. "The General Conditions of the Contract for Construction", is hereby made a part of the specifications for the Electrical, Fire Signal, Security to the same extent as if written out in full. Where any article of the General Conditions is supplemented by the specifications, the provisions of such articles shall remain in effect and all the supplemental provisions shall be considered as added thereto. When any such article is amended, voided or superseded by the specifications the provisions not specifically amended, voided or superseded shall remain in effect.

D. Apply provisions of this division equally and specifically to Sections supplying labor and/or equipment and/or materials as required under Electrical Sections of Specifications.

E. Drawings are diagrammatic and are a graphic representation of contract requirements to the best available standards at the scale required.

F. Light and power and miscellaneous systems riser diagrams, as well as schematic diagrams, generally indicate connections to be used for various systems and equipment. Systems conduit and wiring shall be as required for the actual systems installed on this Project. Provide all work shown on diagrams whether or not it is duplicated on the plans.

1.2 SCOPE OF WORK

A. The Specifications and the accompanying drawings are intended to secure the provisions of all material, labor, equipment, and services necessary to install complete, tested, and ready for operation the Electrical Systems in accordance with the Specifications and Drawings. All systems shall be complete with all necessary appurtenances and minor auxiliaries, including pull boxes, offsets to clear interferences, and supports which are not shown but are needed to make each system complete in every respect. All work described in the Specifications and not shown on the Drawings, or vice versa, shall be furnished in complete working order. If mention has been omitted of any item of work or material, necessary for completion of the system, then such items must be and are hereby included.

1. Modification to the secondary service (in coordination with Utility Company).
2. Power and light distribution system (120/208V and 277/480V).
3. Transformers indoor dry type.
4. Panelboards lighting, power and distribution.
5. Fuses and/or circuit breakers.
6. Installation and wiring of individual controllers including starters and VFDs. Erecting starter racks where required.
7. Control devices, only where specifically called for.
8. Safety and disconnect switches, unless furnished with starters or on equipment. Weatherproof devices for outdoor equipment.
10. Raceways and installation components.
11. Wire and Cable.
12. Overhead cable tray system.
13. Electrical work in connection with equipment specified and furnished under other Sections of the Specifications, or furnished by the Owner under separate contracts or direct purchase.
14. Grounding system in conformance with applicable codes.
15. Wiring devices.
16. Lighting fixtures, interior and exterior, including lamps, as described in these Specifications, and in accordance with Schedule on Drawings.
17. Occupancy sensors for light control.
18. Emergency battery packs in selected fluorescent lighting fixtures.
19. Power wiring for fan coil, incremental units.
20. Power and control wiring for unit and cabinet heaters.
22. Automatic transfer switch(es).
23. Furnishing of access doors.
24. Furnishing and setting of all sleeves through the floors, roof and wall, where required including waterproofing and fireproof sealing and cap flashing.
25. The Contractor shall be responsible for maintaining the fire resistance rating of any rated wall, ceiling or floor for which his work partially or fully penetrates. Work which could potentially penetrate or breach a rated wall, ceiling or floor including, but are not limited to flush-mounted recessed panel boards, conduit and pipe, ducts, equipment, supports or reinforcements. For any such situation, the Contractor shall provide the necessary fire stopping material, insulation or system in order to maintain the fire rating of the wall, ceiling or floor. The Contractor is responsible for reviewing the building construction drawings, including those of the architectural and structural trades, in order to determine the fire resistance ratings for the walls, floors and ceilings for which their work will partially or fully penetrate.
26. Hardware, such as inserts, bolts, etc., associated with concrete pads.
27. Cutting and core drilling associated with electrical work.
28. Prime painting, where required for electrical equipment and installation.
29. Removal of existing electrical work in accordance with Architectural Demolition Scheme or as directed and required. Restoration of electrical service in affected adjoining areas which are to continue to function.
30. Interconnections and interfacing with pertinent existing systems shall be as required to achieve fully integrated operation of systems, as described in these Specifications and/or shown on Drawings.
31. Provision for temporary light and power.
32. Paying all fees as required by governing agency and performing all testing as required by governing agency and adjusting and furnishing all certificates of approval, and those of Underwriters.
33. UPS system for IT equipment, complete with batteries, etc.
34. PDU distribution panels with integral transformers.
35. Modification of existing switchboards.
36. Local disconnecting switches.
37. Hospital specialty items.
38. Film viewers.
39. Communications, alarm and signaling systems, including the following:
   a. Fire alarm, smoke and heat detection, sprinkler alarm (including preaction controls) systems for IT room.
   b. Furnishing, installing and connecting of all alarm initiating and signaling devices, except as noted hereinafter:
      1) Installation of duct smoke detectors.
      2) Furnishing and installation of sprinkler devices, including preaction and deluge valves.
   c. All fan shutdown wiring and furnishing, installing and connecting equipment required for fan shutdown.
   d. Empty conduit system and low voltage wiring, including terminal cabinets and plywood backboards.
   e. Empty conduit system for low voltage wiring supplied and installed under other sections, including terminal cabinets and plywood backboards.
   f. Closed circuit television system (security and/or media) raceways only.
   g. Door security alarm system.

1.3 QUALITY ASSURANCE AND STANDARDS

A. The complete installation shall be in accordance with the applicable requirements and standards of National Electrical Manufacturers Association (NEMA), National Fire Protection Association (NFPA), New York City Electrical Code (NYCEC), National Electrical Code (NEC), Institute of Electrical and Electronic Engineers (IEEE), American National Standard Institute (ANSI), Occupational Safety and Health Administration (OSHA), National Electrical Safety Code, Insulated Cable Engineers Association (ICEA), Underwriters' Laboratories (UL), Factory Mutual (FM), Factory Insurance Association (FIA), Local Power Company, Local Telephone Company, along with state and local municipal codes and all applicable codes and authorities having jurisdiction. Any items or requirements noted in the Specifications or on Drawings, which conflict with these shall be referred to the Engineer for decision. All work necessary to comply with these requirements shall be performed by the Contractor at no extra cost to the Owner.

B. Where reference is made to the National Electrical Code only, without mention of the New York City Electrical Code, the requirements of the latter, where they differ from the former, shall take precedence, where applicable.

C. All electrical equipment, materials and appliances shall have the listing of the Underwriters' Laboratories, Inc., and shall bear labels attesting to UL listing, and types approved by Municipal Departments having jurisdiction.
1.4 REMOVAL AND RELOCATION OF EXISTING WORK

A. Disconnect, remove and/or relocate electrical material, equipment, devices, components, and other work noted and required by demolition or alterations in existing construction.

B. Provide new material and equipment required for relocated equipment.

C. Remove conductors from existing raceways to be rewired. Clean raceways as required prior to rewiring.

D. Dispose of removed raceways and wiring.

E. Dispose of removed electrical equipment as directed by Hospital.

F. All electrical work in adjoining areas which is indicated on the Drawings to continue to function but is affected by demolition work shall be reconnected and restored to present function as part of the electrical system of the Buildings. Maintain service continuity to all essential areas at all times. Make provisions for temporary connections during demolition of active feeders.

G. Connect new work to existing work in a neat and acceptable manner, with minimum interference to existing facilities.

H. Maintain continuous operation of existing facilities affected by the work.

I. Alarm and emergency systems are to be interrupted only with the written consent of the Owner.

J. Temporary shutdowns when required, to be made only with written consent of Owner at times not to interfere with normal operations.

K. Where indicated on the Drawings or required by the alteration scheme, the Contractor shall remove all electrical outlets, switches, and other devices, complete with associated wiring, conduit, etc., from partitions, walls, and floors that are to be removed. When the removal of these makes dead electrical wiring that is to remain, Contractor shall install junction boxes or other devices necessary to make the circuits affected continuous and ready for operation. Otherwise, wiring shall be removed back to the nearest electrical outlet box that is to remain, or to the panelboard.

L. All raceways which become exposed beyond finished surfaces because of the alteration work shall be removed and rerouted behind finished surfaces.

M. Wiring that is to be removed as a result of demolition work, but is required to continue to function, shall be interrupted at convenient locations, rerouted (new wiring and conduits) and reconnected for continuation of their original function. New wiring extensions shall match existing ones in all respects, conductor ampacity, conduit size, etc. Contractor shall make arrangements for use of emergency power during demolition of normal service.
1.5 ALLOWANCE FOR BYPASS CONNECTIONS

A. The Contractor shall include all costs for removals and relocations in the Contract. These costs shall include work described in the Specifications and shown on the Drawings with allowances for normal unforeseen difficulties when concealed work has been opened. Each bypass connection shall include 50 feet of 1 inch conduit with 4 #12 AWG conductors and 2 junction boxes and all associated connections. Each bypass connections shall require verification by the Architect's Representative in order to be included under the bypass connections allowance.

1.6 SUBMITTALS

A. Product Data and installation requirements: see Section 01 31 46.

1.7 COORDINATION

A. Coordinate arrangement, mounting, and support of electrical equipment:

1. To allow maximum possible headroom unless specific mounting heights that reduce headroom are indicated.
2. To provide for ease of disconnecting the equipment with minimum interference to other installations.
3. To allow right of way for piping and conduit installed at required slope.
4. So connecting raceways, cables, wireways, cable trays, and busways will be clear of obstructions and of the working and access space of other equipment.
5. Provide concrete housekeeping pads for floor mounted electrical equipment.
6. Coordinate installation of conduits in existing ceilings with all obstructions. Reinstall all ceiling tiles and light fixtures in their original locations.

B. Coordinate installation of required supporting devices and set sleeves in cast-in-place concrete, masonry walls, and other structural components as they are constructed.

C. Coordinate location of access panels and doors for electrical items that are behind finished surfaces or otherwise concealed. Access doors and panels are specified in Division 08 Section "Access Doors and Frames."

D. Coordinate sleeve selection and application with selection and application of firestopping specified in Division 07.

1.8 ROUGH-IN

A. Verify final locations for rough-ins with field measurements and with the requirements of the actual equipment to be connected.

B. Ceiling Markers:
1. Provide color-coded ceiling markers indicating the location of all electrical equipment located above hung ceilings. Markers shall be provided for, but not limited to the following:
2. All pull or junction boxes, (excluding branch circuits), smoke detectors and other alarm or signal initiating devices, disconnected switches and starters where not identified by other trades.

1.9 CHANGES IN CONDUITS AND EQUIPMENT

A. Wherever field conditions are such that for proper execution of the work reasonable changes in location of conduits and equipment are necessary and required, the Contractor shall make such changes as directed and approved, without extra cost.

1.10 INSPECTION AND TESTS

A. Prior to commencing the testing procedure the contractor shall submit the following information;
   1. Describe methods utilized.
   2. Submit information for each electrical system to be tested.
   3. Advise Owner and Engineer of schedule.
   4. PRELIMINARY FIELD TEST - Furnish labor and materials for, and make, preliminary field tests of equipment to ascertain compliance with requirements of Contract. In the event preliminary field test disclose non-compliance, make necessary changes prior to acceptance test.

B. At the time of the final inspection and tests, all connections at the panels and all splices, etc., must have been completed. All fuses must be in place and the circuits continuous from service switches to all receptacles, outlets, motors, etc. Each entire wiring system must test free from short circuits and grounds. When wiring systems are "megger" tested, the insulation resistance between conductors and between conductors and grounds, based on maximum load, shall not be less than that required by National Electrical Code and local authorities having jurisdiction. A written record of all test data shall be supplied to the Architect (five copies). The tests shall cover but not be limited to the following:
   1. Distribution system.
   2. Newly derived secondary service and distribution system.
   3. Emergency transfer switches equipment and distribution system
   4. Fire alarm, smoke detection and sprinkler alarm systems.
   5. UPS system, including PDU equipment.
   6. Power installations and motor controls.
   7. Light installations and circuit switching.
   8. Any part of the work called for in the Specifications, or Drawings and as designated by the Architect or Engineers.
   9. Test equipment for rated output as indicated on drawings. Adjust as required.

C. Provide all necessary testing equipment, instruments, and skilled personnel for the tests. If in the opinion of the Architect, the results of such tests show that the work has not complied with the requirements of the Specifications or Drawings, the Contractor shall make all additions or changes necessary to put the system in proper working condition and shall pay for all the expenses and for all subsequent tests which are necessary to determine whether the work is satisfactory. Any additional work or subsequent tests shall be carried out at the convenience of
the Owner, prior to final payment. Contractor shall obtain services of factory technician to conduct specific tests.

D. Upon completion of the testing procedures contractor to submit a report for each system tested and include all testing data, including tests at the factory.

1.11 TEMPORARY LIGHT AND POWER

A. Electric services for temporary light and power shall be obtained from the nearest existing switchboard and extended as required. Consult the Owner prior to making any connections to existing services.

B. The Electrical Contractor shall furnish, install and maintain the temporary lighting and power system for all Contractors. The use of electricity shall be kept to a minimum.

C. The Hospital’s Representative will pay for all energy required by the temporary lighting and power system.

D. Provide all wiring, supports, lamp sockets, receptacle sockets and any other materials, supplies or equipment necessary for temporary light and power system.

E. Ground fault protection required by OSHA for temporary receptacle circuits shall be accomplished by providing branch circuit panels containing ground fault protection branch circuit breakers.

F. Provide a grounding conductor connection to each receptacle grounding terminal. Minimum size branch circuit and grounding conductors shall be No. 12 AWG.

G. Install separate stringer circuits for lighting and receptacles. Provide one lamp socket and one duplex receptacle (or two single receptacles) for every 400 square feet of new general construction area. (Approximately 20 feet on centers). Furthermore, provide one lamp socket and one duplex receptacle every 20 feet along the peripheral walls of the construction areas for temporary conditions. Each lamp socket shall be provided with a 100 watt incandescent or equivalent source lamp. Replace burned out lamps as required for as long as the temporary lighting system is maintained in operation.

H. Provide sufficient supplementary temporary lighting to permit proper execution of the work. This supplementary lighting shall consist of but not be limited to the following:
   1. Construction hoist landings.
   2. Stairways and stairway landings where existing illumination is inadequate due to alterations or construction.
   3. Interior rooms not covered with general construction area lighting.

I. Provide power wiring to operate construction hoist. Provide fused disconnect switch at hoist location. Fuse size, wiring size and disconnect shall be as required. Coordinate requirement of the hoist with General Contractor.

J. Keep the temporary lighting and power system operational commencing fifteen (15) minutes before the established starting time of that trade which starts work earliest in the morning and
ending fifteen (15) minutes after the established quitting time of that trade which stops work latest in the evening. This applies to all weekdays, Monday through Friday inclusive, which are established as regular working days for any trade engaged in the work, and shall continue until Final Acceptance of the work or until these services are ordered terminated by the Owner or the Owner's Representative.

PART 2 - PRODUCTS

PART 3 - EXECUTION

3.1 COMMON REQUIREMENTS FOR ELECTRICAL INSTALLATION

A. Comply with NECA1.

B. Measure indicated mounting heights to bottom of unit for suspended items and to center of unit for wall-mounting items.

C. Headroom Maintenance: If mounting heights or other location criteria are not indicated, arrange and install components and equipment to provide maximum possible headroom consistent with these requirements.

D. Equipment: Install to facilitate service, maintenance, and repair or replacement of components of both electrical equipment and other nearby installations. Connect in such a way as to facilitate future disconnecting with minimum interference with other items in the vicinity.

E. Right of Way: Give to piping systems installed at a required slope.

END OF SECTION 26 05 00
SECTION 26 05 19 - LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. This Section is to coordinate with and be complementary to the General Conditions and Supplementary General Conditions of the work, and Division 01 Specification Sections wherever applicable to Mechanical and Electrical Work.

B. Section 01 31 46 – Special Requirements for Mechanical and Electrical Work shall apply.

C. Section 26 05 00 – General Provisions For Electrical Work shall apply

1.2 SUMMARY

A. Section Includes:
   1. Copper building wire rated 600V or less.
   2. Metal-clad cable, Type MC, rated 600V or less.
   3. Connectors, splices, and terminations rated 600V and less.

B. Related Requirements:
   1. Section 262413 “Switchboards” for switchboard operating at 600V or lower.

1.3 DEFINITIONS

A. VFC(S): Variable-frequency controller.(System)

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For testing agency or manufacturer's authorized service representative.

1.6 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
B. Comply with NFPA 70.

PART 2 - PRODUCTS

2.1 COPPER BUILDING WIRE

A. Description: Flexible, insulated and uninsulated, drawn copper current-carrying conductor with an overall insulation layer or jacket, or both, rated 600 V or less.

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Alpha Wire Company
   2. American Bare Conductor
   3. Belden Inc
   4. Cerro Wire LLC
   5. Encore Wire Corporation
   6. Okonite Company
   7. Service wire Co
   8. Southwire Company
   9. Wesco

C. Standards:
   1. Listed and labeled as defined in NFPA70, by a qualified testing agency, and marked for intended location and use.
   2. RoHS compliant.
   3. Conductor and Cable Marking: Comply with wire and cable marking according to UL's "Wire and Cable Marking and Application Guide."

D. Conductors: Copper, complying with ASTM B3 for bare annealed copper and with ASTM B496 for stranded conductors.

E. Conductor Insulation:
   1. Type NM: Comply with UL83 and UL719.
   2. Type RHH and Type RHW-2: Comply with UL44.
   3. Type USE-2 and Type SE: Comply with UL854.
   4. Type TC-ER: Comply with NEMAWC 0/ICEA S-95-658 and UL 1277.
   5. Type THHN and Type THWN-2: Comply with UL 83.
   6. Type THW and Type THW-2: Comply with NEMA WC-70/ICEA S-95-658 and UL 83.
   7. Type UF: Comply with UL 83 and UL 493.
   8. Type XHHW-2: Comply with UL 44.

2.2 METAL-CLAD CABLE, TYPE MC

A. Description: A factory assembly of one or more current-carrying insulated conductors in an overall metallic sheath.
B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Alpha Wire Company
   2. American Bare Conductor
   3. Belden Inc
   4. Cerro Wire LLC
   5. Encore Wire Corporation
   6. Okonite Company
   7. Service wire Co
   8. Southwire Company
   9. Wesco

C. Standards:
   1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and use.
   2. Comply with UL 1569.
   3. RoHS compliant.
   4. Conductor and Cable Marking: Comply with wire and cable marking according to UL's "Wire and Cable Marking and Application Guide."

D. Circuits:

E. Conductors:
   1. Copper, complying with ASTM B3 for bare annealed copper and with ASTM B8 for stranded conductors

F. Ground Conductor: Insulated.

G. Conductor Insulation:
   1. Type TFN/THHN/THWN-2: Comply with UL 83.
   2. Type XHHW-2: Comply with UL 44.

H. Armor: Aluminum, interlocked.

2.3 ARMORED CABLE, TYPE AC

A. Description: A factory assembly of insulated current-carrying conductors with or without an equipment grounding conductor in an overall metallic sheath.

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Alpha Wire Company
   2. American Bare Conductor
   3. Belden Inc
4. Cerro Wire LLC  
5. Encore Wire Corporation  
6. Okonite Company  
7. Service wire Co  
8. Southwire Company  
9. Wesco  

C. Standards:  
1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and use.  
2. RoHS compliant.  
4. Conductor and Cable Marking: Comply with wire and cable marking according to UL's "Wire and Cable Marking and Application Guide."

D. Circuits:  

E. Conductors:  
1. Copper, complying with ASTM B3 for bare annealed copper and with ASTM B8 for stranded conductors.

F. Ground Conductor: Insulated.

G. Conductor Insulation:  
1. Type TFN/THHN/THWN-2: Comply with UL 83.  
2. Type XHHW-2: Comply with UL 44.

H. Conductor Insulation: Type THHN/THWN-2. Comply with UL 83.

I. Armor Aluminum, interlocked.

2.4 TRAY CABLE, TYPE TC  
A. Standards:  
1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and use.  
2. RoHS compliant.  
3. Comply with UL 1277.  
4. Comply with ICEA S-73-532/NEMA WC 57 for Type TC cables used for control, thermocouple extension, and instrumentation.  
5. Comply with ICEA S-95-658/NEMA WC 70 for Type TC cables used for power distribution.
6. Conductor and Cable Marking: Comply with wire and cable marking according to UL's "Wire and Cable Marking and Application Guide."

B. Conductors:
   1. Copper, complying with ASTM B3 for bare annealed copper and with ASTM B8 for stranded conductors
   2. Aluminum, complying with ASTM B800 and ASTM B801.

C. Ground Conductor: Insulated.

D. Conductor Insulation: Type XHHW-2. Comply with UL 44.

E. Shield: None.

2.5 CONNECTORS AND SPLICES

A. Description: Factory-fabricated connectors, splices, and lugs of size, ampacity rating, material, type, and class for application and service indicated; listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and use.

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. 3M Electrical Products
   2. AFC Cable systems
   3. Gardnes Bender
   4. Hubblee Power systems
   5. ILSCO
   6. O-Z/Gedney
   7. Service wire Co.
   8. TE Connectivity
   9. Thomas & Betts Corp.

B. Jacketed Cable Connectors: For steel and aluminum jacketed cables, zinc die-cast with set screws, designed to connect conductors specified in this Section.

PART 3 - EXECUTION

3.1 CONDUCTOR MATERIAL APPLICATIONS

A. Feeders: Copper; solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.

B. Branch Circuits: Copper. Solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.

C. VFC Output Circuits Cable: Extra-flexible stranded for all sizes.

3.2 CONDUCTOR INSULATION AND MULTICONDUCTOR CABLE APPLICATIONS AND WIRING METHODS

A. Exposed Feeders: Type THHN/THWN-2, single conductors in raceway.

B. Feeders Concealed in Ceilings, Walls, Partitions, and Crawls: Type THHN/THWN-2, single conductors in raceway,
   1. Type THHN/THWN-2, single conductors in raceway
   2. Armored cable, Type AC,
   3. Metal-clad cable,

C. Feeders Concealed in Concrete, below Slabs-on-Grade, and Underground: Type THHN/THWN-2, single conductors in raceway.

D. Feeders in Cable Tray:
   1. Type THHN/THWN-2, single conductors in raceway
   2. Armored cable, Type AC,
   3. Metal-clad cable,
   4. Type MC, Mineral-insulated, metal-sheathed cable, Type MI

E. Exposed Branch Circuits:
   1. Type THHN/THWN-2, single conductors in raceway
   2. Armored cable, Type AC,
   3. Metal-clad cable,

F. Branch Circuits Concealed in Ceilings, Walls, and Partitions:
   1. Type THHN/THWN-2, single conductors in raceway
   2. Armored cable, Type AC,
   3. Metal-clad cable,

G. Branch Circuits in Cable Tray:
   1. Type THHN/THWN-2, single conductors in raceway
   2. Armored cable, Type AC,
   3. Metal-clad cable,

H. VFC Output Circuits:
   1. Type XHHW-2 in metal conduit

3.3 INSTALLATION OF CONDUCTORS AND CABLES

A. Conceal cables in finished walls, ceilings, and floors unless otherwise indicated.

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. Complete cable tray systems installation according to Section 260536 "Cable Trays for Electrical Systems" prior to installing conductors and cables.

3.4 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.

   1. Use oxide inhibitor in each splice, termination, and tap for aluminum conductors.

C. Wiring at Outlets: Install conductor at each outlet, with at least 6 inches (150 mm) of slack.

3.5 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.

3.6 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."

3.7 FIRESTOPPING

A. Apply firestopping to electrical penetrations of fire-rated floor and wall assemblies to restore original fire-resistance rating of assembly according to Section 078413 "Penetration Firestopping."

3.8 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 tests and inspections with the assistance of a factory-authorized service representative.
1. After installing conductors and cables and before electrical circuitry has been energized, test service entrance and feeder conductors for compliance with requirements.

2. After installing conductors and cables and before electrical circuitry has been energized, test service entrance and feeder conductors and conductors feeding the following critical equipment and services for compliance with requirements:
   a. Main Distribution Switchboards, if separate from the Service equipment
   b. ATS(s)
   c. Life Safety Panels
   d. Fire Alarm Control and associated panels

3. Perform each of the following visual and electrical tests:
   a. Inspect exposed sections of conductor and cable for physical damage and correct connection according to the single-line diagram.
   b. Test bolted connections for high resistance using one of the following:
      1) A low-resistance ohmmeter.
      2) Calibrated torque wrench.
      3) Thermographic survey.
   c. Inspect compression-applied connectors for correct cable match and indentation.
   d. Inspect for correct identification.
   e. Inspect cable jacket and condition.
   f. Insulation-resistance test on each conductor for ground and adjacent conductors. Apply a potential of 500-Vdc for 300-V rated cable and 1000-Vdc for 600-V rated cable for a one-minute duration.
   g. Continuity test on each conductor and cable.
   h. Uniform resistance of parallel conductors.

4. Initial Infrared Scanning: After Substantial Completion, but before Final Acceptance, perform an infrared scan of each splice in conductors No. 3 AWG and larger. Remove box and equipment covers so splices are accessible to portable scanner. Correct deficiencies determined during the scan.
   a. Instrument: Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.
   b. Record of Infrared Scanning: Prepare a certified report that identifies switches checked and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

5. Follow-up Infrared Scanning: Perform an additional follow-up infrared scan of each switch 11 months after date of Substantial Completion.

C. Cables will be considered defective if they do not pass tests and inspections.
D. Prepare test and inspection reports to record the following:

1. Procedures used.
2. Results that comply with requirements.
3. Results that do not comply with requirements, and corrective action taken to achieve compliance with requirements.

END OF SECTION 26 05 19
SECTION 26 05 26 - GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. This Section is to coordinate with and be complementary to the General Conditions and Supplementary General Conditions of the work, and Division 01 Specification Sections wherever applicable to Mechanical and Electrical Work.

B. Section 01 31 46 – Special Requirements for Mechanical and Electrical Work shall apply.

C. Section 26 05 00 – General Provisions For Electrical Work shall apply.

1.2 SUMMARY

A. Section includes grounding and bonding systems and equipment, plus the following special applications:

1. Underground distribution grounding.

1.3 DESCRIPTION OF WORK

A. The work includes the providing of all labor, materials, equipment, accessories, services and tests necessary to complete and make ready for operation by the Hospital, all grounding in accordance with Drawings and Specifications and as required for a complete system.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

1.5 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Plans showing dimensioned locations of grounding features specified in "Field Quality Control" Article, including the following:

1. Ground rods.
2. Grounding arrangements and connections for separately derived systems.

B. Qualification Data: For testing agency and testing agency’s field supervisor.

C. Field quality-control reports.
1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For grounding 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. Plans showing as-built, dimensioned locations of grounding features specified in "Field Quality Control" Article, including the following:

         1) Ground rods.
         2) Grounding arrangements and connections for separately derived systems.

      b. Instructions for periodic testing and inspection of grounding features at **grounding connections for separately derived systems** based on NETA MTS.

         1) Tests shall determine if ground-resistance or impedance values remain within specified maximums, and instructions shall recommend corrective action if values do not.
         2) Include recommended testing intervals.

1.7 QUALITY ASSURANCE

A. Testing Agency Qualifications: Certified by NETA.

B. "Manufacturers" - Firms regularly engaged in manufacture of the type of equipment required for the application, whose products have been in satisfactory use in similar service for not less than 10 years. Refer to Approved Manufacturers in this Section.

C. Provide equipment whose performance under specified conditions is certified by the manufacturer and comply with applicable publications of NFPA and UL.

D. Grounding shall comply with New York City Electrical Code (NYCEC) for construction and installation.

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. Comply with UL 467 for grounding and bonding materials and equipment.
2.2 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. ERICO International Corporation
   2. O-Z/Gedney
   3. Thomas and Betts Corporation
   4. Burndy
   5. Galvan Industries

2.3 CONDUCTORS

A. Insulated Conductors: Copper or tinned-copper wire or cable insulated for 600 V unless otherwise required by applicable Code or authorities having jurisdiction.

B. Bare Copper Conductors:
   4. Bonding Cable: 28 kcmil, 14 strands of No. 17 AWG conductor, 1/4 inch (6 mm) in diameter.
   5. Bonding Conductor: No. 4 or No. 6 AWG, stranded conductor.
   6. Bonding Jumper: Copper tape, braided conductors terminated with copper ferrules; 1-5/8 inches (41 mm) wide and 1/16 inch (1.6 mm) thick.
   7. Tinned Bonding Jumper: Tinned-copper tape, braided conductors terminated with copper ferrules; 1-5/8 inches (41 mm) wide and 1/16 inch (1.6 mm) thick.

C. Grounding Bus: Predrilled rectangular bars of annealed copper, 1/4 by 24 inches in cross section, with 9/32-inch (7.14-mm) holes spaced 1-1/8 inches (28 mm) apart. Stand-off insulators for mounting shall comply with UL 891 for use in switchboards, 600 V and shall be Lexan or PVC, impulse tested at 5000 V.

2.4 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. Welded Connectors: Exothermic-welding kits of types recommended by kit manufacturer for materials being joined and installation conditions.

C. Bus-Bar Connectors: Mechanical type, cast silicon bronze, solderless compression wire terminals, and long-barrel, two-bolt connection to ground bus bar.

D. Bus-Bar Connectors: Compression type, copper or copper alloy, with two wire terminals.
E. Beam Clamps: Mechanical type, terminal, ground wire access from four directions, with dual, tin-plated or silicon bronze bolts.

F. Cable-to-Cable Connectors: Compression type, copper or copper alloy.

G. Cable Tray Ground Clamp: Mechanical type, zinc-plated malleable iron.

H. Conduit Hubs: Mechanical type, terminal with threaded hub.

I. Ground Rod Clamps: Mechanical type, copper or copper alloy, terminal with socket set screw.

J. Service Post Connectors: Mechanical type, bronze alloy terminal, in short- and long-stud lengths, capable of single and double conductor connections.

K. Signal Reference Grid Clamp: Mechanical type, stamped-steel terminal with hex head screw.

L. Straps: Solid copper, copper lugs. Rated for 600 A.

M. U-Bolt Clamps: Mechanical type, copper or copper alloy, terminal listed for direct burial.

2.5 GROUNDING ELECTRODES

A. Ground Rods: Copper-clad 5/8 by 96 inches (16 by 2400 mm).

B. Chemical-Enhanced Grounding Electrodes: Copper tube, straight or L-shaped, charged with nonhazardous electrolytic chemical salts.

1. Termination: Factory-attached No. 4/0 AWG bare conductor at least 48 inches (1200 mm) long.
2. Backfill Material: Electrode manufacturer's recommended material.

PART 3 - EXECUTION

3.1 APPLICATIONS

A. Conductors: Install solid conductor for No. 8 AWG and smaller, and stranded conductors for No. 6 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. Grounding Bus: Install in electrical equipment rooms, in rooms housing service equipment, and elsewhere as indicated.

1. Install bus horizontally, on insulated spacers 2 inches (50 mm) minimum from wall, 6 inches (150 mm) above finished floor unless otherwise indicated.
2. Where indicated on both sides of doorways, route bus up to top of door frame, across top of doorway, and down; connect to horizontal bus.

D. Conductor Terminations and Connections:

1. Pipe and Equipment Grounding Conductor Terminations: Bolted connectors.
2. Connections to Structural Steel: Welded connectors.

3.2 GROUNDING AT THE SERVICE

A. Equipment grounding conductors and grounding electrode conductors shall be connected to the ground bus. Install a main bonding jumper between the neutral and ground buses.

3.3 GROUNDING SEPARATELY DERIVED SYSTEMS

A. Transformer: Install grounding electrode(s) at the transformer location. The electrode shall be connected to the equipment grounding conductor and to the frame of the transformer.

3.4 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.
5. Three-phase motor and appliance branch circuits.
6. Flexible raceway runs.
7. Armored and 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.

3.5 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. Ground Rods: Drive rods until tops are 2 inches (50 mm) below finished floor or final grade unless otherwise indicated.

1. Interconnect ground rods with grounding electrode conductor below grade and as otherwise indicated. Make connections without exposing steel or damaging coating if any.
2. Use exothermic welds for all below-grade connections.
3. For grounding electrode system, install at least three rods spaced at least one-rod length from each other and located at least the same distance from other grounding electrodes, and connect to the service grounding electrode conductor.

C. 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.
3. Use exothermic-welded connectors for outdoor locations; if a disconnect-type connection is required, use a bolted clamp.

D. Bonding Interior Metal Ducts: Bond metal air ducts to equipment grounding conductors of associated fans, blowers, electric heaters, and air cleaners. Install tinned bonding jumper to bond across flexible duct connections to achieve continuity.

E. Connections: Make connections so possibility of galvanic action or electrolysis is minimized. Select connectors, connection hardware, conductors, and connection methods so metals in direct contact are galvanically compatible.

1. Use electroplated or hot-tin-coated materials to ensure high conductivity and to make contact points closer in order of galvanic series.
2. Make connections with clean, bare metal at points of contact.
5. Coat and seal connections having dissimilar metals with inert material to prevent future penetration of moisture to contact surfaces.
3.6 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

B. Tests and Inspections:

1. After installing grounding system but before permanent electrical circuits have been energized, test for compliance with requirements.
2. Inspect physical and mechanical condition. Verify tightness of accessible, bolted, electrical connections with a calibrated torque wrench according to manufacturer's written instructions.
3. Test completed grounding system at each location where a maximum ground-resistance level is specified, at service disconnect enclosure grounding terminal, at ground test wells, and at individual ground rods. Make tests at ground rods before any conductors are connected.
   a. Measure ground resistance no fewer than two full days after last trace of precipitation and without soil being moistened by any means other than natural drainage or seepage and without chemical treatment or other artificial means of reducing natural ground resistance.
   b. Perform tests by fall-of-potential method according to IEEE 81.

C. Grounding system will be considered defective if it does not pass tests and inspections.

D. Prepare test and inspection reports.

E. Report measured ground resistances that exceed the following values:
   1. Power and Lighting Equipment or System with Capacity of 500 to 1000 kVA: 5 ohms.
   2. Power Distribution Units or Panelboards Serving Electronic Equipment: 1 ohm(s).

F. Excessive Ground Resistance: If resistance to ground exceeds specified values, notify Architect promptly and include recommendations to reduce ground resistance.

END OF SECTION 26 05 26
SECTION 26 05 29 - HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. This Section is to coordinate with and be complementary to the General Conditions and Supplementary General Conditions of the work, and Division 01 Specification Sections wherever applicable to Mechanical and Electrical Work.

B. Section 01 31 46 – Special Requirements for Mechanical and Electrical Work shall apply.

C. Section 26 05 00 – General Provisions For Electrical Work shall apply

1.2 SUMMARY

A. Section Includes:

1. Steel slotted support systems.
2. Aluminum slotted support systems.
3. Nonmetallic slotted support systems.
4. Conduit and cable support devices.
5. Support for conductors in vertical conduit.
6. Structural steel for fabricated supports and restraints.
7. Mounting, anchoring, and attachment components, including powder-actuated fasteners, mechanical expansion anchors, concrete inserts, clamps, through bolts, toggle bolts, and hanger rods.
8. Fabricated metal equipment support assemblies.

1.3 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. Slotted support systems, hardware, and accessories.
   b. Clamps.
   c. Hangers.
   d. Sockets.
   e. Eye nuts.
   f. Fasteners.
   g. Anchors.
   h. Saddles.
   i. Brackets.
2. Include rated capacities and furnished specialties and accessories.

B. Shop Drawings: Signed and sealed by a qualified professional engineer. For fabrication and installation details for electrical hangers and support systems.

2. Slotted support systems.
3. Equipment supports.
4. 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.
5. Include design calculations for seismic restraints.

1.4 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. Suspended ceiling components.
2. Ductwork, piping, fittings, and supports.
3. Structural members to which hangers and supports will be attached.
4. Size and location of initial access modules for acoustical tile.
5. Items penetrating finished ceiling, including the following:
   a. Luminaires.
   b. Air outlets and inlets.
   c. Sprinklers.
   d. Access panels.

B. Seismic Qualification Data: Certificates, for hangers and supports for electrical equipment and systems, 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. Welding certificates.
PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Engage a qualified professional engineer, as defined in "Quality Requirements," to design hanger and support system.
   1. Design supports for multiple raceways, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.
   2. Design supports for multiple raceways capable of supporting combined weight of supported systems and its contents.
   3. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.
   4. Rated Strength: Adequate in tension, shear, and pullout force to resist maximum loads calculated or imposed for this Project, with a minimum structural safety factor of five times the applied force.

B. Seismic Performance: Hangers and supports shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.
   1. The term "withstand" means "the supported equipment and systems will remain in place without separation of any parts when subjected to the seismic forces specified and the supported equipment and systems will be fully operational after the seismic event."

C. 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 Rating: Class 1.
   2. Self-extinguishing according to ASTM D 635.

2.2 SUPPORT, ANCHORAGE, AND ATTACHMENT COMPONENTS

A. Steel Slotted Support Systems: Preformed steel channels and angles with minimum 13/32-inch-(10-mm-) diameter holes at a maximum of 8 inches (200 mm) o.c. in at least one surface.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Allied Tube & Conduit.
      b. Cooper B-Line, Inc.; a division of Cooper Industries.
      c. ERICO International Corporation.
      d. GS Metals Corp.
      e. Thomas & Betts Corporation.
      f. Unistrut; Tyco International, Ltd.
      g. Wesanco, Inc.
   2. Standard: Comply with MFMA-4 factory-fabricated components for field assembly.
   3. Material for Channel, Fittings, and Accessories: **Galvanized steel.**
   4. Channel Width: 13/16 inches (20.64 mm)
   5. Metallic Coatings: Hot-dip galvanized after fabrication and applied according to MFMA-4.
6. Painted Coatings: Manufacturer's standard painted coating applied according to MFMA-4.

7. Protect finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

B. Conduit and Cable Support Devices: **Steel and malleable-iron** hangers, clamps, and associated fittings, designed for types and sizes of raceway or cable to be supported.

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, provide products by one of the following:
      1) Hilti, Inc
      2) ITW Ramset/Red Head
      3) MKT Fastening, LLC
      4) Simpson Strong-Tie Co.

2. Mechanical-Expansion Anchors: Insert-wedge-type, **zinc-coated** steel, for use in hardened portland cement concrete, with tension, shear, and pullout capacities appropriate for supported loads and building materials where used.
   a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      1) B-line
      2) Hilti, Inc
      3) ITW Ramset/Red Head
      4) MKT Fastening, LLC

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.


PART 3 - EXECUTION

3.1 APPLICATION

A. Comply with the following standards for application and installation requirements of hangers and supports, except where requirements on Drawings or in this Section are stricter:

1. NECA 1.
2. NECA 101
3. NECA 102.
4. NECA 105.
5. NECA 111.

B. Comply with requirements in Section 078413 "Penetration Firestopping" for firestopping materials and installation for penetrations through fire-rated walls, ceilings, and assemblies.

C. Comply with requirements for raceways and boxes specified in Section 260533 "Raceways and Boxes for Electrical Systems."

D. EMT, IMC, and RMC as scheduled in NECA 1, where its Table 1 lists maximum spacings that are less than those stated in NFPA 70. Minimum rod size shall be 1/4 inch (6 mm) in diameter.

E. 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**.

F. 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.

3.2 SUPPORT INSTALLATION

A. Comply with NECA 1 and NECA 101 for installation requirements except as specified in this article.

B. Raceway Support Methods: In addition to methods described in NECA 1, **EMT** 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:
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. To Steel: Beam clamps (MSS SP-58, Type 19, 21, 23, 25, or 27), complying with MSS SP-69 Spring-tension clamps.
6. Items Mounted on Hollow Walls and Nonstructural Building Surfaces: Mount cabinets, panelboards, disconnect switches, control enclosures, pull and junction boxes, transformers, and other devices on slotted-channel racks attached to substrate by means that comply with seismic-restraint strength and anchorage requirements.

E. Drill holes for expansion anchors in concrete at locations and to depths that avoid the need for reinforcing bars.

3.3 INSTALLATION OF FABRICATED METAL SUPPORTS

A. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor electrical materials and equipment.

B. Field Welding: Comply with AWS D1.1/D1.1M.

3.4 CONCRETE BASES

A. Construct concrete bases of dimensions indicated, but not less than 4 inches (100 mm) larger in both directions than supported unit, and so anchors will be a minimum of 10 bolt diameters from edge of the base.

B. Use 3000-psi (20.7-MPa], 28-day compressive-strength concrete. Concrete materials, reinforcement, and placement requirements are specified in "Cast-in-Place Concrete" and "Miscellaneous Cast-in-Place Concrete" portions of the specifications.

C. Anchor equipment to concrete base as follows:

1. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
2. Install anchor bolts to elevations required for proper attachment to supported equipment.
3. Install anchor bolts according to anchor-bolt manufacturer's written instructions.

D. Where indicated on drawings, extend existing concrete pad to accept installation of new equipment.

E. Touchup: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.
1. Apply paint by brush or spray to provide minimum dry film thickness of 2.0 mils (0.05 mm).

F. 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
SECTION 26 05 33 - RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. This Section is to coordinate with and be complementary to the General Conditions and Supplementary General Conditions of the work, and Division 01 Specification Sections wherever applicable to Mechanical and Electrical Work.

B. Section 01 31 46 – Special Requirements for Mechanical and Electrical Work shall apply.

C. Section 26 05 00 – General Provisions For Electrical Work shall apply

1.2 SUMMARY

A. This Section includes raceways, fittings, boxes, enclosures, and cabinets for electrical wiring.

B. Related Sections include the following:
   1. Section 26 05 36 – Cable Trays For electrical systems
   2. Section 26 05 43 – Sleeves and Sleeve Seals for Electrical Systems

C. The requirements of this section apply to raceway work required for the protection of electrical conductors. Raceways are required for all wiring unless otherwise specified.

D. The work includes the furnishing and installation of completely coordinated, effectively grounded raceway systems complete with boxes, fittings, flexible connections to vibrating equipment and other accessories, as required. Conduit or tubing sizes referred to in the Specifications and on the Drawings are nominal trade sizes.

1.3 DEFINITIONS

A. EMT: Electrical metallic tubing.

B. FMC: Flexible metal conduit.

C. IMC: Intermediate metal conduit.

D. LFMC: Liquidtight flexible metal conduit.

E. LFNC: Liquidtight flexible nonmetallic conduit.

F. NBR: Acrylonitrile-butadiene rubber.

G. RNC: Rigid nonmetallic conduit.
1.4 SUBMITTALS

A. Product Data: For surface raceways, wireways and fittings, floor boxes, hinged-cover enclosures, and cabinets.

B. Shop Drawings: For the following raceway components. Include plans, elevations, sections, details, and attachments to other work.
   1. Custom enclosures and cabinets.

C. Samples for Initial Selection: For wireways, nonmetallic wireways and surface raceways with factory-applied texture and color finishes.
   1. Size: 8” x 8” wireways; 24” x 36” x 8” D boxes

D. Coordination Drawings: Conduit routing plans, drawn to scale, on which the following items are shown and coordinated with each other, based on input from installers of the items involved:
   1. Structural members in the paths of conduit groups with common supports.
   2. HVAC and plumbing items and architectural features in the paths of conduit groups with common supports.

E. Manufacturer Seismic Qualification Certification: Submit certification that enclosures and cabinets and their mounting provisions, including those for internal components, will withstand seismic forces defined in Section 26 05 48 Seismic Controls for Electrical Systems and Section 01 35 48 Seismic Restraint for Isolated & Unisolated Equipment, Piping, Ductwork, Tanks & Stacks. Include the following:
   1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
      a. The term "withstand" means "the cabinet or enclosure will remain in place without separation of any parts when subjected to the seismic forces specified and the unit will retain its enclosure characteristics, including its interior accessibility, after the seismic event."
   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.

F. Source quality-control test reports.

1.5 QUALITY ASSURANCE

A. Comply with NFPA 70.
B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

C. Comply with New York City electrical Code (NYCEC).

D. Electrical Components, Devices, and Accessories: Listed and labeled as defined in, NYCEC Article 100 by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

PART 2 - PRODUCTS

2.1 METAL CONDUIT AND TUBING

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. AFC Cable Systems, Inc.
2. Alflex Inc.
3. Allied Tube & Conduit; a Tyco International Ltd. Co.
4. Anamet Electrical, Inc.; Anaconda Metal Hose.
5. Electri-Flex Co.
7. Maverick Tube Corporation.

B. Rigid Steel Conduit: ANSI C80.1.

C. Aluminum Rigid Conduit: ANSI C80.5.

D. IMC: ANSI C80.6.

E. PVC-Coated Steel Conduit: PVC-coated rigid steel conduit.

1. Comply with NEMA RN 1.
2. Coating Thickness: 0.040 inch (1 mm), minimum.

F. EMT: ANSI C80.3.

G. FMC: Zinc-coated steel or aluminum where magnetic interference is indicated

H. LFMC: Flexible steel conduit with PVC jacket.

I. Fittings for Conduit (Including all Types and Flexible and Liquidtight), EMT, and Cable: NEMA FB 1; listed for type and size raceway with which used, and for application and environment in which installed.
2. Fittings for EMT: Steel, compression type.
3. Coating for Fittings for PVC-Coated Conduit: Minimum thickness, 0.040 inch (1 mm), with overlapping sleeves protecting threaded joints.

J. Joint Compound for Rigid Steel Conduit or IMC: Listed for use in cable connector assemblies, and compounded for use to lubricate and protect threaded raceway joints from corrosion and enhance their conductivity.

2.2 NONMETALLIC CONDUIT, TUBING AND FITTINGS

A. Nonmetallic Conduit
1. Listing and Labeling: Nonmetallic conduit shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Petroflex
   b. AFC Cable Systems, Inc.
   c. Anamet Electrical, Inc.; Anaconda Metal Hose.
   d. Arnco Corporation.
   e. CANTEX Inc.
   g. Condux International, Inc.
   h. ElecSYS, Inc.
   i. Electri-Flex Co.
   j. Lamson & Sessions; Carlon Electrical Products.
   k. Manhattan/CDT/Cole-Flex.
   l. RACO; a Hubbell Company.
   m. Thomas & Betts Corporation.
4. RNC: NEMA TC 2, Type EPC-80-PVC, unless otherwise indicated.
5. LFNC: UL 1660.
6. Continuous HDPE: Comply with UL 651A.
7. Coilable HDPE: Preassembled with conductors or cables, and complying with ASTM D 3485.
8. RTRC: Comply with UL 2515A and NEMA TC 14.

B. Nonmetallic Fittings
1. Fittings, General: Listed and labeled for type of conduit, location, and use.
2. Fittings for ENT and RNC: NEMA TC 3; match to conduit or tubing type and material.
   a. Fittings for LFNC: UL 514B.
3. Solvents and Adhesives: As recommended by conduit manufacturer.

2.3 METAL WIREWAYS AND AUXILIARY GUTTERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Cooper B-Line, Inc.
2. Hoffman.
3. Square D; Schneider Electric.
4. Legrand Wiremold

B. Description: Sheet metal sized and shaped as indicated, NEMA 250, Type 1, 4, 12, or 3R, 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 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: Screw-cover type; Flanged-and-gasketed type (outdoors_.

E. Finish: Manufacturer's standard enamel finish.

2.4 NONMETALLIC WIREWAYS AND AUXILIARY GUTTERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Hoffman.
2. Lamson & Sessions; Carlon Electrical Products.
3. Legrand Wiremold

B. Listing and Labeling: Nonmetallic wireways and auxiliary gutters shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

C. Description: Fiberglass polyester, extruded and fabricated to size and shape indicated, with no holes or knockouts. Cover is gasketed with oil-resistant gasket material and fastened with captive screws treated for corrosion resistance. Connections are flanged, with stainless-steel screws and oil-resistant gaskets.

D. Fittings and Accessories: Include couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings to match and mate with wireways as required for complete system.

E. Solvents and Adhesives: As recommended by conduit manufacturer.

2.5 SURFACE RACEWAYS

A. Surface Metal Raceways: Galvanized steel with snap-on covers. Manufacturer's standard enamel finish in color selected by Architect.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Thomas & Betts Corporation.
   b. Legrand Walker Systems, Inc.;
   c. Legrand Wiremold.

B. Listing and Labeling: Surface raceways and tele-power poles shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

C. Surface Nonmetallic Raceways: Two-piece construction, manufactured of rigid PVC with texture and color selected by Architect from manufacturer's standard colors.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Butler Manufacturing Company; Walker Division.
      b. Enduro Systems, Inc.; Composite Products Division.
      c. Hubbell Incorporated; Wiring Device-Kellems Division.
      d. Lamson & Sessions; Carlon Electrical Products.
      e. Panduit Corp.
      f. Legrand Walker Systems, Inc.;
      g. Legrand Wiremold.

2.6 BOXES, ENCLOSURES, AND CABINETS

A. Listing and Labeling: boxes shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Cooper Crouse-Hinds; Div. of Cooper Industries, Inc.
   2. EGS/Appleton Electric.
   7. RACO; a Hubbell Company.
   10. Spring City Electrical Manufacturing Company.
   12. Legrand Walker Systems, Inc.;

C. General Requirements for Boxes, Enclosures, and Cabinets: Boxes, enclosures, and cabinets installed in wet locations shall be listed for use in wet locations.
D. Sheet Metal Outlet and Device Boxes: NEMA OS 1.
E. Cast-Metal Outlet and Device Boxes: NEMA FB 1, aluminum, Type FD, with gasketed cover.
F. Nonmetallic Outlet and Device Boxes: NEMA OS 2.
G. Metal Floor Boxes: Cast or sheet metal, fully adjustable, rectangular.
H. Nonmetallic Floor Boxes: Nonadjustable, round.
I. Small Sheet Metal Pull and Junction Boxes: NEMA OS 1.
J. 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.
K. Box extensions used to accommodate building finishes shall be of same material as recessed box.
L. Device Box Dimensions: 4 inches square by 2-1/8 inches deep (100 mm square by 60 mm deep) for quad and telecommunication installations, and 4 inches by 2-1/8 inches by 2-1/8 inches deep (100 mm by 60 mm by 60 mm deep) for single device installations.
M. Gangable boxes are prohibited.
N. Cast-Metal Access, Pull, and Junction Boxes: NEMA FB 1 and UL 1773, galvanized, cast iron, or cast aluminum for high frequency applications, with gasketed cover.
O. Hinged-Cover Enclosures: NEMA 250, Type 1, with continuous-hinge cover with flush latch for general use, or NEMA 250, Type 12, for dusty environments.
   1. Metal Enclosures: Steel, finished inside and out with manufacturer's standard enamel.
P. Cabinets:
   1. NEMA 250, Type 1, or NEMA 250, Type 12 as required, galvanized-steel box with removable interior panel and removable front, finished inside and out with manufacturer's standard enamel.
   2. Hinged door in front cover with flush latch and concealed hinge.
   3. Key latch to match panelboards.
   4. Metal barriers to separate wiring of different systems and voltage.
   5. Accessory feet where required for freestanding equipment.

PART 3 - EXECUTION

3.1 RACEWAY APPLICATION

A. Outdoors: Apply raceway products as specified below, unless otherwise indicated:
1. Exposed Conduit: Rigid steel conduit, RNC, Type EPC-80-PVC.
2. Concealed Conduit, Aboveground: Rigid steel conduit RNC, Type EPC-80-PVC.
3. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): LFMC.
4. Boxes and Enclosures, Aboveground: NEMA 250, Type 3R.

B. Comply with the following indoor applications, unless otherwise indicated:

1. Exposed, Not Subject to Physical Damage: EMT
2. Exposed and Subject to Severe Physical Damage: Rigid steel conduit. Includes raceways in the following locations:
   a. Loading dock.
   b. Corridors used for traffic of mechanized carts, forklifts, and pallet-handling units.
   c. Mechanical and electrical switchboard rooms.
3. Concealed in Ceilings and Interior Walls and Partitions: EMT
4. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): FMC, except use LFMC in damp or wet locations.
5. Damp or Wet Locations: Rigid steel conduit.
6. Boxes and Enclosures: NEMA 250, Type 1, except use
   a. NEMA 250, Type 4, stainless steel in corrosive locations, or
   b. NEMA 250, Type 4, nonmetallic in damp or wet locations.

C. Minimum Raceway Size: 3/4-inch (21-mm) trade size.

D. 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.
2. PVC Externally Coated, Rigid Steel Conduits: Use only fittings listed for use with that material. Patch and seal all joints, nicks, and scrapes in PVC coating after installing conduits and fittings. Use sealant recommended by fitting manufacturer.

E. Install nonferrous conduit or tubing for circuits operating above 60 Hz. Where aluminum raceways are installed for such circuits and pass through concrete, install in nonmetallic sleeve.

F. Do not install aluminum conduits in contact with concrete.

G. Install surface raceways only where indicated on Drawings.

H. Do not install nonmetallic conduit where ambient temperature exceeds 120 deg F (49 deg C)

3.2 INSTALLATION

A. Comply with NECA1 and NECA101 for installation requirements except where requirements on Drawings or in this article are stricter. Comply with NECA102 for aluminum conduits.
Comply with NFPA70 limitations for types of raceways allowed in specific occupancies and number of floors.

B. Do not install raceways or electrical items on any "explosion-relief" walls or rotating equipment.

C. Do not fasten conduits onto the bottom side of a metal deck roof.

D. 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.

E. Complete raceway installation before starting conductor installation.

F. Support raceways as specified in Section 260529 – Hangers and Supports for Electrical Systems.

G. Arrange stub-ups so curved portions of bends are not visible above the finished slab.

H. Install no more than the equivalent of three 90-degree bends in any conduit run except for communications conduits, for which fewer bends are allowed. Coordinate specific requirements for conduit routing with telecommunication system installer. See Division 27 sections for additional information.

I. Make bends in raceway using large-radius preformed ells. Field bending shall be according to NFPA70 minimum radii requirements. Use only equipment specifically designed for material and size involved.

J. Conceal conduit and EMT within finished walls, ceilings, and floors, unless otherwise indicated. Use compression fittings for EMT raceways. Set-screw fittings are not acceptable.

K. Raceways Embedded in Slabs:
   1. Run conduit larger than 1-inch (27-mm) trade size, parallel or at right angles to main reinforcement. Where at right angles to reinforcement, place conduit close to slab support.
   2. Arrange raceways to cross building expansion joints at right angles with expansion fittings.
   3. Change from ENT to RNC, Type EPC-40-PVC, rigid steel conduit, or IMC before rising above the floor.

L. Stub-Ups to Above Recessed Ceilings:
   1. Use EMT, IMC, or RMC for raceways.
   2. Use a conduit bushing or insulated fitting to terminate stub-ups not terminated in hubs or in an enclosure.

M. 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. Conduits containing feeders shall terminate in insulated grounding bushing.
N. Coat field-cut threads on PVC-coated raceway with a corrosion-preventing conductive compound prior to assembly.

O. 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.

P. Install raceways square to the enclosure and terminate at enclosures with locknuts. Install locknuts hand tight plus 1/4 turn more.

Q. 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.

R. 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.

S. 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.

T. 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.

U. Install raceway sealing fittings at accessible locations according to NFPA70 and fill them with listed sealing compound. For concealed raceways, install each fitting in a flush steel box with a blank cover plate having a finish similar to that of adjacent plates or surfaces. Install raceway sealing fittings according to NFPA70.

V. Install devices to seal raceway interiors at accessible locations. Locate seals so no fittings or boxes are between the seal and the following changes of environments. Seal the interior of all raceways at the following points:
   1. Where conduits pass from warm to cold locations, such as boundaries of refrigerated spaces.
   2. Where an underground service raceway enters a building or structure.
   3. Conduit extending from interior to exterior of building.
   4. Conduit extending into pressurized duct and equipment.
   5. Conduit extending into pressurized zones that are automatically controlled to maintain different pressure set points.
   6. Where otherwise required by NFPA70.

W. Comply with manufacturer's written instructions for solvent welding RNC and fittings.

X. Expansion-Joint Fittings:
1. Install in each run of aboveground RNC that is located where environmental temperature change may exceed 30 deg F (17 deg C) and that has straight-run length that exceeds 25 feet (7.6 m). Install in each run of aboveground RMC and EMT conduit that is located where environmental temperature change may exceed 100 deg F (55 deg C) and that has straight-run length that exceeds 100 feet (30 m).

2. Install type and quantity of fittings that accommodate temperature change listed for each of the following locations:
   a. Outdoor Locations Not Exposed to Direct Sunlight: 125 deg F (70 deg C)
   b. Outdoor Locations Exposed to Direct Sunlight: 155 deg F (86 deg C) temperature change.
   c. Indoor Spaces Connected with Outdoors without Physical Separation: 125 deg F (70 deg C) temperature change.
   d. Attics: 135 deg F (75 deg C) temperature change.

3. Install fitting(s) that provide expansion and contraction for at least 0.00041 inch per foot of length of straight run per deg F (0.06 mm per meter of length of straight run per deg C) of temperature change.

4. Install each expansion-joint fitting with position, mounting, and piston setting selected according to manufacturer's written instructions for conditions at specific location at the time of installation.

5. Install expansion fittings at all locations where conduits cross building or structure expansion joints.

Y. Flexible Conduit Connections: Comply with NEMA RV3. Use a maximum of 36 inches (915 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 or LFNC in damp or wet locations not subject to severe physical damage.

Z. 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.

AA. Recessed Boxes in Masonry Walls: Saw-cut opening for box in center of cell of masonry block, and install box flush with surface of wall. Prepare block surfaces to provide a flat surface for a raintight connection between box and cover plate or supported equipment and box.

BB. Horizontally separate boxes mounted on opposite sides of walls so they are not in the same vertical channel.

CC. Locate boxes so that cover or plate will not span different building finishes.

DD. 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.

EE. Fasten junction and pull boxes to or support from building structure. Do not support boxes by conduits.
FF. Set metal floor boxes level and flush with finished floor surface.

GG. Set nonmetallic floor boxes level. Trim after installation to fit flush with finished floor surface.

3.3 SLEEVE 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."

3.4 FIRESTOPPING

A. Apply firestopping to electrical penetrations of fire-rated floor and wall assemblies to restore original fire-resistance rating of assembly. Firestopping materials and installation requirements are specified in Division 07 Section "Penetration Firestopping."

3.5 PROTECTION

A. Provide final protection and maintain conditions that ensure coatings, finishes, and cabinets are without damage or deterioration at time of Substantial Completion.

1. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.
2. Repair damage to PVC or paint finishes with matching touchup coating recommended by manufacturer.

END OF SECTION 26 05 33
SECTION 26 05 53 - IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. This Section is to coordinate with and be complementary to the General Conditions and Supplementary General Conditions of the work, and Division 01 Specification Sections wherever applicable to Mechanical and Electrical Work.

B. Section 01 31 46 – Special Requirements for Mechanical and Electrical Work shall apply.

C. Section 26 05 00 – General Provisions For Electrical Work shall apply

1.2 SUMMARY

A. Section Includes:

1. Color and legend requirements for raceways, conductors, and warning labels and signs.
2. Labels.
3. Tapes and stencils.
4. Tags.
5. Signs.
6. Cable ties.
7. Paint for identification.
8. Fasteners for labels and signs.
10. Identification of power and control cables.
11. Identification for conductors.
12. Warning labels and signs.
13. Instruction signs.
15. Miscellaneous identification products.

1.3 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.

B. Samples: For each type of label and sign to illustrate composition, size, colors, lettering style, mounting provisions, and graphic features of identification products.
C. Identification Schedule: For each piece of electrical equipment and electrical system components to be an index of nomenclature for electrical equipment and system components used in identification signs and labels. Use same designations indicated on Drawings.

D. Submittal: Design of labeling for arc-flash hazard study.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Comply with ASME A13.1.

B. Comply with NFPA 70.


D. Comply with ANSI Z535.4 for safety signs and labels.

E. Comply with NFPA 70ESection 260573.19 "Arc-Flash Hazard Analysis" requirements for arc-flash warning labels.

F. Adhesive-attached labeling materials, including label stocks, laminating adhesives, and inks used by label printers, shall comply with UL 969.

G. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes.

1. Temperature Change: 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces

2.2 COLOR AND LEGEND REQUIREMENTS

A. Raceways and Cables Carrying Circuits at 600 V or Less:

1. Black letters on an white field.

2. Legend: Indicate voltage and system or service type.

B. Color-Coding for Phase- and Voltage-Level Identification, 600 V or Less: Use colors listed below for ungrounded feeder and branch-circuit conductors.

1. Color shall be factory applied[

2. Colors for 208/120-V Circuits:

   a. Phase A: Black.
   b. Phase B: Red.
   c. Phase C: Blue.

b. Colors for Isolated Grounds: Green with white stripe.

3. Colors for 480/277-V Circuits:
   b. Phase B: Orange.
   c. Phase C: Yellow.
   d. Neutral: Gray.
   e. Color for Equipment Grounds: Green with a yellow stripe.
   f. Colors for Isolated Grounds: Green with white stripe.

C. Warning Label Colors:
   1. Identify system voltage with black letters on an orange background.

D. 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 36 INCHES (915 MM)."

E. Equipment Identification Labels:
   1. Black letters on a white field.
   2. All panelboards shall be provided with a nameplate identifying panel designation. Nameplates shall have white letters on black backgrounds.

2.3 LABELS

A. Vinyl Wraparound Labels: Preprinted, flexible labels laminated with a clear, weather- and chemical-resistant coating and matching wraparound clear adhesive tape for securing label ends.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Brady corporation
      b. Champion America
      c. Emedco
      d. Grafoplast Wire Markers
      e. LEM Products
      f. Marking Services, Inc.
      g. Hellermann Tyton
      h. Panduit Corp.
      i. Seton Identification Products

B. Snap-around Labels: Slit, pretensioned, flexible, preprinted, color-coded acrylic sleeves, with diameters sized to suit diameters and that stay in place by gripping action.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
C. Self-Adhesive Wraparound Labels: Write-on, 3-mil- (0.08-mm-) thick, vinyl flexible label with acrylic pressure-sensitive adhesive.
   1. Self-Lamination: Clear; UV-, weather- and chemical-resistant; self-laminating, protective shield over the legend. Labels sized such that the clear shield overlaps the entire printed legend.
   2. Marker for Labels: Permanent, waterproof, black ink marker recommended by tag manufacturer.

D. Self-Adhesive Labels: Vinyl, thermal, transfer-printed, 3-mil- (0.08-mm-) thick, multicolor, weather- and UV-resistant, pressure-sensitive adhesive labels, configured for intended use and location.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Brady corporation
      b. Emedco
      c. Grafoplast Wire Markers
      d. LEM Products
      e. Marking Services, Inc.
      f. Hellermann Tyton
      g. Panduit Corp.
      h. Seton Edentification Products
   2. Minimum Nominal Size:
      a. 1-1/2 by 6 inches (37 by 150 mm) for raceway and conductors.
      b. 3-1/2 by 5 inches (76 by 127 mm) for equipment.
      c. As required by authorities having jurisdiction.

2.4 TAPES AND STENCILS

A. Marker Tapes: Vinyl or vinyl-cloth, self-adhesive wraparound type, with circuit identification legend machine printed by thermal transfer or equivalent process.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Carlton Industries, LP
      b. Champion America
      c. Marking Services, Inc.
      d. Hellermann Tyton
      e. 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, provide products by one of the following:
   a. Brady Corporation
   b. Carlton Industries, LP
   c. Marking Services, Inc.

C. Tape and Stencil: 4-inch- (100-mm-) wide black stripes on 10-inch (250-mm) centers placed diagonally over orange background and are 12 inches (300 mm) wide. Stop stripes at legends.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. LEM Products
   b. Marking Services, Inc.
   c. Hellermann Tyton
   d. Seton Identification Products

D. Stenciled Legend: In nonfading, waterproof, black ink or paint. Minimum letter height shall be 1 inch (25 mm).

2.5 TAGS

A. Metal Tags: Brass or aluminum, 2 by 2 by 0.05 inch (50 by 50 by 1.3 mm), with stamped legend, punched for use with self-locking cable tie fastener.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Brady Corporation
   b. Emedco
   c. Marking Services, Inc.
   d. Seton Identification Products

B. Nonmetallic Preprinted Tags: Polyethylene tags, [0.015 inch (0.38 mm)] [0.023 inch (0.58 mm)] thick, color-coded for phase and voltage level, with factory screened permanent designations; punched for use with self-locking cable tie fastener.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Brady Corporation
   b. Emedco
   c. Grafoplast Wire Markers
   d. LEM Products
   e. Marking Services, Inc.
   f. Hellermann Tyton
   g. Panduit Corp.
   h. Seton Identification Products

C. Write-on Tags:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Carlton Industries, LP
   b. LEM Products
   c. Seton Identification Products
2. Polyester Tags: [0.010 inch (0.25 mm)] [0.015 inch (0.38 mm)] thick, with corrosion-resistant grommet and cable tie for attachment.
3. Marker for Tags: Permanent, waterproof, black ink marker recommended by tag manufacturer.
4. Marker for Tags: Machine-printed, permanent, waterproof, black ink marker recommended by printer manufacturer.

2.6 SIGNS

A. Baked-Enamel Signs:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Carlton Industries, LP
   b. Emedco
   c. Marking Services, Inc.
2. Preprinted aluminum signs, high-intensity reflective, punched or drilled for fasteners, with colors, legend, and size required for application.
3. 1/4-inch (6.4-mm) grommets in corners for mounting.
4. Nominal Size: 7 by 10 inches (180 by 250 mm).

B. Metal-Backed Butyrate Signs:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Brady corporation
   b. Emedco
   c. Marking Services, Inc.
2. Weather-resistant, nonfading, preprinted, cellulose-acetate butyrate signs, with 0.0396-inch (1-mm) galvanized-steel backing, punched and drilled for fasteners, and with colors, legend, and size required for application.
3. 1/4-inch (6.4-mm) grommets in corners for mounting.
4. Nominal Size: 10 by 14 inches (250 by 360 mm).

C. Laminated Acrylic or Melamine Plastic Signs:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Brady corporation
   b. Emedco
   c. Marking Services, Inc.
2. Engraved legend.
3. Thickness:
   a. For signs up to 20 sq. in. (129 sq. cm), minimum 1/16 inch (1.6 mm) thick.
   b. For signs larger than 20 sq. in. (129 sq. cm), 1/8 inch (3.2 mm) thick.
   c. Engraved legend with **white letters on a dark gray background**.
   d. Punched or drilled for mechanical fasteners with 1/4-inch (6.4-mm grommets in corners for mounting or Self-adhesive as required by project conditions.
   e. Framed with mitered acrylic molding and arranged for attachment at applicable equipment.
2.7 CABLE TIES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Marking Services, Inc.
   2. Hellermann Tyton
   3. Panduit Corp.

B. General-Purpose Cable Ties: Fungus inert, self-extinguishing, one piece, self-locking, and 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).

C. UV-Stabilized Cable Ties: Fungus inert, designed for continuous exposure to exterior sunlight, self-extinguishing, one piece, self-locking, and 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).

D. Plenum-Rated Cable Ties: Self-extinguishing, UV stabilized, one piece, and 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.

2.8 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 3 - EXECUTION

3.1 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.

3.2 INSTALLATION

A. Verify and coordinate identification names, abbreviations, colors, and other features with requirements in other Sections requiring identification applications, Drawings, Shop Drawings, manufacturer's wiring diagrams, and operation and maintenance manual. Use consistent designations throughout Project.

B. Install identifying devices before installing acoustical ceilings and similar concealment.

C. Verify identity of each item before installing identification products.

D. Coordinate identification with Project Drawings, manufacturer's wiring diagrams, and operation and maintenance manual.

E. Apply identification devices to surfaces that require finish after completing finish work.

F. Install signs with approved legend to facilitate proper identification, operation, and maintenance of electrical systems and connected items.

G. System Identification for Raceways and Cables under 600 V: Identification shall completely encircle cable or conduit. Place identification of two-color markings in contact, side by side.
   1. Secure tight to surface of conductor, cable, or raceway.

H. System Identification for Raceways and Cables over 600 V: Identification shall completely encircle cable or conduit. Place adjacent identification of two-color markings in contact, side by side.
   1. Secure tight to surface of conductor, cable, or raceway.


J. Emergency Operating Instruction Signs: Install instruction signs with white legend on a red background with minimum 3/8-inch- (10-mm-) high letters for emergency instructions at equipment used for [power transfer] [load shedding] <Insert emergency operations>.

K. Elevated Components: Increase sizes of labels, signs, and letters to those appropriate for viewing from the floor.
L. Accessible Fittings for Raceways: Identify the covers of each junction and pull box of the following systems with the wiring system legend, circuit number and system voltage. System legends shall be as follows:

   1. "EMERGENCY POWER."
   2. “EMERGENCY POWER LIFE SAFETY”
   3. “EMERGENCY POWER CRITICAL”
   4. “EMERGENCY POWER EQUIPMENT”
   5. “POWER.”
   6. "UPS."

M. Vinyl Wraparound Labels:

   1. Secure tight to surface of raceway or cable at a location with high visibility and accessibility.
   2. Attach labels that are not self-adhesive type with clear vinyl tape, with adhesive appropriate to the location and substrate.

N. Snap-around Labels: Secure tight to surface at a location with high visibility and accessibility.

O. Self-Adhesive Wraparound Labels: Secure tight to surface at a location with high visibility and accessibility.

P. Self-Adhesive Labels:

   1. On each item, install unique designation label that is consistent with wiring diagrams, schedules, and operation and maintenance manual.
   2. Unless otherwise indicated, provide a single line of text with 1/2-inch- (13-mm-) high letters on 1-1/2-inch- (38-mm-) high label; where two lines of text are required, use labels 2 inches (50 mm) high.

Q. Snap-around Color-Coding Bands: Secure tight to surface at a location with high visibility and accessibility.

R. Heat-Shrink, Preprinted Tubes: Secure tight to surface at a location with high visibility and accessibility.

S. Marker Tapes: Secure tight to surface at a location with high visibility and accessibility.

T. Self-Adhesive Vinyl Tape: Secure tight to surface at a location with high visibility and accessibility.

   1. Field-Applied, Color-Coding Conductor Tape: Apply in half-lapped turns for a minimum distance of 6 inches (150 mm) where splices or taps are made. Apply last two turns of tape with no tension to prevent possible unwinding.

U. Tape and Stencil: Comply with requirements in painting Sections for surface preparation and paint application.

V. Metal Tags:
1. Place in a location with high visibility and accessibility.
2. Secure using [general-purpose] [UV-stabilized] [plenum-rated] cable ties.

W. Nonmetallic Preprinted Tags:

1. Place in a location with high visibility and accessibility.
2. Secure using general-purpose cable ties.

X. Write-on Tags:

1. Place in a location with high visibility and accessibility.
2. Secure using general-purpose cable ties.

Y. Baked-Enamel Signs:

1. Attach signs that are not self-adhesive type with mechanical fasteners appropriate to the location and substrate.
2. Unless otherwise indicated, provide a single line of text with 1/2-inch- (13-mm-) high letters on minimum 1-1/2-inch- (38-mm-) high sign; where two lines of text are required, use signs minimum 2 inches (50 mm) high.

Z. Metal-Backed Butyrate Signs:

1. Attach signs that are not self-adhesive type with mechanical fasteners appropriate to the location and substrate.
2. Unless otherwise indicated, provide a single line of text with 1/2-inch- (13-mm-) high letters on 1-1/2-inch- (38-mm-) high sign; where two lines of text are required, use labels 2 inches (50 mm) high.

AA. Laminated Acrylic or Melamine Plastic Signs:

1. Attach signs that are not self-adhesive type with mechanical fasteners appropriate to the location and substrate.
2. Unless otherwise indicated, provide a single line of text with 1/2-inch- (13-mm-) high letters on 1-1/2-inch- (38-mm-) high sign; where two lines of text are required, use labels 2 inches (50 mm) high.

BB. Cable Ties: General purpose, for attaching tags, except as listed below:

1. Outdoors: UV-stabilized nylon.
2. In Spaces Handling Environmental Air: Plenum rated.

3.3 IDENTIFICATION SCHEDULE

A. Install identification materials and devices at locations for most convenient viewing without interference with operation and maintenance of equipment. Install access doors or panels to provide view of identifying devices.
B. Identify conductors, cables, and terminals in enclosures and at junctions, terminals, pull points, and locations of high visibility. Identify by system and circuit designation.

C. Accessible Raceways and Metal-Clad Cables, 600 V or Less, for Service, Feeder, and Branch Circuits, More Than 30 A and 120 V to Ground: Identify with self-adhesive vinyl tape applied in bands.
   1. Locate identification 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.

D. Accessible Fittings for Raceways and Cables within Buildings: Identify the covers of each junction and pull box of the following systems with self-adhesive labels containing the wiring system legend, circuit numbers and system voltage. System legends shall be as follows:
   1. "EMERGENCY POWER."
   2. "EMERGENCY POWER LIFE SAFETY"
   3. "EMERGENCY POWER CRITICAL"
   4. "EMERGENCY POWER EQUIPMENT"
   5. "POWER."
   6. "UPS."

E. Power-Circuit Conductor Identification, 600 V or Less: For conductors in pull and junction boxes, use vinyl wraparound labels to identify the phase.
   1. Locate identification 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.

F. Control-Circuit Conductor Identification: For conductors and cables in pull and junction boxes, use write-on tags with the conductor or cable designation, origin, and destination.

G. Control-Circuit Conductor Termination Identification: For identification at terminations, provide self-adhesive labels with the conductor designation.

H. Conductors to Be Extended in the Future: Attach write-on tags to conductors and list source.

I. Auxiliary Electrical Systems Conductor Identification: Self-adhesive vinyl tape that is uniform and consistent with system used by manufacturer for factory-installed connections.
   1. Identify conductors, cables, and terminals in enclosures and at junctions, terminals, and pull points. Identify by system and circuit designation.

J. Locations of Underground Lines: Underground-line warning tape for power, lighting, communication, and control wiring and optical-fiber cable.

K. Instructional Signs: Self-adhesive labels, including the color code for grounded and ungrounded conductors.
L. Warning Labels for Indoor Cabinets, Boxes, and Enclosures for Power and Lighting: Baked-enamel warning signs.

1. Apply to exterior of door, cover, or other access.
2. 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.
   c. Motor Control Centers
   d. Substation Transformers


N. Operating Instruction Signs: Laminated acrylic or melamine plastic signs.

O. Emergency Operating Instruction Signs: Laminated acrylic or melamine plastic signs with white legend on a red background with minimum 3/8-inch- (10-mm-) high letters for emergency instructions at equipment used for power transfer Sub Station Transformers

P. Equipment Identification Labels:

1. Indoor Equipment: Laminated acrylic or melamine plastic sign.
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 engraved, laminated acrylic or melamine label.
   b. Enclosures and electrical cabinets.
   c. Access doors and panels for concealed electrical items.
   d. Switchboards.
   e. Transformers: Label that includes tag designation indicated on Drawings for the transformer, feeder, and panelboards or equipment supplied by the secondary.
   f. Emergency system boxes and enclosures.
   g. Enclosed switches.
   h. Enclosed circuit breakers.
   i. Enclosed controllers.
   j. Variable-speed controllers.
   k. Push-button stations.
   l. Power-transfer equipment.
   m. Contactors.
   n. Battery-inverter units.
   o. Battery racks.
   p. Monitoring and control equipment.
   q. UPS equipment.

END OF SECTION 26 05 53
SECTION 26 28 16 - ENCLOSED SWITCHES AND CIRCUIT BREAKERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. This Section is to coordinate with and be complementary to the General Conditions and Supplementary General Conditions of the work, and Division 01 Specification Sections wherever applicable to Mechanical and Electrical Work.

B. Section 01 31 46 – Special Requirements for Mechanical and Electrical Work shall apply.

C. Section 26 05 00 – General Provisions For Electrical Work shall apply

1.2 SUMMARY

A. Section Includes:

1. Fusible switches.
2. Non-fusible switches.
3. Shunt trip switches.
4. Molded-case circuit breakers (MCCBs).
5. Molded-case switches.

1.3 DEFINITIONS

A. NC: Normally closed.

B. NO: Normally open.

C. SPDT: Single pole, double throw.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of enclosed switch, circuit breaker, accessory, and component indicated. Include nameplate ratings, dimensioned elevations, sections, weights, and manufacturers' technical data on features, performance, electrical characteristics, ratings, accessories, and finishes.

1. Enclosure types and details for types other than NEMA 250, Type 1.
2. Current and voltage ratings.
3. Short-circuit current ratings (interrupting and withstand, as appropriate).
4. Include evidence of a nationally recognized testing laboratory (NRTL) listing for series rating of installed devices.
5. Detail features, characteristics, ratings, and factory settings of individual overcurrent protective devices, accessories, and auxiliary components.

6. Include time-current coordination curves (average melt) for each type and rating of overcurrent protective device; include selectable ranges for each type of overcurrent protective device.

B. Shop Drawings: For enclosed switches and circuit breakers.

1. Include plans, elevations, sections, details, and attachments to other work.

2. Include wiring diagrams for power, signal, and control wiring.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified testing agency.

B. Manufacturer Seismic Qualification Certification: Submit certification that enclosures and cabinets and their mounting provisions, including those for internal components, will withstand seismic forces defined in Section 26 05 48 Seismic Controls for Electrical Systems and Section 01 35 48 Seismic Restraint for Isolated & Unisolated Equipment, Piping, Ductwork, Tanks & Stacks. Include the following

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.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For enclosed switches and circuit breakers 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. Manufacturer's written instructions for testing and adjusting enclosed switches and circuit breakers.

   b. Time-current coordination curves (average melt) for each type and rating of overcurrent protective device; include selectable ranges for each type of overcurrent protective device. Provide in electronic format.
1.7 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. Fuses: Equal to 10 percent of quantity installed for each size and type, but no fewer than three of each size and type.
2. Fuse Pullers: Two for each size and type.

1.8 QUALITY ASSURANCE

A. Testing Agency Qualifications: Accredited by NETA.

1. Testing Agency's Field Supervisor: Currently certified by NETA to supervise on-site testing.

1.9 FIELD CONDITIONS

A. Environmental Limitations: Rate equipment for continuous operation under the following conditions unless otherwise indicated:

1. Ambient Temperature: Not less than minus 22 deg F (minus 30 deg C) and not exceeding 104 deg F (40 deg C).

1.10 WARRANTY

A. Manufacturer's Warranty: Manufacturer and Installer agree to repair or replace components that fail in materials or workmanship within specified warranty period.

1. Warranty Period: One year(s) from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Seismic Performance: Enclosed switches and circuit breakers shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.

1. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."
2.2 GENERAL REQUIREMENTS

A. Source Limitations: Obtain enclosed switches and circuit breakers, overcurrent protective devices, components, and accessories, within same product category, from single manufacturer.

B. Product Selection for Restricted Space: Drawings indicate maximum dimensions for enclosed switches and circuit breakers, including clearances between enclosures, and adjacent surfaces and other items. Comply with indicated maximum dimensions.

C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by an NRTL, and marked for intended location and application.

D. Comply with NFPA 70.

E. Comply with New York City electrical Code (NYCEC).

F. Electrical Components, Devices, and Accessories: Listed and labeled as defined in, NYCEC Article 100 by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

2.3 FUSIBLE SWITCHES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. ABB Inc.
   2. Eaton
   3. General Electric Company
   4. Siemens Industry, Inc
   5. Square D, by Schneider electric

B. Type HD, Heavy Duty:
   1. Single throw.
   2. Three pole.
   3. 240 600-V ac.
   4. 1200 A and smaller.
   5. UL 98 and NEMA KS 1, horsepower rated, with clips or bolt pads to accommodate specified and indicated fuses.
   6. Lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.

C. Accessories:
   1. Equipment Ground Kit: Internally mounted and labeled for copper and aluminum ground conductors.
   2. Neutral Kit: Internally mounted; insulated, capable of being grounded and bonded; labeled for copper and aluminum neutral conductors.
   3. Isolated Ground Kit: Internally mounted; insulated, labeled for copper and aluminum neutral conductors.
4. Class R Fuse Kit: Provides rejection of other fuse types when Class R fuses are specified.
5. Auxiliary Contact Kit: One NO/NC (Form "C") auxiliary contact(s), arranged to activate before switch blades open. Contact rating - 120-V ac.
6. Lugs: Mechanical type, suitable for number, size, and conductor material.
7. Service-Rated Switches: Labeled for use as service equipment.

2.4 NONFUSIBLE SWITCHES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. ABB Inc.
   2. Eaton
   3. General Electric Company
   4. Siemens Industry, Inc
   5. Square D, by Schneider electric

B. Type GD, General Duty, Three Pole, Single Throw, 240-V ac, 600 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, lockable handle with capability to accept two padlocks, and interlocked with cover in closed position.

C. Type HD, Heavy Duty, Three Pole, Single Throw, 240 600-V ac, 1200 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.

D. Accessories:
   1. Equipment Ground Kit: Internally mounted and labeled for copper and aluminum ground conductors.
   2. Neutral Kit: Internally mounted; insulated, capable of being grounded and bonded; labeled for copper and aluminum neutral conductors.
   3. Isolated Ground Kit: Internally mounted; insulated, labeled for copper and aluminum neutral conductors.
   4. Class R Fuse Kit: Provides rejection of other fuse types when Class R fuses are specified.
   5. Auxiliary Contact Kit: One NO/NC (Form "C") auxiliary contact(s), arranged to activate before switch blades open. Contact rating - 120-V ac.
   6. Lugs: Mechanical type, suitable for number, size, and conductor material.
   7. Service-Rated Switches: Labeled for use as service equipment.

2.5 SHUNT TRIP SWITCHES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Bussman (Eaton)
   2. Littlefuse, Inc.
   3. Mersen USA

B. General Requirements: Comply with ASME A17.1, UL 50, and UL 98, with Class J fuse block and 200-kA interrupting and short-circuit current rating.
ENCLOSED SWITCHES AND CIRCUIT BREAKERS

C. Type HD, Heavy-Duty, Three Pole, Single-Throw Fusible Switch: 240 600-V ac, 30 60 100 A; UL 98 and NEMA KS 1; integral shunt trip mechanism; horsepower rated, with clips or bolt pads to accommodate specified and indicated fuses; lockable handle with capability to accept three padlocks; interlocked with cover in closed position.

D. Type HD, Heavy-Duty, Three Pole, Single-Throw Nonfusible Switch: 240 600-V ac, 30 60 100 > A; UL 98 and NEMA KS 1; integral shunt trip mechanism; horsepower rated, lockable handle with capability to accept three padlocks; interlocked with cover in closed position.

E. Control Circuit: 120-V ac; obtained from integral control power transformer, with primary and secondary fuses.

F. Accessories:
1. Isolated neutral lug; 100 percent rating.
2. Mechanically interlocked auxiliary contacts that change state when switch is opened and closed.
3. Form C alarm contacts that change state when switch is tripped.
4. Three-pole, 24-V dc coil voltage.
5. Neutral Kit: Internally mounted; insulated, capable of being grounded and bonded; labeled for copper and aluminum neutral conductors.
6. Class R Fuse Kit: Provides rejection of other fuse types when Class R fuses are specified.
7. Auxiliary Contact Kit: One NO/NC (Form "C") auxiliary contact(s), arranged to activate before switch blades open. Contact rating - 24-V ac.
8. Lugs: Mechanical type, suitable for number, size, and conductor material.

2.6 MOLDED-CASE CIRCUIT BREAKERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Eaton
2. Square D
3. General Electric Company
4. Seimens

B. Circuit breakers shall be constructed using glass-reinforced insulating material. Current carrying components shall be completely isolated from the handle and the accessory mounting area.

C. Circuit breakers shall have a toggle operating mechanism with common tripping of all poles, which provides quick-make, quick-break contact action. The circuit-breaker handle shall be over center, be trip free, and reside in a tripped position between on and off to provide local trip indication. Circuit-breaker escutcheon shall be clearly marked on and off in addition to providing international I/O markings. Equip circuit breaker with a push-to-trip button, located on the face of the circuit breaker to mechanically operate the circuit-breaker tripping mechanism for maintenance and testing purposes.

D. The maximum ampere rating and UL, IEC, or other certification standards with applicable voltage systems and corresponding interrupting ratings shall be clearly marked on face of circuit breaker. Circuit breakers shall be 100 percent rated.
E. MCCBs shall be equipped with a device for locking in the isolated position.

F. Lugs shall be suitable for 140 deg F (60 deg C) rated wire on 125-A circuit breakers and below.

G. Standard: Comply with UL 489 with interrupting capacity to comply with available fault currents.


I. Adjustable, Instantaneous-Trip Circuit Breakers: Magnetic trip element with front-mounted, field-adjustable trip setting.

J. Electronic Trip Circuit Breakers: Field-replaceable rating plug, rms sensing, with the following field-adjustable settings:
   1. Instantaneous trip.
   2. Long- and short-time pickup levels.
   3. Long- and short-time time adjustments.
   4. Ground-fault pickup level, time delay, and I-squared t response.

K. Current-Limiting Circuit Breakers: Frame sizes 400 A and smaller, and let-through ratings less than NEMA FU 1, RK-5.

L. Integrally Fused Circuit Breakers: Thermal-magnetic trip element with integral limiter-style fuse listed for use with circuit breaker and trip activation on fuse opening or on opening of fuse compartment door.

M. Ground-Fault Circuit Interrupter (GFCI) Circuit Breakers: Single- and two-pole configurations with Class A ground-fault protection (6-mA trip).

N. Ground-Fault Equipment-Protection (GFEP) Circuit Breakers: With Class B ground-fault protection (30-mA trip).

O. Features and Accessories:
   1. Standard frame sizes, trip ratings, and number of poles.
   2. Lugs: Mechanical type, suitable for number, size, trip ratings, and conductor material.
   3. Application Listing: Appropriate for application; Type SWD for switching fluorescent lighting loads; Type HID for feeding fluorescent and high-intensity discharge lighting circuits.
   4. Ground-Fault Protection: Comply with UL 1053; integrally mounted, self-powered type with mechanical ground-fault indicator; relay with adjustable pickup and time-delay settings, push-to-test feature, internal memory, and shunt trip unit; and three-phase, zero-sequence current transformer/sensor.
   5. Shunt Trip: Trip coil energized from separate circuit, with coil-clearing contact.
   6. Undervoltage Trip: Set to operate at 35 to 75 percent of rated voltage without intentional time delay.
7. Auxiliary Contacts: **One SPDT switch** with "a" and "b" contacts; "a" contacts mimic circuit-breaker contacts, "b" contacts operate in reverse of circuit-breaker contacts.
8. Alarm Switch: One **NO** contact that operates only when circuit-breaker has tripped.
9. Key Interlock Kit: Externally mounted to prohibit circuit-breaker operation; key shall be removable only when circuit breaker is in off position.
10. Zone-Selective Interlocking: Integral with **ground-fault** trip unit; for interlocking ground-fault protection function.
11. Electrical Operator: Provide remote control for on, off, and reset operations.
12. Accessory Control Power Voltage: **Integrally mounted, self-powered.**

### 2.7 MOLDED-CASE SWITCHES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Eaton
2. Square D
3. General Electric Company
4. Seimens

B. Description: MCCB with fixed, high-set instantaneous trip only, and short-circuit withstand rating equal to equivalent breaker frame size interrupting rating.

C. Standard: Comply with UL 489 with interrupting capacity to comply with available fault currents.

D. Features and Accessories:

1. Standard frame sizes and number of poles.
2. Lugs:
   a. Mechanical type, suitable for number, size, trip ratings, and conductor material.
   b. Lugs shall be suitable for 140 deg F (60 deg C) rated wire on 125-A circuit breakers and below.

3. Ground-Fault Protection: Comply with UL 1053; remote-mounted and powered type with mechanical ground-fault indicator; relay with adjustable pickup and time-delay settings, push-to-test feature, internal memory, and shunt trip unit; and three-phase, zero-sequence current transformer/sensor.
4. Shunt Trip: Trip coil energized from separate circuit, with coil-clearing contact.
5. Undervoltage Trip: Set to operate at 35 to 75 percent of rated voltage without intentional time delay.
6. Auxiliary Contacts: **One SPDT switch** with "a" and "b" contacts; "a" contacts mimic switch contacts, "b" contacts operate in reverse of switch contacts.
7. Alarm Switch: One **NO** contact that operates only when switch has tripped.
8. Key Interlock Kit: Externally mounted to prohibit switch operation; key shall be removable only when switch is in off position.
9. Zone-Selective Interlocking: Integral with ground-fault shunt trip unit; for interlocking ground-fault protection function.
10. Electrical Operator: Provide remote control for on, off, and reset operations.
11. Accessory Control Power Voltage: **Integrally mounted, self-powered.**

2.8 ENCLOSURES

A. Enclosed Switches and Circuit Breakers: UL 489, NEMA KS 1, NEMA 250, and UL 50, to comply with environmental conditions at installed location.

B. Enclosure Finish: The enclosure shall be finished with **gray baked enamel paint, electrodeposited on cleaned, phosphatized steel** (NEMA 250 Type 1).

C. Conduit Entry: NEMA 250 Types 4, 4X, and 12 enclosures shall contain no knockouts. NEMA 250 Types 7 and 9 enclosures shall be provided with threaded conduit openings in both endwalls.

D. Operating Mechanism: The circuit-breaker operating handle shall be **directly operable through the front cover of the enclosure (NEMA 250 Type 1).** The cover interlock mechanism shall have an externally operated override. The override shall not permanently disable the interlock mechanism, which shall return to the locked position once the override is released. The tool used to override the cover interlock mechanism shall not be required to enter the enclosure in order to override the interlock.

E. Enclosures designated as NEMA 250 Type 4, 4X stainless steel, 12, or 12K shall have a dual cover interlock mechanism to prevent unintentional opening of the enclosure cover when the circuit breaker is ON and to prevent turning the circuit breaker ON when the enclosure cover is open.

F. NEMA 250 Type 7/9 enclosures shall be furnished with a breather and drain kit to allow their use in outdoor and wet location applications.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine elements and surfaces to receive enclosed switches and circuit breakers for compliance with installation tolerances and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

1. Commencement of work shall indicate Installer's acceptance of the areas and conditions as satisfactory.

3.2 PREPARATION

A. Interruption of Existing Electric Service: Do not interrupt electric service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary electric service according to requirements indicated:
1. Notify [Architect] [Construction Manager] [Owner] no fewer than fourteen (14) days in advance of proposed interruption of electric service.
2. Indicate method of providing temporary electric service.
3. Do not proceed with interruption of electric service without [Architect's] [Construction Manager's] [Owner's] written permission.
4. Comply with NFPA 70E.

3.3 ENCLOSURE ENVIRONMENTAL RATING APPLICATIONS

A. Enclosed Switches and Circuit Breakers: Provide enclosures at installed locations with the following environmental ratings.

1. Indoor, Dry and Clean Locations: NEMA 250, Type 1.
2. Outdoor Locations: NEMA 250, [Type 3R] [Type 4X].
3. [Kitchen] [Wash-Down] Areas: NEMA 250, [Type 4X], [stainless steel].
4. Other Wet or Damp, Indoor Locations: NEMA 250, [Type 4].
5. Indoor Locations Subject to Dust, Falling Dirt, and Dripping Noncorrosive Liquids: NEMA 250, Type 12.
6. Hazardous Areas Indicated on Drawings: NEMA 250, [Type 7] [Type 9] [with cover attached by Type 316 stainless steel bolts].

3.4 INSTALLATION

A. Coordinate layout and installation of switches, circuit breakers, and components with equipment served and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.
B. Install individual wall-mounted switches and circuit breakers with tops at uniform height unless otherwise indicated.
C. Comply with mounting and anchoring requirements specified.
D. Temporary Lifting Provisions: Remove temporary lifting of eyes, channels, and brackets and temporary blocking of moving parts from enclosures and components.
E. Install fuses in fusible devices.
F. Comply with NFPA 70 and NECA 1.

3.5 IDENTIFICATION

A. Comply with requirements in Section 260553 "Identification for Electrical Systems."

1. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs.
2. Label each enclosure with engraved metal or laminated-plastic nameplate.
3.6 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.

B. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

C. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.

D. Perform tests and inspections **with the assistance of a factory-authorized service representative.**

E. Tests and Inspections for Switches:

1. Visual and Mechanical Inspection:
   a. Inspect physical and mechanical condition.
   b. Inspect anchorage, alignment, grounding, and clearances.
   c. Verify that the unit is clean.
   d. Verify blade alignment, blade penetration, travel stops, and mechanical operation.
   e. Verify that fuse sizes and types match the Specifications and Drawings.
   f. Verify that each fuse has adequate mechanical support and contact integrity.
   g. Inspect bolted electrical connections for high resistance using one of the two following methods:
      1) Use a low-resistance ohmmeter.
         a) Compare bolted connection resistance values to values of similar connections. Investigate values that deviate from those of similar bolted connections by more than 50 percent of the lowest value.
      2) Verify tightness of accessible bolted electrical connections by calibrated torque-wrench method in accordance with manufacturer's published data or NETA ATS Table 100.12.
         a) Bolt-torque levels shall be in accordance with manufacturer's published data. In the absence of manufacturer's published data, use NETA ATS Table 100.12.
   h. Verify that operation and sequencing of interlocking systems is as described in the Specifications and shown on the Drawings.
   i. Verify correct phase barrier installation.
   j. Verify lubrication of moving current-carrying parts and moving and sliding surfaces.

2. Electrical Tests:
   a. Perform resistance measurements through bolted connections with a low-resistance ohmmeter. Compare bolted connection resistance values to values of similar
connections. Investigate values that deviate from adjacent poles or similar switches by more than 50 percent of the lowest value.

b. Measure contact resistance across each switchblade fuseholder. Drop values shall not exceed the high level of the manufacturer's published data. If manufacturer's published data are not available, investigate values that deviate from adjacent poles or similar switches by more than 50 percent of the lowest value.

c. Perform insulation-resistance tests for one minute on each pole, phase-to-phase and phase-to-ground with switch closed, and across each open pole. Apply voltage in accordance with manufacturer's published data. In the absence of manufacturer's published data, use Table 100.1 from the NETA ATS. Investigate values of insulation resistance less than those published in Table 100.1 or as recommended in manufacturer's published data.

d. Measure fuse resistance. Investigate fuse-resistance values that deviate from each other by more than 15 percent.

e. Perform ground fault test according to NETA ATS 7.14 "Ground Fault Protection Systems, Low-Voltage."

F. Tests and Inspections for Molded Case Circuit Breakers:

1. Visual and Mechanical Inspection:

a. Verify that equipment nameplate data are as described in the Specifications and shown on the Drawings.

b. Inspect physical and mechanical condition.

c. Inspect anchorage, alignment, grounding, and clearances.

d. Verify that the unit is clean.

e. Operate the circuit breaker to ensure smooth operation.

f. Inspect bolted electrical connections for high resistance using one of the two following methods:

1) Use a low-resistance ohmmeter.

   a) Compare bolted connection resistance values to values of similar connections. Investigate values that deviate from those of similar bolted connections by more than 50 percent of the lowest value.

2) Verify tightness of accessible bolted electrical connections by calibrated torque-wrench method in accordance with manufacturer's published data or NETA ATS Table 100.12.

   a) Bolt-torque levels shall be in accordance with manufacturer's published data. In the absence of manufacturer's published data, use NETA ATS Table 100.12.

g. Inspect operating mechanism, contacts, and chutes in unsealed units.

h. Perform adjustments for final protective device settings in accordance with the coordination study.

2. Electrical Tests:
a. Perform resistance measurements through bolted connections with a low-resistance ohmmeter. Compare bolted connection resistance values to values of similar connections. Investigate values that deviate from adjacent poles or similar switches by more than 50 percent of the lowest value.

b. Perform insulation-resistance tests for one minute on each pole, phase-to-phase and phase-to-ground with circuit breaker closed, and across each open pole. Apply voltage in accordance with manufacturer's published data. In the absence of manufacturer's published data, use Table 100.1 from the NETA ATS. Investigate values of insulation resistance less than those published in Table 100.1 or as recommended in manufacturer's published data.

c. Perform a contact/pole resistance test. Drop values shall not exceed the high level of the manufacturer's published data. If manufacturer's published data are not available, investigate values that deviate from adjacent poles or similar switches by more than 50 percent of the lowest value.

d. Perform insulation resistance tests on all control wiring with respect to ground. Applied potential shall be 500-V dc for 300-V rated cable and 1000-V dc for 600-V rated cable. Test duration shall be one minute. For units with solid state components, follow manufacturer's recommendation. Insulation resistance values shall be no less than two megohms.

e. Determine the following by primary current injection:

1) Long-time pickup and delay. Pickup values shall be as specified. Trip characteristics shall not exceed manufacturer's published time-current characteristic tolerance band, including adjustment factors.

2) Short-time pickup and delay. Short-time pickup values shall be as specified. Trip characteristics shall not exceed manufacturer's published time-current characteristic tolerance band, including adjustment factors.

3) Ground-fault pickup and time delay. Ground-fault pickup values shall be as specified. Trip characteristics shall not exceed manufacturer's published time-current characteristic tolerance band, including adjustment factors.

4) Instantaneous pickup. Instantaneous pickup values shall be as specified and within manufacturer's published tolerances.

f. Test functionality of the trip unit by means of primary current injection. Pickup values and trip characteristics shall be as specified and within manufacturer's published tolerances.

g. Perform minimum pickup voltage tests on shunt trip and close coils in accordance with manufacturer's published data. Minimum pickup voltage of the shunt trip and close coils shall be as indicated by manufacturer.

h. Verify correct operation of auxiliary features such as trip and pickup indicators; zone interlocking; electrical close and trip operation; trip-free, anti-pump function; and trip unit battery condition. Reset all trip logs and indicators. Investigate units that do not function as designed.

i. Verify operation of charging mechanism. Investigate units that do not function as designed.

3. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.

4. Perform the following infrared scan tests and inspections and prepare reports:
a. Initial Infrared Scanning: After Substantial Completion, but not more than 60 days after Final Acceptance, perform an infrared scan of each enclosed switch and circuit breaker. Remove front panels so joints and connections are accessible to portable scanner.

b. Follow-up Infrared Scanning: Perform an additional follow-up infrared scan of each enclosed switch and circuit breaker 11 months after date of Substantial Completion.

c. Instruments and Equipment: Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.

5. Test and adjust controls, remote monitoring, and safeties. Replace damaged and malfunctioning controls and equipment.

G. Enclosed switches and circuit breakers will be considered defective if they do not pass tests and inspections.

H. Prepare test and inspection reports.

1. Test procedures used.
2. Include identification of each enclosed switch and circuit breaker tested and describe test results.
3. List deficiencies detected, remedial action taken, and observations after remedial action.

3.7 ADJUSTING

A. Adjust moving parts and operable components to function smoothly, and lubricate as recommended by manufacturer.

B. Set field-adjustable circuit-breaker trip ranges [as specified in Section 260573.16 "Coordination Studies." to values indicated on the Drawings.]

END OF SECTION 26 28 16
PART 1 - GENERAL

1.01 SUMMARY

A. The EcoAisle uses a series of panels, door frames and doors, and air blocks to enclose a hot or cold aisle zone which contains IT equipment warm exhaust air (HACS) or cooling unit supply air (CACS).

B. Hot Aisle Containment (HACS) - The hot aisle zone is the space between two rows of IT equipment racks with the hot air exhaust side of the IT equipment in one row of racks facing the opposite row; or between a single row of racks and an architectural wall, with the hot air exhaust side of the IT equipment in the row of racks facing the architectural wall. In this enclosed space hot exhaust air from all IT racks is collected inside of the EcoAisle. The exhaust air is cooled and conveyed to the outside of the EcoAisle where it is made available to IT equipment inlet air intakes. The HACS is available in ceiling panel or ducted return configurations.

C. By preventing mixing of cool supply air and hot exhaust air, this self-contained configuration is capable of supporting a complete range of low, medium and high power/heat density loads, and can be deployed in multiple environments without affecting the surrounding area.

1.02 REFERENCES

A. General: The publications listed below form a part of this Specification to the extent referenced. The publications are referred to in the text by the basic designation only. The edition/revision of the referenced publications shall be the latest date as of the date of the Contract Documents, unless otherwise specified.

1.03 SYSTEM DESCRIPTION

A. Design Requirements: The EcoAisle shall be sized for two equal length rows of IT enclosures with supporting infrastructure or one row with an adjacent wall. Supporting aisle widths range from 3 to 6 feet. Hot and cold aisle, ceiling and ducted configurations are supported. Ceiling and duct panels must be constructed in a rectangular fashion and extend horizontally and vertically (angled panels or tapers are not supported). Refer to proper documentation for clearance requirements for various components. Data center floor must be level. Some third-party racks may be compatible.

B. System Characteristics:
   1. Physical:
      a. External width dimensions shall be the width of the aisle and two rows of enclosures (or aisle width plus one row of enclosures for single row configurations)
      b. External depth dimensions shall be the length of the row of enclosures and any clearances for end-of-aisle doors.
      c. The PDU shall have a maximum external height shall vary based off customer requirements.

C. Design Number:
1. The EcoAisle system shall be configured and designed as per Schneider Electric solution number “ISX0001554166”.

1.04 SUBMITTALS FOR REVIEW

A. Product Data: Provide for manufactured products and assemblies. Indicate dimensions, System layout, description and location of components, rough-in connections, and materials characteristics and connection requirements.

B. Installation, Operation and Maintenance Data: Include manufacturer's descriptive literature, operating instructions, installation instructions, and maintenance and repair data.

C. Submit installation - startup report provided by manufacturer's factory trained technician.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum 5 years documented experience with service facilities within 8 hours reaction time of Project site.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to the Project site in supplier’s or manufacturer’s original wrappings and containers, labeled with supplier’s or manufacturer’s name, material or product brand name, and lot number, if any.

B. The customer shall store materials in their original, undamaged packages and containers, inside a well ventilated area protected from weather, moisture, soiling, extreme temperatures, and humidity.

1.07 WARRANTY

A. The manufacturer shall provide a one-year warranty against defects in material and workmanship for 12 months after initial start-up or 18 months after ship date, whichever occurs first. (Refer to the Warranty Statement for details.)

B. Additional Owner Rights: The warranty shall not deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents and shall be in addition to and run concurrent with other warranties made by the Contractor under requirements of the Contract Documents.

1.08 MAINTENANCE

A. The equipment supplier shall be capable to maintain, service, and repair the equipment for a period of two (2) years. The supplier is responsible to include all parts & labor and maintain the equipment in accordance to the equipment manufacturer's recommended guidelines as set forth in the equipment's user/operations manual.
PART 2 - PRODUCTS

2.01 MANUFACTURERS
A. Basis of Design: Product specified is EcoAisle Thermal Containment System as manufactured by Schneider Electric. Items specified are to establish a standard of quality for design, function, materials, and appearance.
B. Subject to compliance with these and related specification sections, the following Manufacturers may propose on the project: Schneider Electric
C. Substitutions: Proposed substitutions must be approved prior to bidding. Alternate manufacturers/suppliers will be responsible for any required changes and associated costs if alternate is accepted.
D. UL Listing: All system components shall be certified as suitable for this data center environment by documentation supporting UL Listings: UL484, CSA C22.2 No.236 and UL723S.

2.02 CEILING PANELS
A. Ceiling panels shall be 6.0 mm thick Lexan clear-ribbed panels or 2.36 mm thick V0 clear panels with aluminum framing.
B. Flame spread rates: Smoke development index "0-65" and flame spread index “0” in accordance with UL723 or ASTM84. Nominal thickness: 2.36 mm (V0 clear) --or-- Smoke development index "20" and flame spread index "0" in accordance with UL723 or ASTM84. Nominal thickness: 6.0 mm (Lexan)
C. Minimum Light Transmission per ASTM D1003 equal to 82% or greater.
D. Ceiling panels shall be designed to be supported by the frames of the IT Equipment racks. Ceiling Panel frames sizes shall be suitable to match up with various rack widths, row width, and hot aisle widths.
E. The ceiling system shall be designed to permit removal of the ceiling panel from within the contained zone without the use of tools for service access to the space above the EcoAisle.

2.03 AIR RETURN SYSTEM
A. Shall be 6.0 mm thick Lexan clear-ribbed panels or 2.36 mm thick V0 clear panels with aluminum framing.
B. Flame spread rates: Smoke development index "0-65" and flame spread index “0” in accordance with UL723 or ASTM84. Nominal thickness: 2.36 mm (V0 clear) --or-- Smoke development index "20" and flame spread index "0" in accordance with UL723 or ASTM84. Nominal thickness: 6.0 mm (Lexan)
C. Minimum Light Transmission per ASTM D1003 equal to 82% or greater.
D. Duct panels shall be designed to be supported by the frames of the IT Equipment racks. Ceiling Panel frames sizes shall be suitable to match up with various rack widths, row width, and hot aisle widths.
E. The air return system shall be designed to permit removal of the airblocks from within the contained zone without the use of tools for service access to the space above the EcoAisle.

2.04 RACK EQUIPMENT BAYING KITS

A. Metal and plastic components shall be supplied to establish consistent spacing between the racks or rack based equipment, and to fill the space to provide an air containment seal at the juncture between two adjacent racks or rack based equipment.

2.05 DOOR FRAMES AND DOORS

A. Metal door frames and doors shall be provided to establish air containment at the end of two rows of racks. The door frame system shall match the height of the rack based equipment, and match the design width of the contained aisle.

B. Doors shall be hinged or sliding, to permit access into the contained aisle for maintenance or servicing. Standard door operation shall not interfere with access or service on any rack or rack based equipment.

C. Doors shall be provided with a window, handles and latches. The following options are available and should be provided if specified:
   1. Door locks and three matching keys per door
   2. Two proximity switches provided per door for open/closed status
   3. Automatic door closure system for sliding door
   4. Sliding Doors shall be provided with swing-open functionality in case of emergency inside the aisle.
   5. Door frame includes mounting for differential pressure sensor (Active Flow Controller)

2.06 FRAMES AND COMPONENTS SEALS

A. Foam Rubber gaskets or metal/composite, brush, or plastic air blocks shall be installed at EcoAisle joints to minimize open gaps between containment system components, such as door frames, ceiling and duct panels, and IT Equipment racks and rack based equipment. Gasketing and/or air blocks may include, but not be limited to, the following.
   1. Joints between adjacent ceiling/duct panels
   2. Joints between ceiling/duct panels and top of racks, if not metal to metal.
   3. Joints between door frames and ceiling/duct panels, if not metal to metal.
   4. Joints between door frames and racks at the end of the row(s).
   5. Joints between rack bottom rear frame and floor.
   6. Joints between duct panel and ceiling/roof of room.

2.07 SYSTEM AIR LEAKAGE

A. The EcoAisle is not designed or intended to be air tight. The balance between exhaust air and supply air must be maintained by the match up of server airflow with airflow of the cooling equipment. The recommended minimum total per zone airflow for the cooling equipment is 5% more than the design IT Server airflow. This allows the cooling equipment airflow system to closely match the server airflow system, and avoids excessive cooling airflow system power consumption when variable speed/capacity cooling system fans/blowers are used.
2.08 PROVIDE ADDITIONAL FEATURES

A. Fire Safe Ceiling


2. The Fire Safe Ceiling system shall contain one of the specified ceiling panels described in section 2.0.3.

3. Shrinking panels or thermal links are not an acceptable substitution.

4. Ceiling panel shall be resettable

5. The Ceiling System shall be UL723S certified for use below fire suppression systems at the room ceiling level.
   a. The ceiling system shall use thermal detection for panel release to be UL723S certified
   b. The system shall activate at 135 degF or 57 degC
   c. Multiple temperature switches per aisle must be provided for thermal event detection.

6. The ceiling system shall also have a panel release based on smoke detection to enable fire suppression system in the room
   a. Smoke detection shall be supplied by this contractor
   b. Smoke detector shall send an on/off digital signal to control box (not an analog signal).
   c. A normally closed dry contact smoke detector must be used
   d. Smoke detector shall utilize 24VDC output from pre-action panel power source.

7. The Fire Safe System must have an audible and visible alarm to alert personnel of pending panel release. The system must hold the panels in place for 10 sec after alarm sounds and prior to releasing panels to allow personnel to exit the space in the event of a thermal or smoke event.

8. The ceiling system shall utilize electromagnets for panel release mechanism. The electromagnets shall be powered by supplies located in adjacent IT racks
   a. The power supplies shall utilize dual inputs
   b. The electromagnets shall be connected in series (one by one)
   c. Voltage is 120VAC 60 Hz
   d. The power supply can support up to 30 electromagnetic locks
   e. If smoke detector will draw power from this power supply, the quantity will be decreased based on the power consumption of smoke detector

9. The ceiling system shall include a mechanical locking device to allow system to be serviced without panel release

B. Lighting


2. Available for both ducted and ceiling panel, single or dual rack row installations.
   a. Shall provide additional duct mounting rail for duct configurations:
      1. Lights shall fasten to rail
      2. Wire covers used for spaces between lights
      3. The bulk of the wiring shall be hidden inside the rail behind each light and cover
   b. Lights shall be mounted to upper corners inside contained aisle along aisle length
c. Lighting density options include: end-to-end, 300 mm, or 600 mm spacing between each light
d. Lights are to be install on both sides of aisle
e. Shall include all necessary cabling, connectors, and fasteners (no tools provided)
f. Across aisle cable shall be provided to minimize number of control units per contained pod

3. Specs
   a. CCT = 5000K
   b. CRI = 85
c. Typ Watts = 5, max Watts = 6
d. Lens = frosted
e. Lumens per foot = 187, Lumens/meter = 613
f. Length = 11-1/2", width = 1”, height = ½”

4. Control Unit
   a. Shall be mounted in rack
   b. Voltage options is 120VAC single phase 60 Hz
c. Shall power up to 12 lights per control unit
d. Shall be provided with 2 power cords: (1) C13/C14, (1) C13/NEMA 5-15P
e. Group control capability for use of more than one control unit per contained pod.
   Up to five total control units can be grouped together
f. Control unit comes with integrated rotary switch for adjusting light ON interval.
   Time settings shall consist of various presets from 1 to 75 minutes of light ON operation
g. Two group LED outputs on control unit (lights wired in series)
h. Integrated LED indicates power status of control unit
i. Controller is to be installed to mounting rails in lowest position of rack (preferably the 0U position) (hardware provided)

5. Motion Sensor
   a. Shall provide two motion sensors per control unit
   b. Capable up to four motion sensors per control unit
c. Motion sensors shall mount to door or curtain header (mounting brackets provided)
d. If any of the four motion sensors (per control unit) detect movement, LED bank will illuminate.
e. Utilizes a single RJ45 connection per motion sensor (shall be routed out of visibility)

6. Manual Light Switch
   a. Shall provide two manual light switches
   b. Shall mount inside or outside of aisle
c. Shall mount via three methods (hardware provided): 1) Fastener 2) Magnet, or 3) hook and loop
d. Manual switch turns OFF the light bank
e. Motion sensors become inactive when a manual switch is pushed. After 10 seconds, motion sensors are automatically restored

C. Blanking Panels, Height Adapters, and Depth Extenders
   1. Can be used to provide an aesthetic alternative for varying dimension enclosures.
   2. Blanking Panels shall be placed where gaps between racks exist to seal contained aisle.
   The panel shall match the height of the enclosures and match the width of the gap. It shall not be mounted to any adjacent blanking panels nor shall it support any adjustable height supports.
3. Depth Extenders shall mount to front or back of APC by Schneider Electric enclosures to align aisle. The extender shall match the depth of the adjacent racks and match the width and height of the enclosure (including any height adapters) of which it is being mounted.

4. Height Adapters shall mount to the top of APC by Schneider Electric enclosures to align the enclosure height. The height adapter match the height of the adjacent racks and shall match the width and depth of the rack (including any depth adapters) of which it is being mounted.

PART 3 - EXECUTION

3.01 MANUFACTURER FIELD SERVICE:

A. Prepare, receive, inventory and install containment system components.

B. Prepare and submit report of system installation indicating all system parameters.

C. Provide the services of Skae Power Solutions to attend and participate in the on-site integration and to commission equipment. All vendors and contractors affecting the equipment specified herein shall be present at the same time.

PART 4 - PLANNING AND RECEIVING

A. ROOM PREPARATION

1. During the design of the room, consideration should be given to the following factors: ease of entry for the system, floor-loading factors, and accessibility of piping and wiring. The room must be sealed with a vapor barrier to minimize moisture infiltration. Polyethylene film (plastic sheeting) is a good vapor barrier for ceiling and wall applications. Rubber- or plastic-based paints should be applied to concrete floors and walls. The room should be thoroughly insulated to minimize thermal loads and make-up air (if required) should be preconditioned to reduce additional temperature, filtration, and moisture loads.

B. RECEIVING THE COMPONENTS

1. Your EcoAisle Containment System has been completely tested and inspected prior to shipment. To ensure that you have received the components in excellent condition, perform a careful inspection of the crating and the parts immediately upon receipt. Verify that all parts ordered were received as specified and that the components are the correct size necessary to fulfill your environmental control needs. Report any damage discovered to the freight carrier. If necessary, contact the Schneider Electric field service department for help in repairing or replacing damaged parts. While Schneider Electric is not responsible for damage incurred in transit, we want to make sure that you have no undue delays in your system start-up. Please refer to the unpacking sheet for more information.

END OF SECTION 27 11 16