Winston Churchill High School
Elevator Replacement

11300 Gainsborough Road
Potomac, Maryland 20854
Montgomery County Public Schools

Bid Specifications
January 7, 2025

Project No: 2024-13.04

Winston Churchill HS
Potomac, MD

SPECIFICATIONS
February 2025

Winston Churchill High School
Montgomery County Public Schools
11300 Gainsborough Road
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Division 26 Electrical

Division 28 Electronic Safety and Security

Division 31 Earthwork

Not Used

Division 32 Exterior Improvements

Not Used

- END OF SECTION 00 00 00 -

Montgomery County Public Schools Facilities

DIVISION 1 - GENERAL REQUIREMENTS

SECTION 011000 - SUMMARY OF WORK

PART 1 - GENERAL

1.1 Summary:

A. Unless otherwise noted, Contractor shall provide and pay for labor, materials, equipment, tools, construction machinery, transportation, and other facilities and services necessary for proper execution and completion of Work required by Contract Documents.

B. Work of Contract can be summarized by reference to the Contract, General Conditions, specification sections as listed in the "Table of Contents" bound herewith, drawings as listed in "Schedule of Drawings" bound herewith, addenda and modifications to the Contract Documents issued subsequent to the initial printing of the project specifications and including but not necessarily limited to printed matter referenced by any of these. It is recognized that work of Contract may be affected or influenced by governing regulations, natural phenomenon including weather conditions, and other forces outside Contract Documents.

C. This project includes an interior alteration to an existing high school facility on a previously developed site. Furnish all labor, materials, equipment, and services necessary for and incidental to the selective demolition of portions of the existing building elements, and replacement of an existing elevator at Winston Churchill High School. All work shall be bid as lump sum as indicated on the drawings and specifications. Work on site may begin in June 2026 and be completed for the start of school in August 2026 during summer break. Work is further described as follows:

1. The Owner will be occupying the entire existing school building, following a normal school schedule for the 2025-2026 school years. It is imperative that the Contractor understand the access, operational, safety and utility requirements of the Owner during the occupied periods. All work located on the interior and exterior of the building, and/or affecting occupied areas shall be completed at no disturbance to students or MCPS staff and teachers. All utility outages shall be coordinated with the Owner and occur during unoccupied periods. Site access and staging must be coordinated for continued operations in the existing school during construction. The existing bus loop, drop-off loop, and parking areas must always remain operational when the building is occupied.

2. During the occupied school year, NO deliveries to the building or large pieces of equipment will be permitted to enter or exit the site during the following periods of time during the day (Monday thru Friday): 7:00 – 8:15 AM 2:15 – 3:15 PM. All deliveries and construction traffic must be coordinated with school activities and use. Construction activities may not extend into the occupied areas of the building, including corridors, when students are present.

3. Note that the project is being bid early to allow extended time for procurement of materials due to current extended lead times. The submittals process should begin immediately upon Notice of Award and all long lead time materials shall be ordered as soon as they are approved. Due to limited site area, material storage must occur off-site and all costs for storage shall be included in the Contractor's base bid sum.

4. New Work is indicated on the contract documents and includes architectural, mechanical, electrical, telecommunications, and security work.
   a. Architectural work includes, but is not limited to, the replacement of an existing elevator.
   b. Modifications to mechanical and electrical systems are provided, including HVAC systems, lighting and lighting controls, sprinkler systems, fire alarm, and telecommunications systems.
   c. The General Contractor must engage an MCPS approved Security Contractor to make any required modifications to the security system for the project.

PART 2 - PRODUCTS (not used)

PART 3 - EXECUTION (not used)

PART 4 - SCHEDULE OF DRAWINGS

4.1 Drawings indicating Work to be performed under this Contract include:

GENERAL

T101 COVER SHEET

C101 CODE ANALYSIS

ARCHITECTURAL

D101 DEMOLITION PLANS

A101 FLOOR PLANS

A501 SECTIONS

MECHANICAL

M001 SYMBOLS, ABBREVIATIONS, SCHEDULES AND CONTROLS

MD101 PART ELEVATOR FLOOR PLANS – MECHANICAL – DEMOLITION

M101 PART ELEVATOR FLOOR PLANS – MECHANICAL – NEW WORK

M501 DETAILS AND DIAGRAMS

ELECTRICAL

E001 ELECTRICAL SYMBOLS AND ABBREVIATIONS

E002 PART OVERALL FLOOR PLANS – ELECTRICAL

ED101 PART ELEVATOR FLOOR PLANS ELECTRICAL DEMOLITION

E101 PART ELEVATOR FLOOR PLANS ELECTRICAL NEW WORK

- END OF SECTION 01 10 00 -

SECTION 01300
SUBMITTALS

1.1 RELATED REQUIREMENTS

A. List of Subcontractors: Instructions to Bidders and **Contractors.**

B. Progress Schedule: General and Supplementary Conditions.

C. Schedule of Values: General and Supplementary Conditions.

D. Performance Bond and Payment Bond: General and Supplementary Conditions.

E. Insurance Certificates: General and Supplementary Conditions.

F. Applications for Payment: General and Supplementary Conditions.

1.2 PROGRESS SCHEDULE

A. Prepare and submit in accordance with General and Supplementary Conditions.

1.3 SUBMITTALS LIST AND SCHEDULE

A. Submittal: Within 30 days after award of Contract, and before any items are submitted for review, submit two copies of submittal list and schedule.

B. Schedule: Compile complete schedule of all submittals anticipated to be made during progress of work.
   1. Include list of each type of item for which Contractor's drawings, Shop Drawings, Coordination Drawings, Product Data, Samples, Certificates of Compliance, Manufacturer's Certificates, Warranties, and other types of submittals are required.
   2. Allow at least 10 working days for review of submittals by Architect following receipt of submittal, plus time for return to Contractor.
      a. Submittals requiring Consultant's Review: Allow 15 working days.
   3. Indicate date of submittal by Contractor to Architect and date of receipt of reviewed submittals by Contractor from Architect.
   4. Coordinate schedule with Subcontractors and materials suppliers.
   5. On acceptance by Architect, Contractor shall adhere to schedule except when specifically permitted otherwise.

C. Code Designation: On schedule, designate each item with number code utilizing Specification Section six-digit numbers.
   1. Each Submittal: Marked with same code designation.

D. Revisions: Revise and update schedule on monthly basis as necessary to reflect conditions and sequences. Promptly submit any revised schedules to Architect and MCPS for review.

1.4 SUBMITTALS PROCEDURES

A. Review and Coordination: Prior to submission, carefully review and coordinate all aspects of each item being submitted and ensure that each item in submittal conforms in all respects with requirements of Contract Documents.
   1. Determine and verify all interface conditions, catalog numbers, and similar data.
   2. Coordinate among sections of Specifications in accordance with Section 01 31 00.
   3. Obtain statement of suitability of product for purpose for which it is to be used under this Contract to meet warranty requirements.

B. Reporting: Unless otherwise noted in transmittal, Contractor's submittal of material shall be construed as stipulating that Contractor has thoroughly and completely reviewed, and coordinated data prior to submittal.

C. Timing: Make submittals early enough to account for processing described below and allow at least 10 working days for review of submittals by Architect (15 working days for submittals requiring Consultant's review) following receipt of submittal, plus time for return to Contractor.
   1. Delays caused by tardiness in making submittals or resubmittals will not be an acceptable basis for extension of Contract completion time.

D. Transmittals: Include transmittal letter with each submittal, identify item by above code designation and reference to Specification Section. Use separate transmittal for each submittal.
   1. Identify Project, Contractor, subcontractor, major supplier, pertinent Drawing sheet and detail number, and Specification section.
   2. Each submittal: Have chronological submittal number.
      a. Resubmittals: Have original submittal number and decimal (.01) numerical order for each resubmittal.

E. Submittals:
   1. Grouping of Submittals: Unless otherwise specified, make submittals in groups containing associated items to ensure that information is available for checking each item when it is received. Partial submittals may be rejected as not complying with provisions of Contract Documents and Contractor shall be liable for delays so occasioned.

   2. Internal Identification: On at least first page of each copy of each submittal, and elsewhere as required for positive identification, clearly indicated submittal number in which item is included.

   3. Review submittals for accuracy, completeness, and conformity with Contract Documents.
      Make notes and corrections on submittal.

   4. Contractor is Responsible for:
      a. Submission to and follow up with local building code officials.
      b. Dimensions and field condition which shall be confirmed and correlated at job site.
      c. Quantities.
      d. Fabrication processes.
      e. Construction techniques.

f. Errors or omissions on submittals.
g. Coordination and satisfactory performance of work of all trades.

5. Deviations: Contractor's proposals for deviations shall be submitted for consideration before submittals on affected items. Only changes, substitutions, or other deviations from Contract Documents which have been previously accepted in writing shall be included in submittals.

6. Certification: Certify that each submittal has been reviewed and coordinated by affixing Contractor's stamp and signature of individual who reviewed submittal to each submittal.
   a. Submittals not certified by being stamped and signed by Contractor will be returned.

7. Submittal Log: Maintain accurate submittal log for duration of Contract. Indicate current status of all submittals at all times. Make submittal log available for Architect's review upon request.

F. Architect's Review: For general conformance with design concept of the project and for general compliance with information given in Contract Documents only.
   1. Architect's review of separate item shall not indicate acceptance of assembly of which item is part.
   2. Extra Work: Any Architect's review action shown is subject to requirements of Contract Documents and does not authorize any extra work.
   3. Deviations: Architect's review shall not relieve Contractor from responsibility for errors or deviations from requirements of Contract Documents.
      a. Architect's acceptance of submittals with deviations shall not relieve Contractor from responsibility for additional costs of changes required to accommodate such deviations.
      b. Deviations included in submittals without prior acceptance are excepted from review of submittals whether noted or not on returned copy.
   4. Dimensions: Dimensions revised or added as result of Architect's review are only intended as suggestions to guide Contractor.
      a. Contractor: Verify, and if necessary, modify dimensions and retain responsibility for correctness of dimensions and for proper fit and installation of work.
   5. Submittals Designated for Information Only: Reviewed and returned or not reviewed and not returned at discretion of Architect.

G. Contractor's Revisions: Make only those revisions required or accepted by Architect.
   1. Identify each revision by number, date, and subject in revision block on submittal.
   2. If Contractor considers any required revision to be change, he shall notify Architect as required by Conditions of Contract.

H. Revisions Due to Deviations: Substitutions, revisions, modifications, and adjustments accepted by Architect, which are required due to deviation from Contract Documents by Contractor, shall be made by Contractor at no additional cost to Owner unless made by Change Order.
   1. Additional work required of Architect and Architect's Consultants as result of deviation shall be charged at standard rates and Contractor shall pay such fees to Owner for Architect's extra services in full before submittal of next request for payment under Contract.

2. Redesigning by Contractor: Performed by architect or engineer licensed to perform such work. Submit calculations or other accepted substantiation with drawings and details of proposed change.
    a. If approval is required from authorities having jurisdiction, obtain such approval, at no additional cost to Owner, before submitting revised design to Architect.

I. Revision After Acceptance: When submittal has been reviewed by Architect, resubmittal for substitution of materials or equipment will not be considered unless accompanied by explanation acceptable to Architect.

J. Unauthorized Deviations: In event any unauthorized deviation from Contract Documents, substitution, or change provided by Contractor is detrimental to performance, longevity, security, aesthetics, or other characteristics or qualities required by Contract Documents, Contractor assumes full responsibility for period of time limited only by state statue of limitations, and shall make all necessary replacements and repairs to meet requirements of Contract Documents at no additional cost to Owner.

1.5 SHOP DRAWINGS

A. Shop Drawings: Reference to Specification Section.
    1. Each Shop Drawing Detail: Reference to Contract Documents Drawings detail number.
    2. Scale and Measurements: Prepare Shop Drawings accurately to scale sufficiently large to indicate pertinent aspects of item and its method of connection to other work.
    3. Make particular note of field-measured dimensions, as-built conditions, and conditions requiring special coordination with other contractors and requirements of activities of Owner.
    4. Provide room for review stamp of Architect (5 inches by 5 inches).
    5. Prints: Blackline or blueline (blueprints not acceptable).

B. Coordination Drawings: Prepare and submit coordination drawings where relationship of materials, equipment, or devices installed under different sections involve appearance, safety of maintenance of complete work and where work performed by precedent installer would interfere with work of subsequent installer. Comply with Section 01 45 00.

C. Subcontractor: Submit one sepia tracing and three prints per shop drawing sheet to Contractor.

D. Contractor:
    1. Review and certify as specified above.
    2. Print as required for Contractor's record.
    3. Send sepia tracings and four prints to Architect.

E. Architect:
    1. Check drawings by making notes and corrections on sepia tracings; stamp **NO ACTION TAKEN; NO ACTION REQUIRED; NO EXCEPTION TAKEN; REVISE AS NOTED, RESUBMISSION IS NOT REQUIRED; REVISE AS NOTED, RESUBMISSION IS REQUIRED; REJECTED, RESUBMIT AS SPECIFIED**; etc. as required.
    2. In event that Shop Drawings require consultant's check, route sepia and print through consultant and back to Architect as necessary. Consultant will retain one set of prints.

3. Make prints of marked sepia, retain one print, and distribute prints as required to consultants and Owner.
4. Make prints of marked sepia and distribute as required to consultants.
5. Return marked sepias to Contractor.

F. Contractor:
1. Make prints of marked sepia as required.
2. Send sepia tracings to Subcontractor.

G. Subcontractor:
1. Print necessary copies for record, distribution, etc.

H. Resubmittal: In the event Shop Drawings have to be resubmitted to Architect, original sepia tracings and prints shall be returned directly to Contractor. Subcontractor shall make corrections and re-route new sepia tracings and prints as outlined above.

1.6 PRODUCT DATA

A. Subcontractor: Submit number of copies required by Contractor plus two for Architect and one each for consultants as required.

B. Routing: Route as indicated above for Shop Drawings with Architect retaining two copies for file and returning other copies to Contractor for his file and distribution to subcontractor as applicable.

C. When contents of submitted literature from manufacturers includes data not pertinent to submittal, clearly indicate which portion of contents is being submitted for review.

1.7 JOB SITE DOCUMENTS

A. Documents: Keep complete set of accepted Shop Drawings or Product Data at project site.

1.8 FIELD MEASUREMENTS

A. Field Measurements: Responsibility of Contractor.

1.9 SAMPLES

A. Checklist: Architect will provide Contractor with checklist indicating materials where color, texture or finish is subject to selection by Architect. Certain other samples may also be requested for use by Architect in preparation of color and material sample presentations for Owner.

B. Submittal: Promptly after receipt of checklist, assemble and deliver to Architect complete collection of required samples. Unless otherwise specified, submit number of Samples required by Contractor plus two, one for Architect, and one for Owner.

C. Samples for Selection: Upon receipt of complete collection of Samples, Architect will, with reasonable promptness, make selections and prepare and deliver to Contractor schedule covering items subject to selection. Architect reserves right not to make individual determination or selections until all Samples of all materials are submitted.

1. Unless precise color and pattern are specifically described in Contract Documents, and whenever choice of color or pattern is available in specified product, submit accurate and complete range of color and pattern charts of products for review and selection.
2. Unless standard colors or patterns are specified, provide custom colors and patterns at no additional cost to Owner.

D. Samples: Submit sample of precise article proposed to be furnished.
   1. Accepted Samples: Standard of comparison for finished work.
      a. Defects or deviations in excess of those in accepted samples not acceptable and are subject to rejection of completed work.

   2. After Architect has selected materials, colors, patterns, and textures; provide samples in pairs for products which will have variations due to character of materials or method or nature of production.
      a. Each Pair: Represent maximum acceptable variability in product and demonstrate worst conditions, defects, and deviations which may be acceptable.
      b. Architect: Identify accepted pairs of samples by stamp or other means and retain one pair of samples.
      c. Contractor: Retain one pair of identified samples for comparison with delivered work produced off-site and work produced on-site. Deliver one pair of samples to supplier.
      d. Supplier: Compare work with accepted samples to ensure products shipped are within acceptable parameters.

E. Sample Tag or Label: Large enough for review stamp (5 inches by 5 inches) and bear following information:
   1. Project name and location.
   2. Manufacturer, supplier.
   3. Name, finish, and composition of material.
   4. Location of where material is to be used.
   5. Specification Section number.

F. Field Samples: Provide field samples as required by individual sections. Install samples in locations as directed complete and finished.

1.10 MANUFACTURER'S INSTRUCTIONS

A. Instructions: Submit as required by individual sections. Provide manufacturer's printed installation instructions including delivery, storage, assembly, installation, start-up, adjusting, and finishing.
   1. Quantity: As required for Product Data.

1.11 CERTIFICATES

A. Certificates of Compliance and Manufacturer's Certificates:
   1. Where Certificates are specified, show on each certification name and location of work, name and address of Contractor, quantity and date or dates of shipment or delivery to which certificate applies, and name of manufacturer.
   2. Certification: In form of letter or company standard forms, signed by officer of manufacturer (not vendor, agent, etc.).

3. Certification: Certify that materials or equipment meet or exceed specified requirements.
4. Laboratory Test Reports: Show date of testing, specified requirements for which testing was performed, and results of tests.

END OF SECTION

SECTION 01 45 00
QUALITY CONTROL

1.1 REFERENCES

A. Reference Standards: See Section 01060. Comply with following:
   1. ASTM D3740- Practice for Evaluation of Agencies Engaged in Testing and/or inspection
      of Soil and Rock as Used in Engineering Design and Construction.
   2. ASTM E329- Standard Recommended Practice for inspection and Testing Agencies for Concrete, Steel, and Bituminous Materials as used in Construction.

1.2 QUALITY ASSURANCE

A. Testing: Comply with ASTM D3740 and ASTM E329 as well as any other testing standards specified in individual sections.

1.3 SELECTION AND PAYMENT

A. Owner shall employ and pay for services of independent testing laboratory to perform inspection and testing as directed. Costs for these services shall NOT be included in the Base Bid contract Sum.

1.4 RESPONSIBILITIES

A. Contractor:
   1. Notification: Notify testing laboratory at least 72 hours in advance of time for need for testing.
   2. Furnish required samples without charge and give sufficient notice of placing of orders to permit testing.
   3. Cooperate with testing laboratory personnel and provide access to work.
   4. Provide incidental labor and facilities to provide access to work to be tested, to obtain and handle samples at site or at source of products to be tested, to facilitate tests and inspections, and for storage and curing of test samples.
   5. Do not use materials or equipment represented by samples until tests, if required, have been made and materials or equipment found to be acceptable.
   6. Do not incorporate any product into work which becomes unfit for use after acceptance thereof.
   7. Equipment Testing and Demonstrations: Provide fuel, accessories, and tools required to operate equipment for tests and demonstrations.

1.5 TESTING AND INSPECTIONS- GENERAL

A. Testing and Inspection: Materials or equipment proposed to be used may be tested or inspected at any time during their preparation or use. Products may be sampled either prior to shipment or after being received at site of work.
   1. Specific information concerning testing methods, sample sizes, etc., is included under applicable sections of Specifications.
   2. Any modification of, or elaboration on, these test procedures included for specific materials under their respective sections in Specifications shall take precedence over these procedures.

1.6 TESTING AND INSPECTIONS PAID FOR BY THE OWNER

A. Control Tests and Inspections of Fill and Backfill: At such times and in such numbers as specified in Section 02200 Earthwork and as required by local building authority.

B. Control Tests and Inspections of Asphalt Paving Base and Finish Courses: At such times and in such numbers as specified in Section 02251 Bituminous Paving for Streets.

1.7 OTHER TESTING AND INSPECTION

A. Following Testing and Inspection: Performed at expense of Contractor:
   1. Other Tests and Inspections: Other tests and inspections required by Contract Documents not listed in article above.
   2. Tests and inspections required by applicable codes and local public agencies having jurisdiction over Work.
   3. Additional tests and re-inspections required because of tests or inspections that fail subject to following conditions:
      a. Quantity and Nature of Tests: Determined by Architect.
      b. Tests: Taken in presence of Architect.
      c. Proof of Noncompliance: Contractor liable for corrective action which Architect feels is required including complete removal and replacement of defective material.
   4. Material Substitution: Tests of materials or equipment offered as substitute for specified item on which test may be required in order to prove its compliance with Specifications.

B. Contractor: May have tests performed on material and equipment for his own information and job control so long as Owner does not assume responsibility for costs or for giving them consideration when appraising quality of materials.

1.8 MOCK-UPS

A. Mock-ups: When required by individual sections, erect complete, full scale mock-up of assembly at Project site at location as directed.
   1. Remove at completion of Project when accepted by Architect, unless otherwise specified.

1.9 CONTRACTOR'S QUALITY CONTROL SYSTEM

A. General: Maintain quality control over suppliers, manufacturers, products, service, site conditions, and workmanship to produce work of specified quality.
   1. Workmanship: Comply with industry standards except when more restrictive tolerances or specified requirements require more rigid standards for more precise workmanship.
   2. Perform work by persons qualified to produce workmanship of specified quality.

B. Quality Control: Establish system to perform sufficient inspection and tests of all items of work, including that of subcontractors, to ensure conformance to Contract Documents for materials, workmanship, construction, finish, functional performance and identification.

1. Control System: Establish for all construction except where Contract Documents provide for specific compliance tests by testing laboratories and engineers employed by Owner.
2. Control System: Specifically include all testing required by various sections of Specifications.

C. Quality Control System: Means by which Contractor assures himself that construction complies with requirements of Contract Documents.
1. Controls: Adequate to cover all construction operations and keyed to proposed construction Schedule.

D. Records: Maintain correct records on appropriate form for all inspections and tests performed, Instructions received from Architect and actions taken as result of those instructions.
1. Records: Include evidence that required inspections or tests have been performed (including type and number of inspections or tests, nature of defects, causes for rejection, etc.) proposed or directed remedial action, and corrective action taken.
2. Document inspections and tests as required by each section of Specifications.

1.11 INSTALLATION- GENERAL

A. Examination:
1. Verification of Conditions: Require installer/applicator/erector of each major unit of work to inspect substrate to receive work and conditions under which work is to be performed.
2. Installer/Applicator/Erector:
   a. Verify layout of work before beginning installation.
   b. Report unsatisfactory conditions to General Contractor in writing with copy to Architect.
   c. Do not proceed with work until unsatisfactory conditions have been corrected to satisfaction of installer.
   d. Beginning of work means acceptance of existing conditions by applicator.
3. Pre-installation Conferences: See Section 01200.

B. Manufacturer's Instructions: Where installations include manufactured products, comply with manufacturer's applicable printed instructions and recommendations for installation, to extent that these instructions and recommendations are more explicit or more stringent than requirements specified or indicated.

C. Attachment: Provide attachment and connection devices and methods for securing work to withstand stresses, vibration, and racking.
1. Secure work true to line and level, and within specified tolerances, or if not specified, industry recognized tolerances.
2. Allow for expansion and building movement.
3. Physically separate, provide electrical insulation, or provide protective coatings to prevent galvanic action or corrosion between dissimilar metals.
4. Exposed Joints:
   a. Provide uniform joint width.
   b. Arrange joints to obtain best visual effect.
   c. Refer questionable visual-effect choices to Architect for final decision.

D. Measurements and Dimensions: Recheck as integral step of starting each installation.

E. Climatic Conditions and Project Status: Install each unit of work under conditions to ensure best possible results in coordination with entire project.
   1. Isolate each unit of work from incompatible work as necessary to prevent deterioration.
   2. Coordinate enclosure of work with required inspections and tests to minimize necessity of uncovering work for those purposes.

F. Mounting Heights: Where not indicated, mount individual units of work at industry recognized standard mounting heights for particular application indicated.
   1. Refer questionable mounting heights choices to Architect for final decision.

G. Manufacturer's Field Service and Reports: When specified in individual sections, require manufacturer's to provide qualified personnel to inspect field conditions, conditions of surfaces and installation, quality of workmanship, to make appropriate recommendations and ensure that specified warranties and bonds shall be provided.
   1. Manufacturer's Representative: After each inspection, submit written report to installer, Contractor, and Architect listing observations and recommendations.

END OF SECTION

SECTION 02 41 19
SELECTIVE DEMOLITION

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Demolition and disposal of existing site and building elements as specified in the Contract Documents.

1.2 RELATED SECTIONS

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

B. Contractor shall perform all abatement of materials included in the reports as described in the reports, and/or as required by all codes and standards of practice relating to these materials. Contractor is responsible for proper disposal off site and providing evidence of that proper disposal to the Owner for record.

1.3 DEFINITIONS

A. Remove & Dispose: Remove to an approved off-site facility and legally dispose of any items noted as such in the contract documents, except those items indicated otherwise.

B. Remove and Salvage: Items indicated to be removed and salvaged remain the Owner's property. Remove, clean, and pack or crate items to protect against damage. Identify contents of containers and deliver to Owner's designated storage area.

C. Remove and Reinstall: Remove items indicated; clean, service, and otherwise prepare them for reuse; store and protect against damage. Reinstall items in the same locations or in locations indicated.

D. Existing to Remain: Protect construction indicated to remain against damage and soiling during selective demolition. When permitted by the Architect, items may be removed to a suitable, protected storage location during selective demolition and then cleaned and reinstalled in their original locations.

1.4 SUBMITTALS FOR REVIEW

A. Proposed dust-control measures.

B. Proposed noise-control measures.

C. Schedule of selective demolition activities indicating the following:

1. Detailed sequence of selective demolition and removal work, with starting and ending dates for each activity.

D. Photographs or videotape, sufficiently detailed, of existing conditions of adjoining construction and site improvements that might be misconstrued as damage caused by selective demolition operations.

E. Landfill records indicating receipt and acceptance of all wastes by a landfill facility licensed to accept such wastes.

1.5 REGULATORY REQUIREMENTS

A. Conform to applicable code for demolition work and dust control.

B. Obtain required permits from authorities.

C. Do not close or obstruct egress width to any building or site exit. Do not close or obstruct roadways.

D. Conform to procedures applicable when hazardous or contaminated materials are discovered.

E. Conform to applicable code for demolition of structures, safety of adjacent structures, dust control, runoff control, and disposal.

1.6 QUALITY ASSURANCE

A. Demolition Firm Qualifications: Engage an experienced firm that has successfully completed selective demolition Work similar to that indicated for this Project.

B. Regulatory Requirements: Comply with governing EPA notification regulations before starting selective demolition. Comply with hauling and disposal regulations of authorities having jurisdiction.

C. Pre-demolition Conference: Conduct conference at Project site to comply with pre-installation conference requirements of MCPS.

1.7 PROJECT CONDITIONS

A. Owner assumes no responsibility for actual condition of buildings to be selectively demolished.

B. Conditions existing at time of inspection for bidding purpose will be maintained by Owner as far as practical.

C. Storage or sale of removed items or materials on-site will not be permitted unless agreed upon in advance by the Owner.

D. Conduct demolition to minimize interference with adjacent and occupied building areas.

E. Cease operations immediately if structure appears to be in danger and notify Architect/Engineer. Do not resume operations until directed.

F. Existing Utilities: Locations of existing utilities are approximate. Locations have been determined from field survey, public utility records, and Owner records.
   1. Contractor shall be responsible for contacting "Miss Utility", Owner or controlling agencies of existing utilities within construction area for verification of locations and marking of utilities, prior to beginning of work.

   2. Contractor shall be responsible for coordination of utility relocation or removal by others with phases of construction activities.

G. No tree removal or site clearing other than specifically noted on the Contract drawings shall be performed without written consent of Maryland-National Capital Park & Planning Commission Inspector and Owner.

PART 2 – NOT USED

NOT USED

PART 3 - EXECUTION

3.1 EXAMINATION

A. Survey existing conditions and correlate with requirements indicated to determine extent of selective demolition required.

B. Inventory and record the condition of items to be removed and reinstalled and items to be removed and salvaged.

C. When unanticipated mechanical, electrical, or structural elements that conflict with the intended function or design are encountered, investigate, and measure the nature and extent of the conflict. Promptly submit a written report to the Architect.

D. Survey the condition of the building to determine whether removing any element might result in structural deficiency or unplanned collapse of any portion of the structure or adjacent structures during selective demolition.

E. Perform surveys as the Work progresses to detect hazards resulting from selective demolition activities.

3.3 PREPARATION

A. Provide, erect, and maintain temporary barriers as required for phasing and to maintain occupancy of building during construction.

B. Erect and maintain weatherproof closures for exterior openings.

C. Erect and maintain temporary partitions to prevent spread of dust, odors, and noise.

D. Protect existing materials which are not to be demolished.

E. Prevent movement of structure; provide bracing and shoring.

F. Provide appropriate temporary signage including signage for exit or building egress.

G. Protect existing landscaping materials which are not to be demolished.

H. Conduct demolition operations and remove debris to ensure minimum interference with roads, streets, walks, and other adjacent occupied and used facilities.

1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction. Provide alternate routes around closed or obstructed traffic ways if required by governing regulations.

I. Conduct demolition operations to prevent injury to people and damage to adjacent buildings and facilities to remain. Ensure safe passage of people around selective demolition area.

1. Erect temporary protection, such as walks, fences, railings, canopies, and covered passageways, where required by authorities having jurisdiction.

2. Protect existing site improvements, appurtenances, and landscaping to remain.

3. Erect a plainly visible fence around drip line of individual trees or around perimeter drip line of groups of trees to remain.

4. Provide temporary weather protection, during interval between demolition and removal of existing construction, on exterior surfaces and new construction to ensure that no water leakage or damage occurs to structure or interior areas.

5. Protect walls, ceilings, floors, and other existing finish work that are to remain and are exposed during selective demolition operations.

6. Cover and protect equipment that has not been removed.

3.4 DEMOLITION REQUIREMENTS

A. Conduct demolition to minimize interference with adjacent structures.

B. Cease operations immediately if adjacent structures appear to be in danger. Notify Architect/Engineer. Do not resume operations until directed.

C. Conduct operations with minimum interference to public or private access points. Maintain egress and access at all times.

D. Obtain written permission from adjacent property owners when demolition equipment will traverse, infringe upon, or limit access to their property.

E. Sprinkle Work with water to minimize dust as appropriate. Provide hoses and water for this purpose.

F. Demolish in an orderly and careful manner. Protect existing supporting structural members and utilities to remain. Maintain weathertight and secure enclosure of existing building at all times.

G. Except for items or materials indicated to be reused, salvaged, reinstalled, or otherwise indicated to remain the Owner's property, demolished materials shall become the Contractor's property and shall be removed from the site with further disposition at the Contractor's option. Do not burn or bury materials on site. Leave site in clean condition.

H. Remove materials as Work progresses. Upon completion of Work, leave areas in clean condition, and in orginal configuration unless directed otherwise by the owner.

I. Remove temporary Work and restore existing building to its original condition unless directed otherwise by the owner.

3.5 POLLUTION CONTROLS

A. Use water mist, temporary enclosures, and other suitable methods to limit the spread of dust and dirt. Comply with governing environmental protection regulations.

1. Do not use water when it may damage existing construction or create hazardous or objectionable conditions, such as ice, flooding, and pollution.

B. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.

1. Remove debris from elevated portions of building by chute, hoist, or other device that will convey debris to grade level.

C. Clean adjacent structures and improvements of dust, dirt, and debris caused by selective demolition operations. Return adjacent areas to condition existing before start of selective demolition.

3.6 SELECTIVE DEMOLITION

A. Demolish and remove existing construction only to the extent required by new construction and as indicated. Use methods required to complete Work within limitations of governing regulations and as follows:

1. Dispose of demolished items and materials promptly.

2. Return elements of construction and surfaces to remain to condition existing before start of selective demolition operations.

3.7 DISPOSAL OF DEMOLISHED MATERIALS

A. General: Promptly dispose of demolished materials. Do not allow demolished materials to accumulate on-site.

B. Burning: Do not burn demolished materials.

C. Disposal: Transport demolished materials off Owner's property and legally dispose of them.

3.8 CLEANING

A. Sweep the building broom clean on completion of selective demolition operation.

- END OF SECTION 02 41 19 -

SECTION 07 84 13
PENETRATION FIRESTOPPING

PART 1 – GENERAL

1.1 SUMMARY

A. This Section includes through-penetration firestop systems for penetrations through fire-resistance-rated walls, horizontal assemblies and smoke barriers including both empty openings and openings containing penetrating items.

B. Related Sections include the following:

1. Division 22 and 23 Sections specifying duct and piping penetrations.

2. Division 26 Sections specifying cable and conduit penetrations.

1.2 RELATED DOCUMENTS

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

B. Applicable Codes:

1. International Building Code: Current approved edition per AHJ.

2. NFPA 101 Life Safety Code: Current approved edition per AHJ.

3. NFPA 1 Fire Code: Current approved edition per AHJ.

1.3 DEFINITIONS

Firestopping: A process whereby materials are used to resist (or stop) the spread of fire and its byproducts through openings made to accommodate penetrations in fire-rated walls, floors, and floor/ceiling assemblies. Typical firestopping system comprised of 3 components: Wall or floor; Penetrating item; and Firestopping material.

Assembly: A wall, floor, or other partition. It may include such things as receptacles, outlet boxes, recessed lighting fixtures, or penetrations.

System: The combination of the assembly, the penetrant(s), and the firestop materials. All of these items, together, constitute the system, and the system is the only basis for the classification.

Intumescent: A class or type of firestop materials that will swell or expand upon exposure to elevated temperatures. Material will also form an insulating char.

Fire Barrier: A fire resistance rated vertical or horizontal assembly of materials designed to restrict the spread of fire in which openings are protected.

Fire Wall: A wall separating buildings or subdividing a building to prevent the spread of fire and having a fire resistance rating. Fire walls a structurally stable such that collapse of construction on either side will not cause the wall to collapse.

Smoke Barrier: A continuous membrane, either vertical or horizontal, that is designed and constructed to restrict the movement of smoke.

Engineering Judgements:

A. Engineering judgements (EJ's) are used when a tested, UL classified system is not available.

B. The EJ is based on existing technology and available tested systems.

C. EJ's must be conducted by the manufacturer's technical or engineering group. The installing contractor cannot write their own EJ.

D. A third-party review of the EJ is required.

E. EJ's can only be applied to the specific application for which they were written.

Qualified Contractor Programs:

This category covers Contractor firms who have demonstrated knowledge and a comprehensive management system that specifically focus on the selection and installation of firestop systems or spray-applied fire-resistive materials (SFRMs). The audited Contractor firm systems under UL's Qualified Contractor Programs provide an integrated approach to controlling the processes in addressing architectural, Authorities Having Jurisdiction and customer requirements.

1.4 PERFORMANCE REQUIREMENTS

A. General: For penetrations through the following fire-resistance-rated constructions, including both empty openings and openings containing penetrating items, provide through-penetration firestop systems that are produced and installed to resist spread of fire according to requirements indicated, resist passage of smoke and other gases, and maintain original fire-resistance rating of construction penetrated.

1. Fire-resistance-rated walls including fire walls.

2. Fire-resistance-rated horizontal assemblies including floors.

B. Rated Systems: Provide through-penetration firestop systems with the following ratings determined per UL 1479:

1. F-Rated Systems: Provide through-penetration firestop systems with F-ratings indicated, but not less than that equal or exceed fire-resistance rating of constructions penetrated.

2. T-Rated Systems: For the following conditions, provide through-penetration firestop systems with T-ratings indicated, as well as F-ratings, where systems protect

penetrating items exposed to potential contact with adjacent materials in occupiable floor areas:
   a. Penetrations located outside wall cavities.
   b. Penetrations located outside fire-resistance-rated shaft enclosures.

C. For through-penetration firestop systems exposed to view, traffic, moisture, and physical damage, provide products that, after curing, do not deteriorate when exposed to these conditions both during and after construction.

1. For piping penetrations for plumbing, provide moisture-resistant through-penetration firestop systems.
2. For floor penetrations with annular spaces exceeding 4 inches in width and exposed to possible loading and traffic, provide firestop systems capable of supporting floor loads involved, either by installing floor plates or by other means.

3. For penetrations involving insulated piping, provide through-penetration firestop systems not requiring removal of insulation.

D. For through-penetration firestop systems exposed to view, provide products with flame-spread and smoke-developed indexes of less than 25 and 450, respectively, as determined per ASTM E 84.

1.5 SUBMITTALS

A. Product Data: For each type of product indicated from single manufacturer.

B. Product Schedule: For each penetration firestopping system. Include location and design designation of qualified testing and inspecting agency. See UL Directory or FM Global.

C. Shop Drawings: For each through-penetration firestop system, show each type of construction condition penetrated, relationships to adjoining construction, and type of penetrating item. Include firestop design designation of qualified testing and inspecting agency that evidences compliance with requirements for each condition indicated.

1. Submit documentation, including illustrations, from a qualified testing and inspecting agency that is applicable to each through-penetration firestop system configuration for construction and penetrating items.

2. 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. A third-party review of the Engineering Judgement is required.

D. Qualification Data: For a single source qualified Installer.

E. Installer Certificates: From Installer indicating penetration firestopping has been installed in compliance with requirements and manufacturer's written recommendations.

F. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for penetration firestopping.

G. IgCC Submittals – Comply with Section 01 81 13

1. 801.4.2 IEQ Requirement – Low-Emitting Materials. For interior wet-applied adhesives and sealants: Product Data and Laboratory Test Reports for interior wet-applied adhesives and sealants, including printed statement of VOC content. Provide documentation indicating that products comply with the testing and product requirements of the California Department of Public Health (CDPH) Standard Method v1.1–2010 for either office or classroom spaces, regardless of space type, or comply with the VOC limits established by SCAQMD Rule 1168.
2. 901.4.1.4 Multi-Attribute Product Declaration: For sealant products: Product-specific declaration, Industrywide EPD, or product-specific EPD.

1.6 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. Installer Qualifications: A firm experienced in installing penetration firestopping similar in material, design, and extent to that indicated for this Project, whose work has resulted in construction with a record of successful performance. Qualifications include having the necessary experience, staff, and training to install manufacturer's products per specified requirements. Manufacturer's willingness to sell its penetration firestopping products to Contractor or to Installer engaged by Contractor does not in itself confer qualification on buyer.

C. Source Limitations: Obtain through-penetration firestop systems, for each kind of penetration and construction condition indicated, through one source from a single manufacturer.

D. Fire-Test-Response Characteristics: Penetration firestopping shall comply with the following requirements:

1. Penetration firestopping is identical to those tested per testing standard referenced in "Penetration Firestopping" Article. Provide rated systems complying with the following requirements:
    a. Penetration firestopping products bear classification marking of qualified testing and inspecting agency.
    b. Classification markings on penetration firestopping correspond to designations listed by the following:
        1. UL in its "Fire Resistance Directory."

E. Preinstallation Conference: Conduct conference at Project site to comply with MCPS requirements.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver through-penetration fire-stop system products to Project site in original, unopened containers or packages with intact and legible manufacturers' labels identifying product and manufacturer, date of manufacture, lot number, shelf life if applicable, qualified

testing and inspecting agency's classification marking applicable to Project, curing time, and mixing instructions for multicomponent materials.

B. Store and handle materials for through-penetration firestop systems to prevent their deterioration or damage due to moisture, temperature change, contaminants, or other causes.

1.8 PROJECT CONDITIONS

A. Environmental Limitations: Do not install penetration firestopping when ambient or substrate temperatures are outside limits permitted by penetration firestopping manufacturers or when substrates are wet because of rain, frost, condensation, or other causes.

B. Install and cure penetration firestopping per manufacturer's written instructions using natural means of ventilations or, where this is inadequate, forced-air circulation.

1.9 COORDINATION

A. Coordinate construction of openings and penetrating items to ensure that penetration firestopping is installed according to specified requirements.

B. Coordinate sizing of sleeves, openings, core-drilled holes, or cut openings to accommodate penetration firestopping.

PART 2 – PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Hilti Construction Chemicals Division of Hilti Inc.

2. Specified Technologies Inc.

3. 3M Fire Protection Products.

2.2 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: Provide penetration firestopping with 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: Provide penetration firestopping with 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. Horizontal assemblies include floors.

D. Penetrations in Smoke Barriers: Provide penetration firestopping with ratings determined per UL 1479.

2.3 FIRESTOPPING, GENERAL

A. Compatibility: Provide through-penetration firestop systems that are compatible with one another; with the substrates forming openings; and with the items, if any, penetrating through-penetration firestop systems, under conditions of service and application, as demonstrated by through-penetration firestop system manufacturer based on testing and field experience.

B. Accessories: Provide components for each through-penetration firestop system that are needed to install fill materials and to comply with Part 1 "Performance Requirements" Article. Use only components specified by through-penetration firestop system manufacturer and approved by qualified testing and inspecting agency for firestop systems indicated. Accessories include, but are not limited to, the following items:

1. Permanent forming/damming/backing materials, including the following:
   a. Slag-/rock-wool-fiber insulation.
   b. Sealants used in combination with other forming/damming/backing materials to prevent leakage of fill materials in liquid state.
   c. Fire-rated form board.
   d. Fillers for sealants.

2. Temporary forming materials.

3. Substrate primers.

4. Collars.

5. Steel sleeves.

2.4 FILL MATERIALS

A. General: Provide through-penetration firestop systems containing the types of fill materials indicated in the Through-Penetration Firestop System Schedule at the end of Part 3 by referencing the types of materials described in this Article. Fill materials are those referred to in directories of referenced testing and inspecting agencies as "fill," "void," or "cavity" materials.

B. Cast-in-Place Firestop Devices: Factory-assembled devices for use in cast-in-place concrete floors and consisting of an outer metallic sleeve lined with an intumescent strip, a radial extended flange attached to one end of the sleeve for fastening to concrete formwork, and a neoprene gasket.

C. Latex Sealants: Single-component latex formulations that after cure do not re-emulsify during exposure to moisture.

D. Firestop Devices: Factory-assembled collars formed from galvanized steel and lined with intumescent material sized to fit specific diameter of penetrant.

E. Intumescent Putties: Nonhardening dielectric, water-resistant putties containing no solvents, inorganic fibers, or silicone compounds.

F. Intumescent Wrap Strips: Single-component intumescent elastomeric sheets with aluminum foil on one side.

G. Mortars: Prepackaged dry mixes consisting of a blend of inorganic binders, hydraulic cement, fillers, and lightweight aggregate formulated for mixing with water at Project site to form a non-shrinking, homogeneous mortar.

H. Pillows/Bags: Reusable heat-expanding pillows/bags consisting of glass-fiber cloth cases filled with a combination of mineral-fiber, water-insoluble expansion agents, and fire-retardant additives.

I. Silicone Sealants: Single-component, silicone-based, neutral-curing elastomeric sealants of grade indicated below:

1. Grade: Pourable (self-leveling) formulation for openings in floors and other horizontal surfaces, and non-sag formulation for openings in vertical and other surfaces requiring a nonslumping, gunnable sealant, unless indicated firestop system limits use to non-sag grade for both opening conditions.

2.4 MIXING

A. For those products requiring mixing before application, comply with through-penetration firestop system manufacturer's written instructions for accurate proportioning of materials, water (if required), type of mixing equipment, selection of mixer speeds, mixing containers, mixing time, and other items or procedures needed to produce products of uniform quality with optimum performance characteristics for application indicated.

PART 3 – EXECUTION

3.1 EXAMINATION

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. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Surface Cleaning: Clean out openings immediately before installing penetration firestopping to comply with manufacturer's written instructions and with the following requirements:

1. Remove from surfaces of opening substrates and from penetrating items foreign materials that could interfere with adhesion of penetration firestopping.
2. Clean opening substrates and penetrating items to produce clean, sound surfaces capable of developing optimum bond with penetration firestopping. Remove loose particles remaining from cleaning operation.

3. Remove laitance and form-release agents from concrete.

B. Priming: Prime substrates where recommended in writing by manufacturer using that manufacturer's recommended products and methods. Confine primers to areas of bond; do not allow spillage and migration onto exposed surfaces.

C. Masking Tape: Use masking tape to prevent penetration firestopping from contacting adjoining surfaces that will remain exposed on completion of the Work and that would otherwise be permanently stained or damaged by such contact, or by cleaning methods used to remove stains. Remove tape as soon as possible without disturbing firestopping's seal with substrates.

3.3 INSTALLATION

A. General: Install penetration firestopping to comply with manufacturer's written installation instructions and published drawings for products and applications indicated.

B. 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.

C. 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.

3.4 CLEANING AND PROTECTION

A. Clean off excess fill materials adjacent to openings as the Work progresses by methods and with cleaning materials that are approved in writing by penetration firestopping manufacturers and that do not damage materials in which openings occur.

B. Provide final protection and maintain conditions during and after installation that ensure that penetration firestopping is without damage or deterioration at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, immediately cut

out and remove damaged or deteriorated penetration firestopping and install new materials to produce systems complying with specified requirements.

3.5 THROUGH-PENETRATION FIRESTOP SYSTEM SCHEDULE - Note that the following schedule is to be used as a guide only and is not intended to include every solution that may be required due to field conditions. See UL listings for system details and applicability. Additional or alternative systems shall be proposed by the contractor as required to satisfy field conditions in order to maintain specified fire ratings. Where UL-classified systems are indicated, they refer to alpha-alpha-numeric designations listed in UL's "Fire Resistance Directory" under product Category XHEZ.

A. Firestop Systems with No Penetrating Items (for circular openings in concrete floors or CMU walls to 6-inch diameter):

1. UL-Classified Systems: C-AJ-0060.

B. Firestop Systems with No Penetrating Items (for square or rectangular openings in concrete slabs or CMU walls of up to 36 square feet):

1. UL-Classified Systems: C-AJ-0004.

C. Firestop Systems for Insulated Ducts:

1. UL-Classified Systems (CMU walls): W-J-7030 or W-J-7114.

2. UL-Classified Systems (framed gypsum walls): W-J-7051 or W-J-7195.

D. Firestop Systems for Combination Penetrations:

1. UL-Classified Systems (concrete slab or CMU walls): C-AJ-8087, C-AJ-8088, C-AJ-8123, or C-AJ-8135.

2. UL-Classified Systems (framed gypsum walls): C-AJ-8018, C-AJ-8021, or C-AJ-8039.

E. Firestop Systems for Metallic Pipes, Conduit, or Tubing:

1. UL-Classified Systems (concrete slab or CMU walls): C-AJ-1001, C-AJ-1427, or C-AJ-1551.

2. UL-Classified Systems (framed gypsum walls): W-L-1003 or W-L-1296.

F. Firestop Systems for Multiple Metallic Pipes, Conduit, or Tubing:

1. UL-Classified Systems (concrete slab or CMU walls): C-AJ-1429.

2. UL-Classified Systems (framed gypsum walls): W-L-1287.

G. Firestop Systems for Nonmetallic Pipe, Conduit, or Tubing:

1. UL-Classified Systems: (concrete slab or CMU walls): C-AJ-2001.

2. UL-Classified Systems (framed gypsum walls): W-L-2162.

H. Firestop Systems for Insulated Pipes:

1. UL-Classified Systems (concrete slab or CMU walls):
   a. Insulated Metal Pipe: C-AJ-8072.
   b. Glass Fiber Insulated Metal Pipe: C-AJ-5210.
   c. Insulated Metal Pipe (AB/PVC Flexible Foam): C-AJ-5211.

2. UL-Classified Systems (framed gypsum walls):
   a. Insulated Metal Pipe: W-L-5011 or W-L-8010.
   b. Glass Fiber Insulated Metal Pipe: W-L-5168.
   c. Insulated Metal Pipe (AB/PVC Flexible Foam): W-L-5169.

I. Firestop Systems for Electrical Cables:

1. UL-Classified Systems (concrete slab or CMU walls): C-AJ-3021 or C-AJ-3310.

2. UL-Classified Systems (framed gypsum walls): W-L-3347 or W-L-3371.

J. Firestop Systems for Insulated Electrical Cables via Device:
1. UL-Classified Systems (concrete slab or CMU walls): C-AJ-3250.

2. UL-Classified Systems (framed gypsum walls): W-L-3289.

K. Firestop Systems for Cable Trays:

1. UL-Classified Systems (framed gypsum walls): W-L-4037.

L. Firestop Systems for Multiple Conduit:

1. UL-Classified Systems (framed gypsum walls): W-L-1228 or W-L-1255.

- END OF SECTION 07 84 13-

SECTION 07 92 00
JOINT SEALANTS

PART 1 – GENERAL

1.1 SECTION INCLUDES

A. Preparing substrate surfaces.

B. The required applications of sealants include, but are not limited to, the following general locations in new work, or in areas disturbed by the work of this project:

1. Exterior:
    a. Any new roof penetration perimeter joints.
    b. Masonry control joints.
    c. Others as indicated and required due to job conditions.

2. Interior:
    a. Control and Expansion joints.
    b. Metal Door and window frames.
    c. Toilet fixtures.
    d. Casework tops and backsplashes.
    e. Joints at all surfaces to receive opaque finish.
    f. Joints between steel columns and masonry walls.
    g. Other as indicated.

1.2 RELATED SECTIONS

A. Section 01 81 13 – Sustainable Design Requirements.

B. Section 08 80 00 - Sealants required in conjunction with glazing methods.

C. Section 09 30 00 – Tiling.

1.3 REFERENCES

A. ASTM C790 - Use of Latex Sealing Compounds.

B. ASTM C804 - Use of Solvent-Release Type Sealants.

C. ASTM C834 - Latex Sealing Compounds.

D. ASTM C920 - Elastomeric Joint Sealants.

E. ASTM D1565 - Flexible Cellular Materials - Vinyl Chloride Polymers and Copolymers.

F. SWRI (Sealant, Waterproofing and Restoration Institute) - Sealant and Caulking Guide Specification.

1.4 SUBMITTALS

A. Submit under provisions of Division 1.

B. Product Data: Provide data indicating sealant chemical characteristics, performance criteria, substrate preparation, limitations, and color availability.

C. Samples: Submit two samples illustrating sealant colors for selection.

D. Manufacturer's Installation Instructions: Indicate special procedures, surface preparation and perimeter conditions requiring special attention.

E. Submit manufacturer's certification that field-applied joint sealants installed in building interior meet testing and product requirements of California Department of Health Services Standard Practice for The Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers, including 2004 Addenda.
   1. At minimum, products need to comply with VOC limits specified in LEED-for Schools if alternatives tested to CA protocol are not available.

F. IgCC Submittals – Comply with Section 01 81 13

   1. 801.4.2 IEQ Requirement – Low-Emitting Materials. For interior wet-applied adhesives and sealants: Product Data and Laboratory Test Reports for interior wet-applied adhesives and sealants, including printed statement of VOC content. Provide documentation indicating that products comply with the testing and product requirements of the California Department of Public Health (CDPH) Standard Method v1.1–2010 for either office or classroom spaces, regardless of space type, or comply with the VOC limits established by SCAQMD Rule 1168.

   2. 901.4.1.4 Multi-Attribute Product Declaration: For sealant products: Product-specific declaration, Industrywide EPD, or product-specific EPD.

1.5 QUALITY ASSURANCE

A. Perform work in accordance with sealant manufacturer's requirements for preparation of surfaces and material installation instructions.

B. Specified work shall be installed by skilled tradesmen, experienced in the application of the types of materials.

1.6 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing the Products specified in this section with a minimum five years of documented experience.

B. Applicator: Company specializing in performing the work of this section with minimum five years of documented experience, including installation of products by chosen manufacturer.

C. Manufacturer shall provide qualified technical representative at project site when required for purpose of rendering advice concerning proper installation.

1.7 ENVIRONMENTAL REQUIREMENTS

A. Maintain temperature and humidity recommended by the sealant manufacturer during and after installation. Apply compound prior to final coat of paint.

1.8 PRODUCT DELIVERY, HANDLING AND STORAGE

A. Deliver all materials to job site in factory sealed and labeled containers; label shall show: Manufacturer, Type, Date of Manufacture, Shelf Life, Curing Time at 70 degrees F, Color and Manufacturer's Instructions.

1.9 COORDINATION

A. Coordinate the work with all sections referencing this section.

1.10 WARRANTY

A. Provide five-year warranty under provisions of Division 1.

B. Warranty: Include coverage for installed sealants and accessories which fail to achieve airtight seal, watertight seal and exhibit loss of adhesion or cohesion, or do not cure.

C. Products shall provide a minimum 30-year performance guarantee.

1.11 MAINTENANCE DATA

A. Provide under the provisions of Division 1.

PART 2 – PRODUCTS

2.1 MANUFACTURERS:

A. Sika Corporation

B. Pecora Corporation

C. Tremco, Inc.

D. Bostik Construction Products

2.2 SEALANTS

A. Back-up Materials: Flexible closed cell, expanded polystyrene or polyethylene round rodding, with diameter 1.333 times width of joint

B. Exterior Sealant: Basis-of-Design - Sikaflex-1A, premium grade, or component, polyurethane sealant, Fed. Spec. TT-S-00230C, Type II, Class A, color as selected by the Architect

C. Interior Sealant: Acrylic Emulsion Latex Type C: ASTM C834, single component; color as selected by the Architect. Pecora AC-20, Tremco 834, or Bostik Chem-Calk 600.

D. Interior Walls/Floors (Ceramic Tile): Basis-of-Design - Pecora Urexpan NR-201, one part, self-leveling, moisture curing polyurethane sealant, designed for horizontal joints, Fed. Spec. TT-5-00230C, Type I, ASTM C920, color as selected by the Architect

E. Primers, Cleaners and Bond Breaker Tape: Provide as recommended by sealant manufacturer's installation instructions for the conditions and locations indicated on the drawings.

F. All sealants and sealant primers must meet or exceed Bay Area Air Quality Management District Reg. 8, Rule 51.

2.3 ACCESSORIES

A. Primer: Non-staining type, recommended by sealant manufacturer to suit application.

B. Joint Cleaner: Non-corrosive and non-staining type, recommended by sealant manufacturer; compatible with joint forming materials.

C. Joint Backing: ASTM D1056; round, closed cell polyethylene foam rod; oversized 30 percent larger than joint width; manufactured by Dow Chemical, Sonneborn or approved equivalent.

D. Bond Breaker: Pressure sensitive tape recommended by sealant manufacturer to suit application.

PART 3 – EXECUTION

3.1 EXAMINATION

A. Verify that substrate surfaces and joint openings are ready to receive work.

B. Verify that joint backing and release tapes are compatible with sealant.

3.2 PREPARATION

A. Remove loose materials and foreign matter which might impair adhesion of sealant.

B. Clean and prime joints in accordance with manufacturer's instructions.

C. Perform preparation in accordance with ASTM C804 for solvent release and ASTM C790 for latex base sealants.

D. Protect elements surrounding the work of this section from damage or disfiguration.

3.3 INSTALLATION

A. Perform installation in accordance with ASTM C804 for solvent release and ASTM C790 for latex base sealants.

B. Measure joint dimensions and size materials to achieve required 2:1 width/depth ratios.

C. Install joint backing to achieve a neck dimension no greater than 1/3 of the joint width.

D. Install bond breaker where joint backing is not used.

E. Install sealant free of air pockets, foreign embedded matter, ridges, and sags.

F. Apply sealant within recommended application temperature ranges. Consult manufacturer when sealant cannot be applied within these temperature ranges.

G. Tool joints concave.

3.4 CLEANING

A. Clean adjacent soiled surfaces.

3.5 PROTECTION OF FINISHED WORK

A. Protect finished installation under provisions of Division 1.

B. Protect sealants until cured.

- END OF SECTION 07 92 00 -

SECTION 08 31 00

ACCESS DOORS AND FRAMES

PART 1– GENERAL

1.1 SUMMARY

A. Section Includes:

1. Access doors into pipe and utility spaces, or as required for access to mechanical, plumbing, and electrical components installed in concealed spaces.

1.2 RELATED SECTIONS

A. Division 22 – Plumbing.

B. Division 26 – Electrical.

1.3 SUBMITTALS

A. Submit under provisions of Division 1.

B. Product Data: Indicate product configuration, sizes and anchorages, and materials.

C. Manufacturer's Installation Instructions: Indicate special installation instructions.

PART 2 – PRODUCTS

2.1 MANUFACTURERS

A. Located in Gypsum Drywall:

1. Milcor Style DW.

2. JL Industries WB Series.

3. Nystrom NW Series.

B. Fire-rated or Smoke-rated Access – Provide with flange/trim to match style for substrates listed above:

1. Milcor UFR Fire-rated Access Door.

2. JL Industries FD Series.

3. Nystrom I Series.

2.2 MATERIALS

A. Sizes: As indicated on Drawings or as required to properly service mechanical or electrical equipment.

B. Locking Devices: Key-operated cam locks.

C. Materials: Provide Steel products with recycled content so that post-consumer recycled content plus one-half of pre-consumer recycled content is not less than 25% combined recycled content.

2.3 FINISHES

A. Finish: Prime for painted finish under Section 09 90 00.

PART 3 – EXECUTION

3.1 INSTALLATION

A. Mechanical or Electrical Access: Access doors required for access to mechanical or electrical equipment shall be furnished under Divisions 22, 23, or 26 and installed by the trade responsible for the material in which door is located.

B. General Access: Furnish access doors indicated on Drawings for general access to be installed by trade responsible for material in which door is located.

- END OF SECTION 08 31 00 -

SECTION 09 51 00
ACOUSTICAL CEILINGS

PART 1 – GENERAL

1.1 SECTION INCLUDES

A. Suspended metal grid ceiling system and perimeter trim as indicated on the drawings.

B. Suspended acoustical ceiling panels.

1.2 RELATED SECTIONS

A. Section 01 81 13 - Sustainable Design Requirements

B. Section 09 84 36 – Sound-Absorbing Wall & Ceiling Panels

C. Division 23 - Air diffusion devices in ceiling system.

D. Division 26 - Light fixtures in ceiling system, Fire alarm components in ceiling system, Sound Communication System components in ceiling system.

1.3 REFERENCES

A. ASTM C635 - Metal Suspension Systems for Acoustical Tile and Lay-in Panel Ceilings.

B. ASTM E1264 - Classification of Acoustical Ceiling Products.

C. ANS/ASA S12.60 – Acoustical Performance Criteria, Design Requirements, and Guidelines for Schools

D. Ceilings and Interior Systems Contractors Association (CISCA) - Acoustical Ceilings: Use and Practice.

1.4 SYSTEM DESCRIPTION

A. Suspension system to rigidly secure acoustical ceiling system including integral mechanical and electrical components with maximum deflection of 1/360.

1.5 QUALITY ASSURANCE

A. Installer Qualifications:

1. Engage an experienced installer who has successfully completed acoustical installations similar in scope.

B. Fire - Performance:

1. Provide acoustical ceilings that conform with testing per ASTM E84, Flame spread: 25 or less. Smoke developed: 50 or less and ASTM E1264 for Class A products.

C. Provide minimum 10-year non-sag warranty on all panels.

D. Single - Source Responsibility: Obtain each type of acoustical ceiling and suspension system from a single source.

E. Grid Manufacturer: Company specializing in manufacturing the Products specified in this section with minimum three years documented experience.

F. Acoustical Unit Manufacturer: Company specializing in manufacturing the Products specified in this section with minimum three years' experience.

1.6 SUBMITTALS

A. Submit under provisions of Division 1.

B. Product Data: Provide data on metal grid system components and acoustical units.

C. Samples: Submit two samples 6 x 6 inch in size illustrating material and finish of acoustical units.

D. Samples: Submit two samples each, 6 inches long, of suspension system main runner, cross runner, and edge trim.

E. Manufacturer's Installation Instructions: Indicate special procedures, perimeter conditions requiring special attention.

F. Submit acoustical data: Noise Reduction Coefficient (NRC), Ceiling Attenuation Class (CAC), and Acoustic Performance Data.

G. At the end of the project, provide 5% of the acoustical tile for each size, type and pattern installed.

H. IgCC Submittals - Comply with Section 01 81 13.

1. 801.4.2 IEQ Requirement – Low-Emitting Materials. For all ceiling tile products: Product Data and Laboratory Test Reports for interior ceiling tile products including printed statement of VOC content. Provide documentation indicating that products comply with the testing and product requirements of the California Department of Public Health (CDPH) Standard Method v1.1–2010 for either office or classroom spaces, regardless of space type.

2. 901.4.1.1 Recycled Content of Materials: For products having recycled content: Documentation indicating percentages by weight of pre-consumer and post-consumer recycled content. Include material cost value.

3. 901.4.1.4 Multi-Attribute Product Declaration: For gypsum board products: Product-specific declaration, Industrywide EPD, or product-specific EPD

1.7 ENVIRONMENTAL REQUIREMENTS

A. Maintain uniform temperature of minimum 60 degrees F (16 degrees C) and maximum humidity of 40 percent prior to, during and after acoustical unit installation.

1.8 SEQUENCING

A. Sequence work to ensure acoustical ceilings are not installed until building is enclosed, sufficient heat is provided, dust generating activities have terminated, and overhead work is completed, tested, and approved.

B. Install acoustical units after interior wet work is dry.

1.9 WARRANTY

A. Provide under the provisions of Division 1.

B. Acoustical Ceiling Tile: 2 years.

C. Suspension System: 10 years.

1.10 MAINTENANCE

A. Provide under the provisions of Division 1.

B. Provide maintenance data including methods of cleaning.

PART 2 – PRODUCTS

2.1 MANUFACTURERS - SUSPENSION SYSTEM

A. Armstrong World Industries, Prelude XL System (Used as Basis-of-Design)

B. United States Gypsum Company

C. CertainTeed

2.2 SUSPENSION SYSTEM MATERIALS

A. Non-fire Rated Grid: ASTM C635, intermediate duty, exposed T components die cut and interlocking.

B. Grid Materials: Commercial quality cold rolled steel with galvanized coating.

C. Exposed Grid Surface Width: 15/16 inch.

D. Grid Finish: Baked Polyester Paint, color to be White.

E. Accessories: Stabilizer bars, clips, splices, edge moldings, hold down clips and as required for suspended grid system.

F. Support Channels and Hangers: Primed steel; size and type to suit application and ceiling system flatness requirement specified.

2.3 MANUFACTURERS - ACOUSTICAL UNITS

A. Armstrong World Industries (used as Basis-of-Design)

B. United States Gypsum Company

C. Certainteed

2.4 ACOUSTICAL UNIT MATERIALS

A. ACT 1 – Basis-of-Design, Armstrong Optima (#3151).

1. Size: 24 x 48 inches or 24 x 24 inches
2. Thickness: 1 inch
3. Composition: Wet-formed mineral fiber.
4. NRC: 0.95 (NRC from 0.80 to 0.95 may be considered depending on other criteria)
5. Sound Absorption Coefficient: Minimum 0.75 a
6. Fire Hazard Classification: Class A, Flame Spread less than 25
7. Edge: Square
8. Surface Color: White
9. Other Acceptable Units: Armstrong Ultima High-NRC, CertainTeed Symphony f, CertainTeed Symphony m High-NRC, USG Halcyon, USG Mars High-NRC (85/35), and USG Mars High-NRC (90-30)

B. ACT 2 – Basis-of-Design, Armstrong Fine Fissured High NRC (#1754)

1. Size: 24 x 48 inches
2. Thickness: 7/8 inches
3. Composition: Wet-formed mineral fiber.
4. NRC: 0.74 (NRC from 0.70 to 0.85 may be considered depending on other criteria)
5. Sound Absorption Coefficient: Minimum 0.65 a
6. Fire Hazard Classification: Class A, Flame Spread less than 25
7. Edge: Square Lay-in
8. Surface Color: White
9. Other Acceptable Units: Armstrong Ultima, CertainTeed Fine Fissured High-NRC, CertainTeed Versatone, USG Frost, USG Orion 85, USG Radar High-CAC

C. ACT 3 – Basis-of-Design, Armstrong Fine Fissured (#1729).

1. Size: 24 x 48 inches or 24 x 24 inches
2. Thickness: 5/8 inches
3. Composition: Wet-formed mineral fiber.
4. NRC: 0.55
5. CAC: 35
6. Fire Hazard Classification: Class A, Flame Spread less than 25
7. Edge: Square
8. Surface Color: White

D. ACT 4 – Basis-of-Design, Armstrong Optima (#3151).

1. Size: 24 x 24 inches
2. Thickness: 1 inch
3. Composition: Wet-formed mineral fiber.
4. NRC: 0.95 (NRC from 0.80 to 0.95 may be considered depending on other criteria)
5. Sound Absorption Coefficient: Minimum 0.75 a
6. Fire Hazard Classification: Class A, Flame Spread less than 25
7. Edge: Square
8. Surface Color: White
9. Other Acceptable Units: Armstrong Ultima High-NRC, CertainTeed Symphony f, CertainTeed Symphony m High-NRC, USG Halcyon, USG Mars High-NRC (85/35), and USG Mars High-NRC (90-30)

2.5 ACCESSORIES

A. Touch-up Paint: Type and color to match acoustical and grid units, as necessary.

PART 3 – EXECUTION

3.1 EXAMINATION

A. Verify that layout of hangers will not interfere with other work. Confirm starting lines for layout with Architect.

B. Coordinate with sprinkler heads, existing and new.

3.2 INSTALLATION - LAY-IN GRID SUSPENSION SYSTEM

A. Install suspension system in accordance with ASTM C-636 and manufacturer's instructions and as supplemented in this section.

B. Intermediate - duty grid: Comply with ASTM C-636, suspension requirements of ASTM C-635, intermediate-duty systems, and manufacturer's installation instructions.

C. Install system capable of supporting imposed loads to a deflection of 1/360 maximum.

D. Locate system on room axis according to reflected plan. Center grid in the room unless otherwise noted. For irregularly shaped rooms or rooms without an obvious centerline, verify grid layout with Architect.

E. Install after major above ceiling work is complete and properly conditioned to prevent tiles from accumulating excessive moisture. Install hangers to metal deck or steel beams. Intermediate supports must be provided between main structural members for suspension of ceiling grid in all locations with non-composite metal deck. Coordinate layout and installation of acoustical ceiling units and suspension systems with other construction that penetrates ceiling. Coordinate the location of hangers with other work.

F. Hang suspension system independent of walls, columns, ducts, pipes, and conduit. Where carrying members are spliced, avoid visible displacement of face plane of adjacent members.

G. Nothing shall be suspended from ceiling suspension system. Independent hangers shall be provided for light fixtures, mechanical systems, etc.

H. Where ducts or other equipment prevent the regular spacing of hangers, reinforce the nearest affected hangers and related carrying channels to span the extra distance. Do not support components on main runners or cross runners if weight causes total dead load to exceed deflection capability. Support fixture loads by supplementary hangers located within 6 inches of each corner; or support components independently.

I. Do not eccentrically load system or produce rotation of runners.

J. Install edge molding at intersection of ceiling and vertical surfaces, using longest practical lengths. Miter corners. Provide edge moldings at junctions with other interruptions.

K. Form expansion joints as detailed. Maintain visual closure.

3.3 INSTALLATION - ACOUSTICAL UNITS

A. Install acoustical units in accordance with manufacturer's instructions.

B. Fit acoustical units in place, free from damaged edges or other defects detrimental to appearance and function.

C. Install units after above ceiling work is complete.

D. Install acoustical units' level, in uniform plane, and free from twist, warp and dents.
E. Cut panels to fit irregular grid and perimeter edge trim.

F. Where bullnose concrete block corners occur, provide preformed closers to match edge molding.

G. Install hold-down clips to retain panels tight to grid system within 20 ft of all exterior doors.

3.4 ERECTION TOLERANCES

A. Maximum Variation from Flat and Level Surface: 1/8 inch in 10 feet.

B. Maximum Variation from Plumb of Grid Members Caused by Eccentric Loads: 2 degrees.

- END OF SECTION 09 51 00 -

SECTION 09 65 19
RESILIENT FLOOR TILE

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Resilient tile flooring, including vinyl composition tile and rubber tile.

1.2 RELATED SECTIONS

A. Section 01 81 13 – Sustainable Design Requirements.

B. Section 03 30 00: Cast-in-Place Concrete.

C. Section 09 65 13: Resilient Base and Accessories.

1.3 REFERENCES

A. ASTM E84 - Surface Burning Characteristics of Building Materials.

B. ASTM F1066 - Vinyl Composition Floor Tile.

D. FS SS-W-40 - Wall Base: Rubber and Vinyl Plastic.

E. ASTM F1859 – Standard Specification for Rubber Sheet Flooring Without Backing

1.4 SUBMITTALS

A. Submit under provisions of Division 1.

B. Product Data: Provide data on specified products, describing physical and performance characteristics; sizes, patterns, and colors available.

C. Samples: Submit two sets of samples illustrating color and pattern for vinyl tile for color selection by the Architect.

D. Manufacturer's Installation Instructions: Indicate special procedures, perimeter conditions requiring special attention.

E. Submit MSDS for any applicable products used.

F. Submit manufacturer's certification that resilient flooring and field-applied adhesives meet testing and product requirements of California Department of Health Services Standard Practice for The Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers, including 2004 Addenda.

G. IgCC Submittals - Comply with Section 01 81 13.

1. 801.4.2 IEQ Requirement – Low-Emitting Materials. For all flooring products: Product Data and Laboratory Test Reports for interior flooring products, adhesives, and sealants, including printed statement of VOC content. Provide documentation

indicating that products comply with the testing and product requirements of the California Department of Public Health (CDPH) Standard Method v1.1–2010 for either office or classroom spaces, regardless of space type. Adhesives and sealants alternatively may comply with VOC limits of South Coast Air Quality District Rule #1168.

2. 901.4.1.1 Recycled Content of Materials: For products having recycled content: Documentation indicating percentages by weight of pre-consumer and post-consumer recycled content. Include material cost value.

3. 901.4.1.4 Multi-Attribute Product Declaration: For flooring products: Product-specific declaration, Industrywide EPD, or product-specific EPD.

1.5 REGULATORY REQUIREMENTS

A. Conform to applicable code for flame/smoke rating requirements.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, protect and handle products to site under provisions of Division 1.

1.7 ENVIRONMENTAL REQUIREMENTS

A. Store materials for three days prior to installation in area of installation to achieve temperature stability.

B. Maintain ambient temperature required by adhesive manufacturer three days prior to, during, and 24 hours after installation of materials.

1.8 MAINTENANCE DATA

A. Submit under provisions of applicable Division 1 sections.

B. Maintenance Data: Include maintenance procedures, recommended maintenance materials, and suggested schedule for cleaning, stripping, and re-waxing.

1.9 EXTRA MATERIALS

A. Furnish under provisions of Division 1.

B. Provide one box of each type of tile per 50 boxes of tile per color/pattern used.

1.10 WARRANTY

A. Provide manufacturer's standard 5-year warranty on all tile flooring products.

PART 2 - PRODUCTS

2.1 MATERIALS – VINYL TILE FLOORING

A. Vinyl Composition Tile: ASTM F1066 and SS-T-312 BC, Type IV
   1. Size: 12 x 12 inch

2. Thickness: 1/8 inch
3. Design: marbleized
4. Manufacturers:
   a. Armstrong, Style - Standard Excelon Imperial Textured
   b. Tarkett, Azrock, Style - Custom Cortina
   c. Amtico Stratica Chlorine Free Eco-Polymeric Resilient Tile
5. Pattern: Multiple colors will be selected for use, see drawings for patterns.

2.2 RUBBER SHEET FLOORING

A. Rubber Sheet Basis of Design: Calendared and vulcanized with a base of synthetic rubber, stabilizing agents and pigmentation; Harmoni Flooring, as manufactured by Mondo Contract Flooring.
   1. Product must be free from red listed ingredients (LBC Red List) and manufactured without bisphenol A (BPA), formaldehyde, halogens, heavy metals, isocyanates, phthalates and polyvinyl chloride (PVC), in addition to being manufactured from 100% renewable electric energy sources; water, wind and solar.
   2. Thickness: 0.118" (3mm)
   3. Format: 24" x 24" Tile
   4. Colors: Provided in standard, solid background colors with randomly dispersed color chips throughout the wear layer's entire depth.
   5. Surface Texture: Smooth
   6. Finish: Factory applied low-gloss finish, cured by ultraviolet UV) processing.
   7. Vulcanized, dual durometer construction. The shore hardness of the top layer (wear layer) will be greater than that of the bottom later (backing); shore hardness of layers to be recommended by the manufacturer and to respect limits specified.

B. Critical Radiant Flux (CRF): Minimum 0.45 watt per square centimeter, when tested in accordance with ASTM E 648 or NFPA 253.

2.3 ACCESSORIES

A. Subfloor Filler: White premix latex; type recommended by adhesive material manufacturer.
   1. Armstrong MC #808 liquid latex patch
   2. Gibson Homans Co. #801 Redy Mastic
   3. Ardex Latex Patch

B. Leveling (larger areas):
   1. Ardex cement leveling
   2. Plani/patch by Mapei

C. Edge (transition) Strips: Flooring material manufactured by Mercer, Johnsonite, or equal, color to match vinyl base color adjacent to strip.

2.4 ADHESIVES (must be approved by Tile manufacturer and MCPS's Division of Safety & Environmental Health Unit)

A. Water resistant, Non-flammable, Low odor/odorless when dry, No asbestos content, antimicrobial protection.

B. Adhesives used in flooring installation shall meet testing and product requirements of California Department of Health Services Standard Practice for The Testing of Volatile

Organic Emissions from Various Sources Using Small-Scale Environmental Chambers, including 2004 Addenda.

1. At minimum, products need to comply with VOC limits specified in LEED-for Schools, version 2.2, EQc4. if alternatives tested to the CA protocol are not available.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify concrete floors are dry to a maximum moisture content of 7 percent and exhibit negative alkalinity, carbonization, or dusting.

B. Verify floor and lower wall surfaces are free of substances that may impair adhesion of new adhesive and finish materials.

C. Concrete surface to receive flooring shall be examined and properly prepared to ensure grains of sand and foreign materials have been removed. Surface shall be scraped and buffed with screen.

D. Do not bridge building expansion joints with flooring.

3.2 PREPARATION

A. Remove sub-floor ridges and bumps. Fill minor or local low spots, cracks, joints, holes, and other defects with sub-floor filler to achieve smooth, flat, hard surface.

B. Prohibit traffic until filler is cured.

C. Vacuum clean substrate.

3.3 INSTALLATION – FLOORING

A. Install in accordance with manufacturer's instructions. See drawings for patterns.

B. Mix tile from container to ensure shade variations are consistent when tile is placed.

C. Spread only enough adhesive to permit installation of materials before initial set.

D. Set flooring in place, press with heavy roller to attain full adhesion.

E. Lay flooring with joints and seams parallel to building lines to produce symmetrical tile pattern.

F. Install tile to turn block pattern. Allow minimum 1/2 full size tile width at room or area perimeter.

G. Terminate flooring at centerline of door openings where adjacent floor finish is dissimilar.

H. Install resilient edge strips at unprotected or exposed edges, and where flooring terminates.

I. Scribe flooring to walls, columns, cabinets, floor outlets, and other appurtenances to produce tight joints.

J. Install feature strips and floor markings where indicated. Fit joints tightly.

K. VCT installation should be rolled and protected.

L. Corridor width to be 1/2 inch less than tile width module and base joint at floor to be raked back to receive tile floor and then grouted after tile is in place.

3.4 CLEANING

A. Comply with manufacturer's written instructions for cleaning and protection of resilient products.

B. Perform the following operations immediately after completing resilient product 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. Prior to the general cleaning a classroom shall be selected for a sample cleaning. When ready the contractor shall arrange for inspection and approval by MCPS Building Services Manager. Upon approval the sample room cleaning shall be used as a basis for general cleaning.

D. Protect resilient products from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period.

E. Floor Polish: Remove soil, visible adhesive and surface blemishes from resilient stair treads before applying liquid floor polish.

F. Cover Resilient products until Substantial Completion.

3.5 PROTECTION OF FINISHED WORK

A. Protect finished Work. Entire floor to be protected with red rosin paper, taped.

B. Prohibit traffic on floor finish for 48 hours after installation.

- END OF SECTION 09 65 19 -

SECTION 09 90 00
PAINTING AND COATING

PART 1 – GENERAL

1.1 SUMMARY

A. Section Includes:

1. Paint or natural finish all interior surfaces not specifically excluded. Includes:
   a. All areas indicated on the drawings and included in the schedule noted to be painted.
   b. Exposed mechanical and electrical items in areas to be painted.

2. Paint exposed surfaces not factory finished on exterior and interior materials as determined necessary by project Architect to achieve required material protection and desired project aesthetics.

B. Exclusions: In addition to material obviously not requiring paint such as stainless steel, plastic laminate, glass, flooring, tile, etc. Do not paint or finish:

1. Surfaces indicated by finish schedule to remain unfinished.

2. Factory finished surfaces indicated to be factory finished.
   a. Aluminum with anodized or baked-on finish.
   b. Finish hardware, except hardware with USP finish.
   c. Electrical devices, fixtures, and trim.

3. Equipment such as mechanical and electrical equipment located inside equipment rooms.

1.2 RELATED SECTIONS

A. Section 04 20 00 – Unit Masonry

B. Section 09 29 00 – Gypsum Board

1.3 REFERENCES

A. NPCA (National Paint and Coatings Association) - Guide to U.S. Government Paint Specifications.

B. PDCA (Painting and Decorating Contractors of America) - Painting - Architectural Specifications Manual.

1.4 SYSTEM DESCRIPTION

A. Performance Requirements: Indoor Air Quality: Provide products which will not adversely affect indoor air quality through emission of toxic gasses or vapors. If possible, do not use materials with residual of formaldehyde, epoxy resin, or urea-based materials.

B. Existing oil base surfaces that are to be painted with latex paint shall first be primed with a primer recommended by paint manufacturer to ensure 100 percent bonding of the new paint.

C. Where existing areas with lead-based paints are disturbed, air borne particle, water shall be avoided. Paint containing lead shall be wet scraped (No sanding) and shall comply with COMAR 09.12.32 and 26.02.07 Occupational Exposure to Lead in Construction publications, as administered by Maryland Occupational Safety and Health (MOSH) Public Sector and OSHA.

D. In renovation projects, proper procedures per paint manufacturer's recommendations shall be exercised to ensure 100 percent bonding of paint to surfaces that have weathered a season or more without heat or in adverse environmental conditions.

1.5 SUBMITTALS

A. Submit under provisions of Division 1.

B. Product Data: Provide data on all finishing products and special coatings.

C. Samples: Submit two samples, 6 x 6 inch in size illustrating selected colors and textures for each color selected.

D. Manufacturer's Instructions: Indicate special surface preparation procedures, and substrate conditions requiring special attention.

E. Verify in writing that the products specified will be used as directed or submit for approval a list of comparable materials of another listed approved manufacturer, including full identification of all products by name, color, and catalogue number adjacent to those specified, with a statement of equality by the proposed manufacturer.

F. Submit Manufacturer's certification (MSDS Sheet) for each paint and coating.

1.6 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing the Products specified in this section with minimum five (5) years' experience.

B. Applicator: Company specializing in performing the work of this section with minimum five (5) years' experience and approved by manufacturer.

1.7 REGULATORY REQUIREMENTS

A. Conform to applicable code for flame and smoke rating requirements for finishes.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Deliver products to site in sealed and labeled containers; inspect to verify acceptability.

B. Container label to include manufacturer's name, type of paint, brand name, lot number, brand code, coverage, surface preparation, drying time, cleanup requirements, color designation, VOC content, and instructions for mixing and reducing.

C. Store paint materials at minimum ambient temperature of 45 degrees F (7 degrees C) and a maximum of 90 degrees F (32 degrees C), in ventilated area, and as required by manufacturer's instructions. Storage space shall be designated by the Contractor and approved by the Architect.

1.9 ENVIRONMENTAL REQUIREMENTS

A. Do not apply materials when surface and ambient temperatures are outside the temperature ranges required by the paint product manufacturer.

B. Do not apply exterior coatings during rain or snow, or when relative humidity is outside the humidity ranges required by the paint product manufacturer.

C. Minimum Application Temperatures for Latex Paints: 45 degrees F (7 degrees C) for interiors; 50 degrees F (10 degrees C) for exterior, unless required otherwise by manufacturer's instructions.

1.10 EXTRA MATERIALS

A. Provide 1 gallon of each color and surface texture used in the facility to the Owner at the completion of the project.

B. Contractor shall label each container with color, type, texture, and room locations in addition to the manufacturer’s label.

1.11 MAINTENANCE

A. Provide under the provisions of Division 1.

B. Provide maintenance data including information regarding cleaning instructions.

PART 2 – PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufacturers: Best quality materials as manufactured by one of following manufacturers will be acceptable:

1. For Brush, Roller (no spraying is permitted):

    a. Sherwin Williams (basis-of-design, unless otherwise noted)
    b. McCormick
    c. PPG

B. Quality: All products not specified by name shall be “best grade” or “first line” products of acceptable manufacturers. See Part 3 - Execution for materials required for this project. Where possible, provide materials of single manufacturer.

2.2 MATERIALS

A. Coatings: Ready mixed. Process pigments to a soft paste consistency, capable of being readily and uniformly dispersed to a homogeneous coating; good flow and brushing properties; capable of drying or curing free of streaks or sags.

B. Accessory Materials: Linseed oil, shellac, turpentine, paint thinners and other materials not specifically indicated but required to achieve the finishes specified, of commercial quality.

2.3 FINISHES

A. See finish drawings for quantity of colors and accent paint locations.

1. Interior Surfaces:
    a. Interior Wall Paint (CMU):
        1) 2 coats latex block filler – S-W PreRite Block Filler, B25W25
        2) 2 coats interior latex semi-gloss – S-W ProMar 200 Zero VOC Interior Latex Semi-Gloss, B31 Series

    b. Interior Wall Paint (Gypsum Board):
        1) 1 coat primer – S-W ProMar 200 Zero VOC Interior Latex Primer, B28 Series
        2) 2 coats interior latex eg-shel – S-W ProMar 200 Zero VOC Interior Latex Eg-Shel, B20 Series

    c. Interior Ceiling Paint (Gypsum Board):
        1) 1 coat primer – S-W ProMar 200 Zero VOC Interior Latex Primer, B28 Series
        2) 2 coats interior latex flat – S-W ProMar Ceiling Paint Flat, A27 Series

    d. Interior Paint (Ferrous Metal):
        1) 1 coat primer - Pro Industrial Pro-Cryl Universal Acrylic Primer Off White
        2) 2 coats semi-gloss epoxy - Pro Industrial PreCatalyzed Waterbased Semi-Gloss Epoxy, K46 Series

PART 3 – EXECUTION

3.1 EXAMINATION

A. Verify that substrate conditions are ready to receive work as instructed by the product manufacturer.

B. Examine surfaces scheduled to be finished prior to commencement of work. Report any condition that may potentially affect proper application to the Architect and General Contractor.

C. Test shop applied primer for compatibility with subsequent cover materials.

D. Allow masonry work to cure for at least 30 days before coating. Gypsum board shall be allowed to dry for 15 days before coating.

3.2 PREPARATION

A. Remove or mask electrical plates, hardware, light fixture trim, escutcheons, and fittings prior to preparing surfaces or finishing.

B. Correct defects and clean surfaces which affect work of this section. Remove existing coatings that exhibit loose surface defects.

C. Seal with shellac and seal marks which may bleed through surface finishes.

D. Impervious Surfaces: Remove mildew by scrubbing with solution of tri-sodium phosphate and bleach. Rinse with clean water and allow surface to dry.

E. Gypsum Board Surfaces: Fill minor defects with filler compound. Spot prime defects after repair.

F. Galvanized Surfaces: Clean per SSPC-SP1 using detergent and water or a degreasing cleaner to remove greases and oils. Apply a test area, priming as required. Allow the coating to dry at least one week before testing. If adhesion is poor, Brush Blast per SSPC-SP7 is necessary to remove these treatments.

G. Concrete and Unit Masonry Surfaces Scheduled to Receive Paint Finish: Remove dirt, loose mortar, scale, salt or alkali powder, and other foreign matter. Remove oil and grease with a solution of tri-sodium phosphate; rinse well and allow to dry. Remove stains caused by weathering of corroding metals with a solution of sodium metasilicate after thoroughly wetting with water. Allow to dry.

H. Uncoated Steel and Iron Surfaces: Remove grease, mill scale, weld splatter, dirt, and rust. Where heavy coatings of scale are evident, remove by hand power tool wire brushing or sandblasting; clean by washing with solvent. Apply a treatment of phosphoric acid solution, ensuring weld joints, bolts, and nuts are similarly cleaned. Spot prime paint after repairs.

I. Shop Primed Steel Surfaces: Sand and scrape to remove loose primer and rust. Feather edges to make touch-up patches inconspicuous. Clean surfaces with solvent. Prime bare steel surfaces. Prime metal items including shop primed items.

J. Metal Doors Scheduled for Painting: Seal top and bottom edges with primer.

K. Interior Wood Items Scheduled to Receive Paint Finish: Wipe off dust and grit prior to priming. Seal knots, pitch streaks, and sappy sections with sealer. Fill nail holes and cracks after primer has dried, sand between coats.

3.3 APPLICATION

A. Apply products in accordance with manufacturer's instructions.

B. Painting shall be in accordance with industry standards in reference to preparation of surfaces, environmental conditions, and applications.

C. Scheduling of painting shall be coordinated to precede installation of finished materials such as flooring, casework, etc. Any finished material installed prior to painting shall be properly protected.

D. Do not apply finishes to surfaces that are not dry.

E. Apply each coat to uniform finish to eliminate possibility of laps, skips and brush marks.

F. Apply each coat of paint slightly darker than preceding coat unless otherwise approved.

G. Sand surfaces lightly between coats to achieve required finish.

H. Vacuum clean surfaces free of loose particles. Use tack cloth just prior to applying next coat.

I. Allow applied coat to dry before next coat is applied.

J. Prime concealed surfaces of interior woodwork with primer paint.

K. Full wall shall be painted where paint is scheduled, including but not limited to portions of wall concealed by casework.

L. Finished work is to be adequately covered with uniform color and finish. The number of coats herein specified being a minimum, this contract shall provide any additional coats to produce a first-class job. Architect may select accent colors or deeptone colors (contrasting bright colors) for interior painted walls or ceilings. Where bright colors are selected, apply extra coats of paint where required to obtain completely opaque surface. Make allowances for 10 percent deep tones in bid. Additional labor or materials used for this purpose not allowable as extra cost.

M. Allow the following minimum drying time between coats:

1. Interior work-24 hours.

3.4 FINISHING MECHANICAL AND ELECTRICAL EQUIPMENT

A. Refer to Mechanical, Plumbing, and Electrical specifications for schedule of color coding and identification banding of equipment, duct work, piping, and conduit.

B. Paint shop primed equipment.

C. Remove unfinished louvers, grilles, covers, and access panels on mechanical and electrical components and paint separately.

D. Prime and paint insulated and exposed pipes, conduit, boxes, insulated and exposed ducts, hangers, brackets, collars and supports, except where items are prefinished.

E. Paint interior surfaces of air ducts, and convector and baseboard heating cabinets that are visible through grilles and louvers with one coat of flat black paint, to visible surfaces. Paint dampers exposed behind louvers, grilles, and convector and baseboard cabinets to match face panels.

F. Paint exposed conduit and electrical equipment occurring in finished areas.

G. Paint both sides and edges of plywood backboards for electrical and telephone equipment before installing equipment.

H. Color code equipment, piping, conduit, and exposed duct work in accordance with requirements indicated. Color band and identify with flow arrows, names, and numbering.

I. Reinstall electrical cover plates, hardware, light fixture trim, escutcheons, and fittings removed prior to finishing.

3.5 PROTECTION AND CLEANING

A. Protection: Protect floors and adjacent surfaces from paint smears, spatters, and droppings.

1. Cover fixtures not to be painted. Mask off areas as required.

2. Finish Hardware: Ensure hardware is removed prior to starting painting operations and that it is replaced only after painting operations have been completed.
   a. Hardware Removal and Replacement: Section 08 71 00.

B. Damage to Other Work: Be responsible for damage done to adjacent work. Repair damaged work to satisfaction of Architect. Replace materials damaged to extent that they cannot be restored to their original condition.

C. Cleaning: Daily clean-up of empty cans, rags, rubbish, and other discarded paint materials shall be removed from site by Contractor, in accordance with Federal, State and Local regulations.

D. Upon completion, clean glass and paint spattered surfaces.

- END OF SECTION 09 90 00 -

SECTION 10 14 23
SIGNAGE

PART 1 – GENERAL

1.1 SECTION INCLUDES

A. Requirements of the General Conditions, Supplementary Conditions and Division 1 of these specifications apply to this Section.

B. Interior ADA-compliant Room Signage.

1.2 RELATED SECTIONS

A. Section 04 20 00: Unit Masonry

B. Section 09 29 00: Gypsum Board

1.3 REFERENCES

A. Publications listed below form a part of this specification to extent referenced. Publications are referenced in text by basic designation only.

1. American National Standards Institute (ANSI): ANSI A117.1 – Specifications for Making Buildings and Facilities Accessible to and Usable by Physically Handicapped People.

2. Architectural and Transportation Barriers Compliance Board (ATBCB): Americans with Disabilities Act Accessibility Guidelines for Buildings and Facilities (ADAAG)

3. American Society for Testing & Materials (ASTM)

4. Uniform Sign Code

1.4 SUBMITTALS

A. Manufacturer's Data: Submit manufacturer's descriptive literature and specifications, including color samples of material for selection, as well as installation and maintenance instructions.

B. Submit shop drawings for approval, including sign styles, materials, artwork, lettering and locations, finishes, fabrication details, overall dimensions of each sign, and installation details.

C. Submit full size sample sign or letter of type, style and color specified including method of attachment.

C. Submit manufacturer's standard warranty information.

1.5 QUALITY ASSURANCE

A. Regulatory Requirements: Signage shall comply with applicable requirements of ADAAG and ANSI A117.1

1.6 DELIVERY, STORAGE, AND HANDLING

A. Package to prevent damage or deterioration during shipment, handling, storage, and installation.

B. Store products in dry location inside enclosed facilities and in accordance with manufacturer's requirements.

C. Maintain protective coverings in place and in good repair until removal is necessary.

1.7 PROJECT CONDITIONS

A. Environmental Requirements: Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's absolute limits.

1.8 WARRANTY

A. Provide manufacturer's warranty against defect in materials. Warranty shall provide material and labor to repair or replace defective materials at the manufacturer's discretion. Damage caused by physical or chemical abuse or damage from excessive heat will not be warranted. Removal and reinstallation of existing signage is not warranted.

PART 2 – PRODUCTS

2.1 INTERIOR ROOM SIGNAGE

A. Manufacturers for interior signage systems shall be as follows, subject to compliance with requirements as specified in this section:
   1. 2/90 Sign Systems - Used as the Basis of Design
   2. Apco Signs
   3. ASI

B. MATERIALS
   1. Signs shall have the following characteristics:
      a. Signs shall be of one-piece construction; added-on and/or engraved characters are unacceptable.
      b. Interior sign plaque material shall consist of melamine plastic laminate, approximately 1/4-inch thick, with core painted a contrasting color and rated non-static, fire-retardant, and self-extinguishing. Plastic Laminate shall be impervious to most acids, alkalis, alcohol, solvents, abrasives, and boiling water.
      c. Finish colors to be selected from all of manufacturer's available standard color options.

d. Numbers, letters, symbols, and braille shall be raised .032" from the background surface.
e. Lettering style shall be either Helvetica Medium, upper case, and 5/8-inch in height.
f. Restroom signage to include 6" high pictogram area with the international symbol of accessibility included.
g. Text shall be accompanied by Grade 2 braille.
h. Braille dimension measurements shall comply with 2010 ADA Section 703.
i. All letters, number and/or symbols shall contrast with their background – either light characters on a dark background or dark characters on a light background. Characters and background shall have matte finish.
j. Provide signage for all new and modified interior doors.
k. Provide additional signage as required by local codes and ADA to designate the means of egress to exits.

PART 3 – EXECUTION

3.1 EXAMINATION

A. Examine all surfaces to which the work of this Section will attach to determine that all finish work has been completed and is completely dry.

B. Do not begin installation until substrates have been properly prepared.

3.2 PREPARATION

A. Clean surfaces thoroughly prior to installation.

B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

3.3 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Locate signs in accordance with ADAAG requirements.

C. Install signs plumb and square.

3.4 PROTECTION

A. Protect installed products until completion of project.

B. Repair or replace damaged products before Substantial Completion.

3.5 SCHEDULES

A. Refer to signage types and locations on drawings.

3.6 CLEAN-UP

A. Remove all containers and packaging from the site at the completion of the work.

B. Clean all signage.

- END OF SECTION 10 14 23 -

SECTION 14 24 00
MODERNIZATION OF EXISTING HYDRAULIC ELEVATORS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY OF WORK

A. Section includes modernization of one in-ground hydraulic passenger elevator with four (4) stops.

B. Related Requirements:
   a. Section 09 64 19 "Resilient Flooring" for finish flooring in elevator cars and lobby.
   b. Divisions 22, 23, and 26 Sections for coordination with plumbing, mechanical, and electrical work.

1.3 SCOPE OF WORK

A. The following is a comprehensive checklist of work items to be included in this contract. Where required, items identified as "Provide New" are further specified in Part 2 of this specification. Where items are not specified beyond this scope of work, Contractor shall supply materials compatible with existing conditions and meeting current industry standards.

B. MACHINE ROOM SYSTEMS AND COMPONENTS

a. Drive Machines:	
i. Hydraulic Pump Unit (pump, tank & valve)	Provide New
ii. Sound Isolation Pads	Provide New
iii. Hydraulic Fluid	Provide New
b. Hydraulic Jack Assembly	
i. Jack Assembly	Retain & Recondition
c. Motion Controls:	
i. Motion Controllers	Provide New
ii. Landing Devices and Selectors	Provide New
iii. Positioning Devices	Provide New
d. Electrical Wiring:	
i. Traveling Conductors and Electrical Field Wiring	Provide New
ii. Machine Room Conduit and Trough Work	Provide New
iii. Hoistway Raceway and Fasteners	Provide New
iv. Electrical Door Lock Wiring	Provide New
v. GFCI Electrical Receptacles in Elev. Mach. Room/Pits	Provide New
vi. Electrical Signal Wiring	Provide New

C. HOISTWAY EQUIPMENT AND COMPONENTS

a. Hatch Equipment	
i. Car Top Inspection Stations	Provide New
ii. Hoistway Leveling Switches	Provide New
iii. Digital Landing Devices	Provide New
iv. Terminal Limit Switches	Provide New
v. Directional Limit Switches	Provide New

vi. Hoistway Junction Boxes	Provide New
b. Car Door Equipment (Standard):	
i. Car door hangers and tracks	Provide New
ii. Neoprene car door rollers	Provide New
iii. Linear door operators	Provide New
iv. Door arms and linkages	Provide New
v. Door relation cables	Provide New
vi. Car door clutches	Provide New
vii. Car door restrictors	Provide New
viii. Infra-Red Detector curtains	Provide New
ix. Nickel-silver car door sills	Provide New
c. Hoistway Door Components:	
i. Hoistway door hangers and tracks	Provide New
ii. Hatch door rollers and hardware	Provide New
iii. Hatch door tracks eccentrics	Provide New
iv. Electrical Interlocks	Provide New
v. Hatch door relating cables	Provide New
vi. Hatch door engaging devices and pick-up rollers	Provide New
vii. Hatch door sill closures	Provide New
viii. Dust Covers	Replace as warranted
ix. Hatch door sills	Retain and recondition
d. Door Panels & Entrances:	
i. Stainless steel Hatch Door panels	Provide New
Entrance dimensions 36" wide x 84" height	
ii. Escutcheon holes and Trim rings	Provide New
iii. Lobby entrance frames Clad #4 Stainless Steel	
iv. Door stops and bumpers	Provide New
e. Pit Equipment:	
i. Car spring buffers	Retain
ii. Steel buffer channels and stands	Retain
iii. Steel pit channels	Retain
iv. Pit Stop Switches	Provide New
v. Pit Lighting	Provide New
vi. Pit Ladder	Provide New
f. Car Slings:	
i. Platform	Retain/Recondition/Align
ii. Cross head and side styles	Retain/Recondition/Align
iii. Car guides (slide type)	Provide New Roller Type
iv. Car top steady plates	As Required
v. Sound isolation pads	Provide New
vi. Mounting hardware	Replace as warranted
D. SIGNAL FIXTURES:	
1. Car and Corridor Fixtures:	
a. Main car operating panel	Provide New
b. Corridor call stations	Provide New
c. Fire emergency key switches	Provide New
d. Digital car position indicators	Provide New
e. Code compliant passing chimes	Provide New
f. Digital lobby positional indicators	Provide New
g. Corridor directional lanterns	Provide New
h. Code compliant arrival gongs	Provide New
i. Phone line monitoring	Provide New

2. Emergency Communication Devices:
    a. Fire fighter's emergency recall service — Provide New
    b. Hands free emergency communication devices — Provide New
    c. Braille jamb plates — Provide New
    d. Emergency evacuation signage — Provide New
    e. Inspection certificate frames — Provide New

E. ELEVATOR CABS:

1. -
    a. Cab Shell — Retain and Recondition
        Interior cab dimensions 5'-9" width x 4'-4" depth (VIF)
    b. Interior wall panels, SS#4 — Provide New
    c. Suspended ceiling panels and grids — Provide New
    d. Incandescent down-lighting fixtures — Provide New
    e. Two speed cab exhaust fans — Provide New
    f. Two speed cab exhaust fans — Provide New
    g. Cab handrails, SS#4 — Provide New
    h. Cab Flooring — Provide New
    i. Sub-flooring panels — Provide New
    j. Re-clad all existing steel returns, reveals and transoms — Provide New

F. SPECIAL FEATURES:

1. -
    a. Addressable firefighter's emergency recall systems — Modify Existing
        or (Recall to Floor 1) — Provide New
    b. Lobby and machine room smoke detectors — Provide New
    c. Batter decent unit — Provide New
    d. Electrical feeders — Retain if viable
    e. Dedicated ground wires — Provide if required
    f. Hoistway ventilation — If Required
    g. HVAC in elevator machine room — Provide New
    h. Shunt trips, flow sensors and heat detectors — Provide New
    i. Hoistway beveling — Not Required
    j. Machine room lighting — Provide New
    k. Sump pit and pump — Provide New

1.04 UNIT PRICES

A. Base bid includes the reuse of existing jack hole and existing jacks and pistons. If existing jack is found to be damaged beyond reuse and jack hole is found to be insufficiently sized for lining and reuse, further excavation may be required. Bid is to include unit prices for excavation for cylinder well holes.

1.05 DEFINITIONS

A. Definitions in ASME A17.1/CSA B44 "Safety Code for Elevators and Escalators" apply to work of this Section.

B. Service Elevator: A passenger elevator that is also used to carry freight.

1.06 ACTION SUBMITTALS

A. Product Data: Include capacities, sizes, performances, operations, safety features, finishes, and similar information. Include product data for car enclosures; hoistway entrances; and operation, control, and signal systems.

B. Shop Drawings:
   1. Include plans, elevations, sections, and large-scale details indicating service at each landing; machine room layout; coordination with building structure; relationships with other construction; and locations of equipment.
   2. Include large-scale layout of car-control station.
   3. Indicate maximum dynamic and static loads imposed on building structure at points of support as well as maximum and average power demands. Existing conditions prevail.

C. Samples for Initial Selection: For finishes involving color selection.

D. Samples for Verification: For exposed car, hoistway door and frame, and signal equipment finishes, 3-inch- (75-mm-) square Samples of sheet materials and 4-inch (100-mm) lengths of running trim members.

1.07 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Sample Warranty: For special warranty.

1.08 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For elevators to include in emergency, operation, and maintenance manual.
   1. Submit manufacturer's/installer's standard operation and maintenance manual, in accordance with ASME A17.1/CSA B44.

B. Inspection and Acceptance Certificates and Operating Permits: As required by authorities having jurisdiction for normal, unrestricted elevator use.

1.09 QUALITY ASSURANCE

A. Installer Qualifications: Elevator manufacturer or an authorized representative who is trained and approved by manufacturer.

1.10 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, and handle materials, components and equipment in manufacturer's protective packaging. Store materials, components, and equipment off of ground, under cover, and in a dry location.

1.11 COORDINATION

A. Coordinate installation of sleeves, block outs, elevator equipment with integral anchors, and other items that are embedded in concrete or masonry for elevator equipment. Furnish templates, sleeves, elevator equipment with integral anchors, and installation instructions and deliver to Project site in time for installation.

B. Coordinate locations and dimensions of other work specified in other Sections that relates to hydraulic elevators, including pit ladders; electrical service; and electrical outlets, lights, and switches in hoistways, pits, and machine rooms. Include other trades as necessary for a complete modernization.

1.12 WARRANTY

A. Manufacturer's Special Warranty: Manufacturer agrees to repair, restore, or replace elevator work that fails in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, operation or control system failure, including excessive malfunctions; performances below specified ratings; excessive wear; unusual deterioration or aging of materials or finishes; unsafe conditions; need for excessive maintenance; abnormal noise or vibration; and similar unusual, unexpected, and unsatisfactory conditions.
2. Warranty Period: 2 years from date of Substantial Completion.

PART 2 – PRODUCTS

2.01 HYDRAULIC ELEVATOR CONTROL MANUFACTURERS

A. SMARTRISE ENGINEERING, INC
B. MOTION CONTROL ENGINEERING, INC.
C. ELEVATOR CONTROLS, INC.

2.02 PERFORMANCE REQUIREMENTS

A. Regulatory Requirements: Comply with ASME A17.1/CSA B44 "Safety Code for Elevators and Escalators".
B. Accessibility Requirements: Comply with Section 407 in the United States Access Board's 2010 ADA- ABA Accessibility Guidelines and with ICC A117.1.

2.03 ELEVATOR DESCRIPTION

A. Elevator System, General: Elevator modernization includes the replacement of controller (VA controls), pump unit, and associated piping and wiring. Existing jack assembly is to be examined and reconditioned. Existing elevator car and frame assemblies, hoistway steel and related car support structures are to be are to be refurbished.
B. Elevator Descriptions:
    1. Elevators:Twin holeless oil hydraulic passenger elevators (1 units total)
    2. Stops:
        a. Elevator #1 – 4 stops, front and rear opening
    3. Travel Distance: 25'-0"
    4. Rated Load: 2,100 lb.
    5. Rated Speed: 100 fpm.
    6. Operation System: Selective, collective.
    7. Auxiliary Operations:
        a. Battery-powered lowering.
        b. Automatic operation of lights and ventilation fans.
    8. Security Features: Access control card operation.
    9. Car Enclosures:
        a. Existing cab is to be reused and refurbished. All finishes to be replaced.
        b. Existing cab dimensions 7'-0" width x 5'-9" depth
        c. Front Walls (Return Panels): Satin stainless steel, No. 4 finish
        d. Car Fixtures: Satin applied stainless steel, No. 4 finish.
        e. Side and Rear Wall Panels: Satin stainless steel, No. 4 finish.
        f. Door Faces (Interior): Satin stainless steel, No. 4 finish.
        g. Door Sills: Retain and recondition existing.
        h. Ceiling: Stainless steel, see 2.07, B. below.
        i. Handrails: Rectangular satin stainless steel, located at sides and rear of car, see 2.07, B. below.
        j. Floor prepared to receive resilient flooring (specified in Section 09 65 19 "Resilient Flooring").

10. Hoistway Entrances:
    a. Existing hoistway entrances are to be reused. Existing openings approximately 36" wide x 96" tall.
    b. Type: Two Speed Side Opening.
    c. Doors: Provide new code compliant. UL listed door. Stainless steel, No. 4 finish.
       1) Door Operation: Automatic, D.C. Powered
    d. Frames: Reface existing with new. Stainless steel, No. 4 finish.
    e. Sills: Retain and recondition existing.
11. Hall Fixtures Satin stainless steel, No. 4 finish
    a. Hall fixtures are to be new, and replace existing floor push buttons, access controls, and fire emergency key switches.
    b. Provide new code compliant signage at all floors, including 4" tactile Braille jamb plates and emergency evacuation signage.
12. Additional Requirements:
    a. Provide inspection certificate, mounted under acrylic cover with frame made from satin stainless steel, No. 4 finish.
    b. Infrared curtain unit (ICU) door protection
    c. Emergency cab lighting and alarm.
    d. Locate all fixtures to comply with ADA
    e. Exhaust fan – 2 speed

2.04 MACHINE ROOM SYSTEMS AND COMPONENTS

A. Pump Units (New): Remove and replace existing unit with new positive displacement type with a maximum of 10 percent variation between no load and full load and with minimum pulsations.
   1. Pump shall be submersible type with submersible squirrel-cage induction motor (15 H.P.) and shall be suspended inside oil tank from vibration isolation mounts. Provide appropriate sized AC pump motor, and pressure compensated hydraulic flow control valve.
   2. Motor shall have wye-delta starting.
   3. Motor shall have variable-voltage, variable-frequency control.
   4. Remove and dispose of all existing hydraulic oil lines, mufflers. victaulic couplings and connectors.

B. Hydraulic Silencers (New): System shall have hydraulic silencer containing pulsation- absorbing material in blowout-proof housing at pump unit.

C. Piping (New): Provide new 2" or greater schedule 80 piping, flexible oil lines and tank hoses with 2" or greater Victaulic couplings, seals and connectors.

D. Hydraulic Fluid (New): Elevator manufacturer's standard fire-resistant fluid with additives as needed to prevent oxidation of fluid, corrosion of cylinder and other components, and other adverse effects.

E. Car Frame and Platform: Existing frame and platform assemblies are to be retained.
   Recondition and align existing car sling, platform and car sill.
   1. Replace missing car sling assembly hardware as required.
   2. Provide new:
      a. 48" code compliant steel toe guards.
      b. Sound isolation, steady plates and mounting hardware.
      c. Piston platen plates and steel bolster assemblies as required.
      d. Spring tension car roller guides (Basis of design Model B by Elsco).

F. Pit equipment:

1. Provide new:
    a. Automatic oil recovery unit and related return line.
2. Recondition existing:
    a. Car and counterweight spring buffers.
    b. Steel pit channels and buffer stands.

G. Hoistway Steel and related Car Support Structures
1. Thoroughly clean and remove all debris
2. Secure/tighten all existing fasteners. Replace missing mounting hardware as required.
3. Clean and paint all:
    a. Existing steel fascias, toe guards and dust covers at all landings.
    b. New steel pit channels, buffer stands, pit ladders and repairs to concrete flooring as required by hydraulic cylinder replacement.
    c. All main rail sections and fishplate adapters.

2.05 OPERATION SYSTEMS

A. General: Provide new replacement computerized microprocessor operation system as required to provide type of operation indicated. Include computer based logic dispatching capabilities, interface software and factory wiring.
1. Provide new lockable wall mounted NEMA class 1 controller cabinet enclosures.

B. Auxiliary Operations:
1. Provide manual lowering devices
2. Provide battery-powered emergency descent units: When power fails, car is lowered to the lowest floor, opens its doors, and shuts down. System includes rechargeable battery and automatic recharging system.

C. Security Features: Security features shall not affect emergency firefighters' service.
1. Key Card Access Control Operation: Push buttons are activated and deactivated by card reader security at hall push-button stations.

D. Replace existing starter panel with new size 2 relay starter control panels with electronic "soft start" in-line Wye/Delta starters.

E. Provide associated transformers, overload protection devices, control fuses. All electrical wiring from fused main line disconnect switches is to be replaced, including all conduit, trough work and raceway throughout the elevator machine room and hoistway and from the controls to appropriate car, hoistway, and halt signal destinations. Provide junction boxes, terminal blocks and connectors as required.

2.06 DOOR-REOPENING DEVICES

A. Infrared Array: Provide door-reopening device with uniform array of 36 or more microprocessor controlled, infrared light beams projecting across car entrance. Interruption of one or more light beams shall cause doors to stop and reopen.

B. Nudging Feature: After car doors are prevented from dosing for predetermined adjustable time, through activating door-reopening device, a loud buzzer shall sound and doors shall begin to close at reduced kinetic energy.

2.07 CAR ENCLOSURES

A. General: Existing car enclosure is to be reused. Protect from damage during the modernization period. Cab interior finishes are to be replaced with new.

B. Materials and Finishes: Manufacturer's standards, but not less than the following:
1. Floor Finish: Resilient flooring, as Specified in Section 09 65 19.

2. Interior Cab Finish: SS #4 wall finish with 3" flat bar handrail attached to stainless steel band.
3. Utilize car recesses and cutouts for signal equipment.
4. Fabricate car door frame integrally with front wall of car.
5. Doors:
   a. Clad with No. 4 stainless steel.
   b. Car door components and related operating devices are to be replaced. Provide and install new:
      1) Car door tracks and hangers.
      2) Neoprene car door rollers, track eccentrics and oilers.
      3) Closed loop car door operators and motors.
      4) Door linkages, drive arms and door belts.
      5) Zone-locking car door mechanical clutches.
      6) Mechanical car door restrictors.
      7) Electro-mechanical car door gate switches and assoc. elec. wiring.
6. Sight Guards: Provide sight guards on car doors.
7. Sills: Clean and refurbish existing sills.
8. Ceiling: modular downlight ceiling – six stainless steel panels with #4 finish and one downlight in each panel. Equivalent systems by other manufacturers will also be considered acceptable.

C. Replace existing Car Top Inspection Station and Positioning Selector. Provide new:

1. Digital landing device and positioning encoder.
2. Steel hoistway selector tape, car top reader and guides.
3. Code compliant car top inspection station equipped with 110 volt receptacle outlet and lighting.
4. Mechanical hoistway limit switches.
5. Mounting brackets, installation adaptors and associated hardware.

2.08 HOISTWAY ENTRANCES

A. General: Existing Hoistway Entrance Assemblies are to be refurbished and reclad with No. 4 stainless steel. Protect from damage during the modernization period.

B. Materials and Fabrication: Manufacturer's standards, but not less than the following:
   1. Frames: Existing frames are to be re-faced (clad) with new satin finish no. 4 stainless steel. Field verify existing dimensions prior to fabrication. Minimize disturbance of existing VCT flooring and resilient wall base to limit patching.
   2. Doors: Hoistway door components and related operated operating devices are to be replaced.
      a. Provide and install new:
         1) Two speed, side sliding hoistway doors. Satin finish No.4 stainless steel.
         2) Hoistway door tracks and hangers.
         3) Neoprene hoistway door rollers, track eccentrics and oilers.
         4) Electrical interlocks, relating cables and engaging roller mechanisms.
         5) Electrical door lock wiring, flexible conduit and associated connectors.
         6) Mechanical door sill closures and/or spirator closers.

7) Nylon door gib inserts, brackets, fire rated door restrictor plates and door eccentrics.

b. Provide new floor identification stencils on interior surface of hoistway doors

c. Provide and install new Mechanical operating devices and mounting hardware as required to properly secure all door panels in strict compliance with approved industry standards and national ANSI code regulations.

3. Sight Guards: Provide sight guards on doors matching door edges.
4. Sills: Clean and refurbish existing sills.

2.09 SIGNAL EQUIPMENT

A. General: Provide hall-call and car-call buttons that light when activated and remain lit until call has been fulfilled. Provide vandal-resistant buttons and lighted elements illuminated with LEDs.

B. Car-Control Stations: Provide recessed car-control stations. Mount in return panel adjacent to car door unless otherwise indicated.
1. Mark buttons and switches for required use or function. Use both tactile symbols and Braille.
2. Provide "No Smoking" sign matching car-control station, either integral with car-control station or mounted adjacent to it. with text and graphics as required by authorities having Jurisdiction.

C. Emergency Communication System: Provide new replacement two-way voice communication system with video, with visible signal, which dials preprogrammed number of monitoring station and does not require handset use. System is contained in flush-mounted cabinet, with identification, instructions for use, and battery backup power supply.
1. Connect existing telephone wiring in machine room to new two way communication system.
2. General Contractor responsible for providing 24/7 monitoring service of communication system for duration of elevator warranty.
3. County shall supply and maintain a dedicated phone line to the machine room.

D. Car Position Indicator: Provide illuminated, digital-type car position indicator, located above car door or above car-control station. Also, provide audible signal to indicate to passengers that car is either stopping at or passing each of the floors serviced. Include travel direction arrows if not provided in car-control station.

E. Hall Push-Button Stations: Provide one hall push-button station at each landing.
1. Provide new replacement jamb-mounted units.
2. Equip units with buttons for calling elevator and for indicating applicable direction of travel.

F. Hall Lanterns: Units with illuminated arrows; however, provide single arrow at terminal landings.
Provide the following:
1. Replacement corridor directional lantern.

G. Hall Annunciator: With each hall lantern, provide audible signals indicating car arrival and direction of travel. Signals sound once for up and twice for down.
1. At manufacturer's option, audible signals may be placed on cars.

H. Emergency Pictorial Signs: Fabricate from materials matching hall push-button stations, with text and graphics as required by authorities having jurisdiction, indicating that in case of fire, elevators are out of service and exits should be

used instead. Provide one sign at each hall push-button station unless otherwise indicated.

2.10 FINISH MATERIALS

A. Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, commercial steel, Type B, exposed, matte finish.
B. Hot-Rolled Steel Sheet: ASTM A 1011/A 1011M, commercial steel, Type B, pickled.
C. Stainless-Steel Sheet: ASTM A 240/A 240M, Type 304.
D. Stainless-Steel Bars: ASTM A 276, Type 304.
E. Stainless-Steel Tubing: ASTM A 554, Grade MT 304.
F. Aluminum Extrusions: ASTM B 221 (ASTM B 221M), Alloy 6063.
G. Nickel Silver Extrusions: ASTM B 151/B 151M, Alloy UNS No. C74500 or No. C77600.
H. Plastic Laminate: High-pressure type complying with NEMA LO 3, Type HGS for flat applications.

PART 3 • EXECUTION

3.01 EXAMINATION

A. Examine elevator areas, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work. Verify critical dimensions and examine supporting structure and other conditions under which elevator work is to be installed.
B. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.
C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

A. Examine exterior surface conditions of existing hydraulic jacks and pistons. Inspect piston seams for irregularities and repair same. Remove surface scars from piston exteriors and hone same.
B. Welded Construction: Provide welded connections for installing elevator work where bolted connections are not required for subsequent removal or for normal operation, adjustment, inspection, maintenance, and replacement of worn parts. Comply with AWS workmanship and welding operator qualification standards.
C. Sound Isolation: Mount rotating and vibrating equipment on vibration-isolating mounts to minimize vibration transmission to structure and structure-borne noise due to elevator system.
D. Install new oil piping above the floor.
E. Lubricate operating parts of systems as recommended by manufacturers.
F. Alignment: Coordinate existing hoistway entrances with installation of elevator guide rails for accurate alignment of entrances with car. Where possible, delay installation of sills and frames until car is operable in shaft. Reduce clearances to minimum, safe, workable dimension at each landing.
G. Leveling Tolerance: 1/4 inch, up or down, regardless of load and travel direction.
H. Locate hall signal equipment for elevators as follows unless otherwise indicated:
    1. At locations of existing removed hall signal equipment.

3.03 FIELD QUALITY CONTROL

A. Acceptance Testing: On completion of elevator installation and before permitting elevator use (either temporary or permanent), perform acceptance

tests as required and recommended by ASME A17.1/CSA B44 and by governing regulations and agencies.

B. Advise Owner, Architect, and authorities having jurisdiction in advance of dates and times that tests are to be performed on elevators.

3.04 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to operate elevator(s).

B. Check operation of elevator with Owner's personnel present before date of Substantial Completion and again not more than one month before end of warranty period. Determine that operation systems and devices are functioning properly.

3.05 MAINTENANCE

A. Initial Maintenance Service: Beginning at Substantial Completion, maintenance service shall include 24 months' full maintenance by skilled employees of elevator Installer. Include monthly preventive maintenance, repair or replacement of worn or defective components, lubrication, cleaning, and adjusting as required for proper elevator operation. Parts and supplies shall be manufacturer's authorized replacement parts and supplies.

1. Perform maintenance during normal working hours.
2. Perform emergency callback service during normal working hours with response time of two hours or less.
3. Include 24-hour-per-day, 7-day-per-week emergency callback service with response time of two hours or less.

B. Maintenance contract is to be executed independently from modernization contract. Within the elevator modernization bid, include a line item for maintenance costs. Maintenance contract will be executed based off cost submitted within Modernization bid.

END OF SECTION

SECTION 21 01 01
FIRE-SUPPRESSION GENERAL PROVISIONS

PART 1 - GENERAL

1.1 SUMMARY

A. General provisions and requirements for all fire-suppression work.

1.2 RELATED SECTIONS

A. Requirements of this section generally supplement requirements of Division 01.

1.3 REFERENCES

A. NFPA 10: Portable Fire Extinguishers.

B. NFPA 241: Safeguarding Construction, Alteration, and Demolition Operations.

1.4 SYSTEM DESCRIPTION

A. The full set of Contract Documents applies to work of Division 21.

B. Visit the site and study all aspects of the project and working conditions, as required by General and Supplementary Conditions, Bidding and Contracting Requirements, Drawings, and Specifications. Verify field dimensions.

C. The work covered in technical sections includes the furnishing of all labor, equipment and materials, and the performance of all operations pertinent to the work described.

D. Except as required otherwise in Division 01, promptly obtain and pay for, including all necessary signatures and paperwork, all permits, fees and inspections required for work of this division by authorities having jurisdiction, including any utility connection or extension charge. No payment will be made until a copy of the permit is forwarded to the Owner.

E. Fire-suppression work of this project includes, as a brief general description, the following:

1. Selective modifications to the existing automatic wet-pipe sprinkler system to accommodate the elevator modifications.

F. See Division 01 for requirements related to Owner's occupancy of the premises, limits on use of site, time restrictions on work, limits on utility outages or shutdowns, and phasing (sequencing) and scheduling.

1.5 PRODUCT OPTIONS

A. Except as modified by provisions of Bidding and Contracting Requirements and Division 01, these options apply to Division 21 specifications.

B. General: Where Contractor is permitted to use a product other than the specified item and model named as the basis of design, Contractor is responsible for all coordination and additional costs as specified in the article "Substitutions," below for substitutions.

C. Products specified by reference standards or by description only: Any product meeting those standards or description.

D. Products specified by naming one or more manufacturers, or model name or catalog reference number: Products specified establish a standard of quality, options to be included, and performance.

1. Where other acceptable manufacturers are named, Contractor may provide products of those named manufacturers only, which meet the specifications.
2. Where specification permits "equal" products, without naming other acceptable manufacturers, Contractor may use products of any manufacturer, which meet the specifications.

1.6 SUBSTITUTIONS

A. Substitutions will be considered only as permitted or required by the Bidding and Contracting Requirements and Division 01. Except as modified by those requirements, the requirements below apply to Division 21 specifications.

B. Substitutions may be considered when a product becomes unavailable through no fault of the Contractor.

C. Document each request with complete data substantiating compliance of proposed substitution with contract documents.

D. A request constitutes a representation that the Bidder or Contractor:

1. Has investigated proposed product and determined that it meets or exceeds the quality level of the specified product.
2. Will provide the same warranty for the substitution as for the specified product.
3. Will coordinate installation and make changes to other work which may be required for the work to be complete with no additional cost to Owner.
4. Waives claims for additional costs or time extension which may subsequently become apparent.
5. Will reimburse Owner for review or redesign services associated with re-approval by authorities.

E. Substitutions will not be considered when they are indicated or implied on shop drawing or product data submittals, without separate written request, or when acceptance will require revision to the Contract Documents.

F. Substitution submittal procedure is specified in Bidding and Contracting Requirements and Division 01.

1.7 MATERIALS AND EQUIPMENT

A. All materials and equipment shall be new and the best of their respective kinds, suitable for the conditions and duties imposed on them by the project and of representative manufacture. The description, characteristics and requirements of the materials to be used shall be in accordance with the specifications.

B. All equipment, construction and installation must meet requirements of local, state and federal governing codes.

C. Singular number: In cases where material, a device, or part of the equipment is referred to in the singular number in the specifications, it is intended that such reference shall apply to as many items of material, devices, or parts of the equipment as are required to complete the installation as shown on the drawings or required for proper operation of the system.

D. Terms have the following meanings:

1. Furnish: Supply item
2. Install: Mount and connect item
3. Provide: Furnish and install.

E. All materials and equipment shall be installed and completed in a first class and workmanlike manner and in accordance with the best modern methods, practice and manufacturers' instructions. Any work which shall not present an orderly and neat or workmanlike appearance shall be removed and replaced with satisfactory work when so directed in writing by the Engineer.

F. The specifications and drawings are intended to define the minimum requirements, as to quality of materials, construction, finish and overall workmanship.

G. General Conditions describe the correlation and intent of the Contract Documents. In case of discrepancies between the specifications and drawings, the specifications should be followed as to the general methods and principles and the drawings followed as to sizes, capacities and specifics for corresponding parts. If sizes are omitted, the Engineer will determine sizes to be utilized.

H. In all cases of doubt, uncertainty, or conflict as to the true meaning of the specifications or drawings, it is the responsibility of the Contractor to notify the Engineer of said uncertainty, doubt, or conflict and obtain a decision as to the intent before starting any work which may be affected by this decision.

1.8 COORDINATION

A. Should a situation develop during construction to prevent the proper installation of any equipment or item where shown on the drawings, call the situation to the attention of the Engineer and await a written decision.

B. Plan and coordinate all work to proceed in an orderly and continuous manner without undue delay, and in conformance with project schedule. Submit samples, shop drawings, schedules, insurance policies and certificates, and the like in time to avoid delays in actual construction. Coordinate work so that work of each trade is completed before other construction begins which would obstruct it.

1. Perform work in compliance with approved coordination drawings specified in “Submittals” below.

C. Coordinate trades to ensure that proper clearances between work of the various trades allow access to items which require operation and maintenance.

D. Coordinate location and elevation of all piping, equipment, and appurtenances in such a manner that the finished installation is as indicated on drawings. In the event difficulties are encountered which prevent this, it is the Contractor's responsibility to bring this to the attention of the Engineer prior to initiation of work. Correct improperly coordinated installation at no additional cost.

E. The Contractor's assistants shall include a competent mechanical foreman, who shall be on the premises at all times to check, layout, coordinate and superintend the installation of work. The foreman shall establish all grades and lines relative to the work before starting, and be responsible for the accuracy thereof.

1.9 SUBMITTALS

A. Manufacturers' and subcontractors' lists:

1. As specified in Division 01, submit a complete list of proposed manufacturers for all equipment, materials and subcontractors used for the work of this division. Lists shall follow the sequence of the specifications. No considerations will be given for partial or incomplete lists. After review of lists, submit shop drawings and product data.

B. Shop drawings and product data:

1. Submit in accordance with the requirements of Division 01 or as established at the preconstruction conference, the required number of copies of shop drawings and product data for every item of equipment. Shop drawings or product data will not be considered until manufacturers' lists have been approved. Shop drawings and product data shall be submitted, as required by the General Conditions, with sufficient time for checking, return to Contractor, and resubmission as required before Contractor shall install any item.
2. Each item submitted shall be properly labeled, indicating the specific service for which the equipment or material is to be used, section and paragraph number of specification or drawing number to which it applies, Contractor's name and project name and number. Data submitted shall be specific and shall include product data and printed information in sufficient detail and scope to verify compliance with requirements of the contract documents. Clearly identify each item within the data. Data of a general nature will not be accepted. Each sheet must clearly show the project name and number.

3. The review of a shop drawing or product data shall not be considered as a guarantee of the measurements or building conditions or that the shop drawings or product data have been checked to see that item submitted properly fits the building conditions. This review shall not relieve the Contractor of the responsibility for furnishing material or performing work as required by the contract documents, for correctness of dimensions and quantities, or for proper coordination of details and interfaces among trades.
4. All exclusively electrical items furnished as items associated with fire-suppression items but not specifically described in the fire-suppression item submission, shall be submitted as a separate submittal but shall be clearly marked as associated with the fire-suppression item by identification specification paragraph.
5. Product data sheets shall be 8.5-inches by 11-inches cut sheets for operating and maintenance manual.
6. Provide submittal compliance cover letter for each project submittal indicating compliance with the contract documents. Sample compliance cover letter is included at the end of this section for reference.

C. Submit at least three copies of the results of every test required under any section in this division.

D. Specialist shall submit a list of at least three projects similar to this project in type, size, and quality, which have been in place and operating satisfactorily for at least five years.

1. Include project name, address, name and phone number of owner's representative, and project type and size.

E. After the work is completed, submit all required certificates of approval from approved inspection agencies and authorities having jurisdiction over work of this division. Certificates of approval must be received by the Engineer prior to final acceptance of the work.

1.10 SPECIALIST

A. The term "Specialist" as used in the specification shall mean an individual or firm of established reputation (or, if newly organized, whose personnel have previously established a reputation in the same field,) which is regularly engaged in, and which maintains a regular force of workers skilled in either (as applicable) manufacturing or fabricating items required by the contract, installing items required by the contract, or otherwise performing work required by the contract. Where the specification requires installation by a specialist, the term shall also be deemed to mean the manufacturer of the item, an individual or firm licensed by the manufacturer, or an individual or firm who will perform the work under the manufacturer's direct supervision.

1.11 CONTRACT CLOSEOUT SUBMITTALS

A. Project record documents:

1. Maintain on site one set of the following record documents; record actual revisions to the work of this division:

a. Contract drawings.
b. Specifications.
c. Addenda.
d. Change orders and other modifications to the Contract.
e. Reviewed shop drawings, product data, and samples.

2. Maintain record documents separate from documents used for construction.
3. Record information concurrent with construction progress.
4. Specifications: Legibly mark and record in each section a description of actual products installed, including the following:

   a. Manufacturer's name and product model and number.
   b. Product options, substitutions, or alternates utilized.
   c. Changes made by addenda and modifications.

5. Record documents and shop drawings: Legibly mark each item to record actual construction, including:

   a. Measured locations of internal utilities and appurtenances concealed in construction, referenced to visible and accessible features of the work.
   b. Field changes of dimension and detail.
   c. Details not on original Contract Drawings.

6. Submit documents as specified in Division 01.

B. Operation and maintenance data:

1. Submit sets prior to final inspection as specified in Division 01. Unless otherwise specified in Division 01, submit no fewer than three sets. In addition to requirements specified in Division 01, submit operating and maintenance manuals for the work of this division as specified below.
2. Lubrication charts: Prepare lubrication charts for each piece of mechanical equipment that requires grease or oil.

   a. Include the following:

      (1) Types of lubricants required.
      (2) Locations of lubrication points.
      (3) Frequency of lubrication.

   b. Provide one extra set of lubrication charts mounted in plastic covers, besides those required in Operating and Maintenance Manuals.

3. Binders: Three-ring binders with vinyl-covered hard covers. Provide large enough binders, and sufficient quantity, that the required contents can be easily turned, removed, and reinserted.
4. Prepare binder covers with printed title "OPERATION AND MAINTENANCE INSTRUCTIONS," and title of project. Print on spine of binder "O & M INSTRUCTIONS." If more than one binder is required, print covers and spines with volume numbers. Include in the front of every binder an index to all binders.

5. Internally subdivide the binder contents with permanent page dividers, logically organized as described below; with tab titling clearly printed under reinforced laminated plastic tabs.
6. Contents: Prepare a Table of Contents for each volume, with each product or system description identified, typed on white paper.
7. Part 1: Directory, listing names, addresses, and telephone numbers of mechanical engineers; Contractor; mechanical subcontractors; and major mechanical equipment suppliers.
8. Part 2: Operation and maintenance instructions, arranged by specification section. For each category, identify names, addresses, and telephone numbers of subcontractors and suppliers. Identify the following:

    a. Significant design criteria, including pump curves and similar performance charts.
    b. List of equipment, including operating weight of each piece.
    c. Parts list for each component, including recommended spare parts list.
    d. Operating instructions.
    e. Maintenance instructions for equipment and systems.
    f. Maintenance instructions for special finishes, including recommended cleaning methods and materials and special precautions identifying detrimental agents.
    g. Valve charts, including locations of flow fittings.

9. Part 3: Project documents and certificates, including the following:

    a. Shop drawings and product data.
    b. Photocopies of certificates.
    c. Photocopies of warranties and guarantees.
    d. Test reports: Copies of the results of all tests required under all sections of specifications.

10. Submit one copy of completed volumes in final form 15 days prior to final inspection. This copy will be returned after final inspection, with Engineer comments. Revise content of documents as required prior to final submittal.
11. Submit final volumes revised, within ten days after final inspection.
12. Submit DVD optical disc storage media specified in Section 21 05 00.

1.12 REGULATORY REQUIREMENTS

A. When these specifications call for materials or construction of a better quality or larger sizes than required by the following codes and standards, the provisions of the specifications shall take precedence.

B. Provide, without extra charge, any additional materials and labor that may be required for compliance with these codes and standards even though the work is not mentioned in these specifications or shown on the contract drawings.

C. Perform the work of this division in strict accordance with the following authorities. The latest revision of these codes accepted by the authority having jurisdiction as of the date of the contract documents shall apply.

1. The plumbing, mechanical, electrical, building, fire, and safety codes of the state and county or city in which the work is being performed.
2. The National Electric Code, NFPA 70 (NEC).
3. The National Fire Protection Association Code. (NFPA).
4. International Energy Conservation, Fire, Fuel Gas, Mechanical, and Plumbing Codes (ICC).

1.13 REFERENCE STANDARDS

A. Perform the work of this division using the standards of the following organizations, as referred to in technical sections, as a minimum requirement for construction and testing. Unless otherwise specified in Bidding and Contract Documents or Division 01, the latest revision current as of the date of the contract documents shall apply. Products shall be certified by manufacturers to meet the requirements of referenced standards.

1. American National Standards Institute (ANSI)
2. ASME International (ASME)
3. American Society for Testing and Materials (ASTM)
4. American Society of Sanitary Engineering (ASSE)
5. American Water Works Association (AWWA)
6. International Code Council (ICC)
7. Manufacturer's Standardization Society of the Valve and Fittings Industry Inc. (MSS)
8. National Electrical Code, NFPA 70 (NEC)
9. National Electrical Manufacturer's Association (NEMA)
10. National Fire Protection Association (NFPA)
11. National Sanitary Foundation (NSF)
12. The Occupational Safety and Health Act (OSHA)
13. Piping and Drainage Institute (PDI)
14. Underwriters Laboratory Inc. (UL)
15. Maryland Occupational Safety and Health Act (MOSHA)

1.14 TEMPORARY STORAGE

A. Maintain upon premises, where directed, a storage area, and be responsible for all contents within these areas. Provide all security measures necessary for this area.

B. Area shall be maintained and shall be returned to original condition at the completion of the project.

1.15 PROTECTION

A. Control dust resulting from construction work to prevent its spread beyond the immediate work area, and to avoid creation of a nuisance.

1. Do not use water to control dust. Use drop cloths or other suitable barriers.
2. In areas where dirt or dust is produced as a result of the work, sweep daily, or more often as required.
3. Provide walk-off mats at entries and replace them at regular intervals.
4. Construct dust partitions, where indicated on the drawings or as required.

5. Seal off all return air registers and other mechanical systems to prevent dust from entering.

B. Each trade and subcontractor is responsible for preventing damage and soiling of work performed by other trades or subcontractors. Each trade and subcontractor is responsible for providing temporary protection of its own work.

1. Protect work from spills, splatters, drippings, adhesives, bitumens, mortars, paints, plasters, and damage from welding or burning.
2. Protect finished work from damage, defacement, staining, or scratching.
3. Protect finishes from cleaning agents, or grinding and finishing equipment.
4. Protect adjacent and finished work from damage, using tape, masking, covers or coatings and protective enclosures.
5. Coordinate installations and temporarily remove items to avoid damage from finishing work.

C. Repair all damage or soiling to the complete satisfaction of the Engineer; replace any materials or work damaged to such an extent that they cannot be restored to their original condition, all at no addition to the Contract Sum.

D. Protect work stored in place and supplies stored in the building.

1. Store materials and products, subject to damage from moisture, in dry locations. If necessary, provide in protective wraps or covers.
2. Store plastics, other materials, and products subject to damage from heat or cool at manufacturer's recommended temperatures.

E. Use of sidewalk or roadway areas outside of the property lines shall be with permission and approval of the local authorities having jurisdiction.

1.16 FIRE PROTECTION

A. As a minimum, provide hand-carried, portable, UL-rated extinguishers with each work crew working inside the building.

B. Select extinguishers in accordance with NFPA 10 and NFPA 241 for classification, extinguishing agent, and size required by location and class of fire exposure.

1.17 PROJECT CONDITIONS

A. Drawings showing utilities in concealed locations are based on the best information available but are not represented as being precisely correct. Work of the contract includes digging, cutting, drilling, using nondestructive methods, and other methods of locating concealed utilities in the field, as well as patching and repairing as specified in "Cutting and Patching" below.

B. If, in the course of the work, workers encounter a material they suspect to present some hazard:

1. Promptly notify the Engineer in writing.
2. Do not perform any work which would disturb the suspected material until written instructions have been received.

1.18 WARRANTY

A. All work and equipment provided as work of this division shall be fully warranted under the general project warranty, which shall include a 2 year/24 hour/7 day full parts and labor warranty for all fire protection work and equipment. In addition, provide added special warranties specified in individual sections.

B. During the correction period, the Contractor shall begin correcting any work found to be not in accordance with the requirements of the Contract Documents within 4-hours of receiving written notice from the Owner. Provide detailed schedule for completion of work within 24-hours of receiving written notice from the Owner and revise schedule based on any Owner comments generated. Except as otherwise required in General Conditions and Division 01, the correction period is two years after the date of substantial completion of the work. Work requiring correction shall promptly be repaired or completely replaced at no addition to the Contract Sum.

1. Provide service log on all equipment repairs to the Owner at the end of the warranty period.

C. When use of the permanent equipment has been permitted for temporary use or occupancy of the building, the warranty and correction periods shall nevertheless begin at the time of substantial completion, unless another date of acceptance has been agreed to by the Owner.

D. Special warranties are warranties required by individual specification sections, incidental product warranties, manufacturers' standard warranties, installer or subcontractor service agreements, and other individual warranties in addition to the general project warranty.

E. Provide copies of warranties as required for Operation and Maintenance Manual specified above, and by Division 01.

F. For items of work delayed beyond date of substantial completion, provide updated submittal within ten days after acceptance, listing date of acceptance as start of warranty period.

PART 2 - PRODUCTS

NOT USED

PART 3 - EXECUTION

3.1 CUTTING AND PATCHING

A. General: Employ skilled workers to perform cutting and patching. Proceed with cutting and patching at the earliest feasible time, and complete without delay.

B. Cut walls, floors, partitions, roofs, and other appurtenances for the passage or accommodation of pipes, ducts and appurtenances. Close superfluous openings and remove all debris caused by work of this division.

C. No cutting of any structure or finish shall be done until the condition requiring such cutting has been examined and approved by the Engineer.

D. New or existing surfaces disturbed as a result of such cutting or otherwise damaged shall be restored to match original work and all materials used for any patching or mending shall conform to the class of materials originally installed.

E. Refinish surfaces to match adjacent finish. For continuous surfaces, refinish to nearest intersection or natural break. For an assembly, refinish entire unit.

3.2 TEMPORARY FACILITIES

A. Temporary water facilities, electricity, telephone, toilet facilities, and temporary heat, shall be provided as specified in Division 01.

3.3 PROGRESS MEETINGS

A. Progress meetings shall be held as specified in Division 01, and also when and if the Contractor or Engineer finds them necessary or advantageous to progress of work.

B. Contractor, those subcontractors and those material suppliers concerned with current progress or with the scheduling of future progress, Engineer and Owner shall each be represented at these meetings by persons familiar with the details of work and authorized to conclude matters relating to work progress.

- END OF SECTION 21 01 01 -

(Sample Submittal Compliance Cover Letter Follows this Section)

Submittal Compliance Cover Letter

Project: MCPS – XXX Elementary School
Engineer: James Posey

Specification Section:
Section Title: PACKAGED ROOFTOP AIR HANDLING UNITS

Basis of Design: Comply: Yes ☐ No ☒

Approved Alternate Manufacturer: Comply: Yes ☐ No ☐ N/A ☒

Specification Section	Compliance
1.01	Comply
1.02	Comply
1.03	Comply
1.04	
1.04.A	Comply
1.04.B	Wiring Diagrams to be provided with submittal for record.
1.04.C	Comply
1.04.D	Comply
1.05	Comply
1.06	Comply
2.01	Comply
2.02	Comply
2.03	Comply
2.04	Comply
2.05	Comply
2.06	Comply
2.07	Comply
2.08	Comply
2.09	Comply
2.10	Comply
2.11	Comply
3.1.A	Comply
3.1.B	Comply
3.1.C	By others
3.1.D	Comply
3.1.E	By others
3.1.F	Comply – To be completed during start up; downstream of gas regulator only. Gas Pressure entering gas regulator is responsibility of others.
3.1.G	By others

SECTION 21 05 00
COMMON WORK RESULTS FOR FIRE SUPPRESSION

PART 1 - GENERAL

1.1 SUMMARY

A. Basic material and equipment required for the fire-suppression piping work as indicated on the drawings and specified in Division 21.

B. Other requirements applicable to more than one section of Division 21.

C. Identification of fire-suppression systems and equipment.

D. Piping tests.

1.2 RELATED SECTIONS

A. Project and special warranties: Division 01 and Section 21 01 01.

B. Operation and Maintenance Manuals: Division 01 and Section 21 01 01.

C. Painting: Division 09.

1.3 REFERENCES

A. American National Standards Institute

1. ANSI 13.1: Standard for Identification of Pipes

B. ASME

1. ASME B31.9: Building Services Piping

C. ASTM International

1. ASTM A 234: Standard Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service
2. ASTM E 548: Standard Guide for General Criteria Used for Evaluating Laboratory Competence

D. American Welding Society

1. AWS D1.1: Structural Welding - Steel
2. AWS D10.9: Specification for Qualification of Welding Procedures and Welders for Piping and Tubing
3. AWS QC1: Specification for AWS Certification of Welding Inspectors

E. National Fire Protection Association

1. NFPA 70: National Electric Code

1.4 DEFINITIONS

A. Project correction period: A period after Substantial Completion of the work during which the Contractor shall correct every part of the work found to be not in accordance with the requirements of the contract documents, promptly after receipt of written notice.

B. Qualified testing agency: 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.

C. DN: Dimension Nominale, nominal pipe size in millimeters, in accordance with the metric system for construction, Systeme Internationale (SI).

D. NPS: Nominal pipe size in inches, in accordance with standard U.S. designations for manufactured pipe. Pipe sizes do not change when projects are designed and built in metric units; each size has a consistent name (nominal dimension) in each system.

1.5 DESIGN REQUIREMENTS

A. The drawings and system performances have been designed based on using the particular manufacturer's products specified and scheduled on the drawings.

B. Products of other manufacturers that are listed under the article "Acceptable Manufacturers," or permitted as "equal," are permitted provided:

1. Product shall meet the specifications.
2. Contractor shall make, without addition to the contract sum, all adjustments for deviations so that the final installation is complete and functions as the design basis product is intended.

C. Do not propose products with dimensions or other characteristics different from the design basis product that render their use impractical, or cause functional fit, access, or connection problems.

D. The contract drawings are generally diagrammatic and do not indicate all fittings or offsets in pipe, all access panels, or other specialties required.

1. Install pipe exposed to view parallel with the lines of the building and as close to walls, columns, and ceilings as may be practical, maintaining proper clearances for access at all parts requiring servicing.
2. Install pipe a sufficient distance from other work to permit a clearance of not less than 0.5 inches (15 mm) between its finished covering and adjacent work.
3. No pipe shall be run below the head of a window or door.

4. Pull boxes and other appurtenances which require operation or maintenance shall be easily accessible. Do not cut or form handholes for operation or maintenance of appliances through walls or ceilings.

1.6 SUBMITTALS

A. Shop drawings:

1. Schedule of welding and brazing procedures proposed for fire suppression piping.

B. Certifications: Proof of operator and testing agency personnel qualifications as required for welding and brazing in the article "Quality Assurance" below.

C. Test reports: Field test results for each piping system as specified in Part 3 below.

1.7 QUALITY ASSURANCE

A. Provide materials and perform work in accordance with the plumbing, mechanical, electrical, building, fire, health and safety, and other applicable codes and regulations of the state, county or city in which the work is performed.

B. Welding procedures and operator qualifications for structural welding: AWS D1.1, Structural Welding Code Steel, electric arc process.

C. Welding, brazing, and soldering procedures and operator qualifications for fire suppression piping:

1. AWS D10.9, Qualification of Welding Procedures and Welders for Piping and Tubing.
2. ASME B31.9, Building Services Piping.

D. Qualifications of independent testing laboratory personnel:

1. Welding inspectors: AWS QC1, Certification of Welding Inspectors.

E. Electrical control panels, equipment, materials and devices provided or installed as work of Division 21 shall bear UL label or, if UL label is not available, the item shall be tested and labeled by a qualified testing agency, acceptable to authorities having jurisdiction, and in accordance with NFPA 70 (NEC). Provide testing, if required, without addition to the contract sum.

F. Qualifications of DVD documentation technician: For video documentation specified in "Operating Instructions (Demonstration)," employ persons knowledgeable in DVD optical storage media format for video and audio production and editing.

PART 2 - PRODUCTS

2.1 MATERIALS

A. General piping techniques, testing, identification, painting, and operating instructions specified in this section apply to products specified in other sections of Division 21.

B. Weldolets and thredolets: Fittings designed for installing branches on piping, with either welded or threaded connection to branch; conforming to ASTM A 234.

C. Pipe jointing compound:

1. Polytetrafluoroethylene (PTFE) pipe thread tape, "Teflon."
2. Pipe cement and oil.

2.2 IDENTIFICATION DEVICES AND MATERIALS

A. Stenciling materials:

1. Stencils: Manufactured standard stencils prepared for required applications, conforming to ANSI A13.1 for color and size of legend letters, including arrows showing direction of flow.
2. Paint: Exterior type enamel, colors conforming to ANSI A13.1, or black.

B. Equipment identification tags:

1. Laminated plastic with adhesive back, white core and black outer layers, which, when engraved, will produce white letters and numerals on a black background.
2. Tags installed on curved surfaces shall be aluminum or brass.

C. Valve tags: Brass, 1.5 inches (40 mm) in diameter with black-filled numbers not less than 0.25 inches (6 mm) high, complete with brass attachment chains.

D. Ceiling identification tags: Laminated plastic with adhesive back, engraved black letters on white background, minimum 0.5 inches (15 mm) wide and length as required for letters 0.375 inches (10 mm) high for name of concealed device and number.

PART 3 - EXECUTION

3.1 INSTALLATION OF PRODUCTS AND EQUIPMENT

A. Manufacturers' instructions: Except as modified by drawings or specifications, install products and equipment in accordance with manufacturers' instructions and recommendations applicable to the project conditions.

1. Immediately notify Engineer if a difference or discrepancy is found between manufacturers' instructions and the drawings or specifications.

3.2 PIPE INSTALLATION

A. Remove burrs resulting from cutting pipe or from any other operation.

B. Threaded connections:

1. Cut threads full and clean.
2. Apply specified pipe jointing compound or tape on male threads only.

C. Thoroughly clean pipe and fittings before they are installed, and keep them clean until the acceptance of the completed work. Cap or plug the ends of the lines so as to prevent earth and other debris from entering during construction.

D. Do not weld galvanized piping.

E. Use welding fittings, tees, wyes, reducers, eccentric reducers, and caps as required. Branches at least two nominal pipe sizes less than the main may be made with "Weldolets" or "Thredolets" installed with full size opening in larger pipe and in accordance with manufacturer's printed instructions. Flanges shall be welded neck or slip-on pattern of class to suit the valves or equipment connections. Flanges shall have machine bolts with hex nuts and washers.

3.3 INTERFACE WITH OTHER PRODUCTS

A. Where it is necessary to run pipes through walls, provide finished, permanent, waterproof installation complete with inserts, sleeves, supports or hangers, seals, and other appurtenances as required. Do not pierce, cut, or notch any footing or other structural member.

B. Building waterproofing and dampproofing shall be unharmed by installation of the work. Where pipe pierces waterproofing or dampproofing, including outside walls, make the penetration watertight. Repair damaged or destroyed waterproofing or replace with new waterproofing.

3.4 IDENTIFICATION

A. General: Do not apply identification until insulation and finish painting work is complete.

B. Equipment:

1. Stencil equipment with letters 2-inches (50-mm) high minimum or provide identification tags. Clearly identify function, equipment served, and area served.
2. Firmly fasten identification tags to equipment with drive screws, sheet metal screws, or rivets. Do not interfere with operation of, or damage the item being marked.

C. Piping:

1. Mark by stenciling.
2. Mark to identify service with arrows showing direction of flow. Apply markings near building walls where pipes enter or leave an accessible space and in intermediate locations so that markings are no more than 30 feet (9 m) apart. They shall be readily visible to a person standing on the floor.
3. Fully identify all piping installed as work of the project.
4. Mark pipe with letters of height and colors required by OSHA and conforming to ANSI A13.1.
5. Identify every gauge, and control device.
6. Provide valve tags for all valves. Numbers shall correspond to those shown on the Valve Chart. Attach tags to valve shaft.

D. Ceiling identification tags: Provide on the access door or, in suspended ceilings, on the ceiling support adjacent to the device.

1. Valves: Identify with the same number shown on the valve tag.

3.5 PIPING TESTS

A. Notify Owner at least one day prior to the actual test.

B. Test before pipes are concealed. Test the piping in sections as the work progresses, so as not to delay progress of the building construction. Furnish pumps and gauges required for testing.

C. Conduct piping tests before connecting equipment that would be subject to damage from the test pressure. Replace piping or fittings found defective with new material.

D. Bracing and supporting: Adequately brace and support piping during the test, so that no movement, displacement, or damage results from the application of the test pressure.

E. Test the piping systems for not less than four hours to fulfill the conditions in the Piping Systems Test Schedule at the end of this section.

F. Documentation of tests: Prepare a test report for each portion of piping tested, identified by service, material, location, and pipe size. Include these items:

1. Date of test.
2. Starting and completion times.
3. Initial test pressure.
4. Final test pressure.
5. Problems or leaks detected.
6. Corrective actions taken.
7. Record of successful completion of testing.
8. Name, title, and signature of person conducting test.

3.6 CLEANING AND PAINTING

A. Cleaning: Clean piping and equipment. Where items are to be painted, clean and prepare surfaces for painting.

B. Painting: Coordinate painting with requirements of Division 09. Paint the items identified below to be painted. Use paint materials and systems specified in Division 09.

C. Items to be painted:

1. Items identified below to have protective coating.
2. Items furnished with manufacturer's prime coat.
3. Mechanical rooms:

    a. Piping.
    b. Hangers and supports.

D. Items not to be painted: Stainless steel and equipment furnished with manufacturer's finish.

E. Paint piping in mechanical rooms: Paint piping using colors in accordance with ANSI A13.1 and as coordinated with the owner.

1. Galvanized steel: One coat of primer recommended for galvanized surfaces and one coat of glossy alkyd enamel.
2. Ferrous metal: One coat of primer recommended for ferrous metal and one coat of glossy alkyd enamel.

F. Paint systems for exposed piping: Primer compatible with the substrate; one coat or two, if required to cover, to match adjacent surfaces in color and texture.

3.7 OPERATING INSTRUCTIONS (DEMONSTRATION)

A. Furnish the necessary technicians, skilled workers, and helpers to operate all the fire-suppression systems and equipment of the entire project for one 8-hour days.

B. Where specified in technical sections, provide longer periods required for specialized equipment.

C. Instruct the Owner or designated personnel in operation, maintenance, lubrication, and adjustment of all systems and equipment.

1. Instructions by manufacturer's technical representative for each type of system shall include the performance of the recommended preventive maintenance procedures for that equipment.

D. The Operating and Maintenance Manual shall be available at the time of the instructions, for use by instructors and Owner personnel.

E. Record video and audio of each instruction session on DVD media, including both the sessions specified above and added sessions required in technical sections for specialized equipment. Provide one complete set of DVDs with each Operating and Maintenance Manual.

F. Schedule the general and specialized instruction periods for a time agreed upon by the Owner and Engineer.

3.8 SCHEDULES

A. Piping Systems Test Schedule:

SYSTEM	TEST PRESSURE	ALLOWABLE DROP	MEDIUM
Sprinkler water and fire line	200 psig (1370 kPa)	None	Water

- END OF SECTION 21 05 00 -

SECTION 21 10 00
WATER-BASED FIRE-SUPPRESSION SYSTEM

PART 1 - GENERAL

1.1 SUMMARY

A. This section includes the following fire suppression systems inside the building:

1. Wet pipe sprinkler systems.

B. Related sections include the following:

1. Piping materials and joining requirements: Section 21 05 00.

1.2 DEFINITIONS

A. AHJ: Authority having jurisdiction, typically the fire marshal.

B. Registered fire protection engineer:

1. Registered professional engineer in Maryland.
2. Bachelor's degree in fire protection engineering and no less than two years' experience working in fire protection; or Bachelor's degree in engineering and no less than 4 years' experience working in fire protection; or other combination of qualifications satisfactory to the AHJ.

1.3 SYSTEM DESCRIPTIONS

A. Wet pipe sprinkler system: Automatic sprinklers are attached to piping containing water and that is connected to water supply. Water discharges immediately from sprinklers when they are opened. Sprinklers open when heat melts fusible link or destroys frangible device. Hose connections are included if indicated.

1.4 DESIGN REQUIREMENTS

A. Design the system by using the hydraulic calculation method or pipe schedule method.

1.5 PERFORMANCE REQUIREMENTS

A. Standard piping system component working pressure: Listed for at least 175 psig (1200 kPa).

1.6 SUBMITTALS

A. Product data: Include copy of UL report verifying each product's UL listing for Fire Protection Service.

1. Piping materials, including dielectric fittings, flexible connections, and sprinkler specialty fittings.
2. Pipe hangers and supports.

3. Valves, including listed fire protection valves, unlisted general duty valves, and specialty valves and trim.
4. Each type of sprinkler, escutcheon, and guard. Include sprinkler flow characteristics, mounting, finish, and other pertinent data.

B. Shop drawings: Diagram power, signal, and control wiring.

C. Fire hydrant or base of riser flow test report, as required by the AHJ, if the hydraulic calculation method is used.

D. Welding certificates.

E. Field quality control test reports.

F. Operation and maintenance data: For sprinkler specialties to include in emergency, operation, and maintenance manuals.

1.7 QUALITY ASSURANCE

A. Installer qualifications:

1. Installer's responsibilities include designing, fabricating, and installing fire suppression systems and providing professional engineering services needed to assume engineering responsibility. Base calculations on results of fire-hydrant flow test.

   a. Engineering responsibility: Preparation of working plans, calculations, and field test reports by a qualified professional engineer.

B. Welding: Qualify processes and operators according to ASME Boiler and Pressure Vessel Code: Section IX.

C. NFPA Standards: Fire-suppression-system equipment, specialties, accessories, installation, and testing shall comply with the following:

1. NFPA 13, "Installation of Sprinkler Systems."
2. NFPA 14, "Installation of Standpipe, Private Hydrant, and Hose Systems."
3. NFPA 24, "Installation of Private Fire Service Mains and Their Appurtenances."
4. NFPA 230, "Fire Protection of Storage."

D. Pipe shall be certified by the manufacturer to meet referenced standards and shall bear a label directly on the pipe indicating compliance.

1.8 REGULATORY REQUIREMENTS

A. Backflow preventers shall be installed by a licensed plumber. Coordinate fire suppression system piping installation with domestic water piping installation.

1.9 COORDINATION

A. Coordinate layout and installation of sprinklers with existing conditions and other construction that penetrates ceilings, including light fixtures, HVAC equipment, and partition assemblies.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:

1. Available manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the work include, but are not limited to, manufacturers specified.

2.2 ABOVEGROUND PIPE AND FITTINGS

A. Pipe: Black steel, Schedule 40 for piping NPS 2 and smaller, Schedule 10 or 40 for piping NPS 2.5 and larger. Piping shall be UL listed and FM approved and suitable for specified fittings.

B. Fittings: Compatible with pipe, types permitted by NFPA 13, UL listed and FM approved.

1. NPS 2 and smaller: Threaded malleable iron. Unions shall be ferrous metal ground joint type having brass seats.
2. NPS 2.5 and larger: Compression fittings shall be mechanical coupling for grooved pipe only; other compression types are not permitted.

C. Hangers and supports: UL approved, supporting piping from above, black steel conforming to NFPA 13.

2.3 SPRINKLER SPECIALTY FITTINGS

A. Sprinkler specialty fittings shall be UL listed or FMG approved, with 175-psig (1200-kPa) minimum working-pressure rating, and made of materials compatible with piping.

B. Drop-nipple fittings: UL 1474, adjustable with threaded inlet and outlet, and seals.

2.4 SPRINKLERS

A. Sprinklers shall be UL listed or FMG approved, with 175-psig (1200-kPa) minimum pressure rating.

B. Sprinkler types and categories:

1. Provide quick-response type.
2. Provide high-temperature heat-responsive elements where required.
3. Open sprinklers: UL 199, without heat-responsive element.

a. Orifice: 0.5 inch (12.7 mm), with discharge coefficient K between 5.3 and 5.8.
b. Orifice: 0.53125 inch (13.5 mm), with discharge coefficient K between 7.4 and 8.2.

4. Extended coverage sprinklers are not acceptable.

C. Sprinkler types, features, and options as indicated in Part 3.

D. Sprinkler finishes: Chrome-plated in areas with ceilings, and plain brass in other areas.

E. Sprinkler escutcheons: Chrome-plated for sidewall and ceiling mounting.

F. Sprinkler guards: Wire cage type, including fastening device for attaching to sprinkler. Provide guards on sprinklers mounted in gymnasium mechanical rooms and where mounted 7.5 feet above floor and lower.

G. Where required by the authority having jurisdiction, provide heat deflectors of proper size, painted to match surrounding area.

PART 3 - EXECUTION

3.1 PREPARATION

A. Perform either fire hydrant or base of riser flow test report, as required by the AHJ if the hydraulic calculation method is used, according to NFPA 13 and NFPA 291. Use results for system design calculations required in Part 1 "Quality Assurance" Article.

B. Report test results promptly and in writing.

3.2 PIPING APPLICATIONS, GENERAL

A. Shop weld pipe joints where welded piping is indicated.

B. Do not use welded joints for galvanized-steel pipe.

C. Flanges, flanged fittings, unions, nipples, and transition and special fittings with finish and pressure ratings same as or higher than system's pressure rating may be used in aboveground applications, unless otherwise indicated.

3.3 JOINT CONSTRUCTION

A. Refer to Section 21 05 00, Common Work Results for Fire Suppression, for basic piping joint construction.

B. Threaded joints: Comply with NFPA 13 for pipe thickness and threads. Do not thread pipe with wall thickness less than Schedule 40.

C. Twist locked joints: Insert plain end piping into locking lug fitting and rotate retainer lug one quarter turn.

D. Grooved joints: Assemble joints with listed coupling and gasket, lubricant, and bolts.

1. Ductile iron pipe: Radius cut groove ends of piping. Use grooved end fittings and grooved end pipe couplings.
2. Steel pipe: Square cut or roll groove piping as indicated. Use grooved end fittings and rigid, grooved end pipe couplings, unless otherwise indicated.
3. Copper tube: Roll groove tubing. Use grooved end fittings and grooved end tube couplings.

4. Dry pipe systems: Use fittings and gaskets listed for dry-pipe service.

E. Dissimilar-metal piping joints: Construct joints using dielectric fittings compatible with both piping materials.

1. NPS 2 (DN 50) and smaller: Use dielectric unions, couplings, or nipples.
2. NPS 2.5 to NPS 4 (DN 65 to DN 100): Use dielectric flanges.
3. NPS 5 (DN 125) and larger: Use dielectric flange insulation kits.

3.4 ABOVEGROUND PIPING INSTALLATION

A. Install piping above the finished ceiling wherever ceilings occur. For bar joist construction, run the pipes between or threaded through bar joists, arranged so as to give clear path for ductwork, lighting fixtures, and appurtenances below joists and to permit possible clearance for future relocation of light fixtures and ductwork. Consult Finish Schedules on Architectural drawings. Do not install piping so that it blocks access doors or panels of ductwork, air handling equipment, or the space required for filter removal. Provide padlocks for valves.

1. The finished ceilings shall not be erected until all fire protection piping has been installed, tested, and inspected.
2. Hanger spacing shall conform to NFPA 13.

B. System drains shall be piped to drain into service sinks, drains, or through wall to grade with all exterior fittings of brass. At low points in piping provide ball valves with hose nipples with vacuum breakers.

1. Except as shown otherwise on drawings, drains 1.5 inches and larger shall be piped through wall to grade.

C. Obtain written approval from Engineer for necessary openings through steel beams for passage of sprinkler pipes. Make openings as small as possible. Where necessary, reinforce the beams around openings with welded steel plates or angle irons in accordance with Structural Engineer's details or instructions. Perform cutting, welding, and reinforcing as specified in Structural Steel Section of Specifications, including requirements for welders' certification and for inspection and testing. Costs for this inspection shall be paid by the Contractor. Provide certification of each inspection as required in "Submittals" in Part 1 above.

3.5 SPRINKLER APPLICATIONS

A. Installation in suspended ceilings: Locate sprinklers in the geometrical centers of ceiling tiles or in the geometrical centers of either half of rectangular ceiling tiles. Provide pipe, fittings, and number of sprinklers to accomplish this, with no addition to the contract sum.

B. Adjustable recessed pendent: Areas with ceilings.

C. Adjustable pendent: Areas with obstructions such as surface-mounted light fixtures.

D. Upright: Areas without ceilings.

E. Sidewall: Where required to match existing.

3.6 CONNECTIONS

A. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Install piping adjacent to equipment to allow service and maintenance.

C. Connect piping to specialty valves, hose valves, specialties, fire department connections, and accessories.

3.7 LABELING AND IDENTIFICATION

A. Install labeling and pipe markers on equipment and piping according to requirements in NFPA 13 and in Section 21 05 00.

3.8 FIELD QUALITY CONTROL

A. Perform the following field tests and inspections and prepare test reports:

1. Leak test after installation:

    a. Charging medium: water.
    b. Test pressure and duration of test as required by NFPA 13.
    c. Repair leaks and retest until no leaks exist.

2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
3. Energize circuits to electrical equipment and devices.
4. Flush, test, and inspect sprinkler systems according to NFPA 13, "Systems Acceptance" chapter.
5. Flush, test, and inspect standpipe systems according to NFPA 14, "System Acceptance" chapter.
6. Coordinate with fire alarm tests. Operate as required.
7. Verify that equipment hose threads are same as local fire department equipment.

B. Report test results promptly and in writing to Engineer and authorities having jurisdiction.

C. Grooved pipe installation:

1. Install grooved joints in accordance with the manufacturer's latest published installation instructions. Grooved ends shall be clean and free from indentations, projections, and roll marks. Gaskets shall be molded and produced by the coupling manufacturer, and shall be verified as suitable for the intended service.
2. A factory-trained field representative (direct employee) of the mechanical joint manufacture shall provide on-site training for contractor's field personnel in the proper use of grooving tools and installation of grooved piping products. The factory-trained representative shall periodically review the product installation and ensure best practices are being followed. Contractor shall remove and replace any improperly installed products. A distributor's representative is not considered qualified to conduct the training.

3.9 CLEANING AND PROTECTION

A. Clean dirt and debris from sprinklers.

B. Remove and replace sprinklers with paint other than factory finish.

C. Protect sprinklers from damage until Substantial Completion.

- END OF SECTION 21 10 00 -

SECTION 22 01 01
PLUMBING GENERAL PROVISIONS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. General provisions and requirements for all plumbing work.

1.2 RELATED SECTIONS

A. Requirements of this section generally supplement requirements of Division 01.

1.3 REFERENCES

A. NFPA 10: Portable Fire Extinguishers.

B. NFPA 241: Safeguarding Construction, Alteration, and Demolition Operations.

1.4 SYSTEM DESCRIPTION

A. The full set of Contract Documents applies to work of Division 22.

B. Visit the site and study all aspects of the project and working conditions, as required by General and Supplementary Conditions, Bidding and Contracting Requirements, Drawings, and Specifications. Verify field dimensions.

C. The work covered in technical sections includes the furnishing of all labor, equipment and materials, and the performance of all operations pertinent to the work described.

D. Except as required otherwise in Division 01, promptly obtain and pay for, including all necessary signatures and paperwork, all permits, fees and inspections required for work of this division by authorities having jurisdiction, including any utility connection or extension charge. No payment will be made until a copy of the permit is forwarded to the Owner. Note that Owner will pay fees for plumbing permit and off-site inspections by WSSC. Contractor shall transfer fee.

E. Plumbing work of this project includes, as a brief general description, the following:

1. Condensate piping for new mechanical system equipment.

F. See Division 01 for requirements related to Owner's occupancy of the premises, limits on use of site, time restrictions on work, limits on utility outages or shutdowns, and phasing (sequencing) and scheduling.

1.5 PRODUCT OPTIONS

A. Except as modified by provisions of Bidding and Contracting Requirements and Division 01, these options apply to Division 22 specifications.

B. General: Where Contractor is permitted to use a product other than the specified item and model named as the basis of design, Contractor is responsible for all coordination and additional costs as specified in the article "Substitutions," below for substitutions.

C. Products specified by reference standards or by description only: Any product meeting those standards or description.

D. Products specified by naming one or more manufacturers, or model name or catalog reference number: Products specified establish a standard of quality, options to be included, and performance.

1. Where other acceptable manufacturers are named, Contractor may provide products of those named manufacturers only, which meet the specifications.
2. Where specification permits "equal" products, without naming other acceptable manufacturers, Contractor may use products of any manufacturer, which meet the specifications.

E. Products specified by naming one manufacturer and particular product, with no provision for other options: No options or substitutions allowed.

1.6 SUBSTITUTIONS

A. Substitutions will be considered only as permitted or required by the Bidding and Contracting Requirements and Division 01. Except as modified by those requirements, the requirements below apply to Division 22 specifications.

B. Substitutions may be considered when a product becomes unavailable through no fault of the Contractor.

C. Document each request with complete data substantiating compliance of proposed substitution with contract documents.

D. A request constitutes a representation that the Bidder or Contractor:

1. Has investigated proposed product and determined that it meets or exceeds the quality level of the specified product.
2. Will provide the same warranty for the substitution as for the specified product.
3. Will coordinate installation and make changes to other work which may be required for the work to be complete with no additional cost to Owner.
4. Waives claims for additional costs or time extension which may subsequently become apparent.
5. Will reimburse Owner for review or redesign services associated with re-approval by authorities.

E. Substitutions will not be considered when they are indicated or implied on shop drawing or product data submittals, without separate written request, or when acceptance will require revision to the Contract Documents.

F. Substitution submittal procedure is specified in Bidding and Contracting Requirements and Division 01.

1.7 MATERIALS AND EQUIPMENT

A. All materials and equipment shall be new and the best of their respective kinds, suitable for the conditions and duties imposed on them by the project, and of representative manufacturer. The description, characteristics and requirements of the materials to be used shall be in accordance with the specifications.

B. All equipment, construction and installation must meet requirements of local, state and federal governing codes.

C. Singular number: In cases where material, a device, or part of the equipment is referred to in the singular number in the specifications, it is intended that such reference shall apply to as many items of material, devices, or parts of the equipment as are required to complete the installation as shown on the drawings or required for proper operation of the system.

D. Terms have the following meanings:

1. Furnish: Supply item
2. Install: Mount and connect item
3. Provide: Furnish and install.

E. All materials and equipment shall be installed and completed in a first class and workmanlike manner and in accordance with the best modern methods, practice and manufacturers' instructions. Any work which shall not present an orderly and neat or workmanlike appearance shall be removed and replaced with satisfactory work when so directed in writing by the Engineer.

F. The specifications and drawings are intended to define the minimum requirements, as to quality of materials, construction, finish and overall workmanship.

G. General Conditions describe the correlation and intent of the Contract Documents. In case of discrepancies between the specifications and drawings, the specifications should be followed as to the general methods and principles and the drawings followed as to sizes, capacities and specifics for corresponding parts. If sizes are omitted, the Engineer will determine sizes to be utilized.

H. In all cases of doubt, uncertainty, or conflict as to the true meaning of the specifications or drawings, it is the responsibility of the Contractor to notify the Engineer of said uncertainty, doubt, or conflict and obtain a decision as to the intent before starting any work which may be affected by this decision.

1.8 COORDINATION

A. Should a situation develop during construction to prevent the proper installation of any equipment or item where shown on the drawings, call the situation to the attention of the Engineer and await a written decision.

B. Plan and coordinate all work to proceed in an orderly and continuous manner without undue delay, and in conformance with project schedule. Submit samples, shop drawings, schedules, insurance policies and certificates, and the like in time to avoid delays in actual construction. Coordinate plumbing work so that work of each trade is completed before other construction begins which would obstruct it.

1. Install plumbing piping as high as possible in mechanical rooms.

C. Coordinate trades to ensure that proper clearances between work of the various trades allow access to items which require operation and maintenance.

D. Coordinate location and elevation of all piping, ductwork, light fixtures, equipment, and appurtenances in such a manner that the finished installation is as indicated on drawings. In the event difficulties are encountered which prevent this, it is the Contractor's responsibility to bring this to the attention of the Engineer prior to initiation of work. Correct improperly coordinated installation at no additional cost.

E. The Contractors' assistants shall include a competent foreman, who shall be on the premises at all times to check, layout, coordinate and superintend the installation of work. The foreman shall establish all grades and lines relative to the work before starting, and be responsible for the accuracy thereof.

1.9 SUBMITTALS

A. Manufacturers' and subcontractors' lists:

1. As specified in Division 01, submit a complete list of proposed manufacturers for all equipment, materials and subcontractors used for the work of this division. Lists shall follow the sequence of the specifications. No considerations will be given for partial or incomplete lists. After review of lists, submit shop drawings and product data.

B. Shop drawings and product data:

1. Submit in accordance with the requirements of Division 01 or as established at the preconstruction conference, the required number of copies of shop drawings and product data for every item of equipment. Shop drawings or product data will not be considered until manufacturers' lists have been approved. Shop drawings and product data shall be submitted, as required by the General Conditions, with sufficient time for checking, return to Contractor, and resubmission as required before Contractor shall install any item.
2. Each item submitted shall be properly labeled, indicating the specific service for which the equipment or material is to be used, section and paragraph number of specification or drawing number to which it applies, Contractor's name and project name and number. Data submitted shall be specific and shall include product data and printed information in sufficient detail and scope to verify compliance with requirements of the contract documents. Clearly identify each item within the data. Data of a general nature will not be accepted. Each sheet must clearly show the project name and number.

3. The review of a shop drawing or product data shall not be considered as a guarantee of the measurements or building conditions or that the shop drawings or product data have been checked to see that item submitted properly fits the building conditions. This review shall not relieve the Contractor of the responsibility for furnishing material or performing work as required by the contract documents, for correctness of dimensions and quantities, or for proper coordination of details and interfaces among trades.
4. All exclusively electrical items furnished as items associated with plumbing items but not specifically described in the plumbing item submission, shall be submitted as a separate submittal but shall be clearly marked as associated with the plumbing item by identification specification paragraph.
5. Product data sheets shall be 8.5-inch by 11-inch cut sheets for operating and maintenance manual.
6. Provide submittal compliance cover letter for each project submittal indicating compliance with the contract documents. Sample compliance cover letter is included at the end of this section for reference.

C. Submit at least three copies of the results of every test required under any section in this division.

D. Specialist shall submit a list of at least three projects similar to this project in type, size, and quality, which have been in place and operating satisfactorily for at least five years.

1. Include project name, address, name and phone number of owner's representative, and project type and size.

E. After the work is completed, submit all required certificates of approval from approved inspection agencies and authorities having jurisdiction over work of this division. Certificates of approval must be received by the Engineer prior to final acceptance of the work.

1.10 SPECIALIST

A. The term "Specialist" as used in the specification shall mean an individual or firm of established reputation (or, if newly organized, whose personnel have previously established a reputation in the same field,) which is regularly engaged in, and which maintains a regular force of workers skilled in either (as applicable) manufacturing or fabricating items required by the contract, installing items required by the contract, or otherwise performing work required by the contract. Where the specification requires installation by a specialist, the term shall also be deemed to mean the manufacturer of the item, an individual or firm licensed by the manufacturer, or an individual or firm who will perform the work under the manufacturer’s direct supervision.

1.11 CONTRACT CLOSEOUT SUBMITTALS

A. Project record documents:

1. Maintain on site one set of the following record documents; record actual revisions to the work of this division:

a. Contract drawings.
b. Specifications

c. Addenda
d. Change orders and other modifications to the Contract
e. Reviewed shop drawings, product data, and samples

2. Maintain record documents separate from documents used for construction.
3. Record information concurrent with construction progress.
4. Specifications: Legibly mark and record in each section a description of actual products installed, including the following:

   a. Manufacturer's name and product model and number
   b. Product options, substitutions, or alternates utilized
   c. Changes made by addenda and modifications

5. Record documents and shop drawings: Legibly mark each item to record actual construction, including:

   a. Measured horizontal and vertical locations of underground utilities and appurtenances, referenced to permanent surface improvements.
   b. Measured locations of internal utilities and appurtenances concealed in construction, referenced to visible and accessible features of the work.
   c. Field changes of dimension and detail.
   d. Details not on original Contract Drawings.

6. Submit documents as specified in Division 01.

B. Operation and maintenance data:

1. Submit sets prior to final inspection as specified in Division 01. Unless otherwise specified in Division 01, submit no fewer than three sets. In addition to requirements specified in Division 01, submit operating and maintenance manuals for the work of this division as specified below.
2. Lubrication charts: Prepare lubrication charts for each piece of mechanical equipment that requires grease or oil.

   a. Include the following:
      (1) Types of lubricants required
      (2) Locations of lubrication points
      (3) Frequency of lubrication.

   b. Provide one extra set of lubrication charts mounted in plastic covers, besides those required in Operating and Maintenance Manuals.

3. Binders: Three-ring binders with vinyl-covered hard covers. Provide large enough binders, and sufficient quantity, that the required contents can be easily turned, removed, and reinserted.
4. Prepare binder covers with printed title "OPERATION AND MAINTENANCE INSTRUCTIONS," and title of project. Print on spine of binder "O & M INSTRUCTIONS." If more than one binder is required, print covers and spines with volume numbers. Include in the front of every binder an index to all binders.
5. Internally subdivide the binder contents with permanent page dividers, logically organized as described below; with tab titling clearly printed under reinforced laminated plastic tabs.

6. Contents: Prepare a Table of Contents for each volume, with each product or system description identified, typed on white paper.
7. Part 1: Directory, listing names, addresses, and telephone numbers of mechanical engineers; Contractor; mechanical subcontractors; and major mechanical equipment suppliers.
8. Part 2: Operation and maintenance instructions, arranged by specification section. For each category, identify names, addresses, and telephone numbers of subcontractors and suppliers. Identify the following:

    a. Significant design criteria, including pump curves and similar performance charts.
    b. List of plumbing equipment, including operating weight of each.
    c. Parts list for each plumbing fixture, faucet, and pump, including recommended spare parts list.
    d. Operating instructions.
    e. Maintenance instructions for plumbing equipment and systems.
    f. Maintenance instructions for special finishes, including recommended cleaning methods and materials and special precautions identifying detrimental agents.
    g. Valve charts, including locations of flow fittings.
    h. New burner installations: Include firing rate, nozzle size, and fuel pressure.

9. Part 3: Project documents and certificates, including the following:

    a. Shop drawings and product data for plumbing systems.
    b. Water balance reports.
    c. Photocopies of certificates.
    d. Photocopies of warranties and guarantees.
    e. Test reports: Copies of the results of all tests required under all sections of specifications.

10. Submit one copy of completed volumes in final form 15 days prior to final inspection. This copy will be returned after final inspection, with Engineer comments. Revise content of documents as required prior to final submittal.
11. Submit final volumes revised, within ten days after final inspection.
12. Submit DVD optical disc storage media specified in Section 22 05 00.

1.12 REGULATORY REQUIREMENTS

A. When these specifications call for materials or construction of a better quality or larger sizes than required by the following codes and standards, the provisions of the specifications shall take precedence.

B. Provide, without extra charge, any additional materials and labor which may be required for compliance with these codes and standards even though the work is not mentioned in these specifications or shown on the contract drawings.

C. Perform the work of this division in strict accordance with the following authorities. The latest revision of these codes accepted by the authority having jurisdiction as of the date of the contract documents shall apply.

1. The plumbing, mechanical, electrical, building, fire, and safety codes of the state and county or city in which the work is being performed.
2. The National Electric Code, NFPA 70 (NEC).

3. The National Fire Protection Association Code. (NFPA).
4. International Energy Conservation, Fire, Fuel Gas, Mechanical, and Plumbing Codes (ICC).

1.13 REFERENCE STANDARDS

A. Perform the work of this division using the standards of the following organizations, as referred to in technical sections, as a minimum requirement for construction and testing. Unless specified otherwise in Bidding and Contract Documents or Division 01, the latest revision current as of the date of the contract documents shall apply. Products shall be certified by manufacturers to meet the requirements of referenced standards.

1. American National Standards Institute (ANSI)
2. American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE)
3. ASME International (ASME)
4. American Society for Testing and Materials (ASTM)
5. American Society of Sanitary Engineering (ASSE)
6. American Water Works Association (AWWA)
7. International Code Council (ICC)
8. Manufacturer's Standardization Society of the Valve and Fittings Industry Inc. (MSS)
9. National Electrical Code, NFPA 70 (NEC)
10. National Electrical Manufacturer's Association (NEMA)
11. National Fire Protection Association (NFPA)
12. National Fuel Gas Code, NFPA 54
13. National Sanitary Foundation (NSF)
14. National Standard Plumbing Code (NSPC)
15. The Occupational Safety and Health Act (OSHA)
16. Piping and Drainage Institute (PDI)
17. Sheet Metal and Air Conditioning Contractors National Association, Inc. (SMACNA)
18. Underwriters Laboratory Inc. (UL)
19. Maryland Occupational Safety and Health Act (MOSHA)

1.14 TEMPORARY STORAGE

A. Maintain upon premises, where directed, a storage area, and be responsible for all contents within these areas. Provide all security measures necessary for this area.

B. Area shall be maintained and shall be returned to original condition at the completion of the project.

1.15 PROTECTION

A. Control dust resulting from construction work to prevent its spread beyond the immediate work area, and to avoid creation of a nuisance.

1. Do not use water to control dust. Use drop cloths or other suitable barriers.
2. In areas where dirt or dust is produced as a result of the work, sweep daily, or more often as required.
3. Provide walk-off mats at entries and replace them at regular intervals.
4. Construct dust partitions, where indicated on the drawings or as required.
5. Seal off all return air registers and other mechanical systems to prevent dust from entering.

B. Each trade and subcontractor is responsible for preventing damage and soiling of work performed by other trades or subcontractors. Each trade and subcontractor is responsible for providing temporary protection of its own work.

1. Protect work from spills, splatters, drippings, adhesives, bitumens, mortars, paints, plasters, and damage from welding or burning.
2. Protect finished work from damage, defacement, staining, or scratching.
3. Protect finishes from cleaning agents, or grinding and finishing equipment.
4. Protect adjacent and finished work from damage, using tape, masking, covers or coatings and protective enclosures.
5. Coordinate installations and temporarily remove items to avoid damage from finishing work.

C. Repair all damage or soiling to the complete satisfaction of the Engineer; replace any materials or work damaged to such an extent that they cannot be restored to their original condition, all at no addition to the Contract Sum.

D. Protect work stored in place and supplies stored in the building.

1. Store materials and products, subject to damage from moisture, in dry locations. If necessary, protect in wraps or covers.
2. Store plastics, other materials, and products subject to damage from heat or cold at manufacturer's recommended temperatures.

E. All equipment shall be covered during shipping and wrapped prior to leaving factory.

F. Use of sidewalk or roadway areas outside of the property lines shall be with permission and approval of the local authorities having jurisdiction.

1.16 FIRE PROTECTION

A. As a minimum, provide hand-carried, portable, UL-rated extinguishers with each work crew working inside the building.

B. Select extinguishers in accordance with NFPA 10 and NFPA 241 for classification, extinguishing agent, and size required by location and class of fire exposure.

1.17 PROJECT CONDITIONS

A. Drawings showing utilities in concealed locations are based on the best information available but are not represented as being precisely correct. Work of the contract includes digging, cutting, drilling, using nondestructive methods, and other methods of locating concealed utilities in the field, as well as patching and repairing as specified in "Cutting and Patching" below.

B. If, in the course of the work, workers encounter a material they suspect to present some hazard:

1. Promptly notify the Owner and Engineer in writing.
2. Do not perform any work which would disturb the suspected material until written instructions have been received.

1.18 WARRANTY

A. All work and equipment provided as work of this division shall be fully warranted under the general project warranty, which shall include a 2 year/24 hour/7 day full parts and labor warranty for all plumbing work and equipment. In addition, provide added special warranties specified in individual sections.

B. During the correction period, the Contractor shall begin correcting any work found to be not in accordance with the requirements of the Contract Documents within 4-hours of receiving written notice from the Owner. Provide detailed schedule for completion of work within 24-hours of receiving written notice from the Owner and revise schedule based on any Owner comments generated. Except as otherwise required in General Conditions and Division 01, the correction period is two years after the date of substantial completion of the work. Work requiring correction shall promptly be repaired or completely replaced at no addition to the Contract Sum.

   1. Provide service log on all equipment repairs to the Owner at the end of the warranty period.

C. When use of the permanent equipment has been permitted for temporary use or occupancy of the building, the warranty and correction periods shall nevertheless begin at the time of substantial completion, unless another date of acceptance has been agreed to by the Owner.

D. Special warranties are warranties required by individual specification sections, incidental product warranties, manufacturers' standard warranties, installer or subcontractor service agreements, and other individual warranties in addition to the general project warranty.

E. Provide copies of warranties as required for Operation and Maintenance Manual specified above, and by Division 01.

F. For items of work delayed beyond date of substantial completion, provide updated submittal within ten days after acceptance, listing date of acceptance as start of warranty period.

PART 2 - PRODUCTS

NOT USED

PART 3 - EXECUTION

3.1 CUTTING AND PATCHING

A. General: Employ skilled workers to perform cutting and patching. Proceed with cutting and patching at the earliest feasible time, and complete without delay.

B. Cut walls, floors, partitions, roofs, and other appurtenances for the passage or accommodation of pipes, ducts and appurtenances. Close superfluous openings and remove all debris caused by work of this division.

C. No cutting of any structure or finish shall be done until the condition requiring such cutting has been examined and approved by the Engineer.

D. New or existing surfaces disturbed as a result of such cutting or otherwise damaged shall be restored to match original work and all materials used for any patching or mending shall conform to the class of materials originally installed.

E. Refinish surfaces to match adjacent finish. For continuous surfaces, refinish to nearest intersection or natural break. For an assembly, refinish entire unit.

3.2 TEMPORARY FACILITIES

A. Temporary water facilities, electricity, telephone, toilet facilities, and temporary heat, shall be provided as specified in Division 01.

3.3 PROGRESS MEETINGS

A. Progress meetings shall be held as specified in Division 01, and also when and if the Contractor or Engineer finds them necessary or advantageous to progress of work.

B. Contractor, those subcontractors and those material suppliers concerned with current progress or with the scheduling of future progress, Engineer and Owner shall each be represented at these meetings by persons familiar with the details of work and authorized to conclude matters relating to work progress.

- END OF SECTION 22 01 01 -

(Sample Submittal Compliance Cover Letter Follows this Section)

Submittal Compliance Cover Letter

Project: MCPS – XXX Elementary School
Engineer: James Posey

Specification Section:
Section Title: PACKAGED ROOFTOP AIR HANDLING UNITS

Basis of Design: Comply: Yes ☐ No ☒

Approved Alternate Manufacturer: Comply: Yes ☐ No ☐ N/A ☒

Specification Section	Compliance
1.01	Comply
1.02	Comply
1.03	Comply
1.04	
1.04.A	Comply
1.04.B	Wiring Diagrams to be provided with submittal for record.
1.04.C	Comply
1.04.D	Comply
1.05	Comply
1.06	Comply
2.01	Comply
2.02	Comply
2.03	Comply
2.04	Comply
2.05	Comply
2.06	Comply
2.07	Comply
2.08	Comply
2.09	Comply
2.10	Comply
2.11	Comply
3.1.A	Comply
3.1.B	Comply
3.1.C	By others
3.1.D	Comply
3.1.E	By others
3.1.F	Comply – To be completed during start up; downstream of gas regulator only. Gas Pressure entering gas regulator is responsibility of others.
3.1.G	By others

SECTION 22 05 00
COMMON WORK RESULTS FOR PLUMBING

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Requirements applicable to more than one section of Division 22.

B. Basic material and equipment required for the plumbing piping work.

C. Cleaning and painting.

D. Operating instructions.

E. Piping tests.

1.2 RELATED SECTIONS

A. Project and special warranties: Division 01 and Section 22 01 01.

B. Operation and Maintenance Manuals: Division 01 and Section 22 01 01.

C. Painting: Division 09.

1.3 REFERENCES

A. American Society of Mechanical Engineers

1. ASME A 13.1: Scheme for the Identification of Piping Systems
2. ASME B 31.9: Building Services Piping

B. American Society of Testing and Materials

1. ASTM B 32: Standard Specification for Solder Metal
2. ASTM B 88: Standard Specification for Seamless Copper Water Tube
3. ASTM B 813: Standard Specification for Liquid and Paste Fluxes for Soldering of Copper and Copper Alloy Tube
4. ASTM D 635: Standard Test Method for Rate of Burning and/or Extent and Time of Burning of Plastics in a Horizontal Position
5. ASTM E 84: Standard Test Method for Surface Burning Characteristics of Building Materials
6. ASTM E 548: Standard Guide for General Criteria Used for Evaluating Laboratory Competence
7. ASTM D 2564: Standard Specification for Solvent Cements for Poly (Vinyl Chloride) (PVC) Plastic Piping Systems
8. ASTM F 656: Standard Specification for Primers for use in Solvent Cement Joints of Poly (Vinyl Chloride) (PVC) Plastic Pipe and Fittings

C. American Welding Society

1. AWS D1.1: Structural Welding - Steel

2. AWS D10.9: Specification for Qualification of Welding Procedures and Welders for Piping and Tubing

D. NSF

1. NSF/ANSI 61: Drinking Water System Components - Health Affects
2. NSF/ANSI 372: Drinking Water System Components – Lead Content

1.4 DEFINITIONS

A. Project correction period: A period after Substantial Completion of the work during which the Contractor shall correct every part of the work found to be not in accordance with the requirements of the contract documents, promptly after receipt of written notice.

B. Qualified testing agency: 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.

C. DN: Dimension Nominale, nominal pipe size in millimeters, in accordance with the metric system for construction, Systeme Internationale (SI).

D. NPS: Nominal pipe size in inches, in accordance with standard U.S. designations for manufactured pipe. Pipe sizes do not change when projects are designed and built in metric units; each size has a consistent name (nominal dimension) in each system.

1.5 DESIGN REQUIREMENTS

A. The drawings and system performances have been designed based on use of the particular manufacturer's products specified and scheduled on the drawings.

B. Products of other manufacturers that are listed under the article "Acceptable Manufacturers," or permitted as "equal," are permitted provided:

1. Product shall meet the specifications.
2. Contractor shall make, without addition to the contract sum, all adjustments for deviations so that the final installation is complete and functions as the design basis product is intended.

C. Do not propose products with dimensions or other characteristics different from the design basis product that render their use impractical, or cause functional fit, access, or connection problems.

1.6 SUBMITTALS

A. Shop drawings:

1. Schedule of welding and brazing procedures proposed for each piping system in the project.
2. Shop drawings of backboards for piping specialties.

B. Certifications: Proof of operator and testing agency personnel qualifications as required for welding and brazing in the article "Quality Assurance" below.

C. Test reports: Field test results for each piping system as specified in Part 3 below.

1.7 QUALITY ASSURANCE

A. Provide materials and perform work in accordance with the plumbing, mechanical, electrical, building, fire, health and safety, and other applicable codes and regulations of the state, county or city in which the work is performed.

1. Product specifications herein may not necessarily meet all regulations for the limits on lead content. The Contractors and product suppliers shall be responsible to provide products that comply with NSF/ANSI 61 and NSF/ANSI 372 for domestic water systems.

B. Welding procedures and operator qualifications for structural welding: AWS D1.1, Structural Welding Code Steel, electric arc process.

C. Brazing, and soldering procedures and operator qualifications for building systems piping:

1. ASME B31.9, Building Services Piping.
2. Copper Development Association "Copper Tube Handbook."
3. Safe Drinking Water Act.

D. Electrical control panels, equipment, materials and devices provided or installed as work of Division 22 shall bear UL label or, if UL label is not available, the item shall be tested and labeled by a qualified testing agency, acceptable to authorities having jurisdiction, and in accordance with NFPA 70 (NEC). Provide testing, if required, without addition to the contract sum.

E. VOC content: Field-applied adhesives and sealants, limits per South Coast Air Quality Management District (SCAQMD), Rule No. 1168.

F. Products shall contain no urea-formaldehyde content.

PART 2 - PRODUCTS

2.1 GENERAL

A. General piping techniques, testing, identification, painting, and operating instructions specified in this section apply to products specified in other sections of Division 22.

B. Equipment that uses or processes date and time data in order to perform its function shall be warranted by the manufacturer to properly function and correctly use or process all time-related data for all dates and times which occur during a reasonable life expectancy of the equipment.

2.2 PIPING MATERIALS

A. Soldering materials:

1. Solder: Free of lead, antimony, and zinc and meeting the requirements of ASTM B 32. No solder containing lead is permitted.

   a. Tin 95.5 percent, copper 4 percent, and silver 0.5 percent. Equal to "Silvabrite 100" manufactured by Engelhard Corporation.
   b. Tin, copper, bismuth, and silver. Equal to "Oatey Silver" manufactured by Oatey.

2. Flux: Meeting the requirements of ASTM B 813 and NSF 61 certified. Equal to Oatey H-2095.

B. Threaded pipe joint materials:

1. Pipe jointing compound:

   a. Pipe joint compound recommended by the manufacturer for use at the temperature and pressure of the system.
   b. For sanitary piping overhead of food storage, preparation, and serving and dining areas: Litharge and glycerin.

2. Pipe joint tape: Polytetrafluoroethylene (PTFE) pipe thread tape, "Teflon."

PART 3 - EXECUTION

3.1 INSTALLATION OF PRODUCTS AND EQUIPMENT

A. Manufacturers' instructions: Except as modified by drawings or specifications, install products and equipment in accordance with manufacturers' instructions and recommendations applicable to the project conditions.

1. Immediately notify Engineer if a difference or discrepancy is found between manufacturers' instructions and the drawings or specifications.

B. The contract drawings are diagrammatic and do not indicate all fittings or offsets in pipe, all access panels, or all specialties required. Provide required fittings, offsets, access panels, and specialties to coordinate the work.

C. No pipe shall be run below the head of a window or door.

D. Equipment and pipes installed in areas without a suspended ceiling shall be as tight to structure as possible, but at least above a height of 6'-8", unless otherwise noted.

E. Items which require access for operation or maintenance shall be easily accessible. Do not cut or form hand holes for operation or maintenance of appliances through walls or ceilings.

3.2 PIPE INSTALLATION

A. Install pipe exposed to view parallel to building lines and as close to walls, columns, and ceilings as may be practical, maintaining proper clearances for access at all parts requiring servicing.

B. Install pipe a sufficient distance from other work to permit a clearance of not less than 0.5 inch (15 mm) between its finished covering and adjacent work.

C. Remove burrs resulting from cutting pipe or from any other operation.

D. Thoroughly clean pipe and fittings before they are installed, and keep them clean until the acceptance of the completed work. Cap or plug the ends of the lines so as to prevent earth and other debris from entering during construction.

E. Pipe connection flexibility:

1. Connections shall be arranged so that movement in piping due to expansion and contraction will not transmit excessive force to equipment or fixtures.

F. Install unions or flanges in the piping at each item of equipment, solenoid valve, central thermostatic mixing valve, and appliance, so as to provide easy removal of the equipment, valve, or appliance.

G. Pitch water piping so that air in the system can be properly vented. Provide shutoff valves where necessary to isolate parts of system for repairs without draining the entire system.

H. Interface with other products:

1. Where pipe is provided through walls, provide finished, permanent, waterproof installation complete with inserts, sleeves, supports or hangers, seals, and other appurtenances as required. Do not pierce, cut, or notch any footing or other structural member.
2. Waterproofing and dampproofing of the building shall be unharmed by the installation of the work. Where pipe has to pierce waterproofing or dampproofing, including outside walls, the penetration shall be made watertight. Waterproofing damaged or destroyed shall be repaired or replaced with new waterproofing.

I. Thoroughly clean pipe and fittings before they are installed, and keep them clean until the acceptance of the completed work. Cap or plug the ends of the lines so as to prevent earth and other debris from entering during construction.

J. Threaded connections:

1. Cut threads full and clean.
2. Apply specified pipe joint compound or tape on male threads only.
3. Where piping is installed in crawl spaces and tunnels, cover exposed threads with rust-inhibitive paint. Apply after joints have been assembled and tested.

K. Copper tubing installation:

1. Cut pipe with a tubing cutter or fine-tooth saw. Cuts made with a saw shall be true and square, and the end shall be filed smooth with a fine-tooth file. Remove all marks and burrs with sandpaper.
2. Solder joints for copper tubing: Clean ends of tubing and inside of fitting ends thoroughly with emery cloth before applying flux.
3. Provide dielectric fittings between copper and steel piping to prevent electrolysis.
4. Follow the techniques for soldering and brazing pipe, fittings, and valves as recommended by the manufacturer.

3.3 CLEANING AND PAINTING

A. Cleaning: Clean all piping and equipment. Where items are to be painted, clean ready for painting.

B. Painting: Coordinate painting with requirements of Division 09. Paint the items identified below to be painted. Use paint materials and systems specified in Division 09.

C. Items to be painted:

1. Items identified below to have protective coating.
2. Items furnished with manufacturer's prime coat.
3. Mechanical rooms (including but not limited to boiler, chiller, and air-handling unit rooms):

   a. Insulation and uninsulated steel: Piping, pumps, tanks, and vessels.
   b. Hangers and supports.

4. Piping exposed in finished spaces, insulated and uninsulated.

D. Items not to be painted: Copper, stainless steel, and equipment furnished with manufacturer's finish.

E. Paint systems in mechanical rooms: Paint piping using colors in accordance with Owner's identification legend in "Identification" above. Paint systems as specified in Division 09.

1. Galvanized steel: One coat of primer recommended for galvanized surfaces and one coat of glossy alkyd enamel.
2. Ferrous metal: One coat of primer recommended for ferrous metal and one coat of glossy alkyd enamel.
3. Items protected with rust-inhibitive primer: Finish coat of compatible glossy enamel.

F. Paint systems for exposed piping: Primer compatible with the substrate, whether steel, galvanized steel, insulation jacket, or other material; one coat or two, if required to cover, to match adjacent surfaces in color and texture.

3.4 OPERATING INSTRUCTIONS (DEMONSTRATION)

A. Furnish the necessary technicians, skilled workers, and helpers to operate all the plumbing systems and equipment of the entire project for one 8-hour day.

B. Where specified in technical sections, provide longer periods required for specialized equipment.

C. Instruct the Owner or designated personnel in operation, maintenance, lubrication, and adjustment of all systems and equipment.

1. Instructions by manufacturer's technical representative for each type of equipment shall include the performance of the recommended preventive maintenance procedures for that equipment.

D. The Operating and Maintenance Manual shall be available at the time of the instructions, for use by instructors and Owner personnel.

E. Record each instruction session only in DVD media format (video and audio format), including both the sessions specified above and added sessions required in technical sections for specialized equipment. Provide one complete set of DVDs with each Operating and Maintenance Manual.

F. Schedule the general and specialized instruction periods for a time agreed upon by the Owner and Engineer.

3.5 PIPING TESTS

A. Hydrostatic testing:

1. Notify Owner in writing at least 24 hours prior to the test.
2. Test before pipes are concealed or insulated.
3. Piping may be tested in sections as the work progresses.
4. Provide fluid, pumps, valves, and gages required for testing.
5. Where water is used as the test fluid, provide ambient temperature water and provide means to avoid freezing. Drain and dispose of test fluid when testing is concluded.
6. Isolate equipment and expansion tanks during test.
7. Isolate or remove any components with a pressure rating below the required test pressure.
8. Brace and support piping during the test, so that no movement, displacement, or damage results from the application of the test pressure.
9. Provide a pressure relief valve, set at a pressure no more than one-third higher than test pressure, to protect against damage caused by expanding liquid or other source of overpressure during test.
10. Replace piping or fittings found defective with new material.
11. Air conditioning condensate piping tests:

a. Before connection of condensate producing HVAC equipment, cap or plug all new air conditioning condensate drain piping systems of the building.
b. Test following the methods of testing required by the plumbing code, and no less than the duration and pressures required in the Schedule of Piping Systems Tests.
c. Where pipes are in trenches, leave the trenches open until the completion of the test.

12. Documentation of tests: Prepare a test report for each portion of piping tested, identified by service, material, location, and pipe size. Include these items:

    a. Date of test.
    b. Starting and completion times.
    c. Initial test pressure.
    d. Final test pressure.
    e. Problems or leaks detected.
    f. Corrective actions taken.
    g. Record of successful completion of testing.
    h. Name, title, and signature of person conducting test.

13. Piping Systems Test Schedule:

System	Test Pressure psig (kPa)	Duration	Allowable Drop	Medium
Air conditioning condensate drain piping	4.3 (30)**	4 Hours	None	Water

** Where piping is above food service area, test pressure shall be 11 psig (76 kPa).

- END OF SECTION 22 05 00 -

SECTION 22 05 02
SLEEVES AND PLATES FOR PLUMBING PIPING

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Sleeves and escutcheon plates for piping systems.

B. Mechanical seals for piping penetrations.

1.2 SUBMITTALS

A. Product data: Sleeves, plates, sealants, and mechanical penetration seals.

PART 2 - PRODUCTS

2.1 SLEEVES, PLATES, AND ACCESSORIES

A. Steel sleeves: Schedule 40 black steel pipe, ASTM A 53.

B. Copper sleeves: Type L, ASTM B 88 hard drawn.

C. Cast-iron sleeves: Extra heavy, with waterstop and ends as shown on the drawings. Equal to product of U.S. Pipe Co.

D. Sealing compound in walls and floors: Equal to the following:

1. Bare and insulated pipes carrying fluids 150 degrees F (65 degrees C) and below: Sika Corporation "Sikaflex – 1a." Use a primer for applications required by the manufacturer.
2. Bare and insulated piping carrying fluids 151 degrees F (66 degrees C) and above: Dow Corning Corporation "795 Silicone." Use a primer for applications required by the manufacturer.

E. Floor, wall, and ceiling plates for existing piping: Stamped or cast brass with chrome finish and set screw, split and tabbed.

F. Floor, wall, and ceiling plates for new piping: Stamped or cast brass with chrome finish and set screw.

PART 3 - EXECUTION

3.1 INSTALLING SLEEVES

A. Install sleeves for piping, or piping with insulation continuous through sleeve, passing through walls, partitions, beams, or slabs.

B. Do not cut, drill, or burn structural steel for installation of piping without specific instructions from the Engineer.

C. Locations in nonfire-rated construction:

1. Install steel sleeves for penetrations of steel, iron, and insulated piping.
2. Install copper sleeves for penetrations of uninsulated copper tubing and piping.

D. Locations in floors and fire-rated construction: Sleeves used in piping penetrations through fire-rated construction shall be an acceptable component of the through-penetration firestop assembly as specified in Section 22 05 07, Firestopping for Plumbing Work.

1. Where firestop assembly is UL listed, sleeve material shall be as directed in the listing.
2. Where other specified approval and acceptance is required, sleeve shall be as described in the approved assembly.

E. Install sleeves through walls and partitions flush with finished surfaces.

F. Sleeves through floors shall extend 2 inches (50 mm) above top of finished floor and be finished neat and level. Provide projecting sleeves with anchor clips to prevent them from being loosened and knocked down in the floor construction.

G. Sleeves for insulated piping shall be large enough to pass piping and insulation.

H. Seal spaces between sleeves and pipe, or pipe insulation, in nonrated walls, with mineral wool.

3.2 INSTALLING PLATES

A. Exposed piping passing through interior walls, partitions, floors, and ceilings shall be fitted with plates of size and depth to conceal sleeves. Secure plates firmly in place with set screws.

B. Do not install floor or wall plates on pipes in the kitchen and food service areas.

- END OF SECTION 22 05 02 -

SECTION 22 05 07
FIRESTOPPING FOR PLUMBING WORK

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Through-penetration firestopping in fire-rated construction.

B. Through-penetration smoke-stopping in smoke partitions.

1.2 RELATED SECTIONS

A. Sleeves and plates: Section 22 05 02.

1.3 REFERENCES

A. Underwriters Laboratories

1. UL Fire Resistance Directory.
2. UL 1479: Through Penetration Firestops.

B. American Society for Testing and Materials Standards:

1. ASTM E 814: Standard Test Method for Fire Tests of Through-Penetration Firestops.

1.4 DEFINITIONS

A. Assembly: Particular arrangement of materials specific to given type of construction described in referenced documents.

B. Barriers: Time-rated fire walls, smoke barrier walls, time-rated ceiling/floor assemblies and structural floors.

C. Firestopping: Methods and materials applied in penetrations and unprotected openings to limit spread of heat, fire, gasses and smoke.

D. Penetration: Opening or foreign materials passing through or into barrier or structural floor such that full thickness of rated materials is not obtained.

E. Sleeve: Metal fabrication or pipe section extending through thickness of barrier and used to permanently guard penetration. Sleeves are described as part of penetrating system in other sections and may or may not be required.

F. System: Specific products and applications, classified and numbered by the rating agency to close specific barrier penetrations.

1.5 SYSTEM DESCRIPTION

A. Design requirements:

1. Fire-rated construction: Maintain barrier and structural floor fire resistant ratings including resistance to cold smoke at all penetrations.
2. Smoke barrier construction: Maintain barrier and structural floor resistance to cold smoke at all penetrations.

1.6 SUBMITTALS

A. Product data: Manufacturer's specifications and technical data including the following:

1. Detailed specification of construction and fabrication.
2. Manufacturer's installation instructions.

B. Shop drawings: Submit firestop assemblies and devices for all openings and through penetrations in fire-rated construction. Indicate dimensions, description of materials and finishes, general construction, specific modifications, component connections, anchorage methods, hardware, and installation procedures, plus the following specific requirements.

1. Details of each proposed assembly identifying intended products and applicable rating agency classification.
2. Manufacturer or manufacturer's representative shall provide qualified engineering judgments and drawings relating to conditions where rated assemblies do not exist.

C. Quality control submittals:

1. Statement of qualifications.

D. Applicators' qualifications statement:

1. List past projects indicating required experience.

E. Certifications: Letters or forms showing acceptance by local authorities for systems without acceptance by a rating agency.

1.7 QUALITY ASSURANCE

A. Products and assemblies shall be tested and labeled by an independent, nationally recognized testing and labeling authority.

B. Installer's qualification: Firm experienced in installation or application of systems similar in complexity to those required for this project, plus the following:

1. Acceptable to or licensed by manufacturer, state, or local authority where applicable.
2. At least 2 years' experience with systems.
3. Successfully completed at least 5 projects of comparable scale, using these systems.

C. Local and state regulatory requirements: Obtain acceptance for proposed assemblies not conforming to specific rating agency classifications or rated assemblies.

D. Materials shall have been tested to provide fire rating at least equal to that of the construction in which they are to be installed.

E. VOC content: Field-applied adhesives and sealants, limits per South Coast Air Quality Management District (SCAQMD), Rule No. 1168.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Packing and shipping:

1. Deliver products in original unopened packaging with legible manufacturer's identification.
2. Coordinate delivery with scheduled installation date, allow minimum storage at site.

B. Storage and protection: Store materials in a clean, dry, ventilated location. Protect from soiling, abuse, moisture and freezing when required. Follow manufacturer's instructions.

1.9 PROJECT CONDITIONS

A. Existing conditions:

1. Verify existing conditions and substrates before starting work. Correct unsatisfactory conditions before proceeding.
2. Proceed with installation only after penetrations of the substrate and supporting brackets have been installed.

B. Environmental requirements:

1. Furnish adequate ventilation if using solvent.
2. Furnish forced-air ventilation during installation if required by manufacturer.
3. Keep flammable materials away from sparks or flame.
4. Provide masking and drop cloths to prevent contamination of adjacent surfaces by firestopping materials.
5. Comply with manufacturing recommendations for temperature and humidity conditions before, during and after installation of firestopping.

1.10 WARRANTY

A. General project warranty and correction period, as required in general conditions and Division 01, requires repair or replacement of materials or systems which fail in joint adhesion, co-adhesion, abrasion resistance, weather resistance, extrusion resistance, migration resistance, stain resistance, or general durability or appear to deteriorate in any other manner not clearly specified by submitted manufacturer's data as an inherent quality of the material for the exposure indicated.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Acceptable manufacturers and products: Those listed in the UL Fire Resistance Directory for the UL System involved, or rated for the application by Warnock Hersey or by another acceptable rating agency.

2.2 THROUGH-PENETRATION FIRESTOPPING OF FIRE-RATED CONSTRUCTION

A. Provide systems or devices listed and labeled by a rating agency, and conforming to the construction type, penetrant type, annular space requirements and fire rating involved in each separate instance. The system shall be symmetrical for wall applications. Systems or devices shall be asbestos-free.

1. Additional requirements: Firestopping shall withstand the passage of cold smoke either as an inherent property of the system, or by the use of a separate product included as a part of the rated system or device, and designed to perform this function.
2. Additional requirements: Firestopping sealants shall be red in color to facilitate field verification of firestopping application.

2.3 SMOKE-STOPPING AT SMOKE PARTITIONS

A. Through-penetration smoke-stopping: Any system complying with the requirements for through-penetration firestopping in fire-rated construction is acceptable, provided that the system includes the specified smoke seal or will provide a smoke seal. The length of time of the fire resistance may be disregarded.

2.4 ACCESSORIES

A. Fill, void or cavity materials and forming materials: Classified for firestopping use, or included in a rated firestopping assembly, by a rating agency.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verification of conditions: Examine areas and conditions under which work is to be performed and identify conditions detrimental to proper or timely completion.

1. Verify barrier penetrations are properly sized and in suitable condition for application of materials.
2. Do not proceed until unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Clean surfaces to be in contact with penetration seal materials, of dirt, grease, oil, loose materials, rust, or other substances that may affect proper fitting, adhesion, or the required fire resistance.

3.3 INSTALLATION

A. Provide firestop devices or assemblies for every opening and penetration in floors or fire-rated construction.

B. Install penetration seal materials in accordance with printed instructions of the rating agency and in accordance with manufacturer's instruction.

C. Ensure an effective smoke barrier in each sealed penetration. Install smoke stopping as specified for firestopping.

D. Protect materials from damage on surfaces subject to traffic.

E. Where large openings are created in walls or floors to permit installation of pipes, or other items, close unused portions of opening with firestopping material tested for the application.

3.4 FIELD QUALITY CONTROL

A. Examine penetration seals to ensure proper installation before concealing or enclosing them.

B. Keep areas of work accessible until inspection and acceptance by applicable authorities.

C. Before substantial completion, patch and repair firestopping cut or penetrated by other construction work.

3.5 ADJUSTING AND CLEANING

A. Clean up spills of liquid components.

B. Neatly cut and trim materials as required.

C. Remove equipment, materials and debris, leaving area in undamaged, clean condition.

- END OF SECTION 22 05 07 -

SECTION 22 05 29
HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Pipe hangers and supports.

B. Trapeze pipe hangers.

C. Insulation protection.

D. Fasteners.

1.2 RELATED SECTIONS

A. Plumbing Piping Insulation: Section 22 07 19.

1.3 REFERENCES

A. American Society of Mechanical Engineers

1. ASME B31.9: Building Services Piping.

B. ASTM International

1. ASTM A 36: Standard Specification for Carbon Structural Steel
2. ASTM A 53: Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless
3. ASTM A 307: Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60 000 PSI Tensile Strength
4. ASTM A 563: Standard Specification for Carbon and Alloy Steel Nuts
5. ASTM A 1064: Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete
6. ASTM C 533: Standard Specification for Calcium Silicate Block and Pipe Thermal Insulation
7. ASTM C 552: Standard Specification for Cellular Glass Thermal Insulation
8. ASTM F 594: Standard Specification for Stainless Steel Nuts
9. ASTM F 3125: Standard Specification for High Strength Structural Bolts and Assemblies, Steel and Alloy Steel, Heat Treated

C. American Welding Society

1. AWS-D.1.1: Structural Welding – Steel

D. Metal Framing Manufacturer's Association

1. MFMA-4: Metal Framing Standards Publication
2. MFMA-103: Guidelines for the Use of Metal Framing

E. Manufacturer's Standardization Society

1. MSS SP-58: Pipe Hangers and Supports - Materials, Design, Manufacture, Selection, Application, and Installation.

1.4 DEFINITIONS

A. Hot Systems: Maximum operating (service) temperatures 120 degrees F (49 degrees C) and above.

B. Ambient Systems: Maximum operating temperatures 60 to 119 degrees F (16 to 48 degrees C).

C. Cold Systems: Maximum operating temperatures 59 degrees F (15 degrees C) and below.

1.5 SUBMITTALS

A. Product data:

1. Provide manufacturer's literature showing compliance with specifications for each type of hanger, framing system, support, fastener and accessory materials.
2. Provide a schedule of piping types and sizes and associated pipe hanger types.
3. Provide a schedule of building attachment types and associated attachment hardware.
4. Provide a schedule of pipe types and sizes and proposed hanger spacing and support rod diameters.
5. Provide manufacturer's recommended pipe hanger spacing criteria for stainless steel piping.
6. For supports used as components of fire protections systems, include certification of listing and label as required in "Quality Assurance" below.

B. Welding certificates.

1.6 QUALITY ASSURANCE

A. Qualifications of welders: As specified in Section 22 05 00, Common Work Results for Plumbing.

B. Hangers and supports used as components of fire protection systems shall:

1. Comply with NFPA 13.
2. Be listed and labeled by a nationally recognized testing laboratory (NRTL) according to 29 CFR 1910.7.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Pipe hangers:

1. Anvil International

2. Carpenter and Paterson, Inc.
3. Cooper Industries
4. National Pipe Hanger Corporation
5. PHD Manufacturing, Inc.
6. PHP Systems/Design

B. Pipe covering protection shields:

1. Anvil International
2. Carpenter and Patterson, Inc.
3. Cooper Industries
4. National Pipe Hanger Corporation
5. PHD Manufacturing, Inc.
6. Pipe Shields, Inc.
7. Rilco Manufacturing Co., Inc.

2.2 PIPE HANGERS AND SUPPORTS

A. General: Comply with requirements of MSS SP-58.

B. Hangers and clamps:

1. Typical interior applications: Galvanized steel or factory painted.
2. Exterior and corrosive applications: Stainless steel.
3. For use with uninsulated copper pipe: Copper plated.

C. Trapeze pipe hanger: MSS SP-58, Type 59, shop-fabricated or field-fabricated pipe support assembly made from structural carbon-steel shapes with pipe saddles and U-bolts to secure piping on top of hanger.

D. Supplemental materials:

1. Threaded rod: Continuously threaded.

a. Zinc-plated or galvanized carbon steel for indoor applications.
b. Stainless steel for outdoor and corrosive applications.

2. Nuts and washers: Provide the same material used for threaded rods (ASTM A 563 for steel, ASTM F 594 for stainless steel).
3. Structural carbon-steel shapes: ASTM A 36.
4. Steel pipe: ASTM A 53, Grade B, Type E (electric resistance welded), Schedule 40, black and galvanized steel.

E. Insulation protection:

1. Pipe covering protection shield:

a. Shield: Galvanized steel, meeting the requirements of MSS SP-58 Type 40. Provide with alignment ridges when used in conjunction with pipe hanger.

b. Structural insulation insert: Structural insulation insert to form the insulation for the lower half of. or the entire pipe circumference. Provide ASTM C 533, Type I calcium silicate with 100-psig (688-kPa) minimum compressive strength; or ASTM C 552, Type II cellular glass with 100-psig (688-kPa) minimum compressive strength. Insert thickness shall match adjacent piping insulation thickness.

2. Combination insulating insert and insulation protection shield:

a. Insulating insert material for cold and ambient system piping: ASTM C 552, Type II cellular glass with 100-psig (688-kPa) minimum compressive strength and vapor barrier. Insert thickness shall match adjacent piping insulation thickness.
b. Insulating insert material for hot system piping: Water-repellent treated, ASTM C 533, Type I calcium silicate with 100-psig (688-kPa) minimum compressive strength; or ASTM C 552, Type II cellular glass with 100-psig (688-kPa) minimum compressive strength. Insert thickness shall match adjacent piping insulation thickness.
c. Insulation protection shield: Galvanized steel.
d. Insulating insert and insulation protection shield shall cover entire circumference of pipe.
e. Insulating insert length: Extend 2 inches minimum (50 mm) beyond insulation protection shield.

3. Pipe covering protection saddle:

a. Saddle: Steel, meeting requirements of MSS SP-58 Type 39.
b. Insulation insert: Insulating material located in the space between saddle and pipe.

4. Pipe clamp insulating insert:

a. Insulating insert material: Closed-cell, sponge or expanded rubber, ASTM C 534, Type I for tubing material, with integral supports constructed from non-compressive closed cell material, single piece construction with self-adhesive closure strips. Insert thickness shall match adjacent piping insulation thickness. If insulation thickness is not available, provide maximum available thickness and seal insulation vapor barrier at thickness transition.
b. Insulation protection jacket: Aluminum or stainless steel, bonded to insulation insert.
c. Insulating insert and jacket shall cover entire circumference of pipe.
d. Equal to Armacell "Armafix" insulating inserts.

2.3 FASTENERS

A. Mechanical expansion anchors: Self-drilling type expansion shields or machine bolt drop-in anchors for drilled holes. Fasteners to floor slabs shall be vibration and shock resistant. Load applied to fasteners shall not exceed 25 percent of manufacturer's stated load capacity in 3500 psi (24,000 kPa) concrete. Provide zinc-coated anchors for indoor applications and stainless-steel anchors for outdoor applications. Equal to ITT Phillips Anchors "Red Head."

B. Fasteners to drywall or cavity wall construction: Toggle bolts, with hollow wall drive anchors or nylon anchors as required. Equal to ITT Phillips Anchors "Red Head" toggle bolts.

C. Bolts, nuts, and washers: ASTM A 307, or ASTM F 3125 where high strength is required.

PART 3 - EXECUTION

3.1 GENERAL

A. Provide hangers and supports in accordance with schedules at the end of this section, as modified by specifications for each location and type.

B. Comply with MSS SP-58. Provide hangers, supports, clamps, and attachments as required to properly support piping from the building structure.

C. Provide hangers and supports complete with necessary attachments, inserts, bolts, rods, nuts, washers, and other accessories.

D. Where required, provide structural steel shapes or metal framing system channels and hardware to transfer load from a hanger location to multiple locations in the structure in order to get support from an appropriate location or to increase the strength of the connection to the structure.

E. Support horizontal piping from above with hangers and threaded rod where possible, unless otherwise indicated.

F. Secure vertical piping at stack bases.

G. Support vertical piping at each floor with riser clamps. Provide additional supports as needed not to exceed scheduled maximum vertical support spacing.

H. Provide hanger sizes to allow for continuous insulation for insulated piping systems.

I. Fabricate wall-mounted and floor-mounted supports using metal framing systems or structural steel where required.

J. Support groups of small piping along a structural wall using a metal framing system secured to the wall.

K. Trim threaded rods with a maximum excess length of 1 inch (25 mm). Provide protective rubber red end caps on the ends of threaded rods exposed and within 8 feet (2.4 meters) of the floor, roof, or grade below.

L. Install hangers and supports to allow controlled thermal and seismic movement of piping systems, to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends, and similar units.

M. Install lateral bracing with pipe hangers and supports to prevent swaying.

N. Install hangers and supports so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.

O. Install hangers and supports to provide indicated pipe slopes and to not exceed maximum pipe deflections allowed by ASME B31.9 for building services piping.

P. Coordinate with requirements for hangers that require vibration control. See Section 23 05 48.

Q. Trapeze pipe hangers: Provide where required for grouping of parallel runs of horizontal piping.

1. Weld steel according to AWS D-1.1.
2. Hang with threaded rods. Size threaded rods in accordance with MSS SP-58.
3. Design trapeze pipe hangers and supports based on supported load plus a 50 percent minimum safety factor.
4. Hanger spacing shall not exceed the requirements for the smallest pipe in the rack.
5. Hanger spacing shall not exceed 6 feet (1.8 m) where hung from wood.

R. Remove, add, and modify existing hangers and supports to coordinate with new work and support existing to remain elements.

3.2 BUILDING ATTACHMENTS

A. Attaching to structural walls:

1. Provide a minimum of two 0.375 inch (9.5 mm) minimum screw-type fasteners for attaching brackets and a minimum of three 0.5 inch (13 mm) minimum bolt-type fasteners for attaching structural supports.

B. Attaching to structural steel beams, channels, or angles:

1. Secure threaded rods to MSS SP-58 Type 20 adjustable beam clamps that are clamped to the bottom flange of steel beams for any pipe size.
2. Secure threaded rods to MSS SP-58 Type 23 beam clamps for beams with maximum flange thickness of 0.75 inch (19 mm) and for single pipes NPS 2 (DN 50) and smaller.

C. Attaching to bar joists:

1. Provide MSS SP-58 Type 19 top-beam C-clamps attached to top flange of the joists at panel points.
2. Piping perpendicular to joists:

a. Pipes NPS 2.5 (DN 65) and smaller: Support from at least every other joist to spread the load among joists. Where multiple pipes are grouped together, stagger hangers to distribute the load among available joists.
b. Pipes NPS 3 (DN 80) and larger: Support from every joist to spread the load among joists.
c. If additional support is required between joists, hang metal framing system channel or structural steel shape from joists using MSS SP-58 Type 19 C-clamps attached to the top flange of two joists, and hang piping from metal framing system channel or structural steel shape.

3. Piping parallel to joists:

    a. Hang metal framing system channel or structural steel shape from joists using MSS SP-58 Type 19 C-clamps attached to the top flange of two joists. Hang piping from metal framing system channel or structural steel shape.
    b. For pipes NPS 2.5 (DN 65) and smaller: A single pipe may be hung from a single joist.

D. Attaching to concrete slabs and composite slabs: Not permitted.

E. Attaching to steel decks: Not permitted.

F. Attaching to metal grating:

1. Piping perpendicular to structural members supporting grating:

    a. Attach threaded rods to the structural members using MSS SP-58 Type 23 beam clamps.
    b. If intermediate support is needed for proper hanger spacing, attach additional threaded rods to 2.5 by 2.5 by 0.25-inch (90 by 90 by 8-mm) angles, 12 inches (305 mm) long, welded to the underside of the grating.

2. Piping NPS 2 (DN 50) and smaller parallel with structural members supporting grating:

    a. Attach threaded rods to 2.5 by 2.5 by 0.25-inch (90 by 90 by 8-mm) angles, 12 inches (305 mm) long, welded to the underside of the grating for piping between structural members.
    b. Attach threaded rods to the structural members using MSS SP-58 Type 23 beam clamps for piping under structural members.

3. Piping NPS 2.5 (DN 65) and larger parallel with structural members supporting grating:

    a. Support as specified above for bar joist construction.
    b. Hang metal framing system channel or structural steel shape from structural members using MSS SP-58 Type 23 beam clamps. Hang piping from metal framing system channel or structural steel shape.

4. Threaded rods shall have locknuts.

3.3 INSTALLING STORM WATER PIPING

A. Provide hanger to support horizontal storm drainage piping within 12 inches of the first fitting downstream of connections to roof drains and overflow roof drains.

3.4 PIPING HANGER AND SUPPORT SCHEDULES

A. Insulated cold and ambient applications: Applications include, but are not limited to, domestic cold water and insulated storm water systems.

HANGERS & SUPPORTS FOR INSULATED COLD AND AMBIENT APPLICATIONS		
MSS SP-58 Classification	Description	Piping Applications
Hung from Above		
Types 1 & 40	Clevis hanger & pipe covering protection shield.	NPS 0.5 (DN 15) through NPS 2 (DN 50)
Types 1 & 40 (with structural insulation insert)	Clevis hanger & pipe covering protection shield, with structural insulation insert.	NPS 2.5 (DN 65) and larger
Type 59 (with combination insulating insert and insulation protection shield)	Trapeze pipe hanger with pipe saddles & U-bolts (with combination insulating insert and insulation protection shield).	NPS 0.5 (DN 15) through NPS 4 (DN 100)
N/A	Metal framing system with metal framing system pipe clamps and pipe clamp insulating inserts.	NPS 0.5 (DN 15) through NPS 4 (DN 100)
Supported from Below		
Type 37 (with combination insulating insert and insulation protection shield)	Adjustable pipe stanchion saddle with U-bolt and floor flange anchored to floor (with combination insulating insert and insulation protection shield).	All sizes where supported from floor or a concrete support pier.
N/A	Metal framing system with metal framing system pipe clamps and pipe clamp insulating inserts.	NPS 0.5 (DN 15) through NPS 8 (DN 200)
Risers		
Type 8	Riser clamp.	All sizes

B. Uninsulated applications: Applications include but are not limited to uninsulated storm water systems.

HANGERS & SUPPORTS FOR UNINSULATED APPLICATIONS		
MSS SP-58 Classification	Description	Piping Applications
Hung from Above		
Type 1	Clevis hanger	All sizes
Type 10	Adjustable swivel ring	NPS 0.5 (DN 15) through NPS 4 (DN 100)
Type 59	Trapeze pipe hanger with pipe saddles & U-bolts.	NPS 0.5 (DN 15) through NPS 4 (DN 100)
N/A	Metal framing system with metal framing system pipe clamps for uninsulated piping.	NPS 0.5 (DN 15) through NPS 4 (DN 100)
Supported from Below		
Type 37	Adjustable pipe stanchion saddle with U-bolt, with floor flange and base anchored to floor.	All sizes where supported from the floor or a concrete support pier.
N/A	Metal framing system with metal framing system pipe clamps and pipe clamp insulating inserts.	NPS 0.5 (DN 15) through NPS 8 (DN 200)
Risers		
Type 8	Riser clamp.	All sizes

C. Minimum threaded rod sizes: Provide at least the following minimum rod diameters for single rods supporting a single pipe hanger.

Pipe Size	Minimum Rod Diameter
NPS 2 (DN 50) and below	0.375 inches (10 mm)
NPS 2.5 and NPS 3 (DN 65 and DN 75)	0.5 inches (15 mm)
NPS 4 and NPS 5 (DN 100 and DN 125)	0.625 inches (16 mm)
NPS 6 and NPS 8 (DN150 and DN 200)	0.75 inches (20 mm)

D. Maximum hanger and support spacing for pressurized piping: Provide additional hangers or supports for concentrated loads such as flanges, valves, expansion compensators, fittings, and other specialties.

1. Horizontal spacing:

<table>
<tr><th>Pipe Size</th><th>Copper Piping</th><th>Ductile Iron Piping</th><th>PVC (Schedule 80)</th></tr>
<tr><td>NPS 0.75 (DN 20) and below</td><td>5 feet (1.5 m)</td><td rowspan="3">7 feet (2.1 m)</td><td>2.5 feet (0.76 m)</td></tr>
<tr><td>NPS 1 (DN 25)</td><td>6 feet (1.8 m)</td><td rowspan="2">3 feet (1.0 m)</td></tr>
<tr><td>NPS 1.25 (DN 32)</td><td>7 feet (2.1 m)</td></tr>
<tr><td>NPS 1.5 (DN 40)</td><td rowspan="2">8 feet (2.4 m)</td><td>9 feet (2.7 m)</td><td rowspan="2">3.5 feet (1.1 m)</td></tr>
<tr><td>NPS 2 (DN 50)</td><td>10 feet (3 m)</td></tr>
<tr><td>NPS 2.5 (DN 65)</td><td>9 feet (2.7 m)</td><td>11 feet (3.4 m)</td><td rowspan="6">4 feet (1.2 m)</td></tr>
<tr><td>NPS 3 (DN 75)</td><td>10 feet (3 m)</td><td>12 feet (3.7 m)</td></tr>
<tr><td>NPS 4 (DN 100)</td><td rowspan="4">12 feet (3.7 m)</td><td>14 feet (4.3 m)</td></tr>
<tr><td>NPS 5 (DN 125)</td><td>16 feet (4.9 m)</td></tr>
<tr><td>NPS 6 (DN 150)</td><td>17 feet (5.2 m)</td></tr>
<tr><td>NPS 8 (DN 200)</td><td>19 feet (5.8 m)</td></tr>
</table>

2. Vertical spacing:

Copper Piping	Ductile Iron Piping	PVC
10 feet (3 m)	15 feet (4.5 m)	10 feet (3 m) with guides at mid-span for piping NPS 2 (DN 50) and smaller

E. Maximum hanger and support spacing for metal and PVC gravity piping: Provide additional hangers or supports for concentrated loads such as fittings, and other specialties.

1. Horizontal spacing:

<table>
<tr><th>Pipe Size</th><th>Copper DWV Tubing</th><th>Cast-iron (Hub & Spigot)</th><th>Cast-iron (No-hub)</th><th>High-silicon Cast-iron</th><th>PVC</th></tr>
<tr><td>1.5 inches (40 mm)</td><td rowspan="2">8 feet (2.4 m)</td><td>N/A</td><td rowspan="8">5 feet (1.5 m)</td><td rowspan="4">5 feet (1.5 m)</td><td rowspan="2">3 feet (0.9 m)</td></tr>
<tr><td>2 inches (50 mm)</td><td rowspan="6">5 feet (1.5 m)</td></tr>
<tr><td>3 inches (75 mm)</td><td rowspan="6">10 feet (3 m)</td><td>42 inches (1.1 m)</td></tr>
<tr><td>4 inches (100 mm)</td><td rowspan="5">4 feet (1.2 m)</td></tr>
<tr><td>5 inches (125 mm)</td><td rowspan="3">N/A</td></tr>
<tr><td>6 inches (150 mm)</td></tr>
<tr><td>8 inches (200 mm)</td></tr>
<tr><td colspan="6">Cast-iron horizontal support spacing may be increased up to but not in excess of 10 feet (3 m) where 10 foot (3 m) or greater lengths of pipe are used.</td></tr>
</table>

2. Vertical spacing:

Copper DWV Tubing	Cast-iron (Hub & Spigot)	Cast-iron (No-hub)	High-silicon Cast-iron	PVC
10 feet (3 m)	15 feet (4.5 m)	15 feet (4.5 m)	14 feet (4.3 m)	10 feet (3 m) with guides at mid-span for piping NPS 2 (DN 50) and smaller

- END OF SECTION 22 05 29 -

SECTION 22 07 00
PLUMBING INSULATION

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Definitions and general requirements applicable to the insulation systems specified in "Related Sections."

1.2 RELATED SECTIONS

A. Plumbing piping insulation: Section 22 07 19.

1.3 REFERENCES

A. ASTM E 84: Standard Test Method for Surface Burning Characteristics of Building Materials

B. NFPA 255: Standard Method of Test of Surface Burning Characteristics of Building Materials

C. UL 723: Standard for Test for Surface Burning Characteristics of Building Materials

1.4 DEFINITIONS

A. Concealed insulation shall include work:

1. Above ceilings.
2. Where furred in and in pipe chases.

B. Exposed insulation shall include work:

1. In all rooms and areas.
2. In mechanical equipment rooms, penthouses, or other similar utility spaces.
3. In storage rooms.

C. Unconditioned areas: Areas outside of the insulated envelope.

D. Finished spaces: Areas of the building accessible to the public and to building occupants other than service personnel.

1.5 QUALITY ASSURANCE

A. Perform work in strict accordance with the building, fire and safety codes of the state, county or city in which the work is performed.

B. Insulation, including fittings and butt strips, jackets, facings, and accessories such as adhesives, mastics, cements, tapes and cloth, shall have a fire and smoke hazard rating and label as tested by ASTM E84, NFPA 255, and UL 723, not exceeding Flame Spread 25, Fuel Contributed 50, Smoke Developed 50.

C. All insulation and accessories shall be free of asbestos.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver insulation and accessory products in manufacturers' wrapping or cartons, identified on the exterior and bearing labels showing conformance to flame and smoke rating requirements.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Refer to sections listed in “Related Sections.”

PART 3 - EXECUTION

NOT USED

- END OF SECTION 22 07 00 -

SECTION 22 07 19
PLUMBING PIPING INSULATION

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Plumbing piping insulation for the interior piping systems listed in the minimum insulation thickness schedule at the end of this section.

B. Work of this section includes: Insulation for new piping installed under this contract.

1.2 RELATED SECTIONS

A. Firestopping: Section 22 05 07.

B. Painting: Division 09.

C. Definitions and general insulation requirements: Section 22 07 00.

D. Pipe hangers and protection shields: Section 22 05 29.

1.3 REFERENCES

A. American Society of Testing and Materials

1. Standards for mineral fiber insulation materials

   a. ASTM C 449: Standard Specification for Mineral Fiber Hydraulic-Setting Thermal Insulating and Finishing Cement
   b. ASTM C 547: Mineral Fiber Pipe Insulation.
   c. ASTM C 553: Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications.
   d. ASTM C 1136: Standard Specification for Flexible, Low Permeance Vapor Retarders for Thermal Insulation.

2. Standards for flexible elastomeric insulation materials

   a. ASTM C 534: Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form.

3. Standards for all insulation materials

   a. ASTM C 450: Prefabrication and Field Fabrication of Thermal Insulating Fitting Covers for NPS Piping, Vessel Lagging, and Dished Head Segments.
   b. ASTM E 84: Standard Test Method for Surface Burning Characteristics of Building Materials

4. Standards for field applied jackets and accessories

   a. ASTM C 1729: Standard Specification for Aluminum Jacketing for Insulation

b. ASTM D 1784: Standard Specification for Rigid Poly(Vinyl Chloride) (PVC) Compounds and Chlorinated Poly(Vinyl Chloride) (CPVC) Compounds
c. ASTM B 209: Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate

1.4 SUBMITTALS

A. Material list: Each type of insulation and accessory, with manufacturer's name and material name and number. Identify locations for use, thickness of material, type of jacket, vapor barrier, and method of application.

B. Product data: Sufficient to show that the product meets the specified requirements for materials, composition, and performance.

C. Submit a single manufacturer for each product. Submittals that include multiple manufacturers for a single product are not acceptable.

D. Installer qualifications.

1.5 QUALITY CONTROL SUBMITTALS

A. Manufacturer's instructions: Recommended accessory materials and products; installation instructions.

1.6 QUALITY ASSURANCE

A. Installers shall be mechanics skilled in this trade, employed with a firm that has a minimum of five years of experience installing mechanical insulation.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. The listed manufacturers and particular products are intended to set a standard for materials, composition, and performance. Products of other manufacturers may be proposed as permitted by the provisions of Division 01 and the article "Product Options" in Section 22 01 01.

B. Mineral fiber insulation:

1. CertainTeed Corporation.
2. Johns Manville
3. Knauf Fiber Glass GmbH
4. Owens-Corning

C. Flexible elastomeric insulation:

1. Aeroflex USA
2. Armacell LLC
3. Rubatex

D. Coatings, adhesives, and fabrics:

1. Childers
2. Foster
3. Manville Building Materials Group
4. Rock Wool Manufacturing Company
5. Trimac

2.2 MINERAL FIBER INSULATION MATERIALS

A. Mineral fiber preformed pipe insulation: Glass fibers bonded with a thermosetting resin, ASTM C 547 Type I, with factory-applied ASJ-SSL jacket. ASTM E 84 surface burning characteristics (flame spread/smoke developed) rating less than 25/50.

B. ASJ-SSL jacket:

1. All service jacket with self-sealing lap
2. White, kraft-paper, fiberglass-reinforced scrim with aluminum-foil backing; with self-sealing, pressure-sensitive, acrylic-based adhesive covered by a removable protective strip
3. Complying with ASTM C 1136, Type I.

C. ASJ Tape: White vapor-retarder tape matching factory-applied jacket with acrylic adhesive, pressure sensitive, complying with ASTM C 1136; 3 inch (75 mm) width. ASTM E 84 surface burning characteristics (flame spread/smoke developed) rating less than 25/50.

D. Mineral fiber preformed fitting and valve covers: Glass fibers bonded with a thermosetting resin, made from the same material and density as adjacent pipe insulation, meeting ASTM C 450 requirements for dimensions used in forming insulation to cover valves, elbows, tees, flanges, strainers, and unions. Provide with preformed PVC field-applied jacket. ASTM E 84 surface burning characteristics (flame spread/smoke developed) rating less than 25/50.

E. Mineral fiber insulation adhesive:

1. Solvent free, low VOC, water-based adhesive designed for bonding mineral fiber insulation to steel or aluminum surfaces, and compatible with service temperatures. ASTM E 84 surface burning characteristics (flame spread/smoke developed) rating less than 25/50.
2. Equal to Foster 85-60 “Quick-Tack”.

F. Mineral fiber insulation vapor barrier mastic:

1. Vapor barrier coating for use over ASJ jackets to give a vapor barrier seal at joints, laps and punctures. ASTM E 84 surface burning characteristics (flame spread/smoke developed) rating less than 25/50.
2. Equal to Foster 30-65 “Vapor-Fas”.

G. Insulating cement: Mineral fiber cement with a hydraulic-setting binder, conforming to ASTM C 449. ASTM E 84 surface burning characteristics (flame spread/smoke developed) rating less than 25/50.

2.3 FLEXIBLE ELASTOMERIC INSULATION MATERIALS

A. Flexible elastomeric preformed pipe insulation: Closed-cell, sponge- or expanded-rubber, ASTM C 534, Type I for tubular materials. ASTM E 84 surface burning characteristics (flame spread/smoke developed) rating less than 25/50.

1. Use of lap seal type flexible elastomeric piping insulation products is not acceptable.

B. Flexible elastomeric preformed fitting and valve covers: Closed-cell, sponge- or expanded-rubber, made from the same material and density as adjacent pipe insulation, meeting ASTM C 450 requirements for dimensions used in forming insulation to cover valves, elbows, tees, flanges, strainers, and unions. Provide with preformed PVC field-applied jacket. ASTM E 84 surface burning characteristics (flame spread/smoke developed) rating less than 25/50.

C. Flexible elastomeric insulation adhesive:

1. Water resistant contact cement designed especially suited for bonding two impermeable surfaces and recommended for rubber foam, steel, or aluminum surfaces, and compatible with service temperatures. ASTM E 84 surface burning characteristics (flame spread/smoke developed) rating less than 25/50.
2. Equal to Foster 85-75 “Drion”.

D. Flexible Elastomeric Tape: Black, closed cell, self-adhering, elastomeric thermal insulation tape for insulating pipes and fittings, 0.125 inch (3 mm) thick, 2 inches (50 mm) wide, ASTM C 534, Type I — Grade 1. ASTM E 84 surface burning characteristics (flame spread/smoke developed) rating less than 25/50.

E. Flexible elastomeric insulation vapor barrier coating:

1. Water-based latex enamel coating for use over flexible elastomeric insulation, providing a moisture-resistant protective finish suitable for both indoor and outdoor applications. ASTM E 84 surface burning characteristics (flame spread/smoke developed) rating less than 25/50.
2. Equal to Armacell “WB Armaflex” latex enamel.

2.4 FASTENERS

A. Aluminum bands: ASTM B 209, 0.75 inches (19 mm) wide and 0.020 inches (0.4 mm) thick.

2.5 FIELD-APPLIED JACKETS

A. Aluminum jacket:

1. Jacket material: Smooth aluminum 0.016-inch (0.4 mm) thickness, lined with a bonded moisture barrier, factory cut and rolled to size, conforming to ASTM C 1729.
2. Fitting covers: Manufacturer’s factory-fabricated fitting covers made from the same material, finish, and thickness as the jacket, suitable to the size of fittings and thickness of insulation. Provide factory fabricated fitting covers for elbows, tees, flanges, unions, reducers, end caps, valves, and other fittings. Field fabricate fitting covers only if factory-fabricated fitting covers are not available.

3. Aluminum straps: Same alloy as jacket, conforming to ASTM B 209.

B. Polyvinyl chloride (PVC) jacket:

1. Jacket material: High-impact-resistant, UV-resistant PVC complying with ASTM D 1784, Class 16354-C; 20 mils (0.5 mm) thick; roll stock ready for shop or field cutting and forming. ASTM E 84 surface burning characteristics (flame spread/smoke developed) rating less than 25/50.
2. Color:

   a. Color-code jackets based on system within mechanical rooms. Color selected to comply with industry standards and color requirements indicated in Section 22 05 00.
   b. Provide white for all non-mechanical room applications.

3. Adhesive: As recommended by jacket material manufacturer. ASTM E 84 surface burning characteristics (flame spread/smoke developed) rating less than 25/50.
4. Fitting covers: Manufacturer's factory-fabricated fitting covers made from the same material, finish, and thickness as the jacket, suitable to the size of fittings and thickness of insulation. Provide factory fabricated fitting covers for elbows, tees, flanges, unions, reducers, end caps, valves, and other fittings. ASTM E 84 surface burning characteristics (flame spread/smoke developed) rating less than 25/50.Field fabricate fitting covers only if factory-fabricated fitting covers are not available.
5. PVC Tape: White vapor-retarder tape matching field-applied PVC jacket and fitting covers with acrylic adhesive; suitable for indoor and outdoor applications, 2 inch (50 mm) width, 6 mil (0.15 mm) thickness. ASTM E 84 surface burning characteristics (flame spread/smoke developed) rating less than 25/50.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Provide interior piping insulation in accordance with the Minimum Insulation Thickness Schedule for Interior Applications at the end of this section, as modified by specifications for each location and type.

B. Provide field applied jackets in accordance with the Field-Applied Jacket Schedule at the end of this section, as modified by specifications for each location and type.

C. Provide mineral fiber insulation unless otherwise indicated.

D. Apply insulation in a neat and workmanlike manner and in accordance with manufacturer's printed instructions.

E. Maintain a continuous vapor barrier on systems that convey fluid at below-ambient temperatures, including the following applications:

1. Storm water piping
2. Sanitary piping receiving air-conditioning condensate
3. Air-conditioning condensate piping

F. Where a continuous vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.

G. Installation at pipe hangers:

1. Insulation shall be continuous through hangers for all piping systems.
2. Install pipe covering protection shields with thickness of structural insulation inserts equal, under load, to that of adjoining insulation.
3. Install insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.
4. Cover inserts with jacket material matching adjacent pipe insulation. Install shields over jacket, arranged to protect jacket from tear or puncture by hanger, support, and shield.
5. Shields and structural insulation inserts are specified in Section 22 05 29, Hangers and Supports for Plumbing Piping and Equipment.

H. Where insulated piping systems pass through sleeves or openings in partitions and floors, the insulation shall be continuous through the sleeves and openings. See Firestopping specifications for coordinating insulation and firestopping.

I. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of piping including fittings, valves, and specialties.

J. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.

K. Install insulation with longitudinal seams at top and bottom of horizontal runs.

L. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.

M. Install insulation with least number of joints practical.

N. Finish installation with systems at operating conditions. Repair separations and cracking caused by thermal movement.

3.2 INSTALLING MINERAL FIBER INSULATION

A. Install insulation with factory-applied jackets as follows:

1. Cover circumferential joints with 3-inch- (75-mm-) wide strips, of same material as insulation jacket. Secure strips with adhesive.
2. Overlap jacket longitudinal seams at least 1-1/2 inches (38 mm). Install insulation with longitudinal seams at bottom of pipe. Clean and dry surface to receive self-sealing lap.
3. Cover circumferential joints and longitudinal seams with tape, according to insulation material manufacturer's written instructions, to maintain vapor seal.

4. Where a continuous vapor barrier is indicated, apply vapor-barrier mastic on longitudinal seams and circumferential joints and at ends adjacent to pipe flanges and fittings.
5. Repair damaged insulation jackets by applying same jacket material over damaged areas. Extend patches at least 4 inches (100 mm) beyond damaged areas. Adhere and seal patches.

B. Installation on fittings, valves, strainers, flanges, and unions:

1. Install insulation over fittings, valves, strainers, flanges, unions, and other specialties with continuous thermal and vapor-retarder integrity unless otherwise indicated.
2. Insulate using mineral fiber preformed fitting and valve covers whenever possible. Install preformed fittings with adhesive.
3. Where mineral fiber preformed fitting and valve covers are not available, insulate using mitered fittings made from same material and density as adjacent pipe insulation. Each piece shall be butted tightly against adjoining pieces and bonded with adhesive. Fill joints, seams, voids, and irregular surfaces with insulating cement finished to a smooth, hard, and uniform contour that is uniform with adjoining pipe insulation. Coat with mastic. Reinforce the mastic with fabric-reinforcing mesh. Trowel the mastic to a smooth and well-shaped contour.
4. Valves: Insulate up to and including the bonnets, stuffing-box studs, bolts, and nuts. Fill joints, seams, and irregular surfaces with insulating cement. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
5. Strainers: Insulate so strainer basket flange or plug can be easily removed and replaced without damaging the insulation and jacket. Provide a removable reusable insulation cover.
6. Flanges and unions: Install preformed pipe insulation to outer diameter of flange or union. Make width of insulation section same as overall width of union or flange and bolts, plus twice the thickness of pipe insulation. Fill voids between inner circumference of flange or union insulation and outer circumference of adjacent straight pipe segments with mineral-fiber blanket insulation.
7. Install fitted PVC cover. Terminate ends with PVC end caps. Tape PVC covers to adjoining insulation facing using PVC tape.

3.3 INSTALLING FLEXIBLE ELASTOMERIC INSULATION

A. Seal longitudinal seams and circumferential joints with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

B. Installation on fittings and flanges:

1. Install insulation over fittings and flanges with continuous thermal and vapor-retarder integrity unless otherwise indicated.
2. Insulate using flexible elastomeric preformed fitting covers whenever possible. Install preformed fittings with adhesive. Tape and seal with vapor barrier coating.
3. Where flexible elastomeric preformed fitting covers are not available, insulate using mitered fittings made from same material and density as adjacent pipe insulation. Each piece shall be butted tightly against adjoining pieces and bonded with adhesive. Tape and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated. Seal with vapor barrier coating.

4. Flanges: Install pre-formed pipe insulation to outer diameter of pipe flange. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of sheet insulation of same thickness as pipe insulation. Secure insulation to flanges and tape and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated. Seal with vapor barrier coating.
5. Install fitted PVC cover. Terminate ends with PVC end caps. Tape PVC covers to adjoining insulation facing using PVC tape.

3.4 INSTALLING FIELD-APPLIED JACKETS

A. Installing aluminum jacket:

1. Provide jacket tight to insulation.
2. Secure in place with aluminum straps at all circumferential joints and on minimum 12-inch (305-mm) centers.
3. Provide with 2-inch (50-mm) overlap at longitudinal seams and circumferential joints.
4. Interior Applications: Orient longitudinal seams to face a wall or ceiling.
5. Exterior Applications: Arrange overlap at longitudinal seams and joints to shed water. Seal seams and joints with weatherproof sealant recommended by insulation manufacturer.

B. Installing PVC jacket:

1. Provide jacket tight to insulation.
2. Provide with 1-inch (25-mm) overlap at longitudinal seams and circumferential joints.
3. For horizontal applications, install with longitudinal seams along top and bottom of pipes.
4. Seal with manufacturer’s recommended adhesive. Apply two continuous beads of adhesive to seams and joints, one bead under the jacket lap and another finish bead along each seam and joint edge.
5. Seams and joints shall completely prevent the entrance of water.

3.5 SCHEDULES

A. Minimum insulation thickness schedule for interior applications:

MINIMUM INSULATION THICKNESS SCHEDULE FOR INTERIOR APPLICATIONS (3)		
Application	Fluid Temperature Range	All Pipe Sizes
All Storm Water Piping Receiving Air-Conditioning Condensate (1)	--	1-inch (25 mm)
Sanitary Piping Receiving Air-Conditioning Condensate (1)	--	1-inch (25 mm)
Air-conditioning Condensate Piping, Gravity and Pumped (1)	--	1-inch (25 mm)
(1) - Contractor's Option within partitions only: 0.5-inch (13mm) flexible elastomeric insulation. (2) - Contractor's Option within partitions only: 1-inch (25 mm) flexible elastomeric insulation for piping NPS 1.25 (DN 32) and smaller. (3) - See additional specified thickness requirements for exterior applications. (4) - Insulate where fluid conveyed is below ambient temperature, including but not limited to storm water, ground water, and air conditioning condensate.		

B. Field-applied jacket schedule:

FIELD-APPLIED JACKET SCHEDULE		
Application	PVC Jacket	Aluminum Jacket
Exterior applications	X	X
Pipe insulation exposed in finished areas within 8 feet (2440 mm) of the finished floor		X
Pipe insulation exposed in finished areas more than 8 feet (2440 mm) above the finished floor	X	
Pipe insulation exposed in mechanical rooms, penthouses, and other service areas not accessible to the public	X	

- END OF SECTION 22 07 19 -

SECTION 22 14 13
STORM DRAINAGE PIPING

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Air-conditioning condensate drain.

1.2 RELATED SECTIONS

A. Piping installation and testing: Section 22 05 00.

1.3 REFERENCES

A. Copper (DWV) piping standards

1. ANSI/ASME B16.29: Wrought Copper and Wrought Copper Alloy Solder-Joint Drainage Fitting: DWV
2. ASME/ANSI B16.23: Cast Copper Alloy Solder Joint Drainage Fittings: DWV
3. ASTM B 306: Standard Specification for Copper Drainage Tube (DWV)

B. Copper Type L and M piping standards

1. ASME/ANSI B 16.18: Cast Copper Alloy Solder Joint Pressure Fittings
2. ASME/ANSI B 16.22: Wrought Copper and Copper Alloy Solder Joint Pressure Fittings
3. ASTM B 88: Standard Specification for Seamless Copper Water Tube

C. PVC (DWV) piping standards

1. ASTM D 1785: Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120
2. ASTM D 2321: Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications
3. ASTM D 2564: Standard Specification for Solvent Cements for Poly(Vinyl Chloride) (PVC) Plastic Piping Systems
4. ASTM D 2665: Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Drain, Waste, and Vent Pipe and Fittings

1.4 SUBMITTALS

A. Product data: Each specified material and product.

B. Submit a single manufacturer for each product. Submittals that include multiple manufacturers for a single product are not acceptable.

1.5 QUALITY ASSURANCE

A. Cast iron pipe and fittings shall be marked with the collective trademarks of the Cast Iron Soil Pipe Institute (CISPI) and listed by NSF International.

B. Prior to any new piping installation, the Contractor shall verify the inverts of all piping to which new work is to be attached. The Contractor shall demonstrate to the satisfaction of the construction manager and/or Owner, that the connections to existing storm water pipes meet the intent of the contract.

C. Pipe shall be certified by the manufacturer to meet referenced standards and shall bear a label, directly on the pipe, indicating compliance.

D. The Contractor shall rod, clean, and flush existing storm water piping as necessary to maintain gravity flow.

E. Prior to beginning the addition construction or work in any phase, the Contractor shall inspect via video camera and digitally record, for turnover to the Owner, all existing underground storm water pipes sized 3 inches in diameter or above. The Contractor shall notify the Construction Manager and Owner immediately of any clogged, broken, or collapsed piping which is to remain or any conditions preventing free gravity flow.

F. Upon completion of the addition or each phase, the Contractor shall re-inspect via video camera and digitally record, for turnover to the Owner, all existing underground storm water pipes sized 3 inches in diameter or above.

PART 2 - PRODUCTS

2.1 PIPING AND FITTINGS

A. Install each type of pipe and fittings in locations required or permitted in Part 3, including the Pipe Installation Schedule at the end of the section.

B. Copper Type L and M pipe and fittings:

1. Pipe: ASTM B 88, Type L or M, hard drawn.
2. Fittings: Solder joint, cast brass, ASME B16.18; or wrought copper, ASME B16.22.

C. PVC (DWV) pipe and fittings:

1. Pipe: PVC, Schedule 40, ASTM D 1785.
2. Fittings: PVC, DWV, ASTM D 2665.
3. Solvent cement: PVC, ASTM D 2564.

PART 3 - EXECUTION

3.1 PREPARATION

A. Connect piping as shown on the drawings. Check elevations of connection points before installing new work.

3.2 INSTALLATION, GENERAL

A. Use suitable tools and appliances for the safe and convenient handling and laying of pipe. Examine each section of pipe for defects. Do not lay any piece that is known to be defective. If any defective piece should be discovered after having been laid, remove and replace it at no change to the contract price.

B. Install piping in accordance with the Pipe Installation Schedule at the end of this section, as indicated on the drawings, and in accordance with Section 22 05 00, Common Work Results for Plumbing. Materials and work shall conform to local plumbing codes and health department regulations.

C. Thoroughly clean all pipe and fittings before installing them, and keep them clean until the acceptance of the completed work. Cap or plug ends of lines to prevent debris from entering during construction.

D. Make changes in direction of storm water piping with approved sanitary fittings, Y branches, 1/8 or 1/16 bends.

E. Install all storm water piping at a 2 percent minimum downward slope in the direction of flow unless otherwise indicated.

F. Seal air-conditioning condensate drain where it passes through outside wall and provide splash block if required.

3.3 INSTALLING PVC (DWV) PIPING

A. Install aboveground PVC piping according to ASTM D 2665.

B. Install underground PVC piping according to ASTM D 2321.

C. Provide listed plastic pipe penetration protection at penetrations of fire-rated floors and assemblies.

D. PVC piping is not permitted in ceiling plenums or shafts used to convey HVAC system air.

3.4 INSTALLING PUMPED STORM WATER AND AIR CONDITIONING CONDENSATE

A. Above ground piping:

1. Brace piping at changes in direction.

3.5 CONNECTING TO EXISTING PIPING

A. Clean the inside of existing piping at connections to new piping using a water blasting device.

B. Blasting device: Flexible high pressure hose with self-propelling nozzle which blasts to front, sides, and rear (propulsion).

C. Operation: Blasting device is operated with water at 15,000 psi (10^7 kPa). The piping system being cleaned is not pressurized.

Clean from the connection point to at least 5 feet (1.5 m) outside the exterior building wall.

3.6 SCHEDULES

A. Storm water pipe installation schedule.

STORM WATER PIPE INSTALLATION SCHEDULE Contractor has option where more than one X appears on a line		
MATERIAL TYPE		
Application	Copper Type L or M	PVC (DWV0
Pumped storm water or air conditioning condensate	X	X
Air conditioning condensate, interior NPS 1 (DN 25) and smaller	X	X
Air conditioning condensate, interior NPS 1.25 (DN 32) and larger	X	X
All information in this schedule is subject to local plumbing code and health department requirements.		

- END OF SECTION 22 14 13 -

SECTION 23 01 00
OPERATION AND MAINTENANCE OF HVAC SYSTEMS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Service for heating, ventilating, and air conditioning equipment required for the work as indicated on the drawings, including the items listed in “Related Sections”.

1.2 RELATED SECTIONS

A. Operating manuals: Division 01 and Section 23 01 01.

B. General project warranty: General Conditions.

C. Ductless split-system units: Section 23 81 27.

1.3 DESIGN REQUIREMENTS

A. The products specified, scheduled, and shown on drawings are the basis of the design of this project.

B. For requirements affecting use of optional manufacturers, or substitutions, see Division 01 and Section 23 01 01, HVAC General Provisions, and Section 23 05 00, Common Work Results for HVAC.

C. Provide field disconnects for all equipment; factory provided disconnects are not acceptable on HVAC equipment.

D. All service manuals, wiring diagrams, equipment control display, and other devices shall be in English units with temperature related display in Fahrenheit.

1.4 SUBMITTALS

A. Shop drawings:

1. Refrigeration service organization: Name and address of proposed agency.
2. Proposed service or test agreement of each type included in the project, showing conformance to specifications. Include detailed list of work to be performed at each visit.

B. Certifications:

1. Qualifications of refrigeration installation and service agency.
2. Each installation and service organization: A list of at least ten projects, similar to this project in type, size, and components, which have been operating satisfactorily for at least two heating and cooling seasons.
3. Include evidence of each requirement specified in the article below for qualifications of each service and maintenance agency.

C. Field test reports:

1. Test and inspection reports for refrigeration equipment.
2. Besides the number specified in general submittal requirements, submit copies to the County Health Department, Division of Air Quality Control and the Owner.

D. Closeout Submittals: As required for operating and maintenance manuals in Division 01 and Section 23 01 01, provide a schedule of locations of belts, identifying equipment, belt types, and sizes.

1.5 QUALITY ASSURANCE

A. Perform work in accordance with the plumbing, electrical, building, fire and safety codes of the state, county or city in which the work is performed.

B. UL label and local testing (if required): As specified in Section 23 05 00, Common Work Results for HVAC.

C. HVAC equipment shall meet the energy performance requirements of ASHRAE 90.1 Energy Efficient Design of New Buildings Except Low-rise Residential Buildings.

1.6 QUALIFICATIONS OF EACH SERVICE AND MAINTENANCE AGENCY

A. Regularly engaged in performing installation, startup, and service work for equipment and systems of the types included in this project.

B. Located in the Baltimore/Washington, DC, metropolitan area.

C. Staff factory-trained by the manufacturer of the equipment included in this project.

D. Staff factory-trained by the manufacturer of the equipment included in this project. Start-up of HVAC equipment shall be performed by service technicians with a minimum of 40 hours of factory training.

E. Provides emergency service on call 24 hours a day.

F. Maintains an adequate stock of manufacturer's genuine or approved parts to service this equipment.

G. Has service contracts available, which can meet requirements specified for the equipment and systems of this project.

1.7 DELIVERY, STORAGE, AND HANDLING

A. All equipment shall be wrapped in plastic before leaving the factory.

1.8 REFRIGERATION EQUIPMENT WARRANTY AND SERVICE

A. Manufacturer employed and factory-trained startup and service organization will be responsible for starting, adjusting, and servicing the complete refrigeration system for two years of the correction period of this contract from the date of substantial completion.

B. For the following mechanical equipment, provide two-years of preventative maintenance in accordance with the manufacturer's recommendations, with a minimum of four preventative maintenance site visits per year:

1. Ductless split system units.

C. Ascertain that piping installation, wiring, control installation, and appurtenances of each refrigeration unit are in accordance with the recommendations of the manufacturer. Upon initial startup, operate and adjust the unit to obtain the performance specified by the manufacturer.

D. Special warranties shall cover the replacement of all parts and components for no less than the time of the general project correction period, starting from the date of substantial completion.

E. Compressors shall have an additional extended parts and labor warranty for a total of five years including the general correction period.

F. Refrigerant circuits (including refrigerant and oil) shall have an additional extended parts and labor warranty for a total of five years including the general correction period. Warranty shall include any refrigerant leaks that occur during this five year time period.

G. Supply emergency service promptly upon call during correction period with no extra charge to Owner.

H. Maintenance in addition to repair: In addition to the repair service required during the correction period, provide preventative maintenance by the manufacturer's authorized factory-trained local agent including routine calls by a factory trained representative. Preventative maintenance shall follow the manufacturer's requirements and shall be performed a minimum of six times per year, inclusive of start-up and shut down of chiller, unless additional service is recommended by the manufacturer. The planned maintenance program shall include:

1. Inspect complete refrigerant circuit for refrigerant leaks with approved halide or electronic leak detector.
2. Replace defective parts and refrigerant at no addition to the contract sum.
3. Tighten belts, nuts, screws, and terminal wiring connections as required.
4. Clean evaporator-condenser coils as needed.
5. Lubricate moving parts as needed.
6. Removing and cleaning strainer screen.
7. Adjust, align, and replace belts where needed.
8. Check for oil or refrigerant leaks and correct as necessary.
9. Check for blockage of condensate elimination system and correct as required.
10. Check and record unit starting and running amperage.
11. Check and record power voltage and control voltage.
12. Check and record operating temperatures and pressure. (Pressure not required on hermetic circuits.)
13. Check and record thermostatic expansion valve super heat.
14. Check temperature and pressure controls and adjust as required.
15. Check for proper operation of limit switches and safety controls.
16. Provide service log on all preventative maintenance activities and service repairs to the Owner at the end of the warranty period.

PART 2 - PRODUCTS

NOT USED

PART 3 - EXECUTION

3.1 ELECTRIC WIRING FOR MOTORS, STARTERS, AND CONTROLS

A. Furnish and install and in most cases factory-wire motor starters specified under each technical section in this division. Furnish and install under Division 26 magnetic starters not specifically specified with equipment. Unless specified otherwise, automatic control devices for equipment are furnished with the equipment.

B. Unless explicitly specified otherwise, mount and completely wire under Division 26 all starters and automatic control devices, except those which are factory-mounted on equipment.

C. Unless specified otherwise, motor disconnects, manual starters, pushbutton stations, and pilot lights are specified in Division 26, Electrical. Equipment specified in Division 23 shall be suitable for operation in conjunction therewith.

D. Unless specified otherwise in a particular section, electric motors shall comply with the requirements of Section 23 05 13.

3.2 IDENTIFICATION

A. Identify equipment as required in Section 23 05 00, Common Work Results for HVAC.

B. Thermometers, gauges, and control devices shall be identified.

3.3 TESTING MECHANICAL EQUIPMENT

A. Check and adjust all heating and cooling equipment installed.

B. Operate heating and cooling equipment and check controls including high and low limit controls.

C. Mechanical equipment shall be proven to function properly by actual operation prior to final acceptance.

3.4 EQUIPMENT LUBRICATION

A. Bearings of equipment shall be provided with adequate facilities for lubrication. Oiling devices shall be accessible. Lubricate bearings upon completion of work prior to startup of the equipment. Lubricants shall be as specified by equipment manufacturers.

- END OF SECTION 23 01 00 -

SECTION 23 01 01
HVAC GENERAL PROVISIONS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. General provisions and requirements for all HVAC work.

1.2 RELATED SECTIONS

A. Requirements of this section generally supplement requirements of Division 01.

1.3 REFERENCES

A. NFPA 10: Portable Fire Extinguishers.

B. NFPA 241: Safeguarding Construction, Alteration, and Demolition Operations.

1.4 SYSTEM DESCRIPTION

A. The full set of Contract Documents applies to work of Division 23.

B. Visit the site and study all aspects of the project and working conditions, as required by General and Supplementary Conditions, Bidding and Contracting Requirements, Drawings, and Specifications. Verify field dimensions.

C. The work covered in technical sections includes the furnishing of all labor, equipment and materials, and the performance of all operations pertinent to the work described.

D. Except as required otherwise in Division 01, promptly obtain and pay for, including all necessary signatures and paperwork, all permits, fees and inspections required for work of this division by authorities having jurisdiction, including any utility connection or extension charge. No payment will be made until a copy of the permit is forwarded to the Owner. Contractor shall obtain and pay all fees for the mechanical permit.

E. HVAC work of this project includes, as a brief general description, the following:

1. Installation of a ductless split system and associated condensate to serve the elevator machine room.

F. See Division 01 for requirements related to Owner's occupancy of the premises, limits on use of site, time restrictions on work, limits on utility outages or shutdowns, and phasing (sequencing) and scheduling.

1.5 PRODUCT OPTIONS

A. Except as modified by provisions of Bidding and Contracting Requirements and Division 01, these options apply to Division 23 specifications.

B. General: Where Contractor is permitted to use a product other than the specified item and model named as the basis of design, Contractor is responsible for all coordination and additional costs as specified in the article "Substitutions," below for substitutions.

C. Products specified by reference standards or by description only: Any product meeting those standards or description.

D. Products specified by naming one or more manufacturers, or model name or catalog reference number: Products specified establish a standard of quality, options to be included, and performance.

1. Where other acceptable manufacturers are named, Contractor may provide products of those named manufacturers only, which meet the specifications.
2. Where specification permits "equal" products, without naming other acceptable manufacturers, Contractor may use products of any manufacturer, which meet the specifications.

E. Products specified by naming one manufacturer and particular product, with no provision for other options: No options or substitutions allowed.

1.6 SUBSTITUTIONS

A. Substitutions will be considered only as permitted or required by the Bidding and Contracting Requirements and Division 01. Except as modified by those requirements, the requirements below apply to Division 23 specifications.

B. Substitutions may be considered when a product becomes unavailable through no fault of the Contractor.

C. Document each request with complete data substantiating compliance of proposed substitution with contract documents.

D. A request constitutes a representation that the Bidder or Contractor:

1. Has investigated proposed product and determined that it meets or exceeds the quality level of the specified product.
2. Will provide the same warranty for the substitution as for the specified product.
3. Will coordinate installation and make changes to other work which may be required for the work to be complete with no additional cost to Owner.
4. Waives claims for additional costs or time extension which may subsequently become apparent.
5. Will reimburse Owner for review or redesign services associated with re-approval by authorities.

E. Substitutions will not be considered when they are indicated or implied on shop drawing or product data submittals, without separate written request, or when acceptance will require revision to the Contract Documents.

F. Substitution submittal procedure is specified in Bidding and Contracting Requirements and Division 01.

1.7 MATERIALS AND EQUIPMENT

A. All materials and equipment shall be new and the best of their respective kinds, suitable for the conditions and duties imposed on them by the project, and of representative manufacture. The description, characteristics and requirements of the materials to be used shall be in accordance with the specifications.

B. All equipment, construction and installation must meet requirements of local, state and federal governing codes.

C. Singular number: In cases where material, a device, or part of the equipment is referred to in the singular number in the specifications, it is intended that such reference shall apply to as many items of material, devices, or parts of the equipment as are required to complete the installation as shown on the drawings or required for proper operation of the system.

D. Terms have the following meanings:

1. Furnish: Supply item
2. Install: Mount and connect item
3. Provide: Furnish and install.

E. All materials and equipment shall be installed and completed in a first class and workmanlike manner and in accordance with the best modern methods, practice and manufacturers' instructions. Any work which shall not present an orderly and neat or workmanlike appearance shall be removed and replaced with satisfactory work when so directed in writing by the Engineer.

F. The specifications and drawings are intended to define the minimum requirements, as to quality of materials, construction, finish and overall workmanship.

G. General Conditions describe the correlation and intent of the Contract Documents. In case of discrepancies between the specifications and drawings, the specifications should be followed as to the general methods and principles and the drawings followed as to sizes, capacities and specifics for corresponding parts. If sizes are omitted, the Engineer will determine sizes to be utilized.

H. In all cases of doubt, uncertainty, or conflict as to the true meaning of the specifications or drawings, it is the responsibility of the Contractor to notify the Engineer of said uncertainty, doubt, or conflict and obtain a decision as to the intent before starting any work which may be affected by this decision.

1.8 COORDINATION

A. Should a situation develop during construction to prevent the proper installation of any equipment or item where shown on the drawings, call the situation to the attention of the Engineer and await a written decision.

B. Plan and coordinate all work to proceed in an orderly and continuous manner without undue delay, and in conformance with project schedule. Submit samples, shop drawings, schedules, insurance policies and certificates, and the like in time to avoid delays in actual construction. Coordinate HVAC work so that work of each trade is completed before other construction begins which would obstruct it.

1. Install mechanical and plumbing piping as high as possible in mechanical rooms.

C. Coordinate trades to ensure that proper clearances between work of the various trades allow access to items which require operation and maintenance.

D. Coordinate location and elevation of all piping, ductwork, light fixtures, equipment, and appurtenances in such a manner that the finished installation is as indicated on drawings. In the event difficulties are encountered which prevent this, it is the Contractor's responsibility to bring this to the attention of the Engineer prior to initiation of work. Correct improperly coordinated installation at no additional cost.

E. The Contractors' assistants shall include a competent foreman, who shall be on the premises at all times to check, lay out, coordinate and superintend the installation of work. The foreman shall establish all grades and lines relative to the work before starting, and be responsible for the accuracy thereof.

F. For HVAC equipment located above ceilings, coordinate installation of all work above that ceiling such that service clearances are maintained. Install HVAC no more than two feet above the finished ceiling.

1.9 SUBMITTALS

A. Manufacturers' and subcontractors' lists:

1. As specified in Division 01, submit a complete list of proposed manufacturers for all equipment, materials and subcontractors used for the work of this division. Lists shall follow the sequence of the specifications. No considerations will be given for partial or incomplete lists. After review of lists, submit shop drawings and product data.

B. Shop drawings and product data:

1. Submit in accordance with the requirements of Division 01 or as established at the preconstruction conference, the required number of copies of shop drawings and product data for every item of equipment. Shop drawings or product data will not be considered until manufacturers' lists have been approved. Shop drawings and product data shall be submitted, as required by the General Conditions, with sufficient time for checking, return to Contractor, and resubmission as required before Contractor shall install any item.
2. Each item submitted shall be properly labeled, indicating the specific service for which the equipment or material is to be used, section and paragraph number of specification or drawing number to which it applies, Contractor's name and project name and number. Data submitted shall be specific and shall include product data and printed information in sufficient detail and scope to verify compliance with requirements of the contract documents. Clearly identify each item within the data. Data of a general nature will not be accepted. Each sheet must clearly show the project name and number.

a. For roof-mounted equipment, submit manufacturer's certified drawings and other coordination drawings as required so that openings can be framed through the roof in accordance with structural requirements.

3. Submit coordination drawings prepared and stamped by appropriate subcontractors participating in the work. Coordination drawings shall show the following:

   a. All ductwork, indicating elevations above floor.
   b. Each diffuser and grille.
   c. Fire suppression sprinkler system, including each sprinkler location.
   d. Each ceiling-mounted light fixture, smoke detector, and other device.
   e. All HVAC, plumbing, and sprinkler piping above floors.
   f. Approved structural steel drawings, including bottom of beam or joist elevation.
   g. Finished ceiling height.

4. The review of a shop drawing or product data shall not be considered as a guarantee of the measurements or building conditions or that the shop drawings or product data have been checked to see that item submitted properly fits the building conditions. This review shall not relieve the Contractor of the responsibility for furnishing material or performing work as required by the contract documents, for correctness of dimensions and quantities, or for proper coordination of details and interfaces among trades.
5. All exclusively electrical items furnished as items associated with mechanical items but not specifically described in the mechanical item submission, shall be submitted as a separate submittal but shall be clearly marked as associated with the mechanical item by identification specification paragraph.
6. Product data sheets shall be 8.5-inches by 11-inches cut sheets for operating and maintenance manual.
7. Provide submittal compliance cover letter for each project submittal indicating compliance with the contract documents. Sample compliance cover letter is included at the end of this section for reference.

C. Submit at least three copies of the results of every test required under any section in this division.

D. Specialist shall submit a list of at least three projects similar to this project in type, size, and quality, which have been in place and operating satisfactorily for at least five years.

   1. Include project name, address, name and phone number of owner's representative, and project type and size.

E. After the work is completed, submit all required certificates of approval from approved inspection agencies and authorities having jurisdiction over work of this division. Certificates of approval must be received by the Engineer prior to final acceptance of the work.

1.10 SPECIALIST

A. The term "Specialist" as used in the specification shall mean an individual or firm of established reputation (or, if newly organized, whose personnel have previously established a reputation in the same field,) which is regularly engaged in, and which maintains a regular force of workers skilled in either (as applicable) manufacturing or fabricating items required by the contract, installing items required by the contract, or otherwise performing work required by the contract. Where the specification requires installation by a specialist, the term shall also be deemed to mean the manufacturer of the item, an individual or firm licensed by the manufacturer, or an individual or firm who will perform the work under the manufacturer's direct supervision.

1.11 CONTRACT CLOSEOUT SUBMITTALS

A. Project record documents:

1. Maintain on site one set of the following record documents; record actual revisions to the work of this division:

   a. Contract drawings.
   b. Specifications.
   c. Addenda.
   d. Change orders and other modifications to the Contract.
   e. Reviewed shop drawings, product data, and samples.

2. Maintain record documents separate from documents used for construction.
3. Record information concurrent with construction progress.
4. Specifications: Legibly mark and record in each section a description of actual products installed, including the following:

   a. Manufacturer's name and product model and number.
   b. Product options, substitutions, or alternates utilized.
   c. Changes made by addenda and modifications.

5. Record documents and shop drawings: Legibly mark each item to record actual construction, including:

   a. Measured horizontal and vertical locations of underground utilities and appurtenances, referenced to permanent surface improvements.
   b. Measured locations of internal utilities and appurtenances concealed in construction, referenced to visible and accessible features of the work.
   c. Field changes of dimension and detail.
   d. Details not on original Contract Drawings.

6. Submit documents as specified in Division 01.

B. Operation and maintenance data:

1. Submit sets prior to final inspection as specified in Division 01. Unless otherwise specified in Division 01, submit no fewer than three sets. In addition to requirements specified in Division 01, submit operating and maintenance manuals for the work of this division as specified below.

2. Lubrication charts: Prepare lubrication charts for each piece of mechanical equipment that requires grease or oil.

    a. Include the following:

        (1) Types of lubricants required.
        (2) Locations of lubrication points.
        (3) Frequency of lubrication.

    b. Provide one extra set of lubrication charts mounted in plastic covers, besides those required in Operating and Maintenance Manuals.

3. Binders: Three-ring binders with vinyl-covered hard covers. Provide large enough binders, and sufficient quantity, that the required contents can be easily turned, removed, and reinserted.
4. Prepare binder covers with printed title "OPERATION AND MAINTENANCE INSTRUCTIONS," and title of project. Print on spine of binder "O & M INSTRUCTIONS." If more than one binder is required, print covers and spines with volume numbers. Include in the front of every binder an index to all binders.
5. Internally subdivide the binder contents with permanent page dividers, logically organized as described below; with tab titling clearly printed under reinforced laminated plastic tabs.
6. Contents: Prepare a Table of Contents for each volume, with each product or system description identified, typed on white paper.
7. Part 1: Directory, listing names, addresses, and telephone numbers of mechanical engineers; Contractor; mechanical subcontractors; and major mechanical equipment suppliers.
8. Part 2: Operation and maintenance instructions, arranged by specification section. For each category, identify names, addresses, and telephone numbers of subcontractors and suppliers. Identify the following:

    a. Significant design criteria, including pump and fan curves and similar performance charts.
    b. List of equipment, including operating weight of each piece.
    c. Parts list for each component, including recommended spare parts list.
    d. Operating instructions.
    e. Maintenance instructions for equipment and systems.
    f. Maintenance instructions for special finishes, including recommended cleaning methods and materials and special precautions identifying detrimental agents.
    g. Valve charts, including locations of flow fittings.
    h. New burner installations: Include firing rate, nozzle size, and fuel pressure.

9. Part 3: Project documents and certificates, including the following:

    a. Shop drawings and product data.
    b. Air and water balance reports.
    c. Photocopies of certificates.
    d. Photocopies of warranties and guarantees.
    e. Test reports: Copies of the results of all tests required under all sections of specifications.

10. Submit one copy of completed volumes in final form 15 days prior to final inspection. This copy will be returned after final inspection, with Engineer comments. Revise content of documents as required prior to final submittal.
11. Submit final volumes revised, within ten days after final inspection.
12. Submit DVD optical disc storage media specified in Section 23 05 00.

C. Mechanical equipment log:

1. Provide comprehensive log for all mechanical equipment provided for the project. Mechanical equipment log shall identify the following:

   a. Equipment manufacturer.
   b. Unit ID or designation.
   c. Manufacturer's model number.
   d. Serial number.
   e. Equipment location.
   f. Location of area(s) served.
   g. Electrical data (voltage, phase, HZ, motor HP, etc.).
   h. Equipment capacity.
   i. Filter sizes.
   j. Additional information, as requested by the Owner.

2. Sample mechanical equipment log is included at the end of this section for reference.

1.12 REGULATORY REQUIREMENTS

A. When these specifications call for materials or construction of a better quality or larger sizes than required by the following codes and standards, the provisions of the specifications shall take precedence.

B. Provide, without extra charge, any additional materials and labor which may be required for compliance with these codes and standards even though the work is not mentioned in these specifications or shown on the contract drawings.

C. Perform the work of this division in strict accordance with the following authorities. The latest revision of these codes accepted by the authority having jurisdiction as of the date of the contract documents shall apply.

1. The plumbing, mechanical, electrical, building, fire, and safety codes of the state and county or city in which the work is being performed.
2. The National Electric Code, NFPA 70 (NEC).
3. The National Fire Protection Association Code. (NFPA).
4. International Energy Conservation, Fire, Fuel Gas, Mechanical, and Plumbing Codes (ICC).

D. All equipment displays shall indicate English units.

1.13 REFERENCE STANDARDS

A. Perform the work of this division using the standards of the following organizations, as referred to in technical sections, as a minimum requirement for construction and testing. Unless specified otherwise in Bidding and Contract Documents or Division 01, the latest revision current as of the date of the contract documents shall apply. Products shall be certified by manufacturers to meet the requirements of referenced standards.

1. Federal Specifications (FS)
2. Military Specification (MS)
3. Military Standards (Mil. Std.)
4. Air Conditioning and Refrigeration Institute (ARI)
5. Air Movement and Control Association (AMCA)
6. Associated Air Balance Council (AABC)
7. American Association State Highway and Transportation Officials (AASHTO)
8. American National Standards Institute (ANSI)
9. American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE)
10. ASME International (ASME)
11. American Society for Testing and Materials (ASTM)
12. American Society of Sanitary Engineering (ASSE)
13. American Water Works Association (AWWA)
14. International Code Council (ICC)
15. Manufacturer's Standardization Society of the Valve and Fittings Industry Inc. (MSS)
16. National Electrical Code, NFPA 70 (NEC)
17. National Electrical Manufacturer's Association (NEMA)
18. National Fire Protection Association (NFPA)
19. National Fuel Gas Code, NFPA 54
20. National Sanitary Foundation (NSF)
21. National Standard Plumbing Code (NSPC)
22. The Occupational Safety and Health Act (OSHA)
23. Piping and Drainage Institute (PDI)
24. Sheet Metal and Air Conditioning Contractors National Association, Inc. (SMACNA)
25. Underwriters Laboratory Inc. (UL)
26. Maryland Occupational Safety and Health Act (MOSHA)

1.14 TEMPORARY STORAGE

A. Maintain upon premises, where directed, a storage area, and be responsible for all contents within these areas. Provide all security measures necessary for this area.

B. Area shall be maintained and shall be returned to original condition at the completion of the project.

1.15 PROTECTION

A. Control dust resulting from construction work to prevent its spread beyond the immediate work area, and to avoid creation of a nuisance.

1. Do not use water to control dust. Use drop cloths or other suitable barriers.
2. In areas where dirt or dust is produced as a result of the work, sweep daily, or more often as required.
3. Provide walk-off mats at entries and replace them at regular intervals.

4. Construct dust partitions, where indicated on the drawings or as required.
5. Seal off all return air registers and other mechanical systems to prevent dust from entering.

B. Each trade and subcontractor is responsible for preventing damage and soiling of work performed by other trades or subcontractors. Each trade and subcontractor is responsible for providing temporary protection of its own work.

1. Protect work from spills, splatters, drippings, adhesives, bitumens, mortars, paints, plasters, and damage from welding or burning.
2. Protect finished work from damage, defacement, staining, or scratching.
3. Protect finishes from cleaning agents, or grinding and finishing equipment.
4. Protect adjacent and finished work from damage, using tape, masking, covers or coatings and protective enclosures.
5. Coordinate installations and temporarily remove items to avoid damage from finishing work.

C. Repair all damage or soiling to the complete satisfaction of the Engineer; replace any materials or work damaged to such an extent that they cannot be restored to their original condition, all at no addition to the Contract Sum.

D. Protect work stored in place and supplies stored in the building.

1. Store materials and products, subject to damage from moisture, in dry locations. If necessary, protect in wraps or covers.
2. Store plastics, other materials, and products subject to damage from heat or cold at manufacturer's recommended temperatures.

E. Cover all ductwork stored on site, including exposed ends of installed ductwork.

F. All equipment shall be covered during shipping and wrapped prior to leaving the factory.

G. Use of sidewalk or roadway areas outside of the property lines shall be with permission and approval of the local authorities having jurisdiction.

1.16 FIRE PROTECTION

A. As a minimum, provide hand-carried, portable, UL-rated extinguishers with each work crew working inside the building.

B. Select extinguishers in accordance with NFPA 10 and NFPA 241 for classification, extinguishing agent, and size required by location and class of fire exposure.

1.17 PROJECT CONDITIONS

A. Drawings showing utilities in concealed locations are based on the best information available but are not represented as being precisely correct. Work of the contract includes digging, cutting, drilling, using nondestructive methods, and other methods of locating concealed utilities in the field, as well as patching and repairing as specified in "Cutting and Patching" below.

B. If, in the course of the work, workers encounter a material they suspect to present some hazard:

1. Promptly notify the Owner and Engineer in writing.
2. Do not perform any work which would disturb the suspected material until written instructions have been received.

1.18 WARRANTY

A. All work and equipment provided as work of this division shall be fully warranted under the general project warranty, which shall include a 2 year/24 hour/7 day full parts and labor warranty for all mechanical work and equipment, 5 years parts and labor for compressors, and 5 years parts and labor for refrigerant and refrigerant leaks. In addition, provide added special warranties specified in individual sections.

B. During the correction period, the Contractor shall begin correcting any work found to be not in accordance with the requirements of the Contract Documents within 4-hours of receiving written notice from the Owner. Provide detailed schedule for completion of work within 24-hours of receiving written notice from the Owner and revise schedule based on any Owner comments generated. Except as otherwise required in General Conditions and Division 01, the correction period is two years after the date of substantial completion of the work. Work requiring correction shall promptly be repaired or completely replaced at no addition to the Contract Sum.

1. Provide service log on all equipment repairs to the Owner at the end of the warranty period.

C. When use of the permanent equipment has been permitted for temporary heating or ventilation of the building, the warranty and correction periods shall nevertheless begin at the time of substantial completion, unless another date of acceptance has been agreed to by the Owner.

1. Use of variable-refrigerant-flow HVAC equipment for temporary heating and cooling is not acceptable.

D. Special warranties are warranties required by individual specification sections, incidental product warranties, manufacturers' standard warranties, installer or subcontractor service agreements, and other individual warranties in addition to the general project warranty.

E. Provide copies of warranties as required for Operation and Maintenance Manual specified above, and by Division 01.

F. For items of work delayed beyond date of substantial completion, provide updated submittal within ten days after acceptance, listing date of acceptance as start of warranty period.

PART 2 - PRODUCTS

NOT USED

PART 3 - EXECUTION

3.1 CUTTING AND PATCHING

A. General: Employ skilled workers to perform cutting and patching. Proceed with cutting and patching at the earliest feasible time, and complete without delay.

B. Cut walls, floors, partitions, roofs, and other appurtenances for the passage or accommodation of pipes, ducts and appurtenances. Close superfluous openings and remove all debris caused by work of this division.

C. No cutting of any structure or finish shall be done until the condition requiring such cutting has been examined and approved by the Engineer.

D. New or existing surfaces disturbed as a result of such cutting or otherwise damaged shall be restored to match original work and all materials used for any patching or mending shall conform to the class of materials originally installed.

E. Refinish surfaces to match adjacent finish. For continuous surfaces, refinish to nearest intersection or natural break. For an assembly, refinish entire unit.

3.2 TEMPORARY FACILITIES

A. Temporary water facilities, electricity, telephone, toilet facilities, and temporary heat, shall be provided as specified in Division 01.

3.3 PROGRESS MEETINGS

A. Progress meetings shall be held as specified in Division 01, and also when and if the Contractor or Engineer finds them necessary or advantageous to progress of work.

B. Contractor, those subcontractors and those material suppliers concerned with current progress or with the scheduling of future progress, Engineer and Owner shall each be represented at these meetings by persons familiar with the details of work and authorized to conclude matters relating to work progress.

- END OF SECTION 23 01 01 -

(Sample Submittal Compliance Cover Letter and Mechanical Equipment Log Follows this Section)

Submittal Compliance Cover Letter

Project: MCPS – XXX Elementary School
Engineer: James Posey

Specification Section:
Section Title: PACKAGED ROOFTOP AIR HANDLING UNITS

Basis of Design: Comply: Yes ☐ No ☒

Approved Alternate Manufacturer: Comply: Yes ☐ No ☐ N/A ☒

Specification Section	Compliance
1.01	Comply
1.02	Comply
1.03	Comply
1.04	
1.04.A	Comply
1.04.B	Wiring Diagrams to be provided with submittal for record.
1.04.C	Comply
1.04.D	Comply
1.05	Comply
1.06	Comply
2.01	Comply
2.02	Comply
2.03	Comply
2.04	Comply
2.05	Comply
2.06	Comply
2.07	Comply
2.08	Comply
2.09	Comply
2.10	Comply
2.11	Comply
3.1.A	Comply
3.1.B	Comply
3.1.C	By others
3.1.D	Comply
3.1.E	By others
3.1.F	Comply – To be completed during start up; downstream of gas regulator only. Gas Pressure entering gas regulator is responsibility of others.
3.1.G	By others

SAMPLE EQUIPMENT LOG PROJECT FORM

Job Name: [Enter School Name]

Equipment Manufacturer	Unit ID	Model	Serial	Equipment Location	Service Location	Volt	Phase	Hz	RLA Amps	Capacity (CFM)	Filter Size
Daikin	RTU-1	DPS005AHCG4DW-4	FBOU200401594	Roof	Kitchen	480Vac	3Ph	60hz	5.4	600-1,200	(2) 16X20X2 MERV 8 / (2) 16" X 16" X 4" MERV 11
Daikin	RTU-2	DPS020AHMG4DW-4	FBOU200402158	Roof	Cafeteria	480Vac	3Ph	60hz	30.1	2,000-5,000	(9) 18" X 24" X 2" MERV 8 / (9) 18" X 24" X 4" MERV 11
Daikin	DOAS-1	DPS015AHMG4DC-6	FBOU200401896	Roof	Classrooms	480Vac	3Ph	60hz	33.44	3,800	(12) 18" X 24" X 2" MERV 8 / (6) 18" X 24" X 4" MERV 14
Daikin	DOAS-2	DPS010AHMG4DC-4	FBOU200401897	Roof	Classrooms	480Vac	3Ph	60hz	12.4	2,300	(12) 18" X 24" X 2" MERV 8 / (6) 18" X 24" X 4" MERV 14

Equipment Manufacturer	Unit ID	Model	Serial	Equipment Location	Service Location	Volt	Phase	Hz	Amps	Design Capacity (CFM)	Filter Size
Daikin	UV-1	UAVV9515AE00R23AB24GI01	SLPU201601090	Music Room 222	Music Room 222	120Vac	1Ph	60hhz	3.2	1,143	36" x 1"
Daikin	UV-2	UAVV9S07AF00S23AB24GI01	SLPU201601107	Instrumental Music 224	Instrumental Music 224	120Vac	1Ph	60hhz	3.2	592	36" x 1"
Daikin	UV-3	UAVV9515AE00R23AB24GI01	SLPU201601094	Classroom 228	Classroom 228	120Vac	1Ph	60hhz	3.2	1,143	36" x 1"
Daikin	UV-4	UAVV9515AE00R23AB24GI01	SLPU201601096	Classroom 227	Classroom 227	120Vac	1Ph	60hhz	3.2	1,143	36" x 1"
Daikin	UV-5	UAVV9515AG66A23AB24GI01	SLPU201601077	Classroom 225	Cassroom 225	120Vac	1Ph	60hhz	3.2	1,143	36" x 1"
Daikin	UV-6	UAVV9S07AF00S23AB24GI01	SLPU201601106	Classroom 223	Classroom 223	120Vac	1Ph	60hhz	3.2	592	36" x 1"
Daikin	UV-7	UAVV9515AG66A23AB24GI01	SLPU201601081	Pep Classroom 103	Pep Classroom 103	120Vac	1Ph	60hhz	3.2	1,143	36" x 1"
Daikin	UV-8	UAVV9515AG66A23AB24GI01	SLPU201601084	Pep Classroom 110	Pep Classroom110	120Vac	1Ph	60hhz	3.2	1,143	36" x 1"
Daikin	UV-9	UAVV9515AE00R23AB24GI01	SLPU201601097	Kindergarten 118	Kindergarten 118	120Vac	1Ph	60hhz	3.2	1,143	36" x 1"
Daikin	UV-10	UAVV9515AE00523AB24GIB1	SLPU201601080	Kindergarten 124	Kindergarten 124	120Vac	1Ph	60hhz	3.2	1,143	36" x 1"

Equipment Manufacturer	Unit ID	Model	Serial	Equipment Location	Service Location	Volt	Phase	Hz	Design Capacity (CFM)	Hp
GreenHeck	EF-1	CUE-131-B-X	16412189	Roof	Kitchen	120Vac	1Ph	60hz	1000	1/4hp
GreenHeck	EF-2	GB-220-3-X	16412267	Roof	Electric room 200c	120Vac	1Ph	60hz	2800	1/3hp
GreenHeck	EF-3	G-096-D-X	16412272	Roof	Health 152	120Vac	1Ph	60hz	500	1/8hp

Equipment Manufacturer	Unit ID	Model	Serial	Equipment Location	Service Location	Volt	Phase	Hz	Amps	Hp
Baldor Reliance	P-1	CEM3311T	37B102S520G1	Mechanical room	Chilled water/hot water pump	460Vac	3Ph	60hz	9.7	7.5
Baldor Reliance	P-2	CEM3311T	37B102S520G1	Mechanical room	Chilled water/hot water pump	460Vac	3Ph	60hz	9.7	7.5

Equipment Manufacturer	Unit ID	Model	Serial/Date code	Equipment Location	Service Location	Volt	Phase	Hz	Amps
Q-mark	EPUH-1	MUH0381	CAC02A03	Gym Air Handler room	Gym Air Handler room	208Vac	1Ph	60hz	0.28

Equipment Manufacturer	Unit ID	Model	Serial	Equipment Location	Service Location	Volt	Phase	Hz	Amps	Hp
Intertek	PUH-1	HS-084	C2001725564001001	Boiler room	Boiler room	120Vac	1Ph	60hz	2.2	1/12hp
Intertek	PUH-2	HS-085	C2001725564001002	Boiler room	Boiler room	120Vac	1Ph	60hz	2.2	1/12hp
Mestek	CUH-1	RC1200-03	17257900420	Admin Corridor 003	Admin Corridor 003	120Vac	1Ph	60hz	0.8	1/10hp
Mestek	CUH-2	RC1200-03	17257900420	Vestibule 200A	Vestibule 200A	120Vac	1Ph	60hz	0.8	1/10hp
Mestek	CUH-3	RC1200-04	17257900420	Kitchen 211	Kitchen 211	120Vac	1Ph	60hz	0.8	1/10hp

Equipment Manufacturer	Unit ID	Model	Serial	Equipment Location	Service Location	Volt	Phase	Hz	Amps (FLA)	Filter Size
Daikin	FCU-1	E031123601200	SLPU201500132	Office 226	Office 226	120Vac	1Ph	60hz	4.25	(1) 27" X 8.75" X 1"
Daikin	FCU-2	E031123601300	SLPU201580126	Music Storage 222A	Music Storage 222A	120Vac	1Ph	60hz	2.5	(1) 21.5" X 8.75" X 1"
Daikin	FCU-3	E031123601200	SLPU201580131	Counseling 154	Counseling 154	120Vac	1Ph	60hz	5.3	(1) 27" X 8.75" X 1"
Daikin	FCU-4	E031123601200	SLPU201580130	Office 109B	Office 109B	120Vac	1Ph	60hz	4.25	(1) 27" X 8.75" X 1"
Daikin	FCU-5	E031123600800	SLPU201580122	Office 109c	Office 109c	120Vac	1Ph	60hz	4.25	(1) 27" X 8.75" X 1"
Daikin	FCU-6	E031123601300	SLPU201580125	Support 121	Support 121	120Vac	1Ph	60hz	4.25	(1) 21.5" X 8.75" X 1"

Equipment Manufacturer	Unit ID	Model	Serial	Equipment Location	Service Location	Volt	Phase	Hz	Amps
Eaton	VFD-1	EHB0114A2JU0000000	12919234	Mechanical Room	Controls pump-1 speed	480Vac	3Ph	60hz	11
Eaton	VFD-2	EHB0114A2JU0000001	12919235	Mechanical Room	Controls pump-2 speed	480Vac	3Ph	60hz	11

Equipment Manufacturer	Unit ID	Model	Serial	Equipment Location	Service Location	Volt	Phase	Hz	Amps (FLA)	Filter Size
Daikin	ACCU-1	REYQ72XAYDU	1908217197	Roof		460Vac	3Ph	60Hz	11.4	
Daikin	ACCU-2	DX16TC0601CB	2003601124	Roof	Serves Uv-5	208Vac	1Ph	60hz	2.8	

Equipment Manufacturer	Unit ID	Model	Serial	Equipment Location	Service Location	Volt	Phase	Hz	Amps (RLA)
Daikin	Chiller-1	AGZ110EDSEMNN00	STNU200500043	Roof	Chilled water loop	460Vac	3Ph	60hz	99.4

Equipment Manufacturer	Unit ID	Model	Serial	Equipment Location	Service Location	Volt	Phase	Hz	Amps (RLA)
Fulton	B-1	EDR-2000	6473-HFTC	Mechanical room	Hot water loop	120Vac	1Ph	60hz	20
Fulton	B-2	EDR-2000	6382-HFTC	Mechanical room	Hot water loop	120Vac	1Ph	60hz	20

SAMPLE EQUIPMENT LOG PROJECT FORM (CONTINUED)

Job Name: [Enter School Name]

Equipment Manufacturer	Unit ID	Model	Serial	Equipment Location	Service Location	Volt	Phase	Hz	Amps (RLA)
Daikin	BS-1	BSQ36TVJ	A047900	Media Workroom 203	VRT-1	208Vac	1Ph	60hz	0.1
Daikin	BS-2	BSQ36TVJ	A047895	Media Office 205A	VRT-2	208Vac	1Ph	60hz	0.1
Daikin	BS-3	BSQ36TVJ	A047957	Media Prep 214	VRT-3	208Vac	1Ph	60hz	0.1
Daikin	BS-4	BSQ36TVJ	A047972	Communications Center 215	VRT-4	208Vac	1Ph	60hz	0.1
Daikin	BS-5	BSQ36TVJ	A047965	Tv Studio 215B	VRT-5	208Vac	1Ph	60hz	0.1
Daikin	BS-6	BSQ36TVJ	A047889	Office 102	VRT-6	208Vac	1Ph	60hz	0.1
Daikin	BS-7	BSQ36TVJ	A047897	Office 107	VRT-7	208Vac	1Ph	60hz	0.1
Daikin	BS-8	BSQ36TVJ	A047971	Office 109A	VRT-8	208Vac	1Ph	60hz	0.1
Daikin	BS-9	BSQ36TVJ	A047951	Faculty 109	VRT-9	208Vac	1Ph	60hz	0.1
Daikin	BS-10	BSQ36TVJ	A047891	Office 115	VRT-10	208Vac	1Ph	60hz	0.1
Daikin	VRT-1	FXZQ07TAVJU	J007055	Media Workroom 203	Media Workroom 203	208Vac	1Ph	60hz	0.2
Daikin	VRT-2	FXZQ05TAVJU	J004598	Media Office 205A	Media Office 205A	208Vac	1Ph	60hz	0.2
Daikin	VRT-3	FXZQ05TAVJU	J004725	Media Prep 214	Media Prep 214	208Vac	1Ph	60hz	0.2
Daikin	VRT-4	FXFQ18TVJU	C005702	Communications Center 215	Communications Center 215	208Vac	1Ph	60hz	0.6
Daikin	VRT-5	FXZQ05TAVJU	J004639	Tv Studio 215B	Tv Studio 215B	208Vac	1Ph	60hz	0.2
Daikin	VRT-6	FXZQ05TAVJU	J004393	Office 102	Office 102	208Vac	1Ph	60hz	0.2
Daikin	VRT-7	FXAQ07PVJU	E030267	Office 107	Office 107	208Vac	1Ph	60hz	0.3
Daikin	VRT-8	FXZQ05TAVJU	J004934	Office 109A	Office 109A	208Vac	1Ph	60hz	0.2
Daikin	VRT-9	FXAQ07PVJU	E030222	Faculty 109	Faculty 109	208Vac	1Ph	60hz	0.3
Daikin	VRT-10	FXAQ07PVJU	E030223	Office 115	Office 115	208Vac	1Ph	60hz	0.3

Equipment Manufacturer	Unit ID	Model	Serial	Equipment Location	Max presssure	Max temp.
Wessels Co.	ET-1	NLA-300	E02865.6C	Mechanical Room	150psi	240F
Spirotherm	AS-1	VDN400FA	89158	Mechanical Room	150psi	270F
Spirotherm	AS-2	VDN200FA	89153	Mechanical Room	150psi	270F

SECTION 23 05 00
COMMON WORK RESULTS FOR HVAC

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Requirements applicable to more than one section of Division 23.

B. Basic material and equipment required for the HVAC piping work.

C. Identification of HVAC systems and equipment.

D. Cleaning and painting.

E. Treated wood lumber.

F. Operating instructions.

G. Piping tests.

1.2 RELATED SECTIONS

A. Project and special warranties: Division 01 and Section 23 01 01.

B. Operation and Maintenance Manuals: Division 01 and Section 23 01 01.

C. Painting: Division 09.

1.3 REFERENCES

A. American Society of Mechanical Engineers

1. ASME Boiler and Pressure Vessel Code
2. ASME A 13.1: Scheme for the Identification of Piping Systems
3. ASME B 31.1: Power Piping
4. ASME B 31.9: Building Services Piping

B. American Society of Testing and Materials

1. ASTM A 234: Standard Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service
2. ASTM B 32: Standard Specification for Solder Metal
3. ASTM B 88: Standard Specification for Seamless Copper Water Tube
4. ASTM B 813: Standard Specification for Liquid and Paste Fluxes for Soldering of Copper and Copper Alloy Tube
5. ASTM D 635: Standard Test Method for Rate of Burning and/or Extent and Time of Burning of Plastics in a Horizontal Position
6. ASTM E 84: Standard Test Method for Surface Burning Characteristics of Building Materials

7. ASTM E 548: Standard Guide for General Criteria Used for Evaluating Laboratory Competence
8. ASTM D 2564: Standard Specification for Solvent Cements for Poly (Vinyl Chloride) (PVC) Plastic Piping Systems
9. ASTM F 656: Standard Specification for Primers for use in Solvent Cement Joints of Poly (Vinyl Chloride) (PVC) Plastic Pipe and Fittings

C. American Welding Society

1. AWS D1.1: Structural Welding - Steel
2. AWS D10.9: Specification for Qualification of Welding Procedures and Welders for Piping and Tubing
3. AWS QC1: Specification for AWS Certification of Welding Inspectors

1.4 DEFINITIONS

A. Project correction period: A period after Substantial Completion of the work during which the Contractor shall correct every part of the work found to be not in accordance with the requirements of the contract documents, promptly after receipt of written notice.

B. Qualified testing agency: 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.

C. DN: Dimension Nominale, nominal pipe size in millimeters, in accordance with the metric system for construction, Systeme Internationale (SI).

D. NPS: Nominal pipe size in inches, in accordance with standard U.S. designations for manufactured pipe. Pipe sizes do not change when projects are designed and built in metric units; each size has a consistent name (nominal dimension) in each system.

1.5 DESIGN REQUIREMENTS

A. The drawings and system performances have been designed based on the use of the particular manufacturer's products specified and scheduled on the drawings.

B. Products of other manufacturers that are listed under the article "Acceptable Manufacturers," or permitted as "equal," are permitted provided:

1. Product shall meet the specifications.
2. Contractor shall make, without addition to the contract sum, all adjustments for deviations so that the final installation is complete and functions as the design basis product is intended.

C. Do not propose products with dimensions or other characteristics different from the design basis product that render their use impractical, or cause functional fit, access, or connection problems.

1.6 SUBMITTALS

A. Shop drawings:

1. Schedule of welding and brazing procedures proposed for each piping system in the project.
2. Shop drawings of backboards for piping specialties.

B. Certifications: Proof of operator and testing agency personnel qualifications as required for welding and brazing in the article "Quality Assurance" below.

C. Test reports: Field test results for each piping system as specified in Part 3 below.

1.7 QUALITY ASSURANCE

A. Provide materials and perform work in accordance with the plumbing, mechanical, electrical, building, fire, health and safety, and other applicable codes and regulations of the state, county or city in which the work is performed.

B. Welding procedures and operator qualifications for structural welding: AWS D1.1, Structural Welding Code Steel, electric arc process.

C. Welding, brazing, and soldering procedures and operator qualifications for building systems piping:

1. AWS D10.9, Qualification of Welding Procedures and Welders for Piping and Tubing.
2. ASME B31.9, Building Services Piping.
3. Copper Development Association "Copper Tube Handbook."

D. Qualifications of independent testing laboratory personnel:

1. Welding inspectors: AWS QC1, Certification of Welding Inspectors.
2. Nondestructive evaluation personnel: American Society for Nondestructive Testing Recommended Practice.

E. Electrical control panels, equipment, materials and devices provided or installed as work of Division 23 shall bear UL label or, if UL label is not available, the item shall be tested and labeled by a qualified testing agency, acceptable to authorities having jurisdiction, and in accordance with NFPA 70 (NEC). Provide testing, if required, without addition to the contract sum.

F. Qualifications of DVD documentation technician: For video documentation specified in “Operating Instructions (Demonstration),” employ persons knowledgeable in video and audio production and editing who practice photography and videography as their primary profession.

G. VOC content: Field-applied adhesives and sealants, limits per South Coast Air Quality Management District (SCAQMD), Rule No. 1168.

H. Products shall contain no urea-formaldehyde content.

1.8 EXTRA MATERIALS

A. Cogged belts: For each belt included for regular service, provide one complete set of extra belts. Identify each belt with its equipment name, intended location, and use. Hang all belts on wall of main mechanical room.

B. Fuses: Provide one complete set of fuses (three of each type and size) for all project equipment.

C. Belt, filter, and fuse equipment use: For equipment requiring belts, filters, and fuses, provide a detailed list of each type of belt and filters. Include sizes, locations, and equipment name.

D. Allen keys and socket sets to work with furnished equipment for access panels, belt replacement, and other similar small tools required for general maintenance work for equipment provided.

E. Non-contact digital laser IR infrared thermometer temperature gun measuring in Fahrenheit and Celsius.

PART 2 - PRODUCTS

2.1 GENERAL

A. Piping techniques, testing, identification, painting, and operating instructions specified in this section apply to products specified in other sections of Division 23.

B. Equipment that uses or processes date and time data in order to perform its function shall be warranted by the manufacturer to properly function and correctly use or process all time-related data for all dates and times which occur during a reasonable life expectancy of the equipment.

2.2 PIPING MATERIALS

A. Weldolets and thredolets: Fittings designed for installing branches on piping, with either welded or threaded connection to branch; conforming to ASTM A 234.

B. Soldering materials:

1. Solder: Free of lead, antimony, and zinc and meeting the requirements of ASTM B 32. No solder containing lead is permitted.

    a. Tin 95.5 percent, copper 4 percent, and silver 0.5 percent; equal to “Silvabrite 100” manufactured by Engelhard Corporation.
    b. Tin, copper, bismuth, and silver; equal to "Oatey Silver" manufactured by Oatey.

2. Flux: Meeting the requirements of ASTM B 813 and NSF 61 certified, equal to Oatey H-20^{95}.

C. Threaded pipe joint materials:

1. Pipe joint compound:

a. Pipe joint compound recommended by the manufacturer for use at the temperature and pressure of the system.

2. Pipe joint tape: Polytetrafluoroethylene (PTFE) pipe thread tape, "Teflon."

2.3 IDENTIFICATION DEVICES AND MATERIALS

A. Stenciling materials:

1. Stencils: Manufactured standard stencils prepared for required applications, conforming to ASME A 13.1 for color and size of legend letters, including arrows showing direction of flow.
2. Paint: Exterior type enamel, colors conforming to ASME A 13.1, or black.

B. Equipment identification tags:

1. Laminated plastic with adhesive back, white core and black outer layers, which, when engraved, will produce white letters and numerals on a black background.
2. Tags installed on curved surfaces shall be aluminum or brass.

C. Valve tags: Brass, 1.5 inch (40 mm) in diameter with black-filled numbers not less than 0.25 inch (6 mm) high, complete with brass attachment chains.

D. Ceiling identification tags: Laminated plastic with adhesive back, engraved black letters on white background, minimum 0.5 inch (15 mm) wide and length as required for 0.375 inch (10 mm) high letters for name of concealed device and number.

2.4 RUST INHIBITIVE PAINT

A. Rust-inhibitive paint:

1. Alkyd based, white, black, or bronze tone.
2. Applied in a wet film thickness of at least 2.9 mils (0.07 mm).
3. Equal to Benjamin Moore Super Spec HP D.T.M. Alkyd Low Lustre P23.

2.5 TREATED WOOD LUMBER

A. Wood-preservative-treated lumber: Treated by pressure process, AWPA C2, with chemicals acceptable to authorities having jurisdiction, and marked with treatment quality mark of an inspection agency approved by ALSC Board of Review.

PART 3 - EXECUTION

3.1 GENERAL

A. Manufacturers' instructions: Except as modified by drawings or specifications, install products and equipment in accordance with manufacturers' instructions and recommendations applicable to the project conditions.

1. Immediately notify Engineer if a difference or discrepancy is found between manufacturers' instructions and the drawings or specifications.

B. The contract drawings are diagrammatic and do not indicate all fittings or offsets in pipe and ductwork, all access panels, or all specialties required. Provide required fittings, offsets, access panels, and specialties to coordinate the work.

C. No pipe or duct shall be run below the head of a window or door.

D. Equipment, ducts, and pipes installed in areas without a suspended ceiling shall be as tight to structure as possible, but at least above a height of 6'-8", unless otherwise noted.

E. Items which require access for operation or maintenance shall be easily accessible. Do not cut or form hand holes for operation or maintenance of appliances through walls or ceilings.

3.2 PIPE INSTALLATION

A. Install pipe exposed to view parallel to building lines and as close to walls, columns, and ceilings as may be practical, maintaining proper clearances for access at all parts requiring servicing.

B. Install pipe a sufficient distance from other work to permit a clearance of not less than 0.5 inch (15 mm) between its finished covering and adjacent work.

C. Remove burrs resulting from cutting pipe or from any other operation.

D. Thoroughly clean pipe and fittings before they are installed, and keep them clean until the acceptance of the completed work. Cap or plug the ends of the lines so as to prevent earth and other debris from entering during construction.

E. Provide for expansion and contraction of piping and connections so that no breakage or excessive strain will occur. Provide anchors and guides of approved design where shown on drawings and where necessary to allow for proper expansion and contraction. At the time of installation, expansion loops shall be cold sprung to one-half of the calculated expansion.

F. Pipe connection flexibility:

1. Connect risers and branch connections to mains with at least five pipe fittings, including tee in main.
2. Connect risers and branch connections to equipment with at least four pipe fittings, including tee in riser.
3. Connect mains and branch connections to equipment with at least four pipe fittings, including tee in main.
4. Connections shall be arranged so that movement in piping due to expansion and contraction will not transmit excessive force to equipment.

G. Install unions or flanges in the piping at each item of equipment, control valve, and appliance, so as to provide easy removal of the equipment, valve, or appliance, and to provide for easy removal of coils.

H. Pitch hydronic piping so that air in the system can be properly vented. Provide shutoff valves where necessary to isolate parts of system for repairs without draining the entire system.

I. Interface with other products:

1. Where pipe is provided through walls, provide finished, permanent, waterproof installation complete with inserts, sleeves, supports or hangers, seals, and other appurtenances as required. Do not pierce, cut, or notch any footing or other structural member.
2. Waterproofing and dampproofing of the building shall be unharmed by the installation of the work. Where pipe has to pierce waterproofing or dampproofing, including outside walls, the penetration shall be made watertight. Waterproofing damaged or destroyed shall be repaired or replaced with new waterproofing.

J. Thoroughly clean pipe and fittings before they are installed, and keep them clean until the acceptance of the completed work. Cap or plug the ends of the lines so as to prevent earth and other debris from entering during construction.

K. Use welding fittings, tees, wyes, reducers, eccentric reducers, and caps as required. Branches at least two nominal pipe sizes less than the main may be made with "Weldolets" or "Thredolets" installed with full size opening in larger pipe and in accordance with manufacturer's printed instructions. Flanges shall be welded neck or slip-on pattern of class to suit the valves or equipment connections. Flanges shall have machine bolts with hex nuts and washers.

L. Threaded connections:

1. Cut threads full and clean.
2. Apply specified pipe joint compound or tape on male threads only.
3. Where piping is installed in crawl spaces and tunnels, cover exposed threads with rust-inhibitive paint. Apply after joints have been assembled and tested.

M. Copper tubing installation:

1. Cut pipe with a tubing cutter or fine-tooth saw. Cuts made with a saw shall be true and square, and the end shall be filed smooth with a fine-tooth file. Remove all marks and burrs with sandpaper.
2. Solder joints for copper tubing: Clean ends of tubing and inside of fitting ends thoroughly with emery cloth before applying flux.
3. Provide dielectric fittings between copper and steel piping to prevent electrolysis.
4. Follow the techniques for soldering and brazing pipe, fittings, and valves as recommended by the manufacturer.

3.3 IDENTIFICATION

A. General: Do not apply identification until insulation and finish painting work is complete.

B. Equipment:

1. Stencil equipment with minimum two-inch (50-mm) -high letters or provide identification tags. Clearly indicate equipment designation and area served.
2. Firmly fasten each identification tag to its appropriate piece of equipment with drive screws, sheet metal screws, or rivets. Do not interfere with operation of, or damage the item being marked.

C. Piping:

1. Mark by stenciling.
2. Mark to identify service with arrows showing direction of flow. Apply markings near building walls where pipes enter or leave an accessible space and in intermediate locations so that markings are no more than 30 feet (9 m) apart. They shall be readily visible to a person standing on the floor.
3. Fully identify all piping installed as work of the project.
4. Mark pipe with letters of height and with colors as required by OSHA and conforming to ASME A 13.1.
5. Identify every thermometer, gauge, and control device.
6. Provide valve tags for all valves except shutoff valves on individual fixtures or equipment where their function is obvious, or where the fixture or equipment is immediately adjacent. Numbers shall correspond to those shown on the Valve Chart. Attach tags to valve shaft.

D. Ductwork: Stencil ductwork after insulation is applied, if required, with minimum two-inch (50-mm)-high letters, clearly identifying clearly identifying equipment (DOAS, RTU, EF), service (supply, return, exhaust) and showing direction of flow with arrows. Mark ducts near the building walls where they enter or leave a space, and at intervals of not more than 30 feet (9 m). Identification shall be visible to a person standing on the floor. Use of labels or stickers for ductwork identification is not acceptable.

E. Piping and ducts identification legend:

SERVICE	COLOR	STENCIL
Refrigerant piping	Black	REF

F. Ceiling identification tags: Provide on the access door or, in suspended ceilings, on the ceiling support adjacent to the unit.

1. Valves: Identify with the same number shown on the valve tag.
2. Terminal equipment (such as fan coil units) located above ceilings: Identify with unit description and number.

G. Label pipe chases within HVAC units to identify piping systems within.

3.4 CLEANING AND PAINTING

A. Cleaning: Clean all piping and equipment. Where items are to be painted, clean ready for painting.

B. Painting: Coordinate painting with requirements of Division 09. Paint the items identified below to be painted. Use paint materials and systems specified in Division 09.

C. Items to be painted:

1. Items identified below to have protective coating.
2. Items furnished with manufacturer's prime coat.
3. Mechanical rooms (including but not limited to boiler, chiller, and air-handling unit rooms):

   a. Insulation and uninsulated steel: Piping, pumps, tanks, and vessels.
   b. Hangers and supports.

4. Piping and ductwork exposed in finished spaces, insulated and uninsulated.
5. Inside ducts behind registers, grilles, and diffusers.

D. Items not to be painted: Copper, stainless steel, and equipment furnished with manufacturer's finish.

E. Paint systems in mechanical rooms: Paint piping using colors in accordance with Owner's identification legend in the "Identification" article above. Paint systems are specified in Division 08.

1. Galvanized steel: One coat of primer recommended for galvanized surfaces and one coat of glossy alkyd enamel.
2. Ferrous metal: One coat of primer recommended for ferrous metal and one coat of glossy alkyd enamel.
3. Items protected with rust-inhibitive primer: Finish coat of compatible glossy enamel.

F. Paint systems in mechanical rooms: Paint using colors in accordance with Owner's identification legend in "Identification" above. Paint systems are specified in Division 09.

G. Painting inside ducts behind registers, grilles, and diffusers: Matte black, compatible with substrate and suitable for the temperatures at which the duct will operate, extending from the duct opening to a depth such that no unpainted surface will be visible to a person standing on the floor or adjacent balconies.

3.5 TREATED WOOD LUMBER

A. Provide wood-preservative-treated lumber where wood members are required as detailed on the drawings and in the following applications:

1. Cants, nailers, curbs, equipment support bases, blocking, stripping, and similar members in connection with roofing, flashing, vapor barriers, or waterproofing.
2. Sills, sleepers, blocking, and similar concealed members in contact with masonry or concrete.
3. Framing and furring attached directly to the interior of below-grade exterior masonry or concrete walls.
4. Framing members that are less than 18 inches (460 mm) above the ground in crawlspaces or unexcavated areas.

3.6 OPERATING INSTRUCTIONS (DEMONSTRATION)

A. Furnish the necessary technicians, skilled workers, and helpers to operate all the HVAC systems and equipment of the entire project for one 8-hour day.

B. Where specified in technical sections, provide longer periods required for specialized equipment.

C. Instruct the Owner or designated personnel in operation, maintenance, lubrication, and adjustment of all systems and equipment.

1. Instructions by manufacturer's technical representative for each type of equipment shall include the performance of the recommended preventive maintenance procedures for that equipment.

D. The Operating and Maintenance Manual shall be available at the time of the instructions, for use by instructors and Owner personnel.

E. Record each instruction session only in DVD media format (video and audio format), including both the sessions specified above and added sessions required in technical sections for specialized equipment. Provide one complete set of DVDs with each Operating and Maintenance Manual.

F. Schedule the general and specialized instruction periods for a time agreed upon by the Owner and Engineer.

3.7 PIPING TESTS

A. Refrigerant pipe testing: Test as specified in Section 23 23 00.

- END OF SECTION 23 05 00 -

SECTION 23 05 02
SLEEVES AND PLATES FOR HVAC PIPING

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Sleeves and escutcheon plates for piping systems.

1.2 SUBMITTALS

A. Product data: Sleeves, plates, sealants, and mechanical penetration seals.

PART 2 - PRODUCTS

2.1 SLEEVES, PLATES, AND ACCESSORIES

A. Steel sleeves: Schedule 40 black steel pipe, ASTM A 53.

B. Copper sleeves: Type L, ASTM B 88 hard drawn.

C. Cast-iron sleeves: Extra heavy, equal to product of U.S. Pipe Co. with waterstop and ends as shown on the drawings.

D. Sealing compound in walls and floors: Equal to the following:

1. Bare and insulated pipes carrying fluids 150 degrees F (65 degrees C) and below: Sika Corporation “Sikaflex - Ia.”
2. Bare and insulated piping carrying fluids 151 degrees F (66 degrees C) and above: Dow Corning Corporation “790 Silicone.”

E. Floor, wall, and ceiling plates for existing piping: Stamped or cast brass with chrome finish and set screw, split and tabbed.

F. Floor, wall, and ceiling plates for new piping: Stamped or cast brass with chrome finish and set screw.

PART 3 - EXECUTION

3.1 INSTALLING SLEEVES

A. Install sleeves for piping, or piping with insulation continuous through sleeve, passing through walls, partitions, beams, or slabs.

1. Exception: Where steel pipe penetrates a steel beam that is not part of a fire- or smoke-rated assembly, no sleeve is required.

B. Do not cut, drill, or burn structural steel for installation of piping without specific instructions from the Engineer and Owner.

C. Locations in nonfire-rated construction:

1. Install steel sleeves for penetrations of steel, iron, and insulated piping.
2. Install copper sleeves for penetrations of uninsulated copper tubing and piping.

D. Locations in floors and fire-rated construction: Sleeves used in piping penetrations through fire-rated construction shall be an acceptable component of the through-penetration firestop assembly as specified in Section 23 05 07, Firestopping for HVAC Work.

1. Where firestop assembly is UL listed, sleeve material shall be as directed in the listing.
2. Where other specified approval and acceptance is required, sleeve shall be as described in the approved assembly.

E. Install sleeves through walls and partitions flush with finished surfaces.

F. Sleeves through floors shall extend 2 inches (50 mm) above top of finished floor and be finished neat and level. Provide projecting sleeves with anchor clips to prevent them from being loosened and knocked down in the floor construction.

G. Sleeves for insulated piping with vapor barrier shall be large enough to pass piping and insulation.

H. Seal spaces between sleeves and pipe, or pipe insulation, in nonrated walls, with mineral wool.

3.2 INSTALLING PLATES

A. Exposed piping passing through interior walls, partitions, floors, and ceilings shall be fitted with plates of size and depth to conceal sleeves. Secure plates firmly in place with set screws.

B. Do not install floor or wall plates on pipes in the kitchen and food service areas.

- END OF SECTION 23 05 02 -

SECTION 23 05 06
CURBS AND FLASHINGS FOR HVAC PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Curbs, rails, and flashing devices for HVAC items and equipment penetrating roof and mounted on roof.

1.2 RELATED SECTIONS

A. Ductless split-system units: Section 23 81 27.

1.3 SUBMITTALS

A. Shop drawings: Roof curbs and rails, showing compatibility with roof membrane, insulation, and slope, and configuration for the supported equipment.

1. If curbs are provided by curb manufacturer, coordinate with approved shop drawings provided as specified in related equipment sections, to determine configuration of equipment requiring curb support.

B. Product data: Each type of manufactured unit, accessory, and accessory material.

1.4 QUALITY ASSURANCE

A. Curbs and rails may be the product of the manufacturer of the equipment they support, or of a roof curb and support manufacturer, provided they are equal to the products of the named manufacturers and meet this specification.

1.5 SEQUENCING

A. Coordinate installation of rooftop equipment and supports with roof structure and membrane. Loads and penetrations shall not exceed or damage structural capacity or weathertightness.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Wood-preservative-treated lumber: As specified in Section 23 05 00.

1. Application: Treat items indicated on the drawings, and the following:

a. Wood cants, nailers, curbs, equipment support bases, blocking, stripping, and similar members in connection with roofing, flashing, vapor barriers, or waterproofing.

2.2 PENETRATIONS OF GROUPS OF PIPES

A. Basis-of-design product: Subject to compliance with requirements, provide the specified product, or comparable product by another manufacturer.

B. Provide stainless steel cap and roof curb as detailed on the drawings.

2.3 CURBS AND RAILS

A. Basis-of-design product: Subject to compliance with requirements, provide the specified product, or comparable product by one of the following:

1. Curbs Plus, Inc.
2. Pate Co.
3. Roof Products & Systems (RPS) Corp.
4. ThyCurb Division, ThyBar Corp.

B. Curbs for condensing units: Equal to Pate pedestal curb with solid top and "Dektite" flashing system, size to fit each unit.

1. Top: Plywood of adequate thickness and reinforcement to support unit, covered with no less than 18 gauge stainless-steel counterflashing cap. Include intermediate structural supports as required to support the weight of the associated equipment with allowing deflection of the solid top.

2.4 ROOFTOP PIPE SUPPORT SYSTEM

A. Equal to Caddy "Pyramid ST" Series PSF UV-stabilized; polyethylene, polypropylene, and hot-dip galvanized strut-based support, 10 inches minimum strut length by 4 inches in height.

B. Provide manufacturer's standard pipe clamps and accessories designed for strut system, as required for size, material, and configuration of air-conditioning condensate lines across roof.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Flashing of roofing felts into clamping devices of sleeves through roof, and flashing and counterflashing of pipe curb assemblies and of roof rails and curbs shall be as specified under Division 07.

B. Securely attach curb to roof construction with a 6-inch-(150-mm) wide wood frame, with countersunk flat-head 0.375-inch (10-mm) diameter cadmium-plated through bolts with washer and double nuts on underside of structural framing around roof opening. Secure curb to wood frame with No. 10 cadmium-plated wood screws.

1. Place bolts and screws on maximum 12-inch (305-mm) centers, with no fewer than two for each side of rail, curb, or frame.

C. Where dissimilar metals would come in contact with each other, coat them with bituminous protective coating or other coating compatible with adjacent materials.

3.2 INSTALLING ROOFTOP PIPE SUPPORT SYSTEM

A. Where air-conditioning condensate lines cross roof from equipment to drain, support on rooftop support system.

B. Use clamps and fasteners compatible with piping.

C. Follow manufacturer's instructions.

3.3 FIELD QUALITY CONTROL

A. Notify the Engineer at least two days in advance of the time when the installation of sound-deadening materials will be complete. Do not cover the work until the Engineer has inspected it and signed the certificate required in the article "Submittals" in Part 1 above, stating that the installation of sound deadening is in accordance with the specifications and drawings.

- END OF SECTION 23 05 06 -

SECTION 23 05 07
FIRESTOPPING FOR HVAC WORK

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Through-penetration firestopping in fire-rated construction.

B. Through-penetration smoke-stopping in smoke partitions.

1.2 RELATED SECTIONS

A. Sleeves and plates: Section 23 05 02.

1.3 REFERENCES

A. Underwriters Laboratories

1. UL Fire Resistance Directory
2. UL 1479: Through Penetration Firestops.

B. American Society for Testing and Materials Standards:

1. ASTM E 814: Standard Test Method for Fire Tests of Through-Penetration Firestops.

1.4 DEFINITIONS

A. Assembly: Particular arrangement of materials specific to given type of construction described in referenced documents.

B. Barriers: Time-rated fire walls, smoke barrier walls, time-rated ceiling/floor assemblies and structural floors.

C. Firestopping: Methods and materials applied in penetrations and unprotected openings to limit spread of heat, fire, gasses and smoke.

D. Penetration: Opening or foreign materials passing through or into barrier or structural floor such that full thickness of rated materials is not obtained.

E. Sleeve: Metal fabrication or pipe section extending through thickness of barrier and used to permanently guard penetration. Sleeves are described as part of penetrating system in other sections and may or may not be required.

F. System: Specific products and applications, classified and numbered by the rating agency to close specific barrier penetrations.

1.5 SYSTEM DESCRIPTION

A. Design requirements:

1. Fire-rated construction: Maintain barrier and structural floor fire resistant ratings including resistance to cold smoke at all penetrations.
2. Smoke barrier construction: Maintain barrier and structural floor resistance to cold smoke at all penetrations.

1.6 SUBMITTALS

A. Product data: Manufacturer's specifications and technical data including the following:

1. Detailed specification of construction and fabrication.
2. Manufacturer's installation instructions.

B. Shop drawings: Submit firestop assemblies and devices for all openings and through penetrations in fire-rated construction. Indicate dimensions, description of materials and finishes, general construction, specific modifications, component connections, anchorage methods, hardware, and installation procedures, plus the following specific requirements.

1. Details of each proposed assembly identifying intended products and applicable rating agency classification.
2. Manufacturer or manufacturer's representative shall provide qualified engineering judgments and drawings relating to conditions where rated assemblies do not exist.

C. Quality control submittals:

1. Statement of qualifications.

D. Applicators' qualifications statement:

1. List past projects indicating required experience.

E. Certifications: Letters or forms showing acceptance by local authorities for systems without acceptance by a rating agency.

1.7 QUALITY ASSURANCE

A. Products and assemblies shall be tested and labeled by an independent, nationally recognized testing and labeling authority.

B. Installer's qualification: Firm experienced in installation or application of systems similar in complexity to those required for this project, plus the following:

1. Acceptable to or licensed by manufacturer, state, or local authority where applicable.
2. At least 2 years' experience with systems.
3. Successfully completed at least 5 projects of comparable scale, using these systems.

C. Local and state regulatory requirements: Obtain acceptance for proposed assemblies not conforming to specific rating agency classifications or rated assemblies.

D. Materials shall have been tested to provide fire rating at least equal to that of the construction in which they are to be installed.

E. VOC content: Field-applied adhesives and sealants, limits per South Coast Air Quality Management District (SCAQMD), Rule No. 1168.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Packing and shipping:

1. Deliver products in original unopened packaging with legible manufacturer's identification.
2. Coordinate delivery with scheduled installation date, allow minimum storage at site.

B. Storage and protection: Store materials in a clean, dry, ventilated location. Protect from soiling, abuse, moisture and freezing when required. Follow manufacturer's instructions.

1.9 PROJECT CONDITIONS

A. Existing conditions:

1. Verify existing conditions and substrates before starting work. Correct unsatisfactory conditions before proceeding.
2. Proceed with installation only after penetrations of the substrate and supporting brackets have been installed.

B. Environmental requirements:

1. Furnish adequate ventilation if using solvent.
2. Furnish forced-air ventilation during installation if required by manufacturer.
3. Keep flammable materials away from sparks or flame.
4. Provide masking and drop cloths to prevent contamination of adjacent surfaces by firestopping materials.
5. Comply with manufacturing recommendations for temperature and humidity conditions before, during and after installation of firestopping.

1.10 WARRANTY

A. General project warranty and correction period, as required in general conditions and Division 01, requires repair or replacement of materials or systems which fail in joint adhesion, co-adhesion, abrasion resistance, weather resistance, extrusion resistance, migration resistance, stain resistance, or general durability or appear to deteriorate in any other manner not clearly specified by submitted manufacturer's data as an inherent quality of the material for the exposure indicated.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Acceptable manufacturers and products: Those listed in the UL Fire Resistance Directory for the UL System involved, or rated for the application by Warnock Hersey or by another acceptable rating agency.

2.2 THROUGH-PENETRATION FIRESTOPPING OF FIRE-RATED CONSTRUCTION

A. Provide systems or devices listed and labeled by a rating agency, and conforming to the construction type, penetrant type, annular space requirements and fire rating involved in each separate instance. The system shall be symmetrical for wall applications. Systems or devices shall be asbestos-free.

1. Additional requirements: Firestopping shall withstand the passage of cold smoke either as an inherent property of the system, or by the use of a separate product included as a part of the rated system or device, and designed to perform this function.
2. Additional requirements: Firestopping sealants shall be red in color to facilitate field verification of firestopping application.

2.3 SMOKE-STOPPING AT SMOKE PARTITIONS

A. Through-penetration smoke-stopping: Any system complying with the requirements for through-penetration firestopping in fire-rated construction is acceptable, provided that the system includes the specified smoke seal or will provide a smoke seal. The length of time of the fire resistance may be disregarded.

2.4 ACCESSORIES

A. Fill, void or cavity materials and forming materials: Classified for firestopping use, or included in a rated firestopping assembly, by a rating agency.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verification of conditions: Examine areas and conditions under which work is to be performed and identify conditions detrimental to proper or timely completion.

1. Verify barrier penetrations are properly sized and in suitable condition for application of materials.
2. Do not proceed until unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Clean surfaces to be in contact with penetration seal materials, of dirt, grease, oil, loose materials, rust, or other substances that may affect proper fitting, adhesion, or the required fire resistance.

3.3 INSTALLATION

A. Provide firestop devices or assemblies for every opening and penetration in floors or fire-rated construction.

B. Install penetration seal materials in accordance with printed instructions of the rating agency and in accordance with manufacturer's instruction.

C. Ensure an effective smoke barrier in each sealed penetration. Install smoke stopping as specified for firestopping.

D. Protect materials from damage on surfaces subject to traffic.

E. Where large openings are created in walls or floors to permit installation of pipes, ducts, or other items, close unused portions of opening with firestopping material tested for the application.

3.4 FIELD QUALITY CONTROL

A. Examine penetration seals to ensure proper installation before concealing or enclosing them.

B. Keep areas of work accessible until inspection and acceptance by applicable authorities.

C. Before substantial completion, patch and repair firestopping cut or penetrated by other construction work.

3.5 ADJUSTING AND CLEANING

A. Clean up spills of liquid components.

B. Neatly cut and trim materials as required.

C. Remove equipment, materials and debris, leaving area in undamaged, clean condition.

- END OF SECTION 23 05 07 -

SECTION 23 05 13
COMMON MOTOR REQUIREMENTS FOR HVAC EQUIPMENT

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Unless otherwise specified in a particular section or required for a particular application, motors shall conform to the following requirements, whether factory-installed or field-installed.

1.2 PRODUCTS FURNISHED BUT NOT INSTALLED UNDER THIS SECTION

A. Motor capacitors: Section 26 05 21, Wiring Connections.

1.3 RELATED WORK SPECIFIED ELSEWHERE

A. Ductless split-system units: Section 23 81 27.

1.4 REFERENCES

A. NEMA MG 1: Motors and Generators.

B. NEMA MG 10: Energy Management Guide for Selection and Use of Polyphase Motors.

C. NEMA MG 11: Energy Management Guide for Selection and Use of Single-Phase Motors.

D. UL 508: Industrial Control Equipment.

1.5 DEFINITIONS

A. Energy efficient motor: Motor meeting the nominal and minimum efficiency levels listed for its horsepower and speed in Table 12-10 of NEMA MG 1.

B. Nominal efficiency: Efficiency as defined in Table 12-8, Efficiency Levels, in NEMA MG 1, and identified on the motor nameplate.

1.6 SUBMITTALS

A. Product data:

1. Motors and drives not provided with equipment: Show nameplate data and ratings; characteristics; mounting arrangements; size and location of winding termination lugs, conduit entry, and grounding lugs, and coatings.
2. Motor capacitors.

B. Wiring diagrams required for the proper installation of mechanical equipment.

C. Submit product data which verifies compliance with ASHRAE 90.1 or provide certified performance ratings by a qualified independent testing agency.

D. Certifications:

1. Actual motor power factor for each motor, certified test results for each motor proposed for use on this project.
2. Field test showing corrected power factor, if required.
3. Motors controlled by variable frequency controllers: Certification that motor meets specified requirements.

1.7 QUALITY ASSURANCE

A. Actual motor power factor shall be tested and certified by an independent testing laboratory.

B. Where power factor is field tested as required in "Power Factor" in Part 2 below, specialist performing tests shall be acceptable to the local authorities having jurisdiction.

C. UL label and local testing (if required): As specified in Section 23 05 00, Common Work Results for HVAC.

D. HVAC equipment shall meet the energy performance requirements of ASHRAE 90.1.

1.8 REGULATORY REQUIREMENTS

A. Motors shall conform to the requirements of NEMA MG1 and applicable portions of the National Electric Code (NEC, NFPA 70).

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Motors:

1. Baldor Electric Co.
2. Marathon
3. Rockwell
4. Siemens
5. A.O. Smith
6. Toshiba International

B. Motor capacitors:

1. ABB Power Distribution
2. Commonwealth Sprague
3. General Electric

2.2 BASIC MOTOR REQUIREMENTS

A. Capacity: Each motor shall have sufficient capacity and torque to start, accelerate, and operate the machine it drives without exceeding the motor nameplate rating at the speed specified, or at any speed and load which may be obtained by the drive actually furnished.

B. Starting: Each automatically controlled motor shall be capable of starting as frequently as the control sequence may demand. Motors not automatically controlled shall be capable of making no fewer than 4 starts per hour.

C. Ratings: Motors shall be rated for continuous duty at 100 percent of rated capacity, and temperature rise shall be based on ambient temperature of 40 degrees C.

D. Phase: Unless otherwise indicated, motors one-half horsepower and larger shall be polyphase and motors smaller than one-half horsepower shall be single-phase motors.

E. Efficiency: The term "energy efficient" is defined in the article "Definitions" in Part 1 above.

1. Single-phase motors, alternating-current fractional horsepower, rated 1/20 to 1 horsepower, 250 volts or less: NEMA MG 11, types and efficiencies selected for their applications.
2. Polyphase motors, medium alternating-current, squirrel-cage, 1 to 500 horsepower, 600 volts or less: NEMA MG 10, energy-efficient types selected for their application. Nominal full-load efficiencies shall meet or exceed ratings of Table 12-10 of NEMA MG 1.
3. Motors for packaged hermetic and semi-hermetic refrigeration compressors need not comply with these efficiency requirements but they shall comply with the requirements indicated for power factor and power consumption.

2.3 SINGLE-PHASE MOTORS

A. Permanent split-capacitor or split-phase type.

B. Bearings: Sealed, prelubricated ball-bearing type.

2.4 POLYPHASE MOTORS

A. NEMA MG1 Design B.

B. Stator: Copper windings.

C. Rotor: Squirrel cage.

D. Bearings: Doubly shielded, prelubricated ball bearings suitable for radial and thrust loading of connected equipment.

E. Temperature rise shall not exceed insulation rating.

F. Insulation: Class F.

G. Motors used with inrush controllers: Match wiring requirements for indicated controller with required motor leads brought to motor terminal box to suit control method.

H. Horsepower/frame relationship: NEMA Standard for T frame motors.

I. Motor frame and endshields: Cast iron.

J. Conduit box: Either steel or aluminum, diagonally split and rotatable in 90-degree increments, with grounding provision.

K. Finishes:

1. External hardware: Plated to resist corrosion.
2. External paint: Industrial enamel.

L. Nameplates: Stainless steel or aluminum, and stamped in accordance with NEMA MG1. Nameplate information shall include the nominal efficiency value in accordance with NEMA MG1 and the manufacturer's minimum guaranteed efficiency value.

M. Multi-phase motors serving mechanical equipment shall be provided with single phase protection. When single phasing is detected, the unit shall deenergize completely. When all power phases are restored, the units shall automatically energize.

2.5 ELECTRONICALLY COMMUTATED MOTOR (ECM)

A. Brushless direct current (DC) variable speed motor supplied with alternating current, with a permanent magnet with near zero rotor losses, permanently-lubricated ball bearings, electronic commutation, designed for synchronous rotation, and at least 70 percent efficient at all operating speeds.

B. As a minimum, the motor shall include the following features:

1. Integrated controller / invertor that operates the wound stator and senses rotor position to electronically commutate the stator.
2. Thermal overload protection.
3. Built-in soft start and soft speed change ramps.
4. Inductors to minimize harmonic distortion and line noise.
5. Designed to overcome reverse rotation without affecting life expectancy.
6. Motor speed shall be controllable down to 20 percent of full speed. Speed shall be controlled by either a potentiometer with manual adjustment on the motor or by a 0-10Vdc analog signal from a remote source, as required by other sections of Division 23 specifications.
7. Software for motor control shall be as indicated or described in other Division 23 specifications.

2.6 TOTALLY ENCLOSED FAN-COOLED (TEFC) MOTORS

A. Polyphase motors with the following additional requirements:

1. TEFC construction for severe environment.
2. Ventilating fans: Made of corrosion-resistant, non-sparking material.
3. Conduit box: Heavy-wall cast construction, gasketed with a lead gasket between box and motor frame.
4. Motor shaft shall be provided with an external slinger on the drive end.
5. Rotor and stator air-gap surfaces coated to prevent corrosion.
6. Finish: At least two coats of catalyzed epoxy enamel.

B. Explosion-proof motors: TEFC NEMA Type K and NFPA hazardous Class I or Class II as required.

2.7 MOTORS CONTROLLED BY VARIABLE FREQUENCY DRIVES

A. Specifically constructed and warranted by the manufacturer to meet the voltage requirements of NEMA MG 1, Part 31.4.4.2.

B. Temperature rise: Match rating for Class B insulation.

C. Insulation: Class B or F (TEFC), or Class F (ODP).

D. Provide ICM-450 phase monitor, including all required wiring for final connections between phase monitor and motor/VFD. Include automatic restart with a 300 second time delay.

E. Bearing protection: Conductive shaft grounding ring, equal to Aegis SGR by Electro Static Technology, to transmit induced current from shaft to motor frame without harming bearings.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Mount direct-connected motors securely and in accurate alignment. The drive shall be free from both angular and parallel misalignment when both motor and driven machine are operating at normal temperatures.

B. Mount capacitors shipped separately beside motor connection box as required. Connect in accordance with the requirements of Division 26, Electrical.

1. Test units at full rated load after the installation of the motor capacitors, and submit reports.

C. Provide wiring required from phase monitor to motor. Ensure automatic restart time delay is adjusted to 300 seconds.

3.2 OPERATING INSTRUCTIONS

A. As specified in Section 23 05 00, provide operating instructions.

- END OF SECTION 23 05 13 -

SECTION 23 05 29
HANGERS AND SUPPORTS FOR HVAC PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Pipe hangers and supports.

B. Trapeze pipe hangers.

C. Insulation protection.

D. Fasteners.

1.2 RELATED SECTIONS

A. Vibration control supports: Section 23 05 48.

B. HVAC Piping Insulation: Section 23 07 19.

1.3 REFERENCES

A. American Society of Mechanical Engineers

1. ASME B31.1: Power Piping.
2. ASME B31.9: Building Services Piping.

B. ASTM International

1. ASTM A 36: Standard Specification for Carbon Structural Steel
2. ASTM A 53: Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless
3. ASTM A 307: Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60 000 PSI Tensile Strength
4. ASTM A 563: Standard Specification for Carbon and Alloy Steel Nuts ASTM A 1064: Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete
5. ASTM C 533: Standard Specification for Calcium Silicate Block and Pipe Thermal Insulation
6. ASTM C 552: Standard Specification for Cellular Glass Thermal Insulation
7. ASTM F 594: Standard Specification for Stainless Steel Nuts
8. ASTM F 3125: Standard Specification for High Strength Structural Bolts and Assemblies, Steel and Alloy Steel, Heat Treated

C. American Welding Society

1. AWS-D.1.1: Structural Welding – Steel

D. Metal Framing Manufacturer's Association

1. MFMA-4: Metal Framing Standards Publication
2. MFMA-103: Guidelines for the Use of Metal Framing

E. Manufacturer's Standardization Society

1. MSS SP-58: Pipe Hangers and Supports - Materials, Design, Manufacture, Selection, Application, and Installation.

1.4 DEFINITIONS

A. High Temperature Hot Systems: Operating temperatures 200 degrees F (93 degrees C) and above.

B. Hot Systems: Operating temperatures 120 degrees F (49 degrees C) to 200 degrees F (93 degrees C).

C. Ambient Systems: Operating temperatures 60 to 119 degrees F (16 to 48 degrees C).

D. Cold Systems: Minimum operating temperatures 59 degrees F (15 degrees C) and below.

1.5 SUBMITTALS

A. Product data:

1. Provide manufacturer's literature showing compliance with specifications for each type of hanger, framing system, support, fastener and accessory materials.
2. Provide a schedule of piping types and sizes and associated pipe hanger types.
3. Provide a schedule of building attachment types and associated attachment hardware.
4. Provide a schedule of pipe types and sizes and proposed hanger spacing and support rod diameters.
5. Provide manufacturer's recommended pipe hanger spacing criteria for plastic piping.

B. Welding certificates.

C. Delegated-Design Submittal: For each structural support pier, provide details, signed and sealed by the qualified professional engineer responsible for their preparation.

1. Design Calculations: Calculate required loads to be supported and capacity of piers.
2. Detail fabrication of each pier including dimensions, materials, depth of excavation, and base preparation.

1.6 QUALITY ASSURANCE

A. Qualifications of welders: As specified in Section 23 05 00, Common Work Results for HVAC.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Pipe hangers:

1. Anvil International
2. Carpenter and Paterson, Inc.
3. Cooper Industries
4. National Pipe Hanger Corporation
5. PHD Manufacturing, Inc.
6. PHP Systems/Design

B. Pipe covering protection shields:

1. Anvil International
2. Carpenter and Patterson, Inc.
3. Cooper Industries
4. National Pipe Hanger Corporation
5. PHD Manufacturing, Inc.
6. Pipe Shields, Inc.
7. Rilco Manufacturing Co., Inc.

2.2 PIPE HANGERS AND SUPPORTS

A. General: Types are identified by MSS type numbers in the article "Installing Pipe Hangers and Supports" below.

B. Materials for hangers and clamps:

1. For copper pipe: Copper plated.
2. For steel, insulated, and cast-iron pipe: Galvanized in crawl spaces, tunnels, or wet areas; galvanized or factory-painted in other areas.
3. For refrigerant piping: Clamp inserts, Cooper "B-line" armafix clamps or Cush-A-Therm by ZSi-Foster, suitable for channel (trapeze) supports.

C. Insulating-insert materials and protection shields:

1. Insulation-insert material for cold piping: ASTM C 552, Type II cellular glass with 100-psig (688-kPa) minimum compressive strength and vapor barrier. Insert thickness shall match adjacent piping insulation thickness.
2. Insulation-insert material for hot piping: Water-repellent treated, ASTM C 533, Type I calcium silicate with 100-psig (688-kPa) minimum compressive strength; or ASTM C 552, Type II cellular glass with 100-psig (688-kPa) minimum compressive strength. Insert thickness shall match adjacent piping insulation thickness.
3. Insert and shield shall cover entire circumference of piping.
4. Insert length: Extend 2 inches (50 mm) beyond shield.

D. Pipe covering protection saddle: Steel, meeting requirements of MSS SP-58 Type 39, with calcium silicate insulation in the space between saddle and pipe.

E. Hanger rod nuts and washers shall be zinc-plated. Hanger rods shall be solid steel, all threaded, and zinc-plated.

F. Channel: Slotted cold-rolled steel, equal to Grinnell PS 150 S, 12 gage with 0.406- by 3-inch (10 by 76-mm) slots on 4-inch (102-mm) centers.

G. Wall- and floor-mounted supports: Structural support system equal to Grinnell "Power Strut."

H. Structural shapes: ASTM A 36.

I. Steel pipe: ASTM A 53, standard weight.

J. Threaded rod: MSS SP-58.

2.3 FASTENERS

A. Mechanical expansion anchors: Self-drilling type expansion shields or machine bolt drop-in anchors for drilled holes, equal to ITT Phillips Anchors "Red Head." Fasteners to floor slabs shall be vibration and shock resistant. Load applied to fasteners shall not exceed 25 percent of manufacturer's stated load capacity in 3500 psi (24,000 kPa) concrete. Provide zinc-coated anchors for indoor applications and stainless-steel anchors for outdoor applications.

B. Fasteners to drywall or cavity wall construction: Equal to ITT Phillips Anchors "Red Head" toggle bolts, with hollow wall drive anchors or nylon anchors as required.

C. Bolts, nuts, and washers: ASTM A 307, or ASTM F 3125 where high strength is required.

PART 3 - EXECUTION

3.1 GENERAL

A. Provide hangers and supports in accordance with schedules at the end of this section, as modified by specifications for each location and type.

B. Comply with MSS SP-58. Provide hangers, supports, clamps, and attachments as required to properly support piping from the building structure.

C. Provide hangers and supports complete with necessary attachments, inserts, bolts, rods, nuts, washers, and other accessories.

D. Where required, provide structural steel shapes or metal framing system channels and hardware to transfer load from a hanger location to multiple locations in the structure in order to get support from an appropriate location or to increase the strength of the connection to the structure.

E. Support horizontal piping from above with hangers and threaded rod where possible, unless otherwise indicated.

F. Support pipe risers through floor slabs with riser clamps.

G. Provide hanger sizes to allow for continuous insulation for insulated piping systems.

H. Fabricate wall-mounted and floor-mounted supports using metal framing systems or structural steel where required.

I. Support groups of small piping along a structural wall using a metal framing system secured to the wall.

J. Trim threaded rods with a maximum excess length of 1 inch (25 mm). Provide protective rubber red end caps on the ends of threaded rods exposed and within 8 feet (2.4 meters) of the floor, roof, or grade below.

K. Install hangers and supports to allow controlled thermal and seismic movement of piping systems, to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends, and similar units.

L. Install lateral bracing with pipe hangers and supports to prevent swaying.

M. Install hangers and supports so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.

N. Install hangers and supports to provide indicated pipe slopes and to not exceed maximum pipe deflections allowed by ASME B31.9 for building services piping.

O. Trapeze pipe hangers: Provide where required for grouping of parallel runs of horizontal piping, including all refrigerant piping.

1. Weld steel according to AWS D-1.1.
2. Hang with threaded rods. Size threaded rods in accordance with MSS SP-58.
3. Design trapeze pipe hangers and supports based on supported load plus a 50 percent minimum safety factor.
4. Hanger spacing shall not exceed the requirements for the smallest pipe in the rack.
5. Hanger spacing shall not exceed 3 feet (0.9 m) when supporting refrigerant piping.

P. Remove, add, and modify existing hangers and supports to coordinate with the new work and support existing to remain elements.

3.2 BUILDING ATTACHMENTS

A. Attaching to structural walls:

1. Provide a minimum of two 0.375 inch (9.5 mm) minimum screw-type fasteners for attaching brackets and a minimum of three 0.5 inch (13 mm) minimum bolt-type fasteners for attaching structural supports.

B. Attaching to structural steel beams, channels, or angles:

1. Secure threaded rods to MSS SP-58 Type 20 adjustable beam clamps that are clamped to the bottom flange of steel beams for any pipe size.
2. Secure threaded rods to MSS SP-58 Type 23 beam clamps for beams with maximum flange thickness of 0.75 inch (19 mm) and for single pipes NPS 2 (DN 50) and smaller.

C. Attaching to bar joists:

1. Provide MSS SP-58 Type 19 top-beam C-clamps attached to top flange of the joists at panel points.
2. Piping perpendicular to joists:

   a. Pipes NPS 2.5 (DN 65) and smaller: Support from at least every other joist to spread the load among joists. Where multiple pipes are grouped together, stagger hangers to distribute the load among available joists.
   b. Pipes NPS 3 (DN 80) and larger: Support from every joist to spread the load among joists.
   c. If additional support is required between joists, hang metal framing system channel or structural steel shape from joists using MSS SP-58 Type 19 C-clamps attached to the top flange of two joists, and hang piping from metal framing system channel or structural steel shape.

3. Piping parallel to joists:

   a. Hang metal framing system channel or structural steel shape from joists using MSS SP-58 Type 19 C-clamps attached to the top flange of two joists. Hang piping from metal framing system channel or structural steel shape.
   b. For pipes NPS 2.5 (DN 65) and smaller: A single pipe may be hung from a single joist.

D. Attaching to concrete slabs and composite slabs: Not permitted.

E. Attaching to steel decks: Not permitted.

3.3 PIPING HANGER AND SUPPORT SCHEDULES

A. Refrigerant piping applications:

HANGERS & SUPPORTS FOR REFRIGERANT PIPING APPLICATIONS		
MSS SP-58 Classification	Description	Piping applications
Hung from Above		
N/A	Metal framing system with metal framing system pipe clamps and pipe clamp insulating inserts.	All sizes.
Supported from Below		
N/A	Metal framing system with metal framing system pipe clamps and pipe clamp insulating inserts.	All sizes.
Risers		
Type 8	Riser clamp.	All sizes

B. Minimum threaded rod sizes: Provide at least the following minimum rod diameters for single rods supporting a single pipe hanger.

PIPE SIZE	MINIMUM ROD DIAMETER
NPS 2 (DN 50) and below	0.375 inches (10 mm)
NPS 2.5 and NPS 3 (DN 65 and DN 75)	0.5 inches (15 mm)
NPS 4 and NPS 5 (DN 100 and DN 125)	0.625 inches (16 mm)
NPS 6 and NPS 8 (DN150 and DN 200)	0.75 inches (20 mm)
NPS 10 to NPS 12 (DN 250 to DN 300)	0.875 inches (22 mm)

C. Maximum hanger and support spacing: Provide additional hangers or supports for concentrated loads such as flanges, valves, expansion compensators, fittings, and other specialties.

<table>
<tr><th>PIPE SIZE</th><th>COPPER HYDRONIC PIPING</th><th>STEEL HYDRONIC PIPING</th><th>REFRIGERANT PIPING</th></tr>
<tr><td>NPS 0.75 (DN 20) and below</td><td>5 feet (1.5 m)</td><td rowspan="3">7 feet (2.1 m)</td><td rowspan="17">3 feet (0.91 m)</td></tr>
<tr><td>NPS 1 (DN 25)</td><td>6 feet (1.8 m)</td></tr>
<tr><td>NPS 1.25 (DN 32)</td><td>7 feet (2.1 m)</td></tr>
<tr><td>NPS 1.5 (DN 40)</td><td rowspan="2">8 feet (2.4 m)</td><td>9 feet (2.7 m)</td></tr>
<tr><td>NPS 2 (DN 50)</td><td>10 feet (3 m)</td></tr>
<tr><td>NPS 2.5 (DN 65)</td><td>9 feet (2.7 m)</td><td>11 feet (3.4 m)</td></tr>
<tr><td>NPS 3 (DN 75)</td><td>10 feet (3 m)</td><td>12 feet (3.7 m)</td></tr>
<tr><td>NPS 4 (DN 100)</td><td rowspan="2">12 feet (3.7 m)</td><td>14 feet (4.3 m)</td></tr>
<tr><td>NPS 5 (DN 125)</td><td>16 feet (4.9 m)</td></tr>
<tr><td>NPS 6 (DN 150)</td><td>14 feet (4.3 m)</td><td>17 feet (5.2 m)</td></tr>
<tr><td>NPS 8 (DN 200)</td><td rowspan="5">16 feet (4.9 m)</td><td>19 feet (5.8 m)</td></tr>
<tr><td>NPS 10 (DN 250)</td><td>22 feet (6.7 m)</td></tr>
<tr><td>NPS 12 (DN 300</td><td>23 feet (7.0 m)</td></tr>
<tr><td>NPS 14 (DN 350)</td><td>25 feet (7.6 m)</td></tr>
<tr><td>NPS 16 (DN 400)</td><td>27 feet (8.2 m)</td></tr>
</table>

1. Provide hanger spacing to meet manufacturer's recommendations and MSS SP-58 for plastic hydronic piping.

- END OF SECTION 23 05 29 -

SECTION 23 07 00
HVAC INSULATION

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Definitions and general requirements applicable to the insulation systems specified in "Related Sections."

1.2 RELATED SECTIONS

A. HVAC piping insulation: Section 23 07 19.

1.3 REFERENCES

A. ASTM E 84: Standard Test Method for Surface Burning Characteristics of Building Materials

B. NFPA 255: Standard Method of Test of Surface Burning Characteristics of Building Materials

C. UL 723: Standard for Test for Surface Burning Characteristics of Building Materials

1.4 DEFINITIONS

A. Ceiling space: The space between the ceiling and the floor of an air-conditioned space above.

B. Roof space: The space between the ceiling and the roof, where building insulation is located at the roof level or the space between the ceiling and the floor of a non-air conditioned space above.

C. Attic space: The space between the ceiling and the roof, where building insulation is located at the ceiling level.

D. Air-conditioned areas or spaces: Areas or spaces where the occupied room temperature is maintained between 65 and 80 degrees F (18.3 and 26.7 degrees C).

E. Concealed insulation shall include work:

1. Above ceilings.
2. Where furred in and in pipe chases.

F. Exposed insulation shall include work:

1. In all rooms and areas.
2. In mechanical equipment rooms, penthouses, or other similar utility spaces.
3. In storage rooms.

G. Unconditioned areas: Areas outside of the insulated envelope.

H. Finished spaces: Areas of the building accessible to the public and to building occupants other than service personnel.

1.5 QUALITY ASSURANCE

A. Perform work in strict accordance with the building, fire and safety codes of the state, county or city in which the work is performed.

B. Insulation, including fittings and butt strips, jackets, facings, and accessories such as adhesives, mastics, cements, tapes and cloth, shall have a fire and smoke hazard rating and label as tested by ASTM E84, NFPA 255, and UL 723, not exceeding Flame Spread 25, Fuel Contributed 50, Smoke Developed 50.

C. All insulation and accessories shall be free of asbestos.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver insulation and accessory products in manufacturers' wrapping or cartons, identified on the exterior and bearing labels showing conformance to flame and smoke rating requirements.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Refer to sections listed in "Related Sections."

PART 3 - EXECUTION

NOT USED

- END OF SECTION 23 07 00 -

SECTION 23 07 19
HVAC PIPING INSULATION

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. HVAC piping insulation for the interior piping systems listed in the minimum insulation thickness schedule at the end of this section.

B. HVAC piping insulation for the exterior piping systems.

C. Work of this section includes:

1. Insulation for new piping installed under this contract.
2. Patching existing insulation where removed to make connections to existing piping.
3. Patching existing insulation damaged during demolition and construction.

1.2 RELATED SECTIONS

A. Firestopping: Section 23 05 07.

B. Painting: Division 09.

C. Definitions and general insulation requirements: Section 23 07 00.

D. Pipe hangers and protection shields: Section 23 05 29.

E. Pre-insulated refrigerant tubing system: Section 23 23 00.

1.3 REFERENCES

A. American Society of Testing and Materials

1. Standards for flexible elastomeric insulation materials

a. ASTM C411: Standard Test Method for Hot-Surface Performance of High-Temperature Thermal Insulation
b. ASTM C 534: Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form.

2. Standards for all insulation materials

a. ASTM C 450: Prefabrication and Field Fabrication of Thermal Insulating Fitting Covers for NPS Piping, Vessel Lagging, and Dished Head Segments.
b. ASTM E 84: Standard Test Method for Surface Burning Characteristics of Building Materials

3. Standards for field applied jackets and accessories

a. ASTM D 1784: Standard Specification for Rigid Poly(Vinyl Chloride) (PVC) Compounds and Chlorinated Poly(Vinyl Chloride) (CPVC) Compounds

1.4 SUBMITTALS

A. Material list: Each type of insulation and accessory, with manufacturer's name and material name and number. Identify locations for use, thickness of material, type of jacket, vapor barrier, and method of application.

B. Product data: Sufficient to show that the product meets the specified requirements for materials, composition, and performance.

C. Submit a single manufacturer for each product. Submittals that include multiple manufacturers for a single product are not acceptable.

D. Installer qualifications.

1.5 QUALITY CONTROL SUBMITTALS

A. Manufacturer's instructions: Recommended accessory materials and products; installation instructions.

1.6 QUALITY ASSURANCE

A. Installers shall be mechanics skilled in this trade, employed with a firm that has a minimum of five years of experience installing mechanical insulation.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. The listed manufacturers and particular products are intended to set a standard for materials, composition, and performance. Products of other manufacturers may be proposed as permitted by the provisions of Division 01 and the article "Product Options" in Section 23 01 01.

B. Interior flexible elastomeric insulation:

1. Aeroflex USA
2. Armacell LLC
3. Rubatex

C. Exterior flexible elastomeric insulation:

1. K-Flex Titan (no substitutions)

D. Coatings, adhesives, and fabrics:

1. Childers
2. Foster
3. Manville Building Materials Group
4. Rock Wool Manufacturing Company

5. Trimac

2.2 INTERIOR FLEXIBLE ELASTOMERIC INSULATION MATERIALS

A. Flexible elastomeric preformed pipe insulation: Closed-cell, sponge- or expanded-rubber, ASTM C 534, Type I for tubular materials. ASTM E 84 surface burning characteristics (flame spread/smoke developed) rating less than 25/50.

1. Use of lap seal type flexible elastomeric piping insulation products is not acceptable.

B. Flexible elastomeric preformed fitting and valve covers: Closed-cell, sponge- or expanded-rubber, made from the same material and density as adjacent pipe insulation, meeting ASTM C 450 requirements for dimensions used in forming insulation to cover valves, elbows, tees, flanges, strainers, and unions. Provide with preformed PVC field-applied jacket. ASTM E 84 surface burning characteristics (flame spread/smoke developed) rating less than 25/50.

1. Where flexible elastomeric insulation is used on hot gas piping in VRF applications, insulation shall be tested in accordance with ASTM C411 at 250 degrees F (121 degrees C) for a 96 hour time period and shall meet an ASTM E 84 surface burning characteristic (flame spread/smoke developed) rating less than 25/50 at 2 inches (50 mm) of thickness.

C. Flexible elastomeric insulation adhesive:

1. Water resistant contact cement designed especially suited for bonding two impermeable surfaces and recommended for rubber foam, steel, or aluminum surfaces, and compatible with service temperatures. ASTM E 84 surface burning characteristics (flame spread/smoke developed) rating less than 25/50.
2. Equal to Foster 85-75 “Drion”.

D. Flexible Elastomeric Tape: Black, closed cell, self-adhering, elastomeric thermal insulation tape for insulating pipes and fittings, 0.125 inch (3 mm) thick, 2 inches (50 mm) wide, ASTM C 534, Type I — Grade 1. ASTM E 84 surface burning characteristics (flame spread/smoke developed) rating less than 25/50.

E. Flexible elastomeric insulation vapor barrier coating:

1. Water-based latex enamel coating for use over flexible elastomeric insulation, providing a moisture-resistant protective finish suitable for both indoor and outdoor applications. ASTM E 84 surface burning characteristics (flame spread/smoke developed) rating less than 25/50.
2. Equal to Armacell “WB Armaflex” latex enamel.

2.3 EXTERIOR FLEXIBLE ELASTOMERIC INSULATION

A. K-Flex “Titan” closed-cell, flexible, elastomeric foam insulation complete with flexible co-extruded UV resistant jacketing.

2.4 FASTENERS

A. Aluminum bands: ASTM B 209, 0.75 inches (19 mm) wide and 0.020 inches (0.4 mm) thick.

2.5 FIELD-APPLIED JACKETS

A. Polyvinyl chloride (PVC) jacket:

1. Jacket material: High-impact-resistant, UV-resistant PVC complying with ASTM D 1784, Class 16354-C; 20 mils (0.5 mm) thick; roll stock ready for shop or field cutting and forming. ASTM E 84 surface burning characteristics (flame spread/smoke developed) rating less than 25/50.

    a. Adhesive: As recommended by jacket material manufacturer.

2. Color:

    a. Color-code jackets based on system within mechanical rooms. Color selected to comply with industry standards and color requirements indicated in Section 23 0500.
    b. Provide white for all non-mechanical room applications.

3. Adhesive: As recommended by jacket material manufacturer. ASTM E 84 surface burning characteristics (flame spread/smoke developed) rating less than 25/50.
4. Fitting covers: Manufacturer's factory-fabricated fitting covers made from the same material, finish, and thickness as the jacket, suitable to the size of fittings and thickness of insulation. Provide factory fabricated fitting covers for elbows, tees, flanges, unions, reducers, end caps, valves, and other fittings. ASTM E 84 surface burning characteristics (flame spread/smoke developed) rating less than 25/50.Field fabricate fitting covers only if factory-fabricated fitting covers are not available.
5. PVC Tape: White vapor-retarder tape matching field-applied PVC jacket and fitting covers with acrylic adhesive; suitable for indoor and outdoor applications, 2 inch (50 mm) width, 6 mil (0.15 mm) thickness. ASTM E 84 surface burning characteristics (flame spread/smoke developed) rating less than 25/50.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Provide field applied jackets in accordance with the Field-Applied Jacket Schedule at the end of this section, as modified by specifications for each location and type.

B. Provide flexible elastomeric insulation for refrigerant piping.

C. Apply insulation in a neat and workmanlike manner and in accordance with manufacturer's printed instructions.

D. Maintain a continuous vapor barrier on systems that convey fluid at below-ambient temperatures, including the following applications:

1. Refrigerant piping

E. Where a continuous vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.

F. Installation at pipe hangers:

1. Insulation shall be continuous through hangers for all piping systems.
2. Install pipe covering protection shields with thickness of structural insulation inserts equal, under load, to that of adjoining insulation.
3. Install insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.
4. Cover inserts with jacket material matching adjacent pipe insulation. Install shields over jacket, arranged to protect jacket from tear or puncture by hanger, support, and shield.
5. Shields and structural insulation inserts are specified in Section 23 05 29, Hangers and Supports for HVAC Piping and Equipment.

G. Where insulated piping systems pass through sleeves or openings in partitions and floors, the insulation shall be continuous through the sleeves and openings. See Firestopping specifications for coordinating insulation and firestopping.

H. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of piping including fittings, valves, and specialties.

I. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.

J. Install insulation with longitudinal seams at top and bottom of horizontal runs.

K. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.

L. Install insulation with least number of joints practical.

M. Finish installation with systems at operating conditions. Repair separations and cracking caused by thermal movement.

N. Return piping systems shall be insulated to meet the temperature demands of supply piping systems. There shall be no reduction of insulation thickness for anticipated temperature change between supply and return.

3.2 INSTALLING INTERIOR AND EXTERIOR FLEXIBLE ELASTOMERIC INSULATION

A. Interior flexible elastomeric insulation: Apply by slipping seamless sections of tubing over the end of the piping, wherever possible. Use slit tubing only as necessary. Seal joints and slit seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

1. Fittings and valves: Field fabricated from insulation same thickness as on the piping. Use manufacturer's miter tubes and boxes and templates.

B. Exterior flexible elastomeric insulation: Install insulation and provide watertight joints in accordance with the manufacturer's recommendations. Seal joints and slit seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

1. For pre-insulated tubing systems, remove factory-applied insulation when refrigerant piping is installed outdoors and provide specified exterior flexible elastomeric insulation product. Use of factory-applied insulation outdoor is not acceptable.
2. Thickness: Minimum 2 inches (50 mm) thick, or 0.5 inches (13 mm) thicker than scheduled for interior insulation on similar system, whichever is greater.

C. Provide yellow tape on exterior surface of refrigerant piping insulation at each solder joint for all ductless split systems.

D. Installation on fittings and flanges:

1. Install insulation over fittings and flanges with continuous thermal and vapor-retarder integrity unless otherwise indicated.
2. Insulate using flexible elastomeric preformed fitting covers whenever possible. Install preformed fittings with adhesive. Tape and seal with vapor barrier coating.
3. Where flexible elastomeric preformed fitting covers are not available, insulate using mitered fittings made from same material and density as adjacent pipe insulation. Each piece shall be butted tightly against adjoining pieces and bonded with adhesive. Tape and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated. Seal with vapor barrier coating.
4. Install fitted PVC cover. Terminate ends with PVC end caps. Tape PVC covers to adjoining insulation facing using PVC tape.
5. Flanges: Install pre-formed pipe insulation to outer diameter of pipe flange. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of sheet insulation of same thickness as pipe insulation. Secure insulation to flanges and tape and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated. Seal with vapor barrier coating.

3.3 INSTALLING FIELD-APPLIED JACKETS

A. Installing PVC jacket:

1. Provide jacket tight to insulation.
2. Provide with 1-inch (25-mm) overlap at longitudinal seams and circumferential joints.
3. For horizontal applications, install with longitudinal seams along top and bottom of pipes.
4. Seal with manufacturer's recommended adhesive. Apply two continuous beads of adhesive to seams and joints, one bead under the jacket lap and another finish bead along each seam and joint edge.
5. Seams and joints shall completely prevent the entrance of water.

3.4 SCHEDULES

A. Minimum insulation thickness schedule for interior air conditioning refrigeration applications:

MINIMUM INSULATION THICKNESS SCHEDULE FOR INTERIOR AIR CONDITIONING REFRIGERATION APPLICATIONS (1)			
Application	Fluid Temperature Range	NPS 1.25 (DN 32) & Smaller	NPS 1.5 (DN 40) & Greater
Refrigerant Liquid (3)	61F to 104F (16.1C to 40C)	Not Required	
Refrigerant Suction	40F to 104F (4.4C to 40C)	1-inch (25 mm)	
Refrigerant Hot Gas (2)	105F to 140F (40.6C to 60C)	1-inch (25 mm)	1.5-inch (38 mm)
(1) - See additional thickness requirements for exterior applications. (2) - Hot gas may be required for split system hot gas reheat applications. (3) - Insulate piping with 0.5-inch (13 mm) thick insulation where there is a possibility of contact with the piping by occupants other than service personnel.			

B. Field-applied jacket schedule:

FIELD-APPLIED JACKET SCHEDULE	
Application	PVC Jacket
Pipe insulation exposed in finished areas more than 8 feet (2440 mm) above the finished floor	X
Pipe insulation exposed in mechanical rooms, penthouses, and other service areas not accessible to the public.	X

- END OF SECTION 23 07 19 -

SECTION 23 23 00
REFRIGERANT PIPING

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Refrigerant piping and accessories for equipment in related sections.

1.2 RELATED SECTIONS

A. Piping materials and methods: Section 23 05 00.

B. Piping hangers and supports: Section 23 05 29.

C. Piping insulation: Section 23 07 19.

D. Equipment:

1. Ductless split-system units: Section 23 81 27.

1.3 REFERENCES

A. Air Conditioning, Heating, and Refrigeration Institute

1. AHRI 495: Performance Rating Of Refrigerant Liquid Receivers
2. AHRI 730: Flow Capacity Rating of Suction Line Filters and Suction Line Filter Driers
3. AHRI 750: Thermostatic Refrigerant Expansion Valves
4. AHRI 760: Performance Rating of Solenoid Valves for Use with Volatile Refrigerants

B. American Society of Testing and Materials

1. ASTM B 280: Standard Specification for Seamless Copper Tube for Air Conditioning and Refrigeration Field Service
2. ASTM C 1427-07: Standard Specification for Extruded Preformed Flexible Cellular Polyolefin Thermal Insulation in Sheet and Tubular Form

C. American Society of Mechanical Engineers/American National Standards Institute

1. ASME/ANSI B16.22: Wrought Copper and Copper Alloy Solder-Joint Pressure Fittings

D. American Society of Refrigerating and Air-Conditioning Engineers

1. ASHRAE Standard 15: Safety Standard for Refrigeration Systems
2. ASHRAE Standard 34: Designation and Classification of Refrigerants
3. ASHRAE Standard 147: Reducing the Release of Halogenated Refrigerants from Refrigerating and Air-Conditioning Equipment and Systems

E. American Welding Society

1. AWS A5.8/A5.8M: Specification for Filler Metals for Brazing and Braze Welding

F. Society of Automotive Engineers

1. SAE J533: Flares for Tubing

G. UL

1. UL 429: Standard for Safety Electrically Operated Valves

1.4 DESIGN REQUIREMENTS

A. Refrigerant piping shall be sized by the manufacturer of the refrigeration compressor, as specified in sections describing refrigeration equipment.

B. Design pressures: Calculated in accordance with "System Design Pressure" in ASHRAE Standard 15.

1.5 SUBMITTALS

A. Product data:

1. Piping, fittings, brazing filler metal, brazing flux, and pipe joint compound.
2. Each type of valve, including materials, classifications, arrangement, dimensions and required clearances, and installation instructions.
3. Each type of device and accessory.

B. Shop drawings:

1. Pre-insulated tubing, including sizes and approximate lengths of lines.
2. Submit system design pressures for use in testing system. In accordance with the International Mechanical Code, "Field Test" for refrigeration systems, including the pressures listed on the condensing unit, compressor, or compressor unit nameplate, and the settings of pressure relief devices.

C. Certifications: Provide certificate of field tests in a form acceptable to the authority having jurisdiction, as part of the permit and inspection records. Certificate shall include no less than:

1. Name of refrigerant.
2. Field test pressure applied to high and low sides of the system.
3. Signature and printed name of the installer.

1.6 QUALITY ASSURANCE

A. Pipe shall be certified by the manufacturer to meet referenced standards and shall bear a label, directly on the pipe, indicating compliance.

PART 2 - PRODUCTS

2.1 MATERIAL

A. Refrigerant: R-32, R-454b, or similar EPA compliant refrigerant.

2.2 PIPING (PRE-INSULATED TUBING)

A. Refrigerant pipe:

1. Pre-insulated Type L soft drawn seamless copper tubing, ASTM B 280. Provide complete with factory-applied, closed-cell insulation and jacketing in accordance with ASTM C 1427-07, Type I, Grade I, suitable for a maximum operating temperature of 250 degrees F, and meeting the minimum insulation thickness requirements of Section 23 07 19.
2. Basis of design: H Max pre-insulated copper line sets.

PART 3 - EXECUTION

3.1 INSTALLATION (GENERAL)

A. Install piping as indicated on the drawings and in accordance with provisions of Section 23 05 00 and the piping system application article at the end of Part 3.

B. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Actual size and configuration of refrigerant piping shall be in conformance with the recommendations of the refrigeration equipment manufacturer.

C. Install refrigerant piping according to ASHRAE Standard 15.

D. Hang horizontal piping NPS 2 (DN 50) and smaller using a metal framing system, clamps, and insulation inserts in accordance with Section 23 05 29.

1. For pre-insulated tubing systems, remove section of factory-applied insulation at metal framing system and provide specified clamps and insulation inserts. Seal ends of piping insulation and inserts in accordance with manufacturer's instructions.

E. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.

F. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls.

G. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.

H. Install piping adjacent to machines to allow service and maintenance.

I. Install piping free of sags and bends.

J. Select system components with pressure rating equal to or greater than system operating pressure.

K. Install piping as short and direct as possible, with a minimum number of joints, elbows, and fittings.

L. Arrange piping to allow inspection and service of refrigeration equipment.

M. Install valves and specialties in accessible locations to allow for service and inspection.

N. Slope refrigerant piping as follows:

1. Install horizontal hot-gas discharge piping with a uniform slope downward away from compressor.
2. Install horizontal suction lines with a uniform slope downward to compressor.
3. Install traps and double risers to entrain oil in vertical runs.
4. Liquid lines may be installed level.

O. When brazing or soldering, remove solenoid-valve coils and sight glasses; also remove valve stems, seats, and packing, and accessible internal parts of refrigerant specialties. Do not apply heat near expansion-valve bulb.

3.2 INSTALLATION (PRE-INSULATED TUBING)

A. Install piping and seal ends of piping insulation as shown on drawings and in accordance with manufacturer's instructions and approved shop drawings.

3.3 LEAK TEST

A. After the refrigeration systems have been installed, perform a leak test before evacuating the systems.

1. The cylinder of oil-pumped nitrogen shall be equipped with a shutoff valve, pressure reducing valve, cylinder pressure gauge, line pressure gauge, and bleed valve.

B. Remove controls or relief valves which could be damaged by test pressures.

C. Separate the high side from the low side and bleed in enough refrigerant to raise the system pressure to 12 to 15 psig (83 to 103 kPa). Then, using oil-pumped dry nitrogen, raise the pressures to the test pressures established as required in "Submittals" in Part 1 above.

D. Test the entire system for leaks.

E. Bleed off the pressure into cylinders, in accordance with ASHRAE Standard 147, and repair leaks. Do not attempt to repair a leak while the system is under pressure. Do not repair bad joints by remelting and adding more brazing material. Take joint apart, thoroughly clean, and remake as a new joint.

F. Retest the system if a leak is found.

G. When tests and repairs are complete, replace valves or controls removed for protection.

H. Submit test certificate required in "Submittals" in Part 1 above.

3.4 EVACUATION

A. To evacuate the system, use a vacuum pump capable of producing at least 1 mm (0.039 inches) mercury absolute vacuum. Proceed as follows:

1. Connect an accurate high vacuum gauge (Micron), such as a Stoke's or Zimmerli gauge, to the system. Do not use compound gauges.
2. Connect the vacuum pump to both the high and low sides of the system. Leave the compressor suction and discharge valves closed. Evacuate the system to 2.5 mm (0.098 inches) mercury absolute. Keep ambient air temperatures above 60 degrees F (15.6 degrees C) during the evacuation process.
3. Break the system vacuum with oil-pumped dry nitrogen. Open the compressor suction and discharge service valves and re-evacuate the system to 2.5 mm (0.098 inches) mercury absolute.
4. After the system has been double evacuated to 2.5 mm (0.098 inches) mercury absolute, close the vacuum-pump suction valve and stop the pump. Allow the system to stand under a vacuum a minimum of 12 hours and recheck the vacuum. Notify the Engineer in time for him to verify the test pressure at beginning and end of time limit, before proceeding to charge the system.

3.5 CHARGING

A. Charge the system with refrigerant through the liquid-line charging valve. Use a clean strainer-drier in the charging line, along with a pressure gauge and shut-off valve to control pressures. Before starting the compressor, ascertain that the oil sight glass, if provided, is 75 percent full, and suction and discharge valves back-seated.

3.6 FINAL START-UP PROCEDURE

A. Check out operating and safety controls in accordance with the compressor manufacturer's recommendations.

B. Recheck the oil level in the sight glass at frequent intervals. It should not drop below 50 percent level.

C. Adjust compressor suction unloaders, if provided, for proper evaporator-compressor balance to maintain the scheduled minimum discharge temperature.

D. Reinspect the system after it has been in normal operation for at least 72 hours. At this time, instruct the Owner in the operation and maintenance of the equipment, as required in the equipment section.

3.7 LUBRICATION

A. If it becomes necessary to add oil to the system, use only the oil recommended by the compressor manufacturer.

3.8 PIPING SYSTEM APPLICATIONS

A. Provide pre-insulated piping for the following equipment as indicated:

1. Equipment:

a. Ductless split-systems

- END OF SECTION 23 23 00 -

SECTION 23 81 27
DUCTLESS SPLIT-SYSTEM UNITS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Ductless split system with interior and exterior units and refrigerant piping.

1.2 RELATED SECTIONS

A. Motors: Section 23 05 13.

B. Refrigerant piping: Section 23 23 00.

C. Refrigeration system startup and service, preventative maintenance, and compressor warranty: Section 23 01 00.

1.3 REFERENCES

A. ASHRAE 15: Safety Code for Mechanical Refrigeration.

B. ASHRAE 90.1: Energy Efficient Design of New Buildings Except Low-rise Residential Buildings.

1.4 PERFORMANCE REQUIREMENTS

A. Design of the HVAC system, including associated work of other design disciplines and trades, is based on scheduled and specified equipment. If a different item of equipment should be proposed, as permitted under the article "Acceptable Manufacturers" below, ascertain that it will:

1. Perform to the scheduled and specified capacities.
2. Make no additional demands on other systems such as domestic, heating, and chilled water, or electricity.
3. Meet or exceed all specified requirements.
4. Electrical power connections for the basis-of-design unit require the indoor unit to be wired through the outdoor unit. Other manufacturers may require separate power connections, which the contractor shall provide as required.

1.5 SUBMITTALS

A. Shop drawings: Detail equipment assemblies and indicate dimensions, weights, loadings, required clearances, method of field assembly, components, and location and size of each field connection.

1. Wiring diagrams: For power, signal, and control systems, differentiating between factory- and field-installed wiring.

B. Product data: Include rated capacities; shipping, installed, and operating weights; furnished specialties; and accessories for each model.

1. Submit product data which verifies compliance with ASHRAE 90.1, or provide certified performance ratings by a qualified independent testing agency.

C. Samples: Color chips, showing manufacturer's complete line of finishes.

1.6 QUALITY ASSURANCE

A. UL label and local testing (if required): As specified in Section 23 05 00, Common Work Results for HVAC.

B. Fabricate and label refrigeration components to comply with ASHRAE 15.

C. Energy efficiency ratio and coefficient of performance: Equal to or greater than prescribed by ASHRAE 90.1.

1.7 EXTRA MATERIALS

A. Filters: For each interior unit provided with washable type filters, provide one extra washable filter per unit.

1.8 SPECIAL WARRANTY

A. Besides general project warranty, provide manufacturer's five-year extended warranty for replacing compressors, for each system, executed to the Owner.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Basis-of-design product: Subject to compliance with requirements, provide the scheduled Mitsubishi Electric Corporation P Series unit, or comparable product by one of the following:

1. Carrier
2. Daikin
3. LG
4. Mitsubishi Electric Corporation
5. Trane

2.2 MATERIALS

A. Refrigerant: R-32, R-454b, or similar EPA compliant refrigerant.

B. Refrigerant pipe: Refer to Section 23 23 00, Refrigerant Piping.

2.3 UNITS, GENERAL

A. Each unit shall be provided with factory-installed means of disconnect in compliance with NEC (NFPA 70) and local codes. In the event a factory-installed disconnect is not available, provide an approved means of disconnect for field mounting.

B. Heat pump units: Include reversing valves and defrost controls. When heat is called for, the reversing valve reverses the refrigerant flow, the interior coil operates as a condenser, heat is circulated into the room, and the outdoor coil operates as an evaporator.

C. Air-conditioning units: Interior unit is an air conditioner and the outdoor coil is a condenser.

D. Each unit shall be complete with a thermostatic expansion metering device and factory-mounted hard start kit.

2.4 INTERIOR UNIT

A. Frames: Steel angles or aluminum extrusions, welded construction.

B. Panels:

1. Insulated with 0.5-inch (13-mm) thick, 2 lbs per cubic foot (32 kg per cubic meter) density glass fiber insulation, with an R value no less than 15.
2. Fasteners: Concealed, captive, easily operated for access without tools.
3. Exterior finish: Manufacturer's standard baked enamel.

C. Grilles: Each one-piece construction, aluminum, brushed finish, with foam gasket providing airtight seal between grille and cabinet. Supply grille adjustable in three directions. Return air grille hinged for access to filter.

D. Drain pan: Insulated steel or plastic, with connections to exterior of cabinet.

1. Slope to drain in two directions, minimum 0.25 inch in 1 foot, to 0.75-inch drain connection.
2. Provide access for cleaning.

E. Cooling coil: Aluminum fins extruded on to copper tubing with quick connections to precharged tubing. Pressure tested at 1.5 times working pressure. Provide expansion device.

F. Fan: Centrifugal type with direct-connected controlled-speed motor mounted on vibration isolators.

G. Filter: Washable or throwaway, as required by the equipment manufacturer. Coordinate piping and electrical connections so they do not interfere with filter access.

2.5 EXTERIOR UNIT

A. Unit shall be factory-assembled and -tested, of capacity and current characteristics indicated on the drawings. Unit shall be packaged type. Cabinet: weatherproof construction, steel, with baked enamel finish.

B. Refrigeration circuit: Completely pre-piped, equipped with refrigerant; access valves in suction and liquid lines; filter dryer, sight glass, and pressure fittings for charging and evacuation.

C. Compressors: Welded shell; reciprocating hermetic, rotary screw or scroll type; high efficiency.

1. Controls: Include high- and low-pressure switches, low suction temperature cut-off, motor thermal overload protection, 5-minute anti-cycle timer, and start capacitor kit.

D. Condenser coil: Constructed of copper tube and aluminum fins, factory leak-tested at 1.5 times working pressure, dehydrated, and provided with full charge of refrigerant. Provide subcooler and accumulator.

1. Low ambient control: Provide head pressure control and accessories required to operate at temperatures down to 0 degrees F (minus 18 degrees C).

E. Fans: Propeller, direct drive, dynamically balanced, speed-controlled motor.

2.6 CONTROLS

A. Wall-mounted hard-wired controllers shall incorporate the following features:

1. Operation mode setting (Heat, Auto, Cool)
2. Temperature setting: The LCD indicator displays the set temperature in units of 2 degrees F.
3. Room temperature (intake air) display
4. 24-hour on/off timer: Operation can be set to start or stop after a specified time in 1-hour increments from 1 to 24. The remaining time is indicated on the LCD display.
5. Fan speed indicator: Displays the fan speed setting (high or low).
6. Vane control: The angle of the air outlet vanes can be adjusted to one of four positions by pressing the air discharge Up/Down button.
7. Auto air swing vanes: The air outlet vanes swing up and down for uniform air distribution.
8. Self-diagnostic display: When unit stops, the display indicates where the trouble is located.
9. Memory feature for storing instructions

PART 3 - EXECUTION

3.1 INSTALLATION

A. Assemble and set each unit in place in accordance with the manufacturer's instructions, plumb and level, firmly anchored, maintaining manufacturer's recommended clearances, tight to adjoining surfaces.

B. In rooms with ceilings, conceal piping and tubing, controls, and electrical power serving units above ceilings.

C. In rooms without ceiling, arrange piping and tubing, controls, and electrical power serving units to provide a neat and finished appearance.

D. Connect piping as shown on the drawings and in accordance with manufacturer's instructions.

E. In a finished space, all piping, wiring, and conduit shall be behind finished surfaces.

F. For wall-mounted units installed in occupied areas, provide line set covers shall be Aerco, Inc. “Slim-Duct-MD”, Rectorseal “Slimduct”, or Diversitech “Speedichannel” in a color to match indoor terminal unit. Installation shall conceal all exposed refrigerant line sets and condensate drain piping.

1. Line set covers not required for units serving utility spaces, such as elevator machine rooms, storage rooms, and electrical rooms.

G. Test each drain pan and ensure that installed slope is as specified and pan drains completely.

H. Filters: Provide temporary protection and clean (washable) or replace (disposable) filters.

I. Install accessories required for low ambient operation.

3.2 SYSTEM CONTROLS INSTALLATION

A. Provide the entire system with required controls, including wall-mounted controller, designed and installed by the equipment manufacturer to provide a complete working system.

B. No control voltage, either temperature or interlock, shall exceed 120 VAC. Color code or number all wires whether individual or in cables, for identification. Work shall be in compliance with the National Electric Code and as follows:

1. Minimum size conduit shall be 1/2" EMT.
2. Minimum line voltage, size wire shall be #14 and in accordance with hardware manufacturers’ recommendations for signal wiring.
3. Control wiring to starts shall conform to Para. 430-74 of the National Electric Code.
4. Control cabling shall conform to NEC 725-2b and NEC 760-2b fire protective signaling, and U.L. classified as a low smoke flame retardant cable suitable for installation in plenums and environmental spaces. Maximum allowable voltage shall be 24V. Cable shall be stranded wire type. Shielding shall be provided on cable wiring where required to preclude interference from or to building electronic components and/or systems.
5. CAT6 cables shall be color coded to differentiate separate loops.

3.3 OPERATING INSTRUCTIONS

A. As specified in Section 23 05 00, provide operating instructions.

- END OF SECTION 23 81 27 -

SECTION 26 01 01
ELECTRICAL GENERAL PROVISIONS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. General provisions and requirements for electrical work.

1.2 RELATED SECTIONS

A. Requirements of this section generally supplement requirements of Division 01.

1.3 REFERENCES

A. NFPA 10: Portable Fire Extinguishers.

B. NFPA 241: Safeguarding Construction, Alteration, and Demolition Operations.

1.4 SYSTEM DESCRIPTION

A. The full set of Contract Documents applies to work of Division 26 and Section 28 31 00.

B. Visit the site and study aspects of the project and working conditions, as required by General and Supplementary Conditions, Bidding and Contracting Requirements, Drawings, and Specifications. Verify field dimensions.

C. The work covered in technical sections includes the furnishing of labor, equipment and materials, and the performance of operations pertinent to the work described.

D. Except as required otherwise in Division 01, promptly obtain and pay for necessary signatures and paperwork, permits, fees and inspections required for work of this division by authorities having jurisdiction, including any utility connection or extension charge. No payment will be made until a copy of the permit is forwarded to the Owner.

E. Electrical work of this project includes, as a brief general description, the following:

1. Power and lighting provisions for elevator replacement.
2. Fire detection and alarm system provisions for elevator replacement.

F. See Division 01 for requirements related to Owner's occupancy of the premises, limits on use of site, time restrictions on work, limits on utility outages or shutdowns, and phasing (sequencing) and scheduling.

1.5 PRODUCT OPTIONS

A. Except as modified by provisions of Bidding and Contracting Requirements and Division 01, these options apply to Division 26 specifications and Section 28 31 00.

B. General: Where Contractor is permitted to use a product other than the specified item and model named as the basis of design, Contractor is responsible for coordination and additional costs as specified in article "Substitutions" below for substitutions.

C. Products specified by reference standards or by description only: Any product meeting those standards or description.

D. Products specified by naming one or more manufacturers, or model name or catalog reference number: Products specified establish a standard of quality, options to be included, and performance.

1. Where other acceptable manufacturers are named, Contractor may provide products of those named manufacturers only, which meet the specifications.
2. Where specification permits "equal" products, without naming other acceptable manufacturers, Contractor may use products of any manufacturer, which meet the specifications.

E. Products specified by naming one manufacturer and particular product, with no provision for other options: No options or substitutions allowed.

1.6 SUBSTITUTIONS

A. Substitutions will be considered only as permitted or required by the Bidding and Contracting Requirements and Division 01. Except as modified by those requirements, the requirements below apply to Division 26 specifications and Section 28 31 00.

B. Substitutions may be considered when a product becomes unavailable through no fault of the Contractor.

C. Document each request with complete data substantiating compliance of proposed substitution with contract documents.

D. A request constitutes a representation that the Bidder or Contractor:

1. Has investigated proposed product and determined that it meets or exceeds the quality level of the specified product.
2. Will provide the same warranty for the substitution as for the specified product.
3. Will coordinate installation and make changes to other work which may be required for the work to be complete with no additional cost to Owner.
4. Waives claims for additional costs or time extension which may subsequently become apparent.
5. Will reimburse Owner for review or redesign services associated with re-approval by authorities.

E. Substitutions will not be considered when they are indicated or implied on shop drawing or product data submittals, without separate written request, or when acceptance will require revision to the Contract Documents.

F. Substitution submittal procedure is specified in Bidding and Contracting Requirements and Division 01.

1.7 MATERIALS AND EQUIPMENT

A. Materials and equipment shall be new and the best of their respective kinds, suitable for the conditions and duties imposed on them by the project, and of representative manufacturer. The description, characteristics, and requirements of the materials to be used shall be in accordance with the specifications.

B. Equipment, construction, and installation must meet requirements of local, state and federal governing codes.

C. Singular number: In cases where material, a device, or part of the equipment is referred to in the singular number in the specifications, it is intended that such reference shall apply to as many items of material, devices, or parts of the equipment as are required to complete the installation as shown on the drawings or required for proper operation of the system.

D. Terms have the following meanings:

1. Furnish: Supply item
2. Install: Mount and connect item
3. Provide: Furnish and install

E. Materials and equipment shall be installed and completed in a first class and workmanlike manner and in accordance with the best modern methods, practice, and manufacturers' instructions. Any work which shall not present an orderly and neat or workmanlike appearance shall be removed and replaced with satisfactory work when so directed in writing by the Architect.

F. The specifications and drawings are intended to define the minimum requirements, as to quality of materials, construction, finish, and overall workmanship.

G. General Conditions describe the correlation and intent of the Contract Documents. In case of discrepancies between the specifications and drawings, the specifications should be followed as to the general methods and principles and the drawings followed as to sizes, capacities, and specifics for corresponding parts. If sizes are omitted, the Architect will determine sizes to be utilized.

H. In cases of doubt, uncertainty, or conflict as to the true meaning of the specifications or drawings, it is the responsibility of the Contractor to notify the Architect of said uncertainty, doubt, or conflict and obtain a decision as to the intent prior to initiating any work which may be affected by this decision.

1.8 COORDINATION

A. Should a situation develop during construction to prevent the proper installation of any equipment or item where shown on the drawings, call the situation to the attention of the Architect and await a written decision.

B. Plan and coordinate work to proceed in an orderly and continuous manner without undue delay, and in conformance with the project schedule. Submit samples, shop drawings, schedules, insurance policies and certificates, and the like in time to avoid delays in actual construction. Coordinate electrical work so that work of each trade is completed before other construction begins which would obstruct it.

C. Coordinate trades to ensure that proper clearances between work of the various trades allow access to items which require operation and maintenance.

D. Coordinate location and elevation of conduit, light fixtures, equipment, and appurtenances in such a manner that the finished installation is as indicated on drawings. In the event difficulties are encountered which prevent this, it is the Contractor's responsibility to bring this to the attention of the Architect prior to initiation of work. Correct improperly coordinated installation at no additional cost.

E. The Contractors' assistants shall include a competent electrical foreman, who shall be on the premises at all times to check, layout, coordinate and superintend the installation of work. The foreman shall establish basic requirements relative to the work before starting, and be responsible for the accuracy thereof.

1.9 SUBMITTALS

A. Manufacturers' and subcontractors' lists:

1. As specified in Division 01, submit a complete list of proposed manufacturers for equipment, materials and subcontractors used for the work of this division. Lists shall follow the sequence of the specifications. No considerations will be given for partial or incomplete lists. After review of lists, submit shop drawings and product data.

B. Shop drawings and product data:

1. Submit in accordance with the requirements of Division 01 or as established at the preconstruction conference, the required number of copies of Shop Drawings and Product Data for every item of equipment. Shop drawings or product data will not be considered until Manufacturers' Lists have been approved. Shop drawings and product data shall be submitted, as required by the General Conditions, with sufficient time for checking, return to Contractor, and resubmission as required before Contractor shall install any item.
2. Each item submitted shall be properly labeled, indicating the specific service for which the equipment or material is to be used, section and paragraph number of specification or drawing number to which it applies, Contractor's name and project name and number. Data submitted shall be specific and shall include product data and printed information in sufficient detail and scope to verify compliance with requirements of the contract documents. Clearly identify each item within the data. Data of a general nature will not be accepted. Each sheet must clearly show the project name and number.

3. The review of a shop drawing or product data shall not be considered as a guarantee of the measurements or building conditions or that the shop drawings or product data have been checked to see that item submitted properly fits the building conditions. This review shall not relieve the Contractor of the responsibility for furnishing material or performing work as required by the contract documents, for correctness of dimensions and quantities, or for proper coordination of details and interfaces among trades.
4. Exclusively electrical items furnished as items associated with mechanical items but not specifically described in the mechanical item submission, shall be submitted as a separate submittal but shall be clearly marked as associated with the mechanical item by identified specification paragraph.
5. Product data sheets shall be 8.5-inches by 11-inches cut sheets for operating and maintenance manual.

C. Submit results of every test required under any section in this division.

D. After the work is completed, submit required certificates of approval from approved inspection agencies and authorities having jurisdiction over work of this division. Certificates of approval must be received by the Architect prior to final acceptance of the work.

1.10 CONTRACT CLOSEOUT SUBMITTALS

A. Project record documents:

1. Maintain on site one set of the following record documents; record actual revisions to the work of this division:

   a. Contract Drawings.
   b. Specifications.
   c. Addenda.
   d. Change Orders and other Modifications to the Contract.
   e. Reviewed shop drawings, product data, and samples.

2. Maintain record documents separate from documents used for construction.
3. Record information concurrent with construction progress.
4. Specifications: Legibly mark and record in each section a description of actual products installed, including the following:

   a. Manufacturer's name and product model and number.
   b. Product options, substitutions, or alternates utilized.
   c. Changes made by addenda and modifications.

5. Record documents and shop drawings: Legibly mark each item to record actual construction, including:

   a. Measured locations of internal utilities and appurtenances concealed in construction, referenced to visible and accessible features of the work.
   b. Field changes of dimension and detail.
   c. Details not on original Contract Drawings.

6. Submit documents as specified in Division 01.

B. Operation and maintenance data:

1. Submit data prior to final inspection as specified in Division 01. In addition to requirements specified in Division 01, submit operating and maintenance manuals for the work of this division as specified below.
2. Prepare covers with printed title "OPERATION AND MAINTENANCE INSTRUCTIONS," and title of project.
3. Internally subdivide the contents with permanent page dividers, logically organized as described below.
4. Contents: Prepare a Table of Contents, with each product or system description identified.
5. Part 1: Directory, listing names, addresses, and telephone numbers of electrical engineers; contractor; electrical subcontractors; and major electrical equipment suppliers.
6. Part 2: Operation and maintenance instructions, arranged by specification section. For each category, identify names, addresses, and telephone numbers of subcontractors and suppliers. Identify the following:

    a. Significant design criteria.
    b. List of equipment.
    c. Parts list for each component, including recommended spare parts list.
    d. Operating instructions.
    e. Maintenance instructions for equipment and systems.
    f. Maintenance instructions for special finishes, including recommended cleaning methods and materials and special precautions identifying detrimental agents.

7. Part 3: Project documents and certificates, including the following:

    a. Shop drawings and product data.
    b. Photocopies of certificates.
    c. Photocopies of warranties, guarantees, and bonds.
    d. Test reports: Copies of the results of tests required under sections of specifications.

8. Submit data in final form 15 days prior to final inspection. This data will be returned after final inspection, with Engineer comments. Revise content of documents as required prior to final submittal.
9. Submit final revised data within ten days after final inspection.
10. Submit operation and maintenance data in electronic format.

1.11 REGULATORY REQUIREMENTS

A. When these specifications call for materials or construction of a better quality or larger sizes than required by the following codes and standards, the provisions of the specifications shall take precedence.

B. Provide, without extra charge, any additional materials and labor which may be required for compliance with these codes and standards even though the work is not mentioned in these specifications or shown on the contract drawings.

C. Perform the work of this division in strict accordance with the following authorities. The latest revision of these codes accepted by the authority having jurisdiction as of the date of the contract documents shall apply.

1. The electrical, building, fire, and safety codes of the state and county or city in which the work is being performed.
2. The National Electric Code, NFPA 70 (NEC).
3. The National Fire Protection Association Code (NFPA).
4. International Building Code (IBC).
5. International Energy Conservation, Fire, and Electrical Codes (ICC).

1.12 REFERENCE STANDARDS

A. Perform the work of this division using the standards of the following organizations, as referred to in technical sections, as a minimum requirement for construction and testing. Unless specified otherwise in Bidding and Contract Documents or Division 01, the latest revision current as of the date of the contract documents shall apply.

1. American National Standards Institute (ANSI)
2. American Society for Testing and Materials (ASTM)
3. International Code Council (ICC)
4. Institute of Electrical and Electronics Engineers (IEEE)
5. National Electrical Code (NEC) (NFPA 70)
6. National Electrical Manufacturer's Association (NEMA)
7. National Fire Protection Association (NFPA)
8. The Occupational Safety and Health Act (OSHA)
9. Underwriters Laboratory Inc. (UL)
10. American Association of State Highway and Transportation Officials (AASHTO)
11. American Society of Heating, Refrigerating, and Air Conditioning Engineers (ASHRAE)
12. Maryland Occupational Safety and Health Act (MOSHA)
13. Illuminating Engineering Society of North America (IESNA)

1.13 TEMPORARY STORAGE

A. Maintain upon premises, where directed, a storage area, and be responsible for contents within these areas. Provide security measures necessary for this area.

B. Area shall be maintained and shall be returned to original condition at the completion of the project.

C. Store electrical construction materials such as wire, raceways and boxes, devices, and equipment in buildings, enclosed trailers, or portable enclosed warehouses.

1. Materials and products subject to damage from moisture: Store in dry locations. If necessary, protect with protective wraps or covers.
2. Plastics and other materials and products subject to damage from heat or cold: Store at manufacturer's recommended temperatures.
3. Plastics and other materials and products subject to damage from sunlight: Protect from sunlight.

D. Electrical equipment such as motor controllers, panelboards and circuit breakers stored before installation and installed during construction: Provide clean, dry locations at manufacturer's recommended temperatures, and cover or wrap if required to protect from incidental damage.

1.14 PROTECTION

A. Control dust resulting from construction work to prevent its spread beyond the immediate work area, and to avoid creation of a nuisance.

1. Do not use water to control dust. Use drop cloths or other suitable barriers.
2. In areas where dirt or dust is produced as a result of the work, sweep daily, or more often as required.
3. Provide walk-off mats at entries and replace them at regular intervals.
4. Construct dust partitions, where indicated on the drawings or as required.
5. Protect areas occupied by Owner's personnel or equipment.
6. Seal off return air registers and other mechanical systems to prevent dust from entering.

B. Each trade and subcontractor is responsible for preventing damage and soiling of work performed by other trades or subcontractors. Each trade and subcontractor is responsible for providing temporary protection of its own work.

1. Protect work from spills, splatters, drippings, adhesives, bitumens, mortars, paints, plasters, and damage from welding or burning.
2. Protect finished work from damage, defacement, staining, or scratching.
3. Protect finishes from cleaning agents, or grinding and finishing equipment.
4. Protect adjacent and finished work from damage, using tape, masking, covers or coatings and protective enclosures.
5. Coordinate installations and temporarily remove items to avoid damage from finishing work.

C. Repair damage or soiling to the complete satisfaction of the Architect; replace any materials or work damaged to such an extent that they cannot be restored to their original condition, at no addition to the Contract sum.

D. Protect work stored in place and supplies stored in the building.

1. Store materials and products, subject to damage from moisture, in dry locations. If necessary, protect in wraps or covers.
2. Store plastics, other materials, and products subject to damage from heat or cold at manufacturer's recommended temperatures.

E. Protect electrical materials and products from weather events and accidents of construction.

F. Use of sidewalk or roadway areas outside of the property lines shall be with permission and approval of the local authorities having jurisdiction.

1.15 FIRE PROTECTION

A. As a minimum, provide hand-carried, portable, UL-rated extinguishers with each work crew working inside the building.

B. Select extinguishers in accordance with NFPA 10 and NFPA 241 for classification, extinguishing agent, and size required by location and class of fire exposure.

1.16 PROJECT CONDITIONS

A. Drawings showing utilities in concealed locations are based on the best information available but are not represented as being precisely correct. Work of the contract includes digging, cutting, drilling, using nondestructive methods, and other methods of locating concealed utilities in the field, as well as patching and repairing as specified in "Cutting and Patching" below.

B. If, in the course of the work, workers encounter a material they suspect to present some hazard:

1. Promptly notify the Owner and Architect in writing.
2. Do not perform any work which would disturb the suspected material until written instructions have been received.

1.17 WARRANTY

A. Work and equipment provided as work of this division shall be fully warranted under the general project warranty. In addition, provide added special warranties as specified in individual sections.

B. During the correction period, the Contractor shall begin correcting any work found to be not in accordance with the requirements of the Contract Documents within 4-hours of receiving written notice from the Owner. Provide detailed schedule for completion of work within 24-hours of receiving written notice from the Owner and revise schedule based on any Owner comments generated. Except as otherwise required in General Conditions and Division 01, the correction period is two years after the date of substantial completion of the work. Work requiring correction shall promptly be repaired or completely replaced at no addition to the Contract Sum.

1. Service reports for warranty work shall be provided to the Owner.

C. When use of the permanent equipment has been permitted for temporary services during construction of the building, the warranty and correction periods shall nevertheless begin at the time of substantial completion, unless another date of acceptance has been agreed to by the Owner.

D. Special warranties are warranties required by individual specification sections, incidental product warranties, manufacturers' standard warranties, installer or subcontractor service agreements, and other individual warranties in addition to the general project warranty.

E. Provide copies of warranties as required for Operation and Maintenance Manual specified above, and by Division 01.

F. For items of work delayed beyond date of substantial completion, provide updated submittal within ten days after acceptance, listing date of acceptance as start of warranty period.

PART 2 - PRODUCTS

NOT USED

PART 3 - EXECUTION

3.1 CUTTING AND PATCHING

A. General: Employ skilled workers to perform cutting and patching. Proceed with cutting and patching at the earliest feasible time, and complete without delay.

B. Cut walls, floors, partitions, roofs, and other appurtenances for the passage or accommodation of conduits. Close superfluous openings and remove debris caused by work of this division.

C. No cutting of any structure or finish shall be done until the condition requiring such cutting has been examined and approved by the Architect.

D. New or existing surfaces disturbed as a result of such cutting or otherwise damaged shall be restored to match original work and materials used for any patching or mending shall conform to the class of materials originally installed.

E. Refinish surfaces to match adjacent finish. For continuous surfaces, refinish to nearest intersection or natural break. For an assembly, refinish entire unit.

3.2 TEMPORARY FACILITIES

A. Temporary water facilities, electricity, telephone, toilet facilities, and temporary heat, shall be provided as specified in Division 01.

3.3 PROGRESS MEETINGS

A. Progress meetings shall be held as specified in Division 01, and also when and if the Contractor or Architect finds them necessary or advantageous to progress of work.

B. Contractor, those subcontractors and those material suppliers concerned with current progress or with the scheduling of future progress, Architect and Owner shall each be represented at these meetings by persons familiar with the details of work and authorized to conclude matters relating to work progress.

- END OF SECTION 26 01 01 -

SECTION 26 05 00
COMMON WORK RESULTS FOR ELECTRICAL

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Requirements applicable to work of more than one section of Division 26.

B. Basic materials and equipment required for electrical work.

C. Date sensitive equipment.

D. Operating instructions.

E. Testing wiring systems.

1.2 RELATED SECTIONS

A. Project and special warranties: Division 01 and Section 26 01 01.

B. Operation and Maintenance Manuals: Division 01 and Section 26 01 01.

C. Painting: Division 09.

1.3 DEFINITIONS

A. Project correction period: A period after Substantial Completion of the work during which the Contractor shall correct every part of the work found to be not in accordance with the requirements of the contract documents, promptly after receipt of written notice.

B. Qualified testing agency: 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.

1.4 DESIGN REQUIREMENTS

A. The drawings and system performances have been designed on the basis of using the particular manufacturers' products specified and scheduled on the drawings.
B. Products of other manufacturers that are listed under the article "Acceptable Manufacturers," or permitted as "equal," are permitted provided:

1. Product shall meet the specifications.

2. Contractor shall make, without addition to the contract sum, all adjustments for deviations so that the final installation is complete and functions as the design basis product is intended.

C. Do not propose products with dimensions or other characteristics different from the design basis product that make their use impractical or cause functional fit, access, or connection problems.

1.5 SUBMITTALS

A. Test reports: Show that tests specified in Part 3 below demonstrate the specified results.

1.6 QUALITY ASSURANCE

A. Provide materials and perform work in accordance with the electrical, building, fire, and safety codes and regulations of the state, county, or city in which the work is performed.

B. Electrical control panels, equipment, materials, and devices provided or installed as work of Division 26 and Section 28 31 00 shall bear UL label, or, if UL label is not available, the item shall be tested and labeled by a qualified testing agency, acceptable to authorities having jurisdiction, and in accordance with NFPA 70. Provide testing, if required, without addition to the contract sum.

PART 2 - PRODUCTS

2.1 GENERAL

A. Techniques, testing, and operating instructions specified in this section apply to products specified in other sections of Division 26 and Section 28 31 00.

B. Equipment that uses or processes date and time data to perform its function shall be warranted by the manufacturer to properly function and correctly use or process all time-related data for all dates and times which occur during a reasonable life expectancy of the equipment.

2.2 MATERIALS

A. Electrical equipment backing panels: Plywood, DOC PS 1, Exposure 1, C-D Plugged, fire-retardant treated in accordance with AWPA C27, in thickness indicated, not less than 0.5 inches nominal.

1. One side finished.

B. Wood-preservative-treated lumber: Treated by pressure process, AWPA C2, with chemicals acceptable to authorities having jurisdiction, and marked with treatment quality mark of an inspection agency approved by the ALSC Board of Review.

1. Application: Treat items indicated on the drawings, and the following:

a. Wood cants, nailers, curbs, equipment support bases, blocking, stripping, and similar members in connection with roofing, flashing, vapor barriers, or waterproofing.

b. Wood sills, sleepers, blocking, and similar concealed members in contact with masonry or concrete.
c. Wood framing and furring attached directly to the interior of below-grade exterior masonry or concrete walls.
d. Wood framing members that are less than 18 inches above the ground in crawlspaces or unexcavated areas.
e. Wood floor plates that are installed over concrete slabs-on-grade.

C. Aircraft cable: 0.25-inch steel wire rope, galvanized, construction 7 by 19 strands, minimum 7000 pounds breaking strength.

2.3 DATE-SENSITIVE EQUIPMENT

A. Date-sensitive equipment: Systems, equipment, or components which use or process date and time data to perform their functions.

B. Each item of date-sensitive equipment used in the project shall be warranted by the manufacturer to properly function and correctly use or process all time-related data for all dates and times which occur during a reasonable life expectancy of the equipment.

PART 3 - EXECUTION

3.1 GENERAL

A. Manufacturers' instructions: Except as modified by drawings or specifications, install products and equipment in accordance with manufacturers' instructions and recommendations applicable to the project conditions.

1. Immediately notify Architect if a difference or discrepancy is found between manufacturers' instructions and the drawings or specifications.

B. The contract drawings are diagrammatic, and do not indicate all fittings or offsets in conduit or all pull boxes, access panels, or other specialties required. Provide required fittings, offsets, access panels, and specialties to coordinate the work.

C. No conduit shall be run below the head of a window or door.

D. Equipment and conduits installed in areas without a suspended ceiling shall be as tight to structure as possible, but at least above a height of 6'-8", unless otherwise noted.

E. Items which require access for operation or maintenance shall be easily accessible. Do not cut or form hand holes for operation or maintenance of appliances through walls or ceilings.

3.2 INSTALLATION OF PRODUCTS AND EQUIPMENT

A. Install conduit exposed to view parallel with the lines of the building and as close to walls, columns, and ceilings as may be practical, maintaining adequate clearance for access at parts requiring servicing.

B. Install conduit a sufficient distance from other work to permit a clearance of not less than 0.5 inches between its finished covering and adjacent work.

C. Pull boxes and other appurtenances which require operation or maintenance shall be easily accessible. Do not cut or form handholes for operation or maintenance of appliances through walls or ceilings.

D. Install plywood backing panels with finished face exposed.

3.3 OPERATING INSTRUCTIONS (DEMONSTRATION)

A. Furnish the necessary technicians, skilled workers, and helpers to operate the electrical systems and equipment of the entire project for one 8-hour day.

B. Where specified in technical sections, provide longer periods required for specialized equipment.

C. Instruct the Owner or designated personnel in operation, maintenance, lubrication, and adjustment of systems and equipment.

1. Instructions by manufacturer's technical representative for each type of equipment shall include the performance of the recommended preventive maintenance procedures for that equipment.

D. The Operating and Maintenance Manual shall be available at the time of the instructions for use by instructors and Owner personnel.

E. Schedule the general and specialized instruction periods for a time agreed upon by the Owner and Architect.

3.4 TESTS

A. During the progress of the work and after completion, test the branch circuits and distribution system, and the low-voltage alarm and signal systems.

B. Results of the tests shall show that the wiring meets the requirements of this specification. Should any test indicate defect in materials or workmanship, immediately repair, or replace with new, the faulty installation, and retest the affected portions of the work.

C. Furnish equipment and instruments necessary for testing.

D. Tests shall demonstrate the following:

1. Lighting, power, and control circuits are continuous and free from short circuits.
2. Circuits are free from unspecified grounds.
3. The resistance to ground of each non-grounded circuit is not less than one megohm.
4. Circuits are properly connected in accordance with the applicable wiring diagrams.
5. Circuits are operable. Demonstration shall include functioning of each control not less than ten times, and continuous operation of each lighting and power circuit for not less than 0.5 hours.

E. Test circuit breakers larger than 100 amps at full voltage.

F. Make voltage built-up tests with a voltage sufficient to determine that no short circuits exist.

G. Immediately repair defects and retest until systems are operating correctly.

H. Submit test reports.

- END OF SECTION 26 05 00 -

SECTION 26 05 04
ELECTRICAL DEMOLITION

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Extent and location of demolition are shown on the drawings.

1.2 RELATED SECTIONS

A. Demolition: Division 02.

1.3 QUALITY ASSURANCE

A. Demolition shall be carried out as expeditiously as possible, in accordance with accepted practice and applicable building code provisions.

1.4 PROJECT CONDITIONS

A. If, in the course of the work, workers unexpectedly encounter a material not identified for special removal but which they suspect to be asbestos, to contain lead or PCBs, or to present some other hazard:

1. Promptly notify the Owner and Architect in writing.
2. Do not perform any work which would disturb the suspected material until written instructions have been received.

B. Protect adjacent materials indicated to remain. Install and maintain dust and noise barriers to keep dirt, dust, and noise from being transmitted to adjacent areas. Remove protection and barriers after demolition operations are complete.

C. Locate, identify, and protect mechanical and electrical services passing through demolition area and serving other areas outside the demolition limits. Maintain services to areas outside demolition limits. When services must be interrupted, install temporary services for affected areas.

PART 2 - PRODUCTS

NOT USED

PART 3 - EXECUTION

3.1 PREPARATION

A. Protect existing building and equipment that is to remain, particularly to prevent entry of either dust or water. Ensure weathertightness at all times. Keep materials on hand to patch and maintain protection.

3.2 DEMOLITION

A. Comply with demolition and disposal requirements of Division 02.

B. Perform removal work neatly with the least possible disturbance to the building.

C. Provide temporary barriers, danger signals, and appurtenances for protection of personnel and equipment during removal operations.

D. Demolish, remove, demount, and disconnect inactive and obsolete conduit, fittings and specialties, equipment, and fixtures.

1. Conduit and ducts embedded in floors, walls, and ceilings may be abandoned in place if they do not interfere with new installations. Cut back to at least one inch below finished surface.
2. Remove materials above accessible ceilings.
3. Disconnect and cap items to remain behind finished surfaces.
4. Patch and repair surface materials as required in Division 01 and Section 26 01 01 article, “Cutting and Patching.”

E. Remove the anchors, bolts, and fasteners associated with conduit and equipment to be removed.

3.3 DISPOSAL

A. Dispose of equipment and materials removed, and rubbish and waste material, as work progresses. Do not allow demolition debris to accumulate on site. Remove products of demolition from the building daily.

- END OF SECTION 26 05 04 -

SECTION 26 05 07
FIRESTOPPING FOR ELECTRICAL WORK

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Through-penetration firestopping in fire-rated construction.

B. Through-penetration smoke-stopping in smoke partitions.

1.2 RELATED SECTIONS

A. Conduit: Section 26 05 33.

1.3 REFERENCES

A. Underwriters Laboratories

1. UL Fire Resistance Directory
2. UL 1479: Through Penetration Firestops.

B. American Society for Testing and Materials Standards:

1. ASTM E 814: Standard Test Method for Fire Tests of Through-Penetration Firestops.

1.4 DEFINITIONS

A. Assembly: Particular arrangement of materials specific to given type of construction described in referenced documents.

B. Barriers: Time-rated fire walls, smoke barrier walls, time-rated ceiling/floor assemblies and structural floors.

C. Firestopping: Methods and materials applied in penetrations and unprotected openings to limit spread of heat, fire, gasses and smoke.

D. Penetration: Opening or foreign materials passing through or into barrier or structural floor such that full thickness of rated materials is not obtained.

E. System: Specific products and applications, classified and numbered by the rating agency to close specific barrier penetrations.

1.5 SYSTEM DESCRIPTION

A. Design requirements:

1. Fire-rated construction: Maintain barrier and structural floor fire resistant ratings including resistance to cold smoke at all penetrations.
2. Smoke barrier construction: Maintain barrier and structural floor resistance to cold smoke at all penetrations.

1.6 SUBMITTALS

A. Product data: Manufacturer's specifications and technical data including the following:

1. Detailed specification of construction and fabrication.
2. Manufacturer's installation instructions.

B. Shop drawings: Submit firestop assemblies and devices for all openings and through penetrations in fire-rated construction. Indicate dimensions, description of materials and finishes, general construction, specific modifications, component connections, anchorage methods, hardware, and installation procedures, plus the following specific requirements.

1. Details of each proposed assembly identifying intended products and applicable rating agency classification.
2. Manufacturer or manufacturer's representative shall provide qualified engineering judgments and drawings relating to conditions where rated assemblies do not exist.

C. Certifications: Letters or forms showing acceptance by local authorities for systems without acceptance by a rating agency.

1.7 QUALITY ASSURANCE

A. Products and assemblies shall be tested and labeled by an independent, nationally recognized testing and labeling authority.

B. Local and state regulatory requirements: Obtain acceptance for proposed assemblies not conforming to specific rating agency classifications or rated assemblies.

C. Materials shall have been tested to provide fire rating at least equal to that of the construction in which they are to be installed.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Packing and shipping:

1. Deliver products in original unopened packaging with legible manufacturer's identification.
2. Coordinate delivery with scheduled installation date, allow minimum storage at site.

B. Storage and protection: Store materials in a clean, dry, ventilated location. Protect from soiling, abuse, moisture and freezing when required. Follow manufacturer's instructions.

1.9 PROJECT CONDITIONS

A. Existing conditions:

1. Verify existing conditions and substrates before starting work. Correct unsatisfactory conditions before proceeding.
2. Proceed with installation only after penetrations of the substrate and supporting brackets have been installed.

B. Environmental requirements:

1. Furnish adequate ventilation if using solvent.
2. Furnish forced-air ventilation during installation if required by manufacturer.
3. Keep flammable materials away from sparks or flame.
4. Provide masking and drop cloths to prevent contamination of adjacent surfaces by firestopping materials.
5. Comply with manufacturing recommendations for temperature and humidity conditions before, during and after installation of firestopping.

1.10 WARRANTY

A. General project warranty and correction period, as required in general conditions and Division 01, requires repair or replacement of materials or systems which fail in joint adhesion, co-adhesion, abrasion resistance, weather resistance, extrusion resistance, migration resistance, stain resistance, or general durability or appear to deteriorate in any other manner not clearly specified by submitted manufacturer's data as an inherent quality of the material for the exposure indicated.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Acceptable manufacturers and products: Those listed in the UL Fire Resistance Directory for the UL System involved, or rated for the application by Warnock Hersey or by another acceptable rating agency.

2.2 THROUGH-PENETRATION FIRESTOPPING OF FIRE-RATED CONSTRUCTION

A. Systems or devices listed and labeled by a rating agency, and conforming to the construction type, penetrant type, annular space requirements and fire rating involved in each separate instance. The system shall be symmetrical for wall applications. Systems or devices shall be asbestos-free.

1. Additional requirements: Firestopping shall withstand the passage of cold smoke either as an inherent property of the system, or by the use of a separate product included as a part of the rated system or device, and designed to perform this function.
2. Additional requirements: Firestopping sealants shall be red in color to facilitate field verification of firestopping application.

2.3 SMOKE-STOPPING AT SMOKE PARTITIONS

A. Through-penetration smoke-stopping: Any system complying with the requirements for through-penetration firestopping in fire-rated construction is acceptable, provided that the system includes the specified smoke seal or will provide a smoke seal. The length of time of the fire resistance may be disregarded.

2.4 ACCESSORIES

A. Fill, void or cavity materials and forming materials: Classified for firestopping use, or included in a rated firestopping assembly, by a rating agency.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verification of conditions: Examine areas and conditions under which work is to be performed and identify conditions detrimental to proper or timely completion.

1. Verify barrier penetrations are properly sized and in suitable condition for application of materials.
2. Do not proceed until unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Clean surfaces to be in contact with penetration seal materials, of dirt, grease, oil, loose materials, rust, or other substances that may affect proper fitting, adhesion, or the required fire resistance.

3.3 INSTALLATION

A. Provide firestop devices or assemblies for every opening and penetration in floors or fire-rated construction.

B. Install penetration seal materials in accordance with printed instructions of the rating agency and in accordance with manufacturer's instruction.

C. Ensure an effective smoke barrier in each sealed penetration. Install smoke stopping as specified for firestopping.

D. Protect materials from damage on surfaces subject to traffic.

E. Where large openings are created in walls or floors to permit installation of conduits, cables, or other items, close unused portions of opening with firestopping material tested for the application.

3.4 FIELD QUALITY CONTROL

A. Examine penetration seals to ensure proper installation before concealing or enclosing them.

B. Keep areas of work accessible until inspection and acceptance by applicable authorities.

C. Before substantial completion, patch and repair firestopping cut or penetrated by other construction work.

3.5 ADJUSTING AND CLEANING

A. Clean up spills of liquid components.

B. Neatly cut and trim materials as required.

C. Remove equipment, materials and debris, leaving area in undamaged, clean condition.

- END OF SECTION 26 05 07 -

SECTION 26 05 19
WIRES AND CABLES

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Wires and cables rated 600 volts and less.

B. Type MC as permitted in Part 3.

C. Type AC and Type NM cables are not permitted.

1.2 RELATED SECTIONS

A. Conduits: Section 26 05 33.

B. Surface metal raceways: Section 26 05 35.

C. Lighting: Section 26 51 00.

1.3 REFERENCES

A. ANSI/NEMA WC 70: Power Cables rated 2000 Volts or Less for Distribution of Electrical Energy.

B. ASTM B3: Standard Specification for Soft or Annealed Copper Wire.

C. ASTM B8: Standard Specification for Concentric-Lay-Stranded Copper Conductors.

D. UL 44: Standard for Thermoset-Insulated Wires and Cables.

E. UL 83: Standard for Thermoplastic-Insulated Wires and Cables.

F. Additional UL Standards as indicated.

1.4 SUBMITTALS

A. Product data:

1. Each type of wire and cable, including accessories.
2. Include copies of UL certifications showing compliance with requirements in "Quality Assurance" below.

1.5 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. Products and installation shall comply with NFPA 70 and other applicable national, state, and local electrical codes.

1.6 DELIVERY, STORAGE, AND HANDLING

A. General requirements: Deliver, store, and handle wire and cable in accordance with the manufacturer's instructions.

1. Wire and cable shall be packaged in a manner that protects them during ordinary handling and shipping. Ship from manufacturer with ends temporarily sealed against moisture.
2. Protect wire and cable during storage (both onsite and offsite).

    a. Store in a clean and dry location. Elevate from surfaces where water can accumulate, and cover cable rolls to protect against weather.

3. Handle wire and cable as recommended by the manufacturer. Do not pull from the center or periphery of the cable reel.
4. Damaged wire and cable shall be removed from the project site.

PART 2 - PRODUCTS

2.1 COPPER BUILDING WIRE (600 volts maximum)

A. Conductors: UL listed and NEMA WC 70 compliant; Copper, 98 percent conductivity, suitable for 600-volt duty; rated 90-degree Celsius temperature for wet/dry applications; solid bare annealed copper for No. 10 and smaller complying with ASTM B 3, and stranded for No. 8 and larger complying with ASTM B 8.

B. Conductor insulation:

1. Type THHN / THWN-2: Comply with UL 83; PVC insulation, nylon jacket.

C. Conductor identification: Markings along outer braid denoting conductor size, voltage classification, type of insulation, and manufacturer's trade name, and color code. Identification shall extend to branch circuits and outlets. Use the color coding system tabulated below throughout the building's network of feeders and circuits, unless otherwise required by the authority having jurisdiction.

1. Colors on conductors No. 10 and smaller, or No. 6 and smaller for grounded and grounding conductors: Solid colored insulation.
2. Colors on conductors No. 8 and larger, or No. 4 and larger grounded and grounding conductors: Colored tape wrapped a minimum of 6 inches (150 mm) on either end of conductor.

COLOR CODE (600 volts maximum)				
VOLTAGE	NEUTRAL	PHASE		
		A	B	C
120 volts, 2-wire	White	Black, Red, or Blue depending on phase		
277 volts, 2-wire	Gray	Brown, Orange, or Yellow depending on phase		
208 volts, single-phase, 2-wire		Black/Red, Red/Blue, or Blue/Black		
208/120 volts wye, 3-phase, 4-wire	White	Black	Red	Blue
480/277 volts wye, 3-phase, 4-wire	Gray	Brown	Orange	Yellow
480 volts delta, 3-phase, 3-wire		Brown	Orange	Yellow

D. Wires used solely for grounding purposes shall be green, where insulated.

E. Control wiring shall be coded with colors different from those used to designate phase wires.

2.2 WIRING ACCESSORIES

A. Factory-fabricated connectors and splices of size, ampacity rating, material, type, and class for application and service where installed.

B. Twist-on wire connectors (dry locations):

1. Color-keyed.
2. Basis of design: Ideal Industries, Inc., Wingnut®, 3M Company "Scotchlok", or King Innovation.

C. Twist-on wire connectors (damp and wet locations):

1. Connectors shall be listed under UL 486D.
2. Basis of design: Ideal Industries, Inc., UnderGround®, models 60, 64, or 66 as appropriate; King Innovation DryConn®; or 3M Company.

D. Compression connectors:

1. Color-keyed.
2. Basis of design: 3M Company "Scotchlok"™ compressor connectors, "10000" series for copper conductors, "20000" series for aluminum conductors, or Thomas & Betts (Blackburn) or Ilsco.

E. Compression connectors (damp and wet locations):

1. Protect connectors with a waterproof system, UL-listed for direct burial and 600 volts.
2. Basis of design: 3M Company 8420 series, Thomas & Betts Model DBSK82, or Ilsco.

F. Compression taps:

1. Series CT-2 tap with CT-2C cover, or Series 54710 color-keyed compression taps,
2. Basis of design: Burndy Corporation "Versitap" or OZ/Gedney.

G. Power distribution blocks:

1. Basis of design: Hubbell Burndy “U-Blok.”

H. Multi-tap connectors, clear insulated:

1. Basis of design: Burndy Corporation "UNITAP" or Ilsco "Cleartap".

2.3 ALUMINUM CONDUCTORS

A. Aluminum conductors:

1. UL 44 listed and NEMA WC 70 compliant; suitable for 600-volt duty; rated 90-degree Celsius temperature for wet/dry applications; complying with ASTM B800 and ASTM B801. Compact, stranded Aluminum Association 8000 Series electrical conductor alloy material.
2. Sizes No. 2 through 750 kcmil only.
3. Basis of design: Alcan Cable "Stabiloy."

B. Conductor insulation: Type THHN / THWN-2: Comply with UL 83; PVC insulation, nylon jacket.

C. Connectors: Compression type.

1. UL 486B, AL7CU or AL9CU.
2. Lugs: Aluminum, tin electroplated, high conductivity, marked with wire size, die index, color code, and proper number and location of crimps.

   a. Barrels: Factory-filled with oxide-inhibiting compound.

3. Connection to bus bar: Apply UL-listed lubricant to hardware and surfaces before tightening.

   a. Aluminum bus bar. Two-hole compression lug and aluminum hardware.
   b. Copper bus bar: Two-hole compression lug, plated steel hardware, and Belleville spring washer.

4. Connection to mechanical lugs and equipment not suited for aluminum conductor termination: Aluminum compression lug with stranded copper wire pigtail, equipment lug compression body with insulating cover.

D. Termination hardware:

1. Bolts: Anodized alloy 2023-T4 and conforming to ANSI B18.2.1 and ASTM B 211 or B 221 chemical and mechanical property limits.
2. Nuts: Alloy 6061-T6 or 6262-T9 and ANSI B18.2.2.
3. Washers: Flat, alloy Alclad 2024-T4, Type A plain, standard wide series, ANSI B27.2.
4. Belleville spring washers: Conical; hardened steel, cadmium-plated, or silicon bronze.

2.4 METAL-CLAD CABLE, TYPE MC

A. Cable: UL 83 and UL 1569 listed; 600-volt, single- or multi-circuit Type MC Cable, multi-conductor with ground conductor; aluminum or steel interlocked armor.

B. Conductors: Solid copper No. 10 and smaller, and stranded copper No. 8 and larger; conforming to ASTM B 3 or B 8.

C. Conductor Insulation: Type THHN/THWN insulated single conductors including ground conductor.

D. Fittings:

1. UL 514B listed, steel or malleable iron fittings. Zinc die-cast fittings shall not be acceptable.
2. Basis of design: KonKore/Atkore International.

PART 3 - EXECUTION

3.1 VERIFICATION OF CONDITIONS

A. Where aluminum conductors are proposed for feeders to equipment, verify with the manufacturer of the approved equipment, before beginning feeder installation, that aluminum wiring is compatible. Where aluminum is not compatible with equipment, provide copper wiring.

3.2 INSTALLATION, GENERAL

A. Provide wire and cable indicated in accordance with national, state, and local electrical codes.

B. Conceal wire and cable in new construction and in locations with finished walls, ceilings, and floors unless otherwise noted on drawings.

C. Wire and cable serving systems over 100 volts shall be installed in raceways, except where otherwise noted on drawings.

D. Wire and cable serving systems rated below 100 volts shall be installed in raceways, except where otherwise noted in individual specification sections. Refer to paragraph "INSTALLING CABLE RATED BELOW 100 VOLTS" below for additional information.

3.3 INSTALLING INTERIOR WIRING

A. Sizes: Minimum sizes shall be as follows, unless a larger size is indicated on the drawings.

1. 120-volt branch circuits:

a. Homerun from first outlet to panel: No. 12 when run is 50 feet or less; No. 10 when run is between 50 feet and 100 feet; No. 8 when run is more than 100 feet.
b. First outlet to other outlets: No. 12.

2. Exit light and emergency lighting circuits: No. 10. Do not install in raceways, outlet boxes, or other locations with non-emergency wiring systems.
3. Other systems (over 100-volts): Minimum No. 12 unless specified or shown on drawings to be smaller.

B. Wiring methods and locations: Wires and cables shall be installed based on the following requirements, unless otherwise noted.

1. Feeders, Type THHN / THWN-2, single conductors in raceway.
2. Branch circuits:

   a. Unless otherwise indicated, utilize Type THHN / THWN-2, single conductors in raceway.
   b. Metal-clad cable, Type MC cable - Refer to section "INSTALLING MC CABLE" below for acceptable locations.

3. All other applications: Provide Type THHN / THWN-2, single conductors in raceway or wire and cable type as indicated.

C. Splicing shall be done in outlet boxes and junction boxes and not in conduit.

1. Conductors No. 8 and larger: Terminated, spliced and taped, wherever practical, with compression connectors or solderless connectors. Use tools recommended by the manufacturer.
2. Splices in conductors No. 10 and smaller, including lighting fixtures: Made with wire connectors.
3. Taps in conductors No. 6 and larger: Made with compression taps or power distribution blocks.

D. Wiring in high ambient temperature areas shall be of types required by NFPA 70 including on rooftops.

E. Wires shall be neatly shaped in panels, wireways, boxes, and appurtenances.

3.4 COORDINATION WITH DEVICES AND EQUIPMENT

A. Where conductor size or parallel conductors shown on drawings connect to terminals on devices or equipment which is not sized for the connection:

1. Provide a junction box as near the equipment as possible, but no more than 10 feet (3 m) away. Obtain approval of location before installing.
2. Provide conductor(s) sized to the ampacity of the equipment, from equipment to junction box.
3. In the junction box, splice the conductors from the equipment to the conductors of sizes, or parallel conductors, shown on the drawings.

3.5 INSTALLING EXTERIOR WIRING

A. Sizes: Minimum sizes shall be as follows, unless a larger size is indicated on the drawings.

1. 600-volt branch circuits: Copper, No. 10 minimum.

B. Wiring methods and locations: Wires and cables shall be installed based on the following requirements, unless otherwise noted.

1. Feeders and branch circuits: Type THHN / THWN-2, single conductors in raceway.

C. Splicing shall be done in outlet boxes and junction boxes and not in conduit. Treat these boxes as wet locations.

1. Conductors No. 8 and larger: Terminated, spliced and taped, wherever practical, with compression connectors. Use tools recommended by the manufacturer.
2. Splices in conductors No. 10 and smaller, including lighting fixtures: Made with wire connectors.
3. Taps in conductors No. 6 and larger: Made with compression taps or power distribution blocks.

3.6 INSTALLING ALUMINUM CONDUCTORS

A. Feeder sizes and associated conduit sizes shown on the drawings are based on the use of copper conductors. Where aluminum conductors are used, increase the size of conductors and conduits to provide the same ampacity as the specified copper conductors.

B. Do not install aluminum conductors where verification of conditions proves conductors are not compatible with equipment.

3.7 INSTALLING CABLE RATED BELOW 100 VOLTS

A. Install in raceway, unless otherwise indicated in individual specification sections.

B. Where individual specification sections allow cable to be installed either in raceway or on J-hooks, install as follows:

1. Wiring method:

a. Wiring in walls, above inaccessible ceilings, where exposed in finished spaces, exposed on walls, and wherever it may not be accessible or may be subject to physical damage: Install cables in raceway.
b. Wiring exposed in ceilings of unfinished spaces: Install cables in raceway.
c. Wiring concealed above accessible suspended ceilings: Install cables on J-hooks.
d. Wiring in ceiling spaces of communications equipment rooms: Install cables on cable trays or J-hooks.
e. Wiring within enclosures, consoles, cabinets, desks, and counters: Bundle, lace, and train cables to terminal points with no excess and without exceeding manufacturer's limitations on bending radii. Provide and use lacing bars and/or distribution spools.

2. Conceal raceway and cables, except in unfinished spaces, in open ceiling spaces, and raceways on existing walls.
3. Cable not in raceways:

a. Do not install in hangers used for pipes, electric conduits, or ceiling hangers, nor support it in any way by attachments to pipes, conduits, or ceiling hangers.

b. Install without damaging conductors, shield, or jacket. Cables shall not run through structural members or be in contact with pipes, ducts, or other potentially damaging items.
c. Install away from potential EMI sources, including electrical power lines and equipment.
d. Install parallel and perpendicular to surfaces or exposed structural members and follow surface contours where possible.

4. Cable support with J-hooks:

a. Install J-hooks at intervals not exceeding 60 inches.
b. Secure cables on J-hooks with cable ties. Avoid cinching cables.

5. Each cable run shall contain an 'S' loop or other means to accommodate expansion or contraction.
6. Where ceiling plenums are used for passage of air by heating and air conditioning system, install cable in conduit or use UL listed plenum cable.

C. For cable installed in conduit, comply with requirements for raceways and boxes specified in Section 26 05 33, Conduits, and Section 26 05 34, Boxes.

1. Provide separate conduit systems for each low-voltage system.
2. Pull cables without exceeding cable manufacturer's recommended pulling tensions.

a. Pull cables simultaneously if more than one is being installed in same raceway.
b. Use pulling compound or lubricant, if necessary. Use compounds that will not damage conductor or insulation.
c. Use pulling means, including fish tape, cable, rope, and basket-weave wire or cable grips, that will not damage cables or raceway.

D. Avoid installing near hot utilities, which might adversely affect system performance or result in damage to the cable. If cable must be placed close to such utilities, keep it separate and protect with insulation.

E. Cable bends shall have a radius not less than the value recommended by the cable manufacturer.

F. Tag cables connected to electronic equipment, to show function and the location of other end. Securely fasten labels to the cable.

3.8 INSTALLING MC CABLE

A. Install in compliance with NFPA 70.

1. Bend radius shall not be less than 7 times the external diameter of the cable.
2. Securely fasten in place at intervals of not more than six feet, with suitable clamps or fasteners of approved type.
3. Maintain at least 6-inch clearance between MC cables and other piping systems.
4. Do not fasten MC cable to conduits, pipes, or ducts.
5. Support individual MC cables hung from roof structure or structural ceiling by independently supported hangers using hanger rods, jack chains, or No. 10 wire.

6. Support groups of MC cable run in parallel on trapeze hangers suspended from 0.5-inch hanger rods, held in place with MC cable clamps or fasteners.
7. Installing hangers for MC cable shall be similar to installing conduit hangers.
8. Support MC cable on each side of a bend and not more than 1 foot from an enclosure where an MC cable is terminated.

B. Sizes: Cables larger than No. 8 shall not be permitted.

C. Locations: Type MC cable may be used for branch circuits in the following locations and conditions, unless otherwise indicated:

1. Concealed in accessible ceiling spaces or within casework.
2. Light fixture whips from junction box in accessible ceiling to recess-mounted lighting fixtures. Whips shall not exceed 20 feet in length.
3. Do not use between ceiling junction boxes and homeruns back to panelboard. Homeruns shall be wire in raceway.
4. Do not install in masonry partitions or masonry walls.

D. Connect cable with wiring accessories specified above.

E. Install in lengths no longer than 20 feet, terminating at junction box or outlet box at each end.

- END OF SECTION 26 05 19 -

SECTION 26 05 21
WIRING CONNECTIONS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Power and control wiring for equipment.

1.2 RELATED SECTIONS

A. Equipment: Installed items requiring electricity, specified in other sections or shown on drawings.

B. Motors: Motors requirements for HVAC equipment: Section 23 05 13.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Conduits, wires and cables, devices, and accessories as specified in other sections.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Provide power wiring from the motor starters to each motor and its manual controlling device.

1. Make flexible or liquid tight connections as specified in Section 26 05 33, Conduits.

B. Rough in and connect to equipment furnished under other sections. Make connections as indicated on drawings with exact locations and details determined by approved shop drawings of the equipment.

1. Under equipment sections, equipment will be set in position and the electrical devices and components furnished loose. Assemble, install, and wire under this section.
2. Accomplish rough-in from walls with flush outlet boxes and from floors by means of conduit couplings finishing flush with finished floor.

C. Certain equipment, as indicated, will be furnished with control panels and auxiliary control components. Mount the panels, provide source wiring and disconnects, and completely connect controls and motors.

D. Provide source wiring, connections, and disconnects for mechanical heating, ventilating, and air-conditioning (HVAC) equipment specified in Division 23. Refer to sections of Division 23 for equipment and controls.

1. Provide weathertight enclosures for disconnects for outdoor equipment.

E. Where a Division 23 section requires installation of equipment under supervision of equipment manufacturer's representative, coordinate electrical installation to cooperate with representative's requirements.

- END OF SECTION 26 05 21 -

SECTION 26 05 26
GROUNDING AND BONDING

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Grounding and bonding electrical systems and equipment.

B. Ground system test.

1.2 REFERENCES

A. IEEE STD 142

B. NFPA 70

C. ASTM F467 and F468

D. UL 467

1.3 SUBMITTALS

A. Product data: Ground connections.

B. Certifications: System test.

PART 2 - PRODUCTS

2.1 MANUFACTURED UNITS

A. Ground conductor, unless specifically noted otherwise, shall be copper, 98 percent conductivity, solid for No. 10 AWG and smaller and stranded for No. 8 AWG and larger.

B. Mechanical type ground connectors:

1. Connectors:

   a. IEEE 837 and UL 467 compliant, listed for use for specific types, sizes, and combinations of conductors and connected items.
   b. Basis of design: FCI Burndy G Series.

2. Nuts, bolts, and washers: Silicon bronze alloy type B per ASTM F467 and F468.

C. Lugs:

1. Lugs shall be two- or four-hole.
2. Basis of design: Burndy Hylug series.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Provide the complete grounding of conduit systems, electrical equipment, conductor and equipment enclosures, motors, transformers, and neutral conductors in accordance with applicable codes. Grounded phase and neutral conductors shall be continuously identified. Continuity of metal raceways shall be insured by double locknuts.

3.2 EQUIPMENT GROUNDING AND BONDING

A. Provide insulated equipment grounding conductors with feeders and branch circuits.

3.3 IDENTIFICATION

A. Comply with requirements in Section 26 05 53, Identification for Electrical Systems, for instruction signs. The label or its text shall be green.

3.4 GROUNDING SYSTEM TEST

A. Ensure that grounding system is continuous and that resistance to earth is not more than 10 ohms.

- END OF SECTION 26 05 26 -

SECTION 26 05 33
CONDUITS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Conduit, raceways, and accessories.

1.2 RELATED SECTIONS

A. Firestopping: Section 26 05 07.

B. Boxes: Section 26 05 34.

C. Surface raceways: Section 26 05 35.

1.3 DEFINITIONS

A. Conduit: Conduit, raceway, or tubing.

B. EMT: Electrical metallic tubing.

C. FMC: Flexible metal conduit.

D. IMC: Intermediate metal conduit.

E. LFMC: Liquid-tight flexible metal conduit.

1.4 SUBMITTALS

A. Product data:

1. Each type of conduit and raceway included in the work, and related fittings.
2. Sleeves.
3. Accessory materials.
4. Hangers and fasteners.

PART 2 - PRODUCTS

2.1 CONDUIT AND FITTINGS

A. Galvanized steel conduit: Hot-dip galvanized with threads galvanized after cutting:

1. Intermediate steel conduit (IMC) conforming to UL 1242 and ANSI C80.6.

B. Steel conduit fittings: Cast malleable iron fittings with smooth finish and full threaded hubs. Include steel or malleable iron locknuts, bushings, and other fittings.

1. Insulating bushings: Basis of design: Thomas & Betts Series 22.

2. Hub fittings with recessed sealing ring and nylon insulated throat: Basis of design: Thomas & Betts Series 370.
3. Fittings for exposed locations: Conduit outlet bodies, cast iron or cast aluminum, zinc or cadmium plated.

C. Electrical metallic tubing (EMT): Hot-dip galvanized or sherardized thin-wall steel conduit conforming to UL 797 and ANSI C80.3.

D. Connectors and couplings for EMT: Concrete- or rain-tight, compression or set-screw type, made of zinc- or chromium-plated steel. Connectors shall have nylon insulating throats.

1. Compression connector: Basis of design: Thomas & Betts No. 5223.
2. Compression coupling: Basis of design: Thomas & Betts No. 5220.
3. Set-screw connector: Basis of design: Steel City No. TC722A.
4. Set-screw coupling: Basis of design: Steel City No. TK122A.

E. Flexible metal conduit (Type FMC): Made of sheet metal strip, interlocked construction, conforming to UL 1.

F. Liquidtight flexible metal conduit (Type LFMC) shall conform to UL 360.

G. Connectors for flexible metal conduit:

1. Angle wedge with nylon insulated throat.
2. Basis of design: Thomas & Betts “Tite-Bite” connector Series 3110 and 3130.

H. Liquidtight type connectors:

1. UL 14814A. Fittings: With nylon insulated throat.
2. Basis of design: Thomas & Betts Series 5331.

I. Wireways: Steel wireway with hinged cover, complying with UL 870 Standard for Wireways, Auxiliary Gutters, and Associated Fittings.

1. Cover: Front accessible opening along complete length of wireway.
2. Finish: Gray polyester powder finish inside and out.
3. Basis of design: Square D "Square-Duct" or Pentair/Hoffman "Angled Trough".

J. Fittings for wireways: Made with removable covers to permit installation of a complete system with access to wires throughout the system, UL listed with wireways. Connections: Threaded screws at every connector.

K. Weatherproof expansion fittings:

1. With bonding jumpers.
2. Basis of design: O-Z/Gedney Types AX and TX.

2.2 SLEEVES FOR RACEWAYS

A. Steel pipe sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, galvanized steel, plain ends.

1. Sleeves for exterior walls: Anchor flange welded to perimeter.

B. Sleeves for rectangular openings: Galvanized sheet steel of length to suit application. Minimum thickness:

1. For sleeve cross-section rectangle perimeter less than 50 inches and no side more than 16 inches: 0.052 inches.
2. For sleeve cross-section rectangle perimeter equal to or more than 50 inches and 1 or more sides equal to or more than 16 inches: 0.138 inches.

C. Coordinate sleeve selection and application with selection and application of firestopping specified in Section 26 05 07.

2.3 ACCESSORY MATERIALS

A. Pull rope: Polypropylene, minimum 0.1875-inches thick, tensile strength 800 pounds, work load 130 pounds.

B. Caps and plugs: Basis of design: Thomas & Betts Series 1470.

C. Lubricant:

1. UL approved.
2. Basis of design: Ideal Industries, Inc. “Yellow 77” or “Aqua-Gel II”.

D. Bituminous protective coating: Coal tar based, self-priming on steel, applied in a wet film thickness at least 22.0 mils per coat.

E. Rust inhibitive paint:

1. Alkyd based, white, black, or bronzetone; applied in a wet film thickness of at least 2.9 mils.
2. Basis of design: Benjamin Moore Super Spec HP D.T.M. Alkyd Low Lustre P23.

2.4 CONDUIT HANGERS

A. Adjustable hangers: Basis of design: Kindorf C-711 lay-in hanger or C-710 Clevis hanger.

B. Trapeze hangers:

1. Constructed of channels with notched steel straps.
2. Steel strap basis of design: Kindorf C-105.

C. Channels:

1. Steel, 1.5 inches wide with 7/8-inch continuous slot, gauges and weights.
2. Basis of design: Kindorf B-900 series, hot-dipped galvanized finish.

D. Beam clamps:

1. Adjustable type for connecting hanger rod to steel beam.
2. Basis of design: Kindorf E-160 or U-569

E. Hangers for conduit 1 inch and smaller, through or below bar joists: “Hang-on” hangers attached to joists with Minerallac scissor clips or two-piece stud clips.

F. Finish: For hangers, assemblies, plate washers, rods, locknuts, channels, bolts, and appurtenances:

1. Zinc plated.
2. Hot-dip galvanized, where required for weather-exposed or damp locations.

2.5 FASTENERS

A. General: Select fasteners such that load applied does not exceed one-fourth of manufacturer’s load capacity in 3500 psi concrete.

B. Fasteners to concrete: Self-drilling type expansion anchors, or machine bolt drop-in anchors for drilled holes. Fasteners to concrete ceilings shall be vibration- and shock-resistant.

C. Fasteners to drywall or cavity wall: Toggle bolts, hollow-wall drive anchors, or nylon anchors as required.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Provide complete, separate, and independent raceway system for each of the various wiring systems including, but not limited to, the following:

1. Lighting
2. Power
3. Exit Lighting*
4. Emergency Lighting System*
5. Fire Detection and Alarm System
6. Low Voltage Control System
7. Control Wiring
8. Voice and Data Systems

*These wiring systems may be installed in common raceways.

B. Wire raceway systems completely, except where otherwise indicated, as shown on drawings and as required for satisfactory operation of each system.

C. Where wireways are required or used to facilitate the installation, size them to accommodate conductors, in accordance with NFPA 70.

D. Types and locations of conduits are scheduled at the end of the section.

E. Do not install conductors or pull rope during installation of conduit.

F. Where conduit is connected to a cabinet, junction box, pull box, or auxiliary gutter, protect the conductors with an insulating bushing. Provide locknuts both inside and outside the enclosure. Where conduit is stubbed up to above ceilings for future wiring, close ends with bushings.

G. Bituminous protective coating:

1. Coat exposed threads on steel conduits in concrete slabs at couplings and fittings, after joints are made up.
2. Coat metallic conduits below grade not in concrete, and where emerging from below grade or slabs, four inches above and below grade or slab.

H. Rust-inhibitive paint:

1. Exposed threads of exterior conduit.
2. Unfinished metal components.

I. Make turns in conduit runs with manufactured elbows or using machines or tools designed to bend conduit. Turns shall be not less than the various radii permitted by NFPA 70.

J. Sizes:

1. Do not use conduit smaller than 0.75 inches.
2. Feeder conduits shall be as large as indicated, or as required by NFPA 70 (whichever is larger). Do not install more than one feeder in a single conduit.
3. Conduit sizes shown on drawings are based on Type THHN/THWN-2 wire.

K. Make vertical runs plumb and horizontal runs level and parallel with building walls and partitions.

L. Ground conduits as required by NFPA 70.

M. Where conduits pass through building expansion joints, and wherever relative movement could occur between adjacent slabs, equip with weatherproof expansion fittings and bonding jumpers.

N. Where conduits through roof cannot be installed inside equipment or pipe curbs, flash them in accordance with the SMACNA Architectural Manual.

1. Coordinate flashing details and materials with manufacturer and installer of roofing system.

O. Run conduits concealed in new construction except where connecting to surface-mounted cabinets and equipment, and in electrical and mechanical equipment spaces. Install conduit above suspended ceilings and within walls and partitions.

P. Immediately after each run of conduit is completed, test it for clearance, smooth the joints, and close at each end with caps or plugs to prevent entrance of moisture or debris.

Q. Conduit installed outdoors or at indoor locations exposed to continuous or intermittent moisture shall provide a liquid-tight seal. Use steel or malleable iron hub fittings. Coat exposed threads with bituminous protective coating.

R. Install insulated bushings on ends of conduit stubs and sleeves.

3.2 INSTALLING PULL BOXES, JUNCTION BOXES, OUTLET BOXES

A. Install as specified in Section 26 05 34, Boxes.

B. Install pull or junction boxes in long runs of conduits or where necessary to reduce the number of bends in a run.

C. Verify door swings with door frame installed before locating switch outlets. Locate switch outlets on the strike side of the door frame.

3.3 INSTALLING FLEXIBLE CONDUIT

A. Installation shall comply with NFPA 70.

1. Minimum length: 2 feet.
2. Maximum length: 6 feet.

B. Make immediate connections to recessed lighting fixtures and other equipment in suspended ceilings with flexible metal conduit. Include sufficient slack to permit removal of fixture or equipment.

C. Make immediate connections to motors with liquid-tight flexible metal conduit. Include sufficient slack to reduce the effects of vibration.

D. In wet locations, install liquid-tight type, in such a manner that liquid tends to run off the surface and not drain toward the fittings.

E. Where fittings are brought into an enclosure with a knockout, install a gasket assembly consisting of an O ring and retainer on the outside.

3.4 INSTALLING PULL ROPE AND CONDUCTORS

A. After conduit is installed, fish pull rope. After completion of the work of this project, pull rope shall remain in conduits identified as to be left empty. For each empty conduit, pull rope shall be of the same size, strength, and material as the ropes used to pull cables and conductors through similar conduits. Provide minimum 6 inches of pull rope at each end.

B. Do not use a pull rope that has a tensile strength of more than one of the conductors of a two-wire circuit, more than two of the conductors of a three-wire circuit, or more than three of the conductors of a four-wire circuit.

C. Do not pull conductors into the conduits until the system is entirely completed and wet building materials are dry.

D. Use only a lubricant approved for use with conductor materials and pull rope materials.

3.5 INSTALLING SLEEVES

A. Coordinate sleeve selection and application with selection and application of firestopping specified in Section 26 05 07.

B. Concrete slabs and walls: Install sleeves for penetrations unless core-drilled holes or formed openings are used. Install sleeves during erection of slabs and walls.

C. Fire-rated assemblies: Install sleeves for penetrations of fire-rated floor and wall assemblies unless openings compatible with firestop system used are fabricated during construction of floor or wall.

D. Cut sleeves to length for mounting flush with both surfaces of walls.

E. Extend sleeves installed in floors 2 inches above finished floor level.

F. Size pipe sleeves to provide 0.25-inch annular clear space between sleeve and raceway unless sleeve seal is to be installed.

G. Seal space outside of sleeves with grout for penetrations of concrete and masonry and with approved joint compound for gypsum board assemblies.

H. Interior penetrations of non-fire-rated walls and floors: Seal annular space between sleeve and raceway, using joint sealant appropriate for size, depth, and location of joint.

I. Fire-rated-assembly penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at raceway penetrations. Install sleeves and seal with firestop materials. Comply with Section 26 05 07.

J. Roof-penetration sleeves: Seal penetration of individual raceways with flexible, boot-type flashing units applied in coordination with roofing work.

3.6 INSTALLING CONDUIT HANGERS

A. Single runs of overhead conduits 1.25-inch size and larger shall be supported by adjustable hangers, using 0.375-inch rods for conduits up to 2.0-inch size and 0.5-inch rods for conduits larger than 2.0 inches.

B. Support groups of conduits run in parallel on trapeze hangers suspended from 0.5-inch hanger rods.

C. Space hangers not over 10 feet apart for metal conduits. Support conduits within 3 feet of each outlet, junction or pull box.

D. Below bar joist construction, support hangers from a length of structural channel, welded to the top chords of at least two joists.

E. Where large numbers of conduits are grouped together, stagger individual hangers so as not to concentrate the load on a few joists.

F. Where hanger rods are attached to structural beams, use adjustable beam clamps.

G. Below precast plank construction, hanger rods shall pass through the precast planks and be secured on top side with nut, locknut, and plate washer. Plate washers shall be at least 4 inches square and 0.125-inch thick. Top of hanger assembly shall be concealed in the concrete fill which will be placed over the planks.

H. Attach hanger rods to concrete with expansion bolts and anchors.

3.7 CONDUIT IN EXISTING BUILDING

A. Remove superfluous electrical equipment and cap outlets not being used, as specified in Section 26 05 04, Electrical Demolition.

B. In existing areas that are being renovated it is the intent to show on the drawings what the finished areas will contain when completed. Except as specified otherwise, existing conduit, and outlet boxes may be reused where they meet specifications and code requirements. Replace existing products or materials which are not suitable for reuse as determined by the Architect.

C. Suitably cap superfluous concealed outlets, and remove unused wire. Remove superfluous raceways exposed in finished areas, and abandon superfluous raceways concealed in walls.

D. Install concealed conduit in existing building wherever possible above ceilings and in existing furred spaces. Install exposed conduit in secondary rooms, such as storage rooms. Install exposed surface raceways on existing wall as specified in Section 26 05 35, Surface Raceways.

E. Where existing conduit penetrates fire-rated partitions, and where there is no firestopping, provide firestopping. Maintain fire rating of walls, partitions, ceilings, and floors at existing conduit penetrations. Comply with Section 26 05 07.

3.8 SCHEDULE OF LOCATIONS

A. IMC with screw joint couplings: Wiring to exterior equipment.

B. EMT: Sizes 4 inches and smaller except as noted above.

C. FMC and LFMC: Where noted elsewhere in this section.

- END OF SECTION 26 05 33 -

SECTION 26 05 34
BOXES

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Boxes with covers.

1.2 RELATED SECTIONS

A. Conduits: Section 26 05 33.

B. Wiring devices: Section 26 27 26.

1.3 SUBMITTALS

A. Product data: Each type of box included in the project.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Outlet, switch, and junction boxes:

1. Sheet metal: NEMA OS 1, sherardized or galvanized stamped.
2. Cast-metal, where required for weather-exposed locations: NEMA FB 1, ferrous alloy or aluminum, Type FD, with gasketed cover.

2.2 JUNCTION AND PULL BOXES

A. Junction and pull boxes in feeder conduit runs: Galvanized, of size required for conduit arrangement and not less than the size required by NFPA 70, and furnished with screwed covers.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Provide box at each outlet, switch, and appurtenance. Each box shall be of a type suitable for the duty intended and shall be installed in accordance with the manufacturer's instructions.

1. Where conduit is weather-exposed, provide cast-steel or cast-aluminum boxes.

B. Coordinate locations of boxes with installation of conduit as specified in Section 26 05 33.

C. Firmly secure the boxes in place, plumb, level, and with front of device cover even with finished wall surface.

D. Provide a single cover plate where two or more devices are grouped together in one box.

E. Verify door swings with door frame installed before locating switch outlets.

3.2 IDENTIFICATION

A. Identification on outside covers of pull and junction boxes in ceiling space or exposed on walls: Paint with colored enamel or mark with permanent waterproof black marker, or both, as specified.

1. Fire alarm system: Red.
2. Other special systems: Mark with system type, such as Data.
3. Power and lighting: Panelboard designation and circuit number(s).

- END OF SECTION 26 05 34 -

SECTION 26 05 35
SURFACE RACEWAYS

PART 1 - GENERAL

1.1 WORK INCLUDES

A. Surface raceway, metal.

1.2 RELATED SECTIONS

A. Conduits: Section 26 05 33.

1.3 SUBMITTALS

A. Product data: Surface raceway.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Basis-of-design product: Subject to compliance with requirements, provide the specified Wiremold product, or comparable product by one of the following:

1. Hubbell Inc./Hubbell Wiring Device-Kellems
2. Legrand North and Central America, LLC/Wiremold

2.2 SURFACE METAL RACEWAYS

A. UL listed and meeting requirements of NFPA 70 (NEC).

B. One-piece type:

1. 3/4 inch by 21/32 inch as a minimum size, galvanized steel 0.04-inch thick, complete with device boxes, fittings, connectors, and appurtenances.
2. Basis of design: Wiremold 700.

C. Finish: Field paintable baked enamel, ivory.

PART 3 - EXECUTION

3.1 INSTALLING SURFACE METAL RACEWAYS

A. Install surface metal raceways in accordance with sizes as required by NFPA 70 (NEC).

B. Install each assembly as recommended by the manufacturer.

1. Where field cutting is required, make each cut with the manufacturer's tool specifically designed for cutting the part and model.
2. Metal raceway shall be electrically continuous and bonded in accordance with NEC.

3. Each assembly shall be installed so each section or component is coupled together and no conductors or cables are exposed at any location.

C. Attach raceway and boxes to walls and ceilings with fasteners as specified for conduits. Attach each outlet box with at least two screws. Secure one-piece raceways with two-hole straps at intervals not exceeding four feet and with no less than two straps per straight raceway section.

D. Raceway routes, mounting heights, and locations of types of outlets are shown on drawings.

E. Make raceway runs plumb and true and parallel with building and casework lines.

3.2 CLEANING AND ADJUSTING

A. Touch up surfaces damaged during installation with paint supplied by the manufacturer.

- END OF SECTION 26 05 35 -

SECTION 26 05 53
IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. This section includes electrical identification materials and devices required to comply with ANSI, NFPA, and OSHA standards.

B. This section addresses identification of electrical equipment, raceways, boxes, conductors, and other related electrical system components.

1.2 SECTION INCLUDES

A. Identification of power conductors and control cables.

B. Identification of equipment and instructions.

C. Miscellaneous identification products.

1.3 RELATED SECTIONS

A. Sections in Division 26 and Section 28 31 00.

1.4 REFERENCES

A. ANSI Z535.4: Standard for Product Safety Signs and Labels.

B. ANSI/IEEE C2: National Electrical Safety Code.

C. NFPA 70: National Electrical Code.

D. NFPA 70E: Standard for Electrical Safety in the Workplace.

E. OSHA 29 CFR 1910.144: Safety Color Code for Marking Physical Hazards.

F. UL 969: Standard for Marking and Labeling Systems.

G. Definitions: Circuit designation includes both equipment source and equipment position.

1.5 SUBMITTALS

A. Product data: For each type of electrical identification product.

1.6 QUALITY ASSURANCE

A. Comply with ANSI A13.1 and IEEE C2.

B. Comply with NFPA 70.

C. Comply with OSHA standards.

D. Comply with ANSI Z535.4 for safety labels.

1.7 COORDINATION

A. Coordinate identification names, abbreviations, colors, and other features with requirements in other sections requiring identification applications, drawings, shop drawings, manufacturer's wiring diagrams, and the operation and maintenance manual; and with those required by codes, standards, and safety regulations. Use consistent designations throughout Project.

B. Coordinate installation of identification materials and devices with completion of covering and painting of surfaces where devices are to be applied.

C. Install identifying materials and devices before installing acoustical ceilings and similar concealment.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Subject to compliance with requirements, provide products by one of the following manufacturers, or approved equal:

1. Brady USA, Inc.
2. Carlton Industries
3. Graphic Products, Inc.
4. Ideal Industries, Inc.
5. Panduit Corporation
6. Presco
7. Seton Identification Products
8. Thomas & Betts Company
9. Utility Safeguard

2.2 GENERAL PRODUCT REQUIREMENTS

A. Except where otherwise indicated, provide manufacturer's standard identification products of category and type suitable for each application. Where more than one identification method is specified for an application, the Installer shall select and utilize each material in a consistent manner.

2.3 CONDUCTOR AND CABLING IDENTIFICATION

A. Adhesive labels: Preprinted, flexible, self-adhesive vinyl with legend overlaminated with a clear weather- and chemical-resistant coating and matching wraparound adhesive tape for securing ends of legend label.

B. Color-coded, adhesive tape: Self-adhesive, vinyl tape, in appropriate colors for system voltage and phase.

C. Marker tapes: Vinyl or vinyl-cloth, self-adhesive, wraparound type with preprinted numbers and letters.

D. Wrap-around marker bands: Diameter sized to suit conductor or cable it identifies.

1. Plastic, color-coded, pretensioned, grip-type, flexible, acrylic sleeve.

2.4 EQUIPMENT IDENTIFICATION

A. Engraved plastic nameplates: Laminated plastic, engraved, white letters on black background, except where other color schemes are noted or specified.

1. Size: Minimum 0.75 inches by 2.5 inches.
2. Letter size: Minimum height of 0.375 inches.
3. Mechanically fastened, except adhesive mounted where necessary due to substrate.

a. Mechanical fastener: Punched or drilled, with vandal-proof stainless steel or brass screws or rivets.

B. Adhesive film label: Machine-printed, black letters on white background, through thermal transfer or equivalent process, with clear weatherproof and UV-resistant covering. Minimum letter size height of 0.375 inches.

2.5 MISCELLANEOUS IDENTIFICATION PRODUCTS

A. Wiring device tape labels:

1. Adhesive film label: Machine-printed, black letters on clear background, through thermal transfer or equivalent process. Minimum letter size height of 0.25 inches.

a. Labeling for electrical devices and components such as receptacles, switches, control device stations, manual motor starters, network and phone jacks, junction and pull boxes, etc.

B. Warning labels:

1. Self-adhesive warning labels: Factory-printed, multicolor, pressure-sensitive adhesive labels, configures for display on front cover, door, or other access to equipment unless otherwise noted.
2. Fasteners: Self-tapping, stainless-steel screws or, stainless-steel machine screws with nuts, flat and lock washers.

C. Tape markers: Vinyl, pressure-sensitive, with clear vinyl overlay.

D. Cable ties: Fungus-inert, self-extinguishing, one-piece, self-locking, color-coded, nylon cable ties suitable for the application (general purpose, UV-stabilized outdoor, or plenum rated).

E. Paint: Formulated for the type of surface, location, and intended use.

F. Adhesive: Heavy-duty, thermo-resistant, industrial grade adhesive, for adhesion to any surface without identification curling, peeling, or falling off.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Verify identity of each item before installing identification products.

B. Location: Install identification products at locations for most convenient viewing without interference with operation and maintenance of equipment.

C. Existing equipment: Apply identification products to unmarked existing equipment where work is being performed.

D. Apply identification products to surfaces after equipment finish work has been completed.

E. Clean surfaces before applying identification products, using materials and methods recommended by manufacturer of identification device.

F. Attach plastic labels that are not self-adhesive type with mechanical fasteners appropriate to the location and substrate.

G. Painted identification: Comply with requirements in Division 09 painting Sections for surface preparation and paint application.

3.2 APPLICATION

A. Junction and pull boxes:

1. Label each junction and pull box, identifying circuit designation or type of system.

   a. Exposed and concealed boxes: Mark with permanent ink marker on cover plate, externally visible.

2. Fire detection and alarm system boxes shall have red finish. Boxes shall be prefinished prior to installation.

B. Wiring and cabling identification:

1. Power circuit conductor identification, 600 volts or less: Apply color-coded identification for cables, feeders, and power circuit conductors exposed in accessible vaults, junction and pull boxes, utility structures, and equipment enclosures. Apply color-coding scheme as indicated below throughout the building's network of feeders and circuits, unless otherwise required by the authority having jurisdiction.

   a. Colors on conductors No. 10 and smaller, or No. 6 and smaller for grounded and grounding conductors: Solid colored insulation.

b. Colors on conductors No. 8 and larger, or No. 4 and larger for grounded and grounding conductors: Apply colored tape wrapped a minimum of 6 inches on either end of conductor and in boxes where splices or taps are made.
c. Conductors used solely for grounding purposes shall be green, if insulated.
d. Where multi-conductor cables are used, use same color coding system for identification of wiring.

COLOR CODE (600 volts maximum)				
VOLTAGE	NEUTRAL	PHASE		
		A	B	C
120 volts, 2-wire	White	Black, Red, or Blue depending on phase		
277 volts, 2-wire	Gray	Brown, Orange, or Yellow depending on phase		
208 volts, single-phase, 2-wire		Black/Red, Red/Blue, or Blue/Black		
208/120 volts wye, 3-phase, 4-wire	White	Black	Red	Blue
480/277 volts wye, 3-phase, 4-wire	Gray	Brown	Orange	Yellow
480 volts delta, 3-phase, 3-wire		Brown	Orange	Yellow

2. Control and low-voltage system wiring shall be coded with colors and markings different from those used to designate phase wires.

C. Wiring device labels: For wiring devices such as receptacles, devices installed in surface raceway assemblies, and other wiring devices operating at or greater than 120 volts.

1. Apply adhesive film labels on outside of wiring device cover plates identifying circuit designation serving device.
2. Apply labels to devices serving low-voltage system devices including the following:

a. Fire alarm devices and test stations: Circuit designation.
b. Communications device stations: Work area outlet designation.

D. Equipment identification: Install unique designation label consistent with contract documents and shop drawings.

1. Labeling instructions:

a. Engraved plastic laminate nameplates, unless otherwise indicated.
b. Unless otherwise required, provide a single line of text with 0.5-inch high lettering on 1.5-inch high label. Where two or more lines are required, use single label with increased height.
c. For multi-section or multi-compartment equipment, apply labels identifying each compartment or section.
d. For fusible equipment, identify fuse type and size on the front cover.
e. For enclosed circuit breaker equipment, identify device trip rating where rating is not visible.

2. Additional labeling requirements:

a. Identify the designation and location of the power source where the equipment power feed originates. (Example “Feed from: XXXXX; Location: XXXXX”).

(1) Where equipment has more than one source of power (i.e., transfer switch, separate control power source), the location and designation of each power source shall be clearly identified at the equipment location.

3. Apply nameplates and labels to equipment according to the below identification schemes:

   a. Identify equipment designation; primary and secondary voltage ratings; phase and number of wires; circuit designation and location of primary source; and designation and location of load served. Apply products to the following equipment:

      (1) Enclosed switches (disconnects/safety switches)

4. Nameplates shall incorporate white lettering on colored backgrounds based on the following color-coding scheme:

   a. Normal power system: Black background.
   b. Generator power system: Red background.

E. Warning and caution labels:

1. Apply warning and caution labels on equipment in accordance with NFPA 70 and 70E, ANSI, and OSHA requirements including arc flash hazard warning labels and special clearance requirements.
2. Apply warning and caution labels at locations where safe operation and maintenance of electrical system equipment is of concern.

3.3 FIELD QUALITY CONTROL

A. Coordinate names, abbreviations, colors, and other designations with construction documents, submittals, and applicable code and standards requirements. Utilize consistent designations and identification techniques throughout project.

B. Install identification products at locations that are clearly visible at normal viewing angles and without interference with operation and maintenance of the equipment.

C. Install identification products in a neat and clean, workmanship-like manner where products are securely attached and oriented parallel to equipment edges.

- END OF SECTION 26 05 53 -

SECTION 26 27 26
WIRING DEVICES

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Receptacles.

B. Toggle / snap switches for power.

1.2 RELATED SECTIONS

A. Boxes: Section 26 05 34.

B. Identification: Section 26 05 53.

C. Toggle / snap switches for lighting: Section 26 09 23.

1.3 REFERENCES

A. ANSI/NEMA WD 6: Wiring Devices - Dimensional Specifications.

B. NEMA WD 1: General Color Requirements for Wiring Devices.

C. UL 498: Attachment Plugs and Receptacles.

D. UL 508: Standard for Industrial Control Equipment.

1.4 SUBMITTALS

A. Product data: Each type of device used in the project.

B. Field quality-control test reports.

PART 2 - PRODUCTS

2.1 RECEPTACLES

A. Acceptable manufacturers:

1. Eaton/Arrow Hart
2. Hubbell/Bryant
3. Legrand/Pass & Seymour (P&S)
4. Leviton Manufacturing Co.

B. Receptacles: NEMA 5-20R, 20-ampere rating, 125 volts AC, 2-pole, 2-wire plus ground, conforming to NEMA WD 1 and WD 6 configuration numbers, and UL 498.

1. Specification grade:

a. General-use, duplex: Basis of design: P&S TR5362, hard-use, tamper-resistant.
b. Ground-fault circuit-interrupter (GFCI) type, self-test, duplex: Basis of design: P&S 2097TR, tamper-resistant.
c. Ground-fault circuit-interrupter (GFCI) type for exterior and wet locations, duplex: Basis of design: P&S 2097TRWR, tamper-resistant, weather-resistant.

C. Device colors:

1. Normal power receptacles: White.
2. Generator power receptacles: Red.

D. Device covers:

1. Wall plates: Smooth nylon, color shall match device color.

a. Basis of design: P&S smooth nylon, TP series, color shall match device color.

2. Wet-location, weatherproof cover, single-gang, extra-duty:

a. Basis of design: P&S WIUC10FRED, while-in-use, polycarbonate, frosted.

2.2 TOGGLE / SNAP SWITCHES FOR POWER

A. Acceptable manufacturers:

1. Arrow Hart/Eaton Wiring Devices
2. Hubbell/Bryant Electric
3. Legrand/Pass & Seymour (P&S)
4. Leviton Manufacturing Co.

B. Toggle / snap switches: Specification grade:

1. Manual motor rated switch: UL 508, toggle type, 30 amperes, 600 volts, no overload protection, capable of being locked in the off position:

a. Basis of design: P&S 7802MD, double-pole, single-phase.

C. Device color: White.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install devices in complete compliance with the manufacturer's recommendations.

B. Arrangement of devices: Unless otherwise indicated, mount flush with long dimension vertical. Group adjacent devices under single multi-gang wall plates.

C. Receptacles: Install ground pin of vertically mounted receptacles up, and on horizontally mounted receptacles to the right.

D. Wall plates: Do not use oversized or extra-deep plates. Repair wall finishes and remount outlet boxes when standard wall plates do not fit flush or do not cover rough wall opening.

3.2 IDENTIFICATION

A. Comply with Section 26 05 53 "Identification for Electrical Systems."

B. Identify receptacles and toggle / snap switches with panelboard identification and circuit number. Use self-adhesive labeling.

3.3 FIELD QUALITY CONTROL

A. Perform tests and inspections and prepare test reports.

B. Tests and inspections:

1. After installing devices and after electrical circuitry has been energized, test for compliance with requirements.
2. Receptacles:

    a. Insert and remove test plug to verify that device is securely mounted.
    b. Verify polarity of hot and neutral pins.
    c. Measure line voltage.
    d. Measure grounding circuit continuity; impedance shall be not greater than 2 ohms.

C. Correct malfunctioning devices on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new devices and retest.

D. Report results of tests and inspections in writing.

- END OF SECTION 26 27 26 -

SECTION 26 28 00
ENCLOSED CIRCUIT PROTECTIVE DEVICES

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Enclosed switches (disconnects/safety switches).

B. Elevator disconnecting switch.

1.2 RELATED SECTIONS

A. Motors: Motor requirements for HVAC equipment: Section 23 05 13.

B. Fuses: Section 26 28 13.

1.3 REFERENCES

A. NEMA KS 1: Enclosed and Miscellaneous Distribution Equipment Switches (600 Volts Maximum).

B. UL 98: Enclosed and Dead-Front Switches.

1.4 SUBMITTALS

A. Product data: Each type of enclosed switch and elevator disconnecting switch.

1.5 QUALITY ASSURANCE

A. Comply with the following standards:

1. NEMA KS 1 for enclosed switches.
2. UL 98.
3. UL 198E.

B. UL label and local testing (if required): As specified in Section 26 05 00, Common Work Results for Electrical.

PART 2 - PRODUCTS

2.1 ENCLOSED SWITCHES (DISCONNECTS/SAFETY SWITCHES)

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. ABB; General Electric products.
2. Eaton Corporation.
3. Schneider Electric; Square D products.
4. Siemens Industry, Inc.

B. Properly size switches for number of poles and provide fused or non-fused as required for project conditions and to meet NFPA 70 requirements.

C. Fuse contacts and quick-make/quick-break jaws shall ensure positive contacts with reinforcing spring clips or other approved means.

D. Switches shall be front-operated.

E. Current-carrying parts: Plated copper.

F. Hinges: Noncurrent-carrying.

G. Switches shall be lockable in either open or closed position.

H. Type:

1. Non-fused switches: General-duty type on 120/208-volt systems, and heavy-duty type on 277/480-volt systems.
2. Fused switches: Heavy-duty type.

I. Enclosures: Indoors NEMA 250 Type 1; outdoors Type 3R with raintight hubs.

2.2 ELEVATOR DISCONNECTING SWITCH

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Eaton Corporation; Bussmann.
2. Mersen.
3. Littelfuse, Inc.

B. Separately enclosed in NEMA 250 Type 1 enclosure with externally operable lockable handle allowing switch to be locked in the OFF position ensuring load side power isolation during servicing.

1. Properly sized Class J fuses, Class J fuse block, connected in series with molded case safety switch.

a. Basis of design: Cooper Bussmann JKS Limitron fuse.

2. Properly sized molded case switch, with 120 VAC shunt trip operation, connected in series with fuses.
3. Control circuit: 120-volt.

a. Control power transformer: Primary voltage as required for the motor, 120-volt secondary voltage; capacity to operate control devices and 100 percent spare capacity.
b. Primary and secondary fuse protection for each control power transformer: Class CC fuses, current-limiting rejection type, rated 0.1 to 30 amperes, 600 volts, and 200 kA interrupting rating.

4. Fire safety interface isolation relay: 3PDT, 10-ampere, 120-volt relay with coil voltage as required to interface with the fire alarm system.
5. Voltage monitoring relay: To monitor shunt trip voltage.
6. Auxiliary control contacts:

    a. One normally open and one normally closed primary auxiliary contact.
    b. One normally open and one normally closed secondary auxiliary contact.

7. Power ON pilot light.
8. Ground lug.
9. Key-to-test switch.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install enclosed switches where indicated and as required for motor outlets, transformers, and other equipment.

B. Securely attach and properly connect enclosed switches and elevator disconnecting switches.

C. Provide an enclosed switch for each motor, as required by NFPA 70, except where it is provided in a panelboard within sight and easy reach of the motor, and provide wiring and connections from source. Enclosed switches shall be fused where protection is required or indicated on drawings and unfused elsewhere.

- END OF SECTION 26 28 00 -

SECTION 26 28 13
FUSES

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Fuses.

1.2 RELATED SECTIONS

A. Motors: Motor requirements for HVAC equipment: Section 23 05 13.

B. Enclosed switches: Section 26 28 00.

1.3 REFERENCES

A. UL 198E: Class R fuses.

B. UL 198C: High-Interrupting-Capacity Fuses, Current Limiting Types.

1.4 SUBMITTALS

A. Product data: Each type of fuse.

B. Published data on fuses shall include time/current curves, peak-let-through curves and I^2t melting and clearing curves.

1.5 QUALITY ASSURANCE

A. Comply with UL 198C, Class L fuses, also Classes G and J.

B. UL label and local testing (if required): As specified in Section 26 05 00, Common Work Results for Electrical.

1.6 EXTRA MATERIALS

A. Provide three spare fuses for each type and size of fuse in the work.

PART 2 - PRODUCTS

2.1 FUSES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Eaton Corporation; Bussmann
2. Littelfuse, Inc.
3. Mersen

B. Characteristics: NEMA FU 1, nonrenewable cartridge fuses with voltage ratings consistent with circuit voltages.

C. Fuses 0-600 amperes for 600-volt or 250-volt, UL labeled Class RK1 with time delay, with a minimum short-circuit interrupting capacity of 200,000 rms symmetrical amperes, and shall carry 500 percent of rating for a minimum of 10 seconds.

1. Fuses for enclosed switches (disconnects/safety switches) for packaged HVAC equipment: Size and type recommended by the equipment manufacturer and as required for equipment to meet UL rating.

D. Fuses 601 amperes and larger shall be UL labeled Class L with time delay, 600-volt, with minimum short circuit interrupting capacity of 200,000 rms symmetrical amperes and dimensions to properly mount in switchboard or disconnecting switches.

E. Fuses 0-30 amperes for control power transformers shall be UL labeled Class CC with time delay, 600-volt, with a minimum short-circuit interrupting capacity of 200,000 rms symmetrical amperes, and dimensions to properly mount in fuse blocks at control power transformers.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install fuses where indicated and as required for motor outlets or other equipment.

- END OF SECTION 26 28 13 -

SECTION 26 51 00
INTERIOR LIGHTING

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Lighting fixtures, including LED light engines, LED drivers, and accessories.

1.2 SUBMITTALS

A. Product data: For each type of lighting fixture indicated, arranged in order of lighting fixture designation. Include data on features, accessories, and the following:

1. Dimensions of lighting fixtures, photometrics and efficiency, wattage, reflectors, voltage, suspension, and appurtenances.
2. Certified results of laboratory tests for lighting fixtures for photometric performance.
3. LED drivers.
4. Lumen output, rated color temperature, and manufacturer's LED binning procedures.

1.3 QUALITY ASSURANCE

A. UL label and local testing (if required): As specified in Section 26 05 00, Common Work Results for Electrical.

B. Lighting fixtures and accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction.

C. Comply with NFPA 70.

D. NFPA 101 Compliance: Comply with visibility and luminance requirements for exit signs.

1.4 COORDINATION

A. Lighting fixtures, mounting hardware, and trim: Coordinate layout and installation of lighting fixtures with ceiling system and other construction.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis-of-design products: Lighting fixtures indicated on the drawings are the basis of design of the project.

1. Subject to compliance with requirements, provide the scheduled products. Unnamed products will only be considered and approved according to Bidding and Contracting requirements and Division 01 requirements for substitutions.

B. Subject to compliance with requirements, provide products by one of the following:

1. Drivers:

a. Philips/Advance
b. Osram Sylvania
c. Universal Lighting Technologies
d. Lutron
e. EldoLED

2.2 LIGHTING FIXTURES, GENERAL

A. Lighting fixtures shall comply with UL 1598 and be complete with casings, fittings, holders, shades, and appurtenances, wired and completely assembled.

B. Metal parts: Free from burrs, sharp corners, and edges.

C. Sheet metal components: Steel, unless otherwise indicated. Form and support to prevent warping and sagging.

D. Doors, frames, and other internal access: Smoothly operating, free from light leakage under operating conditions, and arranged to permit access without use of tools. Arrange doors, frames, lenses, diffusers, and other pieces to prevent accidental falling during access and when secured in operating position.

E. Metal finishes: Painted after lighting fixture fabrication.

F. Reflecting surfaces: Minimum reflectance as follows, unless otherwise indicated:

1. White surfaces: 85 percent.
2. Specular surfaces: 83 percent.
3. Diffusing specular surfaces: 75 percent.
4. Laminated silver metalized film: 90 percent.

G. Lenses, diffusers, and covers: 100 percent virgin acrylic plastic or annealed crystal glass, unless otherwise indicated, exactly as scheduled or specified in optical details and lighting characteristics.

1. Plastic: High resistance to yellowing and other changes due to aging, exposure to heat, and ultraviolet radiation.

2.3 LED DRIVERS

A. Driver shall operate from a 120-volt or 277-volt, 60-Hz input power source and be suitable for outputting power to 12-volt or 24-volt LED light sources, as required.

B. Drivers, where specified, shall be capable of being dimmed. Dimmable drivers shall be controlled by a Class 2 low-voltage 0-10VDC controller.

C. Performance Criteria:

1. Driver shall have a Class A sound rating.

2. Driver shall have a power factor (PF) greater than 0.90.
3. Driver shall have Total Harmonic Distortion (THD) of input current equal to or less than 20 percent.

D. Driver shall meet FCC and Title 47 CFR regulations for EMI/RFI.

E. Driver shall comply with ANSI C62.41 Class A requirements for transient protection.

2.4 LED LIGHT ENGINES

A. The LED manufacturer shall provide the quantity and wattage of LEDs required to achieve the defined lighting output set forth by the lighting fixture manufacturer.

B. LED light engines shall be integrated into an engineered package for the specific lighting fixture application, including heat dissipation components.

C. Color temperature: As specified in lighting fixture schedule, with a tolerance of plus or minus 100K and within a range of three macadam ellipses. Noticeable color temperature variation between adjacent lighting fixtures shall be considered a failure to meet these specifications and shall be replaced at no cost to the owner.

D. Minimum performance characteristics:

1. Life: Minimum lumen maintenance of L70 at 50,000 hours, as defined by IES LM-80.
2. Lumen output: Based on absolute photometry, lumens (total luminous flux exiting the physical luminaire), as specified on contract drawings and schedules.
3. Color rendering index: Rated at 80 or higher.

2.5 LIGHTING FIXTURE SUPPORT COMPONENTS

A. Comply with Section 26 05 00, Common Work Results for Electrical, for channel- and angle-iron supports and nonmetallic channel and angle supports.

B. Rod hangers: 3/16-inch-minimum diameter, cadmium-plated, threaded steel rod.

C. Hook hangers: Integrated assembly matched to lighting fixture and line voltage and equipped with threaded attachment, cord, and locking-type plug.

D. Aircraft cable support: Use cable, anchorages, and intermediate supports recommended by lighting fixture manufacturer.

2.6 FINISHES

A. Lighting fixtures: Manufacturer's standard, unless otherwise indicated.

1. Paint finish: Applied after fabrication over corrosion-resistant treatment or primer, free of defects.
2. Metallic finish: Corrosion-resistant.

PART 3 - EXECUTION

3.1 PREPARATION

A. Before ordering the lighting fixtures, consult with the installer of the ceilings to ensure that the correct lighting fixture trim is supplied and installed. Provide the supports and accessories required for installation in each ceiling system.

B. Before ordering the lighting fixtures, verify the specified voltage with the voltage shown on the drawings to ensure the correct voltage is supplied.

3.2 INSTALLATION

A. Furnish and install a complete lighting fixture for every outlet indicated on the drawings so that every outlet shall be properly provided with a suitable lighting fixture of type specified, of wattage indicated.

B. Lighting fixture wire shall bear UL label. Lighting fixture wiring for lighting fixtures and branch circuit wiring in lighting fixture channels shall be type THHN.

C. Furnish lighting fixtures in the quantities, sizes, and types indicated on drawings.

D. Provide recessed lighting fixtures with flexible conduit connector and wire (lighting fixture whip), or a removable wiring access plate, so that they may be wired without removing ballast cover. Plate shall be screwed to lighting fixture housing and conduit shall be securely attached and grounded to lighting fixture to meet NEC requirements.

3.3 LIGHTING FIXTURE SUPPORT

A. Support from building structure: Provide fasteners appropriate to the supporting substrate, and wire, jack chain, or rods as specified for lighting fixture types below.

1. Provide channels bolted or welded between joists where required to obtain proper spacing for lighting supports.
2. Connections to joists or beams: Beam clamps. For wire supports, wrap wire securely around structural member.
3. Connections to concrete: Embedded, as specified in Section 26 05 33, Conduits.

B. In suspended plaster and drywall ceilings, lighting fixtures may be supported from the suspended ceiling construction. Fasten box and lighting fixture supports securely to suspension system. Where lighting fixtures are surface-mounted, cut neat holes in the plaster as required for supports.

C. Recessed lighting fixtures in suspended acoustical ceilings: Coordinate lighting fixture installation with ceiling.

1. Support from building structure: Use fasteners specified in Section 26 05 33, Conduits, and 0.25-inch rods, jack chains, or No. 10 wire.

a. Provide two supports for each individual lighting fixture, one at each end of lighting fixture. In continuous rows, install additional supports at each joint.

2. Provide double nuts on rods.

D. Where it is necessary for a lighting fixture to be installed directly below an air duct, install two hanger rods, one on each side of the duct, bolted to a channel or angle suspended from the hangers under the duct, and support the lighting fixtures from the suspended channel or angle.

3.4 CLEANING

A. Light fixtures, used for temporary lighting during construction, shall be cleaned free of construction dirt to like-new condition.

- END OF SECTION 26 51 00 -

SECTION 28 31 00
FIRE DETECTION AND ALARM SYSTEM

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Provide a complete fire detection and alarm system of the noncoded, addressable, analog type, with manual stations, detectors, notification appliances, controls, and devices.

B. Costs of certification and testing, including tests required by NFPA 72, shall be included in the contract sum.

1.2 DEFINITIONS

A. FACP: Fire alarm control panel.

B. LED: Light-emitting diode.

C. SPDT: Single pole, double throw.

D. Definitions in NFPA 72 apply to fire alarm terms used in this section.

1.3 SUBMITTALS

A. General:

1. When approved, no variation will be permitted except with the approval of the Architect.
2. Submit to the authority having jurisdiction and to the Architect for review and approval.

B. Shop drawings:

1. Floor plans indicating final equipment and device locations and raceway routes.
2. System operation description: Detailed description for this project, including method of operation and supervision of each type of circuit and sequence of operations for manually and automatically initiated system inputs and outputs. Manufacturer's standard descriptions for generic systems are not acceptable.
3. Wiring diagrams and riser diagrams.

C. Product data: Schedule and each type of system component, including dimensioned plans and elevations showing minimum clearances and installed features and devices. Include UL listings.

D. Provide a complete project record drawing as specified in Division 01 and Section 26 01 01 showing the location of all the outlets, cable taps, cable routes, and other components installed. Drawings shall be made part of Operating and Maintenance Manuals.

E. Certifications:

1. UL Certificate of Compliance of system supplier as specified in "Quality Assurance" below.
2. Fire and smoke detection system inspection and test report, completed by the factory representative, endorsed by the Owner and the factory representative, including test data, detector locations and serial numbers, a summary of maintenance performed, recommendations for relocation or addition of detectors and final action regarding these recommendations, and system certification.

1.4 QUALITY ASSURANCE

A. System and equipment shall be UL listed. Each major component shall bear the manufacturer's name and catalog number.

B. UL labels and local testing (if required): As specified in Section 26 05 00, Common Work Results for Electrical.

C. Single-source responsibility: Obtain system components from a single source who assumes responsibility for their compatibility.

D. Qualifications of system supplier and installer:

1. Staff shall consist of at least one NICET Level III Technician or a professional engineer registered in Maryland.
2. Has installed at least ten systems of the type specified which have performed satisfactorily for not less than two years.
3. Maintains a facility with a sufficient stock of spare parts.
4. Shall respond within 24 hours of notification to correct system failure or malfunction. During the project correction period defined in General Conditions and in Section 26 05 00, perform such corrections at no addition to the Contract Sum.

E. Factory-authorized service representative: Trained and certified by the manufacturer of the system, and experienced in the installation and operation of the type of system included in the work.

F. Comply with NFPA 72, applicable local codes, and regulations and requirements of the authorities having jurisdiction. Montgomery County is the local code authority.

1.5 SEQUENCING AND SCHEDULING

A. Existing fire alarm equipment: Maintain fully operational until new equipment has been tested and accepted.

1. Field verify existing system is fully operational before beginning work on the existing components. If existing system is not fully operational immediately notify the Owner and Architect in writing, and do not perform any work on the existing system until directed by the Architect.
2. As new equipment is installed, label it NOT IN SERVICE until new equipment is accepted. As equipment is put in service, remove label and label existing equipment NOT IN SERVICE until it is physically removed.

B. Disconnected equipment: Remove equipment and restore damaged surfaces.

1. Operational disconnected equipment: Package, label, and deliver to Owner.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Basis-of-design system: Existing fire alarm control panel is manufactured by Simplex.

1. New components shall be compatible with existing equipment.

2.2 SMOKE DETECTORS

A. General: UL 268A listed. Include the following features:

1. Operating voltage: 24 volts DC, nominal.
2. Self-restoring: Detectors shall not require resetting or readjustment after actuation to restore them to normal operation.
3. Plug-in arrangement: Detector and associated electronic components are mounted in a module that connects in a tamper-resistant manner to a fixed base with a twist-locking plug connection. Terminals in the fixed base accept building wiring.
4. Integral visual-indicating light: LED type. Indicates detector has operated.
5. Sensitivity: Can be tested and adjusted in-place after installation.
6. Integral addressable module: Arranged to communicate detector status (normal, alarm, or trouble) to the FACP.
7. Remote controllability: Unless otherwise indicated, detectors are analog-addressable type, individually monitored at the FACP for calibration, sensitivity, and alarm condition, and individually adjustable for sensitivity from the FACP.

B. Photoelectric smoke detectors: Include the following features:

1. Sensor: LED or infrared light source with matching silicon-cell receiver.
2. Detector sensitivity: Between 2.5 and 3.5 percent/foot smoke obscuration when tested according to UL 268A.
3. Integral thermal detector: Fixed-temperature type with 135 degrees F setting.

2.3 OTHER DETECTORS

A. Heat detector, fixed-temperature type:

1. Actuated by temperature that exceeds a fixed temperature of the following:

a. Elevator shafts and elevator machine rooms: 135 degrees F.

2. Mounting:

a. Adapter plate for outlet box mounting.
b. Plug-in or twist-lock base, interchangeable with smoke detector bases.

3. Integral addressable module: Arranged to communicate detector status (normal, alarm, or trouble) to the FACP.

2.4 NOTIFICATION APPLIANCES

A. Description: Equipped for mounting as indicated and have screw terminals for system connections.

1. Combination devices: Factory-integrated audible and visible devices in a single-mounting assembly.

B. Visible alarm devices: Synchronized LED or xenon strobe lights listed under UL 1971 with clear or nominal white polycarbonate lens. Mount lens on an aluminum faceplate. The word "FIRE" is engraved in minimum 1-inch-high letters on a removable sleeve on the lens.

1. Rated light output: Indicated on drawings for each location.
2. Strobe leads: Factory connected to screw terminals.
3. Housing: Red in color, fire-retardant, high-impact, polycarbonate suitable for flush or surface mounting.

2.5 ADDRESSABLE INTERFACE DEVICE

A. Monitor module: Microelectronic monitor module listed for use in providing a system address for external alarm-initiating devices with normally open contacts.

1. Dual circuit, intelligent, signaling circuit interface module.

B. Control module: Microelectronic control relay module listed for use in providing control to external appliances or equipment shutdown, to elevator controller to initiate elevator recall, and to circuit-breaker shunt trip for power shutdown.

1. One Form C (SPDT) dry relay contact rated at 2 amps and 24 volts DC.

C. Isolator module: Microelectronic fault isolator module listed for isolating and removing a fault from a data circuit while allowing the remaining data loop to continue operating.

1. Protect loop system against wire-to-wire short circuits by isolating section of loop and permitting other loop sections to continue to operate.

2.6 WIRE AND WIRING SYSTEM

A. Non-power-limited circuits: Solid-copper conductors with 600-V rated, 75 deg C, color-coded insulation.

1. Low-voltage circuits: No. 14 AWG, minimum.
2. Line-voltage circuits: No. 12 AWG, minimum.

B. Power-limited circuits: NFPA 70, Types FPL, FPLR, or FPLP, as recommended by manufacturer.

C. Wiring system: Class B in accordance with NFPA 72.

D. Type MC fire alarm cable: Equal to AFC Cable Systems FPLP metal-clad, multi-conductor, fire alarm and control cable.

1. Ratings:

a. Plenum rated.
b. Approved for use as fixed wiring concealed in building.
c. Maximum operating temperatures:

(1) 105 degrees C dry for FPLP applications at nominal voltage ratings 300 V and less.
(2) 90 degrees C dry for MC cable installations at nominal voltage ratings of 600 V and less.

d. UL listed for penetrations of wall and floor assemblies of gypsum wallboard, concrete, and concrete masonry with one-, 2-, and 3-hour fire ratings.

2. Shield over conductor assembly: Laminated aluminum and mylar tape and tinned copper drain wire.

a. Drain wire: Minimum No. 18 AWG, in contact with aluminum shield.

3. Listed in accordance with UL 1596:

a. Insulated or bare grounding conductor in accordance with Table 6.3, cabled with the circuit conductors and identified in compliance with Section 35.
b. Galvanized steel armor, red, applied over inner cable assembly with positive interlock conforming to the requirements of Section 12.
c. Tested in accordance with applicable requirements.

E. Survivability: Circuits necessary for the operation of notification appliances shall be protected by a 2-hour fire-rated cable, a 2-hour fire-rated cable system, or a 2-hour fire-rated enclosure.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Factory-authorized service representative, as required in "Quality Assurance" in Part 1 above, shall supervise installation, software documentation, adjustment, preliminary testing, final testing, and certification of the system, and provide the operating instructions.

B. Provide wiring, conduit, and outlet boxes required for the complete system, in accordance with system manufacturer's instructions and with requirements specified in Division 26 for wiring, conduit, and boxes. Provide 12 inches of slack at each outlet.

1. Install wiring in conduit, except where noted on drawings to provide Type MC fire alarm cable.
2. Install Type MC fire alarm cable in accordance with Article 330 of the National Electric Code (NFPA 70).
3. Identification: Paint fire alarm junction box covers red.

C. Wires, cables, conduits, and wiring connections are specified in Division 26, Electrical. Include in the work of this section, wiring, conduits, and equipment connections complying with the requirements of Division 26, so that the fire alarm system will function as specified and indicated on the drawings.

D. Wiring: Free from grounds or crosses between conductors.

1. Identification: Color code wiring, not duplicating building wiring colors. Tag each wire at each junction point.

E. Final connections between equipment and the wiring system shall be made under the direction and supervision of the qualified supplier.

F. Locate 135 degrees F rated heat detectors in elevator shafts and elevator machine rooms within 18 inches of sprinkler heads.

3.2 INTERFACE WITH OTHER WORK

A. Coordinate with sprinkler contractor for number and locations of sprinklers in elevator shafts and elevator machine rooms.

3.3 LOCATIONS OF FIRE ALARM EQUIPMENT

A. Visual indicating appliances: Install where shown on the drawings. If field conditions require variation from drawings, do not violate ADA requirements, including, but not limited to, the following:

3.4 INSPECTION, TEST, ADJUSTMENT AND REPORT

A. Furnish equipment and appliances for testing the complete system during progress of the work and after completion of the installation, including a megger test of wiring. The tests generally shall demonstrate the following:

1. Circuits are continuous and free from short circuits.
2. Circuits are free from unspecified grounds.
3. Resistance to ground of non-grounded circuits is not less than one megohm.
4. Circuits are properly connected in accordance with the applicable wiring diagrams.
5. Each detector operates correctly.
6. Detectors are correctly located and sufficient in number.

B. Defects or omissions observed during general and system tests shall be repaired as quickly as possible and the tests reconducted.

C. Submit report as required in Part 1 above.

3.5 OPERATING INSTRUCTIONS

A. As specified in Section 26 05 00, provide operating instructions.

B. Provide at least 8 hours of additional instruction time for the systems and equipment specified in this section, consisting of 2 periods of 4 consecutive hours, during a period of not more than 60 days.

- END OF SECTION 28 31 00 -