

TECHNICAL SPECIFICATIONS

SUNY Purchase Academic Restrooms Renovation Project

PHASE 2

Music Building

Dance Building

Library

**Physical Education
(Alternate)**

SU 050522

PROJECT

Restrooms Renovations
Purchase College
State University of New York

CLIENT

State University of New York
Purchase College
735 Anderson Hill Road
New York, New York 10577

ARCHITECT

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SECTION 02 41 13 - SELECTIVE DEMOLITION

PART 1 - GENERAL

1.01 SUMMARY

- A. Work Included: Provide products in accordance with the Contract Documents. The Contract Documents are as defined in the "Agreement". The "General Conditions" shall apply to all work under the Contract. The Work of this Section shall include but not be limited to the following:
1. The work shall generally include removal of portions of existing building structures and assemblies indicated on drawings and as required to accommodate new construction including walls, fixtures, equipment, and interior finishes.
 2. The extent of selective demolition work required is shown by notes and graphic information on the drawings, and may be summarized, but not by way of limitation, as the removal of interior work as indicated, the removal of existing construction (to the extent indicated) from the building and removal work at existing adjacent construction, as necessary to receive or provide for new construction and related items to be reinstalled and/or retained.
 3. Primary repair and restoration of existing and installation of new construction after completion of the selective removal work. The work of this section is limited to that necessary to enable subsequent new construction work to proceed in a phased schedule as described in the contract documents.
 4. Removal of portions of existing assemblies indicated on drawings and as required to accommodate new construction; including walls, partitions, finishes, doors, door frames, fixtures, built-in casework, office partitions, equipment and assemblies, as indicated.
 5. Removal of assemblies and adjacent concrete and masonry work as well structural items to accommodate new construction and new openings.
 6. Removal and protection of existing items to remain or to be relocated.
 7. Removal of debris, rubbish, materials and equipment resulting from removals, abandoned items, and items serving no useful purpose in new construction, including items such as piping, fixtures, conduit, wiring, ducts, etc. except for material intended for reuse or to be retained by the Client.
 8. Provisions for storage and protection of salvaged materials and other materials in good condition intended for reuse or to be retained.
 9. Patching of existing surfaces damaged as a result of this work, for refinishing of existing surfaces prior to installation of new work.
 10. Cutting of non-structural concrete and masonry for piping ducts, and conduit is included in the respective mechanical and electrical sections in Divisions 23 and 26.
- B. Related Sections
1. Refer to Division 1 for coordination, cutting and patching standards, submittals, temporary facilities, materials, close-out and other related requirements specified.
 2. Division 22 Plumbing.
 3. Division 23 - Mechanical.
 4. Division 26 - Electrical.

1.02 SUBMITTALS

- A. Schedule indicating proposed sequence of operations for selective demolition work to the Architect for review prior to start of work. Include coordination for shutoff, capping, and continuation of utility services as required, together with details for dust and noise control protection.
 - 1. Include written proposals, supplemented by diagrams and shop drawings as necessary, indicating proposed procedures for the protection of portions of the existing building indicated to remain.
- B. Data Sheets: Submit manufacturers' data sheets of all materials to be used for protection.
- C. Photographs of existing conditions of structures, surfaces, equipment, and adjacent improvements that might be misconstrued as damage related to removal operations. Submit copies to the Architect prior to start of work.
- D. Contractor shall obtain permits for the demolition of existing premises prior to the start of any demolition.

1.03 QUALITY ASSURANCE

- A. Code: Perform the work in accordance with the applicable provisions of the New York City Building Code including, but not limited to, "Safety in Building Operations" and "Safety of Public and Property During Construction Operations, and Demolition Operations".
- B. Structural Work: Do not remove or cut-and-patch structural work in a manner resulting in a reduction of load carrying capacity or load/deflection ratio, unless specifically indicated, or adequate temporary support is provided.
 - 1. The Contractor shall employ at no additional cost to the Owner, a structural engineer, licensed in the State of New York, to assist in determining correct methods and materials to be used during the Work of this Section.
 - 2. Where structural elements of the building are removed, submit certification by licensed engineer that the means and methods used are appropriate and do not endanger remaining structure.
- C. Operational and Safety Limitations: Do not remove or cut-and-patch operational elements and safety-related components in a manner intended or resulting in decreased operational life or decreased safety, unless specifically indicated.
- D. Workman's Qualifications: Assign the work of moving, removal, cutting, and patching to trades qualified to perform the work in a manner to cause least damage to each type of work and provide means of returning surfaces to appearance of new work.
- E. Contractor's Responsibility: Be solely responsible for construction means, methods, techniques, sequences, procedures, and safety precautions, including work necessary to support existing construction. Correct, at no additional cost, damage caused by movement or settlement due to inadequate or improper supports.

1.04 JOB CONDITIONS

- A. Existing Information: Data on existing conditions are not intended as representations or warranties of accuracy or continuity of as-built conditions. It is expressly understood that the Architect will not be responsible for deviations from conditions indicated. Data made available are derived from existing documents or field survey and is made available for convenience of the Contractor.
- B. Condition of Structures: The Owner assumes no responsibility for actual condition of items or structures to be demolished.
 - 1. Conditions existing at time of inspection for bidding purposes will be maintained by the Owner in so far as practicable. However, variations within structure may occur by Owner's removal and salvage operations prior to start of this demolition work.
- C. Partial Demolition and Removal: Items to be removed, of salvageable value to Contractor, may be removed from structure as work progresses. The Architect shall designate items that are to be removed by the Contractor for the Owner and items that will be reinstalled or turned over to the Owner. All other demolition items shall be removed by the Contractor and removed from the premises.
 - 1. Storage or sale of removed items on site will not be permitted.
- D. Protections: Ensure safe passage of persons around area of demolition. Conduct operations to prevent injury to adjacent buildings, structures, other facilities, and persons.
 - 1. Provide shoring, bracing, or support to prevent movement, settlement or collapse of structures to be demolished and adjacent facilities to remain.
 - 2. Protect from damage existing finish work that is to remain in place and becomes exposed during demolition operations.
 - 3. Carefully remove items indicated to be reinstalled using methods that will not cause damage or prevent reinstallation.
 - 4. Provide at least one general type fire extinguisher in each area where removal work is taking place. Locate extinguisher where easily accessible and insure that workmen are familiar with their use.
 - 5. Refer to the Drawings for existing connection and materials requiring special care be exercised to protect and maintain them in their original condition.
 - 6. Remove and dispose of temporary protections at completion of work or when no longer necessary.
- E. Damages: Promptly repair damages caused to adjacent facilities by demolition work at no cost to the Owner. All remedial work to be done by the Contractor shall first be approved by the Architect.

- F. Traffic: Conduct selective demolition operations and removal of debris to ensure minimum interference with streets, walks, and other adjacent occupied or used facilities.
 - 1. Do not close or obstruct streets, walks or other occupied or used facilities without permission from authorities having jurisdiction. Provide alternate routes around closed or obstructed traffic ways if required by governing regulations.
- G. Explosives: Do not bring explosives to site or use explosives.
- H. Utility Services: Maintain existing utilities indicated to remain, keep in service, and protect against damage during demolition operations.
 - 1. Verify that utilities not required to remain in service have been shut off. Disconnecting and capping indicated utilities where noted before starting demolition is part of this Work. Confirm with local utilities the locations of existing utilities so that adequate protection of services is provided.
 - 2. Should uncharted, or incorrectly charted piping or other utilities be encountered during alteration work, consult Architect and Engineer immediately for directions.
 - 3. Demolish and completely remove existing utilities indicated to be removed. Coordinate shut-off of services if lines are active.
- I. Flame Cutting: Do not use cutting torches until work area is cleared of flammable materials. Maintain portable fire extinguisher during flame-cutting operations.
- J. Protect and support conduits, drains, pipes and wires to remain which are subject to damage by construction activities.
- K. Environmental Controls: Use temporary enclosures, water sprinkling, and other methods to limit dust and dirt migration. Comply with governing regulations pertaining to environmental protection.
- L. Do not use water when it may create hazardous or objectionable conditions such as damage to finishes, flooding, and pollution.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Where indicated on the Drawings or otherwise indicated furnish all required lumber, plywood and fasteners for use as protection materials.
- B. Other materials indicated on the Drawings or otherwise required for use as protection include the following:
 - 1. Masonite: 1/4" thick minimum.
 - 2. Polyethylene sheeting, 6 mil minimum, reinforced.

2.02 REPAIR MATERIALS

- A. Use repair materials identical to existing materials.
 - 1. Where identical materials are unavailable or cannot be used for exposed surfaces, use materials that visually match existing adjacent surfaces to the fullest extent possible.
 - 2. Use materials whose installed performance equals or surpasses that of existing materials.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. General: Prior to commencement of selective demolition operations, verify that existing utilities have been located, identified, disconnected and capped.
- B. Survey existing conditions and correlate with requirements indicated to determine extent of selective demolition required.
- C. Inventory and record the condition of items to be removed and reinstalled and items to be removed and salvaged.
- D. 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.
- E. 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. Design for shoring and bracing shall be prepared by a licensed engineer.
- F. Perform surveys as the Work progresses to detect hazards resulting from selective demolition activities.

3.02 UTILITY SERVICES

- A. Maintain existing utilities indicated to remain in service and protect them against damage during selective demolition operations.
 - 1. Do not interrupt existing utilities serving occupied or operating facilities, except when authorized in writing by the Owner and authorities having jurisdiction, including building management. Provide temporary services during interruptions to existing utilities, as acceptable to governing authorities.
 - a. Provide not less than 72 hours notice to Architect and Owner if shutdown of service is required during changeover.
- B. Utility Requirements: Refer to Division 22, 23 and 26 Sections for shutting off, disconnecting, removing, and sealing or capping utility services. Do not start selective demolition work until utility disconnecting and sealing have been completed and verified in writing.

3.03 PREPARATION

- A. General: Provide interior shoring, bracing, or support to prevent movement, settlement, or collapse of areas to be demolished or disassembled and adjacent facilities to remain.
- B. Cease operations and notify the Architect immediately if safety of structure appears to be endangered. Take precautions to support structure until determination is made for continuing operations.
- C. Cover and protect finishes, equipment, and fixtures from spoilage or damage when demolition or disassembly work is performed in areas where such items have not been removed.
- D. Locate, identify, stub off, and disconnect utility services that are not indicated to remain.
 - 1. Each respective trade to provide bypass connections as necessary to maintain continuity of service to occupied areas of building. Provide minimum of 72 hours advance notice to the Architect if shutdown of service is necessary during changeover.

3.04 DEMOLITION

- A. General: Perform selective demolition work in a systematic manner. Use such methods as required to complete work indicated on Drawings in accordance with demolition schedule and governing regulations.
 - 1. Demolish concrete and masonry in small sections. Cut concrete and masonry at junctures with construction to remain using power-driven masonry saw or hand tools; do not use power-driven impact tools.
 - 2. Locate demolition equipment throughout structure and promptly remove debris to avoid imposing excessive loads on supporting walls, floors, or framing.
 - 3. Provide services for effective air and water pollution controls as required by local authorities having jurisdiction.
 - 4. For interior slabs, use removal methods that will not crack or structurally disturb adjacent slabs or partitions. Use power saw where possible.
- B. If unanticipated mechanical, electrical, or structural elements that conflict with intended function or design are encountered, investigate and measure both nature and extent of the conflict. Submit report to the Architect in written, accurate detail. Pending receipt of directive from the Architect and Engineer, rearrange the selective demolition schedule as necessary to continue overall job progress without undue delay.

3.05 SALVAGED MATERIALS

- A. Salvaged Items: Where indicated on Drawings as "Salvage" or "to be salvaged", carefully remove indicated items, clean, store, and turn over to the Resident Engineer and obtain receipt.
 - 1. Where Salvage is indicated clean store and protect as directed. Turn over or reinstall as indicated.

3.06 DISPOSAL OF DEMOLISHED MATERIALS

- A. Remove from building site debris, rubbish, and other materials resulting from demolition operations. Transport and legally dispose off site.
 - 1. If hazardous materials are encountered during demolition operations, comply with applicable regulations, laws, and ordinances concerning removal, handling, and protection against exposure or environmental pollution.
 - 2. Burning of removed materials is not permitted on project site.
 - 3. All lead-contaminated debris and wastes generated during the demolition must be disposed of as hazardous waste, pursuant to the local State of New York and federal environmental regulations.

3.07 CLEANUP, PATCHING AND REPAIR

- A. General: Upon completion of demolition work, remove tools, equipment, and demolished materials from site. Remove protections and leave interior areas broom clean.
 - 1. Repair demolition performed in excess of that required. Return elements of construction and surfaces to remain to condition existing prior to start operations. Repair adjacent construction or surfaces soiled or damaged by selective demolition work.
 - 2. Clean adjacent areas, of all dust, dirt, and debris caused by demolition, cutting, and patching operations. Daily and final clean up shall be satisfactory to the Architect.
 - 3. Where repairs to existing surfaces are required, patch to produce surfaces suitable for new materials. Restore exposed finishes of patched areas and extend finish restoration into adjoining construction to remain in a manner that eliminates evidence of patching and refinishing.
 - 4. Restore the integrity of rated construction where compromised by demolition.
 - 5. Patch and repair floor and wall surfaces where demolished walls or partitions extend one finished area into another. Provide a flush and even surface of uniform color. Closely match texture and finish of existing adjacent surface with durable seams that are as invisible as possible, complying with specified tolerances.

END OF SECTION

SECTION 03 35 00 – CONCRETE FINISHING

PART 1 - GENERAL

1.01 SUMMARY

- A. Work Included: Provide products in accordance with the Contract Documents. The Contract Documents are as defined in the "Agreement". The "General Conditions " shall apply to all work under the Contract. The Work of this Section shall include but not be limited to the following:

1. Self-leveling latex modified lightweight concrete floor fill.
2. Floor primers and accessories.
3. Patching material.

- B. Related Sections:

1. Section 09 30 00 - Tile
2. Section 09 65 00 - Resilient Flooring

1.02 QUALITY ASSURANCE

- A. Engage an experienced firm that has recently completed Cementitious Floor Topping projects similar in cost, design, and extent to that indicated by this section and whose work has resulted in construction with a record of successful in-service performance.

1.03 SUBMITTALS

- A. Product Data: Submit data for proprietary materials and items, as requested by Resident Engineer.
- B. Samples: Submit samples of each material as requested by Resident Engineer, including names, sources, and descriptions.
- C. Laboratory Test Reports: Submit laboratory test reports.
- D. Materials Certificates: Provide materials certificates in lieu of materials laboratory test reports when permitted by Architect and signed by Manufacturer and Contractor, certifying that each material complies with, or exceeds, specified requirements.

1.04 PROJECT CONDITIONS

- A. Maintain environmental conditions and protect work before, during, and after installation to comply with manufacturer's printed recommendations.
- B. Maintain temperatures at not less than 50 deg F in areas designated to receive fill material, during and after installation, unless otherwise required by manufacturer's instructions.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, provide products as manufactured by one of the following, or approved equal:
 - 1. Ardex, Inc.
 - 2. Euclid.
 - 3. Increte Systems.
 - 4. or Approved equal.
- B. Product:
 - 1. Engineered Cement: Provide "Ardex K-15" as manufactured by Ardex, Inc., or an approved equal with a 3 day compressive strength of not less than 3000 psi, and with a 28 day compressive strength of not less than 4000 psi per ASTM C 109.
 - a. For leveling of floors.
 - 2. Finishing Underlayment: "SD-Fb Feather Finish" as manufactured by Ardex Inc., or an approved equal.

2.02 MIX DESIGN

- A. General: Mix proportions and methods shall be in strict compliance with the manufacturer's recommendations.
- B. Mix Proportions: Provide mixture proportions in strict accordance with manufacturer's printed instructions.
 - 1. Mix materials in a high-speed mixing device for not less than two minutes.
- C. Mixing devices: Provide mechanical mixer for mixing topping material with water at project site. Equip mixer with a suitable water-measuring device.
 - 1. Use only mixers which are capable of mixing cement and water into a uniform mix.

PART 3 - EXECUTION

3.01 CONDITION OF SURFACES

- A. Substrate Surfaces: Remove dirt, loose material, oil, grease, paint or other contaminants, leaving a clean structurally sound substrate surface that complies with manufacturer's requirements.
- B. Leak Prevention: Fill cracks, seams, and voids of substrate with a quick setting patching compound as recommended by fill manufacturer to prevent leakage of fill materials where leakage could occur.
- C. Primer: Apply primer, as recommended by fill manufacturer, in compliance with the manufacturer's directions. Porosity of substrate may require multiple coats of primer; comply with manufacturer's recommendations.

3.02 PLACING

- A. Apply materials to comply with the manufacturer's instructions.
- B. Application: Place lightweight concrete fill product over properly prepared substrates. Spread and screed fill material to a smooth surface. Place fill material as continuously as possible until application is complete so that no fill material slurry is placed against fill material which has obtained its initial set.
- C. Drying: General Contractor shall provide continuous ventilation and adequate heat to rapidly remove moisture from the area until the fill material product is dry. General Contractor shall provide mechanical ventilation if necessary under the above conditions.
 - 1. To test for dryness, tape a 24 inch by 24 inch section of plastic to the surface of the underlayment. After 48 to 72 hours, if no condensation occurs, the underlayment shall be considered dry. Perform dryness test 7 days after pour, and each day thereafter until dryness test proves successful.

3.03 PERFORMANCES

- A. Failure of materials to bond to substrates (as indicated by a hollow sound when tapped), or disintegration or other failure of underlayment to perform in accordance with product data, will be considered failure of materials and workmanship. Repair or replace materials in areas of such failures.

3.04 PROTECTION

- A. Protection: During construction, place temporary protections, as recommended by the manufacturer, to protect systems from construction traffic and similar loads.

END OF SECTION

SECTION 06 10 00 - ROUGH CARPENTRY

PART 1 - GENERAL

1.01 SUMMARY

- A. Work Included: Provide products in accordance with the Contract Documents. The Contract Documents are as defined in the "Agreement". The "General Conditions " shall apply to all work under the Contract. The Work of this Section shall include but not be limited to the following:
 - 1. Wood grounds, nailing strips, blocking, furring, nailers, and framing.
 - 2. Preservative treatment for wood.
 - 3. Fire-retardant treatment for wood.
 - 4. Miscellaneous lumber.
 - 5. Plywood construction and backing panels.
 - 6. Plywood subfloor and underlayment where required.
 - 7. Rough hardware, including nails, screws, anchors, brackets, braces, bolts, nuts, fittings, and other devices required for the proper fitting, connecting, and erecting of the Work.
- B. Related Sections
 - 3. Section 09 21 00 - Gypsum Drywall Systems.
 - 4. Section 09 90 00 - Painting.

1.02 DEFINITIONS

- A. Rough carpentry includes carpentry work not specified as part of other Sections and generally not exposed, unless otherwise specified.

1.03 SUBMITTALS

- A. Product Data: Submit manufacturer's specifications and installation instructions for manufactured materials.
 - 1. Construction adhesives.
 - 2. Construction panels.
 - 3. Hardware and fasteners.
- B. Material certificates for dimensional lumber specified to comply with minimum allowable unit stresses. Indicate species and grade selected for each use as well as design values approved by the Board of Review of American Lumber Standards Committee.

- C. Wood treatment data as follows including chemical treatment manufacturer's instructions for handling, storing, installation, and finishing of treated material:
 - 1. For each type of preservative treated wood product include certification by treating plant stating type of preservative solution and pressure process used, net amount of preservative retained, and compliance with applicable standards.
 - 2. For water-borne treated products include statement that moisture content of treated materials was reduced to levels indicated prior to shipment to project site.
 - 3. For fire-retardant-treated wood products include certification by treating plant that treated material complies with specified standard and other requirements.
 - 4. Material test reports from qualified independent testing laboratory indicating and interpreting test results relative to compliance of fire-retardant-treated wood products with requirements indicated.
 - 5. Warranty of chemical treatment manufacturer for each type of treatment.
 - 6. Submit product specifications and material data (MSD) safety sheets for each product.
- D. Research reports or evaluation reports of the model code organization acceptable to authorities having jurisdiction evidencing compliance of the following wood products with specified requirements and building code in effect for Project.
 - 1. Power driven fasteners.
 - 2. Fire-retardant-treated wood.

1.04 QUALITY ASSURANCE

- A. Single-Source Responsibility for Fire Retardant Treated Wood: Obtain each type of fire-retardant-treated wood products from one source for both treatment and fire-retardant formulation.
- B. Mill and Producers Mark: Each piece of lumber and plywood shall be grade-stamped indicating type, grade, mill, and grading agency certified by the Board of Review of the American Lumber Standards Committee. Mark shall appear on unfinished surface, or ends of pieces with finished surfaces.
 - 1. Pressure Preservative Treated Material: Accredited agency quality mark on each piece of wood including treatment.
 - 2. Fire-Retardant Treated Material: Accredited testing agency mark on each piece of wood indicating compliance with the fire hazard classification.
- C. Standards: Comply with the following unless otherwise specified or indicated on the Drawings:
 - 1. Lumber: American Softwood Lumber Standard PS 20 by the U.S. Department of Commerce. Comply with applicable provisions by each indicated use.
 - 2. Plywood: Product Standard PS 1 for Softwood Plywood, Construction and Industrial by the U.S. Department of Commerce.

3. Plywood Installation: APA Design/Construction Guide, by the American Plywood Association (APA), except as indicated otherwise.
4. Grading Rules: Refer to the following organizations for applicable wood species grading requirements:
 - a. Douglas Fir, Hem-Fir, Idaho White Pine, and other Western Woods: Western Wood Products Association (WWPA) or West Coast Lumber Inspection Bureau (WCLIB).
 - b. Southern Pine: Southern Pine Inspection Bureau (SPIB).
5. Preservative Treatment: American Wood Preservers' Association (AWPA) and American Wood Preservers Bureau (AWPB) Standards, quality control methods, and inspection requirements.
6. Fire-Retardant Treatment: American Wood Preservers' Association (AWPA) Standards. Comply with local code requirements.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Delivery and Storage: Keep materials under cover and dry. Protect against exposure to weather and contact with damp or wet surfaces. Stack lumber as well as plywood and other panels; provide for air circulation within and around stacks and under temporary coverings including polyethylene and similar materials.
- B. For lumber and plywood pressure treated with waterborne chemicals, place spacers between each bundle to provide air circulation.

PART 2 - PRODUCTS

2.01 LUMBER, GENERAL

- A. Lumber Standards: Furnish lumber manufactured to comply with PS 20 "American Softwood Lumber Standard" and with applicable grading rules of inspection agencies certified by American Lumber Standards Committee's (ALSC) Board of Review.
- B. Inspection Agencies: Inspection agencies and the abbreviations used to reference them with lumber grades and species include the following:

SPIB - Southern Pine Inspection Bureau.
WCLIB - West Coast Lumber Inspection Bureau.
WWPA - Western Wood Products Association.
- C. Grade Stamps: Provide lumber with each piece factory-marked with grade stamp of inspection agency evidencing compliance with grading rule requirements and identifying grading agency, grade, species, moisture content at time of surfacing, and mill.

- D. Nominal sizes are indicated, except as shown by detail dimensions. Provide actual sizes as required by PS 20, for moisture content specified for each use.

1. Provide dressed lumber, S4S, unless otherwise indicated.
2. Provide seasoned lumber with 19 percent maximum moisture content at time of dressing and shipment for sizes 2 inches or less in nominal thickness, unless otherwise indicated.

2.02 CONSTRUCTION PANELS, GENERAL

- A. Construction Panel Standards: Comply with PS 1 "U.S. Product Standard for Construction and Industrial Plywood" for plywood construction panels and, for products not manufactured under PS 1 provisions, with APA PRP-108.
- B. Trademark: Furnish construction panels that are each factory-marked with APA trademark evidencing compliance with grade requirements.
- C. General: Where construction panels are indicated for the following concealed types of applications, provide APA Performance-Rated Panels complying with requirements designated under each application for grade designation, span rating, exposure durability classification, edge detail (where applicable), and thickness.

2.03 INTERIOR SUBFLOORING AND UNDERLAYMENT

- A. General: Where structural-use panels are indicated for the following concealed types of applications, provide APA-performance-rated panels complying with requirements designated under each application for grade, span rating, exposure durability classification, and edge detail (where applicable). Provide fire resistant material unless otherwise indicated.
1. Thickness: Provide panels meeting requirements specified but not less than thickness indicated.
 2. Span Ratings: Provide panels with span ratings required to meet "Code Plus" provisions of APA Form No. E30, "APA Design/Construction Guide: Residential & Commercial."
 3. Combination Subfloor-Underlayment: APA-rated Sturd-I-Floor.
 4. Exposure Durability Classification: Exterior.
 5. Provide 250Lbs per sq. ft. for 24" span Min. or as indicated.
- B. Plywood Underlayment: Provide APA-rated, Underlayment grade, exterior plywood, 5/8 inch (15.9 mm) thick unless otherwise indicated.

2.04 DIMENSION LUMBER

- A. For light framing provide "Stud," "No. 3," or "Standard" grade lumber for stud framing (2 to 4 inches thick, 2 to 4 inches wide, 10 feet and shorter) and "Stud" or "No. 3" grade for other light framing (2 to 4 inches thick, 2 to 6 inches wide), any species.

2.05 CONSTRUCTION PANELS FOR BACKING

- A. Plywood Backing Panels: For mounting electrical or telephone equipment, provide fire-retardant-treated plywood panels with grade designation, APA C-D Plugged Exposure 1, in thickness indicated, or, if not otherwise indicated, not less than 15/32 inch.

2.06 FASTENERS

- A. General: Provide fasteners of size and type indicated that comply with requirements specified in this article for material and manufacture.
 - 1. Where rough carpentry is exposed to masonry or concrete contact, or in areas of high relative humidity, provide fasteners with a hot-dip zinc coating per ASTM A 153 or of AISI Type 304 stainless steel.
- B. Nails, Wire, Brads, and Staples: FS FF-N-105.
- C. Power Driven Fasteners: National Evaluation Report NER-272.
- D. Wood Screws: ANSI B18.6.1.
- E. Lag Bolts: ANSI B18.2.1.
- F. Bolts: Steel bolts complying with ASTM A 307, Grade A; with ASTM A 563 hex nuts and where indicated, flat washers.
- G. Masonry Anchoring Devices: Expansion shields, masonry nails and drive screws: FS FF-S-325.
- H. Toggle Bolts: FS FF-B-588.
- I. Bar or Strap Anchors: ASTM A575 carbon steel bars.
- J. Wall Plugs: Corrugated type, galvanized steel, 24 USS gage min, not less than 2" wide x 2-1/2" deep.

2.07 MISCELLANEOUS MATERIALS

- A. Adhesives for Field Gluing Panels: Formulation complying with APA AFG-01 that is approved for use with type of construction panel indicated by both adhesive and panel manufacturer.

2.08 PRESERVATIVE WOOD TREATMENT BY PRESSURE PROCESS

- A. General: Where lumber or plywood is indicated as preservative-treated wood or is specified herein to be treated, comply with applicable requirements of AWP Standards C2 (Lumber) and C9 (Plywood). Mark each treated item with the AWPB or SPIB Quality Mark Requirements.

- B. Pressure-treat with water-borne preservatives to a minimum retention of 0.25 pcf. For interior uses, after treatment, kiln-dry lumber and plywood to a maximum moisture content, respectively, of 19 percent and 15 percent. Treat indicated items and the following:
 - 1. Wood nailers, sub floors and underlayment, equipment support bases, blocking, stripping, and similar members in connection with concrete vapor barriers, and waterproofing.
 - 2. Wood sleepers, blocking, furring, stripping, and similar concealed members in contact with masonry or concrete.
- C. Complete fabrication of treated items prior to treatment, where possible. If cut after treatment, coat cut surfaces to comply with AWP A M4. Inspect each piece of lumber or plywood after drying and discard damaged or defective pieces.

2.09 FIRE-RETARDANT TREATMENT BY PRESSURE PROCESS

- A. General: Where fire-retardant-treated wood is indicated, pressure impregnate lumber and plywood with fire-retardant chemicals to comply with AWP A C20 and C27, respectively, for treatment type indicated; identify "fire-retardant- treated wood" with appropriate classification marking of Underwriters Laboratories, Inc., U.S. Testing, Timber Products Inspection, Inc. or other testing and inspecting agency acceptable to authorities having jurisdiction.
 - 1. Current Evaluation/Research Reports: Provide fire-retardant-treated wood for which a current model code evaluation/research report exists that is acceptable to authorities having jurisdiction and that evidences compliance of fire-retardant-treated wood for application indicated.
- B. Interior Type A: For interior locations use fire-retardant chemical formulation that produces treated lumber and plywood with the following properties under conditions present after installation:
 - 1. No reduction takes place in bending strength, stiffness, and fastener holding capacities below values published by manufacturer of chemical formulation that are based on tests by a qualified independent testing laboratory of treated wood products identical to those indicated for this Project under elevated temperature and humidity conditions simulating installed conditions.
 - 2. No other form of degradation occurs due to acid hydrolysis or other causes related to manufacture and treatment.
 - 3. No corrosion of metal fasteners results from their contact with treated wood.
- C. Inspect each piece of treated lumber or plywood after drying and discard damaged or defective pieces.

- D. Available Products: Subject to compliance with requirements, fire-retardant-treated wood products that may be incorporated in the Work include, but are not limited to, the following:
 - 1. Interior Type A Fire-Retardant-Treated Wood:
 - a. "Dricon," Hickson Corporation.
 - b. "Pyro-Guard," Hoover Treated Wood Products.
 - c. "Flameproof LHC-HTT," Osmose Wood Preserving Co, Inc.
 - d. Or Approved Equal.
- E. Fire-Retardant Treatment: Treat all wood and wood products to be fire-retardant, using the method prescribed in the New York City Building Code. Identify treated lumber with appropriate marking.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Verification of Conditions: Examine substrate and supporting structure on which rough carpentry is to be installed for defects that will adversely affect the execution and quality of the Work. Do not proceed with installation until unsatisfactory conditions are corrected.

3.02 INSTALLATION, GENERAL

- A. Discard units of material with defects that impair quality of rough carpentry construction and that are too small to use in fabricating rough carpentry with minimum joints or optimum joint arrangement.
- B. Set rough carpentry to required levels and lines, with members plumb and true to line and cut and fitted.
- C. Fit rough carpentry to other construction; scribe and cope as required for accurate fit. Correlate location of furring, nailers, blocking, grounds, and similar supports to allow attachment of other construction.
- D. Securely attach rough carpentry work to substrate by anchoring and fastening with threaded fasteners unless otherwise as indicated.
- E. Countersink nail heads on exposed carpentry work and fill holes.
- F. Use threaded fasteners and screws, unless otherwise indicated. Select fasteners of size that will not penetrate members where opposite side will be exposed to view or will receive finish materials. Make tight connections between members. Install fasteners without splitting of wood; predrill as required.
- G. Fire-Retardant Treated Wood: Do not rip or mill; only end cuts, drilling holes and joining cuts shall be permitted.
 - 1. Where material is cut to length, shaped or grooved after treatment, surfaces thereby exposed shall be protected by tightly butting them against noncombustible or fire-retardant treated material, in accordance with the NYC Building Code. Drilled holes shall be covered with tightly fitting noncombustible cover plates.

3.03 WOOD GROUNDS, NAILERS, AND BLOCKING

- A. Install wood grounds, nailers, and blocking, where shown and where required for screeding or attachment of other work. Form to shapes as shown and cut as required for true line and level of work to be attached. Coordinate location with other work involved.
- B. Attach to substrates as required to support applied loading. Countersink bolts and nuts flush with surfaces, unless otherwise indicated. Build into masonry during installation of masonry work. Where possible, anchor to formwork before concrete placement.

3.04 WOOD FURRING

- A. Install plumb and level with closure strips at edges and openings. Shim with wood as required for tolerance of finished work.
- B. Furring to Receive Paneling: Install horizontally and vertically. Select furring for freedom from knots capable of producing bent-over nails and resulting damage to paneling.

3.05 INSTALLATION OF CONSTRUCTION AND BACKING PANELS

- A. General: Comply with applicable recommendations contained in Form No. E30, "APA Design/Construction Guide - Residential & Commercial," for types of construction panels and applications indicated.
- B. Fastening Methods: Fasten panels as indicated below:
 - 1. Plywood Backing Panels: Nail, screw or bolt to supports.
 - 2. Panels exposed to High Humidity: As indicated by substrate material or directed. Nails, screws or bolts, galvanized or stainless steel for use where applicable.
- C. Fastening Methods: Fasten panels as indicated below:
 - 1. Subflooring: Glue and screw to framing. Continually glue and screw, 6" o.c. on panel edges and 8" o.c. over sleepers or blocking.

3.06 ROUGH HARDWARE

- A. Furnish all rough hardware, such as nails, bolts, buck anchors, clips, (including expansion and carriage bolts for wall mounting, etc.), and all other rough hardware required to secure the carpentry work in place, unless otherwise specified.

END OF SECTION

SECTION 07 84 00 - FIRESTOPPING

PART 1 - GENERAL

1.01 SUMMARY

- A. Work Included: Provide products in accordance with the Contract Documents. The Contract Documents are as defined in the "Agreement". The "General Conditions Governing All Contracts" shall apply to all work under the Contract. The Work of this Section shall include but not be limited to the following:
1. Penetrations through fire-resistance-rated floor and roof construction including both empty openings and openings containing cables, pipes, ducts, conduits, and other penetrating items.
 2. Penetrations through fire-resistance-rated walls and partitions including both empty openings and openings containing cables, pipes, ducts, conduits, and other penetrating items.
 3. Penetrations through smoke barriers and construction enclosing compartmentalized areas involving both empty openings and openings containing penetrating items.
 4. Joints and terminations in fire-resistance-rated walls, partitions, smoke barriers and construction enclosing compartmentalized areas, including both same plane, changes in plane, edge of slab and other joint conditions.
 5. Sealant joints in fire-resistance-rated construction.
 6. Furnishing of dams, clips and closures for support and containment of fire stopping materials and installation of dams, clips and closures where possible to install after completion of floors, walls or other construction.
 7. Coordinate with all trades and construction which affects or is affected by the Work of this Section.

1.02 SYSTEM PERFORMANCE REQUIREMENTS

- A. General: For the following constructions, provide 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 assembly penetrated.
1. Fire-resistance-rated load-bearing walls, including partitions, with fire-protection-rated openings.
 2. Fire-resistance-rated non-load-bearing walls, including partitions, with fire-protection-rated openings.
 3. Fire-resistance-rated floor assemblies, including slab perimeter and floor edge conditions.
 4. Fire-resistance-rated roof assemblies.

- B. Systems shall be capable of preventing passage of smoke, flame and hot gases sufficient to ignite cotton waste, when tested in accordance with ASTM E 814 and ANSI/UL 1479 for firestop systems and ASTM E 119 and ANSI/UL 2079 for joint systems and fire containment, including perimeter conditions.
- C. F-Rated Systems: Provide through-penetration firestop systems with F-ratings indicated, as determined per ASTM E 814, but not less than that equaling or exceeding fire-resistance rating of constructions penetrated.
- D. T-Rated Systems: For the following conditions, provide through-penetration firestop systems with T-ratings indicated, as well as F-ratings, as determined per ASTM E 814, where systems protect penetrating items exposed to potential contact with adjacent materials in occupied floor areas:
 - 1. Penetrations located outside wall cavities.
 - 2. Penetrations located outside fire-resistive shaft enclosures.
 - 3. Penetrations located in construction containing fire-protection-rated openings.
 - 4. Penetrating items larger than 4-inch-diameter nominal pipe or 16 sq. in. in overall cross-sectional area.
- E. Jointed Systems: Provide joint firestop systems indicated, as determined per ASTM E 1399, but not less than that equaling or exceeding fire-resistance rating of adjoining construction.
- F. For 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 and wet-pipe sprinkler systems, 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.
- G. For firestop systems exposed to view, provide products with flame-spread ratings of less than 25 and smoke-developed ratings of less than 450, as determined per ASTM E 84.
- H. Firestop Systems do not reestablish the structural integrity of load bearing partitions/assemblies or support live loads and traffic. Installer shall consult the Resident Engineer prior to penetrating any load bearing assembly.
- I. Where subject to movement, firestopping materials used shall remain flexible and allow for normal movement of building structure, substrates, penetrating items and related surfaces and items without affecting integrity and performance of firestopping materials and systems.

1.03 SUBMITTALS

- A. Product data for each type of product specified.
 - 1. Certification by firestopping manufacturer that products supplied comply with local regulations controlling use of volatile organic compounds (VOCs) and are nontoxic to building occupants.
 - 2. In addition to the above requirements, provide MEA certificates indicating the proposed product/system (including all system components), MEA approval numbers and other data illustrating acceptance of such products as required by the NYC Department of Buildings.
- B. Shop Drawings detailing materials, installation methods, and relationships to adjoining construction for each through-penetration firestop system, and each kind of construction condition penetrated and kind of penetrating item. Include firestop design designation of qualified testing and inspecting agency evidencing compliance with requirements for each condition indicated.
 - 1. List of Conditions: Shop Drawings shall list all firestopping categories indicated or expected for the project. For each type of construction element and assembly indicated, list the UL Design Number to be complied with, include coordinated specified product data for each product incorporated into firestopping assemblies. Attach a copy of each UL Design Number listed.
 - a. In addition to the above requirements, provide MEA certificates indicating the proposed product/system (including all system components), MEA approval numbers and other data illustrating acceptance of such products and conditions as required by the NYC Department of Buildings.
 - 2. For unusual penetrations which have no formal tested assembly and which require modification of qualified testing and inspecting agency's illustration to suit the particular unusual through-penetration firestop condition, submit Drawings and product data and associated illustrations prepared by qualified firestopping Manufacturer's Fire Protection Engineer including required modifications clearly illustrated.
 - a. Manufacturer's engineering judgment shall be derived from similar UL system designs or other applicable tests. Engineer judgment Drawings must follow requirements set forth by the International Firestop Council.
 - (1) The Manufacturer issuing the engineering judgment shall be responsible for issued engineering judgments without any adjustment to the responsibilities of the entities involved.
- C. Product certificates signed by manufacturers of firestopping products certifying that their products comply with specified requirements.
- D. Product test reports from, and based on tests performed by, a qualified testing and inspecting agency evidencing compliance of firestopping with requirements based on comprehensive testing of current products.
- E. Qualification data for firms and persons specified in "Quality Assurance" article to demonstrate their capabilities and experience. Include list of completed projects with project names, addresses, names of Architects and Owners, and other information specified.
- F. Submit product specifications and material data (MSD)safety sheets for each product.

1.04 QUALITY ASSURANCE

- A. Fire-Test-Response Characteristics: Provide firestopping that complies with the following requirements and those specified under the "System Performance Requirements" article:
 - 1. All firestopping systems shall be U.L. listed and shall be installed as a completed U.L. listed assembly. Firestop System installation must meet requirements of ASTM E-814, UL 1479 or UL 2079 tested assemblies that provide a fire rating equal to that of construction being penetrated
 - 2. Firestopping tests are performed by a qualified testing and inspecting agency. A qualified testing and inspecting agency is UL, Warnock Hersey, or another agency performing testing and follow-up inspection services for firestop systems that is acceptable to authorities having jurisdiction.
 - 3. Fire-Resistance Ratings of Joint Sealants: As indicated by reference to design designations listed by UL in their "Fire Resistance Directory" or by another qualified testing and inspecting agency.
 - a. Joint sealants, including backing materials, bear classification marking of qualified testing and inspection agency.
 - 4. Proposed firestopping materials and methods shall conform to State and Local Codes and other authorities having jurisdiction.
- B. Information on Drawings referring to specific design designations of through-penetration firestop systems is intended to establish requirements for performance based on conditions that are expected to exist during installation. Any changes in conditions and designated systems require the Resident Engineer's prior approval. Submit documentation showing that the performance of proposed substitutions equals or exceeds that of the systems they would replace and are acceptable to authorities having jurisdiction.
- C. Installer Qualifications: Engage an experienced firm that has recently completed Firestopping projects similar in cost, material, design and extent to that indicated by this section and whose work has resulted in construction with a record of successful in-service performance.
 - 1. The Contractor performing the Work of this Section may demonstrate compliance with the above qualification requirements by demonstrating that it is certified or authorized as an installer by a manufacturer designated as acceptable in these Specifications or by a manufacturer determined by Owner to be an approved equal.
 - a. A copy of such manufacturer certification or authorizations must be submitted, or verified in writing by the manufacturer.
- D. Single-Source Responsibility: Obtain all firestopping systems for each kind of penetration, joint and construction condition indicated from a single manufacturer.

- E. Field-Constructed Mockup: Prior to installing firestopping, erect mockups for each different through-penetration firestop system indicated to verify selections made and to demonstrate qualities of materials and execution. Build mockups to comply with the following requirements, using materials indicated for final installations.
 - 1. Locate mockups on site in locations indicated or, if not indicated, as directed by Resident Engineer.
 - 2. Notify Resident Engineer 1 week in advance of the dates and times when mockups will be erected.
 - 3. Obtain Resident Engineers acceptance of mockups before start of final unit of Work.
 - 4. Retain and maintain mockups during construction in an undisturbed condition as a standard for judging completed unit of Work.
 - a. Accepted mockups in an undisturbed condition at time of Substantial Completion may become part of completed unit of Work.
- F. Provide firestopping products containing no detectable asbestos as determined by the method specified in 40 CFR Part 763, Subpart F, Appendix A, Section 1, "Polarized Light Microscopy."
- G. Coordinating Work: Coordinate construction of openings and penetrating items to ensure that designated through-penetration firestop systems are installed per specified requirements.
- H. The Contractor will employ and pay a qualified inspection agency to check installed firestopping systems for compliance with requirements.
 - 1. Tests for thickness and density of applied material may be performed by an independent testing agency retained by and paid by the Contractor. Where test results are unsatisfactory in sample areas, additional tests in other areas may be made. Such further testing, if required, shall be by the same testing agency and shall be paid for by the Contractor.
- I. Firestopping system manufacturer's direct representative (not distributor or agent) shall be on-site during initial installation of firestop systems to train appropriate contractor personnel in proper selection and installation procedures. This will be done per manufacturer's written recommendations published in their literature and drawing details.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Deliver firestopping 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 firestopping materials to prevent their deterioration or damage due to moisture, temperature changes, contaminants, or other causes.

1.06 PROJECT CONDITIONS

- A. Environmental Conditions: Do not install firestopping when ambient or substrate temperatures are outside limits permitted by firestopping manufacturers or when substrates are wet due to rain, frost, condensation, or other causes.
- B. Ventilation: Ventilate firestopping per firestopping manufacturers' instructions by natural means or, where this is inadequate, forced air circulation.

1.07 SEQUENCING AND SCHEDULING

- A. Notify the City's inspection agency at least 1 week in advance of firestopping installations; confirm dates and times on days preceding each series of installations.
- B. Do not cover up those firestopping installations that will become concealed behind other construction until the Architect and Resident Engineer, and authorities having jurisdiction, if required, have examined each installation.

1. Provide inspection schedule for anticipated work and submit as of part 1.08A.

PART 2 - PRODUCTS

2.01 FIRESTOPPING, GENERAL

- A. Compatibility: Provide firestopping composed of components that are compatible with each other, the substrates forming openings, and the items, if any, penetrating the firestopping under conditions of service and application, as demonstrated by firestopping manufacturer based on testing and field experience.
- B. Accessories: Provide components for each firestopping system that are needed to install fill materials and to comply with "System Performance Requirements" article in Part 1. Use only components specified by the firestopping manufacturer and approved by the qualified testing and inspecting agency for the designated fire-resistance-rated systems. Accessories include but are not limited to the following items:
 - 1. Permanent forming/damming/backing materials including the following:
 - a. Semi-refractory fiber (mineral wool) insulation.
 - b. Ceramic fiber.
 - c. Sealants used in combination with other forming/damming materials to prevent leakage of fill materials in liquid state.
 - d. Fire-rated formboard.
 - e. Joint fillers for joint sealants.
 - 2. Temporary forming materials.
 - 3. Substrate primers.
 - 4. Collars.
 - 5. Steel sleeves.
 - 6. Safing Clips.
 - 7. Metal support plates.

- C. Applications: Provide firestopping systems composed of materials specified in this Section that comply with system performance and other requirements.

2.02 MANUFACTURERS AND PRODUCTS

- A. General: Specified products may be components of a complete firestopping system. Provide all components necessary to provide complete systems as designated on Drawings.
- B. Manufacturers: Subject to compliance with requirements, provide firestop systems for each application indicated that are produced by the following manufacturers:
 - 1. Hilti Construction Chemicals, Inc.
 - 2. 3M Fire Protection Products.
 - 3. Specified Technologies Inc. (STI).
 - 4. Or Approved equal.
- C. Firestopping Products: Subject to compliance with all other requirements, provide the following approved products, acceptable to the Resident Engineer and in accordance with an Approved UL System as provided by the firestop manufacturers published UL Listed Drawing.
 - 1. Water Based Intumescent Firestop Sealant
 - 2. Intumescent Firestop Flexible Block / Pillows
 - 3. Water Based Elastomeric Firestop Joint Spray
 - 4. Silicone Based Elastomeric Firestop Sealant
 - 5. Acrylic Based Firestop Sealant
 - 6. Intumescent Firestop Collar
 - 7. Cast-In Place Intumescent Firestop Sleeve Device
 - 8. Intumescent, Non-hardening Firestop Putty
 - 9. Trowable Firestop Compound/Mortar

2.03 MIXING

- A. For those products requiring mixing prior to application, comply with firestopping manufacturer's directions for accurate proportioning of materials, water (if required), type of mixing equipment, selection of mixer speeds, mixing containers, mixing time, and other procedures needed to produce firestopping products of uniform quality with optimum performance characteristics for application indicated.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Examine substrates and conditions, with Installer present, for compliance with requirements for opening and joint configurations, penetrating items, substrates, and other conditions affecting performance of firestopping. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.02 PREPARATION

- A. Surface Cleaning: Clean out openings and joints immediately prior to installing firestopping to comply with recommendations of firestopping manufacturer and the following requirements:
 - 1. Remove all foreign materials from surfaces of opening and joint substrates and from penetrating items that could interfere with adhesion of firestopping.
 - 2. Clean opening and joint substrates and penetrating items to produce clean, sound surfaces capable of developing optimum bond with firestopping. Remove loose particles remaining from cleaning operation.
 - 3. Remove latence and form release agents from concrete.
- B. Priming: Prime substrates where recommended by firestopping 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 firestopping from contacting adjoining surfaces that will remain exposed upon completion of Work and that would otherwise be permanently stained or damaged by such contact or by cleaning methods used to remove smears from firestopping materials. Remove tape as soon as it is possible to do so without disturbing firestopping's seal with substrates.

3.03 INSTALLATION / GENERAL

- A. The Contractor shall select the material and UL test assemblies to be used as may be required for each type of material, location, rating and penetration or hole size. Do not proceed with the work until all submittals have been fully approved.
- B. Materials and equipment shall be as approved by the manufacturer. Application procedures shall be in strict accordance with the manufacturer's directions and specifications. Only experienced, skilled mechanics approved by the materials manufacturers shall be allowed to place the materials.
- C. Provide firestopping materials and thicknesses as required to provide indicated ratings. Where not otherwise indicated, comply with U.L. standard designs. In multiple layer work, offset joints by at least 6 inches.
- D. Anchor firestopping using manufacturers' recommended system and in compliance with U.L. standard designs.
- E. Install firestopping without gaps and voids of any kind. Do not use damaged materials. Remove and replace nonfitting or disturbed work. Do not use fire safing materials containing solvents.

3.04 INSTALLING THROUGH-PENETRATION FIRESTOPS

- A. General: Comply with the "System Performance Requirements" article in Part 1 and the through-penetration firestop manufacturer's installation instructions and Drawings pertaining to products and applications indicated.

- B. Install forming/damming materials and other accessories of types required to support fill materials during their application and in the position needed to produce the cross-sectional shapes and depths required to achieve fire ratings of designated through-penetration firestop systems. After installing fill materials, remove combustible forming materials and other accessories not indicated as permanent components of firestop systems.
- C. Install fill materials for through-penetration firestop systems by proven techniques to produce the following results:
 - 1. Completely fill voids and cavities formed by openings, forming materials, accessories, and penetrating items.
 - 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 Work, finish to produce smooth, uniform surfaces that are flush with adjoining finishes.
 - 4. Provide 20 gage minimum metal plates where required for fire safing support to comply with fire rating.
 - 5. For mineral safing insulation, apply in continuous length using manufacturer's standard safing clips compress insulation until stable without movement.

3.05 INSTALLING FIRE-RESISTIVE JOINT SEALANTS

- A. General: Comply with the "System Performance Requirements" article in Part 1, with ASTM C 1193, and with the sealant manufacturer's installation instructions and Drawings pertaining to products and applications indicated.
- B. Install fire resistive joint fillers to provide support of sealants during application and at position required to produce the cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability and develop fire-resistance rating required.
- C. Install sealants by proven techniques that result in sealants directly contacting and fully wetting joint substrates, completely filling recesses provided for each joint configuration, and providing uniform, cross-sectional shapes and depths relative to joint width that optimum sealant movement capability. Install sealants at the same time joint fillers are installed.
- D. Tool nonsag sealants immediately after sealant application and prior to the time skinning or curing begins. Form smooth, uniform beads of configuration indicated or required to produce fire-resistance rating, as well as to eliminate air pockets, and to ensure contact and adhesion of sealants with sides of joint. Remove excess sealant from surfaces adjacent to joint. Do not use tooling agents that discolor sealants or adjacent surfaces or are not approved by sealant manufacturer.

3.06 FIELD QUALITY CONTROL

- A. A qualified Inspecting agency performing controlled inspections will be employed and paid by the Contractor and will examine completed firestopping to determine, in general, if it is being installed in compliance with requirements.
- B. Inspecting agency will report observations promptly and in writing to Contractor and Resident Engineer.
- C. Do not proceed to enclose firestopping with other construction until reports of examinations are issued.

- D. Where deficiencies are found, repair or replace firestopping so that it complies with requirements.

3.07 CLEANING

- A. Clean off excess fill materials and sealants adjacent to openings and joints as work progresses by methods and with cleaning materials approved by manufacturers of firestopping products and of products in which opening and joints occur.
- B. Protect firestopping during and after curing period from contact with contaminating substances or from damage resulting from construction operations or other causes so that they are without deterioration or damage at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out and remove damaged or deteriorated firestopping immediately and install new materials to produce firestopping complying with specified requirements.

END OF SECTION

SECTION 07 92 00 - JOINT SEALANTS

PART 1 - GENERAL

1.01 SUMMARY:

- A. Work Included: Provide products in accordance with the Contract Documents. The Contract Documents are as defined in the "Agreement". The "General Conditions Governing All Contracts" shall apply to all work under the Contract. The Work of this Section shall include but not be limited to the following:

- 1. Joint sealant assemblies in horizontal and vertical surfaces.

- B. Related Sections

- 1. Section 08100 - Steel Doors and Frames.

1.02 QUALITY ASSURANCE

- A. Installer Qualifications: Engage an experienced firm that has recently completed Joint Sealer projects similar in cost, material, design and extent to that indicated by this section and whose work has resulted in construction with a record of successful in-service performance.

- B. Source for Materials: Obtain joint sealer materials from a single manufacturer for each different product.

1.03 SUBMITTALS

- A. Product Data: Submit manufacturer's technical data for each product required, including instructions for preparation and application.

- 1. Certification by firestopping manufacturer that products supplied comply with local regulations controlling use of volatile organic compounds (VOCs) and are nontoxic to building occupants.

- B. Samples: Submit manufacturer's standard bead samples consisting of strips of actual products showing full range of colors available.

- C. Submit product specifications and material data (MSD) safety sheets for each product.

1.04 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials in original unopened containers with labels indicating manufacturer, expiration date, and other pertinent data.

- B. Store and handle materials to prevent their deterioration or damage due to moisture, temperature changes, contaminants, or other causes.

1.05 PROJECT CONDITIONS

- A. Environmental Conditions: Do not install joint sealers when air and surface temperatures are outside the limits permitted by joint sealer manufacturer, or when joint substrates are wet or dirty.
- B. Joint Widths: Do not proceed with installation of joint sealers when joint widths are not as allowed by joint sealer manufacturer.

1.06 EXTENDED WARRANTY

- A. Submit a warranty to repair or replace defective joint sealer materials or workmanship; including staining, loss of adhesion, loss of cohesion, cracking or discoloration, for a period of 5 years from the date of Substantial Completion.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, provide products as manufactured by one of the following, or approved equal:
 - 1. Dow Corning
 - 2. General Electric Co.
 - 3. Pecora Corp.
 - 4. Tremco, Inc.
 - 5. Or Approved Equal.

2.02 MATERIALS, GENERAL

- A. Compatibility: Provide joint sealers, joint fillers and related materials that are compatible with one another and with joint substrates, as demonstrated by testing and field experience.
- B. Colors: Provide colors of joint sealers as selected by the Architect from manufacturer's standard colors.

2.03 ELASTOMERIC JOINT SEALANTS

- A. Elastomeric Sealant Standard: Comply with ASTM C 920.
- B. One-Part Mildew-Resistant Silicone Sealant: Type S; Grade NS; Class 25; Uses: Non-traffic, formulated with fungicide for sealing interior joints with nonporous substrates at vertical surfaces of ceramic tile in toilets, kitchens and between plumbing fixtures and tile.
 - 1. Products: Subject to compliance with requirements, provide one of the following mildew-resistant sealants.
 - a. "Dow Corning 786"; Dow Corning Corp.
 - b. "SCS 1702"; General Electric Co.
 - c. "863 #345 White"; Pecora Corp.
 - d. "Proglaze White"; Tremco, Inc.
 - e. Or Approved Equal.

2.04 LATEX JOINT SEALANTS

- A. Acrylic-Emulsion Sealant: One part, nonsag sealant complying with ASTM C 834, paintable and recommended for interior applications with joint movement of not more than plus or minus 5 percent. Subject to compliance with requirements, provide one of the following:

1. "Chem-Calk 600"; Bostik Construction Products Div.
2. "AC-20"; Pecora Corp.
3. "Tremco Acrylic Latex 834"; Tremco Inc.
4. Or Approved Equal.

2.05 NON-ELASTOMERIC SEALANT

- A. Acrylic-Emulsion Sealant: Provide acrylic-emulsion or latex-rubber-modified acrylic-emulsion sealant compound complying with ASTM C 834, permanently flexible, nonstaining and nonbleeding; recommended by manufacturer for protected exterior exposure and general interior exposure. Provide one of the following, or approved equal:

1. Acrylic Latex Caulk, Tremco Inc.
2. AC-20 Acrylic Latex, Pecora
3. Igas Calking-L, Sika Chemical Corp.
4. Approved equal

- B. Additional performance requirements for sealants supplied under paragraph A above are as follows:

1. Adhesive strength to aluminum: 12 psi min.
2. % total solids: minimum of 95% after 7 days at 75 degrees F.
3. Pot life: 6 hours at 75 degrees F. minimum.

2.06 JOINT SEALANT BACKING

- A. General: Provide backings which are non-staining; are compatible with joint substrates, sealants, primers and other joint fillers; and are approved for applications indicated by sealant manufacturer.

- B. Plastic Foam Joint-Fillers: Preformed, compressible, resilient, non-waxing, non-extruding strips of plastic foam of material indicated below, and of size, shape and density to control sealant depth.

1. Either flexible, open cell polyurethane foam or non-gassing, closed-cell polyethylene foam, unless otherwise indicated.

- C. Tubing Joint-Fillers: Neoprene, EPDM or silicone tubing complying with ASTM D 1056, non-absorbent to water and gas, resilient at temperatures down to -26 deg F., of size and shape to provide a secondary seal.

- D. Bond-Breaker Tape: Polyethylene tape or other plastic tape to prevent bond between sealant and materials at back of joint. Provide self-adhesive tape where applicable.

2.07 MISCELLANEOUS MATERIALS

- A. Primer: Provide type recommended by joint sealer manufacturer where required for adhesion of sealant to joint substrates, as determined from preconstruction joint sealer-substrate and field tests.
- B. Cleaners: Provide non-staining cleaner of type acceptable to manufacturer of sealant and sealant backing materials.
- C. Masking Tape: Provide non-staining, non-absorbent type compatible with joint sealants and to surfaces adjacent to joints.

PART 3 - EXECUTION

3.01 INSPECTION

- A. Inspect joints to receive joint sealers for compliance with requirements. Report conditions detrimental to joint sealer work. Proceed after unsatisfactory conditions have been corrected.

3.02 PREPARATION

- A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealers to comply with recommendations of joint sealer manufacturers and the following requirements:
 - 1. Remove all foreign material from joint substrates which could interfere with adhesion of joint sealer, including water.
 - 2. Clean porous joint substrate surfaces to produce a clean, sound substrate. Remove loose particles remaining from cleaning.
 - 3. Remove laitance and form release agents from concrete.
 - 4. Clean non-porous surfaces with cleaners which are not harmful to substrates or leave residues that may affect joint sealers.
- B. Joint Priming: Prime joint substrates to comply with joint sealer manufacturer's recommendations. Confine primers to areas of joint sealer bond; not on adjoining surfaces.
- C. Masking Tape: Mask adjoining surfaces which might be permanently stained or damaged by sealant or by cleaning required to remove sealant. Remove tape immediately after tooling without disturbing joint.

3.03 INSTALLATION OF JOINT SEALERS

- A. General: Comply with joint sealer manufacturers' printed installation instructions, except where more stringent requirements apply.
- B. Elastomeric Sealant Installation Standard: Comply with ASTM C 962 for use of joint sealants as applicable to conditions indicated.
- C. Installation of Sealant Backings: Install sealant backings to produce the shapes and depths of sealants for optimum performance.

1. Do not leave gaps between ends of joint-fillers.
 2. Do not stretch, twist, puncture or tear joint-fillers.
 3. Do not use absorbent joint-fillers which are wet.
 4. Install bond breaker tape where required to prevent third-side adhesion of sealant to back of joint.
 5. Install compressible seals serving as sealant backings to comply with requirements indicated above for joint fillers.
- D. Installation of Sealants: Install sealants by proven techniques that result in sealants directly contacting joint substrates, completely filling joints and providing uniform, cross-sectional shapes and depths for optimum sealant movement. Mask adjacent surfaces if necessary.
- E. Tooling of Nonsag Sealants: Tool sealants to form smooth, uniform beads to eliminate air pockets and to ensure adhesion of sealant with sides of joint. Remove excess sealants from adjacent surfaces. Provide concave joint configuration per Figure 6A in ASTM C 962.
- F. Installation of Preformed Foam Sealants: Comply with manufacturer's directions, to produce seal continuity at ends, turns, and joints.
- G. Installation of Fire-Stopping Sealant: Install sealant and accessory materials to fill openings penetrating floors and walls to provide fire-stops with required fire resistance ratings.
- 3.04 CLEANING
- A. Clean off excess sealants or sealant smears as work progresses by methods and materials approved by manufacturers of joint sealers. Remove masking tape when no longer required.
- 3.05 PROTECTION
- A. Protect joint sealers from contamination or damage, so that they are without deterioration or damage at time of Substantial Completion.
- B. Remove damaged or defective joint sealers and reseal joints to match original work.

END OF SECTION

SECTION 08 11 13 - HOLLOW METAL DOORS AND FRAMES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
1. Standard and custom hollow metal doors and frames.
 2. ~~Steel sidelight, borrowed lite and transom frames.~~
 3. Louvers installed in hollow metal doors.
 4. ~~Light frames and glazing installed in hollow metal doors.~~
- B. Related Sections:
1. Division 04 Section "Unit Masonry" for embedding anchors for hollow metal work into masonry construction.
 2. Division 08 Section "Door Hardware".
 3. Division 09 Sections "Exterior Painting" and "Interior Painting" for field painting hollow metal doors and frames.
- C. Codes and References: Comply with the version year adopted by the Authority Having Jurisdiction.
1. ANSI/SDI A250.8 - Recommended Specifications for Standard Steel Doors and Frames.
 2. ANSI/SDI A250.4 - Test Procedure and Acceptance Criteria for Physical Endurance for Steel Doors, Frames, Frames Anchors and Hardware Reinforcing.
 3. ANSI/SDI A250.6 - Recommended Practice for Hardware Reinforcing on Standard Steel Doors and Frames.
 4. ANSI/SDI A250.10 - Test Procedure and Acceptance Criteria for Prime Painted Steel Surfaces for Steel Doors and Frames.
 5. ANSI/SDI A250.11 - Recommended Erection Instructions for Steel Frames.
 6. ASTM A1008 - Standard Specification for Steel Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability.
 7. ASTM A653 - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
 8. ASTM A924 - Standard Specification for General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process.
 9. ASTM C 1363 - Standard Test Method for Thermal Performance of Building Assemblies by Means of a Hot Box Apparatus.
 10. ANSI/BHMA A156.115 - Hardware Preparation in Steel Doors and Frames.
 11. ANSI/SDI 122 - Installation and Troubleshooting Guide for Standard Steel Doors and Frames.
 12. ANSI/NFPA 80 - Standard for Fire Doors and Fire Windows; National Fire Protection Association.
 13. ANSI/NFPA 105: Standard for the Installation of Smoke Door Assemblies.
 14. NFPA 252 - Standard Methods of Fire Tests of Door Assemblies; National Fire Protection Association.

15. UL 10C - Positive Pressure Fire Tests of Door Assemblies.
16. UL 1784 - Standard for Air Leakage Tests of Door Assemblies.

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated. Include construction details, material descriptions, core descriptions, hardware reinforcements, profiles, anchors, fire-resistance rating, and finishes.
- B. Door hardware supplier is to furnish templates, template reference number and/or physical hardware to the steel door and frame supplier in order to prepare the doors and frames to receive the finish hardware items.
- C. Shop Drawings: Include the following:
 1. Elevations of each door design.
 2. Details of doors, including vertical and horizontal edge details and metal thicknesses.
 3. Frame details for each frame type, including dimensioned profiles and metal thicknesses.
 4. Locations of reinforcement and preparations for hardware.
 5. Details of anchorages, joints, field splices, and connections.
 6. Details of accessories.
 7. Details of moldings, removable stops, and glazing.
 8. Details of conduit and preparations for power, signal, and control systems.
- D. Samples for Verification:
 1. Samples are only required by request of the architect and for manufacturers that are not current members of the Steel Door Institute.

1.4 QUALITY ASSURANCE

- A. Source Limitations: Obtain hollow metal doors and frames through one source from a single manufacturer wherever possible.
- B. Quality Standard: In addition to requirements specified, furnish SDI-Certified manufacturer products that comply with ANSI/SDI A250.8, latest edition, "Recommended Specifications for Standard Steel Doors and Frames".
- C. Fire-Rated Door Assemblies: Assemblies complying with NFPA 80 that are listed and labeled by a qualified testing agency, for fire-protection ratings indicated, based on testing at positive pressure according to UL10C (neutral pressure at 40" above sill) or UL 10C.
 1. Oversize Fire-Rated Door Assemblies Construction: For units exceeding sizes of tested assemblies, attach construction label certifying doors are built to standard construction requirements for tested and labeled fire rated door assemblies except for size.
 2. Temperature-Rise Limit: Where indicated and at vertical exit enclosures (stairwell openings) and exit passageways, provide doors that have a maximum transmitted temperature end point of not more than 450 deg F (250 deg C) above ambient after 30 minutes of standard fire-test exposure.
 3. Smoke Control Door Assemblies: Comply with NFPA 105.
 - a. Smoke "S" Label: Doors to bear "S" label, and include smoke and draft control gasketing applied to frame and on meeting stiles of pair doors.
- D. Fire-Rated, Borrowed-Light Frame Assemblies: Assemblies complying with NFPA 80 that are listed and labeled, by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire-protection ratings indicated, based on testing according to NFPA 257. Provide labeled glazing material.

- E. Pre-Submittal Conference: Conduct conference in compliance with requirements in Division 01 Section "Project Meetings" with attendance by representatives of Supplier, Installer, and Contractor to review proper methods and procedures for installing hollow metal doors and frames and to verify installation of electrical knockout boxes and conduit at frames with electrified or access control hardware.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Deliver hollow metal work palletized, wrapped, or crated to provide protection during transit and Project site storage. Do not use non-vented plastic.
- B. Deliver welded frames with two removable spreader bars across bottom of frames, tack welded to jambs and mullions.
- C. Store hollow metal work under cover at Project site. Place in stacks of five units maximum in a vertical position with heads up, spaced by blocking, on minimum 4-inch high wood blocking. Do not store in a manner that traps excess humidity.
 - 1. Provide minimum 1/4-inch space between each stacked door to permit air circulation. Door and frames to be stacked in a vertical upright position.

1.6 PROJECT CONDITIONS

- A. Field Measurements: Verify actual dimensions of openings by field measurements before fabrication.

1.7 COORDINATION

- A. Coordinate installation of anchorages for hollow metal frames. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors. Deliver such items to Project site in time for installation.

1.8 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace doors that fail in materials or workmanship within specified warranty period.
- B. Warranty includes installation and finishing that may be required due to repair or replacement of defective doors.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide steel doors and frames from a SDI Certified manufacturer:
 - 1. CECO Door Products (C).
 - 2. Curries Company (CU).
 - 3. Fleming (FL).
 - 4. Or Approved Equal.

2.2 MATERIALS

- A. Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, Commercial Steel (CS), Type B; suitable for exposed applications.
- B. Metallic-Coated Steel Sheet: ASTM A 653/A 653M, Commercial Steel (CS), Type B; with minimum G60 (Z180) or A60 (ZF180) metallic coating.
- C. Frame Anchors: ASTM A 653/A 653M, Commercial Steel (CS), Commercial Steel (CS), Type B; with minimum G60 (Z180) or A60 (ZF180) metallic coating.

2.3 HOLLOW METAL DOORS

- A. General: Provide 1-3/4 inch doors of design indicated, not less than thickness indicated; fabricated with smooth surfaces, without visible joints or seams on exposed faces unless otherwise indicated. Comply with ANSI/SDI A250.8 and ANSI/NAAMM HMMA 867.
- B. Interior Doors: Face sheets fabricated of commercial quality cold rolled steel that complies with ASTM A 1008/A 1008M. Provide doors complying with requirements indicated below by referencing ANSI/SDI A250.8 for level and model and ANSI/SDI A250.4 for physical performance level:
 - 1. Design: Flush panel.
 - 2. Core Construction: Manufacturer's standard one-piece polystyrene core, securely bonded to both faces.
 - a. Fire Door Core: As required to provide fire-protection and temperature-rise ratings indicated.
 - 3. Level/Model: Level 2 and Physical Performance Level B (Heavy Duty), Minimum 18 gauge (0.042-inch - 1.0-mm) thick steel, Model 1.
 - 4. Vertical Edges: Vertical edges to have the face sheets joined by a continuous weld extending the full height of the door. Welds are to be ground, filled and dressed smooth. Beveled Lock Edge, 1/8 inch in 2 inches (3 mm in 50 mm).
 - 5. Top and Bottom Edges: Reinforce tops and bottoms of doors with a continuous steel channel not less than 16 gauge, extending the full width of the door and welded to the face sheet.
 - 6. Hinge Reinforcement: Minimum 7 gauge (3/16") plate 1-1/4" x 9" or minimum 14 gauge continuous channel with pierced holes, drilled and tapped.
 - 7. Hardware Reinforcements: Fabricate according to ANSI/SDI A250.6 with reinforcing plates from same material as door face sheets.
- C. Manufacturers Basis of Design:
 - 1. CECO Door Products (C) Polystyrene Core - Legion Series.

2.4 HOLLOW METAL FRAMES

- A. General: Comply with ANSI/SDI A250.8 and with details indicated for type and profile.
- B. Interior Frames: Fabricated from cold-rolled steel sheet that complies with ASTM A 1008/A 1008M.
 - 1. Fabricate frames with mitered or coped corners. Profile as indicated on drawings.
 - 2. Frames: Minimum 16 gauge (0.053-inch -1.3-mm) thick steel sheet.
 - 3. Manufacturers Basis of Design:
 - a. CECO Door Products (C) - DU Series.
- C. Fire rated frames: Fabricate frames in accordance with NFPA 80, listed and labeled by a qualified testing agency, for fire-protection ratings indicated.

- D. Hardware Reinforcement: Fabricate according to ANSI/SDI A250.6 Table 4 with reinforcement plates from same material as frames.

2.5 FRAME ANCHORS

- A. Jamb Anchors:
 - 1. Masonry Type: Adjustable strap-and-stirrup or T-shaped anchors to suit frame size, formed from A60 metallic coated material, not less than 0.042 inch thick, with corrugated or perforated straps not less than 2 inches wide by 10 inches long; or wire anchors not less than 0.177 inch thick.
 - 2. Stud Wall Type: Designed to engage stud and not less than 0.042 inch thick.
- B. Floor Anchors: Floor anchors to be provided at each jamb, formed from A60 metallic coated material, not less than 0.042 inches thick.
- C. Mortar Guards: Formed from same material as frames, not less than 0.016 inches thick.

2.6 LOUVERS

- A. Metal Louvers: Door manufacturer's standard metal louvers unless otherwise indicated.
 - 1. Blade Type: Vision proof inverted V or inverted Y.
 - 2. Metal and Finish: Galvanized steel, 0.040 inch thick, factory primed for paint finish with baked enamel or powder coated finish. Match pre-finished door paint color where applicable.
- B. Louvers for Fire Rated Doors: Metal louvers with fusible link and closing device, listed and labeled for use in doors with fire protection rating of 1-1/2 hours and less.
 - 1. Manufacturers: Subject to compliance with requirements, provide door manufacturers standard louver to meet rating indicated.
 - 2. Metal and Finish: Galvanized steel, 0.040 inch thick, factory primed for paint finish with baked enamel or powder coated finish. Match pre-finished door paint color where applicable.

2.7 ACCESSORIES

- A. Mullions and Transom Bars: Join to adjacent members by welding or rigid mechanical anchors.
- B. Grout Guards: Formed from same material as frames, not less than 0.016 inches thick.

2.8 FABRICATION

- A. Fabricate hollow metal work to be rigid and free of defects, warp, or buckle. Accurately form metal to required sizes and profiles, with minimum radius for thickness of metal. Where practical, fit and assemble units in manufacturer's plant. When shipping limitations so dictate, frames for large openings are to be fabricated in sections for splicing or splining in the field by others.
- B. Tolerances: Fabricate hollow metal work to tolerances indicated in ANSI/SDI A250.8.
- C. Hollow Metal Doors:
 - 1. Louvers: Factory cut openings in door and install louvers into prepared openings where indicated.

D. Hollow Metal Frames:

1. Shipping Limitations: Where frames are fabricated in sections due to shipping or handling limitations, provide alignment plates or angles at each joint, fabricated of same thickness metal as frames.
2. Knocked Down Frames: Provide frames with locking corner tabs which permit field assembly. Factory install compression type anchors and countersunk screw holes to secure the bottom of the jambs.
3. High Frequency Hinge Reinforcement: Provide high frequency hinge reinforcements at door openings 48-inches and wider with mortise butt type hinges at top hinge locations.
4. Provide countersunk, flat- or oval-head exposed screws and bolts for exposed fasteners unless otherwise indicated for removable stops, provide security screws at exterior locations.
5. Mortar Guards: Provide guard boxes at back of hardware mortises in frames at all hinges and strike preps regardless of grouting requirements.
6. Floor Anchors: Weld anchors to bottom of jambs and mullions with at least four spot welds per anchor.
7. Jamb Anchors: Provide number and spacing of anchors as follows:
 - a. Stud Wall Type: Locate anchors not more than 18 inches from top and bottom of frame. Space anchors not more than 32 inches o.c. and as follows:
 - 1) Three anchors per jamb up to 60 inches high.
 - 2) Four anchors per jamb from 60 to 90 inches high.
 - 3) Five anchors per jamb from 90 to 96 inches high.
 - 4) Five anchors per jamb plus 1 additional anchor per jamb for each 24 inches or fraction thereof above 96 inches high.
 - 5) Two anchors per head for frames above 42 inches wide and mounted in metal stud partitions.
8. Door Silencers: Except on weatherstripped or gasketed doors, drill stops to receive door silencers. Silencers to be supplied by frame manufacturer regardless if specified in Division 08 Section "Door Hardware".

E. Hardware Preparation: Factory prepare hollow metal work to receive template mortised hardware; include cutouts, reinforcement, mortising, drilling, and tapping according to the Door Hardware Schedule and templates furnished as specified in Division 08 Section "Door Hardware."

1. Locate hardware as indicated, or if not indicated, according to ANSI/SDI A250.8.
2. Reinforce doors and frames to receive non-template, mortised and surface mounted door hardware.
3. Comply with applicable requirements in ANSI/SDI A250.6 and ANSI/DHI A115 Series specifications for preparation of hollow metal work for hardware.
4. Coordinate locations of conduit and wiring boxes for electrical connections with Division 26 Sections.

2.9 STEEL FINISHES

A. Prime Finishes: Doors and frames to be cleaned, and chemically treated to insure maximum finish paint adhesion. Surfaces of the door and frame exposed to view to receive a factory applied coat of rust inhibiting shop primer.

1. Shop Primer: Manufacturer's standard, fast-curing, lead and chromate free primer complying with ANSI/SDI A250.10 acceptance criteria; recommended by primer manufacturer for substrate; and compatible with substrate and field-applied coatings.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. General Contractor to verify the accuracy of dimensions given to the steel door and frame manufacturer for existing openings or existing frames (strike height, hinge spacing, hinge back set, etc.).
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Remove welded in shipping spreaders installed at factory. Restore exposed finish by grinding, filling, and dressing, as required to make repaired area smooth, flush, and invisible on exposed faces.
- B. Prior to installation, adjust and securely brace welded hollow metal frames for square, level, twist, and plumb condition.
- C. Tolerances shall comply with SDI-117 "Manufacturing Tolerances Standard Steel Doors and Frames."
- D. Drill and tap doors and frames to receive non-template, mortised, and surface-mounted door hardware.

3.3 INSTALLATION

- A. General: Install hollow metal work plumb, rigid, properly aligned, and securely fastened in place; comply with Drawings and manufacturer's written instructions.
- B. Hollow Metal Frames: Install hollow metal frames of size and profile indicated. Comply with ANSI/SDI A250.11 and NFPA 80 at fire rated openings.
 - 1. Set frames accurately in position, plumbed, leveled, aligned, and braced securely until permanent anchors are set. After wall construction is complete and frames properly set and secured, remove temporary braces, leaving surfaces smooth and undamaged. Shim as necessary to comply with installation tolerances.
 - 2. Floor Anchors: Provide floor anchors for each jamb and mullion that extends to floor, and secure with post-installed expansion anchors.
 - 3. Masonry Walls: Coordinate installation of frames to allow for solidly filling space between frames and masonry with mortar.
 - 4. Grout Requirements: Do not grout head of frames unless reinforcing has been installed in head of frame. Do not grout vertical or horizontal closed mullion members.
- C. Hollow Metal Doors: Fit hollow metal doors accurately in frames, within clearances specified below. Shim as necessary.
 - 1. Non-Fire-Rated Standard Steel Doors:
 - a. Jambs and Head: 1/8 inch plus or minus 1/16 inch.
 - b. Between Edges of Pairs of Doors: 1/8 inch plus or minus 1/16 inch.
 - c. Between Bottom of Door and Top of Threshold: Maximum 3/8 inch.
 - d. Between Bottom of Door and Top of Finish Floor (No Threshold): Maximum 3/4 inch.
 - 2. Fire-Rated Doors: Install doors with clearances according to NFPA 80.
- D. ~~Field Glazing: Comply with installation requirements in Division 08 Section "Glazing" and with hollow metal manufacturer's written instructions.~~

3.4 ADJUSTING AND CLEANING

- A. Final Adjustments: Check and readjust operating hardware items immediately before final inspection. Leave work in complete and proper operating condition. Remove and replace defective work, including hollow metal work that is warped, bowed, or otherwise unacceptable.
- B. Remove grout and other bonding material from hollow metal work immediately after installation.
- C. Prime-Coat and Painted Finish Touchup: Immediately after erection, sand smooth rusted or damaged areas of prime coat, or painted finishes, and apply touchup of compatible air drying, rust-inhibitive primer, zinc rich primer (exterior and galvanized openings) or finish paint.

END OF SECTION

SECTION 08 31 00 - ACCESS DOORS

PART 1 - GENERAL

1.01 SUMMARY

- A. Work Included: Provide products in accordance with the Contract Documents. All access panels and doors for mechanical, ventilation, plumbing and electrical work to be furnished by respective trade contractors and installed this contract. The Contract Documents are as defined in the "Agreement". The "General Conditions Governing All Contracts" shall apply to all work under the Contract. The Work of this Section shall include but not be limited to the following:
 - 1. Wall and ceiling access doors.
 - 2. Fire-rated wall and ceiling access doors.
- B. Related Sections
 - 1. Section 04 20 00 - Unit Masonry.
 - 2. Section 08 71 00 - Door Hardware.
 - 3. Section 09 21 00 - Gypsum Drywall Systems.
 - 4. Section 09 30 00 - Tile.
 - 5. Section 09 90 00 - Painting.
 - 6. Division 23 - Mechanical.

1.02 SUBMITTALS

- A. Product data for each type of access door assembly specified, including details of construction relative to materials, individual components, profiles, finishes, and fire-protection ratings (if required).
 - 1. Include complete schedule, including types, general locations, sizes, wall and ceiling construction details, latching or locking provisions, and other data pertinent to installation.
- B. Shop Drawings showing fabrication and installation of access doors and frames, including details of each frame type, elevations of door design types, anchorage, and accessory items.
- C. Samples, 3-inch by 5-inch minimum size, of each panel face material showing factory-finished color and texture.

1.03 QUALITY ASSURANCE

- A. Single-Source Responsibility: Obtain access doors for entire Project from one source and by a single manufacturer.
- B. Fire-Rated Door Assemblies: Units that comply with NFPA 80, are identical to door and frame assemblies tested for fire-test-response characteristics per test method as indicated below, and are labeled and listed by UL, Warnock Hersey, or another testing and inspecting agency acceptable to authorities having jurisdiction.
 - 1. Test Method for Vertical Installations: ASTM E 152.
 - 2. Test Method for Horizontal Installations: ASTM E 119.

- C. Size Variations: Obtain Architects acceptance of manufacturer's standard size units, which may vary slightly from sizes indicated.

1.04 COORDINATION

- A. Verification: Determine specific locations and sizes for access doors needed to gain access to concealed equipment, and indicate on schedule specified under "Submittals" Article.
 - 1. Coordinate installation of access doors to minimize the need for other trades to cut or remove work.
 - 2. Where possible access panels shall be concealed from view. Coordinate locations and install as directed by Resident Engineer.

1.05 DEFINITIONS

- A. General: Where access doors are to be provided in wet locations, note, wet locations are any area that has running water, including but not limited to toilet rooms, mechanical rooms and chases.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, provide products as manufactured by one of the following, or approved equal:
 - 1. J.L. Industries.
 - 2. Karp Associates, Inc.
 - 3. Larsen's Manufacturing Co.
 - 4. Bilco.
 - 5. Hallman.
 - 6. Or Approved Equal.

2.02 MATERIALS

- A. Steel Sheet: ASTM A 366/A 366M commercial-quality, cold-rolled steel sheet with baked-on, rust-inhibitive primer.
- B. Stainless-Steel Sheet: At wet locations provide, ASTM A 167, Type 304 with No. 4 finish according to ASTM A 480/A 480M.
- C. Aluminum Extrusions: ASTM B 221, 6063-T6.
- D. Plate and Steel: ASTM B 209, 6061-T6.

2.03 ACCESS DOORS

- A. Noninsulated, Fire-Rated Doors for Walls: Self-latching units consisting of frame, concealed trim, door, and hardware, including automatic closer, interior latch release, and complying with the following requirements:

1. Frame: 0.0598-inch thick steel sheet.
2. Frame for Wet Areas: 0.0625-inch thick stainless-steel sheet.
3. Door: 0.0598-inch thick steel sheet.
4. Door for Wet Areas: 0.0625-inch- thick stainless-steel sheet.
5. Hinge: Continuous type / Concealed
6. Latches: Bolt type, operated by ring turn device.
7. Fire-Protection Rating for Walls: 1-1/2 hours.

- B. Trimless, Flush Access Doors for Gypsum Board: Units consisting of frame, concealed edge trim, door, hardware, and complying with the following requirements:

1. Frame: 0.0598-inch thick steel sheet.
2. Frame for Wet Locations: 0.0625-inch- thick stainless-steel sheet.
3. Door: 0.0747 inch thick steel sheet.
4. Door for Wet Locations: 0.0781 inch thick stainless-steel sheet.
5. Concealed, Gypsum Board Edge Trim: 0.0299 inch zinc-coated or galvanized-steel sheet with face flange formed to receive joint compound.
6. Hinge: Concealed spring pin or continuous type.
7. Locks: Flush, screwdriver-operated cam.

- C. Recessed Doors where indicated: Units consisting of frame with no exposed trim, recessed door to receive tile, hardware, and complying with the following requirements:

1. Frame: 0.0897 inch thick steel sheet.
2. Door: 0.0598 inch thick steel sheet, recessed 1 inch.
3. Frame for Wet Locations: 0.0625 inch thick stainless-steel sheet.
4. Door for Wet Locations: 0.0781 inch thick stainless-steel sheet.
5. Hinge: Concealed, pivoting-rod type.
6. Locks: Flush, screwdriver-operated cam.

2.04 FABRICATION

- A. General: Manufacture each access door assembly as an integral unit ready for installation.
- B. Steel Access Doors and Frames: Continuous welded construction. Grind welds smooth and flush with adjacent surfaces. Furnish attachment devices and fasteners of type required to secure access panels to types of supports indicated.
 - 1. Exposed Flange: Nominal 1 to 1-1/2 inches (25.4 to 38.1 mm) wide around perimeter of frame.
 - 2. For gypsum board assemblies or gypsum veneer plaster, furnish frames with edge trim for gypsum board or gypsum base.
 - 3. For installation in masonry construction, furnish frames with adjustable metal masonry anchors.
- C. Recessed Panel Doors: Form face of panel to provide recess for application of applied finish. Reinforce panel as required to prevent buckling.
- D. Locking Devices: Furnish number required to hold door in flush, smooth plane when closed.
 - 1. For recessed panel doors, provide access sleeves for each locking device. Furnish plastic grommets and install in holes cut through finish.
- E. Finish: Provide units factory primed for finish painting unless otherwise indicated.
 - 1. Provide directional satin finish for stainless steel units or as selected by Architect.

PART 3 - EXECUTION

3.01 PREPARATION

- A. Advise Installers of other work about specific requirements relating to access door installation, including sizes of openings to receive access door and frame, as well as locations of supports, inserts, and anchoring devices. Furnish inserts and anchoring devices for access doors that must be built into other construction. Coordinate delivery with other work to avoid delay.

3.02 INSTALLATION

- A. Comply with manufacturer's instructions for installing access doors.
- B. Set frames accurately in position and attach securely to supports with plane of face panels aligned with adjacent finished surfaces.
- C. Install concealed-frame access doors flush with adjacent finish surfaces.

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State University of New York
735 Anderson Hill Road, Purchase, NY 10577

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3.03 ADJUST AND CLEAN

- A. Adjust hardware and panels after installation for proper operation.
- B. Remove and replace panels or frames that are warped, bowed, or otherwise damaged.

END OF SECTION

SECTION 087100 - DOOR HARDWARE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes commercial door hardware for the following:
 - 1. Swinging doors.
- B. Door hardware includes, but is not necessarily limited to, the following:
 - 1. Mechanical door hardware.
- C. Related Sections:
 - 1. Division 06 Section "Rough Carpentry".
 - 2. Division 08 Section "Door Schedule".
 - 3. Division 08 Section "Hollow Metal Doors and Frames".
 - 4. Division 08 Section "Flush Wood Doors".
- D. Codes and References: Comply with the version year adopted by the Authority Having Jurisdiction.
 - 1. ANSI A117.1 - Accessible and Usable Buildings and Facilities.
 - 2. ICC/IBC - International Building Code.
 - 3. NFPA 80 - Fire Doors and Windows.
 - 4. NFPA 101 - Life Safety Code.
 - 5. State Building Codes, Local Amendments.
- E. Standards: All hardware specified herein shall comply with the following industry standards as applicable. Any undated reference to a standard shall be interpreted as referring to the latest edition of that standard:
 - 1. ANSI/BHMA Certified Product Standards - A156 Series.
 - 2. UL10C - Positive Pressure Fire Tests of Door Assemblies.

1.3 SUBMITTALS

- A. Product Data: Manufacturer's product data sheets including installation details, material descriptions, dimensions of individual components and profiles, operational descriptions and finishes.
- B. Door Hardware Schedule: Prepared by or under the supervision of supplier, detailing fabrication and assembly of door hardware, as well as procedures and diagrams. Coordinate the final Door Hardware Schedule with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of door hardware.
 - 1. Format: Comply with scheduling sequence and vertical format in DHI's "Sequence and Format for the Hardware Schedule."
 - 2. Organization: Organize the Door Hardware Schedule into door hardware sets indicating complete designations of every item required for each door or opening. Organize door hardware sets in same order as in the Door Hardware Sets at the end of Part 3. Submittals that do not follow the same format and order as the Door Hardware Sets will be rejected and subject to resubmission.
 - 3. Content: Include the following information:
 - a. Type, style, function, size, label, hand, and finish of each door hardware item.
 - b. Manufacturer of each item.
 - c. Fastenings and other pertinent information.
 - d. Location of door hardware set, cross-referenced to Drawings, both on floor plans and in door and frame schedule.
 - e. Explanation of abbreviations, symbols, and codes contained in schedule.
 - f. Mounting locations for door hardware.
 - g. Door and frame sizes and materials.
 - h. Warranty information for each product.
 - 4. Submittal Sequence: Submit the final Door Hardware Schedule at earliest possible date, particularly where approval of the Door Hardware Schedule must precede fabrication of other work that is critical in the Project construction schedule. Include Product Data, Samples, Shop Drawings of other work affected by door hardware, and other information essential to the coordinated review of the Door Hardware Schedule.
- C. Keying Schedule: After a keying meeting with the owner has taken place prepare a separate keying schedule detailing final instructions. Submit the keying schedule in electronic format. Include keying system explanation, door numbers, key set symbols, hardware set numbers and special instructions. Owner must approve submitted keying schedule prior to the ordering of permanent cylinders/cores.
- D. Informational Submittals:
 - 1. Product Test Reports: Indicating compliance with cycle testing requirements, based on evaluation of comprehensive tests performed by manufacturer and witnessed by a qualified independent testing agency.

- E. Operating and Maintenance Manuals: Provide manufacturers operating and maintenance manuals for each item comprising the complete door hardware installation in quantity as required in Division 01, Closeout Procedures.

1.4 QUALITY ASSURANCE

- A. Manufacturers Qualifications: Engage qualified manufacturers with a minimum 5 years of documented experience in producing hardware and equipment similar to that indicated for this Project and that have a proven record of successful in-service performance.
- B. Installer Qualifications: A minimum 3 years documented experience installing both standard and electrified door hardware similar in material, design, and extent to that indicated for this Project and whose work has resulted in construction with a record of successful in-service performance.
- C. Door Hardware Supplier Qualifications: Experienced commercial door hardware distributors with a minimum 5 years documented experience supplying both mechanical and electromechanical hardware installations comparable in material, design, and extent to that indicated for this Project. Supplier recognized as a factory direct distributor by the manufacturers of the primary materials with a warehousing facility in Project's vicinity. Supplier to have on staff a certified Architectural Hardware Consultant (AHC) available during the course of the Work to consult with Contractor, Architect, and Owner concerning both standard and electromechanical door hardware and keying.
- D. Each unit to bear third party permanent label demonstrating compliance with the referenced standards.
- E. Keying Conference: Conduct conference to comply with requirements in Division 01 Section "Project Meetings." Keying conference to incorporate the following criteria into the final keying schedule document:
 - 1. Function of building, purpose of each area and degree of security required.
 - 2. Plans for existing and future key system expansion.
 - 3. Requirements for key control storage and software.
 - 4. Installation of permanent keys, cylinder cores and software.
 - 5. Address and requirements for delivery of keys.
- F. Pre-Submittal Conference: Conduct coordination conference in compliance with requirements in Division 01 Section "Project Meetings" with attendance by representatives of Supplier(s), Installer(s), and Contractor(s) to review proper methods and the procedures for receiving, handling, and installing door hardware.
 - 1. Prior to installation of door hardware, conduct a project specific training meeting to instruct the installing contractors' personnel on the proper installation and adjustment of their respective products. Product training to be attended by installers of door hardware (including electromechanical hardware) for aluminum, hollow metal and wood doors. Training will include the use of installation manuals, hardware schedules, templates and physical product samples as required.
 - 2. Inspect and discuss electrical roughing-in, power supply connections, and other preparatory work performed by other trades.
 - 3. Review sequence of operation narratives for each unique access controlled opening.
 - 4. Review and finalize construction schedule and verify availability of materials.

5. Review the required inspecting, testing, commissioning, and demonstration procedures

- G. At completion of installation, provide written documentation that components were applied to manufacturer's instructions and recommendations and according to approved schedule.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Inventory door hardware on receipt and provide secure lock-up and shelving for door hardware delivered to Project site. Do not store electronic access control hardware, software or accessories at Project site without prior authorization.
- B. Tag each item or package separately with identification related to the final Door Hardware Schedule, and include basic installation instructions with each item or package.
- C. Deliver, as applicable, permanent keys, cylinders, cores, access control credentials, software and related accessories directly to Owner via registered mail or overnight package service. Instructions for delivery to the Owner shall be established at the "Keying Conference".

1.6 COORDINATION

- A. Templates: Obtain and distribute to the parties involved templates for doors, frames, and other work specified to be factory prepared for installing standard and electrified hardware. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing hardware to comply with indicated requirements.
- B. Door and Frame Preparation: Doors and corresponding frames are to be prepared, reinforced and pre-wired (if applicable) to receive the installation of the specified electrified, monitoring, signaling and access control system hardware without additional in-field modifications.

1.7 WARRANTY

- A. General Warranty: Reference Division 01, General Requirements. Special warranties specified in this Article shall not deprive Owner of other rights Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by Contractor under requirements of the Contract Documents.
- B. Warranty Period: Written warranty, executed by manufacturer(s), agreeing to repair or replace components of standard and electrified door hardware that fails in materials or workmanship within specified warranty period after final acceptance by the Owner. Failures include, but are not limited to, the following:
1. Structural failures including excessive deflection, cracking, or breakage.
 2. Faulty operation of the hardware.
 3. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
 4. Electrical component defects and failures within the systems operation.
- C. Standard Warranty Period: One year from date of Substantial Completion, unless otherwise indicated.

D. Special Warranty Periods:

1. Ten years for mortise locks and latches.
2. Seven years for heavy duty cylindrical (bored) locks and latches.
3. Twenty five years for manual overhead door closer bodies.

1.8 MAINTENANCE SERVICE

- A. Maintenance Tools and Instructions: Furnish a complete set of specialized tools and maintenance instructions as needed for Owner's continued adjustment, maintenance, and removal and replacement of door hardware.

PART 2 - PRODUCTS

2.1 SCHEDULED DOOR HARDWARE

- A. General: Provide door hardware for each door to comply with requirements in Door Hardware Sets and each referenced section that products are to be supplied under.
- B. Designations: Requirements for quantity, item, size, finish or color, grade, function, and other distinctive qualities of each type of door hardware are indicated in the Door Hardware Sets at the end of Part 3. Products are identified by using door hardware designations, as follows:
1. Named Manufacturer's Products: Product designation and manufacturer are listed for each door hardware type required for the purpose of establishing requirements. Manufacturers' names are abbreviated in the Door Hardware Schedule.
- C. Substitutions: Requests for substitution and product approval for inclusive mechanical and electromechanical door hardware in compliance with the specifications must be submitted in writing and in accordance with the procedures and time frames outlined in Division 01, Substitution Procedures. Approval of requests is at the discretion of the architect, owner, and their designated consultants.

2.2 HANGING DEVICES

- A. Hinges: ANSI/BHMA A156.1 certified butt hinges with number of hinge knuckles and other options as specified in the Door Hardware Sets.
1. Quantity: Provide the following hinge quantity:
 - a. Two Hinges: For doors with heights up to 60 inches.
 - b. Three Hinges: For doors with heights 61 to 90 inches.
 - c. Four Hinges: For doors with heights 91 to 120 inches.
 - d. For doors with heights more than 120 inches, provide 4 hinges, plus 1 hinge for every 30 inches of door height greater than 120 inches.
 2. Hinge Size: Provide the following, unless otherwise indicated, with hinge widths sized for door thickness and clearances required:

- a. Widths up to 3'0": 4-1/2" standard or heavy weight as specified.
 - b. Sizes from 3'1" to 4'0": 5" standard or heavy weight as specified.
3. Hinge Weight and Base Material: Unless otherwise indicated, provide the following:
 - a. Exterior Doors: Heavy weight, non-ferrous, ball bearing or oil impregnated bearing hinges unless Hardware Sets indicate standard weight.
 - b. Interior Doors: Standard weight, steel, ball bearing or oil impregnated bearing hinges unless Hardware Sets indicate heavy weight.
4. Hinge Options: Comply with the following:
 - a. Non-removable Pins: With the exception of electric through wire hinges, provide set screw in hinge barrel that, when tightened into a groove in hinge pin, prevents removal of pin while door is closed; for the all out-swinging lockable doors.
5. Manufacturers:
 - a. Hager Companies (HA).
 - b. McKinney (MK).
 - c. Stanley Hardware (ST).

2.3 CYLINDERS AND KEYING

- A. General: Cylinder manufacturer to have minimum (10) years' experience designing secured master key systems and have on record a published security keying system policy.
- B. Interchangeable Cores: Provide small format interchangeable cores as specified, core insert, removable by use of a special key; usable with other manufacturers' cylinders.
- C. Keying System: Each type of lock and cylinders to be factory keyed.
 1. Supplier shall conduct a "Keying Conference" to define and document keying system instructions and requirements.
 2. Furnish factory cut, nickel-silver large bow permanently inscribed with a visual key control number as directed by Owner.
 3. Existing System: Field verify and key cylinders to match Owner's existing system.
- D. Key Quantity: Provide the following minimum number of keys:
 1. Change Keys per Cylinder: Three (3).
- E. Construction Keying: Provide temporary keyed construction cores.

2.4 MECHANICAL LOCKS AND LATCHING DEVICES

- A. Mortise Locksets, Grade 1 (Heavy Duty): ANSI/BHMA A156.13, Series 1000, Operational Grade 1 Certified Products Directory (CPD) listed. Locksets are to be manufactured with a

corrosion resistant steel case and be field-reversible for handing without disassembly of the lock body.

1. Manufacturers:

- a. Sargent Manufacturing (SA) - 8200 Series.

B. Cylindrical Locksets, Grade 1 (Heavy Duty): ANSI/BHMA A156.2, Series 4000, Operational Grade 1 Certified Products Directory (CPD) listed.

1. Locks shall meet or exceed the requirements of ANSI/BHMA A156.2 Series 4000, Grade 1 with all standard trims, as follows:

- a. Cycle Test: ANSI/BHMA A156.2 Grade 1 requirements with no lever sag.
- b. Abusive Locked Lever Torque: Exceed 3,100 in-lb with no entry; lock to maintain egress functionality in compliance with BHMA certification requirements.
- c. Offset Lever Pull: Exceed 1,600 lbs with no entry (8 times ANSI/BHMA A156.2 requirements).
- d. Latch Retraction with Preload: Exceed 100 lb preload while maintaining ANSI/BHMA requirements for operation in warped doors (2 times ANSI/BHMA A156.2 requirements).

2. Vertical Impact: Exceed 100 vertical impacts (20 times ANSI/BHMA A156.2 requirements).

3. Furnish with solid cast levers, standard 2 3/4" backset, and 1/2" (3/4" at rated paired openings) throw brass or stainless steel latchbolt.

4. Locks are to be non-handed and fully field reversible.

5. Locksets to incorporate a free-wheeling lever design.

6. Manufacturers:

- a. These locks shall be provided as an ALT DEDUCT ONLY FOR BOTH ETR DOOR @ WORK ROOM AND JANITOR CLOSET.

- 1) Sargent Manufacturing (SA) - 10X Line.

2.5 DOOR CLOSERS

A. All door closers specified herein shall meet or exceed the following criteria:

- 1. General: Door closers to be from one manufacturer, matching in design and style, with the same type door preparations and templates regardless of application or spring size. Closers to be non-handed with full sized covers.
- 2. Standards: Closers to comply with UL-10C for Positive Pressure Fire Test and be U.L. listed for use of fire rated doors.

3. Size of Units: Comply with manufacturer's written recommendations for sizing of door closers depending on size of door, exposure to weather, and anticipated frequency of use. Where closers are indicated for doors required to be accessible to the Americans with Disabilities Act, provide units complying with ANSI ICC/A117.1.
 4. Closer Arms: Provide heavy duty, forged steel closer arms unless otherwise indicated in Hardware Sets.
 5. Closers shall not be installed on exterior or corridor side of doors; where possible install closers on door for optimum aesthetics.
 6. Closer Accessories: Provide door closer accessories including custom templates, special mounting brackets, spacers and drop plates as required for proper installation. Provide through-bolt and security type fasteners as specified in the hardware sets.
- B. Door Closers, Surface Mounted (Heavy Duty): ANSI/BHMA A156.4, Grade 1 Certified Products Directory (CPD) listed surface mounted, heavy duty door closers with complete spring power adjustment, sizes 1 thru 6; and fully operational adjustable according to door size, frequency of use, and opening force. Closers to be rack and pinion type, one piece cast iron or aluminum alloy body construction, with adjustable backcheck and separate non-critical valves for closing sweep and latch speed control. Provide non-handed units standard.
1. Manufacturers:
 - a. Norton Rixson (NO) - 7500 Series.

2.6 ARCHITECTURAL TRIM

A. Door Protective Trim

1. General: Door protective trim units to be of type and design as specified below or in the Hardware Sets.
2. Size: Fabricate protection plates (kick, armor, or mop) not more than 2" less than door width (LDW) on stop side of single doors and 1" LDW on stop side of pairs of doors, and not more than 1" less than door width on pull side. Coordinate and provide proper width and height as required where conflicting hardware dictates. Height to be as specified in the Hardware Sets.
3. Where plates are applied to fire rated doors with the top of the plate more than 16" above the bottom of the door, provide plates complying with NFPA 80. Consult manufacturer's catalog and template book for specific requirements for size and applications.
4. Protection Plates: ANSI/BHMA A156.6 certified protection plates (kick, armor, or mop), fabricated from the following:
 - a. Stainless Steel: 300 grade, .050-inch thick.
5. Options and fasteners: Provide manufacturer's designated fastener type as specified in the Hardware Sets. Provide countersunk screw holes.

6. Manufacturers:

- a. Hiawatha, Inc. (HI).
- b. Rockwood (RO).
- c. Trimco (TC).

2.7 DOOR STOPS AND HOLDERS

- A. General: Door stops and holders to be of type and design as specified below or in the Hardware Sets.
- B. Door Stops and Bumpers: ANSI/BHMA A156.16, Grade 1 certified door stops and wall bumpers. Provide wall bumpers, either convex or concave types with anchorage as indicated, unless floor or other types of door stops are specified in Hardware Sets. Do not mount floor stops where they will impede traffic. Where floor or wall bumpers are not appropriate, provide overhead type stops and holders.

1. Manufacturers:

- a. Hiawatha, Inc. (HI).
- b. Rockwood (RO).
- c. Trimco (TC).

2.8 ARCHITECTURAL SEALS

- A. General: Thresholds, weatherstripping, and gasket seals to be of type and design as specified below or in the Hardware Sets. Provide continuous weatherstrip gasketing on exterior doors and provide smoke, light, or sound gasketing on interior doors where indicated. At exterior applications provide non-corrosive fasteners and elsewhere where indicated.
- B. Smoke Labeled Gasketing: Assemblies complying with NFPA 105 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for smoke control ratings indicated, based on testing according to UL 1784.
 - 1. Provide smoke labeled perimeter gasketing at all smoke labeled openings.
- C. Fire Labeled Gasketing: Assemblies complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire ratings indicated, based on testing according to UL-10C.
 - 1. Provide intumescent seals as indicated to meet UL10C Standard for Positive Pressure Fire Tests of Door Assemblies, and NPFA 252, Standard Methods of Fire Tests of Door Assemblies.
- D. Sound-Rated Gasketing: Assemblies that are listed and labeled by a testing and inspecting agency, for sound ratings indicated.
- E. Replaceable Seal Strips: Provide only those units where resilient or flexible seal strips are easily replaceable and readily available from stocks maintained by manufacturer.

F. Manufacturers:

1. Pemko (PE).

2.9 FINISHES

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine scheduled openings, with Installer present, for compliance with requirements for installation tolerances, labeled fire door assembly construction, wall and floor construction, and other conditions affecting performance.
- B. Notify architect of any discrepancies or conflicts between the door schedule, door types, drawings and scheduled hardware. Proceed only after such discrepancies or conflicts have been resolved in writing.

3.2 PREPARATION

- A. Hollow Metal Doors and Frames: Comply with ANSI/DHI A115 series.
- B. Wood Doors: Comply with ANSI/DHI A115-W series.

3.3 INSTALLATION

- A. Install each item of mechanical and electromechanical hardware and access control equipment to comply with manufacturer's written instructions and according to specifications.
 1. Installers are to be trained and certified by the manufacturer on the proper installation and adjustment of fire, life safety, and security products including: hanging devices; locking devices; closing devices; and seals.
- B. Mounting Heights: Mount door hardware units at heights indicated in following applicable publications, unless specifically indicated or required to comply with governing regulations:
 1. Standard Steel Doors and Frames: DHI's "Recommended Locations for Architectural Hardware for Standard Steel Doors and Frames."
 2. DHI TDH-007-20: Installation Guide for Doors and Hardware.
 3. Where indicated to comply with accessibility requirements, comply with ANSI A117.1 "Accessibility Guidelines for Buildings and Facilities."
 4. Provide blocking in drywall partitions where wall stops or other wall mounted hardware is located.
- C. Retrofitting: Install door hardware to comply with manufacturer's published templates and written instructions. Where cutting and fitting are required to install door hardware onto or into surfaces that are later to be painted or finished in another way, coordinate removal, storage,

and reinstallation of surface protective trim units with finishing work specified in Division 9 Sections. Do not install surface-mounted items until finishes have been completed on substrates involved.

- D. Thresholds: Set thresholds for exterior and acoustical doors in full bed of sealant complying with requirements specified in Division 7 Section "Joint Sealants."
- E. Storage: Provide a secure lock up for hardware delivered to the project but not yet installed. Control the handling and installation of hardware items so that the completion of the work will not be delayed by hardware losses before and after installation.

3.4 FIELD QUALITY CONTROL

- A. Field Inspection (Punch Report): Reference Division 01 Sections "Closeout Procedures". Produce project punch report for each installed door opening indicating compliance with approved submittals and verification hardware is properly installed, operating and adjusted. Include list of items to be completed and corrected, indicating the reasons or deficiencies causing the Work to be incomplete or rejected.

3.5 ADJUSTING

- A. Initial Adjustment: Adjust and check each operating item of door hardware and each door to ensure proper operation or function of every unit. Replace units that cannot be adjusted to operate as intended. Adjust door control devices to compensate for final operation of heating and ventilating equipment and to comply with referenced accessibility requirements.

3.6 CLEANING AND PROTECTION

- A. Protect all hardware stored on construction site in a covered and dry place. Protect exposed hardware installed on doors during the construction phase. Install any and all hardware at the latest possible time frame.
- B. Clean adjacent surfaces soiled by door hardware installation.
- C. Clean operating items as necessary to restore proper finish. Provide final protection and maintain conditions that ensure door hardware is without damage or deterioration at time of owner occupancy.

3.7 DEMONSTRATION

- A. Instruct Owner's maintenance personnel to adjust, operate, and maintain mechanical and electromechanical door hardware.

3.8 DOOR HARDWARE SETS

- A. The hardware sets represent the design intent and direction of the owner and architect. They are a guideline only and should not be considered a detailed hardware schedule.

Discrepancies, conflicting hardware and missing items should be brought to the attention of the architect with corrections made prior to the bidding process. Omitted items not included in a hardware set should be scheduled with the appropriate additional hardware required for proper application and functionality.

1. Quantities listed are for each pair of doors, or for each single door.
2. The supplier is responsible for handing and sizing all products.
3. Where multiple options for a piece of hardware are given in a single line item, the supplier shall provide the appropriate application for the opening.

B. Manufacturer's Abbreviations:

1. MK - McKinney
2. SA - SARGENT
3. NO - Norton
4. RO - Rockwood
5. PE - Pemko

Hardware Sets

Set: 1.0

Doors: 01, 02, 05, 06, 07, 10, 12, 13

3 Hinge, Full Mortise, Hvy Wt	T4A3386	US32D	MK	087100
1 Classroom Security Intruder Lock	70 8238 LNMI	US32D	SA	087100
2 Small Format Inter Core	SFIC Core to match facility system			087100
1 Surface Closer	PR7500 / R 7500	689	NO	087100
1 Kick Plate	K1050 10" CSK BEV	US32D	RO	087100
1 Wall Stop	400	US26D	RO	087100
3 Silencer	608-RKW		RO	087100

Notes: Lockset provided for maintenance purposes only.

Set: 2.0

Doors: 03, 08, 11

3 Hinge, Full Mortise	TA2314	US32D	MK	087100
1 Dormitory/Exit Lock	SG T3 V20 70 8225 LNMI	US32D	SA	087100
1 Small Format Inter Core	SFIC Core to match facility system			087100
1 Surface Closer	PR7570	689	NO	087100
1 Kick Plate	K1050 10" CSK BEV	US32D	RO	087100
1 Wall Stop	400	US26D	RO	087100
1 Gasketing	S88		PE	087100
1 Coat Hook	RM802	US32D	RO	087100

Keyed cylinder provided to lock door for maintenance only. Door unlocks upon depressing inside lever.

Set: 3.0

Doors: 09

3 Hinge, Full Mortise	TA2314	US32D	MK	087100
1 Storeroom/Closet Lock	70 8204 LNMI	US32D	SA	087100
1 Small Format Inter Core	SFIC Core to match facility system			087100
1 Surface Closer	PR7500 / R 7500	689	NO	087100
1 Kick Plate	K1050 10" CSK BEV	US32D	RO	087100
1 Wall Stop	406	US32D	RO	087100
1 Silencer	608-RKW		RO	087100

Set: 4.0

Doors: 04

3 Hinge, Full Mortise, Hvy Wt	VIF Match Ht and Wt of ETR door preps	US32D	MK	087100
1 Classroom Security Intruder Lock	70 8238 LNMI	US32D	SA	087100
1 Small Format Inter Core	SFIC Core to match facility system			087100
1 Surface Closer	PR7500 / R 7500	689	NO	087100
1 Wall Stop	406	US32D	RO	087100
1 Gasketing	S88		PE	087100

Notes: VIF existing door preps...patch and repair as required. Report any deficiencies to Architect.
Intent is to provide new mortise lockset into ETR Door... provide new frame w/ preps to match ETR door.
Provide Sargent 10X lock w/ alt deduct if ETR door has 161 prep.

END OF SECTION 087100

Ronnette Riley Architect
05/05/2022

Door Hardware
Issue to Bid_ Phase 2

SUPPLEMENT: SUNY PURCHASE CAMPUS KEYING REQUIREMENTS

Keys and Keying:

1. All locksets and cylinders shall be keyed into the existing Campus Master Key System for this project. Allow for 100% expansion. For the protection of the Campus, all cylinders shall be keyed at the factor where permanent records shall be established and maintained.
2. Cylinders, permanent and removable cores, and keys to be Campus standard – by Best Access Systems **'Premium Series'** (**no substitutions allowed**).
3. Conduct conference on-site at the Campus to comply with all requirements set forth in project documents and verify Campus requirements. In addition to the Campus, Architect, and Contractor, conference participants shall also include; Hardware Sub-Contractor, Hardware Consultant, and Campus Representatives. Incorporate keying conference decisions, but not limited to, the following:
 - a) Function of building, flow of traffic, purpose of each area, degree of security required, and plans for future expansion.
 - b) Preliminary key system schematic diagram.
 - c) Requirements for key control system.
 - d) Arrangements for delivery of keys.
4. During construction, all new locksets shall be construction masterkeyed. Provide temporary construction cores. The General Contractor shall receive ten (10) construction masterkeys. Under no circumstance shall the General Contractor receive any permanent building masterkeys or change keys unless authorized by the Campus Representative.
5. All permanent cores and keys shall be requested directly by the Campus to the manufacturer. The General Contractor shall be responsible for all payments to the manufacturer and shall supply the Campus with all necessary information (account number, etc.), in order for the Campus to order final cores and keys.
6. All construction cores will be returned to General Contractor once Campus has received and installed final cores.
7. Standard Lock Cylinders: BHMA A156.5, Grade 1.
8. Cylinders: Manufacturer's standard tumbler type, constructed from brass, or bronze, stainless steel, or nickel silver, complying with the following:
 - a) Number of Pins: Seven (7)
 - b) Bored-Lock Type: Cylinders with tailpieces to suit locks.
 1. High-Security Grade: BHMA A156.5, Grade 1A, listed and labeled as complying with pick- and drill-resistant testing requirements in UL-437 (SuffixA).
 - c) Permanent Cores: Manufacturer's standard; finish face to match lockset; complying with the following:

1. Removable Cores: Core insert, removable by use of a special key; for use only with core manufacturer's cylinder and door hardware.
9. Keying system shall be factory registered, complying with guidelines in BHMA A156.28, Appendix A. Incorporate decisions made in keying conference, and as follows:
 - a) Master Key System: Cylinders are operated by a change key and a master key.
 - b) Existing System: Re-key Campus' existing master key system into new keying system.
 - c) Keyed Alike: Key all cylinders to same change key.
10. All master keys shall be identified with a registry number, and shall **not** be stamped with MASTER or letter M.
11. All keys shall be stamped "DO NOT DUPLICATE".
12. Furnish:
 - a) Cylinder Change Key: Three (3) per building.
 - b) Master Keys: Two (2) per building.
 - c) Key Blanks: Two (2) per door.
13. All keying shall be thoroughly checked with the Campus Representative. Final keying requirements shall be submitted in writing, for final approval by the Campus Representative.

END OF SECTION 087100 SUPPLEMENT

SECTION 09 21 00 - GYPSUM DRYWALL SYSTEMS

PART 1 - GENERAL

1.01 SUMMARY

- A. Work Included: Provide products in accordance with the Contract Documents. The Contract Documents are as defined in the "Agreement". The "General Conditions Governing All Contracts" shall apply to all work under the Contract. The Work of this Section shall include but not be limited to the following:
 - 1. Gypsum drywall panels, including screw-type metal framing support system.
 - 2. Drywall finishing with joint tape-and-compound.
 - 3. Cementitious backerboards.
 - 4. Metal supports and backer plates for other finishes.
 - 5. Acoustical insulation and sealant for drywall.
 - 6. Metal fabrications and accessories.
- B. Related Sections:
 - 1. Section 06 10 00 - Rough Carpentry.
 - 2. Section 07 84 00 - Penetration Firestopping.
 - 3. Section 07 92 00 - Joint Sealants.
 - 4. Section 08 31 13 - Access Doors.
 - 5. Section 09 30 00 - Tile.
 - 6. Section 09 91 00 - Painting.

1.02 QUALITY ASSURANCE

- A. Fire-Resistance Rating: Where ratings are indicated, match applicable assemblies tested per ASTM E119 by fire testing laboratories, or to design designations in UL "Fire Resistance Directory" or in listing of other testing agencies acceptable to authorities having jurisdiction.
- B. Gypsum Board Terminology Standard: GA-505 by Gypsum Association.
- C. Installer: Engage an experienced firm that has recently completed Gypsum Drywall System assemblies with Fire-Resistant Ratings similar in cost, material, design and extent to that indicated by this work which has resulted in construction with a record of successful in-service performance.
- D. Single Source Responsibility: Obtain each type of gypsum board and related joint treatment materials from a single manufacturer.

1.03 PERFORMANCE REQUIREMENTS

- A. Sound Transmission Characteristics: For gypsum drywall assemblies indicated to have STC ratings, provide materials and construction identical to those of assemblies whose STC ratings were determined per ASTM E 90 and classified per ASTM E 413 by a qualified independent testing agency.
- B. Installer: Engage an experienced firm that has recently completed Gypsum Drywall System assemblies with STC ratings similar in cost, material, design and extent to that indicated in this work which has resulted in construction with a record of successful in-service performance.
- C. Sound-Attenuation Performance: For gypsum board shaft-wall assemblies, provide materials and construction identical to those of assemblies whose STC ratings were determined per ASTM E 90 and classified per ASTM E 413 by a qualified independent testing agency.
 - 1. STC Rating: 47 Min. unless otherwise indicated for each partition type.
- D. General: All systems shall conform to requirements of the current Code for the seismic hazard group required and all applicable modifications as required by the building code and amendments as required.
- E. Hanger Anchorage Devices: Provide devices appropriate for anchorage to the structure whose suitability has been proven through standard construction practices and certified test data, and as follows:
 - 1. General: Size devices to develop full strength of hanger but not less than 3 times calculated hanger loading, except size direct pull-out concrete inserts for 5 times the calculated hanger loading.
 - 2. Concrete Slabs - 4" Minimum: Provide drilled expansion type anchors of size to suit the load.
- F. Field Evaluation and Testing: Provide pull-out tests by a qualified testing agency subject to the approval of the Resident Engineer, on a selected anchor section. Include all proposed components for anchoring to existing slabs, provide tests in accordance with ASTM E 488. Tests shall evaluate design, and safety factor loading and shall not test beyond design and safety factor loading to failure, unless otherwise indicated approved and required.

1.04 SUBMITTALS

- A. Product Data: Submit manufacturer's specifications and installation instructions for gypsum drywall and gypsum sheathing. Submit other data as required to show compliance with these specifications.
- B. Samples: Submit 12" long samples of each type of trim accessory.
- C. Shop Drawings: Submit Shop Drawings showing locations of control joints.
- D. Research Reports: Submit research reports or evaluation reports of the model code organization acceptable to authorities having jurisdiction that evidence each assembly's compliance with requirements and with the building code in effect for Project.

1.05 DELIVERY, STORAGE AND HANDLING

- A. Deliver materials in original packages, containers or bundles bearing brand name and identification of manufacturer or supplier.
- B. Store materials inside under cover and keep them dry and protected against damage from weather, sunlight, soiling, dirt or other causes. Neatly stack gypsum boards flat to prevent sagging.
- C. Handle gypsum boards to prevent damage to edges, ends or surfaces. Do not bend or otherwise damage metal corner beads and trim.

1.06 PROJECT CONDITIONS

- A. Environmental Requirements: Comply with referenced standards and recommendations of gypsum board manufacturer, for environmental conditions before, during and after application of gypsum board.
- B. Cold Weather Protection: When air temperature is below 55 deg F maintain temperature of not less than 55 deg F for at least 48 hours before, during and after application of joint treatment materials.
- C. Ventilation: Ventilate building spaces to remove water not required for drying joint treatment materials. Avoid drafts during dry, hot weather to prevent materials from drying too rapidly.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, provide products as manufactured by one of the following, or approved equal:
1. Metal Support Materials:
 - a. Dale Industries, Inc.
 - b. Marino Industries.
 - c. United States Gypsum Co.
 - d. Or Approved Equal.
 2. Gypsum Board and Related Products:
 - a. Georgia-Pacific Corp.
 - b. Gold Bond Building Products Div., National Gypsum Co.
 - c. United States Gypsum Co.
 - d. Or Approved Equal.
 3. Cementitious Backer Board:
 - a. United States Gypsum Co.
 - b. Custom Building Products.
 - c. Domtar Gypsum.
 - d. Or Approved Equal.
 4. Grid Suspension Systems:
 - a. Chicago Metallic Corp.
 - b. National Rolling Mills Co.
 - c. United States Gypsum Co.
 - d. Or Approved Equal.
 5. Furring Member: "C" Shaped Studs:
 - a. Gold Bond Building Products.
 - b. Domtar Gypsum Co.
 - c. Georgia Pacific Corp.
 - d. Or Approved Equal.

2.02 CEILING SUPPORTS

- A. General: Provide metal suspension systems of type, structural classification and finish indicated which comply with applicable ASTM C 754 requirements and the requirements of the New York City Building Code.
- B. Hangers: Mild steel rods or flats with zinc-coating or rust-inhibitive primer paint, sizes as indicated.
- C. Wire for Hangers and Ties: ASTM A 641, Class 1 zinc coating, soft temper.
- D. Hanger Anchorage Devices: Devices whose suitability for use has been proven by standard construction practices or by certified test data. Size devices for 3x load, as determined by ASTM E 488.
- E. Main Runners: 1-1/2" cold rolled, 475 lbs per 1000 ft. channel, painted.
- F. Furring Members: ASTM C 645; 0.0179" minimum thickness, hat-shaped; "C"-shaped studs for spans of more than 4 feet.
- G. Furring Anchorages: 16-gage galvanized wire ties, clips and anchorages recommended by furring manufacturer.
- H. Grid Suspension System: ASTM C 645, manufacturer's standard grid suspension system composed of main beams and cross furring members which interlock to form a modular supporting network.
- I. Carry Channel Members: ASTM C 645; 0.0179" minimum thickness, hat-shaped; "C"-shaped studs for spans of more than 4 feet.

2.03 WALL AND PARTITION FRAMING

- A. Studs: ASTM C 645; of profile, size and base metal thickness required to produce assemblies complying with structural performance requirements of ASTM C 754 under required deflection and lateral loading conditions.
 - 1. Depth of Section: Standard sizes as shown.
 - 2. Gauge: Provide Gauge as indicated.
 - a. Provide non standard profiles and gauges for use in installations where required.
 - 3. Runners: Match studs, type as recommended by stud manufacturer.
- B. Furring Members: ASTM C 645; 0.0179" minimum thickness (25 gage) of base metal, hat-shaped, except "Z"-furring members.
- C. Z-Furring Members: Standard screw-type galvanized steel, "Z"-shaped furring members complying with ASTM A 525, G60, 0.0179" min. thickness (25 gage); of depth to suit insulation thickness indicated.

- D. Steel Resilient Furring Channels: Manufacturer's standard product designed to reduce sound transmission, complying with ASTM C 645 for base metal, finish and widths of face and fastening flange, fabricated to form ½ inch deep channel of the following configuration:
 - 1. Single-Leg Configuration: Asymmetric-shaped channel with face connected to one flange by a slotted leg.
- E. Flat Reinforcing Strips: 14 gage by 8" wide minimum (unless otherwise noted) galvanized strip for wall mounted items and accessories such as handrails, grab bars, wall mounted shelving, cabinets, and counters.
- F. Fasteners for Furring Members: Type and size recommended by furring manufacturer for the indicated substrates.

2.04 GYPSUM BOARD

- A. Gypsum Wallboard: ASTM C 36, of types and edge profile indicated; in maximum lengths available, 5/8" thick unless otherwise indicated.
 - 1. Type: Regular, unless otherwise indicated.
 - 2. Type: Type X for fire-resistant rated assemblies.
 - 3. Edges: Tapered.
 - 4. Provide sag resistant type for ceiling surfaces.
- B. Water-Resistant Backing Board: ASTM C 630, of type indicated; in maximum lengths available; 5/8" thick unless otherwise indicated.
 - 1. Type: Regular, unless otherwise indicated.
 - 2. Type: Type X for fire-resistant rated assemblies.

2.05 CEMENTITIOUS BACKER UNITS

- A. Provide cementitious backer units complying with ANSI A118.9, of thickness and width as indicated, and in maximum lengths available to minimize end-to-end butt joints.
- B. Products: Subject to compliance with requirements, provide one of the following products:
 - 1. Sheetrock Brand Glass Mat Mold Tough Firecode X
 - 2. The Original Wonderboard; Custom Building Products.
 - 3. DUROCK Cement Board; United States Gypsum Co.
 - 4. Or Approved Equal.

2.06 TRIM ACCESSORIES

- A. General: ASTM C 1047; standard trim accessories of types required for drywall work, formed of galvanized steel and beaded for concealment of flanges in joint compound. Provide corner beads, L-type edge trim-beads, U-type edge trim-beads, and one-piece control joint beads.
- B. Accessory for Curved Edges: Cornerbead formed of metal, plastic, or metal combined with plastic, with either notched or flexible flanges that are bendable to curvature radius.
 - 1. Product: Rip casing bead, PVC tear away L bead as manufactured by Trim Tex (size as required), Amico, Placar or approved equal.

2.07 JOINT TREATMENT MATERIALS

- A. General: Provide materials comply with ASTM C 475; and recommendations of manufacturer of both gypsum board and joint treatment for the application indicated.
- B. Joint Tape: Paper reinforcing tape, unless otherwise indicated.
- C. Joint Compound: Ready-mixed vinyl-type for interior use. Provide 2 separate grades; one specifically for bedding tapes and filling depressions, and one for topping and sanding.
- D. Water-Resistant Joint Compound: Water-resistant type for joints, fastener heads and cut edges of water-resistant backing board.

2.08 ACOUSTICAL SEALANT

- A. Acoustical Sealant for Exposed and Concealed Joints: Manufacturer's standard nonsag, paintable, nonstaining latex sealant complying with ASTM C 834 and the following requirements:
 - 1. Product is effective in reducing airborne sound transmission through perimeter joints and openings in building construction as demonstrated by testing representative assemblies according to ASTM E 90.
- B. Acoustical Sealant for Concealed Joints: Manufacturer's standard nondrying, nonhardening, nonskinning, nonstaining, gunnable, synthetic-rubber sealant recommended for sealing interior concealed joints to reduce transmission of airborne sound.
- C. Exposed Acoustical Sealant: Nonoxidizing, skinnable, paintable, gunnable sealant for exposed applications per ASTM C 919.
 - 1. Available Products: Subject to compliance with requirements, acoustical sealants that may be incorporated in the Work include, but are not limited to, the following:
 - 2. Acoustical Sealant for Exposed and Concealed Joints:
 - a. PL Acoustical Sealant; ChemRex, Inc.; Contech Brands.
 - b. AC-20 FTR Acoustical and Insulation Sealant; Pecora Corp.
 - c. Miracle Adhesives/Pratt & Lambert SCS-21/SCS-180.
 - d. Phenoseal "Surpass".
 - e. Or Approved Equal.
 - 3. Acoustical Sealant for Concealed Joints:
 - a. BA-98; Pecora Corp.
 - b. Tremco Acoustical Sealant; Tremco, Inc.
 - c. Or Approved Equal.
- D. Acoustical Insulation: ASTM C 665, Type I; mineral fiber blanket without membrane, Class 25 flame-spread, minimum thickness shall be 2-1/2 inches or as required to meet STC ratings.
 - 1. Mineral Fiber Type: Fibers manufactured from glass.
 - 2. Insulation must meet New York City Building Code requirements.

2.09 MISCELLANEOUS MATERIALS

- A. General: Provide auxiliary materials for gypsum drywall construction which comply with referenced standards and the recommendations of the manufacturer of the gypsum board.
- B. Laminating Adhesive: Special adhesive or joint compound recommended for laminating gypsum boards.
- C. Spot Grout: ASTM C 475, setting-type joint compound of type recommended for spot grouting hollow metal door frames.
- D. Fastening Adhesive for Metal: Special adhesive recommended for laminating gypsum boards to steel framing.
- E. Gypsum Board Screws: Comply with ASTM C 1002.
- F. Foam Gaskets and Strips: Closed-cell vinyl foam adhesive-backed strips that allow fastener penetration without foam displacement, 1/8 inch thick, in width to suit metal stud size indicated.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Examine substrates to which drywall construction attaches or abuts, preset hollow metal frames, cast-in-anchors, and structural framing, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of drywall construction. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.02 PREPARATION

- A. Ceiling Anchorages: Coordinate installation of ceiling suspension system with installation of overhead structural systems to ensure that inserts and other structural anchorage provisions have been installed to receive ceiling anchors in a manner that will develop their full strength and at spacing required to support ceiling.
 - 1. Furnish concrete inserts and other devices indicated, to other trades for installation well in advance of time needed for coordination with other construction.
 - 2. Coordinate installation of work attached to areas to receive spray-fireproofing install ceiling anchors, offset anchors and plates prior to work.
 - 3. Clean hangers and accessories after installation of fireproofing as required.
- B. Firestopping: Coordinate installation of firestopping with installation of gypsum wall systems so there will not be any conflict in schedule or delay.

3.03 INSTALLATION OF FRAMING, GENERAL

- A. Installation Standard: Comply with ASTM C 754 and ASTM C 840. Provide support for all edges of gypsum board.

- B. Install supplementary backing plates, framing, blocking and bracing at terminations in the work and for support of toilet accessories and other similar construction.
 - 1. Where handrails, grab bars, crash rails, coat hooks, shelving, and the like are attached to drywall, unless other sizes are indicated, provide a 16 gage 8" wide galvanized steel strip behind gypsum board and between studs securely fastened to studs.
 - 2. For shelving install 16 gauge 8" high metal attachment plates at 4", 1'-9", and 5'-9" aff. To centerline of plates.
 - 3. For HDC Grab Bars provide where indicated.
- C. Isolate steel framing from building structure to prevent transfer of structural loading, at locations indicated below.
 - 1. Where edges of suspended ceilings abut building structure.
 - 2. Where partition and wall framing abuts overhead structure.
 - 3. Provide slip- or cushioned-type joints as detailed to attain lateral support and avoid axial loading
- D. Do not bridge building expansion joints with support system, frame both sides of joints with furring and other support as indicated.

3.04 CEILING SUPPORT SYSTEMS

- A. Secure hangers directly to structure where possible, otherwise connect to inserts, clips or other anchorage devices or fasteners as per N.Y.C. Code requirements.
- B. Space carrying channels 4'-0" o.c. and space hangers 4'-0" o.c. at runners.
- C. Level carrying channels to a tolerance of 1/8" in 12'-0", measured both lengthwise on each runner and transversely between parallel runners.
- D. Wire-tie or clip furring members to supports.
- E. Space ceiling furring members 16" o.c.
- F. Provide sufficient supplementary framing and hangers for runner channels on each side of light fixtures, ceiling diffusers and grilles, access panels and other items penetrating the ceiling.

3.05 WALL AND PARTITION FRAMING

- A. Install runner tracks at floors, ceilings and structural walls and columns where gypsum drywall stud system abuts other work. At exterior walls, install asphalt felt strips between wall and framing.
- B. Extend partition stud system through ceilings to the structural support above the ceiling, unless otherwise indicated.
- C. Space studs 16" o.c., unless otherwise indicated.

- D. Frame door openings to comply with recommendations of gypsum board manufacturer, or with "Gypsum Construction Handbook" by United States Gypsum Co. Screw studs to jambs of door frames; install runner track at head of frame and secure to jamb studs.
 - 1. Extend vertical jamb studs through suspended ceilings and attach to underside of structure above. Brace studs where required.
- E. Frame openings, other than door openings, in same manner as required for door openings; and install framing below sills of openings to match framing above door heads.
- F. Space wall furring members 16" o.c. unless otherwise shown.
- G. Install insulation between framing or furring members where indicated. Until gypsum board is installed, hold insulation with wire staples.
- H. Install insulation between framing or furring members where indicated. Until gypsum board is installed, hold insulation with wire staples.

3.06 GYPSUM BOARD APPLICATION AND FINISHING, GENERAL

- A. Application and Finishing Standards: ASTM C 840.
- B. Install acoustical insulation prior to gypsum board unless readily installed after board has been installed.
 - 1. Where S.T.C.-rated gypsum board assemblies are indicated or required, seal construction at perimeters, behind control and expansion joints, openings, and penetrations with a continuous bead of acoustical sealant including a bead at both faces of the partitions. Comply with ASTM C 919 and manufacturer's recommendations for location of edge trim and closing off sound-flanking paths around or through gypsum board assemblies, including sealing partitions above acoustical ceilings.
- C. Locate exposed end-butt joints away from center of walls and ceilings, and stagger not less than 1'-0" in alternate courses. Install boards to form smooth curved surfaces where shown.
- D. Install ceiling boards to minimize the number of end-butt joints, and to avoid end joints in the center of each ceiling. Stagger end joints at least 24".
- E. Install wall and partition boards vertically to avoid end-butt joints wherever possible. At stairwells and similar high walls, install boards horizontally with end joints staggered over studs.
- F. In addition to partition types indicated to receive "MR" gypsum board, install moisture resistant gypsum board at all column returns and at heads and jambs for all windows and openings.
- G. Install exposed gypsum board with face side out. Do not install defective or damp boards. Butt boards lightly together with not more than 1/16" space between boards. Do not force into place.
- H. Locate edges and ends over supports or other solid backing. Position boards so that like edges abut, tapered edges against tapered edges and cut ends against cut ends. Stagger joints over different studs on opposite sides of partitions.
- I. Provide framing for support at openings and cutouts.
- J. Form control joints and expansion joints to receive trim accessories. Locate these joints to

comply with manufacturer's instructions and not more than 30 ft. o.c. when not indicated on Drawings.

- K. Cover both faces of partition framing with gypsum board in concealed spaces, except in chase walls which are braced internally.
 - 1. Except for sound or fire rated applications, scraps of not less than 8 sq. ft. area may be used where concealed.
 - 2. Fit gypsum board around ducts, pipes and conduit.
- L. Isolate perimeter of non-load-bearing partitions from the structure. Provide 1/4" to 1/2" space and trim edge with J-type edge trim. Seal joints with acoustical sealant.
- M. Space fasteners in gypsum boards in accordance with referenced standards and manufacturer's recommendations.
- N. Spot grout hollow metal frames. Except where full grouting is required for fire-resistance rating, grout 6" lengths at each anchorage.
- O. Install Cementitious backerboards as recommended by manufacturer.
 - 1. Finish backing board forming base for ceramic tile to comply manufacturer's directions for treatment of joints behind tile.

3.07 SINGLE-LAYER APPLICATION

- A. On ceilings apply gypsum board prior to wall and partition board application to the greatest extent possible.
- B. On partitions and walls apply gypsum board horizontally, and provide sheet lengths which will minimize end joints.
- C. On Z-furring members apply gypsum board horizontally, (parallel) with no end joints. Locate edge joints over furring members
- D. Single-Layer Fastening: Apply gypsum boards to supports with screws.

3.08 DOUBLE-LAYER APPLICATION

- A. General: Install gypsum backing board for base layer and exposed gypsum board for face layer.
- B. On ceilings apply base layer prior to base layer on walls; apply face layers in same sequence. Offset joints between layers at least 10". Apply base layers at right angles to supports.
- C. On partitions and walls apply base layer and face layers horizontally (parallel) with joints of base layer over supports and face layer joints offset at least 10" with base layer joints.
 - 1. Provide triple layer installations and framing as indicated for Studio areas as indicated. Stagger joints if layers.
- D. On Z-furring members apply base layer and face layer horizontally, with vertical joints offset at least one furring member. Locate edges of base layer over furring members.
- E. Double-Layer Fastening: Screw base layers and face layers separately to supports.

3.09 INSTALLATION OF DRYWALL TRIM

- A. General: Where feasible, use the same fasteners to anchor trim as required to fasten gypsum board. Fasten flanges of trim in accordance with manufacturer's instructions. Closely fit and align ends of trim.
- B. Install metal corner beads at external corners of drywall work.
- C. Install edge trim at exposed or semi-exposed edges of drywall. Install L-type trim where work abuts other work, and install kerf-type where other work is kerfed to receive trim. Install U-type trim where edge is exposed, revealed, gasketed, or sealant-filled.
- D. Install semi-finishing trim where trim flanges are not to be covered with joint compound.
- E. Install metal control joints (beaded-type) where indicated.

3.10 FINISHING OF DRYWALL

- A. General: Treat gypsum board joints, trim accessories, penetrations, fastener heads, surface defects and elsewhere as required for applied finishes. Prefill open joints using proper compound.
 - 1. Apply joint tape between gypsum boards, except at trim.
 - 2. Apply joint compound in 3 coats, not including prefill in joints, and sand between last 2 coats and after last coat.
 - 3. Skim coat all wall applications unless otherwise indicated.
- B. Water-Resistant and Tile Backer Board: Treat joints and fasteners to comply with directions of backer board and water-resistant joint compound manufacturer, using water-resistant joint compound. Do not crown the joints. Embed tape in joints and form true angles.
- C. Partial Finishing: Omit third coat and sanding on concealed drywall work which requires finishing to achieve fire-resistance rating, sound rating, or to act as an air or smoke barrier.

3.11 PROTECTION OF WORK

- A. Provide final protection and maintain conditions, in a manner suitable to Installer, which ensures gypsum drywall work being without damage or deterioration at time of substantial completion.

END OF SECTION

SECTION 09 30 00 - TILE

PART 1 - GENERAL

1.01 SUMMARY

- A. Work Included: Provide products in accordance with the Contract Documents. The Contract Documents are as defined in the "Agreement". The "General Conditions Governing All Contracts" shall apply to all work under the Contract. The Work of this Section shall include but not be limited to the following:
 - 1. Glazed and unglazed wall tile.
 - 2. Unglazed ceramic floor tile.... Quarry tile, paver tile
 - 3. Special-purpose tile
 - 4. Stone thresholds installed as part of tile installations
 - 3. Trim units matching field tile.
 - 4. Membrane waterproofing, mortars, grouts and similar setting accessories.
- B. Related Sections:
 - 1. Section 06 10 00 - Rough Carpentry.
 - 2. Section 07 90 00 - Joint Sealers.

1.02 QUALITY ASSURANCE

- A. Source of Materials: Provide materials obtained from one source for each type and color of tile, grout, and setting materials. Provide tile from same run to assure color consistency.
- B. Installer Qualifications: Engage an experienced firm hat has recently completed Tile installations similar in cost, material, design, and extent to that indicated by this section and whose work has resulted in construction with a record of successful in-service performance.
- C. Mockups: Before installing tile, construct mockups for each form of construction and finish required to verify selections made under Sample submittals and to demonstrate aesthetic effects and qualities of materials and execution. Build mockups to comply with the following requirements, using materials indicated for completed Work.
 - 1. Install tile work mock-up in rooms selected.
 - 2. Notify Architect 7 days in advance of the dates and times when mockup section will be constructed.
 - 3. Demonstrate the proposed range of aesthetic effects and workmanship.
 - 4. Obtain approval of mockups before proceeding with final unit of Work.
 - 5. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.
 - a. Approved mockups in an undisturbed condition at the time of Substantial Completion may become part of the completed Work.

1.03 SUBMITTALS

- A. Product Data: Submit manufacturer's technical data and installation instructions for materials required, except bulk materials.
 - 1. Each tile type.
 - 2. Setting and grouting materials.
 - 3. Waterproof membrane materials.
- B. Shop Drawings: Submit shop drawings indicating tile patterns and locations and widths of control joints in tile surfaces.
- C. Samples for Initial Selection: Submit actual tiles showing full range of colors, textures and patterns available. Include samples of grout.
- D. Samples for Verification Purposes: Submit the following:
 - 1. Samples for each type of tile and for each color, type and texture and finish required, not less than 12 inches square, mounted and grouted.
 - 2. Full size samples for each type of trim for each type and color.
 - 3. Samples for verification purposes in the form of 12-inch-square samples of each type of stone and tile required, showing full range of colors, textures, finishes, and other variations related to visual characteristics to be expected in the finished Work.
 - a. Prepare samples from same material to be used for the Work.
- E. Certification: Furnish Master Grade Certificate for each shipment and type of tile, signed by manufacturer and Installer.
- F. Material Certification: Supplier's/manufacturer's written certification that terrazzo materials provided meet or exceed specified NTMA properties.
- G. Reports: Submit certified test reports from a qualified laboratory to show compliance of tile and tile setting products with requirements specified. Include laboratory's interpretation of test results.
- H. Provide certification by manufacturer that products supplied for tile installation and cleaning comply with regulations controlling use of volatile organic compounds (VOC's).

1.04 DELIVERY, STORAGE, AND HANDLING

- A. Deliver and store packaged materials in original containers with seals unbroken and labels intact until time of use. Prevent damage or contamination to materials by water, freezing or other causes.

1.05 PROJECT CONDITIONS

- A. Maintain environmental conditions and protect work during and after installation to comply with referenced standards and manufacturer's printed recommendations.
- B. Vent temporary heaters to exterior to prevent damage to tile work from carbon dioxide buildup.
- C. Maintain temperatures at not less than 50 deg. F in tiled areas during and for 7 days after installation, unless otherwise required by referenced installation standard or manufacturer's instructions.

1.06 WARRANTY

- A. General: Submit warranties to repair or replace defective ceramic tile materials and workmanship for a period of not less than 2 years after date of substantial completion.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, provide products as manufactured by one of the following as scheduled, or approved equal:

1. Nemo Tile

Contact: Priscilla Bissi
A&D Account Manager
212.477.1425 ext. 240
(c) 201.615.8534
pbissi@nemotile.com

2. Landmark Ceramics

Contact: Mahawa Diakite
Architectural Representative
1427 N. Main Street, Mount Pleasant, TN 38474
T: 931-325-5700 | F: 914-422-0069
(c) 615.305.7530
M.diakite@lcusa.com

5. Or Approved Equal

2.02 PRODUCTS, GENERAL

- A. ANSI Standard for Ceramic Tile: Comply with ANSI A137.1 "American National Standard Specifications for Ceramic Tile" for tile indicated. Comply with "Standard Grade" requirements.
- B. ANSI Standard for Tile Installation Materials: Comply with ANSI standard referenced with materials for setting and grouting.
- C. Sizes, Colors, Textures and Patterns: Provide tile, grout and other products of colors, textures or other qualities, as selected by Architect from manufacturer's standards.
1. Provide tile trim and grout of color and finish as selected by Architect.
- a. Grout Color Schedule: TBD
- D. Mounting: Where factory-mounted tile is required, provide back- or edge-mounted tile assemblies as standard with manufacturer, and as recommended by manufacturer for installation in wet areas.

2.03 TILE PRODUCTS (As Scheduled)

- A. Provide tile of manufacturer and in size indicated in Wall and Floor Finish Schedules on Drawings:

MUSIC BUILDING:

TYPE T-100

Porcelain Tile (accent walls Women's Restroom)
LANDMARK PORTUGUESE BLACK & WHITE, 12"X24"

TYPE T-101

Porcelain Tile (floor in All Gender Restroom and accent walls in Men's & All Gender Restrooms)
LANDMARK PORTUGUESE ECLECTIC, 12"X24"

TYPE T-102

Porcelain Tile (floors and some walls)
LANDMARK EXPLORE STAR GRAY, 12"X24"

TYPE T-103

Porcelain Tile (floors and some walls)
LANDMARK ATTITUDE LIGHT WHITE, 12"X24"

TYPE T-104

Ceramic Tile (accent walls in Women's Restroom)
NEMO TILE BOND COTTON Wall Tile, 2.5"X8"

TYPE T-105

Ceramic Tile (accent walls in Women's Restroom)
NEMO TILE BOND ONYX Wall Tile, 2.5"X8"

TYPE T-106

Ceramic Tile (accent walls in Women's Restroom)
NEMO TILE REGOLO, LUNARIA, 3"X12"

DANCE BUILDING:

TYPE T-110

Ceramic Tile (accent walls)
NEMO TILE HAWTHORN CLOUD Wall Tile, 8"X20"

TYPE T-113

Ceramic Tile (partition wall)
NEMO TILE REGOLO, MATTONE TATAMI, 3"X12"

TYPE T-114

Porcelain Tile (floors)
LANDMARK JOURNEY NATURAL IVORY, 24"X24"

TYPE T-115

Porcelain Tile (some walls)
LANDMARK JOURNEY NATURAL IVORY, 12"X24"

PHYSICAL EDUCATION BUILDING:

TYPE T-120

Porcelain Tile (walls)
LANDMARK CHARME VEINED STATUTARIO, 12"X24"

TYPE T-122

Ceramic Tile (accent walls in Women's & All Gender Restroom)
NEMO TILE BOND OPAL, 2.5"X8", Gloss

TYPE T-123

Ceramic Tile (accent walls Men's Restroom)
NEMO TILE BOND PEWTER, 2.5"X8", Gloss

TYPE T-124

Porcelain Tile (floors)
LANDMARK MADE IN FREEDOM WHITE, 24"X24"

TYPE T-125

Porcelain Tile (walls)
LANDMARK MADE IN FREEDOM WHITE, 12"X24"

LIBRARY BUILDING:

TYPE T-130

Porcelain Tile (floors)
LANDMARK JOURNEY NATURAL IVORY, 24"X24"

TYPE T-131

Porcelain Tile (walls)
LANDMARK JOURNEY NATURAL IVORY, 12"X24"

TYPE T-132

Ceramic Tile (accent walls in Men's Restroom)
NEMO TILE HAWTHORN CELADON, 8"X20", Gloss

TYPE T-133

Ceramic Tile (walls in Women's Restroom)
NEMO TILE HAWTHORN SKY, 8"X20", Gloss

TYPE T-134

Ceramic Tile (walls)
NEMO TILE BOND COTTON, 2.5"X8", Gloss

- B. Trims: Provide matching trim tiles for corners (inside and outside), terminations, transitions, corners and similar locations matching the field tiles as acceptable to the Architect.
 - 1. Size: As indicated, coordinated with sizes and coursing of adjoining flat tile where applicable.
 - 2. Shapes: As follows, selected from manufacturer's standard shapes:
 - a. Base for Thin-Set Mortar Installations: Straight.
 - b. Internal Corners: Field-butt square corners, except with coved base and cap angle pieces designed to member with stretcher shapes.
 - c. Outside edges, top edges of field cut base and other miscellaneous exposed edges:
Metal strip:
 - 1. ANI-100 Schluter Jolly, Stainless Steel finish
 - 2. Jolly tile where available and indicated in Finish Legend on sheet A-601
 - 2. Or Equal Approved

2.04 STONE THRESHOLDS

- A. General: Provide stone thresholds that are free of cracks, seams, and starts impairing their structural integrity or function, and are from a single quarry for each type, variety, color, and quality of stone specified.
 - 1. Size and Profile and Location: As indicated or required to provide transition between finished surfaces of ceramic tile and that of adjacent finished flooring.
 - 2. Type: ST-1, honed; Caesarstone 4141 Misty Carrera, honed finish, ADA compliant
Or Approved Equal.

2.05 MEMBRANE WATERPROOFING

- A. Latex Rubber Waterproofing: Manufacturer's standard factory- prepackaged, job-mixed, proprietary two-part formulation consisting of liquid latex rubber and powder for trowel application and glass fiber fabric reinforcing.
- B. Products: Subject to compliance with requirements, provide "Laticrete 9235 Waterproof Membrane"; Laticrete International Inc.

2.06 SETTING MATERIALS

- A. Latex Thin-Set Mortar Additive mixed with Crete Filler Powder and Grout & Mortar Admix: Comply with ANSI A118.4, with prepackaged latex additive. Added at job site to dry mortar mix.
 - 1. Physical Properties:
 - a. Wet Density: (ASTM C905-79); 102 pounds per cubic feet.
 - b. Pot Life: (LIL 1011-92); 4-5 hours.
 - c. Open Time: (ANSI A118.4-1992; F-4.4); 50 minutes.
 - d. Tensile Adhesion Strength: (BS 5980: 1980 Class AA; 14 days); 355 pounds.
 - e. Shear Adhesion Strength: (BS 5980: 1980 Class AA; 14 days); 5126 pounds.
 - f. Shear Bond Strength: (ANSI A118.4-1992; F-5.2.4); 500 pounds per square inch.
 - g. Compressive Strength: (ANSI A118.4-1992; F-6); 5000 pounds per square inch.
 - h. Hardness: (ASTM D2240; D-Scale; 72 hours); 50-60.
 - i. Linear Coefficient of Thermal Expansion: (ANSI C531-81); 65 x 0.0000001 Fahrenheit.

j. Service Rating: (ASTM C627-87; TCA Service Rating); Cycle 1-14 Extra Heavy.

- B. Product: Subject to compliance with requirements, provide "Laticrete 4237 latex thin-set mortar additive mixed with Laticrete 211 Crete Filler Powder and Laticrete 3701 Grout and Mortar Admix"; Laticrete International Inc., Atlas Minerals & Chemicals, Inc., DAP, Inc., Mapei Corporation or approved equal.

2.07 GROUTING MATERIALS

- A. Latex-Portland Cement Grout Consisting of a Carefully Blended Mix of Portland Cement, Graded Aggregates and Color-fast Pigments: Provide product complying with ANSI A118.6, and of color scheduled.

1. Physical Properties:

- a. Flexural Strength: (ANSI A118.7): 1250 psi.
- b. Tensile Strength (ANSI A118.7): 510 psi.
- c. Compressive Strength: (ANSI A118.7); 3500 pounds per square inch.
- d. Water Absorption: (ANSI A118.7): < 5%.

2. Basis of Design, Product: Subject to compliance with requirements, provide "Laticrete Permacolor Select Grout" or approved equal.

- B. Epoxy Grout (Commercial) (for floors): Non-toxic, non-flammable, non-hazardous during storage, mixing, application and when cured. Provide product complying with ANSI A118.7, and of color scheduled.

1. Physical Properties:

- b. Shear Bond Strength: (ANSI A118.3): 1100 psi.
- c. Tensile Strength (ANSI A118.3): 1100 psi.
- d. Compressive Strength: (ANSI A118.3); 3800 pounds per square inch.
- e. Water Absorption: (ANSI A118.3): < 0.05%.

2. Basis of Design, Product: Subject to compliance with requirements, provide "Laticrete Spectralock Pro Premium Grout" or approved equal.

2.08 MISCELLANEOUS MATERIALS

- A. Trowelable Underlayments and Patching Compounds: Latex-modified, portland-cement-based formulation provided or approved by manufacturer of tile-setting materials for installations indicated.

- B. Tile Cleaner: Product acceptable to manufacturers of tile and grout and recommended by National Tile Promotion Federation, 112 North Alfred St., Alexandria, VA 22134 or Ceramic Tile Institute, 700 N. Virgil Ave., Los Angeles, CA 90029.

2.09 MIXING MORTARS AND GROUT

- A. Mix mortars and grouts to comply with referenced standards and manufacturers recommendations for accurately proportioning materials and mixing procedures needed to produce mortars and grouts of uniform quality for optimum performance.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Examine surfaces to receive tile work and verify working conditions. Do not proceed with tile work until surfaces and conditions comply with requirements of referenced tile installation standard.

3.02 INSTALLATION, GENERAL

- A. ANSI Tile Installation Standard: Comply with applicable parts of ANSI 108 series of standards included under "American National Standard Specifications for the Installation of Ceramic Tile".
- B. TCA Installation Guidelines: TCA "Handbook for Ceramic Tile Installation"; comply with TCA methods indicated or, if not otherwise indicated, as applicable to installation conditions shown.
- C. Extent: Extend tile work into recesses and under or behind equipment and fixtures, to form a complete covering without interruptions, except as otherwise shown. Terminate work neatly at obstructions, edges and corners without disrupting pattern or joint alignments.
- D. Fitting: Accurately form intersections and returns. Perform cutting and drilling of tile without marring visible surfaces. Carefully grind exposed cut edges of tile for straight aligned joints. Fit tile closely to electrical outlets, piping, fixtures and other penetrations so that plates, collars, or covers overlap tile.
- E. Jointing Pattern: Lay tile in grid pattern. Align joints when tiles on floor, base, walls and trim are same size. Layout tile work and center tile fields in both directions in each space or on each wall area, unless otherwise shown. Adjust to minimize tile cutting. Provide uniform joints.
 - 1. Make joints between mounted tile sheets same width as joints within tile sheets so that extent of each sheet is not apparent.
- F. Expansion Joints: Locate expansion joints and other sealant filled joints where indicated. Do not saw cut joints.
- G. Grout: Grout tile to comply with ANSI A108.10.

3.03 MEMBRANE WATERPROOFING

- A. Install waterproofing in compliance with waterproofing manufacturer's instructions to produce a waterproof membrane of uniform thickness bonded securely to substrate. Turn waterproofing membrane up walls a minimum of 4 inches above finish floor surface.
- B. Do not install tile over waterproofing until waterproofing has cured and been tested to determine that it is watertight.

3.04 FLOOR INSTALLATION METHODS

- A. Ceramic Floor Tile: Install tile to comply with requirements indicated below for setting bed methods, TCA installation methods related to types of subfloor construction, and grout types:
 - 1. Latex-Portland Cement Mortar: ANSI A108.5; for tile floors unless otherwise indicated.

- a. Waterproof Membrane, Interior; Thin-Set: TCA F122; latex-portland cement bond coat with waterproof membrane over a leveling compound and concrete subfloor.
- b. Grout: Latex-portland cement.

- B. Stone Thresholds: Install stone thresholds at locations indicated; set in same type of setting bed as abutting field tile.

3.05 WALL TILE INSTALLATION METHODS

- A. Install types of wall tile designated to comply with requirements indicated below for setting-bed methods, and TCA installation methods related to subsurface and grout.
- B. Latex-Portland Cement Mortar: ANSI A108.5.
 - 1. Toilet Area: Cement (Backer) Mortar Units, Interior: TCA W244.

3.06 CLEANING AND PROTECTION

- A. Cleaning: Upon completion of placement and grouting, clean all ceramic tile surfaces so they are free of foreign matter.
 - 1. Unglazed tile may be cleaned with acid solutions only when permitted by tile and grout manufacturer's printed instructions, but not sooner than 14 days after installation. Protect metal and vitreous plumbing fixtures from effects of acid cleaning. Flush surface with clean water before and after cleaning.
 - 2. Protect tile from damage and wear during construction operation.
- B. Finished Tile Work: Leave finished installation clean and free of cracked, chipped, broken, unbonded, or otherwise defective tile work.
- C. Protection: Protect installed tile work with Kraft paper or other approved heavy covering during construction period to prevent staining, damage and wear.
- D. Prohibit foot and wheel traffic from using tiled floors for at least 7 days after grouting is completed.

3.07 TILE SCHEDULE

- A. Refer to finish Schedule on Contract Drawings for product, manufacture, sizes and color selection.

END OF SECTION

SECTION 09 51 13 - ACOUSTICAL CEILINGS

PART 1 - GENERAL

1.01 WORK SUMMARY

- A. Work Included: Provide products in accordance with the Contract Documents. The Contract Documents are as defined in the "Agreement". The "General Conditions Governing All Contracts" shall apply to all work under the Contract. The Work of this Section shall include but not be limited to the following:

1. Acoustical ceilings.
2. Indirect suspension system.
3. Edge trim.

- B. Related Sections:

2. Section 09 21 00 - Gypsum Drywall Systems.
3. Section 09 90 00 - Painting.
4. Division 23 and 26 for Mechanical and Electrical work.

1.02 COORDINATION:

- A. Coordinate with all equipment, mechanical, electrical, and other trades affected by the work and resolve all discrepancies and conflicts in an approved manner.

1.03 QUALITY ASSURANCE:

- A. Qualifications of Installer: Work under this Section shall be performed by an experienced specialty installer who is regularly engaged in the type of work required herein.

1. Installer shall be acceptable to the manufacturer of both the suspension system and the acoustical units.
2. Installer shall be capable of producing the modifications of standard components as shown.

- B. Flame Spread Rating: Acoustical ceiling panels shall be classified by Underwriter's Laboratories, Inc., under hazard classification for a flame spread of 25 or under.

- C. All suspended ceilings and suspension systems shall be in accordance with the requirements of the Building Code of the City of New York.

1.04 SUBMITTALS:

- A. Manufacturer's Data: Manufacturer's product specifications and installation instructions for acoustical ceiling material, and for suspension system, including certified laboratory test reports and other data as required to show compliance with this Section.

1. Indicate structural classification of suspension system.
 - B. Shop Drawings: Submit Show Drawing details and reflected ceiling plans of suspension systems and ceilings required by this Section. Show location of ceiling units and other items of general construction, equipment, mechanical and electrical work which are to be coordinated with the ceilings. Indicate framing and support details for work supported by the suspension system.
 - C. Samples:
 1. Acoustical Panels: Submit full size samples of each acoustic panel unit specified. Samples shall show the full range of exposed color and texture to be expected in the completed work.
 2. Suspension System: Submit 12" long samples of each trim molding of suspension system.
 - D. Maintenance Stock: At time of substantial completion, deliver stock of maintenance material to the Resident Engineer. Furnish full size units matching the units installed, packaged with protective covering for storage, and identified with appropriate labels. Furnish one carton for each type acoustic panel unit installed.
- 1.05 PRODUCT DELIVERY, STORAGE AND HANDLING:
- A. Deliver all acoustical units and suspension system components in manufacturer's original unopened packages fully identified with type, finish, performance data and compliance labels.
 - B. Handle and store in accordance with manufacturer's instructions and recommendations. Store in a place protected from damage, exposure to the elements and high humidity.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, provide products as manufactured by one of the following, or approved equal:
 1. Mineral Fiber Panel Ceilings
 - a. Armstrong World Industries, Inc.
 - b. Celotex Corporation.
 - c. USG Interiors, Inc.
 - d. Or Approved Equal.
 2. Indirect-Hung Suspension Systems and Edge Moldings
 - a. Armstrong World Industries.
 - b. USG Interiors, Inc.
 - d. Celotex Corporation.

d. Or Approved Equal.

2.02 ACOUSTIC PANELS

- A. Water-Felted, Mineral-Base Acoustical Panels for Acoustical Panel Ceiling: Provide acoustical panels complying with the following:
1. Products: USG "Olympia Mars Clima Plus".
 2. Classification: Panels fitting ASTM E 1264 for Type III, mineral base with painted finish; Form 2, water felted.
 3. Color: As selected.
 4. Light Reflectance Coefficient: Not less than LR 0.80.
 5. Noise Reduction Coefficient: NRC 0.50.
 6. Ceiling Attenuation Class: Not less than CAC 35.
 7. Edge Detail: Reveal sized to fit flange of exposed suspension system members.
 8. Thickness: 5/8 inch
 9. Size: 24 by 24 inches

2.03 SUSPENSION SYSTEM MATERIALS:

- A. Standard for Metal Suspension Systems: Provide metal suspension systems of type and finish indicated which comply with applicable ASTM C 635 requirements and local Building Code.
1. Provide suspension systems acceptable to manufacturers of ceiling units.
- B. Attachment Devices: Size for 5 times design load indicated in ASTM C 635, Table 1, Indirect Hung.
- C. Hangers: Wire hangers, 9 gage, with paint or zinc coating.
- D. Main Runners: Carrying channels fabricated from cold rolled steel with rust inhibitive paint finish. Size shall be 1-1/2" deep, weighing 475 lbs/1000 l.f., for a hanger spacing of 4'-0" on center. Clips for attachment of hangers to carrying channels shall comply with the seismic design requirements.
- E. Coordination of Components: Provide suspension system which is coordinated with partitions, and which is coordinated with the indicated limitations and requirements for hanging from the structure and supporting equipment, light fixtures, HVAC components, and similar work indicated to be supported by or located in suspended ceilings. Include all necessary components for a complete system.
- F. Exposed tee grid systems "Fineline DXF/DXLF" as manufactured by Donn-USG Interior Systems.
1. Main and cross tees shall be fabricated of cold-rolled steel, electro-zinc coated and factory painted to match color of tile; 9/16" exposed flange.
 2. Edge Molding: "Z" and "F" shaped, 9/16" reveal edge molding, finish to match grid,

unless otherwise indicated.

3. Maximum deflection: 1/360 span.

- G. Support Clips: Manufacturer's standard support clips for securing tee grid to metal ceiling suspension system (runner bars).

2.04 MISCELLANEOUS MATERIALS

- A. Acoustical Sealant: Resilient, non-staining, non-shrinking, non-hardening, non-skinning, non-drying, non-sag sealant intended for interior sealing of joints. Provide one of the following:
 1. BA-98; Pecora Corp.
 2. Tremco Acoustical Sealant; Tremco.
 3. Or Approved Equal.

PART 3 - EXECUTION

3.01 PRE-INSTALLATION CONFERENCE:

- A. Prior to the start of ceiling installation, meet at the Project Site with the installers of related work, including lighting, ductwork and similar work in the ceiling plenum. Review areas of potential interference and resolve conflicts before proceeding with the work. Coordinate ceiling layout with the layout of other work which penetrates or is supported by the ceiling.

3.02 ENVIRONMENTAL CONDITIONS:

- A. Space Enclosure: Do not install ceilings until wet work in the space has been completed and is nominally dry, and until work above ceilings has been completed, and until ambient conditions of temperature and humidity will be continuously maintained at values near those indicated for final occupancy.

3.03 INSPECTION AND PREPARATORY WORK:

- A. Examine metal ceiling suspension system previously installed by others and the conditions under which acoustical ceiling work is to be performed; remedy any unsatisfactory conditions.

3.04 INSTALLATION - GENERAL:

- A. Codes and Standards: Install materials in accordance with manufacturer's printed instructions, and to comply with governing regulations, fire resistance rating requirements where indicated, and industry standards applicable to the work.
- B. Suspended Ceiling Installation: Comply with ASTM C-636 as applicable to acoustical panel ceilings, except to the extent more stringent requirements are indicated or required for compliance with governing regulations or fire resistance ratings.

1. Provide supplementary framing and support members as required to support ceiling system where items of work do not permit standard hanger and support system.
 2. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of the supporting structure or of the ceiling suspension system.
 3. Splay hangers only where required, and if permitted with fire-resistance-rated ceilings, to miss obstructions; offset resulting horizontal forces by bracing, counter splaying, or other equally effective means.
 4. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with the location of hangers at spacings required to support standard suspension system members, install supplemental suspension members and hangers in the form of trapezes or equivalent devices. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced standards and publications.
 5. Secure wire hangers to ceiling suspension members and to supports above with a minimum of 3 tight turns. Connect hangers either directly to structures or to inserts, eye screws, or other devices that are secure, that are appropriate for substrate, and that will not deteriorate or otherwise fail due to age, corrosion, or elevated temperatures.
 6. Secure flat, angle, channel, and rod hangers to structure, including intermediate framing members, by attaching to inserts, eye screws, or other devices that are secure and appropriate for both the structure to which hangers are attached and the type of hanger involved. Install hangers in a manner that will not cause them to deteriorate or fail due to age, corrosion, or elevated temperatures.
 7. Secure bracing wires to ceiling suspension members and to supports with a minimum of 4 tight turns.
 8. Do not attach hangers to steel deck tabs.
 9. Do not attach hangers to steel roof deck. Attach hangers to structural members.
 10. Space hangers not more than 48 inches (1200 mm) o.c. along each member supported directly from hangers, unless otherwise shown; and provide hangers not more than 8 inches (200 mm) from ends of each member.
 11. No tile shall be less than half a tile length.
- C. Install edge moldings and reveal moldings of the type indicated at edges of acoustical panel ceiling areas, and at locations where edge of tile would otherwise be exposed after completion of the work.
1. Sealant Bed: Apply continuous ribbon or tape of acoustical sealant on back of vertical leg before fastening to vertical surface. Locate so that sealant will not be exposed after installation is completed.
 2. Secure moldings to building construction by fastening through holes drilled in vertical leg. Space holes not more than 3" from each end and not more than 16" o.c. between end holes. Draw-up fasteners for tight set against vertical surfaces.
 - a. Masonry or Concrete: Fasten with wood or machine screws into lead shield type anchors drilled into construction.

- b. Steel Stud: Fasten with toggle bolts, or similar self-expanding screw anchors.
 - 3. Miter corners of moldings accurately to provide hairline joints.
 - 4. Level moldings with ceiling suspension system, to a level tolerance of 1/8" in 12'-0".
 - 5. All joints in moldings shall be cut accurately and installed with tight neat joint; all corners shall be mitered. Field applied tape and excess drywall compound shall be removed from moldings immediately.
 - 6. Provide perimeter tiles @ half size at all times.
- D. Install exposed spline acoustical panel systems in coordination with suspension system and according to ASTM C-636 "Recommended Practice for Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-in Panels".

3.05 CLEANING AND PROTECTION:

- A. Clean exposed surfaces of acoustical panels and edge moldings; comply with manufacturer's instructions for cleaning and touch-up of minor finish damage. Remove and replace work which cannot be successfully cleaned and repaired to permanently eliminate evidence of damage.
- B. Protect acoustical panel ceilings so that the work will be without damage and deterioration at the time of acceptance by the Architect.

END OF SECTION

SECTION 09650 - RESILIENT FLOORING

PART 1 - GENERAL

1.01 SUMMARY

- A. Work Included: Provide products in accordance with the Contract Documents. The Contract Documents are as defined in the "Agreement". The "General Conditions Governing All Contracts" shall apply to all work under the Contract. The Work of this Section shall include but not be limited to the following:
 - 1. Vinyl composition tile.
 - 2. Rubber wall base.
 - 3. Miscellaneous accessories.
- B. Related Sections:
 - 1. Section 09260 - Gypsum Drywall Systems.

1.02 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Firm with not less than 3 years of production experience, whose published literature clearly indicates general compliance of products with requirements of this section.
- B. Installer Qualifications: Engage an experienced firm that has recently completed Resilient Flooring installations similar in cost, material, design and extent to that indicated by this section and whose work has resulted in construction with a record of successful in-service performance.
- C. Single Source Responsibility: Provide resilient flooring produced by a single manufacturer for each type required, including adhesives.
- D. Fire Test Performance: Provide resilient flooring which complies with the following performance criteria, as determined by an independent testing laboratory acceptable to authorities having jurisdiction.
 - 1. Critical Radiant Flux (CRF): Not less than 0.45 watts per sq. cm. per ASTM E 648.
 - 2. Smoke Density: Not more than 450 as per ASTM E 662.

1.03 SUBMITTALS

- A. Product Data, Samples and Maintenance Data: Submit all information necessary for evaluating, furnishing and installing this work. Submit fire test data.
 - 1. Certification by tile manufacturer that products supplied for tile installation comply with local regulations controlling use of volatile organic compounds (VOC's).
- B. Samples for Initial Selection: Submit manufacturer's standard colors in the form of actual sections of resilient flooring, including accessories, showing full range of colors and patterns.

C. Samples for Verification: Submit the following samples of each type, color, and pattern of resilient flooring required, showing full-range of color and pattern variations.

1. Two 12" x 12" samples of the VCT.
2. 12" long sections of resilient flooring accessories.
3. Other materials as requested.

D. Maintenance Instructions: Submit manufacturer's recommended practices for maintaining each type of resilient flooring required.

1.04 PROJECT CONDITIONS

A. Maintain minimum temperature of 65 deg. F in spaces to receive resilient flooring. Store resilient flooring materials in spaces where they will be installed for at least 48 hours before installation.

B. Install resilient flooring and accessories after other finishing operations, including painting, have been completed.

1.05 EXTRA MATERIALS

A. Furnish extra materials described below that match products installed, are packaged with protective covering for storage, and are identified with appropriate labels.

1. Extra Stock: Deliver the following extra stock to Resident Engineer where directed.
 - a. Resilient Tile Flooring: Furnish quantity of each type of material equal to 10 percent of amount installed, for each color and type of tile flooring; but not less than one sealed carton of each.

1.06 EXTENDED WARRANTIES

A. General: Provide warranties to repair or replace materials or workmanship for a period of not less than 2 years after date of Substantial Completion.

PART 2 - PRODUCTS

2.01 MATERIALS

A. General: Refer to Drawings, for finish schedules indicating the resilient flooring and accessories selected, and for their locations.

2.02 VINYL COMPOSITION TILES

- A. Vinyl Composition Tile General: FS SS-T-312B, Type IV; 12" x 12" x 1/8", composition 1 - asbestos-free.
- B. Manufacturers: Subject to compliance with requirements, provide vinyl composition tiles as manufactured by the following manufacturers or approved equal:
 1. Armstrong World Industries.
 2. Azrock.

3. Kentile Floors, Inc.
4. Or Approved Equal.

- C. Product: Armstrong Premium Excelon Crown Texture or approved equal, colors to be confirmed (Pewter and Silk).

2.03 ACCESSORIES

- A. Wall Base: Provide wall base trim complying with ASTM F 1861, FS SS-W-40, Type I or II, height as indicated and other requirements specified in the Finish Schedule.
1. Manufacturer: Subject to compliance with requirements provide resilient base as manufactured by the following, or approved equal:
 - a. Roppe Corp.
 - b. Johnsonite, Inc.
 - c. Mercer Products Co., Inc.
 - d. Or Approved Equal.
 2. Products: Provide Series P123 Charcoal as manufactured by Roppe or approved equal. Height 4" or 6" to match existing or as scheduled.
- B. Resilient Edge Strips: Provide 1/8" thick, composition, tapered edge, not less than 1" wide, unless otherwise indicated by Architect.
1. Model and Colors: As selected by Architect from manufactures standard edge strip selection.
 2. Provide edge strips of longest lengths commercially available by edge strip manufacturer.
- C. Adhesives (Cements): Waterproof, stabilized type as recommended by flooring manufacturer to suit material and substrate conditions.
- D. Leveling and Patching Compound: Polymer reinforced cement based formulation as recommended by flooring manufacturer equal to the following:
1. Levelex by L&M Construction Chemicals, Inc.
 2. K-55 by Ardex, Inc.
 3. Skimcrete by Burke Co.
 4. Or Approved Equal.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Examine subfloor surfaces to determine that they are smooth and free from cracks, holes, ridges, coatings preventing adhesive bond, and other defects impairing performance or appearance.
- B. Perform bond and moisture tests on concrete subfloors to determine if surfaces are sufficiently dry and suitable.

3.02 PREPARATION

- A. Prepare concrete subfloor surfaces as follows:
 - 1. Use leveling and patching compound for filling small cracks, holes and depressions in subfloors. Also use to build up floor thickness at intersections with adjoining floor finishes. Install in strict accordance with the manufacturer's requirements.
 - 2. Remove coatings from subfloor surfaces that would prevent adhesive bond, including paint, oils, waxes and sealers.
- B. Broom clean or vacuum surfaces to be covered, and inspect subfloor.
- C. Apply primer, if recommended by flooring manufacturer, in compliance with manufacturer's directions.

3.03 INSTALLATION

- A. Install resilient flooring using method indicated in strict compliance with manufacturer's printed instructions. Extend resilient flooring into toe spaces, door reveals, and into closets and similar openings. Install resilient base continuous along entire wall lengths, with a minimum of joints between lengths of base.
- B. Scribe, cut and fit resilient flooring to permanent fixtures, built-in furniture and cabinets, pipes, outlets and permanent columns, walls and partitions.
- C. Maintain reference markers, holes, or openings that are in place or plainly marked for future cutting by repeating on finish flooring as marked on subfloor. Use chalk or other non-permanent marking device.
- D. Install resilient flooring on flush covers and similar items occurring within finished floor areas to remain concealed. Maintain overall continuity of color and pattern with pieces of flooring installed on these covers. Tightly cement edges to perimeter of floor around covers and to covers.
- E. Tightly cement resilient flooring to subbase without open cracks, voids, raising and puckering at joints, telegraphing of adhesive spreader marks, or other surface imperfections. Hand roll flooring at perimeter of each covered area to assure adhesion.

3.04 INSTALLATION OF TILE FLOORS

- A. Lay tile square to room axis. Cut tile neatly around all fixtures.
- B. Match tiles for color by using tile from cartons in same sequence as manufactured and packaged if so numbered. Damaged or defective tiles are not acceptable.
- C. All tiles shall be laid in the same direction.
- D. Layout: As indicated on Drawings.

3.05 RESILIENT ACCESSORY INSTALLATION

- A. General: Install resilient accessories according to manufacturer's written installation instructions.

- B. Apply resilient wall base to walls, columns, pilasters, casework and cabinets in toe spaces, and other permanent fixtures in rooms and areas where base is required. Apply transition edge strip to comply with the following as well as manufactures recommendation.
 - 1. Install resilient accessories in lengths as long as practicable without gaps at seams and with tops of adjacent pieces aligned.
 - 2. Tightly adhere resilient accessories to substrate throughout length of each piece, with base in continuous contact with horizontal and vertical substrates.
 - 3. Do not stretch resilient accessories during installation.
 - 4. Install premolded outside and inside corners before installing straight pieces.
 - 5. Place resilient accessories so they are butted to adjacent materials and bond to substrates with adhesive. Install reducer strips at edges of flooring that would otherwise be exposed.

3.06 CLEANING AND PROTECTION

- A. Perform following operations after installation of resilient flooring:
 - 1. Sweep or vacuum floor thoroughly.
 - 2. Do not wash floor until time period recommended by resilient flooring manufacturer has elapsed to allow resilient flooring to become well-sealed in adhesive.
 - 3. Damp-mop floor to remove marks and excessive soil.
 - 4. Remove any excess adhesive or other surfaces blemishes, using cleaner as recommended by resilient flooring manufacturer.
- B. Protect flooring against damage during construction period to comply with resilient flooring manufacturer's directions.
 - 1. Apply protective floor polish to resilient flooring surfaces free from soil, excess adhesive or surfaces blemishes. Use commercially available product acceptable to resilient flooring manufacturer.
 - 2. Protect resilient flooring against damage for initial period following installation by covering with plywood or hardboard. Use dollies to move materials across floors.
 - 3. Cover resilient flooring with undyed, untreated building paper until inspection for Substantial Completion.

END OF SECTION

SECTION 09 91 00 - PAINTING

PART 1 - GENERAL

1.01 SUMMARY

- A. Work Included: Provide products in accordance with the Contract Documents. The Contract Documents are as defined in the "Agreement". The "General Conditions Governing All Contracts" shall apply to all work under the Contract. The Work of this Section shall include but not be limited to the following:
 - 1. Painting of interior exposed items and surfaces, except as otherwise indicated
 - 2. Surface preparation, priming and coats of paint specified herein, are in addition to shop-priming specified under other sections of work.
- B. Work Not Included:
 - 1. Factory and shop finished items, including shop priming of ferrous metal included under hollow metal work.
 - 2. Concealed surfaces.
 - 3. Operating parts.
- C. Do not paint over any code-required labels, such as Underwriters' Laboratories and Factory Mutual, or any equipment identification, performance rating, name, or nomenclature plates.

1.02 QUALITY ASSURANCE

- A. Single Source Responsibility: Provide primers and other undercoat paint produced by same manufacturer as finish coats. Use only thinners approved by paint manufacturer, and use only within recommended limits.
- B. Coordination of Work: Review other sections of these specifications for prime paints, to ensure compatibility of total coatings system. Upon request from other trades, furnish information of finish materials to be used.
- C. Qualifications: Engage an experienced firm that has recently completed interior Painting projects similar in cost, material, design and extent tot hat indicated by this section and whose work has resulted in construction with a record of successful in-service performance.
- D. All paint/coating products must comply with V.O.C. requirements of the City and Local authorities at place of application. Federal numbers, where specified or referred to, are for guidelines only.

1.03 SUBMITTALS

- A. Product Data: Submit manufacturer's technical information including paint label analysis and application instructions for each material proposed for use.
- B. Samples: Submit representative samples of for Architect's review of color and texture only. Provide a listing of material and application for each coat of each finish sample.
 - 1. Submit on 12" x 12" substrate sample provide two samples of each color and material, with finish and texture to simulate actual conditions. Resubmit samples as requested by Architect until acceptable sheen, color, and texture is achieved.

1.04 MOCK-UP

- A. On actual wall surfaces and other building components, duplicate painted finishes of prepared samples. On at least 500 sq. ft. of surface, provide full-coat finish samples until required sheen, color and texture is obtained. Simulate finished lighting conditions for review of in-place work.

1.05 DELIVERY AND STORAGE

- A. Deliver materials in original, new and unopened packages and containers bearing manufacturer's name and label, and following information:
 - 1. Name or title of material.
 - 2. Fed. Spec. number, if applicable.
 - 3. Manufacturer's stock number and date of manufacture.
 - 4. Manufacturer's name.
 - 5. Contents by volume, for major pigment and vehicle.
 - 6. Thinning and application instructions.
 - 7. Color name and number.
- B. Store materials not in actual use in tightly covered containers. Maintain containers used in storage of paint in a clean condition, free of foreign materials and residue.
 - 1. Protect from freezing where necessary. Keep storage area neat and orderly. Remove oily rags and waste daily. Take all precautions to ensure that workmen and work areas are adequately protected from fire hazards and health hazards resulting from handling, mixing and application of paints.

1.06 JOB CONDITIONS

- A. Apply water-base paints only when temperature of surfaces to be painted and surrounding air are between 50 deg F and 90 deg F, unless otherwise permitted by paint manufacturer.
- B. Apply solvent-thinned paints only when temperature of surfaces to be painted and surrounding air are between 45 deg F and 95 deg F, unless otherwise permitted by paint manufacturer.
- C. Do not apply paint when relative humidity exceeds 85%; or to damp or wet surfaces; unless otherwise permitted by paint manufacturer.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

- A. Manufacturer: Subject to compliance with requirements, provide products of one of the following, or approved equal.
 - 1. Benjamin Moore and Co. (Moore). - recommended
 - 2. PPG Industries, Pittsburgh Paints (P.P.).
 - 3. Sherwin Williams (S-W).
 - 5. Or Approved Equal.

2.02 MATERIALS

- A. Material Quality: Provide best quality grade of coatings as regularly manufactured by acceptable paint manufacturers. Materials not displaying manufacturer's identification as a standard, best-grade product will not be acceptable.
- B. Color Pigments: Pure, non-fading, applicable types to suit substrates and service indicated.
- C. Primers: Provide prime paint as recommended by manufacturer to be compatible with substrate and finish coat.

PART 3 - EXECUTION

3.01 INSPECTION

- A. Examine areas and conditions under which painting work is to be applied and notify Resident Engineer of conditions detrimental to the work. Do not proceed with work until unsatisfactory conditions have been corrected.
- B. Starting of painting work will be construed as acceptance of surfaces and conditions within any particular area.
- C. Do not paint over dirt, rust, scale, grease, moisture, scuffed surfaces, or conditions otherwise detrimental to formation of a durable paint film.

3.02 SURFACE PREPARATION

- A. General: Perform preparation and cleaning procedures in accordance with paint manufacturer's instructions and as specified for each substrate.
 - 1. Provide barrier coats over incompatible primers or remove and reprime as required. Notify Resident Engineer in writing of any anticipated problems in using the specified coating systems with substrates primed by others.
 - 2. Remove hardware, plates, lighting fixtures, and similar items not to be finish-painted, or provide surface-applied protection prior to surface preparation and painting operations. Following completion of painting, reinstall removed items.
 - 3. Clean surfaces to be painted before applying paint. Remove oil and grease prior to mechanical cleaning. Program cleaning and painting so that contaminants from cleaning process will not fall onto wet, newly-painted surfaces.

- B. Ferrous Metals: Clean ferrous surfaces, which are not galvanized or shop-coated, of oil, grease, dirt, loose mill scale and other foreign substances by solvent or mechanical cleaning.

1. Touch-up shop-applied prime coats wherever damaged or bare, where required by other sections of these specifications. Clean and touch-up with same type shop primer.
2. Remove loose paint from existing convector enclosure surfaces. Touch-up, fill, sand and prepare convector enclosures and windows to receive paint.

3.03 MATERIALS PREPARATION

- A. Mix and prepare painting materials in accordance with manufacturer's directions.
- B. Maintain containers used in mixing and application of paint in a clean condition, free of foreign materials and residue.
- C. Stir materials before application to produce a mixture of uniform density, and stir as required during application. Do not stir surface film into material. Remove film and, if necessary, strain material before using.

3.04 APPLICATION

- A. General: Apply paint in accordance with manufacturer's directions. Use applicators and techniques best suited for substrate and type of material being applied.
1. Paint colors, surface treatments, and finishes, are indicated in "schedules" of the contract documents.
 2. Provide finish coats which are compatible with prime paints used.
 3. Apply additional coats when undercoats or other conditions show through final coat of paint, until paint film is of uniform finish, color and appearance. Give special attention to ensure that edges, corners, crevices, welds, and exposed fasteners receive a dry film thickness equal to flat surfaces.
 4. Paint surfaces behind movable equipment and furniture same as similar exposed surfaces. Paint surfaces behind permanently fixed equipment or furniture with prime coat only before final installation of equipment.
 5. Paint interior surfaces of ducts, where visible through registers or grilles, with a flat, non-specular black paint.
 6. Paint back sides of access panels, and removable or hinged covers to match exposed surfaces.
 7. Sand lightly between each succeeding enamel or varnish coat.
 8. Omit first coat (primer) on metal surfaces which have been shop-primed and touch-up painted, unless otherwise indicated.
- B. Scheduling Painting: Apply first-coat material to surfaces that have been cleaned, or otherwise prepared as soon as practicable after preparation and before subsequent surface deterioration.
1. Allow sufficient time between successive coatings to permit proper drying. Do not recoat until paint has dried to where it feels firm, does not deform or feel sticky under moderate thumb pressure, and application of another coat of paint does not cause lifting or loss of adhesion of the undercoat.
- C. Minimum Coating Thickness: Apply materials at not less than manufacturer's recommended spreading rate, to establish a total dry film thickness as recommended by coating manufacturer.

- D. Mechanical and Electrical Work: Painting of mechanical and electrical work is limited to those items exposed in occupied spaces.
- E. Prime Coats: Apply prime coat on material which has not been prime coated by others.
 - 1. Recoat defects in primed and sealed surfaces, to assure a finish coat with no burn-through or other defects due to insufficient sealing.
- F. Pigmented (Opaque) Finishes: Provide an opaque, smooth surface of uniform finish, color, appearance and coverage. Cloudiness, spotting, fish eyes, holidays, laps, brush marks, runs, sags, ropiness or other surface imperfections will not be acceptable.
- G. Completed Work: Match approved samples for color, texture and coverage. Remove, refinish or repaint work not in compliance with specified requirements.

3.05 CLEAN-UP AND PROTECTION

- A. Clean-Up: During progress of work, remove from site discarded paint materials, rubbish, cans and rags at end of each work day. Upon completion of painting work, clean window glass and other paint-spattered surfaces. Remove spattered paint by proper methods of washing and scraping, using care not to scratch otherwise damage finished surfaces.
- B. Protection: Protect work of other trades against damage by painting and finishing work. Correct any damage by cleaning, repairing or replacing, and repainting, as acceptable to Resident Engineer.
 - 1. Provide "Wet Paint" signs to protect newly-painted finishes. Remove temporary protection after completion of painting.
 - 2. At completion of work of other trades, touch-up and restore all damaged or defaced surfaces.

3.06 INTERIOR PAINT SCHEDULE

- A. General: Provide following interior paint systems, or approved equal, as selected by Architect. Ceilings to be flat finish; walls (except at bathroom) to be eggshell finish; walls at bathroom to be semi-gloss finish; painted woodwork to be semi-gloss finish.
- B. Drywall and Plaster:
 - 1. Acrylic Latex, Flat Finish: Factory-formulated flat acrylic-emulsion latex paint for interior application, applied at a dry film thickness of not less than 1.3 mils with a degree of gloss between 2-5. (Interior Drywall Ceiling – New Work and Painted)
 - a. Primer Coat: Interior wall primer equal to Benjamin Moore's Regal Premium Interior Latex Primer & Underbody #N216.
 - b. Two Coats: Acrylic latex paint equal Benjamin Moore Regal Select Flat Finish Wall Satin #547.

2. Acrylic Latex, Eggshell (low-luster) Finish: Factory-formulated eggshell acrylic-latex interior enamel, applied at a dry film thickness of not less than 1.4 mil with a degree of gloss between 7-15. (Interior Plaster and Drywall – New Work or Painted)
 - a. Primer Coat: Interior wall primer equal to Benjamin Moore's Regal Premium Interior Latex Primer & Underbody #N216 for New Work OR Spot Prime – Moorcraft Enamel Undercoater & Primer Sealer #253 for Previously Painted Surfaces.
 - b. Two Coats: Acrylic latex paint equal to Benjamin Moore Regal Eggshell #549
 3. Acrylic Enamel, Satin (Pearl): Factory-formulated pearl acrylic-latex interior enamel for interior application, applied at a dry film thickness of not less than 1.3 mils with a degree of gloss between 15-20. (Interior Plaster and Drywall – New Work or Painted where indicated)
 - a. Primer Coat: Interior wall primer equal to Benjamin Moore's Regal Premium Interior Latex Primer & Underbody #N216 for New Work OR Spot Prime – Moorcraft Enamel Undercoater & Primer Sealer #253 for Previously Painted Surfaces.
 - b. Two Coats: Acrylic latex paint equal to Benjamin Moore Regal Select Pearl Finish #550
 4. Acrylic Enamel, Semi-Gloss Finish: Factory-formulated semigloss acrylic-latex interior enamel for interior application, applied at a dry film thickness of not less than 1.3 mils with a degree of gloss between 40-55. (Interior Plaster and Drywall – New Work or Painted where indicated)
 - a. Primer Coat: Interior wall primer equal to Benjamin Moore's Regal Premium Interior Latex Primer & Underbody #N216 for New Work OR Spot Prime – Moorcraft Enamel Undercoater & Primer Sealer #253 for Previously Painted Surfaces.
 - b. Two Coats: Acrylic latex paint equal to Benjamin Moore Regal Select Semi-Gloss #551.
- C. Previously Painted Concrete, Masonry, Stucco: Verify existing substrate condition and paint type.
1. Acrylic Enamel, Satin/Semi-Gloss Finish: Factory-formulated flat acrylic-emulsion latex paint for interior application, applied at a dry film thickness of not less than 1.3 mils with a degree of gloss between 40-55.
 - a. Primer Coat: Interior wall primer equal to Benjamin Moore's Fresh Start All Purpose 100% Acrylic Primer #023
 - b. Two Coats: Acrylic latex paint equal Benjamin Moore Regal Select Semi-Gloss #551.
- D. Interior Wood Trim, Cabinets & Doors - New and Painted:
1. Acrylic Enamel, Semi-Gloss Finish: Factory-formulated semigloss acrylic-latex interior enamel for interior application, applied at a dry film thickness of not less than 1.3 mils with a degree of glass between 40-55.
 - a. Primer Coat: Primer equal to Benjamin Moore's Fresh Start All Purpose 100% Acrylic Primer #023.
 - b. Two Coats: Acrylic latex paint equal Benjamin Moore Regal Select Semi-Gloss #551.

E. Ferrous Metal – New and Painted: For painted surfaces, verify substrate paint type.

1. Alkyd Enamel, Satin Finish:

- a. Primer Coat: Primer equal to Benjamin Moore's D.T.M. Semi-Gloss #HP26.
- b. Two Coats: Regal Select Semi-Gloss Enamel #551.

F. Galvanized Metal – New and painted:

1. Latex Enamel, Satin Finish:

- a. Primer Coat: Primer equal to Benjamin Moore's D.T.M. Semi-Gloss #HP29.
- b. Two Coats: Regal Select Semi-Gloss Enamel #551.

3.07 PAINT COLOR SCHEDULE

A. Colors and Locations: As indicated on Finish Schedule and Elevations.

END OF SECTION

SECTION 10 21 13 –TOILET COMPARTMENTS

PART 1 - GENERAL

1.01 SUMMARY

- A. Work Included: Provide products in accordance with the Contract Documents. The Contract Documents are as defined in the "Agreement". The "General Conditions Governing All Contracts" shall apply to all work under the Contract. The Work of this Section shall include but not be limited to the following:
 - 1. Compact laminate (CL/Solid Phenolic), moisture resistant substrate toilet compartment work with floor-anchored partitions, hardware for toilet compartments, shop drawings and working drawings and manufacturer's guarantee.
 - a. Toilet partitions.
 - b. Urinal privacy screens.
- B. Related Section: Refer to the following sections for related work:
 - 1. Section 06 10 00, "Rough Carpentry" for overhead supports of ceiling anchored units.
 - 2. Section 10 28 13, "Toilet Accessories" for toilet paper holders, grab bars, and similar accessories.

1.02 SUBMITTALS

- A. Product Data: For each type and style of toilet compartment and screen specified. Include details of construction relative to materials, fabrication, and installation. Include details of anchors, hardware, and fastenings.
- B. Shop Drawings: For fabrication and installation of toilet compartment and screen assemblies. Include plans, elevations, sections, details, and attachments to other work. Show locations of cutouts for compartment-mounted accessories and compartment-mounted grab bars. Submit manufacturer's shop drawings for each product specified, including the following:
 - 1. Plans, elevations, details of construction and attachment to adjacent construction.
 - 2. Show anchorage locations and accessory items.
 - 3. Verify dimensions with field measurements prior to final production of toilet compartments.
- C. Selection Samples: For each finish product specified, two complete sets of color chips representing manufacturer's full range of available colors and patterns.
- D. Verification Samples: For each finish product specified, two samples, minimum size 6 inches (150 mm) square representing actual product, color, and patterns.

1.03 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Minimum 10 year experience manufacturing similar products.
- B. Installer Qualifications: Minimum 2 year experience installing similar products.
- C. Single Source Requirements: To the greatest extent possible provide products from a single manufacturer.
- D. Accessibility Requirements: Comply with requirements applicable in the jurisdiction of the project, including but not limited to ADA and ICC/ANSI A117.1 requirements as applicable.
- E. Mock-Up: Provide a mock-up for evaluation of surface preparation techniques and application workmanship.
 - a. Finish areas designated by Architect.
 - b. Do not proceed with remaining work until workmanship is approved by Architect.
 - c. Refinish mock-up area as required to produce acceptable work.

1.04 PRE-INSTALLATION MEETINGS

- F. Convene minimum two weeks prior to starting work of this section.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Delivery: Deliver materials in manufacturer's original unopened and undamaged packages. Clearly identify manufacturer, brand name, contents, color, stock number, and order number on each package.
- B. Storage: Store in original packaging under protective cover and protect from damage. Stack containers in accordance with manufacturer's recommendations.
- C. Handling: Handle materials in accordance with manufacturer's instructions to prevent damage to products and finishes.

1.06 PROJECT CONDITIONS

- A. Field Measurements: Verify dimensions in areas of installation by field measurements before fabrication and indicate measurements on shop drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.
 - 1. Established Dimensions: Where field measurements cannot be made without delaying the Work, establish dimensions and proceed with fabricating units without field measurements. Coordinate supports, adjacent construction, and fixture locations to ensure actual dimensions correspond to established dimensions.

1.07 SEQUENCING

- A. Ensure that products of this section are supplied to affected trades in time to prevent interruption of construction progress.

1.08 WARRANTY

- A. Manufacturer's Warranty: Manufacturer's standard 25 year limited warranty for panels, doors, and stiles against breakage, corrosion, delamination, and defects in factory workmanship. Manufacturer's standard 1 year guarantee against defects in material and workmanship for stainless steel door hardware and mounting brackets.

PART 2 – PRODUCTS

2.01 MANUFACTURERS

- A. Basis of Design:

Bobrick Toilet Partitions: Dura Line Series 1082G.67, CGL
Contact: Fred Sylvester 631-249-7171
BOBRICK Washroom Equipment, Inc., which is located at: 6901 Tujunga Ave.;
North Hollywood, CA 91605-6213; Tel: 818-764-1000; Fax: 818-765-2700;
Email: info@bobrick.com; Web: www.bobrick.com

- B. Substitutions:

The Architect will consider products of comparable manufacturers as a substitution, pending the Contractor's submission of adequate documentation of the substitution in accordance with procedures in Division 1 of the Project Manual. Documentation shall include a list of five similar projects of equivalent size where products have been installed for a minimum of two years, and manufacturer's certification that products are fabricated in the United States.

- C. METPAR _ Compact Laminate Floor Mounted Partition

- D. GLOBAL – Compact Laminate Floor Mounted Partition

- E. Requests for substitutions will be considered in accordance with provisions of Section 01 60 00 - Product Requirements.

1. Mounting:

- a. Floor-mounted, overhead-braced with satin finish, extruded anodized aluminum headrails, 0.065 inch (1.65 mm) thick with anti-grip profile.
 - 1) Stile Height: As required up to 10 feet 0 inches (305 cm) maximum.
- b. Wall-hung.
 - 1) Screen Height: 42 inches (107 cm) with 18 inches (46 cm) floor clearance.
 - 2) Screen Height: 48 inches (122 cm) with 12 inches (30 cm) floor clearance.

- E. Performance Requirements:
 - 1. Graffiti Resistance (ASTM D 6578): Passed cleanability test; 5 staining agents.
 - 2. Scratch Resistance (ASTM D 2197): Maximum load value exceeds 10 kilograms.
 - 3. Impact Resistance (ASTM D 2794): Maximum impact force exceeds 30 inch-pounds.
 - 4. Smoke Developed Index (ASTM E 84): Less than 450.
 - 5. Flame Spread Index (ASTM E 84): Less than 75.
 - 6. National Fire Protection Association/International Building Code Interior Wall and Ceiling Finish: Class B.
 - 7. Uniform Building Code: Class II.
- F. Finished Thickness:
 - 8. Stiles and Doors: 3/4 inch (19 mm).
 - 9. Panels and Screens: 1/2 inch (13 mm).
- G. Stiles: Floor-anchored stiles furnished with expansion shields and threaded rods.
 - 1. Leveling Devices: 7 gauge, 3/16 inches (5 mm) thick, corrosion-resistant, chromate-treated, double zinc-plated steel angle leveling bar bolted to stile; furnished with 3/8 inch (10 mm) diameter threaded rods, hex nuts, lock washers, flat washers, spacer sleeves, expansion anchors, and shoe retainers.
 - 2. Stile Shoes: One-piece, 22 gauge (0.8 mm), 18-8, Type 304 stainless steel, 4 inch (102 mm) height; tops with 90 degree return to stile. One-piece shoe capable of adapting to 3/4 inch (19 mm) or 1 inch (25 mm) stile thickness and capable of being fastened (by clip) to stiles starting at wall line.
- H. Wall Posts: Pre-drilled for door hardware, 18-8, Type 304, 16 gauge (1.6 mm) stainless steel with satin finish; 1 inch (25 mm) x 1-1/2 inches (38 mm) x 58 inches high (1473 mm).
- I. Anchors: Expansion shields and threaded rods at floor connections as applicable. Threaded rods secured to supports above ceiling as applicable. Supports above ceiling furnished and installed as Work of Section 05 50 00 - Metal Fabrications.
- J. Hardware: Chrome-plated "Zamak", aluminum, extruded plastic hardware **not acceptable**.
 - 1. Compliance: Operating force of less than 5 lb (2.25 kg).
 - 2. Emergency Access: Hinges, door latch allow door to be lifted over keeper from outside compartment on inswing doors.
 - 3. Materials: 18-8, Type 304, heavy-gauge stainless steel with satin finish.
 - 4. Doorstops: Prevents inswinging doors from swinging out beyond stile; on outswing doors, doorstop prevents door from swinging in beyond stile.
 - 5. Fastening: Hardware secured to door and stile by through-bolted, theft-resistant, pin-in-head Torx stainless steel machine screws into factory-installed, threaded brass inserts. Fasteners secured directly into core not acceptable.
 - a. Threaded Brass Inserts: Factory-installed; withstand direct pull force exceeding 1500 lb (680 kg) per insert.
 - 6. Clothes Hooks: Projecting no more than 1-1/8 inch (29 mm) from face of door.
 - 7. Door Latch: Track of door latch prevents inswing doors from swinging out beyond stile; on outswing doors, door keeper prevents door from swinging in beyond stile; 16 gauge (1.6 mm) sliding door latch, 14 gauge (2 mm) keeper.
 - 8. Locking: Door locked from inside by sliding door latch into keeper.
 - 9. Hinge Type:

- a. Standard.
 - 1. Balanced, with field-adjustable cam to permit door to be fully closed or partially open when compartment is unoccupied.
 - b. Full-Height Institutional Hinge.
 - 1. Hinges: 16 gauge (1.6 mm) stainless steel, self-closing, 3 section hinges.
10. Mounting Brackets:
- a. Standard Concealed.
 - 1. Mounting Brackets: Mounted inside compartment; exposed brackets on exterior of compartment not acceptable with the exception of outswing doors.
 - b. Full-Height.
 - 1. Mounting Brackets: 18 gauge (1.2 mm) stainless steel and extend full height of panel.
 - 2. U-Channels: Secure panels to stiles.
 - 3. Angle Brackets: Secure stiles-to-walls and panels to walls.

2.02 COMPACT LAMINATE (SOLID PHENOLIC), MOISTURE RESISTANT SUBSTRATE

- A. Compact Laminate (Solid Phenolic) Toilet Partitions: Bobrick DuraLineSeries.
 - 1. Design Type:
 - a. Standard Height.
 - 1) Door/Panel Height: 58 inches (147 cm).
 - 2) Floor Clearance: 12 inches (30 cm).
 - 2. Privacy Style Partitions: No sightlines with gap-free interlocking doors and stiles routed 0.300 inches (7.6 mm) from the edge to allow for 0.175 inch (4.4 mm) overlap to prevent line-of-sight into the toilet compartment. Privacy strips fastened or adhered onto the partition material are not acceptable.
 - 3. Mounting Configuration:
 - a. Floor-mounted, overhead-braced with satin finish, extruded anodized aluminum headrails, 0.065 inch (1.65 mm) thick with anti-grip profile.
 - 1) Stile Maximum Height: 83 inches (211 cm).
- B. Compact Laminate (Solid Phenolic) Urinal Screens: Bobrick DuraLineSeries.
 - 1. Mounting Configuration:
 - a. Floor-to-ceiling.
 - 1) Screen Height: 58 inches (178 cm) with floor clearance: 12 inches (30 cm).
 - 2) Stile Height: As required up to 10 feet 0 inches (305 cm) maximum.
 - b. Post-to-ceiling.
 - 1) Screen Height: 58 inches (178 cm).
 - 2) Floor Clearance: 12 inches (30 cm).
 - 3) Post Height: Up to 10 feet 0 inches (305 cm) maximum.
 - c. Wall-hung.
 - 1) Screen Height: 42 inches (107 cm) with 18 inches (46 cm) floor clearance.
 - 2) Screen Height: 48 inches (122 cm) with 12 inches (30 cm) floor clearance.

- C. Materials: Solidly fused plastic laminate with matte-finish melamine surfaces; integrally bonded colored face sheets and black phenolic-resin core.
- D. Edges: Black; brown edges not acceptable.
- E. Color:
 - 1. As selected by Architect from manufacturer's standard DuraLineSeries range.
 - 2. Color: 4878 Pewter Mesh
UNLESS OTHERWISE NOTED
 - 3. Color: Other color as selected by architect based on Manufacturer's range and confirmed by local Manufacturer Representative.
- F. Fire Resistance:
 - 1. National Fire Protection Association/International Building Code Interior Wall and Ceiling Finish: Class B / Uniform Building Code: Class II.
 - a. Flame Spread Index (ASTM E 84): 30 for panels and stiles.
 - b. Smoke Developed Index (ASTM E 84): 55 for panels, 20 for stiles.
- G. Finished Thickness:
 - 1. Stiles and Doors: 3/4 inch (19 mm).
 - 2. Panels and Screens: 1/2 inch (13 mm).
- H. Stiles: Floor-anchored stiles furnished with expansion shields and threaded rods.
 - 1. Leveling Devices: 7 gauge, 3/16 inches (5 mm) thick, corrosion-resistant, chromate-treated, double zinc-plated steel angle leveling bar bolted to stile; furnished with 3/8 inch (10 mm) diameter threaded rods, hex nuts, lock washers, flat washers, spacer sleeves, expansion anchors, and shoe retainers.
 - 2. Stile Shoes: One-piece, 22 gauge (0.8 mm), 18-8, Type 304 stainless steel, 4 inch (102 mm) height; tops with 90 degree return to stile. One-piece shoe capable of adapting to 3/4 inch (19 mm) or 1 inch (25 mm) stile thickness and capable of being fastened (by clip) to stiles starting at wall line.
- I. Wall Posts: Pre-drilled for door hardware, 18-8, Type 304, 16 gauge (1.6 mm) stainless steel with satin finish; 1 inch (25 mm) x 1-1/2 inches (38 mm) x 58 inches high (1473 mm).
- J. Anchors: Expansion shields and threaded rods at floor connections as applicable. Threaded rods secured to supports above ceiling as applicable. Supports above ceiling furnished and installed as Work of Section 05 50 00 - Metal Fabrications.

- K. Hardware:
1. Compliance: Operating force of less than 5 lb (2.25 kg).
 2. Emergency Access: Hinges, latch allow door to be lifted over keeper from outside compartment on inswing doors.
 3. Materials: 18-8, Type 304, heavy-gauge stainless steel with satin finish.
 4. Doorstops: Prevents inswinging doors from swinging out beyond stile; on outswing doors, doorstop prevents door from swinging in beyond stile.
 5. Fastening: Hardware is secured to door and stile with pin-in-head Torx stainless steel machine screws. Hinges, latch and optional door stops secured to door with pin-in-head Torx stainless steel machine screws into factory-installed, threaded brass inserts. Fasteners for hinges, latch and optional door stops secured directly into core not acceptable.
 - a. Threaded Brass Inserts: Factory-installed; withstand direct pull force exceeding 1500 lb (680 kg) per insert.
 6. Clothes Hooks: Projecting no more than 1-1/8 inch (29 mm) from face of door.
 7. Door Latch: Track of door latch prevents inswinging doors from swinging out beyond stile; on outswing doors, door keeper prevents door from swinging in beyond stile; 16 gauge (1.6 mm) sliding door latch, 14 gauge (2 mm) keeper.
 8. Locking: Door locked from inside by sliding door latch into keeper.
 9. Hinge Type:
 - a. Standard.
 - 1) Balanced, with field-adjustable cam to permit door to be fully closed or partially open when compartment is unoccupied.
 - b. Full-Height Institutional Hinge.
 - 1) Hinges: 16 gauge (1.6 mm) stainless steel, self-closing, 3 section hinges.
 10. Mounting Brackets:
 - a. Standard concealed.
 - 1) Mounting Brackets: Mounted inside compartment; exposed brackets on exterior of compartment not acceptable with the exception of outswing doors.
 - b. Full-Height.
 - 1) Mounting Brackets: 18 gauge (1.2 mm) stainless steel and extend full height of panel.
 - 2) U-Channels: Secure panels to stiles.
 - 3) Angle Brackets: Secure stiles-to-walls and panels to walls.
- L. Fire Resistance:
1. National Fire Protection Association/International Building Code Interior Wall and Ceiling Finish: Class B / Uniform Building Code: Class II.
 - a. Flame Spread Index (ASTM E 84): 60 for panels and stiles.
 - b. Smoke Developed Index (ASTM E 84): 265 for panels and stiles.
- M. Stiles: Floor-anchored stiles furnished with expansion shields and threaded rods
1. Stile Leveling Device:
 - a. Standard:
 - 1) Overhead-Braced: 12 gauge (2.8 mm), 3 inches x 1-1/4 inches (75 x 32 mm) plated steel stile bracket factory installed to bottom of stile. Furnished with leveling bolt, shoe retainer, floor L-bracket, plastic anchor #14-16, #14 x 5/8 inches (M6.3 x 16 mm)

- 2) stainless steel sheet-metal screws and #14 x 1-3/4 inches (M6.3 x 45 mm) stainless steel sheet-metal floor screws.
 - 2) Floor-Anchored: 3/8 inches x 1 inches (10 x 25 mm) steel bar, zinc-chromate plated, bolted to stile using 6 inches x 3/8 inches (152 x 10 mm) diameter carbon steel lag bolt. Furnished with 3/8 inches (10mm) diameter threaded rods, hex nuts, washers, spacer sleeve (ceiling-hung only), expansion shield and shoe retainer.
 - 3) Ceiling-Hung: 3/8 inches x 1 inches (10 x 25 mm) steel bar, zinc-chromate plated, bolted to stile using 6 inches x 3/8 inches (152 x 10 mm) diameter carbon steel lag bolt. Furnished with 3/8 inches (10mm) diameter threaded rods, hex nuts, washers, spacer sleeve (ceiling-hung only), expansion shield and shoe retainer.
 - b. Steel Core Stile Option:
 - 1) Leveling Devices: 3/8 inch x 7/8 inch (10 mm x 22 mm) steel bar welded to 11 gauge (3 mm) steel-reinforcing core; chromate-treated and double zinc-plated; welded to sheet-steel core of stiles.
 - 2. Stile Shoes: One-piece, 22 gauge (0.8 mm), 18-8, Type 304 stainless steel, 4 inch (102 mm) height; tops with 90 degree return to stile. One-piece shoe capable of adapting to 3/4 inch (19 mm) or 1 inch (25 mm) stile thickness and capable of being fastened (by clip) to stiles starting at wall line.
- N. Wall Posts: Pre-drilled for door hardware, 18-8, Type 304, 16 gauge (1.6 mm) stainless steel with satin finish; 1 inch (25 mm) x 1-1/2 inches (38 mm) x 58 inches high (1473 mm).
- O. Anchors: Expansion shields and threaded rods at floor connections as applicable. Threaded rods secured to supports above ceiling as applicable. Supports above ceiling furnished and installed as Work of Section 05 50 00 - Metal Fabrications.
- P. Hardware:
 - 1. Compliance: Operating force of less than 5 lb (2.25 kg).
 - 2. Emergency Access: Hinges, latch allow door to be lifted over keeper from outside compartment on inswing doors.
 - 3. Materials:
 - a. Stainless Steel
 - 1) Hinges: Pivot hinges constructed of stainless steel with satin finish.
 - 2) Door Hardware: Latches, keepers, coat hooks constructed of stainless steel with satin finish.
 - 3) Mounting Brackets: Constructed of 18-8, Type-304, heavy-gauge stainless steel with satin finish.

2.03 FABRICATION

- A. General: Provide standard doors, panels, screens, and pilasters fabricated for compartment system, unless otherwise indicated. Provide units with cutouts, drilled holes, and internal reinforcement to receive compartment-mounted hardware, accessories, and grab bars, as indicated.
- B. Overhead-Braced and-Floor-Anchored Compartments: Provide manufacturer's standard corrosion-resistant supports, leveling mechanism, fasteners, and anchors at pilasters to suit floor conditions. Make provisions for setting and securing continuous head rail at top of each pilaster. Provide shoes at pilasters to conceal supports and leveling mechanism.
- C. Floor-Anchored Screens: Provide pilasters and panels of same construction and finish as toilet compartments. Provide manufacturer's standard corrosion resistant anchoring assemblies complete with threaded rods, lock washers, and leveling adjustment nuts at pilasters for structural connection to floor. Provide shoes at pilasters to conceal anchorage.
- D. Wall-Hung Screens: Provide units in size indicated of same construction and finish as compartment panels, unless otherwise indicated.
- E. Doors: Unless otherwise indicated, provide min. 24-inch- (610-mm-) wide in-swinging doors for standard toilet compartments, and min. 36-inch- (914-mm-) wide out-swinging doors with a minimum 32-inch- (813-mm-) wide clear opening for compartments indicated to be handicapped accessible.
 - 1. Hinges: Manufacturer's standard self-closing type that can be adjusted to hold door open at any angle up to 90 degrees.
 - 2. Latch and Keeper: Manufacturer's standard latching emergency access and with combination rubber-faced door strike and keeper. Provide units that comply with accessibility requirements at compartments indicated to be handicapped accessible.
 - 3. Coat Hook: Manufacturer's standard combination hook and rubber-tipped bumper, sized to prevent door from hitting compartment-mounted accessories. Install one per stall.
 - 4. Door Pull: Manufacturer's standard unit that complies with ADA accessibility requirements at out-swinging doors. Provide units on both sides of doors at compartments indicated to be handicapped accessible.
 - 5. Door Bumper: Manufacturer's standard rubber-tipped bumpers at out-swinging doors.

PART 3 - EXECUTION

3.01 PREPARATION

- A. Prepare substrates including but not limited to blocking and supports in walls and ceilings at points of attachment using methods recommended by the manufacturer for achieving the best result for the substrates under the project conditions.
 - 1. Inspect areas scheduled to receive compartments for correct dimensions, plumbness of walls, and soundness of surfaces that would affect installation of mounting brackets.
 - 2. Verify spacing of plumbing fixtures to assure compatibility with installation of compartments.
- B. If preparation is the responsibility of another installer, notify Architect in writing of deviations from manufacturer's recommended installation tolerances and conditions.
- C. Do not proceed with installation until substrates have been properly prepared with blocking and supports in walls and ceilings at points of attachment and deviations from manufacturer's recommended tolerances are corrected. Commencement of installation constitutes acceptance of conditions.

3.02 INSTALLATION

- Q. Install products in strict compliance with manufacturer's written instructions and recommendations, including the following:
 - 1. Verify blocking and supports in walls and ceilings has been installed properly at points of attachment.
 - 2. Verify location does not interfere with door swings or use of fixtures.
 - 3. Use fasteners and anchors suitable for substrate and project conditions
 - 4. Install units rigid, straight, plumb, and level.
 - 5. Conceal evidence of drilling, cutting, and fitting to room finish.
 - 6. Test for proper operation.
 - 7.

3.03 ADJUSTING, CLEANING AND PROTECTION

- R. Adjust hardware for proper operation after installation. Set hinge cam on in-swinging doors to hold doors open when unlatched. Set hinge cam on out-swinging doors to hold unlatched doors in closed position.
- S. Touch-up, repair or replace damaged products.
- T. Clean exposed surfaces of compartments, hardware, and fittings.

END OF SECTION

SECTION 10 28 13 – BATHROOM ACCESSORIES

PART 1 - GENERAL

1.01 SUMMARY

- A. Work Included: Provide products in accordance with the Contract Documents. The Contract Documents are as defined in the "Agreement". The "General Conditions Governing All Contracts" shall apply to all work under the Contract. The Work of this Section shall include but not be limited to the following:

1. Provide indicated and scheduled toilet accessories.

- B. Related Sections:

1. Section 092100 - Gypsum Drywall Systems.
2. Section 093000 - Tile.

1.02 QUALITY ASSURANCE

- A. Single Source Responsibility: Subject to compliance with requirements, provide toilet accessories of same manufacturer for each type of accessory unit with not less than 5 years successful experience manufacturing similar products.
- B. Inserts and Anchorages: Furnish inserts and anchoring devices which must be set in concrete or built into masonry; coordinate delivery with other work to avoid delay.
- C. Accessory Locations: Coordinate accessory locations with other work to avoid interference and to assure proper operation and servicing.
- D. Comply with Building Code, ADA provisions, other authorities having jurisdiction at project location and NYIT Standards.

1.03 SUBMITTALS

- A. Product Data: Submit manufacturer's technical data and installation instructions for each toilet accessory.
- B. Samples: Submit full-size samples of each toilet accessory. All samples will be returned and acceptable samples may be used in the work.
- C. Setting Drawings: Provide setting Drawings, templates, instructions and directions for installation of anchorage devices and for cut-outs in other work.

1.04 PROJECT CONDITIONS

- A. Coordination: Coordinate accessory locations, installation, and sequencing with other work to avoid interference and to assure proper installation, operation, adjustment, cleaning, and servicing of toilet accessory items.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, provide products as manufactured by one of the following, or approved equal:
 - 1. Bobrick, Inc.
 - 2. American Specialties, Inc.
 - 3. Bradley Corp.
 - 4. Or Approved Equal.

2.02 MATERIALS, GENERAL

- A. Stainless Steel: AISI Type 302/304, with No. 4 satin finish, 22 gage (.034") minimum thickness, unless otherwise indicated.
- B. Brass: Leaded and unleaded, flat products, FS QQ-B-613; Rods, shapes, forgings, and flat products with finished edges, FS QQ-B-626.
- C. Chromium Plating: Nickel and chromium electro-deposited on base metal, ASTM B 456, Type SC 2.
- D. Galvanized Steel Mounting Devices: ASTM A 153, hot-dip galvanized after fabrication.
- E. Phenolic Plastic: ASTM D 4617.
- F. Fasteners: Screws, bolts, and other devices of same material as accessory unit or of galvanized steel where concealed.
- G. Mirror Glazing: Comply with ASTM C 1036 for 1/4" thick mirror glass coated with silver and protective coats as required for compliance with Federal Specification DD-M-00411D, min. 150 hours of 20% salt spray application.
 - 1. Cut glass to final size and complete edge treatment prior to silvering. Coat back of glass with full silvering of chemically deposited silver, covered by a film of copper, and coated with 2-mil dry film thickness of organic coating.
 - 2. Reflectance: 83% minimum.

2.03 FABRICATION

- A. General: If approved, an unobtrusive logo of manufacturer is permitted on exposed surfaces. Provide manufacturer's name and product model number on concealed surfaces.
- B. Surface-Mounted Accessories, General: Fabricate units with tight seams and joints, exposed edges rolled. Hang doors or access panels with continuous stainless steel piano hinge. Provide concealed anchorage.
- C. Recessed Accessories, General: Fabricate units of all welded construction. Hang doors or access panels with full-length stainless steel piano hinge. Provide concealed anchorage.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Install accessories in accordance with manufacturers' instructions. Install units plumb and level, firmly anchored in locations indicated.
- B. Secure units to walls in concealed, tamperproof manner with special hangers, toggle bolts, or screws. Set units plumb, level, and square, at locations indicated, and in accordance with manufacturer's instructions.
- C. Coordinate installation of blocking, grounds, backing plates and other concealed supports, refer to Sections 05500 - Metal Fabrications and 09260 -Gypsum Drywall Systems.

3.02 ADJUSTING AND CLEANING

- A. Adjust accessories for proper operation and verify that mechanisms function smoothly. Replace damaged or defective items.
- B. Clean and polish all exposed surfaces after removing protective coatings.

3.03 TOILET ACCESSORY SCHEDULE

- A. General: Provide toilet accessories as scheduled and as selected by architect.
(Accessories Schedule: Sheet A601.00: if any discrepancies confirm with Architect)

A1. BABY CHANGING TABLE

Description	:	Horizontal
Manufacturer	:	Koala
Model	:	#KB-110-SSWM
Mounting	:	Wall mounted
Construction	:	18-gauge satin stainless-steel exterior High-density polyethylene antimicrobial interior

A2. HAND DRYER

Description	:	Automatic hand dryer
Manufacturer	:	Bobrick
Model	:	TimeLine Series #B-3725
Mounting	:	Recessed
Construction	:	Type 304 stainless steel, satin finish

A3. WASTE RECEPTACLE

Description	:	Paper Towel Dispenser/waste Receptacle
Manufacturer	:	Bobrick
Model	:	TimeLine Series #B-35633
Mounting	:	Recessed
Construction	:	Type 304 stainless steel, satin finish

A4. FULL LENGTH MIRROR

Description	:	Glass Mirror with Welded St. Steel Angle Frame
Manufacturer	:	Bobrick
Model	:	B-290 Series - 2472: 24"x72"
Mounting	:	Frame
Construction	:	Type 304 stainless steel, with a satin finish

- A5. DOUBLE-ROLL TOILET TISSUE DISPENSER
Description : Twin Jumbo-Roll Toilet Tissue Dispenser
Manufacturer : Bobrick
Model : B-2892
Mounting : Surface
Construction : Type 304 stainless steel, with a satin finish
- A6. COAT HOOK
Description : Double Coat Hook
Manufacturer : Bobrick
Model : B-549
Mounting : Surface
Construction : Type 304 stainless steel, with a satin finish
- A7. SOAP DISPENSER – DECK MOUNTED, AUTOMATIC
Description : Sloan Foam Soap Dispenser, sensor activated
With 2 bottles of 1500ml soap
Manufacturer : Sloan
Model : ESD-2000-CP (#3346089)
Mounting : Deck Mounted
Construction : Polished Chrome finish, die cast body
Accessories : AC Adapter: #0346090
- A8. SOAP DISPENSER – WALL MOUNTED, AUTOMATIC
Description : Foam Soap Dispenser, sensor-activated
Manufacturer : Bobrick
Model : B-2013
Mounting : Wall Mounted
Construction : Type 304 stainless steel, with a satin finish
- A9. SANITARY NAPKIN DISPOSAL
Description : Sanitary Napkin Disposal
Manufacturer : Bobrick Contura Series
Model : #B-270
Mounting : Surface
Construction : Type 304 stainless steel, with a satin finish
- A10, A11, A12 - GRAB BARS
Description : 1-1/4" Grab Bar
Manufacturer : Bobrick
Model : #B-5806
A10 – x36"; A11 – x42"; A12 – x18"
Mounting : Surface mounted
Construction : Type 304 stainless steel, satin finish
- A13 VANITY MIRROR
Description : Glass Mirror with Welded St. Steel Angle Frame
Manufacturer : Bobrick
Model : B-290 Series - 2436: 24"x36"
Mounting : Frame
Construction : Type 304 stainless steel, with a satin finish

A14	TOILET PARTITIONS		(See Section 10-21-13 Toilet Partitions)
	Description	:	Compact Laminate (Solid Phenolic Partitions and Screens)
	Manufacturer	:	Bobrick
	Model	:	Dura Line Series - 1082
	Mounting	:	Overhead Braced
	Construction	:	Solid Phenolic
A15	VANITY MIRROR		
	Description	:	Glass Mirror w/ Welded St. Steel Angle Frame - NOT USED
	Manufacturer	:	Bobrick
	Model	:	B-290 Series - 1836: 18"x36"
	Mounting	:	Frame
	Construction	:	Type 304 stainless steel, with a satin finish
A16	KLUTCH HOLDER		
	Description	:	Klutch Mobile Device Holder – NOT USED
	Manufacturer	:	Bobrick
	Model	:	# B- 635
	Mounting	:	Surface Mounted
	Construction	:	Type 304 stainless steel

END OF SECTION

SECTION 210517 - SLEEVES AND SLEEVE SEALS FOR FIRE-SUPPRESSION PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Sleeves.
 - 2. Grout.
 - 3. Silicone sealants.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.

1.4 INFORMATIONAL SUBMITTALS

- A. Field quality-control reports.

PART 2 - PRODUCTS

2.1 SLEEVES

- A. Cast-Iron Pipe Sleeves: Cast or fabricated of cast or ductile iron and equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop.
- B. PVC Pipe Sleeves: ASTM D 1785, Schedule 40.

2.2 GROUT

- A. Description: Nonshrink, for interior and exterior sealing openings in non-fire-rated walls or floors.
- B. Standard: ASTM C 1107/C 1107M, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.

- C. Design Mix: 5000-psi, 28-day compressive strength.
- D. Packaging: Premixed and factory packaged.

2.3 SILICONE SEALANTS

- A. Silicone, S, NS, 25, NT: Single-component, nonsag, plus 25 percent and minus 25 percent movement capability, nontraffic-use, neutral-curing silicone joint sealant, ASTM C 920, Type S, Grade NS, Class 25, Use NT.
- B. Silicone, S, P, 25, T, NT: Single-component, pourable, plus 25 percent and minus 25 percent movement capability, traffic- and nontraffic-use, neutral-curing silicone joint sealant; ASTM C 920, Type S, Grade P, Class 25, Uses T and NT. Grade P Pourable (self-leveling) formulation is for opening in floors and other horizontal surfaces that are not fire rated.
- C. Silicone Foam: Multicomponent, silicone-based liquid elastomers that, when mixed, expand and cure in place to produce a flexible, nonshrinking foam.

PART 3 - EXECUTION

3.1 SLEEVE INSTALLATION

- A. Install sleeves for piping passing through penetrations in floors, partitions, and walls.
- B. Install sleeves for pipes passing through interior partitions.
 - 1. Cut sleeves to length for mounting flush with both surfaces.
 - 2. Install sleeves that are large enough to provide 1/4-inch annular clear space between sleeve and pipe or pipe insulation.
 - 3. Seal annular space between sleeve and piping or piping insulation; use joint sealants appropriate for size, depth, and location of joint.
- C. Fire-Resistance-Rated Penetrations, Horizontal Assembly Penetrations, and Smoke Barrier Penetrations: Maintain indicated fire or smoke rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with fire- and smoke-stop materials. Comply with requirements for firestopping and fill materials specified in Section 078413 "Penetration Firestopping."

3.2 FIELD QUALITY CONTROL

- A. Perform the following tests and inspections:
 - 1. Leak Test: After allowing for a full cure, test sleeves and sleeve seals for leaks. Repair leaks and retest until no leaks exist.
- B. Sleeves and sleeve seals will be considered defective if they do not pass tests and inspections.

- C. Prepare test and inspection reports.

3.3 SLEEVE AND SLEEVE-SEAL SCHEDULE

- A. Use sleeves for the following piping-penetration applications:

1. Exterior Concrete Walls below Grade:
 - a. Piping Smaller Than NPS 6: Cast-iron pipe sleeves.
 - 1) Select sleeve size to allow for 1-inch annular clear space between piping and sleeve for installing sleeve-seal system.
2. Concrete Slabs-on-Grade:
 - a. Piping NPS 6 or smaller: Cast-iron pipe sleeves.
 - 1) Select sleeve size to allow for 1-inch annular clear space between piping and sleeve for installing sleeve-seal system.
3. Concrete Slabs above Grade:
 - a. Piping Smaller Than NPS 6: PVC pipe sleeves.
4. Interior Partitions:
 - a. Piping Smaller Than NPS 6: Steel pipe sleeves or PVC pipe sleeves.

END OF SECTION 210517

SECTION 210518 - ESCUTCHEONS FOR FIRE-SUPPRESSION PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Escutcheons.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.

PART 2 - PRODUCTS

2.1 ESCUTCHEONS

- A. One-Piece, Steel Type: With polished, chrome-plated finish and setscrew fastener.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install escutcheons for piping penetrations of walls, ceilings, and finished floors.
- B. Install escutcheons with ID to closely fit around pipe, tube, and insulation of piping and with OD that completely covers opening.
 - 1. Escutcheons for New Piping:
 - a. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece steel with polished, chrome-plated finish.
- C. Install floor plates for piping penetrations of equipment-room floors.

3.2 FIELD QUALITY CONTROL

- A. Using new materials, replace broken and damaged escutcheons and floor plates.

END OF SECTION

SECTION 210553 IDENTIFICATION FOR FIRE-SUPPRESSION PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Pipe labels.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.

PART 2 - PRODUCTS

2.1 PIPE LABELS

- A. General Requirements for Manufactured Pipe Labels: Preprinted, color-coded, with lettering indicating service and showing flow direction according to ASME A13.1.
- B. Self-adhesive Pipe Labels: Printed plastic with contact-type, permanent-adhesive backing.
- C. Pipe-Label Contents: Include identification of piping service using same designations or abbreviations as used on Drawings, pipe size, and an arrow indicating flow direction.
 - 1. Flow-Direction Arrows: Integral with piping-system service lettering to accommodate both directions or as separate unit on each pipe label to indicate flow direction.
 - 2. Lettering Size: Size letters according to ASME A13.1 for piping or at least 1/2 inch for viewing distances up to 72 inches and proportionately larger lettering for greater viewing distances.
- D. Pipe-Label Colors:
 - 1. Background Color: Safety Red.
 - 2. Letter Color: White.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Clean piping and equipment surfaces of incompatible primers, paints, and encapsulants, as well as dirt, oil, grease, release agents, and other substances that could impair bond of identification devices.

3.2 GENERAL INSTALLATION REQUIREMENTS

- A. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be installed.
- B. Coordinate installation of identifying devices with locations of access panels and doors.
- C. Install identifying devices before installing acoustical ceilings and similar concealment.

3.3 PIPE LABEL INSTALLATION

- A. Piping: Painting of piping is specified in Section 099123 "Interior Painting."
- B. Pipe-Label Locations: Locate pipe labels where piping is above accessible ceilings in finished spaces; machine rooms; accessible maintenance spaces such as shafts, tunnels, and plenums; and exterior exposed locations as follows:
 - 1. Near each valve and control device.
 - 2. Near each branch connection excluding short takeoffs. Where flow pattern is not obvious, mark each pipe at branch.
 - 3. Near major equipment items and other points of origination and termination.
 - 4. Spaced at maximum intervals of 25 feet along each run. Reduce intervals to 15 feet in areas of congested piping and equipment.
 - 5. On piping above removable acoustical ceilings. Omit intermediately spaced labels.
- C. Directional Flow Arrows: Arrows shall be used to indicate direction of flow in pipes including pipes where flow is allowed in both directions.

3.4 WARNING-TAG INSTALLATION

- A. Write required message on, and attach warning tags to, equipment and other items where required.

END OF SECTION

SECTION 211313 – WET PIPE SPRINKLER SYSTEMS FOR FIRE-SUPPRESSION PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Pipes, fittings, and specialties.
 - 2. Sprinklers.
 - 3. Hangers and supports.
- B. Related Requirements:
 - 1. Section 210517 "Sleeves and Sleeve Seals for Fire-Suppression Piping"
 - 2. Section 210518 "Escutcheons for Fire-Suppression Piping"
 - 3. Section 210553 "Identification for Fire-Suppression Piping and Equipment"

1.3 DEFINITIONS

- A. Standard-Pressure Sprinkler Piping: Wet-pipe sprinkler system piping designed to operate at working pressure of 175-psig maximum.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.
- B. Shop Drawings and hydraulic calculations:
 - 1. Include plans, elevations, sections, and attachment details and hydraulic calculations in accordance with NFPA 13 "Plans and Calculations" Chapter. Hydraulic nodes shall be visibly shown on the drawings.

1.5 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Sprinkler systems, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:
 - 1. Domestic water piping.
 - 2. HVAC hydronic piping.
 - 3. Items penetrating finished ceiling include the following:

- a. Lighting fixtures.
 - b. Air outlets and inlets.
 - c. Fire alarm devices.
 - d. Security/communications devices.
 - B. Qualification Data:
 - 1. Qualified Installer
 - 2. Professional engineer or NICET III or IV technician responsible for the preparation of shop drawings, hydraulic calculations, and product data submittal package.
 - C. Design Data:
 - 1. Approved Sprinkler Piping Drawings: Working plans, prepared according to NFPA 13, that have been approved by authorities having jurisdiction.
 - D. Welding certificates.
 - E. Field Test Reports:
 - 1. Indicate and interpret test results for compliance with performance requirements and as described in NFPA 13. Include "Contractor's Material and Test Certificate for Aboveground Piping."
 - F. Field quality-control reports.
- 1.6 CLOSEOUT SUBMITTALS
- A. Operation and Maintenance Data: For wet-pipe sprinkler systems and specialties to include in emergency, operation, and maintenance manuals.
- 1.7 MAINTENANCE MATERIAL SUBMITTALS
- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Spare sprinklers: furnish no less than two sprinklers of each type provided.
- 1.8 QUALITY ASSURANCE
- A. Installer Qualifications:
 - 1. Installer's responsibilities include designing, fabricating, and installing sprinkler systems and providing professional engineering services needed to assume engineering responsibility. Base calculations on results of fire-hydrant flow test not less than one year old from the date of shop drawing submittal.
 - a. Engineering Responsibility: Preparation of working plans, calculations, and field test reports by a qualified NICET III or IV technician or professional engineer.
 - B. Welding Qualifications: Qualify procedures and operators according to 2010 ASME Boiler and Pressure Vessel Code.

- C. All fire protection materials and equipment shall be UL listed and/or FM approved. Valve components (including valve trim, internal parts, gaskets, etc.) and other components as permitted by NFPA 13 shall not be required to be individually listed.
- D. Piping materials shall bear label, stamps, or other markings of specified testing agency.

1.9 DELIVERY, STORAGE, AND HANDLING

- A. Preparation for Transport: Prepare valves and piping according to the following:
 - 1. Ensure that valves and piping are dry and internally protected against rust and corrosion.
 - 2. Protect valves against damage to threaded ends and flange faces.
 - 3. Set valves in best position for handling. Set valves closed to prevent rattling.
- B. During Storage: Use precautions for valves according to the following:
 - 1. Do not remove end protectors unless necessary for inspection; then reinstall for storage.
 - 2. Protect from weather, humidity, temperature, dust, dirt, and water damage. Store indoors and maintain temperature higher than ambient dew point temperature. Support off the ground or pavement in watertight enclosures when outdoor storage is necessary.
- C. Deliver piping with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe-end damage and to prevent entrance of dirt, debris, and moisture.
- D. Protect stored piping from moisture and dirt. Elevate above grade. Do not exceed structural capacity of floor when storing inside.
- E. Protect flanges, fittings, and specialties from moisture and dirt.

1.10 FIELD CONDITIONS

- A. Interruption of Existing Sprinkler Service: Do not interrupt sprinkler service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary sprinkler service according to requirements indicated:
 - 1. Notify Construction Manager and/or Owner no fewer than three days in advance of proposed interruption of sprinkler service.
 - 2. Do not proceed with interruption of sprinkler service without Construction Manager's and/or Owner's written permission.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Sprinkler system equipment, specialties, accessories, installation, and testing shall comply with the following:
 - 1. NFPA 13.
- B. Standard-Pressure Piping System Component: Listed for 175-psig minimum working pressure.
- C. Delegated Design: Engage a qualified professional engineer or NICET III or IV technician, as defined in Section 014000 "Quality Requirements," to design wet-pipe sprinkler systems.

1. Refer to fire protection drawings for fire-hydrant flow test records.
 2. Sprinkler system design shall be approved by authorities having jurisdiction.
 - a. Margin of Safety for Available Water Flow and Pressure: 10 psi, including losses through water-service piping, valves, and backflow preventers.
 - b. Sprinkler Occupancy Hazard Classifications:
 - 1) Light Hazard Occupancy: Offices, lobbies, conference rooms, classrooms, restrooms, sleeping rooms, and similar spaces.
 3. Minimum Density for Automatic-Sprinkler Piping Design:
 - a. Light-Hazard Occupancy: 0.10 gpm over 1500-sq. ft. area.
 4. Maximum Protection Area per Sprinkler: According to UL listing and below.
 - a. Light Hazard Occupancy: 225 sq. ft..
- D. Seismic Performance: Sprinkler piping shall withstand the effects of earthquake motions determined according to NFPA 13 and ASCE/SEI 7.

2.2 STEEL PIPE AND FITTINGS

- A. Schedule 40, Black-Steel Pipe: ASTM A53 Type E or S.
- B. Malleable- or Ductile-Iron Unions: UL 860.
- C. Cast-Iron Flanges: ASME 16.1, Class 125.
- D. Steel Welding Fittings: ASTM A 234/A 234M and ASME B16.9.
1. Welding Filler Metals: Comply with AWS D10.12M/D10.12 for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.
- E. Grooved-Joint, Steel-Pipe Appurtenances:
1. Pressure Rating: 175-psig minimum.
 2. Grooved-End-Pipe Couplings for Steel Piping: AWWA C606 and UL 213 rigid pattern, unless otherwise indicated, for steel-pipe dimensions. Include ferrous housing sections, EPDM-rubber gasket, and bolts and nuts.

2.3 SPRINKLER PIPING SPECIALTIES

- A. Branch Outlet Fittings:
1. Standard: UL 213.
 2. Pressure Rating: 175-psig minimum.
 3. Body Material: Ductile-iron housing with EPDM seals and bolts and nuts.
 4. Type: Mechanical-tee and -cross fittings.
 5. Configurations: Snap-on and strapless, ductile-iron housing with branch outlets.
 6. Size: Of dimension to fit onto sprinkler main and with outlet connections as required to match connected branch piping.
 7. Branch Outlets: Grooved, plain-end pipe, or threaded.
- B. Adjustable Drop Nipples:
1. Standard: UL 1474.

2. Pressure Rating: 250-psig minimum.
3. Body Material: Steel pipe with EPDM-rubber O-ring seals.
4. Size: Same as connected piping.
5. Length: Adjustable.
6. Inlet and Outlet: Threaded.

2.4 SPRINKLERS

- A. Listed in UL's "Fire Protection Equipment Directory" or FM Global's "Approval Guide."
- B. Pressure Rating for Automatic Sprinklers: 175-psig minimum.
- C. Automatic Sprinklers with Heat-Responsive Element:
 1. Nonresidential Applications: UL 199.
 2. Residential Applications: UL 1626.
 3. Characteristics: Nominal 1/2-inch orifice with Discharge Coefficient K of 5.6, and for "Ordinary" temperature classification rating unless otherwise indicated or required by application.
- D. Sprinkler Finishes: Chrome plated, bronze, and painted. Refer to sprinkler schedule.
- E. Special Coatings: corrosion-resistant paint. Refer to sprinkler schedule.
- F. Sprinkler Escutcheons: Materials, types, and finishes for the following sprinkler mounting applications. Escutcheons for concealed, flush, and recessed-type sprinklers are specified with sprinklers.
 1. Ceiling Mounting: Chrome-plated steel, one piece, flat or Plastic, white finish, one piece, flat.
- G. Sprinkler Guards:
 1. Standard: UL 199.
 2. Type: Wire cage with fastening device for attaching to sprinkler.

2.5 HANGERS AND SUPPORTS

- A. Hangers and supports for fire suppression piping shall be UL listed or FM approved and installed in accordance with NFPA 13.
- B. Components of hanger assemblies that directly attach to the pipe or to the building structure shall be listed unless the following requirements are met:
 1. Mild steel hanger rods and hangers formed from mild steel rods shall be permitted to be not listed.
 2. Fasteners in concrete, steel, or, wood in accordance with NFPA 13.
- C. Use carbon-steel pipe hangers and supports for general service applications.

PART 3 - EXECUTION

3.1 PIPING INSTALLATION

- A. Locations and Arrangements: Drawing plans, schematics, and diagrams indicate general location and arrangement of piping. Install piping as indicated on approved working plans.
 - 1. Deviations from approved working plans for piping require written approval from authorities having jurisdiction. File written approval with Architect before deviating from approved working plans.
 - 2. Coordinate layout and installation of sprinklers with other construction that penetrates ceilings, including light fixtures, HVAC equipment, and partition assemblies.
- B. Piping Standard: Comply with NFPA 13 requirements for installation of sprinkler piping.
- C. Install seismic restraints on piping. Comply with NFPA 13 requirements for seismic-restraint device materials and installation.
- D. Use listed fittings to make changes in direction, branch takeoffs from mains, and reductions in pipe sizes.
- E. Install unions adjacent to each valve in pipes NPS 2 and smaller.
- F. Install sprinkler piping with drains for complete system drainage. Where low points cannot be avoided, auxiliary drains shall be provided in accordance with NFPA 13.
- G. Install hangers and supports for sprinkler system piping according to NFPA 13. Comply with requirements for hanger materials in NFPA 13.
- H. Fill sprinkler system piping with water.
- I. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Section 210517 "Sleeves and Sleeve Seals for Fire-Suppression Piping."
- J. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Section 210518 "Escutcheons for Fire-Suppression Piping."

3.2 JOINT CONSTRUCTION

- A. Install couplings, flanges, flanged fittings, unions, nipples, and transition and special fittings that have finish and pressure ratings same as or higher than system's pressure rating for aboveground applications unless otherwise indicated.
- B. Install unions adjacent to each valve in pipes NPS 2 and smaller.
- C. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
- D. Remove scale, slag, dirt, and debris from inside and outside of pipes, tubes, and fittings before assembly.

- E. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:
 - 1. Apply appropriate tape or thread compound to external pipe threads.
 - 2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged.

3.3 SPRINKLER INSTALLATION

- A. Install sprinklers in suspended ceilings in center of narrow dimension of acoustical ceiling panels.

3.4 IDENTIFICATION

- A. Install labeling and pipe markers on equipment and piping according to requirements in NFPA 13.
- B. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

3.5 FIELD QUALITY CONTROL

- A. Perform the following tests and inspections:
 - 1. Where modifications affect less than 20 sprinklers, the new portion may be tested at system working pressure and shall maintain that pressure without loss for 2 hours. Repair leaks and retest until no leaks exist.
 - 2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
 - 3. Flush, test, and inspect sprinkler systems according to NFPA 13, "Systems Acceptance" Chapter.
 - 4. Main drain valve test shall be performed, and the resulting static and residual pressure recorded in accordance with NFPA 13.
 - 5. Energize circuits to electrical equipment and devices.
 - 6. Coordinate with fire-alarm tests. Operate as required.
 - 7. Coordinate with fire-pump tests. Operate as required.
 - 8. Verify that equipment hose threads are same as local fire department equipment.
- B. Sprinkler piping system will be considered defective if it does not pass tests and inspections.
- C. Prepare test and inspection reports.

3.6 CLEANING

- A. Clean dirt and debris from sprinklers.
- B. Only sprinklers with their original factory finish are acceptable. Remove and replace any sprinklers that are painted or have any other finish than their original factory finish.

3.7 DEMONSTRATION

- A. Train Owner's maintenance personnel to adjust, operate, and maintain installed sprinkler system.

3.8 PIPING SCHEDULE

- A. Sprinkler specialty fittings may be used, downstream of control valves, instead of specified fittings.
- B. Standard-pressure, wet-pipe sprinkler system, NPS 2 and smaller, shall be one of the following:
 - 1. Standard-weight, black-steel pipe with threaded ends; uncoated, gray-iron threaded fittings; and threaded joints.
 - 2. Standard-weight, black-steel pipe with roll-grooved ends; uncoated, grooved-end fittings for steel piping; grooved-end-pipe couplings for steel piping; and grooved joints.
 - 3. Standard-weight, black-steel pipe with plain ends; steel welding fittings; and welded joints.

3.9 SPRINKLER SCHEDULE

- A. Use sprinkler types in subparagraphs below for the following applications:
 - 1. Match existing sprinkler type and rating.
 - 2. Rooms without Ceilings: Upright sprinklers.
 - 3. Rooms with Suspended Ceilings: Recessed sprinklers.
- B. Provide sprinkler types in subparagraphs below with finishes indicated.
 - 1. Match existing sprinkler type and finish

END OF SECTION

SECTION 220517 - SLEEVES FOR PLUMBING PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Sleeves.
 - 2. Grout.
 - 3. Silicone sealants.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.

1.4 INFORMATIONAL SUBMITTALS

- A. Field quality-control reports.

PART 2 - PRODUCTS

2.1 SLEEVES

- A. Cast-Iron Pipe Sleeves: Cast or fabricated of cast or ductile iron and equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop.
- B. PVC Pipe Sleeves: ASTM D 1785, Schedule 40.

2.2 GROUT

- A. Description: Nonshrink, for interior and exterior sealing openings in non-fire-rated walls or floors.
- B. Standard: ASTM C 1107/C 1107M, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.

- C. Design Mix: 5000-psi, 28-day compressive strength.
- D. Packaging: Premixed and factory packaged.

2.3 SILICONE SEALANTS

- A. Silicone, S, NS, 25, NT: Single-component, nonsag, plus 25 percent and minus 25 percent movement capability, nontraffic-use, neutral-curing silicone joint sealant, ASTM C 920, Type S, Grade NS, Class 25, Use NT.
- B. Silicone, S, P, 25, T, NT: Single-component, pourable, plus 25 percent and minus 25 percent movement capability, traffic- and nontraffic-use, neutral-curing silicone joint sealant; ASTM C 920, Type S, Grade P, Class 25, Uses T and NT. Grade P Pourable (self-leveling) formulation is for opening in floors and other horizontal surfaces that are not fire rated.
- C. Silicone Foam: Multicomponent, silicone-based liquid elastomers that, when mixed, expand and cure in place to produce a flexible, nonshrinking foam.

PART 3 - EXECUTION

3.1 SLEEVE INSTALLATION

- A. Install sleeves for piping passing through penetrations in floors, partitions, and walls.
- B. Install sleeves for pipes passing through interior partitions.
 - 1. Cut sleeves to length for mounting flush with both surfaces.
 - 2. Install sleeves that are large enough to provide 1/4-inch annular clear space between sleeve and pipe or pipe insulation.
 - 3. Seal annular space between sleeve and piping or piping insulation; use joint sealants appropriate for size, depth, and location of joint.
- C. Fire-Resistance-Rated Penetrations, Horizontal Assembly Penetrations, and Smoke Barrier Penetrations: Maintain indicated fire or smoke rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with fire- and smoke-stop materials. Comply with requirements for firestopping and fill materials specified in Section 078413 "Penetration Firestopping."

3.2 FIELD QUALITY CONTROL

- A. Perform the following tests and inspections:
 - 1. Leak Test: After allowing for a full cure, test sleeves and sleeve seals for leaks. Repair leaks and retest until no leaks exist.
- B. Sleeves and sleeve seals will be considered defective if they do not pass tests and inspections.

- C. Prepare test and inspection reports.

3.3 SLEEVE AND SLEEVE-SEAL SCHEDULE

- A. Use sleeves for the following piping-penetration applications:

1. Exterior Concrete Walls below Grade:
 - a. Piping Smaller Than NPS 6: Cast-iron pipe sleeves.
 - 1) Select sleeve size to allow for 1-inch annular clear space between piping and sleeve for installing sleeve-seal system.
2. Concrete Slabs-on-Grade:
 - a. Piping NPS 6 or smaller: Cast-iron pipe sleeves.
 - 1) Select sleeve size to allow for 1-inch annular clear space between piping and sleeve for installing sleeve-seal system.
3. Concrete Slabs above Grade:
 - a. Piping Smaller Than NPS 6: PVC pipe sleeves.
4. Interior Partitions:
 - a. Piping Smaller Than NPS 6: Steel pipe sleeves or PVC pipe sleeves.

END OF SECTION

SECTION 220518 – ESCUTCHEONS FOR PLUMBING PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Escutcheons.

1.3 DEFINITIONS

- A. Existing Piping to Remain: Existing piping that is not to be removed and that is not otherwise indicated to be removed and salvaged, or removed and reinstalled.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. BrassCraft Manufacturing Co.; a Masco company.
 - 2. Dearborn Brass.
 - 3. Jones Stephens Corp.
 - 4. Mid-America Fittings, Inc.
 - 5. ProFlo; a Ferguson Enterprises, Inc. brand.

2.2 ESCUTCHEONS

- A. One-Piece, Steel Type: With polished, chrome-plated finish and setscrew fastener.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install escutcheons for piping penetrations of walls, ceilings, and finished floors.
- B. Install escutcheons with ID to closely fit around pipe, tube, and insulation of insulated piping and with OD that completely covers opening.
 - 1. Escutcheons for New Piping and Relocated Existing Piping:
 - a. Chrome-Plated Piping: One-piece steel with polished, chrome-plated finish.

Purchase College
State University of New York
735 Anderson Hill Road, Purchase, NY 10577

Academic Restrooms Renovation Project
#SU-050522

- b. Insulated Piping: One-piece steel with polished, chrome-plated finish.

3.2 FIELD QUALITY CONTROL

- A. Using new materials, replace broken and damaged escutcheons and floor plates.

END OF SECTION

SECTION 220523.12 – BALL VALVES FOR PLUMBING PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Bronze ball valves.

1.3 DEFINITIONS

- A. CWP: Cold working pressure.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of valve.
 - 1. Certification that products comply with NSF 61 and NSF 372.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Prepare valves for shipping as follows:
 - 1. Protect internal parts against rust and corrosion.
 - 2. Protect threads, flange faces, and soldered ends.
 - 3. Set ball valves open to minimize exposure of functional surfaces.
- B. Use the following precautions during storage:
 - 1. Maintain valve end protection.
 - 2. Store valves indoors and maintain at higher-than-ambient-dew-point temperature. If outdoor storage is necessary, store valves off the ground in watertight enclosures.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS FOR VALVES

- A. Source Limitations for Valves: Obtain each type of valve from single source from single manufacturer.
- B. ASME Compliance:
 - 1. ASME B1.20.1 for threads for threaded end valves.
 - 2. ASME B16.10 and ASME B16.34 for ferrous valve dimensions and design criteria.
 - 3. ASME B16.18 for solder-joint connections.
 - 4. ASME B31.9 for building services piping valves.

- C. NSF Compliance: NSF 61 and NSF 372 for valve materials for potable-water service.
- D. Bronze valves shall be made with dezincification-resistant materials. Bronze valves made with copper alloy (brass) containing more than 15 percent zinc are not permitted.
- E. Valve Pressure-Temperature Ratings: Not less than indicated and as required for system pressures and temperatures.
- F. Valve Sizes: Same as upstream piping unless otherwise indicated.
- G. Valve Actuator Types:
 - 1. Handlever: For quarter-turn valves smaller than NPS 4.
- H. Valves in Insulated Piping:
 - 1. Include 2-inch stem extensions.
 - 2. Extended operating handles of nonthermal-conductive material and protective sleeves that allow operation of valves without breaking vapor seals or disturbing insulation.
 - 3. Memory stops that are fully adjustable after insulation is applied.

2.2 BRONZE BALL VALVES

- A. Bronze Ball Valves, Two-Piece with Full Port and Stainless-Steel Trim:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Milwaukee Valve Company.
 - b. NIBCO INC.
 - c. WATTS.
 - 2. Description:
 - a. Standard: MSS SP-110 or MSS-145.
 - b. CWP Rating: 600 psig.
 - c. Body Design: Two piece.
 - d. Body Material: Bronze.
 - e. Ends: Threaded or soldered.
 - f. Seats: PTFE.
 - g. Stem: Stainless steel.
 - h. Ball: Stainless steel, vented.
 - i. Port: Full.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine valve interior for cleanliness, freedom from foreign matter, and corrosion. Remove special packing materials, such as blocks, used to prevent disc movement during shipping and handling.
- B. Operate valves in positions from fully open to fully closed. Examine guides and seats made accessible by such operations.

- C. Examine threads on valve and mating pipe for form and cleanliness.
- D. Examine mating flange faces for conditions that might cause leakage. Check bolting for proper size, length, and material. Verify that gasket is of proper size, that its material composition is suitable for service, and that it is free from defects and damage.
- E. Do not attempt to repair defective valves; replace with new valves.

3.2 VALVE INSTALLATION

- A. Locate valves for easy access and provide separate support where necessary.
- B. Install valves in horizontal piping with stem at or above center of pipe.
- C. Install valves in position to allow full stem movement.

3.3 GENERAL REQUIREMENTS FOR VALVE APPLICATIONS

- A. If valves with specified CWP ratings are unavailable, the same types of valves with higher CWP ratings may be substituted.
- B. Select valves with the following end connections:
 - 1. For Copper Tubing, NPS 2 and Smaller: Threaded ends.

3.4 DOMESTIC HOT- AND COLD-WATER VALVE SCHEDULE

- A. Pipe NPS 2 and Smaller:
 - 1. Bronze ball valves, two-piece and stainless steel trim. Provide with threaded-joint ends.

END OF SECTION

SECTION 220529 – HANGERS AND SUPPORTS FOR PLUMBING PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Metal pipe hangers and supports.
 - 2. Thermal hanger-shield inserts.
 - 3. Pipe-positioning systems.

1.3 ACTION SUBMITTALS

- 1. Product data for all products included in this section

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Structural Performance: Hangers and supports for plumbing piping and equipment shall withstand the effects of gravity loads and stresses within limits and under conditions indicated according to ASCE/SEI 7.
 - 1. Design supports for multiple pipes, including pipe stands, capable of supporting combined weight of supported systems, system contents, and test water.
 - 2. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.

2.2 METAL PIPE HANGERS AND SUPPORTS

- A. Carbon-Steel Pipe Hangers and Supports:
 - 1. Description: MSS SP-58, Types 1 through 58, factory-fabricated components.
 - 2. Galvanized Metallic Coatings: Pregalvanized, hot-dip galvanized, or electro-galvanized.
 - 3. Nonmetallic Coatings: Plastic coated or epoxy powder coated.
 - 4. Hanger Rods: Continuous-thread rod, nuts, and washer made of carbon steel.

2.3 MATERIALS

- A. Aluminum: ASTM B 221.
- B. Carbon Steel: ASTM A 1011/A 1011M.
- C. Stainless Steel: ASTM A 240/A 240M.

PART 3 - EXECUTION

3.1 APPLICATION

- A. Comply with requirements in Section 078413 "Penetration Firestopping" for firestopping materials and installation, for penetrations through fire-rated walls, ceilings, and assemblies.
- B. Strength of Support Assemblies: Where not indicated, select sizes of components, so strength will be adequate to carry present and future static loads within specified loading limits. Minimum static design load used for strength determination shall be weight of supported components plus 200 lb.

3.2 HANGER AND SUPPORT INSTALLATION

- A. Metal Pipe-Hanger Installation: Comply with MSS SP-58. Install hangers, supports, clamps, and attachments as required to properly support piping from building structure.
- B. Install hangers and supports complete with necessary attachments, inserts, bolts, rods, nuts, washers, and other accessories.
- C. 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.
- D. Install lateral bracing with pipe hangers and supports to prevent swaying.
- E. Install building attachments within concrete slabs or attach to structural steel. Install additional attachments at concentrated loads, including valves, flanges, and strainers, NPS 2-1/2 and larger and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten inserts to forms, and install reinforcing bars through openings at top of inserts.
- F. Load Distribution: Install hangers and supports, so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.
- G. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and to not exceed maximum pipe deflections allowed by ASME B31.9 for building services piping.
- H. Insulated Piping:
 - 1. Attach clamps and spacers to piping.
 - a. Piping Operating Above Ambient Air Temperature: Clamp may project through insulation.
 - b. Piping Operating Below Ambient Air Temperature: Use thermal hanger-shield insert with clamp sized to match OD of insert.
 - c. Do not exceed pipe stress limits allowed by ASME B31.9 for building services piping.
 - 2. Install MSS SP-58, Type 39 protection saddles if insulation without vapor barrier is indicated. Fill interior voids with insulation that matches adjoining insulation.
 - a. Option: Thermal hanger-shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 and larger if pipe is installed on rollers.

3. Install MSS SP-58, Type 40 protective shields on cold piping with vapor barrier. Shields shall span an arc of 180 degrees.
 - a. Option: Thermal hanger-shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 and larger if pipe is installed on rollers.
4. Shield Dimensions for Pipe: Not less than the following:
 - a. NPS 1/4 to NPS 3-1/2: 12 inches long and 0.048 inch thick.

3.3 ADJUSTING

- A. Hanger Adjustments: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.
- B. Trim excess length of continuous-thread hanger and support rods to 1-1/2 inches.

3.4 PAINTING

- A. Touchup: Clean field welds and abraded, shop-painted areas. Paint exposed areas immediately after erecting hangers and supports. Use same materials as those used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.
 1. Apply paint by brush or spray to provide a minimum dry film thickness of 2.0 mils.
- B. Touchup: Cleaning and touchup painting of field welds, bolted connections, and abraded, shop-painted areas on miscellaneous metal are specified in Div. 09 specifications.
- C. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas, and apply galvanizing-repair paint to comply with ASTM A 780/A 780M.

3.5 HANGER AND SUPPORT SCHEDULE

- A. Specific hanger and support requirements are in Sections specifying piping systems and equipment.
- B. Comply with MSS SP-58 for pipe-hanger selections and applications that are not specified in piping system Sections.
- C. Use nonmetallic coatings on attachments for electrolytic protection where attachments are in direct contact with copper tubing.
- D. Use carbon-steel pipe hangers and supports and attachments for general service applications.
- E. Horizontal-Piping Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
 1. Adjustable, Steel Clevis Hangers (MSS Type 1): For suspension of noninsulated or insulated, stationary pipes NPS 1/2 to NPS 30.
- F. Vertical-Piping Clamps: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Extension Pipe or Riser Clamps (MSS Type 8): For support of pipe risers NPS 3/4 to NPS 24.
- G. Hanger-Rod Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
 1. Steel Clevises (MSS Type 14): For 120 to 450 deg F piping installations.
- H. Building Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
 1. Steel or Malleable-Concrete Inserts (MSS Type 18): For upper attachment to suspend pipe hangers from concrete ceiling.
 2. Top-Beam C-Clamps (MSS Type 19): For use under roof installations with bar-joint construction, to attach to top flange of structural shape.
 3. Side-Beam or Channel Clamps (MSS Type 20): For attaching to bottom flange of beams, channels, or angles.
- I. Saddles and Shields: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
 1. Steel-Pipe-Covering Protection Saddles (MSS Type 39): To fill interior voids with insulation that matches adjoining insulation.
 2. Protection Shields (MSS Type 40): Of length recommended in writing by manufacturer to prevent crushing insulation.
 3. Thermal Hanger-Shield Inserts: For supporting insulated pipe.

END OF SECTION

SECTION 220553 – IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Pipe labels.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Equipment Label Schedule: Include a listing of all equipment to be labeled with the proposed content for each label.
- C. Valve numbering scheme.
- D. Valve Schedules: For each piping system to include in maintenance manuals.

PART 2 - PRODUCTS

2.1 PIPE LABELS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Brady Corporation.
 - 2. Champion America.
 - 3. Craftmark Pipe Markers.
- B. General Requirements for Manufactured Pipe Labels: Preprinted, color-coded, with lettering indicating service, and showing flow direction.
- C. Self-Adhesive Pipe Labels: Printed plastic with contact-type, permanent-adhesive backing.
- D. Pipe Label Contents: Include identification of piping service using same designations or abbreviations as used on Drawings; also include pipe size and an arrow indicating flow direction.
 - 1. Flow-Direction Arrows: Integral with piping-system service lettering to accommodate both directions or as separate unit on each pipe label to indicate flow direction.
 - 2. Lettering Size: Size letters according to ASME A13.1 for piping or at least 1/2 inch for viewing distances up to 72 inches and proportionately larger lettering for greater viewing distances.

2.2 VALVE TAGS

- 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. Brady Corporation.
 - 2. Carlton Industries, LP.
 - 3. Champion America.
 - 4. Marking Services Inc.
- B. Valve Schedules: For each piping system, on 8-1/2-by-11-inch bond paper. Tabulate valve number, piping system, system abbreviation (as shown on valve tag), location of valve (room or space), normal-operating position (open, closed, or modulating), and variations for identification. Mark valves for emergency shutoff and similar special uses.
 - 1. Valve-tag schedule shall be included in operation and maintenance data.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Clean piping and equipment surfaces of substances that could impair bond of identification devices, including dirt, oil, grease, release agents, and incompatible primers, paints, and encapsulants.

3.2 GENERAL INSTALLATION REQUIREMENTS

- A. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.
- B. Coordinate installation of identifying devices with locations of access panels and doors.
- C. Install identifying devices before installing acoustical ceilings and similar concealment.

3.3 EQUIPMENT LABEL INSTALLATION

- A. Install or permanently fasten labels on each major item of mechanical equipment.
- B. Locate equipment labels where accessible and visible.

3.4 PIPE LABEL INSTALLATION

- A. Piping Color Coding: Painting of piping is specified in Div. 09 specifications.
- B. Pipe Label Locations: Locate pipe labels where piping is exposed or above accessible ceilings in finished spaces; machine rooms; accessible maintenance spaces such as shafts, tunnels, and plenums; and exterior exposed locations as follows:
 - 1. Near each valve and control device.
 - 2. Near each branch connection, excluding short takeoffs for fixtures and terminal units. Where flow pattern is not obvious, mark each pipe at branch.
 - 3. Near penetrations through walls, floors, ceilings, and inaccessible enclosures.
 - 4. At access doors, manholes, and similar access points that permit view of concealed piping.

5. Near major equipment items and other points of origination and termination.
 6. Spaced at maximum intervals of 50 feet along each run. Reduce intervals to 25 feet in areas of congested piping and equipment.
 7. On piping above removable acoustical ceilings. Omit intermediately spaced labels.
- C. Directional Flow Arrows: Arrows shall be used to indicate direction of flow in pipes, including pipes where flow is allowed in both directions.
- D. Pipe Label Color Schedule:
1. Domestic Water Piping
 - a. Background: Safety green.
 - b. Letter Colors: White.
 2. Sanitary Waste Piping:
 - a. Background Color: Safety black.
 - b. Letter Color: White.

END OF SECTION

SECTION 220719 PLUMBING PIPING INSULATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes insulating the following plumbing piping services:

- 1. Domestic cold-water piping.
- 2. Domestic hot-water piping.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated. Include thermal conductivity, water-vapor permeance thickness, and jackets (both factory- and field-applied, if any).
- B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.
 - 1. Detail application of protective shields, saddles, and inserts at hangers for each type of insulation and hanger.
 - 2. Detail insulation application at elbows, fittings, flanges, valves, and specialties for each type of insulation.
 - 3. Detail application of field-applied jackets.
 - 4. Detail application at linkages of control devices.

1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For qualified Installer.
- B. Material Test Reports: From a qualified testing agency acceptable to authorities having jurisdiction indicating, interpreting, and certifying test results for compliance of insulation materials, sealers, attachments, cements, and jackets, with requirements indicated. Include dates of tests and test methods employed.
- C. Field quality-control reports.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: Skilled mechanics who have successfully completed an apprenticeship program or another craft training program certified by the Department of Labor, Bureau of Apprenticeship and Training.
- B. Surface-Burning Characteristics: For insulation and related materials, as determined by testing identical products according to ASTM E 84 by a testing agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers, with appropriate markings of applicable testing agency.

1. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Packaging: Insulation material containers shall be marked by manufacturer with appropriate ASTM standard designation, type and grade, and maximum use temperature.

1.7 COORDINATION

- A. Coordinate sizes and locations of supports, hangers, and insulation shields specified in Section 220529 "Hangers and Supports for Plumbing Piping and Equipment."
- B. Coordinate clearance requirements with piping Installer for piping insulation application. Before preparing piping Shop Drawings, establish and maintain clearance requirements for installation of insulation and field-applied jackets and finishes and for space required for maintenance.

1.8 SCHEDULING

- A. Schedule insulation application after pressure testing systems and, where required, after installing and testing heat tracing. Insulation application may begin on segments that have satisfactory test results.
- B. Complete installation and concealment of plastic materials as rapidly as possible in each area of construction.

PART 2 - PRODUCTS

2.1 INSULATION MATERIALS

- A. Comply with requirements in "Piping Insulation Schedule, General," and "Indoor Piping Insulation Schedule," articles for where insulating materials shall be applied.
- B. Products shall not contain asbestos, lead, mercury, or mercury compounds.
- C. Mineral-Fiber, Preformed Pipe Insulation:
 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Fibrex Insulations Inc.; Coreplus 1200.
 - b. Johns Manville; Micro-Lok.
 - c. Knauf Insulation; 1000-Degree Pipe Insulation.
 1. Type I, 850 Deg F Materials: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 547, Type I, Grade A, with factory-applied ASJ. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.
 2. Thermal Conductivity $K = 0.21 \text{ BTU-in/h-ft}^2\text{-}^\circ\text{F}$ at 75°F or lower.

2.2 ADHESIVES

- A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated, unless otherwise indicated.
- B. Mineral-Fiber Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Childers Brand; H. B. Fuller Construction Products.
 - b. Foster Brand; H. B. Fuller Construction Products.

2.3 MASTICS

- A. Vapor-Barrier Mastic: Water based; suitable for indoor use on below-ambient services.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Childers Brand; H. B. Fuller Construction Products.
 - b. Foster Brand; H. B. Fuller Construction Products.
 - c. Knauf Insulation.
2. Water-Vapor Permeance: ASTM E 96/E 96M, Procedure B, 0.013 perm at 43-mil dry film thickness.
3. Service Temperature Range: Minus 20 to plus 180 deg F.
4. Solids Content: ASTM D 1644, 58 percent by volume and 70 percent by weight.
5. Color: White.

2.4 FACTORY-APPLIED JACKETS

- A. Insulation system schedules indicate factory-applied jackets on various applications. When factory-applied jackets are indicated, comply with the following:
1. ASJ: White, kraft-paper, fiberglass-reinforced scrim with aluminum-foil backing; complying with ASTM C 1136, Type I.

2.5 TAPES

- A. ASJ Tape: White vapor-retarder tape matching factory-applied jacket with acrylic adhesive, complying with ASTM C 1136.
1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. ABI, Ideal Tape Division; 428 AWF ASJ.
 - b. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0836.
 - c. Compac Corporation; 104 and 105.
 2. Width: 3 inches.
 3. Thickness: 11.5 mils.
 4. Adhesion: 90 ounces force/inch in width.
 5. Elongation: 2 percent.
 6. Tensile Strength: 40 lbf/inch in width.
 7. ASJ Tape Disks and Squares: Precut disks or squares of ASJ tape.

2.6 SECUREMENTS

- A. Wire: 0.080-inch nickel-copper alloy.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions for compliance with requirements for installation tolerances and other conditions affecting performance of insulation application.
 - 1. Verify that systems to be insulated have been tested and are free of defects.
 - 2. Verify that surfaces to be insulated are clean and dry.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.
- B. Mix insulating cements with clean potable water; if insulating cements are to be in contact with stainless-steel surfaces, use demineralized water.

3.3 GENERAL INSTALLATION REQUIREMENTS

- A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of piping including fittings, valves, and specialties.
- B. Install insulation materials, forms, vapor barriers or retarders, jackets, and thicknesses required for each item of pipe system as specified in insulation system schedules.
- C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.
- D. Install insulation with longitudinal seams at top and bottom of horizontal runs.
- E. Install multiple layers of insulation with longitudinal and end seams staggered.
- F. Do not weld brackets, clips, or other attachment devices to piping, fittings, and specialties.
- G. Keep insulation materials dry during application and finishing.
- H. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.
- I. Install insulation with least number of joints practical.
- J. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.
 - 1. Install insulation continuously through hangers and around anchor attachments.
 - 2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends at attachment to structure with vapor-barrier mastic.

3. Install insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.
 4. Cover inserts with jacket material matching adjacent pipe insulation. Install shields over jacket, arranged to protect jacket from tear or puncture by hanger, support, and shield.
- K. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.
- L. Install insulation with factory-applied jackets as follows:
1. Draw jacket tight and smooth.
 2. Cover circumferential joints with 3-inch-wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip, spaced 4 inches o.c.
 3. Overlap jacket longitudinal seams at least 1-1/2 inches. Install insulation with longitudinal seams at bottom of pipe. Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at 2 inches o.c.
 - a. For below-ambient services, apply vapor-barrier mastic over staples.
 4. Cover joints and seams with tape, according to insulation material manufacturer's written instructions, to maintain vapor seal.
 5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to pipe flanges and fittings.
- M. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.
- N. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.
- O. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.
- P. For above-ambient services, do not install insulation to the following:
1. Vibration-control devices.
 2. Testing agency labels and stamps.
 3. Nameplates and data plates.
 4. Cleanouts.

3.4 PENETRATIONS

- A. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.
- B. Insulation Installation at Fire-Rated Wall and Partition Penetrations: Install insulation continuously through penetrations of fire-rated walls and partitions.
1. Comply with requirements in Section 078413 "Penetration Firestopping" for firestopping and fire-resistive joint sealers.

3.5 GENERAL PIPE INSULATION INSTALLATION

- A. Requirements in this article generally apply to all insulation materials except where more specific requirements are specified in various pipe insulation material installation articles.
- B. Insulation Installation on Fittings, Valves, and Unions:
 - 1. Install insulation over fittings, valves, unions, and other specialties with continuous thermal and vapor-retarder integrity unless otherwise indicated.
 - 2. Insulate pipe elbows using preformed fitting insulation or mitered fittings made from same material and density as adjacent pipe insulation. Each piece shall be butted tightly against adjoining piece and bonded with adhesive. Fill joints, seams, voids, and irregular surfaces with insulating cement finished to a smooth, hard, and uniform contour that is uniform with adjoining pipe insulation.
 - 3. Insulate tee fittings with preformed fitting insulation or sectional pipe insulation of same material and thickness as used for adjacent pipe. Cut sectional pipe insulation to fit. Butt each section closely to the next and hold in place with tie wire. Bond pieces with adhesive.
 - 4. Insulate flanges and unions using a section of oversized preformed pipe insulation. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker.
 - 5. Label the outside insulation jacket of each union with the word "union." Match size and color of pipe labels.

3.6 INSTALLATION OF MINERAL-FIBER INSULATION

- A. Insulation Installation on Straight Pipes and Tubes:
 - 1. Secure each layer of preformed pipe insulation to pipe with wire or bands and tighten bands without deforming insulation materials.
 - 2. Where vapor barriers are indicated, seal longitudinal seams, end joints, and protrusions with vapor-barrier mastic and joint sealant.
 - 3. For insulation with factory-applied jackets on above-ambient surfaces, secure laps with outward clinched staples at 6 inches o.c.
 - 4. For insulation with factory-applied jackets on below-ambient surfaces, do not staple longitudinal tabs. Instead, secure tabs with additional adhesive as recommended by insulation material manufacturer and seal with vapor-barrier mastic and flashing sealant.
- B. Insulation Installation on Pipe Fittings and Elbows:
 - 1. Install preformed sections of same material as straight segments of pipe insulation when available.
 - 2. When preformed insulation elbows and fittings are not available, install mitered sections of pipe insulation, to a thickness equal to adjoining pipe insulation. Secure insulation materials with wire or bands.
- C. Insulation Installation on Valves and Pipe Specialties:
 - 1. Install preformed sections of same material as straight segments of pipe insulation when available.
 - 2. When preformed sections are not available, install mitered sections of pipe insulation to valve body.

3. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
4. Install insulation to flanges as specified for flange insulation application.

3.7 FIELD QUALITY CONTROL

- A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.
- B. Perform tests and inspections.
- C. All insulation applications will be considered defective Work if sample inspection reveals noncompliance with requirements.

3.8 PIPING INSULATION SCHEDULE, GENERAL

- A. Acceptable preformed pipe and tubular insulation materials and thicknesses are identified for each piping system and pipe size range. If more than one material is listed for a piping system, selection from materials listed is Contractor's option.
- B. Items Not Insulated: Unless otherwise indicated, do not install insulation on the following:
 1. Drainage piping.
 2. Chrome-plated pipes and fittings unless there is a potential for personnel injury.

3.9 INDOOR PIPING INSULATION SCHEDULE

- A. Domestic Cold Water:
 1. NPS 1 and Smaller: Insulation shall be one of the following:
 - a. Mineral-Fiber, Preformed Pipe Insulation, Type I with vapor barrier: 1/2 inch thick.
- B. Domestic Hot Water:
 1. NPS 1-1/4 and Smaller: Insulation shall be one of the following:
 - a. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch thick.

END OF SECTION

SECTION 221116 – DOMESTIC WATER PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Copper tube and fittings.
 - 2. Piping joining materials.
 - 3. Transition fittings.

1.3 ACTION SUBMITTALS

- A. Product Data: For transition fittings.

1.4 INFORMATIONAL SUBMITTALS

- A. System purging and disinfecting activities report.
- B. Field quality-control reports.

1.5 FIELD CONDITIONS

- A. Interruption of Existing Water Service: Do not interrupt water service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary water service according to requirements indicated:
 - 1. Notify Architect / Construction Manager / Owner no fewer than two days in advance of proposed interruption of water service.
 - 2. Do not interrupt water service without Architect's / Construction Manager's / Owner's written permission.

PART 2 - PRODUCTS

2.1 PIPING MATERIALS

- A. Comply with requirements in "Piping Schedule" Article for applications of pipe, tube, fitting materials, and joining methods for specific services, service locations, and pipe sizes.
- B. Potable-water piping and components shall comply with NSF 14, NSF 61, and NSF 372. Include marking "NSF-pw" on piping.

2.2 COPPER TUBE AND FITTINGS

- A. Hard Copper Tube: ASTM B 88, Type L water tube, annealed temper.

B. Wrought-Copper, Solder-Joint Fittings: ASME B16.22, wrought-copper pressure fittings.

C. Copper Unions:

1. MSS SP-123.
2. Cast-copper-alloy, hexagonal-stock body.
3. Ball-and-socket, metal-to-metal seating surfaces.
4. Solder-joint ends.

2.3 PIPING JOINING MATERIALS

A. Solder Filler Metals: ASTM B 32, lead-free alloys.

B. Flux: ASTM B 813, water flushable.

2.4 TRANSITION FITTINGS

A. General Requirements:

1. Same size as pipes to be joined.
2. Pressure rating at least equal to pipes to be joined.
3. End connections compatible with pipes to be joined.

B. Fitting-Type Transition Couplings: Manufactured piping coupling or specified piping system fitting.

PART 3 - EXECUTION

3.1 PIPING INSTALLATION

- A. Drawing plans, schematics, and diagrams indicate general location and arrangement of domestic water piping. Indicated locations and arrangements are used to size pipe and calculate friction loss, expansion, and other design considerations. Install piping as indicated unless deviations to layout are approved on coordination drawings.
- B. Install domestic water piping level without pitch and plumb.
- C. Install piping concealed from view and protected from physical contact by building occupants unless otherwise indicated and except in equipment rooms and service areas.
- D. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
- E. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal, and coordinate with other services occupying that space.
- F. Install piping to permit valve servicing.
- G. Install nipples, unions, special fittings, and valves with pressure ratings the same as or higher than the system pressure rating used in applications below unless otherwise indicated.
- H. Install piping free of sags and bends.

- I. Install fittings for changes in direction and branch connections.
- J. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Section 220518 "Escutcheons for Plumbing Piping."

3.2 JOINT CONSTRUCTION

- A. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
- B. Remove scale, slag, dirt, and debris from inside and outside of pipes, tubes, and fittings before assembly.
- C. Soldered Joints for Copper Tubing: Apply ASTM B 813, water-flushable flux to end of tube. Join copper tube and fittings according to ASTM B 828 or CDA's "Copper Tube Handbook."

3.3 TRANSITION FITTING INSTALLATION

- A. Install transition couplings at joints of dissimilar piping.

3.4 HANGER AND SUPPORT INSTALLATION

- A. Comply with requirements for pipe hanger, support products, and installation in Section 220529 "Hangers and Supports for Plumbing Piping and Equipment."

3.5 CONNECTIONS

- A. Drawings indicate general arrangement of piping, fittings, and specialties.

3.6 IDENTIFICATION

- A. Identify system components. Comply with requirements for identification materials and installation in Section 220553 "Identification for Plumbing Piping and Equipment."
- B. Label pressure piping with system operating pressure.

3.7 FIELD QUALITY CONTROL

- A. Perform the following tests and inspections:
 - 1. Piping Inspections:
 - a. Do not enclose, cover, or put piping into operation until it has been inspected and approved by authorities having jurisdiction.
 - b. During installation, notify authorities having jurisdiction at least one day before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction:
 - 1) Roughing-in Inspection: Arrange for inspection of piping before concealing or closing in after roughing in and before setting fixtures.
 - 2) Final Inspection: Arrange for authorities having jurisdiction to observe tests specified in "Piping Tests" Subparagraph below and to ensure compliance with requirements.

- c. Reinspection: If authorities having jurisdiction find that piping will not pass tests or inspections, make required corrections and arrange for reinspection.
- d. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.

2. Piping Tests:

- a. Fill domestic water piping. Check components to determine that they are not air bound and that piping is full of water.
- b. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit a separate report for each test, complete with diagram of portion of piping tested.
- c. Leave new, altered, extended, or replaced domestic water piping uncovered and unconcealed until it has been tested and approved. Expose work that was covered or concealed before it was tested.
- d. Cap and subject piping to static water pressure of 50 psig above operating pressure, without exceeding pressure rating of piping system materials. Isolate test source and allow it to stand for four hours. Leaks and loss in test pressure constitute defects that must be repaired.
- e. Repair leaks and defects with new materials, and retest piping or portion thereof until satisfactory results are obtained.
- f. Prepare reports for tests and for corrective action required.

B. Domestic water piping will be considered defective if it does not pass tests and inspections.

C. Prepare test and inspection reports.

3.8 ADJUSTING

A. Perform the following adjustments before operation:

- 1. Open shutoff valves to fully open position.
- 2. Remove plugs used during testing of piping and for temporary sealing of piping during installation.

3.9 CLEANING

A. Clean and disinfect potable domestic water piping as follows:

- 1. Purge new piping and parts of existing piping that have been altered, extended, or repaired before using.
- 2. Use purging and disinfecting procedures prescribed by authorities having jurisdiction; if methods are not prescribed, use procedures described in either AWWA C651 or AWWA C652 or follow procedures described below:
 - a. Flush piping system with clean, potable water until dirty water does not appear at outlets.
 - b. Fill and isolate system according to either of the following:
 - 1) Fill system or part thereof with water/chlorine solution with at least 50 ppm of chlorine. Isolate with valves and allow to stand for 24 hours.
 - 2) Fill system or part thereof with water/chlorine solution with at least 200 ppm of chlorine. Isolate and allow to stand for three hours.

- c. Flush system with clean, potable water until no chlorine is in water coming from system after the standing time.
 - d. Repeat procedures if biological examination shows contamination.
 - e. Submit water samples in sterile bottles to authorities having jurisdiction.
- B. Prepare and submit reports of purging and disinfecting activities. Include copies of water-sample approvals from authorities having jurisdiction.
- C. Clean interior of domestic water piping system. Remove dirt and debris as work progresses.

3.10 PIPING SCHEDULE

- A. Transition and special fittings with pressure ratings at least equal to piping rating may be used in applications below unless otherwise indicated.
- B. Aboveground domestic water piping, NPS 2 and smaller, shall be the following:
 - 1. Hard copper tube, ASTM B 88, Type L; wrought-copper, solder-joint fittings; and soldered joints.

3.11 VALVE SCHEDULE

- A. Drawings indicate valve types to be used. Where specific valve types are not indicated, the following requirements apply:
 - 1. Shutoff Duty: Use ball valves for piping NPS 2 and smaller.

END OF SECTION

SECTION 221119 – DOMESTIC WATER PIPING SPECIALTIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Temperature-actuated, water mixing valves.
- B. Related Requirements:
 - 1. Section 221116 "Domestic Water Piping"

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: For domestic water piping specialties.

1.4 INFORMATIONAL SUBMITTALS

- A. Field quality-control reports.

1.5 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For domestic water piping specialties to include in emergency, operation, and maintenance manuals.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS FOR PIPING SPECIALTIES

- A. Potable-water piping and components shall comply with NSF 61 and NSF 14. Mark "NSF-pw" on plastic piping components.
- B. Comply with NSF 372 for low lead.

2.2 PERFORMANCE REQUIREMENTS

- A. Minimum Working Pressure for Domestic Water Piping Specialties: 125 psig unless otherwise indicated.

2.3 TEMPERATURE-ACTUATED, WATER MIXING VALVES

- A. Individual-Fixture, Water Tempering Valves:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

- a. Acorn Engineering Company; a Division of Morris Group International.
 - b. Leonard Valve Company.
 - c. POWERS; A WATTS Brand.
 - d. Zurn Industries, LLC.
2. Standard: ASSE 1016, thermostatically controlled, water tempering valve.
 3. Pressure Rating: 125 psig minimum unless otherwise indicated.
 4. Body: Bronze body with corrosion-resistant interior components.
 5. Temperature Control: Adjustable.
 6. Inlets and Outlet: soldered union.
 7. Finish: Rough or chrome-plated bronze.
 8. Tempered-Water Setting: 105 deg F.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Temperature-Actuated, Water Mixing Valves: Install with shutoff valves on inlets and with shutoff valve on outlet.
 1. Install in existing relocated sink below sink cabinet space.

3.2 CONNECTIONS

- A. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. When installing piping specialties adjacent to equipment and machines, allow space for service and maintenance.
- C. Comply with requirements for grounding equipment in Section 260526 "Grounding and Bonding for Electrical Systems."

3.3 FIELD QUALITY CONTROL

- A. Perform the following tests and inspections:
 1. Verify temperature-actuated, water mixing valves meet specified temperature at hot water outlet.
- B. Domestic water piping specialties will be considered defective if they do not pass tests and inspections.
- C. Prepare test and inspection reports.

3.4 ADJUSTING

- A. Set field-adjustable temperature set points of temperature-actuated, water mixing valves.

END OF SECTION

SECTION 221316 - SANITARY WASTE AND VENT PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Hub-and-spigot, cast-iron soil pipe and fittings.
 - 2. Hubless, cast-iron soil pipe and fittings.
 - 3. Specialty pipe fittings.
 - 4. Encasement for underground metal piping.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: For hubless, single-stack drainage system. Include plans, elevations, sections, and details.

1.4 INFORMATIONAL SUBMITTALS

- A. Seismic Qualification Certificates: For waste and vent piping, accessories, and components, from manufacturer.
 - 1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
 - 2. Detailed description of piping anchorage devices on which the certification is based and their installation requirements.
- B. Field quality-control reports.

1.5 FIELD CONDITIONS

- A. Interruption of Existing Sanitary Waste Service: Do not interrupt service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary service according to requirements indicated:
 - 1. Notify Architect / Construction Manager / Owner no fewer than three days in advance of proposed interruption of sanitary waste service.

2. Do not proceed with interruption of sanitary waste service without Architect's / Construction Manager's / Owner's written permission.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Components and installation shall be capable of withstanding the following minimum working pressure unless otherwise indicated:
 1. Soil, Waste, and Vent Piping: 10-foot head of water.
- B. Seismic Performance: Soil, waste, and vent piping and support and installation shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.

2.2 PIPING MATERIALS

- A. Piping materials shall bear label, stamp, or other markings of specified testing agency.
- B. Comply with requirements in "Piping Schedule" Article for applications of pipe, tube, fitting materials, and joining methods for specific services, service locations, and pipe sizes.

2.3 HUB-AND-SPIGOT, CAST-IRON SOIL PIPE AND FITTINGS

- A. Pipe and Fittings: ASTM A 74, Service class.
- B. Gaskets: ASTM C 564, rubber.
- C. Calking Materials: ASTM B 29, pure lead and oakum or hemp fiber.

2.4 HUBLESS, CAST-IRON SOIL PIPE AND FITTINGS

- A. Pipe and Fittings: ASTM A 888 or CISPI 301.
- B. CISPI, Hubless-Piping Couplings:
 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. ANACO-Husky.
 - b. Charlotte Pipe and Foundry Company.
 - c. Josam Company.
 - d. MIFAB, Inc.
 2. Standards: ASTM C 1277 and CISPI 310.
 3. Description: Stainless-steel corrugated shield with stainless-steel bands and tightening devices; and ASTM C 564, rubber sleeve with integral, center pipe stop.

C. Cast-Iron, Hubless-Piping Couplings:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Charlotte Pipe and Foundry Company.
 - b. MG Piping Products Company.
2. Standard: ASTM C 1277.
3. Description: Two-piece ASTM A 48/A 48M, cast-iron housing; stainless-steel bolts and nuts; and ASTM C 564, rubber sleeve with integral, center pipe stop.

2.5 SPECIALTY PIPE FITTINGS

A. Transition Couplings:

1. Fitting-Type Transition Couplings: Manufactured piping coupling or specified piping system fitting.
2. Unshielded, Nonpressure Transition Couplings:
 - a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1) Dallas Specialty & Mfg. Co.
 - 2) Fernco Inc.
 - 3) Froet Industries LLC.
 - 4) Mission Rubber Company, LLC; a division of MCP Industries.
 - b. Standard: ASTM C 1173.
 - c. Description: Elastomeric, sleeve-type, reducing or transition pattern. Include shear ring and corrosion-resistant-metal tension band and tightening mechanism on each end.
 - d. End Connections: Same size as and compatible with pipes to be joined.
 - e. Sleeve Materials:
 - 1) For Cast-Iron Soil Pipes: ASTM C 564, rubber.
 - 2) For Dissimilar Pipes: ASTM D 5926, PVC or other material compatible with pipe materials being joined.

B. Dielectric Fittings:

1. Dielectric Unions:
 - a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1) Jomar Valve.
 - 2) WATTS.
 - 3) Wilkins.
 - 4) Zurn Industries, LLC.
 - b. Description:

- 1) Standard: ASSE 1079.
- 2) Pressure Rating: 150 psig.
- 3) End Connections: Solder-joint copper alloy and threaded ferrous.

2. Dielectric Flanges:

- a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

- 1) WATTS.
- 2) Wilkins.
- 3) Zurn Industries, LLC.

- b. Description:

- 1) Standard: ASSE 1079.
- 2) Factory-fabricated, bolted, companion-flange assembly.
- 3) Pressure Rating: 150 psig.
- 4) End Connections: Solder-joint copper alloy and threaded ferrous; threaded solder-joint copper alloy and threaded ferrous.

2.6 ENCASEMENT FOR UNDERGROUND METAL PIPING

- A. Standard: ASTM A 674 or AWWA C105/A 21.5.
- B. Material: high-density, cross-laminated polyethylene film of 0.004-inch minimum thickness.
- C. Form: Sheet or tube.
- D. Color: Black or natural.

PART 3 - EXECUTION

3.1 PIPING INSTALLATION

- A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems.
1. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations.
 2. Install piping as indicated unless deviations to layout are approved on coordination drawings.
- B. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.
- C. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

- D. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.
- E. Install piping to permit valve servicing.
- F. Install piping at indicated slopes.
- G. Install piping free of sags and bends.
- H. Install fittings for changes in direction and branch connections.
- I. Install piping to allow application of insulation.
- J. Make changes in direction for soil and waste drainage and vent piping using appropriate branches, bends, and long-sweep bends.
 - 1. Sanitary tees and short-sweep 1/4 bends may be used on vertical stacks if change in direction of flow is from horizontal to vertical.
 - 2. Use long-turn, double Y-branch and 1/8-bend fittings if two fixtures are installed back to back or side by side with common drain pipe.
 - a. Straight tees, elbows, and crosses may be used on vent lines.
 - 3. Do not change direction of flow more than 90 degrees.
 - 4. Use proper size of standard increasers and reducers if pipes of different sizes are connected.
 - a. Reducing size of waste piping in direction of flow is prohibited.
- K. Lay buried building waste piping beginning at low point of each system.
 - 1. Install true to grades and alignment indicated, with unbroken continuity of invert. Place hub ends of piping upstream.
 - 2. Install required gaskets according to manufacturer's written instructions for use of lubricants, cements, and other installation requirements.
 - 3. Maintain swab in piping and pull past each joint as completed.
- L. Install soil and waste and vent piping at the following minimum slopes unless otherwise indicated:
 - 1. Building Sanitary Waste: 1 percent downward in direction of flow for piping NPS 3 and smaller; 2 percent downward in direction of flow for piping NPS 4 and larger.
 - 2. Horizontal Sanitary Waste Piping: 2 percent downward in direction of flow.
 - 3. Vent Piping: 1 percent down toward vertical fixture vent or toward vent stack.
- M. Install cast-iron soil piping according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook," Chapter IV, "Installation of Cast Iron Soil Pipe and Fittings."
 - 1. Install encasement on underground piping according to ASTM A 674 or AWWA C105/A 21.5.
- N. Install engineered soil and waste and vent piping systems as follows:
 - 1. Combination Waste and Vent: Comply with standards of authorities having jurisdiction.

2. Hubless, Single-Stack Drainage System: Comply with ASME B16.45 and hubless, single-stack aerator fitting manufacturer's written installation instructions.
3. Reduced-Size Venting: Comply with standards of authorities having jurisdiction.

O.

P. Plumbing Specialties:

1. Install cleanouts at grade and extend to where building sanitary drains connect to building sanitary sewers in sanitary waste gravity-flow piping.
 - a. Install cleanout fitting with closure plug inside the building in sanitary drainage force-main piping.
 - b. Comply with requirements for cleanouts specified in Section 221319 "Sanitary Waste Piping Specialties."
2. Install drains in sanitary waste gravity-flow piping.
 - a. Comply with requirements for drains specified in Section 221319 "Sanitary Waste Piping Specialties."

Q. Do not enclose, cover, or put piping into operation until it is inspected and approved by authorities having jurisdiction.

R. Install sleeves for piping penetrations of walls, ceilings, and floors.

1. Comply with requirements for sleeves specified in Section 220517 "Sleeves and Sleeve Seals for Plumbing Piping."

S. Install escutcheons for piping penetrations of walls, ceilings, and floors.

1. Comply with requirements for escutcheons specified in Section 220518 "Escutcheons for Plumbing Piping."

3.2 JOINT CONSTRUCTION

- A. Join hub-and-spigot, cast-iron soil piping with gasket joints according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for compression joints.
- B. Join hub-and-spigot, cast-iron soil piping with calked joints according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for lead-and-oakum calked joints.
- C. Join hubless, cast-iron soil piping according to CISPI 310 and CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for hubless-piping coupling joints.
- D. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1.
 1. Cut threads full and clean using sharp dies.
 2. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:

- a. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.
 - b. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged.
 - c. Do not use pipe sections that have cracked or open welds.
- E. Flanged Joints: Align bolt holes. Select appropriate gasket material, size, type, and thickness. Install gasket concentrically positioned. Use suitable lubricants on bolt threads. Torque bolts in cross pattern.

3.3 SPECIALTY PIPE FITTING INSTALLATION

A. Transition Couplings:

- 1. Install transition couplings at joints of piping with small differences in ODs.
- 2. In Waste Drainage Piping: Unshielded, nonpressure transition couplings.
- 3. In Aboveground Force Main Piping: Fitting-type transition couplings.
- 4. In Underground Force Main Piping:
 - a. NPS 1-1/2 and Smaller: Fitting-type transition couplings.
 - b. NPS 2 and Larger: Pressure transition couplings.

B. Dielectric Fittings:

- 1. Install dielectric fittings in piping at connections of dissimilar metal piping and tubing.
- 2. Dielectric Fittings for NPS 2 and Smaller: Use dielectric unions.
- 3. Dielectric Fittings for NPS 2-1/2 to NPS 4: Use dielectric flanges.

3.4 HANGER AND SUPPORT INSTALLATION

- A. Comply with requirements for seismic-restraint devices specified in Section 220548 "Vibration and Seismic Controls for Plumbing Piping and Equipment."
- B. Comply with requirements for pipe hanger and support devices and installation specified in Section 220529 "Hangers and Supports for Plumbing Piping and Equipment."
 - 1. Install carbon-steel pipe hangers for horizontal piping in noncorrosive environments.
 - 2. Install stainless-steel pipe hangers for horizontal piping in corrosive environments.
 - 3. Install carbon-steel pipe support clamps for vertical piping in noncorrosive environments.
 - 4. Install stainless-steel pipe support clamps for vertical piping in corrosive environments.
 - 5. Vertical Piping: MSS Type 8 or Type 42, clamps.
 - 6. Install individual, straight, horizontal piping runs:
 - a. 100 Feet and Less: MSS Type 1, adjustable, steel clevis hangers.
 - b. Longer Than 100 Feet: MSS Type 43, adjustable roller hangers.
 - c. Longer Than 100 Feet if Indicated: MSS Type 49, spring cushion rolls.
 - 7. Multiple, Straight, Horizontal Piping Runs 100 Feet or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.
 - 8. Base of Vertical Piping: MSS Type 52, spring hangers.

- C. Support horizontal piping and tubing within 12 inches of each fitting[, **valve**,] and coupling.
- D. Support vertical piping and tubing at base and at each floor.
- E. Rod diameter may be reduced one size for double-rod hangers, with 3/8-inch minimum rods.
- F. Install hangers for cast-iron soil piping with the following maximum horizontal spacing and minimum rod diameters:
 - 1. NPS 1-1/2 and NPS 2: 60 inches with 3/8-inch rod.
 - 2. NPS 3: 60 inches with 1/2-inch rod.
 - 3. NPS 4 and NPS 5: 60 inches with 5/8-inch rod.
 - 4. NPS 6 and NPS 8: 60 inches with 3/4-inch rod.
 - 5. NPS 10 and NPS 12: 60 inches with 7/8-inch rod.
 - 6. Spacing for 10-foot lengths may be increased to 10 feet. Spacing for fittings is limited to 60 inches.
- G. Install supports for vertical cast-iron soil piping every 15 feet.

3.5 CONNECTIONS

- A. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Connect soil and waste piping to exterior sanitary sewerage piping. Use transition fitting to join dissimilar piping materials.
- C. Connect waste and vent piping to the following:
 - 1. Plumbing Fixtures: Connect waste piping in sizes indicated, but not smaller than required by plumbing code.
 - 2. Plumbing Fixtures and Equipment: Connect atmospheric vent piping in sizes indicated, but not smaller than required by authorities having jurisdiction.
 - 3. Plumbing Specialties: Connect waste and vent piping in sizes indicated, but not smaller than required by plumbing code.
 - 4. Install test tees (wall cleanouts) in conductors near floor and floor cleanouts with cover flush with floor.
- D. Where installing piping adjacent to equipment, allow space for service and maintenance of equipment.
- E. Make connections according to the following unless otherwise indicated:
 - 1. Install unions, in piping NPS 2 and smaller, adjacent to each valve and at final connection to each piece of equipment.
 - 2. Install flanges, in piping NPS 2-1/2 and larger, adjacent to flanged valves and at final connection to each piece of equipment.

3.6 IDENTIFICATION

- A. Identify exposed sanitary waste and vent piping.

- B. Comply with requirements for identification specified in Section 220553 "Identification for Plumbing Piping and Equipment."

3.7 FIELD QUALITY CONTROL

- A. During installation, notify authorities having jurisdiction at least 24 hours before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction.
 - 1. Roughing-in Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in and before setting fixtures.
 - 2. Final Inspection: Arrange for final inspection by authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.
- B. Reinspection: If authorities having jurisdiction find that piping will not pass test or inspection, make required corrections and arrange for reinspection.
- C. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.
- D. Test sanitary waste and vent piping according to procedures of authorities having jurisdiction or, in absence of published procedures, as follows:
 - 1. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired.
 - a. If testing is performed in segments, submit separate report for each test, complete with diagram of portion of piping tested.
 - 2. Leave uncovered and unconcealed new, altered, extended, or replaced waste and vent piping until it has been tested and approved.
 - a. Expose work that was covered or concealed before it was tested.
 - 3. Roughing-in Plumbing Test Procedure: Test waste and vent piping except outside leaders on completion of roughing-in.
 - a. Close openings in piping system and fill with water to point of overflow, but not less than 10-foot head of water.
 - b. From 15 minutes before inspection starts to completion of inspection, water level must not drop.
 - c. Inspect joints for leaks.
 - 4. Finished Plumbing Test Procedure: After plumbing fixtures have been set and traps filled with water, test connections and prove they are gastight and watertight.
 - a. Plug vent-stack openings on roof and building drains where they leave building. Introduce air into piping system equal to pressure of 1-inch wg.
 - b. Use U-tube or manometer inserted in trap of water closet to measure this pressure.
 - c. Air pressure must remain constant without introducing additional air throughout period of inspection.
 - d. Inspect plumbing fixture connections for gas and water leaks.

5. Repair leaks and defects with new materials and retest piping, or portion thereof, until satisfactory results are obtained.
6. Prepare reports for tests and required corrective action.

3.8 CLEANING AND PROTECTION

- A. Clean interior of piping. Remove dirt and debris as work progresses.
- B. Protect sanitary waste and vent piping during remainder of construction period to avoid clogging with dirt and debris and to prevent damage from traffic and construction work.
- C. Place plugs in ends of uncompleted piping at end of day and when work stops.
- D. Repair damage to adjacent materials caused by waste and vent piping installation.

3.9 PIPING SCHEDULE

- A. Flanges and unions may be used on aboveground pressure piping unless otherwise indicated.
- B. Aboveground, soil and waste piping NPS 4 and smaller shall be any of the following:
 1. Service class, cast-iron soil pipe and fittings; gaskets; and gasketed joints.
 2. Hubless, cast-iron soil pipe and fittings; CISPI hubless-piping couplings; and coupled joints.
- C. Aboveground, soil and waste piping NPS 5 and larger shall be the following:
 1. Service class, cast-iron soil pipe and fittings; gaskets; and gasketed joints.
- D. Aboveground, vent piping NPS 4 and smaller shall be any of the following:
 1. Service class, cast-iron soil pipe and fittings; gaskets; and gasketed joints.
 2. Hubless, cast-iron soil pipe and fittings; CISPI hubless-piping couplings; and coupled joints.
- E. Aboveground, vent piping NPS 5 and larger shall be the following:
 1. Service class, cast-iron soil pipe and fittings; gaskets; and gasketed joints.
- F. Underground, soil, waste, and vent piping NPS 4 and smaller shall be the following:
 1. Service class, cast-iron soil piping; gaskets; and gasketed joints.
- G. Underground, soil and waste piping NPS 5 and larger shall be the following:
 1. Service class, cast-iron soil piping; gaskets; and gasketed joints.

END OF SECTION

SECTION 221319 - SANITARY WASTE PIPING SPECIALTIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Cleanouts.
 - 2. Through-penetration firestop assemblies.

1.3 DEFINITIONS

- A. ABS: Acrylonitrile-butadiene-styrene.
- B. PVC: Polyvinyl chloride.

1.4 ACTION SUBMITTALS

- A. Shop Drawings:
 - 1. Cleanouts

1.5 INFORMATIONAL SUBMITTALS

- A. Field quality-control reports.

1.6 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For sanitary waste piping specialties to include in emergency, operation, and maintenance manuals.

PART 2 - PRODUCTS

2.1 ASSEMBLY DESCRIPTIONS

- A. Sanitary waste piping specialties shall bear label, stamp, or other markings of specified testing agency.

- B. Comply with NSF 14 for plastic sanitary waste piping specialty components.
- C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing, and marked for intended location and application.

2.2 CLEANOUTS

A. Cast-Iron Exposed Cleanouts:

- 1. <Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Jay R. Smith Mfg Co; a division of Morris Group International.
 - b. Josam Company.
 - c. MIFAB, Inc.
 - d. WATTS.
 - e. Zurn Industries, LLC.
- 2. Standard: ASME A112.36.2M.
- 3. Size: Same as connected drainage piping
- 4. Body Material: Hub-and-spigot, cast-iron soil pipe T-branch as required to match connected piping.
- 5. Closure: , cast-iron plug.
- 6. Closure Plug Size: Same as or not more than one size smaller than cleanout size.

B. Cast-Iron Exposed Floor Cleanouts:

- 1. <Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Jay R. Smith Mfg Co; a division of Morris Group International.
 - b. Josam Company.
 - c. MIFAB, Inc.
 - d. WATTS.
 - e. Zurn Industries, LLC.
- 2. Standard: ASME A112.36.2M for threaded, adjustable housing cleanout.
- 3. Size: Same as connected branch.
- 4. Type: Threaded, adjustable housing.
- 5. Body or Ferrule: Cast iron.
- 6. Clamping Device: Required.
- 7. Outlet Connection: Spigot.
- 8. Closure: Cast-iron plug.
- 9. Adjustable Housing Material: Cast iron with threads.
- 10. Frame and Cover Material and Finish: Nickel-bronze, copper alloy.
- 11. Frame and Cover Shape: Round.
- 12. Top Loading Classification: Heavy Duty.
- 13. Riser: ASTM A 74, Service class, cast-iron drainage pipe fitting and riser to cleanout.

C. Cast-Iron Wall Cleanouts:

1. <Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Jay R. Smith Mfg Co; a division of Morris Group International.
 - b. Josam Company.
 - c. MIFAB, Inc.
 - d. WATTS.
 - e. Zurn Industries, LLC.
2. Standard: ASME A112.36.2M. Include wall access.
3. Size: Same as connected drainage piping.
4. Body: Hubless, cast-iron soil pipe test tee as required to match connected piping.
5. Closure Plug:
 - a. Cast iron.
 - b. Countersunk or raised head.
 - c. Drilled and threaded for cover attachment screw.
 - d. Size: Same as or not more than one size smaller than cleanout size.
6. Wall Access: Round, flat, chrome-plated brass or stainless-steel cover plate with screw.
7. Wall Access: Square, wall-installation frame and cover.

2.3 THROUGH-PENETRATION FIRESTOP ASSEMBLIES

A. Through-Penetration Firestop Assemblies:

1. <Manufacturers: Subject to compliance with requirements, provide products by the following or approved equal:
 - a. ProVent Systems.
2. Standard: UL 1479 assembly of sleeve-and-stack fitting with firestopping plug.
3. Size: Same as connected soil, waste, or vent stack.
4. Sleeve: Molded-PVC plastic, of length to match slab thickness and with integral nailing flange on one end for installation in cast-in-place concrete slabs.
5. Stack Fitting: ASTM A 48/A 48M, gray-iron, hubless-pattern wye branch with neoprene O-ring at base and gray-iron plug in thermal-release harness. Include PVC protective cap for plug.
6. Special Coating: Corrosion resistant on interior of fittings.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install cleanouts in aboveground piping and building drain piping according to the following, unless otherwise indicated:
 1. Size same as drainage piping up to NPS 4. Use NPS 4 for larger drainage piping unless larger cleanout is indicated.
 2. Locate at each change in direction of piping greater than 45 degrees.

3. Locate at minimum intervals of 50 feet for piping NPS 4 and smaller and 100 feet for larger piping.
 4. Locate at base of each vertical soil and waste stack.
- B. For floor cleanouts for piping below floors, install cleanout deck plates with top flush with finished floor.
- C. For cleanouts located in concealed piping, install cleanout wall access covers, of types indicated, with frame and cover flush with finished wall.
- D. Install fixture air-admittance valves on fixture drain piping.
- E. Install stack air-admittance valves at top of stack vent and vent stack piping.
- F. Install through-penetration firestop assemblies in plastic conductors and stacks at floor penetrations.
1. Comply with requirements in Section 078413 "Penetration Firestopping."
- G. Install floor-drain, trap-seal primer fittings on inlet to floor drains that require trap-seal primer connection.
1. Exception: Fitting may be omitted if trap has trap-seal primer connection.
 2. Size: Same as floor drain inlet.
- H. Install sleeve and sleeve seals with each riser and stack passing through floors with waterproof membrane.
- I. Install traps on plumbing specialty drain outlets. Omit traps on indirect wastes unless trap is indicated.

3.2 CONNECTIONS

- A. Comply with requirements in Section 221316 "Sanitary Waste and Vent Piping" for piping installation requirements. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Install piping adjacent to equipment to allow service and maintenance.

3.3 LABELING AND IDENTIFYING

- A. Equipment Nameplates and Signs: Install engraved plastic-laminate equipment nameplate or sign on or near each of the following:
1. FOG disposal systems.
- B. Distinguish among multiple units, inform operator of operational requirements, indicate safety and emergency precautions, and warn of hazards and improper operations, in addition to identifying unit.

1. Nameplates and signs are specified in Section 220553 "Identification for Plumbing Piping and Equipment."

3.4 FIELD QUALITY CONTROL

A. Tests and Inspections:

1. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

3.5 PROTECTION

- A. Protect drains during remainder of construction period to avoid clogging with dirt or debris and to prevent damage from traffic or construction work.
- B. Place plugs in ends of uncompleted piping at end of each day or when work stops.

END OF SECTION

SECTION 221319.13 - SANITARY DRAINS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Floor drains.

1.3 DEFINITIONS

- A. ABS: Acrylonitrile-butadiene styrene.
- B. PVC: Polyvinyl chloride.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.

PART 2 - PRODUCTS

2.1 DRAIN ASSEMBLIES

- A. Sanitary drains shall bear label, stamp, or other markings of specified testing agency.
- B. Comply with NSF 14 for plastic sanitary piping specialty components.

2.2 FLOOR DRAINS

- A. Plastic Floor Drains:
 - 1. <Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Josam Company.
 - b. Proset.
 - c. Zurn Industries, LLC.

2. Standard: ASME A112.6.3.
3. Material: ABS or PVC.
4. Seepage Flange: Required.
5. Clamping Device: Required.
6. Outlet: Refer Schedule
7. Sediment Bucket: Not required.
8. Top or Strainer Material: Plastic.
9. Top of Body and Strainer Finish: Nickel bronze or Polished bronze.
10. Top Shape: Square.
11. Dimensions of Top or Strainer: Refer model as described in Plumbing Schedules.
12. Trap Material: Plastic drainage piping.
13. Trap Pattern: Standard P-trap.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install floor drains at low points of surface areas to be drained. Set grates of drains flush with finished floor, unless otherwise indicated.
 1. Position floor drains for easy access and maintenance.
 2. Set floor drains below elevation of surrounding finished floor to allow floor drainage.
 3. Set with grates depressed according to the following drainage area radii:
 - a. Radius, 30 Inches or Less: Equivalent to 1 percent slope, but not less than 1/4-inch total depression.
 - b. Radius, 30 to 60 Inches: Equivalent to 1 percent slope.
 - c. Radius, 60 Inches or Larger: Equivalent to 1 percent slope, but not greater than 1-inch total depression.
 4. Install floor-drain flashing collar or flange, so no leakage occurs between drain and adjoining flooring.
 - a. Maintain integrity of waterproof membranes where penetrated.
 5. Install individual traps for floor drains connected to sanitary building drain, unless otherwise indicated.

3.2 CONNECTIONS

- A. Comply with requirements in Section 221316 "Sanitary Waste and Vent Piping" for piping installation requirements. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Comply with requirements in Section 221319 "Sanitary Waste Piping Specialties" for backwater valves, air admittance devices and miscellaneous sanitary drainage piping specialties.
- C. Install piping adjacent to equipment to allow service and maintenance.

- D. Ground equipment according to Section 260526 "Grounding and Bonding for Electrical Systems."
- E. Connect wiring according to Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

3.3 LABELING AND IDENTIFYING

- A. Distinguish among multiple units, inform operator of operational requirements, indicate safety and emergency precautions, and warn of hazards and improper operations, in addition to identifying unit. Nameplates and signs are specified in Section 220553 "Identification for Plumbing Piping and Equipment."

3.4 PROTECTION

- A. Protect drains during remainder of construction period to avoid clogging with dirt or debris and to prevent damage from traffic or construction work.
- B. Place plugs in ends of uncompleted piping at end of each day or when work stops.

END OF SECTION

SECTION 224213.13 - COMMERCIAL WATER CLOSETS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Water closets.
 - 2. Flushometer valves.
 - 3. Toilet seats.
 - 4. Supports.

1.3 DEFINITIONS

- A. Effective Flush Volume: Average of two reduced flushes and one full flush per fixture.
- B. Remote Water Closet: Located more than 30 feet from other drain line connections or fixture and where less than 1.5 drainage fixture units are upstream of the drain line connection.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for water closets.
 - 2. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.
- B. Shop Drawings: Include diagrams for power, signal, and control wiring.

1.5 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For flushometer valves and electronic sensors to include in operation and maintenance manuals.

1.6 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that are packaged with protective covering for storage and identified with labels describing contents.

1. Flushometer-Valve Repair Kits: Equal to [10] <Insert number> percent of amount of each type installed, but no fewer than [one] [six] <Insert number> of each type.

PART 2 - PRODUCTS

2.1 WALL-MOUNTED WATER CLOSETS

A. Water Closets: Wall mounted, top spud, accessible.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. American Standard.
 - b. Kohler Co.
 - c. Sloan Valve Company.
 - d. TOTO USA, INC.
 - e. Zurn Industries, LLC.
2. Bowl:
 - a. Standards: ASME A112.19.2/CSA B45.1 and ASME A112.19.5.
 - b. Material: Vitreous china.
 - c. Type: Siphon jet.
 - d. Style: Flushometer valve.
 - e. Height: Standard.
 - f. Rim Contour: Elongated.
 - g. Water Consumption: 1.28 gal. per flush.
 - h. Spud Size and Location: NPS 1-1/2; top.
3. Support: Water closet carrier.
4. Water-Closet Mounting Height: Standard / Handicapped/elderly according to ICC/ANSI A117.1.

2.2 FLUSHOMETER VALVES

A. Battery-Powered, Solenoid-Actuator, Piston Flushometer Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. American Standard.
 - b. Kohler Co.
 - c. Sloan Valve Company.
 - d. Zurn Industries, LLC.
2. Standard: ASSE 1037.
3. Minimum Pressure Rating: 125 psig.
4. Features: Include integral check stop and backflow-prevention device.
5. Material: Brass body with corrosion-resistant components.
6. Exposed Flushometer-Valve Finish: Chrome plated.
7. Panel Finish: Chrome plated or stainless steel.

8. Style: Exposed.
9. Actuator: Solenoid complying with UL 1951, and listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
10. Trip Mechanism: Battery-powered electronic sensor complying with UL 1951, and listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
11. Consumption: 1.28 gal. per flush.
12. Minimum Inlet: NPS 1.
13. Minimum Outlet: NPS 1-1/4.

2.3 TOILET SEATS

A. Toilet Seats:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. American Standard.
 - b. Kohler Co.
 - c. TOTO USA, INC.
 - d. Zurn Industries, LLC.
2. Standard: IAPMO/ANSI Z124.5.
3. Material: Plastic.
4. Type: Commercial (Standard).
5. Shape: Elongated rim, open front.
6. Hinge: Self-sustaining, check.
7. Hinge Material: Noncorroding metal.
8. Seat Cover: Not required.
9. Color: Coordinate with Architect.

2.4 SUPPORTS

A. Water Closet Carrier:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Josam Company.
 - b. Zurn Industries, LLC.
2. Standard: ASME A112.6.1M.
3. Description: Waste-fitting assembly, as required to match drainage piping material and arrangement with faceplates, couplings gaskets, and feet; bolts and hardware matching fixture. Include additional extension coupling, faceplate, and feet for installation in wide pipe space.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine roughing-in of water supply and sanitary drainage and vent piping systems to verify actual locations of piping connections before water-closet installation.
- B. Examine walls and floors for suitable conditions where water closets will be installed.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Water-Closet Installation:

- 1. Install level and plumb according to roughing-in drawings.
- 2. Install floor-mounted water closets on bowl-to-drain connecting fitting attachments to piping or building substrate.
- 3. Install accessible, wall-mounted water closets at mounting height for handicapped/elderly, according to ICC/ANSI A117.1.

B. Support Installation:

- 1. Install supports, affixed to building substrate, for floor-mounted, back-outlet water closets.
- 2. Use carrier supports with waste-fitting assembly and seal.
- 3. Install floor-mounted, back-outlet water closets attached to building floor substrate, onto waste-fitting seals; and attach to support.
- 4. Install wall-mounted, back-outlet water-closet supports with waste-fitting assembly and waste-fitting seals; and affix to building substrate.

C. Flushometer-Valve Installation:

- 1. Install flushometer-valve, water-supply fitting on each supply to each water closet.
- 2. Attach supply piping to supports or substrate within pipe spaces behind fixtures.
- 3. Install lever-handle flushometer valves for accessible water closets with handle mounted on open side of water closet.
- 4. Install actuators in locations that are easy for people with disabilities to reach.
- 5. Install fresh batteries in battery-powered, electronic-sensor mechanisms.

D. Install toilet seats on water closets.

E. Wall Flange and Escutcheon Installation:

- 1. Install wall flanges or escutcheons at piping wall penetrations in exposed, finished locations and within cabinets and millwork.
- 2. Install deep-pattern escutcheons if required to conceal protruding fittings.
- 3. Comply with escutcheon requirements specified in Section 220518 "Escutcheons for Plumbing Piping."

F. Joint Sealing:

1. Seal joints between water closets and walls and floors using sanitary-type, one-part, mildew-resistant silicone sealant.
2. Match sealant color to water-closet color.
3. Comply with sealant requirements specified in Section 079200 "Joint Sealants."

3.3 CONNECTIONS

- A. Connect water closets with water supplies and soil, waste, and vent piping. Use size fittings required to match water closets.
- B. Comply with water piping requirements specified in Section 221116 "Domestic Water Piping."
- C. Comply with soil and waste piping requirements specified in Section 221316 "Sanitary Waste and Vent Piping."
- D. Where installing piping adjacent to water closets, allow space for service and maintenance.

3.4 ADJUSTING

- A. Operate and adjust water closets and controls. Replace damaged and malfunctioning water closets, fittings, and controls.
- B. Adjust water pressure at flushometer valves to produce proper flow.
- C. Install fresh batteries in battery-powered, electronic-sensor mechanisms.

3.5 CLEANING AND PROTECTION

- A. Clean water closets and fittings with manufacturers' recommended cleaning methods and materials.
- B. Install protective covering for installed water closets and fittings.
- C. Do not allow use of water closets for temporary facilities unless approved in writing by Owner.

END OF SECTION

SECTION 224213.16 - COMMERCIAL URINALS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Urinals.
 - 2. Flushometer valves.
 - 3. Supports.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for urinals.
 - 2. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.
- B. Shop Drawings: Include diagrams for power, signal, and control wiring.

1.4 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For flushometer valves and electronic sensors to include in operation and maintenance manuals.

1.5 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Flushometer-Valve Repair Kits: Equal to 10 percent of amount of each type installed, but no fewer than one of each type.

PART 2 - PRODUCTS

2.1 WALL-HUNG URINALS

A. Urinals: Wall hung, bottom outlet, wash down.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. American Standard.
 - b. Kohler Co.
 - c. Sloan Valve Company.
 - d. Zurn Industries, LLC.
2. Fixture:
 - a. Standards: ASME A112.19.1/CSA B45.2 and ASME A112.19.5.
 - b. Material: Enameled cast iron.
 - c. Style: Wash sink with back and without pedestal modified for use as urinal.
 - d. Size: Refer Arch. drawings.
 - e. Drain: Separate removable chrome-plated dome strainer with chrome-plated, NPS 1-1/2 tailpiece.
 - f. Water Consumption: Not applicable.
 - g. Flushing Device: Manufacturer's standard self-closing valve with washdown pipe of length matching fixture.
 - h. Outlet Size and Location: NPS 1-1/2; bottom.
 - i. Color: White, coordinate with Architect for final finishes.
3. Flushometer Valve:
 - a. Standard: ASME A112.18.1/CSA B125.1.
 - b. Flushing Device: Manufacturer's standard for NPS 1/2 supply; self-closing valve; and wash-down pipe of length matching fixture.
4. Waste Fitting:
 - a. Standard: ASME A112.18.2/CSA B125.2.
 - b. Trap:
 - 1) Size: NPS 1-1/2.
 - 2) Material: Chrome-plated, two-piece, cast-brass trap and swivel elbow with 0.032-inch-thick brass tube to wall; and chrome-plated brass or steel wall flange.
 - 3) Material: Stainless-steel, two-piece trap and swivel elbow with 0.012-inch-thick stainless-steel tube to wall; and stainless-steel wall flange.
5. Support: Type I Sink Carrier.
6. Sink/Urinal Mounting Height: Standard / Handicapped/elderly according to ICC A117.1.

2.2 URINAL FLUSHOMETER VALVES

A. Battery-Powered, Solenoid-Actuator, Piston Flushometer Valves:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
 - a. American Standard.
 - b. Kohler Co.
 - c. Sloan Valve Company.
 - d. Zurn Industries, LLC.
2. Standard: ASSE 1037.
3. Minimum Pressure Rating: 125 psig.
4. Features: Include integral check stop and backflow-prevention device.
5. Material: Brass body with corrosion-resistant components.
6. Exposed Flushometer-Valve Finish: Chrome plated.
7. Panel Finish: Chrome plated or stainless steel.
8. Style: Exposed.
9. Actuator: Solenoid complying with UL 1951; listed and labeled as defined in NFPA 70, by a qualified testing agency; and marked for intended location and application.
10. Trip Mechanism: Battery-powered electronic sensor complying with UL 1951; listed and labeled as defined in NFPA 70, by a qualified testing agency; and marked for intended location and application.
11. Consumption: 0.5 gal. per flush.
12. Minimum Inlet: NPS 3/4.
13. Minimum Outlet: NPS 3/4.

2.3 SUPPORTS

A. Type I Urinal Carrier:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Jay R. Smith Mfg Co; a division of Morris Group International.
 - b. Josam Company.
 - c. MIFAB, Inc.
 - d. WATTS.
 - e. Zurn Industries, LLC.
2. Standard: ASME A112.6.1M.

B. Type I Sink Carrier:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Jay R. Smith Mfg Co; a division of Morris Group International.
 - b. Josam Company.
 - c. MIFAB, Inc.

- d. WATTS.
 - e. Zurn Industries, LLC.
2. Standard: ASME A112.6.1M.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine roughing-in of water supply and sanitary drainage and vent piping systems to verify actual locations of piping connections before urinal installation.
- B. Examine walls and floors for suitable conditions where urinals will be installed.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Urinal Installation:

- 1. Install urinals level and plumb according to roughing-in drawings.
- 2. Install wall-hung, back-outlet urinals onto waste fitting seals and attached to supports.
- 3. Install wall-hung, bottom-outlet urinals with tubular waste piping attached to supports.
- 4. Install accessible, wall-mounted urinals at mounting height for the handicapped/elderly, according to ICC/ANSI A117.1.
- 5. Install trap-seal liquid in waterless urinals.

B. Support Installation:

- 1. Install supports, affixed to building substrate, for wall-hung urinals.
- 2. Use off-floor carriers with waste fitting and seal for back-outlet urinals.
- 3. Use carriers without waste fitting for urinals with tubular waste piping.
- 4. Use chair-type carrier supports with rectangular steel uprights for accessible urinals.

C. Flushometer-Valve Installation:

- 1. Install flushometer-valve water-supply fitting on each supply to each urinal.
- 2. Attach supply piping to supports or substrate within pipe spaces behind fixtures.
- 3. Install lever-handle flushometer valves for accessible urinals with handle mounted on open side of compartment.
- 4. Install fresh batteries in battery-powered, electronic-sensor mechanisms.

D. Wall Flange and Escutcheon Installation:

- 1. Install wall flanges or escutcheons at piping wall penetrations in exposed, finished locations.
- 2. Install deep-pattern escutcheons if required to conceal protruding fittings.
- 3. Comply with escutcheon requirements specified in Section 220518 "Escutcheons for Plumbing Piping."

E. Joint Sealing:

1. Seal joints between urinals and walls and floors using sanitary-type, one-part, mildew-resistant silicone sealant.
2. Match sealant color to urinal color.
3. Comply with sealant requirements specified in Section 079200 "Joint Sealants."

3.3 CONNECTIONS

- A. Connect urinals with water supplies and soil, waste, and vent piping. Use size fittings required to match urinals.
- B. Comply with water piping requirements specified in Section 221116 "Domestic Water Piping."
- C. Comply with soil and waste piping requirements specified in Section 221316 "Sanitary Waste and Vent Piping."
- D. Where installing piping adjacent to urinals, allow space for service and maintenance.

3.4 ADJUSTING

- A. Operate and adjust urinals and controls. Replace damaged and malfunctioning urinals, fittings, and controls.
- B. Adjust water pressure at flushometer valves to produce proper flow.
- C. Install fresh batteries in battery-powered, electronic-sensor mechanisms.

3.5 CLEANING AND PROTECTION

- A. Clean urinals and fittings with manufacturers' recommended cleaning methods and materials.
- B. Install protective covering for installed urinals and fittings.
- C. Do not allow use of urinals for temporary facilities unless approved in writing by Owner.

END OF SECTION

SECTION 224216.13 - COMMERCIAL LAVATORIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:

- 1. Lavatories.
- 2. Faucets.
- 3. Supply fittings.
- 4. Waste fittings.
- 5. Supports.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for lavatories.
 - 2. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.
- B. Shop Drawings: Include diagrams for power, signal, and control wiring of automatic faucets.

1.4 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Counter cutout templates for mounting of counter-mounted lavatories.

1.5 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For lavatories and faucets to include in operation and maintenance manuals.
 - 1. In addition to items specified in Section 017823 "Operation and Maintenance Data," include the following:
 - a. Servicing and adjustments of automatic faucets.

1.6 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Faucet Washers and O-Rings: Equal to 10 percent of amount of each type and size installed.
 - 2. Faucet Cartridges and O-Rings: Equal to 5 percent of amount of each type and size installed.

PART 2 - PRODUCTS

2.1 VITREOUS-CHINA, COUNTER-MOUNTED LAVATORIES

- A. Lavatory: Rectangular, self-rimming, vitreous china, counter mounted.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. American Standard.
 - b. Kohler Co.
 - c. TOTO USA, INC.
 - 2. Fixture:
 - a. Standard: ASME A112.19.2/CSA B45.1.
 - b. Type: Self-rimming for above-counter mounting.
 - c. Nominal Size: Rectangular, Refer Arch drawings and Plumbing schedules for dimensions.
 - d. Faucet-Hole Punching: One hole.
 - e. Faucet-Hole Location: Top.
 - f. Color: White / Coordinate with Architect for final finish.
 - g. Mounting Material: Sealant.
 - 3. Faucet: Refer schedule on drawings.

2.2 SOLID-BRASS, AUTOMATICALLY OPERATED LAVATORY FAUCETS

- A. NSF Standard: Comply with NSF 372 for faucet materials that will be in contact with potable water.
- B. Lavatory Faucets: Automatic-type, battery-powered, electronic-sensor-operated, mixing, solid-brass valve.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. American Standard.
 - b. Kohler Co.
 - c. Sloan Valve Company.

d. Zurn Industries, LLC.

2. Standards: ASME A112.18.1/CSA B125.1 and UL 1951.
3. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
4. General: Include hot- and cold-water indicators; coordinate faucet inlets with supplies and fixture hole punchings; coordinate outlet with spout and fixture receptor.
5. Body Type: Single hole.
6. Body Material: Commercial, solid brass.
7. Finish: Polished chrome plate.
8. Maximum Flow Rate: 0.5 gpm.
9. Mounting Type: Refer schedules.
10. Spout: Rigid, gooseneck type.
11. Spout Outlet: Aerator.

2.3 SUPPLY FITTINGS

- A. NSF Standard: Comply with NSF 372 for supply-fitting materials that will be in contact with potable water.
- B. Standard: ASME A112.18.1/CSA B125.1.
- C. Supply Piping: Chrome-plated-brass pipe or chrome-plated copper tube matching water-supply piping size. Include chrome-plated-brass or stainless-steel wall flange.
- D. Supply Stops: Chrome-plated-brass, one-quarter-turn, ball-type or compression valve with inlet connection matching supply piping.
- E. Operation: Loose key.
- F. Risers:
 1. NPS 1/2.
 2. Chrome-plated, rigid-copper-pipe and brass straight or offset tailpieces riser.

2.4 WASTE FITTINGS

- A. Standard: ASME A112.18.2/CSA B125.2.
- B. Drain: Grid type with NPS 1-1/4 offset and straight tailpiece.
- C. Trap:
 1. Size: NPS 1-1/2 by NPS 1-1/4.
 2. Material: Chrome-plated, two-piece, cast-brass trap and swivel elbow with 0.032-inch-thick brass tube to wall; and chrome-plated, brass or steel wall flange.
 3. Material: Stainless-steel, two-piece trap and swivel elbow with 0.012-inch-thick stainless-steel tube to wall; and stainless-steel wall flange.

2.5 SUPPORTS

- A. Type II Lavatory Carrier:
 - 1. Standard: ASME A112.6.1M.
- B. Type III Lavatory Carrier:
 - 1. Standard: ASME A112.6.1M.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine roughing-in of water supply and sanitary drainage and vent piping systems to verify actual locations of piping connections before lavatory installation.
- B. Examine counters and walls for suitable conditions where lavatories will be installed.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Install lavatories level and plumb according to roughing-in drawings.
- B. Install supports, affixed to building substrate, for wall-mounted lavatories.
- C. Install accessible wall-mounted lavatories at handicapped/elderly mounting height for people with disabilities or the elderly, according to ICC/ANSI A117.1.
- D. Install wall flanges or escutcheons at piping wall penetrations in exposed, finished locations. Use deep-pattern escutcheons if required to conceal protruding fittings. Comply with escutcheon requirements specified in Section 220518 "Escutcheons for Plumbing Piping."
- E. Seal joints between lavatories, counters, and walls using sanitary-type, one-part, mildew-resistant silicone sealant. Match sealant color to fixture color. Comply with sealant requirements specified in Section 079200 "Joint Sealants."
- F. Install protective shielding pipe covers and enclosures on exposed supplies and waste piping of accessible lavatories. Comply with requirements in Section 220719 "Plumbing Piping Insulation."

3.3 CONNECTIONS

- A. Connect fixtures with water supplies, stops, and risers, and with traps, soil, waste, and vent piping. Use size fittings required to match fixtures.
- B. Comply with water piping requirements specified in Section 221116 "Domestic Water Piping."

- C. Comply with soil and waste piping requirements specified in Section 221316 "Sanitary Waste and Vent Piping."

3.4 ADJUSTING

- A. Operate and adjust lavatories and controls. Replace damaged and malfunctioning lavatories, fittings, and controls.
- B. Adjust water pressure at faucets to produce proper flow.
- C. Install fresh batteries in battery-powered, electronic-sensor mechanisms.

3.5 CLEANING AND PROTECTION

- A. After completing installation of lavatories, inspect and repair damaged finishes.
- B. Clean lavatories, faucets, and other fittings with manufacturers' recommended cleaning methods and materials.
- C. Provide protective covering for installed lavatories and fittings.
- D. Do not allow use of lavatories for temporary facilities unless approved in writing by Owner.

END OF SECTION

SECTION 224216.16 - COMMERCIAL SINKS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:

- 1. Service basins.
- 2. Service sinks.
- 3. Utility sinks.
- 4. Sink faucets.
- 5. Supports.
- 6. Supply fittings.
- 7. Waste fittings.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.

- 1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for sinks.
- 2. Include rated capacities, operating characteristics and furnished specialties and accessories.

1.4 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Counter cutout templates for mounting of counter-mounted lavatories.

1.5 CLOSEOUT SUBMITTALS

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

1.6 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Faucet Washers and O-Rings: Equal to 10 percent of amount of each type and size installed.

2. Faucet Cartridges and O-Rings: Equal to 5 percent of amount of each type and size installed.

PART 2 - PRODUCTS

2.1 SERVICE BASINS

A. Service Basins: Terrazzo, floor mounted.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Acorn Engineering Company; a Division of Morris Group International.
 - b. Fiat Products.
 - c. Stern-Williams Co., Inc.
2. Fixture:
 - a. Standard: IAPMO PS 99.
 - b. Shape: Square.
 - c. Nominal Size: 24 by 24 inches.
 - d. Height: 10 inches.
 - e. Tiling Flange: On three sides.
 - f. Rim Guard: On all top surfaces.
 - g. Color: Coordinate with Architect for finish.
 - h. Drain: Grid with NPS 3 outlet.
3. Mounting: On floor and flush to wall.
4. Faucet: Refer Plumbing schedules.

2.2 SINK FAUCETS

A. NSF Standard: Comply with NSF 372 for faucet-spout materials that will be in contact with potable water.

B. Sink Faucets: Manual type, two lever handle mixing valve.

1. Commercial, Solid-Brass Faucets:
 - a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1) American Standard.
 - 2) Bradley Corporation.
 - 3) Delta Faucet Company.
 - 4) Kohler Co.
 - 5) Sloan Valve Company.
 - 6) Zurn Industries, LLC.
2. General-Duty, Solid-Brass Faucets:

- a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1) American Standard.
 - 2) Bradley Corporation.
 - 3) Chicago Faucets; Geberit Company.
 - 4) Delta Faucet Company.
 - 5) Kohler Co.
 - 6) Zurn Industries, LLC.
- 3. Standard: ASME A112.18.1/CSA B125.1.
- 4. General: Include hot- and cold-water indicators; coordinate faucet inlets with supplies and fixture hole punchings; coordinate outlet with spout and sink receptor.
- 5. Body Type: Single hole.
- 6. Body Material: Commercial, solid brass.
- 7. Finish: Polished chrome plate / Coordinate with Architect for final finishes.
- 8. Maximum Flow Rate: 2.2 gpm.
- 9. Handle(s): Lever.
- 10. Mounting Type: Back/wall, exposed.
- 11. Spout Type: Rigid, solid brass with wall brace.
- 12. Vacuum Breaker: Required for hose outlet.
- 13. Spout Outlet: Laminar flow / Hose thread according to ASME B1.20.7.

2.3 LAMINAR-FLOW, FAUCET-SPOUT OUTLETS

- A. NSF Standard: Comply with NSF 372 for faucet-spout-outlet materials that will be in contact with potable water.
- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. AM Conservation Group, Inc.
 - 2. Chronomite Laboratories, Inc; a division of Morris Group International.
 - 3. T&S Brass and Bronze Works, Inc.
- C. Description: Chrome-plated brass, faucet-spout outlet that produces non-aerating, laminar stream. Include external or internal thread that mates with faucet outlet for attachment to faucets where indicated and flow-rate range that includes flow of faucet.

2.4 SUPPORTS

- A. Type II Sink Carrier:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Jay R. Smith Mfg Co; a division of Morris Group International.
 - b. MIFAB, Inc.
 - c. WATTS.
 - d. Zurn Industries, LLC.

2. Standard: ASME A112.6.1M.

2.5 SUPPLY FITTINGS

- A. NSF Standard: Comply with NSF 372 for supply-fitting materials that will be in contact with potable water.
- B. Standard: ASME A112.18.1/CSA B125.1.
- C. Supply Piping: Chrome-plated brass pipe or chrome-plated copper tube matching water-supply piping size. Include chrome-plated brass or stainless-steel wall flange.
- D. Supply Stops: Chrome-plated brass, one-quarter-turn, ball-type or compression valve with inlet connection matching supply piping.
- E. Operation: Loose key.
- F. Risers:
 1. NPS 1/2.
 2. Chrome-plated, rigid-copper pipe.

2.6 WASTE FITTINGS

- A. Standard: ASME A112.18.2/CSA B125.2.
- B. Drain: Grid type with NPS 1-1/2 offset and straight tailpiece.
- C. Trap:
 1. Size: NPS 1-1/2.
 2. Material: Chrome-plated, two-piece, cast-brass trap and swivel elbow with 0.032-inch-thick brass tube to wall two-piece, cast-brass trap and ground-joint swivel elbow with 0.032-inch-thick brass tube to wall.
 3. Material: Stainless-steel, two-piece trap and swivel elbow with 0.012-inch-thick stainless-steel tube to wall; and stainless-steel wall flange.

2.7 GROUT

- A. Standard: ASTM C 1107/C 1107M, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.
- B. Characteristics: Nonshrink; recommended for interior and exterior applications.
- C. Design Mix: 5000-psi, 28-day compressive strength.
- D. Packaging: Premixed and factory packaged.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine roughing-in of water supply and sanitary drainage and vent piping systems to verify actual locations of piping connections before sink installation.
- B. Examine walls, floors, and counters for suitable conditions where sinks will be installed.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Install sinks level and plumb according to roughing-in drawings.
- B. Install supports, affixed to building substrate, for wall-hung sinks.
- C. Install accessible wall-mounted sinks at handicapped/elderly mounting height according to ICC/ANSI A117.1.
- D. Set floor-mounted sinks in leveling bed of cement grout.
- E. Install water-supply piping with stop on each supply to each sink faucet.
 - 1. Exception: Use ball or gate valves if supply stops are not specified with sink. Comply with valve requirements specified in Section 220523.12 "Ball Valves for Plumbing Piping" and Section 220523.15 "Gate Valves for Plumbing Piping."
 - 2. Install stops in locations where they can be easily reached for operation.
- F. Install wall flanges or escutcheons at piping wall penetrations in exposed, finished locations. Use deep-pattern escutcheons if required to conceal protruding fittings. Comply with escutcheon requirements specified in Section 220518 "Escutcheons for Plumbing Piping."
- G. Seal joints between sinks and counters, floors, and walls using sanitary-type, one-part, mildew-resistant silicone sealant. Match sealant color to fixture color. Comply with sealant requirements specified in Section 079200 "Joint Sealants."
- H. Install protective shielding pipe covers and enclosures on exposed supplies and waste piping of accessible sinks. Comply with requirements in Section 220719 "Plumbing Piping Insulation."

3.3 CONNECTIONS

- A. Connect sinks with water supplies, stops, and risers, and with traps, soil, waste, and vent piping. Use size fittings required to match fixtures.
- B. Comply with water piping requirements specified in Section 221116 "Domestic Water Piping."
- C. Comply with soil and waste piping requirements specified in Section 221316 "Sanitary Waste and Vent Piping."

3.4 ADJUSTING

- A. Operate and adjust sinks and controls. Replace damaged and malfunctioning sinks, fittings, and controls.
- B. Adjust water pressure at faucets to produce proper flow.

3.5 CLEANING AND PROTECTION

- A. After completing installation of sinks, inspect and repair damaged finishes.
- B. Clean sinks, faucets, and other fittings with manufacturers' recommended cleaning methods and materials.
- C. Provide protective covering for installed sinks and fittings.
- D. Do not allow use of sinks for temporary facilities unless approved in writing by Owner.

END OF SECTION

SECTION 23 05 17 - SLEEVES AND SLEEVE SEALS FOR HVAC PIPING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. Section Includes:
 - 1. Sleeves.
 - 2. Sleeve-seal systems.
 - 3. Grout.

1.03 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.

PART 2 - PRODUCTS

2.01 SLEEVES

- A. Galvanized-Steel-Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, zinc coated, with plain ends.

2.02 SLEEVE-SEAL SYSTEMS

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. Metraflex Company (The).
 - 2. Pipeline Seal and Insulator, Inc.
 - 3. Proco Products, Inc.
- B. Description: Modular sealing-element unit, designed for field assembly, for filling annular space between piping and sleeve.
 - 1. Sealing Elements: EPDM-rubber interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
 - 2. Pressure Plates: Plastic.
 - 3. Connecting Bolts and Nuts: Stainless steel of length required to secure pressure plates to sealing elements.

2.03 GROUT

- A. Standard: ASTM C 1107/C 1107M, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.
- B. Characteristics: Nonshrink; recommended for interior and exterior applications.
- C. Design Mix: 5000-psi, 28-day compressive strength.
- D. Packaging: Premixed and factory packaged.

PART 3 - EXECUTION

3.01 SLEEVE INSTALLATION

- A. Install sleeves for piping passing through penetrations in floors, partitions, roofs, and walls.
- B. For sleeves that will have sleeve-seal system installed, select sleeves of size large enough to provide 1-inch annular clear space between piping and concrete slabs and walls.
 - 1. Sleeves are not required for core-drilled holes.
- C. Install sleeves for pipes passing through interior partitions.
 - 1. Cut sleeves to length for mounting flush with both surfaces.

2. Install sleeves that are large enough to provide 1/4-inch annular clear space between sleeve and pipe or pipe insulation.
 3. Seal annular space between sleeve and piping or piping insulation; use joint sealants appropriate for size, depth, and location of joint.
- D. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials.
- 3.02 SLEEVE-SEAL-SYSTEM INSTALLATION
- A. Install sleeve-seal systems in sleeves in exterior concrete walls and slabs-on-grade at service piping entries into building.
 - B. Select type, size, and number of sealing elements required for piping material and size and for sleeve ID or hole size. Position piping in center of sleeve. Center piping in penetration, assemble sleeve-seal system components, and install in annular space between piping and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make a watertight seal.
- 3.03 SLEEVE AND SLEEVE-SEAL SCHEDULE
- A. Use sleeves and sleeve seals for the following piping-penetration applications:
 1. Exterior Concrete Walls above Grade:
 - a. Piping Smaller Than NPS 6: Galvanized-steel-pipe sleeves.
 2. Concrete Slabs above Grade:
 - a. Piping Smaller Than NPS 6: Galvanized-steel-pipe sleeves.
 3. Interior Partitions:
 - a. Piping Smaller Than NPS 6: Galvanized-steel-pipe sleeves.
- END OF SECTION

SECTION 23 05 18 – ESCUTCHEONS FOR HVAC PIPING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. Section Includes:
 - 1. Escutcheons.

1.03 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.

PART 2 - PRODUCTS

2.01 ESCUTCHEONS

- A. One-Piece, Cast-Brass Type: With polished, chrome-plated and rough-brass finish and setscrew fastener.
- B. One-Piece, Deep-Pattern Type: Deep-drawn, box-shaped brass with chrome-plated finish and spring-clip fasteners.
- C. One-Piece, Stamped-Steel Type: With chrome-plated finish and spring-clip fasteners.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Install escutcheons for piping penetrations of walls, ceilings, and finished floors.
- B. Install escutcheons with ID to closely fit around pipe, tube, and insulation of piping and with OD that completely covers opening.
 - 1. Escutcheons for New Piping:
 - a. Piping with Fitting or Sleeve Protruding from Wall: One-piece, deep-pattern type.
 - b. Insulated Piping: One-piece, stamped-steel type.
 - c. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece, cast-brass type with polished, chrome-plated finish.
 - d. Bare Piping in Unfinished Service Spaces: One-piece, cast-brass type with polished, chrome-plated finish.
 - e. Bare Piping in Equipment Rooms: One-piece, cast-brass type with polished, chrome-plated finish.

3.02 FIELD QUALITY CONTROL

- A. Replace broken and damaged escutcheons using new materials.

END OF SECTION

SECTION 23 05 23 – GENERAL-DUTY VALVES FOR HVAC PIPING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. Section Includes:
 - 1. Brass ball valves.
 - 2. Bronze ball valves.
 - 3. Bronze swing check valves.
 - 4. Iron swing check valves.
- B. Related Sections:
 - 1. Section 23 05 53 "Identification for HVAC Piping and Equipment" for valve tags and schedules.

1.03 DEFINITIONS

- A. CWP: Cold working pressure.
- B. EPDM: Ethylene propylene copolymer rubber.
- C. NBR: Acrylonitrile-butadiene, Buna-N, or nitrile rubber.
- D. NRS: Nonrising stem.
- E. OS&Y: Outside screw and yoke.
- F. RS: Rising stem.
- G. SWP: Steam working pressure.

1.04 ACTION SUBMITTALS

- A. Product Data: For each type of valve indicated.

1.05 QUALITY ASSURANCE

- A. Source Limitations for Valves: Obtain each type of valve from single source from single manufacturer.
- B. ASME Compliance:
 - 1. ASME B16.10 and ASME B16.34 for ferrous valve dimensions and design criteria.
 - 2. ASME B31.1 for power piping valves.
 - 3. ASME B31.9 for building services piping valves.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Prepare valves for shipping as follows:
 - 1. Protect internal parts against rust and corrosion.
 - 2. Protect threads, flange faces, grooves, and weld ends.
 - 3. Set angle valves closed to prevent rattling.
 - 4. Set ball and plug valves open to minimize exposure of functional surfaces.
 - 5. Block check valves in either closed or open position.
- B. Use the following precautions during storage:
 - 1. Maintain valve end protection.
 - 2. Store valves indoors and maintain at higher than ambient dew point temperature. If outdoor storage is necessary, store valves off the ground in watertight enclosures.
- C. Use sling to handle large valves; rig sling to avoid damage to exposed parts. Do not use handwheels or stems as lifting or rigging points.

PART 2 - PRODUCTS

2.01 GENERAL REQUIREMENTS FOR VALVES

- A. Refer to HVAC valve schedule articles for applications of valves.
- B. Valve Pressure and Temperature Ratings: Not less than indicated and as required for system pressures and temperatures.
- C. Valve Sizes: Same as upstream piping unless otherwise indicated.
- D. Valve Actuator Types:
 - 1. Handwheel: For valves other than quarter-turn types.
 - 2. Handlever: For quarter-turn valves NPS 6 and smaller.
 - 3. Wrench: For plug valves with square heads. Furnish Owner with 1 wrench for every 5 plug valves, for each size square plug-valve head.
 - 4. Chainwheel: Device for attachment to valve handwheel, stem, or other actuator; of size and with chain for mounting height, as indicated in the "Valve Installation" Article.
- E. Valves in Insulated Piping: With 2-inch stem extensions and the following features:
 - 1. Ball Valves: With extended operating handle of non-thermal-conductive material, and protective sleeve that allows operation of valve without breaking the vapor seal or disturbing insulation.
- F. Valve-End Connections:
 - 1. Solder Joint: With sockets according to ASME B16.18.
 - 2. Threaded: With threads according to ASME B1.20.1.
- G. Valve Bypass and Drain Connections: MSS SP-45.

2.02 BRASS BALL VALVES

- A. Two-Piece, Full-Port, Brass Ball Valves with Brass Trim:
 - 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Crane Co.; Crane Valve Group; Crane Valves.
 - b. Hammond Valve.
 - c. Milwaukee Valve Company.
 - d. NIBCO INC.
 - 2. Description:
 - a. Standard: MSS SP-110.
 - b. SWP Rating: 150 psig.
 - c. CWP Rating: 600 psig.
 - d. Body Design: Two piece.
 - e. Body Material: Forged brass.
 - f. Ends: Threaded.
 - g. Seats: PTFE or TFE.
 - h. Stem: Brass.
 - i. Ball: Chrome-plated brass.
 - j. Port: Full.

2.03 BRONZE BALL VALVES

- A. Two-Piece, Full-Port, Bronze Ball Valves with Bronze Trim:
 - 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Crane Co.; Crane Valve Group; Crane Valves.
 - b. Hammond Valve.

- c. Milwaukee Valve Company.
- d. NIBCO INC.
- 2. Description:
 - a. Standard: MSS SP-110.
 - b. SWP Rating: 150 psig.
 - c. CWP Rating: 600 psig.
 - d. Body Design: Two piece.
 - e. Body Material: Bronze.
 - f. Ends: Threaded.
 - g. Seats: PTFE or TFE.
 - h. Stem: Bronze.
 - i. Ball: Chrome-plated brass.
 - j. Port: Full.

2.04 BRONZE SWING CHECK VALVES

- A. Class 125, Bronze Swing Check Valves with Bronze Disc:
 - 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Crane Co
 - b. Hammond Valve.
 - c. Milwaukee Valve Company.
 - d. NIBCO INC.
 - 2. Description:
 - a. Standard: MSS SP-80, Type 3.
 - b. CWP Rating: 200 psig.
 - c. Body Design: Horizontal flow.
 - d. Body Material: ASTM B 62, bronze.
 - e. Ends: Threaded.
 - f. Disc: Bronze.
- B. Class 150, Bronze Swing Check Valves with Bronze Disc:
 - 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Crane Co
 - b. Milwaukee Valve Company.
 - c. NIBCO INC.
 - 2. Description:
 - a. Standard: MSS SP-80, Type 3.
 - b. CWP Rating: 300 psig.
 - c. Body Design: Horizontal flow.
 - d. Body Material: ASTM B 62, bronze.
 - e. Ends: Threaded.
 - f. Disc: Bronze.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Examine valve interior for cleanliness, freedom from foreign matter, and corrosion. Remove special packing materials, such as blocks, used to prevent disc movement during shipping and handling.
- B. Operate valves in positions from fully open to fully closed. Examine guides and seats made accessible by such operations.

- C. Examine threads on valve and mating pipe for form and cleanliness.
- D. Examine mating flange faces for conditions that might cause leakage. Check bolting for proper size, length, and material. Verify that gasket is of proper size, that its material composition is suitable for service, and that it is free from defects and damage.
- E. Do not attempt to repair defective valves; replace with new valves.

3.02 VALVE INSTALLATION

- A. Install valves with unions or flanges at each piece of equipment arranged to allow service, maintenance, and equipment removal without system shutdown.
- B. Locate valves for easy access and provide separate support where necessary.
- C. Install valves in horizontal piping with stem at or above center of pipe.
- D. Install valves in position to allow full stem movement.
- E. Install check valves for proper direction of flow and as follows:
 - 1. Swing Check Valves: In horizontal position with hinge pin level.

3.03 ADJUSTING

- A. Adjust or replace valve packing after piping systems have been tested and put into service but before final adjusting and balancing. Replace valves if persistent leaking occurs.

3.04 GENERAL REQUIREMENTS FOR VALVE APPLICATIONS

- A. If valve applications are not indicated, use the following:
 - 1. Shutoff Service: Ball valves.
 - 2. Throttling Service except Steam: ball valves.
- B. If valves with specified SWP classes or CWP ratings are not available, the same types of valves with higher SWP classes or CWP ratings may be substituted.
- C. Select valves, except wafer types, with the following end connections:
 - 1. For Copper Tubing, NPS 2 and Smaller: Threaded ends except where solder-joint valve-end option is indicated in valve schedules below.
 - 2. For Steel Piping, NPS 2 and Smaller: Threaded ends.

3.05 HEATING-WATER VALVE SCHEDULE

- A. Pipe NPS 2 and Smaller:
 - 1. Bronze and Brass Valves: May be provided with solder-joint ends instead of threaded ends.
 - 2. Bronze Angle Valves: Class 125, bronze disc.
 - 3. Ball Valves: Two piece, full or regular port, brass or bronze with brass or bronze trim.
 - 4. Bronze Swing Check Valves: Class 125, bronze disc.

END OF SECTION

SECTION 23 05 29 – HANGERS AND SUPPORTS FOR HVAC PIPING AND EQUIPMENT

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. Section Includes:
 - 1. Trapeze pipe hangers.
 - 2. Fiberglass pipe hangers.
 - 3. Metal framing systems.
- B. Related Requirements:
 - 1. Section 05 50 00 "Metal Fabrications" for structural-steel shapes and plates for trapeze hangers for pipe and equipment supports.
 - 2. Section 23 31 13 "Metal Ducts" for duct hangers and supports.

1.03 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: Show fabrication and installation details and include calculations for the following; include Product Data for components:
 - 1. Trapeze pipe hangers.
 - 2. Metal framing systems.
- C. Delegated-Design Submittal: For trapeze hangers indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
 - 1. Detail fabrication and assembly of trapeze hangers.
 - 2. Include design calculations for designing trapeze hangers.

1.04 INFORMATIONAL SUBMITTALS

- A. Welding certificates.

1.05 QUALITY ASSURANCE

- A. Structural-Steel Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."
- B. Pipe Welding Qualifications: Qualify procedures and operators according to ASME Boiler and Pressure Vessel Code, Section IX.

PART 2 - PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

- A. Structural Performance: Hangers and supports for HVAC piping and equipment shall withstand the effects of gravity loads and stresses within limits and under conditions indicated according to ASCE/SEI 7.
 - 1. Design supports for multiple pipes, including pipe stands, capable of supporting combined weight of supported systems, system contents, and test water.
 - 2. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.
 - 3.

2.02 TRAPEZE PIPE HANGERS

- A. Description: MSS SP-58, Type 59, shop- or field-fabricated pipe-support assembly made from structural carbon-steel shapes with MSS SP-58 carbon-steel hanger rods, nuts, saddles, and U-bolts.

2.03 FIBERGLASS PIPE HANGERS

- A. Clevis-Type, Fiberglass Pipe Hangers:
1. Description: Similar to MSS SP-58, Type 1, factory-fabricated steel pipe hanger except hanger is made of fiberglass or fiberglass-reinforced resin.
 2. Hanger Rods: Continuous-thread rod, washer, and nuts made of stainless steel.
 3. Flammability: ASTM D 635, ASTM E 84, and UL 94.

2.04 METAL FRAMING SYSTEMS

- A. MFMA Manufacturer Metal Framing Systems:
1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Flex-Strut, Inc.
 - b. G-Strut
 - c. Unistrut
 - d. Wesanco, Inc.
 2. Description: Shop- or field-fabricated, pipe-support assembly made of steel channels, accessories, fittings, and other components for supporting multiple parallel pipes.
 3. Standard: Comply with MFMA-4 factory-fabricated components for field assembly.
 4. Channels: Continuous slotted stainless-steel, Type 304 channel with inturned lips.
 5. Channel Width: Selected for applicable load criteria.
 6. Channel Nuts: Formed or stamped nuts or other devices designed to fit into channel slot and, when tightened, prevent slipping along channel.
 7. Hanger Rods: Continuous-thread rod, nuts, and washer made of stainless steel.
 8. Metallic Coating: No coating.

2.05 FIBERGLASS STRUT SYSTEMS

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Flex-Strut, Inc.
 - b. G-Strut
 - c. Unistrut
 - d. Wesanco, Inc.
2. Description: Structural-grade, factory-formed, glass-fiber-resin channels and angles for supporting multiple parallel pipes.
3. Standard: Comply with MFMA-4 factory-fabricated components for field assembly.
4. Channels: Continuous slotted fiberglass-reinforced plastic channel with inturned lips.
5. Channel Width: Selected for applicable load criteria.
6. Fittings and Accessories: Products provided by channel and angle manufacturer and designed for use with those items.
7. Fitting and Accessory Materials: Same as those for channels and angles.
8. Rated Strength: Selected to suit applicable load criteria.
9. Protect finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

PART 3 - EXECUTION

3.01 APPLICATION

- A. Comply with requirements in Section 07 84 13 "Penetration Firestopping" for firestopping materials and installation for penetrations through fire-rated walls, ceilings, and assemblies.
- B. Strength of Support Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static loads within specified loading limits. Minimum static design load used for strength determination shall be weight of supported components plus 200 lb.

3.02 HANGER AND SUPPORT INSTALLATION

- A. Metal Trapeze Pipe-Hanger Installation: Comply with MSS SP-58. Arrange for grouping of parallel runs of horizontal piping, and support together on field-fabricated trapeze pipe hangers.
 - 1. Pipes of Various Sizes: Support together and space trapezes for smallest pipe size or install intermediate supports for smaller diameter pipes as specified for individual pipe hangers.
 - 2. Field fabricate from ASTM A 36/A 36M, carbon-steel shapes selected for loads being supported. Weld steel according to AWS D1.1/D1.1M.
- B. Metal Framing System Installation: Arrange for grouping of parallel runs of piping, and support together on field-assembled strut systems.
- C. Install hangers and supports complete with necessary attachments, inserts, bolts, rods, nuts, washers, and other accessories.
- D. 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.
- E. Install lateral bracing with pipe hangers and supports to prevent swaying.
- F. Install building attachments within concrete slabs or attach to structural steel. Install additional attachments at concentrated loads, including valves, flanges, and strainers, NPS 2-1/2 and larger and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten inserts to forms and install reinforcing bars through openings at top of inserts.
- G. Load Distribution: Install hangers and supports so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.
- H. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and to not exceed maximum pipe deflections allowed by ASME B31.9 for building services piping.
- I. Insulated Piping:
 - 1. Attach clamps and spacers to piping.
 - a. Piping Operating above Ambient Air Temperature: Clamp may project through insulation.
 - b. Do not exceed pipe stress limits allowed by ASME B31.9 for building services piping.
 - 2. Install MSS SP-58, Type 39, protection saddles if insulation without vapor barrier is indicated. Fill interior voids with insulation that matches adjoining insulation.
 - 3. Shield Dimensions for Pipe: Not less than the following:

3.03 METAL FABRICATIONS

- A. Cut, drill, and fit miscellaneous metal fabrications for trapeze pipe hangers.
- B. Fit exposed connections together to form hairline joints. Field weld connections that cannot be shop welded because of shipping size limitations.
- C. Field Welding: Comply with AWS D1.1/D1.1M procedures for shielded, metal arc welding; appearance and quality of welds; and methods used in correcting welding work; and with the following:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove welding flux immediately.
4. Finish welds at exposed connections so no roughness shows after finishing and so contours of welded surfaces match adjacent contours.

3.04 ADJUSTING

- A. Hanger Adjustments: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.
- B. Trim excess length of continuous-thread hanger and support rods to 1-1/2 inches.

3.05 PAINTING

- A. Touchup: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.
 1. Apply paint by brush or spray to provide a minimum dry film thickness of 2.0 mils.

3.06 HANGER AND SUPPORT SCHEDULE

- A. Specific hanger and support requirements are in Sections specifying piping systems and equipment.
- B. Comply with MSS SP-58 for pipe-hanger selections and applications that are not specified in piping system Sections.
- C. Use hangers and supports with galvanized metallic coatings for piping and equipment that will not have field-applied finish.
- D. Use nonmetallic coatings on attachments for electrolytic protection where attachments are in direct contact with copper tubing.
- E. Use stainless-steel pipe hangers and corrosion-resistant attachments for hostile environment applications.
- F. Use copper-plated pipe hangers and copper or stainless-steel attachments for copper piping and tubing.
- G. Use padded hangers for piping that is subject to scratching.
- H. Use thermal-hanger shield inserts for insulated piping and tubing.
- I. Horizontal-Piping Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
 1. Adjustable, Steel Clevis Hangers (MSS Type 1): For suspension of noninsulated or insulated, stationary pipes NPS 1/2 to NPS 30.
 2. Steel Pipe Clamps (MSS Type 4): For suspension of cold and hot pipes NPS 1/2 to NPS 24 if little or no insulation is required.
 3. Pipe Hangers (MSS Type 5): For suspension of pipes NPS 1/2 to NPS 4, to allow off-center closure for hanger installation before pipe erection.
 4. Clips (MSS Type 26): For support of insulated pipes not subject to expansion or contraction.
- J. Vertical-Piping Clamps: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
 1. Extension Pipe or Riser Clamps (MSS Type 8): For support of pipe risers NPS 3/4 to NPS 24.
- K. Hanger-Rod Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
 1. Steel Turnbuckles (MSS Type 13): For adjustment up to 6 inches for heavy loads.
 2. Steel Clevises (MSS Type 14): For 120 to 450 deg F piping installations.

3. Steel Weldless Eye Nuts (MSS Type 17): For 120 to 450 deg F piping installations.
- L. Building Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
 1. Steel or Malleable Concrete Inserts (MSS Type 18): For upper attachment to suspend pipe hangers from concrete ceiling.
 2. Side-Beam or Channel Clamps (MSS Type 20): For attaching to bottom flange of beams, channels, or angles.
 3. Center-Beam Clamps (MSS Type 21): For attaching to center of bottom flange of beams.
 4. C-Clamps (MSS Type 23): For structural shapes.
 5. Top-Beam Clamps (MSS Type 25): For top of beams if hanger rod is required tangent to flange edge.
 6. Side-Beam Clamps (MSS Type 27): For bottom of steel I-beams.
- M. Spring Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
 1. Spring Cushions (MSS Type 48): For light loads if vertical movement does not exceed 1-1/4 inches.
 2. Spring-Cushion Roll Hangers (MSS Type 49): For equipping Type 41, roll hanger with springs.
- N. Comply with MSS SP-58 for trapeze pipe-hanger selections and applications that are not specified in piping system Sections.
- O. Comply with MFMA-103 for metal framing system selections and applications that are not specified in piping system Sections.

END OF SECTION

SECTION 23 05 53 – IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. Section Includes:
 - 1. Pipe labels.
 - 2. Duct labels.
 - 3. Valve tags.

1.03 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Samples: For color, letter style, and graphic representation required for each identification material and device.
- C. Equipment Label Schedule: Include a listing of all equipment to be labeled with the proposed content for each label.
- D. Valve numbering scheme.
- E. Valve Schedules: For each piping system to include in maintenance manuals.

PART 2 - PRODUCTS

2.01 PIPE LABELS

- A. Manufacturers: Subject to compliance with requirements:
 - 1. Craftmark Pipe Markers
 - 2. Kolbi Pipe Marker Co.
 - 3. Marking Services, Inc
 - 4. Seton Identification Products
- B. General Requirements for Manufactured Pipe Labels: Preprinted, color-coded, with lettering indicating service, and showing flow direction according to ASME A13.1.
- C. Pretensioned Pipe Labels: Precoiled, semi rigid plastic formed to partially cover circumference of pipe and to attach to pipe without fasteners or adhesive.
- D. Pipe Label Contents: Include identification of piping service using same designations or abbreviations as used on Drawings; also include pipe size and an arrow indicating flow direction.
 - 1. Flow-Direction Arrows: Integral with piping system service lettering to accommodate both directions or as separate unit on each pipe label to indicate flow direction.
 - 2. Lettering Size: Size letters according to ASME A13.1 for piping.

2.02 DUCT LABELS

- A. Manufacturers: Subject to compliance with requirements:
 - 1. Craftmark Pipe Markers
 - 2. Kolbi Pipe Marker Co.
 - 3. Marking Services, Inc
 - 4. Seton Identification Products
- B. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving 1/8 inch (3.2 mm) thick, and having predrilled holes for attachment hardware.
- C. Letter Color: Black.

- D. Background Color: White.
- E. Maximum Temperature: Able to withstand temperatures up to 160 deg F (71 deg C).
- F. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch (64 by 19 mm).
- G. Minimum Letter Size: 1/4 inch (6.4 mm) for name of units if viewing distance is less than 24 inches (600 mm), 1/2 inch (13 mm) for viewing distances up to 72 inches (1830 mm), and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-quarters the size of principal lettering.
- H. Fasteners: Stainless-steel rivets self-tapping screws.
- I. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.
- J. Duct Label Contents: Include identification of duct service using same designations or abbreviations as used on Drawings; also include duct size and an arrow indicating flow direction.
 - 1. Flow-Direction Arrows: Integral with duct system service lettering to accommodate both directions or as separate unit on each duct label to indicate flow direction.

2.03 VALVE TAGS

- A. Manufacturers: Subject to compliance with requirements:
 - 1. Craftmark Pipe Markers
 - 2. Kolbi Pipe Marker Co.
 - 3. Marking Services, Inc
 - 4. Seton Identification Products
- B. Description: Stamped or engraved with 1/4-inch (6.4-mm) letters for piping system abbreviation and 1/2-inch (13-mm) numbers.
 - 1. Tag Material: Brass, 0.032-inch (0.8-mm) minimum thickness, and having predrilled or stamped holes for attachment hardware.
 - 2. Fasteners: Brass beaded chain.
- C. Valve Schedules: For each piping system, on 8-1/2-by-11-inch (A4) bond paper. Tabulate valve number, piping system, system abbreviation (as shown on valve tag), location of valve (room or space), normal-operating position (open, closed, or modulating), and variations for identification. Mark valves for emergency shutoff and similar special uses.
 - 1. Valve-tag schedule shall be included in operation and maintenance data.

PART 3 - EXECUTION

3.01 PREPARATION

- A. Clean piping and equipment surfaces of substances that could impair bond of identification devices, including dirt, oil, grease, release agents, and incompatible primers, paints, and encapsulants.

3.02 GENERAL INSTALLATION REQUIREMENTS

- A. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.
- B. Coordinate installation of identifying devices with locations of access panels and doors.
- C. Install identifying devices before installing acoustical ceilings and similar concealment.

3.03 PIPE LABEL INSTALLATION

- A. Pipe Label Locations: Locate pipe labels where piping is exposed or above accessible ceilings in finished spaces; machine rooms; accessible maintenance spaces such as shafts, tunnels, and plenums; and exterior exposed locations as follows:
 - 1. Near each valve and control device.

2. Near each branch connection, excluding short takeoffs for fixtures and terminal units. Where flow pattern is not obvious, mark each pipe at branch.
 3. Near penetrations and on both sides of through walls, floors, ceilings, and inaccessible enclosures.
 4. At access doors, manholes, and similar access points that permit view of concealed piping.
 5. Near major equipment items and other points of origination and termination.
 6. Spaced at maximum intervals of 50 feet (15 m) along each run. Reduce intervals to 25 feet (7.6 m) in areas of congested piping and equipment.
 7. On piping above removable acoustical ceilings. Omit intermediately spaced labels.
- B. Directional Flow Arrows: Arrows shall be used to indicate direction of flow in pipes, including pipes where flow is allowed in both directions.
- C. Pipe Label Color Schedule:
1. Heating Water Piping: White letters on a safety-green background.
 2. Refrigerant Piping: Black letters on a safety-orange background.
- 3.04 DUCT LABEL INSTALLATION
- A. Install plastic-laminated duct labels with permanent adhesive on air ducts in the following color codes:
1. Blue: For cold-air supply ducts.
 2. Green: For exhaust-, outside-, relief-, return-, and mixed-air ducts.
- B. Locate labels near points where ducts enter into and exit from concealed spaces and at maximum intervals of 50 feet (15 m) in each space where ducts are exposed or concealed by removable ceiling system.
- 3.05 VALVE-TAG INSTALLATION
- A. Install tags on valves and control devices in piping systems, except check valves, valves within factory-fabricated equipment units, shutoff valves, faucets, convenience and lawn-watering hose connections, and HVAC terminal devices and similar roughing-in connections of end-use fixtures and units. List tagged valves in a valve schedule.
1. Valve-Tag Size and Shape:
 - a. Refrigerant: 1-1/2 inches (38 mm), round.
 - b. Hot Water: 1-1/2 inches (38 mm), round.
 2. Valve-Tag Colors:
 - a. Toxic and Corrosive Fluids: Black letters on a safety-orange background.
 - b. Potable and Other Water: White letters on a safety-green background.

END OF SECTION

SECTION 23 05 93 – TESTING, ADJUSTING, AND BALANCING FOR HVAC

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. Section Includes:
 - 1. Testing, adjusting, and balancing existing systems and equipment.

1.03 DEFINITIONS

- A. AABC: Associated Air Balance Council.
- B. BAS: Building automation systems.
- C. NEBB: National Environmental Balancing Bureau.
- D. TAB: Testing, adjusting, and balancing.
- E. TABB: Testing, Adjusting, and Balancing Bureau.
- F. TAB Specialist: An independent entity meeting qualifications to perform TAB work.
- G. TDH: Total dynamic head.

1.04 PREINSTALLATION MEETINGS

1.05 ACTION SUBMITTALS

- A. Sustainable Design Submittals:
 - 1. Air-Balance Report: Documentation indicating that Work complies with ASHRAE 62.1, Section 7.2.2 - "Air Balancing."
 - 2. TAB Report: Documentation indicating that Work complies with ASHRAE/IES 90.1, Section 6.7.2.3 - "System Balancing."
 - 3. TAB Report: Documentation indicating that Work complies with ASHRAE/IES 90.1, Section 6.7.2.3 - "System Balancing."

1.06 INFORMATIONAL SUBMITTALS

- A. Qualification Data: Within 30 days of Contractor's Notice to Proceed, submit documentation that the TAB specialist and this Project's TAB team members meet the qualifications specified in "Quality Assurance" Article.
- B. Contract Documents Examination Report: Within 30 days of Contractor's Notice to Proceed, submit the Contract Documents review report as specified in Part 3.
- C. Strategies and Procedures Plan: Within 60 days of Contractor's Notice to Proceed, submit TAB strategies and step-by-step procedures as specified in "Preparation" Article.
- D. System Readiness Checklists: Within 90 days of Contractor's Notice to Proceed, submit system readiness checklists as specified in "Preparation" Article.
- E. Examination Report: Submit a summary report of the examination review required in "Examination" Article.
- F. Certified TAB reports.
- G. Sample report forms.
- H. Instrument calibration reports, to include the following:
 - 1. Instrument type and make.
 - 2. Serial number.
 - 3. Application.
 - 4. Dates of use.

- 5. Dates of calibration.
- 1.07 QUALITY ASSURANCE
 - A. TAB Specialists Qualifications: Certified by AABC, NEBB or TABB.
 - 1. TAB Field Supervisor: Employee of the TAB specialist and certified by AABC, NEBB or TABB.
 - 2. TAB Technician: Employee of the TAB specialist and certified by AABC, NEBB or TABB as a TAB technician.
 - B. Instrumentation Type, Quantity, Accuracy, and Calibration: Comply with requirements in ASHRAE 111, Section 4, "Instrumentation."
 - C. ASHRAE 62.1 Compliance: Applicable requirements in ASHRAE 62.1, Section 7.2.2 - "Air Balancing."
 - D. ASHRAE/IES 90.1 Compliance: Applicable requirements in ASHRAE/IES 90.1, Section 6.7.2.3 - "System Balancing."
- 1.08 FIELD CONDITIONS
 - A. Full Owner Occupancy: Owner will occupy the site and existing building during entire TAB period. Cooperate with Owner during TAB operations to minimize conflicts with Owner's operations.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

- 3.01 EXAMINATION
 - A. Examine the Contract Documents to become familiar with Project requirements and to discover conditions in systems designs that may preclude proper TAB of systems and equipment.
 - B. Examine installed systems for balancing devices, such as test ports, gage cocks, thermometer wells, flow-control devices, balancing valves and fittings, and manual volume dampers. Verify that locations of these balancing devices are applicable for intended purpose and are accessible.
 - C. Examine the approved submittals for HVAC systems and equipment.
 - D. Examine design data including HVAC system descriptions, statements of design assumptions for environmental conditions and systems output, and statements of philosophies and assumptions about HVAC system and equipment controls.
 - E. Examine ceiling plenums and underfloor air plenums used for supply, return, or relief air to verify that they are properly separated from adjacent areas. Verify that penetrations in plenum walls are sealed and fire-stopped if required.
 - F. Examine equipment performance data including fan and pump curves.
 - 1. Relate performance data to Project conditions and requirements, including system effects that can create undesired or unpredicted conditions that cause reduced capacities in all or part of a system.
 - 2. Calculate system-effect factors to reduce performance ratings of HVAC equipment when installed under conditions different from the conditions used to rate equipment performance. To calculate system effects for air systems, use tables and charts found in AMCA 201, "Fans and Systems," or in SMACNA's "HVAC Systems - Duct Design." Compare results with the design data and installed conditions.
 - G. Examine system and equipment installations and verify that field quality-control testing, cleaning, and adjusting specified in individual Sections have been performed.
 - H. Examine test reports specified in individual system and equipment Sections.

- I. Examine HVAC equipment and verify that bearings are greased, belts are aligned and tight, filters are clean, and equipment with functioning controls is ready for operation.
- J. Examine terminal units, such as variable-air-volume boxes, and verify that they are accessible and their controls are connected and functioning.
- K. Examine strainers. Verify that startup screens have been replaced by permanent screens with indicated perforations.
- L. Examine control valves for proper installation for their intended function of throttling, diverting, or mixing fluid flows.
- M. Examine heat-transfer coils for correct piping connections and for clean and straight fins.
- N. Examine system pumps to ensure absence of entrained air in the suction piping.
- O. Examine operating safety interlocks and controls on HVAC equipment.
- P. Report deficiencies discovered before and during performance of TAB procedures. Observe and record system reactions to changes in conditions. Record default set points if different from indicated values.

3.02 PREPARATION

- A. Prepare a TAB plan that includes the following:
 - 1. Equipment and systems to be tested.
 - 2. Strategies and step-by-step procedures for balancing the systems.
 - 3. Instrumentation to be used.
 - 4. Sample forms with specific identification for all equipment.
- B. Perform system-readiness checks of HVAC systems and equipment to verify system readiness for TAB work. Include, at a minimum, the following:
 - 1. Airside:
 - a. Verify that leakage and pressure tests on air distribution systems have been satisfactorily completed.
 - b. Duct systems are complete with terminals installed.
 - c. Volume, smoke, and fire dampers are open and functional.
 - d. Clean filters are installed.
 - e. Fans are operating, free of vibration, and rotating in correct direction.
 - f. Variable-frequency controllers' startup is complete and safeties are verified.
 - g. Automatic temperature-control systems are operational.
 - h. Suitable access to balancing devices and equipment is provided.
 - 2. Hydronic:
 - a. Verify leakage and pressure tests on water distribution systems have been satisfactorily completed.
 - b. Piping is complete with terminals installed.
 - c. Water treatment is complete.
 - d. Systems are flushed, filled, and air purged.
 - e. Strainers are pulled and cleaned.
 - f. Control valves are functioning per the sequence of operation.
 - g. Shutoff and balance valves have been verified to be 100 percent open.
 - h. Pumps are started and proper rotation is verified.
 - i. Pump gage connections are installed directly at pump inlet and outlet flanges or in discharge and suction pipe prior to valves or strainers.
 - j. Variable-frequency controllers' startup is complete and safeties are verified.
 - k. Suitable access to balancing devices and equipment is provided.

3.03 GENERAL PROCEDURES FOR TESTING AND BALANCING

- A. Perform testing and balancing procedures on each system according to the procedures contained in AABC's "National Standards for Total System Balance" and in this Section.

- B. Cut insulation, ducts, pipes, and equipment cabinets for installation of test probes to the minimum extent necessary for TAB procedures.
 - 1. After testing and balancing, patch probe holes in ducts with same material and thickness as used to construct ducts.
 - 2. Install and join new insulation that matches removed materials. Restore insulation, coverings, vapor barrier, and finish according to Section 23 07 13 "Duct Insulation," and Section 23 07 19 "HVAC Piping Insulation."
 - C. Mark equipment and balancing devices, including damper-control positions, valve position indicators, fan-speed-control levers, and similar controls and devices, with paint or other suitable, permanent identification material to show final settings.
 - D. Take and report testing and balancing measurements in inch-pound (IP) units.
- 3.04 GENERAL PROCEDURES FOR BALANCING AIR SYSTEMS
- A. Prepare test reports for both fans and outlets. Obtain manufacturer's outlet factors and recommended testing procedures. Cross-check the summation of required outlet volumes with required fan volumes.
 - B. Prepare schematic diagrams of systems' "as-built" duct layouts.
 - C. Determine the best locations in main and branch ducts for accurate duct-airflow measurements.
 - D. Check airflow patterns from the outdoor-air louvers and dampers and the return- and exhaust-air dampers through the supply-fan discharge and mixing dampers.
 - E. Locate start-stop and disconnect switches, electrical interlocks, and motor starters.
 - F. Verify that motor starters are equipped with properly sized thermal protection.
 - G. Check dampers for proper position to achieve desired airflow path.
 - H. Check for airflow blockages.
 - I. Check condensate drains for proper connections and functioning.
 - J. Check for proper sealing of air-handling-unit components.
 - K. Verify that air duct system is sealed as specified in Section 23 31 13 "Metal Ducts."
- 3.05 PROCEDURES FOR CONSTANT-VOLUME AIR SYSTEMS
- A. Adjust fans to deliver total indicated airflows within the maximum allowable fan speed listed by fan manufacturer.
 - 1. Measure total airflow.
 - a. Set outside-air, return-air, and relief-air dampers for proper position that simulates minimum outdoor-air conditions.
 - b. Where duct conditions allow, measure airflow by Pitot-tube traverse. If necessary, perform multiple Pitot-tube traverses to obtain total airflow.
 - c. Where duct conditions are not suitable for Pitot-tube traverse measurements, a coil traverse may be acceptable.
 - d. If a reliable Pitot-tube traverse or coil traverse is not possible, measure airflow at terminals and calculate the total airflow.
 - 2. Measure fan static pressures as follows:
 - a. Measure static pressure directly at the fan outlet or through the flexible connection.
 - b. Measure static pressure directly at the fan inlet or through the flexible connection.
 - c. Measure static pressure across each component that makes up the air-handling system.
 - d. Report artificial loading of filters at the time static pressures are measured.
 - 3. Review Record Documents to determine variations in design static pressures versus actual static pressures. Calculate actual system-effect factors. Recommend adjustments to accommodate actual conditions.

4. Obtain approval from Construction Manager for adjustment of fan speed higher or lower than indicated speed. Comply with requirements in HVAC Sections for air-handling units for adjustment of fans, belts, and pulley sizes to achieve indicated air-handling-unit performance.
 5. Do not make fan-speed adjustments that result in motor overload. Consult equipment manufacturers about fan-speed safety factors. Modulate dampers and measure fan-motor amperage to ensure that no overload occurs. Measure amperage in full-cooling, full-heating, economizer, and any other operating mode to determine the maximum required brake horsepower.
- B. Adjust volume dampers for main duct, submain ducts, and major branch ducts to indicated airflows.
1. Measure airflow of submain and branch ducts.
 2. Adjust submain and branch duct volume dampers for specified airflow.
 3. Re-measure each submain and branch duct after all have been adjusted.
- C. Adjust air inlets and outlets for each space to indicated airflows.
1. Set airflow patterns of adjustable outlets for proper distribution without drafts.
 2. Measure inlets and outlets airflow.
 3. Adjust each inlet and outlet for specified airflow.
 4. Re-measure each inlet and outlet after they have been adjusted.
- D. Verify final system conditions.
1. Re-measure and confirm that minimum outdoor, return, and relief airflows are within design. Readjust to design if necessary.
 2. Re-measure and confirm that total airflow is within design.
 3. Re-measure all final fan operating data, rpms, volts, amps, and static profile.
 4. Mark all final settings.
 5. Test system in economizer mode. Verify proper operation and adjust if necessary.
 6. Measure and record all operating data.
 7. Record final fan-performance data.
- 3.06 GENERAL PROCEDURES FOR HYDRONIC SYSTEMS
- A. Prepare test reports for pumps, coils, and heat exchangers. Obtain approved submittals and manufacturer-recommended testing procedures. Crosscheck the summation of required coil and heat exchanger flow rates with pump design flow rate.
- B. Prepare schematic diagrams of systems' "as-built" piping layouts.
- C. In addition to requirements in "Preparation" Article, prepare hydronic systems for testing and balancing as follows:
1. Check liquid level in expansion tank.
 2. Check highest vent for adequate pressure.
 3. Check flow-control valves for proper position.
 4. Locate start-stop and disconnect switches, electrical interlocks, and motor starters.
 5. Verify that motor starters are equipped with properly sized thermal protection.
 6. Check that air has been purged from the system.
- 3.07 PROCEDURES FOR CONSTANT-FLOW HYDRONIC SYSTEMS
- A. Adjust pumps to deliver total design gpm.
1. Measure total water flow.
 - a. Position valves for full flow through coils.
 - b. Measure flow by main flow meter, if installed.
 - c. If main flow meter is not installed, determine flow by pump TDH or exchanger pressure drop.
 2. Measure pump TDH as follows:
 - a. Measure discharge pressure directly at the pump outlet flange or in discharge pipe prior to any valves.

- b. Measure inlet pressure directly at the pump inlet flange or in suction pipe prior to any valves or strainers.
 - c. Convert pressure to head and correct for differences in gage heights.
 - d. Verify pump impeller size by measuring the TDH with the discharge valve closed. Note the point on manufacturer's pump curve at zero flow, and verify that the pump has the intended impeller size.
 - e. With valves open, read pump TDH. Adjust pump discharge valve until design water flow is achieved.
 - 3. Monitor motor performance during procedures and do not operate motor in an overloaded condition.
 - B. Adjust flow-measuring devices installed in mains and branches to design water flows.
 - 1. Measure flow in main and branch pipes.
 - 2. Adjust main and branch balance valves for design flow.
 - 3. Re-measure each main and branch after all have been adjusted.
 - C. Adjust flow-measuring devices installed at terminals for each space to design water flows.
 - 1. Measure flow at terminals.
 - 2. Adjust each terminal to design flow.
 - 3. Re-measure each terminal after it is adjusted.
 - 4. Position control valves to bypass the coil, and adjust the bypass valve to maintain design flow.
 - 5. Perform temperature tests after flows have been balanced.
 - D. For systems with pressure-independent valves at terminals:
 - 1. Measure differential pressure and verify that it is within manufacturer's specified range.
 - 2. Perform temperature tests after flows have been verified.
 - E. For systems without pressure-independent valves or flow-measuring devices at terminals:
 - 1. Measure and balance coils by either coil pressure drop or temperature method.
 - 2. If balanced by coil pressure drop, perform temperature tests after flows have been verified.
 - F. Verify final system conditions as follows:
 - 1. Re-measure and confirm that total water flow is within design.
 - 2. Re-measure final pumps' operating data, TDH, volts, amps, and static profile.
 - 3. Mark final settings.
 - G. Verify that memory stops have been set.
- 3.08 PROCEDURES FOR VARIABLE-FLOW HYDRONIC SYSTEMS
- A. Balance systems with automatic two- and three-way control valves by setting systems at maximum flow through heat-exchange terminals, and proceed as specified above for hydronic systems.
 - B. Adjust the variable-flow hydronic system as follows:
 - 1. Verify that the differential-pressure sensor is located as indicated.
 - 2. Determine whether there is diversity in the system.
 - C. For systems with no diversity:
 - 1. Adjust pumps to deliver total design gpm.
 - a. Measure total water flow.
 - 1) Position valves for full flow through coils.
 - 2) Measure flow by main flow meter, if installed.
 - 3) If main flow meter is not installed, determine flow by pump TDH or exchanger pressure drop.
 - b. Measure pump TDH as follows:
 - 1) Measure discharge pressure directly at the pump outlet flange or in discharge pipe prior to any valves.

- 2) Measure inlet pressure directly at the pump inlet flange or in suction pipe prior to any valves or strainers.
 - 3) Convert pressure to head and correct for differences in gage heights.
 - 4) Verify pump impeller size by measuring the TDH with the discharge valve closed. Note the point on manufacturer's pump curve at zero flow and verify that the pump has the intended impeller size.
 - 5) With valves open, read pump TDH. Adjust pump discharge valve until design water flow is achieved.
 - c. Monitor motor performance during procedures and do not operate motor in an overloaded condition.
 2. Adjust flow-measuring devices installed in mains and branches to design water flows.
 - a. Measure flow in main and branch pipes.
 - b. Adjust main and branch balance valves for design flow.
 - c. Re-measure each main and branch after all have been adjusted.
 3. Adjust flow-measuring devices installed at terminals for each space to design water flows.
 - a. Measure flow at terminals.
 - b. Adjust each terminal to design flow.
 - c. Re-measure each terminal after it is adjusted.
 - d. Position control valves to bypass the coil and adjust the bypass valve to maintain design flow.
 - e. Perform temperature tests after flows have been balanced.
 4. For systems with pressure-independent valves at terminals:
 - a. Measure differential pressure and verify that it is within manufacturer's specified range.
 - b. Perform temperature tests after flows have been verified.
 5. For systems without pressure-independent valves or flow-measuring devices at terminals:
 - a. Measure and balance coils by either coil pressure drop or temperature method.
 - b. If balanced by coil pressure drop, perform temperature tests after flows have been verified.
 6. Prior to verifying final system conditions, determine the system differential-pressure set point.
 7. If the pump discharge valve was used to set total system flow with variable-frequency controller at 60 Hz, at completion open discharge valve 100 percent and allow variable-frequency controller to control system differential-pressure set point. Record pump data under both conditions.
 8. Mark final settings and verify that all memory stops have been set.
 9. Verify final system conditions as follows:
 - a. Re-measure and confirm that total water flow is within design.
 - b. Re-measure final pumps' operating data, TDH, volts, amps, and static profile.
 - c. Mark final settings.
 10. Verify that memory stops have been set.
- 3.09 PROCEDURES FOR MOTORS
- A. Motors 1/2 HP and Larger: Test at final balanced conditions and record the following data:
1. Manufacturer's name, model number, and serial number.
 2. Motor horsepower rating.
 3. Motor rpm.
 4. Phase and hertz.
 5. Nameplate and measured voltage, each phase.
 6. Nameplate and measured amperage, each phase.
 7. Starter size and thermal-protection-element rating.
 8. Service factor and frame size.

- B. Motors Driven by Variable-Frequency Controllers: Test manual bypass of controller to prove proper operation.

3.10 PROCEDURES FOR HEAT-TRANSFER COILS

- A. Measure, adjust, and record the following data for each water coil:
 - 1. Entering- and leaving-water temperature.
 - 2. Water flow rate.
 - 3. Water pressure drop for major (more than 20 gpm) equipment coils, excluding unitary equipment such as reheat coils, unit heaters, and fan-coil units.
 - 4. Dry-bulb temperature of entering and leaving air.
 - 5. Wet-bulb temperature of entering and leaving air for cooling coils.
 - 6. Airflow.
- B. Measure, adjust, and record the following data for each electric heating coil:
 - 1. Nameplate data.
 - 2. Airflow.
 - 3. Entering- and leaving-air temperature at full load.
 - 4. Voltage and amperage input of each phase at full load.
 - 5. Calculated kilowatt at full load.
 - 6. Fuse or circuit-breaker rating for overload protection.
- C. Measure, adjust, and record the following data for each steam coil:
 - 1. Dry-bulb temperature of entering and leaving air.
 - 2. Airflow.
 - 3. Inlet steam pressure.
- D. Measure, adjust, and record the following data for each refrigerant coil:
 - 1. Dry-bulb temperature of entering and leaving air.
 - 2. Wet-bulb temperature of entering and leaving air.
 - 3. Airflow.

3.11 TOLERANCES

- A. Set HVAC system's airflow rates and water flow rates within the following tolerances:
 - 1. Supply, Return, and Exhaust Fans and Equipment with Fans: Plus or minus 10 percent.
 - 2. Air Outlets and Inlets: Plus or minus 10 percent.
 - 3. Heating-Water Flow Rate: Plus or minus 10 percent.
- B. Maintaining pressure relationships as designed shall have priority over the tolerances specified above.

3.12 PROGRESS REPORTING

- A. Initial Construction-Phase Report: Based on examination of the Contract Documents as specified in "Examination" Article, prepare a report on the adequacy of design for systems balancing devices. Recommend changes and additions to systems balancing devices to facilitate proper performance measuring and balancing. Recommend changes and additions to HVAC systems and general construction to allow access for performance measuring and balancing devices.
- B. Status Reports: Prepare biweekly progress reports to describe completed procedures, procedures in progress, and scheduled procedures. Include a list of deficiencies and problems found in systems being tested and balanced. Prepare a separate report for each system and each building floor for systems serving multiple floors.

3.13 FINAL REPORT

- A. General: Prepare a certified written report; tabulate and divide the report into separate sections for tested systems and balanced systems.
 - 1. Include a certification sheet at the front of the report's binder, signed and sealed by the certified testing and balancing engineer.

2. Include a list of instruments used for procedures, along with proof of calibration.
 3. Certify validity and accuracy of field data.
- B. Final Report Contents: In addition to certified field-report data, include the following:
1. Pump curves.
 2. Fan curves.
 3. Manufacturers' test data.
 4. Field test reports prepared by system and equipment installers.
 5. Other information relative to equipment performance; do not include Shop Drawings and Product Data.
- C. General Report Data: In addition to form titles and entries, include the following data:
1. Title page.
 2. Name and address of the TAB specialist.
 3. Project name.
 4. Project location.
 5. Architect's name and address.
 6. Engineer's name and address.
 7. Contractor's name and address.
 8. Report date.
 9. Signature of TAB supervisor who certifies the report.
 10. Table of Contents with the total number of pages defined for each section of the report. Number each page in the report.
 11. Summary of contents including the following:
 - a. Indicated versus final performance.
 - b. Notable characteristics of systems.
 - c. Description of system operation sequence if it varies from the Contract Documents.
 12. Nomenclature sheets for each item of equipment.
 13. Data for terminal units, including manufacturer's name, type, size, and fittings.
 14. Notes to explain why certain final data in the body of reports vary from indicated values.
 15. Test conditions for fans and pump performance forms including the following:
 - a. Settings for outdoor-, return-, and exhaust-air dampers.
 - b. Conditions of filters.
 - c. Cooling coil, wet- and dry-bulb conditions.
 - d. Face and bypass damper settings at coils.
 - e. Fan drive settings including settings and percentage of maximum pitch diameter.
 - f. Inlet vane settings for variable-air-volume systems.
 - g. Settings for supply-air, static-pressure controller.
 - h. Other system operating conditions that affect performance.
- D. System Diagrams: Include schematic layouts of air and hydronic distribution systems. Present each system with single-line diagram and include the following:
1. Quantities of outdoor, supply, return, and exhaust airflows.
 2. Water and steam flow rates.
 3. Duct, outlet, and inlet sizes.
 4. Pipe and valve sizes and locations.
 5. Terminal units.
 6. Balancing stations.
 7. Position of balancing devices.
- E. Air-Handling-Unit Test Reports: For air-handling units with coils, include the following:
1. Unit Data:
 - a. Unit identification.
 - b. Location.
 - c. Make and type.
 - d. Model number and unit size.

- e. Manufacturer's serial number.
 - f. Unit arrangement and class.
 - g. Discharge arrangement.
 - h. Sheave make, size in inches, and bore.
 - i. Center-to-center dimensions of sheave and amount of adjustments in inches.
 - j. Number, make, and size of belts.
 - k. Number, type, and size of filters.
 - 2. Motor Data:
 - a. Motor make, and frame type and size.
 - b. Horsepower and rpm.
 - c. Volts, phase, and hertz.
 - d. Full-load amperage and service factor.
 - e. Sheave make, size in inches, and bore.
 - f. Center-to-center dimensions of sheave and amount of adjustments in inches.
 - 3. Test Data (Indicated and Actual Values):
 - a. Total airflow rate in cfm.
 - b. Total system static pressure in inches wg.
 - c. Fan rpm.
 - d. Discharge static pressure in inches wg.
 - e. Filter static-pressure differential in inches wg.
 - f. Preheat-coil static-pressure differential in inches wg.
 - g. Cooling-coil static-pressure differential in inches wg.
 - h. Heating-coil static-pressure differential in inches wg.
 - i. Outdoor airflow in cfm.
 - j. Return airflow in cfm.
 - k. Outdoor-air damper position.
 - l. Return-air damper position.
 - m. Vortex damper position.
- F. Fan Test Reports: For supply, return, and exhaust fans, include the following:
 - 1. Fan Data:
 - a. System identification.
 - b. Location.
 - c. Make and type.
 - d. Model number and size.
 - e. Manufacturer's serial number.
 - f. Arrangement and class.
 - g. Sheave make, size in inches, and bore.
 - h. Center-to-center dimensions of sheave and amount of adjustments in inches.
 - 2. Motor Data:
 - a. Motor make, and frame type and size.
 - b. Horsepower and rpm.
 - c. Volts, phase, and hertz.
 - d. Full-load amperage and service factor.
 - e. Sheave make, size in inches, and bore.
 - f. Center-to-center dimensions of sheave, and amount of adjustments in inches.
 - g. Number, make, and size of belts.
 - 3. Test Data (Indicated and Actual Values):
 - a. Total airflow rate in cfm.
 - b. Total system static pressure in inches wg.
 - c. Fan rpm.
 - d. Discharge static pressure in inches wg.
 - e. Suction static pressure in inches wg.

- G. Round, Flat-Oval, and Rectangular Duct Traverse Reports: Include a diagram with a grid representing the duct cross-section and record the following:
1. Report Data:
 - a. System and air-handling-unit number.
 - b. Location and zone.
 - c. Traverse air temperature in deg F.
 - d. Duct static pressure in inches wg.
 - e. Duct size in inches.
 - f. Duct area in sq. ft..
 - g. Indicated airflow rate in cfm.
 - h. Indicated velocity in fpm.
 - i. Actual airflow rate in cfm.
 - j. Actual average velocity in fpm.
 - k. Barometric pressure in psig.
- H. System-Coil Reports: For reheat coils and water coils of terminal units, include the following:
1. Unit Data:
 - a. System and air-handling-unit identification.
 - b. Location and zone.
 - c. Room or riser served.
 - d. Coil make and size.
 - e. Flowmeter type.
 2. Test Data (Indicated and Actual Values):
 - a. Airflow rate in cfm.
 - b. Entering-water temperature in deg F.
 - c. Leaving-water temperature in deg F.
 - d. Water pressure drop in feet of head or psig.
 - e. Entering-air temperature in deg F.
 - f. Leaving-air temperature in deg F.
- I. Pump Test Reports: Calculate impeller size by plotting the shutoff head on pump curves and include the following:
1. Unit Data:
 - a. Unit identification.
 - b. Location.
 - c. Service.
 - d. Make and size.
 - e. Model number and serial number.
 - f. Water flow rate in gpm.
 - g. Water pressure differential in feet of head or psig.
 - h. Required net positive suction head in feet of head or psig.
 - i. Pump rpm.
 - j. Impeller diameter in inches.
 - k. Motor make and frame size.
 - l. Motor horsepower and rpm.
 - m. Voltage at each connection.
 - n. Amperage for each phase.
 - o. Full-load amperage and service factor.
 - p. Seal type.
 2. Test Data (Indicated and Actual Values):
 - a. Static head in feet of head or psig.
 - b. Pump shutoff pressure in feet of head or psig.
 - c. Actual impeller size in inches.
 - d. Full-open flow rate in gpm.
 - e. Full-open pressure in feet of head or psig.

- f. Final discharge pressure in feet of head or psig.
- g. Final suction pressure in feet of head or psig.
- h. Final total pressure in feet of head or psig.
- i. Final water flow rate in gpm.
- j. Voltage at each connection.
- k. Amperage for each phase.

J. Instrument Calibration Reports:

- 1. Report Data:
 - a. Instrument type and make.
 - b. Serial number.
 - c. Application.
 - d. Dates of use.
 - e. Dates of calibration.

3.14 VERIFICATION OF TAB REPORT

- A. The TAB specialist's test and balance engineer shall conduct the inspection in the presence of Construction Manager.
- B. Construction Manager shall randomly select measurements, documented in the final report, to be rechecked. Rechecking shall be limited to either 10 percent of the total measurements recorded or the extent of measurements that can be accomplished in a normal 8-hour business day.
- C. If rechecks yield measurements that differ from the measurements documented in the final report by more than the tolerances allowed, the measurements shall be noted as "FAILED."
- D. If the number of "FAILED" measurements is greater than 10 percent of the total measurements checked during the final inspection, the testing and balancing shall be considered incomplete and shall be rejected.
- E. If TAB work fails, proceed as follows:
 - 1. TAB specialists shall recheck all measurements and make adjustments. Revise the final report and balancing device settings to include all changes; resubmit the final report and request a second final inspection.
 - 2. If the second final inspection also fails, Owner may contract the services of another TAB specialist to complete TAB work according to the Contract Documents and deduct the cost of the services from the original TAB specialist's final payment.
- F. Prepare test and inspection reports.

3.15 ADDITIONAL TESTS

- A. Within 90 days of completing TAB, perform additional TAB to verify that balanced conditions are being maintained throughout and to correct unusual conditions.
- B. Seasonal Periods: If initial TAB procedures were not performed during near-peak summer and winter conditions, perform additional TAB during near-peak summer and winter conditions.

END OF SECTION

SECTION 23 07 13 – DUCT INSULATION

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. Section includes insulating the following duct services:
 - 1. Indoor, concealed supply and outdoor air.
 - 2. Indoor, concealed return located in unconditioned space.
 - 3. Outdoor, exposed supply and return.
- B. Related Sections:
 - 1. Section 23 07 19 "HVAC Piping Insulation."
 - 2. Section 23 31 13 "Metal Ducts" for duct liners.

1.03 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated. Include thermal conductivity, water-vapor permeance thickness, and jackets (both factory- and field-applied if any).
- B. Sustainable Design Submittals:
 - 1. Product Data: For adhesives, indicating VOC content.
 - 2. Laboratory Test Reports: For adhesives, indicating compliance with requirements for low-emitting materials.
 - 3. Product Data: For coatings, indicating VOC content.
 - 4. Laboratory Test Reports: For coatings, indicating compliance with requirements for low-emitting materials.
 - 5. Product Data: For sealants, indicating VOC content.
 - 6. Laboratory Test Reports: For sealants, indicating compliance with requirements for low-emitting materials.
- C. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.
 - 1. Detail application of protective shields, saddles, and inserts at hangers for each type of insulation and hanger.
 - 2. Detail insulation application at elbows, fittings, dampers, specialties and flanges for each type of insulation.
 - 3. Detail application of field-applied jackets.
 - 4. Detail application at linkages of control devices.
- D. Samples: For each type of insulation and jacket indicated. Identify each Sample, describing product and intended use. Sample sizes are as follows:
 - 1. Sheet Form Insulation Materials: 12 inches square.
 - 2. Sheet Jacket Materials: 12 inches square.
 - 3. Manufacturer's Color Charts: For products where color is specified, show the full range of colors available for each type of finish material.

1.04 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For qualified Installer.
- B. Material Test Reports: From a qualified testing agency acceptable to authorities having jurisdiction indicating, interpreting, and certifying test results for compliance of insulation materials, sealers, attachments, cements, and jackets, with requirements indicated. Include dates of tests and test methods employed.
- C. Field quality-control reports.

1.05 QUALITY ASSURANCE

- A. Installer Qualifications: Skilled mechanics who have successfully completed an apprenticeship program or another craft training program certified by the Department of Labor, Bureau of Apprenticeship and Training.
- B. Surface-Burning Characteristics: For insulation and related materials, as determined by testing identical products according to ASTM E 84, by a testing agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers, with appropriate markings of applicable testing agency.
 - 1. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.
 - 2. Insulation Installed Outdoors: Flame-spread index of 75 or less, and smoke-developed index of 150 or less.
- C. Mockups: Before installing insulation, build mockups for each type of insulation and finish listed below to demonstrate quality of insulation application and finishes. Build mockups in the location indicated or, if not indicated, as directed by Architect. Use materials indicated for the completed Work.
 - 1. Ductwork Mockups:
 - a. One 10-foot section each of rectangular and round straight duct.
 - b. One each of a 90-degree mitered round and rectangular elbow, and one each of a 90-degree radius round and rectangular elbow.
 - c. One rectangular branch takeoff and one round branch takeoff from a rectangular duct. One round tee fitting.
 - d. One rectangular and round transition fitting.
 - e. Four support hangers for round and rectangular ductwork.
 - f. Each type of damper and specialty.
 - 2. For each mockup, fabricate cutaway sections to allow observation of application details for insulation materials, adhesives, mastics, attachments, and jackets.
 - 3. Notify Architect seven days in advance of dates and times when mockups will be constructed.
 - 4. Obtain Architect's approval of mockups before starting insulation application.
 - 5. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
 - 6. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.
 - 7. Demolish and remove mockups when directed.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Packaging: Insulation material containers shall be marked by manufacturer with appropriate ASTM standard designation, type and grade, and maximum use temperature.

1.07 COORDINATION

- A. Coordinate sizes and locations of supports, hangers, and insulation shields specified in Section 23 05 29 "Hangers and Supports for HVAC Piping and Equipment."
- B. Coordinate clearance requirements with duct Installer for duct insulation application. Before preparing ductwork Shop Drawings, establish and maintain clearance requirements for installation of insulation and field-applied jackets and finishes and for space required for maintenance.

1.08 SCHEDULING

- A. Schedule insulation application after pressure testing systems and, where required, after installing and testing heat tracing. Insulation application may begin on segments that have satisfactory test results.
- B. Complete installation and concealment of plastic materials as rapidly as possible in each area of construction.

PART 2 - PRODUCTS

2.01 INSULATION MATERIALS

- A. Comply with requirements in "Duct Insulation Schedule, General," "Indoor Duct and Plenum Insulation Schedule," and "Aboveground, Outdoor Duct and Plenum Insulation Schedule" articles for where insulating materials shall be applied.
- B. Products shall not contain asbestos, lead, mercury, or mercury compounds.
- C. Products that come in contact with stainless steel shall have a leachable chloride content of less than 50 ppm when tested according to ASTM C 871.
- D. Insulation materials for use on austenitic stainless steel shall be qualified as acceptable according to ASTM C 795.
- E. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.
- F. Flexible Elastomeric Insulation: Closed-cell, sponge- or expanded-rubber materials. Comply with ASTM C 534, Type II for sheet materials.
- G. Mineral-Fiber Blanket Insulation: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 553, Type II and ASTM C 1290, Type I. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Johns Manville; a Berkshire Hathaway company.
 - b. Knauf Insulation.
 - c. Owens Corning.
- H. Mineral-Fiber Board Insulation: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 612, Type IA or Type IB. For duct and plenum applications, provide insulation with factory-applied ASJ. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Johns Manville; a Berkshire Hathaway company.
 - b. Knauf Insulation.
 - c. Owens Corning.

2.02 FIRE-RATED INSULATION SYSTEMS

- A. Fire-Rated Blanket: High-temperature, flexible, blanket insulation with FSK jacket that is tested and certified to provide a 2-hour fire rating by an NRTL acceptable to authorities having jurisdiction.
 - 1. 3M Firewrap.

2.03 ADHESIVES

- A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated unless otherwise indicated.
- B. Mineral-Fiber Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Childers Brand; H. B. Fuller Construction Products.
 - b. Eagle Bridges - Marathon Industries.
 - c. Foster Brand; H. B. Fuller Construction Products.
 2. Verify fiberglass adhesive has a VOC content of 80 g/L or less when calculated in accordance with 40 CFR 59, Subpart D (EPA Method 24).
 3. Verify adhesive complies with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
- C. ASJ Adhesive, and FSK Jacket Adhesive: Comply with MIL-A-3316C, Class 2, Grade A for bonding insulation jacket lap seams and joints.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Childers Brand; H. B. Fuller Construction Products.
 - b. Eagle Bridges - Marathon Industries.
 - c. Foster Brand; H. B. Fuller Construction Products.
 2. Verify adhesive has a VOC content of 80 g/L or less when calculated in accordance with 40 CFR 59, Subpart D (EPA Method 24).
 3. Verify adhesive complies with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

2.04 MASTICS

- A. Materials shall be compatible with insulation materials, jackets, and substrates; comply with MIL-PRF-19565C, Type II.
1. VOC Content: 300 g/L or less.
 2. Low-Emitting Materials: Verify mastic coatings comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
- B. Vapor-Barrier Mastic: Water based; suitable for indoor use on below ambient services.
1. Water-Vapor Permeance: ASTM E 96/E 96M, Procedure B, 0.013 perm at 43-mil dry film thickness.
 2. Service Temperature Range: Minus 20 to plus 180 deg F.
 3. Solids Content: ASTM D 1644, 58 percent by volume and 70 percent by weight.
 4. Color: White.
- C. Vapor-Barrier Mastic: Solvent based; suitable for indoor use on below ambient services.
1. Water-Vapor Permeance: ASTM F 1249, 0.05 perm at 35-mil dry film thickness.
 2. Service Temperature Range: 0 to 180 deg F.
 3. Solids Content: ASTM D 1644, 44 percent by volume and 62 percent by weight.
 4. Color: White.
- D. Vapor-Barrier Mastic: Solvent based; suitable for outdoor use on below ambient services.
1. Water-Vapor Permeance: ASTM F 1249, 0.05 perm at 30-mil dry film thickness.
 2. Service Temperature Range: Minus 50 to plus 220 deg F.
 3. Solids Content: ASTM D 1644, 33 percent by volume and 46 percent by weight.
 4. Color: White.
- E. Breather Mastic: Water based; suitable for indoor and outdoor use on above ambient services.
1. Water-Vapor Permeance: ASTM F 1249, 1.8 perms at 0.0625-inch dry film thickness.
 2. Service Temperature Range: Minus 20 to plus 180 deg F.
 3. Solids Content: 60 percent by volume and 66 percent by weight.

4. Color: White.

2.05 LAGGING ADHESIVES

- A. Description: Comply with MIL-A-3316C, Class I, Grade A and shall be compatible with insulation materials, jackets, and substrates.
 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
 - a. Childers Brand; H. B. Fuller Construction Products.
 - b. Foster Brand; H. B. Fuller Construction Products.
 - c. Vimasco Corporation.
 2. Verify adhesives have a VOC content of 50 g/L or less.
 3. Verify adhesive complies with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
 4. Fire-resistant, water-based lagging adhesive and coating for use indoors to adhere fire-resistant lagging cloths over duct insulation.
 5. Service Temperature Range: 0 to plus 180 deg F.
 6. Color: White.

2.06 SEALANTS

- A. FSK and Metal Jacket Flashing Sealants:
 1. Materials shall be compatible with insulation materials, jackets, and substrates.
 2. Fire- and water-resistant, flexible, elastomeric sealant.
 3. Service Temperature Range: Minus 40 to plus 250 deg F.
 4. Color: Aluminum.
 5. Verify sealant has a VOC content of 420 g/L or less.
 6. Verify sealant complies with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
- B. ASJ Flashing Sealants, and Vinyl and PVC Jacket Flashing Sealants:
 1. Materials shall be compatible with insulation materials, jackets, and substrates.
 2. Fire- and water-resistant, flexible, elastomeric sealant.
 3. Service Temperature Range: Minus 40 to plus 250 deg F.
 4. Color: White.
 5. Verify sealant has a VOC content of 420 g/L or less.
 6. Verify sealant complies with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

2.07 FACTORY-APPLIED JACKETS

- A. Insulation system schedules indicate factory-applied jackets on various applications. When factory-applied jackets are indicated, comply with the following:
 1. ASJ: White, kraft-paper, fiberglass-reinforced scrim with aluminum-foil backing; complying with ASTM C 1136, Type I.
 2. FSK Jacket: Aluminum-foil, fiberglass-reinforced scrim with kraft-paper backing; complying with ASTM C 1136, Type II.

2.08 FIELD-APPLIED JACKETS

- A. Field-applied jackets shall comply with ASTM C 921, Type I, unless otherwise indicated.
- B. FSK Jacket: Aluminum-foil-face, fiberglass-reinforced scrim with kraft-paper backing.

- C. Self-Adhesive Outdoor Jacket: 60-mil-thick, laminated vapor barrier and waterproofing membrane for installation over insulation located aboveground outdoors; consisting of a rubberized bituminous resin on a crosslaminated polyethylene film covered with white aluminum-foil facing.

2.09 TAPES

- A. ASJ Tape: White vapor-retarder tape matching factory-applied jacket with acrylic adhesive, complying with ASTM C 1136.
1. Width: 3 inches.
 2. Thickness: 11.5 mils.
 3. Adhesion: 90 ounces force/inch in width.
 4. Elongation: 2 percent.
 5. Tensile Strength: 40 lbf/inch in width.
 6. ASJ Tape Disks and Squares: Precut disks or squares of ASJ tape.
- B. FSK Tape: Foil-face, vapor-retarder tape matching factory-applied jacket with acrylic adhesive; complying with ASTM C 1136.
1. Width: 3 inches.
 2. Thickness: 6.5 mils.
 3. Adhesion: 90 ounces force/inch in width.
 4. Elongation: 2 percent.
 5. Tensile Strength: 40 lbf/inch in width.
 6. FSK Tape Disks and Squares: Precut disks or squares of FSK tape.

2.10 SECUREMENTS

- A. Bands:
1. Stainless Steel: ASTM A 167 or ASTM A 240/A 240M, Type 304 or Type 316; 0.015 inch thick, 1/2 inch wide with wing seal or closed seal.
 2. Aluminum: ASTM B 209, Alloy 3003, 3005, 3105, or 5005; Temper H-14, 0.020 inch thick, 1/2 inch wide with wing seal or closed seal.
 3. Springs: Twin spring set constructed of stainless steel with ends flat and slotted to accept metal bands. Spring size determined by manufacturer for application.
- B. Insulation Pins and Hangers:
1. Capacitor-Discharge-Weld Pins: Copper- or zinc-coated steel pin, fully annealed for capacitor-discharge welding, 0.106-inch- diameter shank, length to suit depth of insulation indicated.
 2. Cupped-Head, Capacitor-Discharge-Weld Pins: Copper- or zinc-coated steel pin, fully annealed for capacitor-discharge welding, 0.106-inch- diameter shank, length to suit depth of insulation indicated with integral 1-1/2-inch galvanized carbon-steel washer.
 3. Metal, Adhesively Attached, Perforated-Base Insulation Hangers: Baseplate welded to projecting spindle that is capable of holding insulation, of thickness indicated, securely in position indicated when self-locking washer is in place. Comply with the following requirements:
 - a. Baseplate: Perforated, galvanized carbon-steel sheet, 0.030 inch thick by 2 inches square.
 - b. Spindle: Aluminum or Stainless steel, fully annealed, 0.106-inch-diameter shank, length to suit depth of insulation indicated.
 - c. Adhesive: Recommended by hanger manufacturer. Product with demonstrated capability to bond insulation hanger securely to substrates indicated without damaging insulation, hangers, and substrates.
 4. Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch-thick, galvanized-steel or aluminum sheet, with beveled edge sized as required to hold insulation securely in place but not less than 1-1/2 inches in diameter.
 - a. Protect ends with capped self-locking washers incorporating a spring steel insert to ensure permanent retention of cap in exposed locations.

- C. Staples: Outward-clinching insulation staples, nominal 3/4-inch-wide, stainless steel or Monel.
- D. Wire: 0.062-inch soft-annealed, stainless steel.

2.11 CORNER ANGLES

- A. Aluminum Corner Angles: 0.040 inch thick, minimum 1 by 1 inch, aluminum according to ASTM B 209, Alloy 3003, 3005, 3105, or 5005; Temper H-14.
- B. Stainless-Steel Corner Angles: 0.024 inch thick, minimum 1 by 1 inch, stainless steel according to ASTM A 167 or ASTM A 240/A 240M, Type 304 or Type 316.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Examine substrates and conditions for compliance with requirements for installation tolerances and other conditions affecting performance of insulation application.
 - 1. Verify that systems to be insulated have been tested and are free of defects.
 - 2. Verify that surfaces to be insulated are clean and dry.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

- A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.

3.03 GENERAL INSTALLATION REQUIREMENTS

- A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of ducts and fittings.
- B. Install insulation materials, vapor barriers or retarders, jackets, and thicknesses required for each item of duct system as specified in insulation system schedules.
- C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.
- D. Install insulation with longitudinal seams at top and bottom of horizontal runs.
- E. Install multiple layers of insulation with longitudinal and end seams staggered.
- F. Keep insulation materials dry during application and finishing.
- G. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.
- H. Install insulation with least number of joints practical.
- I. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.
 - 1. Install insulation continuously through hangers and around anchor attachments.
 - 2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends at attachment to structure with vapor-barrier mastic.
 - 3. Install insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.
- J. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.
- K. Install insulation with factory-applied jackets as follows:
 - 1. Draw jacket tight and smooth.

2. Cover circumferential joints with 3-inch-wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip, spaced 4 inches o.c.
 3. Overlap jacket longitudinal seams at least 1-1/2 inches. Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at 2 inches o.c.
 - a. For below ambient services, apply vapor-barrier mastic over staples.
 4. Cover joints and seams with tape, according to insulation material manufacturer's written instructions, to maintain vapor seal.
 5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to duct flanges and fittings.
- L. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.
- M. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.
- N. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.

3.04 PENETRATIONS

- A. Insulation Installation at Roof Penetrations: Install insulation continuously through roof penetrations.
1. Seal penetrations with flashing sealant.
 2. For applications requiring only indoor insulation, terminate insulation above roof surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
 3. Extend jacket of outdoor insulation outside roof flashing at least 2 inches below top of roof flashing.
 4. Seal jacket to roof flashing with flashing sealant.
- B. Insulation Installation at Aboveground Exterior Wall Penetrations: Install insulation continuously through wall penetrations.
1. Seal penetrations with flashing sealant.
 2. For applications requiring only indoor insulation, terminate insulation inside wall surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
 3. Extend jacket of outdoor insulation outside wall flashing and overlap wall flashing at least 2 inches.
 4. Seal jacket to wall flashing with flashing sealant.
- C. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.
- D. Insulation Installation at Fire-Rated Wall and Partition Penetrations: Terminate insulation at fire damper sleeves for fire-rated wall and partition penetrations. Externally insulate damper sleeves to match adjacent insulation and overlap duct insulation at least 2 inches.
1. Comply with requirements in Section 07 84 00 "Firestopping."
- E. Insulation Installation at Floor Penetrations:
1. Duct: For penetrations through fire-rated assemblies, terminate insulation at fire damper sleeves and externally insulate damper sleeve beyond floor to match adjacent duct insulation. Overlap damper sleeve and duct insulation at least 2 inches.
 2. Seal penetrations through fire-rated assemblies. Comply with requirements in Section 07 84 00 "Firestopping."

3.05 INSTALLATION OF FLEXIBLE ELASTOMERIC INSULATION

- A. Seal longitudinal seams and end joints with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

3.06 INSTALLATION OF MINERAL-FIBER INSULATION

- A. Blanket Insulation Installation on Ducts and Plenums: Secure with adhesive and insulation pins.
 - 1. Apply adhesives according to manufacturer's recommended coverage rates per unit area, for 50 percent coverage of duct and plenum surfaces.
 - 2. Apply adhesive to entire circumference of ducts and to all surfaces of fittings and transitions.
 - 3. Install either capacitor-discharge-weld pins and speed washers or cupped-head, capacitor-discharge-weld pins on sides and bottom of horizontal ducts and sides of vertical ducts as follows:
 - a. On duct sides with dimensions 18 inches and smaller, place pins along longitudinal centerline of duct. Space 3 inches maximum from insulation end joints, and 16 inches o.c.
 - b. On duct sides with dimensions larger than 18 inches, place pins 16 inches o.c. each way, and 3 inches maximum from insulation joints. Install additional pins to hold insulation tightly against surface at cross bracing.
 - c. Pins may be omitted from top surface of horizontal, rectangular ducts and plenums.
 - d. Do not overcompress insulation during installation.
 - e. Impale insulation over pins and attach speed washers.
 - f. Cut excess portion of pins extending beyond speed washers or bend parallel with insulation surface. Cover exposed pins and washers with tape matching insulation facing.
 - 4. For ducts and plenums with surface temperatures below ambient, install a continuous unbroken vapor barrier. Create a facing lap for longitudinal seams and end joints with insulation by removing 2 inches from one edge and one end of insulation segment. Secure laps to adjacent insulation section with 1/2-inch outward-clinching staples, 1 inch o.c. Install vapor barrier consisting of factory- or field-applied jacket, adhesive, vapor-barrier mastic, and sealant at joints, seams, and protrusions.
 - a. Repair punctures, tears, and penetrations with tape or mastic to maintain vapor-barrier seal.
 - b. Install vapor stops for ductwork and plenums operating below 50 deg F at 18-foot intervals. Vapor stops shall consist of vapor-barrier mastic applied in a Z-shaped pattern over insulation face, along butt end of insulation, and over the surface. Cover insulation face and surface to be insulated a width equal to two times the insulation thickness, but not less than 3 inches.
 - 5. Overlap unfaced blankets a minimum of 2 inches on longitudinal seams and end joints. At end joints, secure with steel bands spaced a maximum of 18 inches o.c.
 - 6. Install insulation on rectangular duct elbows and transitions with a full insulation section for each surface. Install insulation on round and flat-oval duct elbows with individually mitered gores cut to fit the elbow.
 - 7. Insulate duct stiffeners, hangers, and flanges that protrude beyond insulation surface with 6-inch-wide strips of same material used to insulate duct. Secure on alternating sides of stiffener, hanger, and flange with pins spaced 6 inches o.c.
- B. Board Insulation Installation on Ducts and Plenums: Secure with adhesive and insulation pins.
 - 1. Apply adhesives according to manufacturer's recommended coverage rates per unit area, for 50 percent coverage of duct and plenum surfaces.
 - 2. Apply adhesive to entire circumference of ducts and to all surfaces of fittings and transitions.

3. Install either capacitor-discharge-weld pins and speed washers or cupped-head, capacitor-discharge-weld pins on sides and bottom of horizontal ducts and sides of vertical ducts as follows:
 - a. On duct sides with dimensions 18 inches and smaller, place pins along longitudinal centerline of duct. Space 3 inches maximum from insulation end joints, and 16 inches o.c.
 - b. On duct sides with dimensions larger than 18 inches, space pins 16 inches o.c. each way, and 3 inches maximum from insulation joints. Install additional pins to hold insulation tightly against surface at cross bracing.
 - c. Pins may be omitted from top surface of horizontal, rectangular ducts and plenums.
 - d. Do not overcompress insulation during installation.
 - e. Cut excess portion of pins extending beyond speed washers or bend parallel with insulation surface. Cover exposed pins and washers with tape matching insulation facing.
4. For ducts and plenums with surface temperatures below ambient, install a continuous unbroken vapor barrier. Create a facing lap for longitudinal seams and end joints with insulation by removing 2 inches from one edge and one end of insulation segment. Secure laps to adjacent insulation section with 1/2-inch outward-clinching staples, 1 inch o.c. Install vapor barrier consisting of factory- or field-applied jacket, adhesive, vapor-barrier mastic, and sealant at joints, seams, and protrusions.
 - a. Repair punctures, tears, and penetrations with tape or mastic to maintain vapor-barrier seal.
 - b. Install vapor stops for ductwork and plenums operating below 50 deg F at 18-foot intervals. Vapor stops shall consist of vapor-barrier mastic applied in a Z-shaped pattern over insulation face, along butt end of insulation, and over the surface. Cover insulation face and surface to be insulated a width equal to two times the insulation thickness, but not less than 3 inches.
5. Install insulation on rectangular duct elbows and transitions with a full insulation section for each surface. Groove and score insulation to fit as closely as possible to outside and inside radius of elbows. Install insulation on round and flat-oval duct elbows with individually mitered gores cut to fit the elbow.
6. Insulate duct stiffeners, hangers, and flanges that protrude beyond insulation surface with 6-inch-wide strips of same material used to insulate duct. Secure on alternating sides of stiffener, hanger, and flange with pins spaced 6 inches o.c.

3.07 FIELD-APPLIED JACKET INSTALLATION

- A. Where glass-cloth jackets are indicated, install directly over bare insulation or insulation with factory-applied jackets.
 1. Draw jacket smooth and tight to surface with 2-inch overlap at seams and joints.
 2. Embed glass cloth between two 0.062-inch-thick coats of lagging adhesive.
 3. Completely encapsulate insulation with coating, leaving no exposed insulation.
- B. Where FSK jackets are indicated, install as follows:
 1. Draw jacket material smooth and tight.
 2. Install lap or joint strips with same material as jacket.
 3. Secure jacket to insulation with manufacturer's recommended adhesive.
 4. Install jacket with 1-1/2-inch laps at longitudinal seams and 3-inch-wide joint strips at end joints.
 5. Seal openings, punctures, and breaks in vapor-retarder jackets and exposed insulation with vapor-barrier mastic.

3.08 FIRE-RATED INSULATION SYSTEM INSTALLATION

- A. Where fire-rated insulation system is indicated, secure system to ducts and duct hangers and supports to maintain a continuous fire rating.

- B. Insulate duct access panels and doors to achieve same fire rating as duct.
- C. Install firestopping at penetrations through fire-rated assemblies. Fire-stop systems are specified in Section 07 84 00 "Firestopping."

3.09 FINISHES

- A. Insulation with ASJ, Glass-Cloth, or Other Paintable Jacket Material: Paint jacket with paint system identified below and as specified in Section 09 91 13 "Exterior Painting" and Section 09 91 23 "Interior Painting."
- B. Flexible Elastomeric Thermal Insulation: After adhesive has fully cured, apply two coats of insulation manufacturer's recommended protective coating.
- C. Color: Final color as selected by Architect. Vary first and second coats to allow visual inspection of the completed Work.
- D. Do not field paint aluminum or stainless-steel jackets.

3.10 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
- B. Tests and Inspections:
 - 1. Inspect ductwork, randomly selected by Architect, by removing field-applied jacket and insulation in layers in reverse order of their installation. Extent of inspection shall be limited to one location(s) for each duct system defined in the "Duct Insulation Schedule, General" Article.

3.11 DUCT INSULATION SCHEDULE, GENERAL

- A. Plenums and Ducts Requiring Insulation:
 - 1. Indoor, concealed supply and outdoor air.
 - 2. Indoor, concealed return located in unconditioned space.
 - 3. Outdoor, exposed supply and return.
- B. Items Not Insulated:
 - 1. Fibrous-glass ducts.
 - 2. Metal ducts with duct liner of sufficient thickness to comply with energy code and ASHRAE/IESNA 90.1.
 - 3. Factory-insulated flexible ducts.
 - 4. Factory-insulated plenums and casings.
 - 5. Flexible connectors.
 - 6. Vibration-control devices.
 - 7. Factory-insulated access panels and doors.

3.12 INDOOR DUCT AND PLENUM INSULATION SCHEDULE

- A. Concealed, rectangular, supply-air duct insulation shall be one of the following:
 - 1. Flexible Elastomeric: 1 inch thick.
 - 2. Mineral-Fiber Blanket: 2 inchesthick and 1.5-lb/cu. ft. nominal density.
 - 3. Mineral-Fiber Board: 1-1/2 inchesthick and 2-lb/cu. ft. nominal density.
- B. Concealed, rectangular, return-air duct insulation shall be one of the following:
 - 1. Flexible Elastomeric: 1 inch thick.
 - 2. Mineral-Fiber Blanket: 1-1/2 inches thick and 1.5-lb/cu. ft. nominal density.
 - 3. Mineral-Fiber Board: 1-1/2 inches thick and 2-lb/cu. ft. nominal density.
- C. Exposed, supply-air duct insulation shall be the following:
 - 1. Mineral-Fiber Blanket: 2 inches thick and 1.5-lb/cu. ft. nominal density.

- D. Exposed, return-air duct insulation shall be the following:
 - 1. Mineral-Fiber Blanket: 2 inches thick and 1.5-lb/cu. ft. nominal density.
- 3.13 ABOVEGROUND, OUTDOOR DUCT AND PLENUM INSULATION SCHEDULE
 - A. Insulation materials and thicknesses are identified below. If more than one material is listed for a duct system, selection from materials listed is Contractor's option.
 - B. Exposed, rectangular, supply-air duct insulation shall be the following:
 - 1. Mineral-Fiber Board: 3 inches thick and 3-lb/cu. ft. nominal density.
 - C. Exposed, rectangular, return-air duct insulation shall be the following:
 - 1. Mineral-Fiber Board: 3 inches 3-lb/cu. ft. nominal density.
 - D. Exposed, supply-air plenum insulation shall be the following:
 - 1. Mineral-Fiber Board: 3 inches 3-lb/cu. ft. nominal density.
 - E. Exposed, return-air plenum insulation shall be the following:
 - 1. Mineral-Fiber Board: 3 inches thick and 3-lb/cu. ft. nominal density.
- 3.14 INDOOR, FIELD-APPLIED JACKET SCHEDULE
 - A. Install jacket over insulation material. For insulation with factory-applied jacket, install the field-applied jacket over the factory-applied jacket.
 - B. If more than one material is listed, selection from materials listed is Contractor's option.
 - C. Ducts and Plenums, Concealed:
 - 1. None.
 - D. Ducts and Plenums, Exposed:
 - 1. None.
- 3.15 OUTDOOR, FIELD-APPLIED JACKET SCHEDULE
 - A. Install jacket over insulation material. For insulation with factory-applied jacket, install the field-applied jacket over the factory-applied jacket.
 - B. If more than one material is listed, selection from materials listed is Contractor's option.
 - C. Ducts and Plenums, Exposed, up to 48 Inches in Diameter or with Flat Surfaces up to 72 Inches:
 - 1. Aluminum, Smooth: 0.016 inch thick.
 - 2. Stainless Steel, Type 304, Smooth 2B Finish: 0.020 inch thick.
 - 3. 60 mil self-adhesive rubberized bituminous resin on a crosslaminated polyethylene film covered with white aluminum-foil facing.
 - D. Ducts and Plenums, Exposed, Larger Than 48 Inches in Diameter or with Flat Surfaces Larger Than 72 Inches:
 - 1. Aluminum, Smooth: 0.032 inch thick.
 - 2. Stainless Steel, Type 304: 0.020 inch thick.
 - 3. 60 mil self-adhesive rubberized bituminous resin on a crosslaminated polyethylene film covered with white aluminum-foil facing.

END OF SECTION

SECTION 23 07 19 – HVAC PIPING INSULATION

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. Section includes insulating the following HVAC piping systems:
 - 1. Condensate drain piping, indoors.
 - 2. Heating hot-water piping, indoors.
 - 3. Refrigerant suction and hot-gas piping, indoors and outdoors.
- B. Related Sections:
 - 1. Section 23 07 13 "Duct Insulation."

1.03 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated. Include thermal conductivity, water-vapor permeance thickness, and jackets (both factory and field applied if any).
- B. Sustainable Design Submittals:
 - 1. Product Data: For adhesives, indicating VOC content.
 - 2. Product Data: For coatings, indicating VOC content.
 - 3. Product Data: For sealants, indicating VOC content.
- C. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.
 - 1. Detail application of protective shields, saddles, and inserts at hangers for each type of insulation and hanger.
 - 2. Detail insulation application at elbows, fittings, flanges, valves, and specialties for each type of insulation.
 - 3. Detail removable insulation at piping specialties.
 - 4. Detail application of field-applied jackets.
 - 5. Detail application at linkages of control devices.

1.04 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For qualified Installer.
- B. Field quality-control reports.

1.05 QUALITY ASSURANCE

- A. Installer Qualifications: Skilled mechanics who have successfully completed an apprenticeship program or another craft training program certified by the Department of Labor, Bureau of Apprenticeship and Training.
- B. Surface-Burning Characteristics: For insulation and related materials, as determined by testing identical products according to ASTM E 84, by a testing and inspecting agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers, with appropriate markings of applicable testing agency.
 - 1. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.
 - 2. Insulation Installed Outdoors: Flame-spread index of 75 or less, and smoke-developed index of 150 or less.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Packaging: Insulation material containers shall be marked by manufacturer with appropriate ASTM standard designation, type and grade, and maximum use temperature.

1.07 COORDINATION

- A. Coordinate sizes and locations of supports, hangers, and insulation shields specified in Section 23 05 29 "Hangers and Supports for HVAC Piping and Equipment."
- B. Coordinate clearance requirements with piping Installer for piping insulation application. Before preparing piping Shop Drawings, establish and maintain clearance requirements for installation of insulation and field-applied jackets and finishes and for space required for maintenance.
- C. Coordinate installation and testing of heat tracing.

1.08 SCHEDULING

- A. Schedule insulation application after pressure testing systems and, where required, after installing and testing heat tracing. Insulation application may begin on segments that have satisfactory test results.
- B. Complete installation and concealment of plastic materials as rapidly as possible in each area of construction.

PART 2 - PRODUCTS

2.01 INSULATION MATERIALS

- A. Products shall not contain asbestos, lead, mercury, or mercury compounds.
- B. Products that come in contact with stainless steel shall have a leachable chloride content of less than 50 ppm when tested according to ASTM C 871.
- C. Insulation materials for use on austenitic stainless steel shall be qualified as acceptable according to ASTM C 795.
- D. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.
- E. Flexible Elastomeric Insulation: Closed-cell, sponge- or expanded-rubber materials. Comply with ASTM C 534, Type I for tubular materials.
 - 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
 - a. Aeroflex USA.
 - b. Armacell LLC.
 - c. K-Flex USA.
- F. Mineral-Fiber Blanket Insulation: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 553, Type II and ASTM C 1290, Type I. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Johns Manville; a Berkshire Hathaway company.
 - b. Knauf Insulation.
- G. Preformed Mineral -Fiber Insulation: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 553, Type II and ASTM C 1290, Type I. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Johns Manville; a Berkshire Hathaway company.
 - b. Knauf Insulation.
 - c. Owens Corning.

2.02 ADHESIVES

- A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated unless otherwise indicated.

- B. Flexible Elastomeric and Polyolefin Adhesive: Comply with MIL-A-24179A, Type II, Class I.
 - 1. Verify adhesives have a VOC content of 50 g/L or less.
 - 2. Verify adhesive complies with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
- C. Mineral-Fiber Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.
 - 1. Verify fiberglass adhesive has a VOC content of 80 g/L or less when calculated in accordance with 40 CFR 59, Subpart D (EPA Method 24).
 - 2. Verify adhesive complies with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
- D. ASJ Adhesive, and FSK and PVDC Jacket Adhesive: Comply with MIL-A-3316C, Class 2, Grade A for bonding insulation jacket lap seams and joints.
 - 1. Verify adhesive has a VOC content of 80 g/L or less when calculated in accordance with 40 CFR 59, Subpart D (EPA Method 24).
 - 2. Verify adhesive complies with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

2.03 MASTICS

- A. Materials shall be compatible with insulation materials, jackets, and substrates; comply with MIL-PRF-19565C, Type II.
 - 1. VOC Content: 300 g/L or less.
 - 2. Low-Emitting Materials: Verify mastic coatings comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
- B. Vapor-Barrier Mastic: Water based; suitable for indoor use on below-ambient services.
 - 1. Water-Vapor Permeance: ASTM E 96/E 96M, Procedure B, 0.013 perm at 43-mil dry film thickness.
 - 2. Service Temperature Range: Minus 20 to plus 180 deg F.
 - 3. Solids Content: ASTM D 1644, 58 percent by volume and 70 percent by weight.
 - 4. Color: White.
- C. Vapor-Barrier Mastic: Solvent based; suitable for indoor use on below-ambient services.
 - 1. Water-Vapor Permeance: ASTM F 1249, 0.05 perm at 35-mil dry film thickness.
 - 2. Service Temperature Range: 0 to 180 deg F.
 - 3. Solids Content: ASTM D 1644, 44 percent by volume and 62 percent by weight.
 - 4. Color: White.

2.04 LAGGING ADHESIVES

- A. Description: Comply with MIL-A-3316C, Class I, Grade A and shall be compatible with insulation materials, jackets, and substrates.
 - 1. Verify adhesives have a VOC content of 50 g/L or less.
 - 2. Verify adhesive complies with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
 - 3. Fire-resistant, water-based lagging adhesive and coating for use indoors to adhere fire-resistant lagging cloths over pipe insulation.
 - 4. Service Temperature Range: 0 to plus 180 deg F.

5. Color: White.

2.05 SEALANTS

- A. ASJ Flashing Sealants, and Vinyl, PVDC, and PVC Jacket Flashing Sealants:
 1. Materials shall be compatible with insulation materials, jackets, and substrates.
 2. Fire- and water-resistant, flexible, elastomeric sealant.
 3. Service Temperature Range: Minus 40 to plus 250 deg F.
 4. Color: White.
 5. Verify sealant has a VOC content of 420 g/L or less.
 6. Verify sealant complies with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

2.06 FACTORY-APPLIED JACKETS

- A. Insulation system schedules indicate factory-applied jackets on various applications. When factory-applied jackets are indicated, comply with the following:
 1. ASJ: White, kraft-paper, fiberglass-reinforced scrim with aluminum-foil backing; complying with ASTM C 1136, Type I.
 2. ASJ-SSL: ASJ with self-sealing, pressure-sensitive, acrylic-based adhesive covered by a removable protective strip; complying with ASTM C 1136, Type I.

2.07 FIELD-APPLIED JACKETS

- A. Field-applied jackets shall comply with ASTM C 921, Type I, unless otherwise indicated.
- B. PVC Jacket: High-impact-resistant, UV-resistant PVC complying with ASTM D 1784, Class 16354-C; thickness as scheduled; roll stock ready for shop or field cutting and forming. Thickness is indicated in field-applied jacket schedules.
 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Airex Manufacturing.
 - b. Johns Manville; a Berkshire Hathaway company.
 - c. Proto Corporation.
 2. Adhesive: As recommended by jacket material manufacturer.
 3. Color: White.
 4. Factory-fabricated fitting covers to match jacket if available; otherwise, field fabricate.
 - a. Shapes: 45- and 90-degree, short- and long-radius elbows, tees, valves, flanges, unions, reducers, end caps, soil-pipe hubs, traps, mechanical joints, and P-trap and supply covers for lavatories.

2.08 TAPES

- A. ASJ Tape: White vapor-retarder tape matching factory-applied jacket with acrylic adhesive, complying with ASTM C 1136.
 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. 3M Industrial Adhesives and Tapes Division.
 - b. Avery Dennison Corporation, Specialty Tapes Division.
 - c. Ideal Tape Co., Inc., an American Biltrite Company.
 - d. Knauf Insulation.
 2. Width: 3 inches.
 3. Thickness: 11.5 mils.
 4. Adhesion: 90 ounces force/inch in width.
 5. Elongation: 2 percent.
 6. Tensile Strength: 40 lbf/inch in width.
 7. ASJ Tape Disks and Squares: Precut disks or squares of ASJ tape.
- B. PVC Tape: White vapor-retarder tape matching field-applied PVC jacket with acrylic adhesive; suitable for indoor and outdoor applications.

1. Width: 2 inches.
2. Thickness: 6 mils.
3. Adhesion: 64 ounces force/inch in width.
4. Elongation: 500 percent.
5. Tensile Strength: 18 lbf/inch in width.

2.09 SECUREMENTS

- A. Bands:
 1. Stainless Steel: ASTM A 167 or ASTM A 240/A 240M, Type 304 or Type 316; 0.015 inch thick, 1/2 inch wide with wing seal or closed seal.
- B. Staples: Outward-clinching insulation staples, nominal 3/4-inch-wide, stainless steel or Monel.
- C. Wire: 0.062-inch soft-annealed, stainless steel.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Examine substrates and conditions for compliance with requirements for installation tolerances and other conditions affecting performance of insulation application.
 1. Verify that systems to be insulated have been tested and are free of defects.
 2. Verify that surfaces to be insulated are clean and dry.
 3. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

- A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.
- B. Surface Preparation: Clean and prepare surfaces to be insulated. Before insulating, apply a corrosion coating to insulated surfaces as follows:

3.03 GENERAL INSTALLATION REQUIREMENTS

- A. 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.
- B. Install insulation materials, forms, vapor barriers or retarders, jackets, and thicknesses required for each item of pipe system as specified in insulation system schedules.
- C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.
- D. Install insulation with longitudinal seams at top and bottom of horizontal runs.
- E. Install multiple layers of insulation with longitudinal and end seams staggered.
- F. Do not weld brackets, clips, or other attachment devices to piping, fittings, and specialties.
- G. Keep insulation materials dry during application and finishing.
- H. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.
- I. Install insulation with least number of joints practical.
- J. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.
 1. Install insulation continuously through hangers and around anchor attachments.
 2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends at attachment to structure with vapor-barrier mastic.

3. Install insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.
 4. Cover inserts with jacket material matching adjacent pipe insulation. Install shields over jacket, arranged to protect jacket from tear or puncture by hanger, support, and shield.
- K. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.
- L. Install insulation with factory-applied jackets as follows:
1. Draw jacket tight and smooth.
 2. Cover circumferential joints with 3-inch-wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip, spaced 4 inches o.c.
 3. Overlap jacket longitudinal seams at least 1-1/2 inches. Install insulation with longitudinal seams at bottom of pipe. Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at 2 inches o.c.
 - a. For below-ambient services, apply vapor-barrier mastic over staples.
 4. Cover joints and seams with tape, according to insulation material manufacturer's written instructions, to maintain vapor seal.
 5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to pipe flanges and fittings.
- M. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.
- N. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.
- O. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.
- P. For above-ambient services, do not install insulation to the following:
1. Vibration-control devices.
 2. Testing agency labels and stamps.
 3. Nameplates and data plates.
 4. Manholes.
 5. Handholes.
 6. Cleanouts.

3.04 PENETRATIONS

- A. Insulation Installation at Roof Penetrations: Install insulation continuously through roof penetrations.
1. Seal penetrations with flashing sealant.
 2. For applications requiring only indoor insulation, terminate insulation above roof surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
 3. Extend jacket of outdoor insulation outside roof flashing at least 2 inches below top of roof flashing.
 4. Seal jacket to roof flashing with flashing sealant.
- B. Insulation Installation at Underground Exterior Wall Penetrations: Terminate insulation flush with sleeve seal. Seal terminations with flashing sealant.
- C. Insulation Installation at Aboveground Exterior Wall Penetrations: Install insulation continuously through wall penetrations.
1. Seal penetrations with flashing sealant.
 2. For applications requiring only indoor insulation, terminate insulation inside wall surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install

- insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
3. Extend jacket of outdoor insulation outside wall flashing and overlap wall flashing at least 2 inches.
 4. Seal jacket to wall flashing with flashing sealant.
- D. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.
- E. Insulation Installation at Fire-Rated Wall and Partition Penetrations: Install insulation continuously through penetrations of fire-rated walls and partitions.
1. Comply with requirements in Section 07 84 00 "Firestopping" for firestopping and fire-resistive joint sealers.
- F. Insulation Installation at Floor Penetrations:
1. Pipe: Install insulation continuously through floor penetrations.
 2. Seal penetrations through fire-rated assemblies. Comply with requirements in Section 07 84 00 "Firestopping."

3.05 GENERAL PIPE INSULATION INSTALLATION

- A. Requirements in this article generally apply to all insulation materials except where more specific requirements are specified in various pipe insulation material installation articles.
- B. Insulation Installation on Fittings, Valves, Strainers, Flanges, and Unions:
1. Install insulation over fittings, valves, strainers, flanges, unions, and other specialties with continuous thermal and vapor-retarder integrity unless otherwise indicated.
 2. Insulate pipe elbows using preformed fitting insulation or mitered fittings made from same material and density as adjacent pipe insulation. Each piece shall be butted tightly against adjoining piece and bonded with adhesive. Fill joints, seams, voids, and irregular surfaces with insulating cement finished to a smooth, hard, and uniform contour that is uniform with adjoining pipe insulation.
 3. Insulate tee fittings with preformed fitting insulation or sectional pipe insulation of same material and thickness as used for adjacent pipe. Cut sectional pipe insulation to fit. Butt each section closely to the next and hold in place with tie wire. Bond pieces with adhesive.
 4. Insulate valves using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. For valves, insulate up to and including the bonnets, valve stuffing-box studs, bolts, and nuts. Fill joints, seams, and irregular surfaces with insulating cement.
 5. Insulate strainers using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. Fill joints, seams, and irregular surfaces with insulating cement. Insulate strainers so strainer basket flange or plug can be easily removed and replaced without damaging the insulation and jacket. Provide a removable reusable insulation cover. For below-ambient services, provide a design that maintains vapor barrier.
 6. Insulate flanges and unions using a section of oversized preformed pipe insulation. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker.
 7. Cover segmented insulated surfaces with a layer of finishing cement and coat with a mastic. Install vapor-barrier mastic for below-ambient services and a breather mastic for above-ambient services. Reinforce the mastic with fabric-reinforcing mesh. Trowel the mastic to a smooth and well-shaped contour.

8. For services not specified to receive a field-applied jacket except for flexible elastomeric and polyolefin, install fitted PVC cover over elbows, tees, strainers, valves, flanges, and unions. Terminate ends with PVC end caps. Tape PVC covers to adjoining insulation facing using PVC tape.
 9. Stencil or label the outside insulation jacket of each union with the word "union." Match size and color of pipe labels.
- C. Insulate instrument connections for thermometers, pressure gages, pressure temperature taps, test connections, flow meters, sensors, switches, and transmitters on insulated pipes. Shape insulation at these connections by tapering it to and around the connection with insulating cement and finish with finishing cement, mastic, and flashing sealant.

3.06 INSTALLATION OF FLEXIBLE ELASTOMERIC INSULATION

- A. Seal longitudinal seams and end joints with manufacturers recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.
- B. Insulation Installation on Pipe Flanges:
1. Install pipe insulation to outer diameter of pipe flange.
 2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
 3. 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.
 4. Secure insulation to flanges and seal seams with manufacturers recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.
- C. Insulation Installation on Pipe Fittings and Elbows:
1. Install mitered sections of pipe insulation.
 2. Secure insulation materials and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.
- D. Insulation Installation on Valves and Pipe Specialties:
1. Install preformed valve covers manufactured of same material as pipe insulation when available.
 2. When preformed valve covers are not available, install cut sections of pipe and sheet insulation to valve body. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
 3. Install insulation to flanges as specified for flange insulation application.
 4. Secure insulation to valves and specialties and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

3.07 INSTALLATION OF MINERAL-FIBER INSULATION

- A. Insulation Installation on Straight Pipes and Tubes:
1. Secure each layer of preformed pipe insulation to pipe with wire or bands and tighten bands without deforming insulation materials.
 2. Where vapor barriers are indicated, seal longitudinal seams, end joints, and protrusions with vapor-barrier mastic and joint sealant.
 3. For insulation with factory-applied jackets on above-ambient surfaces, secure laps with outward-clinched staples at 6 inches o.c.
 4. For insulation with factory-applied jackets on below-ambient surfaces, do not staple longitudinal tabs. Instead, secure tabs with additional adhesive as recommended by insulation material manufacturer and seal with vapor-barrier mastic and flashing sealant.
- B. Insulation Installation on Pipe Flanges:
1. Install preformed pipe insulation to outer diameter of pipe flange.
 2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.

3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with mineral-fiber blanket insulation.
 4. Install jacket material with manufacturer's recommended adhesive, overlap seams at least 1 inch, and seal joints with flashing sealant.
- C. Insulation Installation on Pipe Fittings and Elbows:
1. Install preformed sections of same material as straight segments of pipe insulation when available.
 2. When preformed insulation elbows and fittings are not available, install mitered sections of pipe insulation, to a thickness equal to adjoining pipe insulation. Secure insulation materials with wire or bands.
- D. Insulation Installation on Valves and Pipe Specialties:
1. Install preformed sections of same material as straight segments of pipe insulation when available.
 2. When preformed sections are not available, install mitered sections of pipe insulation to valve body.
 3. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
 4. Install insulation to flanges as specified for flange insulation application.

3.08 FIELD-APPLIED JACKET INSTALLATION

- A. Where glass-cloth jackets are indicated, install directly over bare insulation or insulation with factory-applied jackets.
1. Draw jacket smooth and tight to surface with 2-inch overlap at seams and joints.
 2. Embed glass cloth between two 0.062-inch-thick coats of lagging adhesive.
 3. Completely encapsulate insulation with coating, leaving no exposed insulation.
- B. Where FSK jackets are indicated, install as follows:
1. Draw jacket material smooth and tight.
 2. Install lap or joint strips with same material as jacket.
 3. Secure jacket to insulation with manufacturer's recommended adhesive.
 4. Install jacket with 1-1/2-inch laps at longitudinal seams and 3-inch-wide joint strips at end joints.
 5. Seal openings, punctures, and breaks in vapor-retarder jackets and exposed insulation with vapor-barrier mastic.
- C. Where PVC jackets are indicated, install with 1-inch overlap at longitudinal seams and end joints; for horizontal applications. Seal with manufacturer's recommended adhesive.
1. Apply two continuous beads of adhesive to seams and joints, one bead under lap and the finish bead along seam and joint edge.

3.09 FINISHES

- A. Flexible Elastomeric Thermal Insulation: After adhesive has fully cured, apply two coats of insulation manufacturer's recommended protective coating.
- B. Color: Final color as selected by Architect. Vary first and second coats to allow visual inspection of the completed Work.
- C. Do not field paint aluminum or stainless-steel jackets.

3.10 FIELD QUALITY CONTROL

- A. Perform tests and inspections.

3.11 PIPING INSULATION SCHEDULE, GENERAL

- A. Acceptable preformed pipe and tubular insulation materials and thicknesses are identified for each piping system and pipe size range. If more than one material is listed for a piping system, selection from materials listed is Contractor's option.
- B. Items Not Insulated: Unless otherwise indicated, do not install insulation on the following:

1. Drainage piping located in crawl spaces.
2. Underground piping.
3. Chrome-plated pipes and fittings unless there is a potential for personnel injury.

3.12 INDOOR PIPING INSULATION SCHEDULE

- A. Condensate and Equipment Drain Water below 60 Deg F:
 1. All Pipe Sizes: Insulation shall be the following:
 - a. Flexible Elastomeric: 3/4 inch thick.
 - b. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1/2 inch thick.
- B. Heating-Hot-Water Supply and Return, 140 Deg F and Below:
 1. NPS 1-1/4 and Smaller: Insulation shall be the following:
 - a. Mineral-Fiber, Preformed Pipe, Type I: 1 inch thick.
 2. NPS 1-1/2 and Larger: Insulation shall be the following:
 - a. Mineral-Fiber, Preformed Pipe, Type I: 1-1/2 inches thick.
- C. Heating-Hot-Water Supply and Return, 140 Deg F and Above, and below 200 Deg°F:
 1. NPS 1-1/2 and Smaller: Insulation shall be the following:
 - a. Mineral-Fiber, Preformed Pipe, Type I: 1-1/2 inch thick.
 2. NPS 2 and Larger: Insulation shall be the following:
- D. Mineral-Fiber, Preformed Pipe, Type I: 2 inches thick Refrigerant Suction and Hot-Gas Piping:
 1. All Pipe Sizes: Insulation shall be the following:
 - a. Flexible Elastomeric: 1 inch thick.

3.13 OUTDOOR, ABOVEGROUND PIPING INSULATION SCHEDULE

- A. Refrigerant Suction and Hot-Gas Piping:
 1. All Pipe Sizes: Insulation shall be the following:
 - a. Flexible Elastomeric: 2 inches thick.

3.14 OUTDOOR, FIELD-APPLIED JACKET SCHEDULE

- A. Install jacket over insulation material. For insulation with factory-applied jacket, install the field-applied jacket over the factory-applied jacket.
- B. If more than one material is listed, selection from materials listed is Contractor's option.
- C. Piping:
 1. PVC: 30 mils thick.

END OF SECTION

SECTION 230923.11 - CONTROL VALVES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes control valves.

1.3 DEFINITIONS

- A. Cv: Design valve coefficient.
- B. NBR: Nitrile butadiene rubber.
- C. PTFE: Polytetrafluoroethylene

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product, including the following:
 - 1. Construction details, material descriptions, dimensions of individual components and profiles, and finishes.
 - 2. Product description with complete technical data, performance curves, and product specification sheets.
 - 3. Installation, operation, and maintenance instructions, including factors affecting performance.
- B. Shop Drawings:
 - 1. Include plans, elevations, sections, and **mounting** details.
 - 2. Include details of product assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
 - 3. Include diagrams for power, signal, and control wiring.
- C. Delegated-Design Submittal:
 - 1. Schedule and design calculations for control valves and actuators, including the following:
 - a. Flow at project design and minimum flow conditions.

- b. Pressure differential drop across valve at project design flow condition.
- c. Maximum system pressure differential drop (pump close-off pressure) across valve at project minimum flow condition.
- d. Design and minimum control valve coefficient with corresponding valve position.
- e. Maximum close-off pressure.
- f. Leakage flow at maximum system pressure differential.
- g. Torque required at worst case condition for sizing actuator.
- h. Actuator selection indicating torque provided.

1.5 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Plan drawings and corresponding product installation details, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:
 - 1. Control valve installation location shown in relationship to room, duct, pipe, and equipment.
 - 2. Size and location of wall access panels for control valves installed behind walls.
 - 3. Size and location of ceiling access panels for control valves installed above inaccessible ceilings.

1.6 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For control valves to include in operation and maintenance manuals.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Determine control valve sizes and flow coefficients by ISA 75.01.01.
- B. Control valve characteristics and rangeability shall comply with ISA 75.11.01.
- C. Selection Criteria:
 - 1. Control valves shall be suitable for operation at following conditions:
 - a. Heating Hot Water: 180 degrees F.
 - 2. Control valve shutoff classifications shall be FCI 70-2, Class IV or better unless otherwise indicated.
 - 3. Valve pattern, three-way or straight through, shall be as indicated on Drawings.
 - 4. Modulating straight-through pattern control valves shall have equal percentage flow-throttling characteristics unless otherwise indicated.
 - 5. Modulating three-way pattern water valves shall have linear flow-throttling characteristics. The total flow through the valve shall remain constant regardless of the valve's position.
 - 6. Fail positions unless otherwise indicated:

- a. Heating Hot Water: **Open**.
7. Selection shall consider viscosity, flashing, and cavitation corrections.
8. Valves shall have stable operation throughout full range of operation, from design to minimum Cv.
9. Minimum Cv shall be calculated at **10** percent of design flow, with a coincident pressure differential equal to the system design pump head.
10. In water systems, select modulating control valves at terminal equipment for a design Cv based on a pressure drop of **5 psig** at design flow unless otherwise indicated.
11. Two-position control valves shall be line size unless otherwise indicated.

2.2 SELF-CONTAINED TEMPERATURE REGULATING VALVE

A. Description:

1. Self-contained and self-operated temperature regulating valve. Direct acting or reverse acting as required by application.
2. Direct Acting: A rise in temperature at the sensing bulb vaporizes some of the liquid in the bulb, forcing the remaining liquid through a capillary to apply pressure at the diaphragm, in turn closing the valve. The valve shall fail open.
3. Reverse Acting: A rise in temperature at the sensing bulb vaporizes some of the liquid in the bulb, forcing the remaining liquid through a capillary to apply pressure at the diaphragm, in turn opening the valve. The valve shall fail close.
4. Body: Carbon steel.
5. Trim and Seats: 300 series stainless steel.
6. Yoke: Cast iron.
7. Actuator: 300 series stainless steel.
8. End Connections: Threaded.
9. Capillary, Bulb, and Armor: 300 series stainless steel.
10. Thermal Fill Material: Match to the temperature range.
11. Thermowell: Type 316 stainless-steel thermowell sized to fit the bulb and pipe.

B. Operational Characteristics: Control flow from between 5 to 100 percent of rated capacity.

C. Interchangeable trim for one size smaller.

D. Valve Leakage: Comply with FCI 70-2, Class IV.

E. Temperature Range: Match application.

1. Drains from Hot Equipment to Sanitary Sewer System: 105 to 165 deg F

F. Valve Size: Size to pass the design flow required with not more than 95 percent of the stem lift while operating at design pressure.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Examine roughing-in for valves installed in piping to verify actual locations of piping connections before installation.
- C. Prepare written report, endorsed by Installer, listing conditions detrimental to performance.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 CONTROL VALVE APPLICATIONS

- A. Control Valves:
 - 1. Select from valves specified in "Control Valves" Article to achieve performance requirements and characteristics indicated while subjected to full range of system operation encountered.
 - 2. Hot Water System, Two-Way Applications Controlled by Temperature: Self-contained temperature regulating valves.

3.3 INSTALLATION, GENERAL

- A. Furnish and install products required to satisfy most stringent requirements indicated.
- B. Install products level, plumb, parallel, and perpendicular with building construction.
- C. Properly support instruments, tubing, piping, wiring, and conduits to comply with requirements indicated. Brace all products to prevent lateral movement and sway or a break in attachment when subjected to a force.
- D. Provide ceiling, floor, roof, and wall openings and sleeves required by installation. Before proceeding with drilling, punching, or cutting, check location first for concealed products that could potentially be damaged. Patch, flash, grout, seal, and refinish openings to match adjacent condition.
- E. Firestop penetrations made in fire-rated assemblies and seal penetrations made in acoustically rated assemblies.
- F. Fastening Hardware:
 - 1. Stillson wrenches, pliers, and other tools that will cause injury to or mar surfaces of rods, nuts, and other parts are prohibited for assembling and tightening nuts.
 - 2. Tighten bolts and nuts firmly and uniformly. Do not overstress threads by excessive force or by oversized wrenches.
 - 3. Lubricate threads of bolts, nuts, and screws with graphite and oil before assembly.

- G. Install products in locations that are accessible and that will permit calibration and maintenance from floor, equipment platforms, or catwalks. Where ladders are required for Owner's access, confirm unrestricted ladder placement is possible under occupied condition.
- H. Corrosive Environments:
 - 1. Use products that are suitable for environment to which they will be subjected.
 - 2. If possible, avoid or limit use of materials in corrosive environments, including, but not limited to, the following:
 - a. Laboratory exhaust airstreams.
 - b. Process exhaust airstreams.
 - 3. Use Type 316 stainless-steel tubing and fittings when in contact with a corrosive environment.
 - 4. When conduit is in contact with a corrosive environment, use Type 316 stainless-steel conduit and fittings or conduit and fittings that are coated with a corrosive-resistant coating that is suitable for environment.
 - 5. Where control devices are located in a corrosive environment and are not corrosive resistant from manufacturer, field install products in a NEMA 250, Type 4X enclosure constructed of Type 316L stainless steel.

3.4 CONTROL VALVES

- A. Install pipe reducers for valves smaller than line size. Position reducers as close to valve as possible but at distance to avoid interference and impact to performance. Install with manufacturer-recommended clearance.
- B. Install flanges or unions to allow drop-in and -out valve installation.
- C. Where indicated, install control valve with three-valve bypass manifold to allow for control valve isolation and removal without interrupting system flow by providing manual throttling valve in bypass pipe.
- D. Install drain valves in piping upstream and downstream of each control valve installed in a three-valve manifold and for each control valve larger than **NPS 2 (DN 50)**.
- E. Valve Orientation:
 - 1. Install valves in a position to allow full stem movement.
- F. Clearance:
 - 1. Locate valves for easy access and provide separate support of valves that cannot be handled by service personnel without hoisting mechanism.
 - 2. Install valves with at least 12 inches (300 mm) of clear space around valve and between valves and adjacent surfaces.
- G. Threaded Valves:
 - 1. Note internal length of threads in valve ends, and proximity of valve internal seat or wall, to determine how far pipe should be threaded into valve.

2. Align threads at point of assembly.
3. Apply thread compound to external pipe threads, except where dry seal threading is specified.
4. Assemble joint, wrench tight. Apply wrench on valve end as pipe is being threaded.

H. Flanged Valves:

1. Align flange surfaces parallel.
2. Assemble joints by sequencing bolt tightening to make initial contact of flanges and gaskets as flat and parallel as possible. Use suitable lubricants on bolt threads. Tighten bolts gradually and uniformly with a torque wrench.

3.5 IDENTIFICATION

- A. Install engraved phenolic nameplate with valve identification on valve **and on face of ceiling directly below valves concealed above ceilings.**

3.6 CLEANING

- A. Remove grease, mastic, adhesives, dust, dirt, stains, fingerprints, labels, and other foreign materials from exposed interior and exterior surfaces.
- B. Wash and shine glazing.
- C. Polish glossy surfaces to a clean shine.

3.7 CHECKOUT PROCEDURES

A. Control Valve Checkout:

1. Check installed products before continuity tests, leak tests, and calibration.
2. Check valves for proper location and accessibility.
3. Check valves for proper installation for direction of flow, elevation, orientation, insertion depth, or other applicable considerations that will impact performance.
4. Verify that control valves are installed correctly for flow direction.
5. Verify that valve body attachment is properly secured and sealed.
6. Verify that valve actuator and linkage attachment are secure.
7. Verify that actuator wiring is complete, enclosed, and connected to correct power source.
8. Verify that valve ball, disc, and plug travel are unobstructed.
9. After piping systems have been tested and put into service, but before insulating and balancing, inspect each valve for leaks. Adjust or replace packing to stop leaks. Replace the valve if leaks persist.

3.8 ADJUSTMENT, CALIBRATION, AND TESTING

- A. Stroke and adjust control valves following manufacturer's recommended procedure, from 100 percent open to 100 percent closed back to 100 percent open.

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- B. Stroke control valves with pilot positioners. Adjust valve and positioner following manufacturer's recommended procedure, so valve is 100 percent closed, 50 percent closed, and 100 percent open at proper air pressures.
- C. Check and document open and close cycle times for applications with a cycle time of less than 30 seconds.
- D. For control valves equipped with positive position indication, check feedback signal at multiple positions to confirm proper position indication.

END OF SECTION 230923.11

SECTION 23 21 13 – HYDRONIC PIPING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. Section includes pipe and fitting materials and joining methods for the following:
 - 1. Copper tube and fittings.

1.03 ACTION SUBMITTALS

- A. Product Data: For each type of the following:
 - 1. Pipe.
 - 2. Fittings.
 - 3. Joining materials.

1.04 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Piping layout, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:
 - 1. Suspended ceiling components.
 - 2. Other building services.
 - 3. Structural members.
- B. Field quality-control reports.

1.05 QUALITY ASSURANCE

- A. Steel Support Welding: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

PART 2 - PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

- A. Hydronic piping components and installation shall be capable of withstanding the following minimum working pressure and temperature unless otherwise indicated:
 - 1. Hot-Water Heating Piping: 150 psig at 180 deg F.
 - 2. Safety-Valve-Inlet and -Outlet Piping: Equal to the pressure of the piping system to which it is attached.

2.02 COPPER TUBE AND FITTINGS

- A. Drawn-Temper Copper Tubing: ASTM B 88, Type L.
- B. Soldered Joint Fitting with copper or copper alloy.
- C. Wrought-Copper Unions: ASME B16.22.

2.03 JOINING MATERIALS

- A. Solder Filler Metals: ASTM B 32, lead-free alloys. Include water-flushable flux according to ASTM B 813.

PART 3 - EXECUTION

3.01 PIPING APPLICATIONS

- A. Hot-water heating piping, aboveground, NPS 2 and smaller, shall be the following:
 - 1. Type L, drawn-temper copper tubing, wrought-copper fittings, and soldered joints.

- B. Condensate-Drain Piping: Drawn-temper copper tubing, wrought-copper fittings, and soldered joints or Schedule 40 PVC plastic pipe and fittings and solvent-welded joints.
- C. Air-Vent Piping:
 - 1. Inlet: Same as service where installed with metal-to-plastic transition fittings for plastic piping systems according to piping manufacturer's written instructions.
 - 2. Outlet: Type K, annealed-temper copper tubing with soldered or flared joints.
- D. Safety-Valve-Inlet and -Outlet Piping for Hot-Water Piping: Same materials and joining methods as for piping specified for the service in which safety valve is installed with metal-to-plastic transition fittings for plastic piping systems according to piping manufacturer's written instructions.

3.02 PIPING INSTALLATIONS

- A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.
- B. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.
- C. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
- D. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.
- E. Install piping to permit valve servicing.
- F. Install piping at indicated slopes.
- G. Install piping free of sags and bends.
- H. Install fittings for changes in direction and branch connections.
- I. Install piping to allow application of insulation.
- J. Select system components with pressure rating equal to or greater than system operating pressure.
- K. Install groups of pipes parallel to each other, spaced to permit applying insulation and servicing of valves.
- L. Install drains, consisting of a tee fitting, NPS 3/4 ball valve, and short NPS 3/4 threaded nipple with cap, at low points in piping system mains and elsewhere as required for system drainage.
- M. Install piping at a uniform grade of 0.2 percent upward in direction of flow.
- N. Reduce pipe sizes using eccentric reducer fitting installed with level side up.
- O. Install branch connections to mains using tee fittings in main pipe, with the branch connected to the bottom of the main pipe. For up-feed risers, connect the branch to the top of the main pipe.
- P. Install unions in piping, NPS 2 and smaller, adjacent to valves, at final connections of equipment, and elsewhere as indicated.
- Q. Install flanges in piping, NPS 2-1/2 and larger, at final connections of equipment and elsewhere as indicated.
- R. Install shutoff valve immediately upstream of each dielectric fitting.

3.03 HANGERS AND SUPPORTS

- A. Install the following pipe attachments:
 - 1. Adjustable steel clevis hangers for individual horizontal piping less than 20 feet long.
 - 2. Adjustable roller hangers and spring hangers for individual horizontal piping 20 feet or longer.

3. Pipe Roller: MSS SP-58, Type 44 for multiple horizontal piping 20 feet or longer, supported on a trapeze.
 4. Spring hangers to support vertical runs.
 5. Provide copper-clad hangers and supports for hangers and supports in direct contact with copper pipe.
- B. Install hangers for drawn-temper copper piping with the following maximum spacing and minimum rod sizes:
1. NPS 3/4: Maximum span, 5 feet; minimum rod size, 1/4 inch.
 2. NPS 1: Maximum span, 6 feet; minimum rod size, 1/4 inch.
 3. NPS 1-1/4: Maximum span, 7 feet; minimum rod size, 3/8 inch.
 4. NPS 1-1/2: Maximum span, 8 feet; minimum rod size, 3/8 inch.
 5. NPS 2: Maximum span, 8 feet; minimum rod size, 3/8 inch.
- 3.04 PIPE JOINT CONSTRUCTION
- A. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
 - B. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.
 - C. Soldered Joints: Apply ASTM B 813, water-flushable flux, unless otherwise indicated, to tube end. Construct joints according to ASTM B 828 or CDA's "Copper Tube Handbook," using lead-free solder alloy complying with ASTM B 32.
 - D. Welded Joints: Construct joints according to AWS D10.12M/D10.12, using qualified processes and welding operators according to "Quality Assurance" Article.
- 3.05 TERMINAL EQUIPMENT CONNECTIONS
- A. Sizes for supply and return piping connections shall be the same as or larger than equipment connections.
 - B. Install control valves in accessible locations close to connected equipment.
 - C. Install bypass piping with globe valve around control valve. If parallel control valves are installed, only one bypass is required.
 - D. Install ports for pressure gages and thermometers at coil inlet and outlet connections. Comply with requirements in Section 23 05 19 "Meters and Gages for HVAC Piping."
- 3.06 FIELD QUALITY CONTROL
- A. Prepare hydronic piping according to ASME B31.9 and as follows:
 1. Leave joints, including welds, uninsulated and exposed for examination during test.
 2. Provide temporary restraints for expansion joints that cannot sustain reactions due to test pressure. If temporary restraints are impractical, isolate expansion joints from testing.
 3. Flush hydronic piping systems with clean water; then remove and clean or replace strainer screens.
 4. Isolate equipment from piping. If a valve is used to isolate equipment, its closure shall be capable of sealing against test pressure without damage to valve. Install blinds in flanged joints to isolate equipment.
 5. Install safety valve, set at a pressure no more than one-third higher than test pressure, to protect against damage by expanding liquid or other source of overpressure during test.
 - B. Perform the following tests on hydronic piping:
 1. Use ambient temperature water as a testing medium unless there is risk of damage due to freezing. Another liquid that is safe for workers and compatible with piping may be used.
 2. While filling system, use vents installed at high points of system to release air. Use drains installed at low points for complete draining of test liquid.
 3. Isolate expansion tanks and determine that hydronic system is full of water.

4. Subject piping system to hydrostatic test pressure that is not less than 1.5 times the system's working pressure. Test pressure shall not exceed maximum pressure, but not less than 100 psi. for any vessel, pump, valve, or other component in system under test. Verify that stress due to pressure at bottom of vertical runs does not exceed 90 percent of specified minimum yield strength or 1.7 times the "SE" value in Appendix A in ASME B31.9, "Building Services Piping."
 5. After hydrostatic test pressure has been applied for at least 15 minutes, examine piping, joints, and connections for leakage. Eliminate leaks by tightening, repairing, or replacing components, and repeat hydrostatic test until there are no leaks.
 6. Prepare written report of testing.
- C. Perform the following before operating the system:
1. Open manual valves fully.
 2. Inspect pumps for proper rotation.
 3. Set makeup pressure-reducing valves for required system pressure.
 4. Inspect air vents at high points of system and determine if all are installed and operating freely (automatic type), or bleed air completely (manual type).
 5. Set temperature controls so all coils are calling for full flow.
 6. Inspect and set operating temperatures of hydronic equipment, such as boilers, chillers, cooling towers, to specified values.
 7. Verify lubrication of motors and bearings.

END OF SECTION

SECTION 23 21 16 - HYDRONIC PIPING SPECIALTIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:

- 1. Hydronic specialty valves.
 - 2. Air-control devices.
 - 3. Strainers.

- B. Related Requirements:

- 1. Section 23 09 23.11 "Control Valves" for automatic control valve and sensor specifications, installation requirements, and locations.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product:

- 1. Include construction details and material descriptions for hydronic piping specialties.
 - 2. Include rated capacities, operating characteristics, and furnished specialties and accessories.
 - 3. Include flow and pressure drop curves based on manufacturer's testing for calibrated-orifice balancing valves and automatic flow-control valves.

1.4 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For hydronic piping specialties to include in emergency, operation, and maintenance manuals.

1.5 MAINTENANCE MATERIAL SUBMITTALS

- A. Differential Pressure Meter: For each type of balancing valve and automatic flow control valve, include flowmeter, probes, hoses, flow charts, and carrying case.

1.6 QUALITY ASSURANCE

- A. Pipe Welding: Qualify procedures and operators according to ASME Boiler and Pressure Vessel Code: Section IX.

PART 2 - PRODUCTS

2.1 HYDRONIC SPECIALTY VALVES

A. Bronze, Calibrated-Orifice, Balancing Valves:

1. Body: Bronze, ball or plug type with calibrated orifice or venturi.
2. Ball: Brass or stainless steel.
3. Plug: Resin.
4. Seat: PTFE.
5. End Connections: Threaded or socket.
6. Pressure Gage Connections: Integral seals for portable differential pressure meter.
7. Handle Style: Lever, with memory stop to retain set position.
8. CWP Rating: Minimum 125 psig.
9. Maximum Operating Temperature: 250 deg F.

B. Automatic Flow-Control Valves:

1. Body: Brass or ferrous metal.
2. Flow Control Assembly, provide either of the following:
 - a. Piston and Spring Assembly: **Stainless steel**, tamper proof, self-cleaning, and removable.
 - b. Elastomeric Diaphragm and Polyphenylsulfone Orifice Plate: Operating ranges within 2- to 80-psig differential pressure.
3. Combination Assemblies: Include bronze or brass-alloy ball valve.
4. Identification Tag: Marked with zone identification, valve number, and flow rate.
5. Size: Same as pipe in which installed.
6. Performance: Maintain constant flow within plus or minus 10 percent, regardless of system pressure fluctuations.
7. Minimum CWP Rating: **175 psig**.
8. Maximum Operating Temperature: **200 deg F**.

2.2 AIR-CONTROL DEVICES

A. Automatic Air Vents:

1. Body: Bronze or cast iron.
2. Internal Parts: Nonferrous.
3. Operator: Noncorrosive metal float.
4. Inlet Connection: NPS 1/2.
5. Discharge Connection: NPS 1/4.
6. CWP Rating: 150 psig.
7. Maximum Operating Temperature: 240 deg F.

2.3 STRAINERS

A. Y-Pattern Strainers:

1. Body: ASTM A 126, Class B, cast iron with bolted cover and bottom drain connection.
2. End Connections: Threaded ends for NPS 2 and smaller; flanged ends for NPS 2-1/2 and larger.
3. Strainer Screen: Stainless-steel, **60**-mesh strainer, or perforated stainless-steel basket.
4. CWP Rating: 125 psig.

PART 3 - EXECUTION

3.1 VALVE APPLICATIONS

- A. Install shut off-duty valves at each branch connection to supply mains and at supply connection to each piece of equipment.
- B. Install **throttling-duty or calibrated-orifice, balancing** valves at each branch connection to return main.
- C. Install calibrated-orifice, balancing valves in the return pipe of each heating or cooling terminal.
- D. Install check valves at each pump discharge and elsewhere as required to control flow direction.
- E. Install safety valves at hot-water generators and elsewhere as required by ASME Boiler and Pressure Vessel Code. Install drip-pan elbow on safety-valve outlet and pipe without valves to the outdoors; pipe drain to nearest floor drain or as indicated on Drawings. Comply with ASME Boiler and Pressure Vessel Code: Section VIII, Division 1, for installation requirements.
- F. Install pressure-reducing valves at makeup-water connection to regulate system fill pressure.

3.2 HYDRONIC SPECIALTIES INSTALLATION

- A. Install manual air vents at high points in piping, at heat-transfer coils, and elsewhere as required for system air venting.
- B. Install automatic air vents at high points of system piping in mechanical equipment rooms only. Install manual vents at heat-transfer coils and elsewhere as required for air venting.

END OF SECTION

SECTION 23 31 13 – METAL DUCTS

PART 1 - GENERAL

1.01 SUMMARY

- A. Section Includes:
 - 1. Rectangular ducts and fittings.
 - 2. Round ducts and fittings.
 - 3. Sheet metal materials.
 - 4. Sealants and gaskets.
 - 5. Hangers and supports.
 - 6. Seismic-restraint devices.

1.02 PERFORMANCE REQUIREMENTS

- A. Delegated Duct Design: Duct construction, including sheet metal thicknesses, seam and joint construction, reinforcements, and hangers and supports, shall comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" and performance requirements and design criteria indicated in "Duct Schedule" Article.
- B. Structural Performance: Duct hangers and supports and seismic restraints shall withstand the effects of gravity and seismic loads and stresses within limits and under conditions described in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" and ASCE/SEI 7.
 - 1. Seismic Hazard Level A: Seismic force to weight ratio, 0.48.
- C. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.

1.03 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. LEED Submittals:
 - 1. Product Data for Prerequisite IEQ 1: Documentation indicating that duct systems comply with ASHRAE 62.1, Section 5 - "Systems and Equipment."
 - 2. Product Data for Prerequisite EA 2: Documentation indicating that duct systems comply with ASHRAE/IESNA 90.1, Section 6.4.4 - "HVAC System Construction and Insulation."
 - 3. Product Data for Credit IEQ 4.1: For adhesives and sealants, documentation including printed statement of VOC content.
 - 4. Credits IEQ 3 and IEQ 5: Coordination with requirements of Division 01 Section "Indoor Air Quality Requirements" including use of minimum MERV 8 filters if systems used during construction and installation of MERV 13 filters prior to occupancy.
 - 5. Credit IEQ 9: Background noise level to be reduced to 40 dBA or less from HVAC systems in study rooms and other core learning spaces. 1" sound liner in ductwork. All penetrations in assemblies (ducts, piping, recessed cabinets) to be sealed and treated during construction to optimize sound isolation and control sound leakage.
- C. Shop Drawings:
 - 1. Fabrication, assembly, and installation, including plans, elevations, sections, components, and attachments to other work.
 - 2. Factory- and shop-fabricated ducts and fittings.
 - 3. Duct layout indicating sizes, configuration, and static-pressure classes.
 - 4. Elevation of top of ducts.
 - 5. Dimensions of main duct runs from building grid lines.
 - 6. Fittings.
 - 7. Reinforcement and spacing.
 - 8. Seam and joint construction.
 - 9. Penetrations through fire-rated and other partitions.

10. Equipment installation based on equipment being used on Project.
 11. Locations for duct accessories, including dampers, turning vanes, and access doors and panels.
 12. Hangers and supports, including methods for duct and building attachment, seismic restraints, and vibration isolation.
- D. Delegated-Design Submittal:
1. Sheet metal thicknesses.
 2. Joint and seam construction and sealing.
 3. Reinforcement details and spacing.
 4. Materials, fabrication, assembly, and spacing of hangers and supports.
 5. Design Calculations: Calculations, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation for selecting hangers and supports and seismic restraints.
- 1.04 INFORMATIONAL SUBMITTALS
- A. Coordination Drawings: Plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:
1. Duct installation in congested spaces, indicating coordination with general construction, building components, and other building services. Indicate proposed changes to duct layout.
 2. Suspended ceiling components.
 3. Structural members to which duct will be attached.
 4. Size and location of initial access modules for acoustical tile.
 5. Penetrations of smoke barriers and fire-rated construction.
 6. Items penetrating finished ceiling including the following:
 - a. Lighting fixtures.
 - b. Air outlets and inlets.
 - c. Speakers.
 - d. Sprinklers.
 - e. Access panels.
 - f. Perimeter moldings.
- B. Welding certificates.
- 1.05 QUALITY ASSURANCE
- A. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel," for hangers and supports.
- B. Welding Qualifications: Qualify procedures and personnel according to the following:
1. AWS D1.1/D1.1M, "Structural Welding Code - Steel," for hangers and supports.
 2. AWS D1.2/D1.2M, "Structural Welding Code - Aluminum," for aluminum supports.
 3. AWS D9.1M/D9.1, "Sheet Metal Welding Code," for duct joint and seam welding.
- C. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 5 - "Systems and Equipment" and Section 7 - "Construction and System Start-up."
- D. ASHRAE/IESNA Compliance: Applicable requirements in ASHRAE/IESNA 90.1, Section 6.4.4 - "HVAC System Construction and Insulation."

PART 2 - PRODUCTS

2.01 RECTANGULAR DUCTS AND FITTINGS

- A. General Fabrication Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" based on indicated static-pressure class unless otherwise indicated.

- B. Transverse Joints: Select joint types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-1, "Rectangular Duct/Transverse Joints," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
- C. Longitudinal Seams: Select seam types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-2, "Rectangular Duct/Longitudinal Seams," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
- D. Elbows, Transitions, Offsets, Branch Connections, and Other Duct Construction: Select types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 4, "Fittings and Other Construction," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

2.02 SHEET METAL MATERIALS

- A. General Material Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods unless otherwise indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.
- B. Galvanized Sheet Steel: Comply with ASTM A 653/A 653M.
 - 1. Galvanized Coating Designation: G60.
 - 2. Finishes for Surfaces Exposed to View: Mill phosphatized.
- C. Reinforcement Shapes and Plates: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.
 - 1. Where black- and galvanized-steel shapes and plates are used to reinforce aluminum ducts, isolate the different metals with butyl rubber, neoprene, or EPDM gasket materials.
- D. Tie Rods: Galvanized steel, 1/4-inch minimum diameter for lengths 36 inches or less; 3/8-inch minimum diameter for lengths longer than 36 inches.

2.03 SEALANT AND GASKETS

- A. General Sealant and Gasket Requirements: Surface-burning characteristics for sealants and gaskets shall be a maximum flame-spread index of 25 and a maximum smoke-developed index of 50 when tested according to UL 723; certified by an NRTL.
- B. Two-Part Tape Sealing System:
 - 1. Tape: Woven cotton fiber impregnated with mineral gypsum and modified acrylic/silicone activator to react exothermically with tape to form hard, durable, G90 galvanized, airtight seal.
 - 2. Tape Width: 3 inches.
 - 3. Sealant: Modified styrene acrylic.
 - 4. Water resistant.
 - 5. Mold and mildew resistant.
 - 6. Maximum Static-Pressure Class: 10-inch wg, positive and negative.
 - 7. Service: Indoor and outdoor.
 - 8. Service Temperature: Minus 40 to plus 200 deg F.
 - 9. Substrate: Compatible with galvanized sheet steel (both PVC coated and bare), stainless steel, or aluminum.
 - 10. For indoor applications, sealant shall have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- C. Water-Based Joint and Seam Sealant:
 - 1. Application Method: Brush on.

2. Solids Content: Minimum 65 percent.
 3. Shore A Hardness: Minimum 20.
 4. Water resistant.
 5. Mold and mildew resistant.
 6. VOC: Maximum 75 g/L (less water).
 7. Maximum Static-Pressure Class: 10-inch wg, positive and negative.
 8. Service: Indoor or outdoor.
 9. Substrate: Compatible with galvanized sheet steel (both PVC coated and bare), stainless steel, or aluminum sheets.
- D. Flanged Joint Sealant: Comply with ASTM C 920.
1. General: Single-component, acid-curing, silicone, elastomeric.
 2. Type: S.
 3. Grade: NS.
 4. Class: 25.
 5. Use: O.
 6. For indoor applications, sealant shall have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- E. Flange Gaskets: Butyl rubber, neoprene, or EPDM polymer with polyisobutylene plasticizer.
- 2.04 HANGERS AND SUPPORTS
- A. Hanger Rods for Noncorrosive Environments: Cadmium-plated steel rods and nuts.
- B. Hanger Rods for Corrosive Environments: Electrogalvanized, all-thread rods or galvanized rods with threads painted with zinc-chromate primer after installation.
- C. Strap and Rod Sizes: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 5-1, "Rectangular Duct Hangers Minimum Size," and Table 5-2, "Minimum Hanger Sizes for Round Duct."
- D. Steel Cables for Galvanized-Steel Ducts: Galvanized steel complying with ASTM A 603.
- E. Steel Cables for Stainless-Steel Ducts: Stainless steel complying with ASTM A 492.
- F. Steel Cable End Connections: Cadmium-plated steel assemblies with brackets, swivel, and bolts designed for duct hanger service; with an automatic-locking and clamping device.
- G. Duct Attachments: Sheet metal screws, blind rivets, or self-tapping metal screws; compatible with duct materials.
- H. Trapeze and Riser Supports:
1. Supports for Galvanized-Steel Ducts: Galvanized-steel shapes and plates.
 2. Supports for Stainless-Steel Ducts: Stainless-steel shapes and plates.
 3. Supports for Aluminum Ducts: Aluminum or galvanized steel coated with zinc chromate.

PART 3 - EXECUTION

3.01 DUCT INSTALLATION

- A. Drawing plans, schematics, and diagrams indicate general location and arrangement of duct system. Indicated duct locations, configurations, and arrangements were used to size ducts and calculate friction loss for air-handling equipment sizing and for other design considerations. Install duct systems as indicated unless deviations to layout are approved on Shop Drawings and Coordination Drawings.
- B. Install ducts according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" unless otherwise indicated.
- C. Install ducts with fewest possible joints.
- D. Install factory- or shop-fabricated fittings for changes in direction, size, and shape and for branch connections.

- E. Unless otherwise indicated, install ducts vertically and horizontally, and parallel and perpendicular to building lines.
- F. Install ducts close to walls, overhead construction, columns, and other structural and permanent enclosure elements of building.
- G. Install ducts with a clearance of 1 inch, plus allowance for insulation thickness.
- H. Route ducts to avoid passing through transformer vaults and electrical equipment rooms and enclosures.
- I. Where ducts pass through non-fire-rated interior partitions and exterior walls and are exposed to view, cover the opening between the partition and duct or duct insulation with sheet metal flanges of same metal thickness as the duct. Overlap openings on four sides by at least 1-1/2 inches.
- J. Where ducts pass through fire-rated interior partitions and exterior walls, install fire dampers. Comply with requirements in Air Duct Accessories for fire and smoke dampers.
- K. Protect duct interiors from moisture, construction debris and dust, and other foreign materials.

3.02 INSTALLATION OF EXPOSED DUCTWORK

- A. Protect ducts exposed in finished spaces from being dented, scratched, or damaged.
- B. Trim duct sealants flush with metal. Create a smooth and uniform exposed bead. Do not use two-part tape sealing system.
- C. Grind welds to provide smooth surface free of burrs, sharp edges, and weld splatter. When welding stainless steel with a No. 3 or 4 finish, grind the welds flush, polish the exposed welds, and treat the welds to remove discoloration caused by welding.
- D. Maintain consistency, symmetry, and uniformity in the arrangement and fabrication of fittings, hangers and supports, duct accessories, and air outlets.
- E. Repair or replace damaged sections and finished work that does not comply with these requirements.

3.03 DUCT SEALING

- A. Seal ducts for duct static-pressure, seal classes, and leakage classes specified in "Duct Schedule" Article according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
- B. Seal ducts to the following seal classes according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible":
 - 1. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
 - 2. Outdoor, Supply-Air Ducts: Seal Class A.
 - 3. Outdoor, Exhaust Ducts: Seal Class C.
 - 4. Outdoor, Return-Air Ducts: Seal Class A.
 - 5. Unconditioned Space, Supply-Air Ducts in Pressure Classes 2-Inch wg and Lower: Seal Class B.
 - 6. Unconditioned Space, Supply-Air Ducts in Pressure Classes Higher Than 2-Inch wg: Seal Class A.
 - 7. Unconditioned Space, Exhaust Ducts: Seal Class C.
 - 8. Unconditioned Space, Return-Air Ducts: Seal Class B.
 - 9. Conditioned Space, Supply-Air Ducts in Pressure Classes 2-Inch wg and Lower: Seal Class C.
 - 10. Conditioned Space, Supply-Air Ducts in Pressure Classes Higher Than 2-Inch wg: Seal Class B.
 - 11. Conditioned Space, Exhaust Ducts: Seal Class B.
 - 12. Conditioned Space, Return-Air Ducts: Seal Class A.

3.04 HANGER AND SUPPORT INSTALLATION

- A. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 5, "Hangers and Supports."
- B. Building Attachments: Concrete inserts, powder-actuated fasteners, or structural-steel fasteners appropriate for construction materials to which hangers are being attached.
 - 1. Where practical, install concrete inserts before placing concrete.
 - 2. Install powder-actuated concrete fasteners after concrete is placed and completely cured.
 - 3. Use powder-actuated concrete fasteners for standard-weight aggregate concretes or for slabs more than 4 inches thick.
 - 4. Do not use powder-actuated concrete fasteners for lightweight-aggregate concretes or for slabs less than 4 inches thick.
 - 5. Do not use powder-actuated concrete fasteners for seismic restraints.
- C. Hanger Spacing: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 5-1, "Rectangular Duct Hangers Minimum Size," and Table 5-2, "Minimum Hanger Sizes for Round Duct," for maximum hanger spacing; install hangers and supports within 24 inches of each elbow and within 48 inches of each branch intersection.
- D. Hangers Exposed to View: Threaded rod and angle or channel supports.
- E. Support vertical ducts with steel angles or channel secured to the sides of the duct with welds, bolts, sheet metal screws, or blind rivets; support at each floor and at a maximum intervals of 16 feet.
- F. Install upper attachments to structures. Select and size upper attachments with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

3.05 CONNECTIONS

- A. Make connections to equipment with flexible connectors complying with Air Duct Accessories.
- B. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for branch, outlet and inlet, and terminal unit connections.

3.06 DUCT CLEANING

- A. Clean new and existing duct system(s) before testing, adjusting, and balancing.
- B. Use service openings for entry and inspection.
 - 1. Create new openings and install access panels appropriate for duct static-pressure class if required for cleaning access. Provide insulated panels for insulated or lined duct. Patch insulation and liner as recommended by duct liner manufacturer. Comply with Air Duct Accessories for access panels and doors.
 - 2. Disconnect and reconnect flexible ducts as needed for cleaning and inspection.
 - 3. Remove and reinstall ceiling to gain access during the cleaning process.
- C. Particulate Collection and Odor Control:
 - 1. When venting vacuuming system inside the building, use HEPA filtration with 99.97 percent collection efficiency for 0.3-micron-size (or larger) particles.
 - 2. When venting vacuuming system to outdoors, use filter to collect debris removed from HVAC system, and locate exhaust downwind and away from air intakes and other points of entry into building.
- D. Clean the following components by removing surface contaminants and deposits:
 - 1. Air outlets and inlets (registers, grilles, and diffusers).
 - 2. Supply, return, and exhaust fans including fan housings, plenums (except ceiling supply and return plenums), scrolls, blades or vanes, shafts, baffles, dampers, and drive assemblies.

3. Air-handling unit internal surfaces and components including mixing box, coil section, air wash systems, spray eliminators, condensate drain pans, humidifiers and dehumidifiers, filters and filter sections, and condensate collectors and drains.
 4. Coils and related components.
 5. Return-air ducts, dampers, actuators, and turning vanes except in ceiling plenums and mechanical equipment rooms.
 6. Supply-air ducts, dampers, actuators, and turning vanes.
 7. Dedicated exhaust and ventilation components and makeup air systems.
- E. Mechanical Cleaning Methodology:
1. Clean metal duct systems using mechanical cleaning methods that extract contaminants from within duct systems and remove contaminants from building.
 2. Use vacuum-collection devices that are operated continuously during cleaning. Connect vacuum device to downstream end of duct sections so areas being cleaned are under negative pressure.
 3. Use mechanical agitation to dislodge debris adhered to interior duct surfaces without damaging integrity of metal ducts, duct liner, or duct accessories.
 4. Clean fibrous-glass duct liner with HEPA vacuuming equipment; do not permit duct liner to get wet. Replace fibrous-glass duct liner that is damaged, deteriorated, or delaminated or that has friable material, mold, or fungus growth.
 5. Clean coils and coil drain pans according to NADCA 1992. Keep drain pan operational. Rinse coils with clean water to remove latent residues and cleaning materials; comb and straighten fins.
 6. Provide drainage and cleanup for wash-down procedures.
 7. Antimicrobial Agents and Coatings: Apply EPA-registered antimicrobial agents if fungus is present. Apply antimicrobial agents according to manufacturer's written instructions after removal of surface deposits and debris.
- 3.07 START UP
- A. Air Balance: Comply with requirements in Testing, Adjusting, and Balancing for HVAC.
- 3.08 DUCT SCHEDULE
- A. Supply Ducts:
1. Ducts Connected to Fan Coil Units, Furnaces, Heat Pumps, and Terminal Units:
 - a. Pressure Class: Positive 1-inch wg.
 - b. Minimum SMACNA Seal Class: A.
 - c. SMACNA Leakage Class for Rectangular: 12.
 - d. SMACNA Leakage Class for Round and Flat Oval: 12.
 2. Ducts Connected to Constant-Volume Air-Handling Units:
 - a. Pressure Class: Positive 2-inch wg.
 - b. Minimum SMACNA Seal Class: A.
 - c. SMACNA Leakage Class for Rectangular: 6.
 - d. SMACNA Leakage Class for Round and Flat Oval: 6.
 3. Ducts Connected to Variable-Air-Volume Air-Handling Units:
 - a. Pressure Class: Positive 3-inch wg.
 - b. Minimum SMACNA Seal Class: A.
 - c. SMACNA Leakage Class for Rectangular: 3.
 - d. SMACNA Leakage Class for Round and Flat Oval: 3.
 4. Ducts Connected to Equipment Not Listed Above:
 - a. Pressure Class: Positive 2-inch wg.
 - b. Minimum SMACNA Seal Class: A.
 - c. SMACNA Leakage Class for Rectangular: 3.
 - d. SMACNA Leakage Class for Round and Flat Oval: 3.
- B. Return Ducts:
1. Ducts Connected to Fan Coil Units, Furnaces, Heat Pumps, and Terminal Units:

- a. Pressure Class: Positive or negative 1-inch wg.
 - b. Minimum SMACNA Seal Class: A.
 - c. SMACNA Leakage Class for Rectangular: 12.
 - d. SMACNA Leakage Class for Round and Flat Oval: 12.
 2. Ducts Connected to Air-Handling Units:
 - a. Pressure Class: Positive or negative 2-inch wg.
 - b. Minimum SMACNA Seal Class: A.
 - c. SMACNA Leakage Class for Rectangular: 6.
 - d. SMACNA Leakage Class for Round and Flat Oval: 6.
 3. Ducts Connected to Equipment Not Listed Above:
 - a. Pressure Class: Positive or negative 2-inch wg.
 - b. Minimum SMACNA Seal Class: A.
 - c. SMACNA Leakage Class for Rectangular: 3.
 - d. SMACNA Leakage Class for Round and Flat Oval: 3.
- C. Exhaust Ducts:
 1. Ducts Connected to Fans Exhausting (ASHRAE 62.1, Class 1 and 2) Air:
 - a. Pressure Class: Negative 1-inch wg.
 - b. Minimum SMACNA Seal Class: A if negative pressure, and A if positive pressure.
 - c. SMACNA Leakage Class for Rectangular: 12.
 - d. SMACNA Leakage Class for Round and Flat Oval: 6.
 2. Ducts Connected to Air-Handling Units:
 - a. Pressure Class: Positive or negative 2-inch wg.
 - b. Minimum SMACNA Seal Class: A if negative pressure, and A if positive pressure.
 - c. SMACNA Leakage Class for Rectangular: 6.
 - d. SMACNA Leakage Class for Round and Flat Oval: 3.
 - e.
 3. Ducts Connected to Equipment Not Listed Above:
 - a. Pressure Class: Positive or negative 2-inch wg.
 - b. Minimum SMACNA Seal Class: A if negative pressure, and A if positive pressure.
 - c. SMACNA Leakage Class for Rectangular: 6.
 - d. SMACNA Leakage Class for Round and Flat Oval: 3.
- D. Outdoor-Air (Not Filtered, Heated, or Cooled) Ducts:
 1. Ducts Connected to Air-Handling Units:
 - a. Pressure Class: Positive or negative 2-inch wg.
 - b. Minimum SMACNA Seal Class: A.
 - c. SMACNA Leakage Class for Rectangular: 6.
 - d. SMACNA Leakage Class for Round and Flat Oval: 3.
 2. Ducts Connected to Equipment Not Listed Above:
 - a. Pressure Class: Positive or negative 2-inch wg.
 - b. Minimum SMACNA Seal Class: A.
 - c. SMACNA Leakage Class for Rectangular: 3.
 - d. SMACNA Leakage Class for Round and Flat Oval: 3.
- E. Intermediate Reinforcement:
 1. Galvanized-Steel Ducts: Galvanized steel.
 2. PVC-Coated Ducts:
 - a. Exposed to Airstream: Match duct material.
 - b. Not Exposed to Airstream: Galvanized.
 3. Stainless-Steel Ducts:
 - a. Exposed to Airstream: Match duct material.
 - b. Not Exposed to Airstream: Galvanized.
 4. Aluminum Ducts: Aluminum or galvanized sheet steel coated with zinc chromate.
- F. Elbow Configuration:

1. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-2, "Rectangular Elbows."
 - a. Velocity 1000 fpm or Lower:
 - 1) Radius Type RE 1 with minimum 0.5 radius-to-diameter ratio.
 - 2) Mitered Type RE 4 without vanes.
 - b. Velocity 1000 to 1500 fpm:
 - 1) Radius Type RE 1 with minimum 1.0 radius-to-diameter ratio.
 - 2) Radius Type RE 3 with minimum 0.5 radius-to-diameter ratio and two vanes.
 - 3) Mitered Type RE 2 with vanes complying with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-3, "Vanes and Vane Runners," and Figure 4-4, "Vane Support in Elbows."
 - c. Velocity 1500 fpm or Higher:
 - 1) Radius Type RE 1 with minimum 1.5 radius-to-diameter ratio.
 - 2) Radius Type RE 3 with minimum 1.0 radius-to-diameter ratio and two vanes.
 - 3) Mitered Type RE 2 with vanes complying with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-3, "Vanes and Vane Runners," and Figure 4-4, "Vane Support in Elbows."
 2. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-2, "Rectangular Elbows."
 - a. Radius Type RE 1 with minimum 1.5 radius-to-diameter ratio.
 - b. Radius Type RE 3 with minimum 1.0 radius-to-diameter ratio and two vanes.
 - c. Mitered Type RE 2 with vanes complying with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-3, "Vanes and Vane Runners," and Figure 4-4, "Vane Support in Elbows."
- G. Branch Configuration:
1. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-6, "Branch Connection."
 - a. Rectangular Main to Rectangular Branch: 45-degree entry.
 - b. Rectangular Main to Round Branch: Spin in.

END OF SECTION

SECTION 23 33 00 – AIR DUCT ACCESSORIES

PART 1 - GENERAL

1.01 SUMMARY

- A. Section Includes:
 - 1. Backdraft and pressure relief dampers.
 - 2. Manual volume dampers.
 - 3. Control dampers.
 - 4. Fire dampers.
 - 5. Combination fire and smoke dampers
 - 6. Flange connectors.
 - 7. Turning vanes.
 - 8. Duct-mounted access doors.
 - 9. Flexible connectors.
 - 10. Flexible ducts.
 - 11. Duct accessory hardware.

1.02 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. LEED Submittals:
 - 1. Product Data for Prerequisite IEQ 1: Documentation indicating that units comply with ASHRAE 62.1, Section 5 - "Systems and Equipment."
 - 2. Product Data for Prerequisite EA 2: Documentation indicating that duct insulation R-values comply with tables in ASHRAE/IESNA 90.1, Section 6 - "Heating, Ventilating, and Air Conditioning."
 - 3. Product Data for Credit IEQ 4.1: For adhesives and sealants applied within the building water proofing envelope, documentation including printed statement of VOC content in g/L.
- C. Shop Drawings: For duct accessories. Include plans, elevations, sections, details and attachments to other work.
 - 1. Detail duct accessories fabrication and installation in ducts and other construction. Include dimensions, weights, loads, and required clearances; and method of field assembly into duct systems and other construction. Include the following:
 - a. Special fittings.
 - b. Manual volume damper installations.
 - c. Control-damper installations.
 - d. Fire-damper installations, including sleeves; and duct-mounted access doors.
 - e. Wiring Diagrams: For power, signal, and control wiring.

1.03 CLOSEOUT SUBMITTALS

- A. Operation and maintenance data.

PART 2 - PRODUCTS

2.01 ASSEMBLY DESCRIPTION

- A. Comply with NFPA 90A, "Installation of Air Conditioning and Ventilating Systems," and with NFPA 90B, "Installation of Warm Air Heating and Air Conditioning Systems."
- B. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods unless otherwise indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.

2.02 MATERIALS

- A. Galvanized Sheet Steel: Comply with ASTM A 653/A 653M.
 - 1. Galvanized Coating Designation: G60.
 - 2. Exposed-Surface Finish: Mill phosphatized.
- B. Reinforcement Shapes and Plates: Galvanized-steel reinforcement where installed on galvanized sheet metal ducts; compatible materials for aluminum and stainless-steel ducts.
- C. Tie Rods: Galvanized steel, 1/4-inch minimum diameter for lengths 36 inches or less; 3/8-inch minimum diameter for lengths longer than 36 inches.

2.03 BACKDRAFT AND PRESSURE RELIEF DAMPERS

- 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. Air Balance Inc.; a division of Mestek, Inc.
 - 2. American Warming and Ventilating; a division of Mestek, Inc.
 - 3. Cesco Products; a division of Mestek, Inc.
 - 4. Greenheck Fan Corporation.
 - 5. Lloyd Industries, Inc.
 - 6. Nailor Industries Inc.
 - 7. NCA Manufacturing, Inc.
 - 8. Pottorff.
 - 9. Ruskin Company.
 - 10. Vent Products Company, Inc.
- B. Description: Gravity balanced.
- C. Maximum Air Velocity: 1000 fpm.
- D. Frame: Hat-shaped, 0.05-inch-thick, galvanized sheet steel, with welded corners or mechanically attached and mounting flange.
- E. Blades: Multiple single-piece blades, center pivoted, maximum 6-inch width, 0.025-inch-thick, roll-formed aluminum with sealed edges.
- F. Blade Action: Parallel.
- G. Blade Seals: Neoprene, mechanically locked.
- H. Blade Axles:
 - 1. Material: Nonferrous metal.
 - 2. Diameter: 0.20 inch.
- I. Tie Bars and Brackets: Aluminum.
- J. Return Spring: Adjustable tension.
- K. Bearings: Steel ball.
- L. Accessories:
 - 1. Adjustment device to permit setting for varying differential static pressure.
 - 2. Counterweights and spring-assist kits for vertical airflow installations.
 - 3. Electric actuators.
 - 4. Chain pulls.
 - 5. Screen Mounting: Front mounted in sleeve.
 - a. Sleeve Thickness: 20 gage minimum.
 - b. Sleeve Length: 6 inches minimum.
 - 6. Screen Mounting: Rear mounted.
 - 7. Screen Material: Galvanized steel.
 - 8. Screen Type: Bird.
 - 9. 90-degree stops.

2.04 MANUAL VOLUME DAMPERS

- A. Standard, Steel, Manual Volume Dampers:
1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Air Balance Inc.; a division of Mestek, Inc.
 - b. American Warming and Ventilating; a division of Mestek, Inc.
 - c. Flexmaster U.S.A., Inc.
 - d. McGill AirFlow LLC.
 - e. Nailor Industries Inc.
 - f. Pottorff.
 - g. Ruskin Company.
 - h. Trox USA Inc.
 - i. Vent Products Company, Inc.
 2. Standard leakage rating, with linkage outside airstream.
 3. Suitable for horizontal or vertical applications.
 4. Frames:
 - a. Frame: Hat-shaped, 0.094-inch-thick, galvanized sheet steel.
 - b. Mitered and welded corners.
 - c. Flanges for attaching to walls and flangeless frames for installing in ducts.
 5. Blades:
 - a. Parallel- or opposed-blade design. For balancing application use opposed-blade damper and for shutoff application use parallel blade dampers.
 - b. Stiffen damper blades for stability.
 - c. Galvanized-steel, 0.064 inch thick.
 6. Blade Axles: Galvanized steel.
 7. Bearings:
 - a. Oil-impregnated bronze.
 - b. Dampers in ducts with pressure classes of 3-inch wg or less shall have axles full length of damper blades and bearings at both ends of operating shaft.
 8. Tie Bars and Brackets: Galvanized steel.
- B. Jackshaft:
1. Size: 0.5-inch diameter.
 2. Material: Galvanized-steel pipe rotating within pipe-bearing assembly mounted on supports at each mullion and at each end of multiple-damper assemblies.
 3. Length and Number of Mountings: As required to connect linkage of each damper in multiple-damper assembly.
- C. Damper Hardware:
1. Zinc-plated, die-cast core with dial and handle made of 3/32-inch-thick zinc-plated steel, and a 3/4-inch hexagon locking nut.
 2. Include center hole to suit damper operating-rod size.
 3. Include elevated platform for insulated duct mounting.

2.05 CONSTANT AIR REGULATING DAMPERS

- 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. Automatic Airflow Balancing (AAB)
 2. Aldes
 3. Ruskin Company
- B. Frames:
1. UL 94 plastic construction and listed as compliant with UL 2043.
- C. Adjustment:
1. Either field adjustable or pre-set air volume from the factory.

- D. Operating range:
 - 1. Operating range shall be within 0.2 to 2 " WC for all valves. No external power required.
- E. Accuracy:
 - 1. Accuracy of +/- 10% of setpoint CFM (tested per AMCA 500-D-18).

2.06 FIRE DAMPERS

- 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. Air Balance Inc.; a division of Mestek, Inc.
 - 2. Arrow United Industries; a division of Mestek, Inc.
 - 3. Cesco Products; a division of Mestek, Inc.
 - 4. Greenheck Fan Corporation.
 - 5. Nailor Industries Inc.
 - 6. NCA Manufacturing, Inc.
 - 7. Pottorff.
 - 8. Prefco; Perfect Air Control, Inc.
 - 9. Ruskin Company.
 - 10. Vent Products Company, Inc.
 - 11. Ward Industries, Inc.; a division of Hart & Cooley, Inc.
- B. Type: Static; rated and labeled according to UL 555 by an NRTL.
- C. Closing rating in ducts up to 4-inch wg static pressure class and minimum 2000-fpm velocity.
- D. Fire Rating: 1-1/2 and 3 hours.
- E. Frame: Curtain type with blades outside airstream; fabricated with roll-formed, 0.034-inch-thick galvanized steel; with mitered and interlocking corners.
- F. Mounting Sleeve: Factory- or field-installed, galvanized sheet steel.
 - 1. Minimum Thickness: 0.05 thick, as indicated, and of length to suit application.
 - 2. Exception: Omit sleeve where damper-frame width permits direct attachment of perimeter mounting angles on each side of wall or floor; thickness of damper frame must comply with sleeve requirements.
- G. Mounting Orientation: Vertical or horizontal as indicated.
- H. Blades: Roll-formed, interlocking, 0.024-inch-thick, galvanized sheet steel. In place of interlocking blades, use full-length, 0.034-inch-thick, galvanized-steel blade connectors.
- I. Horizontal Dampers: Include blade lock and stainless-steel closure spring.
- J. Heat-Responsive Device: Replaceable, 165 deg F rated fusible links.

2.07 COMBINATION FIRE AND SMOKE DAMPERS

- 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. Air Balance Inc.; a division of Mestek, Inc.
 - 2. Arrow United Industries; a division of Mestek, Inc.
 - 3. Cesco Products; a division of Mestek, Inc.
 - 4. Greenheck Fan Corporation.
 - 5. Nailor Industries Inc.
 - 6. NCA Manufacturing, Inc.
 - 7. Pottorff.
 - 8. Prefco; Perfect Air Control, Inc.
 - 9. Ruskin Company.
 - 10. Vent Products Company, Inc.
 - 11. Ward Industries, Inc.; a division of Hart & Cooley, Inc.

- B. Type: Dynamic; rated and labeled according to UL 555 and UL 555S by an NRTL.
- C. Closing rating in ducts up to 4-inch wg static pressure class and minimum 2000-fpm velocity.
- D. Fire Rating: 1-1/2 and 3 hours (as indicated per wall/shaft rating.)
- E. Frame: Hat-shaped, 0.094-inch- (2.4-mm-) thick, galvanized sheet steel, with welded, interlocking, gusseted or mechanically attached corners and mounting flange.
- F. Heat-Responsive Device: Replaceable, 165 deg F rated, fusible links.
- G. Heat-Responsive Device: Electric resettable link device and switch package, factory installed, rated.
- H. Smoke Detector: Integral, factory wired for single-point connection.
- I. Blades: Roll-formed, horizontal, interlocking, opposed blade, 0.063-inch thick, galvanized sheet steel.
- J. Leakage: Class I.
- K. Rated pressure and velocity to exceed design airflow conditions.
- L. Mounting Sleeve: Factory-installed, 0.05-inch thick, galvanized sheet steel; length to suit wall or floor application with factory-furnished silicone calking.
- M. Master control panel for use in dynamic smoke-management systems.
- N. Damper Motors: two-position action.
- O. Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements for motors specified in Section 23 05 13 "Common Motor Requirements for HVAC Equipment."
 - 1. Motor Sizes: Minimum size as indicated. If not indicated, large enough so driven load will not require motor to operate in service factor range above 1.0.
 - 2. Controllers, Electrical Devices, and Wiring: Comply with requirements for electrical devices and connections specified in Section 23 09 23 "Direct Digital Control (DDC) System for HVAC."
 - 3. Permanent-Split-Capacitor or Shaded-Pole Motors: With oil-immersed and sealed gear trains.
 - 4. Spring-Return Motors: Equip with an integral spiral-spring mechanism where indicated. Enclose entire spring mechanism in a removable housing designed for service or adjustments. Size for running torque rating of 150 in. x lbf and breakaway torque rating of 150 in. x lbf.
 - 5. Outdoor Motors and Motors in Outdoor-Air Intakes: Equip with O-ring gaskets designed to make motors weatherproof. Equip motors with internal heaters to permit normal operation at minus 40 deg F.
 - 6. Nonspring-Return Motors: For dampers larger than 25 sq. ft., size motor for running torque rating of 150 in. x lbf and breakaway torque rating of 300 in. x lbf.
 - 7. Electrical Connection: 115 V, single phase, 60 Hz.
- P. Accessories:

1. Auxiliary switches for signaling or position indication.
2. Momentary test switch, Test and reset switches, damper remote mounted.

2.08 FLANGE CONNECTORS

- 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. Ductmate Industries, Inc.
 2. Nexus PDQ; Division of Shilco Holdings Inc.
 3. Ward Industries, Inc.; a division of Hart & Cooley, Inc.
- B. Description: Add-on or roll-formed, factory-fabricated, slide-on transverse flange connectors, gaskets, and components.
- C. Material: Galvanized steel.
- D. Gage and Shape: Match connecting ductwork.

2.09 TURNING VANES

- 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. Ductmate Industries, Inc.
 2. Duro Dyne Inc.
 3. Elgen Manufacturing.
 4. METALAIRE, Inc.
 5. SEMCO Incorporated.
 6. Ward Industries, Inc.; a division of Hart & Cooley, Inc.
- B. Manufactured Turning Vanes for Metal Ducts: Curved blades of galvanized sheet steel; support with bars perpendicular to blades set; set into vane runners suitable for duct mounting.
- C. General Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible"; Figures 4-3, "Vanes and Vane Runners," and 4-4, "Vane Support in Elbows."
- D. Vane Construction: Single wall.

2.10 DUCT-MOUNTED ACCESS DOORS

- 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. American Warming and Ventilating; a division of Mestek, Inc.
 2. Cesco Products; a division of Mestek, Inc.
 3. Ductmate Industries, Inc.
 4. Elgen Manufacturing.
 5. Flexmaster U.S.A., Inc.
 6. Greenheck Fan Corporation.
 7. McGill AirFlow LLC.
 8. Nailor Industries Inc.
 9. Pottorff.
 10. Ventfabrics, Inc.
 11. Ward Industries, Inc.; a division of Hart & Cooley, Inc.
- B. Duct-Mounted Access Doors: Fabricate access panels according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible"; Figures 7-2, "Duct Access Doors and Panels," Door:
 - a. Double wall, rectangular.

- b. Galvanized sheet metal with insulation fill and thickness as indicated for duct pressure class.
 - c. Vision panel.
 - d. Hinges and Latches: 1-by-1-inch butt or piano hinge and cam latches.
 - e. Fabricate doors airtight and suitable for duct pressure class.
- 2. Frame: Galvanized sheet steel, with bend-over tabs and foam gaskets.
- 3. Number of Hinges and Locks:
 - a. Access Doors Less Than 12 Inches Square: No hinges and two sash locks.
 - b. Access Doors up to 18 Inches Square: Continuous and two sash locks.
 - c. Access Doors up to 24 by 48 Inches: Three hinges and two compression latches with outside and inside handles.
 - d. Access Doors Larger Than 24 by 48 Inches: Four hinges and two compression latches with outside and inside handles.
- C. Pressure Relief Access Door:
 - 1. Door and Frame Material: Galvanized sheet steel.
 - 2. Door: Single wall with metal thickness applicable for duct pressure class.
 - 3. Operation: Open outward for positive-pressure ducts and inward for negative-pressure ducts.
 - 4. Factory set at 3.0- to 8.0-inch wg.
 - 5. Doors close when pressures are within set-point range.
 - 6. Hinge: Continuous piano.
 - 7. Latches: Cam.
 - 8. Seal: Neoprene or foam rubber.
 - 9. Insulation Fill: 1-inch-thick, fibrous-glass or polystyrene-foam board.

2.11 DUCT ACCESS PANEL ASSEMBLIES

- 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. Ductmate Industries, Inc.
 - 2. Flame Gard, Inc.
 - 3. 3M.
- B. Labeled according to UL 1978 by an NRTL.
- C. Panel and Frame: Minimum thickness 0.0528-inch carbon steel.
- D. Fasteners: Carbon steel. Panel fasteners shall not penetrate duct wall.
- E. Gasket: Comply with NFPA 96; grease-tight, high-temperature ceramic fiber, rated for minimum 2000 deg F.
- F. Minimum Pressure Rating: 10-inch wg, positive or negative.

2.12 FLEXIBLE CONNECTORS

- 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. Ductmate Industries, Inc.
 - 2. Duro Dyne Inc.
 - 3. Elgen Manufacturing.
 - 4. Ventfabrics, Inc.
 - 5. Ward Industries, Inc.; a division of Hart & Cooley, Inc.
- B. Materials: Flame-retardant or noncombustible fabrics.
- C. Coatings and Adhesives: Comply with UL 181, Class 1.

- D. Metal-Edged Connectors: Factory fabricated with a fabric strip 3-1/2 inches wide attached to two strips of 2-3/4-inch-wide, 0.028-inch-thick, galvanized sheet steel or 0.032-inch-thick aluminum sheets. Provide metal compatible with connected ducts.
- E. Indoor System, Flexible Connector Fabric: Glass fabric double coated with neoprene.
 - 1. Minimum Weight: 26 oz./sq. yd..
 - 2. Tensile Strength: 480 lbf/inch in the warp and 360 lbf/inch in the filling.
 - 3. Service Temperature: Minus 40 to plus 200 deg F.
- F. Outdoor System, Flexible Connector Fabric: Glass fabric double coated with weatherproof, synthetic rubber resistant to UV rays and ozone.
 - 1. Minimum Weight: 24 oz./sq. yd..
 - 2. Tensile Strength: 530 lbf/inch in the warp and 440 lbf/inch in the filling.
 - 3. Service Temperature: Minus 50 to plus 250 deg F.

2.13 FLEXIBLE DUCTS

- 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. Flexmaster U.S.A., Inc.
 - 2. McGill AirFlow LLC.
 - 3. Ward Industries, Inc.; a division of Hart & Cooley, Inc.
- B. Non-insulated, Flexible Duct: UL 181, Class 1, 2-ply vinyl film supported by helically wound, spring-steel wire.
 - 1. Pressure Rating: 10-inch wg positive and 1.0-inch wg negative.
 - 2. Maximum Air Velocity: 4000 fpm.
 - 3. Temperature Range: Minus 10 to plus 160 deg F.
- C. Insulated, Flexible Duct: UL 181, Class 1, aluminum laminate and polyester film with latex adhesive supported by helically wound, spring-steel wire; fibrous-glass insulation; polyethylene vapor-barrier film.
 - 1. Pressure Rating: 10-inch wg positive and 1.0-inch wg negative.
 - 2. Maximum Air Velocity: 4000 fpm.
 - 3. Temperature Range: Minus 20 to plus 210 deg F.
 - 4. Insulation R-value: Comply with ASHRAE/IESNA 90.1.
- D. Flexible Duct Connectors:
 - 1. Clamps: Stainless-steel band with cadmium-plated hex screw to tighten band with a worm-gear action in sizes 3 through 18 inches, to suit duct size.
 - 2. Non-Clamp Connectors: Adhesive.

2.14 DUCT ACCESSORY HARDWARE

- A. Instrument Test Holes: Cast iron or cast aluminum to suit duct material, including screw cap and gasket. Size to allow insertion of pitot tube and other testing instruments and of length to suit duct-insulation thickness.
- B. Adhesives: High strength, quick setting, neoprene based, waterproof, and resistant to gasoline and grease.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Install duct accessories according to applicable details in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for metal ducts and in NAIMA AH116, "Fibrous Glass Duct Construction Standards," for fibrous-glass ducts.
- B. Install duct accessories of materials suited to duct materials; use galvanized-steel accessories in galvanized-steel and fibrous-glass ducts, stainless-steel accessories in stainless-steel ducts, and aluminum accessories in aluminum ducts.
- C. Install backdraft dampers at inlet of exhaust fans or exhaust ducts as close as possible to exhaust fan unless otherwise indicated.
- D. Install volume dampers at points on supply, return, and exhaust systems where branches extend from larger ducts. Where dampers are installed in ducts having duct liner, install dampers with hat channels of same depth as liner, and terminate liner with nosing at hat channel.
 - 1. Install steel volume dampers in steel ducts.
- E. Set dampers to fully open position before testing, adjusting, and balancing.
- F. Install test holes at fan inlets and outlets and elsewhere as indicated.
- G. Install fire and smoke dampers according to UL listing.
- H. Install duct access doors on sides of ducts to allow for inspecting, adjusting, and maintaining accessories and equipment at the following locations:
 - 1. On both sides of duct coils.
 - 2. Upstream and downstream from duct filters.
 - 3. At outdoor-air intakes and mixed-air plenums.
 - 4. At drain pans and seals.
 - 5. Downstream from manual volume dampers, control dampers, backdraft dampers, and equipment.
 - 6. Adjacent to and close enough to fire or smoke dampers, to reset or reinstall fusible links. Access doors for access to fire or smoke dampers having fusible links shall be pressure relief access doors and shall be outward operation for access doors installed upstream from dampers and inward operation for access doors installed downstream from dampers.
 - 7. At each change in direction and at maximum 50-foot spacing.
 - 8. Upstream and downstream from turning vanes.
 - 9. Control devices requiring inspection.
 - 10. Elsewhere as indicated.
- I. Install access doors with swing against duct static pressure.
- J. Access Door Sizes:
 - 1. One-Hand or Inspection Access: 8 by 5 inches.
 - 2. Two-Hand Access: 12 by 6 inches.
 - 3. Head and Hand Access: 18 by 10 inches.
 - 4. Head and Shoulders Access: 21 by 14 inches.
 - 5. Body Access: 25 by 14 inches.
 - 6. Body plus Ladder Access: 25 by 17 inches.
- K. Label access doors according to Identification for HVAC Piping and Equipment to indicate the purpose of access door.
- L. Install flexible connectors to connect ducts to equipment.
- M. Connect terminal units to supply ducts directly or with maximum 12-inch lengths of flexible duct. Do not use flexible ducts to change directions.

- N. Connect diffusers or light troffer boots to ducts directly or with maximum 60-inch lengths of flexible duct clamped or strapped in place.
- O. Connect flexible ducts to metal ducts with adhesive.
- P. Install duct test holes where required for testing and balancing purposes.

3.02 FIELD QUALITY CONTROL

- A. When installing the constant air regulator (CAR) devices ensure that the device is set to the proper air flow when installed, especially if the device is to be installed in an inaccessible area. Otherwise each device shall be made accessible to the balancer and commissioner to verify design flow values.
- B. A mock-up of each type of opening protective shall be provided at the construction site. The installing contractor and local inspector shall review and approve the mock-up before the remaining units are installed.
- C. Tests and Inspections:
 - 1. Operate dampers to verify full range of movement.
 - 2. Inspect locations of access doors and verify that purpose of access door can be performed.
 - 3. Operate fire and smoke dampers to verify full range of movement and verify that proper heat-response device is installed.
 - 4. Inspect turning vanes for proper and secure installation.

END OF SECTION

SECTION 23 37 13 – DIFFUSERS, REGISTERS, AND GRILLES

PART 1 - GENERAL

1.01 SUMMARY

- A. Section Includes:
 - 1. Rectangular and square ceiling diffusers.
 - 2. Perforated diffusers.
 - 3. Linear slot diffusers.
 - 4. Adjustable bar registers.
 - 5. Fixed face registers and grilles.

1.02 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated, include the following:
 - 1. Data Sheet: Indicate materials of construction, finish, and mounting details; and performance data including throw and drop, static-pressure drop, and noise ratings.
 - 2. Diffuser, Register, and Grille Schedule: Indicate drawing designation, room location, quantity, model number, size, and accessories furnished.
- B. Samples: For each exposed product and for each color and texture specified.

PART 2 - PRODUCTS

2.01 CEILING DIFFUSERS

- A. Rectangular and Square Ceiling Diffusers:
 - 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Anemostat Products; a Mestek company.
 - b. Carnes.
 - c. Hart & Cooley Inc.
 - d. Krueger.
 - e. METALAIRE, Inc.
 - f. Nailor Industries Inc.
 - g. Price Industries.
 - h. Titus.
 - i. Tuttle & Bailey.
 - 2. Material: Steel.
 - 3. Finish: Baked enamel, white.
 - 4. Face Size: 24 by 24 inches.
 - 5. Face Style: Three cone.
 - 6. Mounting: Surface and T-bar.
 - 7. Pattern: Fixed and Adjustable.
 - 8. Dampers: Radial opposed blade.
 - 9. Accessories:
 - a. Equalizing grid.
 - b. Plaster ring.
 - c. Safety chain.
 - d. Wire guard.
 - e. Sectorizing baffles.
 - f. Operating rod extension.
- B. Perforated Diffuser:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Anemostat Products; a Mestek company.
 - b. Carnes.
 - c. Hart & Cooley Inc.
 - d. Krueger.
 - e. METALAIRE, Inc.
 - f. Nailor Industries Inc.
 - g. Price Industries.
 - h. Titus.
 - i. Tuttle & Bailey.
2. Material: Steel backpan and pattern controllers, with steel face.
3. Finish: Baked enamel, white.

2.02 REGISTERS AND GRILLES

A. Adjustable Bar Register:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Anemostat Products; a Mestek company.
 - b. Carnes.
 - c. Hart & Cooley Inc.
 - d. Krueger.
 - e. METALAIRE, Inc.
 - f. Nailor Industries Inc.
 - g. Price Industries.
 - h. Titus.
 - i. Tuttle & Bailey.
2. Material: Steel.
3. Finish: Baked enamel, white.
4. Face Blade Arrangement: Horizontal spaced 3 inches apart.
5. Core Construction: Integral.
6. Rear-Blade Arrangement: Horizontal spaced 3/4 inch apart.
7. Frame: 1-1/4 inches wide.
8. Mounting: Countersunk screw.
9. Damper Type: Adjustable opposed blade.
10. Accessories:
 - a. Front-blade gang operator.

B. Adjustable Bar Grille:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Anemostat Products; a Mestek company.
 - b. Carnes.
 - c. Hart & Cooley Inc.
 - d. Krueger.
 - e. METALAIRE, Inc.
 - f. Nailor Industries Inc.
 - g. Price Industries.
 - h. Titus.
 - i. Tuttle & Bailey.
2. Material: Steel.
3. Finish: Baked enamel, white.

4. Face Blade Arrangement: Horizontal spaced 3 inches apart.
 5. Core Construction: Integral.
 6. Rear-Blade Arrangement: Horizontal spaced 3/4 inch apart.
 7. Frame: 1-1/4 inches wide.
 8. Mounting: Countersunk screw.
- C. Fixed Face Register:
1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Anemostat Products; a Mestek company.
 - b. Carnes.
 - c. Hart & Cooley Inc.
 - d. Krueger.
 - e. Nailor Industries Inc.
 - f. Price Industries.
 - g. Titus.
 - h. Tuttle & Bailey.
 2. Material: Steel.
 3. Finish: Baked enamel, white.
 4. Face Arrangement: 1/2-by-1/2-by-1/2-inch grid Perforated core.
 5. Core Construction: Integral.
 6. Frame: 1-1/4 inches wide.
 7. Mounting: Countersunk screw.
 8. Damper Type: Adjustable opposed blade.
- D. Fixed Face Grille:
1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Anemostat Products; a Mestek company.
 - b. Carnes.
 - c. Hart & Cooley Inc.
 - d. Krueger.
 - e. Nailor Industries Inc.
 - f. Price Industries.
 - g. Titus.
 - h. Tuttle & Bailey.
 2. Material: Steel.
 3. Finish: Baked enamel, white.
 4. Face Arrangement: 1/2-by-1/2-by-1/2-inch grid core.
 5. Core Construction: Integral.
 6. Frame: 1-1/4 inches wide.
 7. Mounting: Countersunk screw.
- 2.03 SOURCE QUALITY CONTROL
- A. Verification of Performance: Rate diffusers, registers, and grilles according to ASHRAE 70, "Method of Testing for Rating the Performance of Air Outlets and Inlets."

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Install diffusers, registers, and grilles level and plumb.

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- B. Ceiling-Mounted Outlets and Inlets: Drawings indicate general arrangement of ducts, fittings, and accessories. Air outlet and inlet locations have been indicated to achieve design requirements for air volume, noise criteria, airflow pattern, throw, and pressure drop. Make final locations where indicated, as much as practical. For units installed in lay-in ceiling panels, locate units in the center of panel. Where architectural features or other items conflict with installation, notify Architect for a determination of final location.
 - C. Install diffusers, registers, and grilles with airtight connections to ducts and to allow service and maintenance of dampers, air extractors, and fire dampers.
- 3.02 ADJUSTING
- A. After installation, adjust diffusers, registers, and grilles to air patterns indicated, or as directed, before starting air balancing.

END OF SECTION

SECTION 23 82 33 - CONVECTORS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes **hydronic** convectors.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include rated capacities, operating characteristics, furnished specialties, and accessories.
- B. Shop Drawings:
 - 1. Include plans, elevations, sections, and details.
 - 2. Include details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
 - 3. Include details and dimensions of custom-fabricated enclosures.
 - 4. Indicate location and size of each field connection.
 - 5. Indicate location and arrangement of piping valves and specialties.
 - 6. Indicate location and arrangement of integral controls.
 - 7. Include enclosure joints, corner pieces, access doors, and other accessories.
 - 8. Include diagrams for power, signal, and control wiring.
- C. Samples: For each exposed product and for each color and texture specified.
- D. Color Samples for Initial Selection: For units with factory-applied color finishes.
- E. Color Samples for Verification: For each type of exposed finish.

1.4 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Floor plans and other details, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:
 - 1. Structural members, including wall construction, to which convectors will be attached.
 - 2. Method of attaching convectors to building structure.
 - 3. Penetrations of fire-rated wall and floor assemblies.

- B. Field quality-control reports.

PART 2 - PRODUCTS

2.1 HOT-WATER CONVECTORS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Slant/Fin Corp.
 2. Sterling HVAC Products; a Mestek company.
 3. Trane.
- B. Heating Elements: Seamless copper tubing mechanically expanded into evenly spaced aluminum fins and rolled into cast-**iron or brass** headers with inlet/outlet and air vent; steel side plates and supports. Factory-pressure-test element at minimum 100 psig.
1. Element Height: as per drawings.
 2. Element Depth: as per drawings.
 3. Element Length: as per drawings.
 4. Entering-Air Temperature: as per drawings.
 5. Heat Output: as per drawings.
 6. Average Water Temperature: as per drawings.
 7. Temperature Drop: as per drawings.
 8. Pressure Loss: as per drawings.
 9. Heat Output: as per drawings.
- C. Front and Top Panel: Minimum **0.0677-inch-** thick steel with exposed corners rounded; removable front panels with tamper-resistant fasteners braced and reinforced for stiffness.
- D. Wall-Mounted Back and End Panels: Minimum 0.0428-inch- thick steel.
- E. Insulation: 1/2-inch- thick, fibrous glass on inside of the back of the enclosure.
- F. Finish: Baked-enamel finish in manufacturer's **custom** color as selected by Architect.
- G. Damper: Knob-operated internal damper.
- H. Access Doors: Factory made, permanently hinged with tamper-resistant fastener, minimum size 6 by 7 inches, integral with enclosure.
- I. Enclosure Style: **Flat** (recessed) top.
1. Front Inlet Grille: Punched louver; painted to match enclosure.
 2. Front Inlet Grille: Extruded-aluminum linear bar grille; pencil-proof bar spacing.
 - a. Mill-finish aluminum.
 - b. Anodized finish, color as selected by Architect from manufacturer's **custom** colors.
 - c. Painted to match enclosure.
 3. **Front** Outlet Grille: Punched louver; painted to match enclosure.

4. **Front** Outlet Grille: Extruded-aluminum linear bar grille; pencil-proof bar spacing.
 - a. Mill-finish aluminum.
 - b. Anodized finish, color as selected by Architect from manufacturer's **custom** colors.
 - c. Painted to match enclosure.
5. Enclosure Height: as per drawings.
6. Enclosure Depth: as per drawings .
7. Enclosure Length: as per drawings.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas to receive convectors for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Examine roughing-in for **hydronic-piping** connections to verify actual locations before installation of convector.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Install convectors level and plumb.
- B. Install valves within reach of access door provided in enclosure.
- C. Install air-seal gasket between wall and recessed flanges or front cover of fully recessed unit.
- D. Install piping within pedestals for freestanding units.

3.3 CONNECTIONS

- A. Piping installation requirements are specified in **Section 23 21 13 "Hydronic Piping" and Section 23 21 16 "Hydronic Piping Specialties."** Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Connect hot-water convectors and components to piping according to Section 23 21 13 "Hydronic Piping" and Section 23 21 16 "Hydronic Piping Specialties."
 1. Install shutoff valves on inlet and outlet, and balancing valve on outlet.
- C. Install control valves as required by Section 23 09 23.11 "Control Valves."
- D. Install piping adjacent to convectors to allow service and maintenance.

3.4 FIELD QUALITY CONTROL

A. Perform the following field tests and inspections:

1. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
2. Operational Test: confirm proper operation.
3. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

B. Convectors will be considered defective if they do not pass tests and inspections.

C. Prepare test and inspection reports.

END OF SECTION 23 82 33

SECTION 260519 - LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Copper building wire rated 600 V or less.
 - 2. Metal-clad cable, Type MC, rated 600 V or less.
 - 3. Fire-alarm wire and cable.
 - 4. Connectors, splices, and terminations rated 600 V and less.

1.3 DEFINITIONS

- A. RoHS: Restriction of Hazardous Substances.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Sustainable Design Submittals: In accordance to applicable requirements in other sections for lead, recycled, solvents and adhesives content.
- C. Product Schedule: Indicate type, use, location, and termination locations.

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For testing agency.
- B. Field quality-control reports.

1.6 QUALITY ASSURANCE

- A. Testing Agency Qualifications: Member Company of NETA.
 - 1. Testing Agency's Field Supervisor: Certified by NETA to supervise on-site testing.

PART 2 - PRODUCTS

2.1 COPPER BUILDING WIRE

- A. Description: Flexible, insulated and uninsulated, drawn copper current-carrying conductor with an overall insulation layer or jacket, or both, rated 600 V or less.
- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Belden Inc.
 - 2. Encore Wire Corporation.
 - 3. General Cable Technologies Corporation.
 - 4. Southwire Incorporated.
- C. Standards:
 - 1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and use.
 - 2. RoHS compliant.
 - 3. Conductor and Cable Marking: Comply with wire and cable marking according to UL's "Wire and Cable Marking and Application Guide."
- D. Conductors: Copper, complying with ASTM B 3 for bare annealed copper and with ASTM B 8 for stranded conductors.
- E. Conductor Insulation:
 - 1. Type THHN and Type THWN-2 Comply with UL 83.

2.2 METAL-CLAD CABLE, TYPE MC

- A. Description: A factory assembly of one or more current-carrying insulated conductors in an overall metallic sheath.
- B. As allowed by NFPA 70 and Building Owner.
- C. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Alpha Wire Company.
 - 2. Belden Inc.
 - 3. Encore Wire Corporation.
 - 4. General Cable Technologies Corporation.
 - 5. Southwire Company.
- D. Standards:
 - 1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and use.
 - 2. Comply with UL 1569.
 - 3. RoHS compliant.

4. Conductor and Cable Marking: Comply with wire and cable marking according to UL's "Wire and Cable Marking and Application Guide."

E. Circuits:

1. Single circuit and multi-circuit with color-coded conductors.
2. Power-Limited Fire-Alarm Circuits: Comply with UL 1424.

- F. Conductors: Copper, complying with ASTM B 3 for bare annealed copper and with ASTM B 8 for stranded conductors.

- G. Ground Conductor: Insulated.

H. Conductor Insulation:

1. Type TFN/THHN/THWN-2: Comply with UL 83.
2. Type XHHW-2: Comply with UL 44.

- I. Armor: Steel, interlocked.

- J. Jacket: PVC applied over armor.

2.3 FIRE-ALARM WIRE AND CABLE

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Allied Wire & Cable Inc.
2. Genesis Cable Products; Honeywell International, Inc.
3. West Penn Wire.

- B. General Wire and Cable Requirements: NRTL listed and labeled as complying with NFPA 70, Article 760.

- C. Signaling Line Circuits: Twisted, shielded pair, not less than No. 18 AWG.

1. Circuit Integrity Cable: Twisted shielded pair, NFPA 70, Article 760, Classification CI, for power-limited fire-alarm signal service Type FPL. NRTL listed and labeled as complying with UL 1424 and UL 2196 for a two-hour rating.

- D. Non-Power-Limited Circuits: Solid-copper conductors with 600-V rated, 75 deg C, color-coded insulation, and complying with requirements in UL 2196 for a two-hour rating.

1. Low-Voltage Circuits: No. 16 AWG, minimum, in pathway.
2. Line-Voltage Circuits: No. 12 AWG, minimum, in pathway.
3. Multi-conductor Armored Cable: NFPA 70, Type MC, copper conductors, Type TFN/THHN conductor insulation, copper drain wire, copper armor with red identifier stripe, NRTL listed for fire-alarm and cable tray installation, plenum rated.

2.4 CONNECTORS AND SPLICES

- A. Description: Factory-fabricated connectors, splices, and lugs of size, ampacity rating, material, type, and class for application and service indicated; listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and use.
- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. 3M Electrical Products.
 - 2. Hubbell Power Systems, Inc.
 - 3. ILSCO.
 - 4. O-Z/Gedney; a brand of Emerson Industrial Automation.
 - 5. Thomas & Betts Corporation; A Member of the ABB Group.
- C. Jacketed Cable Connectors: For steel and aluminum jacketed cables, zinc die-cast with set screws, designed to connect conductors specified in this Section.
- D. Lugs: One piece, seamless, designed to terminate conductors specified in this Section.
 - 1. Material: Copper.
 - 2. Type: One hole with standard barrels.
 - 3. Termination: Compression.

PART 3 - EXECUTION

3.1 CONDUCTOR MATERIAL APPLICATIONS

- A. Feeders: Copper; solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.
- B. Branch Circuits: Copper. Solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.
- C. Power-Limited Fire Alarm and Control: Solid for No. 12 AWG and smaller.

3.2 CONDUCTOR INSULATION AND MULTICONDUCTOR CABLE APPLICATIONS AND WIRING METHODS

- A. Service Entrance: Type THHN/THWN-2, single conductors in raceway.
- B. Exposed Feeders: Type THHN/THWN-2, single conductors in raceway.
- C. Feeders Concealed in Ceilings, Walls, Partitions, and Crawlspace: Type THHN/THWN-2, single conductors in raceway.
- D. Feeders Concealed in Concrete, below Slabs-on-Grade, and Underground: Type THHN/THWN-2, single conductors in raceway.
- E. Exposed Branch Circuits, Including in Crawlspace: Type THHN/THWN-2, single conductors in raceway.

- F. Branch Circuits Concealed in Ceilings, Walls, and Partitions: Type THHN/THWN-2, single conductors in raceway or Metal-clad cable, Type MC as allowed by NFPA 70 or Building Owner.
- G. Branch Circuits Concealed in Concrete, below Slabs-on-Grade, and Underground: Type THHN/THWN-2, single conductors in raceway.
- H. Cord Drops and Portable Appliance Connections: Type SO, hard service cord with stainless-steel, wire-mesh, strain relief device at terminations to suit application.

3.3 INSTALLATION OF CONDUCTORS AND CABLES

- A. Conceal cables in finished walls, ceilings, and floors unless otherwise indicated.
- B. Complete raceway installation between conductor and cable termination points according to other sections prior to pulling conductors and cables.
- C. Use manufacturer-approved pulling compound or lubricant where necessary; compound used must not deteriorate conductor or insulation. Do not exceed manufacturer's recommended maximum pulling tensions and sidewall pressure values.
- D. Use pulling means, including fish tape, cable, rope, and basket-weave wire/cable grips, that will not damage cables or raceway.
- E. Install exposed cables parallel and perpendicular to surfaces of exposed structural members, and follow surface contours where possible.
- F. Support cables according to other sections.

3.4 INSTALLATION OF FIRE-ALARM WIRING

- A. Comply with NECA 1 and NFPA 72.
- B. Wiring Method: Install wiring in metal pathway according to other sections.
 - 1. Install plenum cable in environmental airspaces, including plenum ceilings.
 - 2. Fire-alarm circuits and equipment control wiring associated with fire-alarm system shall be installed in a dedicated pathway system. This system shall not be used for any other wire or cable.
- C. Wiring within Enclosures: Separate power-limited and non-power-limited conductors as recommended by manufacturer. Install conductors parallel with or at right angles to sides and back of the enclosure. Bundle, lace, and train conductors to terminal points with no excess. Connect conductors that are terminated, spliced, or interrupted in any enclosure associated with fire-alarm system to terminal blocks. Mark each terminal according to system's wiring diagrams. Make all connections with approved crimp-on terminal spade lugs, pressure-type terminal blocks, or plug connectors.
- D. Cable Taps: Use numbered terminal strips in junction, pull, and outlet boxes; cabinets; or equipment enclosures where circuit connections are made.

- E. Color-Coding: Color-code fire-alarm conductors differently from the normal building power wiring. Use one color-code for alarm circuit wiring and another for supervisory circuits. Color-code audible alarm-indicating circuits differently from alarm-initiating circuits. Use different colors for visible alarm-indicating devices. Paint fire-alarm system junction boxes and covers red.
- F. Risers: Install at least two vertical cable risers to serve the fire-alarm system. Separate risers in close proximity to each other with a minimum one-hour-rated wall, so the loss of one riser does not prevent receipt or transmission of signals from other floors or zones.
- G. Wiring to Remote Alarm Transmitting Device: 1-inch (25-mm) conduit between the fire-alarm control panel and the transmitter. Install number of conductors and electrical supervision for connecting wiring as needed to suit monitoring function.

3.5 CONNECTIONS

- A. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A-486B.
- B. Make splices, terminations, and taps that are compatible with conductor material and that possess equivalent or better mechanical strength and insulation ratings than unspliced conductors.
- C. Wiring at Outlets: Install conductor at each outlet, with at least 6 inches (150 mm) of slack.
- D. Comply with requirements in other sections for connecting, terminating, and identifying wires and cables.

3.6 IDENTIFICATION

- A. Identify and color-code conductors and cables according to other sections.
- B. Identify each spare conductor at each end with identity number and location of other end of conductor, and identify as spare conductor.

3.7 SLEEVE AND SLEEVE-SEAL INSTALLATION FOR ELECTRICAL PENETRATIONS

- A. Install sleeves and sleeve seals at penetrations of exterior floor and wall assemblies. Comply with requirements in other sections.

3.8 FIRESTOPPING

- A. Apply firestopping to electrical penetrations of fire-rated floor and wall assemblies to restore original fire-resistance rating of assembly according to other sections.

3.9 FIELD QUALITY CONTROL

- A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.
- B. Perform tests and inspections.
 - 1. After installing conductors and cables and before electrical circuitry has been energized, test service entrance and feeder conductors for compliance with requirements.
 - 2. Perform each of the following visual and electrical tests:
 - a. Inspect exposed sections of conductor and cable for physical damage and correct connection according to the single-line diagram.
 - b. Test bolted connections for high resistance using one of the following:
 - 1) A low-resistance ohmmeter.
 - 2) Calibrated torque wrench.
 - 3) Thermographic survey.
 - c. Inspect compression-applied connectors for correct cable match and indentation.
 - d. Inspect for correct identification.
 - e. Inspect cable jacket and condition.
 - f. Insulation-resistance test on each conductor for ground and adjacent conductors. Apply a potential of 500-V dc for 300-V rated cable and 1000-V dc for 600-V rated cable for a one-minute duration.
 - g. Continuity test on each conductor and cable.
 - h. Uniform resistance of parallel conductors.
 - 3. Infrared Scanning: After Substantial Completion, but before Final Acceptance, perform an infrared scan of each splice in conductors No. 3 AWG and larger. Remove box and equipment covers so splices are accessible to portable scanner. Correct deficiencies determined during the scan.
 - a. Instrument: Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.
 - b. Record of Infrared Scanning: Prepare a certified report that identifies switches checked and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.
- C. Cables will be considered defective if they do not pass tests and inspections.
- D. Prepare test and inspection reports to record the following:
 - 1. Procedures used.
 - 2. Results that comply with requirements.
 - 3. Results that do not comply with requirements, and corrective action taken to achieve compliance with requirements.

END OF SECTION 260519

SECTION 260526 - GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes grounding and bonding systems and equipment, plus the following special applications:
 - 1. Foundation steel electrodes.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.

1.4 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Plans showing dimensioned locations of grounding features specified in "Field Quality Control" Article, including the following:
 - 1. Ground rods.
 - 2. Grounding arrangements and connections for separately derived systems.
- B. Qualification Data: For testing agency and testing agency's field supervisor.
- C. Field quality-control reports.

1.5 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For grounding to include in emergency, operation, and maintenance manuals.
 - 1. In addition to items specified in other section for "Operation and Maintenance Data," include the following:
 - a. Plans showing as-built, dimensioned locations of grounding features specified in "Field Quality Control" Article, including the following:

- 1) Ground rods.
 - 2) Grounding arrangements and connections for separately derived systems.
- b. Instructions for periodic testing and inspection of grounding features at grounding connections for separately derived systems based on NETA MTS.
- 1) Tests shall determine if ground-resistance or impedance values remain within specified maximums, and instructions shall recommend corrective action if values do not.
 - 2) Include recommended testing intervals.

1.6 QUALITY ASSURANCE

- A. Testing Agency Qualifications: Certified by NETA.

PART 2 - PRODUCTS

2.1 SYSTEM DESCRIPTION

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. Comply with UL 467 for grounding and bonding materials and equipment.

2.2 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Advanced Lightning Technology, Ltd.
 2. Burndy; Part of Hubbell Electrical Systems.
 3. ERICO International Corporation.
 4. Galvan Industries, Inc.; Electrical Products Division, LLC.
 5. O-Z/Gedney; a brand of Emerson Industrial Automation.
 6. Thomas & Betts Corporation; A Member of the ABB Group.

2.3 CONDUCTORS

- A. Insulated Conductors: Copper wire or cable insulated for 600 V unless otherwise required by applicable Code or authorities having jurisdiction.
- B. Bare Copper Conductors:
1. Solid Conductors: ASTM B 3.
 2. Stranded Conductors: ASTM B 8.
 3. Tinned Conductors: ASTM B 33.
 4. Bonding Cable: 28 kcmil, 14 strands of No. 17 AWG conductor, 1/4 inch (6 mm) in diameter.

5. Bonding Conductor: No. 4 or No. 6 AWG, stranded conductor.
 6. Bonding Jumper: Copper tape, braided conductors terminated with copper ferrules; 1-5/8 inches (41 mm) wide and 1/16 inch (1.6 mm) thick.
 7. Tinned Bonding Jumper: Tinned-copper tape, braided conductors terminated with copper ferrules; 1-5/8 inches (41 mm) wide and 1/16 inch (1.6 mm) thick.
- C. Grounding Bus: Predrilled rectangular bars of annealed copper, 1/4 by 4 inches (6.3 by 100 mm) or as indicated on the contract documents in cross section, with 9/32-inch (7.14-mm) holes spaced 1-1/8 inches (28 mm) apart. Stand-off insulators for mounting shall comply with UL 891 for use in switchboards, 600 V and shall be Lexan or PVC, impulse tested at 5000 V.

2.4 CONNECTORS

- A. Listed and labeled by an NRTL acceptable to authorities having jurisdiction for applications in which used and for specific types, sizes, and combinations of conductors and other items connected.
- B. Welded Connectors: Exothermic-welding kits of types recommended by kit manufacturer for materials being joined and installation conditions.
- C. Bus-Bar Connectors: Mechanical type, cast silicon bronze, solderless compression-type wire terminals, and long-barrel, two-bolt connection to ground bus bar.
- D. Beam Clamps: Mechanical type, terminal, ground wire access from four directions, with dual, tin-plated or silicon bronze bolts.
- E. Cable-to-Cable Connectors: Compression type, copper or copper alloy.
- F. Cable Tray Ground Clamp: Mechanical type, zinc-plated malleable iron.
- G. Conduit Hubs: Mechanical type, terminal with threaded hub.
- H. Ground Rod Clamps: Mechanical type, copper or copper alloy, terminal with hex head bolt.
- I. Lay-in Lug Connector: Mechanical type, copper rated for direct burial terminal with set screw.
- J. Service Post Connectors: Mechanical type, bronze alloy terminal, in short- and long-stud lengths, capable of single and double conductor connections.
- K. Signal Reference Grid Clamp: Mechanical type, stamped-steel terminal with hex head screw.
- L. Straps: Solid copper, copper lugs. Rated for 600 A.
- M. Tower Ground Clamps: Mechanical type, copper or copper alloy, terminal two-piece clamp.
- N. U-Bolt Clamps: Mechanical type, copper or copper alloy, terminal listed for direct burial.
- O. Water Pipe Clamps:
 1. Mechanical type, two pieces with stainless-steel bolts.
 - a. Material: Die-cast zinc alloy.

- b. Listed for direct burial.
- 2. U-bolt type with malleable-iron clamp and copper ground connector rated for direct burial.

2.5 GROUNDING ELECTRODES

- A. Ground Rods: Copper-clad steel; 3/4 inch by 10 feet (19 mm by 3 m).
- B. Ground Plates: 1/4 inch (6 mm) thick, hot-dip galvanized.

PART 3 - EXECUTION

3.1 APPLICATIONS

- A. Conductors: Install solid conductor for No. 8 AWG and smaller, and stranded conductors for No. 6 AWG and larger unless otherwise indicated.
- B. Underground Grounding Conductors: Install bare tinned-copper conductor, No. 2/0 AWG minimum.
 - 1. Bury at least 24 inches (600 mm) below grade.
 - 2. Duct-Bank Grounding Conductor: Bury 12 inches (300 mm) above duct bank when indicated as part of duct-bank installation.
- C. Grounding Bus: Install in electrical equipment rooms, in rooms housing service equipment, and elsewhere as indicated.
 - 1. Install bus horizontally, on insulated spacers 2 inches (50 mm) minimum from wall, 6 inches (150 mm) above finished floor unless otherwise indicated.
 - 2. Where indicated on both sides of doorways, route bus up to top of door frame, across top of doorway, and down; connect to horizontal bus.
- D. Conductor Terminations and Connections:
 - 1. Pipe and Equipment Grounding Conductor Terminations: Bolted connectors.
 - 2. Underground Connections: Welded connectors except at test wells and as otherwise indicated.
 - 3. Connections to Ground Rods at Test Wells: Bolted connectors.
 - 4. Connections to Structural Steel: Welded connectors.

3.2 GROUNDING AT THE SERVICE

- A. Equipment grounding conductors and grounding electrode conductors shall be connected to the ground bus. Install a main bonding jumper between the neutral and ground buses.

3.3 EQUIPMENT GROUNDING

- A. Install insulated equipment grounding conductors with all feeders and branch circuits.

- B. Install insulated equipment grounding conductors with the following items, in addition to those required by NFPA 70:
 - 1. Feeders and branch circuits.
 - 2. Lighting circuits.
 - 3. Receptacle circuits.
 - 4. Single-phase motor and appliance branch circuits.
 - 5. Three-phase motor and appliance branch circuits.
 - 6. Flexible raceway runs.
 - 7. Armored and metal-clad cable runs.
 - 8. Busway Supply Circuits: Install insulated equipment grounding conductor from grounding bus in the switchgear, switchboard, or distribution panel to equipment grounding bar terminal on busway.
- C. Air-Duct Equipment Circuits: Install insulated equipment grounding conductor to duct-mounted electrical devices operating at 120 V and more, including air cleaners, heaters, dampers, humidifiers, and other duct electrical equipment. Bond conductor to each unit and to air duct and connected metallic piping.
- D. Water Heater, Heat-Tracing, and Antifrost Heating Cables: Install a separate insulated equipment grounding conductor to each electric water heater and heat-tracing cable. Bond conductor to heater units, piping, connected equipment, and components.
 - 1. Grounding Conductor: Bare tinned copper, not less than No. 8 AWG.
 - 2. Gates: Shall be bonded to the grounding conductor with a flexible bonding jumper.
 - 3. Barbed Wire: Strands shall be bonded to the grounding conductor.

3.4 INSTALLATION

- A. Grounding Conductors: Route along shortest and straightest paths possible unless otherwise indicated or required by Code. Avoid obstructing access or placing conductors where they may be subjected to strain, impact, or damage.
- B. Ground Rods: Drive rods until tops are 2 inches (50 mm) below finished floor or final grade unless otherwise indicated.
 - 1. Interconnect ground rods with grounding electrode conductor below grade and as otherwise indicated. Make connections without exposing steel or damaging coating if any.
 - 2. Use exothermic welds for all below-grade connections.
 - 3. For grounding electrode system, install at least three rods spaced at least one-rod length from each other and located at least the same distance from other grounding electrodes, and connect to the service grounding electrode conductor.
- C. Bonding Straps and Jumpers: Install in locations accessible for inspection and maintenance except where routed through short lengths of conduit.
 - 1. Bonding to Structure: Bond straps directly to basic structure, taking care not to penetrate any adjacent parts.
 - 2. Bonding to Equipment Mounted on Vibration Isolation Hangers and Supports: Install bonding so vibration is not transmitted to rigidly mounted equipment.
 - 3. Use exothermic-welded connectors for outdoor locations; if a disconnect-type connection is required, use a bolted clamp.

D. Grounding and Bonding for Piping:

1. Metal Water Service Pipe: Install insulated copper grounding conductors, in conduit, from building's main service equipment, or grounding bus, to main metal water service entrances to building. Connect grounding conductors to main metal water service pipes; use a bolted clamp connector or bolt a lug-type connector to a pipe flange by using one of the lug bolts of the flange. Where a dielectric main water fitting is installed, connect grounding conductor on street side of fitting. Bond metal grounding conductor conduit or sleeve to conductor at each end.
2. Water Meter Piping: Use braided-type bonding jumpers to electrically bypass water meters. Connect to pipe with a bolted connector.
3. Bond each aboveground portion of gas piping system downstream from equipment shutoff valve.

E. Bonding Interior Metal Ducts: Bond metal air ducts to equipment grounding conductors of associated fans, blowers, electric heaters, and air cleaners. Install tinned bonding jumper to bond across flexible duct connections to achieve continuity.

F. Grounding for Steel Building Structure: Install a driven ground rod at base of each corner column and at intermediate exterior columns at distances not more than 60 feet (18 m) apart.

G. Ground Ring: Install a grounding conductor, electrically connected to each building structure ground rod and to each steel column, extending around the perimeter of building.

1. Install tinned-copper conductor not less than No. 2/0 AWG for ground ring and for taps to building steel.
2. Bury ground ring not less than 24 inches (600 mm) from building's foundation.

H. Concrete-Encased Grounding Electrode (Ufer Ground): Fabricate according to NFPA 70; use a minimum of 20 feet (6 m) of bare copper conductor not smaller than No. 4 AWG.

1. If concrete foundation is less than 20 feet (6 m) long, coil excess conductor within base of foundation.
2. Bond grounding conductor to reinforcing steel in at least four locations and to anchor bolts. Extend grounding conductor below grade and connect to building's grounding grid or to grounding electrode external to concrete.

I. Connections: Make connections so possibility of galvanic action or electrolysis is minimized. Select connectors, connection hardware, conductors, and connection methods so metals in direct contact are galvanically compatible.

1. Use electroplated or hot-tin-coated materials to ensure high conductivity and to make contact points closer in order of galvanic series.
2. Make connections with clean, bare metal at points of contact.
3. Make aluminum-to-steel connections with stainless-steel separators and mechanical clamps.
4. Make aluminum-to-galvanized-steel connections with tin-plated copper jumpers and mechanical clamps.
5. Coat and seal connections having dissimilar metals with inert material to prevent future penetration of moisture to contact surfaces.

3.5 FIELD QUALITY CONTROL

- A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.
- B. Perform tests and inspections.
- C. Tests and Inspections:
 - 1. After installing grounding system but before permanent electrical circuits have been energized, test for compliance with requirements.
 - 2. Inspect physical and mechanical condition. Verify tightness of accessible, bolted, electrical connections with a calibrated torque wrench according to manufacturer's written instructions.
 - 3. Test completed grounding system at each location where a maximum ground-resistance level is specified, at service disconnect enclosure grounding terminal, at ground test wells, and at individual ground rods. Make tests at ground rods before any conductors are connected.
 - a. Measure ground resistance no fewer than two full days after last trace of precipitation and without soil being moistened by any means other than natural drainage or seepage and without chemical treatment or other artificial means of reducing natural ground resistance.
 - b. Perform tests by fall-of-potential method according to IEEE 81.
 - 4. Prepare dimensioned Drawings locating each test well, ground rod and ground-rod assembly, and other grounding electrodes. Identify each by letter in alphabetical order, and key to the record of tests and observations. Include the number of rods driven and their depth at each location, and include observations of weather and other phenomena that may affect test results. Describe measures taken to improve test results.
- D. Grounding system will be considered defective if it does not pass tests and inspections.
- E. Prepare test and inspection reports.
- F. Report measured ground resistances that exceed the following values:
 - 1. Power and Lighting Equipment or System with Capacity of 500 kVA and Less: 10 ohms.
 - 2. Power and Lighting Equipment or System with Capacity of 500 to 1000 kVA: 5 ohms.
 - 3. Power and Lighting Equipment or System with Capacity More Than 1000 kVA: 3 ohms.
- G. Excessive Ground Resistance: If resistance to ground exceeds specified values, notify Architect promptly and include recommendations to reduce ground resistance.

END OF SECTION

SECTION 260529 - HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Steel slotted support systems.
 - 2. Conduit and cable support devices.
 - 3. Support for conductors in vertical conduit.
 - 4. Structural steel for fabricated supports and restraints.
 - 5. Mounting, anchoring, and attachment components, including powder-actuated fasteners, mechanical expansion anchors, concrete inserts, clamps, through bolts, toggle bolts, and hanger rods.
 - 6. Fabricated metal equipment support assemblies.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for the following:
 - a. Slotted support systems, hardware, and accessories.
 - b. Clamps.
 - c. Hangers.
 - d. Sockets.
 - e. Eye nuts.
 - f. Fasteners.
 - g. Anchors.
 - h. Saddles.
 - i. Brackets.
 - 2. Include rated capacities and furnished specialties and accessories.
- B. Delegated-Design Submittal: For hangers and supports for electrical systems.
 - 1. Include design calculations and details of hangers.

1.4 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Reflected ceiling plan(s) and other details, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:
1. Suspended ceiling components.
 2. Ductwork, piping, fittings, and supports.
 3. Structural members to which hangers and supports will be attached.
 4. Size and location of initial access modules for acoustical tile.
 5. Items penetrating finished ceiling, including the following:
 - a. Luminaires.
 - b. Air outlets and inlets.
 - c. Speakers.
 - d. Sprinklers.
 - e. Access panels.
 - f. Projectors.
- B. Welding certificates.

1.5 QUALITY ASSURANCE

- A. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Engage a qualified professional engineer, as defined in other section for "Quality Requirements," to design hanger and support system.

2.2 SUPPORT, ANCHORAGE, AND ATTACHMENT COMPONENTS

- A. Steel Slotted Support Systems: Preformed steel channels and angles with minimum 13/32-inch- (10-mm-) diameter holes at a maximum of 8 inches (200 mm) o.c. in at least one surface.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Allied Tube & Conduit; a part of Atkore International.
 - b. ERICO International Corporation.
 - c. GS Metals Corp.
 - d. Thomas & Betts Corporation; A Member of the ABB Group.
 - e. Wesanco, Inc.
 2. Standard: Comply with MFMA-4 factory-fabricated components for field assembly.
 3. Material for Channel, Fittings, and Accessories: Galvanized steel.
 4. Channel Width: Selected for applicable load criteria.
 5. Metallic Coatings: Hot-dip galvanized after fabrication and applied according to MFMA-4.

- B. Conduit and Cable Support Devices: Steel hangers, clamps, and associated fittings, designed for types and sizes of raceway or cable to be supported.
- C. Support for Conductors in Vertical Conduit: Factory-fabricated assembly consisting of threaded body and insulating wedging plug or plugs for non-armored electrical conductors or cables in riser conduits. Plugs shall have number, size, and shape of conductor gripping pieces as required to suit individual conductors or cables supported. Body shall be made of malleable iron.
- D. Structural Steel for Fabricated Supports and Restraints: ASTM A 36/A 36M steel plates, shapes, and bars; black and galvanized.
- E. Mounting, Anchoring, and Attachment Components: Items for fastening electrical items or their supports to building surfaces include the following:
 - 1. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete, steel, or wood, with tension, shear, and pullout capacities appropriate for supported loads and building materials where used.
 - a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1) Hilti, Inc.
 - 2) ITW Ramset/Red Head; Illinois Tool Works, Inc.
 - 3) MKT Fastening, LLC.
 - 4) Simpson Strong-Tie Co., Inc.
 - 2. Mechanical-Expansion Anchors: Insert-wedge-type, zinc-coated steel, for use in hardened portland cement concrete, with tension, shear, and pullout capacities appropriate for supported loads and building materials where used.
 - a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1) B-line, an Eaton business.
 - 2) Empire Tool and Manufacturing Co., Inc.
 - 3) Hilti, Inc.
 - 4) ITW Ramset/Red Head; Illinois Tool Works, Inc.
 - 3. Concrete Inserts: Steel or malleable-iron, slotted support system units are similar to MSS Type 18 units and comply with MFMA-4 or MSS SP-58.
 - 4. Clamps for Attachment to Steel Structural Elements: MSS SP-58 units are suitable for attached structural element.
 - 5. Through Bolts: Structural type, hex head, and high strength. Comply with ASTM F 3125/F 3125M, Grade A325 (Grade A325M).
 - 6. Toggle Bolts: All-steel springhead type.
 - 7. Hanger Rods: Threaded steel.

2.3 FABRICATED METAL EQUIPMENT SUPPORT ASSEMBLIES

- A. Description: Welded or bolted structural-steel shapes, shop or field fabricated to fit dimensions of supported equipment.

- B. Materials: Comply with requirements in other section for "Metal Fabrications" for steel shapes and plates.

PART 3 - EXECUTION

3.1 APPLICATION

- A. Comply with the following standards for application and installation requirements of hangers and supports, except where requirements on Drawings or in this Section are stricter:
 - 1. NECA 1.
 - 2. NECA 101
 - 3. NECA 105.
- B. Comply with requirements in other section for "Penetration Firestopping" for firestopping materials and installation for penetrations through fire-rated walls, ceilings, and assemblies.
- C. Comply with requirements for raceways and boxes specified in other section for "Raceways and Boxes for Electrical Systems."
- D. Maximum Support Spacing and Minimum Hanger Rod Size for Raceways: Space supports for EMT, IMC, and RMC as required by NFPA 70. Minimum rod size shall be 1/4 inch (6 mm) in diameter.
- E. Multiple Raceways or Cables: Install trapeze-type supports fabricated with steel slotted support system, sized so capacity can be increased by at least 25 percent in future without exceeding specified design load limits.
 - 1. Secure raceways and cables to these supports with two-bolt conduit clamps.

3.2 SUPPORT INSTALLATION

- A. Comply with NECA 1 and NECA 101 for installation requirements except as specified in this article.
- B. Raceway Support Methods: In addition to methods described in NECA 1, EMT, IMC and RMC may be supported by openings through structure members, according to NFPA 70.
- C. Strength of Support Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static loads within specified loading limits. Minimum static design load used for strength determination shall be weight of supported components plus 200 lb (90 kg).
- D. Mounting and Anchorage of Surface-Mounted Equipment and Components: Anchor and fasten electrical items and their supports to building structural elements by the following methods unless otherwise indicated by code:
 - 1. To Wood: Fasten with lag screws or through bolts.
 - 2. To New Concrete: Bolt to concrete inserts.

3. To Masonry: Approved toggle-type bolts on hollow masonry units and expansion anchor fasteners on solid masonry units.
 4. Instead of expansion anchors, powder-actuated driven threaded studs provided with lock washers and nuts may be used in existing standard-weight concrete 4 inches (100 mm) thick or greater. Do not use for anchorage to lightweight-aggregate concrete or for slabs less than 4 inches (100 mm) thick.
 5. To Steel: Welded threaded studs complying with AWS D1.1/D1.1M, with lock washers and nuts.
 6. To Light Steel: Sheet metal screws.
 7. Items Mounted on Hollow Walls and Nonstructural Building Surfaces: Mount cabinets, panelboards, disconnect switches, control enclosures, pull and junction boxes, transformers, and other devices on slotted-channel racks attached to substrate by means that comply with seismic-restraint strength and anchorage requirements.
- E. Drill holes for expansion anchors in concrete at locations and to depths that avoid the need for reinforcing bars.

3.3 INSTALLATION OF FABRICATED METAL SUPPORTS

- A. Comply with installation requirements in other section for "Metal Fabrications" for site-fabricated metal supports.
- B. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor electrical materials and equipment.
- C. Field Welding: Comply with AWS D1.1/D1.1M.

3.4 CONCRETE BASES

- A. Construct concrete bases of dimensions indicated, but not less than 4 inches (100 mm) larger in both directions than supported unit, and so anchors will be a minimum of 10 bolt diameters from edge of the base.
- B. Use 3000-psi (20.7-MPa), 28-day compressive-strength concrete. Concrete materials, reinforcement, and placement requirements are specified in other sections for "Cast-in-Place Concrete."
- C. Anchor equipment to concrete base as follows:
 1. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 2. Install anchor bolts to elevations required for proper attachment to supported equipment.
 3. Install anchor bolts according to anchor-bolt manufacturer's written instructions.

3.5 PAINTING

- A. Touchup: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.

1. Apply paint by brush or spray to provide minimum dry film thickness of 2.0 mils (0.05 mm).
- B. Touchup: Comply with requirements in other sections for cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal.
- C. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

END OF SECTION 260529

SECTION 260533 - RACEWAYS AND BOXES FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Metal conduits and fittings.
 - 2. Metal wireways and auxiliary gutters.
 - 3. Surface raceways.
 - 4. Boxes, enclosures, and cabinets.

1.3 DEFINITIONS

- A. GRC: Galvanized rigid steel conduit.
- B. IMC: Intermediate metal conduit.

1.4 ACTION SUBMITTALS

- A. Product Data: For surface raceways, wireways and fittings, floor boxes, hinged-cover enclosures, and cabinets.
- B. Shop Drawings: For custom enclosures and cabinets. Include plans, elevations, sections, and attachment details.

1.5 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Conduit routing plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of items involved:
 - 1. Structural members in paths of conduit groups with common supports.
 - 2. HVAC and plumbing items and architectural features in paths of conduit groups with common supports.
- B. Seismic Qualification Data: Certificates, for enclosures, cabinets, and conduit racks and their mounting provisions, including those for internal components, from manufacturer.
 - 1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.

2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.
4. Detailed description of conduit support devices and interconnections on which the certification is based and their installation requirements.

C. Source quality-control reports.

PART 2 - PRODUCTS

2.1 METAL CONDUITS AND FITTINGS

A. Metal Conduit:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Allied Tube & Conduit; a part of Atkore International.
 - b. FSR Inc.
 - c. NEC, Inc.
 - d. O-Z/Gedney; a brand of Emerson Industrial Automation.
2. Listing and Labeling: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
3. GRC: Comply with ANSI C80.1 and UL 6.
4. IMC: Comply with ANSI C80.6 and UL 1242.
5. PVC-Coated Steel Conduit: PVC-coated rigid steel conduit.
 - a. Comply with NEMA RN 1.
 - b. Coating Thickness: 0.040 inch (1 mm), minimum.
6. EMT: Comply with ANSI C80.3 and UL 797.
7. FMC: Comply with UL 1; zinc-coated steel.
8. LFMC: Flexible steel conduit with PVC jacket and complying with UL 360.

B. Metal Fittings:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Allied Tube & Conduit; a part of Atkore International.
 - b. FSR Inc.
 - c. NEC, Inc.
 - d. O-Z/Gedney; a brand of Emerson Industrial Automation.
2. Comply with NEMA FB 1 and UL 514B.
3. Listing and Labeling: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
4. Fittings, General: Listed and labeled for type of conduit, location, and use.
5. Conduit Fittings for Hazardous (Classified) Locations: Comply with UL 1203 and NFPA 70.
6. Fittings for EMT:

- a. Material: Steel.
 - b. Type: compression.
- 7. Expansion Fittings: PVC or steel to match conduit type, complying with UL 651, rated for environmental conditions where installed, and including flexible external bonding jumper.
- 8. Coating for Fittings for PVC-Coated Conduit: Minimum thickness of 0.040 inch (1 mm), with overlapping sleeves protecting threaded joints.
- C. Joint Compound for IMC, or GRC,: Approved, as defined in NFPA 70, by authorities having jurisdiction for use in conduit assemblies, and compounded for use to lubricate and protect threaded conduit joints from corrosion and to enhance their conductivity.

2.2 METAL WIREWAYS AND AUXILIARY GUTTERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. B-line, an Eaton business.
 - 2. Hoffman; a brand of Pentair Equipment Protection.
 - 3. MonoSystems, Inc.
 - 4. Square D.
- B. Description: Sheet metal, complying with UL 870 and NEMA 250, Type 1 unless otherwise indicated, and sized according to NFPA 70.
 - 1. Metal wireways installed outdoors shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- C. Fittings and Accessories: Include covers, couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings to match and mate with wireways as required for complete system.
- D. Wireway Covers: Hinged type unless otherwise indicated.
- E. Finish: Manufacturer's standard enamel finish.

2.3 SURFACE RACEWAYS

- A. Listing and Labeling: Surface raceways and tele-power poles shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. Surface Metal Raceways: Galvanized steel with snap-on covers complying with UL 5. Manufacturer's standard enamel finish in color selected by Architect.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Hubbell Incorporated; Wiring Device-Kellems.
 - b. MonoSystems, Inc.
 - c. Wiremold / Legrand.

2.4 BOXES, ENCLOSURES, AND CABINETS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Crouse-Hinds, an Eaton business.
 - 2. EGS/Appleton Electric.
 - 3. FSR Inc.
 - 4. Hoffman; a brand of Pentair Equipment Protection.
 - 5. Hubbell Incorporated.
 - 6. O-Z/Gedney; a brand of Emerson Industrial Automation.
- B. General Requirements for Boxes, Enclosures, and Cabinets: Boxes, enclosures, and cabinets installed in wet locations shall be listed for use in wet locations.
- C. Sheet Metal Outlet and Device Boxes: Comply with NEMA OS 1 and UL 514A.
- D. Cast-Metal Outlet and Device Boxes: Comply with NEMA FB 1, aluminum, Type FD, with gasketed cover.
- E. Metal Floor Boxes:
 - 1. Material: Cast metal.
 - 2. Type: Fully adjustable.
 - 3. Shape: Rectangular.
 - 4. Listing and Labeling: Metal floor boxes shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- F. Luminaire Outlet Boxes: Nonadjustable, designed for attachment of luminaire weighing 50 lb (23 kg). Outlet boxes designed for attachment of luminaires weighing more than 50 lb (23 kg) shall be listed and marked for the maximum allowable weight.
- G. Paddle Fan Outlet Boxes: Nonadjustable, designed for attachment of paddle fan weighing 70 lb (32 kg).
 - 1. Listing and Labeling: Paddle fan outlet boxes shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- H. Small Sheet Metal Pull and Junction Boxes: NEMA OS 1.
- I. Cast-Metal Access, Pull, and Junction Boxes: Comply with NEMA FB 1 and UL 1773, cast aluminum with gasketed cover.
- J. Box extensions used to accommodate new building finishes shall be of same material as recessed box.
- K. Device Box Dimensions: 4 inches square by 2-1/8 inches deep (100 mm square by 60 mm deep).
- L. Gangable boxes are allowed.

- M. Hinged-Cover Enclosures: Comply with UL 50 and NEMA 250, Type 1 with continuous-hinge cover with flush latch unless otherwise indicated.
 - 1. Metal Enclosures: Steel, finished inside and out with manufacturer's standard enamel.
 - 2. Nonmetallic Enclosures: Plastic.
 - 3. Interior Panels: Steel; all sides finished with manufacturer's standard enamel.
- N. Cabinets:
 - 1. NEMA 250, Type 1 galvanized-steel box with removable interior panel and removable front, finished inside and out with manufacturer's standard enamel.
 - 2. Hinged door in front cover with flush latch and concealed hinge.
 - 3. Key latch to match panelboards.
 - 4. Metal barriers to separate wiring of different systems and voltage.
 - 5. Accessory feet where required for freestanding equipment.
 - 6. Nonmetallic cabinets shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

2.5 SOURCE QUALITY CONTROL FOR UNDERGROUND ENCLOSURES

- A. Handhole and Pull-Box Prototype Test: Test prototypes of handholes and boxes for compliance with SCTE 77. Strength tests shall be for specified tier ratings of products supplied.
 - 1. Tests of materials shall be performed by an independent testing agency.
 - 2. Strength tests of complete boxes and covers shall be by either an independent testing agency or manufacturer. A qualified registered professional engineer shall certify tests by manufacturer.
 - 3. Testing machine pressure gages shall have current calibration certification complying with ISO 9000 and ISO 10012 and traceable to NIST standards.

PART 3 - EXECUTION

3.1 RACEWAY APPLICATION

- A. Outdoors: Apply raceway products as specified below unless otherwise indicated:
 - 1. Exposed Conduit: GRC.
 - 2. Concealed Conduit, Aboveground: GRC.
 - 3. Underground Conduit: RNC, Type EPC-40-PVC, concrete encased.
 - 4. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): LFMC.
 - 5. Boxes and Enclosures, Aboveground: NEMA 250, Type 4.
- B. Indoors: Apply raceway products as specified below unless otherwise indicated:
 - 1. Exposed, Not Subject to Physical Damage: EMT.
 - 2. Exposed, Not Subject to Severe Physical Damage: EMT.
 - 3. Exposed and Subject to Severe Physical Damage: GRC. Raceway locations include the following:
 - a. Mechanical rooms.

4. Concealed in Ceilings and Interior Walls and Partitions: EMT.
 5. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): FMC, except use LFMC in damp or wet locations.
 6. Damp or Wet Locations: GRC.
 7. Boxes and Enclosures: NEMA 250, Type 1, except use NEMA 250, Type 4 stainless steel in damp or wet locations.
- C. Minimum Raceway Size: 3/4-inch (21-mm) trade size.
- D. Raceway Fittings: Compatible with raceways and suitable for use and location.
1. Rigid and Intermediate Steel Conduit: Use threaded rigid steel conduit fittings unless otherwise indicated. Comply with NEMA FB 2.10.
 2. PVC Externally Coated, Rigid Steel Conduits: Use only fittings listed for use with this type of conduit. Patch and seal all joints, nicks, and scrapes in PVC coating after installing conduits and fittings. Use sealant recommended by fitting manufacturer and apply in thickness and number of coats recommended by manufacturer.
 3. EMT: Use compression, steel fittings. Comply with NEMA FB 2.10.
 4. Flexible Conduit: Use only fittings listed for use with flexible conduit. Comply with NEMA FB 2.20.
- E. Install surface raceways only where indicated on Drawings.
- F. Do not install nonmetallic conduit where ambient temperature exceeds 120 deg F (49 deg C).

3.2 INSTALLATION

- A. Comply with requirements in other section for "Hangers and Supports for Electrical Systems" for hangers and supports.
- B. Comply with NECA 1 and NECA 101 for installation requirements except where requirements on Drawings or in this article are stricter. Comply with NECA 102 for aluminum conduits. Comply with NFPA 70 limitations for types of raceways allowed in specific occupancies and number of floors.
- C. Do not install raceways or electrical items on any "explosion-relief" walls or rotating equipment.
- D. Do not fasten conduits onto the bottom side of a metal deck roof.
- E. Keep raceways at least 6 inches (150 mm) away from parallel runs of flues and steam or hot-water pipes. Install horizontal raceway runs above water and steam piping.
- F. Complete raceway installation before starting conductor installation.
- G. Arrange stub-ups so curved portions of bends are not visible above finished slab.
- H. Install no more than the equivalent of three 90-degree bends in any conduit run except for control wiring conduits, for which fewer bends are allowed. Support within 12 inches (300 mm) of changes in direction.

- I. Make bends in raceway using large-radius preformed ells. Field bending shall be according to NFPA 70 minimum radii requirements. Use only equipment specifically designed for material and size involved.
- J. Conceal conduit within finished walls, ceilings, and floors unless otherwise indicated. Install conduits parallel or perpendicular to building lines.
- K. Support conduit within 12 inches (300 mm) of enclosures to which attached.
- L. Raceways Embedded in Slabs:
 - 1. Run conduit larger than 1-inch (27-mm) trade size, parallel or at right angles to main reinforcement. Where at right angles to reinforcement, place conduit close to slab support. Secure raceways to reinforcement at maximum 10-foot (3-m) intervals.
 - 2. Arrange raceways to cross building expansion joints at right angles with expansion fittings.
 - 3. Arrange raceways to keep a minimum of 1 inch (25 mm) of concrete cover in all directions.
 - 4. Do not embed threadless fittings in concrete unless specifically approved by Architect for each specific location.
- M. Stub-Ups to Above Recessed Ceilings:
 - 1. Use EMT, IMC, or RMC for raceways.
 - 2. Use a conduit bushing or insulated fitting to terminate stub-ups not terminated in hubs or in an enclosure.
- N. Threaded Conduit Joints, Exposed to Wet, Damp, Corrosive, or Outdoor Conditions: Apply listed compound to threads of raceway and fittings before making up joints. Follow compound manufacturer's written instructions.
- O. Coat field-cut threads on PVC-coated raceway with a corrosion-preventing conductive compound prior to assembly.
- P. Raceway Terminations at Locations Subject to Moisture or Vibration: Use insulating bushings to protect conductors including conductors smaller than No. 4 AWG.
- Q. Terminate threaded conduits into threaded hubs or with locknuts on inside and outside of boxes or cabinets. Install bushings on conduits up to 1-1/4-inch (35mm) trade size and insulated throat metal bushings on 1-1/2-inch (41-mm) trade size and larger conduits terminated with locknuts. Install insulated throat metal grounding bushings on service conduits.
- R. Install raceways square to the enclosure and terminate at enclosures with locknuts. Install locknuts hand tight plus 1/4 turn more.
- S. Do not rely on locknuts to penetrate nonconductive coatings on enclosures. Remove coatings in the locknut area prior to assembling conduit to enclosure to assure a continuous ground path.
- T. Cut conduit perpendicular to the length. For conduits 2-inch (53-mm) trade size and larger, use roll cutter or a guide to make cut straight and perpendicular to the length.
- U. Install pull wires in empty raceways. Use polypropylene or monofilament plastic line with not less than 200-lb (90-kg) tensile strength. Leave at least 12 inches (300 mm) of slack at each

end of pull wire. Cap underground raceways designated as spare above grade alongside raceways in use.

V. Surface Raceways:

1. Install surface raceway with a minimum 2-inch (50-mm) radius control at bend points.
2. Secure surface raceway with screws or other anchor-type devices at intervals not exceeding 48 inches (1200 mm) and with no less than two supports per straight raceway section. Support surface raceway according to manufacturer's written instructions. Tape and glue are not acceptable support methods.

W. Install raceway sealing fittings at accessible locations according to NFPA 70 and fill them with listed sealing compound. For concealed raceways, install each fitting in a flush steel box with a blank cover plate having a finish similar to that of adjacent plates or surfaces. Install raceway sealing fittings according to NFPA 70.

X. Install devices to seal raceway interiors at accessible locations. Locate seals so no fittings or boxes are between the seal and the following changes of environments. Seal the interior of all raceways at the following points:

1. Where conduits pass from warm to cold locations, such as boundaries of refrigerated spaces.
2. Where an underground service raceway enters a building or structure.
3. Conduit extending from interior to exterior of building.
4. Where otherwise required by NFPA 70.

Y. Comply with manufacturer's written instructions for solvent welding RNC and fittings.

Z. Expansion-Joint Fittings:

1. Install in each run of aboveground RNC that is located where environmental temperature change may exceed 30 deg F (17 deg C) and that has straight-run length that exceeds 25 feet (7.6 m). Install in each run of aboveground RMC conduit that is located where environmental temperature change may exceed 100 deg F (55 deg C) and that has straight-run length that exceeds 100 feet (30 m).
2. Install type and quantity of fittings that accommodate temperature change listed for each of the following locations:
 - a. Outdoor Locations Not Exposed to Direct Sunlight: 125 deg F (70 deg C) temperature change.
 - b. Outdoor Locations Exposed to Direct Sunlight: 155 deg F (86 deg C) temperature change.
 - c. Indoor Spaces Connected with Outdoors without Physical Separation: 125 deg F (70 deg C) temperature change.
 - d. Attics: 135 deg F (75 deg C) temperature change.
3. Install fitting(s) that provide expansion and contraction for at least 0.00041 inch per foot of length of straight run per deg F (0.06 mm per meter of length of straight run per deg C) of temperature change for PVC conduits. Install fitting(s) that provide expansion and contraction for at least 0.000078 inch per foot of length of straight run per deg F (0.0115 mm per meter of length of straight run per deg C) of temperature change for metal conduits.
4. Install expansion fittings at all locations where conduits cross building or structure expansion joints.

5. Install each expansion-joint fitting with position, mounting, and piston setting selected according to manufacturer's written instructions for conditions at specific location at time of installation. Install conduit supports to allow for expansion movement.
 - AA. Flexible Conduit Connections: Comply with NEMA RV 3. Use a maximum of 36 inches (915 mm) of flexible conduit for recessed and semi-recessed luminaires, equipment subject to vibration, noise transmission, or movement; and for transformers and motors.
 1. Use LFMC in damp or wet locations subject to severe physical damage.
 2. Use LFMC or LFNC in damp or wet locations not subject to severe physical damage.
 - BB. Mount boxes at heights indicated on Drawings. If mounting heights of boxes are not individually indicated, give priority to ADA requirements. Install boxes with height measured to center of box unless otherwise indicated.
 - CC. Recessed Boxes in Masonry Walls: Saw-cut opening for box in center of cell of masonry block, and install box flush with surface of wall. Prepare block surfaces to provide a flat surface for a raintight connection between boxes and cover plate or supported equipment and box.
 - DD. Horizontally separate boxes mounted on opposite sides of walls so they are not in the same vertical channel.
 - EE. Locate boxes so that cover or plate will not span different building finishes.
 - FF. Support boxes of three gangs or more from more than one side by spanning two framing members or mounting on brackets specifically designed for the purpose.
 - GG. Fasten junction and pull boxes to or support from building structure. Do not support boxes by conduits.
 - HH. Set metal floor boxes level and flush with finished floor surface.
 - II. Set nonmetallic floor boxes level. Trim after installation to fit flush with finished floor surface.
- 3.3 SLEEVE AND SLEEVE-SEAL INSTALLATION FOR ELECTRICAL PENETRATIONS
- A. Install sleeves and sleeve seals at penetrations of exterior floor and wall assemblies. Comply with requirements in other section for "Sleeves and Sleeve Seals for Electrical Raceways and Cabling."
- 3.4 FIRESTOPPING
- A. Install firestopping at penetrations of fire-rated floor and wall assemblies. Comply with requirements in other section for "Penetration Firestopping."
- 3.5 PROTECTION
- A. Protect coatings, finishes, and cabinets from damage and deterioration.

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1. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.
2. Repair damage to PVC coatings or paint finishes with matching touchup coating recommended by manufacturer.

END OF SECTION

SECTION 260553 - IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Color and legend requirements for raceways, conductors, and warning labels and signs.
 - 2. Labels.
 - 3. Tags.
 - 4. Signs.
 - 5. Cable ties.
 - 6. Paint for identification.
 - 7. Fasteners for labels and signs.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for electrical identification products.
- B. Identification Schedule: For each piece of electrical equipment and electrical system components to be an index of nomenclature for electrical equipment and system components used in identification signs and labels. Use same designations indicated on Drawings.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Comply with ASME A13.1 .
- B. Comply with NFPA 70.
- C. Comply with 29 CFR 1910.144 and 29 CFR 1910.145.
- D. Comply with ANSI Z535.4 for safety signs and labels.
- E. Comply with NFPA 70E requirements for arc-flash warning labels.

- F. Adhesive-attached labeling materials, including label stocks, laminating adhesives, and inks used by label printers, shall comply with UL 969.
- G. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes.
 - 1. Temperature Change: 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.

2.2 COLOR AND LEGEND REQUIREMENTS

- A. Raceways and Cables Carrying Circuits at 600 V or Less:
 - 1. Black letters on an orange field.
 - 2. Legend: Indicate voltage and system or service type.
- B. Color-Coding for Phase- and Voltage-Level Identification, 600 V or Less: Use colors listed below for ungrounded feeder and branch-circuit conductors.
 - 1. Color shall be factory applied.
 - 2. Colors for 208/120-V Circuits:
 - a. Phase A: Black.
 - b. Phase B: Red.
 - c. Phase C: Blue.
 - 3. Colors for 480/277-V Circuits:
 - a. Phase A: Brown.
 - b. Phase B: Orange.
 - c. Phase C: Yellow.
 - 4. Color for Neutral: White.
 - 5. Color for Equipment Grounds: Green.
 - 6. Colors for Isolated Grounds: Green with white stripe.
- C. Warning Label Colors:
 - 1. Identify system voltage with black letters on an orange background.
- D. Warning labels and signs shall include, but are not limited to, the following legends:
 - 1. Multiple Power Source Warning: "DANGER - ELECTRICAL SHOCK HAZARD - EQUIPMENT HAS MULTIPLE POWER SOURCES."
 - 2. Workspace Clearance Warning: "WARNING - OSHA REGULATION - AREA IN FRONT OF ELECTRICAL EQUIPMENT MUST BE KEPT CLEAR FOR 36 INCHES (915 MM)."
- E. Equipment Identification Labels:
 - 1. Black letters on a white field.

2.3 LABELS

- A. Vinyl Wraparound Labels: Preprinted, flexible labels laminated with a clear, weather- and chemical-resistant coating and matching wraparound clear adhesive tape for securing label ends.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Brady Corporation.
 - b. LEM Products Inc.
 - c. Panduit Corp.
- B. Snap-around Labels: Slit, pretensioned, flexible, preprinted, color-coded acrylic sleeves, with diameters sized to suit diameters and that stay in place by gripping action.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Brady Corporation.
 - b. Panduit Corp.
 - c. Seton Identification Products.
- C. Self-Adhesive Wraparound Labels: Preprinted, 3-mil- (0.08-mm-) thick, vinyl flexible label with acrylic pressure-sensitive adhesive.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Brady Corporation.
 - b. LEM Products Inc.
 - c. Panduit Corp.
 2. Self-Lamination: Clear; UV-, weather- and chemical-resistant; self-laminating, protective shield over the legend. Labels sized such that the clear shield overlaps the entire printed legend.
 3. Marker for Labels: Machine-printed, permanent, waterproof, black ink recommended by printer manufacturer.
- D. Self-Adhesive Labels: Vinyl, thermal, transfer-printed, 3-mil- (0.08-mm-) thick, multicolor, weather- and UV-resistant, pressure-sensitive adhesive labels, configured for intended use and location.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Brady Corporation.
 - b. LEM Products Inc.
 - c. Panduit Corp.
 2. Minimum Nominal Size:
 - a. 1-1/2 by 6 inches (37 by 150 mm) for raceway and conductors.
 - b. 3-1/2 by 5 inches (76 by 127 mm) for equipment.
 - c. As required by authorities having jurisdiction.

2.4 TAGS

A. Write-on Tags:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Brady Corporation.
 - b. LEM Products, Inc.
 - c. Panduit Corporation.
2. Polyester Tags: 0.010 inch (0.25 mm) thick, with corrosion-resistant grommet and cable tie for attachment.
3. Marker for Tags: Machine-printed, permanent, waterproof, black ink marker recommended by printer manufacturer.

2.5 SIGNS

A. Baked-Enamel Signs:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Brady Corporation.
 - b. LEM Products, Inc.
 - c. Panduit Corporation.
2. Preprinted aluminum signs, punched or drilled for fasteners, with colors, legend, and size required for application.
3. 1/4-inch (6.4-mm) grommets in corners for mounting.
4. Nominal Size: 7 by 10 inches (180 by 250 mm).

2.6 CABLE TIES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Brady Corporation.
2. LEM Products, Inc.
3. Panduit Corporation.

B. General-Purpose Cable Ties: Fungus inert, self-extinguishing, one piece, self-locking, and Type 6/6 nylon.

1. Minimum Width: 3/16 inch (5 mm).
2. Tensile Strength at 73 Deg F (23 Deg C) according to ASTM D 638: 12,000 psi (82.7 MPa).
3. Temperature Range: Minus 40 to plus 185 deg F (Minus 40 to plus 85 deg C).
4. Color: Black, except where used for color-coding.

C. UV-Stabilized Cable Ties: Fungus inert, designed for continuous exposure to exterior sunlight, self-extinguishing, one piece, self-locking, and Type 6/6 nylon.

1. Minimum Width: 3/16 inch (5 mm).

2. Tensile Strength at 73 Deg F (23 Deg C) according to ASTM D 638: 12,000 psi (82.7 MPa).
3. Temperature Range: Minus 40 to plus 185 deg F (Minus 40 to plus 85 deg C).
4. Color: Black.

D. Plenum-Rated Cable Ties: Self-extinguishing, UV stabilized, one piece, and self-locking.

1. Minimum Width: 3/16 inch (5 mm).
2. Tensile Strength at 73 Deg F (23 Deg C) according to ASTM D 638: 7000 psi (48.2 MPa).
3. UL 94 Flame Rating: 94V-0.
4. Temperature Range: Minus 50 to plus 284 deg F (Minus 46 to plus 140 deg C).
5. Color: Black.

2.7 MISCELLANEOUS IDENTIFICATION PRODUCTS

- A. Paint: Comply with requirements in painting Sections for paint materials and application requirements. Retain paint system applicable for surface material and location (exterior or interior).
- B. Fasteners for Labels and Signs: Self-tapping, stainless-steel screws or stainless-steel machine screws with nuts and flat and lock washers.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Self-Adhesive Identification Products: Before applying electrical identification products, clean substrates of substances that could impair bond, using materials and methods recommended by manufacturer of identification product.

3.2 INSTALLATION

- A. Verify and coordinate identification names, abbreviations, colors, and other features with requirements in other Sections requiring identification applications, Drawings, Shop Drawings, manufacturer's wiring diagrams, and operation and maintenance manual. Use consistent designations throughout Project.
- B. Install identifying devices before installing acoustical ceilings and similar concealment.
- C. Verify identity of each item before installing identification products.
- D. Coordinate identification with Project Drawings, manufacturer's wiring diagrams, and operation and maintenance manual.
- E. Apply identification devices to surfaces that require finish after completing finish work.
- F. Install signs with approved legend to facilitate proper identification, operation, and maintenance of electrical systems and connected items.

- G. System Identification for Raceways and Cables under 600 V: Identification shall completely encircle cable or conduit. Place identification of two-color markings in contact, side by side.
 - 1. Secure tight to surface of conductor, cable, or raceway.
- H. Auxiliary Electrical Systems Conductor Identification: Identify field-installed alarm, control, and signal connections.
- I. Emergency Operating Instruction Signs: Install instruction signs with white legend on a red background with minimum 3/8-inch- (10-mm-) high letters for emergency instructions at equipment used for power transfer.
- J. Elevated Components: Increase sizes of labels, signs, and letters to those appropriate for viewing from the floor.
- K. Accessible Fittings for Raceways: Identify the covers of each junction and pull box of the following systems with the wiring system legend and system voltage. System legends shall be as follows:
 - 1. "EMERGENCY POWER."
 - 2. "POWER."
- L. Vinyl Wraparound Labels:
 - 1. Secure tight to surface of raceway or cable at a location with high visibility and accessibility.
 - 2. Attach labels that are not self-adhesive type with clear vinyl tape, with adhesive appropriate to the location and substrate.
- M. Snap-around Labels: Secure tight to surface at a location with high visibility and accessibility.
- N. Self-Adhesive Wraparound Labels: Secure tight to surface at a location with high visibility and accessibility.
- O. Self-Adhesive Labels:
 - 1. On each item, install unique designation label that is consistent with wiring diagrams, schedules, and operation and maintenance manual.
 - 2. Unless otherwise indicated, provide a single line of text with 1/2-inch- (13-mm-) high letters on 1-1/2-inch- (38-mm-) high label; where two lines of text are required, use labels 2 inches (50 mm) high.
- P. Self-Adhesive Vinyl Tape: Secure tight to surface at a location with high visibility and accessibility.
- Q. Floor Marking Tape: Apply stripes to finished surfaces following manufacturer's written instructions.
- R. Underground Line Warning Tape:
 - 1. During backfilling of trenches, install continuous underground-line warning tape directly above cable or raceway at 6 to 8 inches (150 to 200 mm) below finished grade. Use

- multiple tapes where width of multiple lines installed in a common trench or concrete envelope exceeds 16 inches (400 mm) overall.
- 2. Install underground-line warning tape for direct-buried cables and cables in raceways.
- S. Write-on Tags:
 - 1. Place in a location with high visibility and accessibility.
 - 2. Secure using general-purpose cable ties.
- T. Baked-Enamel Signs:
 - 1. Attach signs that are not self-adhesive type with mechanical fasteners appropriate to the location and substrate.
 - 2. Unless otherwise indicated, provide a single line of text with 1/2-inch- (13-mm-) high letters on minimum 1-1/2-inch- (38-mm-) high sign; where two lines of text are required, use signs minimum 2 inches (50 mm) high.
- U. Cable Ties: General purpose, for attaching tags, except as listed below:
 - 1. Outdoors: UV-stabilized nylon.
 - 2. In Spaces Handling Environmental Air: Plenum rated.

3.3 IDENTIFICATION SCHEDULE

- A. Install identification materials and devices at locations for most convenient viewing without interference with operation and maintenance of equipment. Install access doors or panels to provide view of identifying devices.
- B. Identify conductors, cables, and terminals in enclosures and at junctions, terminals, pull points, and locations of high visibility. Identify by system and circuit designation.
- C. Accessible Raceways and Metal-Clad Cables, 600 V or Less, for Service, Feeder, and Branch Circuits, More Than 30 A and 120 V to Ground: Identify with self-adhesive raceway labels.
 - 1. Locate identification at changes in direction, at penetrations of walls and floors, at 50-foot (15-m) maximum intervals in straight runs, and at 25-foot (7.6-m) maximum intervals in congested areas.
- D. Accessible Fittings for Raceways and Cables within Buildings: Identify the covers of each junction and pull box of the following systems with self-adhesive labels containing the wiring system legend and system voltage. System legends shall be as follows:
 - 1. "EMERGENCY POWER."
 - 2. "POWER."
 - 3. "UPS."
- E. Power-Circuit Conductor Identification, 600 V or Less: For conductors in vaults, pull and junction boxes, manholes, and handholes, use vinyl wraparound labels to identify the phase.
 - 1. Locate identification at changes in direction, at penetrations of walls and floors, at 50-foot (15-m) maximum intervals in straight runs, and at 25-foot (7.6-m) maximum intervals in congested areas.

- F. Control-Circuit Conductor Identification: For conductors and cables in pull and junction boxes, manholes, and handholes, use write-on tags with the conductor or cable designation, origin, and destination.
- G. Control-Circuit Conductor Termination Identification: For identification at terminations, provide heat-shrink preprinted tubes with the conductor designation.
- H. Conductors to Be Extended in the Future: Attach write-on tags to conductors and list source.
- I. Auxiliary Electrical Systems Conductor Identification: Marker tape that is uniform and consistent with system used by manufacturer for factory-installed connections.
 - 1. Identify conductors, cables, and terminals in enclosures and at junctions, terminals, and pull points. Identify by system and circuit designation.
- J. Locations of Underground Lines: Underground-line warning tape for power, lighting, communication, and control wiring and optical-fiber cable.
- K. Workspace Indication: Apply floor marking tape to finished surfaces. Show working clearances in the direction of access to live parts. Workspace shall comply with NFPA 70 and 29 CFR 1926.403 unless otherwise indicated. Do not install at flush-mounted panelboards and similar equipment in finished spaces.
- L. Instructional Signs: Self-adhesive labels, including the color code for grounded and ungrounded conductors.
- M. Warning Labels for Indoor Cabinets, Boxes, and Enclosures for Power and Lighting: Baked-enamel warning signs.
 - 1. Apply to exterior of door, cover, or other access.
 - 2. For equipment with multiple power or control sources, apply to door or cover of equipment, including, but not limited to, the following:
 - a. Power-transfer switches.
 - b. Controls with external control power connections.
- N. Arc Flash Warning Labeling: Self-adhesive labels.
- O. Operating Instruction Signs: Baked-enamel warning signs.
- P. Emergency Operating Instruction Signs: Baked-enamel warning signs with white legend on a red background with minimum 3/8-inch- (10-mm-) high letters for emergency instructions at equipment used for power transfer.
- Q. Equipment Identification Labels:
 - 1. Indoor Equipment: Self-adhesive label.
 - 2. Outdoor Equipment: Laminated acrylic or melamine sign.
 - 3. Equipment to Be Labeled:
 - a. Access doors and panels for concealed electrical items.
 - b. Emergency system boxes and enclosures.
 - c. Contactors.
 - d. Remote-controlled switches, dimmer modules, and control devices.

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Academic Restrooms Renovation Project
#SU-050522

END OF SECTION

SECTION 262726 - WIRING DEVICES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. GFCI receptacles, 125 V, 20 A.
 - 2. Wall Plates.

1.3 DEFINITIONS

- A. AFCI: Arc-fault circuit interrupter.
- B. BAS: Building automation system.
- C. EMI: Electromagnetic interference.
- D. GFCI: Ground-fault circuit interrupter.
- E. Pigtail: Short lead used to connect a device to a branch-circuit conductor.
- F. RFI: Radio-frequency interference.
- G. SPD: Surge protective device.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: List of legends and description of materials and process used for premarking wall plates.

1.5 INFORMATIONAL SUBMITTALS

- A. Field quality-control reports.

1.6 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For wiring devices to include in all manufacturers' packing-label warnings and instruction manuals that include labeling conditions.

PART 2 - PRODUCTS

2.1 GENERAL WIRING-DEVICE REQUIREMENTS

- A. Wiring Devices, Components, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and use.
- B. Comply with NFPA 70.
- C. RoHS compliant.
- D. Comply with NEMA WD 1.
- E. Devices that are manufactured for use with modular plug-in connectors may be substituted under the following conditions:
 - 1. Connectors shall comply with UL 2459 and shall be made with stranding building wire.
 - 2. Devices shall comply with requirements in this Section.
- F. Devices for Owner-Furnished Equipment:
 - 1. Receptacles: Match plug configurations.
 - 2. Cord and Plug Sets: Match equipment requirements.
- G. Device Color:
 - 1. Wiring Devices Connected to Normal Power System: As selected by Architect unless otherwise indicated or required by NFPA 70 or device listing.
 - 2. Wiring Devices Connected to Essential Electrical System: Red.
 - 3. SPD Devices: Blue.
 - 4. Isolated-Ground Receptacles: Orange.
- H. Wall Plate Color: Match device color.
- I. Source Limitations: Obtain each type of wiring device and associated wall plate from single source from single manufacturer.

2.2 GFCI RECEPTACLES, 125 V, 20 A

- A. Duplex GFCI Receptacles, 125 V, 20 A :
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Eaton (Arrow Hart).

- b. Hubbell Incorporated; Wiring Device-Kellems.
 - c. Leviton Manufacturing Co., Inc.
 - d. Pass & Seymour/Legrand (Pass & Seymour).
- 2. Description: Integral GFCI with "Test" and "Reset" buttons and LED indicator light. Two pole, three wire, and self-grounding.
 - 3. Configuration: NEMA WD 6, Configuration 5-20R.
 - 4. Type: Feed through.
 - 5. Standards: Comply with UL 498, UL 943 Class A, and FS W-C-596.

2.3 WALL PLATES

- A. Single Source: Obtain wall plates from same manufacturer of wiring devices.
- B. Single and combination types shall match corresponding wiring devices.
 - 1. Plate-Securing Screws: Metal with head color to match plate finish.
 - 2. Material for Finished Spaces: Steel with white baked enamel, suitable for field painting.
 - 3. Material for Unfinished Spaces: Galvanized steel.
 - 4. Material for Damp Locations: Cast aluminum with spring-loaded lift cover, and listed and labeled for use in wet and damp locations.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Comply with NECA 1, including mounting heights listed in that standard, unless otherwise indicated.
- B. Coordination with Other Trades:
 - 1. Protect installed devices and their boxes. Do not place wall finish materials over device boxes, and do not cut holes for boxes with routers that are guided by riding against outside of boxes.
 - 2. Keep outlet boxes free of plaster, drywall joint compound, mortar, cement, concrete, dust, paint, and other material that may contaminate the raceway system, conductors, and cables.
 - 3. Install device boxes in brick or block walls so that the cover plate does not cross a joint unless the joint is troweled flush with the face of the wall.
 - 4. Install wiring devices after all wall preparation, including painting, is complete.
- C. Conductors:
 - 1. Do not strip insulation from conductors until right before they are spliced or terminated on devices.
 - 2. Strip insulation evenly around the conductor using tools designed for the purpose. Avoid scoring or nicking of solid wire or cutting strands from stranded wire.
 - 3. The length of free conductors at outlets for devices shall comply with NFPA 70, Article 300, without pigtails.
 - 4. Existing Conductors:

- a. Cut back and pigtail, or replace all damaged conductors.
- b. Straighten conductors that remain and remove corrosion and foreign matter.
- c. Pigtailling existing conductors is permitted, provided the outlet box is large enough.

D. Device Installation:

1. Replace devices that have been in temporary use during construction and that were installed before building finishing operations were complete.
2. Keep each wiring device in its package or otherwise protected until it is time to connect conductors.
3. Do not remove surface protection, such as plastic film and smudge covers, until the last possible moment.
4. Connect devices to branch circuits using pigtails that are not less than 6 inches (152 mm) in length.
5. When there is a choice, use side wiring with binding-head screw terminals. Wrap solid conductor tightly clockwise, two-thirds to three-fourths of the way around terminal screw.
6. Use a torque screwdriver when a torque is recommended or required by manufacturer.
7. When conductors larger than No. 12 AWG are installed on 15- or 20-A circuits, splice No. 12 AWG pigtails for device connections.
8. Tighten unused terminal screws on the device.
9. When mounting into metal boxes, remove the fiber or plastic washers used to hold device-mounting screws in yokes, allowing metal-to-metal contact
10. Install floor box assembly in a "flush" manner such that no component shall extend higher than floor finish materials.

E. Receptacle Orientation:

1. Install ground pin of vertically mounted receptacles up, and on horizontally mounted receptacles to the right.

F. Device Plates: Do not use oversized or extra-deep plates. Repair wall finishes and remount outlet boxes when standard device plates do not fit flush or do not cover rough wall opening.

G. Arrangement of Devices: Unless otherwise indicated, mount flush, with long dimension vertical and with grounding terminal of receptacles on top. Group adjacent switches under single, multi-gang wall plates.

H. Adjust locations of floor service outlets and service poles to suit arrangement of partitions and furnishings.

3.2 GFCI RECEPTACLES

- A. Install non-feed-through GFCI receptacles where protection of downstream receptacles is not required.

3.3 IDENTIFICATION

- A. Comply with requirement in other section for "Identification for Electrical Systems."

- B. Identify each receptacle with panelboard identification and circuit number. Use hot, stamped, or engraved machine printing with black-filled lettering on face of plate, and durable wire markers or tags inside outlet boxes.

3.4 FIELD QUALITY CONTROL

- A. Test Instruments: Use instruments that comply with UL 1436.
- B. Test Instrument for Receptacles: Digital wiring analyzer with digital readout or illuminated digital-display indicators of measurement.
- C. Perform the following tests and inspections:
 - 1. Test Instruments: Use instruments that comply with UL 1436.
 - 2. Test Instrument for Receptacles: Digital wiring analyzer with digital readout or illuminated digital-display indicators of measurement.
- D. Tests for Receptacles:
 - 1. Line Voltage: Acceptable range is 105 to 132 V.
 - 2. Percent Voltage Drop under 15-A Load: A value of 6 percent or higher is unacceptable.
 - 3. Ground Impedance: Values of up to 2 ohms are acceptable.
 - 4. GFCI Trip: Test for tripping values specified in UL 1436 and UL 943.
 - 5. Using the test plug, verify that the device and its outlet box are securely mounted.
 - 6. Tests shall be diagnostic, indicating damaged conductors, high resistance at the circuit breaker, poor connections, inadequate fault-current path, defective devices, or similar problems. Correct circuit conditions, remove malfunctioning units and replace with new ones, and retest as specified above.
- E. Wiring device will be considered defective if it does not pass tests and inspections.
- F. Prepare test and inspection reports.

END OF SECTION

SECTION 262816 – ENCLOSED SWITCHES AND CIRCUIT BREAKERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Molded-case circuit breakers (MCCBs).
 - 2. Enclosures.

1.3 DEFINITIONS

- A. NC: Normally closed.
- B. NO: Normally open.
- C. SPDT: Single pole, double throw.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of enclosed switch, circuit breaker, accessory, and component indicated. Include nameplate ratings, dimensioned elevations, sections, weights, and manufacturers' technical data on features, performance, electrical characteristics, ratings, accessories, and finishes.
 - 1. Enclosure types and details for types other than NEMA 250, Type 1.
 - 2. Current and voltage ratings.
 - 3. Short-circuit current ratings (interrupting and withstand, as appropriate).
 - 4. Detail features, characteristics, ratings, and factory settings of individual overcurrent protective devices, accessories, and auxiliary components.
 - 5. Include time-current coordination curves (average melt) for each type and rating of overcurrent protective device; include selectable ranges for each type of overcurrent protective device. Provide in electronic format.
- B. Shop Drawings: For enclosed switches and circuit breakers.
 - 1. Include plans, elevations, sections, details, and attachments to other work.
 - 2. Include wiring diagrams for power, signal, and control wiring.
- C. Contractor shall submit a "specifications compliance statement" for each manufactured piece of equipment. Contractor/Supplier shall add "redlined" line-by-line notations to a PDF of the Specifications Section indicating the product or actions required "complies". Contractor/Supplier

shall itemize all deviations from the specified requirement on a line-by-line basis. List of exceptions to product specification shall include proposed materials, methods and cost difference where substitutions are allowed. If product does not comply with the specification the Contractor/Supplier shall state what modifications and actions are being implemented to ensure the product shall comply per the substitution section of the contract documents.

1.5 STATEMENT OF COMPLIANCE

- A. Contractor shall submit a "specifications compliance statement" for each manufactured piece of equipment. Contractor/Supplier shall add "redlined" notations to a PDF of the Specifications Section indicating the product or actions required "complies". If product does not comply the Contractor/Supplier shall state what modifications and actions are being implemented to ensure the product shall comply per the substitution section of the contract documents.

1.6 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For qualified testing agency.
- B. Seismic Qualification Data: Certificates, for enclosed switches and circuit breakers, accessories, and components, from manufacturer.
 - 1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
 - 2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
 - 3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.
- C. Field quality-control reports.

1.7 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For enclosed switches and circuit breakers to include in emergency, operation, and maintenance manuals.
 - 1. In addition to items specified in other section for "Operation and Maintenance Data," include the following:
 - a. Manufacturer's written instructions for testing and adjusting enclosed switches and circuit breakers.
 - b. Time-current coordination curves (average melt) for each type and rating of overcurrent protective device; include selectable ranges for each type of overcurrent protective device. Provide in electronic format.

1.8 QUALITY ASSURANCE

- A. Testing Agency Qualifications: Accredited by NETA.

1. Testing Agency's Field Supervisor: Currently certified by NETA to supervise on-site testing.

1.9 FIELD CONDITIONS

- A. Environmental Limitations: Rate equipment for continuous operation under the following conditions unless otherwise indicated:
 1. Ambient Temperature: Not less than minus 22 deg F (minus 30 deg C) and not exceeding 104 deg F (40 deg C).
 2. Altitude: Not exceeding 6600 feet (2010 m).

1.10 WARRANTY

- A. Manufacturer's Warranty: Manufacturer and Installer agree to repair or replace components that fail in materials or workmanship within specified warranty period.
 1. Warranty Period: One year from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Seismic Performance: Enclosed switches and circuit breakers shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.
 1. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified."

2.2 GENERAL REQUIREMENTS

- A. Source Limitations: Obtain enclosed switches and circuit breakers, overcurrent protective devices, components, and accessories, within same product category, from single manufacturer.
- B. Product Selection for Restricted Space: Drawings indicate maximum dimensions for enclosed switches and circuit breakers, including clearances between enclosures, and adjacent surfaces and other items. Comply with indicated maximum dimensions.
- C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by an NRTL, and marked for intended location and application.
- D. Comply with NFPA 70.

2.3 MOLDED-CASE CIRCUIT BREAKERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Eaton.
 - 2. General Electric Company.
 - 3. Siemens Industry, Inc., Energy Management Division.
 - 4. Square D; by Schneider Electric.
- B. Circuit breakers shall be constructed using glass-reinforced insulating material. Current carrying components shall be completely isolated from the handle and the accessory mounting area.
- C. Circuit breakers shall have a toggle operating mechanism with common tripping of all poles, which provides quick-make, quick-break contact action. The circuit-breaker handle shall be over center, be trip free, and reside in a tripped position between on and off to provide local trip indication. Circuit-breaker escutcheon shall be clearly marked on and off in addition to providing international I/O markings. Equip circuit breaker with a push-to-trip button, located on the face of the circuit breaker to mechanically operate the circuit-breaker tripping mechanism for maintenance and testing purposes.
- D. The maximum ampere rating and UL, IEC, or other certification standards with applicable voltage systems and corresponding interrupting ratings shall be clearly marked on face of circuit breaker. Circuit breakers shall be 100 percent rated MCCBs shall be equipped with a device for locking in the isolated position.
- E. Lugs shall be suitable for 140 deg F (60 deg C) rated wire on 125-A circuit breakers and below.
- F. Standard: Comply with UL 489 with interrupting capacity to comply with available fault currents.
- G. Thermal-Magnetic Circuit Breakers: Inverse time-current thermal element for low-level overloads and instantaneous magnetic trip element for short circuits. Adjustable magnetic trip setting for circuit-breaker frame sizes 250 A and larger.
- H. Adjustable, Instantaneous-Trip Circuit Breakers: Magnetic trip element with front-mounted, field-adjustable trip setting.
- I. Electronic Trip Circuit Breakers: Field-replaceable rating plug, rms sensing, with the following field-adjustable settings:
 - 1. Instantaneous trip.
 - 2. Long- and short-time pickup levels.
 - 3. Long- and short-time time adjustments.
 - 4. Ground-fault pickup level, time delay, and I-squared t response.
- J. Current-Limiting Circuit Breakers: Frame sizes 400 A and smaller, and let-through ratings less than NEMA FU 1, RK-5.
- K. Ground-Fault Circuit-Interrupter (GFCI) Circuit Breakers: Single- and two-pole configurations with Class A ground-fault protection (6-mA trip).
- L. Ground-Fault Equipment-Protection (GFEP) Circuit Breakers: With Class B ground-fault protection (30-mA trip).

M. Features and Accessories:

1. Standard frame sizes, trip ratings, and number of poles.
2. Lugs: Compression type, suitable for number, size, trip ratings, and conductor material.
3. Application Listing: Appropriate for application; Type SWD for switching fluorescent lighting loads.
4. Ground-Fault Protection: Comply with UL 1053; integrally mounted, self-powered (for solid state trip) or remote-mounted and powered (for thermal magnetic trip units) type with mechanical ground-fault indicator; relay with adjustable pickup and time-delay settings, push-to-test feature, internal memory, and shunt trip unit; and three-phase, zero-sequence current transformer/sensor.
5. Communication Capability: Circuit-breaker-mounted communication module with functions and features compatible with power monitoring and control system, specified in other section for "Electrical Power Monitoring and Control."
6. Shunt Trip: Trip coil energized from separate circuit, with coil-clearing contact.
7. Undervoltage Trip: Set to operate at 35 to 75 percent of rated voltage without intentional time delay.
8. Auxiliary Contacts: One SPDT switch with "a" and "b" contacts; "a" contacts mimic circuit-breaker contacts, "b" contacts operate in reverse of circuit-breaker contacts.
9. Alarm Switch: One NO contact that operates only when circuit breaker has tripped.
10. Key Interlock Kit: Externally mounted to prohibit circuit-breaker operation; key shall be removable only when circuit breaker is in off position.
11. Zone-Selective Interlocking: Integral with electronic (for solid state trip or ground-fault (for thermal magnetic trip units) trip unit; for interlocking ground-fault protection function.
12. Electrical Operator: Provide remote control for on, off, and reset operations.
13. Accessory Control Power Voltage: Remote mounted and powered 120-V ac.

2.4 ENCLOSURES

- A. Enclosed Switches and Circuit Breakers: UL 489, NEMA KS 1, NEMA 250, and UL 50, to comply with environmental conditions at installed location.
- B. Enclosure Finish: The enclosure shall be gray baked enamel paint, electrodeposited on cleaned, phosphatized steel (NEMA 250 Type 1) (For indoor dry and clean locations; gray baked enamel paint, electrodeposited on cleaned, phosphatized galvanized steel (NEMA 250 Types 3R, 12) (for outdoor) a brush finish on Type 304 stainless steel (NEMA 250 Type 4-4X stainless steel) (For Kitchen and other wet and damp locations; copper-free cast aluminum alloy (NEMA 250 Types 7, 9) (for Hazardous Areas).
- C. Conduit Entry: NEMA 250 Types 4, 4X, and 12 enclosures shall contain no knockouts. NEMA 250 Types 7 and 9 enclosures shall be provided with threaded conduit openings in both end walls.
- D. Operating Mechanism: The circuit-breaker operating handle shall be externally operable with the operating mechanism being an integral part of the box, not the cover. The cover interlock mechanism shall have an externally operated override. The override shall not permanently disable the interlock mechanism, which shall return to the locked position once the override is released. The tool used to override the cover interlock mechanism shall not be required to enter the enclosure in order to override the interlock.
- E. Enclosures designated as NEMA 250 Type 4, 4X stainless steel, 12, or 12K shall have a dual cover interlock mechanism to prevent unintentional opening of the enclosure cover when the

circuit breaker is ON and to prevent turning the circuit breaker ON when the enclosure cover is open.

- F. NEMA 250 Type 7/9 enclosures shall be furnished with a breather and drain kit to allow their use in outdoor and wet location applications.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine elements and surfaces to receive enclosed switches and circuit breakers for compliance with installation tolerances and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.
 - 1. Commencement of work shall indicate Installer's acceptance of the areas and conditions as satisfactory.

3.2 PREPARATION

- A. Interruption of Existing Electric Service: Do not interrupt electric service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary electric service according to requirements indicated:
 - 1. Notify Construction Manager no fewer than seven days in advance of proposed interruption of electric service.
 - 2. Indicate method of providing temporary electric service.
 - 3. Do not proceed with interruption of electric service without Construction Manager's written permission.
 - 4. Comply with NFPA 70E.

3.3 ENCLOSURE ENVIRONMENTAL RATING APPLICATIONS

- A. Enclosed Switches and Circuit Breakers: Provide enclosures at installed locations with the following environmental ratings.
 - 1. Indoor, Dry and Clean Locations: NEMA 250, Type 1.
 - 2. Outdoor Locations: NEMA 250, Type 3R.
 - 3. Kitchen and Wash-Down] Areas: NEMA 250, Type 4X, stainless steel.
 - 4. Other Wet or Damp, Indoor Locations: NEMA 250, Type 4.
 - 5. Indoor Locations Subject to Dust, Falling Dirt, and Dripping Noncorrosive Liquids: NEMA 250, Type 12.
 - 6. Hazardous Areas Indicated on Drawings: NEMA 250, Type 7 with cover attached by Type 316 stainless steel bolts.

3.4 INSTALLATION

- A. Coordinate layout and installation of switches, circuit breakers, and components with equipment served and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.
- B. Install individual wall-mounted switches and circuit breakers with tops at uniform height unless otherwise indicated.
- C. Comply with mounting and anchoring requirements specified in other section for "Seismic Controls for Electrical Systems."
- D. Temporary Lifting Provisions: Remove temporary lifting of eyes, channels, and brackets and temporary blocking of moving parts from enclosures and components.
- E. Install fuses in fusible devices.
- F. Comply with NFPA 70 and NECA 1.

3.5 IDENTIFICATION

- A. Comply with requirements in other section for "Identification for Electrical Systems."
 - 1. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs.
 - 2. Label each enclosure with engraved metal or laminated-plastic nameplate.

3.6 FIELD QUALITY CONTROL

- A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.
- B. Perform tests and inspections.
- C. Tests and Inspections for Switches:
 - 1. Visual and Mechanical Inspection:
 - a. Inspect physical and mechanical condition.
 - b. Inspect anchorage, alignment, grounding, and clearances.
 - c. Verify that the unit is clean.
 - d. Verify blade alignment, blade penetration, travel stops, and mechanical operation.
 - e. Verify that fuse sizes and types match the Specifications and Drawings.
 - f. Verify that each fuse has adequate mechanical support and contact integrity.
 - g. Inspect bolted electrical connections for high resistance using one of the two following methods:
 - 1) Use a low-resistance ohmmeter.
 - a) Compare bolted connection resistance values to values of similar connections. Investigate values that deviate from those of similar bolted connections by more than 50 percent of the lowest value.

- 2) Verify tightness of accessible bolted electrical connections by calibrated torque-wrench method in accordance with manufacturer's published data or NETA ATS Table 100.12.
 - a) Bolt-torque levels shall be in accordance with manufacturer's published data. In the absence of manufacturer's published data, use NETA ATS Table 100.12.
 - h. Verify that operation and sequencing of interlocking systems is as described in the Specifications and shown on the Drawings.
 - i. Verify correct phase barrier installation.
 - j. Verify lubrication of moving current-carrying parts and moving and sliding surfaces.
2. Electrical Tests:
- a. Perform resistance measurements through bolted connections with a low-resistance ohmmeter. Compare bolted connection resistance values to values of similar connections. Investigate values that deviate from adjacent poles or similar switches by more than 50 percent of the lowest value.
 - b. Measure contact resistance across each switchblade fuseholder. Drop values shall not exceed the high level of the manufacturer's published data. If manufacturer's published data are not available, investigate values that deviate from adjacent poles or similar switches by more than 50 percent of the lowest value.
 - c. Perform insulation-resistance tests for one minute on each pole, phase-to-phase and phase-to-ground with switch closed, and across each open pole. Apply voltage in accordance with manufacturer's published data. In the absence of manufacturer's published data, use Table 100.1 from the NETA ATS. Investigate values of insulation resistance less than those published in Table 100.1 or as recommended in manufacturer's published data.
 - d. Measure fuse resistance. Investigate fuse-resistance values that deviate from each other by more than 15 percent.
 - e. Perform ground fault test according to NETA ATS 7.14 "Ground Fault Protection Systems, Low-Voltage."

D. Tests and Inspections for Molded Case Circuit Breakers:

1. Visual and Mechanical Inspection:
- a. Verify that equipment nameplate data are as described in the Specifications and shown on the Drawings.
 - b. Inspect physical and mechanical condition.
 - c. Inspect anchorage, alignment, grounding, and clearances.
 - d. Verify that the unit is clean.
 - e. Operate the circuit breaker to ensure smooth operation.
 - f. Inspect bolted electrical connections for high resistance using one of the two following methods:
 - 1) Use a low-resistance ohmmeter.
 - a) Compare bolted connection resistance values to values of similar connections. Investigate values that deviate from those of similar bolted connections by more than 50 percent of the lowest value.

- 2) Verify tightness of accessible bolted electrical connections by calibrated torque-wrench method in accordance with manufacturer's published data or NETA ATS Table 100.12.
 - a) Bolt-torque levels shall be in accordance with manufacturer's published data. In the absence of manufacturer's published data, use NETA ATS Table 100.12.
 - g. Inspect operating mechanism, contacts, and chutes in unsealed units.
 - h. Perform adjustments for final protective device settings in accordance with the coordination study.
2. Electrical Tests:
- a. Perform resistance measurements through bolted connections with a low-resistance ohmmeter. Compare bolted connection resistance values to values of similar connections. Investigate values that deviate from adjacent poles or similar switches by more than 50 percent of the lowest value.
 - b. Perform insulation-resistance tests for one minute on each pole, phase-to-phase and phase-to-ground with circuit breaker closed, and across each open pole. Apply voltage in accordance with manufacturer's published data. In the absence of manufacturer's published data, use Table 100.1 from the NETA ATS. Investigate values of insulation resistance less than those published in Table 100.1 or as recommended in manufacturer's published data.
 - c. Perform a contact/pole resistance test. Drop values shall not exceed the high level of the manufacturer's published data. If manufacturer's published data are not available, investigate values that deviate from adjacent poles or similar switches by more than 50 percent of the lowest value.
 - d. Perform insulation resistance tests on all control wiring with respect to ground. Applied potential shall be 500-V dc for 300-V rated cable and 1000-V dc for 600-V rated cable. Test duration shall be one minute. For units with solid state components, follow manufacturer's recommendation. Insulation resistance values shall be no less than two megohms.
 - e. Determine the following by primary current injection:
 - 1) Long-time pickup and delay. Pickup values shall be as specified. Trip characteristics shall not exceed manufacturer's published time-current characteristic tolerance band, including adjustment factors.
 - 2) Short-time pickup and delay. Short-time pickup values shall be as specified. Trip characteristics shall not exceed manufacturer's published time-current characteristic tolerance band, including adjustment factors.
 - 3) Ground-fault pickup and time delay. Ground-fault pickup values shall be as specified. Trip characteristics shall not exceed manufacturer's published time-current characteristic tolerance band, including adjustment factors.
 - 4) Instantaneous pickup. Instantaneous pickup values shall be as specified and within manufacturer's published tolerances.
 - f. Test functionality of the trip unit by means of primary current injection. Pickup values and trip characteristics shall be as specified and within manufacturer's published tolerances.
 - g. Perform minimum pickup voltage tests on shunt trip and close coils in accordance with manufacturer's published data. Minimum pickup voltage of the shunt trip and close coils shall be as indicated by manufacturer.

- h. Verify correct operation of auxiliary features such as trip and pickup indicators; zone interlocking; electrical close and trip operation; trip-free, anti-pump function; and trip unit battery condition. Reset all trip logs and indicators. Investigate units that do not function as designed.
 - i. Verify operation of charging mechanism. Investigate units that do not function as designed.
 - 3. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.
 - 4. Perform the following infrared scan tests and inspections and prepare reports:
 - a. Initial Infrared Scanning: After Substantial Completion, but not more than 60 days after Final Acceptance, perform an infrared scan of each enclosed switch and circuit breaker. Remove front panels so joints and connections are accessible to portable scanner.
 - b. Instruments and Equipment: Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.
 - 5. Test and adjust controls, remote monitoring, and safeties. Replace damaged and malfunctioning controls and equipment.
- E. Enclosed switches and circuit breakers will be considered defective if they do not pass tests and inspections.
- F. Prepare test and inspection reports.
 - 1. Test procedures used.
 - 2. Include identification of each enclosed switch and circuit breaker tested and describe test results.
 - 3. List deficiencies detected, remedial action taken, and observations after remedial action.

3.7 ADJUSTING

- A. Adjust moving parts and operable components to function smoothly, and lubricate as recommended by manufacturer.
- B. Set field-adjustable circuit-breaker trip ranges as specified in other section for "Coordination Studies."

END OF SECTION

SECTION 260923 - LIGHTING CONTROL DEVICES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Indoor occupancy and vacancy sensors.
 - 2. Switchbox-mounted vacancy sensors.
 - 3. Wired wall dimmers and switches with wireless communication inputs.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings:
 - 1. Show installation details for the following:
 - a. Occupancy sensors.
 - b. Vacancy sensors.
 - c. Wired wall switches.
 - 2. Interconnection diagrams showing field-installed wiring.
 - 3. Include diagrams for power, signal, and control wiring.

1.4 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Reflected ceiling plan(s) and elevations, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:
 - 1. Suspended ceiling components.
 - 2. Structural members to which equipment will be attached.
 - 3. Items penetrating finished ceiling, including the following:
 - a. Luminaires.

- b. Air outlets and inlets.
- c. Speakers.
- d. Sprinklers.
- e. Access panels.
- f. Control modules.

- B. Field quality-control reports.
- C. Sample Warranty: For manufacturer's warranties.

1.5 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For each type of lighting control device to include in operation and maintenance manuals.

1.6 WARRANTY

- A. Manufacturer's Warranty: Manufacturer and Installer agree to repair or replace lighting control devices that fail(s) in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Faulty operation of lighting control software.
 - b. Faulty operation of lighting control devices.
 - 2. Warranty Period: Two years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 INDOOR OCCUPANCY AND VACANCY SENSORS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Hubbell Controls
 - 2. Lutron
 - 3. Leviton
- B. General Requirements for Sensors:
 - 1. Wall or Ceiling-mounted, solid-state indoor occupancy and vacancy sensors.
 - 2. Passive infrared or Ultrasonic or Dual technology.
 - 3. Separate power pack.
 - 4. Hardwired or wireless connection to switch.

5. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
 6. Electrical contractor shall ensure that lighting fixtures are compatible with lighting controls. Coordinate with all manufacturer requirements.
 7. Operation:
 - a. Occupancy Sensor: Unless otherwise indicated, turn lights on when coverage area is occupied, and turn them off when unoccupied; with a time delay for turning lights off, adjustable over a minimum range of 1 to 20 minutes.
 - b. Vacancy Sensor: Unless otherwise indicated, lights are manually turned on and sensor turns lights off when the room is unoccupied; with a time delay for turning lights off, adjustable over a minimum range of 1 to 20 minutes.
 - c. Combination Sensor: Unless otherwise indicated, sensor shall be programmed to turn lights on when coverage area is occupied and turn them off when unoccupied, or to turn off lights that have been manually turned on; with a time delay for turning lights off, adjustable over a minimum range of 1 to 20 minutes.
 8. Sensor Output: Contacts rated to operate the connected relay, complying with UL 773A. Sensor is powered from the power pack.
 9. Power: Line voltage or Battery with 10 year operational life without needing to replace batteries.
 10. Power Pack: Dry contacts rated for 20-A LED load at 120- and 277-V ac, and for 1 HP at 120-V ac. Sensor has 24-V dc, 150-mA, Class 2 power source, as defined by NFPA 70.
 11. Mounting:
 - a. Sensor: Suitable for mounting in any position on a standard outlet box.
 - b. Relay: Externally mounted through a 1/2-inch (13-mm) knockout in a standard electrical enclosure.
 - c. Time-Delay and Sensitivity Adjustments: Recessed and concealed behind hinged door.
 12. Indicator: Digital display, to show when motion is detected during testing and normal operation of sensor.
 13. Bypass Switch: Override the "on" function in case of sensor failure.
 14. Automatic Light-Level Sensor: Adjustable from 2 to 200 fc (21.5 to 2152 lux); turn lights off when selected lighting level is present.
- C. PIR Type: Ceiling mounted; detect occupants in coverage area by their heat and movement.
1. Detector Sensitivity: Detect occurrences of 6-inch- (150-mm-) minimum movement of any portion of a human body that presents a target of not less than 36 sq. in. (232 sq. cm).
 2. Detection Coverage (Room, Ceiling Mounted): Detect occupancy anywhere in a circular area of 1000 sq. ft. (93 sq. m) when mounted on a 96-inch- (2440-mm-) high ceiling.
 3. Detection Coverage (Corridor, Ceiling Mounted): Detect occupancy within 90 feet (27.4 m) when mounted on a 10-foot- (3-m-) high ceiling.

2.2 SWITCHBOX-MOUNTED OCCUPANCY/VACANCY SENSORS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Hubbell Controls
 2. Lutron
 3. Leviton
- B. General Requirements for Sensors: Automatic-wall-switch occupancy sensor with manual on-off switch, suitable for mounting in a single gang switchbox.
1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
 2. Occupancy Sensor Operation: Unless otherwise indicated, turn lights on when coverage area is occupied, and turn lights off when unoccupied; with a time delay for turning lights off, adjustable over a minimum range of 1 to 20 minutes.
 3. Operating Ambient Conditions: Dry interior conditions, 32 to 120 deg F (0 to 49 deg C).
 4. Switch Rating: Not less than 800-VA ballast or LED load at 120 V, 1200-VA ballast or LED load at 277 V, and 800-W incandescent.
- C. Wall-Switch Sensor :
1. Standard Range: 180-degree field of view, field adjustable from 180 to 40 degrees; with a minimum coverage area of 2100 sq. ft (196 sq. m).
 2. Sensing Technology: Dual technology - PIR and ultrasonic.
 3. Switch Type: SP, field-selectable automatic "on," or manual "on," automatic "off."
 4. Capable of controlling load in three-way application.
 5. Voltage: Match the circuit voltage.
 6. Ambient-Light Override: Concealed, field-adjustable, light-level sensor from 10 to 150 fc (108 to 1600 lux). The switch prevents the lights from turning on when the light level is higher than the set point of the sensor.
 7. Concealed, field-adjustable, "off" time-delay selector at up to 30 minutes.
 8. Adaptive Technology: Self-adjusting circuitry detects and memorizes usage patterns of the space and helps eliminate false "off" switching.
 9. Color: As selected by Architect.
 10. Faceplate: Color matched to switch.

2.3 WIRED WALL DIMMERS AND SWITCHES WITH WIRELESS COMMUNICATION INPUTS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Hubbell controls
 2. Lutron

3. Leviton

B. General Requirements:

1. Operates at the rated capacity across the full ambient temperature range including modified capacities for ganged configurations which require removal of fins.
2. Provide radio frequency interference suppression.
3. Surge Tolerance: Designed and tested to withstand surges of 6,000 V, 200 amps according to IEEE C62.41.2 without impairment to performance.
4. Dimmers: Provide full range, continuously variable control of light intensity.
5. Dimmers for Electronic Low Voltage (ELV) Transformers:
 - a. Provide circuitry designed to control the input of electronic (solid-state) low voltage (ELV) transformers. Do not use dimmers that utilize standard phase control.
 - b. Provide resettable overload protection that provides automatic shut-off when dimmer capacity is exceeded. Do not use protection methods that are non-resettable or require device to be removed from outlet box.
 - c. Designed to withstand a short, per UL 1472, between load hot and either neutral or ground without damage to dimmer.
6. Dimmers for Magnetic Low Voltage (MLV) Transformers:
 - a. Provide circuitry designed to control and provide a symmetrical AC waveform to input of magnetic low voltage transformers per UL 1472.
 - b. Magnetic low voltage transformers to operate below rated current or temperature.
7. Electronic Switches:
 - a. Listed as complying with UL 20, UL 508, and UL 1472.

C. Preset Smart Wall Dimmers and Switches with Wireless Communication Inputs

1. Communicates via radio frequency with up to ten compatible occupancy/vacancy sensors, ten wireless control stations, and one daylight sensor.
2. Dimmer Control: Multi-function tap switch with small, raised rocker for dimmer adjustment.
 - a. Rocker raises/lowers light level, with new level becoming the current preset level.
 - b. Switch single tap raises lights to preset level or fades lights to off.
 - c. Switch double tap raises light to full on level.
 - d. Switch tap and hold slowly fades lights to off over period of 10 seconds.
 - e. LEDs adjacent to tap switch indicate light level when dimmer is on, and function as locator light when dimmer is off.
3. Switch Control:
 - a. Switch programming to control L1 light fixtures in the bathrooms in a zone independent from the other fixtures present.
 - b. L1 fixtures are to be dimmed 50% when unoccupied.
 - c. Other fixtures are to turn off when unoccupied.
4. Dimmer High End Trim:
 - a. Incandescent Dimmers: Minimum of 92 percent of line voltage.
 - b. Dimmers for Electronic Low Voltage (ELV) Transformers: Minimum of 95 percent of line voltage.

- c. Dimmers for Magnetic Low Voltage Transformers: Minimum of 92 percent of line voltage.

2.4 CONDUCTORS AND CABLES

- A. Power Wiring to Supply Side of Remote-Control Power Sources: Not smaller than No. 12 AWG. Comply with requirements in other section for "Low-Voltage Electrical Power Conductors and Cables."
- B. Classes 2 and 3 Control Cable: Multi-conductor cable with stranded-copper conductors not smaller than No. 18 AWG. Comply with requirements in other section for "Low-Voltage Electrical Power Conductors and Cables."
- C. Class 1 Control Cable: Multi-conductor cable with stranded-copper conductors not smaller than No. 14 AWG. Comply with requirements in other section for "Low-Voltage Electrical Power Conductors and Cables."

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine lighting control devices before installation. Reject lighting control devices that are wet, moisture damaged, or mold damaged.
- B. Examine walls and ceilings for suitable conditions where lighting control devices will be installed.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 SENSOR INSTALLATION

- A. Comply with NECA 1.
- B. Coordinate layout and installation of ceiling-mounted devices with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, smoke detectors, fire-suppression systems, and partition assemblies.
- C. Install and aim sensors in locations to achieve not less than 90-percent coverage of areas indicated. Do not exceed coverage limits specified in manufacturer's written instructions.

3.3 CONTACTOR INSTALLATION

- A. Comply with NECA 1.

3.4 WIRING INSTALLATION

- A. Comply with NECA 1.
- B. Wiring Method: Comply with other section for "Low-Voltage Electrical Power Conductors and Cables." Minimum conduit size is 1/2 inch (13 mm).
- C. Wiring within Enclosures: Comply with NECA 1. Separate power-limited and non-power-limited conductors according to conductor manufacturer's written instructions.
- D. Size conductors according to lighting control device manufacturer's written instructions unless otherwise indicated.
- E. Splices, Taps, and Terminations: Make connections only on numbered terminal strips in junction, pull, and outlet boxes; terminal cabinets; and equipment enclosures.

3.5 IDENTIFICATION

- A. Identify components and power and control wiring according to other section for "Identification for Electrical Systems."
 - 1. Identify controlled circuits in lighting contactors.
 - 2. Identify circuits or luminaires controlled by photoelectric and occupancy sensors at each sensor.
- B. Label time switches and contactors with a unique designation.

3.6 FIELD QUALITY CONTROL

- A. Testing Agency: Engage a qualified testing agency to evaluate lighting control devices and perform tests and inspections.
- B. Perform the following tests and inspections:
 - 1. Operational Test: After installing time switches and sensors, and after electrical circuitry has been energized, start units to confirm proper unit operation.
 - 2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- C. Lighting control devices will be considered defective if they do not pass tests and inspections.
- D. Prepare test and inspection reports.

3.7 ADJUSTING

- A. Occupancy Adjustments: When requested within 12 months from date of Substantial Completion, provide on-site assistance in adjusting lighting control devices to suit actual occupied conditions. Provide up to two visits to Project during other-than-normal occupancy hours for this purpose.
1. For occupancy and motion sensors, verify operation at outer limits of detector range. Set time delay to suit Owner's operations.
 2. For daylighting controls, adjust set points and deadband controls to suit Owner's operations.
 3. Align high-bay occupancy sensors using manufacturer's laser aiming tool.

END OF SECTION 260923

SECTION 265119 - LED INTERIOR LIGHTING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes the following:
 - 1. Types of LED luminaires:
 - a. Recessed.
 - b. Strip light.
 - c. Surface mount, nonlinear.
 - d. Suspended, nonlinear.
 - 2. Interior light fixtures for buildings and structures (in part with lighting fixture drawings, schedules, and basis of design cut sheets).
 - 3. All labor, materials, and equipment as necessary to complete all work as indicated on the drawings, and as specified herein.
 - 4. The Contractor shall furnish and install all light fixtures, as shown on the drawing. Light fixtures shall conform to the types and manufacturers as specified on the drawings, schedules, basis of design cut sheets, and herein.
 - 5. The Contractor shall furnish all lamps and necessary hangers, supports, wiring, etc., for installation of light fixtures.

1.3 DEFINITIONS

- A. CCT: Correlated color temperature.
- B. CRI: Color Rendering Index.
- C. Fixture: See "Luminaire."
- D. IP: International Protection or Ingress Protection Rating.
- E. LED: Light-emitting diode.
- F. Lumen: Measured output of lamp and luminaire, or both.
- G. Luminaire: Complete lighting unit, including lamp, reflector, and housing.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.

1. Arrange in order of luminaire designation.
2. Include data on features, accessories, and finishes.
3. Include physical description and dimensions of luminaires.
4. Include emergency lighting units, including batteries and chargers.
5. Include life, output (lumens, CCT, and CRI), and energy-efficiency data.
6. Photometric data and adjustment factors based on laboratory tests, complying with IES "Lighting Measurements Testing and Calculation Guides" for each luminaire type. The adjustment factors shall be for lamps and accessories identical to those indicated for the luminaire as applied in this Project.
 - a. Manufacturers' Certified Data: Photometric data certified by manufacturer's laboratory with a current accreditation under the National Voluntary Laboratory Accreditation Program for Energy Efficient Lighting Products.

B. Shop Drawings: For nonstandard or custom luminaires.

1. Include plans, elevations, sections, and mounting and attachment details.
2. Include details of luminaire assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
3. Include diagrams for power, signal, and control wiring.

C. Sustainable Design Submittals:

1. Product Data: Indicating luminaire is certified by ENERGY STAR.

D. Product Schedule: For luminaires and lamps. Use same designations indicated on Drawings.

1.5 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Reflected ceiling plan(s) and other details, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:

1. Luminaires.
2. Suspended ceiling components.
3. Partitions and millwork that penetrate the ceiling or extend to within 12 inches (300 mm) of the plane of the luminaires.
4. Structural members to which luminaires will be attached.
5. Initial access modules for acoustical tile, including size and locations.
6. Items penetrating finished ceiling, including the following:
 - a. Other luminaires.
 - b. Air outlets and inlets.
 - c. Speakers.
 - d. Sprinklers.
 - e. Access panels.
 - f. Ceiling-mounted projectors.
7. Moldings.
8. Location of remote lighting equipment such as drivers, power supplies.

- B. Qualification Data: For testing laboratory providing photometric data for luminaires.
- C. Seismic Qualification Data: For luminaires, accessories, and components, from manufacturer.
 - 1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
 - 2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
 - 3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.
- D. Product Certificates: For each type of luminaire.
- E. Product Test Reports: For each type of luminaire, for tests performed by manufacturer and witnessed by a qualified testing agency.
- F. Sample warranty.
- G. LED module, Driver, and Controls Compatibility: As stated so by each component manufacturer.
- H. Provide lighting shop drawings and fixture information in one submittal. Include required information for all fixtures, lamps, ballasts, and mounting hardware. Incomplete submittals will be returned without being reviewed.
- I. "Approved Equal" specification status does not and shall not exempt non-prime specified manufacturers identified, from full and complete compliance with all criteria of either specification or as attributed to "prime specification" equipment with regards to photometric performance, adjustability, brightness control, size, lamping, ballasts, mounting, or finish. Aesthetic qualities shall be reviewed by Architect.
- J. Submittal review for each unique fixture type specified in the lighting fixture schedule shall be allotted a maximum of three (3) submittal reviews.
- K. All submitted substitutions differing from the prime specified manufacturer and catalog number, shall be required to submit a working sample

1.6 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For luminaires and lighting systems to include in operation and maintenance manuals.
 - 1. Provide a list of all lamp types used on Project; use ANSI and manufacturers' codes.

1.7 QUALITY ASSURANCE

- A. Luminaire Photometric Data Testing Laboratory Qualifications: Luminaire manufacturer's laboratory that is accredited under the NVLAP for Energy Efficient Lighting Products.
- B. Provide luminaires from a single manufacturer for each luminaire type.

- C. Each luminaire type shall be binned within a three-step MacAdam Ellipse to ensure color consistency among luminaires.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Protect finishes of exposed surfaces by applying a strippable, temporary protective covering before shipping.

1.9 WARRANTY

- A. Warranty: Manufacturer and Installer agree to repair or replace components of luminaires that fail in materials or workmanship within specified warranty period.
- B. Warranty Period: Five (5) years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Seismic Performance: Luminaires shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.
- B. Seismic Performance: Luminaires and lamps shall be labeled vibration and shock resistant.
 - 1. The term "withstand" means "the luminaire will remain in place without separation of any parts when subjected to the seismic forces specified."
- C. Ambient Temperature: 41 to 104 deg F (5 to 40 deg C).
 - 1. Relative Humidity: Zero to 95 percent.
- D. Altitude: Sea level to 1000 feet (300 m).

2.2 LUMINAIRE REQUIREMENTS

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. Factory-Applied Labels: Comply with UL 1598. Include recommended lamps. Locate labels where they will be readily visible to service personnel, but not seen from normal viewing angles when lamps are in place.
 - 1. Label shall include the following lamp characteristics:
 - a. "USE ONLY" and include specific lamp type.
 - b. Lamp diameter, shape, size, wattage, and coating.
 - c. CCT and CRI.

- C. Recessed luminaires shall comply with NEMA LE 4.
- D. California Title 24 compliant.

2.3 RECESSED: Type as indicated on the contract drawings.

- A. Nominal Operating Voltage: As indicated on the contract drawings.
- B. Lamp:
 - 1. Minimum 1,500 lm.
 - 2. Minimum allowable efficacy of 85 lm/W.
 - 3. CRI of minimum 80. CCT of 3500 K.
 - 4. Rated lamp life of 50,000 hours to L70.
 - 5. Dimmable from 100 percent to 0 percent of maximum light output.
 - 6. Internal driver.
 - 7. User-Replaceable Lamps:
 - a. Bulb shape complying with ANSI C78.79.
 - b. Lamp base complying with ANSI C81.61.
 - 8. Lens Thickness: At least 0.125-inch (3.175-mm) minimum unless otherwise indicated.
- C. Housings:
 - 1. Extruded-aluminum housing and heat sink.
 - 2. Clear anodized finish.
 - 3. With integral mounting provisions.
- D. Doors, Frames, and Other Internal Access: Smooth operating, free of light leakage under operating conditions, and designed to permit relamping without use of tools. Components are designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally during relamping and when secured in operating position.
- E. Diffusers and Globes:
 - 1. Prismatic acrylic.
 - 2. Acrylic Diffusers: One hundred percent virgin acrylic plastic, with high resistance to yellowing and other changes due to aging, exposure to heat, and UV radiation.
 - 3. Lens Thickness: At least 0.125-inch (3.175-mm) minimum unless otherwise indicated.
- F. Standards:
 - 1. ENERGY STAR certified.
 - 2. RoHS compliant.
 - 3. UL Listing: Listed for damp location.
 - 4. NEMA LE 4.

2.4 STRIP LIGHT: Type as indicated on the contract drawings.

- A. Nominal Operating Voltage: As indicated on the contract drawings.

B. Lamp:

1. Minimum 750 lm.
2. Minimum allowable efficacy of 80 lm/W.
3. CRI of minimum 80. CCT of 3500 K.
4. Rated lamp life of 50,000 hours to L70.
5. Dimmable from 100 percent to 0 percent of maximum light output.
6. Internal driver.
7. User-Replaceable Lamps:
 - a. Bulb shape complying with ANSI C78.79.
 - b. Lamp base complying with ANSI C81.61.
8. Lens Thickness: At least 0.125-inch (3.175-mm) minimum unless otherwise indicated.

C. Housings:

1. Extruded-aluminum housing and heat sink.
2. Clear anodized finish.
3. With integral mounting provisions.

D. Doors, Frames, and Other Internal Access: Smooth operating, free of light leakage under operating conditions, and designed to permit relamping of luminaire without use of tools. Components are designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally during relamping and when secured in operating position.

E. Diffusers and Globes:

1. Prismatic acrylic.
2. Acrylic Diffusers: One hundred percent virgin acrylic plastic, with high resistance to yellowing and other changes due to aging, exposure to heat, and UV radiation.
3. Lens Thickness: At least 0.125-inch (3.175-mm) minimum unless otherwise indicated.

F. Standards:

1. ENERGY STAR certified.
2. RoHS compliant.
3. UL Listing: Listed for damp location.

2.5 SURFACE MOUNT, NONLINEAR: Type as indicated on the contract drawings.

A. Nominal Operating Voltage: As indicated on the contract drawings.

B. Lamp:

1. Minimum 750 lm.
2. Minimum allowable efficacy of 80 lm/W.
3. CRI of minimum 80. CCT of 3500 K.
4. Rated lamp life of 50,000 hours to L70.
5. Dimmable from 100 percent to 0 percent of maximum light output.
6. Internal driver.
7. User-Replaceable Lamps:

- a. Bulb shape complying with ANSI C78.79.
 - b. Lamp base complying with ANSI C81.61.
 8. Lens Thickness: At least 0.125-inch (3.175-mm) minimum unless otherwise indicated.
 - C. Housings:
 1. Extruded-aluminum housing and heat sink.
 2. Clear anodized finish.
 3. With integral mounting provisions.
 - D. Doors, Frames, and Other Internal Access: Smooth operating, free of light leakage under operating conditions, and designed to permit relamping without use of tools. Components are designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally during relamping and when secured in operating position.
 - E. Diffusers and Globes:
 1. Prismatic acrylic.
 2. Acrylic Diffusers: One hundred percent virgin acrylic plastic, with high resistance to yellowing and other changes due to aging, exposure to heat, and UV radiation.
 3. Lens Thickness: At least 0.125-inch (3.175-mm) minimum unless otherwise indicated.
 - F. Standards:
 1. ENERGY STAR certified.
 2. RoHS compliant.
 3. UL Listing: Listed for damp location.
- 2.6 SUSPENDED, NONLINEAR: Type as indicated on the contract drawings
- A. Nominal Operating Voltage: As indicated on the contract drawings.
 - B. Lamp:
 1. Minimum 1,500 lm.
 2. Minimum allowable efficacy of 85 lm/W.
 3. CRI of minimum 80. CCT of 3500 K.
 4. Rated lamp life of 50,000 hours to L70.
 5. Dimmable from 100 percent to 0 percent of maximum light output.
 6. Internal driver.
 7. User-Replaceable Lamps:
 - a. Bulb shape complying with ANSI C78.79.
 - b. Lamp base complying with ANSI C81.61.
 8. Lens Thickness: At least 0.125-inch (3.175-mm) minimum unless otherwise indicated.
 - C. Housings:
 1. Extruded-aluminum housing and heat sink.
 2. Clear anodized finish.

3. Universal mounting bracket.
 4. Integral junction box with conduit fittings.
- D. Doors, Frames, and Other Internal Access: Smooth operating, free of light leakage under operating conditions, and designed to permit relamping without use of tools. Components are designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally during relamping and when secured in operating position.
- E. Diffusers and Globes:
1. Prismatic acrylic.
 2. Acrylic Diffusers: One hundred percent virgin acrylic plastic, with high resistance to yellowing and other changes due to aging, exposure to heat, and UV radiation.
 3. Lens Thickness: At least 0.125-inch (3.175-mm) minimum unless otherwise indicated.
- F. Standards:
1. ENERGY STAR certified.
 2. RoHS compliant.
 3. UL Listing: Listed for damp location.

2.7 MATERIALS

- A. Metal Parts:
1. Free of burrs and sharp corners and edges.
 2. Sheet metal components shall be steel unless otherwise indicated.
 3. Form and support to prevent warping and sagging.
- B. Steel:
1. ASTM A 36/A 36M for carbon structural steel.
 2. ASTM A 568/A 568M for sheet steel.
- C. Stainless Steel:
1. 1. Manufacturer's standard grade.
 2. 2. Manufacturer's standard type, ASTM A 240/240 M.
- D. Galvanized Steel: ASTM A 653/A 653M.
- E. Aluminum: ASTM B 209.

2.8 METAL FINISHES

- A. Variations in finishes are unacceptable in the same piece. Variations in finishes of adjoining components are acceptable if they are within the range of approved Samples and if they can be and are assembled or installed to minimize contrast.

2.9 LUMINAIRE SUPPORT

- A. Comply with requirements in other section for "Hangers and Supports for Electrical Systems" for channel and angle iron supports and nonmetallic channel and angle supports.
- B. Single-Stem Hangers: 1/2-inch (13-mm) steel tubing with swivel ball fittings and ceiling canopy. Finish same as luminaire.
- C. Wires: ASTM A 641/A 641 M, Class 3, soft temper, zinc-coated steel, 12 gage (2.68 mm).
- D. Rod Hangers: 3/16-inch (5-mm) minimum diameter, cadmium-plated, threaded steel rod.
- E. Hook Hangers: Integrated assembly matched to luminaire, line voltage, and equipment with threaded attachment, cord, and locking-type plug.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Examine roughing-in for luminaire to verify actual locations of luminaire and electrical connections before luminaire installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 TEMPORARY LIGHTING

- A. If approved by the Architect, use selected permanent luminaires for temporary lighting. When construction is sufficiently complete, clean luminaires used for temporary lighting and install new lamps.

3.3 INSTALLATION

- A. Comply with NECA 1.
- B. Install luminaires level, plumb, and square with ceilings and walls unless otherwise indicated.
- C. Install lamps in each luminaire.
- D. Supports:
 - 1. Sized and rated for luminaire weight.
 - 2. Able to maintain luminaire position after cleaning and relamping.
 - 3. Provide support for luminaire without causing deflection of ceiling or wall.
 - 4. Luminaire-mounting devices shall be capable of supporting a horizontal force of 100 percent of luminaire weight and a vertical force of 400 percent of luminaire weight.

E. Flush-Mounted Luminaires:

1. Secured to outlet box.
2. Attached to ceiling structural members at four points equally spaced around circumference of luminaire.
3. Trim ring flush with finished surface.

F. Wall-Mounted Luminaires:

1. Attached to structural members in walls.
2. Do not attach luminaires directly to gypsum board.

G. Suspended Luminaires:

1. Ceiling Mount:

- a. Two 5/32-inch- (4-mm-) diameter aircraft cable supports adjustable to 10 feet (3 m) in length.
- b. [Hook mount.

2. Pendants and Rods: Where longer than 48 inches (1200 mm), brace to limit swinging.
3. Stem-Mounted, Single-Unit Luminaires: Suspend with twin-stem hangers. Support with approved outlet box and accessories that hold stem and provide damping of luminaire oscillations. Support outlet box vertically to building structure using approved devices.
4. Continuous Rows of Luminaires: Use tubing or stem for wiring at one point and tubing or rod for suspension for each unit length of luminaire chassis, including one at each end.
5. Do not use ceiling grid as support for pendant luminaires. Connect support wires or rods to building structure.

H. Ceiling-Grid-Mounted Luminaires:

1. Secure to any required outlet box.
2. Secure luminaire to the luminaire opening using approved fasteners in a minimum of four locations, spaced near corners of luminaire.
3. Use approved devices and support components to connect luminaire to ceiling grid and building structure in a minimum of four locations, spaced near corners of luminaire.

I. Comply with requirements in other section for "Low-Voltage Electrical Power Conductors and Cables" for wiring connections.

3.4 IDENTIFICATION

- A. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in other section for "Identification for Electrical Systems."

3.5 FIELD QUALITY CONTROL

- A. Perform the following tests and inspections:

1. Operational Test: After installing luminaires, switches, and accessories, and after electrical circuitry has been energized, test units to confirm proper operation.

2. Test for Emergency Lighting: Interrupt power supply to demonstrate proper operation. Verify transfer from normal power to battery power and retransfer to normal.
- B. Luminaire will be considered defective if it does not pass operation tests and inspections.
- C. Prepare test and inspection reports.

3.6 ADJUSTING

- A. Under the direction of the Lighting Designer, adjust, trim, and lock all luminaires having adjustable components during on-site aiming. Provide a minimum of three (3) visits to Project, with the lighting designer, during other-than-normal occupancy hours, and in the absence of daylight for initial aiming.
- B. Occupancy Adjustments: When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting the direction of aim of luminaires to suit occupied conditions. Make up to two visits to Project during other-than-normal hours for this purpose. Some of this work may be required during hours of darkness.
 1. During adjustment visits, inspect all luminaires. Replace lamps or luminaires that are defective.
 2. Parts and supplies shall be manufacturer's authorized replacement parts and supplies.
 3. Adjust the aim of luminaires in the presence of the Architect.

END OF SECTION

SECTION 284621.11 - ADDRESSABLE FIRE-ALARM SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Fire-alarm control unit.
 - 2. Notification appliances.

1.3 DEFINITIONS

- A. EMT: Electrical Metallic Tubing.
- B. FACP: Fire Alarm Control Panel.
- C. HLI: High Level Interface.
- D. NICET: National Institute for Certification in Engineering Technologies.
- E. PC: Personal computer.
- F. VESDA: Very Early Smoke-Detection Apparatus.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product, including furnished options and accessories.
 - 1. Include construction details, material descriptions, dimensions, profiles, and finishes.
 - 2. Include rated capacities, operating characteristics, and electrical characteristics.
- B. Shop Drawings: For fire-alarm system.
 - 1. Comply with recommendations and requirements in the "Documentation" section of the "Fundamentals" chapter in NFPA 72.
 - 2. Include plans, elevations, sections, details, and attachments to other work.
 - 3. Include details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and locations. Indicate conductor sizes, indicate termination locations and requirements, and distinguish between factory and field wiring.
 - 4. Detail assembly and support requirements.

5. Include voltage drop calculations for notification-appliance circuits.
6. Include input/output matrix.
7. Include statement from manufacturer that all equipment and components have been tested as a system and meet all requirements in this Specification and in NFPA 72.
8. Include performance parameters and installation details for each detector.
9. Include voice/alarm signaling-service equipment rack or console layout, grounding schematic, amplifier power calculation, and single-line connection diagram.
10. Include floor plans to indicate final outlet locations showing address of each addressable device. Show size and route of cable and conduits and point-to-point wiring diagrams.

C. General Submittal Requirements:

1. Submittals shall be approved by authorities having jurisdiction prior to submitting them to Architect.
2. Shop Drawings shall be prepared by persons with the following qualifications:
 - a. Trained and certified by manufacturer in fire-alarm system design.
 - b. NICET-certified, fire-alarm technician; Level III minimum.
 - c. Licensed or certified by authorities having jurisdiction.

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer.
- B. Field quality-control reports.

1.6 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For fire-alarm systems and components to include in emergency, operation, and maintenance manuals.
 1. In addition to items specified in other section for "Operation and Maintenance Data," include the following and deliver copies to authorities having jurisdiction:
 - a. Comply with the "Records" section of the "Inspection, Testing and Maintenance" chapter in NFPA 72.
 - b. Provide "Fire Alarm and Emergency Communications System Record of Completion Documents" according to the "Completion Documents" Article in the "Documentation" section of the "Fundamentals" chapter in NFPA 72.
 - c. Complete wiring diagrams showing connections between all devices and equipment. Each conductor shall be numbered at every junction point with indication of origination and termination points.
 - d. Riser diagram.
 - e. Device addresses.
 - f. Record copy of site-specific software.
 - g. Provide "Inspection and Testing Form" according to the "Inspection, Testing and Maintenance" chapter in NFPA 72, and include the following:
 - 1) Equipment tested.
 - 2) Frequency of testing of installed components.

- 3) Frequency of inspection of installed components.
- 4) Requirements and recommendations related to results of maintenance.
- 5) Manufacturer's user training manuals.
- h. Manufacturer's required maintenance related to system warranty requirements.
- i. Abbreviated operating instructions for mounting at fire-alarm control unit and each annunciator unit.

B. Software and Firmware Operational Documentation:

- 1. Software operating and upgrade manuals.
- 2. Program Software Backup: On magnetic media or compact disk, complete with data files.
- 3. Device address list.
- 4. Printout of software application and graphic screens.

1.7 QUALITY ASSURANCE

- A. Installer Qualifications: Installation shall be by personnel certified by NICET as fire-alarm Level II technician.
- B. NFPA Certification: Obtain certification according to NFPA 72 by an NRTL (nationally recognized testing laboratory).

1.8 PROJECT CONDITIONS

- A. Perform a full test of the existing system prior to starting work. Document any equipment or components not functioning as designed.
- B. Interruption of Existing Fire-Alarm Service: Do not interrupt fire-alarm service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary guard service according to requirements indicated:
 - 1. Notify Construction Manager no fewer than seven days in advance of proposed interruption of fire-alarm service.
 - 2. Do not proceed with interruption of fire-alarm service without Construction Manager's written permission.
- C. Use of Devices during Construction: Protect devices during construction unless devices are placed in service to protect the facility during construction.

1.9 SEQUENCING AND SCHEDULING

- A. Existing Fire-Alarm Equipment: Maintain existing equipment fully operational until new equipment has been tested and accepted. As new equipment is installed, label it "NOT IN SERVICE" until it is accepted. Remove labels from new equipment when put into service, and label existing fire-alarm equipment "NOT IN SERVICE" until removed from the building.
- B. Equipment Removal: After acceptance of new fire-alarm system, remove existing disconnected fire-alarm equipment and wiring.

1.10 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace fire-alarm system equipment and components that fail in materials or workmanship within specified warranty period.
 - 1. Warranty Extent: All equipment and components not covered in the Maintenance Service Agreement.
 - 2. Warranty Period: Five (5) years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 SYSTEM DESCRIPTION

- A. Source Limitations for Fire-Alarm System and Components: Components shall be compatible with, and operate as an extension of, existing system. Provide system manufacturer's certification that all components provided have been tested as, and will operate as, a system.
- B. Noncoded, UL-certified addressable system, with multiplexed signal transmission and voice/strobe evacuation.
- C. Automatic sensitivity control of certain smoke detectors.
- D. All components provided shall be listed for use with the selected system.
- E. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

2.2 SYSTEMS OPERATIONAL DESCRIPTION

- A. Fire-alarm signal initiation shall be by one or more of the following devices and systems:
 - 1. Manual stations.
 - 2. Heat detectors.
 - 3. Smoke detectors.
 - 4. Duct smoke detectors.
 - 5. Automatic sprinkler system water flow.
 - 6. Fire-extinguishing system operation.
 - 7. Fire standpipe system.
 - 8. Dry system pressure flow switch.
 - 9. Fire pump running.
- B. Fire-alarm signal shall initiate the following actions:
 - 1. Continuously operate alarm notification appliances, including voice evacuation notices.
 - 2. Identify alarm and specific initiating device at fire-alarm control unit and remote annunciators.
 - 3. Transmit an alarm signal to the remote alarm receiving station.
 - 4. Unlock electric door locks in designated egress paths.
 - 5. Release fire and smoke doors held open by magnetic door holders.
 - 6. Activate voice/alarm communication system.

7. Switch heating, ventilating, and air-conditioning equipment controls to fire-alarm mode.
8. Close smoke dampers in air ducts of designated air-conditioning duct systems.
9. Recall elevators to primary or alternate recall floors.
10. Activate elevator power shunt trip.
11. Record events in the system memory.
12. Record events by the system printer.
13. Indicate device in alarm on the graphic annunciator.

C. Supervisory signal initiation shall be by one or more of the following devices and actions:

1. Valve supervisory switch.
2. High- or low-air-pressure switch of a dry-pipe or preaction sprinkler system.
3. Elevator shunt-trip supervision.
4. Fire pump running.
5. Fire-pump loss of power.
6. Fire-pump power phase reversal.
7. Independent fire-detection and -suppression systems.
8. User disabling of zones or individual devices.
9. Loss of communication with any panel on the network.

D. System trouble signal initiation shall be by one or more of the following devices and actions:

1. Open circuits, shorts, and grounds in designated circuits.
2. Opening, tampering with, or removing alarm-initiating and supervisory signal-initiating devices.
3. Loss of communication with any addressable sensor, input module, relay, control module, remote annunciator, printer interface, or Ethernet module.
4. Loss of primary power at fire-alarm control unit.
5. Ground or a single break in internal circuits of fire-alarm control unit.
6. Abnormal ac voltage at fire-alarm control unit.
7. Break in standby battery circuitry.
8. Failure of battery charging.
9. Abnormal position of any switch at fire-alarm control unit or annunciator.
10. Voice signal amplifier failure.
11. Hose cabinet door open.

E. System Supervisory Signal Actions:

1. Initiate notification appliances.
2. Identify specific device initiating the event at fire-alarm control unit and remote annunciators.
3. Record the event on system printer.
4. After a time delay of 200 seconds, transmit a trouble or supervisory signal to the remote alarm receiving station.
5. Transmit system status to building management system.
6. Display system status on graphic annunciator.

2.3 PERFORMANCE REQUIREMENTS

- A. Seismic Performance: Fire-alarm control unit and raceways shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.

1. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified.

2.4 NOTIFICATION APPLIANCES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 1. Edwards EST (Base Building Manufacture)
- B. General Requirements for Notification Appliances: Connected to notification-appliance signal circuits, zoned as indicated, equipped for mounting as indicated, and with screw terminals for system connections.
 1. Combination Devices: Factory-integrated audible and visible devices in a single-mounting assembly, equipped for mounting as indicated, and with screw terminals for system connections.
- C. Visible Notification Appliances: Xenon strobe lights complying with UL 1971, with clear or nominal white polycarbonate lens mounted on an aluminum faceplate. The word "FIRE" is engraved in minimum 1-inch- (25-mm-) high letters on the lens.
 1. Rated Light Output:
 - a. 15/30/75/110 cd, selectable in the field.
 2. Mounting: Wall mounted unless otherwise indicated.
 3. For units with guards to prevent physical damage, light output ratings shall be determined with guards in place.
 4. Flashing shall be in a temporal pattern, synchronized with other units.
 5. Strobe Leads: Factory connected to screw terminals.
 6. Mounting Faceplate: Factory finished, red.
- D. Voice/Tone Notification Appliances:
 1. Comply with UL 1480.
 2. Speakers for Voice Notification: Locate speakers for voice notification to provide the intelligibility requirements of the "Notification Appliances" and "Emergency Communications Systems" chapters in NFPA 72.
 3. Low-Range Units: Rated 1 to 2 W.
 4. Mounting: Flush.
 5. Matching Transformers: Tap range matched to acoustical environment of speaker location.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas and conditions for compliance with requirements for ventilation, temperature, humidity, and other conditions affecting performance of the Work.

1. Verify that manufacturer's written instructions for environmental conditions have been permanently established in spaces where equipment and wiring are installed, before installation begins.
- B. Examine roughing-in for electrical connections to verify actual locations of connections before installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 EQUIPMENT INSTALLATION

- A. Comply with NFPA 72, NFPA 101, and requirements of authorities having jurisdiction for installation and testing of fire-alarm equipment. Install all electrical wiring to comply with requirements in NFPA 70 including, but not limited to, Article 760, "Fire Alarm Systems."
 1. Devices placed in service before all other trades have completed cleanup shall be replaced.
 2. Devices installed but not yet placed in service shall be protected from construction dust, debris, dirt, moisture, and damage according to manufacturer's written storage instructions.
- B. Connecting to Existing Equipment: Verify that existing fire-alarm system is operational before making changes or connections.
 1. Connect new equipment to existing control panel in existing part of the building.
 2. Connect new equipment to existing monitoring equipment at the supervising station.
 3. Expand, modify, and supplement existing control and monitoring equipment as necessary to extend existing control and monitoring functions to the new points. New components shall be capable of merging with existing configuration without degrading the performance of either system.
- C. Install wall-mounted equipment, with tops of cabinets not more than 78 inches (1980 mm) above the finished floor.
 1. Comply with requirements for seismic-restraint devices specified in other section for "Seismic Controls for Communications Systems."
- D. Install a cover on each smoke detector that is not placed in service during construction. Cover shall remain in place except during system testing. Remove cover prior to system turnover.
- E. Duct Smoke Detectors: Comply with NFPA 72 and NFPA 90A. Install sampling tubes so they extend the full width of duct. Tubes more than 36 inches (9100 mm) long shall be supported at both ends.
 1. Do not install smoke detector in duct smoke-detector housing during construction. Install detector only during system testing and prior to system turnover.
- F. Remote Status and Alarm Indicators: Install in a visible location near each smoke detector, sprinkler water-flow switch, and valve-tamper switch that is not readily visible from normal viewing position.

- G. Audible Alarm-Indicating Devices: Install not less than 6 inches (150 mm) below the ceiling. Install speakers on flush-mounted back boxes with the device-operating mechanism concealed behind a grille. Install all devices at the same height unless otherwise indicated.
- H. Visible Alarm-Indicating Devices: Install adjacent to each alarm speaker and at least 6 inches (150 mm) below the ceiling. Install all devices at the same height unless otherwise indicated.
- I. Device Location-Indicating Lights: Locate in public space near the device they monitor.

3.3 PATHWAYS

- A. Pathways shall be installed in EMT.
- B. Exposed EMT shall be painted red enamel.

3.4 CONNECTIONS

- A. For fire-protection systems related to doors in fire-rated walls and partitions and to doors in smoke partitions, comply with requirements in other section for "Door Hardware." Connect hardware and devices to fire-alarm system.
 - 1. Verify that hardware and devices are listed for use with installed fire-alarm system before making connections.
- B. Make addressable connections with a supervised interface device to the following devices and systems. Install the interface device less than 36 inches (910 mm) from the device controlled. Make an addressable confirmation connection when such feedback is available at the device or system being controlled.
 - 1. Alarm-initiating connection to smoke-control system (smoke management) at firefighters' smoke-control system panel.
 - 2. Smoke dampers in air ducts of designated HVAC duct systems.
 - 3. Magnetically held-open doors.
 - 4. Electronically locked doors and access gates.
 - 5. Alarm-initiating connection to elevator recall system and components.
 - 6. Alarm-initiating connection to activate emergency lighting control.
 - 7. Alarm-initiating connection to activate emergency shutoffs for gas and fuel supplies.
 - 8. Supervisory connections at valve supervisory switches.
 - 9. Supervisory connections at low-air-pressure switch of each dry-pipe sprinkler system.
 - 10. Supervisory connections at elevator shunt-trip breaker.
 - 11. Data communication circuits for connection to building management system.
 - 12. Data communication circuits for connection to mass notification system.
 - 13. Supervisory connections at fire-extinguisher locations.
 - 14. Supervisory connections at fire-pump power failure including a dead-phase or phase-reversal condition.
 - 15. Supervisory connections at fire-pump engine control panel.

3.5 IDENTIFICATION

- A. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in other section for "Identification for Communications Systems."
- B. Install framed instructions in a location visible from fire-alarm control unit.

3.6 GROUNDING

- A. Ground fire-alarm control unit and associated circuits; comply with IEEE 1100. Install a ground wire from main service ground to fire-alarm control unit.
- B. Ground shielded cables at the control panel location only. Insulate shield at device location.

3.7 FIELD QUALITY CONTROL

- A. Field tests shall be witnessed by authorities having jurisdiction.
- B. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.
- C. Perform tests and inspections.
- D. Perform the following tests and inspections:
 - 1. Visual Inspection: Conduct visual inspection prior to testing.
 - a. Inspection shall be based on completed record Drawings and system documentation that is required by the "Completion Documents, Preparation" table in the "Documentation" section of the "Fundamentals" chapter in NFPA 72.
 - b. Comply with the "Visual Inspection Frequencies" table in the "Inspection" section of the "Inspection, Testing and Maintenance" chapter in NFPA 72; retain the "Initial/Reacceptance" column and list only the installed components.
 - 2. System Testing: Comply with the "Test Methods" table in the "Testing" section of the "Inspection, Testing and Maintenance" chapter in NFPA 72.
 - 3. Test audible appliances for the public operating mode according to manufacturer's written instructions. Perform the test using a portable sound-level meter complying with Type 2 requirements in ANSI S1.4.
 - 4. Test audible appliances for the private operating mode according to manufacturer's written instructions.
 - 5. Test visible appliances for the public operating mode according to manufacturer's written instructions.
 - 6. Factory-authorized service representative shall prepare the "Fire Alarm System Record of Completion" in the "Documentation" section of the "Fundamentals" chapter in NFPA 72 and the "Inspection and Testing Form" in the "Records" section of the "Inspection, Testing and Maintenance" chapter in NFPA 72.
- E. Reacceptance Testing: Perform reacceptance testing to verify the proper operation of added or replaced devices and appliances.

- F. Fire-alarm system will be considered defective if it does not pass tests and inspections.
- G. Prepare test and inspection reports.
- H. Annual Test and Inspection: One year after date of Substantial Completion, test fire-alarm system complying with visual and testing inspection requirements in NFPA 72. Use forms developed for initial tests and inspections.

3.8 DEMONSTRATION

- A. Train Owner's maintenance personnel to adjust, operate, and maintain fire-alarm system.

END OF SECTION



Quality Environmental Solutions & Technologies, Inc.

**PRE-RENOVATION SURVEY REPORT
FOR
ASBESTOS-CONTAINING MATERIALS (ACM)**

Prepared for:

**SUNY PURCHASE
735 Anderson Hill Road
Purchase, NY 10577**

at:

**SUNY PURCHASE
DANCE, LIBRARY, MUSIC, AND PHYSICAL EDUCATION BUILDINGS'
735 Anderson Hill Road
Purchase, NY 10577**

June 08, 2022

QuES&T Project #Q22-4715

QuES&T

Quality Environmental Solutions & Technologies, Inc.

SUNY Purchase
735 Anderson Hill Road
Purchase, NY 10577

ATTN: Anne-Marie Russillo
Via E-mail: anne-marie.russillo@purchase.edu

Re: SUNY Purchase
Phase 2 Bathroom Rehabilitation
Pre-Renovation Asbestos Inspection
QuES&T Project #Q22-4715

Dear Ms. Russillo,

Attached is the Pre-Renovation Inspection Report for Asbestos-containing Materials (ACM) identified throughout interior areas included within the above-referenced location(s) by **Quality Environmental Solutions & Technologies, Inc. (QuES&T)**. The inspection included visual assessment and representative sampling for the detection of ACM in compliance with the requirements of Title 12 NYCRR Part 56-5.1.

The attached report summarizes the inspection protocol and inspection results for your review. **QuES&T** believes this report accurately reflects the material condition existing in the functional spaces at the time of our inspection.

Should you wish to discuss this matter further or require additional information concerning this submittal, please contact us at (845) 298-6031. **QuES&T** appreciates the opportunity to assist SUNY Purchase in the environmental services area.

Sincerely,



Shannon D. Talsma
Field & Technical Services
NYS/AHERA Inspector/Project Monitor
Cert. #AH 16-07559
Niton-Certified XRF Technician
stalsma@qualityenv.com

Cc: QuES&T File
Cc: lgoldstein@qualityenv.com



Quality Environmental Solutions & Technologies, Inc.

TABLE OF CONTENTS

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II.	Inspection Summary	Page 2
III.	Identified Asbestos-containing Materials (ACM)	Page 3
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Appendix A **ACM Location Drawings & Photos**

Appendix B **Results**

Appendix C **Personnel Licenses & Certifications**

I. INTRODUCTION:

Quality Environmental Solutions & Technologies, Inc. (**QuES&T**) performed a Pre-Renovation Asbestos Survey, in conformance with Title 12 NYCRR Part 56-5.1, on June 7, 2022 for SUNY Purchase in support of the planned Phase 2 Bathroom Rehabilitation's, located at multiple building locations at 735 Anderson Hill Road, Purchase, NY 10577. The survey included a visual inspection / assessment for Presumed Asbestos-containing Materials (PACM) and suspect miscellaneous Asbestos-containing Materials (ACM) throughout accessible interior locations to be affected by future renovation activities.

QuES&T established functional spaces based either on physical barriers (i.e., walls, doors, etc.) or homogeneity of material. Within each functional space identified, a visual inspection was performed using reasonable care and judgment, to identify and assess location, quantity, friability, and condition of all accessible installed ACM building materials observed at the affected portion of the building/structure.

Limited localized demolition of building surfaces was performed, as part of this survey, to access concealed surfaces. No disassembly of installed equipment was conducted as part of this inspection. ACM concealed within structural components and equipment interiors or that is accessible only through extensive mechanical or structural demolition may not have been identified as part of this survey. When any construction activity, such as demolition, remodeling, renovation, or repair work, reveals PACM or suspect miscellaneous ACM that has not been identified, as part of this survey, all construction activities shall cease in the affected area.

The survey included both visual inspection of accessible spaces and representative sampling of suspect building materials for ACM. Samples collected were analyzed by a laboratory approved under the New York State Department of Health Environmental Laboratory Approval Program (NYSDOH ELAP). Samples were analyzed in the laboratory by Polarized Light Microscopy (PLM), Polarized Light Microscopy-NOB (PLM-NOB) and/or Quantitative Transmission Electron Microscopy (QTEM), as required. Sample collection and laboratory analysis were conducted in compliance with the requirements of Title 12 NYCRR Part 56-5.1, 29 CFR 1926.1101 and standard EPA & OSHA accepted methods. Samples consisting of multiple layers were separated and analyzed independently in the laboratory.

Certified **QuES&T** personnel (Appendix D), Mr. Shannon D. Talsma (AH #16-07559) & Mr. Shawn A. Conklin (AH #22-05119) performed visual assessments throughout interior and exterior construction areas. A total of ninety-seven (**97**) samples/layers of installed and accessible suspect building materials were analyzed by a laboratory approved under the NYSDOH ELAP. Twenty-five (**25**) samples/layers were analyzed using Polarized Light Microscopy (PLM) for friable materials; forty-seven (**47**) samples/layers were analyzed using Polarized Light Microscopy (PLM-NOB) for non-friable organically bound materials; twenty-one (**21**) samples/layers were analyzed by Confirmatory-QTEM following negative-determinations using PLM-NOB protocols.

II. INSPECTION SUMMARY:

A visual inspection was performed, and homogenous material types were established based on appearance, color, and texture. The findings presented in this report are based upon reasonably available information and observed site conditions at the time the assessment was performed. The findings and conclusions of this report are not meant to be indicative of future conditions at the site and does not warrant against conditions that were not evident from visual observations or historical information obtained from others.

Representative bulk sampling was performed on suspect building materials for laboratory analysis using PLM, PLM-NOB, and/or QTEM. The following is a summary of installed building materials sampled:

- Wall Materials – Cementitious Block, Mortar, Ceramic Wall Tile, Grout, Plaster, Joint Compound, Joint Tape, Sheetrock, Cove Base Molding, Adhesive Ceramic Wall Tile
- Ceiling Materials – 12” x 12” Dot and Canyon Ceiling Tile Splined, Plaster, Textured Paint
- Flooring Materials – Slab, Ceramic Floor Tile, Grout, Mud Set, Peel and Stick Floor Tile, Setting Bed, 12” x 12” Tile, Mastic, Vapor Barrier, Quarry Tile
- Thermal System Insulation (TSI) Materials – Spray on Fire Proofing
- Miscellaneous Materials – Caulk, Slop Sink, Sink Caulk

III. IDENTIFIED ASBESTOS-CONTAINING MATERIALS (ACM):

TABLE I: IDENTIFIED ACM SUNY PURCHASE 735 Anderson Hill Road Purchase, NY 10557 (Refer to Appendix A for Details)				
KEY: ACM = Materials containing greater than 1% of asbestos; LF = Linear Feet; SF = Square Feet; PACM = Presumed Asbestos-containing Materials; Friable = ACM capable of being released into air, and which can be crumbled, pulverized, powdered, crushed, or exposed by hand-pressure.				
Location	Material	Approximate Quantity	Friable?	Condition
LIBRARY BUILDING				
Room 1009, Men's Bathroom, On Wall	Joint Compound	850 SF	Yes	Good
Room 1008, Women's Bathroom, Vestibule, Wall, Partition, On Sheetrock	Joint Compound	800 SF	Yes	Good
Room 1009, Men's Bathroom, Wall, Partition	Mortar	800 SF	Yes	Good
Room 1008, Women's Bathroom, Above Suspended Ceiling, Wall, Partition	Mortar	800 SF	Yes	Good
DANCE BUILDING				
** No Asbestos-Containing Materials (ACM) Identified Within the Scope of Work **				
MUSIC BUILDING				
** No Asbestos-Containing Materials (ACM) Identified Within the Scope of Work **				
PHYSICAL EDUCATION BUILDING				
** No Asbestos-Containing Materials (ACM) Identified Within the Scope of Work **				
IMPORTANT NOTES: A. Suspect ACM Pipe Insulation/Mudded Packing were not observed at the time of the inspection; however, based on the construction history of buildings on the campus, there is potential that these materials exist in concealed locations (i.e., under floorboards, above hard ceilings, inaccessible mechanical plenums, within chases, soffits, wet walls, etc.) throughout the PAC and Music Building. B. ACM Tar was observed above ceilings, along wall to ceiling deck seams. Due to the lack of access to all above ceiling areas within the Music Building, approximate quantities were not possible to determine. The material is assumed to be throughout the building.				

IV. GENERAL DISCUSSION:

All construction personnel as well as individuals who have access to locations where asbestos containing materials (ACM) exists should be informed of its presence and the proper work practices in these areas. Conspicuous labeling of all ACM is suggested to ensure personnel are adequately informed. Personnel should be informed not to rest, lean or store material or equipment on or near these surfaces and not to cut, saw, drill, sand or disturb ACM. All removal, disturbance, and repair of ACM should be performed in compliance with Title 12 NYCRR Part 56 by persons properly trained to handle ACM. Facility custodial and maintenance personnel should receive training commensurate with their work activities; as defined in 29 CFR 1910.1001.

The findings presented in this report are based upon reasonably available information and observed site conditions at the time the assessment was performed. Conditions may have changed since that time and the findings and conclusions of this report are not meant to be indicative of future conditions at the Site. This report does not warrant against conditions that were not evident from visual observations or historical information obtained, or conditions that could only be determined by physical sampling or other intrusive investigation techniques that are outside the proposed scope of work.

V. ABATEMENT REQUIRED:

As specified in Title 12 NYCRR Part 56-5.1 (h) and (i), "If the building/structure asbestos survey finds that the portion of the building/structure to be demolished, renovated, remodeled, or have repair work contains ACM, PACM, suspect miscellaneous ACM assumed to be ACM, or asbestos material, which is impacted by the work, the owner or the owner's agent shall conduct, or cause to have conducted, asbestos removal performed by a licensed asbestos abatement contractor in conformance with all standards set forth in this Part. All ACM, PACM, suspect miscellaneous ACM assumed to be ACM, or asbestos material impacted by the demolition, renovation, remodeling, or repair project shall be removed as per this Part, prior to access or disturbance by other uncertified trades or personnel. No demolition, renovation, remodeling or repair work shall be commenced by any owner or the owner's agent prior to the completion of the asbestos abatement in accordance with the notification requirements of this Part...All building/structure owners and asbestos abatement contractors on a demolition, renovation, remodeling, or repair project, which includes work covered by this part, shall inform all trades on the work site about PACM, ACM, asbestos material and suspect miscellaneous ACM...Bids may be advertised and contracts awarded for demolition, remodeling, renovation, or repair work, but no work on the current intermediate portion of the project shall commence on the demolition, renovation, remodeling or repair work by any owner or agent prior to completion of all necessary asbestos abatement work for the current intermediate portion of the entire project, in conformance with all standards set forth in this Part."

Prior to conducting demolition or construction work at the building, all ACM affected/impacted by such activities shall be removed utilizing a licensed asbestos abatement contractor and NYSDOL/EPA/NYC certified personnel prior to construction/demolition activities. All work conducted should be in accordance with all legal requirements, including but not limited to U.S. Environmental Protection Agency (EPA) National Emissions Standards for Hazardous Air Pollutants (NESHAP) [40 CFR Part 61], New York State Industrial Code Rule 56 Asbestos Regulations (ICR 56) and Chapter 1 of Title 15 of the Rules of the City of New York Regulations, as applicable. Advance notification of the asbestos project to the USEPA, NYSDOL, and NYCDEP may be required.

All suspect building materials not sampled during this survey should be considered ACM until these materials are sampled and analyzed for ACM in the laboratory. Concealed ACM: In addition to the ACMs identified at the site, there is a possibility that concealed ACM may exist at the subject facility. As

such, if any concealed suspect ACM is encountered during future construction related activities, the work should immediately stop. Prior to resuming the work, the suspect ACM should either be 1) Sampled by an appropriately certified asbestos professional and submitted to an Approved NYSDOH ELAP laboratory for asbestos analysis or 2) Presumed to be ACM (PACM) and removed by a licensed asbestos abatement contractor for disposal in accordance with all applicable regulations.

VI. DISCLAIMERS

It should be noted that the information contained within this report is based solely upon site observations and the results of laboratory analysis for samples collected by **QuES&T**. These observations and results are time dependent, subject to changing site conditions and revisions to Federal, State and Local regulations. **QuES&T** warrants that these findings have been promulgated after being prepared in general accordance with generally accepted practices in the abatement industries. **QuES&T** also recognizes that inspection laboratory data is not usually sufficient to make all abatement and management decisions.

Due to the potential for concealed Asbestos-containing Materials (ACM) or other regulated materials, this report should not be construed to represent all ACM or regulated materials within the site(s). All quantities of ACM or other regulated materials identified, and all dimensions listed within this report are approximate and should be verified On-site.

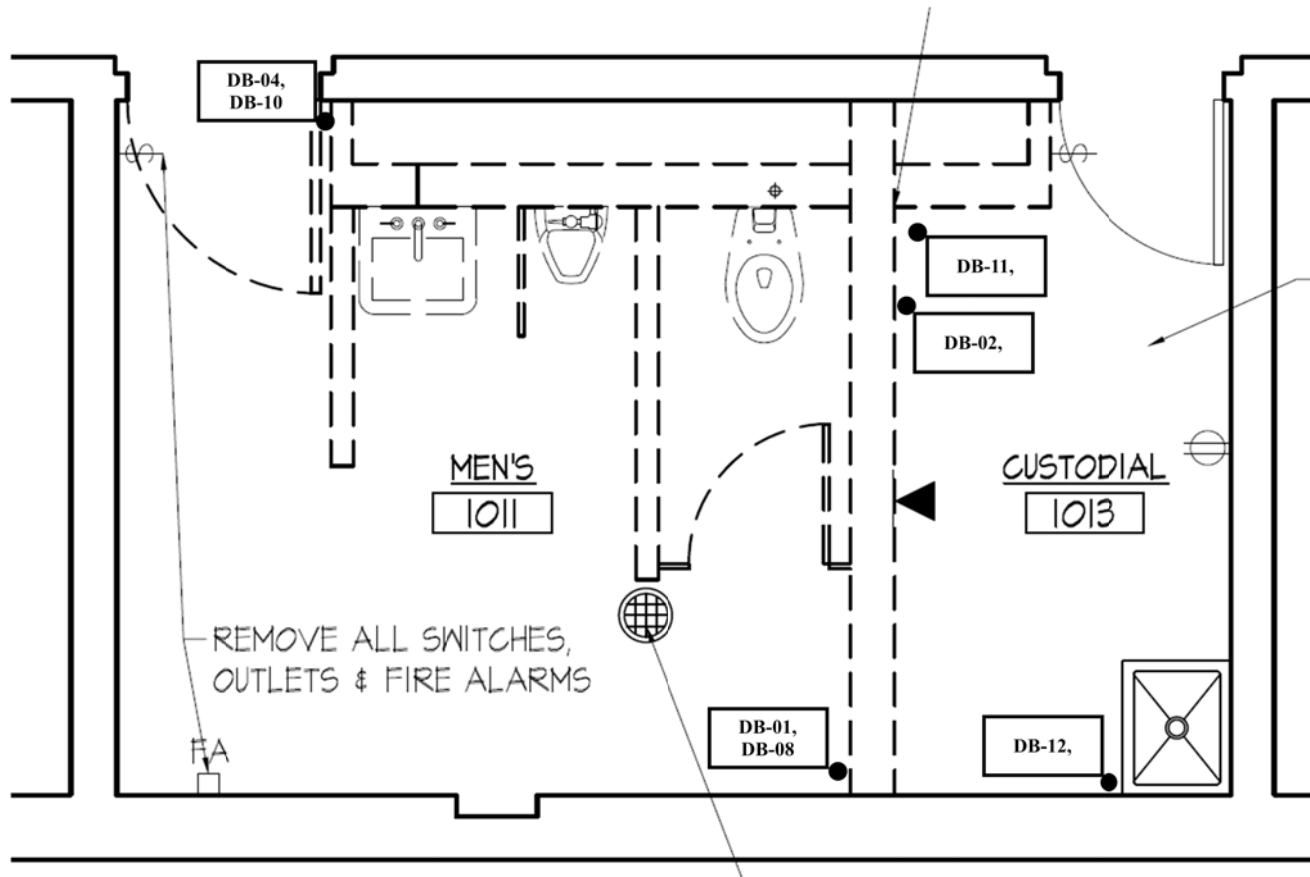
This inspection report is not intended to be used as the sole basis for soliciting pricing for asbestos abatement. An abatement plan, specification, drawing and/or Variances should be developed to identify scope, timing, phasing, and remediation means & methods for any asbestos project. The Linear and/or Square Footages (LF / SF) listed within this Report are only approximates. Abatement Contractor(s) are required to visit the building(s) in order to take actual field measurements within each listed location.



Quality Environmental Solutions & Technologies, Inc.

Appendix A:

ACM LOCATION DRAWINGS & PHOTOS



SAMPLE LOCATION KEY	
●	Sample Location



****Drawing Not to Scale****

This Drawing is not intended to be used as the sole basis for soliciting pricing for asbestos abatement. An abatement plan, specification, drawing and/or variances should be developed to identify scope, timing, phasing and remediation means & methods for any asbestos project.

Date: 06/08/2022	Version # 1
----------------------------	-----------------------

Issued For: Asbestos Survey

QuES&T Project #: 22-4715

Project Manager: LG	Prepared By: SC
-------------------------------	---------------------------

QuES&T

Quality Environmental
Solutions & Technologies, Inc.
1376 Route 9
Wappingers Falls, NY 12590
Phone: (845) 298- 6031
Fax: (845) 298-6251

CLIENT

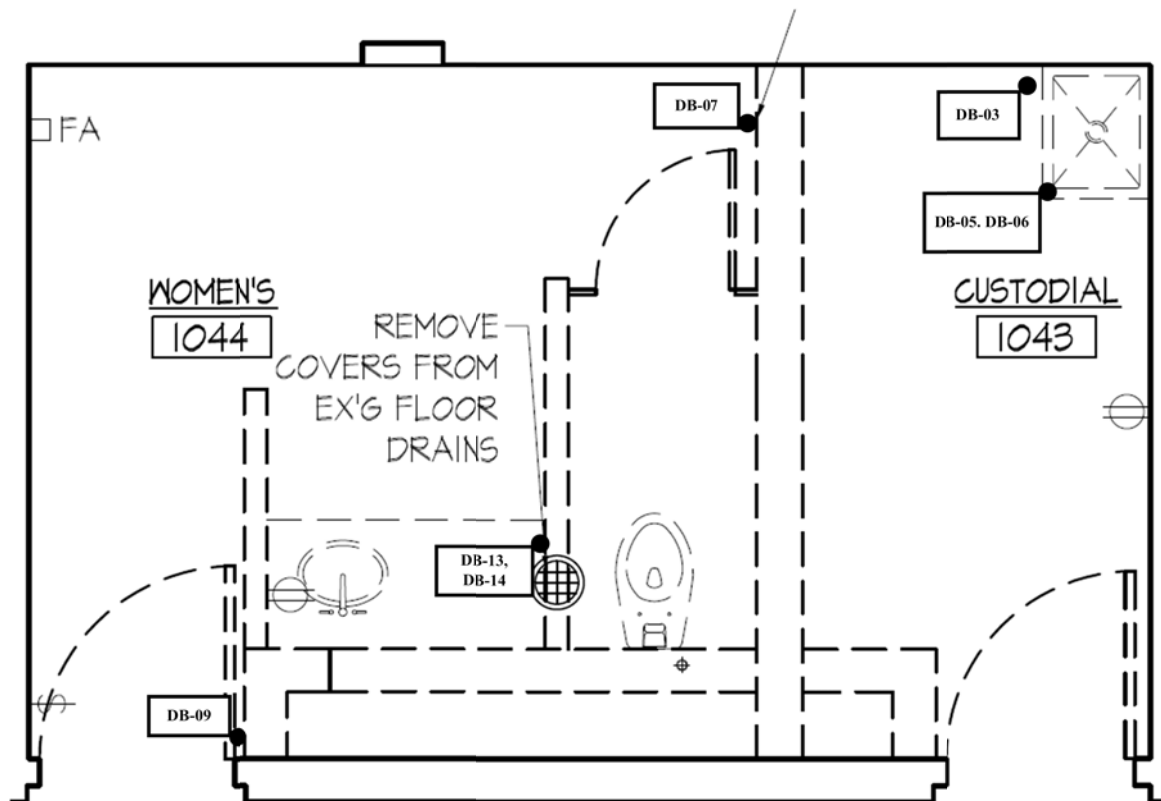
SUNY Purchase
735 Anderson Hill Road
Purchase, NY 10577

PROJECT LOCATION

Dance Building

**1011 & 1013
SAMPLE LOCATIONS**

SL-01



SAMPLE LOCATION KEY	
●	Sample Location



****Drawing Not to Scale****

This Drawing is not intended to be used as the sole basis for soliciting pricing for asbestos abatement. An abatement plan, specification, drawing and/or variances should be developed to identify scope, timing, phasing and remediation means & methods for any asbestos project.

Date: 06/14/2022	Version # 1
----------------------------	-----------------------

Issued For: Asbestos Survey

QuES&T Project #: 22-4715

Project Manager: LG	Prepared By: SC
-------------------------------	---------------------------

QuES&T

Quality Environmental
Solutions & Technologies, Inc.
1376 Route 9
Wappingers Falls, NY 12590
Phone: (845) 298- 6031
Fax: (845) 298-6251

CLIENT

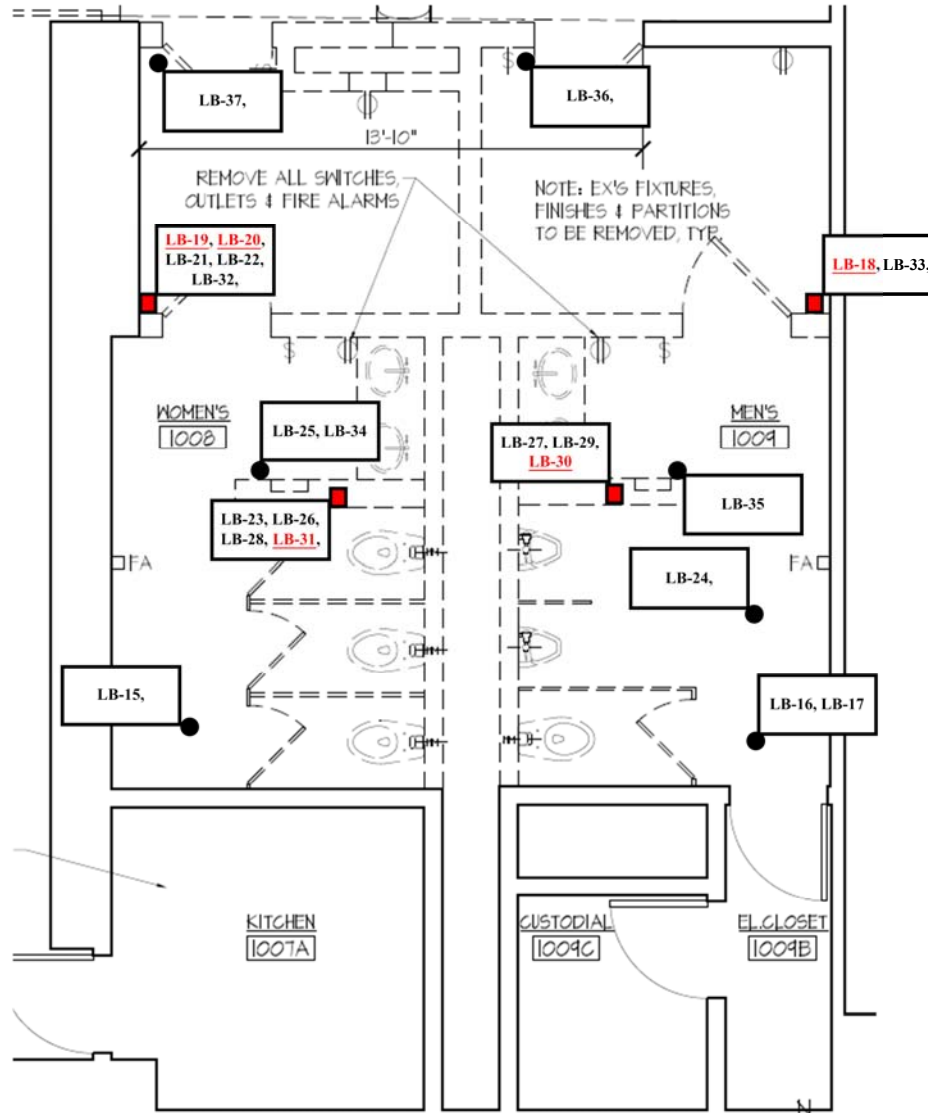
SUNY Purchase
735 Anderson Hill Road
Purchase, NY 10577

PROJECT LOCATION

Dance Building

**1044 & 1043
SAMPLE LOCATIONS**

SL-02



SAMPLE LOCATION KEY	
●	Sample Location
■	Asbestos Location, <u>Underlined Sample Numbers</u> Are Positive For Asbestos.



****Drawing Not to Scale****

This Drawing is not intended to be used as the sole basis for soliciting pricing for asbestos abatement. An abatement plan, specification, drawing and/or variances should be developed to identify scope, timing, phasing and remediation means & methods for any asbestos project.

Date: 06/08/2022	Version # 1
---------------------	----------------

Issued For:
Asbestos Survey

QuES&T Project # :
22-4715

Project
Manager:
LG

Prepared By:
SC

QuES&T

Quality Environmental
Solutions & Technologies, Inc.
1376 Route 9
Wappingers Falls, NY 12590
Phone: (845) 298- 6031
Fax: (845) 298-6251

CLIENT

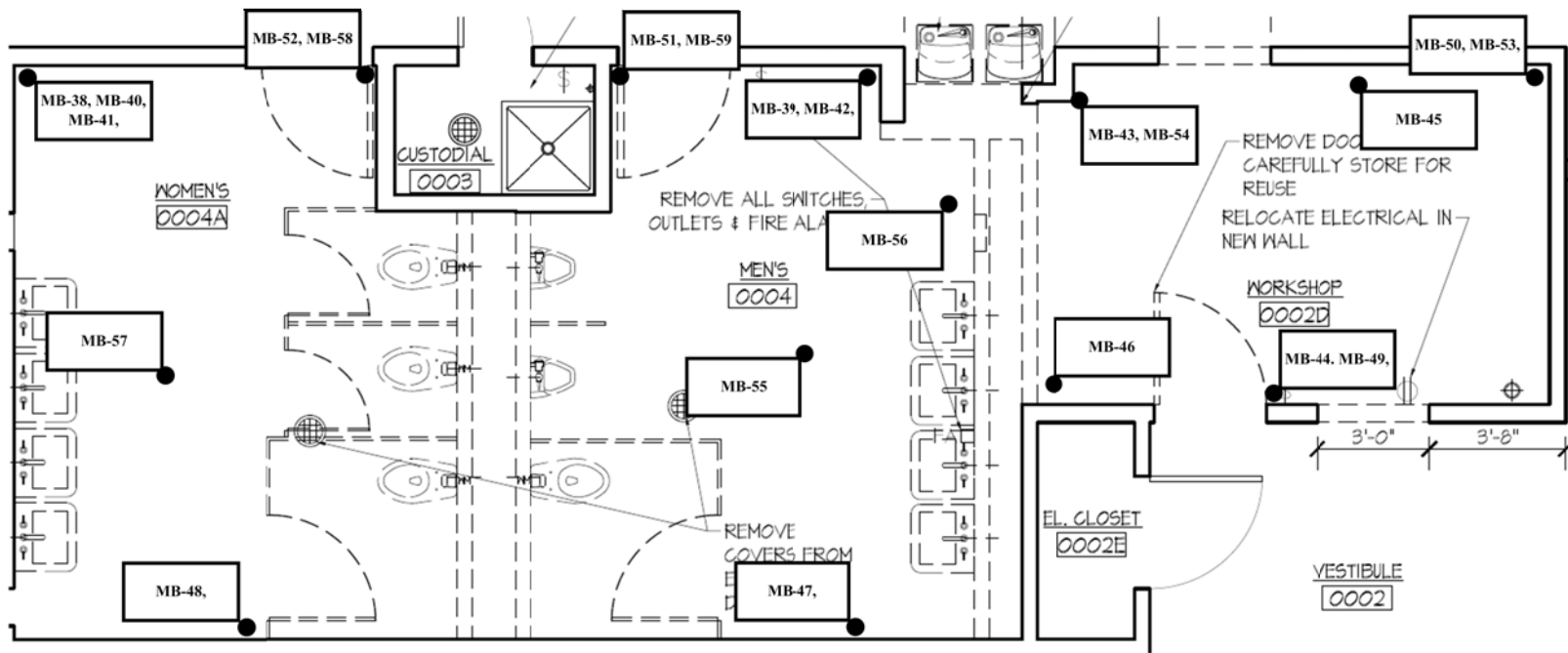
SUNY Purchase,
735 Anderson Hill Road
Purchase, NY 10577

PROJECT LOCATION

Library Building

**1008 & 1009
SAMPLE LOCATIONS**

SL-03



SAMPLE LOCATION KEY	
	Sample Location (Non-ACM)
	Sample Location (ACM)



****Drawing Not to Scale****

This Drawing is not intended to be used as the sole basis for soliciting pricing for asbestos abatement. An abatement plan, specification, drawing and/or variances should be developed to identify scope, timing, phasing and remediation means & methods for any asbestos project.

Date: 06/08/2022	Version # 1
----------------------------	-----------------------

Issued For:
Asbestos Survey

QuES&T Project #:
22-4715

Project Manager: LG	Prepared By: SC
-------------------------------	---------------------------

QuES&T

Quality Environmental
Solutions & Technologies, Inc.
1376 Route 9
Wappingers Falls, NY 12590
Phone: (845) 298- 6031
Fax: (845) 298-6251

CLIENT

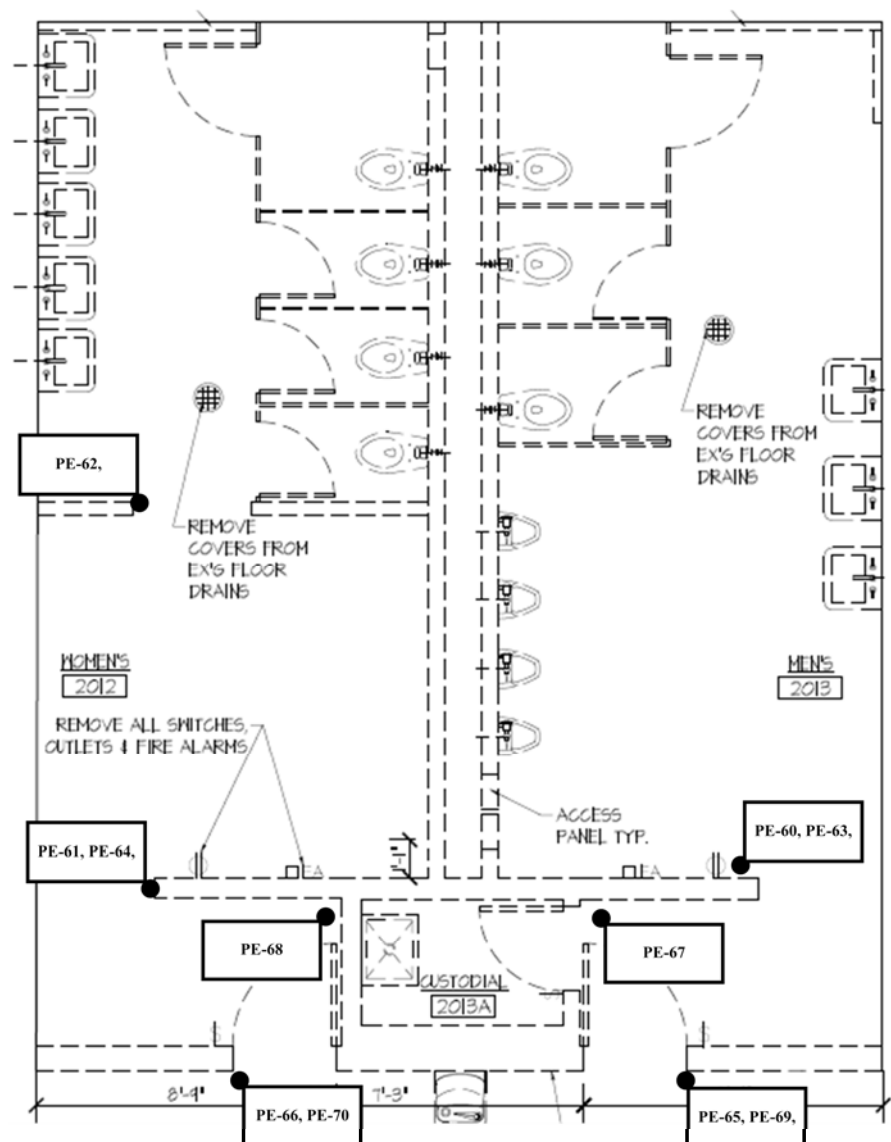
SUNY Purchase,
735 Anderson Hill Road
Purchase, NY 10577

PROJECT LOCATION

Music Building

**0004 & 0004A & 0002D
SAMPLE LOCATIONS**

SL-04



SAMPLE LOCATION KEY	
	Sample Location (Non-ACM)
	Sample Location (ACM)



****Drawing Not to Scale****

This Drawing is not intended to be used as the sole basis for soliciting pricing for asbestos abatement. An abatement plan, specification, drawing and/or variances should be developed to identify scope, timing, phasing and remediation means & methods for any asbestos project.

Date: 06/08/2022	Version # 1
----------------------------	-----------------------

Issued For:
Asbestos Survey

QuES&T Project #:
22-4715

Project Manager:
LG

Prepared By:
SC

QuES&T

Quality Environmental
Solutions & Technologies, Inc.
1376 Route 9
Wappingers Falls, NY 12590
Phone: (845) 298- 6031
Fax: (845) 298-6251

CLIENT

SUNY Purchase,
735 Anderson Hill Road
Purchase, NY 10577

PROJECT LOCATION

Physical Education Building

**2012 & 2013 & 2013A
SAMPLE LOCATIONS**

SL-05



Quality Environmental Solutions & Technologies, Inc.

Appendix B:

RESULTS



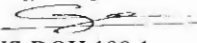
EAS Batch No. 2204039

Eastern Analytical Services, Inc.

Page 1 of 23

Bulk Sample Results

RE: CPN 22-4715 - SUNY Purchase - Phase 2 Bathroom Renovations - Multiple Buildings

Date Collected : 06/08/2022
 Collected By : S. Talsma/S. Conklin
 Date Received : 06/09/2022
 Date Analyzed : 06/16/2022
 Analyzed By : George Htay
 Signature : 
 Analytical Method : NYS-DOH 198.1
 NVLAP Lab Code : 101646-0
 NYS Lab No. 10851

Client: QuES&T, Inc.
 1376 Route 9
 Wappingers Falls, NY 12590

Sample ID Number	4715-DB-01	4715-DB-01	4715-DB-02	4715-DB-02
Layer Number	1	2	1	2
Lab ID Number	2834009	2834009	2834010	2834010
Sample Location	Dance Building, Room 1011, Men's Bathroom, Wall, Upper	Dance Building, Room 1011, Men's Bathroom, Wall, Upper	Dance Building, Room 1013, Wall, Partition	Dance Building, Room 1013, Wall, Partition
Sample Description	Cementitious Block and Mortar (Block Layer)	Cementitious Block and Mortar (Mortar Layer)	Cementitious Block and Mortar (Block Layer)	Cementitious Block and Mortar (Mortar Layer)
Method of Quantification	Scanning Option	Scanning Option	Scanning Option	Scanning Option
Appearance	Layered Homogenous Fibrous Color	Yes No No Gray/White	No Yes No Gray/Brown	Yes No No Gray/Brown
Sample Treatment	Homogenized	None	Homogenized	None
Asbestos Content	% Amosite % Chrysotile % Other % Total Asbestos	ND ND ND ND	ND ND ND ND	ND ND ND ND
Other Fibrous Materials Present	% Fibrous Glass % Cellulose % Other % Unidentified	ND ND ND ND	ND ND ND ND	ND ND ND ND
Non-Fibrous Materials Present	% Silicates % Carbonates % Other % Unidentified	20.0 30.0 ND 50.0	25.0 30.0 ND 45.0	20.0 30.0 ND 50.0

Results Applicable To Those Items Tested. Report Cannot be Reproduced, Except Entirely, Without Written Approval of the Laboratory. ND - Not Detected. Reporting Limit is <1%.
 Liability Limited To Cost Of Analysis. This Report Must Not be Used by the Client to Claim Product Endorsement by NVLAP or Any Agency of the US Government.
 These Results Can Not Be Used To Claim That NOB Items Tested Are Non-Asbestos Containing. Overall Lab Accuracy $\pm 17\%$. Samples received in acceptable condition unless otherwise noted.
 AIIHA LAP, LLC No. 100263 Rhode Island DOH No. AAL-072 Massachusetts DOL No. A A 000072 Connecticut DOH No. PH-0622 Maine DEP No. LA-024 Vermont DOH No. AL-709936



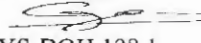
EAS Batch No. 2204039

Eastern Analytical Services, Inc.

Page 2 of 23

Bulk Sample Results

RE: CPN 22-4715 - SUNY Purchase - Phase 2 Bathroom Renovations - Multiple Buildings

Date Collected : 06/08/2022
 Collected By : S. Talsma/S. Conklin
 Date Received : 06/09/2022
 Date Analyzed : 06/16/2022
 Analyzed By : George Htay
 Signature : 
 Analytical Method : NYS-DOH 198.1
 NVLAP Lab Code : 101646-0
 NYS Lab No. 10851

Client: QuES&T, Inc.
 1376 Route 9
 Wappingers Falls, NY 12590

Sample ID Number	4715-DB-03	4715-DB-04	4715-DB-05	4715-DB-06
Layer Number				
Lab ID Number	2834011	2834012	2834013	2834014
Sample Location	Dance Building, Room 1043, Custodial, Floor	Dance Building, Room 1011m, Men's Bathroom, Floor, Under Tile	Dance Building, Room 1043, Custodial	Dance Building, Room 1043, Custodial
Sample Description	Slab	Slab	Slop Sink	Slop Sink
Method of Quantification	Scanning Option	Scanning Option	Scanning Option	Scanning Option
Appearance	Layered	No	No	No
	Homogenous	No	No	No
	Fibrous	No	No	No
	Color	Gray	Gray/White	Gray/White
Sample Treatment	Homogenized	Homogenized	Homogenized	Homogenized
Asbestos	% Amosite	ND	ND	ND
Content	% Chrysotile	ND	ND	ND
	% Other	ND	ND	ND
	% Total Asbestos	ND	ND	ND
Other Fibrous	% Fibrous Glass	ND	ND	ND
Materials	% Cellulose	ND	ND	ND
Present	% Other	ND	ND	ND
	% Unidentified	ND	ND	ND
Non-Fibrous	% Silicates	20.0	20.0	20.0
Materials	% Carbonates	35.0	30.0	30.0
Present	% Other	ND	ND	ND
	% Unidentified	45.0	45.0	50.0

Results Applicable To Those Items Tested. Report Cannot be Reproduced, Except Entirely, Without Written Approval of the Laboratory. ND - Not Detected. Reporting Limit is <1%.
 Liability Limited To Cost Of Analysis. This Report Must Not be Used by the Client to Claim Product Endorsement by NVLAP or Any Agency of the US Government.
 These Results Can Not Be Used To Claim That NOB Items Tested Are Non-Asbestos Containing. Overall Lab Accuracy $\pm 1\%$. Samples received in acceptable condition unless otherwise noted.
 AIHA LAP, LLC No. 100263 Rhode Island DOH No. AAL-072 Massachusetts DOL No. A A 000072 Connecticut DOH No. PH-0622 Maine DEP No. LA-024 Vermont DOH No. AL-709936



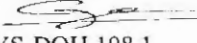
EAS Batch No. 2204039

Eastern Analytical Services, Inc.

Page 3 of 23

Bulk Sample Results

RE: CPN 22-4715 - SUNY Purchase - Phase 2 Bathroom Renovations - Multiple Buildings

Date Collected : 06/08/2022
 Collected By : S. Talsma/S. Conklin
 Date Received : 06/09/2022
 Date Analyzed : 06/16/2022
 Analyzed By : George Htay
 Signature : 
 Analytical Method : NYS-DOH 198.1
 NVLAP Lab Code : 101646-0
 NYS Lab No. 10851

Client: QuES&T, Inc.
 1376 Route 9
 Wappingers Falls, NY 12590

Sample ID Number	4715-DB-07	4715-DB-07	4715-DB-07	4715-DB-08
Layer Number	1	2	3	1
Lab ID Number	2834015	2834015	2834015	2834016
Sample Location	Dance Building, Room 1044, Women's Bathroom, On Wall	Dance Building, Room 1044, Women's Bathroom, On Wall	Dance Building, Room 1044, Women's Bathroom, On Wall	Dance Building, Room 1011, Men's Bathroom, On Wall
Sample Description	Ceramic Wall Tile, Grout, Mortar (Tile Layer)	Ceramic Wall Tile, Grout, Mortar (Grout Layer)	Ceramic Wall Tile, Grout, Mortar (Mortar Layer)	Ceramic Wall Tile, Grout, Mortar (Tile Layer)
Method of Quantification	Scanning Option	Scanning Option	Scanning Option	Scanning Option
Appearance	Layered Homogenous Fibrous Color	No Yes No Tan	No No No Brown	No Yes No Tan
Sample Treatment	None	Homogenized	Homogenized	None
Asbestos Content	% Amosite % Chrysotile % Other % Total Asbestos	ND ND ND ND	ND ND ND ND	ND ND ND ND
Other Fibrous Materials Present	% Fibrous Glass % Cellulose % Other % Unidentified	ND ND ND ND	ND ND ND ND	ND ND ND ND
Non-Fibrous Materials Present	% Silicates % Carbonates % Other % Unidentified	40.0 ND ND 60.0	20.0 30.0 ND 50.0	15.0 35.0 ND 50.0
				40.0 ND ND 60.0

Results Applicable To Those Items Tested. Report Cannot be Reproduced, Except Entirely, Without Written Approval of the Laboratory. ND - Not Detected. Reporting Limit is <1%.
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 AIHA LAP, LLC No. 100263 Rhode Island DOH No. AAL-072 Massachusetts DOL No. A A 000072 Connecticut DOH No. PH-0622 Maine DEP No. LA-024 Vermont DOH No. AL-709936



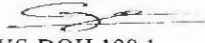
EAS Batch No. 2204039

Eastern Analytical Services, Inc.

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Bulk Sample Results

RE: CPN 22-4715 - SUNY Purchase - Phase 2 Bathroom Renovations - Multiple Buildings

Date Collected : 06/08/2022
 Collected By : S. Talsma/S. Conklin
 Date Received : 06/09/2022
 Date Analyzed : 06/16/2022
 Analyzed By : George Htay
 Signature : 
 Analytical Method : NYS-DOH 198.1
 NVLAP Lab Code : 101646-0
 NYS Lab No. 10851

Client: QuES&T, Inc.
 1376 Route 9
 Wappingers Falls, NY 12590

Sample ID Number	4715-DB-08	4715-DB-08	4715-DB-09	4715-DB-09
Layer Number	2	3	1	2
Lab ID Number	2834016	2834016	2834017	2834017
Sample Location	Dance Building, Room 1011, Men's Bathroom, On Wall	Dance Building, Room 1011, Men's Bathroom, On Wall	Dance Building, Room 1044, Women's Bathroom, Floor	Dance Building, Room 1044, Women's Bathroom, Floor
Sample Description	Ceramic Wall Tile, Grout, Mortar (Grout Layer)	Ceramic Wall Tile, Grout, Mortar (Mortar Layer)	Ceramic Floor Tile, Grout, Mudset (Tile Layer)	Ceramic Floor Tile, Grout, Mudset (Grout Layer)
Method of Quantification	Scanning Option	Scanning Option	Scanning Option	Scanning Option
Appearance	Layered Homogenous Fibrous Color	No No No Brown	No No No White	No No No Rust
Sample Treatment	Homogenized	Homogenized	None	Homogenized
Asbestos	% Amosite	ND	ND	ND
Content	% Chrysotile	ND	ND	ND
	% Other	ND	ND	ND
	% Total Asbestos	ND	ND	ND
Other Fibrous	% Fibrous Glass	ND	ND	ND
Materials	% Cellulose	ND	ND	ND
Present	% Other	ND	ND	ND
	% Unidentified	ND	ND	ND
Non-Fibrous	% Silicates	15.0	15.0	40.0
Materials	% Carbonates	30.0	35.0	ND
Present	% Other	ND	ND	ND
	% Unidentified	55.0	50.0	60.0

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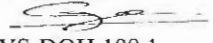
EAS Batch No. 2204039

Eastern Analytical Services, Inc.

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Bulk Sample Results

RE: CPN 22-4715 - SUNY Purchase - Phase 2 Bathroom Renovations - Multiple Buildings

Date Collected : 06/08/2022
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 Date Received : 06/09/2022
 Date Analyzed : 06/16/2022
 Analyzed By : George Htay
 Signature : 
 Analytical Method : NYS-DOH 198.1
 NVLAP Lab Code : 101646-0
 NYS Lab No. 10851

Client: QuES&T, Inc.
 1376 Route 9
 Wappingers Falls, NY 12590

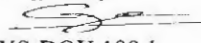
Sample ID Number	4715-DB-09	4715-DB-10	4715-DB-10	4715-DB-10
Layer Number	3	1	2	3
Lab ID Number	2834017	2834018	2834018	2834018
Sample Location	Dance Building, Room 1044, Women's Bathroom, Floor	Dance Building, Room 1011, Men's Bathroom, Floor	Dance Building, Room 1011, Men's Bathroom, Floor	Dance Building, Room 1011, Men's Bathroom, Floor
Sample Description	Ceramic Floor Tile, Grout, Mudset (Mudset Layer)	Ceramic Floor Tile, Grout, Mudset (Tile Layer)	Ceramic Floor Tile, Grout, Mudset (Grout Layer)	Ceramic Floor Tile, Grout, Mudset (Mudset Layer)
Method of Quantification	Scanning Option	Scanning Option	Scanning Option	Scanning Option
Appearance	Layered Homogenous Fibrous Color	No Yes No Gray	No Yes No Rust	No Yes No Gray
Sample Treatment	None	None	Homogenized	None
Asbestos Content	% Amosite % Chrysotile % Other % Total Asbestos	ND ND ND ND	ND ND ND ND	ND ND ND ND
Other Fibrous Materials Present	% Fibrous Glass % Cellulose % Other % Unidentified	ND ND ND ND	ND ND ND ND	ND ND ND ND
Non-Fibrous Materials Present	% Silicates % Carbonates % Other % Unidentified	20.0 35.0 ND 45.0	40.0 ND ND 60.0	20.0 30.0 ND 50.0

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 AIHA LAP, LLC No. 100263 Rhode Island DOH No. AAL-072 Massachusetts DOL No. A A 000072 Connecticut DOH No. PH-0622 Maine DEP No. LA-024 Vermont DOH No. AL-709936



Bulk Sample Results

RE: CPN 22-4715 - SUNY Purchase - Phase 2 Bathroom Renovations - Multiple Buildings

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 Date Received : 06/09/2022
 Date Analyzed : 06/16/2022
 Analyzed By : George Htay
 Signature : 
 Analytical Method : NYS-DOH 198.1
 NVLAP Lab Code : 101646-0
 NYS Lab No. 10851

Client: QuES&T, Inc.
 1376 Route 9
 Wappingers Falls, NY 12590

Sample ID Number	4715-LB-15	4715-LB-16	4715-LB-17	4715-LB-18
Layer Number				1
Lab ID Number	2834019	2834020	2834021	2834022
Sample Location	Library Building, Room 1008, Women's Bathroom, Above Suspended Ceiling, On Steel	Library Building, Room 1009, Men's Bathroom, Above Suspended Ceiling, On Steel Beam	Library Building, Room 1009, Men's Bathroom, Above Suspended Ceiling, On Steel Beam	Library Building, Room 1009, Men's Bathroom, On Wall
Sample Description	Spray On Fire Proofing	Spray On Fire Proofing	Spray On Fire Proofing	Joint Compound and Tape (Joint Compound Layer)
Method of Quantification	Scanning Option	Scanning Option	Scanning Option	Point Count
Appearance	Layered Homogenous Fibrous Color	No Yes Yes Gray	No Yes Yes Gray	Yes No Yes Beige/White
Sample Treatment	None	None	None	Homogenized
Asbestos	% Amosite	ND	ND	ND
Content	% Chrysotile	ND	ND	1.7
	% Other	ND	ND	ND
	% Total Asbestos	ND	ND	1.7
Other Fibrous	% Fibrous Glass	45.0	45.0	ND
Materials	% Cellulose	ND	ND	ND
Present	% Other	ND	ND	ND
	% Unidentified	ND	ND	ND
Non-Fibrous	% Silicates	10.0	10.0	ND
Materials	% Carbonates	20.0	15.0	ND
Present	% Other	ND	ND	ND
	% Unidentified	25.0	30.0	98.3

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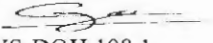
EAS Batch No. 2204039

Eastern Analytical Services, Inc.

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Bulk Sample Results

RE: CPN 22-4715 - SUNY Purchase - Phase 2 Bathroom Renovations - Multiple Buildings

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 Date Received : 06/09/2022
 Date Analyzed : 06/16/2022
 Analyzed By : George Htay
 Signature : 
 Analytical Method : NYS-DOH 198.1
 NVLAP Lab Code : 101646-0
 NYS Lab No. 10851

Client: QuES&T, Inc.
 1376 Route 9
 Wappingers Falls, NY 12590

Sample ID Number	4715-LB-18	4715-LB-19	4715-LB-20	4715-LB-21
Layer Number	2			
Lab ID Number	2834022	2834023	2834024	2834025
Sample Location	Library Building, Room 1009, Men's Bathroom, On Wall	Library Bldg, Rm 1008, Women's Bathrm, Vestibule, Wall, Partition, On Sheetrock	Library Bldg, Rm 1008, Women's Bathrm, Vestibule, Wall, Partition, On Sheetrock	Library Bldg, Rm 1008, Women's Bathrm, Vestibule, Wall, Partition, On Sheetrock
Sample Description	Joint Compound and Tape (Tape Layer)	Joint Compound	Joint Compound	Joint Tape (Tape Only)
Method of Quantification	Scanning Option	Point Count	Point Count	Scanning Option
Appearance	Layered Homogenous Fibrous Color	No Yes Yes Beige	Yes No Yes Beige/White	No Yes Yes Beige
Sample Treatment	None	Homogenized	Homogenized	None
Asbestos	% Amosite	ND	ND	ND
Content	% Chrysotile	ND	1.7	ND
	% Other	ND	ND	ND
	% Total Asbestos	ND	1.7	ND
Other Fibrous	% Fibrous Glass	ND	ND	ND
Materials	% Cellulose	60.0	ND	60.0
Present	% Other	ND	ND	ND
	% Unidentified	ND	ND	ND
Non-Fibrous	% Silicates	10.0	ND	10.0
Materials	% Carbonates	10.0	ND	5.0
Present	% Other	ND	ND	ND
	% Unidentified	20.0	98.3	25.0

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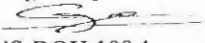
EAS Batch No. 2204039

Eastern Analytical Services, Inc.

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Bulk Sample Results

RE: CPN 22-4715 - SUNY Purchase - Phase 2 Bathroom Renovations - Multiple Buildings

Date Collected : 06/08/2022
 Collected By : S. Talsma/S. Conklin
 Date Received : 06/09/2022
 Date Analyzed : 06/16/2022
 Analyzed By : George Htay
 Signature : 
 Analytical Method : NYS-DOH 198.1
 NVLAP Lab Code : 101646-0
 NYS Lab No. 10851

Client: QuES&T, Inc.
 1376 Route 9
 Wappingers Falls, NY 12590

Sample ID Number	4715-LB-22	4715-LB-23	4715-LB-24	4715-LB-25
Layer Number				
Lab ID Number	2834026	2834027	2834028	2834029
Sample Location	Library Building, Room 1008, Women's Bathroom, On Wall	Library Bldg, Rm 1008, Women's Bathrm, Vestibule, Wall, Partition	Library Building, Room 1009, Men's Bathroom, Under Ceramic Floor Tile	Library Bldg, Rm 1008, Women's Bathrm, Under Ceramic Floor Tile
Sample Description	Sheetrock	Sheetrock	Slab	Slab
Method of Quantification	Scanning Option	Scanning Option	Scanning Option	Scanning Option
Appearance	Layered Homogenous Fibrous Color	Yes No Yes Gray/Brown	Yes No No Gray/Black	Yes No No Gray/Black
Sample Treatment	Homogenized	Homogenized	Homogenized	Homogenized
Asbestos Content	% Amosite % Chrysotile % Other % Total Asbestos	ND ND ND ND	ND ND ND ND	ND ND ND ND
Other Fibrous Materials Present	% Fibrous Glass % Cellulose % Other % Unidentified	5.0 15.0 ND ND	5.0 10.0 ND ND	ND ND ND ND
Non-Fibrous Materials Present	% Silicates % Carbonates % Other % Unidentified	15.0 30.0 ND 35.0	15.0 30.0 ND 40.0	20.0 30.0 ND 50.0
				20.0 35.0 ND 45.0

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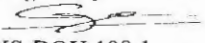
EAS Batch No. 2204039

Eastern Analytical Services, Inc.

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Bulk Sample Results

RE: CPN 22-4715 - SUNY Purchase - Phase 2 Bathroom Renovations - Multiple Buildings

Date Collected : 06/08/2022
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 Date Received : 06/09/2022
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 Analyzed By : George Htay
 Signature : 
 Analytical Method : NYS-DOH 198.1
 NVLAP Lab Code : 101646-0
 NYS Lab No. 10851

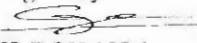
Client: QuES&T, Inc.
 1376 Route 9
 Wappingers Falls, NY 12590

Sample ID Number	4715-LB-26	4715-LB-26	4715-LB-27	4715-LB-27
Layer Number	1	2	1	2
Lab ID Number	2834030	2834030	2834031	2834031
Sample Location	Library Bldg, Rm 1008, Women's Bathroom, Above Suspended Ceiling, Wall, Partition	Library Bldg, Rm 1008, Women's Bathroom, Above Suspended Ceiling, Wall, Partition	Library Building, Room 1009, Men's Bathroom, Above Suspended Ceiling, Wall, Partition	Library Building, Room 1009, Men's Bathroom, Above Suspended Ceiling, Wall, Partition
Sample Description	Cementitious Block and Mortar (Block Layer)	Cementitious Block and Mortar (Mortar Layer)	Cementitious Block and Mortar (Block Layer)	Cementitious Block and Mortar (Mortar Layer)
Method of Quantification	Scanning Option	Scanning Option	Scanning Option	Scanning Option
Appearance	Layered Homogenous Fibrous Color	No Yes No Gray	No No No Gray	No Yes No Gray
Sample Treatment	Homogenized	None	Homogenized	None
Asbestos	% Amosite	ND	ND	ND
Content	% Chrysotile	ND	ND	ND
	% Other	ND	ND	ND
	% Total Asbestos	ND	ND	ND
Other Fibrous	% Fibrous Glass	ND	ND	ND
Materials	% Cellulose	ND	ND	ND
Present	% Other	ND	ND	ND
	% Unidentified	ND	ND	ND
Non-Fibrous	% Silicates	20.0	20.0	30.0
Materials	% Carbonates	30.0	30.0	30.0
Present	% Other	ND	ND	ND
	% Unidentified	50.0	45.0	40.0

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 AJHA LAP, LLC No. 100263 Rhode Island DOH No. AAL-072 Massachusetts DOL No. A A 000072 Connecticut DOH No. PH-0622 Maine DEP No. LA-024 Vermont DOH No. AL-709936

**Bulk Sample Results**

RE: CPN 22-4715 - SUNY Purchase - Phase 2 Bathroom Renovations - Multiple Buildings

Date Collected : 06/08/2022
 Collected By : S. Talsma/S. Conklin
 Date Received : 06/09/2022
 Date Analyzed : 06/16/2022
 Analyzed By : George Htay
 Signature : 
 Analytical Method : NYS-DOH 198.1
 NVLAP Lab Code : 101646-0
 NYS Lab No. 10851

Client: QuES&T, Inc.
 1376 Route 9
 Wappingers Falls, NY 12590


Sample ID Number		4715-LB-30	4715-LB-30	4715-LB-30	4715-LB-31
Layer Number		1	2	3	1
Lab ID Number		2834032	2834032	2834032	2834033
Sample Location		Library Building, Room 1009, Men's Bathroom, Wall, Partition	Library Building, Room 1009, Men's Bathroom, Wall, Partition	Library Building, Room 1009, Men's Bathroom, Wall, Partition	Library Bldg, Rm 1008, Women's Bathroom, Above Suspended Ceiling, Wall, Partition
Sample Description		Ceramic Wall Tile, Grout, Mortar (Tile Layer)	Ceramic Wall Tile, Grout, Mortar (Grout Layer)	Ceramic Wall Tile, Grout, Mortar (Mortar Layer)	Ceramic Wall Tile, Grout, Mortar (Tile Layer)
Method of Quantification		Scanning Option	Scanning Option	Point Count	Scanning Option
Appearance	Layered	Yes	No	No	Yes
	Homogenous	No	Yes	No	No
	Fibrous	No	No	No	No
	Color	White/Beige	Gray	White	White/Beige
Sample Treatment		Homogenized	None	Homogenized	Homogenized
Asbestos Content	% Amosite	ND	ND	ND	ND
	% Chrysotile	ND	ND	1.5	ND
	% Other	ND	ND	ND	ND
	% Total Asbestos	ND	ND	1.5	ND
Other Fibrous Materials Present	% Fibrous Glass	ND	ND	ND	ND
	% Cellulose	ND	ND	ND	ND
	% Other	ND	ND	ND	ND
	% Unidentified	ND	ND	ND	ND
Non-Fibrous Materials Present	% Silicates	40.0	15.0	ND	40.0
	% Carbonates	ND	30.0	ND	ND
	% Other	ND	ND	ND	ND
	% Unidentified	60.0	55.0	98.5	60.0

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Bulk Sample Results

RE: CPN 22-4715 - SUNY Purchase - Phase 2 Bathroom Renovations - Multiple Buildings

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 Analyzed By : George Htay
 Signature : 
 Analytical Method : NYS-DOH 198.1
 NVLAP Lab Code : 101646-0
 NYS Lab No. 10851

Client: QuES&T, Inc.
 1376 Route 9
 Wappingers Falls, NY 12590

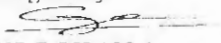
Sample ID Number	4715-LB-31	4715-LB-31	4715-LB-34	4715-LB-34
Layer Number	2	3	1	2
Lab ID Number	2834033	2834033	2834034	2834034
Sample Location	Library Bldg, Rm 1008, Women's Bathroom, Above Suspended Ceiling, Wall, Partition	Library Bldg, Rm 1008, Women's Bathroom, Above Suspended Ceiling, Wall, Partition	Library Building, Room 1008, Women's Bathroom, Floor, On Cement Slab	Library Building, Room 1008, Women's Bathroom, Floor, On Cement Slab
Sample Description	Ceramic Wall Tile, Grout, Mortar (Grout Layer)	Ceramic Wall Tile, Grout, Mortar (Mortar Layer)	Ceramic Floor Tile, Grout, Mudset (Tile Layer)	Ceramic Floor Tile, Grout, Mudset (Grout Layer)
Method of Quantification	Scanning Option	Point Count	Scanning Option	Scanning Option
Appearance	Layered Homogenous Fibrous Color	No No No White	No Yes No Rust	No No No Gray
Sample Treatment	None	Homogenized	None	Homogenized
Asbestos Content	% Amosite % Chrysotile % Other % Total Asbestos	ND 1.5 ND 1.5	ND ND ND ND	ND ND ND ND
Other Fibrous Materials Present	% Fibrous Glass % Cellulose % Other % Unidentified	ND ND ND ND	ND ND ND ND	ND ND ND ND
Non-Fibrous Materials Present	% Silicates % Carbonates % Other % Unidentified	15.0 30.0 ND 55.0	ND ND ND 98.5	40.0 30.0 ND 60.0

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Bulk Sample Results

RE: CPN 22-4715 - SUNY Purchase - Phase 2 Bathroom Renovations - Multiple Buildings

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 NVLAP Lab Code : 101646-0
 NYS Lab No. 10851

Client: QuES&T, Inc.
 1376 Route 9
 Wappingers Falls, NY 12590

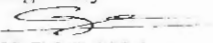
Sample ID Number		4715-LB-34	4715-LB-35	4715-LB-35	4715-LB-35
Layer Number		3	1	2	3
Lab ID Number		2834034	2834035	2834035	2834035
Sample Location		Library Building, Room 1008, Women's Bathroom, Floor, On Cement Slab	Library Building, Room 1009, Men's Bathroom, Floor On Cement Slab	Library Building, Room 1009, Men's Bathroom, Floor On Cement Slab	Library Building, Room 1009, Men's Bathroom, Floor On Cement Slab
Sample Description		Ceramic Floor Tile, Grout, Mudset (Mudset Layer)	Ceramic Floor Tile, Grout, Mudset (Tile Layer)	Ceramic Floor Tile, Grout, Mudset (Grout Layer)	Ceramic Floor Tile, Grout, Mudset (Mudset Layer)
Method of Quantification		Scanning Option		Scanning Option	
Appearance	Layered	No	No	No	No
	Homogenous	No	Yes	No	No
	Fibrous	No	No	No	No
	Color	Brown/Gray	Rust	Gray	Brown/Gray
Sample Treatment		Homogenized		Homogenized	
Asbestos Content	% Amosite	ND	ND	ND	ND
	% Chrysotile	ND	ND	ND	ND
	% Other	ND	ND	ND	ND
	% Total Asbestos	ND	ND	ND	ND
Other Fibrous Materials Present	% Fibrous Glass	ND	ND	ND	ND
	% Cellulose	ND	ND	ND	ND
	% Other	ND	ND	ND	ND
	% Unidentified	ND	ND	ND	ND
Non-Fibrous Materials Present	% Silicates	20.0	40.0	20.0	15.0
	% Carbonates	35.0	ND	30.0	35.0
	% Other	ND	ND	ND	ND
	% Unidentified	45.0	60.0	50.0	50.0

Results Applicable To Those Items Tested. Report Cannot be Reproduced, Except Entirely, Without Written Approval of the Laboratory. ND = Not Detected. Reporting Limit is <1%.
 Liability Limited To Cost Of Analysis. This Report Must Not be Used by the Client to Claim Product Endorsement by NVLAP or Any Agency of the US Government.
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 AIHA LAP, LLC No. 100263 Rhode Island DOH No. AAL-072 Massachusetts DOL No. A A 000072 Connecticut DOH No. PH-0622 Maine DEP No. LA-024 Vermont DOH No. AL-709936



Bulk Sample Results

RE: CPN 22-4715 - SUNY Purchase - Phase 2 Bathroom Renovations - Multiple Buildings

Date Collected : 06/08/2022
 Collected By : S. Talsma/S. Conklin
 Date Received : 06/09/2022
 Date Analyzed : 06/16/2022
 Analyzed By : George Htay
 Signature : 
 Analytical Method : NYS-DOH 198.1
 NVLAP Lab Code : 101646-0
 NYS Lab No. 10851

Client: QuES&T, Inc.
 1376 Route 9
 Wappingers Falls, NY 12590

Sample ID Number		4715-MB-38	4715-MB-39	4715-MB-40	4715-MB-41
Layer Number					
Lab ID Number		2834036	2834037	2834038	2834039
Sample Location		Music Building, Room 0004A, Women's Bathroom, Ceiling	Music Building, Room 0004, Men's Bathroom, Wall	Music Building, Room 0004A, Women's Bathroom, Wall	Music Building, Room 0004A, Women's Bathroom, On Wall
Sample Description		Plaster (Scratch Only)	Plaster (Scratch Only)	Plaster (Scratch Only)	Sheetrock
Method of Quantification		Scanning Option	Scanning Option	Scanning Option	Scanning Option
Appearance	Layered	No	No	No	No
	Homogenous	Yes	Yes	Yes	Yes
	Fibrous	No	No	No	Yes
	Color	Gray/Brown	Gray/Brown	Gray/Brown	Gray
Sample Treatment		None	None	None	None
Asbestos Content	% Amosite	ND	ND	ND	ND
	% Chrysotile	ND	ND	ND	ND
	% Other	ND	ND	ND	ND
	% Total Asbestos	ND	ND	ND	ND
Other Fibrous Materials Present	% Fibrous Glass	ND	ND	ND	10.0
	% Cellulose	ND	ND	ND	ND
	% Other	ND	ND	ND	ND
	% Unidentified	ND	ND	ND	ND
Non-Fibrous Materials Present	% Silicates	25.0	30.0	25.0	20.0
	% Carbonates	30.0	30.0	30.0	30.0
	% Other	ND	ND	ND	ND
	% Unidentified	45.0	40.0	45.0	40.0

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 ALHA LAP, LLC No. 100263 Rhode Island DOH No. AAL-072 Massachusetts DOL No. A A 000072 Connecticut DOH No. PH-0622 Maine DEP No. LA-024 Vermont DOH No. AL-709936



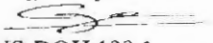
EAS Batch No. 2204039

Eastern Analytical Services, Inc.

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Bulk Sample Results

RE: CPN 22-4715 - SUNY Purchase - Phase 2 Bathroom Renovations - Multiple Buildings

Date Collected : 06/08/2022
 Collected By : S. Talsma/S. Conklin
 Date Received : 06/09/2022
 Date Analyzed : 06/16/2022
 Analyzed By : George Htay
 Signature : 
 Analytical Method : NYS-DOH 198.1
 NVLAP Lab Code : 101646-0
 NYS Lab No. 10851

Client: QuES&T, Inc.
 1376 Route 9
 Wappingers Falls, NY 12590

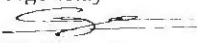
Sample ID Number	4715-MB-42	4715-MB-43	4715-MB-43	4715-MB-44
Layer Number		1	2	1
Lab ID Number	2834040	2834041	2834041	2834042
Sample Location	Music Building, Room 0004, Men's Bathroom, On Wall	Music Building, Room 0002D, Workshop, Wall	Music Building, Room 0002D, Workshop, Wall	Music Building, Room 0002D, Workshop, Wall
Sample Description	Sheetrock	Cementitious Block and Mortar (Block Layer)	Cementitious Block and Mortar (Mortar Layer)	Cementitious Block and Mortar (Block Layer)
Method of Quantification	Scanning Option	Scanning Option	Scanning Option	Scanning Option
Appearance	Layered Homogenous Fibrous Color	No No No Gray/White	No Yes No Gray	No No No Gray/White
Sample Treatment	None	Homogenized	None	Homogenized
Asbestos Content	% Amosite % Chrysotile % Other % Total Asbestos	ND ND ND ND	ND ND ND ND	ND ND ND ND
Other Fibrous Materials Present	% Fibrous Glass % Cellulose % Other % Unidentified	10.0 ND ND ND	ND ND ND ND	ND ND ND ND
Non-Fibrous Materials Present	% Silicates % Carbonates % Other % Unidentified	20.0 35.0 ND 35.0	25.0 35.0 ND 40.0	35.0 25.0 ND 40.0
				20.0 35.0 ND 45.0

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 AIHA LAP, LLC No. 100263 Rhode Island DOH No. AAL-072 Massachusetts DOL No. A A 000072 Connecticut DOH No. PH-0622 Maine DEP No. LA-024 Vermont DOH No. AL-709936



Bulk Sample Results

RE: CPN 22-4715 - SUNY Purchase - Phase 2 Bathroom Renovations - Multiple Buildings

Date Collected : 06/08/2022
 Collected By : S. Talsma/S. Conklin
 Date Received : 06/09/2022
 Date Analyzed : 06/16/2022
 Analyzed By : George Htay
 Signature : 
 Analytical Method : NYS-DOH 198.1
 NVLAP Lab Code : 101646-0
 NYS Lab No. 10851

Client: QuES&T, Inc.
 1376 Route 9
 Wappingers Falls, NY 12590

Sample ID Number		4715-MB-44	4715-MB-47	4715-MB-47	4715-MB-48
Layer Number		2	1	2	1
Lab ID Number		2834042	2834043	2834043	2834044
Sample Location		Music Building, Room 0002D, Workshop, Wall	Music Building, Room 0004, Men's Bathroom, On Wall	Music Building, Room 0004, Men's Bathroom, On Wall	Music Building, Room 0004A, Women's Bathroom, On Wall
Sample Description		Cementitious Block and Mortar (Mortar Layer)	Ceramic Wall Tile, Grout, Adhesive (Tile Layer)	Ceramic Wall Tile, Grout, Adhesive (Grout Layer)	Ceramic Wall Tile, Grout, Adhesive (Tile Layer)
Method of Quantification		Scanning Option	Scanning Option	Scanning Option	Scanning Option
Appearance	Layered	No	Yes	No	Yes
	Homogenous	Yes	No	Yes	No
	Fibrous	No	No	No	No
	Color	Gray	White	White	White
Sample Treatment		None	Homogenized	None	Homogenized
Asbestos Content	% Amosite	ND	ND	ND	ND
	% Chrysotile	ND	ND	ND	ND
	% Other	ND	ND	ND	ND
	% Total Asbestos	ND	ND	ND	ND
Other Fibrous Materials Present	% Fibrous Glass	ND	ND	ND	ND
	% Cellulose	ND	ND	ND	ND
	% Other	ND	ND	ND	ND
	% Unidentified	ND	ND	ND	ND
Non-Fibrous Materials Present	% Silicates	35.0	30.0	10.0	30.0
	% Carbonates	20.0	20.0	35.0	20.0
	% Other	ND	ND	ND	ND
	% Unidentified	45.0	50.0	55.0	50.0

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 AIHA LAP, LLC No. 100263 Rhode Island DOH No. AAL-072 Massachusetts DOL No. A A 000072 Connecticut DOH No. PH-0622 Maine DEP No. LA-024 Vermont DOH No. AL-709936



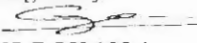
EAS Batch No. 2204039

Eastern Analytical Services, Inc.

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Bulk Sample Results

RE: CPN 22-4715 - SUNY Purchase - Phase 2 Bathroom Renovations - Multiple Buildings

Date Collected : 06/08/2022
 Collected By : S. Talsma/S. Conklin
 Date Received : 06/09/2022
 Date Analyzed : 06/16/2022
 Analyzed By : George Htay
 Signature : 
 Analytical Method : NYS-DOH 198.1
 NVLAP Lab Code : 101646-0
 NYS Lab No. 10851

Client: QuES&T, Inc.
 1376 Route 9
 Wappingers Falls, NY 12590

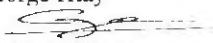
Sample ID Number	4715-MB-48	4715-MB-51	4715-MB-51	4715-MB-51
Layer Number	2	1	2	3
Lab ID Number	2834044	2834045	2834045	2834045
Sample Location	Music Building, Room 0004A, Women's Bathroom, On Wall	Music Building, Room 0004, Men's Bathroom, Floor, On Slab	Music Building, Room 0004, Men's Bathroom, Floor, On Slab	Music Building, Room 0004, Men's Bathroom, Floor, On Slab
Sample Description	Ceramic Wall Tile, Grout, Adhesive (Grout Layer)	Ceramic Floor Tile, Grout, Setting Bed (Tile Layer)	Ceramic Floor Tile, Grout, Setting Bed (Grout Layer)	Ceramic Floor Tile, Grout, Setting Bed (Setting Bed Layer)
Method of Quantification	Scanning Option	Scanning Option	Scanning Option	Scanning Option
Appearance	Layered Homogenous Fibrous Color	No Yes No White	No Yes No Brown	Yes No No Brown/Gray
Sample Treatment	None	None	None	Homogenized
Asbestos Content	% Amosite % Chrysotile % Other % Total Asbestos	ND ND ND ND	ND ND ND ND	ND ND ND ND
Other Fibrous Materials Present	% Fibrous Glass % Cellulose % Other % Unidentified	ND ND ND ND	ND ND ND ND	ND ND ND ND
Non-Fibrous Materials Present	% Silicates % Carbonates % Other % Unidentified	10.0 35.0 ND 55.0	45.0 ND ND 55.0	25.0 30.0 ND 45.0

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 AIHA LAP, LLC No. 100263 Rhode Island DOH No. AAL-072 Massachusetts DOL No. A A 000072 Connecticut DOH No. PH-0622 Maine DEP No. LA-024 Vermont DOH No. AL-709936



Bulk Sample Results

RE: CPN 22-4715 - SUNY Purchase - Phase 2 Bathroom Renovations - Multiple Buildings

Date Collected : 06/08/2022
 Collected By : S. Talsma/S. Conklin
 Date Received : 06/09/2022
 Date Analyzed : 06/16/2022
 Analyzed By : George Htay
 Signature : 
 Analytical Method : NYS-DOH 198.1
 NVLAP Lab Code : 101646-0
 NYS Lab No. 10851

Client: QuES&T, Inc.
 1376 Route 9
 Wappingers Falls, NY 12590

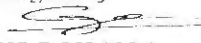
Sample ID Number	4715-MB-52	4715-MB-52	4715-MB-52	4715-PE-60
Layer Number	1	2	3	1
Lab ID Number	2834046	2834046	2834046	2834047
Sample Location	Music Building, Room 0004, Men's Bathroom, Floor, On Slab	Music Building, Room 0004, Men's Bathroom, Floor, On Slab	Music Building, Room 0004, Men's Bathroom, Floor, On Slab	Physical Education Building, Room 2013, Men's Bathroom, Ceiling
Sample Description	Ceramic Floor Tile, Grout, Setting Bed (Tile Layer)	Ceramic Floor Tile, Grout, Setting Bed (Grout Layer)	Ceramic Floor Tile, Grout, Setting Bed (Setting Bed Layer)	Plaster (Plaster Layer)
Method of Quantification	Scanning Option	Scanning Option	Scanning Option	Scanning Option
Appearance	Layered Homogenous Fibrous Color	No Yes No Brown	No Yes No Gray	Yes No No Brown/Gray
Sample Treatment	None	None	Homogenized	Homogenized
Asbestos Content	% Amosite % Chrysotile % Other % Total Asbestos	ND ND ND ND	ND ND ND ND	ND ND ND ND
Other Fibrous Materials Present	% Fibrous Glass % Cellulose % Other % Unidentified	ND ND ND ND	ND ND ND ND	ND ND ND ND
Non-Fibrous Materials Present	% Silicates % Carbonates % Other % Unidentified	45.0 ND ND 55.0	25.0 30.0 ND 45.0	20.0 30.0 ND 50.0

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 AIHA LAP, LLC No. 100263 Rhode Island DOH No. AAL-072 Massachusetts DOL No. A A 009072 Connecticut DOH No. PH-0622 Maine DEP No. LA-024 Vermont DOH No. AL-709936



Bulk Sample Results

RE: CPN 22-4715 - SUNY Purchase - Phase 2 Bathroom Renovations - Multiple Buildings

Date Collected : 06/08/2022
 Collected By : S. Talsma/S. Conklin
 Date Received : 06/09/2022
 Date Analyzed : 06/16/2022
 Analyzed By : George Htay
 Signature : 
 Analytical Method : NYS-DOH 198.1
 NVLAP Lab Code : 101646-0
 NYS Lab No. 10851

Client: QuES&T, Inc.
 1376 Route 9
 Wappingers Falls, NY 12590

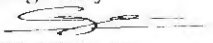
Sample ID Number		4715-PE-60	4715-PE-61	4715-PE-61	4715-PE-62
Layer Number		2	1	2	1
Lab ID Number		2834047	2834048	2834048	2834049
Sample Location		Physical Education Building, Room 2013, Men's Bathroom, Ceiling	Physical Education Building, Room 2012, Women's Bathroom, Wall, Partition	Physical Education Building, Room 2012, Women's Bathroom, Wall, Partition	Physical Education Building, Room 2012, Women's Bathroom, Wall, Partition
Sample Description		Plaster (Scratch Layer)	Plaster (Plaster Layer)	Plaster (Scratch Layer)	Plaster (Plaster Layer)
Method of Quantification		Scanning Option		Scanning Option	
Appearance	Layered	No	Yes	No	Yes
	Homogenous	Yes	No	Yes	No
	Fibrous	No	No	No	No
	Color	Brown/Gray	White	Brown/Gray	White
Sample Treatment		None	Homogenized	None	Homogenized
Asbestos Content	% Amosite	ND	ND	ND	ND
	% Chrysotile	ND	ND	ND	ND
	% Other	ND	ND	ND	ND
	% Total Asbestos	ND	ND	ND	ND
Other Fibrous Materials Present	% Fibrous Glass	ND	ND	ND	ND
	% Cellulose	ND	ND	ND	ND
	% Other	ND	ND	ND	ND
	% Unidentified	ND	ND	ND	ND
Non-Fibrous Materials Present	% Silicates	30.0	5.0	30.0	10.0
	% Carbonates	25.0	50.0	25.0	50.0
	% Other	ND	ND	ND	ND
	% Unidentified	45.0	45.0	45.0	40.0

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Bulk Sample Results

RE: CPN 22-4715 - SUNY Purchase - Phase 2 Bathroom Renovations - Multiple Buildings

Date Collected : 06/08/2022
 Collected By : S. Talsma/S. Conklin
 Date Received : 06/09/2022
 Date Analyzed : 06/16/2022
 Analyzed By : George Htay
 Signature : 
 Analytical Method : NYS-DOH 198.1
 NVLAP Lab Code : 101646-0
 NYS Lab No. 10851

Client: QuES&T, Inc.
 1376 Route 9
 Wappingers Falls, NY 12590

Sample ID Number	4715-PE-62	4715-PE-63	4715-PE-63	4715-PE-63
Layer Number	2	1	2	3
Lab ID Number	2834049	2834050	2834050	2834050
Sample Location	Physical Education Building, Room 2012, Women's Bathroom, Wall, Partition	Physical Education Building, Room 2013, Men's Bathroom, On Wall	Physical Education Building, Room 2013, Men's Bathroom, On Wall	Physical Education Building, Room 2013, Men's Bathroom, On Wall
Sample Description	Plaster (Scratch Layer)	Ceramic Wall Tile, Grout, Mortar (Tile Layer)	Ceramic Wall Tile, Grout, Mortar (Grout Layer)	Ceramic Wall Tile, Grout, Mortar (Mortar Layer)
Method of Quantification	Scanning Option	Scanning Option	Scanning Option	Scanning Option
Appearance	Layered Homogenous Fibrous Color	No Yes No Brown/Gray	Yes No No White	No Yes No Gray
Sample Treatment	None	Homogenized	None	None
Asbestos Content	% Amosite % Chrysotile % Other % Total Asbestos	ND ND ND ND	ND ND ND ND	ND ND ND ND
Other Fibrous Materials Present	% Fibrous Glass % Cellulose % Other % Unidentified	ND ND ND ND	ND ND ND ND	ND ND ND ND
Non-Fibrous Materials Present	% Silicates % Carbonates % Other % Unidentified	30.0 30.0 ND 40.0	45.0 ND ND 55.0	15.0 30.0 ND 55.0
				30.0 25.0 ND 45.0

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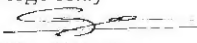
EAS Batch No. 2204039

Eastern Analytical Services, Inc.

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Bulk Sample Results

RE: CPN 22-4715 - SUNY Purchase - Phase 2 Bathroom Renovations - Multiple Buildings

Date Collected : 06/08/2022
 Collected By : S. Talsma/S. Conklin
 Date Received : 06/09/2022
 Date Analyzed : 06/16/2022
 Analyzed By : George Htay
 Signature : 
 Analytical Method : NYS-DOH 198.1
 NVLAP Lab Code : 101646-0
 NYS Lab No. 10851

Client: QuES&T, Inc.
 1376 Route 9
 Wappingers Falls, NY 12590


Sample ID Number	4715-PE-64	4715-PE-64	4715-PE-64	4715-PE-65
Layer Number	1	2	3	1
Lab ID Number	2834051	2834051	2834051	2834052
Sample Location	Physical Education Building, Room 2013, Men's Bathroom, On Wall	Physical Education Building, Room 2013, Men's Bathroom, On Wall	Physical Education Building, Room 2013, Men's Bathroom, On Wall	Physical Education Building, 2nd Floor Hallway, Outside Room 2013 Men's Bathroom, Wall
Sample Description	Ceramic Wall Tile, Grout, Mortar (Tile Layer)	Ceramic Wall Tile, Grout, Mortar (Grout Layer)	Ceramic Wall Tile, Grout, Mortar (Mortar Layer)	Brick and Mortar (Brick Layer)
Method of Quantification	Scanning Option	Scanning Option	Scanning Option	Scanning Option
Appearance	Layered Homogenous Fibrous Color	Yes No No White	No Yes No White	No Yes No Gray
Sample Treatment	Homogenized	None	None	Homogenized
Asbestos Content	% Amosite % Chrysotile % Other % Total Asbestos	ND ND ND ND	ND ND ND ND	ND ND ND ND
Other Fibrous Materials Present	% Fibrous Glass % Cellulose % Other % Unidentified	ND ND ND ND	ND ND ND ND	ND ND ND ND
Non-Fibrous Materials Present	% Silicates % Carbonates % Other % Unidentified	45.0 ND ND 55.0	15.0 35.0 ND 50.0	30.0 25.0 ND 45.0
				70.0

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 AIHA LAP, LLC No. 100263 Rhode Island DOH No. AAL-072 Massachusetts DOL No. A A 090072 Connecticut DOH No. PH-0622 Maine DEP No. LA-024 Vermont DOH No. AL-709936



Bulk Sample Results

RE: CPN 22-4715 - SUNY Purchase - Phase 2 Bathroom Renovations - Multiple Buildings

Date Collected : 06/08/2022
 Collected By : S. Talsma/S. Conklin
 Date Received : 06/09/2022
 Date Analyzed : 06/16/2022
 Analyzed By : George Htay
 Signature : 
 Analytical Method : NYS-DOH 198.1
 NVLAP Lab Code : 101646-0
 NYS Lab No. 10851

Client: QuES&T, Inc.
 1376 Route 9
 Wappingers Falls, NY 12590


Sample ID Number	4715-PE-65	4715-PE-66	4715-PE-66	4715-PE-67
Layer Number	2	1	2	1
Lab ID Number	2834052	2834053	2834053	2834054
Sample Location	Physical Education Building, 2nd Floor Hallway, Outside Room 2013 Men's Bathroom, Wall	Physical Education Building, 2nd Floor, Hallway, Outside Room 2012 Women's Bathroom,	Physical Education Building, 2nd Floor, Hallway, Outside Room 2012 Women's Bathroom,	Physical Education Building, Room 2013, Men's Bathroom, Floor
Sample Description	Brick and Mortar (Mortar Layer)	Brick and Mortar (Brick Layer)	Brick and Mortar (Mortar Layer)	Quarry Tile, Grout, Mudset (Tile Layer)
Method of Quantification	Scanning Option	Scanning Option	Scanning Option	Scanning Option
Appearance	Layered No Homogenous Yes Fibrous No Color Gray	No No No Brown	No Yes No Gray	No Yes No Brown
Sample Treatment	None	Homogenized	None	None
Asbestos Content	% Amosite ND % Chrysotile ND % Other ND % Total Asbestos ND	ND ND ND ND	ND ND ND ND	ND ND ND ND
Other Fibrous Materials Present	% Fibrous Glass ND % Cellulose ND % Other ND % Unidentified ND	ND ND ND ND	ND ND ND ND	ND ND ND ND
Non-Fibrous Materials Present	% Silicates 30.0 % Carbonates 25.0 % Other ND % Unidentified 45.0	30.0 ND ND 70.0	30.0 25.0 ND 45.0	45.0 ND ND 55.0

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 AIHA LAP, LLC No. 100263 Rhode Island DOH No. AAL-072 Massachusetts DOI, No. A A 000072 Connecticut DOH No. PH-0622 Maine DEP No. LA-024 Vermont DOH No. AL-709936



Bulk Sample Results

RE: CPN 22-4715 - SUNY Purchase - Phase 2 Bathroom Renovations - Multiple Buildings

Date Collected : 06/08/2022
 Collected By : S. Talsma/S. Conklin
 Date Received : 06/09/2022
 Date Analyzed : 06/16/2022
 Analyzed By : George Htay
 Signature : 
 Analytical Method : NYS-DOH 198.1
 NVLAP Lab Code : 101646-0
 NYS Lab No. 10851

Client: QuES&T, Inc.
 1376 Route 9
 Wappingers Falls, NY 12590

Sample ID Number	4715-PE-67	4715-PE-67	4715-PE-68	4715-PE-68
Layer Number	2	3	1	2
Lab ID Number	2834054	2834054	2834055	2834055
Sample Location	Physical Education Building, Room 2013, Men's Bathroom, Floor	Physical Education Building, Room 2013, Men's Bathroom, Floor	Physical Education Building, Room 2012, Women's Bathroom, Floor	Physical Education Building, Room 2012, Women's Bathroom, Floor
Sample Description	Quarry Tile, Grout, Mudset (Grout Layer)	Quarry Tile, Grout, Mudset (Mudset Layer)	Quarry Tile, Grout, Mudset (Tile Layer)	Quarry Tile, Grout, Mudset (Grout Layer)
Method of Quantification	Scanning Option	Scanning Option	Scanning Option	Scanning Option
Appearance	Layered Homogenous Fibrous Color	No No No Rust	No Yes No Brown	No No No Rust
Sample Treatment	Homogenized	Homogenized	None	Homogenized
Asbestos Content	% Amosite % Chrysotile % Other % Total Asbestos	ND ND ND ND	ND ND ND ND	ND ND ND ND
Other Fibrous Materials Present	% Fibrous Glass % Cellulose % Other % Unidentified	ND ND ND ND	ND ND ND ND	ND ND ND ND
Non-Fibrous Materials Present	% Silicates % Carbonates % Other % Unidentified	30.0 20.0 ND 50.0	20.0 30.0 ND 50.0	45.0 ND ND 55.0
				30.0 20.0 ND 50.0

Results Applicable To Those Items Tested. Report Cannot be Reproduced, Except Entirely, Without Written Approval of the Laboratory. ND - Not Detected. Reporting Limit is <1%.
 Liability Limited To Cost Of Analysis. This Report Must Not be Used by the Client to Claim Product Endorsement by NVLAP or Any Agency of the US Government.
 These Results Can Not Be Used To Claim That NOB Items Tested Are Non-Asbestos Containing. Overall Lab Accuracy $\pm 17\%$. Samples received in acceptable condition unless otherwise noted.
 AIHA LAP, LLC No. 100263 Rhode Island DOH No. AAL-072 Massachusetts DOL No. A A 900072 Connecticut DOH No. PH-0622 Maine DEP No. LA-024 Vermont DOH No. AL-709936



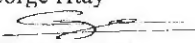
EAS Batch No. 2204039

Eastern Analytical Services, Inc.

Page 23 of 23

Bulk Sample Results

RE: CPN 22-4715 - SUNY Purchase - Phase 2 Bathroom Renovations - Multiple Buildings

Date Collected : 06/08/2022
 Collected By : S. Talsma/S. Conklin
 Date Received : 06/09/2022
 Date Analyzed : 06/16/2022
 Analyzed By : George Htay
 Signature : 
 Analytical Method : NYS-DOH 198.1
 NVLAP Lab Code : 101646-0
 NYS Lab No. 10851

Client: QuES&T, Inc.
 1376 Route 9
 Wappingers Falls, NY 12590

Sample ID Number 4715-PE-68
 Layer Number 3
 Lab ID Number 2834055
 Sample Location Physical Education
 Building, Room
 2012, Women's
 Bathroom, Floor
 Sample Description Quarry Tile, Grout,
 Mudset
 (Mudset Layer)

Method of Quantification Scanning Option

Appearance	Layered	No
	Homogenous	No
	Fibrous	No
	Color	Gray

Sample Treatment Homogenized

Asbestos	% Amosite	ND
Content	% Chrysotile	ND
	% Other	ND
	% Total Asbestos	ND

Other Fibrous	% Fibrous Glass	ND
Materials	% Cellulose	ND
Present	% Other	ND
	% Unidentified	ND

Non-Fibrous	% Silicates	20.0
Materials	% Carbonates	30.0
Present	% Other	ND
	% Unidentified	50.0

Results Applicable To Those Items Tested. Report Cannot be Reproduced, Except Entirely, Without Written Approval of the Laboratory. ND - Not Detected. Reporting Limit is < 1%
 Liability Limited To Cost Of Analysis. This Report Must Not be Used by the Client to Claim Product Endorsement by NVLAP or Any Agency of the US Government.
 These Results Can Not Be Used To Claim That NOB Items Tested Are Non-Asbestos Containing. Overall Lab Accuracy \pm 17%. Samples received in acceptable condition unless otherwise noted.
 AIHA LAP, LLC No. 109263 Rhode Island DOH No. AAL-072 Massachusetts DOL No. A A 000072 Connecticut DOH No. PH-0622 Maine DEP No. LA-024 Vermont DOH No. AL-709936

Eastern Analytical Services, Inc.
Chain of Custody Form

EAS Client: QuES&T, Inc.
1376 Route 9
Wappingers Falls, NY 12590

EAS Batch No. 2204039
Turn-Around: 5 Day
Shipped Via: NY DB004
State of Origin: NY
Sample Disposition: Standard x
Return

Analyte: % Asb

No. of Samples 47
Received:

No. of Samples 47
Analyzed:

Client Project RE: CPN 22-4715 - SUNY Purchase - Phase 2 Bathroom
Number/Name: Renovations - Multiple Buildings

Lab ID Numbers: 2834009-2834018;2834019-2834031;2834032-2834033;2834034-
2834035;2834036-2834042;2834043-2834044;2834045-
2834046;2834047-2834055

Collected By: S. Talsma/S. Conklin

Date: 06/08/2022

Received By: Joseph B. LaPuebla



Date: 06/09/2022

Time: 2104

Logged In By: Marita Prado



Date: 06/14/2022

Prepped By: Marita Prado
George Htay




Date: 06/15-16/2022

Analyzed By: George Htay



Date: 06/16/2022

Time: 1345

Re-Analyzed By: George Htay



Date: 06/16/2022

Checked By: Damien Warner



Date: 06/17/2022

E-Transmitted By: Damien Warner



Date: 06/17/2022

Time: 1152

Logged Out By:

Date:

QUALITY ENVIRONMENTAL SOLUTIONS & TECHNOLOGIES, INC.

BULK SAMPLE FORM

CLIENT: SUNY Purchase

SAMPLED BY: S. Talsma/S. Conklin

ADDRESS: 735 Anderson Hill Road

DATE SAMPLED: 8-Jun-22

Purchase, NY 10577

CONTACT: Anne-Marie Russillo

ANALYSIS METHOD: PLM/PLM-NOB/QTEM as required.

PROJECT ID: Phase 2 Bathroom Renovations -

TURN-AROUND TIME: _____ HOURS

Multiple Buildings

5 DAYS

PROJECT #: 22-4715

OTHER _____

SAMPLE # LAB#	LOCATION	SAMPLE DESCRIPTION	COMMENTS
4715-DB-01 2834009	Dance Building, Room 1011, Men's Bathroom, Wall, Upper	Cementitious Block and Mortar (SEPARATE LAYERS)	
4715-DB-02 2834010	Dance Building, Room 1013, Wall, Partition	Cementitious Block and Mortar (SEPARATE LAYERS)	
4715-DB-03 2834011	Dance Building, Room 1043, Custodial, Floor	Slab	
4715-DB-04 2834012	Dance Building, Room 1011m Men's Bathroom, Floor, Under Tile	Slab	
4715-DB-05 2834013	Dance Building, Room 1043, Custodial	Slop Sink	
4715-DB-06 2834014	Dance Building, Room 1043, Custodial	Slop Sink	
4715-DB-07 2834015	Dance Building, Room 1044, Women's Bathroom, On Wall	Ceramic Wall Tile, Grout, Mortar (SEPARATE LAYERS)	
4715-DB-08 2834016	Dance Building, Room 1011, Men's Bathroom, On Wall	Ceramic Wall Tile, Grout, Mortar (SEPARATE LAYERS)	
4715-DB-09 2834017	Dance Building, Room 1044, Women's Bathroom, Floor	Ceramic Floor Tile, Grout, Mudset (SEPARATE LAYERS)	
4715-DB-10 2834018	Dance Building, Room 1011, Mens Bathroom, Floor	Ceramic Floor Tile, Grout, Mudset (SEPARATE LAYERS)	

CHAIN OF CUSTODY (SEE LAST PAGE)

SUBMITTED BY: [Signature]

DATE: 9-Jun-22

RECEIVED BY: [Signature]

DATE: JUN 9 '22 21:05

PAGE 1 OF 7

AS LABELED ON PAPERWORK

INITIAL/DATE MP, 6/14/22

QUALITY ENVIRONMENTAL SOLUTIONS & TECHNOLOGIES, INC.

BULK SAMPLE FORM

CLIENT: SUNY Purchase

ADDRESS: 735 Anderson Hill Road
Purchase, NY 10577

CONTACT: Anne-Marie Russillo

PROJECT ID: Phase 2 Bathroom Renovations -
Multiple Buildings

PROJECT #: 22-4715

SAMPLED BY: S. Talsma/S. Conklin

DATE SAMPLED: 8-Jun-22

ANALYSIS METHOD: PLM/PLM-NOB/QTEM as required.

TURN-AROUND TIME: _____ HOURS
5 DAYS
 OTHER _____

SAMPLE # LAB#	LOCATION	SAMPLE DESCRIPTION	COMMENTS
4715-DB-11 ✚	Dance Building, Room 1013, Custodial, Floor, 12' x 12' Tile	Peel and Stick	
4715-DB-12 ✚	Dance Building, Room 1013, Custodial, Floor, 12' x 12' Tile	Peel and Stick	
4715-DB-13 ✚	Dance Building, Room 1044, Women's Bathroom, Sink Counter to Ceramic Wall Tile	Caulk	
4715-DB-14 ✚	Dance Building, Room 1044, Women's Bathroom, Sink Counter to Ceramic Wall Tile	Caulk	
4715-LB-15 2834019	Library Building, Room 1008, Women's Bathroom, Above Suspended Ceiling, On Steel Beam	Spray On Fire Proofing	
4715-LB-16 2834020	Library Building, Room 1009, Men's Bathroom, Above Suspended Ceiling, On Steel Beam	Spray On Fire Proofing	
4715-LB-17 2834021	Library Building, Room 1009, Men's Bathroom, Above Suspended Ceiling, On Steel Beam	Spray On Fire Proofing	
4715-LB-18 2834022	Library Building, Room 1009, Mens Bathroom, On Wall	Joint Compound and Tape (SEPARATE LAYERS)	
4715-LB-19 2834023	Library Building, Room 1008, Women's Bathroom, Vestibule, Wall, Partition, On Sheetrock	Joint Compound	
4715-LB-20 2834024	Library Building, Room 1008, Women's Bathroom, Vestibule, Wall, Partition, On Sheetrock	Joint Compound	

CHAIN OF CUSTODY (SEE LAST PAGE)

SUBMITTED BY: [Signature] DATE: 9-Jun-22

RECEIVED BY: [Signature] DATE: JUN 9'22 21:05

QUALITY ENVIRONMENTAL SOLUTIONS & TECHNOLOGIES, INC.

BULK SAMPLE FORM

CLIENT: SUNY Purchase

SAMPLED BY: S. Talsma/S. Conklin

ADDRESS: 735 Anderson Hill Road

DATE SAMPLED: 8-Jun-22

Purchase, NY 10577

CONTACT: Anne-Marie Russillo

ANALYSIS METHOD: PLM/PLM-NOB/OTEM as required.

PROJECT ID: Phase 2 Bathroom Renovations -

TURN-AROUND TIME: _____ HOURS

Multiple Buildings

5 DAYS

PROJECT #: 22-4715

OTHER

SAMPLE # LAB#	LOCATION	SAMPLE DESCRIPTION	COMMENTS
4715-LB-21 2834025	Library Building, Room 1008, Women's Bathroom, Vestibule, Wall, Partition, On Sheetrock	Joint Tape (TAPE ONLY)	
4715-LB-22 2834026	Library Building, Room 1008, Women's Bathroom, On Wall	Sheetrock	
4715-LB-23 2834027	Library Building, Room 1008, Women's Bathroom, Vestibule, Wall, Partition	Sheetrock	
4715-LB-24 2834028	Library Building, Room 1009, Men's Bathroom, Under Ceramic Floor Tile	Slab	
4715-LB-25 2834029	Library Building, Room 1008, Women's Bathroom, Under Ceramic Floor Tile	Slab	
4715-LB-26 2834030	Library Building, Room 1008, Womens Bathroom, Above Suspended Ceiling, Wall, Partition	Cementitious Block and Mortar (SEPARATE LAYERS)	
4715-LB-27 2834031	Library Building, Room 1009, Men's Bathroom, Above Suspended Ceiling, Wall, Partition	Cementitious Block and Mortar (SEPARATE LAYERS)	
4715-LB-28 x	Library Building, Room 1008, Women's Bathroom, Dot and Canyon	Ceiling Tile	
4715-LB-29 f	Library Building, Room 1009, Men's Bathroom, Dot and Canyon	Ceiling Tile	
4715-LB-30 2834032	Library Building, Room 1009, Men's Bathroom, Wall, Partition	Ceramic Wall Tile, Grout, Mortar (SEPARATE LAYERS)	

CHAIN OF CUSTODY (SEE LAST PAGE)

SUBMITTED BY: [Signature]

DATE: 9-Jun-22

RECEIVED BY: [Signature]

DATE: _____

JUN 9'22 21:05

QUALITY ENVIRONMENTAL SOLUTIONS & TECHNOLOGIES, INC.

BULK SAMPLE FORM

CLIENT: SUNY Purchase
 ADDRESS: 735 Anderson Hill Road
Purchase, NY 10577
 CONTACT: Anne-Marie Russillo
 PROJECT ID: Phase 2 Bathroom Renovations -
Multiple Buildings

SAMPLED BY: S. Talsma/S. Conklin
 DATE SAMPLED: 8-Jun-22
 ANALYSIS METHOD: PLM/PLM-NOB/QTEM as required.
 TURN-AROUND TIME: _____ HOURS
5 DAYS
 OTHER

PROJECT #: 22-4715

SAMPLE # LAB#	LOCATION	SAMPLE DESCRIPTION	COMMENTS
4715-LB-31 2834033 ✓	Library Building, Room 1008, Women's Bathroom, Wall, Partition	Ceramic Wall Tile, Grout, Mortar (SEPARATE LAYERS)	
4715-LB-32 +	Library Building, Room 1008, Women's Bathroom, On Wall	Cove base Molding and Mastic (SEPARATE LAYERS)	
4715-LB-33 +	Library Building, Room 1009, Men's Bathroom, On Wall	Cove base Molding and Mastic (SEPARATE LAYERS)	
4715-LB-34 2834034 ✓	Library Building, Room 1008, Women's Bathroom, Floor, On Cement Slab	Ceramic Floor Tile, Grout, Mudset (SEPARATE LAYERS)	
4715-LB-35 2834035 ✓	Library Building, Room 1009, Men's Bathroom, Floor, On Cement Slab	Ceramic Floor Tile, Grout, Mudset (SEPARATE LAYERS)	
4715-LB-36 ✖	Library Building, Room 1009, Men's Bathroom, Floor	Floor Tile and Mastic (SEPARATE LAYERS)	
4715-LB-37 +	Library Building, Room 1008, Women's Bathroom, Floor	Floor Tile and Mastic (SEPARATE LAYERS)	
4715-MB-38 2834036 ✓	Music Building, Room 0004A, Women's Bathroom, Ceiling	Plaster	
4715-MB-39 2834037 ✓	Music Building, Room 0004, Men's Bathroom, Wall	Plaster	
4715-MB-40 2834038 /	Music Building, Room 0004A, Women's Bathroom, Wall	Plaster	

CHAIN OF CUSTODY (SEE LAST PAGE)

SUBMITTED BY: [Signature] DATE: 9-Jun-22
 RECEIVED BY: [Signature] DATE: JUN 9'22 21:06

QUALITY ENVIRONMENTAL SOLUTIONS & TECHNOLOGIES, INC.

BULK SAMPLE FORM

CLIENT: SUNY Purchase

SAMPLED BY: S. Talsma/S. Conklin

ADDRESS: 735 Anderson Hill Road

DATE SAMPLED: 8-Jun-22

Purchase, NY 10577

CONTACT: Anne-Marie Russillo

ANALYSIS METHOD: PLM/PLM-NOB/QTEM as required.

PROJECT ID: Phase 2 Bathroom Renovations -

TURN-AROUND TIME: _____ HOURS

Multiple Buildings

5 DAYS

PROJECT #: 22-4715

OTHER _____

SAMPLE # LAB#	LOCATION	SAMPLE DESCRIPTION	COMMENTS
4715-MB-41 2834039 ✓	Music Building, Room 0004A, Women's Bathroom, On Wall	Sheetrock	
4715-MB-42 2834040 ✓	Music Building, Room 0004, Men's Bathroom, On Wall	Sheetrock	
4715-MB-43 2834041 ✓	Music Building, Room 0002D, Workshop, Wall	Cementitious Block and Mortar (SEPARATE LAYERS)	
4715-MB-44 2834042 ✓	Music Building, Room 0002D, Workshop, Wall	Cementitious Block and Mortar (SEPARATE LAYERS)	
4715-MB-45 ✕	Music Building, Room 0002D, Workshop, Suspended Ceiling, 12' x 12' Splined	Ceiling Tile	
4715-MB-46 ✕	Music Building, Room 0002D, Workshop, Suspended Ceiling, 12' x 12' Splined	Ceiling Tile	
4715-MB-47 2834043 ✓	Music Building, Room 0004, Men's Bathroom, On Wall	Ceramic Wall Tile, Grout, Adhesive (SEPARATE LAYERS)	
4715-MB-48 2834044 /	Music Building, Room 0004A, Women's Bathroom, On Wall	Ceramic Wall Tile, Grout, Adhesive (SEPARATE LAYERS)	
4715-MB-49 ✕	Music Building, Room 0002D, Workshop, On Block & Mortar Wall	Cove Base Molding and Mastic (SEPARATE LAYERS)	
4715-MB-50 ✕	Music Building, Room 0002D, Workshop, On Block & Mortar Wall	Cove Base Molding and Mastic (SEPARATE LAYERS)	

CHAIN OF CUSTODY (SEE LAST PAGE)

SUBMITTED BY: [Signature]

DATE: 9-Jun-22

RECEIVED BY: [Signature]

DATE: _____

JUN 9'22 21:06

QUALITY ENVIRONMENTAL SOLUTIONS & TECHNOLOGIES, INC.

BULK SAMPLE FORM

CLIENT: SUNY Purchase

SAMPLED BY: S. Talsma/S. Conklin

ADDRESS: 735 Anderson Hill Road

DATE SAMPLED: 8-Jun-22

Purchase, NY 10577

CONTACT: Anne-Marie Russillo

ANALYSIS METHOD: PLM/PLM-NOB/QTEM as required.

PROJECT ID: Phase 2 Bathroom Renovations -

TURN-AROUND TIME: _____ HOURS

Multiple Buildings

5 DAYS

PROJECT #: 22-4715

OTHER _____

SAMPLE # LAB#	LOCATION	SAMPLE DESCRIPTION	COMMENTS
4715-MB-51 2834045 ✓	Music Building, Room 0004, Men's Bathroom, Floor, On Slab	Ceramic Floor Tile, Grout, Setting Bed (SEPARATE LAYERS)	
4715-MB-52 2834046 ✓	Music Building, Room 0004, Men's Bathroom, Floor, On Slab	Ceramic Floor Tile, Grout, Setting Bed (SEPARATE LAYERS)	
4715-MB-53	Music Building, Room 0002D, Workshop, Floor, 12' x 12'	Floor Tile and Mastic (SEPARATE LAYERS)	
4715-MB-54	Music Building, Room 0002D, Workshop, Floor, 12' x 12'	Floor Tile and Mastic (SEPARATE LAYERS)	
4715-MB-55	Music Building, Room 0004, Men's Bathroom, Ceiling	Textured Paint	
4715-MB-56	Music Building, Room 0004, Men's Bathroom, Ceiling	Textured Paint	
4715-MB-57	Music Building, Room 0004A, Women's Bathroom, Ceiling	Textured Paint	
4715-MB-58	Music Building, Room 0004A, Women's Bathroom, Floor, Under Setting Bed	Vapor Barrier	
4715-MB-59	Music Building, Room 0004, Men's Bathroom, Floor, Under Setting Bed	Vapor Barrier	
4751-PE-60 2834047	Physical Education Building, Room 2013, Men's Bathroom, Ceiling	Plaster	

CHAIN OF CUSTODY (SEE LAST PAGE)

SUBMITTED BY: 

DATE: 9-Jun-22

RECEIVED BY: 

DATE: _____

JUN 9'22 21:06

QUALITY ENVIRONMENTAL SOLUTIONS & TECHNOLOGIES, INC.

BULK SAMPLE FORM

CLIENT: SUNY Purchase

SAMPLED BY: S. Talsma/S. Conklin

ADDRESS: 735 Anderson Hill Road

DATE SAMPLED: 8-Jun-22

Purchase, NY 10577

CONTACT: Anne-Marie Russillo

ANALYSIS METHOD: PLM/PLM-NOB/QTEM as required.

PROJECT ID: Phase 2 Bathroom Renovations -

TURN-AROUND TIME: _____ HOURS

Multiple Buildings

5 DAYS

PROJECT #: 22-4715

OTHER _____

SAMPLE # LAB#	LOCATION	SAMPLE DESCRIPTION	COMMENTS
4751-PE-61 2834048 ✓	Physical Education Building, Room 2012, Women's Bathroom, Wall, Partition	Plaster	
4751-PE-62 2834049 /	Physical Education Building, Room 2012, Women's Bathroom, Wall, Partition	Plaster	
4751-PE-63 2834050 ✓	Physical Education Building, Room 2013, Men's Bathroom, On Wall	Ceramic Wall Tile, Grout, Mortar (SEPARATE LAYERS)	
4751-PE-64 2834051 ✓	Physical Education Building, Room 2013, Men's Bathroom, On Wall	Ceramic Wall Tile, Grout, Mortar (SEPARATE LAYERS)	
4751-PE-65 2834052 /	Physical Education Building, 2nd Floor Hallway, Outside Room 2013 Men's Bathroom, Wall	Brick and Mortar (SEPARATE LAYERS)	
4751-PE-66 2834053 /	Physical Education Building, 2nd Floor, Hallway, Outside Room 2012 Women's Bathroom, Wall	Brick and Mortar (SEPARATE LAYERS)	
4751-PE-67 2834054 /	Physical Education Building, Room 2013, Men's Bathroom, Floor	Quarry Tile, Grout, Mudset (SEPARATE LAYERS)	
4751-PE-68 2834055 /	Physical Education Building, Room 2012, Women's Bathroom, Floor	Quarry Tile, Grout, Mudset (SEPARATE LAYERS)	
4751-PE-69	Physical Education Building, Room 2013, Men's Bathroom, Door, Metal Frame to Brick & Mortar	Caulk	
4751-PE-70	Physical Education Building, Room 2012, Women's Bathroom, Door, Metal Frame to Brick & Mortar	Caulk	

CHAIN OF CUSTODY (SEE LAST PAGE)

SUBMITTED BY: _____

DATE: 9-Jun-22

RECEIVED BY: _____

DATE: _____

JUN 9'22 21:06



EAS Batch No. 2204040

Eastern Analytical Services, Inc.

Page 1 of 9

Bulk Sample Results

RE: CPN 22-4715 - SUNY Purchase - Phase 2 Bathroom Renovations - Multiple Buildings

Date Collected : 06/08/2022
 Collected By : S. Talsma/S. Conklin
 Date Received : 06/09/2022
 Date Analyzed : 06/16/2022
 Analyzed By : George Htay
 Signature :

Client QuES&T, Inc.
 1376 Route 9
 Wappingers Falls, NY 12590

Analytical Method : NYS-DOH 198.6

NVLAP Lab Code : 101646-0

NYS Lab No. 10851

Sample ID Number	4715-DB-11	4715-DB-12	4715-DB-13	4715-DB-14
Layer Number				
Lab ID Number	2834079	2834080	2834081	2834082
Sample Location	Dance Building, Room 1013, Custodial, Floor, 12" x 12" Tile	Dance Building, Room 1013, Custodial, Floor, 12" x 12" Tile	Dance Bldg, Room 1044, Women's Bathroom, Sink Counter to Ceramic Wall Tile	Dance Bldg, Room 1044, Women's Bathroom, Sink Counter to Ceramic Wall Tile
Sample Description	Peel & Stick	Peel & Stick	Caulk	Caulk
Analytical Method	NOB Plm	NOB Plm	NOB Plm	NOB Plm
Appearance	Layered Homogenous Fibrous Color	No Yes No Gray/Tan	No Yes No White	No Yes No White
Asbestos Content	% Amosite % Chrysotile % Other % Total Asbestos	ND ND ND ND	ND ND ND ND Inconclusive	ND ND ND ND Inconclusive
Other Materials Present	% Organic % Carbonates % Other Inorganic	19.4 79.7 0.9	18.9 80.1 1.0	27.2 69.5 2.9


Results Applicable To Those Items Tested. Report Cannot be Reproduced, Except Entirely, Without Written Approval of the Laboratory. Samples received in acceptable condition unless otherwise noted. ND = Not Detected. Liability Limited To Cost Of Analysis. This Report Must Not be Used by the Client to Claim Product Endorsement by NVLAP or Any Agency of the US Government. These Results Cannot Be Used To Claim That NOB Items Tested Are Non-Asbestos Containing (Unless "Other Inorganic", As Reported Above, Is Less Than One Percent). This method does not remove vermiculite and may underestimate the level of asbestos present in a sample containing greater than 10% vermiculite.

AIHA LAP, LLC No 100263 Rhode Island DOH No AAL-072 Massachusetts DOL No A A 000072 Connecticut DOH No, PH-0622 Maine DEP No, LA-024 Vermont DOH No AL-709936



Bulk Sample Results

RE: CPN 22-4715 - SUNY Purchase - Phase 2 Bathroom Renovations - Multiple Buildings

Date Collected : 06/08/2022
 Collected By : S. Talsma/S. Conklin
 Date Received : 06/09/2022
 Date Analyzed : 06/16/2022
 Analyzed By : George Htay
 Signature : 
 Analytical Method : NYS-DOH 198.6
 NVLAP Lab Code : 101646-0
 NYS Lab No. 10851

Client QuES&T, Inc.
 1376 Route 9
 Wappingers Falls, NY 12590

Sample ID Number	4715-LB-28	4715-LB-29	4715-LB-32	4715-LB-32
Layer Number			1	2
Lab ID Number	2834083	2834084	2834085	2834085
Sample Location	Library Building, Room 1008, Women's Bathroom, Dot and Canyon	Library Building, Room 1009, Men's Bathroom, Dot and Canyon	Library Building, Room 1008, Women's Bathroom, On Wall	Library Building, Room 1008, Women's Bathroom, On Wall
Sample Description	Ceiling Tile	Ceiling Tile	Cove Base Molding and Mastic (Molding Layer)	Cove Base Molding and Mastic (Mastic Layer)
Analytical Method	NOB Plm	NOB Plm	NOB Plm	NOB Plm
Appearance	Layered Homogenous Fibrous Color	Yes No Yes White/Beige	Yes No Yes White/Beige	No Yes No Black/Brown
Asbestos Content	% Amosite % Chrysotile % Other	ND ND ND	ND ND ND	ND ND ND
	% Total Asbestos	ND Inconclusive	ND Inconclusive	ND Inconclusive
Other Materials Present	% Organic % Carbonates % Other Inorganic	10.7 36.8 52.5	10.4 27.4 62.2	34.3 64.6 1.1
				56.0 3.1 40.9

Results Applicable To Those Items Tested. Report Cannot be Reproduced, Except Entirely, Without Written Approval of the Laboratory. Samples received in acceptable condition unless otherwise noted. ND = Not Detected.
 Liability Limited To Cost Of Analysis. This Report Must Not be Used by the Client to Claim Product Endorsement by NVLAP or Any Agency of the US Government.
 These Results Cannot Be Used To Claim That NOB Items Tested Are Non-Asbestos Containing (Unless "% Other Inorganic", As Reported Above, Is Less Than One Percent).
 This method does not remove vermiculite and may underestimate the level of asbestos present in a sample containing greater than 10% vermiculite.
 AIHA LAP, LLC No. 100263 Rhode Island DOH No. AAL-072 Massachusetts DOL No. A A 000072 Connecticut DOH No. PH-0622 Maine DEP No. LA-024 Vermont DOH No. AL-709936




EAS Batch No. 2204040

Eastern Analytical Services, Inc.

Page 3 of 9

Bulk Sample Results

RE: CPN 22-4715 - SUNY Purchase - Phase 2 Bathroom Renovations - Multiple Buildings

Date Collected : 06/08/2022
 Collected By : S. Talsma/S. Conklin
 Date Received : 06/09/2022
 Date Analyzed : 06/16/2022
 Analyzed By : George Htay
 Signature : 
 Analytical Method : NYS-DOH 198.6
 NVLAP Lab Code : 101646-0
 NYS Lab No. 10851

Client QuES&T, Inc.
 1376 Route 9
 Wappingers Falls, NY 12590

Sample ID Number	4715-LB-33	4715-LB-33	4715-LB-36	4715-LB-36
Layer Number	1	2	1	2
Lab ID Number	2834086	2834086	2834087	2834087
Sample Location	Library Building, Room 1009, Men's Bathroom, On Wall	Library Building, Room 1009, Men's Bathroom, On Wall	Library Building, Room 1009, Men's Bathroom, Floor	Library Building, Room 1009, Men's Bathroom, Floor
Sample Description	Cove Base Molding and Mastic (Molding Layer)	Cove Base Molding and Mastic (Mastic Layer)	Floor Tile and Mastic (Tile Layer)	Floor Tile and Mastic (Mastic Layer)
Analytical Method	NOB Plm	NOB Plm	NOB Plm	NOB Plm
Appearance	Layered Homogenous Fibrous Color	No Yes No Beige	No Yes No Brown	No Yes No Black
Asbestos Content	% Amosite % Chrysotile % Other	ND ND ND	ND ND ND	ND ND ND
	% Total Asbestos	ND Inconclusive	ND Inconclusive	ND Inconclusive
Other Materials Present	% Organic % Carbonates % Other Inorganic	34.0 64.0 2.0	55.1 3.4 41.5	20.2 77.7 2.1
				84.0 7.0 9.0

Results Applicable To Those Items Tested. Report Cannot be Reproduced, Except Entirely, Without Written Approval of the Laboratory. Samples received in acceptable condition unless otherwise noted. ND - Not Detected.
 Liability Limited To Cost Of Analysis. This Report Must Not be Used by the Client to Claim Product Endorsement by NVLAP or Any Agency of the US Government.
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 This method does not remove vermiculite and may underestimate the level of asbestos present in a sample containing greater than 10% vermiculite.
 AIHA LAP, LLC No. 100263 Rhode Island DOH No. AAL-072 Massachusetts DOL No. A A 000072 Connecticut DOH No. PH-0622 Maine DEP No. LA-024 Vermont DOH No. AL-709936




EAS Batch No. 2204040

Eastern Analytical Services, Inc.

Page 4 of 9

Bulk Sample Results

RE: CPN 22-4715 - SUNY Purchase - Phase 2 Bathroom Renovations - Multiple Buildings

Date Collected : 06/08/2022
 Collected By : S. Talsma/S. Conklin
 Date Received : 06/09/2022
 Date Analyzed : 06/16/2022
 Analyzed By : George Htay
 Signature : 
 Analytical Method : NYS-DOH 198.6
 NVLAP Lab Code : 101646-0
 NYS Lab No. 10851

Client QuES&T, Inc.
 1376 Route 9
 Wappingers Falls, NY 12590

Sample ID Number	4715-LB-37	4715-LB-37	4715-MB-45	4715-MB-46
Layer Number	1	2		
Lab ID Number	2834088	2834088	2834089	2834090
Sample Location	Library Building, Room 1008, Women's Bathroom, Floor	Library Building, Room 1008, Women's Bathroom, Floor	Music Building, Room 0002D, Workshop, Suspended Ceiling, 12" x 12" Splined	Music Building, Room 0002D, Workshop, Suspended Ceiling, 12" x 12" Splined
Sample Description	Floor Tile and Mastic (Tile Layer)	Floor Tile and Mastic (Mastic Layer)	Ceiling Tile	Ceiling Tile
Analytical Method	NOB Plm	NOB Plm	NOB Plm	NOB Plm
Appearance	Layered Homogenous Fibrous Color	No Yes No Brown	Yes No Yes White/Beige	Yes No Yes White/Beige
Asbestos Content	% Amosite % Chrysotile % Other	ND ND ND	ND ND ND	ND ND ND
	% Total Asbestos	< 0.1 Inconclusive	ND Inconclusive	ND Inconclusive
Other Materials Present	% Organic % Carbonates % Other Inorganic	21.1 76.6 2.3	86.4 6.2 7.4	11.3 44.4 44.5

Results Applicable To Those Items Tested. Report Cannot be Reproduced, Except Entirely, Without Written Approval of the Laboratory. Samples received in acceptable condition unless otherwise noted. ND = Not Detected. Liability Limited To Cost Of Analysis. This Report Must Not be Used by the Client to Claim Product Endorsement by NVLAP or Any Agency of the US Government. These Results Cannot Be Used To Claim That NOB Items Tested Are Non-Asbestos Containing (Unless "% Other Inorganic", As Reported Above, Is Less Than One Percent). This method does not remove vermiculite and may underestimate the level of asbestos present in a sample containing greater than 10% vermiculite.

AIHA LAP, LLC No. 100263 Rhode Island DOH No. AAL-072 Massachusetts DOL No. A A 000072 Connecticut DOH No. PH-0622 Maine DEP No. LA-024 Vermont DOH No. AL-709936



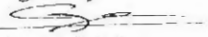
EAS Batch No. 2204040

Eastern Analytical Services, Inc.

Page 5 of 9

Bulk Sample Results

RE: CPN 22-4715 - SUNY Purchase - Phase 2 Bathroom Renovations - Multiple Buildings

Date Collected : 06/08/2022
 Collected By : S. Talsma/S. Conklin
 Date Received : 06/09/2022
 Date Analyzed : 06/16/2022
 Analyzed By : George Htay
 Signature : 
 Analytical Method : NYS-DOH 198.6
 NVLAP Lab Code : 101646-0
 NYS Lab No. 10851

Client QuES&T, Inc.
 1376 Route 9
 Wappingers Falls, NY 12590

Sample ID Number		4715-MB-47	4715-MB-48	4715-MB-49	4715-MB-49
Layer Number				1	2
Lab ID Number		2834091	2834092	2834093	2834093
Sample Location		Music Building, Room 0004, Men's Bathroom, On Wall	Music Building, Room 0004A, Women's Bathroom, On Wall	Music Building, Room 0002D, Workshop, On Block & Mortar Wall	Music Building, Room 0002D, Workshop, On Block & Mortar Wall
Sample Description		Ceramic Wall Tile, Grout, Adhesive (Adhesive Layer)	Ceramic Wall Tile, Grout, Adhesive (Adhesive Layer)	Cove Base Molding and Mastic (Molding Layer)	Cove Base Molding and Mastic (Mastic Layer)
Analytical Method		NOB Plm	NOB Plm	NOB Plm	NOB Plm
Appearance	Layered	No	No	No	No
	Homogenous	Yes	Yes	Yes	Yes
	Fibrous	No	No	No	No
	Color	Tan	Tan	Tan	Brown
Asbestos Content	% Amosite	ND	ND	ND	ND
	% Chrysotile	ND	ND	ND	ND
	% Other	ND	ND	ND	ND
	% Total Asbestos	ND Inconclusive	ND Inconclusive	ND	ND Inconclusive
Other Materials Present	% Organic	56.6	64.1	59.7	51.9
	% Carbonates	4.6	3.7	40.2	3.5
	% Other Inorganic	38.8	32.2	0.1	44.6

Results Applicable To Those Items Tested. Report Cannot be Reproduced, Except Entirely, Without Written Approval of the Laboratory. Samples received in acceptable condition unless otherwise noted. ND = Not Detected.
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 AIHA LAP, LLC No. 100263 Rhode Island DOH No. AAL-072 Massachusetts DOL No. A A 000072 Connecticut DOH No. PH-0622 Maine DEP No. LA-024 Vermont DOH No. AL-709936




EAS Batch No. 2204040

Eastern Analytical Services, Inc.

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Bulk Sample Results

RE: CPN 22-4715 - SUNY Purchase - Phase 2 Bathroom Renovations - Multiple Buildings

Date Collected : 06/08/2022
 Collected By : S. Talsma/S. Conklin
 Date Received : 06/09/2022
 Date Analyzed : 06/16/2022
 Analyzed By : George Htay
 Signature : 
 Analytical Method : NYS-DOH 198.6
 NVLAP Lab Code : 101646-0
 NYS Lab No. 10851

Client QuES&T, Inc.
 1376 Route 9
 Wappingers Falls, NY 12590

Sample ID Number	4715-MB-50	4715-MB-50	4715-MB-53	4715-MB-53
Layer Number	1	2	1	2
Lab ID Number	2834094	2834094	2834095	2834095
Sample Location	Music Building, Room 0002D, Workshop, On Block & Mortar Wall	Music Building, Room 0002D, Workshop, On Block & Mortar Wall	Music Building, Room 0002D, Workshop, Floor, 12" x 12"	Music Building, Room 0002D, Workshop, Floor, 12" x 12"
Sample Description	Cove Base Molding and Mastic (Molding Layer)	Cove Base Molding and Mastic (Mastic Layer)	Floor Tile and Mastic (Tile Layer)	Floor Tile and Mastic (Mastic Layer)
Analytical Method	NOB Plm	NOB Plm	NOB Plm	NOB Plm
Appearance	Layered Homogenous Fibrous Color	No Yes No Tan	No Yes No Brown	No Yes No Black
Asbestos Content	% Amosite % Chrysotile % Other % Total Asbestos	ND ND ND ND	ND ND ND ND Inconclusive	ND ND ND ND Inconclusive
Other Materials Present	% Organic % Carbonates % Other Inorganic	58.3 41.6 0.1	52.1 10.7 37.2	17.7 80.7 1.6
				69.6 18.0 12.4

Results Applicable To Those Items Tested. Report Cannot be Reproduced, Except Entirely, Without Written Approval of the Laboratory. Samples received in acceptable condition unless otherwise noted. ND = Not Detected.
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 AIHA LAP, LLC No. 100263 Rhode Island DOH No. AAL-072 Massachusetts DOL No. A A 000072 Connecticut DOH No. PH-0622 Maine DEP No. LA-024 Vermont DOH No. AL-709936




EAS Batch No. 2204040

Eastern Analytical Services, Inc.

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Bulk Sample Results

RE: CPN 22-4715 - SUNY Purchase - Phase 2 Bathroom Renovations - Multiple Buildings

Date Collected : 06/08/2022
 Collected By : S. Talsma/S. Conklin
 Date Received : 06/09/2022
 Date Analyzed : 06/16/2022
 Analyzed By : George Htay
 Signature : 
 Analytical Method : NYS-DOH 198.6
 NVLAP Lab Code : 101646-0
 NYS Lab No. 10851

Client QuES&T, Inc.
 1376 Route 9
 Wappingers Falls, NY 12590

Sample ID Number	4715-MB-54	4715-MB-54	4715-MB-55	4715-MB-56
Layer Number	1	2		
Lab ID Number	2834096	2834096	2834097	2834098
Sample Location	Music Building, Room 0002D, Workshop, Floor, 12" x 12"	Music Building, Room 0002D, Workshop, Floor, 12" x 12"	Music Building, Room 0004, Men's Bathroom, Ceiling	Music Building, Room 0004, Men's Bathroom, Ceiling
Sample Description	Floor Tile and Mastic (Tile Layer)	Floor Tile and Mastic (Mastic Layer)	Textured Paint	Textured Paint
Analytical Method	NOB Plm	NOB Plm	NOB Plm	NOB Plm
Appearance	Layered Homogenous Fibrous Color	No Yes No Brown	No Yes No White	No Yes No White
Asbestos Content	% Amosite % Chrysotile % Other	ND ND ND	ND ND ND	ND ND ND
	% Total Asbestos	ND Inconclusive	ND Inconclusive	ND Inconclusive
Other Materials Present	% Organic % Carbonates % Other Inorganic	16.6 82.2 1.2	62.3 20.5 17.2	9.5 71.2 19.3
				9.8 71.1 19.1

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 AIHA LAP, LLC No. 100263 Rhode Island DOH No. AAL-072 Massachusetts DOL No. A A 000072 Connecticut DOH No. PH-0622 Maine DEP No. LA-024 Vermont DOH No. AL-709936




EAS Batch No. 2204040

Eastern Analytical Services, Inc.

Page 8 of 9

Bulk Sample Results

RE: CPN 22-4715 - SUNY Purchase - Phase 2 Bathroom Renovations - Multiple Buildings

Date Collected : 06/08/2022
 Collected By : S. Talsma/S. Conklin
 Date Received : 06/09/2022
 Date Analyzed : 06/16/2022
 Analyzed By : George Htay
 Signature : 
 Analytical Method : NYS-DOH 198.6
 NVLAP Lab Code : 101646-0
 NYS Lab No. 10851

Client QuES&T, Inc.
 1376 Route 9
 Wappingers Falls, NY 12590

Sample ID Number	4715-MB-57	4715-MB-58	4715-MB-59	4715-PE-69
Layer Number				
Lab ID Number	2834099	2834100	2834101	2834102
Sample Location	Music Building, Room 0004A, Women's Bathroom, Ceiling	Music Building, Room 0004A, Women's Bathroom, Floor, Under Setting Bed	Music Building, Room 0004, Men's Bathroom, Floor, Under Setting Bed	Phys Ed Building, Room 2013, Men's Bathroom, Door, Metal Frame to Brick & Mortar Caulk
Sample Description	Textured Paint	Vapor Barrier	Vapor Barrier	Caulk
Analytical Method	NOB Plm	NOB Plm	NOB Plm	NOB Plm
Appearance	Layered Homogenous Fibrous Color	No Yes No White	Yes No Yes Black	No Yes No Gray
Asbestos Content	% Amosite % Chrysotile % Other	ND ND ND	ND ND ND	ND ND ND
	% Total Asbestos	ND Inconclusive	ND Inconclusive	ND Inconclusive
Other Materials Present	% Organic % Carbonates % Other Inorganic	10.8 66.2 23.0	66.9 30.8 2.3	84.2 10.6 5.2
				23.9 65.1 11.0

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 AIHA LAP, LLC No. 100263 Rhode Island DOH No. AAL-072 Massachusetts DOL No. A A 000072 Connecticut DOH No. PH-0622 Maine DEP No. LA-024 Vermont DOH No. AL-709936




EAS Batch No. 2204040

Eastern Analytical Services, Inc.

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Bulk Sample Results

RE: CPN 22-4715 - SUNY Purchase - Phase 2 Bathroom Renovations - Multiple Buildings

Date Collected : 06/08/2022
Collected By : S. Talsma/S. Conklin
Date Received : 06/09/2022
Date Analyzed : 06/16/2022
Analyzed By : George Htay
Signature : 
Analytical Method : NYS-DOH 198.6
NVLAP Lab Code : 101646-0
NYS Lab No. 10851

Client QuES&T, Inc.
1376 Route 9
Wappingers Falls, NY 12590

Sample ID Number 4715-PE-70
Layer Number
Lab ID Number 2834103
Sample Location Phys Ed Building,
Room 2012,
Women's Bathroom,
Door, Metal Frame
to Brick & Mortar
Sample Description Caulk

Analytical Method NOB Plm

Appearance	Layered	No
	Homogenous	Yes
	Fibrous	No
	Color	Gray

Asbestos	% Amosite	ND
Content	% Chrysotile	ND
	% Other	ND
	% Total Asbestos	ND Inconclusive

Other	% Organic	24.0
Materials	% Carbonates	64.5
Present	% Other Inorganic	11.5

Results Applicable To Those Items Tested. Report Cannot be Reproduced, Except Entirely, Without Written Approval of the Laboratory. Samples received in acceptable condition unless otherwise noted. ND = Not Detected. Liability Limited To Cost Of Analysis. This Report Must Not be Used by the Client to Claim Product Endorsement by NVLAP or Any Agency of the US Government. These Results Cannot Be Used To Claim That NOB Items Tested Are Non-Asbestos Containing (Unless "% Other Inorganic", As Reported Above, Is Less Than One Percent). This method does not remove vermiculite and may underestimate the level of asbestos present in a sample containing greater than 10% vermiculite.
AIHA LAP, LLC No. 100263 Rhode Island DOH No. AAL-072 Massachusetts DOL No. A A 000072 Connecticut DOH No. PH-0622 Maine DEP No. LA-024 Vermont DOH No. AL-709936

Eastern Analytical Services, Inc.
Chain of Custody Form

EAS Client: QuES&T, Inc.
1376 Route 9
Wappingers Falls, NY 12590

EAS Batch No. 2204040
Turn-Around: 5 Day
Shipped Via: NY DB004
State of Origin: NY
Sample Disposition: Standard x
Return

Analyte: Grav Plm

No. of Samples 25
Received:

No. of Samples 25
Analyzed:

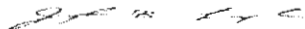
Client Project RE: CPN 22-4715 - SUNY Purchase - Phase 2 Bathroom
Number/Name: Renovations - Multiple Buildings

Lab ID Numbers: 2834079-2834082;2834083-2834084;2834085-2834086;2834087-
2834088;2834089-2834094;2834095-2834101;2834102-2834103

Collected By: S. Talsma/S. Conklin

Date: 06/08/2022

Received By: Joseph B. LaPuebla



Date: 06/09/2022

Time: 2104

Logged In By: Jeffrey B. LaPuebla



Date: 06/14/2022

Prepped By: Johnathon Lapuebla

Date: 06/15/2022

Analyzed By : George Htay



Date: 06/16/2022

Time: 1115

Re-Analyzed By:

Date:

Checked By: Damien Warner



Date: 06/17/2022

E-Transmitted By: Damien Warner



Date: 06/17/2022

Time: 1152

Logged Out By:

Date:

BULK SAMPLE FORM

SAMPLED BY: S. Talsma/S. Conklin

DATE SAMPLED: 8-Jun-22

CONTACT: Anne-Marie Russillo

ANALYSIS METHOD: PLM/PLM-NOB/QTEM as required.

TURN-AROUND TIME: _____ HOURS

5 DAYS

OTHER

SAMPLE # LAB#	LOCATION	SAMPLE DESCRIPTION	COMMENTS
4715-DB-01	Dance Building, Room 1011, Men's Bathroom, Wall, Upper	Cementitious Block and Mortar (SEPARATE LAYERS)	
4715-DB-02	Dance Building, Room 1013, Wall, Partition	Cementitious Block and Mortar (SEPARATE LAYERS)	
4715-DB-03	Dance Building, Room 1043, Custodial, Floor	Slab	
4715-DB-04	Dance Building, Room 1011m Men's Bathroom, Floor, Under Tile	Slab	
4715-DB-05	Dance Building, Room 1043, Custodial	Slop Sink	
4715-DB-06	Dance Building, Room 1043, Custodial	Slop Sink	
4715-DB-07	Dance Building, Room 1044, Women's Bathroom, On Wall	Ceramic Wall Tile, Grout, Mortar (SEPARATE LAYERS)	
4715-DB-08	Dance Building, Room 1011, Men's Bathroom, On Wall	Ceramic Wall Tile, Grout, Mortar (SEPARATE LAYERS)	
4715-DB-09	Dance Building, Room 1044, Women's Bathroom, Floor	Ceramic Floor Tile, Grout, Mudset (SEPARATE LAYERS)	
4715-DB-10	Dance Building, Room 1011, Mens Bathroom, Floor	Ceramic Floor Tile, Grout, Mudset (SEPARATE LAYERS)	

CHAIN OF CUSTODY (SEE LAST PAGE)

SUBMITTED BY:

DATE: 9-Jun-22

RECEIVED BY:

DATE:

JUN 9 '22 21:05

QUALITY ENVIRONMENTAL SOLUTIONS & TECHNOLOGIES, INC.

BULK SAMPLE FORM

CLIENT: SUNY Purchase SAMPLED BY: S. Talsma/S. Conklin

ADDRESS: 735 Anderson Hill Road DATE SAMPLED: 8-Jun-22

Purchase, NY 10577

CONTACT: Anne-Marie Russillo ANALYSIS METHOD: PLM/PLM-NOB/QTEM as required.

PROJECT ID: Phase 2 Bathroom Renovations - TURN-AROUND TIME: _____ HOURS

Multiple Buildings 5 DAYS

PROJECT #: 22-4715 OTHER _____

SAMPLE # LAB#	LOCATION	SAMPLE DESCRIPTION	COMMENTS
4715-DB-11 2834079	Dance Building, Room 1013, Custodial, Floor, 12' x 12' Tile	Peel and Stick	
4715-DB-12 2834080	Dance Building, Room 1013, Custodial, Floor, 12' x 12' Tile	Peel and Stick	
4715-DB-13 2834081	Dance Building, Room 1044, Women's Bathroom, Sink Counter to Ceramic Wall Tile	Caulk	
4715-DB-14 2834082	Dance Building, Room 1044, Women's Bathroom, Sink Counter to Ceramic Wall Tile	Caulk	
4715-LB-15	Library Building, Room 1008, Women's Bathroom, Above Suspended Ceiling, On Steel Beam	Spray On Fire Proofing	
4715-LB-16	Library Building, Room 1009, Men's Bathroom, Above Suspended Ceiling, On Steel Beam	Spray On Fire Proofing	
4715-LB-17	Library Building, Room 1009, Men's Bathroom, Above Suspended Ceiling, On Steel Beam	Spray On Fire Proofing	
4715-LB-18	Library Building, Room 1009, Mens Bathroom, On Wall	Joint Compound and Tape (SEPARATE LAYERS)	
4715-LB-19	Library Building, Room 1008, Women's Bathroom, Vestibule, Wall, Partition, On Sheetrock	Joint Compound	
4715-LB-20	Library Building, Room 1008, Women's Bathroom, Vestibule, Wall, Partition, On Sheetrock	Joint Compound	

CHAIN OF CUSTODY (SEE LAST PAGE)

SUBMITTED BY: [Signature] DATE: 9-Jun-22

RECEIVED BY: [Signature] DATE: JUN 9'22 21:05

QUALITY ENVIRONMENTAL SOLUTIONS & TECHNOLOGIES, INC.

BULK SAMPLE FORM

CLIENT: SUNY Purchase SAMPLED BY: S. Talsma/S. Conklin
 ADDRESS: 735 Anderson Hill Road DATE SAMPLED: 8-Jun-22
Purchase, NY 10577
 CONTACT: Anne-Marie Ruesillo ANALYSIS METHOD: PLM/PLM-NOB/QTEM as required.
 PROJECT ID: Phase 2 Bathroom Renovations - TURN-AROUND TIME: _____ HOURS
Multiple Buildings 5 DAYS
 PROJECT #: 22-4715 OTHER

SAMPLE # LAB#	LOCATION	SAMPLE DESCRIPTION	COMMENTS
4715-LB-21	Library Building, Room 1008, Women's Bathroom, Vestibule, Wall, Partition, On Sheetrock	Joint Tape (TAPE ONLY)	
4715-LB-22	Library Building, Room 1008, Women's Bathroom, On Wall	Sheetrock	
4715-LB-23	Library Building, Room 1008, Women's Bathroom, Vestibule, Wall, Partition	Sheetrock	
4715-LB-24	Library Building, Room 1009, Men's Bathroom, Under Ceramic Floor Tile	Slab	
4715-LB-25	Library Building, Room 1008, Women's Bathroom, Under Ceramic Floor Tile	Slab	
4715-LB-26	Library Building, Room 1008, Womens Bathroom, Above Suspended Ceiling, Wall, Partition	Cementitious Block and Mortar (SEPARATE LAYERS)	
4715-LB-27	Library Building, Room 1009, Men's Bathroom, Above Suspended Ceiling, Wall, Partition	Cementitious Block and Mortar (SEPARATE LAYERS)	
4715-LB-28	Library Building, Room 1008, Women's Bathroom, Out and Canyon	Ceiling Tile	
2834083			
4715-LB-29	Library Building, Room 1009, Men's Bathroom, Out and Canyon	Ceiling Tile	
2834084			
4715-LB-30	Library Building, Room 1009, Men's Bathroom, Wall, Partition	Ceramic Wall Tile, Grout, Mortar (SEPARATE LAYERS)	

CHAIN OF CUSTODY (SEE LAST PAGE)

SUBMITTED BY: [Signature] DATE: 9-Jun-22
 RECEIVED BY: [Signature] DATE: JUN 9'22 21:05

QUALITY ENVIRONMENTAL SOLUTIONS & TECHNOLOGIES, INC.

BULK SAMPLE FORM

CLIENT: SUNY Purchase

SAMPLED BY: S. Talsma/S. Conklin

ADDRESS: 735 Anderson Hill Road

DATE SAMPLED: 8-Jun-22

Purchase, NY 10577

CONTACT: Anne-Marie Russillo

ANALYSIS METHOD: PLM/PLM-NOB/QTEM as required.

PROJECT ID: Phase 2 Bathroom Renovations -

TURN-AROUND TIME: _____ HOURS

Multiple Buildings

5 DAYS

PROJECT #: 22-4715

OTHER

SAMPLE # LAB#	LOCATION	SAMPLE DESCRIPTION	COMMENTS
4715-LB-31	Library Building, Room 1008, Women's Bathroom, Wall, Partition	Ceramic Wall Tile, Grout, Mortar (SEPARATE LAYERS)	
4715-LB-32	Library Building, Room 1008, Women's Bathroom, On Wall	Cove base Molding and Mastic (SEPARATE LAYERS)	
2834085			
4715-LB-33	Library Building, Room 1009, Men's Bathroom, On Wall	Cove base Molding and Mastic (SEPARATE LAYERS)	
2834086			
4715-LB-34	Library Building, Room 1008, Women's Bathroom, Floor, On Cement Slab	Ceramic Floor Tile, Grout, Mudset (SEPARATE LAYERS)	
4715-LB-35	Library Building, Room 1009, Men's Bathroom, Floor, On Cement Slab	Ceramic Floor Tile, Grout, Mudset (SEPARATE LAYERS)	
4715-LB-36	Library Building, Room 1009, Men's Bathroom, Floor	Floor Tile and Mastic (SEPARATE LAYERS)	
2834087			
4715-LB-37	Library Building, Room 1008, Women's Bathroom, Floor	Floor Tile and Mastic (SEPARATE LAYERS)	
2834088			
4715-MB-38	Music Building, Room 0004A, Women's Bathroom, Ceiling	Plaster	
4715-MB-39	Music Building, Room 0004, Men's Bathroom, Wall	Plaster	
4715-MB-40	Music Building, Room 0004A, Women's Bathroom, Wall	Plaster	

CHAIN OF CUSTODY (SEE LAST PAGE)

SUBMITTED BY: [Signature]

DATE: 9-Jun-22

RECEIVED BY: [Signature]

DATE: JUN 9'22 21:06

QUALITY ENVIRONMENTAL SOLUTIONS & TECHNOLOGIES, INC.

BULK SAMPLE FORM

CLIENT: SUNY Purchase SAMPLED BY: S. Talsma/S. Conklin
 ADDRESS: 735 Anderson Hill Road DATE SAMPLED: 8-Jun-22
Purchase, NY 10577
 CONTACT: Anne-Marie Russillo ANALYSIS METHOD: PLM/PLM-NOB/QTEM as required.
 PROJECT ID: Phase 2 Bathroom Renovations - TURN-AROUND TIME: _____ HOURS
Multiple Buildings 5 DAYS
 PROJECT #: 22-4715 OTHER

SAMPLE # LAB#	LOCATION	SAMPLE DESCRIPTION	COMMENTS
4715-MB-41	Music Building, Room 0004A, Women's Bathroom, On Wall	Sheetrock	
4715-MB-42	Music Building, Room 0004, Men's Bathroom, On Wall	Sheetrock	
4715-MB-43	Music Building, Room 0002D, Workshop, Wall	Cementitious Block and Mortar (SEPARATE LAYERS)	
4715-MB-44	Music Building, Room 0002D, Workshop, Wall	Cementitious Block and Mortar (SEPARATE LAYERS)	
4715-MB-45	Music Building, Room 0002D, Workshop, Suspended Ceiling, 12' x 12' Splined	Ceiling Tile	
2834089			
4715-MB-46	Music Building, Room 0002D, Workshop, Suspended Ceiling, 12' x 12' Splined	Ceiling Tile	
2834090			
4715-MB-47	Music Building, Room 0004, Men's Bathroom, On Wall	Ceramic Wall Tile, Grout, Adhesive (SEPARATE LAYERS)	
2834091			
4715-MB-48	Music Building, Room 0004A, Women's Bathroom, On Wall	Ceramic Wall Tile, Grout, Adhesive (SEPARATE LAYERS)	
2834092			
4715-MB-49	Music Building, Room 0002D, Workshop, On Block & Mortar Wall	Cove Base Molding and Mastic (SEPARATE LAYERS)	
2834093			
4715-MB-50	Music Building, Room 0002D, Workshop, On Block & Mortar Wall	Cove Base Molding and Mastic (SEPARATE LAYERS)	
2834094			

CHAIN OF CUSTODY (SEE LAST PAGE)

SUBMITTED BY: [Signature] DATE: 9-Jun-22
 RECEIVED BY: [Signature] DATE: JUN 9'22 21:06

QUALITY ENVIRONMENTAL SOLUTIONS & TECHNOLOGIES, INC.

BULK SAMPLE FORM

CLIENT: SUNY Purchase SAMPLED BY: S. Talsma/S. Conklin
 ADDRESS: 735 Anderson Hill Road DATE SAMPLED: 8-Jun-22
Purchase, NY 10577
 CONTACT: Anne-Marie Russillo ANALYSIS METHOD: PLM/PLM-NOB/QTEM as required.
 PROJECT ID: Phase 2 Bathroom Renovations - TURN-AROUND TIME: _____ HOURS
Multiple Buildings 5 DAYS
 PROJECT #: 22-4715 OTHER

SAMPLE # LAB#	LOCATION	SAMPLE DESCRIPTION	COMMENTS
4715-MB-51	Music Building, Room 0004, Men's Bathroom, Floor, On Slab	Ceramic Floor Tile, Grout, Setting Bed (SEPARATE LAYERS)	
4715-MB-52	Music Building, Room 0004, Men's Bathroom, Floor, On Slab	Ceramic Floor Tile, Grout, Setting Bed (SEPARATE LAYERS)	
4715-MB-53	Music Building, Room 0002D, Workshop, Floor, 12' x 12'	Floor Tile and Mastic (SEPARATE LAYERS)	
2834095			
4715-MB-54	Music Building, Room 0002D, Workshop, Floor, 12' x 12'	Floor Tile and Mastic (SEPARATE LAYERS)	
2834096			
4715-MB-55	Music Building, Room 0004, Men's Bathroom, Ceiling	Textured Paint	
2834097			
4715-MB-56	Music Building, Room 0004, Men's Bathroom, Ceiling	Textured Paint	
2834098			
4715-MB-57	Music Building, Room 0004A, Women's Bathroom, Ceiling	Textured Paint	
2834099			
4715-MB-58	Music Building, Room 0004A, Women's Bathroom, Floor, Under Setting Bed	Vapor Barrier	
2834100			
4715-MB-59	Music Building, Room 0004, Men's Bathroom, Floor, Under Setting Bed	Vapor Barrier	
2834101			
4751-PE-60	Physical Education Building, Room 2013, Men's Bathroom, Ceiling	Plaster	

CHAIN OF CUSTODY (SEE LAST PAGE)

SUBMITTED BY: [Signature] DATE: 9-Jun-22
 RECEIVED BY: [Signature] DATE: JUN 9'22 21:06

QUALITY ENVIRONMENTAL SOLUTIONS & TECHNOLOGIES, INC.

BULK SAMPLE FORM

CLIENT: SUNY Purchase SAMPLED BY: S. Talsma/S. Conklin
 ADDRESS: 735 Anderson Hill Road DATE SAMPLED: 8-Jun-22
Purchase, NY 10577
 CONTACT: Anne-Marie Russillo ANALYSIS METHOD: PLM/PLM-NOB/QTEM as required.
 PROJECT ID: Phase 2 Bathroom Renovations - TURN-AROUND TIME: _____ HOURS
Multiple Buildings 5 DAYS
 PROJECT #: 22-4715 OTHER

SAMPLE # LAB#	LOCATION	SAMPLE DESCRIPTION	COMMENTS
4751-PE-61	Physical Education Building, Room 2012, Women's Bathroom, Wall, Partition	Plaster	
4751-PE-62	Physical Education Building, Room 2012, Women's Bathroom, Wall, Partition	Plaster	
4751-PE-63	Physical Education Building, Room 2013, Men's Bathroom, On Wall	Ceramic Wall Tile, Grout, Mortar (SEPARATE LAYERS)	
4751-PE-64	Physical Education Building, Room 2013, Men's Bathroom, On Wall	Ceramic Wall Tile, Grout, Mortar (SEPARATE LAYERS)	
4751-PE-65	Physical Education Building, 2nd Floor Hallway, Outside Room 2013 Men's Bathroom, Wall	Brick and Mortar (SEPARATE LAYERS)	
4751-PE-66	Physical Education Building, 2nd Floor, Hallway, Outside Room 2012 Women's Bathroom, Wall	Brick and Mortar (SEPARATE LAYERS)	
4751-PE-67	Physical Education Building, Room 2013, Men's Bathroom, Floor	Quarry Tile, Grout, Mudset (SEPARATE LAYERS)	
4751-PE-68	Physical Education Building, Room 2012, Women's Bathroom, Floor	Quarry Tile, Grout, Mudset (SEPARATE LAYERS)	
4751-PE-69	Physical Education Building, Room 2013, Men's Bathroom, Door, Metal Frame to Brick & Mortar	Caulk	
2834102			
4751-PE-70	Physical Education Building, Room 2012, Women's Bathroom, Door, Metal Frame to Brick & Mortar	Caulk	
2834103			

CHAIN OF CUSTODY (SEE LAST PAGE)

SUBMITTED BY: [Signature] DATE: 9-Jun-22
 RECEIVED BY: [Signature] DATE: JUN 9'22 21:05



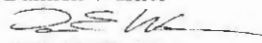
EAS Batch No. 2204041

Eastern Analytical Services, Inc.

Page 1 of 8

Bulk Sample Results

RE: CPN 22-4715 - SUNY Purchase - Phase 2 Bathroom Renovations - Multiple Buildings

Date Collected : 06/08/2022
 Collected By : S. Talsma/S. Conklin
 Date Received : 06/09/2022
 Date Analyzed : 06/17/2022
 Analyzed By : Damien Warner
 Signature : 
 Analytical Method : NYS-DOH 198.4
 NVLAP Lab Code : 101646-0
 NYS Lab No. 10851

Client QuES&T, Inc.
 1376 Route 9
 Wappingers Falls, NY 12590

Sample ID Number	4715-DB-13	4715-DB-14	4715-LB-28	4715-LB-29
Layer Number				
Lab ID Number	2834081	2834082	2834083	2834084
Sample Location	Dance Bldg, Room 1044, Women's Bathroom, Sink Counter to Ceramic Wall Tile	Dance Bldg, Room 1044, Women's Bathroom, Sink Counter to Ceramic Wall Tile	Library Building, Room 1008, Women's Bathroom, Dot and Canyon	Library Building, Room 1009, Men's Bathroom, Dot and Canyon
Sample Description	Caulk	Caulk	Ceiling Tile	Ceiling Tile
Analytical Method	NOB Tem	NOB Tem	NOB Tem	NOB Tem
Appearance	Layered Homogenous Fibrous Color	No Yes No White	No Yes No White	Yes No Yes White/Beige
Asbestos Content	% Amosite % Chrysotile % Other % Total Asbestos	ND ND ND ND	ND ND ND ND	ND ND ND ND
Other Materials Present	% Organic % Carbonates % Other Inorganic	27.2 69.9 2.9	27.2 69.5 3.3	10.7 36.8 52.5

Results Applicable To Those Items Tested. Report Cannot be Reproduced, Except Entirely, Without Written Approval of the Laboratory. Samples received in acceptable condition unless otherwise noted. ND - Not Detected. Liability Limited To Cost Of Analysis. This Report Must Not be Used by the Client to Claim Product Endorsement by NVLAP or Any Agency of the US Government.

AHIA LAP, LLC No. 109263 Rhode Island DOH No. AAL-072 Massachusetts DOL No. A A 000072 Connecticut DOH No. PH-0622 Maine DEP No. LA-024 Vermont DOH No. AL-709936



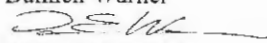
EAS Batch No. 2204041

Eastern Analytical Services, Inc.

Page 2 of 8

Bulk Sample Results

RE: CPN 22-4715 - SUNY Purchase - Phase 2 Bathroom Renovations - Multiple Buildings

Date Collected : 06/08/2022
 Collected By : S. Talsma/S. Conklin
 Date Received : 06/09/2022
 Date Analyzed : 06/17/2022
 Analyzed By : Damien Warner
 Signature : 
 Analytical Method : NYS-DOH 198.4
 NVLAP Lab Code : 101646-0
 NYS Lab No. 10851

Client QuES&T, Inc.
 1376 Route 9
 Wappingers Falls, NY 12590

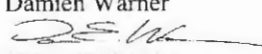
Sample ID Number	4715-LB-32	4715-LB-32	4715-LB-33	4715-LB-33
Layer Number	1	2	1	2
Lab ID Number	2834085	2834085	2834086	2834086
Sample Location	Library Building, Room 1008, Women's Bathroom, On Wall	Library Building, Room 1008, Women's Bathroom, On Wall	Library Building, Room 1009, Men's Bathroom, On Wall	Library Building, Room 1009, Men's Bathroom, On Wall
Sample Description	Cove Base Molding and Mastic (Molding Layer)	Cove Base Molding and Mastic (Mastic Layer)	Cove Base Molding and Mastic (Molding Layer)	Cove Base Molding and Mastic (Mastic Layer)
Analytical Method	NOB Tem	NOB Tem	NOB Tem	NOB Tem
Appearance	Layered Homogenous Fibrous Color	No Yes No Beige	No Yes No Beige	No Yes No Black/Brown
Asbestos Content	% Amosite % Chrysotile % Other % Total Asbestos	ND ND ND ND	ND ND ND ND	ND ND ND ND
Other Materials Present	% Organic % Carbonates % Other Inorganic	34.3 64.6 1.1	56.0 3.1 40.9	34.0 64.0 2.0
				55.1 3.4 41.5

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 AIHA LAP, LLC No. 100263 Rhode Island DOI No. AAL-072 Massachusetts DOL No. A A 000072 Connecticut DOI No. PH-0622 Maine DEP No. LA-024 Vermont DOI No. AL-709936



Bulk Sample Results

RE: CPN 22-4715 - SUNY Purchase - Phase 2 Bathroom Renovations - Multiple Buildings

Date Collected : 06/08/2022
 Collected By : S. Talsma/S. Conklin
 Date Received : 06/09/2022
 Date Analyzed : 06/17/2022
 Analyzed By : Damien Warner
 Signature : 
 Analytical Method : NYS-DOH 198.4
 NVLAP Lab Code : 101646-0
 NYS Lab No. 10851

Client QuES&T, Inc.
 1376 Route 9
 Wappingers Falls, NY 12590

Sample ID Number	4715-LB-36	4715-LB-36	4715-LB-37	4715-LB-37
Layer Number	1	2	1	2
Lab ID Number	2834087	2834087	2834088	2834088
Sample Location	Library Building, Room 1009, Men's Bathroom, Floor	Library Building, Room 1009, Men's Bathroom, Floor	Library Building, Room 1008, Women's Bathroom, Floor	Library Building, Room 1008, Women's Bathroom, Floor
Sample Description	Floor Tile and Mastic (Tile Layer)	Floor Tile and Mastic (Mastic Layer)	Floor Tile and Mastic (Tile Layer)	Floor Tile and Mastic (Mastic Layer)
Analytical Method	NOB Tem	NOB Tem	NOB Tem	NOB Tem
Appearance	Layered Homogenous Fibrous Color	No Yes No Brown	No Yes No Brown	No Yes No Black
Asbestos Content	% Amosite % Chrysotile % Other % Total Asbestos	ND 0.1 ND 0.1	ND 0.1 ND 0.1	ND ND ND ND
Other Materials Present	% Organic % Carbonates % Other Inorganic	20.2 77.7 2.0	84.0 7.0 9.0	21.1 76.6 2.2
				86.4 6.2 7.4

Results Applicable To Those Items Tested. Report Cannot be Reproduced, Except Entirely, Without Written Approval of the Laboratory. Samples received in acceptable condition unless otherwise noted. ND = Not Detected.
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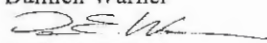
EAS Batch No. 2204041

Eastern Analytical Services, Inc.

Page 4 of 8

Bulk Sample Results

RE: CPN 22-4715 - SUNY Purchase - Phase 2 Bathroom Renovations - Multiple Buildings

Date Collected : 06/08/2022
 Collected By : S. Talsma/S. Conklin
 Date Received : 06/09/2022
 Date Analyzed : 06/17/2022
 Analyzed By : Damien Warner
 Signature : 
 Analytical Method : NYS-DOH 198.4
 NVLAP Lab Code : 101646-0
 NYS Lab No. 10851

Client QuES&T, Inc.
 1376 Route 9
 Wappingers Falls, NY 12590

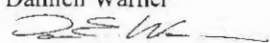
Sample ID Number		4715-MB-45	4715-MB-46	4715-MB-47	4715-MB-48
Layer Number					
Lab ID Number		2834089	2834090	2834091	2834092
Sample Location		Music Building, Room 0002D, Workshop, Suspended Ceiling, 12" x 12" Splined	Music Building, Room 0002D, Workshop, Suspended Ceiling, 12" x 12" Splined	Music Building, Room 0004, Men's Bathroom, On Wall	Music Building, Room 0004A, Women's Bathroom, On Wall
Sample Description		Ceiling Tile	Ceiling Tile	Ceramic Wall Tile, Grout, Adhesive (Adhesive Layer)	Ceramic Wall Tile, Grout, Adhesive (Adhesive Layer)
Analytical Method		NOB Tem	NOB Tem	NOB Tem	NOB Tem
Appearance	Layered	Yes	Yes	No	No
	Homogenous	No	No	Yes	Yes
	Fibrous	Yes	Yes	No	No
	Color	White/Beige	White/Beige	Tan	Tan
Asbestos Content	% Amosite	ND	ND	ND	ND
	% Chrysotile	ND	ND	ND	ND
	% Other	ND	ND	ND	ND
	% Total Asbestos	ND	ND	ND	ND
Other Materials Present	% Organic	11.3	11.1	56.6	64.1
	% Carbonates	45.0	44.4	4.6	3.7
	% Other Inorganic	43.7	44.5	38.8	32.2

Results Applicable To Those Items Tested. Report Cannot be Reproduced, Except Entirely, Without Written Approval of the Laboratory. Samples received in acceptable condition unless otherwise noted. ND - Not Detected.
 Liability Limited To Cost Of Analysis. This Report Must Not be Used by the Client to Claim Product Endorsement by NVLAP or Any Agency of the US Government.
 AIHA LAP, LLC No. 100263 Rhode Island DOH No. AAL-072 Massachusetts DOL No. A.A.000072 Connecticut DOH No. PH-0622 Maine DEP No. LA-024 Vermont DOH No. AL-709936



Bulk Sample Results

RE: CPN 22-4715 - SUNY Purchase - Phase 2 Bathroom Renovations - Multiple Buildings

Date Collected : 06/08/2022
 Collected By : S. Talsma/S. Conklin
 Date Received : 06/09/2022
 Date Analyzed : 06/17/2022
 Analyzed By : Damien Warner
 Signature : 
 Analytical Method : NYS-DOH 198.4
 NVLAP Lab Code : 101646-0
 NYS Lab No. 10851

Client QuES&T, Inc.
 1376 Route 9
 Wappingers Falls, NY 12590

Sample ID Number	4715-MB-49	4715-MB-50	4715-MB-53	4715-MB-53
Layer Number	2	2	1	2
Lab ID Number	2834093	2834094	2834095	2834095
Sample Location	Music Building, Room 0002D, Workshop, On Block & Mortar Wall	Music Building, Room 0002D, Workshop, On Block & Mortar Wall	Music Building, Room 0002D, Workshop, Floor, 12" x 12"	Music Building, Room 0002D, Workshop, Floor, 12" x 12"
Sample Description	Cove Base Molding and Mastic (Mastic Layer)	Cove Base Molding and Mastic (Mastic Layer)	Floor Tile and Mastic (Tile Layer)	Floor Tile and Mastic (Mastic Layer)
Analytical Method	NOB Tem	NOB Tem	NOB Tem	NOB Tem
Appearance	Layered Homogenous Fibrous Color	No Yes No Brown	No Yes No Brown	No Yes No Black
Asbestos Content	% Amosite % Chrysotile % Other % Total Asbestos	ND ND ND ND	ND ND ND ND	ND ND ND ND
Other Materials Present	% Organic % Carbonates % Other Inorganic	51.9 3.5 44.6	52.1 10.7 37.2	17.7 80.7 1.6
				69.6 18.0 12.4

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 AIIIA LAP, LLC No. 100263 Rhode Island DOI No. AAL-072 Massachusetts DOL No. A A 000072 Connecticut DOH No. PH-0622 Maine DEP No. LA-024 Vermont DOH No. AL-709936



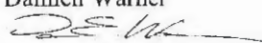
EAS Batch No. 2204041

Eastern Analytical Services, Inc.

Page 6 of 8

Bulk Sample Results

RE: CPN 22-4715 - SUNY Purchase - Phase 2 Bathroom Renovations - Multiple Buildings

Date Collected : 06/08/2022
 Collected By : S. Talsma/S. Conklin
 Date Received : 06/09/2022
 Date Analyzed : 06/17/2022
 Analyzed By : Damien Warner
 Signature : 
 Analytical Method : NYS-DOH 198.4
 NVLAP Lab Code : 101646-0
 NYS Lab No. 10851

Client QuES&T, Inc.
 1376 Route 9
 Wappingers Falls, NY 12590

Sample ID Number	4715-MB-54	4715-MB-54	4715-MB-55	4715-MB-56
Layer Number	1	2		
Lab ID Number	2834096	2834096	2834097	2834098
Sample Location	Music Building, Room 0002D, Workshop, Floor, 12" x 12"	Music Building, Room 0002D, Workshop, Floor, 12" x 12"	Music Building, Room 0004, Men's Bathroom, Ceiling	Music Building, Room 0004, Men's Bathroom, Ceiling
Sample Description	Floor Tile and Mastic (Tile Layer)	Floor Tile and Mastic (Mastic Layer)	Textured Paint	Textured Paint
Analytical Method	NOB Tem	NOB Tem	NOB Tem	NOB Tem
Appearance	Layered Homogenous Fibrous Color	No Yes No Brown	No Yes No White	No Yes No White
Asbestos Content	% Amosite % Chrysotile % Other % Total Asbestos	ND ND ND ND	ND ND ND ND	ND ND ND ND
Other Materials Present	% Organic % Carbonates % Other Inorganic	16.6 82.2 1.2	62.3 20.5 17.2	9.5 71.2 19.3

Results Applicable To Those Items Tested. Report Cannot be Reproduced, Except Entirely, Without Written Approval of the Laboratory. Samples received in acceptable condition unless otherwise noted. ND - Not Detected.
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 AIHA LAP, LLC No. 100263 Rhode Island DOI No. AAL-072 Massachusetts DOL No. A A 000072 Connecticut DOI No. PH-0622 Maine DEP No. LA-024 Vermont DOI No. AL-709936



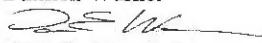
EAS Batch No. 2204041

Eastern Analytical Services, Inc.

Page 7 of 8

Bulk Sample Results

RE: CPN 22-4715 - SUNY Purchase - Phase 2 Bathroom Renovations - Multiple Buildings

Date Collected : 06/08/2022
 Collected By : S. Talsma/S. Conklin
 Date Received : 06/09/2022
 Date Analyzed : 06/17/2022
 Analyzed By : Damien Warner
 Signature : 
 Analytical Method : NYS-DOH 198.4
 NVLAP Lab Code : 101646-0
 NYS Lab No. 10851

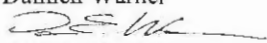
Client QuES&T, Inc.
 1376 Route 9
 Wappingers Falls, NY 12590

Sample ID Number	4715-MB-57	4715-MB-58	4715-MB-59	4715-PE-69
Layer Number				
Lab ID Number	2834099	2834100	2834101	2834102
Sample Location	Music Building, Room 0004A, Women's Bathroom, Ceiling	Music Building, Room 0004A, Women's Bathroom, Floor, Under Setting Bed	Music Building, Room 0004, Men's Bathroom, Floor, Under Setting Bed	Phys Ed Building, Room 2013, Men's Bathroom, Door, Metal Frame to Brick & Mortar Caulk
Sample Description	Textured Paint	Vapor Barrier	Vapor Barrier	Caulk
Analytical Method	NOB Tem	NOB Tem	NOB Tem	NOB Tem
Appearance	Layered Homogenous Fibrous Color	No Yes No Black	Yes No Yes Black	No Yes No Gray
Asbestos Content	% Amosite % Chrysotile % Other % Total Asbestos	ND ND ND ND	ND ND ND ND	ND ND ND ND
Other Materials Present	% Organic % Carbonates % Other Inorganic	10.8 66.2 23.0	66.9 30.8 2.3	84.2 10.6 5.2
				23.9 65.1 11.0

Results Applicable To Those Items Tested. Report Cannot be Reproduced, Except Entirely, Without Written Approval of the Laboratory. Samples received in acceptable condition unless otherwise noted. ND - Not Detected.
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 AIIHA LAP, LLC No. 100263 Rhode Island DOH No. AAL-072 Massachusetts DOL No. A A 000072 Connecticut DOH No. PH-0622 Maine DEP No. LA-024 Vermont DOH No. AL-709936

**Bulk Sample Results**

RE: CPN 22-4715 - SUNY Purchase - Phase 2 Bathroom Renovations - Multiple Buildings

Date Collected : 06/08/2022
Collected By : S. Talsma/S. Conklin
Date Received : 06/09/2022
Date Analyzed : 06/17/2022
Analyzed By : Damien Warner
Signature : 
Analytical Method : NYS-DOH 198.4
NVLAP Lab Code : 101646-0
NYS Lab No. 10851

Client QuES&T, Inc.
1376 Route 9
Wappingers Falls, NY 12590

Sample ID Number 4715-PE-70
Layer Number
Lab ID Number 2834103
Sample Location Phys Ed Building,
Room 2012,
Women's Bathroom,
Door, Metal Frame
to Brick & Mortar
Sample Description Caulk

Analytical Method NOB Tem

Appearance	Layered	No
	Homogenous	Yes
	Fibrous	No
	Color	Gray

Asbestos	% Amosite	ND
Content	% Chrysotile	ND
	% Other	ND
	% Total Asbestos	ND

Other	% Organic	24.0
Materials	% Carbonates	64.5
Present	% Other Inorganic	11.5

Results Applicable To Those Items Tested. Report Cannot be Reproduced, Except Entirely, Without Written Approval of the Laboratory. Samples received in acceptable condition unless otherwise noted. ND - Not Detected.
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AIIIA LAP, LLC No. 100263 Rhode Island DOH No. AAL-072 Massachusetts DOL No. A A 000072 Connecticut DOH No. PIH-0622 Maine DEP No. LA-024 Vermont DOH No. AL-709936

Eastern Analytical Services, Inc.
Chain of Custody Form

EAS Client: QuES&T, Inc.
1376 Route 9
Wappingers Falls, NY 12590

EAS Batch No. 2204041
Turn-Around: Five Day
Shipped Via: NY DB004
State of Origin: NY
Sample Disposition: Standard x
Return

Analyte: Grav Tem

No. of Samples 25
Received:

No. of Samples 21
Analyzed:

Client Project RE: CPN 22-4715 - SUNY Purchase - Phase 2 Bathroom
Number/Name: Renovations - Multiple Buildings

Lab ID Numbers: 2834079-2834082;2834083-2834084;2834085-2834086;2834087-
2834088;2834089-2834094;2834095-2834101;2834102-2834103

Collected By: S. Talsma/S. Conklin

Date: 06/08/2022

Received By: Joseph B. LaPuebla



Date: 06/09/2022

Time: 2104

Logged In By: Jeffrey B. LaPuebla



Date: 06/14/2022

Prepped By: Joseph B. LaPuebla



Date: 06/16/2022

Analyzed By : Damien Warner



Date: 06/17/2022

Time: 1130

Re-Analyzed By:

Date:

Checked By: Damien Warner



Date: 06/17/2022

E-Transmitted By: Damien Warner



Date: 06/17/2022

Time: 1152

Logged Out By:

Date:

QUALITY ENVIRONMENTAL SOLUTIONS & TECHNOLOGIES, INC.

BULK SAMPLE FORM

CLIENT: SUNY Purchase SAMPLED BY: S. Talsma/S. Conklin

ADDRESS: 735 Anderson Hill Road DATE SAMPLED: 8-Jun-22

Purchase, NY 10577

CONTACT: Anne-Marie Russillo ANALYSIS METHOD: PLM/PLM-NOB/QTEM as required.

PROJECT ID: Phase 2 Bathroom Renovations - TURN-AROUND TIME: _____ HOURS

Multiple Buildings 5 DAYS

PROJECT #: 22-4715 OTHER _____

SAMPLE # LAB#	LOCATION	SAMPLE DESCRIPTION	COMMENTS
4715-DB-01	Dance Building, Room 1011, Men's Bathroom, Wall, Upper	Cementitious Block and Mortar (SEPARATE LAYERS)	
4715-DB-02	Dance Building, Room 1013, Wall, Partition	Cementitious Block and Mortar (SEPARATE LAYERS)	
4715-DB-03	Dance Building, Room 1043, Custodial, Floor	Slab	
4715-DB-04	Dance Building, Room 1011m Men's Bathroom, Floor, Under Tile	Slab	
4715-DB-05	Dance Building, Room 1043, Custodial	Stop Sink	
4715-DB-06	Dance Building, Room 1043, Custodial	Stop Sink	
4715-DB-07	Dance Building, Room 1044, Women's Bathroom, On Wall	Ceramic Wall Tile, Grout, Mortar (SEPARATE LAYERS)	
4715-DB-08	Dance Building, Room 1011, Men's Bathroom, On Wall	Ceramic Wall Tile, Grout, Mortar (SEPARATE LAYERS)	
4715-DB-09	Dance Building, Room 1044, Women's Bathroom, Floor	Ceramic Floor Tile, Grout, Mudset (SEPARATE LAYERS)	
4715-DB-10	Dance Building, Room 1011, Mens Bathroom, Floor	Ceramic Floor Tile, Grout, Mudset (SEPARATE LAYERS)	

CHAIN OF CUSTODY (SEE LAST PAGE)

SUBMITTED BY: [Signature] DATE: 9-Jun-22

RECEIVED BY: [Signature] DATE: JUN 9'22 21:05

QUALITY ENVIRONMENTAL SOLUTIONS & TECHNOLOGIES, INC.

BULK SAMPLE FORM

CLIENT: SUNY Purchase SAMPLED BY: S. Talsma/S. Conklin
 ADDRESS: 735 Anderson Hill Road DATE SAMPLED: 8-Jun-22
Purchase, NY 10577
 CONTACT: Anne-Marie Russillo ANALYSIS METHOD: PLM/PLM-NOB/QTEM as required.
 PROJECT ID: Phase 2 Bathroom Renovations - TURN-AROUND TIME: _____ HOURS
Multiple Buildings 5 DAYS
 PROJECT #: 22-4715 OTHER _____

SAMPLE # LAB#	LOCATION	SAMPLE DESCRIPTION	COMMENTS
4715-DB-11 2834079	Dance Building, Room 1013, Custodial, Floor, 12' x 12' Tile	Peel and Stick	
4715-DB-12 2834080	Dance Building, Room 1013, Custodial, Floor, 12' x 12' Tile	Peel and Stick	
4715-DB-13 2834081	Dance Building, Room 1044, Women's Bathroom, Sink Counter to Ceramic Wall Tile	Caulk	
4715-DB-14 2834082	Dance Building, Room 1044, Women's Bathroom, Sink Counter to Ceramic Wall Tile	Caulk	
4715-LB-15	Library Building, Room 1008, Women's Bathroom, Above Suspended Ceiling, On Steel Beam	Spray On Fire Proofing	
4715-LB-16	Library Building, Room 1009, Men's Bathroom, Above Suspended Ceiling, On Steel Beam	Spray On Fire Proofing	
4715-LB-17	Library Building, Room 1009, Men's Bathroom, Above Suspended Ceiling, On Steel Beam	Spray On Fire Proofing	
4715-LB-18	Library Building, Room 1009, Mens Bathroom, On Wall	Joint Compound and Tape (SEPARATE LAYERS)	
4715-LB-19	Library Building, Room 1008, Women's Bathroom, Vestibule, Wall, Partition, On Sheetrock	Joint Compound	
4715-LB-20	Library Building, Room 1008, Women's Bathroom, Vestibule, Wall, Partition, On Sheetrock	Joint Compound	

CHAIN OF CUSTODY (SEE LAST PAGE)

SUBMITTED BY: [Signature] DATE: 9-Jun-22
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QUALITY ENVIRONMENTAL SOLUTIONS & TECHNOLOGIES, INC.

BULK SAMPLE FORM

CLIENT: SUNY Purchase

SAMPLED BY: S. Talsma/S. Conklin

ADDRESS: 735 Anderson Hill Road

DATE SAMPLED: 8-Jun-22

Purchase, NY 10577

CONTACT: Anne-Marie Russillo

ANALYSIS METHOD: PLM/PLM-NOB/QTEM as required.

PROJECT ID: Phase 2 Bathroom Renovations -

TURN-AROUND TIME: _____ HOURS

Multiple Buildings

5 DAYS

PROJECT #: 22-4715

OTHER

SAMPLE # LAB#	LOCATION	SAMPLE DESCRIPTION	COMMENTS
4715-LB-21	Library Building, Room 1008, Women's Bathroom, Vestibule, Wall, Partition, On Sheetrock	Joint Tape (TAPE ONLY)	
4715-LB-22	Library Building, Room 1008, Women's Bathroom, On Wall	Sheetrock	
4715-LB-23	Library Building, Room 1008, Women's Bathroom, Vestibule, Wall, Partition	Sheetrock	
4715-LB-24	Library Building, Room 1009, Men's Bathroom, Under Ceramic Floor Tile	Slab	
4715-LB-25	Library Building, Room 1008, Women's Bathroom, Under Ceramic Floor Tile	Slab	
4715-LB-26	Library Building, Room 1008, Womens Bathroom, Above Suspended Ceiling, Wall, Partition	Cementitious Block and Mortar (SEPARATE LAYERS)	
4715-LB-27	Library Building, Room 1009, Men's Bathroom, Above Suspended Ceiling, Wall, Partition	Cementitious Block and Mortar (SEPARATE LAYERS)	
4715-LB-28 2834083	Library Building, Room 1008, Women's Bathroom, Dot and Canyon	Ceiling Tile	
4715-LB-29 2834084	Library Building, Room 1009, Men's Bathroom, Dot and Canyon	Ceiling Tile	
4715-LB-30	Library Building, Room 1009, Men's Bathroom, Wall, Partition	Ceramic Wall Tile, Grout, Mortar (SEPARATE LAYERS)	

CHAIN OF CUSTODY (SEE LAST PAGE)

SUBMITTED BY: _____

DATE: 9-Jun-22

RECEIVED BY: _____

DATE: _____

JUN 9'22 21:05

QUALITY ENVIRONMENTAL SOLUTIONS & TECHNOLOGIES, INC.

BULK SAMPLE FORM

CLIENT: SUNY Purchase

SAMPLED BY: S. Talsma/S. Conklin

ADDRESS: 735 Anderson Hill Road

DATE SAMPLED: 8-Jun-22

Purchase, NY 10577

CONTACT: Anno-Marie Russillo

ANALYSIS METHOD: PLM/PLM-NOB/QTEM as required.

PROJECT ID: Phase 2 Bathroom Renovations -

TURN-AROUND TIME: _____ HOURS

Multiple Buildings

5 DAYS

PROJECT #: 22-4715

OTHER

SAMPLE # LAB#	LOCATION	SAMPLE DESCRIPTION	COMMENTS
4715-LB-31	Library Building, Room 1008, Women's Bathroom, Wall, Partition	Ceramic Wall Tile, Grout, Mortar (SEPARATE LAYERS)	
4715-LB-32	Library Building, Room 1008, Women's Bathroom, On Wall	Cove base Molding and Mastic (SEPARATE LAYERS)	
2834085			
4715-LB-33	Library Building, Room 1009, Men's Bathroom, On Wall	Cove base Molding and Mastic (SEPARATE LAYERS)	
2834086			
4715-LB-34	Library Building, Room 1008, Women's Bathroom, Floor, On Cement Slab	Ceramic Floor Tile, Grout, Mudset (SEPARATE LAYERS)	
4715-LB-35	Library Building, Room 1009, Men's Bathroom, Floor, On Cement Slab	Ceramic Floor Tile, Grout, Mudset (SEPARATE LAYERS)	
4715-LB-36	Library Building, Room 1009, Men's Bathroom, Floor	Floor Tile and Mastic (SEPARATE LAYERS)	
2834087			
4715-LB-37	Library Building, Room 1008, Women's Bathroom, Floor	Floor Tile and Mastic (SEPARATE LAYERS)	
2834088			
4715-MB-38	Music Building, Room 0004A, Women's Bathroom, Ceiling	Plaster	
4715-MB-39	Music Building, Room 0004, Men's Bathroom, Wall	Plaster	
4715-MB-40	Music Building, Room 0004A, Women's Bathroom, Wall	Plaster	

CHAIN OF CUSTODY (SEE LAST PAGE)

SUBMITTED BY: [Signature]

DATE: 9-Jun-22

RECEIVED BY: [Signature]

DATE:

JUN 9'22 21:06

QUALITY ENVIRONMENTAL SOLUTIONS & TECHNOLOGIES, INC.

BULK SAMPLE FORM

CLIENT: SUNY Purchase SAMPLED BY: S. Talsma/S. Conklin
 ADDRESS: 735 Anderson Hill Road DATE SAMPLED: 8-Jun-22
Purchase, NY 10577
 CONTACT: Anne-Marie Russillo ANALYSIS METHOD: PLM/PLM-NOB/QTEM as required.
 PROJECT ID: Phase 2 Bathroom Renovations - TURN-AROUND TIME: _____ HOURS
Multiple Buildings 5 DAYS
 PROJECT #: 22-4715 OTHER

SAMPLE # LAB#	LOCATION	SAMPLE DESCRIPTION	COMMENTS
4715-MB-41	Music Building, Room 0004A, Women's Bathroom, On Wall	Sheetrock	
4715-MB-42	Music Building, Room 0004, Men's Bathroom, On Wall	Sheetrock	
4715-MB-43	Music Building, Room 0002D, Workshop, Wall	Cementitious Block and Mortar (SEPARATE LAYERS)	
4715-MB-44	Music Building, Room 0002D, Workshop, Wall	Cementitious Block and Mortar (SEPARATE LAYERS)	
4715-MB-45	Music Building, Room 0002D, Workshop, Suspended Ceiling, 12' x 12' Splined	Ceiling Tile	
2834089			
4715-MB-46	Music Building, Room 0002D, Workshop, Suspended Ceiling, 12' x 12' Splined	Ceiling Tile	
2834090			
4715-MB-47	Music Building, Room 0004, Men's Bathroom, On Wall	Ceramic Wall Tile, Grout, Adhesive (SEPARATE LAYERS)	
2834091			
4715-MB-48	Music Building, Room 0004A, Women's Bathroom, On Wall	Ceramic Wall Tile, Grout, Adhesive (SEPARATE LAYERS)	
2834092			
4715-MB-49	Music Building, Room 0002D, Workshop, On Block & Mortar Wall	Cove Base Molding and Mastic (SEPARATE LAYERS)	
2834093			
4715-MB-50	Music Building, Room 0002D, Workshop, On Block & Mortar Wall	Cove Base Molding and Mastic (SEPARATE LAYERS)	
2834094			

CHAIN OF CUSTODY (SEE LAST PAGE)

SUBMITTED BY: [Signature] DATE: 9-Jun-22
 RECEIVED BY: [Signature] DATE: JUN 9'22 21:06

QUALITY ENVIRONMENTAL SOLUTIONS & TECHNOLOGIES, INC.

BULK SAMPLE FORM

CLIENT: SUNY Purchase SAMPLED BY: S. Talsma/S. Conklin
 ADDRESS: 735 Anderson Hill Road DATE SAMPLED: 6-Jun-22
Purchase, NY 10577
 CONTACT: Anne-Marie Russillo ANALYSIS METHOD: PLM/PLM-NOB/QTEM as required.
 PROJECT ID: Phase 2 Bathroom Renovations - TURN-AROUND TIME: _____ HOURS
Multiple Buildings 5 DAYS
 PROJECT #: 22-4715 OTHER

SAMPLE # LAB#	LOCATION	SAMPLE DESCRIPTION	COMMENTS
4715-MB-51	Music Building, Room 0004, Men's Bathroom, Floor, On Slab	Ceramic Floor Tile, Grout, Setting Bed (SEPARATE LAYERS)	
4715-MB-52	Music Building, Room 0004, Men's Bathroom, Floor, On Slab	Ceramic Floor Tile, Grout, Setting Bed (SEPARATE LAYERS)	
4715-MB-53	Music Building, Room 0002D, Workshop, Floor, 12' x 12'	Floor Tile and Mastic (SEPARATE LAYERS)	
2834095			
4715-MB-54	Music Building, Room 0002D, Workshop, Floor, 12' x 12'	Floor Tile and Mastic (SEPARATE LAYERS)	
2834096			
4715-MB-55	Music Building, Room 0004, Men's Bathroom, Ceiling	Textured Paint	
2834097			
4715-MB-56	Music Building, Room 0004, Men's Bathroom, Ceiling	Textured Paint	
2834098			
4715-MB-57	Music Building, Room 0004A, Women's Bathroom, Ceiling	Textured Paint	
2834099			
4715-MB-58	Music Building, Room 0004A, Women's Bathroom, Floor, Under Setting Bed	Vapor Barrier	
2834100			
4715-MB-59	Music Building, Room 0004, Men's Bathroom, Floor, Under Setting Bed	Vapor Barrier	
2834101			
4751-PE-60	Physical Education Building, Room 2013, Men's Bathroom, Ceiling	Plaster	

CHAIN OF CUSTODY (SEE LAST PAGE)

SUBMITTED BY: [Signature] DATE: 9-Jun-22
 RECEIVED BY: [Signature] DATE: JUN 9'22 21:06

QUALITY ENVIRONMENTAL SOLUTIONS & TECHNOLOGIES, INC.

BULK SAMPLE FORM

CLIENT: SUNY Purchase SAMPLED BY: S. Talsma/S. Conklin
 ADDRESS: 735 Anderson Hill Road DATE SAMPLED: 8-Jun-22
Purchase, NY 10577
 CONTACT: Anne-Marie Russillo ANALYSIS METHOD: PLM/PLM-NOB/QTEM as required.
 PROJECT ID: Phase 2 Bathroom Renovations - TURN-AROUND TIME: _____ HOURS
Multiple Buildings 5 DAYS
 PROJECT #: 22-4715 OTHER _____

SAMPLE # LAB#	LOCATION	SAMPLE DESCRIPTION	COMMENTS
4751-PE-61	Physical Education Building, Room 2012, Women's Bathroom, Wall, Partition	Plaster	
4751-PE-62	Physical Education Building, Room 2012, Women's Bathroom, Wall, Partition	Plaster	
4751-PE-63	Physical Education Building, Room 2013, Men's Bathroom, On Wall	Ceramic Wall Tile, Grout, Mortar (SEPARATE LAYERS)	
4751-PE-64	Physical Education Building, Room 2013, Men's Bathroom, On Wall	Ceramic Wall Tile, Grout, Mortar (SEPARATE LAYERS)	
4751-PE-65	Physical Education Building, 2nd Floor Hallway, Outside Room 2013 Men's Bathroom, Wall	Brick and Mortar (SEPARATE LAYERS)	
4751-PE-66	Physical Education Building, 2nd Floor, Hallway, Outside Room 2012 Women's Bathroom, Wall	Brick and Mortar (SEPARATE LAYERS)	
4751-PE-67	Physical Education Building, Room 2013, Men's Bathroom, Floor	Quarry Tile, Grout, Mudset (SEPARATE LAYERS)	
4751-PE-68	Physical Education Building, Room 2012, Women's Bathroom, Floor	Quarry Tile, Grout, Mudset (SEPARATE LAYERS)	
¹⁵ 4751-PE-69 2834102	Physical Education Building, Room 2013, Men's Bathroom, Door, Metal Frame to Brick & Mortar	Caulk	
¹⁵ 4751-PE-70 2834103	Physical Education Building, Room 2012, Women's Bathroom, Door, Metal Frame to Brick & Mortar	Caulk	

CHAIN OF CUSTODY (SEE LAST PAGE)

SUBMITTED BY: [Signature] DATE: 9-Jun-22
 RECEIVED BY: [Signature] DATE: JUN 9'22 21:06



Quality Environmental Solutions & Technologies, Inc.

Appendix C:

PERSONNEL LICENSES & CERTIFICATIONS



NEW YORK STATE **MINORITY- AND WOMEN-OWNED BUSINESS ENTERPRISE ("MWBE")** **CERTIFICATION**

Empire State Development's Division of Minority and Women's Business Development grants a
Women Business Enterprise (WBE)

pursuant to New York State Executive Law, Article 15-A to:

Quality Environmental Solutions & Technologies Inc.

Certification Awarded on: March 28, 2019

Expiration Date: March 28, 2024

File ID#: WBE- 49952



**Division of Minority
and Women's
Business Development**

A Division of Empire State Development

New York State – Department of Labor

Division of Safety and Health
License and Certificate Unit
State Campus, Building 12
Albany, NY 12240

ASBESTOS HANDLING LICENSE

Quality Environmental Solutions & Technologies, Inc.

1376 Route 9

Wappinger Falls, NY 12590

FILE NUMBER: 99-0018

LICENSE NUMBER: 29085

LICENSE CLASS: RESTRICTED

DATE OF ISSUE: 01/21/2022

EXPIRATION DATE: 01/31/2023

Duly Authorized Representative – Lawrence J Holzapfel:

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

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

Amy Phillips, Director
For the Commissioner of Labor

NEW YORK STATE DEPARTMENT OF HEALTH
WADSWORTH CENTER



Expires 12:01 AM April 01, 2023
Issued April 01, 2022

CERTIFICATE OF APPROVAL FOR LABORATORY SERVICE

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

MR. PAUL STASCAVAGE
EAS INC - EASTERN ANALYTICAL SERVICES INC
4 WESTCHESTER PLAZA
ELMSFORD, NY 10523-1610

NY Lab Id No: 10851

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

Miscellaneous

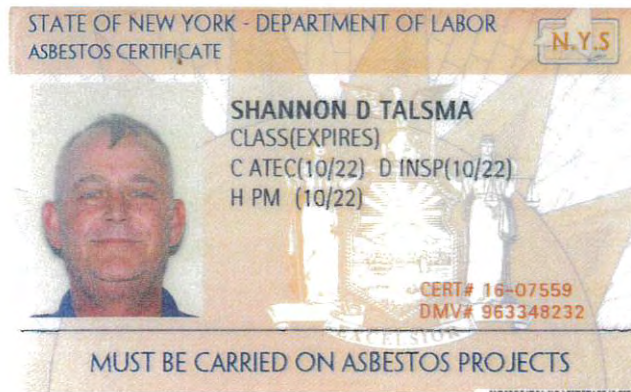
Asbestos in Friable Material	Item 198.1 of Manual EPA 600/M-1/82/020
Asbestos in Non-Friable Material-PLM	Item 198.6 of Manual (NOB by PLM)
Asbestos in Non-Friable Material-TEM	Item 198.4 of Manual
Asbestos-Vermiculite-Containing Material	Item 198.8 of Manual
Lead in Dust Wipes	EPA 7000B
Lead in Paint	EPA 7000B

Sample Preparation Methods

EPA 3050B

Serial No.: 64479

Property of the New York State Department of Health. Certificates are valid only at the address shown, must be conspicuously posted, and are printed on secure paper. Continued accreditation depends on successful ongoing participation in the Program. Consumers are urged to call (518) 485-5570 to verify the laboratory's accreditation status.



01213 006064490 39

EYES GRN
HAIR BLN
HGT 6' 00"

IF FOUND RETURN TO:
NYS DOL - L&C UNIT
ROOM 161A BUILDING 12
STATE OFFICE CAMPUS
ALBANY NY 12240



12-006010504

This card acknowledges that the recipient has successfully completed

10-hour Construction Safety and Health

This card issued to:

Shannon D. Talsma

David Veit

04/22/2016

Trainer Name

Date of Issue



732.235.9450
aotc.sph.rutgers.edu

OSHA recommends Outreach Training Courses as an orientation to occupational safety and health for workers. Participation is voluntary. Workers must receive additional training on specific hazards of their job. This course completion card does not expire.


Use or distribution of this card for fraudulent purposes, including false claims of having received training, may result in prosecution under 18 U.S.C. 1001. Potential penalties include substantial criminal fines, imprisonment up to 5 years, or both.

To verify this training scan the QR code with your mobile device.




Rev 1/2016

STATE OF NEW YORK - DEPARTMENT OF LABOR
ASBESTOS CERTIFICATE



SHAWN A CONKLIN
CLASS(EXPIRES)
D INSP(12/23)



CERT# 22-05119
DMV# 766990344

MUST BE CARRIED ON ASBESTOS PROJECTS



EYES BLU
HAIR BLN
HGT 6' 00"

IF FOUND RETURN TO:
NYSDEL - L&C UNIT
ROOM 161A BUILDING 12
STATE OFFICE CAMPUS
ALBANY NY 12240



26-007380756

This card acknowledges that the recipient has successfully completed:

10-hour Construction Safety and Health

This card issued to:

SHAWN A CONKLIN

Curtis Eugene Chambers
Trainer Name

04/05/2022
Date of Issue



866-906-9190
www.uta.edu/ded/osh

OSHA recommends Outreach Training Courses as an orientation to occupational safety and health for workers. Participation is voluntary. Workers must receive additional training on specific hazards of their job. This course completion card does not expire.

Use or distribution of this card for fraudulent purposes, including false claims of having received training, may result in prosecution under 18 U.S.C. 1001. Potential penalties include substantial criminal fines, imprisonment up to 5 years, or both.

To verify this training, scan the QR code with your mobile device.



Rev. 1/2016

State University of New York
Construction Agreement

PLEASE NOTE: SECTIONS THAT HIGHLIGHTED MUST BE FILLED OUT TO COMPLETE THIS CONTRACT. THIS INCLUDES CONTENT IN PAGE 1, SECTIONS 4.20, 5.06, THE SIGNATURE PAGE & SCHEDULE A. DELETE THIS TEXT BEFORE FINALIZING THIS AGREEMENT.

This Agreement (referred to alternately as "Agreement" or "Contract") made as of the _____ day of _____, 20____, for Contract Number **D990176** by and between STATE UNIVERSITY OF NEW YORK, a corporation organized and existing under the laws of the State of New York, with its principal office located at State University Plaza, 353 Broadway, Albany, New York 12246, on behalf of State University of New York at Purchase College located at 735 Anderson Hill Road, Purchase, NY 10577-1402 hereinafter referred to as "University" and _____ having its principal office located at _____, and a Federal ID or Social Security No. of {insert number}, hereinafter referred to as "the Contractor."

WITNESSETH:

The parties hereto agree that the Contractor shall:

(a) furnish and perform all work of every kind required and all other things necessary to complete in the most substantial and workmanlike manner the construction of

Project SU-050522
Academic Restroom Phase 2
At SUNY Purchase College

in strict accordance with the Contract Documents; and

(b) complete all work necessary for substantial completion **within 475 days after the date of the Notice to Proceed**, or within the time to which such completion may have been extended in accordance with the Contract Documents;

(c) in the event it fails to substantially complete all the work on time, pay to the University liquidated damages in accordance with the liquidated damages schedule listed on page one of the contractors proposal for each calendar day of delay of substantially completing all the work; and

(d) do everything required by the Contract; subject, however, to the terms, provisions and conditions listed hereinafter.

(e) The University shall pay and the Contractor shall accept as full and complete payment for the performance of this Agreement, subject to additions or deductions as provided herein, the total contract compensation of \$_____, (in figures), _____ (in words).

Article I
General Provisions

Section 1.01 Definitions

Where the following words and expressions are used in the Contract Documents it is understood that they have the meaning set forth as follows:

Allowance Any and all work and materials which may be required of the Contractor in performing work set forth under one or more allowances to this Agreement shall be Work, as defined herein, which shall be performed in accordance with the base schedule for the performance of the Contractor's Work. Contractor shall not be entitled to an extension of time for the performance of an allowance or all allowances.

Consultant The Architect or Engineer named in the Notice to Bidders or such other person or firm designated by the University to provide general administration of the Contract and inspection of the work.

Bidding Notice to Bidders, Information for