



Specifications

For construction contracts greater than \$20,000

Rehabilitation of Visual Arts Darkroom Suite

SU-040224

Dated April 2, 2024

Bid Proposal Due Date

June 13, 2024

State University of New York Purchase College
735 Anderson Hill Road
Purchase, New York 10577-1402
Sheli Taylor, Associate Director, Contract & Procurement Services

DIVISION 21

FIRE PROTECTION

TABLE OF CONTENTS

<u>SECTION NO.</u>	<u>TITLE</u>	<u>PAGE</u>
210500	COMMON WORK RESULTS FOR FIRE SUPPRESSION	210500-1
210517	SLEEVE AND SLEEVE SEALS FOR FIRE-SUPPRESSION PIPING	210517-1
211313	WET-PIPE SPRINKLER SYSTEMS	211313-1

COMMON WORK RESULTS FOR FIRE SUPPRESSION

SECTION 210500 - COMMON WORK RESULTS FOR FIRE SUPPRESSION

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following:
 - 1. Piping materials and installation instructions common to most piping systems.
 - 2. Sleeves.
 - 3. Escutcheons.
 - 4. Supports and anchorages.

1.2 DEFINITIONS

- A. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe chases, and unheated spaces immediately below roof and spaces above ceilings.
- B. Exposed, Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and mechanical or electrical equipment rooms.
- C. Exposed, Exterior Installations: Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions. Examples include wall mounted locations.
- D. Concealed, Interior Installations: Concealed from view and protected from physical contact by building occupants. Examples include above ceilings and in chases.

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated and for the final O & M manuals.
- B. Product warranties for all products in this section.
- C. Operation and maintenance data for the final O & M Manuals.

1.4 QUALITY ASSURANCE

- A. Electrical Characteristics for Fire-Suppression Equipment: Equipment of different electrical characteristics may be furnished provided such proposed equipment is approved in writing and connecting electrical services, circuit breakers, and conduit sizes are appropriately modified. If minimum energy ratings or efficiencies are specified, equipment shall comply with requirements.

PART 2 - PRODUCTS

210500-1

Common Work Results for Fire Suppression

COMMON WORK RESULTS FOR FIRE SUPPRESSION

2.1 PIPE, TUBE, AND FITTINGS

- A. Refer to individual Division 21 piping Sections for pipe, tube, and fitting materials and joining methods.
- B. Pipe Threads: ASME B1.20.1 for factory-threaded pipe and pipe fittings.

2.2 JOINING MATERIALS

- A. Refer to individual Division 21 piping Sections for special joining materials not listed below.
- B. Grooved joints are acceptable for 2-1/2" – 6" pipe.

2.3 SLEEVES

- A. Galvanized-Steel Sheet: 0.0239-inch minimum thickness; round tube closed with welded longitudinal joint.
- B. Steel Pipe: ASTM A 53, Type E, Grade B, Schedule 40, galvanized, plain ends.

2.4 ESCUTCHEONS

- A. Description: Manufactured wall and ceiling escutcheons and floor plates, with an ID to closely fit around pipe, tube, and insulation of insulated piping and an OD that completely covers opening.
- B. Split-Casting, Cast-Brass Type: With concealed hinge and set screw.
 - 1. Finish: Polished chrome-plated and rough brass.

PART 3 - EXECUTION

3.1 PIPING SYSTEMS - COMMON REQUIREMENTS

- A. Provide piping according to the following requirements and Division 21 Sections specifying piping systems.
- B. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Provide fire protection piping as indicated unless deviations to layout are approved on the Coordination Drawings.
- C. Provide piping in concealed locations, unless otherwise indicated and except in equipment rooms and service areas.

210500-2

Common Work Results for Fire Suppression

COMMON WORK RESULTS FOR FIRE SUPPRESSION

- D. Provide piping at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
- E. Provide piping above accessible ceilings to allow sufficient space for ceiling panel removal.
- F. Provide piping to permit valve servicing from a standing position on the floor.
- G. Provide piping at indicated slopes. Slope fire protection system drain piping at a minimum of 1 percent to building mop service sinks or an exterior building discharge point. Slope fire protection water piping to permit drainage of system with no trapped locations.
- H. Provide piping free of sags and bends.
- I. Provide fittings for changes in direction and branch connections.
- J. Provide piping to allow application of insulation.
- K. Select system components with pressure rating equal to or greater than system operating pressure.
- L. Provide escutcheons for penetrations of walls, ceilings, and floors.
- M. Provide sleeves for pipes passing through concrete and masonry walls, gypsum-board partitions, and concrete floor and roof slabs.
- N. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with fire stop materials. Refer to Division 07 Section "Penetration Fire Stopping" for materials.
- O. Refer to equipment specifications in other Sections of these Specifications for roughing-in requirements.
- P. Prime and paint all exposed interior and exterior piping with one – (1) coat primer and – (2) coats finish metal alkyd enamel paint. Final color in mechanical spaces is per the Campus. Final color as selected by architect in all places exposed to public. Protect fittings against rust prior to painting or provide fittings that are factory coated.

3.2 PIPING JOINT CONSTRUCTION

- A. Join pipe and fittings according to the following requirements and Division 21 Sections specifying piping systems.
- B. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.

210500-3

Common Work Results for Fire Suppression

COMMON WORK RESULTS FOR FIRE SUPPRESSION

- C. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly. Remove pipe coupons from the inside of pipe where piping is drilled and tapped.
- D. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:
 - 1. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.
 - 2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.

3.3 ERECTION OF METAL SUPPORTS AND ANCHORAGES

- A. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor fire-suppression materials and equipment.

END OF SECTION

SLEEVES AND SLEEVE SEALS FOR FIRE SUPPRESSION

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 other Division 01 Specification Sections, apply to this Section. B. Section Includes:

1. Sleeves.
2. Sleeve-seal systems.
3. Grout.

1.2 ACTION SUBMITTALS

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

PART 2 - PRODUCTS

2.1 SLEEVES

- A. Galvanized-Steel-Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, zinc coated, with plain ends.
- B. Galvanized-Steel-Sheet Sleeves: 0.0239-inch minimum thickness; round tube closed with welded longitudinal joint.

2.2 GROUT

- A. Standard: ASTM C 1107/C 1107M, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.
- B. Characteristics: No shrink; recommended for interior and exterior applications.
- C. Design Mix: 5000-psi, 28-day compressive strength.

210517-1 Sleeves and Sleeve Seals for Fire Suppression

SLEEVES AND SLEEVE SEALS FOR FIRE SUPPRESSION

- D. Packaging: Premixed and factory packaged.

PART 3 - EXECUTION

3.1 SLEEVE INSTALLATION

- A. Install sleeves for piping passing through penetrations in floors, partitions, roofs, and walls.
 - 1. Sleeves are not required for core-drilled holes.
- B. Install sleeves in concrete floors, concrete roof slabs, and concrete walls as new slabs and walls are constructed.
 - 1. Cut sleeves to length for mounting flush with both surfaces.
 - a. Exception: Extend sleeves installed in floors of mechanical equipment areas or other wet areas 2 inches above finished floor level.
 - 2. Using grout, seal the space outside of sleeves in slabs and walls without sleeves seal system.
- 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. Comply with requirements for sealants specified in Section 079200 "Joint Sealants."
- D. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials.
 - 1. Concrete Slabs above Grade:

210517-2 Sleeves and Sleeve Seals for Fire Suppression

SLEEVES AND SLEEVE SEALS FOR FIRE SUPPRESSION

- a. Piping Smaller than NPS 6 Galvanized-steel-pipe sleeve.
- 2. Interior Partitions:
 - a. Piping Smaller Than NPS 6: Galvanized-steel-pipe sleeves.

END OF SECTION 210517

210517-3 Sleeves and Sleeve Seals for Fire Suppression

WET-PIPE SPRINKLER SYSTEMS

SECTION 211313 - WET-PIPE SPRINKLER SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Pipes, fittings, and specialties.
 - 2. Sprinklers.

1.2 SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: For wet-pipe sprinkler systems.
 - 1. Include plans, elevations, sections, and attachment details.
 - 2. Include diagrams for power, signal, and control wiring.
- C. Approved Sprinkler Piping Drawings: Working plans, prepared according to NFPA 13, including hydraulic calculations.
- D. Contractor to provide hydrant flow test.
- E. Contractor to provide as built drawings.
- F. Field Test Reports and Certificates: 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."
- G. Field quality-control reports.
- F. Operation and maintenance data.

1.3 QUALITY ASSURANCE

- A. Installer Qualifications:
 - 1. Installer's responsibilities include fabricating, and installing sprinkler systems and providing New York State licensed professional engineering services needed to assume engineering responsibility.
 - a. Engineering Responsibility: Preparation of working plans, calculations, and field test reports by a qualified New York State licensed professional engineer.

211313-1

Wet-Pipe Sprinkler Systems

WET-PIPE SPRINKLER SYSTEMS

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Sprinkler system equipment, specialties, accessories, installation, and testing shall comply with the following:
 - 1. NFPA 13, 2016 edition.
 - 2. NFPA 25 – Standard for the Inspection, Testing, and Maintenance of WaterBased Fire Protection Systems.
 - 3. NY State Building and Fire Code, 2020 edition.
- B. Standard-Pressure Piping System Component: Listed for 175-psig minimum working pressure.

2.2 STEEL PIPE AND FITTINGS

- A. Standard-Weight, Black Steel Pipe: ASTM A 53/A 53M, Type E, Grade A. Pipe ends may be factory or field formed to match joining method.
- B. Black Steel Pipe Nipples: ASTM A 733, made of ASTM A 53/A 53M, standard-weight, seamless steel pipe with threaded ends.
- C. Uncoated Steel Couplings: ASTM A 865/A 865M, threaded.
- D. Uncoated, Gray-Iron Threaded Fittings: ASME B16.4, Class 125, standard pattern.
- E. Malleable- or Ductile-Iron Unions: UL 860.
- F. Grooved-Joint, Steel-Pipe Appurtenances:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Anvil International.
 - b. National Fittings, Inc.
 - c. Shurjoint Piping Products USA Inc.
 - d. Victaulic
 - 2. Painted, Uncoated Grooved-End Fittings for Steel Piping: ASTM A 47/A 47M, malleable-iron casting or ASTM A 536, ductile-iron casting, with dimensions matching steel pipe.

WET-PIPE SPRINKLER SYSTEMS

3. 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. 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. Anvil International.
 - b. Shurjoint Piping Products USA Inc.
 - c. Victaulic Company.
2. Standard: UL 213.
3. Pressure Rating: 175-psig minimum.
4. Body Material: Ductile-iron housing with EPDM seals and bolts and nuts.
5. Type: Mechanical-tee and -cross fittings.
6. Configurations: Snap-on and strapless, ductile-iron housing with branch outlets.
7. Size: Of dimension to fit onto sprinkler main and with outlet connections as required to match connected branch piping.
8. Branch Outlets: Grooved, plain-end pipe, or 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. 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 Guards: required for exposed sprinklers located

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Reliable Automatic Sprinkler Co., Inc. (The).

211313-3

Wet-Pipe Sprinkler Systems

WET-PIPE SPRINKLER SYSTEMS

- b. Victaulic Company.
 - c. Viking Corporation.
- 2. Standard: UL 199.
 - 3. Type: Wire cage with fastening device for attaching to sprinkler.

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 approval from the design team.
 - 2. Coordinate layout and installation of sprinklers with other construction that penetrates ceilings, including light fixtures, HVAC equipment, and partition assemblies.
- B. Piping Standard: Comply with NFPA 13 requirements for installation of sprinkler piping.
- C. Use listed fittings to make changes in direction, branch takeoffs from mains, and reductions in pipe sizes.
- D. Install unions adjacent to each valve in pipes NPS 2 and smaller.
- E. Install sprinkler piping with drains for complete system drainage.
- F. Install hangers and supports for sprinkler system piping according to NFPA 13. Comply with requirements for hanger materials in NFPA 13.
- G. Fill sprinkler system piping with water.
- H. 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."

3.2 JOINT CONSTRUCTION

WET-PIPE SPRINKLER SYSTEMS

- 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.
- F. Steel-Piping, Roll-Grooved Joints: Roll rounded-edge groove in end of pipe according to AWWA C606. Assemble coupling with housing, gasket, lubricant, and bolts. Join steel pipe and grooved-end fittings according to AWWA C606 for steel-pipe grooved joints.

3.3 SPRINKLER INSTALLATION

- A. Provide sprinkler guards for sprinklers in exposed locations.

3.4 IDENTIFICATION

- A. Install labeling and pipe markers on equipment and piping according to requirements in NFPA 13.

3.5 FIELD QUALITY CONTROL

- A. Contractor shall perform the following tests and inspections:
 - 1. Leak Test: After installation, charge systems and test for leaks. Repair leaks and retest until no leaks exist.
 - 2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
 - 3. Flush, test, and inspect sprinkler systems according to NFPA 13, "Systems Acceptance" Chapter.
 - 4. Energize circuits to electrical equipment and devices.
 - 5. Coordinate with fire-alarm tests. Operate as required.

WET-PIPE SPRINKLER SYSTEMS

- 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 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
 - 1. Standard-weight, black-steel pipe with threaded ends; uncoated, gray-iron threaded fittings; and threaded joints. All piping shall be schedule 40.
 - 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. All piping shall be schedule 40.
- C. Standard-pressure, wet-pipe sprinkler system, NPS 2-1/2 to NPS 4, shall be the following:
 - 1. Standard-weight, black-steel pipe with threaded ends; uncoated, gray-iron threaded fittings; and threaded joints. All piping shall be schedule 40.
 - 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. All piping shall be schedule 40.
- D. Standard-pressure, wet-pipe sprinkler system, NPS 5 and larger, shall be the following:
 - 1. Standard-weight, black-steel pipe with threaded ends; uncoated, gray-iron threaded fittings; and threaded joints. All piping shall be schedule 40.
 - 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. All piping shall be schedule 40.

3.8 SPRINKLER SCHEDULE

WET-PIPE SPRINKLER SYSTEMS

- A. Use sprinkler types in subparagraphs below for the following applications:
 - 1. Rooms with Suspended Ceilings: semi-recessed pendent sprinklers
 - 2. Rooms with no ceilings: exposed upright sprinklers
- B. Provide sprinkler types in subparagraphs below with finishes indicated.
 - 1. Upright Sprinklers: Rough bronze. Provide guards.

END OF SECTION 211313

DIVISION 22

PLUMBING

TABLE OF CONTENTS

DIVISION 22 - PLUMBING

<u>SECTION NO.</u>	<u>TITLE</u>	<u>PAGE</u>
220500	COMMON WORK RESULTS FOR PLUMBING	220500-1
220529	HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT	220529-1
221116	DOMESTIC WATER PIPING	221116-1
221316	SANITARY WASTE AND VENT PIPING	221316-1
221319	SANITARY WASTE PIPING SPECIALTIES	221319-1

COMMON WORK RESULTS FOR PLUMBING

220500 COMMON WORK RESULTS FOR PLUMBING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes the following:
1. Piping materials and installation instructions common to most piping systems.
 2. Transition fittings.
 3. Dielectric fittings.
 4. Mechanical sleeve seals.
 5. Sleeves.
 6. Escutcheons.
 7. Grout.
 8. Plumbing demolition.
 9. Equipment installation requirements common to equipment sections.
 10. Painting and finishing.
 11. Concrete bases.
 12. Supports and anchorages.

1.3 DEFINITIONS

- A. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe chases, unheated spaces immediately below roof, spaces above ceilings and crawlspaces.
- B. Exposed, Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and mechanical equipment rooms.
- C. Exposed, Exterior Installations: Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations.
- D. Concealed, Interior Installations: Concealed from view and protected from physical contact by building occupants. Examples include above ceilings and in chases.
- E. The following are industry abbreviations for rubber materials:
1. EPDM: Ethylene-propylene-diene terpolymer rubber.
 2. NBR: Acrylonitrile-butadiene rubber.

220500-1

Common Work Results for Plumbing

COMMON WORK RESULTS FOR PLUMBING

1.4 SUBMITTALS

- A. Provide product literature and warranty information for all products listed in this section and for the final O & M Manuals:
 - 1. Transition fittings.
 - 2. Dielectric fittings.
 - 3. Mechanical sleeve seals.
 - 4. Escutcheons.
- B. Welding certificates for certified welders.
- C. Maintenance data for the final O & M Manuals.

1.5 COORDINATION DRAWINGS

- A. Before construction work commences, coordinate with all other trades and submit coordination drawings in the form of electronic drawing files or reproducible transparencies, drawn at not less than 1/4 inch scale. Such drawings will be required throughout all work areas. While developing these drawings, be accountable for determining plumbing and equipment conflicts with the ductwork, heating piping, structure, foundations, beams and wall construction with respect to the work of this trade. Provide written descriptions and schematic drawings for any conflicts discovered and determined during demolition and investigation of the building conditions for review by the Engineer. Schematics shall include suggested piping routings if different than the construction plans and proposed cost reductions or additions. The coordination drawings shall show resolutions in congested areas. Boiler, Electrical and Mechanical Equipment Rooms shall be drawn early in coordination drawing process simultaneous with all other congested areas. Provide for and prepare Coordination Drawings As Follows:
 - 1. Prepare the base plan coordination drawings showing all ductwork, all pertinent heating piping, and equipment. These drawings may be sepias of the required ductwork Shop Drawings. The drawings shall be coordinated with lighting fixtures, air diffusers, other ceiling mounted items, ceiling heights, structural work, maintenance clearances, electric code clearance, reflected ceiling plans, and other contract requirements. Reposition proposed locations of work after coordination drawing review by the Owner's Representative. Provide adjustments to exact size, location, and offsets of ducts, pipes, conduit, etc., to achieve reasonable appearance objectives. Provide these adjustments as part of contract. Minor revisions need not be redrawn.
 - 2. Provide reproducible and/or prints for use as the base plan. Electronic drawing files may be furnished to those which have the CAD capabilities required for their use.

COMMON WORK RESULTS FOR PLUMBING

3. Provide draft locations of piping and equipment on the base plan, indicating areas of conflict and suggested resolutions.
 4. Provide draft locations of lighting fixtures, cable trays, and feeders over 1-1/2 in. on the base plan, indicating areas of conflict and suggested resolution.
 5. Indicate areas of architectural/structural conflicts or obstacles and coordinate to suit the overall construction schedule.
 6. In the case of unresolved interferences, notify the Owner's Representative. The Owner's Representative will provide direction on how to revise the drawings as required eliminating installation interferences.
 7. If the installation proceeds prior to resolving conflicts, then if necessary, change to the work shall be provided at no extra cost in order to permit the work to proceed with a coordinated installation. Coordination approval will be given by areas after special site meetings.
- B. The purpose of the coordination drawing process is to identify and resolve potential conflicts, before they occur in construction. Coordination drawings are intended for use during construction and shall not replace any Shop Drawings, or record drawings required elsewhere in these contract documents.

1.6 QUALITY ASSURANCE

- A. Steel Support Welding: Qualify processes and operators according to AWS D1.1, "Structural Welding Code--Steel."
- B. Steel Pipe Welding: Qualify processes and operators according to ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications."
1. Comply with provisions in ASME B31 Series, "Code for Pressure Piping."
 2. Certify that each welder has passed AWS qualification tests for welding processes involved and that certification is current.
- C. Electrical Characteristics for Plumbing Equipment: Equipment of higher electrical characteristics may be furnished provided such proposed equipment is approved in writing and connecting electrical services, circuit breakers, and conduit sizes are appropriately modified. If minimum energy ratings or efficiencies are specified, equipment shall comply with requirements.
- D. Provide all building plumbing systems in compliance with 2020 Plumbing Code of New York State.

COMMON WORK RESULTS FOR PLUMBING

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Deliver pipes and tubes with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe end damage and to prevent entrance of dirt, debris, and moisture.
- B. Store plastic pipes protected from direct sunlight. Support to prevent sagging and bending.

1.8 COORDINATION

- A. Arrange for pipe spaces, chases, slots, and openings in building structure during progress of construction, to allow for plumbing installations.
- B. Coordinate installation of required supporting devices and set sleeves in poured-in-place concrete and other structural components as they are constructed.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. In other Part 2 articles where subparagraph titles below introduce lists, the following requirements apply for product selection:
 - 1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the manufacturers specified.

2.2 PIPE, TUBE, AND FITTINGS

- A. Refer to individual Division 22 piping Sections for pipe, tube, and fitting materials and joining methods.
- B. Pipe Threads: ASME B1.20.1 for factory-threaded pipe and pipe fittings.

2.3 JOINING MATERIALS

- A. Refer to individual Division 22 piping Sections for special joining materials not listed below.
- B. Pipe Flange Gasket Materials: Suitable for chemical and thermal conditions of piping system contents.
 - 1. ASME B16.21, nonmetallic, flat, asbestos-free, 1/8-inch maximum thickness unless thickness or specific material is indicated.

COMMON WORK RESULTS FOR PLUMBING

- a. Full Face Type: For flat face, Class 125, cast iron and cast bronze flanges.
 - b. Narrow Face Type: For raised face, Class 250, cast iron and steel flanges.
- 2. AWWA C110, rubber, flat face, 1/8 inch thick, unless otherwise indicated; and full face or ring type, unless otherwise indicated.
- C. Flange Bolts and Nuts: ASME B18.2.1, carbon steel, unless otherwise indicated.
- D. Solder Filler Metals: ASTM B 32, lead free alloys. Include water-flushable flux according to ASTM B 813.

2.4 TRANSITION FITTINGS

- A. AWWA Transition Couplings: Same size as, and with pressure rating at least equal to and with ends compatible with, piping to be joined.
 - 1. Manufacturers:
 - a. Cascade Waterworks Mfg. Co.
 - b. Dresser Industries, Inc.; DMD Div.
 - c. Ford Meter Box Company, Incorporated (The); Pipe Products Div.
 - d. JCM Industries.
 - e. Smith-Blair, Inc.
 - f. Viking Johnson.
 - 2. Underground Piping NPS 1-1/2 and Smaller: Manufactured fitting or coupling.
 - 3. Underground Piping NPS 2 and Larger: AWWA C219, metal sleeve-type coupling.
 - 4. Aboveground Pressure Piping: Pipe fitting.
- B. Plastic-to-Metal Transition Adaptors and Condensate Drain Connectors: One piece fitting with manufacturer's SDR 11 equivalent dimensions; one end with threaded brass insert, and one solvent cement joint end. For connection HVAC unit manufacturer's plastic P-trap, flexible, clear or fire resistant condensate connection hose and stainless steel band clamp couplings.
 - 1. Manufacturers:
 - a. Thompson Plastics, Inc.
 - b. Dresser Industries, Inc.; DMD Div.
 - c. Diversitech.
 - d. Fernco.

COMMON WORK RESULTS FOR PLUMBING

- e. Rectorseal.
 - f. Watco.
- C. Plastic-to-Metal Transition Unions: MSS SP-107, CPVC four part union. Include brass end, solvent cement joint end, rubber O-ring, and union nut.
 - 1. Manufacturers:
 - a. NIBCO INC.
 - b. NIBCO, Inc.; Chemtrol Div.
 - c. Dresser Industries, Inc.; DMD Div.
 - d. Ford.
- D. Flexible Transition Couplings for Underground Drainage Piping: ASTM C 1173 with elastomeric sleeve ends same size as piping to be joined and corrosion resistant stainless steel metal band clamps with full shield on each end.
 - 1. Manufacturers:
 - a. Cascade Waterworks Mfg. Co.
 - b. Fernco, Inc.
 - c. Mission Rubber Company.
 - d. Plastic Oddities, Inc.

2.5 DIELECTRIC FITTINGS

- A. Description: Combination fitting of copper alloy and ferrous materials with threaded, solder-joint, plain, or weld-neck end connections that match piping system materials.
- B. Insulating Material: Suitable for system fluid, pressure, and temperature.
- C. Dielectric Unions: Factory fabricated, union assembly, for 250-psig minimum working pressure at 180 deg F.
 - 1. Manufacturers:
 - a. Capitol Manufacturing Co.
 - b. Central Plastics Company.
 - c. Eclipse, Inc.
 - d. Epco Sales, Inc.
 - e. Hart Industries, International, Inc.
 - f. Watts Industries, Inc.; Water Products Div.
 - g. Zurn Industries, Inc.; Wilkins Div.

COMMON WORK RESULTS FOR PLUMBING

- D. Dielectric Flanges: Factory fabricated, companion flange assembly, for 150 or 300 psig minimum working pressure as required to suit system pressures.

1. Manufacturers:

- a. Capitol Manufacturing Co.
- b. Central Plastics Company.
- c. Epco Sales, Inc.
- d. Watts Industries, Inc.; Water Products Div.

- E. Dielectric Couplings: Galvanized steel coupling with inert and noncorrosive, thermoplastic lining; threaded ends; and 300-psig minimum working pressure at 225 deg F.

1. Manufacturers:

- a. Calpico, Inc.
- b. Lochinvar Corp.
- c. Watts.

- F. Dielectric Nipples: Electroplated steel nipple with inert and noncorrosive, thermoplastic lining; plain, threaded, or grooved ends; and 300 psig minimum working pressure at 225 deg F.

1. Manufacturers:

- a. Perfection Corp.
- b. Precision Plumbing Products, Inc.
- c. Sioux Chief Manufacturing Co., Inc.
- d. Victaulic Co. of America.

2.6 MECHANICAL SLEEVE SEALS

- A. Description: Modular sealing element unit, designed for field assembly, to fill annular space between pipe and sleeve.

1. Manufacturers:

- a. Advance Products & Systems, Inc.
- b. Calpico, Inc.
- c. Metraflex Co.
- d. Pipeline Seal and Insulator, Inc.

2. Sealing Elements: EPDM interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.

220500-7

Common Work Results for Plumbing

COMMON WORK RESULTS FOR PLUMBING

3. Pressure Plates: Stainless steel. Include two for each sealing element.
4. Connecting Bolts and Nuts: Stainless steel of length required to secure pressure plates to sealing elements. Include one for each sealing element.

2.7 SLEEVES

- A. Galvanized Steel Sheet: 0.0239 inch minimum thickness; round tube closed with welded longitudinal joint.
- B. Cast Iron: Cast or fabricated "wall pipe" equivalent to ductile iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.
- C. Stack Sleeve Fittings: Manufactured, cast iron sleeve with integral clamping flange. Include clamping ring and bolts and nuts for membrane flashing.
 1. Underdeck Clamp: Clamping ring with set screws.

2.8 ESCUTCHEONS

- A. Description: Manufactured wall and ceiling escutcheons and floor plates, with an ID to closely fit around pipe, tube, and insulation of insulated piping and an OD that completely covers opening.
- B. One Piece, Deep Pattern Type: Deep drawn, box shaped brass with polished chrome plated finish.
- C. Two Piece, Cast Brass Type: With set screw.
 1. Finish: Polished chrome plated and rough brass.
- D. Split Casting, Cast Brass Type: With concealed hinge and set screw.
 1. Finish: Polished chrome plated and rough brass.
- E. Two Piece, Stamped Steel Type: With set screw or spring clips and chrome plated finish.
- F. Split Plate, Stamped Steel Type: With concealed hinge, set screw or spring clips, and chrome plated finish.
- G. Two Piece, Floor Plate Type: Cast iron floor plate.
- H. Split Casting, Floor Plate Type: Cast brass with concealed hinge and set screw.

COMMON WORK RESULTS FOR PLUMBING

2.9 GROUT

- A. Description: ASTM C 1107, Grade B, nonshrink and nonmetallic, dry hydraulic cement grout.
 - 1. Characteristics: Post hardening, volume adjusting, non-staining, noncorrosive, nongaseous, and recommended for interior and exterior applications.
 - 2. Design Mix: 5000 psi, 28 day compressive strength.
 - 3. Packaging: Premixed and factory packaged.

PART 3 - EXECUTION

3.1 PLUMBING DEMOLITION

- A. Refer to Division 01 Section "Cutting and Patching" and Division 02 Section "Selective Structure Demolition" for general demolition requirements and procedures.
- B. Disconnect, demolish, and remove plumbing systems, equipment, and components indicated to be removed.
 - 1. Piping to Be Removed: Remove portion of piping indicated to be removed and cap remaining piping with same or compatible piping material if not reused.
 - 2. Piping to Be Abandoned in Place: Drain piping, cut at ends to isolate from existing piping systems to remain and cap or plug piping ends with the same or compatible piping material.
 - 3. Equipment to Be Removed: Disconnect and cap plumbing piping and remove equipment.
 - 4. Equipment to Be Removed and Reinstalled: Disconnect and cap services and remove, clean, and store equipment; when appropriate, reinstall, reconnect, and make plumbing equipment operational.
 - 5. Equipment to Be Removed and Salvaged: Disconnect and cap services and remove plumbing equipment and deliver to Owner. Verify with Owner items to be salvaged prior to commencing with work.
- C. If pipe, insulation, or equipment to remain is damaged in appearance or is unserviceable, due to the work of this contract, remove damaged or unserviceable portions and replace with new products of equal capacity and quality.

3.2 PIPING SYSTEMS - COMMON REQUIREMENTS

- A. Provide piping according to the following requirements and Division 22 Sections specifying piping systems.

COMMON WORK RESULTS FOR PLUMBING

- B. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.
- C. Provide piping in concealed locations, unless otherwise indicated and except in equipment rooms and service areas.
- D. Provide piping at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
- E. Provide piping above accessible ceilings to allow sufficient space for ceiling panel removal.
- F. Provide piping to permit valve servicing.
- G. Provide piping at indicated slopes.
- H. Provide piping free of sags and bends.
- I. Provide fittings for changes in direction and branch connections.
- J. Provide piping to allow application of insulation.
- K. Select system components with pressure rating equal to or greater than system operating pressure.
- L. Provide escutcheons for penetrations of walls, ceilings, and floors according to the following:
 - 1. New Piping:
 - a. Piping with Fitting or Sleeve Protruding from Wall: One piece, deep pattern type.
 - b. Chrome Plated Piping: Two piece, cast brass type with polished chrome plated finish.
 - c. Insulated Piping: Two piece, stamped steel type with spring clips.
 - d. Bare Piping at Wall and Floor Penetrations in Finished Spaces: Two piece, cast brass type with polished chrome plated finish.
 - e. Bare Piping at Ceiling Penetrations in Finished Spaces: Split casting, cast brass type with polished chrome plated finish.
 - f. Bare Piping in Unfinished Service Spaces: Two piece, cast brass type with rough brass finish.
 - g. Bare Piping in Equipment Rooms: Two piece, cast brass type.

COMMON WORK RESULTS FOR PLUMBING

- h. Bare Piping at Floor Penetrations in Equipment Rooms: Two piece, floor plate type.
- 2. Existing Piping: Provide the following:
 - a. Chrome Plated Piping: Split casting, cast brass type with chrome plated finish.
 - b. Insulated Piping: Split plate, stamped steel type with concealed hinge and spring clips.
 - c. Bare Piping at Wall and Floor Penetrations in Finished Spaces: Split casting, cast brass type with chrome plated finish.
 - d. Bare Piping at Ceiling Penetrations in Finished Spaces: Split casting, cast brass type with chrome plated finish.
 - e. Bare Piping in Unfinished Service Spaces: Split casting, cast brass type with rough brass finish.
 - f. Bare Piping in Equipment Rooms: Split casting, cast brass type.
 - g. Bare Piping at Floor Penetrations in Equipment Rooms: Split casting, floor plate type.
- M. Sleeves are not required for core drilled holes.
- N. Permanent sleeves are not required for holes formed by removable PE sleeves.
- O. Provide sleeves for pipes passing through fire rated concrete and masonry walls, gypsum board partitions, and concrete floor and roof slabs.
 - 1. Cut sleeves to length for mounting flush with both surfaces.
 - a. Exception: Extend sleeves installed in floors of mechanical equipment areas or other wet areas 2 inches above finished floor level. Extend cast iron sleeve fittings below floor slab as required to secure clamping ring if ring is specified.
 - 2. Provide sleeves in new walls and slabs as new walls and slabs are constructed.
 - 3. Provide sleeves that are large enough to provide 1/4-inch annular clear space between sleeve and pipe or pipe insulation. Provide the following sleeve materials:
 - a. Steel Sheet Sleeves: For pipes smaller than NPS 6.
 - b. Steel Sheet Sleeves: For pipes NPS 6 and larger, penetrating gypsumboard partitions.
 - c. Stack Sleeve Fittings: For pipes penetrating floors with membrane waterproofing. Secure flashing between clamping flanges. Install section of cast-iron soil pipe to extend sleeve to 2 inches above finished floor level. Refer to Division 07 Section "Sheet Metal Flashing and Trim" for flashing.

COMMON WORK RESULTS FOR PLUMBING

- 1) Seal space outside of sleeve fittings with grout.
4. Except for underground wall penetrations, seal annular space between sleeve and pipe or pipe insulation, using joint sealants appropriate for size, depth, and location of joint. Refer to Division 07 Section "Joint Sealants" for materials and installation.
- P. Underground, Exterior Wall Pipe Penetrations: Provide cast iron "wall pipes" for sleeves. Seal pipe penetrations using mechanical sleeve seals. Select sleeve size to allow for 1 inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.
1. Mechanical Sleeve Seal Installation: Select type and number of sealing elements required for pipe material and size. Position pipe in center of sleeve. Assemble mechanical sleeve seals and install in annular space between pipe and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.
- Q. Fire Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Refer to Division 07 Section "Penetration Firestopping" for materials.
- R. Verify final plumbing equipment and piping locations against other trade work prior to roughing-in.
- S. Refer to equipment specifications in other Sections of these Specifications for roughing-in requirements.
- T. Provide for the final connection of all condensate drain piping at air conditioning units provided by Division 23 to the condensate drain piping provided by Division 22. Condensate piping shall be insulated. Refer to 220700.

3.3 PIPING JOINT CONSTRUCTION

- A. Join pipe and fittings according to the following requirements and Division 22 Sections specifying piping systems.
- B. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
- C. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.
- D. 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.

220500-12

Common Work Results for Plumbing

COMMON WORK RESULTS FOR PLUMBING

- E. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:
 - 1. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.
 - 2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.
- F. Welded Joints: Construct joints according to AWS D10.12, using qualified processes and welding operators according to Part 1 "Quality Assurance" Article.
- G. Flanged Joints: Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Use suitable lubricants on bolt threads.

3.4 PLUMBING PIPING CONNECTIONS

- A. Make connections according to the following, unless otherwise indicated:
 - 1. Provide unions, in piping NPS 2 and smaller, adjacent to each valve and at final connection to each piece of plumbing equipment.
 - 2. Provide flanges, in piping NPS 2-1/2 and larger, adjacent to flanged valves and at final connection to each piece of equipment.

3.5 PLUMBING EQUIPMENT INSTALLATION - COMMON REQUIREMENTS

- A. Provide equipment to allow maximum possible headroom unless specific mounting heights are not indicated.
- B. Provide equipment level and plumb, parallel and perpendicular to other building systems and components in exposed interior spaces, unless otherwise indicated.
- C. Provide plumbing equipment to facilitate service, access, maintenance, and repair or replacement of components. Connect equipment for ease of disconnecting, with minimum interference to other installations. Provide for equipment clearances in compliance with manufacturer's written installation instructions. Coordinate the locations of plumbing equipment with the other trades and report any discrepancies, conflicting equipment locations, building conditions or structural issues to the Engineer. Provide sketches of recommended re-routing of piping or relocation of equipment to the Engineer describing proposed locations.
- D. Provide plumbing piping and equipment with clearances and paths installed at required slopes for drainage. Slopes may be adjusted to accommodate existing conditions. Notify Engineer of any proposed changes in writing.

220500-13

Common Work Results for Plumbing

COMMON WORK RESULTS FOR PLUMBING

3.6 PAINTING

- A. Painting of plumbing systems, equipment, and components is specified in Division 09 Sections "Interior Painting" and "Exterior Painting."
- B. Damage and Touchup: Repair marred and damaged factory-painted finishes with materials and procedures to match original factory finish.

3.7 CONCRETE BASES

- A. Concrete Bases: Anchor equipment to concrete base in accordance with equipment manufacturer's written instructions.
 - 1. Provide and construct concrete bases of dimensions indicated, but not less than 4 inches larger in both directions than supported water heaters, pumps or expansion tanks.
 - 2. Provide and install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18 inch centers around the full perimeter of the base.
 - 3. Provide epoxy-coated anchor bolts for supported equipment that extend through concrete base, and anchor into structural concrete floor.
 - 4. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, written recommended instructions, and directions furnished with items to be embedded.
 - 5. Provide anchor bolts to elevations required for proper attachment to supported equipment.
 - 6. Provide anchor bolts according to anchor-bolt manufacturer's written instructions.
 - 7. Use 3000 psi, 28 day compressive-strength concrete and reinforcement as specified in Division 03 Section "Cast in Place Concrete".

3.8 ERECTION OF METAL SUPPORTS AND ANCHORAGES

- A. Refer to Division 05 Section "Metal Fabrications" for structural steel.
- B. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor plumbing materials and equipment.
- C. Field Welding: Comply with AWS D1.1.
- D. Metal supports or unistrut assemblies shall be used at all thermostatic mixing valve and recirculation pump mounting locations on walls.
- E. Provided supports with factory finish or prime and paint supports.

COMMON WORK RESULTS FOR PLUMBING

3.9 GROUTING

- A. Mix and install grout for plumbing equipment base bearing surfaces, pump and other equipment base plates, and anchors.
- B. Clean surfaces that will come into contact with grout.
- C. Provide forms as required for placement of grout.
- D. Avoid air entrapment during placement of grout. E. Place grout, completely filling equipment bases.
- F. Place grout on concrete bases and provide smooth bearing surface for equipment.
- G. Place grout around anchors.
- H. Cure placed grout.

END OF SECTION

HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT

22 0529 HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Metal pipe hangers and supports.
 - 2. Trapeze pipe hangers.
 - 3. Thermal hanger shield inserts.
 - 4. Fastener systems.
 - 5. Pipe positioning systems.
 - 6. Equipment supports.
 - 7. Roof top pipe supports for gas piping.

1.2 SUBMITTALS

- A. Product data and warranty information for each type of product indicated in this section and for the final O & M Manuals.
- B. Welding certificates for certified welders.
- C. Product warranties for all products in this section.
- D. Operation and maintenance data for the final O & M Manuals.

1.3 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.
- C. Provide all building plumbing systems in compliance with the International Plumbing Code of New York State (2020), and all New York State Amendments.

PART 2 - PRODUCTS

2.1 METAL PIPE HANGERS AND SUPPORTS

- A. Carbon Steel Pipe Hangers and Supports:

220529-1 Hanger and Supports for Plumbing Piping and Equipment

HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT

1. Description: MSS SP-58, Types 1 through 58, factory fabricated components.
2. Galvanized Metallic Coatings: Pregalvanized or hot dipped.
3. Nonmetallic Coatings: Plastic coating, jacket, or liner.
4. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion to support bearing surface of piping.
5. Hanger Rods: Continuous thread rod, nuts, and washer made of carbon steel.

B. Copper Pipe Hangers:

1. Description: MSS SP-58, Types 1 through 58, copper coated steel, factory fabricated components.
2. Hanger Rods: Continuous thread rod, nuts, and washer made of copper coated steel.

2.2 TRAPEZE PIPE HANGERS

- A. Description: MSS SP-69, Type 59, shop or field fabricated pipe support assembly made from structural carbon steel shapes with MSS SP-58 carbon steel hanger rods, nuts, saddles, and U-bolts.

2.3 THERMAL HANGER SHIELD INSERTS

- A. Insulation Insert Material for Piping: ASTM C 552, Type II cellular glass with 100 psig minimum compressive strength and vapor barrier.
- B. For Trapeze or Clamped Systems: Insert and shield shall cover entire circumference of pipe.
- C. For Clevis or Band Hangers: Insert and shield shall cover lower 180 degrees of pipe.
- D. Insert Length: For piping operating above ambient air temperature, provide insert the same length as the sheet metal shield. Extend 2 inches beyond sheet metal shield for piping operating below ambient air temperature.

2.4 FASTENER SYSTEMS

- A. Powder Actuated Fasteners: Threaded steel stud, for use in hardened Portland cement concrete with pull out, tension, and shear capacities appropriate for supported loads and building materials where used.

220529-2Hanger and Supports for Plumbing Piping and Equipment

HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT

- B. Mechanical Expansion Anchors: Insert wedge type, zinc coated steel anchors or stainless steel, for use in hardened portland cement concrete; with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

2.5 PIPE POSITIONING SYSTEMS

- A. Description: IAPMO PS 42, positioning system of metal brackets, clips, and straps for positioning piping in pipe spaces; for plumbing fixtures in commercial applications.

2.6 EQUIPMENT SUPPORTS

- A. Description: Welded, shop or field fabricated equipment support made from structural carbon steel shapes.

2.7 MISCELLANEOUS MATERIALS

- A. Structural Steel: ASTM A 36/A 36M, carbon steel plates, shapes, and bars; black and galvanized.
- B. Grout: ASTM C 1107, factory mixed and packaged, dry, hydraulic cement, nonshrink and nonmetallic grout; suitable for interior and exterior applications.
 - 1. Properties: Nonstaining, noncorrosive, and nongaseous.
 - 2. Design Mix: 5000 psi, 28 day compressive strength.

PART 3 - EXECUTION

3.1 HANGER AND SUPPORT INSTALLATION

- A. Metal Pipe Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Provide hangers, supports, clamps, and attachments as required supporting the piping properly from the building structure.
- B. Metal Trapeze Pipe-Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Arrange for grouping of parallel runs of horizontal piping, and support together on fieldfabricated 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.

220529-3Hanger and Supports for Plumbing Piping and Equipment

HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT

- C. Thermal-Hanger Shield Installation: Provide in pipe hanger or shield for insulated piping.
- D. Fastener System Installation:
 - 1. Provide powder actuated fasteners for use in lightweight concrete or concrete slabs less than 4 inches thick in concrete after concrete is placed and completely cured. Provide operators that are licensed by powder-actuated tool manufacturer. Provide fasteners according to powder actuated tool manufacturer's operating manual.
 - 2. Provide mechanical expansion anchors in concrete after concrete is placed and completely cured. Provide fasteners according to manufacturer's written instructions.
- E. Pipe Positioning System Installation: Provide support devices to make rigid supply and waste piping connections to each plumbing fixture. Refer to Division 22 plumbing fixture Sections for requirements for pipe positioning systems for plumbing fixtures.
- F. Provide hangers and supports complete with necessary attachments, inserts, bolts, rods, nuts, washers, and other accessories.
- G. Equipment Support Installation: Fabricate from welded structural steel shapes.
- H. Provide hangers and supports to allow controlled thermal movement of piping systems, to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends, and similar units.
- I. Provide lateral bracing with pipe hangers and supports to prevent swaying.
- J. Provide building attachments within concrete slabs or attach to structural steel. Provide additional attachments at concentrated loads, including valves, flanges, and strainers, NPS 2-1/2 inches and larger and at changes in direction of piping. Provide concrete inserts before concrete is placed; fasten inserts to forms and install reinforcing bars through openings at top of inserts.
- K. Load Distribution: Provide hangers and supports so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.
- L. Pipe Slopes: Provide hangers and supports to provide indicated pipe slopes and to not exceed maximum pipe deflections allowed by ASME B31.9 for building services piping.
- M. Insulated Piping:
 - 1. Attach clamps and spacers to piping.

220529-4Hanger and Supports for Plumbing Piping and Equipment

HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT

- a. Piping Operating above Ambient Air Temperature: Clamp may project through insulation.
 - b. Piping Operating below Ambient Air Temperature: Provide 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. Provide 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. Provide steel weight distribution plate for pipe NPS 4 and larger if pipe is installed on rollers.
3. Provide 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. Provide steel weight distribution plate for pipe NPS 4 and larger if pipe is installed on rollers.
4. Shield Dimensions for Pipe: Not less than the following:
 - a. NPS 1/4 to NPS 3-1/2: 12 inches long and 0.048 inch thick.
 - b. NPS 4: 12 inches long and 0.06 inch thick.
 - c. NPS 5 and NPS 6: 18 inches long and 0.06 inch thick.
5. Thermal Hanger Shields: Provide with insulation same thickness as piping insulation.

3.2 EQUIPMENT SUPPORTS

- A. Fabricate structural-steel stands to suspend equipment from structure overhead or to support equipment above floor.
- B. Grouting: Place grout under supports for equipment and make bearing surface smooth.
- C. Provide lateral bracing, to prevent swaying, for equipment supports.

3.3 METAL FABRICATIONS

- A. Cut, drill, and fit miscellaneous metal fabrications for trapeze pipe hangers and equipment supports.

220529-5Hanger and Supports for Plumbing Piping and Equipment

HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT

- 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. Provide 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.

3.4 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 inch or less.

3.5 PAINTING

- A. Touchup: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Provide 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.
- B. Touchup: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal are specified in Division 09 painting Sections.
- C. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

3.6 HANGER AND SUPPORT SCHEDULE

- A. Specific hanger and support requirements are in Sections specifying piping systems and equipment.
- B. Comply with MSS SP-69 for pipe-hanger selections and applications that are not specified in piping system Sections.

220529-6Hanger and Supports for Plumbing Piping and Equipment

HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT

- C. Provide hangers and supports with galvanized metallic coatings for piping and equipment that will not have field-applied finish.
- D. Provide nonmetallic coatings on attachments for electrolytic protection where attachments are in direct contact with copper tubing.
- E. Provide carbon steel pipe hangers and supports and metal trapeze pipe hangers and attachments for general service applications.
- F. Provide copper plated pipe hangers and copper attachments for copper piping and tubing.
- G. Provide padded hangers for piping that is subject to scratching.
- H. Provide 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, provide the following types:
 - 1. Adjustable, Steel Clevis Hangers (MSS Type 1): For suspension of noninsulated or insulated, stationary pipes NPS 1/2 inches to NPS 8 inches.
 - 2. Yoke-Type Pipe Clamps (MSS Type 2): For suspension of up to 1050 deg F, pipes NPS 4 inches to NPS 6 inches, requiring up to 4 inches of insulation.
 - 3. Carbon or Alloy Steel, Double Bolt Pipe Clamps (MSS Type 3): For suspension of pipes NPS 3/4 inches to NPS 8 inches, requiring clamp flexibility and up to 4 inches of insulation.
 - 4. Adjustable, Steel Band Hangers (MSS Type 7): For suspension of noninsulated, stationary pipes NPS 1/2 inches to NPS 8 inches.
 - 5. U-Bolts (MSS Type 24): For support of heavy pipes NPS 1/2 inches to NPS 8 inches.
 - 6. Pipe Saddle Supports (MSS Type 36): For support of pipes NPS 4 inches to NPS 8 inches, with steel pipe base stanchion support and cast iron floor flange or carbon steel plate.
 - 7. Pipe Stanchion Saddles (MSS Type 37): For support of pipes NPS 4 inches to NPS 8 inches, with steel pipe base stanchion support and cast iron floor flange or carbon steel plate, and with U-bolt to retain pipe.
 - 8. Single-Pipe Rolls (MSS Type 41): For suspension of pipes NPS 1 inches to NPS 8 inches, from two rods if longitudinal movement caused by expansion and contraction might occur.
 - 9. Complete Pipe Rolls (MSS Type 44): For support of pipes NPS 2 inches to NPS 8 inches if longitudinal movement caused by expansion and contraction might occur but vertical adjustment is not necessary.

220529-7Hanger and Supports for Plumbing Piping and Equipment

HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT

- J. Vertical Piping Clamps: Unless otherwise indicated and except as specified in piping system Sections, provide the following types:
1. Extension Pipe or Riser Clamps (MSS Type 8): For support of pipe risers NPS 3/4 inches to NPS 8 inches.
 2. Carbon- or Alloy-Steel Riser Clamps (MSS Type 42): For support of pipe risers NPS 3/4 inches to NPS 8 inches if longer ends are required for riser clamps.
- K. Hanger Rod Attachments: Unless otherwise indicated and except as specified in piping system Sections, provide 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.
- L. Building Attachments: Unless otherwise indicated and except as specified in piping system Sections, provide the following types:
1. Steel or Malleable Concrete Inserts (MSS Type 18): For upper attachment to suspend pipe hangers from concrete ceiling.
 2. Top of Beam C-Clamps (MSS Type 19): For use under roof installations with bar joist construction; to attach to top flange of structural shape.
 3. Side-Beam or Channel Clamps (MSS Type 20): For attaching to bottom flange of beams, channels, or angles.
 4. Center-Beam Clamps (MSS Type 21): For attaching to center of bottom flange of beams.
 5. Welded Beam Attachments (MSS Type 22): For attaching to bottom of beams if loads are considerable and rod sizes are large.
 6. C-Clamps (MSS Type 23): For structural shapes.
 7. Welded-Steel Brackets: For support of pipes from below, or for suspending from above by using clip and rod. Provide one of the following for indicated loads:
 - a. Light (MSS Type 31): 750 lb.
 - b. Medium (MSS Type 32): 1500 lb.
 - c. Heavy (MSS Type 33): 3000 lb.
 8. Plate Lugs (MSS Type 57): For attaching to steel beams if flexibility at beam is required.
- M. Saddles and Shields: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

220529-8Hanger and Supports for Plumbing Piping and Equipment

HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT

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: Provide for supporting insulated pipe.
- N. Comply with MSS SP-69 for trapeze pipe hanger selections and applications that are not specified in piping system Sections.
- O. Provide powder actuated fasteners or mechanical expansion anchors instead of building attachments where required in concrete construction.
- P. Provide pipe positioning systems in pipe spaces behind plumbing fixtures to support supply and waste piping for plumbing fixtures.

END OF SECTION

220529-9Hanger and Supports for Plumbing Piping and Equipment

DOMESTIC WATER PIPING

221116 DOMESTIC WATER 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.
- B. Provide all building plumbing systems in compliance with the International Plumbing Code of New York State (2020) and all New York State Amendments.
- C. The domestic water piping and components shall comply with ANSI/NSF 61, NSF 62 Annex G and NSF 372 for drinking water components. The lead content of drinking water piping and components shall not exceed 0.25 percent by weighted average. Plastic piping components shall be marked with "NSF-pw."

1.02 SUMMARY

- A. Section Includes:
 - 1. Under-building-slab and aboveground domestic water pipes, tubes, and fittings inside buildings.

1.03 SUBMITTALS

- A. Product data and warranty information for each type of product indicated in this section and for the final O & M Manuals.
- B. System pressure test, purging and disinfecting activities report for the final O & M Manuals.
- C. Product warranties for all products in this section.
- D. Operation and maintenance data for the final O & M Manuals.

1.04 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:

DOMESTIC WATER PIPING

1. Notify Architect no fewer than three days in advance of proposed interruption of water service.
2. Do not interrupt water service without Architect's written permission.

PART 2 - PRODUCTS

2.01 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.

2.02 COPPER TUBE AND FITTINGS

- A. Hard Copper Tube: ASTM B 88, Type L water tube, drawn temper.
- B. Soft Copper Tube: ASTM B 88, Type K.
- C. Wrought Copper, Solder Joint Fittings: ASME B16.22, wrought copper solder fittings.
- D. Bronze Flanges: ASME B16.24, Class 150, with solder joint ends.
- E. 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 or threaded ends.
- F. Copper, Pressure –Seal Fitting:
 1. Basis-of-Design Product: Subject to compliance with requirements, provide Viega Plumbing & Heating Systems or comparable product by one of the following:
 - a. Cello Products
 - b. Gruvlok
 - c. Grinnell
 - d. Anvil
 2. NPS 2" and smaller: Wrought-copper fitting with EPDM O-ring seal in each end
 3. NPS 2-1/2" to NPS 4": Bronze fitting with stainless steel grip ring and EPDM O-ring in each end.
 4. Low lead content less than 0.23 percent in compliance with NSF-62 Annex-G & NSF 372.

DOMESTIC WATER PIPING

2.03 PIPING JOINING MATERIALS

- A. Pipe Flange Gasket Materials:
 - 1. AWWA C110/A21.10, rubber, flat face, 1/8 inch thick or ASME B16.21, nonmetallic and asbestos free unless otherwise indicated.
 - 2. Full face or ring type unless otherwise indicated.
- B. Metal, Pipe Flange Bolts and Nuts: ASME B18.2.1, carbon steel unless otherwise indicated.
- C. Solder Filler Metals: ASTM B 32, lead-free alloys.
- D. Flux: ASTM B 813, water flushable.
- E. Brazing Filler Metals: AWS A5.8/A5.8M, BCuP Series, copper phosphorus alloys for general duty brazing unless otherwise indicated.
- F. Plastic, Pipe Flange Gaskets, Bolts, and Nuts: Type and material recommended by piping system manufacturer unless otherwise indicated.

2.04 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.
- C. Sleeve Type Transition Coupling: AWWA C219.
 - 1. Basis-of-Design Product: Subject to compliance with requirements, provide a Ford Meter Box Company, Inc. (The) or comparable product by one of the following:
 - a. Cascade Waterworks Manufacturing.
 - b. Dresser, Inc.; Piping Specialties Products.
 - c. JCM Industries.
 - d. Romac Industries, Inc.
 - e. Smith-Blair, Inc.; a Sensus company.
 - f. Viking Johnson.

DOMESTIC WATER PIPING

2.05 DIELECTRIC FITTINGS

- A. General Requirements: Assembly of copper alloy and ferrous materials with separating nonconductive insulating material. Include end connections compatible with pipes to be joined.
- B. Dielectric Unions:
 - 1. Basis-of-Design Product: Subject to compliance with requirements, provide Watts; a division of Watts Water Technologies, Inc. Series 3000 or comparable product by one of the following:
 - a. Capitol Manufacturing Company; member of the Phoenix Forge Group.
 - b. Central Plastics Company.
 - c. Hart Industries International, Inc.
 - d. Jomar International.
 - e. Matco-Norca.
 - f. McDonald, A. Y. Mfg. Co.
 - g. Wilkins; a Zurn Company.
 - 2. Standard: ASSE 1079.
 - 3. Pressure Rating: 125 psig minimum at 180 deg F.
 - 4. End Connections: Solder joint copper alloy and threaded ferrous.
- C. Dielectric Flanges:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by the following:
 - 2. Basis-of-Design Product: Subject to compliance with requirements, provide Watts; a division of Watts Water Technologies, Inc. Series 3000 or comparable product by one of the following:
 - a. Capitol Manufacturing Company; member of the Phoenix Forge Group.
 - b. Central Plastics Company.
 - c. Matco-Norca.
 - d. Wilkins; a Zurn company.
 - 3. Standard: ASSE 1079.
 - 4. Factory fabricated, bolted, companion flange assembly.
 - 5. Pressure Rating: 125 psig minimum at 180 deg F.
 - 6. End Connections: Solder joint copper alloy and threaded ferrous; threaded solder joint copper alloy and threaded ferrous.
- D. Dielectric Nipples:

DOMESTIC WATER PIPING

1. Basis-of-Design Product: Subject to compliance with requirements, provide Watts; a division of Watts Water Technologies, Inc. Series 3000 or comparable product by one of the following:
 - a. Elster Perfection Corporation.
 - b. Grinnell Mechanical Products; Tyco Fire Products LP.
 - c. Matco-Norca.
 - d. Precision Plumbing Products, Inc.
 - e. Victaulic Company.
2. Standard: IAPMO PS 66.
3. Electroplated steel nipple complying with ASTM F 1545.
4. Pressure Rating and Temperature: 300 psig at 225 deg F.
5. End Connections: Male threaded or grooved.
6. Lining: Inert and noncorrosive, propylene.

PART 3 - EXECUTION

3.01 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. Provide piping as indicated unless deviations to layout are approved on coordination drawings.
- B. Provide copper tubing under building slab according to CDA's "Copper Tube Handbook."
- C. Provide building shutoff valve, hose-end drain valves, strainer, pressure gauge, and test tee with valve inside the building at each domestic water-service entrance. Comply with requirements for pressure gauges in Division 22 Section "Meters and Gauges for Plumbing Piping" and with requirements for drain valves and strainers in Division 22 Section "Domestic Water Piping Specialties."
- D. Provide full port ball shutoff valve immediately upstream of each dielectric fitting.
- E. Provide water pressure reducing valves downstream from full port ball shutoff valves for mechanical make-up water services. Comply with requirements for pressure-reducing valves in Division 22 Section "Domestic Water Piping Specialties."
- F. Provide domestic water piping level with 0.25 percent slope downward toward drain.
- G. Provide piping concealed from view and protected from physical contact by building occupants unless otherwise indicated and except in equipment rooms and service areas.

DOMESTIC WATER PIPING

- H. Provide 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.
- I. Provide piping above accessible ceilings to allow sufficient space for ceiling panel removal, and coordinate with other services occupying that space.
- J. Provide piping and valves to permit valve servicing, access and removal.
- K. Provide 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.
- L. Provide piping free of sags and bends.
- M. Provide fittings for changes in direction and branch connections.
- N. Provide unions in copper tubing at final connection to each piece of plumbing equipment and specialty.
- O. Provide pressure gauges on the water supplies of mixing valves. Comply with requirements for pressure gauges in Division 22 Section "Meters and Gauges for Plumbing Piping."
- P. Provide thermometers on inlet and outlet piping from each water heater. Provide thermometers on each domestic hot water storage tank. Provide thermometers on all inlet and outlet piping of domestic hot water thermostatic mixing valves. Comply with requirements for thermometers in Division 22 Section "Meters and Gauges for Plumbing Piping."
- Q. Provide sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Division 22 Section "Common Work Results for Plumbing."
- R. Provide sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Division 22 Section "Common Work Results for Plumbing."
- S. Provide escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Division 22 Section "Common Work Results for Plumbing."

3.02 JOINT CONSTRUCTION

- A. Ream ends of pipes and tubes and remove burrs.

221116-6

Domestic Water Piping

DOMESTIC WATER PIPING

- B. Remove scale, slag, dirt, and debris from inside and outside of pipes, tubes, and fittings before assembly.
- C. 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.
- D. 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."
- E. Flanged Joints: Select appropriate asbestos-free, nonmetallic gasket material in size, type, and thickness suitable for domestic water service. Join flanges with gasket and bolts according to ASME B31.9.
- F. Joints for Dissimilar-Material Piping: Make joints using adapters compatible with materials of both piping systems.

3.03 TRANSITION FITTING INSTALLATION

- A. Provide transition couplings at joints of dissimilar piping.
- B. Transition Fittings in Underground Domestic Water Piping:
 - 1. Fittings for NPS 1-1/2 and Smaller: Fitting type coupling.
 - 2. Fittings for NPS 2 and Larger: Sleeve type coupling.

3.04 DIELECTRIC FITTING INSTALLATION

- A. Provide dielectric fittings in piping at connections of dissimilar metal piping and tubing.
- B. Dielectric Fittings for NPS 2 and Smaller: Provide dielectric couplings.
- C. Dielectric Fittings for NPS 2-1/2 to NPS 4: Provide dielectric flanges.

3.05 HANGER AND SUPPORT INSTALLATION

- A. Comply with requirements for pipe hanger, support products, and installation in Division 22 Section "Hangers and Supports for Plumbing Piping and Equipment."
 - 1. Vertical Piping: MSS Type 8 or 42 clamps.
 - 2. Individual, Straight, Horizontal Piping Runs:

221116-7

Domestic Water Piping

DOMESTIC WATER PIPING

- 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.
3. Multiple, Straight, Horizontal Piping Runs 100 Feet or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.
4. Base of Vertical Piping: MSS Type 52, spring hangers.
- B. Support vertical piping and tubing at base and at the midpoint of each floor.
- C. Rod diameter may be reduced one size for double-rod hangers, to a minimum of 3/8 inch.
- D. Provide hangers for copper tubing with the following maximum horizontal spacing and minimum rod diameters:
 1. NPS 3/4 and Smaller: 60 inches with 3/8 inch rod.
 2. NPS 1 and NPS 1-1/4: 72 inches with 3/8 inch rod.
 3. NPS 1-1/2 and NPS 2: 96 inches with 3/8 inch rod.
 4. NPS 2-1/2: 108 inches with 1/2 inch rod.
 5. NPS 3 to NPS 4: 10 feet with 1/2 inch rod.
- E. Provide supports for vertical copper tubing every 10 feet and at the midpoint of each floor.

3.06 CONNECTIONS

- A. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. When installing piping adjacent to equipment allow space for service and maintenance.
- C. Connect domestic water piping to water-service piping with full port ball valve; extend and connect to the following:
 1. Plumbing Fixtures: Cold- and hot-water-supply piping in sizes indicated, but not smaller than that required by plumbing code. Comply with requirements for connection sizes in Division 22 plumbing fixture Sections.
 2. Equipment: Cold- and hot-water-supply piping as indicated, but not smaller than plumbing fixture or equipment connections. Provide full port ball shutoff valve and union for each connection. Provide flanges instead of unions for NPS 2-1/2 and larger.

3.07 IDENTIFICATION

- A. Identify system components. Comply with requirements for identification materials and installation in Division 22 Section "Identification for Plumbing Piping and Equipment."

DOMESTIC WATER PIPING

- B. Label pressure piping with system operating pressure.

3.08 FIELD QUALITY CONTROL

- A. Provide for 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: Provide written inspection reports and have them signed by authorities having jurisdiction. Provide copies of test reports for the final O & M Manuals.

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.

221116-9

Domestic Water Piping

PHOTO LAB – DARKROOM RENOVATION

PURCHASE COLLEGE SUNY | 735 ANDERSON HILL RD. | VISUAL ARTS BUILDING | LA PLLC Project 2306

DOMESTIC WATER PIPING

- B. Domestic water piping will be considered defective if it does not pass tests and inspections.
- C. Provide written test and inspection reports for domestic water systems to be included in the final O & M Manuals.

3.09 ADJUSTING

- A. Perform the following adjustments before operation:
 - 1. Close drain valves, hydrants, and hose bibbs.
 - 2. Open shutoff valves to fully open position.
 - 3. Open throttling valves to proper setting.
 - 4. Adjust balancing valves in hot water circulation return piping to provide adequate flow.
 - a. Manually adjust balancing valves in hot water circulation return piping to provide hot water flow in each branch.
 - b. Adjust calibrated balancing valves to flows indicated.
 - 5. Remove plugs used during testing of piping and for temporary sealing of piping during installation.
 - 6. Remove and clean strainer screens at the completion of all project work. Close drain valves and replace drain plugs.
 - 7. Check plumbing specialties and verify proper settings, adjustments, and operation.

3.010 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 water to stand for 24 hours.

DOMESTIC WATER PIPING

- 2) Fill system or part thereof with water/chlorine solution with at least 200 ppm of chlorine. Isolate and allow water 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. Provide and submit written reports of purging and disinfecting activities. Include copies of water-sample approvals from authorities having jurisdiction for the final O & M Manuals.
- C. Clean interior of domestic water piping system. Remove dirt and debris as work progresses.

3.011 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. Flanges and unions may be used for aboveground piping joints unless otherwise indicated.
- C. Fitting Option: Extruded tee connections and brazed joints may be used on aboveground copper tubing.
- D. 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 no-lead soldered joints.
- E. Aboveground domestic water piping, NPS 2-1/2 to NPS 4, shall be the following:
 1. Hard copper tube, ASTM B 88, Type L; wrought copper, solder joint fittings; and no lead soldered joints.

END OF SECTION

SANITARY WASTE AND VENT PIPING

221316 SANITARY WASTE AND VENT PIPING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Pipe, tube, and fittings.
 - 2. Specialty pipe fittings.

1.2 PERFORMANCE REQUIREMENTS

- A. Provide sanitary waste and vent piping in compliance with Chapter's 7, 8, 9 and 10 the 2020 Plumbing Code of New York State.
- B. Provide all building plumbing systems in compliance with the 2020 Plumbing Code of New York State.

1.3 SUBMITTALS

- A. Product data and warranty information for each type of product indicated in this section and for the final O & M Manuals.
- B. Piping system pressure test reports for the final O & M Manuals.
- C. Product warranties for all products in this section.
- D. Operation and maintenance data for the final O & M Manuals.

1.4 QUALITY ASSURANCE

- A. Piping materials shall bear label, stamp, or other markings of specified testing agency.

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.

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

- A. Pipe and Fittings: ASTM A 74, Service weight class, asphalt coated.
221316-1 Sanitary Waste and Vent Piping

SANITARY WASTE AND VENT PIPING

- B. Gaskets: ASTM C 564, rubber.

2.3 HUBLESS, CAST IRON SOIL PIPE AND FITTINGS

- A. Pipe and Fittings: ASTM A 74, Service weight class, asphalt coated ASTM A 888 or CISPI 310 couplings.
- B. Heavy Duty, Shielded Hubless Piping Couplings:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. ANACO-Husky.
 - b. Clamp-All Corp.
 - c. Dallas Specialty & Mfg. Co.
 - d. MIFAB, Inc.
 - e. Mission Rubber Company; a division of MCP Industries, Inc.
 - f. Stant.
 - g. Tyler Pipe.
 - 2. Standards: ASTM C 1277 and ASTM C 1540.
 - 3. Description: Stainless-steel shielded with double 301 stainless-steel bands and tightening devices; and ASTM C 564, rubber sleeve with integral, center pipe stop.
 - 4. Basis of Design Manufacturer: Mifab Model MI-HUB-TR or approved equal.

PART 3 - EXECUTION

3.1 PIPING INSTALLATION

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

SANITARY WASTE AND VENT PIPING

- D. Provide piping above accessible ceilings to allow sufficient space for ceiling panel removal.
- E. Provide piping at indicated slopes.
- F. Provide piping free of sags and bends.
- G. Provide fittings for changes in direction and branch connections.
- H. Make changes in direction for soil and waste drainage and vent piping using appropriate branches, bends, and long-sweep bends. 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. Provide 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. Straight tees, elbows, and crosses may be used on vent lines. Do not change direction of flow more than 90 degrees. Provide proper size of standard increasers and reducers if pipes of different sizes are connected. Reducing size of drainage piping in direction of flow is prohibited.
- I. Lay buried building drainage piping beginning at low point of each system. Provide true to grades and alignment indicated, with unbroken continuity of invert. Place hub ends of piping upstream. Provide required gaskets according to manufacturer's written instructions for use of lubricants, cements, and other installation requirements. Maintain swab in piping and pull past each joint as completed.
- J. Provide soil and waste drainage and vent piping at the following minimum slopes unless otherwise indicated:
 - 1. Building Sanitary Drain: 2 percent downward in direction of flow for piping NPS 3 and smaller; 1 percent downward in direction of flow for piping NPS 4 and larger.
 - 2. Horizontal Sanitary Drainage Piping: 2 percent downward in direction of flow.
 - 3. Vent Piping: 1 percent down toward vertical fixture vent or toward vent stack.
- K. Provide 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."
- L. Plumbing Specialties:
 - 1. Provide cleanouts at grade and extend to where building sanitary drains connect to building sanitary sewers in sanitary drainage gravity flow piping. Comply with requirements for cleanouts specified in Division 22 Section "Sanitary Waste Piping Specialties."
 - 2. Install drains in sanitary drainage gravity flow piping. Comply with requirements for drains specified in Division 22 Section "Sanitary Waste Piping Specialties."

SANITARY WASTE AND VENT PIPING

- M. Do not enclose, cover, or put piping concealed behind walls or above ceilings into operation until it is inspected and approved by the Engineer or their representative.
- N. Provide sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Division 22 Section "Common Work Results for Plumbing Piping."
- O. Provide sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Division 22 Section "Common Work Results for Plumbing."
- P. Provide escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Division 22 Section "Common Work Results for Plumbing."

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 hubless, cast iron soil piping with shielded couplings according to CISPI 310 and CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for hubless-piping coupling joints.

3.3 HANGER AND SUPPORT INSTALLATION

- A. Comply with requirements for pipe hanger and support devices and installation specified in Division 22 Section "Hangers and Supports for Plumbing Piping and Equipment."
 - 1. Provide carbon steel pipe hangers for horizontal piping in noncorrosive environments.
 - 2. Provide carbon steel pipe support clamps for vertical piping in noncorrosive environments.
 - 3. Vertical Piping: MSS Type 8 or Type 42 clamps.
 - 4. Install individual, straight, horizontal piping runs:
 - a. 100 Feet and Less: MSS Type 1, adjustable, steel clevis hangers.
 - 5. Base of Vertical Piping: MSS Type 52, spring hangers.
- B. Support horizontal piping and tubing within 12 inches of each fitting and coupling.
- C. Support vertical piping and tubing at base and at each floor.
- D. Rod diameter may be reduced one size for double-rod hangers, with 3/8 inch minimum rods.

SANITARY WASTE AND VENT PIPING

- E. Provide hangers for cast-iron soil piping with the following maximum horizontal spacing and minimum rod diameters:
 - 1. NPS 1-1/2 inch and NPS 2 inch: 60 inches with 3/8 inch rod.
 - 2. NPS 3 inch: 60 inches with 1/2-inch rod.
 - 3. NPS 4 inch and NPS 5 inch: 60 inches with 5/8 inch rod.
 - 4. NPS 6 inch and NPS 8 inch: 60 inches with 3/4 inch rod.
 - 5. Spacing for 10-foot lengths may be increased to 10 feet. Spacing for fittings is limited to 60 inches.
- F. Provide supports for vertical cast-iron soil piping every 12 feet, at base of stack and at mid-point of each floor and at floor decks.
- G. Support piping and tubing not listed above according to MSS SP-69 and manufacturer's written instructions.

3.5 CONNECTIONS

- A. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Connect drainage and vent piping to the following:
 - 1. Plumbing Fixtures: Connect drainage piping in sizes indicated, but not smaller than required by the Plumbing Code of New York State.
 - 2. Plumbing Fixtures and Equipment: Connect atmospheric vent piping in sizes indicated, but not smaller than required by the Plumbing Code of New York State.
 - 3. Plumbing Specialties: Connect drainage and vent piping in sizes indicated, but not smaller than required by plumbing code.
 - 4. Provide test tees (wall cleanouts) in conductors near floor and floor cleanouts with cover flush with floor.
 - 5. Comply with requirements for cleanouts and drains specified in Division 22 Section "Sanitary Waste Piping Specialties."
- C. Where installing piping adjacent to equipment, allow space for service and maintenance of equipment.
- D. Make connections according to the following unless otherwise indicated:
 - 1. Provide unions, in piping NPS 2 inches and smaller, adjacent to each valve and at final connection to each piece of equipment.

SANITARY WASTE AND VENT PIPING

3.6 IDENTIFICATION

- A. Identify exposed sanitary waste and vent piping. Install preprinted, color-coded, with lettering indicating service and showing flow direction. Include identification of piping service using same designations as used on Drawings; pipe size; and an arrow indicating flow direction.
- B. Lettering Size: At least 1-1/2 inches high.
- C. Pipe Label Color Schedule:
 - 1. Domestic Cold Water, Hot Water, Hot Water Return, Drain, Waste, and Vent:
 - a. Background Color: Green.

3.7 FIELD QUALITY CONTROL

- A. During installation, notify the Engineer at least 24 hours before inspection must be made. Perform tests specified below in presence of the Engineer or their representative.
 - 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 the Engineer or their representative to observe tests specified below and to ensure compliance with requirements.
- B. Reinspection: If the Engineer finds that piping will not pass test or inspection, make required corrections and arrange for reinspection.
- C. Reports: Provide written pressure test and inspection reports and have them signed by the Engineer or their representative.
- D. Test sanitary drainage and vent piping according to procedures of the Engineer 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. 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 drainage and vent piping until it has been tested and approved. Expose work that was covered or concealed before it was tested.
 - 3. Roughing-in Plumbing Test Procedure: Test drainage and vent piping except outside leaders on completion of roughing-in. Close openings in piping system and fill with water to point of overflow, but not less than 10 foot head of water. From 15 minutes before inspection starts to completion of inspection, water level must not drop. Inspect joints for leaks.

221316-6

Sanitary Waste and Vent Piping

SANITARY WASTE AND VENT PIPING

4. Repair leaks and defects with new materials and retest piping, or portion thereof, until satisfactory results are obtained.
5. Provide written reports for tests for the final O & M Manuals.

3.8 CLEANING AND PROTECTION

- A. Clean interior of piping and fittings. Remove dirt and debris as work progresses.
- B. Protect drains during remainder of construction period to avoid clogging with dirt and debris and to prevent damage from traffic and construction work.
- C. Provide plugs in the ends of uncompleted sanitary sewer piping at the end of each work day and when work stops.

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 inches and smaller shall be any of the following:
 1. Service weight class, cast iron hub and spigot soil pipe and fittings; gaskets; and gasketed joints.
 2. Hubless, service weight cast-iron soil pipe and fittings; heavy duty shielded hubless-piping couplings; and coupled joints.
- C. Aboveground, soil and waste piping NPS 5 inches and larger shall be any of the following:
 1. Service class, cast iron hub and spigot soil pipe and fittings; gaskets; and gasketed joints.
 2. Hubless, service weight cast iron soil pipe and fittings; heavy duty shielded hubless-piping couplings; and coupled joints.
- D. Aboveground, vent piping NPS 4 and smaller shall be any of the following:
 1. Service weight class, cast iron hub and spigot soil pipe and fittings; gaskets; and gasketed joints.
 2. Hubless, service weight cast-iron soil pipe and fittings; heavy duty shielded hubless-piping couplings; and coupled joints.
- E. Underground, soil, waste, and vent piping shall be the following:

SANITARY WASTE AND VENT PIPING

1. Service class, cast iron hub and spigot soil pipe and fittings; gaskets; and gasketed joints.

END OF SECTION

SANITARY WASTE PIPING SPECIALTIES

221319 SANITARY WASTE PIPING SPECIALTIES

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following sanitary drainage piping specialties:

1. Cleanouts
2. Floor drains
3. Miscellaneous sanitary drainage piping specialties
4. Trap guard device

1.2 SUBMITTALS

- A. Product data and warranty information for each type of product indicated in this section and for the final O & M Manuals.
- B. Product Information: Product operation and maintenance data for the final O & M Manuals.

1.3 QUALITY ASSURANCE

- A. Drainage piping specialties shall bear label, stamp, or other markings of specified testing agency.
- B. Provide sanitary waste piping specialties in compliance with Chapters 7, 8, 9 and 10 the Plumbing Code of New York State (2020).
- C. Provide all building plumbing systems in compliance with the Plumbing Code of New York State (2020) and all New York State Amendments.

PART 2 - PRODUCTS

2.1 CLEANOUTS

- A. Cast-Iron Floor Cleanouts (FCO):
1. Basis-of-Design Product: Subject to compliance with requirements, provide Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc. Model # 4028 or a comparable product by one of the following:
 - a. Wade.

SANITARY WASTE PIPING SPECIALITES

- b. Zurn Plumbing Products Group; Specification Drainage Operation.
- 2. Standard: ASME A112.36.2M for heavy-duty, adjustable housing cleanout.
- 3. Size: Same as connected branch.
- 4. Type: Heavy duty, adjustable housing.
- 5. Body or Ferrule: Cast iron.
- 6. Clamping Device: as Required.
- 7. Outlet Connection: Inside calk or Spigot.
- 8. Closure: Bronze plug with tapered threads.
- 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.

2.2 FLOOR DRAINS

A. Cast-Iron Floor Drains: (FD)

- 1. Basis-of-Design Product: Subject to compliance with requirements, provide Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc. Model # 2010-A or a comparable product by one of the following:
 - a. Wade.
 - b. Zurn Plumbing Products Group; Specification Drainage Operation.
- 2. Standard: ASME A112.6.3.
- 3. Pattern: Floor drain.
- 4. Body Material: Gray iron.
- 5. Anchor Flange: Not required.
- 6. Clamping Device: Flashing clamp.
- 7. Outlet: as noted on the plans.
- 8. Coating on Interior and Exposed Exterior Surfaces: Acid resistant enamel.
- 9. Sediment Bucket: Not required.
- 10. Top or Strainer Material: 7 inch diameter nickel bronze.
- 11. Top of Body and Strainer Finish: Nickel bronze.
- 12. Top Shape: Round.
- 13. Dimensions of Top or Strainer: 7 inch diameter.
- 14. Top Loading Classification: Heavy Duty.
- 15. Funnel: Not required.
- 16. Inlet Fitting: Gray iron, with threaded inlet and threaded or spigot outlet, and trapseal primer valve connection].
- 17. Trap Material: Cast iron.
- 18. Trap Pattern: Deep seal P-trap.

SANITARY WASTE PIPING SPECIALITIES

19. Trap Features: Trap guard device. Refer to item 2.5

2.5 TRAP GUARD DEVICE

A. Trap Guard:

1. Basis-of-Design Product: Subject to compliance with requirements, provide a Rectorseal - Sure Seal Model SS2009V or a comparable product by one of the following:
 - a. Mifab - MiGuard
 - b. Provent.
 - c. ProSet.
2. HDPE (high density polyethylene) housing with heavy duty proprietary silicone diaphragm and soft EPDM rubber sealing gasket. Floor rating ASSE 1072 AF GW.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Provide 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. 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.
 3. Provide floor drain flashing collar or flange so no leakage occurs between drain and adjoining flooring. Maintain integrity of waterproof membranes where penetrated.
 4. Provide individual traps for floor drains connected to sanitary building drain, unless otherwise indicated.
 5. Provide a trap guard device inside floor drain bodies below strainer.
- B. Provide deep seal traps on floor drains and other waste outlets unless obstructed by ceilings, steel structure or ductwork.

221319-3

Sanitary Waste Piping Specialties

PHOTO LAB – DARKROOM RENOVATION

PURCHASE COLLEGE SUNY | 735 ANDERSON HILL RD. | VISUAL ARTS BUILDING | LA PLLC Project 2306

SANITARY WASTE PIPING SPECIALITES

- C. Provide traps on plumbing specialty drain outlets. Omit traps on indirect wastes unless a trap is indicated.
- D. Provide trap guard devices in all floor drains bodies below strainer.

3.2 CONNECTIONS

- A. Piping installation requirements are specified in other Division 22 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Provide piping adjacent to plumbing equipment to allow removal, service and maintenance.

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 Division 22 Section "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. Provide plugs in the ends of uncompleted sanitary sewer piping at the end of each work day or when work stops.

END OF SECTION

DIVISION 23
MECHANICAL

TABLE OF CONTENTS

<u>SECTION NO.</u>	<u>TITLE</u>	<u>PAGE</u>
230100	GENERAL PROVISIONS	230100-1
230200	MECHANICAL ACCESSORIES	230200-1
230516	EXPANSION COMPENSATION AND FLEXIBLE CONNECTORS	230516-1
230519	METERS, GAUGES AND INDICATORS	230519-1
230523	MANUAL VALVES, COCKS, FAUCETS	230523-1
230529	PIPING AND EQUIPMENT SUPPORTS, ANCHORS & SLEEVES	230529-1
230530	DUCTWORK SUPPORTS AND SLEEVES	230530-1
230547	VIBRATION ISOLATION	230547-1
230593	TESTING AND ADJUSTING	230593-1
230700	INSULATION	230700-1
230800	HVAC COMMISSIONING	230800-1
230901	AUTOMATIC TEMPERATURE CONTROL SYSTEM	230901-1
230993	SEQUENCE OF OPERATION	230993-1
232000	PIPE AND PIPE FITTINGS	232000-1
232114	PIPING SPECIALTIES	232114-1
232115	PIPING SYSTEM CLEANING	232115-1
232500	WATER TREATMENT	232500-1
233100	DUCTWORK	233100-1
233300	DUCT ACCESSORIES	233300-1
233700	AIR OUTLETS	233700-1

GENERAL PROVISIONS

230100 GENERAL PROVISIONS FOR MECHANICAL WORK

PART 1 - GENERAL

1.1 SUMMARY

- A. Work under this Division shall include all labor, material, equipment, plant services and administrative tasks required to complete and make operable the mechanical work shown on the Drawings and specified herein.

1.2 STANDARDS

- A. All work shall comply with the requirements of the following codes:
 - 1. Building Code of New York State
 - 2. Existing Building Code of New York State
 - 3. Mechanical Code of New York State
 - 4. Plumbing Code of New York State
 - 5. Fire Code of New York State
 - 6. Energy Conservation and Construction Code of New York State
 - 7. National Electric Code
 - 8. ASHRAEASHE Standard 170: Ventilation of Health Care Facilities
 - 9. Federal, State and Local Codes Having Jurisdiction
 - 10. ASHRAE Standards As Applicable
 - 11. SMACNA Standards As Applicable
 - 12. NFPA Standards As Applicable
 - 13. Building Standards and Requirements
- B. All materials and equipment provided shall be new and approved for the application. Materials, equipment, sizes and methods of construction that are not described in the Specifications or detailed on the Drawings, shall conform with the specified codes and standards. Defective or damaged materials shall be replaced or repaired in a manner approved by the Owner.
- C. Fees
 - 1. The Contractor shall include in his Bid the cost of all required permits, fees, controlled inspections, tests and certificates of approval.
- D. Quality, Workmanship, Materials and Safety
 - 1. All work shall be first class in every respect and shall be neatly performed in a practical and workmanlike manner by sufficient mechanics skilled in the work they are to do using the best practices of their trade, and under continuous, competent supervision. The work shall be well organized in advance of operation, and carried out efficiently without delays which would impede progress or the quality of the work of other trades and the job as a whole.

230100-1

General Provisions

GENERAL PROVISIONS

a. Inspection

- 1) Prior to undertaking work of each Section, carefully inspect the installed work of all other trades and verify that all such work is complete and in accordance with all pertinent codes and regulations, the original design and the referenced standards to the point where this installation may commence properly.

b. Discrepancies

- 1) Do not proceed with installation in areas of discrepancy until all such discrepancies have been fully resolved with the Owner.
2. The Contractor shall not employ personnel or means which will cause strikes, work stoppages, jurisdictional disputes, etc., on Owner's premises. Whenever the Owner shall notify the Contractor, in writing, that any person engaged in the work is incompetent, careless, disorderly, or otherwise unsatisfactory, such person shall be discharged from the work, and shall not again be employed on it, except with the consent of the Owner.
3. The Owner contemplates and the Contractor agrees to the most thorough inspection of the work at all times by the Owner, including all labor performed and materials furnished, delivered, or intended to be used in the work, including manufacture, preparation, and testing. The Contractor shall not use any material which has not been inspected or tested, and accepted. The Contractor shall keep the Owner advised of the progress of the work away from the site requiring inspection or witnessing of tests, so that arrangements may be made for inspection at the proper time. Catalogued materials may be submitted for approval by catalog number or copies of catalog data as required by the Owner.
4. Install work so as to be readily accessible for operation, maintenance and repair.

1.3 SUBMITTALS

- A. Submit shop drawings, coordinated with all other trades, minimum of four (4) sets unless otherwise noted.
- B. Submit coordinated system fabrication, layout and routing drawings with dimensions and elevations including:
 1. Sheetmetal
 2. Heating Water Piping
 3. Chilled Water Piping
 4. Dual Temperature Water Piping

GENERAL PROVISIONS

5. Refrigerant Piping
 6. Steam and Condensate Piping
 7. Drainage
 8. Automatic Control Ladder and Wiring Diagrams
- C. Submit material and equipment listed in the Schedules and/or in the Specifications including, but not be limited to:
1. Equipment Nameplates
 2. Valve tags
 3. Structural steel (as required)
 4. Paint (as required)
 5. Miscellaneous steel for equipment support
 6. Vibration Isolation equipment
 7. Pipe Insulation including outdoor weatherproofing
 8. Duct Insulation including outdoor weatherproofing
 9. Equipment Supports
 10. Manual Valves
 11. Balancing Valves
 12. Pipe and Pipe Fittings Shop Standards
 13. Self-Contained Control Valves
 14. Piping Specialties
 15. Thermometers
 16. Pressure Gauges
 17. Air Flow Monitoring Equipment
 18. Water Flow Monitoring Equipment
 19. Expansion Compensation Equipment
 20. Flexible Pipe Connectors
 21. Sheetmetal Ductwork Shop Standards
 22. Flexible Duct Connectors
 23. Fire Dampers
 24. Combination Fire/Smoke Dampers
 25. Air Outlets
 26. Air Terminal VAV Units
 27. Instrumentation and Controls Shop Standards with Automatic Control Operating Sequences
 28. Direct Digital Building Management Control System (BMS)
 29. Control Valves and Actuators
 30. Control Dampers and Actuators
 31. Testing, Adjusting and Balancing Reports
- B. Shop Drawing Requirements
1. Within ten days after the award of the Contract, unless otherwise specified, submit a complete list of the manufacturers of materials and equipment to be incorporated in the work. Intention of using specified materials and equipment does not relieve obligations of submittal.

GENERAL PROVISIONS

2. Shop drawings showing manufacturer's product data shall contain manufacturer's names and catalog numbers, descriptive data, cuts, diagrams, detailed dimensional drawings, accurate and complete description of materials of construction, manufacturer's published performance characteristics and capacity ratings (performance data, alone, is not acceptable), electrical requirements and wiring diagrams. Drawings shall clearly indicate location (terminal block or wire number), voltage and function for all field terminations, and other information necessary to demonstrate compliance with all requirements of contract documents.
3. Shop drawings submitted shall have been reviewed and approved by the Contractor, and shall include all information listed above and as may be required by the Owner to judge compliance with the requirements of the Contract Documents and suitability to the application. Items submitted shall be well organized and clearly identified as to proposed application.
4. The Owner's review of such Drawings or schedules shall not relieve the Contractor from responsibility for deviations from Drawings or Specifications unless he has in writing called the Owner's attention to such deviations at the time of submission, nor shall it relieve him from responsibility for errors of any sort in shop drawings or schedules.
5. Contractor shall submit complete shop drawings, which have been coordinated with all other trades. Shop drawings furnished shall indicate all changes to meet space requirements, code requirements and as necessary to resolve all space conflicts. Where conflicts occur, request clarification through the Engineer. Coordinate all work of this Division with the work of all other trades.
6. Any materials or equipment submitted for review which are not in accordance with the Specification requirements shall be rejected and resubmitted until approved without change in construction schedule and without additional cost to Owner.
7. Obtain all acceptances before ordering or installing any materials and equipment. Contractor shall be liable for its removal and replacement at no charge if, in opinion of Owner, material or equipment does not meet intent of the Contract Documents.
8. Submit system fabrication drawings and automatic control system ladder diagrams. Contractor has the option of submitting PDF electronically or submit one sepi and three prints. Partial submissions will be returned without action taken.
 - a. All piping, ductwork and equipment layout shall be submitted on scale $3/8" = 1'-0"$ drawings, and shall be coordinated and stamped by all trades.

GENERAL PROVISIONS

- b. Shop drawings shall show location of all existing and new equipment, existing work and new work.
 - c. Shop drawings shall show all system dimensions and elevations.
 - d. Shop drawings shall clearly indicate, with "teardrops", notes, etc., all conflicts with other trades, building structure, etc.
 - e. Contractor shall note any questions concerning coordination with other trades, etc. with "teardrops", notes, etc.
9. Submit four copies of manufacturer's submittal sheets or catalog cuts.
- a. Highlight all applicable material and data.
 - b. Non-applicable material and data shall be struck prior to submittal
 - c. Contractor shall note any questions concerning performance, installation, coordination with other trades, etc. and bring them to the attention of the engineer.
10. Submit reproducible "as-built" record drawings for building files at completion of the project, to include ductwork, piping, and equipment drawings. Scale 3/8"=1'-0".

1.4 STORAGE AND PROTECTION

- A. All materials, construction equipment, and materials and equipment to be incorporated in the work shall be so placed as not to injure the work and so that free access may be had at any time to all parts of the work and to all installations in the vicinity of the work. Materials and equipment shall be kept neatly piled and compactly and conveniently stored as to not hinder ongoing operations. The work area shall be kept broom clean daily.
- B. The Contractor shall provide suitable and adequate storage methods for materials and equipment during the progress of the work including approved weathertight storage for all materials and equipment which might deteriorate or fail to function if left uncovered. He shall provide protection against damage or deterioration for all equipment during storage, and after installation, until the equipment and systems are put to use by the Owner. All piping and fittings shall be kept capped and/or plugged.
- C. During adverse environmental conditions the Contractor shall take all necessary precautions so that the work may be properly done and be satisfactory in all respects. When required, protection shall be provided by use of tarpaulins, wood and polyethylene plastic sheet shelters, or approved means. The Owner may

GENERAL PROVISIONS

suspend construction operation at any time, when in his judgment, the conditions are unsuitable or the proper precautions are not being taken.

- D. The Owner reserves the right to make emergency repairs as required to keep equipment in operation without voiding the Contractor's guarantee bond nor relieving the Contractor of his responsibilities during the bonding period.
- E. It is incumbent upon the Contractor to use his expertise to prepare and execute all work with minimal interruptions. Techniques such as prefabrication, on or off site, is a responsibility of the Contractor and shall be used throughout all of the work, subject to approval, in writing by the Owner.
- F. Where interruptions are necessary to avoid hazards to personnel, property or possible contamination, the Contractor shall prepare schedules of proposed interruptions within reasonable time to obtain approval in writing, from the Owner.
- G. The Contractor shall confine and contain operations involving dust generation, demolition, cleaning, and surface preparation operations to eliminate potential contamination, minimize hazards to Owner's employees and public, and to safeguard surrounding facilities and operations.
- H. The Contractor is required to note that if the facility processes or dispenses products for human consumption, it is mandatory that there be no contamination or possible causes of contamination. Further, all Contractor personnel must be directed to perform all work and to personally perform in such a manner as to preclude dirt, dust, odors and/or contamination. The Contractor shall police all of his personnel and those servicing him, in any capacity, to ensure cleanliness.

1.05 INSPECTIONS AND TESTING

- A. Inspection tests, or acceptance of any materials prior to shipment shall not be deemed as a final acceptance of the materials. The Owner may inspect or require tests or analysis of any portion of the materials at any time after delivery at the site either before or after installation. Any material which is found to be defective or which does not otherwise conform to the requirements of the Specifications shall be rejected and removed from the site.
- B. The Contractor shall provide labor, tools and all test equipment for the final inspection of the work. All failures detected in the final inspection shall be uncovered and repaired to the satisfaction of the Owner, and at the expense of the Contractor.
- C. During the progress of the work, the work shall be subject to inspection by the Owner. Inspection of the work by the Owner shall not be construed as acceptance of said work.

GENERAL PROVISIONS

1. If the Owner so requires, the Contractor shall submit to the Owner each morning a report showing the number of mechanics and foremen employed.
- D. The Mechanical Contractor shall arrange for and perform a test of the fire suppression system by the local Fire Inspector or by the authority having jurisdiction. During the test, the Mechanical Contractor shall demonstrate to the Fire Inspector, etc. that the fire suppression system has been properly installed, is functioning properly and that the system is in conformance with these Specifications.
- E. Mechanical Contractor shall contact the Engineer and/or Owner's Representative and arrange for an inspection of all equipment, piping systems, ductwork systems, etc. installed and or modified under this project, prior to startup of systems and/or closing up of walls, ceilings, etc.

1.6 CLEANING

- A. Remove daily all construction debris resulting from the work.
- B. Clean equipment and systems following the detailed procedures specified herein, or as directed.

1.7 GUARANTEE

- A. Furnish, in writing, a complete warrantee against defective materials and guarantee against workmanship, for one (1) year after the Owner's Final Acceptance of the complete installation by the Owner.
 1. The date of shipment of the equipment provided under this Contract notwithstanding, the Contractor shall obtain extensions from the equipment manufacturers, as required, to provide for a one year guarantee on all equipment from the date of acceptance of the complete and operational equipment by the Owner.
 2. Guarantee shall include complete maintenance of the system, including replacement parts, all labor and materials to maintain the system in proper operating condition for the guarantee period.
 3. Provide, to the Owner, all manufacturer warranties for such warranted material, equipment and systems.

1.8 SUBSTITUTIONS

- A. Products or materials, equal in all respects to that specified, as produced by other manufacturers, may be submitted for consideration by the Engineer as a substitute. Substitutions may be accepted by the Engineer, at his sole discretion, only under the following conditions:

GENERAL PROVISIONS

1. The item proposed for substitution is equal to and/or superior to the item named in construction, efficiency and utility, or that the item named in the Specifications cannot be delivered to the job in time to complete the work in proper sequence.
2. To receive consideration, requests for substitutions must be received within 30 days following signing of Contract. The request shall be accompanied by documentary proof of equality and/or difference in price and delivery, if any, in the form of certified quotations from suppliers of both specified and proposed items.
3. In case of a difference in price, the Owner shall receive all benefits of the difference in cost involved in any substitution and the Contract altered by Change Order to credit the Owner with the savings so obtained.
4. The Mechanical Contractor shall be responsible for any and all modifications to the respective mechanical system, necessitated by substitution of specified equipment, and shall provide all modifications at no additional cost to the Owner.
5. When submitting manufacturer's submittal data sheets for the substituted equipment, the Mechanical Contractor shall highlight all deviations from contract specifications, such as unit dimensions and weight, efficiency, performance, etc., changes to power requirements, etc. and shall notify Engineer of any and all other information affecting related trades.
6. The Mechanical Contractor shall be responsible for coordinating all required modifications to general construction, plumbing, electrical, fire protection systems, etc. necessitated by substitution of specified equipment, with the respective trades. Any additional costs, for modifications to general construction, plumbing, electrical, fire protection systems, etc., necessitated by substitution of specified equipment, shall be the sole responsibility of the Mechanical Contractor.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Provide equipment of the type and size specified in these Contract Specifications and Schedules and as indicated on the Contract Drawings.

PART 3 - EXECUTION

3.1 GENERAL

230100-8

General Provisions

PHOTO LAB – DARKROOM RENOVATION

PURCHASE COLLEGE SUNY | 735 ANDERSON HILL RD. | VISUAL ARTS BUILDING | LA PLLC Project 2306

GENERAL PROVISIONS

A. General

1. The Instructions to Bidders, General Conditions, Supplementary Conditions, Insurance Requirements and Division 1 govern the work of this Division.
2. Drawings and Specifications determine general arrangement and locations of facilities, equipment and the work of various systems.
3. Contractor shall not measure any scale drawings. All firm dimensions must be maintained.
4. Contractor shall consult the Owner for guidance as to interpretation of Drawings with regard to dimensions before laying out any of his work.
5. Contractor shall, with approval of Owner and without extra charge, make reasonable modifications in layout needed to achieve symmetry with architectural elements to prevent conflict with work of other trades or for the proper execution of the work.
6. Check Drawings of other trades relating to work to verify spaces in which the work will be installed, to maintain headroom and space conditions at all points. Refer to architectural details in completing and correlating work.
7. After carefully studying the Drawings and Specifications, and before submitting the proposal, each bidder shall visit the site to ascertain conditions of the site, and the nature and exact quantity of work to be performed. No extra will be allowed if the Contractor fails to examine the site, or having examined the site, the Contractor fails to notify the Owner in writing of any discrepancies that he may have noted between the existing conditions and Drawings and Specifications.
8. Verify all measurements of his own or others at the site, and shall be responsible for correctness of same as related to his work.

B. Cutting and Patching

1. All cutting, drilling rough and finish patching required for the work shall be provided by the Contractor.
2. Provide all required sleeves, forms and inserts before walls, partitions, floors or roofs are built. Cutting and patching of walls, partitions, ceilings and floors necessary for reception of work, caused by failure to provide or properly locate sleeves, forms and inserts, incorrect location of work, or failure to cooperate with other trades, shall be done at the expense of the Contractor and in accordance with labor agreements.

GENERAL PROVISIONS

3. Cutting of beams, floors or walls for piping or conduit shall be done as approved by the Owner in a careful manner, with core drills, so as not to seriously impair the appearance or strength of the structure.
4. Where the work pierces waterproofing, installation shall be as approved. Furnish all necessary sleeves, caulking and flashing required to make openings absolutely watertight.
5. Provide all drilling and patching for expansion bolts, hangers and other supports for proper and safe installation of work.

C. Scaffolding, Rigging and Hoisting

1. Provide, erect, maintain and be responsible for the safe and legal use of all scaffolding, hoisting and rigging or additional bracing and services required for the delivery or erection of the equipment and apparatus provided or installed under this Contract.

D. Lubrication

1. All Contractor furnished equipment and/or installed equipment shall be properly lubricated when connected and before operation of the equipment is begun.
2. The Contractor will be held responsible for any damage to equipment that is operated without having been properly lubricated.

E. Coordination and Supervision

1. The work shall be carefully laid out in advance to avoid unnecessary cutting, channeling, chasing or drilling of floors, walls, partitions, ceilings or other surfaces. Where such work is necessary, however, the work shall be carefully done. Any damage to the building or equipment shall be patched and/or repaired in an approved manner by skilled mechanics at no additional cost to the Owner.
2. Plan the work in advance, and coordinate all space requirements with the other trades involved. Where conflicts occur, request clarification through the Owner. Coordinate the work of this Division with the work of other trades with regard to:
 - a. Heights above finished floors.
 - b. Clearance for pipes, conduits, ducts, access doors/covers and lighting fixtures.
 - c. Location of equipment and system components.

GENERAL PROVISIONS

- d. Providing building and equipment shelter prior, during and after rigging of equipment/materials.
- 3. As-Built Drawings
 - a. Provide Owner with a complete set of as-built drawings covering every aspect of the work. The complete set shall include a PDF of all drawings sent electronically and on CD.
 - b. The as-built drawings will be delivered to the Owner within 30 days of completion of the work.
- 4. Service Manuals
 - a. Provide three complete bound sets of instructions for operating and maintaining all systems and equipment.
 - b. Manuals shall include:
 - 1) For each item, the manufacturer's name, address and telephone number.
 - 2) Brief description of each equipment item and basic operating features.
 - 3) Limiting conditions.
 - 4) Start-up instructions.
 - 5) Routine and normal operating instructions.
 - 6) Regulation and control.
 - 7) Shutdown.
 - 8) Emergency procedures.
 - 9) Lubrication and maintenance instructions.
 - 10) Guide to troubleshooting.
 - 11) Parts lists.
 - 12) Drawings.
 - 13) Wiring diagrams.
 - 14) Test data and performance curves.
 - 15) Copies of written guarantee and manufacturer's warranty.
- 5. Documents and Samples at the Site
 - a. Maintain at the project site for the Owner a record copy of all Drawings, Specifications, Addenda, Change Orders and other modifications, in good order and marked currently to record all changes made during construction, and approved shop drawings, product data and samples. These shall be available to the Engineer and shall be delivered to him for the Owner upon completion of the work.

GENERAL PROVISIONS

F. Training

1. Upon completion of the work, fully instruct the Owner as to the operation and maintenance of all material, equipment and systems.

G. Standard Specifications and Abbreviations

1. The following abbreviations used in the Drawings and Specifications refer to recognized organizations publishing specifications and standards. These shall be construed to mean the latest standard adopted and published at the date of advertisement for Bids and such specifications are made part of the Contract Documents to the same extent as if written out in full.

AAMA	- Architectural Aluminum Manufacturers Association
ADC	- Air Diffusion Council
AGA	- American Gas Association
AHDGA	- American Hot Dip Galvanizing Association
AISC	- American Institute of Steel Construction
AMCA	- Air Moving and Conditioning Association
ANSI	- American National Standards Institute
API	- American Petroleum Institute
ARI	- American Refrigeration Institute
ASHRAE	- American Society of Heating, Refrigerating & Air Conditioning Engineers
ASME	- American Society of Mechanical Engineers
ASSE	- American Society of Sanitary Engineers
ASTM	- American Society of Testing Materials
AWS	- American Welding Society
AWWA	- American Water Works Association
BG&E	- Bureau of Gas and Electricity (New York City)
BS&A	- Board of Standards and Appeals (New York City)
CISPI	- Cast Iron Soil Pipe Institute
EPA	- Environmental Protection Agency
ETL	- Electrical Testing Laboratories
FDA	- Food and Drug Administration
FIA	- Factory Insurance Association
FM	- Factory Mutual
FS	- Federal Specifications
IEEE	- Institute of Electrical and Electronics Engineers
IRI	- Industrial Risk Insurers
ISA	- Instrument Society of America
JIC	- Joint Industrial Council
MCAA	- Mechanical Contractors Association of America
MSS	- Manufacturers Standardization Society of Valve and Fittings Industry
NBFU	- National Board of Fire Underwriters
NEC	- National Electrical Code

GENERAL PROVISIONS

NEMA	- National Electrical Manufacturers Association
NFPA	- National Fire Protection Association
NIST	- National Institute of Standards and Technology
NPT	- National Pipe Thread
NSF	- National Sanitation Foundation
OSHA	- Occupational Safety Health Act
PDI	- Plumbing and Drainage Institute
PHCC	- National Association of Plumbing-Heating-Cooling Contractors (National Standard Plumbing Code)
PPI	- Plastics Pipe Institute
SDI	- Steel Deck Institute
SHEMA	- Steam Heating Equipment Manufacturers Association
SMACNA	- Sheet Metal and Air Conditioning Contractors National Association, Inc.
SSPC	- Steel Structures Painting Council
STI	- Steel Tank Institute
UL	- Underwriters Laboratories, Inc.
USDC	- United States Department of Commerce
USPHS	- United States Public Health Service

H. Alternative Bids

1. Alternative work shall be provided by the Contractor in accordance with all applicable provisions and requirements indicated in the Contract Documents for the work under the Project Base Bid.
2. Alternative Bid No. 1
3. Alternative Bid No. 2
4. Deduct Alternative Number 1: Delete the York Model YTHIJ3I-CRD chillers and provide centrifugal chillers with reduced voltage motor starters.

I. Unit Prices

1. State in the Bid Proposal, the following unit prices. Unit prices shall apply to the addition or deletion, as applicable, of the indicated items, complete, as specified.

3.2 MAINTENANCE OF EXISTING FACILITIES AND CONDUCT OF THE WORK

A. General

1. The building will be occupied and in operation during the progress of the work. When necessary to temporarily halt building egress or flow of personnel traffic, confer with the Owner and arrange the period of interruption for a time mutually agreed upon. It is required that the work indicated and/or specified

230100-13

General Provisions

GENERAL PROVISIONS

shall be carried out with a minimum of interference to the established routine of the building.

2. No work shall be left incomplete nor any hazardous situations created which will affect the life or safety of the public and/or building occupants. At no time shall the work interfere with or cut off any of the existing services without the Owner's written permission.
3. Materials required to be removed under this Division of work and turned over to the Owner have been indicated on the Drawings and in the Specifications. The Owner will designate the area or place the Contractor shall deliver and set in place any and all items.
4. When necessary to temporarily disconnect any existing building utilities and service systems including feeder or branch circuiting supplying existing facilities, confer with the Owner and arrange the period of interruption for a time mutually agreed upon.
5. Where replacement, relocation or modification of existing equipment is specified herein, provide and maintain all temporary services, connections, circuit protection and any other materials and appurtenances required for the uninterrupted operating condition of all affected systems.
6. It is required that the work indicated and/or specified shall be carried out with a minimum of interference to the established routine of the building.
7. The right is reserved to operate all existing electrical and mechanical equipment, and perform all required servicing and repairs to this equipment at all times. Existing equipment and existing building utilities and supporting service systems shall be operational at all times.
8. All work is to be performed during normal business hours unless otherwise specified in the Contract Documents.
 - a. If the Owner requires that any of the work be performed after normal business hours, on Sundays or legal Holidays, unless the work was specified as after-hours work in the Contract Documents, the Contractor shall notify the Owner in writing of the number of man hours required to perform the overtime work and the additional cost for premium labor charges prior to commencing work.
 - b. The Contractor's allowance for overtime work, when such work is required by the Owner, shall be the difference between the labor cost as proposed in the base bid and the labor cost to perform the work on overtime, computed in man hours.

GENERAL PROVISIONS

9. The Contractor shall substantially complete his work within the number of calendar days as quoted by the Contractor in his proposal. Perform work after regular working hours, on Sundays or legal holidays, when necessary, without additional cost to the Owner in order to meet the proposed completion date.
10. Work around-the-clock, as well as weekends, if any unscheduled interruption or work interference to the existing electrical or mechanical systems should occur, due to the Contractor's work, until such existing systems are fully restored and operational. There shall be no additional cost to the Owner.
11. All overtime work shall be approved by the Owner.
12. If any unscheduled interruption or work interference to the existing electrical systems occur, the Contractor shall be prepared, at his own expense to work around-the-clock as well as weekends, until such existing electrical systems are fully restored and operational.

END OF SECTION 230100

MECHANICAL ACCESSORIES

230200 MECHANICAL ACCESSORIES

PART 1 - GENERAL

1.01 SCOPE

- A. Work under this Section shall include all labor, material, equipment, etc., required to complete the mechanical work described herein and shown on the Drawings, including but not limited to the following materials and methods listed below.

1.02 STANDARDS

- A. All work shall comply with the requirements of the following codes:
 - 1. Federal, State and local codes having jurisdiction.
 - 2. NFPA.
 - 3. NEC.
 - 4. New York State Building Codes
- B. All materials and equipment provided shall be new and approved for the application. Materials, equipment, sizes and methods of construction that are not described in the Specifications or detailed on the Drawings, shall conform with the specified codes and standards. Defective or damaged materials shall be replaced or repaired in a manner approved by the Owner.
- C. Paint: VOC Emissions
 - 1. VOC emissions from all paints and coatings shall not exceed the VOC and chemical component limits of Green Seals Standard GS-11 requirements.
- D. Quality, Workmanship, Materials and Safety
 - 1. All work shall be first class in every respect and shall be neatly performed in a practical and workmanlike manner by sufficient mechanics skilled in the work they are to do using the best practices of their trade, and under continuous, competent supervision.

1.03 SUBMITTALS

- A. Refer to Section 230100 for submittal procedures.
- B. Provide product specific manufacturer cut sheets with all proposed sizes and options indicated.

1.04 STORAGE AND PROTECTION

230200-1

Mechanical Accessories

MECHANICAL ACCESSORIES

- A. All materials, construction equipment, and materials and equipment to be incorporated in the work shall be so placed as not to injure the work and so that free access may be had at any time to all parts of the work and to all installations in the vicinity of the work. Materials and equipment shall be kept neatly piled and compactly and conveniently stored as to not hinder ongoing operations. The work area shall be kept broom clean daily.

1.05 SUBSTITUTIONS

- A. Products or materials, equal in all respects to that specified, as produced by other manufacturers, may be submitted for consideration by the Engineer as a substitute. Substitutions may be accepted by the Engineer, at his sole discretion. Refer to General Provisions Section regarding Substitutions.

PART 2 - PRODUCTS

2.01 GENERAL

- A. Provide equipment of the type and size specified herein and listed in the Schedules.

2.02 IDENTIFICATION

- A. Equipment Identification
 - 1. Identify equipment, as listed in the Equipment Schedules and Equipment Notes with (laminated plastic) nameplates.
 - a. Laminated plastic nameplates shall be 1/16" thick phenolic plastic, non-conductive and able to withstand temperatures up to 200 degrees F.
 - 1) Minimum length shall be three inches with 3/16 inch lettering.
 - 2) Secure with screws. Where screws are not practical to use adhesive backing
 - 2. When equipment is to be concealed in a ceiling, provide an additional engraved plastic tag, exposed on the underside of the ceiling, mounted, e.g., to the T-bar ceiling grid, access door, etc., under the respective equipment.
 - a. Color of tags to be determined by the Owner.
 - 3. Equipment tags shall contain only information pertinent for identifying the respective equipment. The inclusion of the Contractor's company name, etc., is not acceptable.

230200-2

Mechanical Accessories

MECHANICAL ACCESSORIES

B. Pipe Identification

1. Provide precoiled pipe markers indicating purpose, size and direction of flow. Self-adhesive, non-coiled markers will not be accepted.
 - a. Install markers, after finish painting, as follows:
 - 1) Adjacent to each valve.
 - 2) At each branch and riser takeoff.
 - 3) At each pipe passage through wall, floor and ceiling construction.
 - 4) At each pipe passage to underground.
 - 5) At every 25 feet of horizontal run and minimum one per room.
2. Pipe markers shall be the type and size listed in the Pipe Identification Marker Schedule and the Pipe Identification Marker Color and Symbol List.
3. Pipe Identification Marker Schedule
 - a. Precoiled Wraparound
 - b. Standards: ANSI A13.1-2020
 - c. Description: Marker surface and all printing sealed beneath outdoor grade acrylic plastic. Legend plus directional arrows printed four times on each marker. 360° visibility. 3/4 inch pressure-sensitive adhesive strip.
 - d. Operating Temperature Range: 40 to 180°F
 - e. Manufacturer & Model No.: Seton Setmark pipe Markers (Approved Equal: Brady, MSI)
 - f. Pipe Identification Marker Color and Symbol List

<u>Piping System</u>	<u>Background Color</u>	<u>Letter Color</u>	<u>Piping Symbol</u>
Chemical Treatment	Yellow	Black	TR
Chilled Water	Green	White	CHW
Glycol Make-up	Green	White	GLY
City Water	Green	White	CW
Drain	Green	White	DR
High Temperature Hot Water	Yellow	Black	HTHW

230200-3

Mechanical Accessories

MECHANICAL ACCESSORIES

Heating Hot Water	Yellow	Black	HHW
Heating Hot Glycol	Yellow	Black	HHG
Make-up Water	Green	White	MW

C. Valve Identification

1. Identify each manual, automatic and self-contained valve with a permanently attached tag bearing distinguishing numbers and letters corresponding to the valve chart.
 - a. Tags shall be the following:
 - 1) Standard
 - a) 1-1/2 inch diameter brass with depressed black-filled 1/2 inch high numbers and 1/4 inch high letters Seton Style M4506, American Nameplate Co. or US Nameplate Co.
 - b) 1-1/2 inch diameter stainless steel, No. 4 finish with depressed black-filled 1/2 inch high numbers and 1/4 inch high letters Seton Style M4539, American Nameplate Co. or US Nameplate Co.

D. Valve Charts

1. Provide two copies of valve charts. Charts shall include schematic drawings of piping layouts, valve identification numbers, location and purpose.
 - a. Mount first chart in an aluminum frame with a glass front, Seton Name Plate Corp., Style A 11G, American Nameplate Co. or US Nameplate Co. Secure on the plant wall where directed.
 - b. Mount the second chart in a heavy gauge clear vinyl plastic envelope in a 1/2 inch black opaque vinyl frame with metal eyelets on four sides, and with eight inch length of nickel-plated bead chain as manufactured by Seton Name Plate Corp., Style P, American Nameplate Co. or US Nameplate Co. This chart is to be presented to the Owner.

2.03 PAINTING

A. Painting Notes

1. Undercoats of paint shall be tinted to approximate shade of final coat.

MECHANICAL ACCESSORIES

2. Materials shall be spread with care to a uniform and proper film thickness, showing no runs, sags, crawls, holidays, or other defects. Paint shall be applied in a manner showing a minimum of brush marks; enamels shall be uniformly flowed on. Finished surfaces shall be uniform in sheet, color, and texture. Rate of application shall not exceed average rate of coverage recommended by paint manufacturer for type of surface involved.
3. Coats shall be thoroughly dry before succeeding coats are applied. A minimum of twenty-four (24) hours shall be allowed between applications on any one surface, unless otherwise specified by the manufacturer.
4. Contractor shall not only protect this work at all times, but shall also protect adjacent work and materials by suitable covering or other method during progress of his work.
5. Rejected materials shall be removed from premises immediately.
6. It shall be distinctly understood that by using materials specified, and applying numerous coats, acceptance may not be assured.
7. Acceptance at final inspection will be governed by body finish and effect produced. Additional coats shall be applied as required to produce proper finish and coverage, if required, at no additional cost to the Owner.
8. If metal or any other surfaces to be finished cannot be put in proper condition for finishing by customary cleaning, sanding, and puttying operations, Contractor shall assume responsibility for and rectify any unsatisfactory finish results.
9. Panel box doors and the like shall be painted with doors in the open position.

B. Painting and Finishing Schedule

1. The following schedule shall be construed as a general guide for complete painting and finishing of certain portions or items of mechanical equipment, and the like.
 - a. All paint materials shall be factory mixed and comply with latest VOC regulations. Contractor shall substitute compliant material at no extra cost to the Owner.
 - b. Provide one primer coat and two finish coats of paints.
 - c. In general, paints specified herein are taken from the Pittsburgh Paints (PPG) catalog. Products of equal quality as manufactured by other

MECHANICAL ACCESSORIES

approved manufacturers, Carboline, Benjamin Moore, Pratt and Lambert, and Con-Lux may be used.

PART 3 - EXECUTION

3.01 LUBRICATION

A. Lubrication Notes

1. All Contractor furnished equipment and/or installed equipment shall be properly lubricated when connected and before operation of the equipment is begun.
2. The Contractor will be held responsible for any damage to equipment that is operated without having been properly lubricated.

END OF SECTION

EXPANSION COMPENSATION AND FLEXIBLE CONNECTORS

230516 EXPANSION COMPENSATION AND FLEXIBLE CONNECTORS

PART 1 - GENERAL

1.01 WORK INCLUDED

- A. Expansion loop (EL)
- B. Flexible pipe connection (FPC)

1.02 QUALITY ASSURANCE

- A. All work shall conform to Standards of the Expansion Joint Manufacturers' Association.
- B. Examine piping layout and notify the Engineer of additional anchors or expansion joints required to adequately protect the system.
- C. Provide inspection services by flexible pipe manufacturer's representative for final installing to certify installation is in accordance with manufacturer's recommendations and that connectors are performing satisfactorily.
- D. All flexible hose expansion loops shall be manufactured in accordance with the documented manufacturers weld procedure specifications in accordance with ASME Section IX.

1.03 SUBMITTALS

- A. Refer to Section 230100 for submittal procedures.
- B. Indicate maximum temperature and pressure rating, face-to-face length, live length, hose wall thickness, hose convolutions per foot and per assembly, fundamental frequency of assembly, braid structure, and total number of wires in braid.
- C. Provide product specific manufacturer cut sheets with all proposed sizes and options indicated.

PART 2 - PRODUCTS

- 2.01** Provide equipment of the type and size specified herein, as shown on the Drawings and listed in the Schedules.

2.02 EXPANSION LOOPS

- A. Flexible hose expansion loops shall be nested configuration to conserve space with multiple pipes in parallel. Loops shall be manufactured by The Metraflex Company. Alternate manufacturers shall be Kelco and Flexicraft.

230516-1

Expansion Compensaiton and Flexible Connectors

EXPANSION COMPENSATION AND FLEXIBLE CONNECTORS

- B. Flexible hose expansion loops shall be manufactured complete with two perpendicular sections of corrugated metal hose, compatible braid, 90° return bend, with inlet and outlet connections. Field fabricated loops shall not be acceptable.
- C. Flexible loops shall be capable of movement in the X, Y, and Z planes.
- D. Flexible hose expansion loops shall impart no thrust loads to system support, anchors or building structure.
- E. Corrugated Hose shall be stainless steel type 304.
- F. Fittings shall be carbon steel weld neck flanges in accordance with ASME B16.9.
- G. Flexible hose expansion loops shall have a factory supplied; hanger / support lug located at the bottom of the 180° return.

2.03 FLEXIBLE PIPE CONNECTION

- A. Provide equipment of the type and size listed in the schedules herein.

PART 3 - EXECUTION

3.01 EXPANSION LOOPS

- A. Provide structural work and equipment required to control expansion/contraction of piping, loops, pipe offsets, and swing joints.
- B. Install and guide per manufacturers' installation instructions and Mechanical Contractors Association of America "Guidelines for Quality Piping Installations".

3.01 FLEXIBLE PIPE CONNECTORS

- A. Install flexible connectors where shown on Drawings and on pipes connected to equipment supported by vibration isolation.
- B. Install flexible connectors at right angles to displacement. One end immediately adjacent to isolated equipment and anchor other end.

EXPANSION COMPENSATION AND FLEXIBLE CONNECTORS

FLEXIBLE PIPE CONNECTOR SCHEDULE						
TAG	FPC/1					
TYPE	BRAIDED					
SERVICE	HHW,					
LOCATION						
CONNECTION	SCREWED					
SIZE, IN. O.D.	1/2	3/4	1	1-1/4	1-1/2	2
WORKING PRESS. -PSIG @ 70°F	250	250	212	244	221	442
LENGTH, IN.	9	9	9	11	11	10-1/2
WEIGHT, LBS.	13	15	20	28	33	2
MAX. PIPING MISALIGNMENT, IN.	1/8					
CONSTRUCTION	(PHOSPHOR BRONZE HOSE AND BRONZE BRAID WITH ANNULAR CORRUGATIONS) (T321 STAINLESS STEEL HOSE AND BRAID WITH ANNULAR CORRUGATIONS)					
MANUFACTURER & MODEL NO.	FLEXONICS, MODEL 201 (BRONZE) 101 (STAINLESS STEEL) KEFLEX, METRAFLEX					
REMARKS	BRONZE MODEL SHALL BE USED FOR COPPER PIPE AND STAINLESS STEEL MODEL SHALL BE USED FOR STEEL PIPE PROVIDE SHOP DRAWINGS INSTALL PUMP CONNECTORS IN SUCTION AND DISCHARGE PIPING NEAR PUMP. ANCHOR PIPING ABOVE CONNECTOR DO NOT PERMIT WEIGHT OF PIPING SYSTEM TO REST ON FLEXIBLE SECTION BASE THE CONNECTOR SIZE ON PIPE LINE SIZE. DO NOT USE PUMP SUCTION AND DISCHARGE SIZE					

END OF SECTION

230516-3

Expansion Compensaiton and Flexible Connectors

PHOTO LAB – DARKROOM RENOVATION

PURCHASE COLLEGE SUNY | 735 ANDERSON HILL RD. | VISUAL ARTS BUILDING | LA PLLC Project 2306

METERS, GAUGES AND INDICATORS

230519 METERS, GAUGES AND INDICATORS

PART 1 - GENERAL

1.01 WORK INCLUDED

- A. Hydronic circuit balancing valve (CBV)
- B. Pressure gauge (PG)
- C. Thermometer (TH)

1.02 QUALITY ASSURANCE

- A. All instrumentation shall conform to, and be in accordance with, criteria as set forth by the ISA, Standards and Practices for Instrumentation.

1.03 SUBMITTALS

- A. Refer to Section 230100 for submittal procedures.
- B. Provide product specific manufacturer cut sheets with all proposed sizes and options indicated.
- C. Provide list that indicates use, operating range, total range and location for manufactured components.

PART 2 - PRODUCTS

2.01 Provide equipment and devices of the type and size specified herein and listed in the Schedules.

- A. Refer to equipment manufacturers for all required meters, gauges, indicators, thermometers and pressure gauges and their exact location and mounting requirements for all equipment installed or modified under this project including:
 - 1. Hot Water Coils

PART 3 - EXECUTION

3.01 HYDRONIC CIRCUIT BALANCING VALVE (CBV)

- A. Install at the following locations and wherever shown on the Drawings:
 - 1. Heating hot water supply or return line at each VAV reheat coil.

3.03 PRESSURE GAUGES (PG)

230519-1

Meters, Gauges and Indicators

METERS, GAUGES AND INDICATORS

- A. Install gauges at the following locations and wherever shown on the Drawings:
 - 1. Inlet and outlet of each:
 - a. Heating water coil.
- B. Provide brass shutoff cock in the piping connection to each gauge.
- D. Provide porous filter pulsation snubber with brass body and bronze core ahead of pressure gauges on pumped systems.
- E. Submit gauge ranges to Engineer for review.
- F. Pressure gauge shall have maximum limit of not less than twice the normal working pressure at the point where installed.

3.04 THERMOMETERS (TH)

- A. Install thermometers at the following locations and wherever shown on the Drawings.
 - 1. Inlet and outlet of each
 - a. Heating water coil.
- B. When thermometers or temperature sensors or controllers are to be installed in pipes:
 - 1. Install all pipe mounted thermometers in thermowells filled with heat transfer compound.
 - 2. Install thermometers/thermowells so that tip of stem is at least midspan of the pipe cross-section but less than the pipe diameter.
 - 3. Install thermowells in run of tee or in elbow so that full length of bulb is immersed in fluid flow.
 - 4. When pipe size is less than 2-1/2 inches, increase size at point of immersion to 2-1/2 inches to avoid flow restriction.

METERS, GAUGES AND INDICATORS

HYDRONIC CIRCUIT BALANCING VALVE SCHEDULE			
TAG	CBV		
SERVICE	HHW		
TYPE	DIFFERENTIAL PRESSURE		
FLOW RATE, GPM			
PIPE SIZE, IN.	1/2 THRU 2	1/2 THRU 2	2-1/2 THRU 12
CONNECTION	SOLDER	SCREWED	FLANGED
MAX. WORK. PRESS., PSIG	300	300	250
MAX. OPER. TEMP, °F.	250	250	250
MATERIAL	BRASS COPPER	ALLOY	CAST IRON
VALVE FUNCTIONS	PRECISE FLOW MEASUREMENT PRECISE FLOW BALANCING POSITIVE SHUTOFF WITH TEFLON DISC		
VALVE ADJUSTMENT	MICROMETER TYPE SETTING WITH 360° ADJUSTMENT TURNS HIDDEN MEMORY FEATURE TO PROGRAM VALVE TAMPERPROOF BALANCING SETTING		
MANUFACTURER & MODEL NO.	TOUR & ANDERSSON,		
	TA 786 STAS	TA 787 STAD	TA 788 STAF
	OR EQUAL BY APPROVED MANUFACTURES BELL & GOSSETT, ARMSTRONG		
REMARKS	PROVIDE SHOP DRAWINGS VALVE SHALL HAVE FACTORY CONNECTIONS FOR PORTABLE DIFFERENTIAL METER. EACH CONNECTION SHALL HAVE PRESSURE/TEMPERATURE READOUT POINTS INCLUDE PERFORMANCE CURVES (PROVIDE OWNER WITH TWO WHEEL TYPE BALANCING CALCULATORS) (TURN METER KIT OVER TO OWNER)		

METERS, GAUGES AND INDICATORS

PRESSURE GAUGE SCHEDULE		
TAG	PG/W1	PG/W2
SERVICE	WATER (0-75 PSIG)	WATER (76-150 PSIG)
PRESS. RANGE		
-PSIG	0 TO 100	0 TO 200
-IN. H.G. PSIG	30-100*	30-150*
ACCURACY, % FULL SCALE	1	
DIAL DIAMETER, IN.	4-1/2	
CONNECTION SIZE, IN.	1/4	
CONNECTION LOCATION	BOTTOM	
DIAL COLOR	WHITE	
CASE CONSTRUCTION	FLANGELESS	
MATERIALS		
-CASE	STAINLESS STEEL	
-BOURDON TUBE	PHOSPHOR BRONZE	
-SOCKET	BRASS	
-LENS	PLASTIC	
PRESSURE SNUBBER	FILTER TYPE	
MANUFACTURER & MODEL NO.	WEKSLER, EA14-C	WEKSLER, EA14-E
	*USE COMPOUND GAUGES AT PUMP SUCTION	
	WEKSLER, EA14-K	WEKSLER, EA14-L
	MARSH, MARSHALLTOWN, WEISS	
REMARKS	PROVIDE SHOP DRAWINGS	
	PROVIDE BRASS T-HANDLE COCKS	

METERS, GAUGES AND INDICATORS

THERMOMETER SCHEDULE				
	TH			
SERVICE	HHWS/R			
TEMP. RANGE, °F.	30 TO 240			
ACCURACY % FULL SCALE	1			
TYPE	ADJUSTABLE VERTICAL			
VERT. TUBE HEIGHT, IN.	9			
STEM LENGTH, IN.				
-PIPE DIAMETER, IN.				
-UP TO 6 IN.	3-1/2			
-8 IN. TO 12 IN.	6			
-14 IN. TO 18 IN.	9			
-20 IN. TO 24 IN.	12			
CONNECTION SIZE, IN.	3/4 SCREWED			
CONNECTION LOCATION	BOTTOM			
CASE CONSTRUCTION	PLASTIC WITH GLASS LENS			
MATERIAL				
-CASE	PLASTIC			
-SCALE	ALUMINUM			
-SOCKET	BRASS			
-STEM	BRASS			
-SEPARABLE WELL	STAINLESS STEEL			
-LENS	GLASS			
MOVEMENT	MERCURY FREE ORGANIC LIQUID			
MOUNTING	THERMOWELLS FILLED WITH HEAT TRANSFER COMPOUND			
MANUFACTURER & MODEL NO.	WEKSLER, -AA5H-9 (3-1/2 IN. STEM) -AA5L-9 (6 IN. STEM) -AA5N-9 (9 IN. STEM) AA5Q-9 (12 IN. STEM) WEISS, MARSH, MARSHALLTOWN			
REMARKS	PROVIDE SHOP DRAWINGS FOR TEMPERATURE APPLICATIONS GREATER THAN 400°F., CONSULT WITH THE EQUIPMENT MANUFACTURER			

230519-5

Meters, Gauges and Indicators

PHOTO LAB - DARKROOM RENOVATION

PURCHASE COLLEGE SUNY | 735 ANDERSON HILL RD. | VISUAL ARTS BUILDING | LA PLLC Project 2306

METERS, GAUGES AND INDICATORS

END OF SECTION

230519-6

Meters, Gauges and Indicators

PHOTO LAB – DARKROOM RENOVATION

PURCHASE COLLEGE SUNY | 735 ANDERSON HILL RD. | VISUAL ARTS BUILDING | LA PLLC Project 2306

MANUAL VALVES, COCKS, FAUCETS

230523 MANUAL VALVES, COCKS, FAUCETS

PART 1 - GENERAL

1.01 WORK INCLUDED

- A. Ball valve (BA) (BA/DR)
- B. Cock (CK)
- C. Globe valve (GL)
- D. Silent check valve (CH/SI)
- E. Swing check valve (CH)
- F. Valve operators

1.02 QUALITY ASSURANCE

- A. Use only new valves. Rebuilt or refurbished valves are not acceptable.
- B. Provide manufacturer's certification that valves have been given shell and seat tests.
- C. Unless otherwise specified or required by codes, bronze valves shall conform to the following standards:
 - 1. 125 PSIG or 150 PSIG ASTM B62.
 - 2. 200 PSIG or 300 PSIG ASTM B61.
- D. Unless otherwise specified or required by codes, iron body valves shall conform to the following standards:
 - 1. ASTM A126, Grade B.
 - 2. ANSI B16.10.
- F. All valves shall have the size, manufacturer's name and the working pressure for which they are designed, cast in the valve body.
- G. Pressure-temperature rating of valves shall not be less than the design criteria applicable to all components of the system.

1.03 SUBMITTALS

- A. Refer to Section 230100 for submittal procedures.
- B. Provide product specific manufacturer cut sheets with all proposed sizes and options indicated.

PART 2 - PRODUCTS

MANUAL VALVES, COCKS, FAUCETS

2.01 Provide equipment of the type, size and rating specified herein and listed in the Schedules.

2.02 VALVE OPERATORS

- A. Valve handwheels shall be iron.
- B. Equip globe and butterfly valves four inches and over located more than eight feet from floor with chain operated sheaves and chain.
 - 1. Extend chains to about five feet above floor. Hook to clips to clear walking aisles.
 - 2. Operator shall be Babbit Adjustable Sprocket Rim, Rotork, Hammond Valve or approved equal.
- C. Provide valve stem extensions for ball valves and any other valves as required to clear insulation requirements. Trimming insulation thickness to facilitate valve handle operations is not permitted.

PART 3 - EXECUTION

- 3.01** Install all valves in strict accordance with the manufacturer's recommendations as approved by the Engineer.
- 3.02** Locate valves so they may be conveniently operated and readily repaired or replaced.
- 3.03** Remove all valve parts which may have become damaged during installation upon completion of the work. Replace them with new parts so that all valves are in first-class operating condition.
- 3.04** Provide drain valves in low points of all water piping systems.
- 3.05** Install ball and globe valves with stems upright or horizontal.
- 3.06** Valves are not to be installed inverted.

MANUAL VALVES, COCKS, FAUCETS

BALL VALVE SCHEDULE (NON-HTHW)		
TAG	BA	
SERVICE	DR, HHW	
VALVE TYPE	BALL	
ANSI PRESS. CLASS	150	
SIZE, IN.	1/4 to 2	3/8 to 2
MATERIAL & ASTM SPEC	BRONZE	BRASS
MSS SPEC	N/A	
CONNECTION	SCREWED	SOLDER
MATERIALS		
-BODY	BRONZE	BRASS
-STEM	BRASS	BRASS
-BALL	BRASS	BRASS
-SEAT RING	PTFE	PTFE
-PACKAGING	PTFE	PTFE
STEM OPERATION	LEVER	
MANUFACTURER & MODEL NO.	CRANE, NO. 9201	CRANE NO. 9202
ALTERNATE MANUFACTURES	WORCESTER, JAMESBURY	WORCESTER, JAMESBURY
REMARKS	PROVIDE SHOP DRAWINGS SEE FLOW DIAGRAMS FURNISH AND INSTALL WALL AND CEILING ACCESS DOORS FOR ALL CONCEALED EQUIPMENT.	

MANUAL VALVES, COCKS, FAUCETS

COCK SCHEDULE		
TAG	CK	
SERVICE	G	
VALVE TYPE	COCK – SQUARE HEAD	
ANSI PRESS. CLASS	150	125
SIZE, IN.	1/2 to 2	2-1/2 to 3
MATERIAL & ASTM SPEC	BRONZE B62	CAST IRON A126 CLASS B
CONNECTION	SCREWED	SCREWED
MATERIALS		
-BODY	BRONZE	CAST IRON
-DISC	BRONZE	CAST IRON
-STEM	N/A	N/A
MANUFACTURER & MODEL NO.	CRANE, NO. 250	CRANE, NO. 320
ALTERNATE MANUFACTURERS	WALWORTH, STOCKHAM	WALWORTH, STOCKHAM
REMARKS	PROVIDE SHOP DRAWINGS PROVIDE TWO WRENCHES SEE FLOW DIAGRAMS	

MANUAL VALVES, COCKS, FAUCETS

SILENT CHECK VALVE SCHEDULE			
TAG	CH/SI		
SERVICE			
VALVE TYPE	SILENT CHECK		
BODY TYPE	N/A	WAFER	GLOBE
ANSI PRESS. CLASS	125	125	125
SIZE, IN.	1/2 TO 2	2-1/2 & OVER	2-1/2 & OVER
MATERIAL & ASTM SPEC	BRONZE B61	CAST IRON A126 CLASS B	CAST IRON A126 CLASS B
CONNECTION	SCREWED	BETWEEN FLANGES	FLANGED
MATERIALS -BODY -DISC -SEAT	BRONZE BRONZE BRONZE	CAST IRON BRONZE BRONZE	CAST IRON BRONZE BRONZE
MANUFACTURER & MODEL NO.	MUELLER NO. 203-BP	MUELLER, NO. 103-AP	MUELLER, NO. 107-AP
ALTERNATE MANUFACTURES	APCO, CPV	APCO, CPV	APCO, CPV
REMARKS	SEE FLOW DIAGRAMS		

MANUAL VALVES, COCKS, FAUCETS

SWING CHECK VALVE SCHEDULE			
TAG	CH		
SERVICE	HHW		
VALVE TYPE	SWING CHECK		
ANSI PRESS. CLASS	150	150	125
SIZE, IN.	1/4 TO 2	1/4 TO 2	2-1/2 & OVER
MATERIAL & ASTM SPEC	BRONZE B62	BRONZE B62	CAST IRON A126 CLASS B
MSS SPEC	SP-80	SP-80	SP-71
CONNECTION	SCREWED	SOLDERED	FLANGED
MATERIALS			
-BODY	BRONZE	BRONZE	CAST IRON
-DISC	BRONZE	BRONZE	BRONZE
-SEAT	BRONZE	BRONZE	BRONZE
MANUFACTURER & MODEL NO.	CRANE, NO. 37	CRANE, NO. 1342	CRANE, NO. 373
	WALWORTH, STOCKHAM	WALWORTH, STOCKHAM	WALWORTH, STOCKHAM
REMARKS	SEE FLOW DIAGRAMS		
	FURNISH WALL AND CEILING ACCESS DOORS FOR ALL CONCEALED EQUIPMENT. TURN OVER TO CONTRACTOR FOR INSTALLATION		

230523-6

Manual Valves, Cocks, Faucets

PHOTO LAB – DARKROOM RENOVATION

PURCHASE COLLEGE SUNY | 735 ANDERSON HILL RD. | VISUAL ARTS BUILDING | LA PLLC Project 2306

MANUAL VALVES, COCKS, FAUCETS

SWING CHECK VALVE SCHEDULE	
TAG	CH
SERVICE	TR
VALVE TYPE	SWING CHECK
ANSI PRESS. CLASS	150
SIZE, IN.	1/2 TO 2
MATERIAL & ASTM SPEC	STAINLESS STEEL A351
MSS SPEC	SP-80
CONNECTION	SCREWED
MATERIALS	
-BODY	STAINLESS STEEL
-DISC	STAINLESS STEEL
-SEAT	STAINLESS STEEL
MANUFACTURER & MODEL NO.	CRANE, NO. 370
	WALWORTH, STOCKHAM
REMARKS	PROVIDE SHOP DRAWINGS
	SEE FLOW DIAGRAMS

END OF SECTION

PIPING AND EQUIPMENT SUPPORTS, ANCHORS AND SLEEVES

230529 PIPING AND EQUIPMENT SUPPORTS, ANCHORS AND SLEEVES

PART 1 - GENERAL

1.01 WORK INCLUDED

- A. Anchor (A)
- B. Escutcheons and flashing
- C. Flashing and safig for mechanical equipment
- D. Pipe guide (GD)
- E. Pipe hangers and rods
- F. Pipe spring hanger
- G. Sleeves and seals
- H. Steel channels and surface raceway metal framing (Kindorf)
- I. Vibration isolation hangers and supports
- J. Wall and floor penetration seal (WFS)

1.02 QUALITY ASSURANCE

- A. Manufacturer's certification that materials meet or exceed the minimum requirements specified herein and in the Schedules.
- B. Supports, anchors and seals shall conform to the following standards:
 - 1. Pipe Supports: ANSI B31.1
MSS SP-58, SP-69 & SP-89
 - 2. Hanger Rods: ASTM A575
 - 4. Concrete Expansion Anchors: UL Listed
 - 5. Variable Spring Hangers: ANSI B31.1.0 & MSS SP-69
 - 6. Wall & Floor Seals (Fire-Rated): ASTM E-119-76
 - 7. All applicable local codes.
- C. Hangers, supports, anchors, and guides for stainless steel pipe are to be plastic coated where the support is in contact with the pipe.

1.03 SUBMITTALS

- A. Refer to Section 230100 for submittal procedures.
- B. Provide product specific manufacturer cut sheets with all proposed sizes and options

230529-1

Piping and Equipment Supports, Anchors and Sleeves

PIPING AND EQUIPMENT SUPPORTS, ANCHORS AND SLEEVES

indicated.

230529-2

Piping and Equipment Supports, Anchors and Sleeves

PHOTO LAB – DARKROOM RENOVATION

PURCHASE COLLEGE SUNY | 735 ANDERSON HILL RD. | VISUAL ARTS BUILDING | LA PLLC Project 2306

PIPING AND EQUIPMENT SUPPORTS, ANCHORS AND SLEEVES

- C. Provide shop drawing of concrete equipment pad layout and construction detail.

PART 2 - PRODUCTS

- 2.01** Provide equipment and material of the type and size shown on the Drawings, specified herein and as listed in the Schedules, including accessories, such as nuts, bolts, caulking and sealants.

- 2.02** Select and size pipe hangers and supports in compliance with the latest edition of MSS Manual SP-69 Pipe Hangers and Supports, Selection and Application.

- A. Design and selection shall include consideration of the following:

1. Concrete fasteners and anchors.
2. Insulated vs. uninsulated pipe.
3. Weight of valves, flanges and specialties.
4. Expansion, contraction and cold-springing.
5. Spring supports.
6. Riser supports.

2.03 HORIZONTAL PIPE ISOLATION

- A. Provide vibration isolation hangers and supports for all piping over one inch diameter in the Equipment Rooms and for 50 feet from the equipment connection, where the 50 foot dimension extends beyond the Equipment Room.

1. The three hangers closest to the equipment connection shall be the precompressed spring and neoprene type as specified in the Schedules.
2. The hangers for the remainder of the 50 foot distance shall be the spring and neoprene type as specified in the Schedules.
3. Floor supported pipes shall rest on spring and neoprene mounts as specified in the Schedules.

- 2.04** Hanger and support material in contact with pipe shall be compatible with pipe material to prevent deteriorating action.

- 2.05** Provide Kindorf, Midland-Ross, Uni-Strut or equal, structural support surface raceway metal framing as required.

- 2.06** Provide concrete expansion anchors equal to Hilti HDI (BS&A Calendar No. 469-74-SM).

2.07 ESCUTCHEONS AND FLASHING

PIPING AND EQUIPMENT SUPPORTS, ANCHORS AND SLEEVES

- A. Polished Chrome Plated Pipe
 - 1. Polished chromium-plated brass one piece escutcheons with flush setscrews.
- B. Plain or Painted, Bare or Insulated Pipes, Conduit or Tubes
 - 1. Unfinished Areas
 - a. Cast iron or steel split-hinged escutcheons with flush screws, prime painted.
 - 2. Finished Areas
 - a. Satin finish chromium-plated brass one piece escutcheons with flush setscrews.
- C. Stainless Steel or Aluminum Jacketed Insulated Pipe or Tubing
 - 1. Minimum 1/16 inch thick sheet metal covers of same material as jacket cut round.

2.8 SLEEVES AND SEALS

- A. Install sleeves and seal annular space between sleeve and bare pipe or insulated pipe as specified herein and as shown in the details on the Drawings.
- B. Below Grade Foundation Walls and Floors on Grade
 - 1. Pipe Penetrations
 - a. Provide modular mechanical seals and sleeves (MMS) as specified in the Schedules.
- C. Above Grade Masonry Floors
 - 1. Pipe Penetrations
 - a. Provide structural support at floor opening as required.
 - b. Provide Schedule 40 galvanized steel pipe sleeves with an anchor ring welded to the outside. Internal diameter of sleeve shall be maximum one inch larger than the outside diameter of the bare or insulated pipe.
 - c. Provide escutcheon on both sides.
 - d. Insulated

PIPING AND EQUIPMENT SUPPORTS, ANCHORS AND SLEEVES

- 1) Provide calcium silicate pipe insulation through floor opening.
 - e. Fire-Rated
 - 1) Fill voids to full depth with intumescent fire stopping material as specified in the Schedules.
 - f. Contractor has the option to provide modular mechanical seals and sleeves (MMS) as specified in the Schedules.
- D. Above Grade Masonry Walls
- 1. Pipe Penetrations
 - a. Provide steel lintel to support masonry above opening as required.
 - b. Provide Schedule 40 galvanized steel pipe sleeves with an anchor ring welded to the outside. Internal diameter of sleeve shall be maximum one inch larger than the outside diameter of the bare or insulated pipe.
 - c. Provide escutcheon on both sides.
 - d. Insulated
 - 1) Provide calcium silicate pipe insulation through wall opening.
 - e. Fire-Rated
 - 1) Fill voids to full depth with intumescent fire stopping material as specified in the Schedules.
- E. Gypsum Board, Plaster or Wood Partitions
- 1. Pipe Penetrations
 - a. Provide No. 25 gauge galvanized steel stud header and support.
 - b. Provide No. 20 gauge galvanized sheet metal sleeves.
 - c. Provide escutcheon on both sides if exposed.
 - d. Insulated
 - 1) Provide calcium silicate pipe insulation through wall opening.

PIPING AND EQUIPMENT SUPPORTS, ANCHORS AND SLEEVES

e. Fire-Rated

- 1) Fill voids to full depth with intumescent fire stopping material around calcium silicate as specified in the Schedules.

F. Refer to Architectural Drawings for location and rating of fire-rated walls and floors.

PART 3 - EXECUTION

3.01 ANCHORS

- A. Embed anchors in structural concrete or connect to building structural steel framework.
- B. Locate anchors to permit piping to expand and contract freely in opposite directions away from the anchored points.
- C. Locate anchors to prevent undue strain on piping.

3.03 CONCRETE EXPANSION ANCHORS

- A. Install anchors in accordance with manufacturer's printed instructions.
 1. Use carbide masonry bits of appropriate nominal diameter.
- B. When concrete expansion anchors are used to support loads in tension (pipe hangers suspended from concrete slabs), install a minimum of two anchors per hanger and reduce hanger spacing to ½ the specified distance.

3.04 PIPE HANGERS AND SUPPORTS

- A. General Piping Installations
 1. Fabricate and install hangers and supports in compliance with the latest edition of the following:
 - a. MSS Manual SP-89, Pipe Hangers and Supports, Fabrication and Installation Practices.
 2. Hanging materials shall have a safety factor of five built-in and be designed and arranged to minimize vibration.
 3. Support piping to maintain required grading and pitching of lines. Use hangers which are vertically adjustable 1-1/2 inches minimum after piping is erected. After adjusting hangers in place, trim, cut or file hanger rods so that the ends do not

230529-6

Piping and Equipment Supports, Anchors and Sleeves

PIPING AND EQUIPMENT SUPPORTS, ANCHORS AND SLEEVES

extend more than 1/2 inch below the hanger bolts.

4. Design and install pipe supports to avoid interference with other piping, ducts, conduit and supports.
5. Provide trapeze hangers where several pipes can be installed in parallel at same elevation.
 - a. Hanger spacing shall be determined by the smallest pipe size.
6. Provide hangers of heavy construction suitable for the size of pipe to be supported. Materials, unless otherwise specified, shall be as follows:
 - a. Wrought or malleable iron or steel.
 - b. Rods may be galvanized in lieu of zinc chromate dipping.
7. Provide separate supports for all branches. No branch six feet in length or over shall be installed without an approved hanger.
8. Provide sway bracing at every fourth hanger, where hangers are more than 18 inches in length.
9. Support horizontal piping runs from overhead and vertical structural members. Locate to obtain maximum possible headroom.
10. Provide a structurally sound piping and equipment suspension system, amply strong and rigid for the load, which shall not weaken or unduly stress the building structure.
11. Provide all auxiliary structural steel members necessary to support all piping and equipment.
12. Connect permanently and/or tie the auxiliary steel hanger supports, anchors and guides to the building structure.
13. Do not hanging pipe from other piping.
14. Do not hang piping with chain straps, perforated bars, wire hangers, ropes, wood, perforated metal band or other makeshift systems.
15. Suspend smaller pipes from cross-pieces of pipe or steel angles, which, in turn, shall be securely fastened to building beams or hung from the building structure by means of rods.

PIPING AND EQUIPMENT SUPPORTS, ANCHORS AND SLEEVES

16. Support piping supported from walls with welded steel brackets with an adjustable clevis hanger or a pipe saddle mounted on the bracket.
17. Use double-bolt riser clamps, with each end having equal bearing on the building structure, for supporting vertical piping.
18. Provide clevis type hangers for piping systems subject to minimum expansion and contraction due to temperature changes. In general, clevis type hangers are to be used in all piping systems.
19. Provide roller type hangers for piping systems subject to axial movement.
 - a. In general, roller type hangers are to be used in the following systems:
 - 1) Heating hot water
 - 2) Reheat hot water
 - b. Clevis type hangers may be substituted for roller type under the following conditions:
 - 1) Pipe size less than two inches.
 - 2) Negligible axial movement at point of support.
20. Support riser piping independently of connected horizontal piping.
21. At the inlet and discharge of each pump in piping 2½ inches and larger, use base elbows with base flanges to support piping.

ANCHOR AND PIPE GUIDE SCHEDULE	
ITEM	FEE & MASON* FIG. NO.
-ANCHOR CHAIR (NONWELD)	159
-STEEL PIPE ANCHOR (NONWELD)	141

230529-8

Piping and Equipment Supports, Anchors and Sleeves

PHOTO LAB – DARKROOM RENOVATION

PURCHASE COLLEGE SUNY | 735 ANDERSON HILL RD. | VISUAL ARTS BUILDING | LA PLLC Project 2306

PIPING AND EQUIPMENT SUPPORTS, ANCHORS AND SLEEVES

-STEEL PIPE ANCHOR (WELDED)	140
-SPIDER GUIDE	120
-ROLLER GUIDE	121
-VERTICAL ROLLER GUIDE	122

***OTHER MANUFACTURERS: ELCEN, F&S, CENTRAL, OR EQUAL**

PIPING AND EQUIPMENT SUPPORTS, ANCHORS AND SLEEVES

PIPE HANGER AND SUPPORT MAXIMUM HORIZONTAL SPACING SCHEDULE		
PIPE MATERIAL	STEEL PIPE SPACING	COPPER TUBE SPACING
NOMINAL PIPE OR TUBE SIZE, IN.	WATER SERVICE FT.	WATER FT.
1/4	7	5
3/8	7	5
1/2	7	5
3/4	7	5
1	7	6
1-1/4	7	6
1-1/2	9	8
2	10	8
2-1/2	11	9
3	12	10
3-1/2	12	10
4	12	10
5	12	10
6	12	10
8	12	10
10	22	18
12	23	19
14	25	
16	27	
18	28	
20	30	
24	32	
CAST IRON, DUCTILE IRON PRESSURE PIPE	12 FEET MAX, MIN. ONE HANGER PER SECTION CLOSE TO JOINT HANGER AT BRANCH CONNECTIONS AND CHANGE OF DIRECTION	
NOTE:	1. SCHEDULE DOES NOT APPLY WHEN SPAN CALCULATIONS ARE MADE. 2. PROVIDE ADDITIONAL SUPPORT AT CONCENTRATED LOADS (VALVES, FLANGES, ETC.) AND AT EACH CHANGE IN DIRECTION.	

230529-10

Piping and Equipment Supports, Anchors and Sleeves

PHOTO LAB – DARKROOM RENOVATION

PURCHASE COLLEGE SUNY | 735 ANDERSON HILL RD. | VISUAL ARTS BUILDING | LA PLLC Project 2306

PIPING AND EQUIPMENT SUPPORTS, ANCHORS AND SLEEVES

PIPE SPRING HANGER SELECTION SCHEDULE				
TABLE 2. SPRING SUPPORT SELECTION				
VERTICAL EXPANSION	ALLOWABLE VARIABILITY OR DEVIATION	SINGLE ROD HANGER	DOUBLE ROD HANGER	BASE SUPPORT
	NOTE (1)	NOTE (2) AND NOTE (3)		
MAX. 1/4 INCH (6.3 MM)	25% 6%	48, 51SS 51SS	48, 49 51SS, 51S, 53S	52SS 52S
MAX. 1 INCH (25.4 MM)	25% 6%	51S 54, 55	51S, 53S 54	52S 54, 55
MAX. 2 INCH (50.8 MM)	25%	51LS	51LS, 53LS 54, 55, 56	52LS 54, 55
MAX. 3 INCH (76.2 MM)	25%	51LS	51LS, 53LS 54, 55, 56	52LS 54, 55
OVER 3 INCH (76.2 MM)	25% 6%	54, 55 54, 55	54, 55, 56 54, 55, 56	54, 55 54, 55
NOTE	<p>(1) VARIABLE SPRING HANGERS $\text{VARIABLE FACTOR} = \frac{\text{PIPE TRAVEL, IN. (MM)}}{\text{SPRING RATE, LBS/IN. (KG/MM)}} \times \text{OPERATING LOAD, LBS. (KG)}$</p> <p>CONSTANT SUPPORT HANGERS</p> <p>DEVIATION = MAX. READING MOVING DOWN - <u>MIN. READING MOVING UP</u> MAX. READING MOVING DOWN + MIN. READING MOVING UP</p> <p>(2) NUMBERS IN COLUMNS ARE TYPE NUMBERS FROM FIGURE 1</p> <p>(3) VARIABLE SPRING TYPES 51, 52 AND 53, I.E. STANDARD SPRING, SHORT SPRING AND LONG SPRING MODELS ARE IDENTIFIED AS S, SS, AND LS, RESPECTIVELY</p> <p>(4) THIS TABLE IS FROM TABLE 2 MSS SP. 69</p>			

PIPING AND EQUIPMENT SUPPORTS, ANCHORS AND SLEEVES

VIBRATION ISOLATION PIPE HANGER SCHEDULE	
SERVICE	PIPE OVER 1 INCH DIA. – FIRST THREE HANGERS FROM EQUIPMENT CONNECTION
STATIC DEFLECTION	SAME AS SPECIFIED DEFLECTION FOR EQUIPMENT ISOLATORS
-EXCEPTION	PIPE CONN. TO EQUIP. IN BASEMENT & HANGING FROM CEILING UNDER OCCUPIED SPACE: PIPE 3 INCHES & UNDER – 0.75 INCH PIPE 4 INCHES THRU 6 INCHES – 1.5 INCH PIPE OVER 6 INCHES – 2.5 INCH
HANGER SPECIFICATION	STEEL SPRING & NEOPRENE ELEMENT IN SERIES MOUNTED IN STEEL HANGER BOX. ROD ISOLATION BUSHING MOLDED INTO NEOPRENE ELEMENT. SPRING DIA. & HANGER BOX LOWER HOLE LARGE ENOUGH TO PERMIT HANGER ROD TO SWING THRU 30° ARC. SPRING TO HAVE MIN. ADDITIONAL TRAVEL TO SOLID EQUAL TO 50% OF RATED DEFLECTION SPRING PRECOMPRESSED TO RATED DEFLECTION. PROVIDE SPRING RELEASE MECHANISM & SCALE TO INDICATE DEFLECTION
MANUFACTURER & MODEL NO.	MASON INDUSTRIES, TYPE PC30N
ALTERNATIVE MANUFACTURES	KINETICS, VIBRATION ELIMINATOR
SERVICE	PIPE OVER 1 INCH DIA. BEYOND FIRST THREE HANGERS FOR A DISTANCE OF 50 FEET FROM EQUIPMENT CONNECTION
STATIC DEFLECTION, IN.	0.75 MIN.
HANGER SPECIFICATION	STEEL SPRING & NEOPRENE ELEMENT IN SERIES MOUNTED IN STEEL HANGER BOX. ROD ISOLATION BUSHING MOLDED INTO NEOPRENE ELEMENT. SPRING DIA. & HANGER BOX LOWER HOILE LARGE ENOUGH TO PERMIT HANGER ROD TO SWING THRU 30° ARC. SPRING TO HAVE MIN. ADDITIONAL TRAVEL TO SOLID EQUAL TO 50% OF RATED DEFLECTION SPRING PRECOMPRESSED TO RATED DEFLECTION. PROVIDE SPRING RELEASE MECHANISM & SCALE TO INDICATE DEFLECTION
MANUFACTURER & MODEL NO.	MASON INDUSTRIES, TYPE 30N
ALTERNATIVE MANUFACTURES	KINETICS, VIBRATION ELIMINATOR
REMARKS	PROVIDE SHOP DRAWINGS INCLUDING SCALE DRAWING SHOWING 30° CAPABILITY LOCATE HANGERS AS CLOSE TO OVERHEAD SUPPORT AS POSSIBLE

230529-12

Piping and Equipment Supports, Anchors and Sleeves

PHOTO LAB – DARKROOM RENOVATION

PURCHASE COLLEGE SUNY | 735 ANDERSON HILL RD. | VISUAL ARTS BUILDING | LA PLLC Project 2306

PIPING AND EQUIPMENT SUPPORTS, ANCHORS AND SLEEVES

VIBRATION ISOLATION PIPE HANGER SCHEDULE	
SERVICE	FLOOR SUPPORTED PIPING OVER 1 INCH DIA. FOR A DISTANCE OF 50 FEET FROM EQUIPMENT CONNECTION
STATIC DEFLECTION -FIRST 3 SUPPORTS	SAME AS SPECIFIED DEFLECTION FOR EQUIPMENT ISOLATORS
-REMAINING SUPPORTS	0.75 INCH MM
SUPPORT SPECIFICATION	FREESTANDING & LATERALLY STABLE SPRINGS WITH 1/4 INCH NEOPRENE PAD BETWEEN BASEPLATE AND SUPPORT. LEVELING BOLTS TO BE BOLTED TO EQUIPMENT. SPRING DIA. NOT LESS THAN 0.8 OF COMPRESSED HGT. OF SPRING AT RATED LOAD. SPRING TO HAVE MIN. ADDITIONAL TRAVEL TO SOLID EQUAL TO 50% OF RATED DEFLECTION HOUSING WITH VERTICAL LIMIT STOPS. LIMIT STOPS OUT OF CONTACT DURING NORMAL OPERATION
MANUFACTURER & MODEL NO.	MASON INDUSTRIES, TYPE SLR
ALTERNATIVE MANUFACTURES	KINETICS, VIBRATION ELIMINATOR
REMARKS	PROVIDE SHOP DRAWINGS INCLUDING SPRING DIA., DEFLECTION, COMPRESSED SPRING HEIGHT & SOLID SPRING HEIGHT PROVIDE HOT DIPPED GALVANIZED MOUNTING FOR OUTDOOR USE

230529-13

Piping and Equipment Supports, Anchors and Sleeves

PHOTO LAB – DARKROOM RENOVATION

PURCHASE COLLEGE SUNY | 735 ANDERSON HILL RD. | VISUAL ARTS BUILDING | LA PLLC Project 2306

PIPING AND EQUIPMENT SUPPORTS, ANCHORS AND SLEEVES

WALL AND FLOOR PENETRATION SEAL SCHEDULE		
TYPE	INTUMESCENT FIRE BARRIER	
SERVICE	METAL PIPE AND CONDUIT PLASTIC PIPE AND CONDUIT INSULATED PIPE	
APPLICABLE STANDARDS AND CODES	ASTM E-119, ASTM E-814, UL 1479, NFPA 101, NEC	
ASTM E-14 FIRE TESTS	<u>CAULK</u>	<u>WRAP & SHEET</u>
-FUEL CONTRIBUTION	0	0
-SMOKE DEVELOPMENT	0	190
-FLAME SPREAD	63	17
ACCESSORIES	RESTRICTING COLLAR	
MANUFACTURER & MODEL NO.	3M	
-CAULK	CP 25 NS, CP 25 S/L	
-WRAP/STRIP	FS-195	
-COMPOSITE SHEET	CS-195	
ALTERNATIVE MANUFACTURES	ENVIROGRAF, ASTROFLAME	
REMARKS	PROVIDE PRODUCT SPECIFICATIONS AND INSTALLATION APPROVALS PROCEDURE	

END OF SECTION

DUCTWORK SUPPORTS AND SLEEVES

230530 DUCTWORK SUPPORTS AND SLEEVES

PART 1 - GENERAL

1.01 WORK INCLUDED

- A. Duct hangers and supports
- B. Sleeves and seals
- C. Vibration isolation hangers and supports

1.02 QUALITY ASSURANCE

- A. Provide manufacturer's certification that materials meet or exceed the minimum requirements specified in this Section and in the Schedules.
- B. Supports and seals shall conform to the following standards:
 - 1. Duct Hangers: Latest SMACNA HVAC Duct Construction Standards: Chapter 4 - Hangers & Supports
 - 2. Hanger Rods: ASTM A575
 - 4. Concrete Expansion Anchors: UL Listed
- C. Hangers, supports, anchors, and guides for stainless steel duct are to be plastic coated where the support is in contact with the duct.

1.03 SUBMITTALS

- A. Refer to Section 230100 for submittal procedures.
- B. Provide product specific manufacturer cut sheets with all proposed sizes and options indicated.

PART 2 - PRODUCTS

2.01 Provide hanging and support systems for sheet metal ducts as specified in the latest SMACNA HVAC Duct Construction Standards.

2.02 Provide concrete expansion anchors equal to Hilti HDI. BS&A Calendar No. 469-74-SM.

2.03 HORIZONTAL DUCT ISOLATION

- A. Provide vibration isolation hangers and supports for all supply ducts in the Equipment Rooms and for 50 feet from the equipment connection, where the 50 foot dimension extends beyond the Equipment Room.

DUCTWORK SUPPORTS AND SLEEVES

1. The hangers shall be the spring and neoprene type as specified in the Schedules.
2. Floor supported ducts shall rest on spring and neoprene mounts as specified in the Schedules.

PART 3 - EXECUTION

3.01 HANGERS AND SUPPORTS

A. Duct Systems

1. Install ducts and casings level.
2. Support each duct independently.
3. Support ducts using metal hangers and brackets. Hangers shall have sufficient strength and durability and sufficient resistance to the corrosive effects of the atmosphere to which they will be exposed, and to properly and safely support the ductwork. Hangers shall not be used in direct contact with a dissimilar metal that would cause galvanic action in the hanger, duct, fastenings or structure.
4. Support vertical ducts securely at each floor level by continuous lengths of structural angles of a size at least equivalent to that for stiffening. The angles shall be fastened to the opposite sides of the duct and shall extend across the opening and bear upon the structure or slab on both sides of the opening.
5. Provide sections of ducts containing filters, coils or fans with metal framing and hangers of adequate strength to support such equipment.
6. Support substantially and securely fasten all ducts and all parts of the duct system to the structural members of the building, with approved devices of noncombustible material designed to carry the required loads. The use of expansion bolts in cinder concrete is prohibited. Connections shall not impair the effectiveness of the fire protection of structural members.
7. Contractor shall not support ducts from suspended ceilings,
8. Priming
 - a. Prime coat exposed steel hangers and supports.

B. Install per latest SMACNA HVAC Duct Construction Standards: Chapter 4 - Hangers & Supports

DUCTWORK SUPPORTS AND SLEEVES

3.03 SLEEVES AND SEALS

- A. Install sleeves and seal annular space between sleeve and bare duct or insulated duct as specified herein and as shown in the details on the Drawings.
- B. Above Grade Masonry Floors
 - 1. Duct Penetrations
 - a. Provide structural support at floor opening as required.
 - b. Provide No. 14 gauge galvanized sheet metal sleeves.
 - c. Insulated
 - 1) Provide continuous insulation through floor.
 - d. Fire-Rated
 - 1) Install UL listed damper in accordance with its manufacture's instructions.
- C. Above Grade Masonry Walls
 - 1. Duct Penetrations
 - a. Provide steel lintel to support masonry above opening.
 - b. Provide No. 14 gauge galvanized sheet metal sleeves.
 - c. Insulated
 - 1) Provide continuous insulation through wall.
 - d. Fire-Rated
 - 1) Install UL listed damper in accordance with its manufacture's instructions.
- D. Gypsum Board, Plaster or Wood Partitions
 - 1. Duct Penetrations
 - a. Provide No. 25 gauge galvanized steel stud header and support.

DUCTWORK SUPPORTS AND SLEEVES

- b. Provide No. 20 gauge galvanized sheet metal sleeves.
- c. Insulated
 - 1) 1) Provide continuous insulation through wall.
- d. Fire-Rated
 - 1) Install UL listed damper in accordance with its manufacture's instructions.
- E. Refer to Architectural Drawings for location and rating of fire-rated walls and floors.
- F. Floor Sleeves
 - 1. Dry Floors
 - a. Extend sleeve 1/2 inch above floor.
 - 2. Mechanical Equipment Rooms, Toilet Rooms, Kitchens, Laboratories, Etc.
 - a. Extend sleeve one inch above floor.

3.04 CONCRETE EXPANSION ANCHORS

- A. Install anchors in accordance with manufacturer's printed instructions.
 - 1. Use carbide masonry bits of appropriate nominal diameter.
- B. When concrete expansion anchors are used to support loads in tension (pipe hangers suspended from concrete slabs), install a minimum of two anchors per hanger and reduce hanger spacing to 1/2 the specified distance.

3.05 VIBRATION ISOLATION HANGERS AND SUPPORTS

- A. Install in accordance with manufacturer's printed instructions.

DUCTWORK SUPPORTS AND SLEEVES

VIBRATION ISOLATION DUCT HANGER SCHEDULE	
SERVICE	SUSPENDED SUPPLY DUCTS FOR A DISTANCE OF 50 FEET FROM EQUIPMENT CONNECTION
STATIC DEFLECTION	0.75 IN. MIN.
HANGER SPECIFICATION	STEEL SPRING IN NEOPRENE CUP WITH STEEL WASHER MOUNTED IN STEEL HANGER BOX. SPRING DIA. & HANGER BOX LOWER HOLE LARGE ENOUGH TO PERMIT HANGER ROD TO SWING THROUGH 30° ARC. SPRING TO HAVE MIN. ADDITIONAL TRAVEL TO SOLID EQUAL TO 50% OF RATED DEFLECTION PROVIDE EYE BOLT ON SPRING END & PROVISIONS FOR ATTAINING HOUSING TO FLAT IRON DUCT STRAPS
MANUFACTURER & MODEL NO.	MASON INDUSTRIES, TYPE W30
ALTERNATE MANUFACTURERS	KINETIC, VIBRATION ELIMINATOR
REMARKS	PROVIDE SHOP DRAWINGS INCLUDING SCALE DRAWINGS SHOWING 30° CAPABILITY

230530-5

Ductwork Supports and Sleeves

PHOTO LAB – DARKROOM RENOVATION

PURCHASE COLLEGE SUNY | 735 ANDERSON HILL RD. | VISUAL ARTS BUILDING | LA PLLC Project 2306

DUCTWORK SUPPORTS AND SLEEVES

VIBRATION ISOLATION DUCT HANGER SCHEDULE	
SERVICE	FLOOR SUPPORTED SUPPLY DUCTS FOR A DISTANCE OF 50 FEET FROM EQUIPMENT CONNECTION
STATIC DEFLECTION	0.75 IN. MIN.
HANGER SPECIFICATION	FREESTANDING & Laterally Stable Springs with 1/4 inch Neoprene pad between baseplate & support. Leveling bolts to be bolted to equipment. Spring dia. not less than 0.8 of compressed hgt. of spring at rated load. Spring to have min. additional travel to solid equal to 50% of rated deflection housing with vertical limit stops. Limit stops out of contact during normal operation
MANUFACTURER & MODEL NO.	MASON INDUSTRIES, TYPE SLR
ALTERNATE MANUFACTURERS	KINETIC, VIBRATION ELIMINATOR
REMARKS	PROVIDE SHOP DRAWINGS INCLUDING SPRING DIA. DEFLECTION, COMPRESSED SPRING HGT. & SOLID SPRING HGT. PROVIDE HOT DIPPED GALVANIZED MOUNTING FOR OUTDOOR USE

END OF SECTION

VIBRATION ISOLATION

230547 VIBRATION ISOLATION

PART 1 - GENERAL

1.01 WORK INCLUDED

- A. Vibration isolator (VI)

1.02 SUBMITTALS

- A. Refer to Section 230100 for submittal procedures.
- B. Provide product specific manufacturer cut sheets with all proposed sizes and options indicated.

2.02 QUALITY ASSURANCE

- A. Personnel performing work shall have experience on at least two projects involving complexities similar to those required under this Contract.

PART 2 - PRODUCTS

- 2.01 Provide equipment of the type and size specified herein and listed in the Schedules.

2.02 MANUFACTURERS

- A. Isolation Technology, Inc: www.isolationtech.com.
- B. Kinetics Noise Control, Inc: www.kineticsnoise.com.
- C. Mason Industries: www.mason-ind.com.

2.03 PERFORMANCE REQUIREMENTS

- A. General:
 - 1. All vibration isolators and base frames to conform to all uniform deflection and stability requirements under all operating loads.
 - 2. Steel springs to function without undue stress or overloading.

2.04 VIBRATION ISOLATORS

230547-1

Vibration Isolation

VIBRATION ISOLATION

- A. (Type A) Elastomeric Hangers:
 - 1. Housing: Steel construction containing elastomeric isolation element to prevent rod contact with housing and short-circuiting of isolating function.
 - 2. Incorporate steel load distribution plate sandwiching elastomeric element to housing.
- B. (Type B) Restrained Open Spring Isolators:
 - 1. Springs: Minimum horizontal stiffness equal to 75 percent vertical stiffness, with working deflection between 0.3 and 0.6 of maximum deflection. Color code springs for load carrying capacity.
 - 2. Spring Mounts: Provide with leveling devices, minimum 0.25 inch thick neoprene sound pads, and zinc chromate plated hardware.
 - 3. Sound Pads: Size for minimum deflection of 0.05 inch; meet requirements for neoprene pad isolators.
 - 4. Restraint: Provide heavy mounting frame and limit stops.
- C. (Type C) Spring Hangers:
 - 1. Springs: Minimum horizontal stiffness equal to 75 percent vertical stiffness, with working deflection between 0.3 and 0.6 of maximum deflection. Color code springs for load carrying capacity.
 - 2. Housings: Incorporate neoprene isolation pad meeting requirements for neoprene pad isolators.
 - 3. Misalignment: Capable of 20 degree hanger rod misalignment.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Prior to making piping connections to equipment with operating weights substantially different from installed weights, block up equipment with temporary shims to final height. When full load is applied, adjust isolators to load to allow shim removal.
- C. Support piping connections to equipment mounted on isolators using isolators or resilient hangers as follows:
 - 1. Up to 4 Inches Pipe Size: First three points of support.
 - 2. 5 to 8 Inches Pipe Size: First four points of support.
 - 3. Select three hangers closest to vibration source for minimum 1.0 inch static deflection or static deflection of isolated equipment. Select remaining

230547-2

Vibration Isolation

VIBRATION ISOLATION

isolators for minimum 1.0 inch static deflection or 1/2 static deflection of isolated equipment.

- D. Support ductwork connected to equipment mounted on isolators as follows:
 - 1. Up to 12 inch duct size: First three points of support.
 - 2. Larger than 12 inch duct size: First four points of support.
- E. Provide rubber-in-shear isolators with proper housing and adequate bolting.
- F. Equip spring isolators with sound deadening pads and leveling bolts.
- G. Provide weatherproof construction for isolators exposed to outside air conditions.
- H. Install equipment in accordance with Specifications and manufacturer's written instructions.
- I. Provide inspection services by equipment manufacturer's representative and provide written report that installation is in accordance with manufacturer's instructions.

3.02 SCHEDULE

- A. Pipe Isolation Schedule.
 - 1. 1 Inch Pipe Size: Isolate 120 diameters from equipment. Type C.
 - 2. 2 Inch Pipe Size: Isolate 90 diameters from equipment. Type C.
 - 3. 3 Inch Pipe Size: Isolate 80 diameters from equipment. Type C.
 - 4. 4 Inch Pipe Size: Isolate 75 diameters from equipment. Type B.
 - 5. 6 Inch Pipe Size: Isolate 60 diameters from equipment. Type B.
- B. Equipment Isolation Schedule.
 - 1. AHU Fans. Type B.
 - 2. In-Line Fans 1 HP and greater. Type B.
 - 3. In-Line Fans less than 1 HP. Type A.
 - 4. Utility Set Fans. Type B.
 - 5. Roof Up-Blast Fans. Type B.

END OF SECTION

TESTING AND ADJUSTING

230593 TESTING AND ADJUSTING

PART 1. GENERAL

1.01 SUMMARY

- A. This Section specifies requirements for testing, adjusting and balancing of all air and hydronic fluid distribution systems, including the equipment and devices associated with each system.
- B. The Work includes setting speed and flow, adjusting equipment and devices installed for systems, recording data, conducting tests, preparing and submitting reports, and recommending modifications to the mechanical installations specified in other Sections of the Specifications.
- C. The following related work is specified in other Sections of the Specifications, and is not part of the Work of this Section:
 - 1. Installation and start-up of equipment and devices to be tested, adjusted, and balanced.
 - 2. Pressure testing of piping and ductwork systems.
 - 3. Specifications for materials and installation of adjusting and balancing devices. If devices must be added to achieve proper balancing, refer to the respective system sections for materials and installation requirements.
 - 4. Piping and ductwork system leakage tests.
 - 5. Electrical hook-up and wiring of equipment and devices to be tested, adjusted, and balanced.

1.02 PERFORMANCE REQUIREMENTS

- A. Procedures, measurements, instruments and test reports for testing, adjusting and balancing work shall comply with all applicable Federal, State and Local laws, ordinances, regulations and codes, and the latest industry standards including, but not limited to the entities listed below.

American Society of Heating, Refrigerating and Air- Conditioning Engineers (ASHRAE)

Sheet Metal and Air Conditioning Contractors National Association (SMACNA)

National Environmental Balancing Bureau (NEBB)

Associated Air Balance Council (AABC)

In addition, specific provisions cited herein shall govern for the associated specific application.

TESTING AND ADJUSTING

- B. The air delivery or intake of each diffuser, grille and register shall be as designed or within five percent of the air flow rates shown on the Contract Drawings.
- C. The fan air flow rate and static pressure rise across the fan shall be within 10 percent above the design value at design speed.

1.03 JOB CONDITIONS

- A. The Contractor shall have the testing and balancing specialist review his work with the respective manufacturers of the equipment and devices involved, and shall coordinate and schedule all Work.
- B. Adjustment or replacement of parts recommended by the testing and balancing specialist shall be made in strict accordance with the respective equipment manufacturer's recommendations.
- C. The Contractor shall have the control manufacturer's representative set the adjustment of the automatically operated dampers and control valves to operate as required.

1.04 QUALITY ASSURANCE

- A. Entities performing the work of this Section shall have had experience similar to that required for this Project for not less than three years.
- B. Entities performing the Work of this Section shall be certified by NEBB or AABC and shall have experience on at least two projects involving complexities similar to those required under this Contract.

1.05 SUBMITTALS

- A. The contractor shall submit the following submittals.
 - 1. Balancing credentials and qualifications.
 - 2. Sample Balancing Report.
 - 3. Pre Balance Report on Existing Hot Water Pumps.
 - 4. Pre Air Balance Report on all Existing associated Air Handling Unit (AHU/1).
 - 5. Post Construction Balance Report Existing Hot Water Pumps.
 - 6. Post Construction Balance Report Existing associated Air Handling Unit (AHU/1).
 - 7. Post construction water side balancing report for all heating hot water valves added in this project.
 - 8. Air side balancing report on all terminals and terminal units within scope of work associated with AHU/1.

TESTING AND ADJUSTING

PART 2. PRODUCTS

2.01 PATCHING MATERIALS

Unless otherwise shown on the Contract Drawings, use same products as originally installed for patching holes in insulation, ductwork and housings which have been cut or drilled for test purposes, including access for test instruments, attaching jigs, and similar purposes.

PART 3. EXECUTION

3.01 EXAMINATION

- A. Obtain design drawings and specifications (or as-built drawings and specifications, if such exist), and become thoroughly acquainted with design intent.
- B. Obtain copies of approved shop drawings of all air handling and hydronic equipment, air outlets (supply, return and exhaust), manual valves, automatic valves and the temperature control diagrams, including intended sequence of operation.
- C. Examine installed work and conditions under which testing is to be done to ensure that work has been completed, cleaned, and is operable. Do not proceed with testing, adjusting and balancing until unsatisfactory conditions have been corrected in a manner approved by the testing and balancing specialist.
- D. Examine the air systems to see that they are free from obstructions. Determine that all dampers and registers are open, moving equipment is lubricated, clean filters are installed, and automatic controls are functioning; and perform other inspection and maintenance activities necessary for proper operation of the systems.
- E. Examine the hydronic systems to see that they are free from abnormal obstructions, and that all piping, valves and equipment have been properly made fully operational. Determine that all equipment and control systems are performing correctly by functional testing.

3.02 TESTING, BALANCING, AND ADJUSTING

- A. Cut insulation, ductwork and piping for installation of test probes to the minimum extent necessary to allow adequate performance of test procedure.
- B. Testing and balancing specialist shall perform tests and compile test data for all air systems and hydronic systems.
- C. Data shall include a schematic diagram locating the air inlets, outlets, fans, equipment, dampers and regulating devices for air systems, and a schematic diagram for location of balancing valves, flow indicators, equipment, and devices for hydronic systems.

230593-3

Testing and Adjusting

TESTING AND ADJUSTING

D. All instruments used shall be provided by the entity performing the work of this section, and shall be accurately calibrated and maintained in good working order.

E. Air Systems

The testing, adjusting and balancing of air systems shall be in accordance with the detailed procedures outlined in the referenced standards; and shall include but not be limited to the following:

1. Test, record and adjust fan rpm to design requirements.
2. Test and record motor full load amperes.
3. Make pitot tube traverse of main supply ducts and obtain design flow rate at fans.
4. Test and record system static pressure, velocity pressure and total pressure.
5. Test and adjust system for design supply, transfer and return air flow rate.
6. Test and adjust system for minimum and maximum design flow rates of outside air.
7. Test and record return air temperatures.
8. Test and record entering mixed air temperatures.
9. Test and record coil and fan leaving air temperatures.
10. Adjust all main supply, return, relief, and exhaust air ducts to proper design flow rate.
11. Adjust all zones to proper design flow rate for supply, return, transfer, relief and exhaust air.
12. Test and adjust each diffuser, grille and register.
13. Each grille, diffuser and register shall be identified as to location and area on the schematic diagram.
14. Size, type and manufacturer of diffusers, grilles and registers and all tested equipment shall be identified and listed in the final report. Manufacturer's data on all equipment shall be used to make required calculations for testing, adjusting and balancing. Readings and tests of diffusers, grilles and registers shall include design required velocity and test resultant velocity, required flow rate and test resultant flow rate after adjustments.
15. All diffusers, grilles and registers shall be adjusted to minimize drafts in all areas.
16. Dampers shall be permanently marked after air balance is complete so that they can be restored to their correct position, if disturbed later.
17. Openings in ductwork for pitot tube insertion shall be sealed with snap-in plugs after air balance is complete.

TESTING AND ADJUSTING

F. Hydronic Systems

The testing, adjusting and balancing of hydronic systems (chilled water, hot water, and hot glycol) shall be in accordance with the detailed procedures outlined in the referenced standards; and shall include but not be limited to the following:

1. Preliminary procedure prior to balancing:
 - a. Examine water in systems and determine if water has been treated and cleaned.
 - b. Check expansion tank to determine that it is not air bound and the system is completely full of water.
 - c. Purge all air vents at high points of water systems, check automatic air vents and determine if they are operating properly.
 - d. Coordinate with control manufacturer for required cooling and heating temperature controls and corresponding, automatic valve operation settings.
 - e. Open all normally open valves to full open position. Set automatic valves to full coil flow.
 - f. Complete air balance shall have been accomplished before final water balance begins.
 - g. Check water pumps for pump rotation and for proper flow rate delivery against manufacturer's pump curves.
 - h. Set all balancing valves for required flow delivery at mains and branch mains to cooling and heating elements.
 - i. Upon completion of flow readings and adjustments of balancing valves, mark all settings and record data, so that they can be restored to their correct "balanced" position, if disturbed later.
2. Final balancing shall include the following:
 - a. After required cooling and heating temperature controls and automatic valve operation settings are made, recheck pump flow requirements and readjust system as required.
 - b. Record pressure drop through coil at set flow rate of coil for full cooling and on full heating. Set pressure drop across bypass valve to match coil pressure drop.
 - c. Record and check the following items at each cooling and heating element:
 - (1) Inlet water temperatures and static pressure at connections.
 - (2) Leaving water temperatures and the pressure drop of each coil.
 - (3) Flow rate through coil with control valve stroked manually wide open.

TESTING AND ADJUSTING

- d. Record operating suction and discharge pressures of each pump and final total dynamic head and rated amperage versus actual amperage of pump motors.
 - e. Record entering and leaving water temperatures and flow through all equipment and devices.
 - f. Check and record all flow rates at all locations in the piping system with flow meters.
- G. Upon completion of air and hydronic systems testing, patch insulation, ductwork and housings, using materials identical to those removed (refer to Section 2.01).
- H. Final testing, adjusting and balancing shall be performed during summer season for air conditioning systems and during winter season for heating systems, including operation when outside conditions are within 5 degrees F wet bulb temperature of maximum summer design condition, and within 10 degrees F dry bulb temperature of minimum winter design condition.
- I. Retest, adjust, and balance systems subsequent to system modifications. Resubmit test results.

END OF SECTION

INSULATION

230700 INSULATION

PART 1 - GENERAL

1.01 WORK INCLUDED

- A. Duct and plenum insulation
- B. Insulated pipe protection
- C. Pipe fitting reusable insulation cover
- D. Pipe insulation
- E. Tie wires, adhesives, tapes and associated accessories

1.02 QUALITY ASSURANCE

- A. Qualifications of Installers
 - 1. Insulation subcontractor shall be regularly employed in this work.
 - 2. Installation shall be performed by workmen skilled in insulation work.
- B. Codes and Standards
 - 1. Insulation shall have composite (insulation, jacket and adhesive) Fire and Smoke Hazard Ratings as tested under procedure ASTM E84, NFPA 255 and UL 723, not exceeding:
 - a. Flame Spread - 25
 - b. Smoke Developed - 50
 - c. Insulation must conform to USDA requirements; Non-toxic.
 - d. Calcium Silicate: Flame spread – 0, smoke developed – 0.
 - 2. Accessories such as PVC jacketing, adhesives, mastics, cement and cloth for fittings shall have the same component ratings listed above.
 - 3. Paper laminate jackets shall be permanently fire and smoke resistant.
 - 4. Chemicals used for treating paper in jacket laminates shall be unaffected by water and humidity.
- C. Mechanical fasteners for duct insulation shall conform to SMACNA Mechanical Fastener Standard MF-1-1975.

1.03 SUBMITTALS

- A. Refer to Section 230100 for submittal procedures.
- B. Provide product description, thermal characteristics, list of materials and thickness for

230700-1

Insulation

INSULATION

each service, and locations.

- C. Provide product specific manufacturer cut sheets with all proposed sizes and options indicated.

PART 2 - PRODUCTS

- 2.01** Provide material of the type and thickness specified herein and listed in the Schedules.

PART 3 - EXECUTION

3.01 GENERAL

- A. Repair or replace all existing insulation altered, damaged or removed during the work of this Division.
- B. Insulate all piping and equipment not mentioned in this Division that is subject to sweating.
- C. Apply insulation after all leak and pressure tests of piping and equipment have been witnessed and accepted by the Owner.
- D. Continue pipe and duct insulation through wall, floor and ceiling openings and sleeves.
- E. Apply insulation on all cold surfaces with a continuous unbroken vapor seal.

3.03 DUCT AND PLENUM INSULATION

- A. Rigid Indoor and Outdoor
 - 1. Impaling Overpins - Concealed
 - a. Apply all insulation with edges tightly butted. Impale insulation over mechanical fasteners. The protruding ends of the pins shall be cutoff flush after the speed clips have been applied and sealed with Tape Patch.
 - b. Space pins as required to hold insulation firmly against duct surface, approximately one pin per square foot. Seal all joints and penetrations of the vapor barrier with three inches wide aluminum foil pressure sensitive tape.
 - 2. Impaling Overpins - Exposed
 - a. Apply all insulation with edges tightly butted. Impale insulation over stick clips or pins welded to the duct, and secure with speed clips. Spacing of

230700-2

Insulation

INSULATION

pins shall be as required to hold insulation firmly in place but not less than one pin per square foot. Seal all joints and penetrations of the vapor barrier with a three inch wide strip of aluminum foil pressure sensitive tape, applied with vapor barrier adhesive to both surfaces as recommended by adhesive manufacturers.

3. Optional Methods

- a. If, through space of size restriction, or other causes, the welded pin method is impossible, secure the insulation to the duct with adhesive that meets NFPA 90 AFHC 25/50. The adhesive shall cover the entire surface of the sheet metal when applied to underside of horizontal duct but may be applied in strips or spots for application to top and sides with a minimum of 50% coverage.

B. Flexible Indoor

1. Vapor Barrier Type

- a. Apply faced duct insulation over clean, dry sheet metal surfaces that have been sealed airtight. Cut insulation slightly longer to allow maximum thickness on all areas (avoid excessive compression).
- b. Overlap all joints two inches and staple in place. Seal the stapled seams with a minimum three inches wide pressure sensitive tape designed for use with the duct insulation. Seal all breaks in the vapor barrier facing with the tape.
- c. The underside of ductwork 24 inches or greater in width shall have the insulation additionally secured with mechanical fasteners and speed clips spaced approximately 18 inches on center.
- d. The protruding ends of the fasteners shall be cutoff flush after the speed clips are installed, and then sealed with the three inch wide aluminum foil pressure sensitive tape.

3.07 PIPE INSULATION

- A. Install hangers and supports outside insulation.
- B. Insulate anchors and saddles secured directly to pipe.
- C. Protect insulation at all points of support as with rigid calcium silicate inserts.
- D. Install insulation with longitudinal joints on least conspicuous side of pipe.

230700-3

Insulation

INSULATION

- E. Insulate valves up to the packing nuts.
- F. Finish off freestanding edges of insulation with insulating cement bevel.
- G. Install insulation on piping specialties so that it is readily removed for service and maintenance.

230700-4

Insulation

INSULATION

EXPOSED DUCT/PLENUM INSULATION SCHEDULE	
SERVICE	EXPOSED RECTANGULAR DUCTS
THICKNESS, IN.	2
INSULATION -TYPE & MATERIAL	UNPAINTED PREFORMED FIBERGLASS BOARD BONDED TO LAMINATED KRAFT ALUMINUM FOIL VAPOR BARRIER
-FACING	ALUMINUM FOIL
-DENSITY, LBS./CU.FT.	3.0
-OPER. TEMP. RANGE, °F	450 MAX.
-THERMAL CONDUCT., K	0.22 @ 75°F.
-R-VALUE	9.1
-FLAME SPREAD/SMOKE DEV.	25/50
MANUFACTURER & MODEL NO.	JOHNS-MANVILLE
	817 FSK SPIN-GLAS
ALTERNATIVE MANUFACTURES	OWENS-CORNING, CERTAINTEED, KNAUF
REMARKS	PROVIDE SHOP DRAWINGS INSULATION SHALL COMPLY WITH ASTM 612 AND ASTM E84

230700-5

Insulation

PHOTO LAB – DARKROOM RENOVATION

PURCHASE COLLEGE SUNY | 735 ANDERSON HILL RD. | VISUAL ARTS BUILDING | LA PLLC Project 2306

INSULATION

CONCEALED DUCT/PLENUM INSULATION SCHEDULE	
SERVICE	CONCEALED RECTANGULAR AND ROUND DUCTS
THICKNESS, IN.	2
INSULATION -TYPE & MATERIAL	FLEXIBLE GLASS FIBER BLANKET WITH LAMINATED KRAFT ALUMINUM FOIL VAPOR BARRIER
-DENSITY, LBS./CU.FT.	1.5
-OPER. TEMP. RANGE, °F	350 MAX.
-THERMAL CONDUCT., K	0.24 @ 75°F
-R-VALUE	8.3
-FLAME SPREAD/SMOKE DEV.	25/50
-ASTM COMPLIANCE	ASTM C411, C1104, C665, C1338, E84, C1290 & C553
MANUFACTURER & MODEL NO.	JOHNS-MANVILLE, TYPE 150 MICROLITE DUCT WRAP
ALTERNATIVE MANUFACTURES	OWENS-CORNING, CERTAINTEED, KNAUF
REMARKS	PROVIDE SHOP DRAWINGS

230700-6

Insulation

PHOTO LAB – DARKROOM RENOVATION

PURCHASE COLLEGE SUNY | 735 ANDERSON HILL RD. | VISUAL ARTS BUILDING | LA PLLC Project 2306

INSULATION

EXPOSED ROUND DUCT INSULATION SCHEDULE	
SERVICE	EXPOSED ROUND DUCTS
THICKNESS, IN.	2
INSULATION -TYPE & MATERIAL	UNPAINTED FIBERGLASS DUCT WRAP WITH ALUMINUM FOIL VAPOR BARRIER
-FACING	ALUMINUM FOIL OR AP FACING
-DENSITY, LBS./CU.FT.	2.5
-OPER. TEMP. RANGE, °F.	250 MAX.
-THERMAL CONDUCT., K	0.24 @ 75°F.
-R-VALUE	8.0
-FLAME SPREAD/SMOKE DEV.	25/50
MANUFACTURER & MODEL NO.	JOHNS-MANVILLE FSK MICRO-FLEX
ALTERNATE MANUFACTURERS	OWENS-CORNING, CERTAINTEED, KNAUF
REMARKS	PROVIDE SHOP DRAWINGS COAT STAPLING WITH VAPOR BARRIER MASTIC. COMPLY WITH ASTM C411, ASTM C303, ASTM C165, ASTM C1136, ASTM E 84, ASTM E96

230700-7

Insulation

PHOTO LAB – DARKROOM RENOVATION

PURCHASE COLLEGE SUNY | 735 ANDERSON HILL RD. | VISUAL ARTS BUILDING | LA PLLC Project 2306

INSULATION

INSULATED PIPE PROTECTION SCHEDULE					
PIPE SIZE, INC.	1/2 TO 1	1-1/2 TO 2-1/2	3 TO 6	8 TO 10	12 & OVER
WITH VAPOR BARRIER:					
-INSULATION INSERT					
-MATERIAL	NONE	RIGID CALCIUM SILICATE			
-THICKNESS	NONE	EQUAL TO INSULATION THICKNESS			
-LENGTH, IN.	NONE	10	12	16	22
-PIPE SHIELD					
-MATERIAL	GALV. STEEL				
-THICKNESS, US GAUGE	18	18	16	14	12
-LENGTH, IN.	12	6	8	12	18
WITHOUT VAPOR BARRIER					
-PIPE SHIELD		N/A			
-MATERIAL	GALV. STEEL	N/A			
-THICKNESS, US GAUGE	18	N/A			
-LENGTH, IN.	12	N/A			
-PIPE SADDLE	N/A				
-MATERIAL	-	STEEL			
-LENGTH, IN.	-	12			
REMARKS	PROVIDE SHOP DRAWINGS				
	FORM PIPE SHIELD TO FIT INSULATION AND EXTEND UP TO CENTERLINE OF PIPE				
	PIPE SADDLE SHALL CONFORM TO MSS SP-69, TYPE 39				

230700-8

Insulation

PHOTO LAB – DARKROOM RENOVATION

PURCHASE COLLEGE SUNY | 735 ANDERSON HILL RD. | VISUAL ARTS BUILDING | LA PLLC Project 2306

INSULATION

PIPE FITTING REUSABLE INSULATION COVER SCHEDULE	
SERVICE	MANUAL AND AUTOMATIC VALVES AND STRAINERS
DESCRIPTION -INSULATION MATERIAL -THERMAL CONDUCTIVITY, K -THICKNESS, IN. -JACKET MATERIAL -INSTALLATION	FIBERGLASS 0.29 @ 75°F MEAN TEMPERATURE 2 WOVEN GLASS SUBSTRATE COATED WITH TEFLON HELD IN PLACE WITH DRAWSTRINGS AND VELCRO STRAPS
MAX. OPERATING TEMP., °F	500
MANUFACTURER & MODEL NO.	INSULATION TECHNOLOGY, HEAT HOLDER WITH 500T JACKET
ALTERNATE MANUFACTURERS	THORPE CORPORATION INSUL FLEX
REMARKS	<p>PROVIDE SHOP DRAWINGS</p> <p>JACKET MATERIAL MUST PASS UL214 FLAMMABILITY TEST</p> <p>HEATING WATER: PROVIDE SUPPLEMENTARY PIPE INSULATION AS SPECIFIED WITHIN, THEN OVERSIZE JACKET TO COVER ALL. FINAL COMBINED THICKNESS TO EXCEED THICKNESS IN PIPE INSULATION SCHEDULE BY 1/2".</p>

230700-9

Insulation

PHOTO LAB – DARKROOM RENOVATION

PURCHASE COLLEGE SUNY | 735 ANDERSON HILL RD. | VISUAL ARTS BUILDING | LA PLLC Project 2306

INSULATION

PIPE INSULATION SCHEDULE			
TYPE	FIBERGLASS		
PIPE SIZE, IN.	UNDER 1"	1 TO 1-1/4	1-1/2 AND GREATER
	INSULATION THICKNESS, IN.		
FLUID TEMP (°F) AND SERVICE			
105 TO 140, HHW, HHG	1		1.5
40 TO 60, CHW	1	1	1
INSULATION -TYPE & MATERIAL -FACING -OPER. TEMP. RANGE, °F -THERMAL CONDUCT., K -FLAME SPREAD/ SMOKE DEV -MANUF. & MODEL -ALTERNATIVE MANUFACTURES	HEAVY DENSITY FIBERGLASS PIPE INSULATION WITH SELF-SEALING LAP WHITE KRAFT PAPER 0 TO 850 .24 @ 75°F. MEAN TEMP. 25/50 JOHNS-MANVILLE MICRO-LOK HP OWENS-CORNING, KNAUF		
FITTINGS -ELBOWS, TEES, FLANGES, ETC. -VALVES & STRAINER	CUT & MITERED PIPE INSULATION OR MOLDED REMOVABLE & REUSABLE INSULATION COVER		
REMARKS	PROVIDE SHOP DRAWINGS FLUIDS UNDER 65°F SHALL HAVE LAMINATED ALUMINUM FOIL VAPOR BARRIER FOR PIPE SIZES TO 6 IN. USE PREFORMED PIPE INSULATION FOR PIPE SIZES GREATER THAN 6 IN. USE SHEET INSULATION COMPLY WITH ASTM C411, ASTM C303, ATM C165, ASTM C1136, ASTM E 84, ASTM E96		

230700-10

Insulation

PHOTO LAB – DARKROOM RENOVATION

PURCHASE COLLEGE SUNY | 735 ANDERSON HILL RD. | VISUAL ARTS BUILDING | LA PLLC Project 2306

INSULATION

INSULATION JACKET SCHEDULE	
TYPE	HEATING HOT WATER
PIPE	ALL SERVICE
FITTINGS	PREMOLDED 20 MILWHITE PVC
MANUFACTURER & MODEL NO. -PVC JACKET & FITTING COVER -ALUMINUM JACKET & FITTING COVER	CEELCO, JOHNS-MANVILLE, CERTAINTEED, OR APPROVED EQUAL MSC, GLT, AMERISAFE, OR APPROVED EQUAL
REMARKS	REFER TO INSULATION SCHEDULE FOR INSULATION JACKET REQUIREMENTS

END OF SECTION

230700-11

Insulation

PHOTO LAB – DARKROOM RENOVATION

PURCHASE COLLEGE SUNY | 735 ANDERSON HILL RD. | VISUAL ARTS BUILDING | LA PLLC Project 2306

HVAC COMMISSIONING

230800 HVAC COMMISSIONING

PART 1 - GENERAL

1.01 SUMMARY

- A. This Section includes the systems to be commissioned installed by the Contractor.
- B. Refer to Section 240100 for the contractor's responsibilities in the commissioning process.

1.02 SYSTEMS TO BE COMMISSIONED

- A. The following Mechanical systems will be commissioned in this project.
 - 1. Exhaust Air Valves
 - 2. VAV Terminals
 - 3. Cabinet unit heaters
 - 4. Thermostats
 - 5. CO2 Sensors
 - 6. Occupancy Sensors

END OF SECTION

AUTOMATIC TEMPERATURE CONTROL SYSTEM

230901 AUTOMATIC TEMPERATURE CONTROL SYSTEM

PART 1 - GENERAL

1.01 SUMMARY

- A. This Section specifies the requirements for the direct digital automatic temperature control system, hereinafter referred to as the Building Management System (BMS). Specific sequences of operation for each heating, ventilation, and air conditioning (HVAC) unit are indicated on the Contract Drawings.
- B. New system to tie into Desigo CC installed under a separate project. New devices to connect to virtual server through campus IT.
- C. Control valves for heating hot water.
- D. Remove equipment demolished as part of this contract from existing front end.

1.02 REFERENCES

(Not used)

1.03 DESIGN AND PERFORMANCE REQUIREMENTS

- A. Design and performance of the BMS specified herein shall comply with the applicable provisions of the codes, standards and recommendations of the entities listed below.
 - 1. Underwriter Laboratories (UL).
 - 2. National Electrical Manufacturers Association (NEMA).
 - 3. In addition, specific provisions cited herein shall govern for the associated specific application.
- B. The Contractor shall provide all of the required hardware and software necessary to provide the controls functionally described in this Specification Section and the Sequence of Operations indicated on the Contract Drawings.
- C. General Product Description
 - 1. The Building Management System (BMS) shall integrate multiple building functions including equipment supervision and control, alarm management, energy management and historical data collection.

230901-1

Automatic Temperature Control System

AUTOMATIC TEMPERATURE CONTROL SYSTEM

2. The BMS shall consist of the following
 - a. Stand-alone DDC Controllers.
 - b. Stand-alone Application Specific Controllers (ASCs).
 3. The system shall be modular in nature and shall permit expansion of both capacity and functionality through the addition of sensors, actuators, DDC Controllers, Application Specific Controllers and operator devices.
 4. System architectural design shall eliminate dependence upon any single device for alarm reporting and control execution. Each DDC controller shall operate independently by performing its own specified control, alarm management, operator I/O and data collection. The failure of any single component or network connection shall not interrupt the execution of control strategies at other operational devices.
 5. DDC controllers shall be able to access any data from, or send control commands and alarm reports directly to, any other DDC controller or combination of controllers on the network without dependence upon a central processing device. DDC controllers shall also be able to send alarm reports to multiple operator workstations without dependence upon a central processing device.
 6. The BMS shall utilize an existing central front-end virtual computer and IT connection provided by the campus.
 7. Documentation on a CD shall be provided with BMS.
- D. Related Work
1. Sequence of Operation
 2. Basic Mechanical Requirements
 3. Testing, Adjusting and Balancing
 4. Basic Elec. Materials Methods
 5. Equipment Wiring
 6. Adjustable frequency drives
 7. Commissioning

1.04 QUALITY ASSURANCE

- A. Similar BMS systems designed, manufactured, and installed by the BMS manufacturer shall have been satisfactorily used on at least five projects involving complexities similar to those required under this Contract and shall have been in

230901-2

Automatic Temperature Control System

AUTOMATIC TEMPERATURE CONTROL SYSTEM

use for a minimum of two years.

- B. The BMS shall be installed by competent installers regularly employed by the system's manufacturer.

1.05 SUBMITTALS

- A. Refer to Section 230100 for submittal procedures.
- B. Provide description and engineering data for each control system component. Include sizing as requested. Provide data for each system component and software module.
- C. Indicate complete operating data, system drawings, wiring diagrams, and written detailed operational description of sequences. Submit schedule of valves indicating size, flow, and pressure drop for each valve. For automatic dampers indicate arrangement, velocities, and static pressure drops for each system.
- D. Record actual locations of control components, including panels, thermostats, and sensors. Accurately record actual location of control components, including panels, thermostats, and sensors.
 - 1. Revise shop drawings to reflect actual installation and operating sequences.

1.06 TRAINING

- A. Provide technical representatives of the BMS manufacturer to instruct Owner's personnel in the operation and maintenance of the BMS, utilizing approved operation and maintenance of the BMS, utilizing approved operation and maintenance manuals as the basis for instructions.
 - 1. Provide four (4) 8 hour days of training prior to the start-up of the system. All training shall be provided during normal working hours. Location to be directed by the Owner.
 - 2. Provide an additional eight (8) hours of training two (2) months after system is in operation. Additional training will be for troubleshooting and further training.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Subject to the requirements of the specification, the BMS shall be by the following:
 - 1. Siemens Desigo CC with modular building controllers and terminal equipment
230901-3 Automatic Temperature Control System

AUTOMATIC TEMPERATURE CONTROL SYSTEM

controller.

- B. Manufacturer must provide a system that meets all the hardware, software and performance criteria specified herein. Mention of a particular system above does not relieve the BMS Manufacturer from providing a system that meets all specification requirements.
- C. The Contractor shall have the manufacturer of the BMS perform the installation of such equipment.
- D. Control valves shall be Belimo, Siemens or Griswold.

2.02 NETWORKING COMMUNICATIONS

- A. The design of the BMS shall network operator workstations and stand-alone DDC controllers. The network architecture shall consist of two levels, a high performance peer-to-peer network and DDC controller specific local area networks. The high performance peer-to-peer network shall be of the token ring type, or "baton passing method". Central polling is unacceptable. Each HVAC unit shall have a dedicated peer-to-peer DDC controller.
- B. Token Ring Peer-to-Peer Network Level
 - 1. Operator workstations and DDC controllers shall directly reside on a network such that communications may be executed directly between DDC controllers, directly between workstations and between DDC controllers and workstations on a peer-to-peer basis.
 - 2. Systems that operate via polled response or other types of protocols that rely on a central processor, file server master DDC panel, or similar device to manage panel-to-panel communications may be considered only if a similar device is provided as a standby. Upon a failure or malfunction of the primary central processor, the standby shall automatically, without any operator intervention, assume all BMS network management activities.
- C. DDC Controller Local Area Network (LAN)
 - 1. This level communication shall support a family of application specific controllers for terminal units only and shall communicate bi-directionally with the token ring peer-to-peer network through DDC controllers for transmission of global data.
 - 2. A maximum of 32 application specific controllers may be configured on

230901-4

Automatic Temperature Control System

AUTOMATIC TEMPERATURE CONTROL SYSTEM

individual DDC controller LAN's to insure adequate global data and alarm response times.

3. This level of communication is available only for terminal equipment controller.

2.03 DDC CONTROLLER (MBC AND MEC)

- A. DDC controllers shall be UL listed under UL 864 and UL 94-5V for enclosures.
- B. Stand-alone controllers shall be microprocessor-based with a minimum word size of 16 bits. They shall also be multi-tasking, multi-user, real-time digital control processors consisting of modular hardware with plug-in enclosed processors, communication controllers, power supplies and input/output point modules. Controller size shall be sufficient to fully meet the requirements of this specification and the points as shown on the Contract Documents.
- C. Each DDC controller shall have sufficient memory, a minimum of 1 megabyte, to support its own operating system and databases.
- D. Each DDC controller shall support:
 1. Monitoring of the following types of inputs, without the addition of equipment outside the DDC controller cabinet:
 - a. Analog inputs
 - 1) 4-20 ma
 - 2) 0-10 Vdc
 - 3) Thermistors
 - 4) 1000 ohm RTDs
 - b. Digital inputs
 - 1) Dry contact closure
 - 2) Pulse Accumulator
 - 3) Voltage Sensing
 2. Direct control of electronic actuators and control devices. Each DDC controller shall be capable of providing the following control outputs without the addition of equipment outside the DDC controller cabinet:
 - a. Digital outputs (contact closure)

AUTOMATIC TEMPERATURE CONTROL SYSTEM

- 1) Contact closure (motor starters, sizes 1-4)
- b. Analog outputs
 - 1) 0-20 psi
 - 2) 4-20 mA
 - 3) 0-10 Vdc
- E. Each DDC controller shall have a minimum of 10 percent spare capacity for future point connection. The type of spares shall be in the same proportion as the implemented I/O functions of the panel, but in no case shall there be less than two spares of each implemented I/O type. Provide all processors, power supplies and communication controllers complete so that the implementation of a point only requires the addition of the appropriate point input/output termination module and wiring.
 1. Provide sufficient internal memory for the specified control sequences and have at least 25% of the memory available for future use.
- F. DDC controllers shall provide at least two RS-232C serial data communication ports for operation of operator I/O devices such as industry standard printers, operator terminals, modems and portable laptop operator's terminals. DDC controllers shall allow temporary use of portable devices without interrupting the normal operation of permanently connected modems, printers or terminals.
- G. As indicated in the point I/O schedule, the operator shall have the ability to manually override automatic or centrally executed commands at the DDC controller via local, point discrete, on-board hand/off/auto operator override switches for digital control type points and gradual switches for analog control type points. These override switches shall be operable whether the panel processor is operational or not.
- H. Each DDC controller shall continuously perform self-diagnostics, communication diagnosis and diagnosis of all panel components. The DDC controller shall provide both local and remote annunciation of any detected component failures, low battery conditions or repeated failure to establish communication.
- I. In the event of the loss of normal power, there shall be an orderly shutdown of all DDC controllers to prevent the loss of database or operating system software. Non-volatile memory shall be incorporated for all critical controller configuration data and battery backup shall be provided to support the real-time clock and all volatile memory for a minimum of 5 days. Provide additional battery backup power supplies as required. DDC controller power box shall contain transformers rated under UL Class 2 for power conversion within the panel.

AUTOMATIC TEMPERATURE CONTROL SYSTEM

- J. Provide minimally, individual DDC controllers for all HVAC units, hot water systems, condenser water system and chilled water system. It is intended that each uniquely defined system be provided with its own point resident DDC controller.

2.04 DDC CONTROLLER RESIDENT SOFTWARE FEATURES

A. General

1. All necessary software to form a complete operating system as described in this specification shall be provided.
2. The software programs specified in this Section shall be provided as an integral part of DDC controllers and shall not be dependent upon any higher level computer for execution.

B. Control Software Description

1. The DDC controllers shall have the ability to perform the following pre-tested control algorithms:
 - a. Two-position control
 - b. Proportional control
 - c. Proportional plus integral control
 - d. Proportional, integral, plus derivative control
 - e. Automatic tuning of control loops
2. Upon the resumption of normal power, each DDC Controller shall analyze the status of all controlled equipment, compare it with normal occupancy scheduling and turn equipment on or off as necessary to resume normal operations

C. DDC Controllers shall have the ability to perform any or all the following energy management routines:

1. Time-of-day scheduling
2. Calendar-based scheduling
3. Start-Stop Time Optimization
4. Night setback control
5. Enthalpy switchover (economizer)
6. Peak demand limiting
7. Temperature-compensated duty cycling

All programs shall be executed automatically without the need for operator intervention and shall be flexible enough to allow user customization. Programs

230901-7

Automatic Temperature Control System

AUTOMATIC TEMPERATURE CONTROL SYSTEM

shall be applied to building equipment as described in the Sequence of Operations.

- D. DDC Controllers shall be able to execute custom, job-specific specific processes defined by the user, to automatically perform calculations and special control routines.
 - 1. Processes shall be able to generate operator messages and advisories to operator I/O devices. A process shall be able to directly send a message to a specified device or cause the execution of a dial-up connection to a remote device such as a printer or pager.
 - 2. The custom control programming feature shall be documented via English language descriptors.
- E. Alarm management shall be provided to monitor and direct alarm information to operator devices. Each DDC Controller shall perform distributed, independent alarm analysis and filtering to minimize operator interruptions due to non-critical critical alarms, minimize network traffic and prevent alarms from being lost. At no time shall the DDC Controllers ability to report alarms be affected by either operator or activity at a PC workstation, local I/O device or communications with other panels on the network
 - 1. All alarm or point change reports shall include the point's English language description and the time and date of occurrence.
- F. A variety of historical data collection utilities shall be provided to manually or automatically sample, store and display system data for points as specified in the I/O summary.
 - 1. DDC Controllers shall store point history data for selected analog and digital inputs and outputs:
 - a. Any point, physical or calculated, may be designated for trending. Any point, regardless of physical location in the network, may be collected and stored in each DDC controller's point group. Two methods of collection shall be allowed: Either by a pre-defined time interval or upon a pre-defined change of value. Sample intervals of 1 minute to 7 days shall be provided. Each DDC controller shall have a dedicated RAM-based buffer for trend data and shall be capable of storing a minimum of 10,000 data samples.
 - 2. Trend data shall be stored at the DDC controllers and uploaded to the workstation when retrieval is desired. Uploads shall occur based upon either user-defined interval, manual command or when the trend buffers are full. All

AUTOMATIC TEMPERATURE CONTROL SYSTEM

trend data shall be available for use in 3rd party personal computer applications.

- G. DDC Controllers shall automatically accumulate and store run-time hours for digital input and output points as specified in the point I/O summary.
- H. DDC controllers shall automatically sample, calculate and store consumption totals on a daily, weekly or monthly basis for user-selected analog and digital pulse input type points as specified in the point I/O summary.
- I. DDC controllers shall have the ability to count events such as the number of times a pump or fan system is cycled on and off. Event totalization shall be performed on a daily, weekly or monthly basis for points as specified in the point I/O summary.

2.05 APPLICATION SPECIFIC CONTROLLERS (ASC)

- A. Each DDC controller shall be able to extend its performance and capacity through the use of remote application specific controllers (ASC's).
- B. Each ASC shall operate as a stand-alone controller capable of performing its specified control responsibilities independently of other controllers in the network. Each ASC shall be a microprocessor-based, multi-tasking, real-time digital control processor. Provide the following types of ASC's as a minimum:
 - 1. Terminal Equipment Controllers (TEC)
- C. Terminal Equipment Controllers
 - 1. Controllers shall include all point inputs and outputs necessary to perform the specified control sequences. As a minimum, 50% of the point outputs shall be of the Universal type; that is, the outputs may be utilized either as modulating or two-state, allowing for additional system flexibility. In lieu of Universal outputs, provide a minimum of 50% spare outputs of each type via additional point termination boards or controllers. Analog outputs shall be industry standard signals such as 24V floating control, allowing for interface to a variety of modulating actuators. Terminal equipment controllers utilizing proprietary control signals and actuators shall not be acceptable. As an alternative, provide DDC controllers or other ASC's with industry standard outputs for control of all terminal equipment.
 - 2. Each controller performing space temperature control shall be provided with a matching room temperature sensor. The sensor may be either RTD or thermistor type providing the following minimum performance requirements are met:

230901-9

Automatic Temperature Control System

AUTOMATIC TEMPERATURE CONTROL SYSTEM

- a. Accuracy: $\pm 1^{\circ}\text{F}$ ($\pm 0.6^{\circ}\text{C}$).
 - b. Operating Range: 35 to 115°F (2 to 46°C).
 - c. Set Point Adjustment Range: 55 to 95°F (2 to 30°C).
 - d. Set Point Modes: Independent Heating, Cooling, Night Setback-Heating, Night Setback-Cooling.
 - e. Calibration Adjustments: None required.
 - f. Installation: Up to 100 ft. from controller.
3. Each room temperature sensor shall include a terminal jack integral to the sensor assembly. The terminal jack shall be used to connect a portable operator's terminal to control and monitor all hardware and software points associated with the controller.
4. Each room temperature sensor shall also include the following auxiliary devices:
 - a. Setpoint Adjustment Dial
 - b. Override Switch
5. The setpoint adjustment dial shall allow for modification of the temperature by the occupant. Setpoint adjustment may be locked out, overridden or limited as to time or temperature through software by an authorized operator at the central workstation, DDC controller, or via the portable operator's terminal.
6. An override switch shall initiate override of the night setback mode to normal (day) operation when activated by the occupant. The override function may be locked out, overridden or limited as to the time through software by an authorized operator at the central workstation, DDC controller or via the portable operator's terminal.
7. Each controller shall perform its primary control function independent of other DDC controller LAN communication, or if LAN communication is interrupted. Reversion to a fail-safe safe mode of operation during LAN interruption is not acceptable. The controller shall receive its real-time time data from the DDC controller time clock to insure LAN continuity. Each controller shall include algorithms incorporating proportional, integral and derivative (PID) gains for all

230901-10

Automatic Temperature Control System

AUTOMATIC TEMPERATURE CONTROL SYSTEM

applications. All PID gains and biases shall be field-adjustable by the user via terminals as specified herein. This functionality shall allow for tighter control of space conditions and shall facilitate optimal occupant comfort and energy savings. Controllers that incorporate proportional and integral (P1) control algorithms only shall not be acceptable.

8. Provide each terminal equipment controller with sufficient memory to accommodate point databases, operating programs, local alarming and local trending. All databases and programs shall be stored in non-volatile EEPROM, EPROM and PROM, or minimum of 72-hour battery backup shall be provided. The controllers shall be able to return to full normal operation without user intervention after a power failure of unlimited duration. Provide uninterruptible power supplies (UPS's) of sufficient capacities for all terminal controllers that do not meet this protection requirement. Operating programs shall be field-selectable for specific applications. In addition, specific applications may be modified to meet the user's exact control strategy requirements, allowing for additional system flexibility. Controllers that require factory changes of all applications are not acceptable.

2.06 WORKSTATION OPERATOR INTERFACE

A. Basic Interface Description

1. Contractor is to provide all necessary software to integrate new system into the campus BMS front end.
2. Operator interface software shall minimize operator training through the use of English language prompting, English language point identification and industry standard PC application software. The software shall provide, as a minimum, the following functionality:
 - a. Graphical viewing and control of environment.
 - b. Scheduling and override of building operations.
 - c. Collection and analysis of historical data.
 - d. Definition and construction of dynamic color graphic displays.
 - e. Editing, programming, storage and downloading of controller databases.
 - f. The ability to run Microsoft Word for Windows and Excel for Windows applications

230901-11

Automatic Temperature Control System

AUTOMATIC TEMPERATURE CONTROL SYSTEM

- 3 Provide a graphical user interface which shall minimize the use of a typewriter style keyboard through the use of a mouse or similar pointing device and "point and click" approach to menu selection. Users shall be able to start and stop equipment or change setpoints from graphical displays through the use of a mouse or similar pointing device.
- 4 The software shall provide a multi-tasking type environment that allows the user to run several applications simultaneously. The mouse shall be used to quickly select and switch between multiple applications. This shall be accomplished through the use of Microsoft Windows or similar industry standard software that supports concurrent viewing and controlling of systems operations.
- 5 Multiple-level password access protection shall be provided to allow the user/manager to limit workstation control, display and data base manipulation capabilities as he deems appropriate for each user, based upon an assigned password.
 - a. A minimum of five levels of access shall be supported.
 - b. Operators will be able to perform only those commands available for their respective passwords. Menu selections displayed shall be limited to only those items defined for the access level of the password used to log-on.
 - c. The system shall automatically generate a report of log-on/log-off time and system activity for each user.
- 6 Reports shall be generated and directed to either CRT displays, printers or disk. As a minimum, the system shall allow the user to easily obtain the following types of reports:
 - a. A general listing of all points in the network.
 - b. A DDC controller point module status report.
 - c. A change of value cross-reference report indicating user-defined limit changes.
 - d. List of all points currently in alarm.
 - e. List of all points currently in override status.
 - f. List of all disabled points.

230901-12

Automatic Temperature Control System

AUTOMATIC TEMPERATURE CONTROL SYSTEM

- g. List of all points currently locked out.
- h. DDC Controller trend overflow warning.
- i. List all weekly schedules.
- j. List of holiday programming.
- k. List of limits and deadbands

B. Scheduling

1. Provide a graphical spreadsheet-type format for simplification of time-of-day scheduling and overrides of building operations. Provide the following spreadsheet graphic types as a minimum:
 - a. Weekly schedules
 - b. Zone schedules
 - c. Monthly calendars

C. Collection and Analysis of Historical Data

1. Provide trending capabilities that allow the user to easily monitor and preserve records of system activity over an extended period of time. Any system point may be trended automatically at time-based intervals or changes of value, both of which shall be user-definable. Trend data may be stored on hard disk for future diagnostics and reporting.
2. Trend data report graphics shall be provided to allow the user to view all trended point data. Reports may be customized to include individual points or pre-defined groups of at least 6 points. Provide additional functionality to allow any trended data to be transferred easily to an off-the-shelf spreadsheet package such as Lotus 1-2-3 and Excel. This shall allow the user to perform custom calculations such as energy usage, equipment efficiency and energy costs and shall allow for generation of these reports on high-quality plots, graphs and charts

D. Dynamic Color Graphic Displays

1. Color graphic floor plan displays and system schematics for each piece of mechanical equipment, including air handling units, chilled water systems and hot water boiler systems, shall be provided by the BMS Manufacturer as indicated in the point I/O summary of this specification to optimize system

230901-13

Automatic Temperature Control System

AUTOMATIC TEMPERATURE CONTROL SYSTEM

performance analysis and speed alarm recognition.

2. Graphic generation software shall be provided to allow the user to add, modify or delete system graphic displays.
 - a. The BMS manufacturer shall provide libraries of pre-engineered screens and symbols depicting standard air handling unit components (e.g., fans, cooling coils, filters, dampers, etc.), complete mechanical systems and electrical symbols.

2.07 FIELD DEVICES

A. Temperature Sensors

Provide the following instrumentation as required by the monitoring, control and optimization functions. All temperature sensors for main HVAC equipment (AHU's, chillers, etc.) shall use platinum RTD elements only, nickel or silicon are not acceptable. All control signals shall be via a 4-20 mA loop.

1. Room Temperature

Temperature monitoring range	+40/+90°F
Output signal	4-20 mAdc
Installation adjustments	None required
Calibration adjustments	Zero & span
Factory calibration point	70 deg F
Accuracy at calibration point	±0.5°F

2. Room Temperature With Adjustment

Temperature monitoring range	+40/+90°F.
Output signal	4.10 mAdc
Installation adjustments	None required
Calibration adjustments	Zero span

230901-14

Automatic Temperature Control System

AUTOMATIC TEMPERATURE CONTROL SYSTEM

3. Liquid Immersion Temperature

Temperature monitoring range	+20/+120 F +70/+220 F
Output signal	4-20 ma
Installation adjustment	None required
Calibration adjustments	Zero & span
Factory calibration point	70 deg F
Accuracy at calibration point	±0.5 F Dimensions
Sensor probe length	4.75"L

4. Duct (Single Point) Temperature

Temperature monitoring range	+20/+120 F +70/+220 F
Output signal	4-20 mAdc
Installation adjustments	None required
Calibration adjustments	Zero & span
Factory calibration point	70 deg F
Accuracy at calibration point	±0.5 F
Dimensions	
Sensor probe length	19"L

5. Duct (Averaging) Temperature

Temperature monitoring range	+20/+120 F
Output signal	4 - 20 U'A DC
230901-15	Automatic Temperature Control System

AUTOMATIC TEMPERATURE CONTROL SYSTEM

Installation adjustments	None required
Calibration adjustments	Zero & span
Factory calibration point	70 deg F
Accuracy at calibration point	±0.5 F
Dimensions	
Sensor probe length	12"-48"L

6. Outside Air Temperature

Temperature monitoring range	-50/+122
Installation adjustments	None required
Output signal	4-20 TflAdc
Installation adjustments	
Calibration adjustments	Zero & span
Factory calibration point	70 deg F
Accuracy at calibration point	0.5 F

7. Enthalpy Sensor (Humidity)

a. Type integrated circuit, temperature compensated. 4 to 20 ma output over 0 to 100% RH. Calibration-single point, single adjustment field setting to any standard.	
Accuracy %	± 3 from 0 to 90% RH. Between 59°F and 122°F.
Operating Temp	-10 to 185, non-condensing
Power	9.4 VDC to 45 VDC

B. Pressure Sensors

1. Current Sensing Relays

230901-16

Automatic Temperature Control System

PHOTO LAB – DARKROOM RENOVATION

PURCHASE COLLEGE SUNY | 735 ANDERSON HILL RD. | VISUAL ARTS BUILDING | LA PLLC Project 2306

AUTOMATIC TEMPERATURE CONTROL SYSTEM

- a. Switches shall be current sensing and be used for fan status or pump status as specified in the point schedule.
2. Differential Pressure Transmitter - Water
 - a. Provide industrial grade differential pressure transmitters that shall be factory calibrated for operating range and rated for system pressure. Provide manufacturer's standard 316 stainless steel, 3 valve manifold and pressure gauges for supply and return pressures. Output shall be 4-20 ma. Sensor shall be Rosemount II5IDP, with 316 stainless steel or approved equal.
3. Differential Pressure Switch – Water
 - a. Provide industrial grade differential pressure switch that shall be factory calibrated for operating range and rated for system pressure output shall be SDPT.
4. Pressure Transmitter - Duct

Duct Static range (as required)	- .5 to + 7.5"wg
Accuracy	± .05" w.g
Transmitter	4 - 20 ma
5. Pressure Switch - Duct
 - a. Type-BJNA-N Diaphragm. SPDT switch, makes on rise in pressure, mounting -1/8 inch NPT female threads. Switch shall be by Siemens or approved equal.
6. Differential Pressure Switch – Duct
 - a. Provide switch with auto reset. Ranges: -0.05 to 1" W.C. and 1 to 12" W.C. provided with SPDT. Ambient temperature range: -40 to 180°F, maximum overpressure 0.5 psi. Body: Zinc-plated steel with blue erudite dip. Switch shall be Siemens 141 type or approved equal.
7. Pressure Transmitter – Room

Duct Static range (as required)	- .25 to + .25"wg
Accuracy	± .001" w.g
Transmitter	4 - 20 ma

230901-17

Automatic Temperature Control System

PHOTO LAB – DARKROOM RENOVATION

PURCHASE COLLEGE SUNY | 735 ANDERSON HILL RD. | VISUAL ARTS BUILDING | LA PLLC Project 2306

AUTOMATIC TEMPERATURE CONTROL SYSTEM

C. Electronic Control Valves

1. All automatic control valves shall be fully proportioning with modulating plug or V-port inner valves unless specified otherwise. The valves shall be capable of operating in sequence with other valves and/or dampers when required by the sequence of operation. All control valves shall be sized by the control manufacturer and shall be guaranteed to meet the heating and cooling loads as scheduled. All control valves shall be suitable for the pressure conditions and shall close against the differential pressures involved. Body pressure rating and connection type construction shall conform to fitting and valve specifications. Control valve operators shall be sized to close against a differential pressure equal to the design pump head plus 10 percent. Where pressure and flow combinations exceed ratings for commercial valves and operators, industrial class valves and operators shall be provided.
2. Furnish pressure independent zone control valves (PICV) for all VAV and duct mounted heating coils, perimeter fin tube and cabinet unit heaters. Flow set point shall be by a 0-10V or 2-20mA signal. PICVs shall be equal to Belimo PIQCV, alternate manufactures shall be Siemens and Griswold.
3. Furnish energy monitoring valves on the AHU-1 heating and cooling coils. Valves shall monitor flow and supply and return temperatures and modulate flow based on demand and supply and return temperatures. Temperature and flow data shall be reported to BMS connection by Bacnet IP. Flow set point shall be by a 0-10V or 2-20mA signal. Energy valves shall be equal to Belimo EV series, alternate manufactures shall be Siemens and Griswold.
4. Furnish differential pressure control valves for all water systems where modulating water flow conditions are required to prevent minimum system flow. Provide a valve for the heating hot glycol (HHG) system. Flow set point shall be by a 0-10V or 2-20mA signal. Valve to be characterized ball type, equal to Belimo, alternate manufactures shall be Siemens and Griswold.

D. Electric Thermostats

1. Furnish and install all line voltage thermostats for unit heaters. Thermostat contacts shall be rated for maximum heater amperage and shall be snap acting, SPDT. Thermostat cover shall provide exposed set point and key adjust.

230901-18

Automatic Temperature Control System

AUTOMATIC TEMPERATURE CONTROL SYSTEM

E. Field Equipment Cabinets

1. All relays, electric relays, etc., shall be mounted in a NEMA 1 enclosure (minimum) and factory wired to terminal strips.

PART 3 - EXECUTION

3.01 BUILDING MANAGEMENT SYSTEM - GENERAL

- A. Electronic space mounted devices are to be identical in appearance. All devices shall be mounted under the same style cover.
- B. Provide all relays, switches, sources of electricity and all other auxiliaries, accessories and connections necessary to make a complete operable system in accordance with the sequences specified.
- C. Install controls so that adjustments and calibrations can be readily made.
- D. Mount surface-mounted control devices on brackets to clear the final finished surface on insulation
- E. Conceal control conduit and wiring in all spaces except in the Mechanical Equipment Rooms and in unfinished spaces. Install in parallel banks with all changes in directions made at 90 degree angles.
- F. Install control valves horizontally with the power unit up.
- G. Unless otherwise noted, install wall mounted sensors, thermostats and humidistats at 4'-0" above the finished floor measured to the center line of the instrument. Room devices are to be of the concealed type without indicator. Submit device locations, mounting heights and details for approval.
- H. Install outdoor thermostats in perforated tube and sun shield.
- I. General System Requirements
 1. Normal (no electricity) Positions for controlled components:
 - a. Heating Hot Water Valves - Open
230901-19 Automatic Temperature Control System

AUTOMATIC TEMPERATURE CONTROL SYSTEM

2. Time of Day Scheduling

The Building Management and Control System (BMS) shall be programmed to start and stop the HVAC equipment based on occupancy schedules coordinated with the Owner. The BMS shall also provide equipment interlocks as required.

3. All control valves that are sequenced shall be provided with separate DDC output signals.

3.02 INSTALLATION

- A. Install the BMS and associated DDC panels in accordance with manufacturer's installation procedures and recommendations. A manufacturer's technical representative shall be present to observe the BMS installation and shall certify, in writing, that the BMS has been installed in accordance with the manufacturer's recommendations. The manufacturer's technical representative responsible for certifying the BMS installation shall be identified to the Engineer in writing, prior to the start of construction.
- B. Coordinate all trades to ensure that the installation of the BMS is not in conflict with the work performed by other trades.
- C. Install control valves and field devices per manufacturer's instructions and recommendations.

3.03 PERFORMANCE

- A. Unless stated otherwise, control temperatures within plus or minus 2°F. humidity within plus or minus 3% of the setpoint and static pressure within 10% of setpoint.

3.04 COMMISSIONING, TESTING AND ACCEPTANCE

- A. Perform a commissioning procedure consisting of field I/O calibration and program commissioning. Document all commissioning information on commissioning data sheets which shall be submitted prior to acceptance testing. Commissioning work which requires shutdown of system or deviation from normal function shall be performed when the operation of the system is not required. The commissioning must be coordinated with the Engineer to ensure systems are available when needed. Notify the Engineer in writing of the testing schedule so that authorized personnel from the Owner are present throughout the commissioning procedure.

AUTOMATIC TEMPERATURE CONTROL SYSTEM

1. Field I/O Calibration and Commissioning

Prior to system program commissioning, verify that each control panel has been installed according to plans, specifications and approved shop drawings.

Test, calibrate and bring on line each control sensor and device. Commissioning to include, but not be limited to:

- a. Sensor accuracy at 10, 50 and 90% of range.
- b. Sensor range.
- c. Verify analog limit and binary alarm reporting.
- d. Point value reporting.
- e. Binary alarm and switch settings.
- f. Actuator ranges.
- g. Fail safe operation on loss of control signal, pneumatic air, electric power, network communications, etc.

Record calibration and test data on commissioning data data sheets. Sufficient space should be provided near each point name for sign off.

B. Acceptance Testing

1. Submit for approval, a detailed acceptance test procedure designed to demonstrate compliance with contractual requirements. This Acceptance test procedure will take place after the commissioning procedure but before final acceptance, to verify that sensors and control devices maintain specified accuracy's and the system performance does not degrade over time.

3.05 SUBMITTAL REQUIREMENTS

A. Submit the following.

1. Product Data

Technical bulletins and catalog data for all equipment and system components. Clearly identify, by use of symbol or tag number, the service of each item. All irrelevant information shall be marked out leaving only pertinent data.

230901-21

Automatic Temperature Control System

AUTOMATIC TEMPERATURE CONTROL SYSTEM

2. Shop Drawings

- a. Shop drawing submittals to include sufficient data to indicate complete compliance with Contract Documents. Submission in form of drawings, brochures, bulletins, catalog data, and/or narrative descriptions. Submission shall include, but not be limited to:
 - 1) Symbol and abbreviation lists.
 - 2) System block diagram showing quantity and location of CPU, operator console equipment, DDCs, Field Equipment Panels and Major System Components.
 - 3) Control diagrams for all systems controlled. Controls shall be shown on system flow diagrams.
 - 4) Power wiring diagrams and electrical requirements.
 - 5) Interfaces (software and hardware) with fire alarm system and other equipment provided in other sections of specifications.
 - 6) Narrative description of operation for each system, enumerating and describing the function of each component. Include alarm and emergency sequences, sequences, and equipment interlocks.
 - 7) Description of manual override capabilities.
 - 8) Complete input output point schedule. Identify point function, type and location.
 - 9) Spare capacity provisions.
 - 10) Detailed Bill of materials.
 - 11) Valve and Damper Schedule: Provide identification numbers, location, system, dimensions and performance data. Include damper leakage rates.
 - 12) Device mounting details. Include as a minimum:
 - a) Sensing elements in ducts and casings.
 - b) Sensing elements in piping.

230901-22

Automatic Temperature Control System

AUTOMATIC TEMPERATURE CONTROL SYSTEM

- 13) Ladder wiring diagrams.
- 14) Acceptance test procedure.
- 15) Other information as requested herein.

2. Complete full size drawings, 11" x 17" minimum.

B. Programming

1. Point identification code.
2. System advisory messages, printouts, logging formats.
3. Drawings of system graphics showing monitored points.
4. Software flow charts for applications and DDC programs.
5. Person machine interface program, include commands, commands, alarm annunciation, logs and programming capabilities.
6. Description of system operation under failure conditions.

C. Quality Control Submittals

1. UL listing compliance certificates.
2. Final calibration, commissioning and testing reports.

D. Manuals

1. General
 - a. Submit two (2) draft copies of manuals for review. After review by the Authority, the Contractor shall incorporate review comments and submit four (4) interim final copies. Upon completion of project, submit six (6) copies of final "As-Built" manuals and one (1) reproducible copy (3-mil sepi mylar).
 - b. Update manuals with modifications made to system during testing period. Provide replacement pages or supplements in quantity stated above for "as-built" manuals.
 - c. Assemble manuals into multi-volume sets as necessary and required by the

230901-23

Automatic Temperature Control System

AUTOMATIC TEMPERATURE CONTROL SYSTEM

Engineer.

- d. Protect each volume with a heavy duty vinyl plastic binder. Volumes to have plastic printed dividers between major sections and have oversized binders to accommodate up to 1/2 inch thick set of additional information.
 - e. Each binder to be silk-screened with project name and volume title on front cover and binder.
 - f. On the first page of each manual identify with project name and manual title.
2. Operating manual to serve as training and reference manual for all aspects of day-to-day operation of the system. As a minimum include the following:
 - a. Control flow diagrams.
 - b. Sequence of operation for automatic and manual operating modes. The sequences shall cross-reference the system point names.
 - c. Description of manual override operation of control points.
 - d. System manufacturer's complete operating manuals.
 3. Maintenance manual to serve as training and reference manual for all aspects of day-to-day maintenance and major system repairs. As a minimum include the following:
 - a. Complete as-built installation drawings for each system
 - b. Overall system electrical power supply scheme indicating source of electrical power for each system component. Indicate which components are on emergency power and indicate all battery backup provisions.
 - c. Overall system shielding and grounding scheme indicating all major components and ground paths.
 - d. Photographs and drawings showing installation details and locations of equipment.
 - e. Charts showing normal operating conditions at significant points such as electrical test points.
 - f. Routine preventive maintenance procedures, corrective diagnostics troubleshooting procedures, and calibration procedures.

230901-24

Automatic Temperature Control System

PHOTO LAB – DARKROOM RENOVATION

PURCHASE COLLEGE SUNY | 735 ANDERSON HILL RD. | VISUAL ARTS BUILDING | LA PLLC Project 2306

AUTOMATIC TEMPERATURE CONTROL SYSTEM

- g. Parts lists with manufacturer's catalog numbers and ordering information.
 - h. Lists of ordinary and special tools, operating materials supplies and test equipment recommended for operation and servicing.
 - i. Manufacturer's operating set up, maintenance and catalog literature for each piece of equipment.
 - j. Maintenance and repair instructions.
 - k. Recommended spare parts.
 - l. Field test reports.
- E. Programming Manual to serve as training and reference manual for all aspects of system programming. As a minimum, include the following:
- 1. Complete programming manuals, and reference guides.
 - 2. Details of any special software packages and compilers supplied with system.
 - 3. Information required for independent programming of system.
 - 4. Documentation on application and DDC programs: flow charts, equations, parameters.
 - 5. Point schedule; include all points, real and virtual.
 - 6. Software troubleshooting procedures.

SEQUENCE OF OPERATION

230993 SEQUENCE OF OPERATIONS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

1. Drawings and general provisions of the Contract apply to this Section.

1.2 SUMMARY

1. This Section includes control sequences for HVAC systems, subsystems and equipment.

1.3 DEFINITIONS

AHU: Air Handling Unit.

AI: Analog Input.

AO: Analog output.

ATC: Automatic Temperature Control.

BMS: Building Management System.

CFM: Cubic Feet per Minute.

DDC: Direct-digital controls.

DI: Digital Input.

DO: Digital Output.

FAS: Fire Alarm System.

HVAC: Heating, Ventilating and Air Conditioning.

LAN: Local area network.

LCD: Liquid Crystal Display

MER: Mechanical Equipment Room.

PID: Proportional Integral Derivative.

POT: Portable Operators Terminal.

RAHU: Rooftop Air Handling Unit.

VAV: Variable air volume.

VFD: Variable Frequency Drive.

230993-1

Sequence of Operation

SEQUENCE OF OPERATION

1.4 GENERAL

1. All safety devices shall be hardwired to the starter/VFD and shall have a second contact for monitoring via the BMS.
2. A failure alarm, as included in the point list, shall indicate the type of equipment that has failed (pump, fan, valve, etc.) including the specific designation of the piece of equipment (e.g., supply fan SF-2). It is not acceptable to generate a general failure alarm.
3. All setpoints including setpoints internal to control algorithms shall be adjustable from all BMS operator interfaces. All commands shall be overrideable from all BMS operator interfaces. All control points shall be adjustable or overrideable from the same graphic page that displays the points.
4. All points for a specific mechanical system shall be connected to and controlled by the same DDC controller unless otherwise specified. For example, it is not acceptable to control a supply fan with one (1) DDC controller located at a motor control center and to control the rest of the air-handling unit points with a DDC controller located at the air-handling unit.
5. All points required by the sequence of operation including, but not limited to, the points listed in the sequences of operation below, as well as all of the points' associated values, shall be connected to the BMS and available to the BMS operators on all operator workstations and all operator interface devices as part of a graphical display that depicts the mechanical system controlled.
6. The installed BMS shall be LAN based and communicate via Purchase College's IT network. Contractor to extend IT drops from campus demark in second floor IT closet to end devices. Cabling will be tested per Campus standards before termination on campus switches. Coordinate exact termination point with campus. Communication cable above the hung ceiling shall be a plenum rated cable. Any exposed cable is to be run in conduit.
7. All valves, dampers, controllers, control devices, etc. exposed to outside air conditions shall be specifically designed for outside air conditions including, but not limited to, NEMA 4X enclosures, weatherproof enclosures and all other weather precautions recommended by the manufacturer.
8. Alarms shall be inhibited for equipment not enabled to run.
9. All final field settings applied shall be saved as the default values. These values shall be downloaded to the controller such that they are the default value if the controller loses power. A printed copy shall also be provided to the owner as part of the O & M manuals.
10. When the motor controller is equipped with an HOA, the motors shall only be controlled by the BMS when the HOA switch is in the auto position.
11. The point lists are provided for convenience and are not intended to be all-inclusive. All points required to provide the Sequence of Operation shall be included as if listed.

SEQUENCE OF OPERATION

1.5 TIE-IN TO EXISTING BASE BUILDING BMS

- A. Provide a SEAMLESS tie-in to the existing SIEMENS building BMS. The tie-in shall include Direct Digital Control (DDC), historical data collection, archiving and alarm, energy and information management for all control points specified herein.
- B. Tie-in to existing site BMS of all DDC equipment and points as specified in this section and as required in all other referenced sections and as required to complete the sequences of operation outlined herein. Tie-in shall be made via an extension of the existing BMS.
- C. Provide new color graphics for the following new systems specified in this contract.
 - 1) Room level graphics.
- D. Revisions to all existing BMS workstations as required to incorporate the additional control components provided under this section. Revisions shall include, but are not limited to, revised graphics, update of additional firmware and/or software as required to accommodate new points.
- E. Remove graphics, sequences of operation and all other elements associated with equipment removed under this project and no longer connected to the BMS.

1.6 VARIABLE AIR VOLUME (VAV) BOXES WITH HOT WATER REHEAT

(CONTROL TYPES A, C)

- A. Coordinate field mounting and wiring of Control Panel, actuator, transformer with the VAV box manufacturer. Heating coil and control valve to be field mounted. The contractor shall be responsible for furnishing, installing and wiring of controls that are required for an operational system.
- B. Occupied Mode (Control Types A, C)
 - 1. Upon a fall in space temperature below setpoint, the box damper shall modulate closed to the minimum CFM setpoint. Upon a further fall in space temperature, the box damper shall modulate to the heating CFM setpoint and the hot water reheat valve shall modulate as necessary to maintain the space temperature setpoint. Upon a rise in space temperature, the hot water reheat valve shall close. Upon a further rise in space temperature, the box damper shall modulate from the minimum to the maximum occupied CFM setting (Columns A and B in M-9010) as necessary to maintain the CFM setpoint as reset by the space temperature. The minimum and maximum CFM settings shall be those scheduled on the mechanical drawings.
- C. Constant Volume (Control Type C)
 - 1. Corridor boxes minimum airflow equals their maximum airflow and act as constant volume boxes.
- D. Unoccupied Mode (Control Types A & C) (Columns C and D in M-9010)

SEQUENCE OF OPERATION

1. The box shall modulate between its minimum and maximum unoccupied CFM setpoints using unoccupied temperature setpoints of 65°F (adj.) 85°F (adj.). This mode will be scheduled unless occupancy sensor control is used (described below). A manual override to occupied mode shall be provided on the temperature sensor.
- E. Occupancy Sensor Control (Control Types A)
1. Each supply air VAV box controller shall accept a signal from a space occupancy sensor.
 2. If there are multiple occupancy sensors associated with one (1) supply air VAV box. All of the associated occupancy sensors must be signaled unoccupied in order to activate unoccupied mode for the associated supply air VAV box.
 3. Upon entering unoccupied mode, the associated supply air VAV boxes shall modulate between its unoccupied minimum and maximum set points (Columns C & D in M-9010) to maintain the space temperature set point and CFM offset.
 4. During unoccupied hours, (adj., owner to determine) or after an unoccupied signal of 15 min (adj.) (if activated), shall operate in unoccupied mode.
 5. If during the unoccupied hours, should the occupancy sensor indicate the zone becomes occupied again the VAV will operate in occupied mode for 15 mins.
 6. If a zone is indicated as occupied, during the unoccupied period, for more than 40 hours (adj.) in a row, a warning alarm shall be indicated to confirm if the occupancy sensor is working properly.
- F. For VAV Box Serving High Density Spaces (Demand Control Ventilation Mode) (A-A,I,J,K)
1. The BMS shall monitor space carbon dioxide (CO₂) as indicated on the mechanical plans.
 2. As the space carbon dioxide (CO₂) level exceeds the setpoint of 1000 ppm (adj.), the associated VAV box damper shall modulate open from the minimum to maximum CFM setting. The VAV box damper shall modulate in order to maintain the space CO₂ level setpoint. The VAV box associated reheat valve shall modulate as required to maintain the space temperature setpoint.
 3. As the space carbon dioxide (CO₂) level exceeds the setpoint of 1000 ppm (adj.) continuously for greater than 30 minutes (adj.), an alarm shall be displayed at the BMS operator workstation.
- G. Disabled Mode (All control types)
- H. When the primary fan system serving the VAV box is not running, the VAV box damper shall close.
- I. The VAV box shall not open beyond the maximum CFM setting. Provide one (1) DDC controller and one (1) room temperature sensor for each VAV box or supply/exhaust pair or triplet.

SEQUENCE OF OPERATION

- J. VAV boxes shall not close below their minimum setting unless disabled.
- K. Provide the following points hardwired to the BMS:
 - 1. AI – Space temperature.
 - 2. AI – Supply air CFM.
 - 3. AI – Supply air temperature.
 - 4. AO – Damper control (0-100%).
 - 5. AO – Reheat valve control (0-100%).
- L. Provide the following points and alarm for densely occupied spaces:
 - 1. AI – Space carbon Dioxide level (CO2)
 - 2. Hi CO2 alarm (1000 ppm (adj.))
- M. Provide a room level graphic with the following points and equipment graphics in addition to the hardwired points indicated above:
 - 1. Box enable/disable.
 - 2. Box K factor.
 - 3. High and low space temperature alarms.
 - 4. High and low supply air temperature alarms.
 - 5. Minimum/maximum/heating CFM settings.
 - 6. Occupied/unoccupied command.
 - 7. Occupied/unoccupied, heating/cooling temperature setpoints.
 - 8. Space/area served.
 - 9. Supply air CFM setpoint.

1.7 FIN TUBE (CONTROL TYPES F)

- A. Fin tube controller shall be activated by a local controller when the outside air temperature is below 60 deg. F (adj.). Fin tube control valve shall modulate to maintain space temperature.

1.8 Sculpture Studio (Control Type I)

- A. VAV's to modulate together in triplet configuration to maintain required airflow.

SEQUENCE OF OPERATION

- B. Refer to the mechanical plans for zoning and CFM setpoints. Each local or general exhaust has a exhaust valve associated with it.
- C. Tracking pairs/triplets with occupancy sensors will modulate the supply air flow volume as described above for supply boxes.
 - a. Tracking pairs/triplets shall have demand controlled ventilation
 - b. General
 - 1. Each supply air VAV box and exhaust air VAV box(s) in an associated tracking arrangement shall be zoned according to the mechanical plans.
 - 2. Provide one (1) DDC space temperature sensor per supply air VAV box.
 - c. Occupied and Unoccupied Mode
 - 1. The total supply and total exhaust flows from each air VAV box and exhaust in a tracking arrangement shall be calculated and input into an airflow tracking program on the BMS.
 - 2. The tracking system measures the supply and exhaust flows into and out of the space. The tracking system is varied to maintain a fixed offset air volume differential between the supply and total exhaust in a closed loop tracking arrangement. A space temperature sensor is an input to an anticipatory temperature control proportional / integral / derivative (PID) loop.
 - 3. As the required total supply air volume delivered to the space is changes, the exhaust air volume delivered to the space shall be modulate to a level where the required air volume offset is being maintained.
 - 4. The minimum and maximum CFM settings shall be those scheduled on the mechanical drawings.
 - 5. Spaces with multiple boxes shall have each exhaust box modulate in proportion to their maximum airflow.
 - d. Disabled Mode
 - 1. If the air handling unit serving the VAV boxes in the tracking arrangement are disabled, the supply and exhaust VAV boxes and the reheat valve shall remain closed
 - e. The exhaust VAV boxes shall not open beyond the maximum CFM setting.
 - f. Provide the following points hardwired to the BMS:
 - 1. All points available via integration (BACnet) to each exhaust valve controller.
 - 2. AI – Exhaust CFM.
 - 3. AO – Exhaust VAV box damper control (0-100%).
 - 4. DI – Individual occupancy sensor status.

SEQUENCE OF OPERATION

g. Provide a room level graphic with the following points and equipment graphics in addition to the hardwired points indicated above:

1. Exhaust CFM setpoint.
2. High and low space temperature alarms.
3. Occupied/unoccupied command.
4. Occupied/unoccupied, heating/cooling space temperature setpoints.
5. Space/area served.

1.9 TRACKING EXHAUST BOXES SCULPTURE STUDIO(CONTROL TYPES J)

- A. VAV's to modulate together in sextuplet configuration to maintain required airflow.
- B. Refer to the mechanical plans for zoning and CFM setpoints. Each local or general exhaust has an exhaust valve associated with it.
- C. Tracking pairs/triplets with occupancy sensors will modulate the supply air flow volume as described above for supply boxes.
- D. Tracking pairs/triplets with demand controlled ventilation
- E. General
 1. Each supply air VAV box and exhaust air VAV box(s) in an associated tracking arrangement shall be zoned according to the mechanical plans.
 2. Provide one (1) DDC space temperature sensor per supply air VAV box.
- F. Occupied and Unoccupied Mode
 1. The total supply and total exhaust flows from each air VAV box and exhaust in a tracking arrangement shall be calculated and input into an airflow tracking program on the BMS.
 2. The tracking system measures the supply and exhaust flows into and out of the space. The tracking system is varied to maintain a fixed offset air volume differential between the supply and total exhaust in a closed loop tracking arrangement. A space temperature sensor is an input to an anticipatory temperature control proportional / integral / derivative (PID) loop.
 3. As the required total supply air volume delivered to the space is changes, the exhaust air volume delivered to the space shall be modulate to a level where the required air volume offset is being maintained.
 4. When EF-9 is active, exhaust airflow from the pentuplet exhaust valves will be reduced by the airflow sensed by the EF/9 airflow station.

SEQUENCE OF OPERATION

5. When EF/11 is active, exhaust airflow from the pentruplet exhaust valves will be reduced by the airflow sensed by the EF/11 airflow station.
6. The minimum and maximum CFM settings shall be those scheduled on the mechanical drawings.
7. Spaces with multiple boxes shall have each exhaust box modulate in proportion to their maximum airflow.

G. Disabled Mode

1. If the air handling unit serving the VAV boxes in the tracking arrangement are disabled, the supply and exhaust VAV boxes and the reheat valve shall remain closed

H. The exhaust VAV boxes shall not open beyond the maximum CFM setting.

I. Provide the following points hardwired to the BMS:

1. All points available via integration (BACnet) to each exhaust valve controller.
2. AI – Exhaust CFM.
3. AO – Exhaust VAV box damper control (0-100%).
4. DI – Individual occupancy sensor status.

J. Provide a room level graphic with the following points and equipment graphics in addition to the hardwired points indicated above:

1. Exhaust CFM setpoint.
2. High and low space temperature alarms.
3. Occupied/unoccupied command.
4. Occupied/unoccupied, heating/cooling space temperature setpoints.
5. Space/area served.

1.10 TRACKING EXHAUST BOXES METAL AND PLASTIC SHOP (CONTROL TYPES K)

- A. VAV's to modulate together in sextuplet configuration to maintain required airflow.
- B. Refer to the mechanical plans for zoning and CFM setpoints. Each local or general exhaust has an exhaust valve associated with it.
- C. Tracking pairs/triplets with occupancy sensors will modulate the supply air flow volume as described above for supply boxes.
- D. Tracking pairs/triplets with demand controlled ventilation
- E. General

230993-8

Sequence of Operation

SEQUENCE OF OPERATION

1. Each supply air VAV box and exhaust air VAV box(s) in an associated tracking arrangement shall be zoned according to the mechanical plans.
 2. Provide one (1) DDC space temperature sensor per supply air VAV box.
- F. Occupied and Unoccupied Mode
1. The total supply and total exhaust flows from each air VAV box and exhaust in a tracking arrangement shall be calculated and input into an airflow tracking program on the BMS.
 2. The tracking system measures the supply and exhaust flows into and out of the space. The tracking system is varied to maintain a fixed offset air volume differential between the supply and total exhaust in a closed loop tracking arrangement. A space temperature sensor is an input to an anticipatory temperature control proportional / integral / derivative (PID) loop.
 3. As the required total supply air volume delivered to the space is changes, the exhaust air volume delivered to the space shall be modulate to a level where the required air volume offset is being maintained.
 4. When EF-8 is active, exhaust airflow from the pentuplet exhaust valves will be reduced by the airflow sensed by the EF/8 airflow station.
 5. When EF/6 is active, exhaust airflow from the pentruplet exhaust valves will be reduced by the airflow sensed by the EF/6 airflow station.
 6. When EF/7 is active, exhaust airflow from the pentruplet exhaust valves will be reduced by the airflow sensed by the EF/7 airflow station.
 7. When EF/12 is active, exhaust airflow from the pentruplet exhaust valves will be reduced by the airflow sensed by the EF/12 airflow station.
 8. The minimum and maximum CFM settings shall be those scheduled on the mechanical drawings.
 9. If one or more exhaust fans is active, supply airflow to the space will not be reduced below the exhausted airflow
 10. Spaces with multiple boxes shall have each exhaust box modulate in proportion to their maximum airflow.
- G. Disabled Mode
1. If the air handling unit serving the VAV boxes in the tracking arrangement are disabled, the supply and exhaust VAV boxes and the reheat valve shall remain closed
- H. The exhaust VAV boxes shall not open beyond the maximum CFM setting.
- I. Provide the following points hardwired to the BMS:
1. All points available via integration (BACnet) to each exhaust valve controller.

SEQUENCE OF OPERATION

2. AI – Exhaust CFM.
 3. AO – Exhaust VAV box damper control (0-100%).
 4. DI – Individual occupancy sensor status.
- J. Provide a room level graphic with the following points and equipment graphics in addition to the hardwired points indicated above:
1. Exhaust CFM setpoint.
 2. High and low space temperature alarms.
 3. Occupied/unoccupied command.
 4. Occupied/unoccupied, heating/cooling space temperature setpoints.
 5. Space/area served.

1.11 ROOM PRESSURIZATION MONITORING (TYPICAL)

- A. Please refer to the mechanical drawing M-9021 for locations.
- B. Coordinate with the manufacturer of the room pressure sensor for all field installation requirements.
- C. Provide all points available to the operator interface panel via BACnet or Modbus communication interface to the room pressure monitor. Coordinate with the manufacturer for available protocol.
- D. System operation
1. The room pressurization sensor shall read the pressure in the room relative to the adjacent hallway or room.
- E. Provide the following points on the BMS through an input to local control panel:
1. AI – Room differential pressure.
- F. Provide graphics of each room requiring pressurization. Graphics shall indicate pressure relationship between the room and adjacent pressure related space.
- G. Provide an alarm if room is more than .1" w.g. negative or positive relative to the corridor.

END OF SECTION

PIPE AND PIPE FITTINGS

232000 PIPE AND PIPE FITTINGS

PART 1 - GENERAL

1.01 WORK INCLUDED

- A. Drain (DR)
- B. Heating hot water (HHWS) (HHWR)
- C. Vent (V)

1.02 REFERENCE STANDARDS

- A. Provide pipe and fittings conforming to the ANSI/ASTM Standard listed in the Schedules.
- B. Unless otherwise specified, work performed under this Section shall be in accordance with the following reference specifications:
 - 1. ASME Section IX - Weld Qualifications.
 - 2. ASME Section V - NDT (Non Destructive Testing).
 - 3. ASME Section B31.9 - Piping.
 - 4. AWS D1.1 - Structural.

1.03 QUALITY ASSURANCE

- B. Non-boiler external piping shall comply with the latest revisions of Building Services Piping, ANSI/ASME B31.9.
- C. Requirements of state or local agencies having legal jurisdiction may necessitate the substitution of a state or local boiler law or piping code in place of ASME Section I and ANSI B31.9.
- F. Before any welder shall perform any pipe welding, submit to the engineer, or his authorized representative, a copy of the manufacturer's Record of Welder or Welding Operator Qualification Tests as required by Section IX of the ASME boiler and Pressure Vessel Code.

1.04 DELIVERY, STORAGE AND HANDLING

- A. Clean all pipe sections of foreign matter and cover ends with temporary sheet metal closures or plastic end caps of sufficient tightness to prevent entry of foreign matter prior to shipping to the construction site.
- B. Store pipe, fittings, valves and other components at the construction site on pallets or raised platforms with suitable coverings satisfactory to the Engineer to protect them against damage and weather.

232000-1

Pipe and Pipe Fittings

PIPE AND PIPE FITTINGS

- C. Inspect all pipe, fittings, valves and other components for damage before moving them from storage to installation site.

1.05 SUBMITTALS

- A. Refer to Section 230100 for submittal procedures.
 - 1. General piping layout drawings including hanger and support locations and details.
 - 2. Pipe material and schedule for each piping system.
 - 3. Catalog cuts of fittings and flanges.

1.06 SAFETY

- A. Follow all applicable safety regulations. These include, but are not limited to, use of proper eye and body protection, adequate ventilation, presence of a proper type fire extinguisher, and proper grounding of all electrical equipment.

PART 2 - PRODUCTS

- 2.01** Provide material of the type, size and rating shown on the Drawings, specified herein and listed in the Schedules.

PART 3 - EXECUTION

3.01 GENERAL PIPING INSTALLATION

- A. Install piping systems using the best standard practices of the trade to make the connected equipment and system components complete and ready for regular operation. Installation shall be in accordance with all written installation procedures, piping accessory manufacturer's recommendations, requirements of ANSI B31.9, and as specified.
- B. Modify piping arrangements as necessary to suit conditions in the building, and to permit access to equipment and accessories.
- C. Cut accurately all piping to measurements established and work into place without springing or forcing.
- D. Install piping to avoid pockets of air traps and assure free flow and positive

232000-2

Pipe and Pipe Fittings

PIPE AND PIPE FITTINGS

drainage.

- E. Install piping straight and plumb, as direct as possible, and parallel to ceilings, walls, beams and girders.
- F. Construct pipe lines from full lengths of pipe. Use short sections only when run is less than a full length.
- G. Do not pass piping through ductwork or sheet metal work.
- H. Do not install piping over control panels, switchboards or other electrical equipment except by permission of the Engineer. If approval is obtained, install shields or drip pans as directed by the Engineer.
- I. Seal, as specified in Section 230529, the space around the pipes passing through walls or floors.
- J. Cover, cap or plug open ends of all piping to prevent damage and to prevent entry of foreign matter. Only plugs or caps constructed of wood, plastic or metal are acceptable.
- K. Space piping to permit access for operation and servicing of valves.
- L. Cut piping so that ends are square. Ream or file each pipe cut to remove burrs. Inspect each length of pipe and each fitting for cleanliness, workmanship and clear passageway.
- M. Provide escutcheons on all exposed pipes passing through walls, partitions, floors and ceilings.
- N. Conceal main piping runs concealed in hung ceilings wherever possible, except where otherwise shown.
- O. Install overhead horizontal piping, a minimum of eight feet above the floor, except as dimensioned on Drawings. Unless otherwise noted, install all overhead horizontal piping above lighting fixtures.
- P. Install piping required to be concealed in floor, wall or ceiling construction promptly to not cause delay to other work, and to allow ample time for necessary tasks and approvals. In the event that difficulties are encountered in installing piping, notify the Engineer promptly, and await his decision before installation of the work in question.
- Q. Separate all piping, except water piping, by at least six inches where possible. Contact between pipes is not permitted.

PIPE AND PIPE FITTINGS

- R. Allow ample space between pipes for installing insulation. Space between fully insulated piping shall be a minimum of two inches.
- S. Make all changes in pipe sizes with eccentric reducing or eccentric increasing fittings on horizontal piping for proper drainage or venting. Concentric reducing or concentric increasing fittings shall be used on all vertical piping.
- T. Provide pipe flexibility and expansion by bends, swing joints, loops, offsets and mechanical coupling devices as required unless expansion joints are shown and specified. Support, anchor and guide piping to preserve alignment and direct expansion.
- U. When thermometers or temperature sensors or controllers are to be installed in pipes:
 - 1. Install all pipe mounted thermometers in thermowells filled with heat transfer compound.
 - 2. Install thermometers/thermowells so that tip of stem is at least midspan of the pipe cross section but less than the pipe diameter.
 - 3. Install thermowells in run of tee or in elbow so that full length of well is immersed in fluid flow.
 - 4. When pipe size is less than 2-1/2 inches, increase size at point of immersion to 2-1/2 inches to avoid flow restriction.
- V. Provide dielectric unions to connect piping of dissimilar metals and/or connect piping and equipment of dissimilar metals.
- W. Make all exposed polished, finished or enameled connections with special care. Tool marks or exposed threads on pipe or fittings are not permitted.
- X. Ream the ends of all pipe free from burrs after threading. Threads shall be clean cut and tapered. Keep piping free from scale and dirt. Use graphite on cleanout and drain plugs.
- Y. Do not use face bushings, close nipples, or street elbows, except where specified.
- Z. Make sure thread ends conform to prevailing hose thread at the facility or to the size and type selected by the Owner where hose end fittings or valves are required, or shown on Drawings.
- AA. Water Piping
 - 1. Pitch piping uniformly upward in direction of flow.

PIPE AND PIPE FITTINGS

- a. Make all branch connections in a manner to prevent air trapping and to allow free passage of air.
 - b. Install 3/4 inch drain valves where required to permit complete drainage.
 - c. Vent all high points.
2. On offsets not indicated on the drawings, use 45° elbows instead of 90° elbows to reduce pressure drop.
3. Install mains to maintain head room and clear other trades.
4. Provide sectionalizing valves for testing, drainage and maintenance.
5. Provide expansion loops on hot water lines at intervals not exceeding 100 feet, even though not shown on the Drawings.

3.02 COPPER TUBE INSTALLATION

A. Solder Joints

1. Remove internal parts of valves or other devices in the line.
2. Ream or file tube to remove burrs.
3. Clean and polish contact surfaces of joint.
4. Apply noncorrosive flux to both male and female ends.
5. Insert end of tube into fittings full depth of socket.
6. Form continuous solder bead around entire circumference of joint.
7. Wipe all joints.

B. Flare Joints

1. Ream or file tube to remove burrs.
2. Slip fitting over tube end to be flared.
3. Expand end of tube using flaring tool.
4. Tighten joint using two wrenches.

3.03 TESTING

A. General

1. Perform a preliminary test on all piping upon completion of piping systems and prior to performing the acceptance test on piping.

PIPE AND PIPE FITTINGS

2. Notify the Owner, in writing, upon completion of piping systems and preliminary tests, five days in advance of the time leak tests are to be made.
3. Conduct tests in accordance with the criteria below.
 - 1) Hydro test all pipe at 1.5x operating pressure or 150 PSIG, whichever is

PIPE AND PIPE FITTINGS

greater. Hold pressure for 2 hours minimum.

4. Conduct tests prior to painting, insulating, backfilling or concealing within the building.
5. Provide necessary equipment, instruments, temporary piping, vents, drains and personnel to perform tests.
6. Replace all defective piping and fittings with new material and repeat the tests.
7. Clear all obstructions or stoppages in the piping systems.
8. Include all materials, equipment and costs involved in testing the piping systems in the work.
9. Disconnect all equipment, fixtures and devices which may be damaged by the test pressure and plug or cap the lines.
10. Apply water and soap solution to joints when air is used for testing.

PIPE AND PIPE FITTINGS

PIPING SYSTEM TESTING, CLEANING AND DISINFECTING SCHEDULE					
PIPING SYSTEM	TEST MEDIUM	TEST PRESSURE PSIG	TEST DURATION	SYSTEM CLEANING	SYSTEM DISINFECTING
HHW	WATER	120	2 HRS.	YES	N/A

PIPE AND PIPE FITTINGS

PIPING SCHEDULE		
SERVICE	HEATING HOT WATER (HHW) EQUIPMENT DRAIN (DR) (D) MAKE-UP WATER (MW)	
PIPING -SIZE -MATERIAL -SCHEDULE -STD. ANSI/ASTM	2 INCHES & UNDER DRAWN COPPER TYPE L B88	ALL BLACK STEEL 40 Grade A or B A53, A106 Type E or S
FITTINGS -SIZE -MATERIAL -ANSI PRESS. CLASS -STD. ANSI	2 INCHES & UNDER COPPER OR COPPER ALLOY 150 B16.5, B16.9, B16.11, B16.18, B16.22, B16.25, B16.25	ALL STEEL 150
UNIONS -SIZE -MATERIAL -ANSI PRESS. CLASS -STD. ANSI -TYPE	2 INCHES & UNDER COPPER 150 B16.22	ALL MALLEABLE IRON 150 B16.39 GROUND JOINT
NIPPLES -MATERIAL, SCH, ANSI/ASTM -TYPE	SAME AS PIPE SHOULDER	
PIPING CONNECTIONS -ALL SIZES	COPPER PIPE SHALL BE SOLDERED	FLANGED OR WELDED, PER ASTM A357; FLANGES SHALL BE STEEL, WELD NECK OR SLIP-ON
REMARKS	<p>"COMPACT" OR SHORT-MATERIAL, FIELD FABRICATED FITTINGS OR FISH MOUTHS ARE NOT ACCEPTABLE</p> <p>"WELD-O-LETS" MAY BE USED IN LIEU OF WELDING TEES IF THE BRANCH PIPE IS AT LEAST TWO SIZES SMALLER THAN THE MAIN. WELDING RINGS SHALL BE MADE OF CARBON STEEL WITH KNOCK-OFF SPACER PINS. USE UL LISTED THREAD PIPE SEALANT INDUSTRIAL GRADE THREAD-TYPE. UNLESS OTHERWISE NOTED WITHIN, ALL PIPE OVER 2 IN. DIAMETER SHALL BE FLANGED/WELDED. STUDS SHALL CONFORM TO ASTM A307. NUTS SHALL CONFORM TO ASTM A194 GR. 2</p> <p>SOFT COPPER LINE SETS MAY BE USED WHERE CALLED FOR ON DRAWING M-4122 "WALL RECESSED UNIT WITH ENCLOSED PEX PIPING CONNECTIONS"</p>	
MANUFACTURER	BONNEY FORGE & TOOL WORKS, GRINNELL, WALWORTH, CRANE, TUBE TURN, OR EQUAL	

END OF SECTION

232000-9

Pipe and Pipe Fittings

PHOTO LAB – DARKROOM RENOVATION

PURCHASE COLLEGE SUNY | 735 ANDERSON HILL RD. | VISUAL ARTS BUILDING | LA PLLC Project 2306

PIPING SPECIALTIES

232114 PIPING SPECIALTIES

PART 1 - GENERAL

1.01 WORK INCLUDED

- A. Air vent (AV)
- B. Dielectric fitting (DF)
- C. Pipe line strainer (STR)
- D. Union
- E. Manual Air Vent

1.02 QUALITY ASSURANCE

- A. Manufacturer's certification that materials meet or exceed the minimum requirements specified herein.

1.03 SUBMITTALS

- A. Refer to Section 01 33 23 for submittal procedures.
- B. Provide product specific manufacturer cut sheets with all proposed sizes and options indicated.

PART 2 - PRODUCTS

2.01 Provide equipment of the type and size specified herein and listed in the Schedules.

2.02 AIR VENTS

- A. Manufacturers:
 - 1. Armstrong International, Inc: www.armstronginternational.com.
 - 2. ITT Bell & Gossett: www.bellgossett.com.
 - 3. Taco, Inc: www.taco-hvac.com.
- B. Manual Type: Short vertical sections of 2 inch diameter pipe to form air chamber, with 1/8 inch brass needle valve at top of chamber.
- C. Float Type:
 - 1. Brass or semi-steel body, copper, polypropylene, or solid non-metallic float, stainless steel valve and valve seat; suitable for system operating temperature and pressure; with isolating valve.

PIPING SPECIALTIES

2. Cast iron body and cover, float, bronze pilot valve mechanism suitable for system operating temperature and pressure; with isolating valve.

D. Washer Type:

1. Brass with hygroscopic fiber discs, vent ports, adjustable cap for manual shut-off, and integral spring loaded ball check valve.

PART 3 - EXECUTION

- 3.01** Install all specialties in strict accordance with the manufacturer's written instructions and in accordance with all pertinent codes and regulations.

3.02 AIR VENT

- A. Install air eliminators vertically at high points in hot water and chilled water piping systems to allow air to escape through the orifice.
- B. Provide a manual air vent at all hot water and chilled water piping high points.

3.03 DIELECTRIC FITTINGS

- A. Provide dielectric fittings to connect piping of dissimilar metal and/or connect piping to equipment fabricated of different metal than piping. Piping shall be isolated by means of a dielectric material such as teflon, micarta or thermoplastic screwed insulating unions or flange unions to provide cathodic protection currents and to stop galvanic corrosion.

3.04 PIPE LINE STRAINERS

- A. Install strainers in the inlet connections to steam traps, pressure reducing valves, automatic water valves, and where indicated on the Drawings.
- B. Equip strainers with drain valves.
 1. Water Systems: Ball valve.

3.05 SPOOL PIECES

- A. Fabricate each spool piece in accordance with the "Pipe and Fittings Schedule".
- B. Supply two pipe caps with each spool piece. The pipe ends shall be capped when the spool piece is not in use.
- C. Internally polished "John Perry" type ferrules with sanitary Acme threads are required for spool pieces, caps and their respective connections.

PIPING SPECIALTIES

- D. Test spool pieces and caps in accordance with the "Pipe Testing Schedule".

3.06 UNION

- A. Threads shall be American National Standard Taper Pipe Threads.
- B. Union shall match piping pressure classification of adjoining piping.
- C. Unions shall be galvanically compatible to adjoining piping.

3.07 Manual Air Vent

- A. Install manual air vent at all high points in system. Provide 3/4" ball valve on inlet.

PIPING SPECIALTIES

AIR VENT SCHEDULE	
TAG	AV/1
SERVICE	HHW
CIRCULATING FLUID	WATER
LOCATION	SEE DRAWINGS
TYPE	HIGH CAPACITY FLOAT
MAX. PRESS., PSIG	150
MAX. TEMP., °F	250
INLET SIZE, IN.	3/4
OUTLET SIZE, IN.	3/8
CONNECTION TYPE	SCREWED
MATERIAL	
-BODY	CAST IRON
-BONNET	CAST IRON
-TRIM	STAINLESS STEEL, BRASS AND EDPM COMPONENTS
MANUFACTURER & MODEL NO.	BELL & GOSSETT, MODEL 107
	THRUSH, TACO
REMARKS	PROVIDE SHOP DRAWINGS
	FURNISH AND INSTALL WALL AND CEILING ACCESS DOORS FOR ALL CONCEALED EQUIPMENT.

232114-4

Piping Specialties

PHOTO LAB - DARKROOM RENOVATION

PURCHASE COLLEGE SUNY | 735 ANDERSON HILL RD. | VISUAL ARTS BUILDING | LA PLLC Project 2306

PIPING SPECIALTIES

DIELECTRIC FITTING SCHEDULE			
SERVICE	HHW		
TYPE	NIPPLE	UNION	UNION
SIZE, IN.	1/2 TO 4	2 & UNDER	2-1/2 & OVER
PIPE CONNECTION	SCREWED	SCREWED OR SOLDERED	FLANGED
MATERIAL	ELECTRO-ZINC PLATED STEEL	MALL. IRON OR WROUGHT IRON	MALL. IRON OR CAST BRASS
DIELECTRIC MATERIAL	THERMOPLASTIC COPOLYMER	EPCONITE NO. 1	EPCONITE NO. 1
MAX. PRESS. FITTING, PSIG	250	250	250
MAX. TEMP. FLUID, °F	180	210	210
MANUFACTURER & MODEL NO.	PERFECTION CORP.	EPCO SALES	EPCO SALES
ALTERNATE MANUFACTURERS	WATTS, HART, CLEAR FLOW		
REMARKS	PROVIDE SHOP DRAWINGS FITTINGS SHALL BE EMBOSSED WITH MANUFACTURER'S NAME *FOR LIQUIDS OTHER THAN THOSE LISTED, CONSULT WITH MANUFACTURER FOR PROPER SELECTION		

232114-5

Piping Specialties

PHOTO LAB - DARKROOM RENOVATION

PURCHASE COLLEGE SUNY | 735 ANDERSON HILL RD. | VISUAL ARTS BUILDING | LA PLLC Project 2306

PIPING SPECIALTIES

PIPE LINE STRAINER SCHEDULE (NON-HTHW)		
TAG	STR	STR
SERVICE	HHW	HHW
TYPE	"Y"	"Y"
PIPE SIZE, IN.	2 & UNDER	2-1/2 & UP
CONNECTION	SCREWED	FLANGED
MAX. TEMP., °F	406	353
MAX. PRESS., PSIG	CLASS 150	CLASS 150
MATERIAL		
-BODY	BRONZE	CAST IRON
-SCREEN	STAINLESS STEEL	STAINLESS STEEL
-SCREEN PERFORM., IN.		
-2-1/2 IN. & UNDER	0.033	
-2-1/2 TO 3		0.045
-4 TO 6		0.125
-8 TO 16		0.125
BLOW-OFF VALVE		
-TYPE	BALL	BALL
-SIZE, IN.	3/4	3/4
-MATERIAL	BRONZE	BRONZE
MANUFACTURER & MODEL NO.	SARCO BT	SARCO CI-125
ALTERNATE MANUFACTURERS	ARMSTRONG, MUELLER	ARMSTRONG, MUELLER
REMARKS	PROVIDE SHOP DRAWINGS WATER SYSTEMS (TO 200°F): PROVIDE HOSE CONNECTION ON DISCHARGE FROM BLOWDOWN VALVE	

END OF SECTION

232114-6

Piping Specialties

PHOTO LAB - DARKROOM RENOVATION

PURCHASE COLLEGE SUNY | 735 ANDERSON HILL RD. | VISUAL ARTS BUILDING | LA PLLC Project 2306

PIPING SYSTEM CLEANING

232115 PIPING SYSTEM CLEANING

PART 1 - GENERAL

1.01 WORK INCLUDED

A. Cleaning and degreasing of the following piping systems:

1. Heating Hot Water

1.02 QUALITY ASSURANCE

- A. Manufacturer's certification that materials meet or exceed the minimum requirements specified.
- B. Chemicals shall be EPA and/or local codes approved.

PART 2 - PRODUCTS

2.01 Products shall be as specified herein and shown on the Drawings.

PART 3 - EXECUTION

3.01 CLEANING AND DEGREASING

- A. Do not operate piping systems until all construction dirt and debris have been removed from the system.
- B. Engage the services of an approved, independent subcontractor who specializes in pipe cleaning and internal protective coating.
1. Implement the approved cleaning process. Supply all labor, materials and (pumping equipment) for this purpose.
 2. Keep a competent supervisor and/or equipment operator continuously at the site from commencement of his work until completion. None but experienced men shall operate this pumping equipment.
 3. Perform any repairs or servicing of components of these systems.
 4. Supply a listing of successful jobs completed over the last ten years, including names of mechanical contractors, persons who have applied the cleaning and coating application, as well as job locations.

232115-1

Pipe System Cleaning

PIPING SYSTEM CLEANING

- C. Clean the piping systems following the completion of the leak tests, as shown in the Piping System Testing and Cleaning Schedule, as follows:
1. Drain systems of test water.
 2. Remove control valves, permanent strainers and any other equipment which may become plugged during the cleaning process.
 - a. Provide all temporary connections, strainers for debris, etc.
 3. Provide all required chemicals.
- D. Cleaning Process
1. Provide a supervised program of cleaning and degreasing chemicals and corrosion inhibitors to be used in the systems prior to start-up.
 - a. Detergent with dispersant shall be an alkaline type containing polymers and dispersing agents. Rochester Midland: EQC-3 (Nalco, Drew).
 - b. Sufficient chemicals shall be added to the system to establish a concentration of 0.5% detergent dispersant compatible with piping systems.
 - c. In addition, sufficient inhibitors shall also be maintained in the system to prevent corrosion and to provide an internal protective coating (refer to Water Treatment Section).
 - d. Systems shall be circulated for a minimum of eight hours.
 - e. After the above referenced chemicals have circulated for eight hours, with pumps in operation for all circulating loops and make-up water open to the main loop, a bleed shall be opened on the main loop until bleed water runs clean and clear and pH is within a $\frac{1}{2}$ unit of that of make-up water, while at all times maintaining proper levels of corrosion inhibitor.
- E. At the conclusion of the cleaning process, remove all temporary strainers. Inspect and clean all permanent strainers, mudlegs, float and thermostatic traps and equipment low-point pockets prior to the systems being made operational, as many times as required until clean.
1. Install all control valves, permanent strainers and any other equipment removed for cleaning process.
 2. Charge system to the proper level of corrosion inhibitors.
 3. Add a propylene glycol solution to the Hot Glycol system as specified in the Heat

232115-2

Pipe System Cleaning

PIPING SYSTEM CLEANING

Transfer Section.

4. Refer to Water Treatment specification.
END OF SECTION

232115-3

Pipe System Cleaning

PHOTO LAB - DARKROOM RENOVATION

PURCHASE COLLEGE SUNY | 735 ANDERSON HILL RD. | VISUAL ARTS BUILDING | LA PLLC Project 2306

WATER TREATMENT

232500 WATER TREATMENT

PART 1 - GENERAL

1.01 WORK INCLUDED

- A. Provide chemical treatment equipment for the following water systems:
 - 1. Heating hot water
 - 2. Chilled water
- B. Engage the services of a qualified water treatment specialist, holding a college or university degree in chemistry or related fields with at least ten years experience, to establish the exact requirements for chemical treatment.
- C. One year treatment program, including service and chemicals. Coordinate with Nalco, campus's water treatment contractor.
- D. Acceptable water treatment firms shall be equal to:
 - 1. Nalco Water Company
 - 2. Rochester Midland
 - 3. Drew Industrial Division
- E. All chemicals are to be compatible with the existing water treatment.
- F. Chilled water system is to be filled with treated water before it is opened to campus wide system. Contractor to coordinate water treatment vendor with campus to confirm compatibility with existing water treatment system.
- G. Heating hot water system includes all existing air handlers, base building reheating coils, fan coils ect. Provide water treatment for the entire system. See existing flow diagram on drawing M-6023 for system information.

1.02 QUALITY ASSURANCE

- A. Manufacturer's certification that materials meet or exceed the minimum requirements specified.
- B. The standards of the PDI shall apply where applicable.
- C. Chemicals shall be EPA approved.
- D. Notwithstanding anything contained within these Specifications, the Contractor shall verify that all chemicals used are compatible with all of the equipment, piping, etc.,

232500-1

Water Treatment

WATER TREATMENT

connected to the heating hot water and are approved for use by the EPA and local authorities having jurisdiction.

- E. The Water Treatment Company shall have at least one officer of official holding a college or university degree in chemistry, chemical engineering, or sanitary engineering. The field representative should have at least ten years' experience in treating the water in systems of similar size and capacity, and be in active responsible charge of all treatment work.
- F. The company's laboratory shall be equipped to analyze samples in accordance with the standard methods for the examination of water and waste water of the American Water Works Association, American Public Health Association, Water Environment Federation and United States Environmental Protection Agency. The laboratory shall be CDC ELITE for testing of Legionella Bacteria.
- G. The company's service department shall be adequately equipped to perform monthly complete service visits by trained water treatment service representatives with appropriate State Pesticide Applicator's Certification.

1.03 QUALIFICATIONS OF THE MANUFACTURER

- A. The manufacturer's laboratory shall be located not more than four hours driving time from the project and shall be equipped to analyze water in accordance with the latest edition of "Standard Methods for the Examination of Water and Waste Water" published by the American Public Health Association and the Federal Water Pollution Control Federation.
- B. The laboratory must be under the full time supervision of professional chemists having at least an M.S. degree in chemistry.
- C. The laboratory shall be equipped, without subcontracting, to perform; metallographic examinations and analysis, corrosion test coupon studies and rate determinations in accordance with ASTM-D-2688-70(B).

1.04 SUBMITTALS

- A. Refer to Section 230100 for submittal procedures.

PART 2 - PRODUCTS

2.01 Products shall be as specified herein.

2.02 Provide complete water chemicals and service for water systems. Equipment, chemicals and service to be provided by an independent water treatment specialist who shall supervise the installation of the chemical feed equipment. Chemical treatment shall conform to all local codes and regulations.

WATER TREATMENT

2.03

A. Heating Hot Water

1. Closed water systems will be treated to the following requirements.
2. Nitrite based protective film-forming corrosion inhibitor and scale-suppressant designed to control pitting and corrosion in closed hot water and reheat hot water systems. Inhibitor shall remain effective at temperatures of 250 deg F. and above. Inhibitor shall not affect non-metallic materials in the closed systems.

3. Description

Appearance	Amber liquid
Specific Gravity	1.18
Weight	9.83 lb./gal.
pH	12.0 - 12.5
Solubility in Water	Complete
Freeze/Thaw Recovery	Complete

4. Control Range

- a. All systems 700-1,400 PPM as NO₂

5. Mfr., Product No. Rochester Midland, CLT-407 or equal

6. Microbiological growth should be controlled to less than 10² colonies/cc.

7. Sufficient product must be supplied for initial system charge and replenishment as needed up to 75% of total system water volume.

PART 3 - EXECUTION

3.01 The water treatment specialist shall be regularly engaged in this type of work and service. This firm shall provide the start-up of chemical treatment; instruct the Owner's operating personnel in the performance of control tests and their interpretation and supervise, through monthly visits (minimum), the progress of the water treatment program. Such service shall be provided during construction and for one full year after the Owner's acceptance of the facilities.

3.02 Provide all required chemicals for initial start-up treatments.

3.03 The chemical treatment manufacturer shall provide monthly field service visits as a minimum with additional visits as required by a qualified representative of the manufacture for the supervision of the chemical treatment program. A written report detailing treatment

232500-3

Water Treatment

WATER TREATMENT

conditions and including any necessary recommendations shall be submitted to the Owner following each service visit. In addition, quarterly laboratory analyses, corrosion tests and microbiological tests shall be provided to the Owner.

3.04 INITIAL CLEANOUT SPECIFICATIONS

Immediately after thoroughly draining and flushing, system shall be filled with fresh water and initial charge of the specified inhibitors or HVAC grade antifreeze as specified in these specifications under Treatment Specifications. At no time shall the system be filled with untreated water.

Four samples of system water shall be taken by the Contractor from each system dated with time of sampling noted; first one prior to addition of cleanout chemical, second one after addition of cleanout chemical during circulation, third one after draining and flushing system to verify cleanliness, and fourth one after initial charge of inhibitor and biocide have been added and circulated for a minimum of one hour to verify inhibitor level. Samples shall be analyzed completely for pH, detergent levels, inhibitor, total bacteria and suspended matter, with confirming reports issued to Contractor.

END OF SECTION

DUCTWORK

233100 DUCTWORK

PART 1 - GENERAL

1.01 WORK INCLUDED

- A. Duct materials, fabrication, openings, cleaning, and testing
- B. Ductwork and plenums
- C. Fasteners
- D. Flexible duct
- E. Sealants

1.02 QUALITY ASSURANCE

- A. Fabricate ductwork in accordance with latest SMACNA HVAC Duct Construction Standards.
- B. Except as otherwise specified on the Drawings, fabricate all ductwork to the following static pressure classes.
 - 1. Minimum: Four inch W.G. positive for all ductwork upstream of a VAV box.
 - 2. Minimum: Two inch W.G. negative for all exhaust ductwork.
 - 3. Minimum: Four inch W.G. negative for all duct downstream of an exhaust valve.
- 2. Variable-Air-Volume (VAV)(EAV) Systems
 - a. Minimum Four inch W.G. up to inlet of VAV terminal.
 - b. Minimum one inch W.G. on discharge side of VAV terminal.
- C. Construct and install ductwork to conform with latest
 - 1. NFPA 90A: Air Conditioning and Ventilating Systems.

1.03 SUBMITTALS

- A. Refer to Section 230100 for submittal procedures.
- B. Provide product specific manufacturer cut sheets with all proposed sizes and options indicated.
- C. Provide site specific drawings of proposed ductwork layout including heights accurately reflecting existing conditions, proposed duct sizes, equipment and all other associated items related to the ductwork system.

PART 2 - PRODUCTS

- 2.01** Equipment shall be of the type and size specified herein and listed in the Schedules.

233100-1

Ductwork

2.02 SEALANTS

- A. Verify shelf life of all sealants.
- B. Liquids
 - 1. Recommended for slip-type joints.
- C. Mastics
 - 1. Suitable for application as a fillet, in grooves or between flanges.
 - 2. Oil base caulking and glazing compounds are not acceptable.
- D. Gaskets
 - 1. Soft elastomer butyl or extruded sealants for use in flanged joints.
- E. Tapes
 - 1. Use of tapes shall comply with UL 181 tests.

PART 3 - EXECUTION

3.01 FABRICATION

- A. Sheet Metal Ducts
 - 1. Fabricate sheet metal ducts, casings and plenums in compliance with latest SMACNA HVAC Duct Construction Standards.
 - a. Basic Duct Construction - Chapter 1
 - b. Fittings and Other Construction - Chapter 2
 - c. Round, Oval and Flexible Duct - Chapter 3
 - d. Exterior Components - Chapter 5
 - e. Casings - Chapter 6
 - f. Function Criteria - Chapter 7
 - 2. Connect dissimilar metals with flanged joints made with fiber or neoprene gaskets to prevent contact between metals. Protect flange bolts with ferrules and washers made of same material as gaskets.
 - 3. Provide double-thickness turning vanes for all square elbows.

DUCTWORK

- a. In the event that the width of the duct leaving the elbow is different from the width entering the elbow, construct vane entering and leaving edges to

233100-3

Ductwork

PHOTO LAB – DARKROOM RENOVATION

PURCHASE COLLEGE SUNY | 735 ANDERSON HILL RD. | VISUAL ARTS BUILDING | LA PLLC Project 2306

DUCTWORK

project tangents parallel to the duct sides.

4. All ductwork sizes shown on Drawings are inside dimensions.
5. Provide one inch test wells in the following:
 - a. Air handling unit discharge and mixing box.
 - b. Fan discharge ducts.
 - c. Return fan suction ducts.
 - d. Air handling unit outdoor air intake.

B. Plenum Construction

1. Unless otherwise shown on contract drawings, provide casings and plenums of the designated pressure classification as specified herein.
2. Construction appropriate for the pressure classification shall be used.
3. All casing on the suction side of the fan shall be of 2" w.g. pressure classification.
 - a. Casing on fan discharge shall be of the designated pressure class.
4. All joints, seams, connections and abutments to building structure shall be sealed with suitable compounds or gaskets.
5. Drains shall have water seals not less than 2" w.g. greater than the maximum operating pressure in the chamber.
6. Pipe penetrations shall be sealed to prevent air leakage and condensation movement through the seal.
7. Casing material shall be of the same commercial grades as for ducts except that G90 coated galvanized steel shall be used in all chambers with moisture present.
8. Metal drain pans shall be of G90 coated galvanized steel.
9. All welds on casing interiors shall be painted.
10. Close off or safining sheets and strips shall be G90 galvanized steel of thickness of not less than that associated with duct widths and shall be securely attached.
 - a. Wall and roof deflection at rated pressure shall not exceed 1/8" per foot of width.

233100-4

Ductwork

DUCTWORK

11. Casing for negative pressures greater than 3" w.g. shall be constructed in accordance with the SMACNA Rectangular Industrial Duct Construction Standards.
12. Wherever possible casings shall be built in a rectangular box shape.
13. Single thickness Wall Construction
 - a. Single wall casings shall be constructed using continuous standing seam reinforced panels. The same gauge of metal shall be used on all sides.
14. Double Thickness Wall Construction
 - a. Double wall, factory or shop insulated casings shall be fabricated with a perforated inner liner.
15. Casing Access Doors
 - a. Except as required to permit replacement of larger equipment such as a fan motor, etc. duct access door size shall be limited to approximately 20 inches wide by 54 inches high.
16. Joint Sealing
 - a. All joints, seams and connections shall be sealed.
17. Drainage
 - a. Drainage facilities shall be provided in cooling coil and humidifier sections of the casing to handle condensation. Drains shall have deep seal traps.
 - b. The drain line shall be provided with a water seal at least 2 inches greater than the maximum static pressure in the casing.

3.02 INSTALLATION

A. General

1. Provide openings in ducts where required to accommodate controllers.
2. Provide pitot tube openings where required for testing of systems, complete with metal cap and spring device or screw to ensure against air leakage.
 - a. Where openings are provided in insulated ductwork, install insulation

233100-5

Ductwork

DUCTWORK

material inside a metal ring.

3. Locate ducts with sufficient space around equipment to allow normal operating and maintenance activities.
5. Seal space around ducts with non-combustible material at each point where ducts pass through partitions.
6. Cover all open ends of installed ductwork during construction.

B. Exhaust Ducts

1. General Exhaust Systems
 - a. Provide residue traps at base of vertical risers with provision for cleanout.
 - b. Provide cleanout access doors at all changes of direction in ducts and where shown on the Drawings.

C. Flexible Duct

1. Flexible duct may be used within the following limits:
 - a. Maximum length of 36 inches to an air outlet. Flexible duct cannot be used as a fitting. Provide sheet metal elbow for connection to outlet.

3.03 LEAKAGE TESTS

- A. Conduct duct leakage testing on all supply, return and exhaust ductwork greater than 2 square feet except downstream of VAV boxes or upstream of EAV boxes.
- B. All ductwork that is to be installed for future is to be tested at 4" W.G. for supply and 4" W.G. for return.
- C. Leakage tests shall be performed as specified in the latest edition of the SMACNA HVAC Air Duct Leakage Test Manual.
- D. Notify the Owner, in writing, five days in advance of the time leak tests are to be made.
- E. Submit electronic copy of the complete test report to the Owner.

3.04 CLEANING

- A. Remove all construction debris prior to operation of fans.

233100-6

Ductwork

DUCTWORK

1. Vacuum-clean the inside of all air handling equipment.
- B. Replace all dirty filters before systems are turned over to Owner.

233100-7

Ductwork

DUCTWORK

SMACNA DUCT SEAL AND LEAKAGE CLASS CLASSIFICATION SCHEDULE FOR SHEET METAL DUCTS	
DUCT PRESSURE CLASS, IN. W.G.	1/2 TO 10 POSITIVE AND NEGATIVE
SEAL CLASS	A
SEALING	ALL JOINTS & SEAMS ALL DUCT WALL PENETRATIONS
LEAKAGE CLASS, CFM/100 SQ. FT. DUCT SURFACE	
RECTANGULAR DUCT	4
ROUND DUCT	4

233100-8

Ductwork

PHOTO LAB – DARKROOM RENOVATION

PURCHASE COLLEGE SUNY | 735 ANDERSON HILL RD. | VISUAL ARTS BUILDING | LA PLLC Project 2306

DUCTWORK

DUCTWORK MATERIAL AND FABRICATION SCHEDULE		
DUCT MATERIAL	SPECIFICATION	SERVICE
GALVANIZED STEEL	ASTM A527 WITH ASTM A525 ZINC COATING DESIGNATION G90	ALL SYSTEMS
REMARKS	PROVIDE SHOP DRAWINGS	

233100-9

Ductwork

PHOTO LAB – DARKROOM RENOVATION

PURCHASE COLLEGE SUNY | 735 ANDERSON HILL RD. | VISUAL ARTS BUILDING | LA PLLC Project 2306

DUCTWORK

FLEXIBLE DUCT SCHEDULE	
TYPE	ROUND
CONSTRUCTION	CALENDERED FILM CORE, COATED SPRING STEEL WIRE HELIX, FIBERGLASS INSULATION, FIBERGLASS REINFORCED METALLIZED FILM LAMINATE VAPOR BARRIER.
MAX. OPERATING PRESS., IN. W.G.	10"
OPER. TEMP. RANGE, °F	50 TO 100
INSULATION	YES
INSULATION SPECS -MATERIAL -THICKNESS, IN. -R VALUE -VAPOR BARRIER	FIBERGLASS 2 8@ 70°F VINYL FILM
MANUFACTURER & MODEL NO.	THERMAFLEX M-KE
ALTERNATE MANUFACTURERS	CLEVEPAK, DAYCO
REMARKS	PROVIDE SUBMITTAL

END OF SECTION

233100-10

Ductwork

PHOTO LAB – DARKROOM RENOVATION

PURCHASE COLLEGE SUNY | 735 ANDERSON HILL RD. | VISUAL ARTS BUILDING | LA PLLC Project 2306

DUCT ACCESSORIES

233300 DUCT ACCESSORIES

PART 1 - GENERAL

1.01 WORK INCLUDED

- A. Splitter Damper
- B. Access door (AD)
- C. Fire damper with access door (FD/AD)
- D. Fire Smoke Damper
- E. Manual damper (VD)
- F. Variable-air-volume terminal unit (VAV)
- G. Exhaust air valve (EAV)

1.02 QUALITY ASSURANCE

- A. Fabricate accessories in accordance with SMACNA Duct Manuals and ASHRAE Handbooks.
- B. Accessories shall conform with NFPA 90A - Air Conditioning and Ventilating Systems.
- C. Fire Dampers shall be constructed in accordance with UL Standard 555.
 - 1. Fire dampers shall be UL labeled.
- D. Fusible links on fire dampers shall be constructed to UL Standard 33 - Fusible Links for Fire Protection Service.
- E. Combination Fire/Smoke dampers shall be constructed in accordance with UL Standard 555 and 555S.

1.03 SUBMITTALS

- A. Refer to Section 230100 for submittal procedures.
- B. Provide product specific manufacturer cut sheets with all proposed sizes and options indicated.
- C. Provide for shop fabricated assemblies including volume control dampers, duct access doors, and hardware used. Include electrical characteristics and connection requirements.

PART 2 - PRODUCTS

- 2.01 Provide equipment of the type, size and quantity specified herein, shown on the Drawings and listed in the Schedules.

233300-1

Duct Accessories

DUCT ACCESSORIES

2.02 VAV BOXES

- A. Provide shop drawings including sound data, box performance, and controls.
- B. Provide 120V-24V transformer.
- C. Controller to be provided by Siemens.
- D. Performance to be per ASHRAE 130-2008 and AHRI 880-2008.
- E. Provide multipoint averaging velocity sensor.
- F. Provide 22gauge casing with slip and drive or flanged discharge.
- G. VAV boxes to have access door before and after coil. Coordinate handedness before release.
- H. See heating coil section for requirements for factory mounted heating coils.
- I. Provide 1" fiber free EPFI (engineered polymer foam insulation) insulation.

2.03 EAV BOXES

- A. Provide shop drawings including sound data, box performance, and controls.
- B. All performance tests based on tests conducted in accordance with ASHRAE 130-2016 and AHRI 880-2017.
- C. Controller to be provided by approved controls vendor and mounted by factory.
- D. Furnish with integral 120v to 24 v transformer and disconnect.
- E. Valve shall be Accutrol AVC4000. Alternate manufacturers shall be Pheonix and Triatec.
- F. Valve shall have built-in BACnet MS/TP and on board airflow controller.

2.04 DUCT MOUNTED HEATING COILS

- A. Provide shop drawing.
- B. Hot water coil to be furnished with copper tube and aluminum fins.
- C. Provide submittal for hot water piping schematic including all valves controls and wiring.
- D. Fin count shall be less than 10 FPI.
- E. Provide access panels upstream and downstream of coil.

PART 3 - EXECUTION

- 3.01** Install items in accordance with manufacturer's printed instructions.

3.02 SPLITTER DAMPERS

- A. Fabricate splitter dampers of double thickness sheet metal to streamline shape, minimum 18 gauge.
- B. 1/4 inch diameter steel adjusting rod extending through side of duct.
- C. Metal grommet and thumb screw lock.

233300-2

Duct Accessories

DUCT ACCESSORIES

3.03 ACCESS DOORS

- A. Provide upstream and downstream duct access doors for servicing and maintaining duct-mounted equipment such as air flow measuring stations, smoke detectors, etc.

3.04 FIRE DAMPERS

- A. Install fire dampers in sleeves with perimeter mounting angles and breakaway joints.

3.05 FIRE SMOKE DAMPERS

- A. Install fire smoke dampers in sleeves with perimeter mounting angles and breakaway joints.

3.06 VAV BOXES

- A. Install per manufacturer's instructions.

3.07 DUCT MOUNTED HEATING COILS

- A. Install per manufacturer's instructions.

DUCT ACCESSORIES

ACCESS DOOR SCHEDULE	
TAG	AD
LOCATION	SEE DRAWINGS
SIZE	AS REQUIRED FOR SERVICE OR ACCESS, SEE ACCESS DOOR SIZING SCHEDULE BELOW
TYPE	DOUBLE CASED INSULATED
DUCTWORK PRESS. CLASS	1", W.G., 2" W.G., 4" W.G.,
CONSTRUCTION	
-FRAME	NO. 22 GA. GALV. STEEL W/1 IN. FLANGE & ½ IN. WIDE GASKET
-DOOR	NO. 22 GA. GALV. STEEL OUTER PANEL, 1 IN. THICK FIBERGLASS INSULATION, NO. 24 GA. GALV. STEEL INNER PANEL
-HINGE	HEAVY BRASS RIVETED OR CONTINUOUS ALUMINUM WITH REMOVABLE PIN
-FASTENER	HEAVY BRASS LATCH; VENT FABRICS, INC., MODEL NO. 260 VENTLOK LATCH DURODYNE, MODEL NO. SP-20
MANUFACTURER & MODEL NO.	AIR BALANCE INC., DUCTMATE OR CONTRACTOR FABRICATED
REMARKS	PROVIDE SHOP DRAWINGS PROVIDE TWO HINGES & LATCHES ON DOORS UP TO 30 IN. MAXIMUM DIMENSION PROVIDE THREE HINGES & LATCHES ON DOORS OVER 30 IN.

233300-4

Duct Accessories

PHOTO LAB – DARKROOM RENOVATION

PURCHASE COLLEGE SUNY | 735 ANDERSON HILL RD. | VISUAL ARTS BUILDING | LA PLLC Project 2306

DUCT ACCESSORIES

UNINSULATED ACCESS DOOR SCHEDULE	
TAG	AD
LOCATION	SEE DRAWINGS
SIZE	AS REQUIRED FOR SERVICE OR ACCESS, SEE ACCESS DOOR SIZING SCHEDULE BELOW
TYPE	UNINSULATED
DUCTWORK PRESS. CLASS	1", W.G., 2" W.G., 4" W.G.,
CONSTRUCTION	
-FRAME	NO. 22 GA. GALV. STEEL W/1 IN. FLANGE & ½ IN. WIDE GASKET
-DOOR	HEAVY BRASS RIVETED OR CONTINUOUS ALUMINUM WITH REMOVABLE PIN
-HINGE	HEAVY BRASS LATCH; VENT FABRICS, INC., MODEL NO. 260 VENTLOK LATCH
-FASTENER	DURODYNE, MODEL NO. SP-20
MANUFACTURER & MODEL NO.	AIR BALANCE INC., DUCTMATE OR CONTRACTOR FABRICATED
REMARKS	PROVIDE SHOP DRAWINGS PROVIDE TWO HINGES & LATCHES ON DOORS UP TO 30 IN. MAXIMUM DIMENSION PROVIDE THREE HINGES & LATCHES ON DOORS OVER 30 IN.

233300-5

Duct Accessories

PHOTO LAB – DARKROOM RENOVATION

PURCHASE COLLEGE SUNY | 735 ANDERSON HILL RD. | VISUAL ARTS BUILDING | LA PLLC Project 2306

DUCT ACCESSORIES

ACCESS DOOR SCHEDULE	
LOCATION OR SERVICE DESCRIPTION	SIZE, IN.*
SERVICE AND ACCESSIBILITY TO FIRE DAMPER AND FUSIBLE LINKS	24 x 24
ENTRY TO MIXING PLENUMS OF AIR HANDLING UNITS	66 x 24
INLET PLENUM OF SWSI FANS	30 x 30
UPSTREAM AND DOWNSTREAM IN-LINE FANS	30 x 30
INLET SIDE OF AIR FLOW MEASURING STATIONS	24 x 24
INLET SIDE OF REHEAT COILS	12 x 12
SERVICE AND ACCESS TO AUTOMATIC DAMPERS	24 x 24
EXHAUST DUCT CLEANOUT	8 x 12

*IF DUCT SIZE IS LESS THAN ACCESS DOOR SIZES INDICATED, PROVIDE ACCESS DOOR SIZE 2 IN. SMALLER THAN WIDTH OF DUCT.

233300-6

Duct Accessories

PHOTO LAB – DARKROOM RENOVATION

PURCHASE COLLEGE SUNY | 735 ANDERSON HILL RD. | VISUAL ARTS BUILDING | LA PLLC Project 2306

DUCT ACCESSORIES

FIRE/SMOKE DAMPER COMBINATION SCHEDULE	
TAG	FSD
SERVICE	SUPPLY / RETURN / EXHAUST DUCTWORK
LOCATION	SEE DRAWINGS
TYPE	RECTANGULAR DUCT , BLADE PACKAGE OUT OF AIR STREAM
UL LISTING	UL 555 AND UL 555S
UL CLASSIFICATION	1-1/2 HR. DYNAMIC RATED FIRE DAMPER
LEAKAGE CLASS	1
MOUNTING	HORIZONTAL OR VERTICAL
SIZE, IN.	SEE DRAWINGS
CONSTRUCTION -BLADES -FRAME -ELECTRIC "FUSE" LINK SWITCH SETTING -LINKAGE	IN CONFORMANCE WITH UL 555 AND UL 555S NO. 16 GAUGE GALVANIZED THIN PLATE, OVERLAPPED 5 IN. x 16 GAUGE GALVANIZED USE 212 DEG. F. ON SMOKE PURGE SYSTEMS ONLY USE 165 DEG. F. ON ALL OTHER SYSTEMS CONCEALED IN FRAME
SLEEVE	IN CONFORMANCE WITH MANUFACTURERS REQUIREMENTS
MANUFACTURER & MODEL NO. -FIRE DAMPER	RUSKIN, MODEL FSD37 ARLAN, PREFCO, GREENHECK
REMARKS	PROVIDE SHOP DRAWINGS PROVIDE WITH NORMALLY-CLOSED ELECTRIC ACTUATOR (POWER TO OPEN)

233300-7

Duct Accessories

PHOTO LAB – DARKROOM RENOVATION

PURCHASE COLLEGE SUNY | 735 ANDERSON HILL RD. | VISUAL ARTS BUILDING | LA PLLC Project 2306

DUCT ACCESSORIES

FIRE DAMPER/ACCESS DOOR SCHEDULE (ROUND DUCT)	
TAG	FD/AD
SERVICE	SUPPLY / RETURN / EXHAUST DUCTWORK
LOCATION	SEE DRAWINGS
TYPE	DYNAMIC CURTAIN – ROUND DUCT, BLADE PACKAGE OUT OF AIR STREAM
UL LISTING	UL 555
UL CLASSIFICATION	¾ HR OR 1-1/2 HR. DYNAMIC RATED FIRE DAMPER
MOUNTING	HORIZONTAL OR VERTICAL
SIZE, IN.	SEE DRAWINGS
CONSTRUCTION	IN CONFORMANCE WITH UL 555
-BLADES	CURTAIN TYPE NO. 24 GAUGE GALVANIZED STEEL
-ENCLOSURE	NO. 20 GAUGE GALVANIZED STEEL
-FUSIBLE LINK SETTING	USE 165°F. ON ALL OTHER SYSTEMS
-SPRINGS	HORIZONTAL AND VERTICAL CLOSURE SPRINGS TO ASSURE CLOSURE UNDER OPERATING AIR FLOW CONDITIONS
SLEEVE	IN CONFORMANCE WITH MANUFACTURERS INSTALLATION REQUIREMENTS
MANUFACTURER & MODEL NO.	RUSKIN, MODEL D-IBD2, STYLE C
REMARKS	ARLAN, PREFCO, GREENHECK PROVIDE SHOP DRAWINGS PROVIDE CLOSURE SPRINGS AND LATCHES FOR HORIZONTAL INSTALLATION

233300-8

Duct Accessories

PHOTO LAB – DARKROOM RENOVATION

PURCHASE COLLEGE SUNY | 735 ANDERSON HILL RD. | VISUAL ARTS BUILDING | LA PLLC Project 2306

DUCT ACCESSORIES

FIRE DAMPER/ACCESS DOOR SCHEDULE (RECT. DUCT)	
TAG	FD/AD
SERVICE	SUPPLY / RETURN / EXHAUST DUCTWORK
LOCATION	SEE DRAWINGS
TYPE	DYNAMIC CURTAIN – RECTANGULAR DUCT
UL LISTING	UL 555
UL CLASSIFICATION	¾ HR OR 1.5 HR. DYNAMIC RATED FIRE DAMPER
MOUNTING	HORIZONTAL OR VERTICAL
SIZE, IN.	SEE DRAWINGS
CONSTRUCTION -BLADES -ENCLOSURE -FUSIBLE LINK SETTING -SPRINGS	IN CONFORMANCE WITH UL 555 CURTAIN TYPE NO. 16 GAUGE GALVANIZED STEEL NO. 16 GAUGE GALVANIZED STEEL USE 165°F. ON ALL OTHER SYSTEMS HORIZONTAL AND VERTICAL CLOSURE SPRINGS TO ASSURE CLOSURE UNDER OPERATING AIR FLOW CONDITIONS
SLEEVE	IN CONFORMANCE WITH MANUFACTURERS INSTALLATION REQUIREMENTS
MANUFACTURER & MODEL NO.	RUSKIN, MODEL DFD35
ALTERNATE MANUFACTURERS	ARLAN, PREFCO, GREENHECK
REMARKS	PROVIDE SHOP DRAWINGS PROVIDE CLOSURE SPRINGS AND LATCHES FOR HORIZONTAL INSTALLATION

END OF SECTION

233300-9

Duct Accessories

PHOTO LAB – DARKROOM RENOVATION

PURCHASE COLLEGE SUNY | 735 ANDERSON HILL RD. | VISUAL ARTS BUILDING | LA PLLC Project 2306

AIR OUTLETS

233700 AIR OUTLETS

PART 1 - GENERAL

1.01 WORK INCLUDED

- A. Air devices (diffusers, grilles and registers)

1.02 QUALITY ASSURANCE

- A. Design and performance of air devices shall comply with applicable provisions of the Air Diffusion Council Standards and recommendations.
- B. Manufacturer shall certify catalog performance data and ensure correct application of air outlet types.

1.03 SUBMITTALS

- A. Shop drawing submittals for each type of air device shall include:
 - 1. Identification tag, model number, size, CFM and pressure drop.
 - 2. Sound power level at design point.
 - 3. Throw and drop at design point.
 - 4. Material and finish.
 - 5. Frame or border type.
 - 6. Accessories.

PART 2 - PRODUCTS

- 2.01 Provide products of the type, size, quantity and finish specified herein, shown on the Drawings and listed in the Schedules.

PART 3 - EXECUTION

- 3.01 Check location of outlets and make necessary adjustment in position to conform with architectural features, symmetry and lighting arrangement.
- 3.02 Install all items in accordance with manufacturer's printed instructions.

END OF SECTION

233700-1

Air Outlets

DIVISION 26

ELECTRICAL

TABLE OF CONTENTS

DIVISION 26 - ELECTRICAL

<u>SECTION NO.</u>	<u>TITLE</u>	<u>PAGE</u>
260100	BASIC ELECTRICAL REQUIREMENTS	260100-1
260500	BASIC ELECTRICAL MATERIALS AND METHODS	260500-1
260509	SUPPORTING DEVICES	260509-1
260511	REQUIREMENTS FOR ELECTRICAL INSTALLATIONS	260511-1
260519	WIRES AND CABLES BELOW 600 VOLTS	260519-1
260526	GROUNDING	260526-1
260529	FASTENERS, ATTACHMENTS AND SUPPORTING DEVICES	260529-1
260530	CONDUIT RACEWAYS	260530-1
260532	CABINETS, BOXES AND FITTINGS	260532-1
260553	ELECTRICAL IDENTIFICATION	260553-1
260800	ELECTRICAL COMMISSIONING	260800-1
260923	LIGHTING CONTROL DEVICES	260923-1
262716	CABINETS AND ENCLOSURES	262419-1
262726	WIRING DEVICES UNDER 600 VOLTS	262726-1
262813	FUSES	262813-1
262816	CIRCUIT DISCONNECTS – BELOW 600 VOLTS	262816-1
265100	INTERIOR LIGHTING	265100-1

BASIC ELECTRICAL REQUIREMENTS

260100 BASIC ELECTRICAL REQUIREMENTS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification Sections, apply to this and the other sections of Division 26.
- B. Where items of General Conditions are repeated in this Section of these Specifications, it is intended to qualify or to call particular attention to them; it is not intended that any other parts of the General Conditions shall be assumed to be omitted if not repeated herein.

1.02 DEFINITIONS

- A. "The Contractor" means specifically the Contractor working under the Contract.
- B. "Provide" means to supply, erect, install, and connect up in complete readiness for regular operation, the particular work referred to.
- C. "Furnish" means to supply and deliver to the job.
- D. "Conduit" includes, in addition to conduit, all fittings, boxes, hangers, and other accessories related to such conduit.
- E. "Concealed" means hidden from sight as in chases, furred spaces, shafts, hung ceilings, or embedded in construction.
- F. "Exposed" means "not concealed" as defined above. Work in trenches, crawl spaces, and tunnels shall be considered "exposed" unless otherwise specifically noted.
- G. "Approved equal" means any equipment or material which, in the opinion of the Design Professional, is equal in quality, durability, appearance, strength, design, performance, physical dimensions, and arrangement to the equipment or material specified, and will function adequately in accordance with the general design and is made in the USA within 500 miles from the project site.
- H. "Governmental" means all municipal, state and federal governmental agencies.

BASIC ELECTRICAL REQUIREMENTS

- I. Where any device or part of equipment is herein referred to in the singular number (such as "the pump"), such reference shall be deemed to apply to as many such devices as are required to complete the installation as shown on the Drawings.
- J. "Contractor" means the Contractor doing electrical work.
- K. Wherever the words "Plan" or "Plans" are used under this Contract, it shall also mean "Drawing" or "Drawings".
- L. Design Professional shall mean the firm of:
LIZARDOS ENGINEERING ASSOCIATES, P.C.
200 OLD COUNTRY ROAD
MINEOLA, NEW YORK 11501-4207

1.03 PERMITS AND INSPECTIONS

- A. The Contractor shall procure and pay for all certificates, fees, tests, inspections, bonds, deposits, and escrow accounts required for complete installation of the work.
- B. All necessary permits shall be secured by and at the cost and expense of the Contractor who shall give all notices required by law, ordinances, or the rules and regulations of the various Bureaus or Departments, and also as a part of the Contract, and without extra charge or compensation, shall comply with all orders of the Local Department of Buildings, County Department of Health, Fire Marshal, etc., which shall be issued in compliance with ordinances or regulations existing at the time bids are presented by any or all of said Departments as applying to the work of the Contract.
- C. Wherever in these specifications the name of an official, bureau or department is mentioned, it is intended to mean the official, bureau or department having jurisdiction under the Local, County and State Laws.
- D. Attention is called to certain provisions of the State Building Code regarding support of walls adjoining scaffolding, floors to be filled in or covered, protection of floor openings, overloading, etc., which provisions shall be complied with.
- E. Deliver to the Owner's Representative all permits and certificates of approval issued by all Town, County, and State agencies having jurisdiction in connection with this work before the certificate for the final payment is issued.

BASIC ELECTRICAL REQUIREMENTS

- F. Furnish and hang, in a glazed metal frame, the Town, County, and State official equipment use permit.
- G. Comply with the requirements of Article 10 of New York State Labor Law, Rule No.23, Industrial Code, State of New York Department of Labor, latest edition, and all amendments thereof, insofar as the provision of such law is applicable to the work.
- H. Equipment Use Permits shall be obtained by the Contractor in accordance with Town, County, and State Code.
- I. Royalties
 - 1. Obtain all necessary allowance and pay all royalties in connection with the use of any patented devices or lawsuits arising from such use.
- J. Applications
 - 1. Assist the Owner in the preparation of any applications or forms referring to the work which the Owner desires or is required to file.
- K. No work shall be covered over until tests have been performed and the authorities having jurisdiction have examined, inspected and approved the tests and the work. The Contractor, through its agent, will provide all controlled inspections required by the regulations of Town, County, and State. The controlled inspections will be made by an inspector meeting the professional requirements set forth by State and Local Law. Controlled inspections shall be carried out in accordance with applicable Town, County, and State Building Code Sections. The Engineer or Architect employed by the Contractor will file all initial amendments, properly executed before work commences and all final amendments immediately upon completion of work. A copy of each approved amendment shall be forwarded to the Owner's Representative. Initial amendments must be on file before work commences and final amendments must be on file before final acceptance of the work. All Contractors shall notify in writing the Engineer designated for controlled inspection five (5) days before the specific work item commences.
- L. Thereafter, it will be the Contractor's responsibility to keep up with the progress of the work. The inspections and tests performed under controlled inspection shall in no way relieve the Contractor of his responsibility to construct in accordance with drawings and specifications.

BASIC ELECTRICAL REQUIREMENTS

1.04 CODES AND STANDARDS

A. Codes

1. All work installed under this Division shall comply with all Local, State and Federal Codes and the requirements of any other authorities having jurisdiction. At the completion of the work, secure certificates of approval from the various authorities having jurisdiction and deliver same to the Design Professional.

B. Standards

1. State Uniform fire Prevention and Building Code
2. State Energy Code
3. NFPA National Fire Protection Association
4. ASME American Society of Mechanical Engineers
5. ANSI American National Standards Institute
6. ASTM American Society for Testing Materials
7. NEMA National Electrical Manufacturers Association
8. UL Underwriters Laboratories
9. NEC National Electric Code

C. Safety and Health Regulations

1. The Contractor shall comply with the Department of Labor, Safety and Health Regulations for construction promulgated under the Occupational Safety and Health Act of 1970 (PL 91-596) and under Section 107 of the Contract Work Hours and Safety Standards Act (PL 91-54), including all the installation procedures, methods, conditions and requirements in effect at the time the work is to be performed.
2. Existing hazardous materials during the course of the work:
 - a. Should any existing construction materials be encountered which are listed by Local, State and Federal Agencies as being hazardous for health or safety, the Contractor shall stop work and consult Owner for directions. The Owner's hazardous materials consultant shall determine if such materials should be removed, enclosed, or encapsulated as required by regulatory agencies in strict conformance with their procedures. The removal and disposal of the existing lead cables by this Contractor shall be performed in accordance with all local, state and Federal agencies.

BASIC ELECTRICAL REQUIREMENTS

3. Asbestos-containing materials shall be not be used on this project.
4. All pertinent precautions for accident prevention recommended by the Local Building Trades Employers Association, or by State or Local Laws and Regulations, shall be considered to form a part of the Contract Work.
5. First Aid
 - a. Provide, at site, kit of articles and medications for supplying first-aid treatment to anyone injured in connection with the work.
 - b. Make kit available for use by other Contractors working on site.
6. Reports of Accidents and Claims
 - a. Submit promptly, on printed forms, reports of all accidents arising out of performance of Contract work.
 - b. Furnish full details, including statements of witnesses, if any.
 - c. Report immediately all accidents resulting in death, serious personal injury or serious property damage.
7. If any claim is made against the Contractor as the result of any accident, the Contractor shall submit the facts, in written report, giving full details of claims.

1.05 INDEMNIFICATION

- A. Pay all royalties and defend all suits or claims for infringement of any patent rights and save the Owner harmless from loss on account thereof.
- B. If process or article specified is an infringement of a patent, promptly notify the Design Professional in writing, and any necessary changes shall be as provided in the Contract for changes in the work. If the Contractor performs any work specified knowing it to be an infringement of patent, he shall bear all costs arising therefrom.
- C. Take out all necessary insurance, free of extra charge, and agree to indemnify and save harmless the party contracting for services against loss or expense, by reason of the liability imposed by law upon such party for damages because of bodily injuries, including death at any time resulting therefrom, accidentally sustained by any person or persons or on account of damage to property arising out of or in consequences of the performance of this Contract, whether such injuries to persons or damage to property are due or claimed to be due to any negligence in the performance of the

BASIC ELECTRICAL REQUIREMENTS

Contract, the party contracting for services, employees or agents, or any other person.

1.06 INTENT

- A. It is the intention that these Specifications and drawings accompanying same shall provide for the work as specified and shown. Any work shown on the drawings and not particularly described in the Specifications, or vice-versa, or any work or changes which may be evidently necessary to complete the installation shall be provided as being included in the Contract.
- B. Where no specified manufacturer or quality of material is given, a first-class standard article as approved by the Design Professional shall be furnished. The drawings and specifications do not undertake to illustrate or set forth every item necessary for the work, as it is assumed that with his bid submissions, the Contractor acknowledges that he is expert in the several lines of the work and is capable on interpreting them.
- C. Small details not shown or specified, but necessary for proper installation and finishing, shall be included in the estimate, the same as if herein specified or shown.

1.07 DRAWINGS

- A. The Drawings are generally diagrammatic and are intended to convey the scope of work and indicate general arrangement of equipment, conduits, piping, fixtures, lighting controls, fire alarm devices, etc.
- B. The locations of all items shown on the Drawings or called for in the Specifications that are not definitely fixed by dimensions are approximate only. The exact locations necessary to secure the best conditions and results must be determined at the project and shall have the approval of the Design Professional before being installed.
- C. Follow Drawings in laying out work and check to verify spaces in which work will be installed. Maintain maximum headroom and space conditions at all points. Where headroom and space conditions appear inadequate, Design Professional shall be notified before proceeding with installation.
- D. If directed by the Design Professional, without extra charge, make reasonable modifications in the layout as needed to prevent conflict with work of other trades or for proper execution of the work.

BASIC ELECTRICAL REQUIREMENTS

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

1.08 INTERPRETATION OF DRAWINGS AND SPECIFICATIONS

- A. Any questions or disagreements arising as to the true intent of this Specification or the Drawings or the kind and quality of work required thereby shall be decided by the Design Professional, whose interpretations thereof shall be final, conclusive, and binding on all parties.
- B. In case of disagreement between Drawings and Specifications, or within either document itself, the better quality, greater quantity or more costly work shall be included in the Contract Price and the matter referred to the Design Professional's attention for decision and/or adjustment.
- C. Maintain an awareness to avoid conflict with existing conditions.
- D. Purchase the equipment and material required in accordance with field measurements taken at the proper time during the construction progress.

1.09 EQUIPMENT AND MATERIALS

- A. The words "or approved equal" shall be understood to apply only to those items of equipment and material listed under the paragraph "List of Approved Manufacturers" or as otherwise indicated on the Drawings or in the Specifications.
- B. Within ten (10) working days after the acceptance of the proposal, and prior to the submission of any shop drawings for review, a complete list of manufacturers shall be submitted to the Design Professional of all equipment and materials proposed for the work. No reviews will be rendered on shop drawings submitted before the complete list of manufacturers is reviewed.
- C. If material or equipment is installed before the Contractor obtained "No Objections" comment from the Design Professional, trade installing same shall be liable for the removal and replacement at no extra charge to the Owner if, in the opinion of the Design Professional, the material or equipment does not meet the intent of the Drawings and Specifications.
 - 1. The words "or approved equal" are understood as follows:
 - a. The name of any manufacturer, vendor, equipment of materials;

BASIC ELECTRICAL REQUIREMENTS

- b. Any trade name, plate number, or catalog number;
 - c. Any detailed description used to define equipment or material; except where otherwise indicated on the Drawings or in the Specifications.
- 2. It is the intent of these Specifications that wherever a manufacturer of a product is specified, and the terms "other approved" or "or approved equal" are used, the substituted item must conform in all respects to the specified item. Consideration will not be given to claim that the substituted item meets the performance requirements with lesser construction. Performance as delineated in schedules and in the Specifications shall be interpreted as minimum performance.
- D. All equipment and materials required for installation under these Specifications shall be new and without blemish or defect. All electrical equipment shall bear labels attesting to Underwriters Laboratories and Factory Mutual approval. Where no specific indication as to the type of quality of the material or equipment is indicated, a first class standard article shall be furnished, material to be delivered knocked-down where necessary for entrance into the building.
- E. Where it is proposed to use an item of equipment other than that specified or detailed on the Drawings which requires any redesign of the structure, partitions, piping, wiring, or of any other part of the mechanical, electrical, or architectural layout, all such redesign, and all new drawings and detailing required therefore shall, with the review of the Design Professional and subsequent comments by the Design Professional "No Substitution" or "Approved as Noted" on the shop drawings, be prepared at no additional cost to the Owner.
- F. Where such deviation from contract documents requires a different quantity and arrangement of equipment, piping, wiring, and conduit, etc., from that specified or indicated on the Drawings, furnish and install any such equipment, piping, structural supports, insulation, controllers, motors, starters, electrical wiring, and conduit, and any other additional equipment required by the system at no additional cost to the Owner.
- G. All equipment of one type (such as switchgear, panels, wiring devices, etc.) shall be the product of the same manufacturer.
- H. Note that the comments "No Exception" or "Exception as Noted" marked on the shop drawings or other information submitted in accordance with the requirements hereinbefore specified does not assure that the Design Professional or any other Owner's representative attests to the dimensional

BASIC ELECTRICAL REQUIREMENTS

accuracy or dimensional suitability of the material or equipment involved or the mechanical performance of equipment.

Comment on the shop drawings does not invalidate the Plans and Specifications if the shop drawings are in conflict with the Plans and Specifications.

1.10 REVIEW OF MATERIALS AND EQUIPMENT

A. Submissions and Shop Drawings

1. Submit complete and accurate Shop Drawings consisting of roughing drawings, manufacturer's shop drawings, field drawings, cuts, bulletins, and method of installation of all materials, and all equipment shown on the Drawings and specified, prior to procurement or fabrication.
2. Review and stamp indicating approval and submit, with reasonable promptness and in orderly sequence, so as to cause no delay in the work of any other Contractor, all Shop Drawings and Samples required by the Contract Documents or subsequently by the Design Professional. Shop Drawings and samples shall be properly identified as specified, or as the Design Professional may require. At the time of submission, the Contractor shall inform the Design Professional, in writing, of any deviation in the Shop Drawings or samples from the requirements of the Contract Documents.
3. By approving and submitting Shop Drawings and Samples, the Contractor thereby represents that he has determined and verified all field measurements, field construction criteria, materials, catalogue numbers and similar data, or will do so, and that he has checked and coordinated each Shop Drawing and Sample with the requirements of the work and of the Contract Documents and has coordinated his work with all trades and all other Contractors.
4. Samples shall be submitted in duplicate to the Design Professional with all shipping charges prepaid.
5. Submit eight (8) copies of all catalogue cuts. Submit two (2) white prints and one (1) reproducible transparency of all Drawings prepared in multiples of 8-1/2" x 11". All corrected shop drawings will be returned by the Design Professional.
6. Provide on each Drawing a clear space for stamp: "Date Received", "Approved", "Approved as Noted", "Disapproved", and "Resubmit".
7. After completion of checking, the Design Professional will obtain prints of the transparency for his record and will return the transparency to the Contractor.

BASIC ELECTRICAL REQUIREMENTS

8. Drawings Returned "Resubmit" or "Disapproved": The original drawing shall be corrected, and a new transparency reproduction made and resubmitted until final approval is obtained.
9. Drawings Returned "Approved" or "Approved as Noted": The Contractor shall obtain and provide such number of prints as is required for field distribution.
10. The Contractor's responsibility for shop drawings includes his responsibility for correctness of shop drawings and the coordination of shop drawings of each trade with those of all other trades wherein the work of the one or another is involved or affected. The Design Professional's check will cover only general design.
11. As part of the work, sleeve drawings, equipment base, and foundation drawings shall be prepared and distributed for coordinating purposes.
12. Shop Drawings at the time of submission shall bear evidence with an accompanying transmittal letter that such drawings have been checked by the Contractor. Any drawings submitted not in accordance with this procedure will be returned to the Contractor for resubmission and will not be considered. In such event, it will be deemed that the Contractor has not complied with the provisions herein specified and shall bear the risks of all delays as if no drawings had been submitted at all.
13. The Contractor shall prepare composite shop drawings and installation layouts, when required, to solve tight field conditions. Such drawings are to consist of dimensioned plans and elevations, and must give complete information, particularly as to size and location of sleeves, inserts, attachments, openings, pipes, sprinkler heads, conduits, underground conduit banks, ducts, lighting fixtures, boxes, structural interferences, etc. Prepare complete scale working drawings and sections, clearly showing how the work is to be installed in relation to work of other trades. The scale of the drawings shall be $3/8" = 1'-0"$ or as directed by the Design Professional. If work is installed before coordinating with other trades, or as to cause interference with work of other trades, the Contractor shall make changes necessary to correct the condition without extra charge.
14. These composite shop drawings and field installation layouts shall be coordinated in the field by the Contractor and his Sub-Contractors and all other Contractors for proper relationship to the work of other trades, based on field conditions, and shall be checked for accuracy and approved by them before submission to the Design Professional for his final approval. The Contractor shall have competent technical personnel readily available for such coordinating and checking as well as for accordance with the shop drawings and field installations as determined by him to be correct and carrying the Design Professional's stamp of approval.

BASIC ELECTRICAL REQUIREMENTS

15. Prepare sleeve drawings, showing the locations of all sleeves both horizontal and vertical. Location of sleeves shall be dimensioned from center line of columns and in the elevation from the underside of slab and from finished floor. Sleeve drawings will not be checked by the Design Professional. The responsibility for the accuracy of the drawings rests with the Contractor preparing same.
16. The costs of preparing all of the above listed drawings and prints of same shall be borne by the Contractor.
17. All Shop Drawings and Samples shall be identified as follows:
 - Name of Project
 - Name of Contractor
 - Name of Supplier
 - Job Number
 - Reference to Specification Section and/or Drawing Number
18. In addition, samples shall have additional information, as may be required, to establish characteristics such as finish, color, texture, gauge or thickness, weight, etc.
19. The Shop Drawing and Sample Identification label shall include sufficient blank space for approval stamps, including 2" wide x 3" high for the Design Professional's approval stamp.

B. Approval of Submissions

1. The Design Professional will review and approve shop drawings and samples, but only for conformance with the design concept of the project and with the information given in the Contract Documents. The Design Professional's approval of a separate item shall not indicate approval of an assembly in which the item functions.
2. The Design Professional's Approval is for design only. The Contractor is responsible for dimensions, field measurements, quantities, and coordination with other trades. Approval does not authorize change to Contract requirements.
3. The approval of shop drawings, composite drawings and samples shall not be construed as an order for extra work. Such claims shall be made in accordance with Contract Conditions.
4. Failure of any sample to pass the specified test or tests shall be sufficient cause for refusal to consider any further sample of the same brand or manufacturer.
5. After the shop drawings are "Approved," record copies of all data for maintenance and operating instructions shall be accumulated.

C. Resubmission of Submissions

BASIC ELECTRICAL REQUIREMENTS

1. The Contractor shall make any corrections required by the Design Professional and shall resubmit the required number of corrected copies of shop drawings or new samples until approved. The Contractor shall direct specific attention in writing or on resubmitted shop drawings to revisions other than the corrections requested by the Design Professional on previous submissions.

D. Execution of Work

1. No work requiring a shop drawing or sample submission shall be commenced until the submission has been approved by the Design Professional. All such work shall be in accordance with approved shop drawings and samples.
2. After shop drawings and samples have been approved, no changes will be permitted unless satisfactory evidence is presented to and approved by the Design Professional that the manufacturer cannot make scheduled delivery of approved material, or that material developed has been rejected and the substitution of a suitable material is an urgent necessity, or that other conditions become apparent which indicate the approval of changes to be in the best interest of the Owner.

E. Packaged Equipment

1. Where packaged (factory assembled) mechanical and electrical equipment is furnished, a certificate shall be included with the submission of shop drawings or catalog data stating that the equipment complies with OSHA, National Electric Code, and applicable Underwriters Laboratories Standards in respect to motor protection, grounding and protection against hazards, and is approved by all Regulatory Agencies.

F. Products

1. Products of the specified "EQUIPMENT" AND "MATERIALS" manufacturers may be considered as acceptable for use on this Project, provided that such products conform to Specification Requirements as hereinafter set forth. Whenever a manufacturer's name is mentioned, it shall only serve as a guide to a possible source of supply. Before submitting a bid, verify that the named manufacturers can, in fact, comply with the specification requirements. Assume all responsibility for the source of supply.
2. Where several "MATERIALS" are specified by name, the Design Professional shall have the right, before execution of the Contract, to

BASIC ELECTRICAL REQUIREMENTS

require any and all bidders to state the materials upon which they based their bid. Where any materials are specified by name or trade name, or by catalog number of a company or companies, without the words "or equal" or "similar to," the Contractor shall furnish the article mentioned, unless approval of the Design Professional is obtained in writing for a substitution. Should the Contractor desire to substitute another material for one or more specified by name, he shall apply in writing for such permission and state credit or extra involved. He shall also provide supporting data and samples for Design Professional's consideration.

3. Unless particularly specified otherwise, all manufactured articles, materials and equipment shall be applied, assembled, installed, connected, erected, used, cleaned and conditioned as directed by the manufacturer and including the necessary preparation to properly install the work. Where reference is made to manufacturer's directions, the Contractor shall submit such directions to the Design Professional as required.

G. Equivalents

1. The mention of apparatus, articles, or materials by trade name, and such specific description of same as is made, with the words "similar to" or "or equal", is intended to convey to the Contractor's understanding, the degree of excellence required. An article of material which will conform substantially to the standard of excellence established and furnish an article of equivalent merit, strength, durability and appearance to perform the required functions, is deemed to be eligible for offer.

H. Material and Equipment List

1. Within ten (10) days after the date of award of the Contract, the Contractor shall submit for approval a complete list of suppliers, materials, and equipment proposed for use in connection with the project. After ten (10) days, no changes for approved materials and equipment will be considered. Partial lists submitted from time to time will not be considered.
2. After any material or piece of equipment has been approved, no change in brand or make will be permitted unless satisfactory written evidence is presented and approved by the Design Professional that the manufacturer cannot make scheduled delivery of approved material, or that material delivered has been rejected and the substitution of a suitable material is an urgent necessity, or that other

BASIC ELECTRICAL REQUIREMENTS

conditions have become apparent which indicate that the approval of such other material is in the best interest of the Owner.

I. Equipment and Material Certifications

1. Be responsible for obtaining certificates and guarantees from the various manufacturers of equipment and materials proposed for use on the project. The manufacturers shall certify and guarantee that their equipment and materials, when installed, shall, as a minimum, conform to all the requirements specified and indicated on the drawings. In addition, the Contractor shall guarantee that all systems conform to the design shown on the drawings or specified herein and will develop and deliver the capacities of all certified equipment.

1.11 MINOR DEVIATIONS

- A. Whenever field conditions or the proper execution of the work requires reasonable changes in piping, ducts, outlets, conduit work and equipment shown on the drawings, make all such changes as directed or approved, without extra cost to the Owner. This the bidder must take into consideration.
- B. All locations are approximately correct, but are understood to be subject to modifications as may be found necessary or desirable in order to meet structural conditions and the requirements of other equipment installations prior to or at the time of installation.
- C. The Design Professional reserves the right to change the locations of electrical equipment outlets, fixtures, conduits, switches, panels, and the like, to accommodate the architectural treatment and any other conditions which may arise during the progress of the work, without additional compensation to the Contractor for such changes. Should it be found that any work is laid out and interference will occur, the Contractor shall report to the Design Professional.

1.12 ORGANIZATION OF WORK

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

BASIC ELECTRICAL REQUIREMENTS

- B. Provide all new materials and workmanship of the best grade; and install all apparatus in a practical and first class manner; being complete in operation, nothing being omitted in the way of labor and materials required to make it so, although not specifically shown or mentioned herein; and delivered in well-working order, complete and perfect in every respect.
- C. All materials, design, apparatus, and workmanship shall be subject to the approval of the Design Professional and shall be in accordance with all new and existing laws, rules, and regulations, both Local and State, together with the National Fire Protection Association.
- D. Parts of the building may be used as a shop and storage facilities, subject to the written approval of the Design Professional.
- E. Make the necessary arrangements with other trades to leave openings large enough to bring in the equipment and set same in place. Where necessary, equipment shall be brought into the building in sections and reassembled on the job by the manufacturer's mechanics or qualified mechanics under the supervision of the manufacturer's Representative.
- F. Operate and test all equipment in the presence of, and to the satisfaction of, the Design Professional and as hereinafter specified. All systems shall be properly balanced and controls adjusted to meet the design requirements. All equipment shall be tested for quiet operation and for freedom of excess vibration, as determined by the Design Professional and as elsewhere specified.
- G. The ratings, capacities, and requirements of all equipment are scheduled on the drawings or specified. Obtain Certifications and Guarantees from the various manufacturers of equipment proposed for use, that said equipment shall, as a minimum, conform to the hereinbefore referred-to requirements. In addition, at the time of completion of this Contract, guarantee that all equipment, apparatus, switchgear and transformers is installed in a manner conforming to the design shown on the drawings and specified, and will develop and deliver the capacities of all certified equipment. Assume all responsibilities and costs for temporary furnishing and installation of all instruments and recording devices as requested by the Design Professional for checking design conditions, at no extra cost to the Owner.
- H. Put all work in place as fast as reasonably possible and at all times keep a competent superintendent in charge of the work.
- I. Place upon the work or any part thereof only such loads as are consistent with the safety of that portion of the work, and to check and verify that

BASIC ELECTRICAL REQUIREMENTS

equipment and apparatus shall not be stacked on or be carried over floor and roof construction that would stress any of its members beyond the designed live loads.

- J. Provide scaffolding, platforms, ladders, rigging, temporary supports and braces as required to accomplish the work.
- K. Verify the agreements between all collective bargaining agencies and Sub-Contractors after which prepare a sequence of operations and a division of labor which will not result in any jurisdictional labor disputes or work delays.
- L. Provide all necessary trailers, extension cords, and lamps to provide light and power for the proper execution of the work.
- M. Maintain a complete file of shop drawings at all times available to the Owner's representative.
- N. Every facility shall be provided to permit inspection of the work by the Owner's Representative during the course of construction.
- O. Where items of equipment and/or materials are indicated in the Specifications as being furnished by other trades for installation, assume responsibility for the unloading of such equipment and/or materials from the delivery trucks, and for providing safe storage for same as required pending installation.
- P. Where the work is to be installed in close proximity to work of other trades, or where there is evidence that the work is to interfere with work of other trades, assist in working out space conditions to make a satisfactory adjustment.

1.13 PROTECTION OF WORK AND PROPERTY

- A. Maintain and protect all equipment, materials and tools from loss or damage from all causes until final acceptance by the Owner.
- B. Assume responsibility for the protection of any finished work or other traces from damage or defacement by the operations and remedy any such injury or damages.
- C. General Safety Restrictions
 - 1. The operation of the existing power distribution interior fire alarm system, gongs, bells and telephone in the building shall not be

BASIC ELECTRICAL REQUIREMENTS

interfered with, except during final connections are made to buildings electric services.

2. Nothing shall be done to in any way block the streets at or about exits, or exits themselves.
3. There shall be no unauthorized interference with free and unobstructed use of corridors, stairways, toilets, and rooms.
4. Whenever work is carried on during normal working hours, not more than one stairway shall be closed off from free and safe use at any time, and this only after the written permission of the Owner's Representative has been obtained.
5. No part of the building or premises shall be closed to the use of the occupants without the permission of the Owner's Representative has been obtained.

D. Precautions Against Fire

1. Take every precaution in the performance of the work to prevent fires.
2. Smoking shall not be permitted within the premises at any time.
3. Fire Department regulations shall govern the storage and use of flammable materials. Flammable materials and fire-producing equipment shall not be left unattended about the premises in locations accessible to the public.
4. Rubbish shall be removed as hereinafter specified.
5. Fire extinguishers and other protective equipment shall be provided as required by regulations.
6. During all interruptions of work, flammable mixtures shall be stored in Fire Department Approved Enclosures in Fire Department designated locations. Coordinate work with Local Fire Department.

E. Fire Watch

1. Contractors using open flame or spark-producing tools, blow torches and welding rods shall provide fire guards to maintain a fire watch over the operation of these items at all times when it is in use. Provide any additional by Local Fire Department inspector after work is underway.
2. Throughout the duration of switchovers/shutdowns of electrical service to the buildings, Contractor shall provide fire guards to maintain a fire watch throughout the buildings.
3. The Contractor shall provide all fire guards required by Fire Department for total work (all items), and shall include in his bid a particular amount for payment of such guards. The Contractor shall employ and pay all the required guards.

BASIC ELECTRICAL REQUIREMENTS

F. Temporary Maintenance of Hazardous Conditions

1. Upon receipt of official notice to start work, carefully inspect all existing work which is required to be repaired, altered or removed. Any such work which is found to be hazardous shall be immediately put in a safe condition and so maintained until such time as the permanent work in connection therewith is completed.
2. Any restrictions regarding sequence of operations and locations of work do not apply to the elimination of hazardous conditions; all parts of the premises will be available at all times for the performance of work.

G. Protection of Property

1. The Contractor shall be responsible for all damage to all new and existing work of the premises due to his operations, and shall provide and maintain adequate protection against such damage.
2. The premises shall not be used as a work shop to the detriment of any portion thereof.
3. Desk, tables, benches and other furniture and equipment shall not be used as workbenches; neither shall materials and furniture be piled thereon without proper protection.
4. Provide decking on floors, steps, platforms and pavements where subject to damage from heavy traffic.
5. Protect doors and door jambs when conveying rubbish and materials.
6. Provide and maintain barricades to confine dust to work areas.
7. Provide watertight enclosures over openings at roof and walls; provide watertight protection where tank houses, bulkheads and other roof structures are removed; remove temporary waterproofing protection for installation of new permanent work.
8. All damage to adjoining work due to failure to provide adequate protection shall be made good by the Contractor causing same at his own expense.
9. After completion of his work, each Contractor shall thereafter protect his own work until accepted, except as otherwise required to be protected or made good by other Contractors hereinbefore specified.

H. Protection of Public

1. Each Contractor shall be responsible for all injury to persons due to his operations and shall provide and maintain adequate protection against injury.

BASIC ELECTRICAL REQUIREMENTS

2. Provide guards, rails, barricades, fences, sidewalk sheds, catch-platforms, decking, night lighting, etc. as required by N.Y.S Building Code, Laws and as further required to provide adequate protection.
3. Protect sidewalks and curbs around the premises so that they may be safely used by the public at all times.
4. Provide barricades around work areas as required to prevent unauthorized persons from entering therein.
5. Provide plumbing and/or temporary drainage as required to keep all pits, trenches and other excavations, and the adjoining areas of the premises, dry during the course of the work; provide pumping for removal of rain and ground-water, back-up from sewers and drains, return-line flow, etc.

1.14 CONTRACTOR'S RESPONSIBILITY

- A. Examine all of the drawings and specifications data covering the work of the Mechanical, Electrical, and Construction Trades and with the work as a whole to determine the relations and extent of this work.
- B. Confer with the proper execution of the drawing and specification requirements for the purpose of eliminating any and all conflicts. Where conflict exists which cannot be resolved at the job site, except to the detriment of this work, the Design Professional shall be consulted for instructions before proceeding with the work in question.

1.15 CUTTING AND ROUGH PATCHING

- A. Cutting and rough and finished patching for the installation of the work of this Contract shall be included in the bid of the Contract which requires the cutting and patching. Finished patching will be done by the Contractor. No structural beams or walls shall be cut until approval is given by the Design Professional.
- B. Provide all labor, materials, etc. necessary to complete all cutting, rough patching, painting and finishing work including, but not limited to, the following:
 1. Exterior ferrous metals disturbed by the work of this Contract, including door frames and miscellaneous metals.
 2. Interior ferrous metals disturbed by the work of this Contract, including: structural and miscellaneous metals doors and frames, interior partitions, access panels and doors, louvers, miscellaneous metal supports, grilles, registers and diffusers.

BASIC ELECTRICAL REQUIREMENTS

3. Existing surfaces disturbed by the work of this Contract (walls, ceilings, floors, partitions, frames, trim, etc., of whatever materials).
 4. Interior exposed block masonry disturbed by the work of this Contract.
 5. Interior existing surfaces in corridors disturbed by the work of this Contract.
 6. Interior plaster, concrete and cement disturbed by the work of this Contract.
 7. Interior drywall construction disturbed by the work of this Contract.
 8. Interior carpentry and millwork disturbed by the work of this Contract.
 9. All concrete work, all pavements and all walls disturbed by the work of this Contract.
 10. All other items disturbed by the work of this Contract.
- C. The type of materials to be used and the number of coats to be applied shall match existing. All materials shall match existing. Colors and paint type shall be as selected by the Owner.
- D. Existing Hung Ceilings
1. Remove the existing hung ceiling as required to permit the installation of the new work.
 2. Reinstall the altered existing ceilings.
 3. Do all reframing; provide additional members and furring to provide proper arrangement to receive altered ceilings.
- E. Do not cut existing floor or walls until shop drawings have approved by the Owner's Representative.
- F. Verify that spaces to remain unaltered adjacent to areas of alteration, or cutting are completely secured and rendered dustproof before beginning such work.
- G. Cutting and Drilling
1. Do cutting and drilling of existing floors walls, partitions, ceilings, and like for installation of new work shown, including cutting of holes and other openings for new mechanical and electrical work.
 2. Perform cutting by hand or with small power tools wherever possible. Cut holes and slots neatly to size required, with minimum disturbance of adjacent work. Cut around holes in concrete slabs, floors and walls for pipes and conduit with core drills or required sizes and types. Cut square and rectangular holes by line drilling and using chipping

BASIC ELECTRICAL REQUIREMENTS

hammers to remove material between drill holes. Large air hammers will not be permitted.

3. Drilling or cutting of columns, beams, joist, girders, or other structural supporting elements will not be permitted, unless specifically approved in each case.
4. Cover openings temporarily when not in use and patch as soon as work is installed.

H. Alterations, Patching and Repairs

1. Cut, remove, alter, temporarily remove and install, or relocate existing work as required for performance of work.
 2. Restore finish work of floors, walls and ceilings remaining in place but damaged or defaced because of demolition of alteration work to condition equal to original condition before the work under this Contract was started.
 3. Where alterations or removals exposed damaged to unfinished surfaces or materials, finish or refinish such surfaces or material, or remove the damaged or unfinished surfaces or materials and provide new, acceptable, salvaged materials to make continuous areas and surfaces uniform.
 4. Perform new work and restoration and refinishing of existing work to comply with applicable requirements of the performance specification, except as follows:
 - a. Materials for use in repair of existing surfaces but not otherwise specified, shall conform to the highest standards of the trade involved, and be in accordance with approved industry standards, as required to match the existing surface.
 - b. Workmanship for existing materials to be repaired, but not otherwise specified, shall conform to similar workmanship existing in or adjacent to the space in which alterations are to be made.
 - c. Reinstallation of salvaged items where no similar item exist shall be done in accordance with the highest standards of the trade involved and in accordance with approved shop drawing.
- I. Properly close and patch holes and openings in existing floor, wall and ceiling surfaces to be filled or resulting from alteration work. Match adjacent undisturbed surfaces.

BASIC ELECTRICAL REQUIREMENTS

- J. Firestop all openings caused by cutting and patching work and as required by Local and State Codes.

1.16 CHASES AND OPENINGS

- A. Chases and openings shall be laid out in advance to permit their provision in the work. Sleeves and inserts shall be set in forms before concrete is poured. Any extra work required where sleeves, chases, openings, or inserts have been omitted or improperly placed shall be performed at the expense of the trade which made the error or omission.

1.17 FIELD MEASUREMENTS

- A. Maintain all reference points and perform all field operations required to insure that work shall conform with grades, elevations, and lines required. Take all necessary field measurements of work previously executed as required for fabrication and installation of the work, and assume complete responsibility for the conditions on the job and be responsible for knowledge of same so that all work will properly join the other work. Verify the construction program of the other trades, ascertain and promptly furnish the information they may require for the proper installation of their work and his work.

1.18 DETAIL DRAWINGS

- A. Provide drawings to scale of such portions of the work as may be required by the Design Professional and furnish prints of same, as required. Such drawings shall show the work and its exact relation to the construction and adjoining work of all other trades. When necessary, sections and elevations shall be made, as well as plans.
- B. Provide sleeve opening and core drilling opening drawings showing the locations of all sleeves, core drilling opening and sizes, duct opening and sizes, conduit opening and sizes, both horizontal and vertical. Location of sleeves shall be dimensioned from center line of columns and in the elevation from the underside of slab and from finished floor. Three (3) sets of the sleeve drawings shall be furnished to the General Contractor for his use, and a copy of the distribution transmittal sent to the Design Professional for record purposes. Sleeve drawings will not be checked by the Design Professional. The responsibility for the accuracy of the drawings rests with the Contractor.
- C. Provide coordination drawings in accordance with Division 1 Section "PROJECT COORDINATION," to a scale of 3/8"=1'-0" or larger; detailing

BASIC ELECTRICAL REQUIREMENTS

major elements, components, and systems of mechanical equipment and materials in relationship with other systems, installations, and building components. Indicate locations where space is limited for installation and access and where sequencing and coordination of installations are of importance to the efficient flow of the work, including (but not necessarily limited to) the following:

1. Indicate the proposed locations of switchgear, transformers and other equipment, and materials. Include the following:
 - a. Clearances for installing and maintaining equipment.
 - b. Clearances for servicing and maintaining equipment, including removal of switches and disassembly required for periodic maintenance.
 - c. Equipment connections and support details.
 - d. Exterior wall and foundation penetrations.
 - e. Fire-rated wall and floor penetrations.
 - f. Sizes and location of required concrete pads and bases.
 - g. Conduit supports and routing.
 2. Indicate scheduling, sequencing, movement, and positioning of large equipment into the building during construction.
 3. Prepare floor plans, elevations, and details to indicate penetrations in floor, walls and ceilings and their relationship to other penetrations and installations.
 4. Prepare reflected ceiling plans to coordinate and integrate installations of conduits with existing equipment in spaces of work.
- D. Where the work to be installed is in close proximity to existing work, or where it appears that work may interfere with existing work, assist in working out space conditions to make satisfactory adjustments. If so directed, prepare complete scale working drawings and sections, clearly showing how this work is to be installed in relation to the existing work. The scale of the drawings shall be $\frac{3}{8}" = 1'-0"$, or as directed by the Design Professional. If work is installed before coordinating with other trades or so as to cause interference with work of other trades, the Sub-Contractor at fault shall make changes necessary to correct condition without extra charge.

1.19 RECORD DRAWINGS

- A. During construction keep an accurate record of all deviations between the work as shown on the Contract Drawings and that which is actually installed.

BASIC ELECTRICAL REQUIREMENTS

- B. Prepare a complete set of Mylar transparencies and AutoCAD of the Drawings and note thereon all changes. Make a complete record of all changes and revisions in the original design which exist in the complete work. The cost for the Mylar transparencies and AutoCAD drawings shall be paid for the Contractor.
- C. Prepare Record Drawings of the work as it proceeds. The drawings shall be kept current at all times, and prints of the drawings shall be submitted with all requests for payments. The drawings will include the amount of work accomplished during the construction period and will form part of the request for payment data. The responsibility of keeping the drawings current rests with the Contractor.
- D. Furnishing of above documents and preparing these Record Drawings shall be at no additional cost to the Owner. When all revisions showing the work as finally installed are made, the corrected Mylar transparencies and AutoCAD drawings shall be submitted for review by the Design Professional.
- E. After review of the "Record Drawings" transparencies by the Design Professional, provide the Owner with one (1) set of black-line prints, Mylar transparencies and AutoCAD drawing file, at no additional cost to the Owner.
- F. In addition to the requirements specified in Division I, indicate the following installed conditions:
 - 1. Outdoor switchgear layout.
 - 2. Electric service room layout.
 - 3. Locations of riser conduits and branch feeders.
 - 4. Underground conduit banks and feeders.
 - 5. Equipment locations (exposed and concealed), dimensioned from prominent building lines.
 - 6. Approved substitution, Contract Modifications, and actual equipment and materials installed.
 - 7. Contract Modifications, actual equipment and materials installed.
 - 8. Location of manholes.
 - 9. Emergency system equipment (generators, automatic transfer switches, etc.)

1.20 SUPERVISION

- A. In addition to the provisions of Division 1, the following shall provide the services of a competent supervisor who is not a working job foreman to supervise the entire installation and report on same. The supervisor shall be responsible for maintaining progress reports and shall furnish same to the

BASIC ELECTRICAL REQUIREMENTS

Design Professional upon request, but not less than one each month. The Supervisor shall coordinate his work with the Owner's Representative and Design Professional in accomplishing the foregoing. The supervisor shall meet the Professional Requirements set forth by Local and State Laws.

1.21 TEMPORARY AND TRIAL USAGE

- A. The Owner shall have the privilege of temporary and trial usage of any portion of the Mechanical and Electrical Equipment before final acceptance by the Design Professional. It is expressly stipulated that such usage shall not be construed as evidence of acceptance of any part of the work by the Design Professional.

1.22 TEMPORARY LIGHT, POWER, HEAT AND WATER

- A. The Contractor may utilize the existing Electric System for temporary light and power except where the power tools would overload existing circuits or otherwise inhibit the normal operation of the existing building. Upon completion of temporary use, all worn and damaged parts are to be replaced and all equipment placed in proper operating condition.
- B. The Contractor during his work shall provide temporary transformer, disconnects, panels, and a standby generator (75 dB sound attenuation) so that power interruption in all the buildings shall be limited to a minimum to the equipment indicated on contract drawings which has been coordinated with SUCF and Campus Facilities. Power shutdowns during switchover of equipment shall be performed after hours or during weekends.
- C. Energy charges for the electricity taken from the existing service shall be borne by the Owner.
- D. Provide all necessary trailers, extension cords and lamps to provide light and power for the proper execution of his work.
- E. The existing cold water distribution system may be used for temporary water, except where its use would inhibit the normal operation of the existing building. Upon completion of temporary use, all worn or damaged parts are to be replaced and all equipment placed in proper operating condition.
- F. The costs of temporary water will be borne by the Owner.
- G. The existing building is occupied and operational. The Owner's forces will operate and maintain the existing boiler plants. The Owner's forces will provide heat.

BASIC ELECTRICAL REQUIREMENTS

1.23 OPERATING AND MAINTENANCE INSTRUCTIONS

A. General

1. Upon completion of all work and of all tests, furnish the necessary skilled labor and helpers for operating the systems and equipment for a period of five (5) days of eight (8) hours each for all the Systems specified. During this period, instruct the Owner or his Representative fully in the operation, adjustment and maintenance of all equipment furnished. Give at least two (2) weeks notice to the Owner in advance of this period.
2. Furnish six (6) complete bound sets of typewritten or blue-printed instructions for operating and maintaining all systems and equipment included in this Contract. All instructions shall be submitted in draft, for approval, prior to final issue. Manufacturer's advertising literature or catalogs will not be acceptable for operating and maintenance instructions. After "Approval", the copies shall be distributed, through the Design Professional, as follows: Two (2) copies to the Design Professional, and four (4) copies to the Owner.
3. Inasmuch as the Operating and Maintenance Instruction affects the operation of the building as a whole, the work will not be considered substantially complete until the Design Professional acknowledges, in writing, the acceptance thereof.
4. It is recommended that during the progress of the work, the material which must be included in the above manual be accumulated. After the shop drawings of each item is "Approved", the Maintenance and Operation Data shall be accumulated.
5. In the above-mentioned instructions, include the maintenance and lubrication schedule for all items of equipment furnished.

B. Instruction Manual

1. The following materials shall be included in the Instruction Manual:
 - a. Brief description of each system, sub-system and basic operating features.
 - b. Manufacturer's name and model numbers of all components of the systems listed on the equipment schedules, drawings, control diagrams and wiring diagrams of controllers.
 - c. Chart of the numbers, location, position and function of all components of the systems listed on the equipment schedules, drawings, control diagrams and wiring diagrams of controllers.

BASIC ELECTRICAL REQUIREMENTS

- d. Step-by-step operating instructions, including preparation for starting summer operation, winter operation, shutdown and draining.
- e. Maintenance instructions.
- f. Possible breakdowns and repairs.
- g. Manufacturer's literature describing each piece of equipment listed on the equipment schedules, drawings, control diagrams and wiring diagrams of controllers.
- h. As installed control diagrams by the Control Manufacturer.
- i. Description of sequence of operation by the manufacturer.
- j. Parts of list of major equipment.
- k. As installed, color coded wiring diagrams of electrical connections and interlock connection.
- l. Manufacturer's literature describing the lubrication type, source, quantity and schedule for each item of equipment and each component part of an item.

NOTE: Items h and k shall be available at the final inspection and all other items at least four (4) weeks prior to the "Substantial Completion Date", which will determine the type of final inspection and the Owner's Instruction Period.

- 2. The format of the instruction manuals shall be per ASHRAE 2020 Systems Handbook (modified to include all work of Division 23 and Division 26).
- 3. Include the following labeling on all documents:

SUCF, Engineers and Contractors project numbers, name, address and phone no. of the Contractor.

1.24 QUIET OPERATION

- A. All equipment and material shall operate under all conditions of load without any sound or vibration conditions areas, which are considered objectionable by the Design Professional, eliminate same in a manner reviewed by the Design Professional.

1.25 DELIVERY OF MATERIAL

- A. Deliver the material and store same in spaces indicated by the Design Professional and assume full responsibility for damage to structure caused by any overloading of the material.

BASIC ELECTRICAL REQUIREMENTS

- B. Deliver products to the project properly identified with names, model numbers, types, grades, compliance labels, and other information needed for identification.

1.26 TESTS, ADJUSTING AND DEMONSTRATION

A. General

1. Test, adjust and demonstrate all the systems and equipment specified as per NETA standards. In addition, perform all tests and adjustments required by Local, State and Federal Authorities. Provide all labor, materials, appliances, equipment, instruments, water, electricity and transportation and engage, a NETA approved, independent testing company to conduct the tests for the electrical equipment as per NETA standards.
2. Tests to demonstrate the capacity specified and general operating characteristics of all apparatus shall be conducted in the presence of the Design Professional, to the satisfaction of the Design Professional.
3. Test instruments shall be checked and certified for accuracy by an approved laboratory or by the manufacturer, and certificates showing degree of accuracy shall be furnished to the Design Professional.
4. See the Section entitled, "Permits and Inspections" for additional requirements.
5. All piping, wiring, and equipment shall be tested as specified under the various sections of the work.
6. Tests shall be performed to the satisfaction of the Design Professional. The Design Professional will be present at such tests, when he deems necessary and such other parties as may have legal jurisdiction.
7. All defective work shall be promptly repaired or replaced and the tests shall be repeated until the particular system and component parts thereof receive the review of the Design Professional.
8. Any damages resulting from tests shall be repaired or replaced and the tests shall be repeated until the particular system and component parts thereof receive the approval of the Design Professional.
9. The duration of tests shall be as determined by all authorities have in jurisdiction, but in no case less than the time prescribed in the Specifications.

B. Equipment Tests

BASIC ELECTRICAL REQUIREMENTS

1. Capacities of all equipment shall be determined by operating tests of not less than two (2) hours duration, after stable conditions have been established. Test procedures shall be in accordance with the portions of recognized test codes and as hereinafter specified.
2. Should any grounds, defective materials, or equipment be found during the testing operations, such grounds shall be corrected and defective materials and equipment replaced. After corrections have been made, tests shall be repeated until all systems are proven satisfactory to the Design Professional. All corrections and retests shall be made until satisfactory without additional cost to the Owner.
3. Equipment and systems which normally operate during certain seasons of the year shall be tested during the appropriate season. Tests shall be performed on individual equipment, systems, and their controls. Whenever the equipment or systems under test is interrelated with and depends upon the operation of other equipment, systems and controls for proper operation, functioning, and performance, the latter shall be operated simultaneously with the equipment or system being tested.

C. Adjusting

1. Adjust all systems and equipment in the presence of and to the satisfaction of the Design Professional, and as hereinafter specified.
2. Assume all responsibilities and costs for temporary furnishing and installation of all instruments and recording devices.
3. All instrumentation shall be calibrated by an approved laboratory not more than one (1) month preceding its use.
4. All systems shall be adjusted and placed in operation by the manufacturer. Readjustments necessary to accomplish the specified results during the first year of operation shall be made during the first year of operation and shall be made without cost to the Owner.

D. Demonstration

1. After the adjusting report is approved and the Contractor certifies that all adjustments have been performed, demonstrate to the satisfaction of the Design Professional that the system meets all the Design Criteria and all items hereinbefore listed have been satisfactorily accomplished.

E. Additional Requirements: As set forth in each Section of the Project Specification.

BASIC ELECTRICAL REQUIREMENTS

- F. Test instruments shall be checked and certified for accuracy by an approved laboratory or by the manufacturer, and certificates showing degree of accuracy shall be furnished to the Design Professional.
- G. If gauges and other instruments which are to be left permanently installed are used for tests, they shall not be installed until just prior to the tests to avoid possible change in calibration.

1.27 PROTECTION AND CLEANING

- A. The Contractor shall protect all finished surfaced, including the jambs and soffits of all openings used as passageways or through which materials are handled, against any possible damage resulting from the conduct of work by all trades.
- B. All finished surface, including factory-finished and job finished items, shall be clean and not marred upon delivery in the building to the Owner. The Contractor shall, without extra compensation, refinish all such spaces where such surfaces prove to have been inadequately protected and are damaged.
- C. Tight wood sheeting shall be laid under any materials that are stored on finished cement surfaces. Reinforced non-staining kraft building paper and plywood or planking must be laid over all types of finished floor surfaces in traffic areas and before moving any materials over these finished areas. Wheelbarrows, if used over such areas, shall have rubber-tired wheels.
- D. Roof surfaces shall not be subjected to traffic nor shall they be used for storage of material. Where some activity must take place in order to carry out the Contract, adequate protection shall be provided.
- E. All materials and equipment shall be properly and effectively protected. All piping and conduits must be properly capped during construction so as to prevent obstruction and damage. Any damage resulting in the failure to use proper precautions to this work shall be replaced or altered to the satisfaction of the Design Professional.
- F. The following shall be protected by heavy fiberglass cloth protective covers.
- G. All pull boxes and junction boxes to be painted shall be cleaned to remove dirt and grease or oil.
- H. All conduit, wiring, fixtures, apparatus, equipment, and appurtenances shall be thoroughly cleaned and put in first-operating condition before being offered for acceptance.

BASIC ELECTRICAL REQUIREMENTS

- I. Be responsible for keeping the building clean at all times. Remove all rubbish, debris, cartons, boxes, waste and the like originating with the work.
- J. Cleaning Up
 - 1. In addition to cleaning up detailed in Conditions of the Contract, the following shall apply:
 - a. All areas of the building in which work is to be performed shall be cleaned throughout by the Contractor just prior to the start of this work, and these areas shall be continuously maintained in safe and satisfactory condition at all times. This cleaning shall include the removal of trash and rubbish from area; broom cleaning of floors, the removal of any plaster, mortar, dust and other extraneous materials from all finish surfaces, including but not limited to: all exposed structural, miscellaneous metal, woodwork, plaster, masonry, concrete, mechanical conduit and also all surfaces visible after all permanent fixtures, fan coil units covers, covers for heating and cooling piping, grilles, registers, and other such fixtures or devices are in place.
 - b. Electrical closets, pipe and duct shafts, chases, furred spaces, and similar spaces which are generally unfinished shall be cleaned and left free from rubbish, loose plaster, mortar drippings, extraneous construction materials, dirt and dust before preliminary inspection of the work.
 - c. Care shall be taken by all workmen not to mark, soil or otherwise deface any finished surfaces. In the event that any finished surface becomes defaced in any way by mechanics or workmen, the Contractor responsible shall clean and restore such surfaces to their original condition.
 - d. Before final payment will be approved, the Contractor shall prepare the construction area as follows: The Contractor shall clean all construction areas free from construction materials. All areas shall be broom cleaned from excess dirt and materials.

1.28 ALLOWABLE TOLERANCES

- A. Equipment shall fit in space allocated.
- B. Clearances around all equipment shall permit removal of switchboards, transformers, compressors, fans, motors, and all components.

BASIC ELECTRICAL REQUIREMENTS

- C. Clearances must conform to State, Local and OSHA Requirements.
- D. Clearances must be provided for access to all parts and components.

1.29 LUBRICATION

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

1.30 WATERPROOFING

- A. Where any work pierces waterproofing, including waterproof concrete, the method of installation shall be as approved by the Design Professional before the work is done. The General Contractor shall provide all necessary sleeves, caulking, and flashing required to make openings absolutely watertight.

1.31 SCAFFOLDING, RIGGING, AND HOISTING

- A. Provide all scaffolding, rigging, hoisting, and services necessary for erection and delivery into the premises of any equipment and apparatus furnished. Remove same from premises when no longer required.

1.32 GUARDS AND RAILINGS

- A. Provide belt drives and rotating machinery with readily removable guards and railings. Guards shall consist of heavy galvanized iron wire crimped mesh securely fastened to frames. Railings shall be galvanized 1-1/2" pipe and railing fittings.

1.33 ALTERATIONS

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

BASIC ELECTRICAL REQUIREMENTS

- B. When existing piping and duct system at points of connection to new work or in rerouting are found defective, such defective portions shall be removed and replaced with new materials without cost to the Owner.
- C. Provide temporary supports where required.
- D. When alterations reveal piping, ductwork, conduit circuits, wiring, and accessories that must necessarily remain in service, same shall be rerouted, replaced with new material without cost to the Owner.
- E. Where existing piping or ductwork insulation is damaged by the requirements of the work, replace all damaged insulation to match existing.

1.34 EXISTING MECHANICAL AND ELECTRICAL WORK

- A. Remove, abandon, relocate or reroute, as required to accomplish the work, all piping, conduit, wiring, ductwork, equipment, fixtures, materials, and apparatus which are laid bare in the course of, or interfere with, the alterations and additions to the building. Abandon, behind patched finishes, all unused piping and remove all exposed piping and branch work which may interfere with the alterations and additions required.
- B. All removals, abandonments, relocations and rerouting shall be performed in strict conformance with Federal, State and Local Codes and N.F.P.A. Standards.
- C. Compare the drawings with the existing conditions to determine the amount of work affected. Remove all "unused exposed" piping, conduit, ductwork, wiring, materials, apparatus, and the like not required by alterations and additions to the building.
- D. All piping, conduit, ductwork, wiring, materials, apparatus, and equipment laid bare by the removal of floors, ceiling, walls and partitions, and which are required in the present building and alterations, shall be rearranged, rerouted, relocated and installed as indicated, specified or directed.

1.35 EXISTING ELECTRIC WORK

- A. Remove or re-route, as required for the work, any conduit, and/or wiring and outlets which are laid bare in the course of, or interfere with, the alterations in the building. Abandon, behind patched finishes, all unused outlets, and remove all exposed outlets, conduit and branch circuit work, which may interfere with the alterations, as directed.

BASIC ELECTRICAL REQUIREMENTS

- B. Compare the drawings with the existing conditions to determine the amount of work affected. Remove all unused switches, transformers, exposed circuit work, outlets, fixtures, switches, underground high voltage feeders and the like not required by alterations in the building. Any conduits, outlets, circuit work, feeders, etc. laid bare by the removal of floors, ceilings, walls, and partitions, and which are required in the present building and alterations, shall be rearranged, rerouted and installed as specified herein, shown on the Contract Drawings or as approved by shop drawings and as required by the National Electric Codes.
- C. Miscellaneous branch circuits, other than those which are specifically indicated to be rerouted and connected to the new or existing panelboards, shall be rerouted to suitable spare branch circuits at nearest available panel. It is the intention of this specification to provide for the continuance of all electrical facilities now installed in the unaltered portions of the building. Furnish and install all conduit and wiring, pull boxes, etc. to permanently maintain service to these facilities, as required, at no additional cost to the Owner.
- D. All existing local switches, receptacles, device plates, and other existing wiring devices indicated for removal shall not be required in this alteration.
- E. All existing wire and cable involved or disturbed in any relocation and extension shall be removed back to the nearest outlet, junction or pull box in the runs, and shall be replaced with new wire or cable as herein specified.
- F. The Contractor shall be responsible for notifying the Campus Public Safety or as directed by the Campus before any alterations are begun in the existing building for the purpose of removing, rerouting, etc., of existing fire alarm system and equipment, telephone conduits, cables, strip boxes, outlets, wiring and equipment, as specified above.

1.36 REMOVALS AND RELOCATIONS

- A. Where conduit, panels, wiring, piping, ductwork, equipment, materials, apparatus, and other items are specified or indicated as being removed, or are required to be removed in order to accomplish the new work, the Contractor shall, as a minimum, be subject to the following operations:
 - 1. Disconnect item from adjoining piping, conduit, panels, materials, apparatus, wiring, ductwork, equipment, and items.
 - 2. Existing pipe, conduit, panels, wiring, and/or ductwork connections to items being removed shall be terminated, capped and concealed.

BASIC ELECTRICAL REQUIREMENTS

- 3. If the item is specified or indicated to remain on the property of the Owner, the item shall be transported to a place on the site designated by the Owner.
- B. Items not specified or indicated as becoming the property of the Contractor shall remain the property of the Owner.
- C. If the item is specified or indicated to become the property of the Contractor, the Contractor shall transport the item off the site.
- D. All items indicated as being relocated shall be removed, transported to the place of designation location, and connected to the system as indicated, specified or directed.

1.37 CONDUCT OF WORK IN AND OPERATION OF EXISTING PLANT

- A. The term "Existing Plant" shall be understood to mean all existing buildings at the site, grounds, equipment, and services.
- B. In general, all the existing buildings will be occupied and in operation during the progress of the work. Provide all required temporary transformer, standby generators and connections to insure the continued operating condition of all existing services within the existing building.
- C. No work shall be left incomplete or any hazardous situations created which will affect the life or safety of the building occupants. At no time shall the work interfere with or cut off any of the existing services without the Owner's Representative's written permission.
- D. It is required that the work indicated and/or specified shall be carried out with a minimum of interference to the established routine of the existing buildings, and that all work required herein shall be performed within the required contract time. Furnish a schedule indicating the time required to complete the work in the existing building. The above schedule will be reviewed and times and dates established for the accomplishment of this work. Do not perform work in the present building without the Owner's written permission.
- E. Any work necessary to be performed after regular working hours, on Sundays, or Legal Holidays, shall be performed without additional expense to the Owner.
- F. Existing steam, storm water and sanitary drainage water, domestic cold water, domestic hot water, condensate return, electric and gas services and systems shall be operational at all times.

BASIC ELECTRICAL REQUIREMENTS

The Owner's Representative shall be notified, in writing, when, for any reason, interruption of the presently maintained services, mechanical, electrical or otherwise, is required to accomplish the work. Written permission shall be obtained from the Owner's Representative prior to commencing with the work.

- G. Written permission shall be obtained from the Owner's Representative prior to commencing with the work.

1.38 P.M. PROGRAM

- A. A computerized program of scheduling preventative and routine maintenance will be implemented by the Owner. In order to fit any equipment furnished into this program, the Contractor shall furnish the Owner with the date shown on the attached form for each piece of equipment.

DATA ON EQUIPMENT FURNISHED

DATE:

1. Equipment Name.
2. Manufacturer.
3. Model No.
4. Serial No.
5. Contractor.
6. Sub-Contractor.
7. Vendor.
8. Job Name.
9. Job Number.
10. Agency from whom parts may be obtained:
11. Agency from whom service may be obtained:
12. Service Agreement: Yes No Expires
13. a) Guarantee: Yes No Expires
- b) Warrantee: Yes No Expires
14. Equipment Location: Building Floor
- Room No. Area Des.
15. Area Served: Building Floor
- Room No. Area Des.
16. Furnished in accordance with:
- Contract Drawing No.
- Specification Paragraph
- Specified by Design Professional
17. List Shop Drawings, Equipment Cuts, Catalogs, or the other drawings which show this equipment.

BASIC ELECTRICAL REQUIREMENTS

18. Indicate spare parts lists, maintenance and instruction manuals, or other data furnished.
19. Indicate all services connected to this equipment - water, drain, steam, return, gas, vacuum, chilled water, electric, etc. Give sizes of connections, amount used, pressure, etc.
20. Capacity of equipment.
21. Electrical Characteristics: Voltage Amp Phase
22. Electrical Circuit Data Panel Designation
Panel Location Circuit Number
Fuse Size Fuse Type
23. Location and data of any auxiliaries.
24. Other Data.

1.39 MANUFACTURER'S DIRECTIONS

- A. Except as elsewhere specified, all proprietary and manufactured articles and materials shall be used, connected, cleaned and finished, in accordance with the directions and recommendations of the manufacturers of such articles and materials.

1.40 ELECTRIC SERVICE CHARACTERISTICS

- A. Electrical service from utility company consisting of 13.2kV, 480V. Distribution to buildings shall be 13.2kV. Electrical distribution in buildings consist of 480V.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.01 ROUGH-IN

- A. Verify final locations for rough-ins with field measurements and with the requirements of the actual equipment to be connected.
- B. Refer to equipment specifications in Divisions 2 through 33 for rough-in requirements.

3.02 ELECTRICAL INSTALLATIONS

BASIC ELECTRICAL REQUIREMENTS

- A. General: Sequence, coordinate, and integrate the various elements of electrical systems, materials and equipment. Comply with the following requirements:
1. Coordinate electrical systems, equipment, and materials installation with other building components.
 2. Verify all dimensions by field measurements.
 3. Arrange for chases, slots, and openings in other building components during progress of construction, to allow for electrical installations.
 4. Coordinate the installation of required supporting devices and sleeves to be set in poured-in-place concrete and other structural components, as they are constructed.
 5. Sequence, coordinate, and integrate installations of electrical materials and equipment for efficient flow of the Work. Give particular attention to large equipment requiring positioning prior to closing in the building.
 6. Where mounting heights are not detailed or dimensioned, install systems, materials, and equipment to provide the maximum headroom possible.
 7. Coordinate connection of electrical systems with exterior underground and overhead utilities and services. Comply with requirements of governing regulations, franchised service companies, and controlling agencies. Provide required connection for each service.
 8. Install systems, materials, and equipment to conform with approved submittal data, including coordination drawings, to the greatest extent possible. Conform to arrangements indicated by the Contract Documents, recognizing that portions of the Work are shown only in diagrammatic form. Where coordination requirements conflict with individual system requirements, refer conflict to the Design Professional.
 9. Install systems, materials, and equipment level and plumb, parallel and perpendicular to other building systems and components, where installed exposed in finished spaces.
 10. Install electrical equipment to facilitate servicing, maintenance, and repair or replacement of equipment components. As much as practical, connect equipment for ease of disconnecting, with minimum of interference with other installations.
 11. Install access panel or doors where equipment is concealed behind finished surfaces. Access panels and doors are specified in Division 8 Section "ACCESS DOORS AND FRAMES" and Division 26 Section "BASIC Electrical MATERIALS AND METHODS."
 12. Install systems, materials, and equipment giving right-of-way priority to systems required to be installed at a specified slope.

BASIC ELECTRICAL REQUIREMENTS

3.03 CUTTING AND PATCHING

- A. General: Perform cutting and patching as specified in Part 1 of this Section "CUTTING AND PATCHING." In addition to the requirements specified in Division 1, the following requirements apply:
 - 1. Protection of Installed Work: During cutting and patching operations, protect adjacent installations.
- B. Perform cutting, fitting, and patching of electrical equipment and materials required to:
 - 1. Uncover Work to provide for installation of ill-timed Work.
 - 2. Remove and replace defective Work.
 - 3. Remove and replace Work not conforming to requirements of the Contract Documents.
 - 4. Remove samples of installed Work as specified for testing.
 - 5. Install equipment and materials in existing structures.
 - 6. Upon written instructions from the Design Professional, uncover and restore Work to provide for Design Professional observation of concealed Work.
 - 7. Cut, remove and legally dispose of selected electrical equipment, components, and materials as indicated.
 - 8. Protect the structure, furnishings, finishes, and adjacent materials not indicated or scheduled to be removed.
 - 9. Provide and maintain temporary partitions or dust barriers adequate to prevent the spread of dust and dirt to adjacent areas.
 - 10. Patch existing finished surfaces and building components using new materials matching existing materials and experienced Installers. Installers' qualifications refer to the materials and methods required for the surface and building components being patched.
 - 11. Patch finished surfaces and building components using new materials specified for the original installation and experienced Installers. Installers' qualifications refer to the materials and methods required for the surface and building components being patched.

END OF SECTION

BASIC ELECTRICAL MATERIALS AND METHODS

260500 BASIC ELECTRICAL MATERIALS AND METHODS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification Sections, apply to this Section.
- B. Requirements specified in Division 26 Section "Basic Electrical Requirements" apply to this Section.
- C. Related Sections:
 - 1. Division 7 Section 078400 - Firestopping system applies to this Section.
 - 2. Division 7 Section 079200 – Joint Sealants.
- D. Contractor shall refer to the front end specification sections for General Requirements.

1.02 SUMMARY

- A. Include all labor, materials, tools, equipment and services required to furnish, deliver and install all work under this Section as required by the drawings and as specified hereinafter.
- B. This Section includes limited scope general construction materials and methods for application with electrical installations as follows:
 - 1. Miscellaneous metals for support of electrical materials and equipment.
 - 2. Wood grounds, nailers, blocking, fasteners, and anchorage for support of electrical materials and equipment.
 - 3. Joint sealers for sealing around electrical materials and equipment; and firestopping for sealing penetrations in fire and smoke barriers, floors, and foundation walls.
 - 4. Firestopping shall be provided in the following locations:
 - a. Conduit, penetrations through walls, floor slabs, through partitions and through walls.
 - b. Other locations where shown or required.
 - c. All conduits shall be concealed in wall and above hung ceiling. Exposed conduits will be run in basement only.

BASIC ELECTRICAL MATERIALS AND METHODS

5. Electrical equipment nameplate data.

1.03 SUBMITTALS

- A. General: Submit the following in accordance with Conditions of Contract and Division 1 Specification Sections.
- B. Product data for the following products:
 1. Joint sealers.
 2. Firestopping.

1.04 QUALITY ASSURANCE

- A. Installer Qualifications: Engage an experienced Installer for the installation and application joint sealers.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Deliver joint sealer materials in original unopened containers or bundles with labels informing about manufacturer, product name and designation, color, expiration period for use, pot life, curing time, and mixing instructions for multi-component materials.
- B. Store and handle joint sealer materials in compliance with the manufacturers' recommendations to prevent their deterioration and damage.

1.06 PROJECT CONDITIONS

- A. Conditions Affecting Existing Services: The following project conditions apply:
 1. Install and maintain dust and noise barriers to keep dirt, dust, and noise from being transmitted to adjacent areas. Remove protection and barriers after demolition operations are complete.
 2. Locate, identify, and protect electrical services passing through Construction area and serving other areas outside the Construction limits. Maintain services to areas outside Construction limits. When services must be interrupted, install temporary services for affected areas.
- B. Environmental Conditions: Apply joint sealers and firestopping under temperature and humidity conditions within the limits permitted by the joint sealer manufacturer. Do no

BASIC ELECTRICAL MATERIALS AND METHODS

t apply joint sealers to wet substrate.

1.07 SEQUENCE AND SCHEDULING

- A. Notify the Owner prior to commencing of power shut-off operations as indicated in Division 1, Section C "Special Conditions".
- B. Perform work as required and requested by Owner.
- C. All power shutdowns shall be performed during weekends at no extra cost and/or as requested by Owner.

PART 2 - PRODUCTS

2.01 ELECTRICAL EQUIPMENT NAMEPLATE DATA

- A. Nameplate: For each item of electrical equipment, provide a permanent operational data nameplate indicating manufacturer, product name, model number, serial number, capacity, operating and power characteristics, labels of tested compliances, and similar essential data. Locate nameplates in an accessible location.

2.02 MISCELLANEOUS METALS

- A. Steel Plates, Shapes, Bars, and Bar Grating: ASTM A 36.
- B. Cold-Formed Steel Tubing: ASTM A 500.
- C. Hot-Rolled Steel Tubing: ASTM A 501.
- D. Steel Pipe: ASTM A 53, Schedule 40, welded.
- E. Nonshrink, Nonmetallic Grout: Premixed, factory-packaged, nonstaining, noncorrosive, nongaseous grout, recommended for interior and exterior applications.
- F. Fasteners: Zinc-coated, type, grade, and class as required.

2.03 MISCELLANEOUS LUMBER

- A. Framing Materials: Standard Grade, light-framing-size lumber of any species. Number 3 Common or standard grade boards complying with WCLIB or AWPB rules, or Number 3 boards complying with SPIB rules. Lumber shall be preservative treated in accordance with AWPB LP-2, and kiln dried to a moisture content of not more

260500-3

Basic Electrical Materials and Methods

BASIC ELECTRICAL MATERIALS AND METHODS

e than 19%.

- B. Construction Panels: Plywood panels; APA C-D PLUGGED INT, with exterior glue; thickness as indicated, or if not indicated, not less than 3/4 inches, fire retardant treated.

PART 3 - EXECUTION

3.01 PREPARATION FOR JOINT SEALERS

- A. Surface Cleaning for Joint Sealers: Clean surfaces of joints immediately before applying joint sealers to comply with recommendations of joint sealer manufacturer.
- B. Apply joint sealer primer to substrate as recommended by joint sealer manufacturer. Protect adjacent areas from spillage and migration of primers, using masking tape. Remove tape immediately after tooling without disturbing joint seal.

3.02 ELECTRICAL MATERIALS AND EQUIPMENT

- A. Compare the site drawings with the existing site conditions to determine the amount of work affected. Remove all unused underground work, and the like not required for the building.
- B. Perform cutting and patching required for demolition in accordance with Section Removals, Restorations, Additions, Alterations, Cutting and Patching for Work in Buildings, Areaways, Service Rooms and Site Work.

3.03 REMOVALS AND RELOCATIONS

- A. Where pipe, fittings, valves, conduit, feeders, equipment, materials, apparatus, and other items are required to be removed in order to accomplish the new work, the work required shall, as a minimum, shall be subject to the following operation:
 - 1. Disconnect item from adjoining piping, conduit, materials, apparatus, wiring, equipment, and other items.
 - 2. Existing pipe, conduit, panels, wiring, and/or connections to items being removed shall be terminated, capped and concealed.
 - 3. If the item is specified or indicated to remain on the property of the Owner, the item shall be transported to a place on the site designated by the Owner.
- B. Items not specified or indicated on drawings as becoming the property of the Owner shall

BASIC ELECTRICAL MATERIALS AND METHODS

remain the property of the Contractor and be disposed in accordance with all State and Federal laws.

- C. If the item is specified or indicated to become the property of the Contractor, the Contractor shall transport the item off the site and legally disposed.

3.04 ERECTION OF METAL SUPPORTS AND ANCHORAGE

- A. Cut, fit, and place miscellaneous metal fabrications accurately in location, alignment, and elevation to support and anchor electrical materials and equipment.
- B. Field Welding: Comply with AWS "Structural Welding Code."

3.05 ERECTION OF WOOD SUPPORTS AND ANCHORAGE

- A. Cut, fit, and place wood grounds, nailers, blocking, and anchorage accurately in location, alignment, and elevation to support and anchor electrical materials and equipment.
- B. Select fastener sizes 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 wood members.
- C. Attach to substrate as required to support applied loads.

3.06 APPLICATION OF JOINT SEALERS

- A. General: Comply with joint sealer manufacturers' printed application instructions applicable to products and applications indicated, except where more stringent requirements apply.
 - 1. Comply with recommendations of ASTM C962 for use of elastomeric joint sealants.
 - 2. Comply with recommendations of ASTM C790 for use of acrylic-emulsion joint sealants.
- B. Tooling: Immediately after sealant application and prior to time shinning or curing begins, tool sealants to form smooth, uniform beads; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint. Remove excess sealants from surfaces adjacent to joint. Do not use tooling agents that discolor sealants or adjacent surfaces or are not approved by sealant manufacturer.

BASIC ELECTRICAL MATERIALS AND METHODS

- C. Installation of Fire-Stopping Sealant: Install sealant, including forming, packing, and other accessory materials, to fill openings around electrical services penetrating floors and walls, to provide fire-stops with fire-resistance ratings indicated for floor or wall assembly in which penetration occurs. Comply with installation requirements established by testing and inspecting agency.
- D. See Joint Sealant Schedule on Drawings.

3.07 EQUIPMENT BASES

- A. Construct concrete equipment pads as follows:
 - 1. Form concrete pads using framing lumber with form release compounds; chamfer top edge and corners of pad.
 - 2. Place concrete and allow to cure before installation of equipment. Use portland cement conforming to ASTM C150, 4,000 psi compressive strength, and normal weight aggregate.
 - 3. Clean exposed steel form and apply 2 coats of rust-preventative metal primer and 2 coats of exterior, gloss, alkyd enamel. Color shall be as selected by the Design Professional.

3.08 BUILDING PENETRATIONS

- A. General Penetration Requirements: Provide properly sized, fabricated, located, and trade coordinated sleeves and prepared openings, for conduits, ductwork piping, and other item penetrations, for the surface to be penetrated. Provide sleeves for round duct and items 15 inches and smaller and prepared openings for round duct larger than 15 inches and all square or rectangular duct. Sleeves, except as otherwise specified or indicated, shall be 20-gauge, 0.0396-inch thick mill galvanized sheet metal. Sleeves penetrating load bearing surfaces shall be standard weight galvanized steel pipe.
- B. Framed Opening: Provide framing for new openings as specified and indicated and in accordance with approved shop drawings. For application with approved firestopping material.
- C. Clearances: Provide not less than one inch clearance between penetrating and penetrated surfaces. Fill clearance space with approved firestopping material and seal and close as required.
- D. Tightness: Penetrations shall be: weathertight and fireproof where new fire rated surfaces are penetrated. They shall be vaportight to prevent vapor transmission to con

BASIC ELECTRICAL MATERIALS AND METHODS

ditioned spaces, soundtight to prevent sound transmission to or between normally occupied or finished spaces, deleterious or hazardous substance-tight where toxic and/or flammable substances or gases could migrate.

- E. Sealants: Sealant shall be elastomeric type or foamed silicone type, as specified under paragraph entitled "sealants", applied to oil free surfaces to not less than 3/8 inch depth.
- F. Conduits, Ductwork, Pipe, Closure Collars: Closure collar, not less than 4 inches wide, unless otherwise indicated, shall be provided for all items on each side of penetrated surface. Install collar tight against the surface and fit snugly around penetrating item without contact. Sharp edges shall be ground smooth to preclude damage to penetrating surface. Collars for pipes, conduits and round ducts 15 inches in diameter or less shall be fabricated from 20-gauge, 0.0396 inch nominal thickness, mill galvanized steel. Not less than 4 fasteners shall be used to attach collars where the opening is 12 inches in diameter or less, and not less than 8 fasteners shall be used where the opening is 20 inches in diameter or less.

Collars for square and rectangular ducts with a minimum side of 15 inches or less shall be fabricated from 20-gauge, 0.0396 inch nominal thickness, mill galvanized steel. Collars for round, square, and rectangular ducts with minimum dimension over 15 inches shall be fabricated from 18-gauge, 0.0516 inch in nominal thickness, mill galvanized steel. Collars shall be installed with fasteners on maximum 6-inch centers. Where penetrating items are irregularly shaped and where approved, smoothly finished, fire-retardant, foamed silicone elastomer may be utilized without closure collar.

- G. Conduit Sleeves: Conduit passing through concrete or masonry walls or concrete floors shall be provided with conduit sleeves. Sleeves shall not be installed in structural members except where indicated or approved. Each sleeve shall extend through its respective wall, floor, and shall be cut flush with each surface. Unless otherwise indicated, sleeves shall be of such size as to provide a minimum of 1/4 inch all around clearance between bare conduit and sleeves. Sleeves in bearing walls, waterproofing membrane floors, and wet areas shall be steel pipe or cast iron pipe. Sleeves in nonbearing walls, floors, or ceilings may be steel pipe, cast iron pipe, or galvanized sheet metal with lock-type longitudinal seam. Except in conduit and pipe chases or interior walls, the annular space between conduit and sleeve in nonfire rated walls and floors shall be sealed as indicated and specified in section: caulking, sealants and firestopping and in fire rated walls and floors shall be as indicated and hereinbefore specified. Conduit passing through wall waterproofing membrane shall be sleeved as described above. In addition, as waterproofing clamping flange shall be installed as indicated.

BASIC ELECTRICAL MATERIALS AND METHODS

1. Conduits passing through floor waterproofing membrane: Pipes shall be installed through a 4-pound lead-flashing sleeve, a 16-ounce copper sleeve, or a 0.032 inch thick aluminum sleeve, each within an integral skirt or flange. Flashing sleeve shall be suitably formed, and the skirt or flange shall extend 8 or more inches from the pipe and shall be set over the floor membrane in a troweled coating of bituminous cement. The flashing sleeve shall extend up the conduits a minimum of 10 inches above the floor. The annular space between the flashing sleeve and the metal-jacket-covered insulation shall be sealed as indicated. Conduits and pipes up to and including 10 inches in diameter passing through floor waterproofing membrane may be installed through a cast iron sleeve with caulking races, anchor lugs, flashing clamp device, and pressure ring with brass bolts. Waterproofing membrane shall be clamped into place and sealant shall be placed in the caulking recess.
 2. Sealing of Conduits or Uninsulated Pipes Passing Through Waterproofing Membrane: A modular mechanical type sealing assembly may be installed. The seals shall consist of interlocking synthetic rubber links shaped to continuously fill the annular space between the pipe/conduit and sleeve with corrosion protected carbon steel bolts, nuts, and pressure plates. The links shall be loosely assembled with bolts to form a continuous rubber belt around the pipe with a pressure plate under each bolt head and each nut.
After the seal assembly is properly positioned in the sleeve, tightening of the bolt shall cause the rubber sealing elements to expand and provide a watertight seal between the pipe/conduit and the sleeve. Each seal assembly shall be sized as recommended by the manufacturer to fit the pipe/conduit and sleeve involved. Contractor electing to use the modular mechanical type seals shall provide sleeves of the proper diameters.
 3. Optional Counterflashing: As an alternate to caulking and sealing, the annular space between the conduit and flashing sleeve or counterflashing may be by standard roof coupling for threaded pipe up to 6 inches in diameter; lead-flashing sleeve for dry vents and turning the sleeve down into the pipe to form a waterproofing joint; or tack-welded or banded-metal rain shield round the pipe and sealing as indicated.
- H. Escutcheons shall be provided at all finished surfaces where exposed conduit and piping, bare or covered, passes through floors, walls, or ceilings, including mechanical equipment rooms. Escutcheons shall be fastened securely to pipe sleeves or to extensions of sleeves without any part of sleeves being visible. Where sleeves project slightly from floors, special deep-type escutcheons shall be used. Escutcheons shall be chromium-plated iron or chromium-plated brass, either one-piece or split pattern, held in place by internal spring tension or setscrew.

BASIC ELECTRICAL MATERIALS AND METHODS

END OF SECTION

260500-9

Basic Electrical Materials and Methods

PHOTO LAB – DARKROOM RENOVATION

PURCHASE COLLEGE SUNY | 735 ANDERSON HILL RD. | VISUAL ARTS BUILDING | LA PLLC Project 2306

SUPPORTING DEVICES

260509 SUPPORTING DEVICES

PART 1 - GENERAL

1.01 DESCRIPTION

- A. Provide all materials, equipment and perform all operations for complete installation of the equipment support system and related Work as indicated on the Drawings and specified herein, including but not limited to the following:
 - 1. Conduit and equipment supports.
 - 2. Anchors and fasteners.
- B. This Section does not intend to describe supporting assemblies which are normally purchased with or fabricated for a particular system such as cable tray.

1.02 RELATED SECTIONS

- A. Section 260100- "Electrical General Requirements" applies to the Work specified in this Section.

1.03 REFERENCES

- A. All materials and Work shall conform to the latest industry standards, all applicable requirements included in the below references, specification requirements, and all applicable codes and requirements of the local authorities having jurisdiction, whichever are more stringent. In each of the publications referred to herein, consider the advisory provisions to be mandatory, as though the word "shall" had been substituted for "should" wherever it appears.
 - 1. National Electric Codes (NEC).
 - 2. NFPA 101 - Life Safety Code (LSC).
 - 3. ASTM E699 - Standard Criteria for Evaluation of Agencies Involved in Testing, Quality Assurance, and Evaluating Building Components.

1.04 SUBMITTALS

- A. Submit manufacturer's latest published literature for approval under the provisions of Section 260100 - "Electrical General Requirements".
- B. Product Data: Submit manufacturer's product data for each type of product specified including but not limited to:
 - 1. Hanger and support schedule indicating, size, spacing, features, and application for each required type of hanger, support, sleeve, seal, and fastener to be used.

SUPPORTING DEVICES

2. Indicate compliance with seismic ratings where items supported are subject to seismic support and bracing requirements.
 3. Submit proposed methods for attaching hangers to primary building steel.
- C. Shop Drawings: Submit shop drawings indicating details of fabricated products and materials. Include calculations or proposed structural steel supports and hangers.

1.5 QUALITY ASSURANCE

- A. Manufacturer's Qualifications: Firms regularly engaged in manufacture of supporting devices of sizes, types and ratings required, whose products have been in satisfactory use in similar service for not less than 10 years. When requested by the Design Professional, an acceptable list of installations with similar equipment shall be provided demonstrating compliance with this requirement.
- B. Installer's Qualifications: A firm with at least 10 years of successful installation experience on projects with supports similar to those required for this Project.
- C. Testing Agency Qualifications: The testing organization must demonstrate conformance with requirements of ASTM E699, that it has the experience and capability to satisfactorily conduct the testing indicated.
- D. Comply with the requirements of ASTM and NFPA.
- E. UL Compliance: Provide products that are UL-listed and labeled for the installed environment and comply with the listed UL standards.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Subject to compliance with requirements, manufacturers offering products that may be incorporated in the Work include, but are not limited to, the following:
 1. Allied Tube & Conduit
 2. B-Line Systems, Inc.
 3. Unistrut Diversified Products

2.02 PRODUCT REQUIREMENTS

- A. Provide supporting devices which comply with manufacturer's standards materials, design and construction in accordance with product information and as required for complete installation. Where more than one type of supporting device meets indicated requirements, selection is installer's option.

SUPPORTING DEVICES

- B. Provide materials, sizes, and types of anchors, fasteners and supports to carry the loads of equipment and conduit. Consider weight of wire in conduit when selecting products.
- C. Unless otherwise noted, supports, hardware, fittings and fasteners shall be protected with zinc coating or with treatment of equivalent corrosion resistance using approved alternative treatment. Products shall be treated after cutting and threading. Products utilized outdoors shall be hot-dip galvanized. Products utilized in corrosive areas shall have 316 stainless steel finish.
- D. Anchors and Fasteners:
 - 1. Concrete Structural Elements and Masonry Walls: Use carbon steel wedge or sleeve type expansion anchors and preset concrete inserts. Holes cut to a depth of 1-1/2 inches into reinforced concrete beams or 3/4 inches into concrete shall not cut reinforcement bars.
 - 2. Steel Structural Elements: Use beam clamps, steel fasteners and clevis hangers.
 - 3. Concrete Surfaces: Use self-drilling anchors and carbon steel wedge type expansion anchors. Coordinate all anchor locations in post-tensioned slabs. Anchors longer than 3/4 inch are not permitted.
 - 4. Hollow Masonry: Use steel spring-head type toggle bolts and hollow wall fasteners.
 - 5. Wood Elements: Use wood screws.
 - 6. Steel Surfaces: Machine screws, welded threaded studs, or spring-tension clamps.
 - 7. Partitions of Light Steel Construction: Sheet metal screws.
- E. Holes cut to a depth of more than 1-1/2 inches in reinforced concrete beams or more than 3/4 inch in reinforced concrete shall not cut the main reinforcing bars. Fill holes that are not used.
- F. Ensure that the load applied to any fastener does not exceed 25 percent of the proof test load. Use vibration and shock-resistant fasteners for attachments to concrete slabs.
- G. Raceway Supports: Clevis hangers, riser clamps, malleable iron conduit straps, threaded C-clamps with retainers, ceiling trapeze hangers, wall brackets, and spring steel clamps.
- H. U-Channel (Strut) Systems: 12 gauge steel channels, with 9/16-inch-diameter holes, at a minimum of 8 inches on center, in top surface. Provide fittings and accessories that mate and match with U-channel and are of the same manufacturer.
- I. Steel Brackets: Fabricated of angles, channels, and other standard structural shapes. Connect with welds and machine bolts to form rigid supports.

SUPPORTING DEVICES

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Provide a system of support and fastening for all conduit, fixtures, and equipment complete with hangers, anchorage, sway braces, rods, bolts, angels, channels, plates, inserts, fastening, welding and all operations and appurtenances required to make the supporting system complete in all respects. Install products in accordance with manufacturer's instructions. All hangers shall be fabricated from steel and adjustable for elevation. Provide anchors, fasteners, and supports in accordance with NECA "Standard of Installation."
- B. It is the intent of this Specification that all hangers be supported from the primary building structural system.
- C. Provide all angles, channels, plates and bolts or other structural shapes necessary to fasten hangers to the primary building construction for supporting conduit, transformers and similar equipment. Hangers shall be bolted or welded to the primary building steel or concrete beams or other structural load carrying shapes where they occur. Beam and channel clamps may be used to attach equipment to I-beams but the hanger spacing must be reduced by 33 percent. If the spacing of the building steel, concrete beams or structural beams is in excess of that required for the component supported, provide intermediate structural steel shapes securely fastened to building beams or where specifically approved, hung from building concrete construction by means of rods and inserts. Attachments shall be rated by an independent testing laboratory for the rated loading with a safety factor of 5 based on the ultimate tensile strength of the material. All steel loaded in shear shall be based on a maximum working stress of 15,000 pounds per square inch. Testing for concrete and steel attachments shall be in accordance with test criteria established by UL. Provide supports which, in each case, are amply strong and rigid for the load, but which will not weaken or unduly stress the building construction.
- D. Conduits shall in all cases be substantially supported in an approved manner, but they shall not be fastened to or come in contact with any other pipes, ducts or other Work of a similar nature.
- E. Do not use powder-actuated anchors.
- F. Do not drill or cut or punch holes in structural shapes or members unless specifically permitted in writing by the Design Professional. The Contractor will be responsible to provide calculations that are sealed and signed by a Professional Engineer, registered in the project State, substantiating that the holes will not detrimentally affect the structure in any way. Under no conditions shall any hangers, supports, bolts, or rivets pierce ducts.
- G. Fabricate equipment supports from structural steel or steel channel. Rigidly weld members or use hexagon head bolts to present neat appearance with adequate strength and rigidity.

SUPPORTING DEVICES

Use spring lock washers under all nuts. Freestanding supports shall include flanges on the floor and ceiling or wall and all supplemental bracing.

- H. Hangers or supports shall be based on the weight of the item and for conduit or raceway systems with a concentrated load of 250 pounds at the center of the span between supports.
- I. Hangers shall be spaced as follows, unless otherwise indicated, and shall be provided with the minimum sizes shown, complete with the necessary adjusting and lock-nuts.

CONDUIT SIZE	MAXIMUM HANGER SPACING	MINIMUM ROD SIZE
Up to 1-1/4 inch	6 feet	3/8 inch
1-1/2 inch and 2 inch	7 feet	1/2 inch
2-1/2 inch and 3 inch	10 feet	1/2 inch
4 inch and 5 inch	10 feet	5/8 inch

Hanger rods for trapeze-type hangers shall be not less than 5/8 inch diameter. Conduits shall be securely fastened to each support with straps or clamps.

- J. A hanger or support shall be installed close to the point of a change in direction of all conduit runs, in either a horizontal or vertical plane.
- K. Lighting Fixture Supports: Provide separate supports consisting of formed steel and rods to suspend lighting fixtures independently of the finished ceiling construction (plaster, sheet rock, acoustic tile, etc.). Hangers shall be fully adjustable to allow fixture level to coincide with the finished ceiling level, and shall be securely fastened to the primary structural members of the building construction. Minimum fixture support shall include, but not be limited to:
 - 1. Recessed Lighting Fixtures: Support fixtures from two diametrically opposite corners, independent of the ceiling structural system and directly to the building slab or primary structural steel. Fasten fixtures securely at the other corners to the ceiling structural system (black iron, grid hangers, etc.).
 - 2. Surface and Pendant Fixtures: Support independently of the ceiling structural system and directly to the building slab or primary structural steel. Provide pendant/surface fixtures longer than 2 feet with a minimum two hangers. Fasten fixtures securely at all other points to the ceiling structural system. Ensure that pendant fixtures are plumb and level. For continuous rows of fixtures provide additional hangers attached to the primary structural system as required but not less than one per fixture.
 - 3. "High-hats": Support from two points on the ceiling structural system in lieu of attachment to the primary structure.
- L. Raceway Supports: Comply with the NEC and the following requirements:

SUPPORTING DEVICES

1. Provide individual and multiple (trapeze) raceway hangers and riser clamps as necessary to support raceways.
 2. Support parallel runs of horizontal raceways together on trapeze-type hangers.
 3. Support individual horizontal raceways by separate pipe hangers or on pipe straps for wall mounting applications. Spring steel fasteners may be used in lieu of hangers only for 1 inch and smaller raceways serving lighting and receptacle branch circuits above suspended ceiling only. Hanger rods for spring steel fasteners shall be 1/4 inch diameter minimum threaded steel. Use spring steel fasteners that are specifically designed for supporting single conduits or tubing.
 4. In vertical runs, arrange support so the load produced by the weight of the raceway and the enclosed conductors is carried entirely by the conduit supports with no weight load on raceway terminals.
- M. Conductor Supports: All conductors installed in vertical raceways shall be supported in accordance with NEC and the following requirements:
1. Provide at intervals required by code consisting of circular type insulating wedges installed simultaneously with conductors. Supports shall be of the non-deteriorating insulating material manufactured specifically for the purpose.
 2. Supports shall be provided where conduit terminations are located and in accessible cable support boxes complete with removable covers.
- N. Where conduit and equipment is required to be supported from pre-cast or pre-stressed concrete, utilize tee hangers between adjacent flanges with through bolts and plates that are attached in locations and by methods specifically intended by the design of the pre-cast or pre-stressed concrete. Under special conditions, where the Contractor provides calculations that are sealed and signed by a Professional Engineer, registered in the project State, substantiating that concrete slabs will not be detrimentally affected, field drilled dual expansion shields may be acceptable.
- O. Miscellaneous Supports: Install metal channel racks for mounting cabinets, panelboards, disconnects, control enclosures, pull boxes, junction boxes, transformers, and other devices. Use steel channel supports to stand cabinets and panelboards one inch off wall where installed on exterior masonry walls and on walls in wet or damp locations.

3.02 FIELD QUALITY CONTROL

- A. Test the pull-out resistance of one of each type and size expansion anchor and toggle bolt utilized on the project. Test to 90 percent of the rated proof load for the fastener. If fastening fails the test, the Contractor will be required to revise all similar fastener installations and retest until satisfactory results are achieved.

SUPPORTING DEVICES

- B. Provide all equipment necessary for reliable testing including calibrated scales.
- C. Restore all fireproofing on steel beams that was disturbed by the installation of support hangers.

END OF SECTION

260509-7

Supporting Devices

REQUIREMENTS FOR ELECTRICAL INSTALLATIONS

260511 REQUIREMENTS FOR ELECTRICAL INSTALLATIONS

PART 1 - GENERAL

1.01 DESCRIPTION

- A. This section applies to all sections of Division 26.
- B. Furnish and install electrical systems, materials, equipment, and accessories in accordance with the specifications and drawings. Capacities and ratings of motors, transformers, conductors and cable, switchboards, switchgear, panelboards, motor control centers, generators, automatic transfer switches, and other items and arrangements for the specified items are shown on the drawings.
- C. Conductor ampacities specified or shown on the drawings are based on copper conductors, with the conduit and raceways sized per NEC. Aluminum conductors are prohibited.

1.02 MINIMUM REQUIREMENTS

- A. The latest International Building Code (IBC), Underwriters Laboratories, Inc. (UL), Institute of Electrical and Electronics Engineers (IEEE), and National Fire Protection Association (NFPA) codes and standards are the minimum requirements for materials and installation.
- B. The drawings and specifications shall govern in those instances where requirements are greater than those stated in the above codes and standards.

1.03 TEST STANDARDS

- A. All materials and equipment shall be listed, labeled, or certified by a Nationally Recognized Testing Laboratory (NRTL) to meet Underwriters Laboratories, Inc. (UL), standards where test standards have been established. Materials and equipment which are not covered by UL standards will be accepted, providing that materials and equipment are listed, labeled, certified or otherwise determined to meet the safety requirements of a NRTL. Materials and equipment which no NRTL accepts, certifies, lists, labels, or determines to be safe, will be considered if inspected or tested in accordance with national industrial standards, such as ANSI, NEMA, and NETA. Evidence of compliance shall include certified test reports and definitive shop drawings.

REQUIREMENTS FOR ELECTRICAL INSTALLATIONS

B. Definitions:

1. Listed: Materials and equipment included in a list published by an organization that is acceptable to the Authority Having Jurisdiction and concerned with evaluation of products or services, that maintains periodic inspection of production or listed materials and equipment or periodic evaluation of services, and whose listing states that the materials and equipment either meets appropriate designated standards or has been tested and found suitable for a specified purpose.
2. Labeled: Materials and equipment to which has been attached a label, symbol, or other identifying mark of an organization that is acceptable to the Authority Having Jurisdiction and concerned with product evaluation, that maintains periodic inspection of production of labeled materials and equipment, and by whose labeling the manufacturer indicates compliance with appropriate standards or performance in a specified manner.
3. Certified: Materials and equipment which:
 - a. Have been tested and found by a NRTL to meet nationally recognized standards or to be safe for use in a specified manner.
 - b. Are periodically inspected by a NRTL.
 - c. Bear a label, tag, or other record of certification.
4. Nationally Recognized Testing Laboratory: Testing laboratory which is recognized and approved by the Secretary of Labor in accordance with OSHA regulations.

1.04 QUALIFICATIONS (PRODUCTS AND SERVICES)

- A. Manufacturer's Qualifications: The manufacturer shall regularly and currently produce, as one of the manufacturer's principal products, the materials and equipment specified for this project, and shall have manufactured the materials and equipment for at least three years.
- B. Product Qualification:
 1. Manufacturer's materials and equipment shall have been in satisfactory operation, on three installations of similar size and type as this project, for at least three years.
 2. The Government reserves the right to require the Contractor to submit a list of installations where the materials and equipment have been in operation before approval.
- C. Service Qualifications: There shall be a permanent service organization maintained or trained by the manufacturer which will render satisfactory

REQUIREMENTS FOR ELECTRICAL INSTALLATIONS

service to this installation within four hours of receipt of notification that service is needed. Submit name and address of service organizations.

1.05 APPLICABLE PUBLICATIONS

- A. Applicable publications listed in all Sections of Division 26 shall be the latest issue, unless otherwise noted.
- B. Products specified in all sections of Division 26 shall comply with the applicable publications listed in each section.

1.06 MANUFACTURED PRODUCTS

- A. Materials and equipment furnished shall be of current production by manufacturers regularly engaged in the manufacture of such items, and for which replacement parts shall be available. Materials and equipment furnished shall be new, and shall have superior quality and freshness.
- B. When more than one unit of the same class or type of materials and equipment is required, such units shall be the product of a single manufacturer.
- C. Equipment Assemblies and Components:
 - 1. Components of an assembled unit need not be products of the same manufacturer.
 - 2. Manufacturers of equipment assemblies, which include components made by others, shall assume complete responsibility for the final assembled unit.
 - 3. Components shall be compatible with each other and with the total assembly for the intended service.
 - 4. Constituent parts which are similar shall be the product of a single manufacturer.
- D. Factory wiring and terminals shall be identified on the equipment being furnished and on all wiring diagrams.
- E. When Factory Tests are specified, Factory Tests shall be performed in the factory by the equipment manufacturer, and witnessed by the contractor. In addition, the following requirements shall be complied with:
 - 1. The Owner shall have the option of witnessing factory tests. The Contractor shall notify the Owner through the CM (Construction Manager) a minimum of thirty (30) days prior to the manufacturer's performing of the factory tests.
 - 2. When factory tests are successful, contractor shall furnish four (4) copies of the equipment manufacturer's certified test reports to the

260511-3

Requirements for Electrical Installations

REQUIREMENTS FOR ELECTRICAL INSTALLATIONS

CM fourteen (14) days prior to shipment of the equipment, and not more than ninety (90) days after completion of the factory tests.

3. When factory tests are not successful, factory tests shall be repeated in the factory by the equipment manufacturer, and witnessed by the Contractor. The Contractor shall be liable for all additional expenses for the Owner to witness factory re-testing.

1.07 MATERIALS AND EQUIPMENT PROTECTION

- A. Materials and equipment shall be protected during shipment and storage against physical damage, vermin, dirt, corrosive substances, fumes, moisture, cold and rain.
 1. Store materials and equipment indoors in clean dry space with uniform temperature to prevent condensation.
 2. During installation, equipment shall be protected against entry of foreign matter, and be vacuum-cleaned both inside and outside before testing and operating. Compressed air shall not be used to clean equipment. Remove loose packing and flammable materials from inside equipment.
 3. Damaged equipment shall be repaired or replaced, as determined by the Engineer.
 4. Painted surfaces shall be protected with factory installed removable heavy kraft paper, sheet vinyl or equal.
 5. Damaged paint on equipment shall be refinished with the same quality of paint and workmanship as used by the manufacturer so repaired areas are not obvious.

1.08 WORK PERFORMANCE

- A. All electrical work shall comply with requirements of the latest NFPA 70 (NEC), NFPA 70B, NFPA 70E, NFPA 99, NFPA 110, OSHA Part 1910 subpart J – General Environmental Controls, OSHA Part 1910 subpart K – Medical and First Aid, and OSHA Part 1910 subpart S – Electrical, in addition to other references required by contract.
- B. Job site safety and worker safety is the responsibility of the Contractor.
- C. Electrical work shall be accomplished with all affected circuits or equipment de-energized. However, energized electrical work may be performed only for the non-destructive and non-invasive diagnostic testing(s), or when scheduled outage poses an imminent hazard to patient care, safety, or physical security. In such case, all aspects of energized electrical work, such as the availability of appropriate/correct personal protective equipment (PPE) and the use of PPE, shall comply with the latest NFPA 70E, as well as the following requirements:

260511-4

Requirements for Electrical Installations

REQUIREMENTS FOR ELECTRICAL INSTALLATIONS

1. Only Qualified Person(s) shall perform energized electrical work. Supervisor of Qualified Person(s) shall witness the work of its entirety to ensure compliance with safety requirements and approved work plan.
 2. At least two weeks before initiating any energized electrical work, the Contractor and the Qualified Person(s) who is designated to perform the work shall visually inspect, verify and confirm that the work area and electrical equipment can safely accommodate the work involved.
 3. At least two weeks before initiating any energized electrical work, the Contractor shall develop and submit a job specific work plan, and energized electrical work request to the Engineer, and Medical Center's Chief Engineer or his/her designee. At the minimum, the work plan must include relevant information such as proposed work schedule, area of work, description of work, name(s) of Supervisor and Qualified Person(s) performing the work, equipment to be used, procedures to be used on and near the live electrical equipment, barriers to be installed, safety equipment to be used, and exit pathways.
 4. Energized electrical work shall begin only after the Contractor has obtained written approval of the work plan, and the energized electrical work request from the Engineer and CM, and Medical Center's Chief Engineer or his/her designee. The Contractor shall make these approved documents present and available at the time and place of energized electrical work.
 5. Energized electrical work shall begin only after the Contractor has invited and received acknowledgment from the Engineer and CM, and Medical Center's Chief Engineer or his/her designee to witness the work.
- D. For work that affects existing electrical systems, arrange, phase and perform work to assure minimal interference with normal functioning of the facility.
- E. New work shall be installed and connected to existing work neatly, safely and professionally. Disturbed or damaged work shall be replaced or repaired to its prior conditions, as required by Section 01 00 00, GENERAL REQUIREMENTS.
- F. Coordinate location of equipment and conduit with other trades to minimize interference.

REQUIREMENTS FOR ELECTRICAL INSTALLATIONS

1.09 EQUIPMENT INSTALLATION AND REQUIREMENTS

- A. Equipment location shall be as close as practical to locations shown on the drawings.
- B. Working clearances shall not be less than specified in the NEC.
- C. Inaccessible Equipment:
 - 1. Where the Owner determines that the Contractor has installed equipment not readily accessible for operation and maintenance, the equipment shall be removed and reinstalled as directed at no additional cost to the Government.
 - 2. "Readily accessible" is defined as being capable of being reached quickly for operation, maintenance, or inspections without the use of ladders, or without climbing or crawling under or over obstacles such as, but not limited to, motors, pumps, belt guards, transformers, piping, ductwork, conduit and raceways.
- D. Electrical service entrance equipment and arrangements for temporary and permanent connections to the electric utility company's system shall conform to the electric utility company's requirements. Coordinate fuses, circuit breakers and relays with the electric utility company's system, and obtain electric utility company approval for sizes and settings of these devices.

1.10 EQUIPMENT IDENTIFICATION

- A. In addition to the requirements of the NEC, install an identification sign which clearly indicates information required for use and maintenance of items such as switchboards and switchgear, panelboards, cabinets, motor controllers, fused and non-fused safety switches, generators, automatic transfer switches, separately enclosed circuit breakers, individual breakers and controllers in switchboards, switchgear and motor control assemblies, control devices and other significant equipment.
- B. Identification signs for Normal Power System equipment shall be laminated black phenolic resin with a white core with engraved lettering. Identification signs for Essential Electrical System (EES) equipment, as defined in the NEC, shall be laminated red phenolic resin with a white core with engraved lettering. Lettering shall be a minimum of 12 mm (1/2 inch) high. Identification signs shall indicate equipment designation, rated bus amperage, voltage, number of phases, number of wires, and type of EES power branch as applicable. Secure nameplates with screws.

REQUIREMENTS FOR ELECTRICAL INSTALLATIONS

- C. Install adhesive arc flash warning labels on all equipment as required by the latest NFPA 70E. Label shall show specific and correct information for specific equipment based on its arc flash calculations. Label shall show the followings:
 - 1. Nominal system voltage.
 - 2. Equipment/bus name, date prepared, and manufacturer name and address.
 - 3. Arc flash boundary.
 - 4. Available arc flash incident energy and the corresponding working distance.
 - 5. Minimum arc rating of clothing.
 - 6. Site-specific level of PPE.

1.11 SUBMITTALS

- A. Submit to the Engineer in accordance with frond end section, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. The Owner's approval shall be obtained for all materials and equipment before delivery to the job site. Delivery, storage or installation of materials and equipment which has not had prior approval will not be permitted.
- C. All submittals shall include two copies of adequate descriptive literature, catalog cuts, shop drawings, test reports, certifications, samples, and other data necessary for the Government to ascertain that the proposed materials and equipment comply with drawing and specification requirements. Catalog cuts submitted for approval shall be legible and clearly identify specific materials and equipment being submitted.
- D. Submittals for individual systems and equipment assemblies which consist of more than one item or component shall be made for the system or assembly as a whole. Partial submittals will not be considered for approval.
 - 1. Mark the submittals, "SUBMITTED UNDER SECTION_____".
 - 2. Submittals shall be marked to show specification reference including the section and paragraph numbers.
 - 3. Submit each section separately.
- E. The submittals shall include the following:
 - 1. Information that confirms compliance with contract requirements. Include the manufacturer's name, model or catalog numbers, catalog information, technical data sheets, shop drawings, manuals, pictures, nameplate data, and test reports as required.

REQUIREMENTS FOR ELECTRICAL INSTALLATIONS

2. Submittals are required for all equipment anchors and supports. Submittals shall include weights, dimensions, center of gravity, standard connections, manufacturer's recommendations and behavior problems (e.g., vibration, thermal expansion, etc.) associated with equipment or piping so that the proposed installation can be properly reviewed. Include sufficient fabrication information so that appropriate mounting and securing provisions may be designed and attached to the equipment.
 3. Elementary and interconnection wiring diagrams for communication and signal systems, control systems, and equipment assemblies. All terminal points and wiring shall be identified on wiring diagrams.
 4. Parts list which shall include information for replacement parts and ordering instructions, as recommended by the equipment manufacturer.
- F. Maintenance and Operation Manuals:
1. Submit as required for systems and equipment specified in the technical sections. Furnish in hardcover binders or an approved equivalent.
 2. Inscribe the following identification on the cover: the words "MAINTENANCE AND OPERATION MANUAL," the name and location of the system, material, equipment, building, name of Contractor, and contract name and number. Include in the manual the names, addresses, and telephone numbers of each subcontractor installing the system or equipment and the local representatives for the material or equipment.
 3. Provide a table of contents and assemble the manual to conform to the table of contents, with tab sheets placed before instructions covering the subject. The instructions shall be legible and easily read, with large sheets of drawings folded in.
 4. The manuals shall include:
 - a. Internal and interconnecting wiring and control diagrams with data to explain detailed operation and control of the equipment.
 - b. A control sequence describing start-up, operation, and shutdown.
 - c. Description of the function of each principal item of equipment.
 - d. Installation instructions.
 - e. Safety precautions for operation and maintenance.
 - f. Diagrams and illustrations.
 - g. Periodic maintenance and testing procedures and frequencies, including replacement parts numbers.
 - h. Performance data.
 - i. Pictorial "exploded" parts list with part numbers. Emphasis shall be placed on the use of special tools and instruments. The list

REQUIREMENTS FOR ELECTRICAL INSTALLATIONS

- shall indicate sources of supply, recommended spare and replacement parts, and name of servicing organization.
- j. List of factory approved or qualified permanent servicing organizations for equipment repair and periodic testing and maintenance, including addresses and factory certification qualifications.
- G. Approvals will be based on complete submission of shop drawings, manuals, test reports, certifications, and samples as applicable.
- H. After approval and prior to installation, furnish the Engineer and CM with one sample of each of the following:
 1. A minimum 300 mm (12 inches) length of each type and size of wire and cable along with the tag from the coils or reels from which the sample was taken. The length of the sample shall be sufficient to show all markings provided by the manufacturer.
 2. Each type of conduit coupling, bushing, and termination fitting.
 3. Conduit hangers, clamps, and supports.
 4. Duct sealing compound.
 5. Each type of receptacle, toggle switch, lighting control sensor, outlet box, manual motor starter, device wall plate, engraved nameplate, wire and cable splicing and terminating material, and branch circuit single pole molded case circuit breaker.

1.12 SINGULAR NUMBER

- A. Where any device or part of equipment is referred to in these specifications in the singular number (e.g., "the switch"), this reference shall be deemed to apply to as many such devices as are required to complete the installation as shown on the drawings.

1.13 ACCEPTANCE CHECKS AND TESTS

- A. The Contractor shall furnish the instruments, materials, and labor for tests.
- B. Where systems are comprised of components specified in more than one section of Division 26, the Contractor shall coordinate the installation, testing, and adjustment of all components between various manufacturer's representatives and technicians so that a complete, functional, and operational system is delivered to the Owner. All testing shall be done as per NETA standards, and the tester must be NETA certified.
- C. When test results indicate any defects, the Contractor shall repair or replace the defective materials or equipment, and repeat the tests for the

REQUIREMENTS FOR ELECTRICAL INSTALLATIONS

equipment. Repair, replacement, and re-testing shall be accomplished at no additional cost to the Owner.

1.14 INSTRUCTION

- A. Instruction to designated Owner's personnel shall be provided for the particular equipment or system as required in each associated technical specification section.
- B. Furnish the services of competent and factory-trained instructors to give full instruction in the adjustment, operation, and maintenance of the specified equipment and system, including pertinent safety requirements. Instructors shall be thoroughly familiar with all aspects of the installation, and shall be factory-trained in operating theory as well as practical operation and maintenance procedures.
- C. A training schedule shall be developed and submitted by the Contractor and approved by the Engineer and CM at least 30 days prior to the planned training.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION

WIRES AND CABLES-BELOW 600 VOLTS

260519 WIRES AND CABLES – BELOW 600 VOLTS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.
- B. Requirements of the following Division 26 Sections apply to this Section:
 - 1. Section 260100 - Basic Electrical Requirements
 - 2. Section 260500 - Basic Electrical Materials and Methods
 - 3. Section 260530 – Conduits Raceways
 - 4. Section 260532 – Cabinets, Boxes and Fittings
 - 5. Section 262726 - Wiring Devices
 - 6. Section 260553 - Electrical Identification
- C. Contractor shall refer to Section 011200 - "Summary", Section 015000 - "Temporary Facilities and Controls" and contract drawings inclusive, for the sequencing required to accomplish the work.

1.02 SUMMARY

- A. This Section includes wires, cables, and connectors for systems rated 600 volts and less.

1.03 SUBMITTALS

- A. Waiver of Submittals: The "Waiver of Certain Submittal Requirements" in Section 013300 does not apply to Shop Drawings.
- B. Shop Drawings:
 - 1. For Electrical Circuit Protective Systems: Show proposed routes and installation details (include UL classification data, listing, and system number).
- C. Product Data: Catalog sheets, FHIT's, specifications and installation instructions.

1.04 QUALITY ASSURANCE

- A. Regulatory Requirements: Comply with provisions of the following code:

WIRES AND CABLES-BELOW 600 VOLTS

1. National Electrical Code 2017.
 2. Conform to applicable codes and regulations regarding toxicity of combustion products of insulating materials.
 3. All testing shall be performed as per NETA Standards.
- B. UL Compliance: Provide components which are listed and labeled, (as designed by NFPA 70, ART 100), by UL under the following standards.
1. UL Std. 83 Thermoplastic-Insulated Wires and Cables.
 2. UL Std. 486A Wire Connectors and Soldering Lugs for Use with Copper Conductors.
 3. UL Std. 854 Service Entrance Cable.
 4. UL Std. 44 Standard for Thermoset-Insulated Wire and Cable.
 5. UL Std. 2196 Standard for Fire Test for Circuit Integrity of Fire-Resistive Power, Instrumentation, Control, and Data Cables.
- C. IEEE Compliance: Provide components which comply with the following standard.
1. Std. 82 Test Procedures for Impulse Voltage Tests on Insulated Conductors.
 2. Provide testing of 600V cables as per ICEA S-95-658/WC70.

1.05 DELIVERY AND STORAGE

- A. Deliver wires and cables according to NEMA WC 26.
- B. Mark and tag insulated conductors and cables for delivery to the site. Include:
1. Contractor's name.
 2. Project title and number.
 3. Date of manufacture (month & year).
 4. Manufacturer's name.
 5. Data which explains the meaning of coded identification (UL assigned electrical reference numbers, UL assigned combination of color marker threads, etc.).
 6. Environmental suitability information (listed or marked "sunlight resistant" where exposed to direct rays of sun; wet locations listed/marked for use in wet locations; other applications listed/marked suitable for the applications).

1.06 QUALIFICATIONS OF TESTING ORGANIZATION AND PERSONNEL

- A. Testing Organization
1. The testing organization shall be retained by the Contractor shall be an independent, third party entity which can function as an

WIRES AND CABLES-BELOW 600 VOLTS

- unbiased testing authority, professionally independent of the manufacturers, suppliers, and installers of equipment or systems being evaluated, and shall be certified by NETA.
2. The testing organization shall be regularly engaged in the testing of electrical equipment devices, installations, and systems.
 3. The testing organization shall use technicians who are regularly employed for testing services.
 4. An organization having a designation of NETA Accredited Company issued by the InterNational Electrical Testing Association meets the above criteria.
 5. The testing organization shall submit appropriate documentation to demonstrate that it satisfactorily complies with these requirements.
- B. Testing Personnel
1. Technicians performing these electrical tests and inspections shall be trained and experienced concerning the apparatus and systems being evaluated. These individuals shall be capable of conducting the tests in a safe manner and with complete knowledge of the hazards involved. They must evaluate the test data and make a judgement on the serviceability of the specific equipment.
 2. Technicians shall be certified in accordance with ANSI/NETA ETT-2010, Standard for Certification of Electrical Testing Technicians. Each on-site crew leader shall hold a current certification, Level III or higher in electrical testing.

PART 2 - PRODUCTS

2.01 INSULATED CONDUCTORS AND CABLES

- A. Date of Manufacture: No insulated conductor more than one year old when delivered to the site will be acceptable.
- B. Acceptable Companies:
- 1) Southwire Co.
 - 2) General Cable Industries Inc.
 - 3) Cerro Wire & Cable Co. Inc.
 - 4) Prysmian Group
 - 5) Houston Wire and Cable Co.
 - 6) Atkore HCF Cable Systems
 - 7) Or Engineer Approved Equal
- C. Conductors: Annealed uncoated copper or annealed coated copper in conformance with the applicable standards for the type of insulation to be

260519-3

Wires and Cables-Below 600 Volts

WIRES AND CABLES-BELOW 600 VOLTS

applied on the conductor. Conductor sizes No. 8 and larger shall be stranded.

D. Types:

1. Electric Light and Power Wiring:
 - a. General: Rated 600V, NFPA 70 Type FEP, THHN-2, THW, THW-2, THWN, THWN-2, XHH, XHHW-2.
 - b. THWN Gasoline and Oil Resistant: Polyvinylchloride insulation rated 600 V with nylon jacket conforming to UL requirements for type THWN insulation, with the words "GASOLINE AND OIL RESISTANT II" marked thereon.
 - c. USE, USE-2: Dual rated heat and moisture resistant insulation rated 600 V with jacket or dual purpose insulation/protective covering conforming to UL requirements for type USE service entrance cables.
 - d. Metal clad cable, NFPA 70 Article 330 Type MC:
 - 1) Interlocked flexible galvanized steel strip with aluminum armor, conforming to UL requirements for type MC approved. With redundant ground.
 - 2) Insulated copper conductors, suitable for 600 volts, rated 90°C, one of the types listed in NFPA 70 or of a type identified for use in Type MC cable.
 - 3) Internal full size copper ground conductor with green insulation.
 - 4) Acceptable Companies: AFC Cable Systems Inc., Coleman Cable Co.
 - 5) Connectors for HCF cable: HCF Fitting Inc.'s AFC Series, Arlington Industries Inc.'s Saddle grip, or Thomas & Betts Co.'s Tite-Bite with anti-short bushings.
 - e. MI: AFC Cable Systems' Type MI Cable, or BICC/Pyrotenax Mineral Insulated System 1850 Pyrotenax Cable:
 - 1) Copper conductors.
 - 2) Seamless copper sheath.
 - 3) Two hour fire resistive rating UL system classified, listed in UL Building Materials Directory product category Electrical circuit Protective Systems (FHIT), or Fire Resistive Cables (FHJR)
 - 4) PVC or HDPE jacketing (where shown on drawings).
 - 5) 600 volt rating.
 - 6) Fittings and accessories as required for a complete system to suit listing and installation conditions.
 - 8) Mineral Insulated wiring Type MI cable shall have:

WIRES AND CABLES-BELOW 600 VOLTS

- Description: ANSI/NFPA 70, Type MI
- Conductor: solid high conductivity copper
- Insulation Voltage Rating: 600 volts
- Cable Temperature Rating: 90 degrees C
- Termination Temperature Rating: 90 degrees C
- Insulation Material: magnesium oxide
- Sheath Material: seamless soft-drawn copper
- Fire Rating: complete cable system shall have a 2-hour fire rating as listed and classified by Underwriters Laboratories, Inc.

E. See Section 260553 Electrical Identification for color coding of wires and cables.

2.02 ELECTRICAL CIRCUIT PROTECTIVE SYSTEM

A. Minimum 2-Hour Fire Rating: A system listed in UL Building Materials Directory, product category Electrical Circuit Protective Systems (FHIT).

2.03 CONNECTORS

A. General:

1. Connectors specified are part of a system. Furnish connectors and components, and use specific tools and methods as recommended by connector manufacturer to form complete connector system.
2. Connectors shall be UL 486 A listed, or UL 486 B listed for combination dual rated copper/aluminum connectors (marked AL7CU for 75 degrees C rated circuits and AL9CU for 90 degrees C rated circuits).

B. Splices:

1. Spring Type:
 - a. Rated 105° C, 600V:
 - 1) Buchanan/Ideal Industries Inc.'s B-Cap
 - 2) Electrical Products Div./3M's Scotchlok Type Y, R, G, B, O/B+, R/Y+, or B/G+
 - 3) Ideal Industries Inc.'s Wing Nuts or Wire Nuts.
 - b. Rated 150° C, 600V:
 - 1) Ideal Industries Inc.'s High Temperature Wire-Nut Model 73B, 59B.
2. Indent Type with Insulating Jacket:

WIRES AND CABLES-BELOW 600 VOLTS

- a. Rated 105° C, 600V:
 - 1) Buchanan/Ideal Industries Inc.'s Crimp Connectors
 - 2) Ideal Industries Inc.'s Crimp Connectors
 - 3) Penn-Union Corp.'s Penn-Crimps
 - 4) Thomas & Betts Corp.'s STA-KON.
- 3. Indent Type (Uninsulated):
 - 1) Anderson/Hubbell's Versa-Crimp
 - 2) VERSAtile
 - 3) Blackburn/T&B Corp.'s Color-Coded Compression Connectors
 - 4) Electrical Products Div./3M's Scotchlok 1000011000 Series
 - 5) Framatome Connectors/Burndy's Hydent
 - 6) Penn-Union Corp.'s BCU, BBCU Series,
 - 7) Thomas & Betts Corp.'s Compression Connectors.
- 4. Connector Blocks:
 - 1) NIS Industries Inc.'s Polaris System
 - 2) Thomas & Betts Corp.'s Blackburn AMT Series.
- 5. Resin Splice Kits:
 - 1) Electrical Products Div./3M's Scotchcast Brand Kit Nos. 82A Series, 82-B1 or 90-B1,
 - 2) Scotchcast Brand Resin Pressure Splicing Method.
- 6. Heat Shrinkable Splices:
 - 1) Electrical Products Div./3M's ITCSN
 - 2) Raychem Corp.'s Thermofit Type WCS
 - 3) Thomas & Betts Corp.'s SHRINK-KON Insulators.
- 7. Cold Shrink Splices:
 - 1) Electrical Products Div./3M's 8420 Series.
- C. Gutter Taps:
 - 1. Anderson/Hubbell's GP/GT with GTC Series Covers
 - 2. Blackburn/T&B Corp.'s H-Tap Type CF with Type C Covers
 - 3. Framatome Connectors/Burndy's Polytap KPU-AC
 - 4. H-Crimpfit Type YH with CF-FR Series Covers
 - 5. ILSCO's GTA Series with GTC Series Covers
 - 6. Ideal Industries Inc.'s Power-Connect GP
 - 7. GT Series with GIC covers
 - 8. NSI Industries Inc.'s Polaris System
 - 9. OZ/Gedney Co.'s PMX or PT with PMXC
 - 10. PTC Covers
 - 11. Penn-Union Corp.'s CDT Series
 - 12. Thomas & Betts Corp.'s Color-Keyed H Tap CHT with HTC Covers.
- D. Terminals:

260519-6

Wires and Cables-Below 600 Volts

PHOTO LAB – DARKROOM RENOVATION

PURCHASE COLLEGE SUNY | 735 ANDERSON HILL RD. | VISUAL ARTS BUILDING | LA PLLC Project 2306

WIRES AND CABLES-BELOW 600 VOLTS

1. Nylon insulated pressure terminal connectors by Amp-Tyco/Electronics
2. Electrical Products Div./3M
3. Framatome Connectors/Burndy
4. Ideal Industries Inc.
5. Panduit Corp.
6. Penn-Union Corp.
7. Thomas & Betts Corp.
8. Wiremold Co.

E. Lugs:

1. Single Cable (Compression Type Lugs)- Copper, one or 2 hole style (to suit conditions), long barrel:
 - a. Anderson/Hubbell's VERSAtile VHCL
 - b. Blackburn/T&B Corp.'s Color-Coded CTL
 - c. LCN
 - d. Framatome Connectors/Burndy's Hylug YA
 - e. Electrical Products Div./3M Scotchlok 31036 or 31145 Series
 - f. Ideal Industries Inc.'s CCB or CCBL
 - g. NSI Industries Inc.'s L, LN Series
 - h. Penn-Union Corp.'s BBLU Series
 - i. Thomas & Betts Corp.'s 54930BE or 54850BE Series.
2. Single Cable (Mechanical Type Lugs) - Copper, one or 2 hole style (to suit conditions):
 - a. Blackburn/T&B Corp.'s Color-Keyed Locktite Series
 - b. Framatome Connectors/Burndy's Qiklug Series
 - c. NSI Industries Inc.'s Type TL
 - d. Penn-Union Corp.'s VI-TITE Terminal Lug Series
 - e. Thomas & Betts Corp.'s Locktite Series.
3. Multiple Cable (Mechanical Type Lugs)- Copper, configuration to suit conditions:
 - a. Framatome Connectors/Burndy's Qiklug Series
 - b. NSI Industries Inc.'s Type TL
 - c. Penn-Union Corp.'s VI-TITE Terminal Lug Series
 - d. Thomas & Betts Corp.'s Color-Keyed Locktite Series.

2.04 TAPES

A. Insulation Tapes:

1. Plastic Tape:
 - a. Electrical Products Div./3M's Scotch Super 33+ or Scotch 88
 - b. Plymouth Rubber Co.'s Plymouth/ Bishop Premium 85CW.

WIRES AND CABLES-BELOW 600 VOLTS

2. Rubber Tape:
 - a. Electrical Products Div./3M's Scotch 130C
 - b. Plymouth Rubber Co.'s Plymouth/Bishop W963 Plysafe.
- B. Moisture Sealing Tape:
 - a. Electrical Products Div./3M's Scotch 2200 or 2210,
 - b. Plymouth Rubber Co.'s Plymouth/Bishop 4000 Plyseal-V.
- C. Electrical Filler Tape:
 - a. Electrical Products Div./3M's Scotchfil,
 - b. Plymouth Rubber Co.'s Plymouth/Bishop 125 Electrical Filler Tape.
- D. Color Coding Tape:
 - a. Electrical Products Div./3M's Scotch 35
 - b. Plymouth Rubber Co.'s Plymouth/Bishop Premium 37 Color Coding.
- E. Arc Proofing Tapes:
 1. Arc Proofing Tape:
 - a. Electrical Products Div./3M's Scotch 77
 - b. Mac Products Inc.'s AP Series
 - c. Plymouth Rubber Co.'s Plymouth/Bishop 53 Plyarc.
 2. Glass Cloth Tape:
 - a. Electrical Products Div./3M's Scotch 27/Scotch 69
 - b. Mac Products Inc.'s TAPGLA 5066
 - c. Plymouth Rubber Co.'s Plymouth/Bishop 77 Plyglas.
 3. Glass-Fiber Cord:
 - a. Mac Products Inc's MAC 0527.

2.05 WIRE-PULLING COMPOUNDS

- A. To suit type of insulation;
 1. American Polywater Corp.'s Polywater Series
 2. Electric Products Div./3M's WL, WLX, or WLW
 3. Greenlee Textron Inc.'s Y-ER-EAS
 4. Cable Cream
 5. Cable Gel
 6. Winter Gel
 7. Ideal Industries Inc.'s Yellow 77
 8. Aqua-Gel II
 9. Aqua-Gel CW
 10. Thomas & Betts Corp.'s Series 15-230 Cable Pulling Lubricants
 11. Series 15-631 Wire Slick.

260519-8

Wires and Cables-Below 600 Volts

PHOTO LAB – DARKROOM RENOVATION

PURCHASE COLLEGE SUNY | 735 ANDERSON HILL RD. | VISUAL ARTS BUILDING | LA PLLC Project 2306

WIRES AND CABLES-BELOW 600 VOLTS

2.06 TAGS

As Per Specification Section 260553

2.07 WIRE MANAGEMENT PRODUCTS

- A. Cable Clamps and Clips, Cable Ties, Spiral Wraps, etc: Catamount/T&B Corp., or Ideal Industries Inc.

PART 3 - EXECUTION

3.01 WIRING METHOD

- A. Install conductors in raceways after the raceway system is completed. Exceptions: Type MC, MI, RHW-2 Lifeline or other type specifically indicated on the drawings not to be installed in raceways.
- B. No grease, oil, or lubricant other than wire-pulling compounds specified may be used to facilitate the installation of conductors
- C. Unless otherwise noted USE-2 Type cable shall be utilized for all underground power feeders.

3.02 CIRCUITING

- A. Do not change, group or combine circuits other than as indicated on the drawings.
- B. Do not change, group or combine circuits other than as indicated on the drawings except as permitted under Section 260532 when reusing existing raceways.

3.03 NEUTRAL CONDUCTORS- FOR BRANCH CIRCUITS

- A. Common neutral conductors are not allowed for newly installed grouped branch circuits where circuits are installed enclosed within the same raceway, contractor shall provide a dedicated neutral for each circuit provided in each branch circuit.
- B. The following circuits shall have a separate neutral:
 - 1. Circuits containing ground fault circuit interrupter devices.

WIRES AND CABLES-BELOW 600 VOLTS

2. Circuits containing solid state dimmers.
3. Multi circuits in common raceway shall have separate neutrals.

3.04 CONDUCTOR SIZE

- A. Conductor Size:
1. For Electric Light and Power Branch Circuits: Install conductors of size shown on drawings. Where size is not indicated, the minimum size allowed is No. 12 AWG.
 2. For Class 1 Circuits:
 - a. No. 18 and No. 16 AWG may be used provided they supply loads that do not exceed 6 amps (No. 18 AWG), or 8 amps (No. 16 AWG).
 - b. Larger than No. 16 AWG: Use to supply loads not greater than the ampacities given in NFPA 70 Section 310-15.
 3. For Class 2 Circuits: Any size to suit application.
 4. For Class 3 Circuits: Minimum No. 18 AWG.

3.05 COLOR CODING

- A. Color Coding for 120/208 Volt Electric Light and Power Wiring:
1. Color Code:
 - a. 2 wire circuit - black, white.
 - b. 3 wire circuit - black, red, white.
 - c. 4 wire circuit - black, red, blue, white.
 2. White to be used only for an insulated grounded conductor (neutral). If neutral is not required use black and red, or black, red and blue for phase to phase circuits.
 - a. "White" for Sizes No. 6 AWG or Smaller:
 - 1) Continuous white outer finish, or:
 - 2) Three continuous white stripes on other than green insulation along its continuous length.
 - b. "White" for Sizes Larger Than No. 6 AWG:
 - 1) Continuous white outer finish, or:
 - 2) Three continuous white stripes on other than green insulation along its continuous length, or:
 - 3) Distinctive white markings (color coding tape) encircling the conductor, installed on the conductor at time of its installation. Install white color coding tape at terminations, and at 1' 0" intervals in gutters, pullboxes, and manholes.
 3. Colors (Black, Red, Blue):
 - a. For Branch Circuits: Continuous color outer finish.
 - b. For Feeders:

WIRES AND CABLES-BELOW 600 VOLTS

- 1) Continuous color outer finish, or:
 - 2) Color coding tapes encircling the conductors, installed on the conductors at time of their installation. Install color coding tapes at terminations, and at 1' 0" intervals in gutter, pullboxes, and manholes.
- B. Color Coding For 277/480 Volt Electric Light and Power Wiring:
1. Color Code:
 - a. 2 wire circuit – brown, gray.
 - b. 3 wire circuit – brown, yellow, gray.
 - c. 4 wire circuit – brown, yellow, orange, gray.
 2. Gray to be used only for an insulated grounded conductor (neutral). If neutral is not required use brown and yellow, or brown, yellow and orange for phase to phase circuits.
 - a. "Gray" For Sizes No. 6 AWG or Smaller.
 - 1) Continuous gray outer finish.
 - b. "Gray" For Sizes Larger Than No. 6 AWG:
 - 1) Distinctive gray markings (color coding tape) encircling the conductor, installed on the conductor at time of its installation. Install gray color coding tape at terminations, and at 1' 0" intervals in gutters, pullboxes, and manholes.
 - c. Colors (Brown, Yellow, Orange):
 - d. For Branch Circuits: Continuous color outer finish.
 - e. For Feeders:
 - 1) Continuous color outer finish, or:
 - 2) Color coding tapes encircling the conductors, installed on the conductors at the time of their installation. Install color coding tapes at terminations, and at 1' 0" intervals in gutters, pullboxes, and manholes.
- C. More Than One Nominal Voltage System Within A building: Permanently post the color coding scheme at each branch-circuit panelboard.
- D. Existing Color Coding Scheme: Where an existing color coding scheme is in use, match the existing color coding if it is in accordance with the requirements of NFPA 70.
- E. Color Code For Wiring Other Than Electric Light and Power: In accordance with ICEA/NEMA WC-30 "Color Coding of Wires and Cables". Other coding methods may be used, as approved.

WIRES AND CABLES-BELOW 600 VOLTS

3.06 IDENTIFICATION

- A. Identification Tags: Use tags to identify feeders and designated circuits. Install tags so that they are easily read without moving adjacent feeders or requiring removal of arc proofing tapes. Attach tags with non-ferrous wire or brass chain.
 - 1. Interior Feeders: Identify each feeder in pullboxes and gutters. Identify by feeder number and size.
 - 2. Exterior Feeders: Identify each feeder in manholes and in interior pullboxes and gutters. Identify by feeder number and size, and also indicate building number and panel designation from which feeder originates.
 - 3. Street and Grounds Lighting Circuits: Identify each circuit in manholes and lighting standard bases. Identify by circuit number and size, and also indicate building number and panel designation from which circuit originates.
- B. Identification Plaque: Where a building or structure is supplied by more than one service, or has any combination of feeders, branch circuits, or services passing through it, install a permanent plaque or directory at each service, feeder and branch circuit disconnect location denoting all other services, feeders, or branch circuits supplying that building or structure or passing through that building or structure and the area served by each.
- C. In addition to identification as call for in sections 3.06-A and 3.06-B above provide identification as called for in specification section 260533.

3.07 WIRE MANAGEMENT

- A. Use wire management products to bundle, route, and support wiring in junction boxes, pullboxes, wireways, gutters, channels, and other locations where wiring is accessible.

3.08 EQUIPMENT GROUNDING CONDUCTOR

- A. Install equipment grounding conductor:
 - 1. Where specified in other Sections or indicated on the drawings.
 - 2. In conjunction with circuits recommended by equipment manufacturers to have equipment grounding conductor.
- B. Equipment grounding conductor is not intended as a current carrying conductor under normal operating circumstances.
- C. Color Coding For Equipment Grounding Conductor:

WIRES AND CABLES-BELOW 600 VOLTS

1. Color Code: Green.
2. "Green" For sizes No. 6 AWG or Smaller:
 - a. Continuous green outer finish, or:
 - b. Continuous green outer finish with one or more yellow stripes, or:
 - c. Bare copper (see exception below).
3. "Green" For Sizes Larger Than No. 6:
 - a. Stripping the insulation or covering from the entire exposed length (see exception below).
 - b. Marking the exposed insulation or covering with green color coding tapes.
 - c. Identify at each end and at every point where the equipment grounding conductor is accessible.
4. Exception For use of Bare Copper: Not allowed for use where NFPA 70 specifically requires equipment grounding conductor to be insulated, or where specified in other Sections or indicated on the drawings to be insulated.

3.09 SPECIAL GROUNDING CONDUCTORS

- A. Technical Power System Grounding (Equipment grounding conductor isolated from the premises grounded conductor except at a single grounded termination point): Install an insulated grounding conductor running with the circuit conductors for isolated receptacles or utilization equipment requiring an isolated ground:
 1. Color Code: Green.
 2. "Green" For Isolated Grounding Conductor:
 - a. Continuous green outer finish, or:
 - b. Continuous green outer finish with one or more yellow stripes, and:
 - c. Different than the "green" used for the equipment grounding conductor run with the circuit (where required).
 3. Install label at every point where the conductor is accessible, identifying it as an "Isolated Grounding Conductor".

3.10 INSULATED CONDUCTOR AND CABLE SCHEDULE - TYPES AND USE

- A. Electric Light and Power Circuits:
 1. FEP, THHN, THW, THW-2, THWN, THWN-2, XHH, XHHW, or XHHW-2: Wiring in dry or damp locations (except where special type insulation is required).
 2. THWN, THWN-2, XHHW, XHHW-2, USE, or USE-2: Wiring in wet locations (except where type USE or USE-2 insulated conductors

WIRES AND CABLES-BELOW 600 VOLTS

- are specifically required, or special type insulation is required).
3. THHN, THWN or THWN-2: Wiring installed in existing raceway systems (except where special type insulation is required).
 4. THHN, THW-2, THWN-2, XHHW, or XHHW-2: Wiring for electric discharge lighting circuits (fluorescent, HID), except where fixture listing requires wiring rated higher than 90° C.
 5. THWN Marked "Gasoline and Oil Resistant": Wiring to gasoline and fuel oil pumps.
 6. USE, or USE-2: Wiring indicated on the drawings to be direct burial in earth.
 7. USE, or USE-2 Marked "Sunlight Resistant":
 - a. Service entrance wiring from overhead service to the service equipment.
 - b. Wiring exposed to the weather and unprotected (except where special type insulation is required).
 8. MC Cable For branch circuits in drywall and above ceilings in dry areas, MC Cable shall not be used for circuits home runs:
 - a. Non-Emergency branch circuit wiring in wood framed construction (wood joists and wood stud partitions):
 - 1) Install conductors parallel with joists or studs and attach to the side of these timbers by galvanized straps spaced not more than 6 feet apart.
 - 2) Install conductors through holes bored in the center of the timbers when running at right angles to joists or studs.
 - 3) Do not attach the conductors to the edge of joists or studs.
 - b. Non-Emergency branch circuit wiring in movable metal partitions and movable gypsum partitions.
 - 1) Install conductors in accordance with partition manufacturer's recommendations.
 - c. Non-Emergency branch circuit wiring in metal stud partitions:
 - 1) Install conductors parallel with studs and attach to the side by galvanized straps spaced not more than 6 feet apart.
 - 2) Install conductors through holes bored in the center of the metal member when running at right angles to studs.
 - a) Conductors shall be protected by listed bushings or listed grommets covering all metal edges.
 - 3) Do not attach the conductors to the edge of studs.
 9. MI:

WIRES AND CABLES-BELOW 600 VOLTS

- a. Wiring for underplaster extensions.
 - b. Wiring in areas where indicated on drawings.
 - c. Where MI cable is installed in areas subjecting cable to corrosion, use PVC or HDPE jacketed MI cable (nonmetallic jacketed cable is not suitable for use in ducts, plenums or other spaces used for environmental air).
- B. Emergency Feeder Circuits: Use electrical circuit protective system (applicable FHIT document).

3.11 CONNECTOR SCHEDULE - TYPES AND USE

- A. Temperature Rating: Use connectors that have a temperature rating, equal to, or greater than the temperature rating of the conductors to which they are connected.
- B. Splices:
 - 1. Dry Locations:
 - a. For Conductors No. 8 AWG or Smaller: Use spring type pressure connectors, indent type pressure connectors with insulating jackets, or connector blocks (except where special type splices are required).
 - b. For Conductors No. 6 AWG or Larger: Use connector blocks or uninsulated indent type pressure connectors. Fill indentions in uninsulated connectors with electrical filler tape and apply insulation tape to insulation equivalent of the conductor, or insulate with heat shrinkable splices or cold shrink splices.
 - c. Gutter Taps in Panelboards: For uninsulated type gutter taps fill indentions with electrical filler tape and apply insulation tape to insulation equivalent of the conductor, or insulate with gutter tap cover.
 - 2. Damp Locations: As specified for dry locations, except apply moisture sealing tape over the entire insulated connection (moisture sealing tape not required if heat shrinkable splices or cold shrink splices are used).
 - 3. Wet Locations: Use uninsulated indent type pressure connectors and insulate with resin splice kits, cold shrink splices or heat shrinkable splices. Exception: Splices above ground which are totally enclosed and protected in NEMA 3R, 4, 4X enclosures may be spliced as specified for damp locations.
- C. Terminations:
 - 1. For Conductors No. 10 AWG or Smaller: Use terminals for:

WIRES AND CABLES-BELOW 600 VOLTS

- a. Connecting wiring to equipment designed for use with terminals.
2. For Conductors No. 8 AWG or Larger: Use compression or mechanical type lugs for:
 - a. Connecting cables to flat bus bars.
 - b. Connecting cables to equipment designed for use with lugs.
3. For Conductor Sizes Larger Than Terminal Capacity on Equipment: Reduce the larger conductor to the maximum conductor size that terminal can accommodate (reduced section not longer than one foot). Use compression or mechanical type connectors suitable for reducing connection.

3.12 ACCEPTANCE TEST

- A. Division of Responsibility
 1. Contractor – The Contractor shall provide the testing organization with the following:
 - a. A short-circuit analysis, a coordination study, and a protective device setting sheet as described in Section 6.
 - b. A complete set of electrical plans and specifications, including all change orders.
 - c. Drawings and instruction manuals applicable to the scope of work.
 - d. An itemized description of equipment to be inspected and tested.
 - e. A determination of who shall provide a suitable and stable source of electrical power to each test site.
 - f. A determination of who shall perform certain preliminary low-voltage insulation-resistance, continuity, and low-voltage motor rotation tests prior to and in addition to tests specified herein
 - g. Notification of when equipment becomes available for acceptance tests. Work shall be coordinated to expedite project scheduling.
 - h. Site-specific hazard notification
 2. The Testing Organization – The testing organization shall provide the following:
 - a. All field technical services, tooling, equipment, instrumentation, and technical supervision to perform such tests and inspections.
 - b. Specific power requirements for test equipment.
 - c. Notification to the Owner's representative prior to commencement of any testing.
 - d. A timely notification of any system, material, or

WIRES AND CABLES-BELOW 600 VOLTS

workmanship that is found deficient based on the results of the acceptance tests.

- e. A written record of all tests and a final report.

B. General

1. Safety and Precautions – All parties involved must be cognizant of industry-standard safety procedures. This document does not contain any procedures including specific safety procedures. It is recognized that an overwhelming majority of the tests and inspections recommended in these specifications are potentially hazardous. Individuals performing these tests shall be qualified and capable of conducting the tests in a safe manner and with complete knowledge of the hazards involved.
 - a. Safety practices shall include, but are not limited to, the following requirements:
 - 1) All applicable provisions of the Occupational Safety and Health Act, particularly OSHA 29 CFR Part 1910 and 29 CFR Part 1929.
 - 2) ANSI/NFPA 70E, Standard for Electrical Safety in the Workplace.
 - 3) Applicable state and local safety operating procedures.
 - 4) Owner's safety practices.
 - b. The testing organization shall have a designated safety lead person on site to supervise operations with respect to safety.
 - c. A job hazard analysis and a safety briefing shall be conducted prior to the commencement of work.
 - d. All tests shall be performed with the apparatus de-energized and grounded except where otherwise specifically required to be ungrounded or energized for certain tests.
 - e. The testing organization shall have a designated safety representative on the project to supervise operations with respect to safety. This individual may be the same person described above.
2. Suitability of Test Equipment
 - a. All test equipment shall meet the requirements and be in good mechanical and electrical condition.
 - b. Field test metering used to check power system meter calibration must be more accurate than the instrument being tested.
 - c. Accuracy of metering in test equipment shall be appropriate for the test being performed.
 - d. Waveshape and frequency of test equipment output

WIRES AND CABLES-BELOW 600 VOLTS

waveforms shall be appropriate for the test to be performed and the equipment to be tested.

3. Test Instrument Calibration

- a. The testing organization shall have a calibration program which assures that all applicable test instruments are maintained within rated accuracy for each test instrument calibrated.
- b. The firm providing calibration service shall maintain up-to-date instrument calibration instructions and procedures for each test instrument calibrated.
- c. The accuracy shall be directly traceable to the National Institute of Standards and Technology (NIST).
- d. Instruments shall be calibrated in accordance with the following frequency scheduled:
 - 1) Field instruments: Analog and Digital, 12 months maximum.
 - 2) Laboratory instruments: 12 months maximum.
 - 3) Leased specialty equipment: 12 months maximum.
- e. Dated calibration labels shall be visible on all test equipment.
- f. Records which show date and results of instruments calibrated or tested must be kept up to date.
- g. Calibrating standard shall be of better accuracy than that of the instrument tested.

4. Test Report

- a. The test report shall include the following:
 - 1). Summary of project.
 - 2) Description of equipment tested.
 - 3) Description of tests.
 - 4) Test data.
 - 5) Analysis and recommendations.
- b. Test data records shall include the following minimum requirements:
 - 1) Identification of the testing organization.
 - 2) Equipment identification.
 - 3) Humidity, temperature, and other conditions that may affect the results of the test and/or calibrations.
 - 4) Date of inspections, tests, maintenance, and/or calibrations.
 - 5) Identification of the testing technician.
 - 6) Indication of inspections, tests, maintenance, and/or calibrations to be performed and recorded.
 - 7) Indication of expected results when calibrations are to be performed.

WIRES AND CABLES-BELOW 600 VOLTS

- 8) Indication of as-found and as-left, as applicable.
 - 9) Identification of all test results outside of specified tolerances.
 - 10) Sufficient spaces to allow all results and comments to be indicated.
 - c. The testing organizations shall furnish a copy or copies of the complete report as specified in the acceptance testing contract.
- 5. Test Decal
 - a. The testing organization shall affix a test decal on the exterior of equipment or equipment enclosure of protective devices after performing electrical tests.
 - b. The test decal shall be color-coded to communicate the condition of maintenance for the protective device. Color scheme for condition of maintenance or overcurrent protective device shall be:
 - 1) White: electrically and mechanically acceptable.
 - 2) Yellow: minor deficiency not affecting fault detection and operation, but minor electrical or mechanical condition exists.
 - 3) Red: deficiency exists affecting performance, not suitable for service.
 - c. The decal shall include:
 - 1) Testing organization
 - 2) Project number
 - 3) Test date
 - 4) Technician name
- C. Required Acceptance Test
 - 1. Retain the services of a certified company for all testing to be performed as per NETA Standards for acceptance testing Section – 7. 3.2 cable, low voltage, 600V maximum, but not limited to this Section.
 - 2. Thermographic surveys shall be performed per NETA ATS Section 9 on all feeder splices, and follow-up testing shall be performed six (6) months later.

END OF SECTION

GROUNDING

260526 GROUNDING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.
- B. Division-26 Basic Materials and Methods sections apply to work of this section.
- C. Requirements of this Section apply to electrical grounding and bonding work specified elsewhere in these Specifications.

1.02 SUMMARY

- A. Extent of electrical grounding and bonding work is indicated by drawings and schedules and as specified herein. Grounding and bonding work is defined to encompass systems, circuits, and equipment.
- B. Type of electrical grounding and bonding work specified in this Section includes the following:
 - 1. Solidly grounded system.
- C. Applications of electrical grounding and bonding work in this Section include the following:
 - 1. Underground metal piping.
 - 2. Transformer, switchboards, panelboards
 - 3. Electrical power systems.
 - 4. Grounding electrodes.
 - 5. Raceways.
 - 6. Service equipment.
 - 7. Enclosures.
 - 8. Equipment.
- D. Refer to other Division-26 sections for wires/cables, electrical raceways, boxes and fittings which are required in conjunction with electrical grounding and bonding work; not work of this section.

1.03 SUBMITTALS

260526-1

Grounding

GROUNDING

- A. Product Data: Submit manufacturer's data on grounding and bonding products and associated accessories.
- B. Wiring Diagrams: Submit wiring diagrams for electrical grounding and bonding work which indicates layout of ground rings, location of system grounding electrode connections, routing of grounding electrode conductors, also include diagrams for circuits and equipment grounding connections.

1.04 QUALITY ASSURANCE

- A. Manufacturer's Qualifications: Firms regularly engaged in manufacture of grounding and bonding products, of types, and ratings required, and ancillary grounding materials, including stranded cable, copper braid and bus, grounding electrodes and plate electrodes, and bonding jumpers whose products have been in satisfactory use in similar service for not less than five (5) years.
- B. Installer's Qualifications: Firm with at least five (5) years of successful installation experience on projects with electrical grounding work similar to that required for project.
- C. Codes and Standards
 - 1. Electrical Code Compliance: Comply with applicable local electrical code requirements of the authority having jurisdiction, and NEC as applicable to electrical grounding and bonding, pertaining to systems, circuits and equipment.
 - 2. UL Compliance: Comply with applicable requirements of UL Standards No.'s 467, "Electrical Grounding and Bonding Equipment", and 869 "Electrical Service Equipment", pertaining to grounding and bonding of systems, circuits and equipment. In addition, comply with UL Std 486A, "Wire Connectors and soldering Lugs for Use with Copper Conductors." Provide grounding and bonding products which are UL-listed and labeled for their intended usage.
 - 3. IEEE Compliance: Comply with applicable requirements and recommended installation practices of IEEE Standards 80, 81, 141 and 142 pertaining to grounding and bonding of systems, circuits and equipment.

GROUNDING

D. Qualifications of Testing Organization and Personnel

1. Testing Organization

- a. The testing organization shall be an independent, third party entity which can function as an unbiased testing authority, professionally independent of the manufacturers, suppliers, and installers of equipment or systems being evaluated.
- b. The testing organization shall be regularly engaged in the testing of electrical equipment devices, installations, and systems.
- c. The testing organization shall use technicians who are regularly employed for testing services.
- d. An organization having a designation of NETA Accredited Company issued by the InterNational Electrical Testing Association meets the above criteria.
- e. The testing organization shall submit appropriate documentation to demonstrate that it satisfactorily complies with these requirements.

2. Testing Personnel

- a. Technicians performing these electrical tests and inspections shall be trained and experienced concerning the apparatus and systems being evaluated. These individuals shall be capable of conducting the tests in a safe manner and with complete knowledge of the hazards involved. They must evaluate the test data and make a judgement on the serviceability of the specific equipment.
- b. Technicians shall be certified in accordance with ANSI/NETA ETT-2010, Standard for Certification of Electrical Testing Technicians. Each on-site crew leader shall hold a current certification, Level III or higher in electrical testing.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

260526-3

Grounding

GROUNDING

- A. Manufacturers: Subject to compliance with requirements, provide grounding and bonding products of one of the following (for each type of product):

1. Burndy Corporation.
2. Crouse-Hinds Div; Cooper Industries.
3. Eagle Electric Mfg Co.
4. Ideal Industries, Inc.
5. Okonite Company.
6. OZ Gedney Div; General Signal Corp.
7. Thomas and Betts Corp.

2.02 GROUNDING AND BONDING

- A. Materials and Components

1. General: Except as otherwise indicated, provide electrical grounding and bonding systems indicated; with assembly of materials, including, but not limited to, cables/wires, connectors, solderless lug terminals, grounding electrodes, bonding jumper braid, surge arresters, and additional accessories needed for a complete installation. Where more than one type component product meets indicated requirements, selection is Installer's option. Where materials or components are not indicated, provide products which comply with NEC, UL, and IEEE requirements and with established industry standards for those applications indicated.
2. Conductors: Unless otherwise indicated, provide copper grounding conductors for grounding system connections that match power supply wiring materials and are sized according to NEC.
3. Bonding Jumper Braid: Copper braided tape, constructed of 30-gauge bare copper wires and properly sized for indicated applications.
4. Flexible Jumper Strap: Flexible flat conductor, 480 strands of 30-gage bare copper wire; 3/4" wide, 9-1/2" long; 48,250 CM. Select braid with holes sized for 3/8" diameter bolts, and protect braid with copper bolt hole ends.
5. Service Arrester: Electrical service arrester, gap type, 480-volt, 3-phase, 4-wire, for exterior mounting for 480V systems.

GROUNDING

6. Ground Electrodes
 - a. Grounding Electrodes: Stainless steel, 3/4" dia. by 10 feet. Unless otherwise indicated, ground rods shall be driven into the ground until tops of rods are approximately 1 foot below finished grade. In counterpoise systems, tops of ground rods shall be approximately at elevations of counterpoises. Where the specified ground resistance cannot be met with the indicated number of ground rods, additional ground rods, longer ground rods, or deep-driven sectional rods shall be installed and connected until the specified resistance is obtained, except that not more than three (3) additional 10-foot ground rods shall be required at any one installation. Ground rods shall be spaced as evenly as possible at least 6 feet apart and connected 2 feet below grade.
7. Electrical Grounding Connection Accessories: Provide electrical insulating tape, heat-shrinkable insulating tubing, welding materials, bonding straps, as recommended by accessories manufacturers for type service indicated.
8. Field Welding: All grounding system connections shall be field welded by exothermically welded connections or approved equal.
 - a. Installation shall conform to the manufacturer's instructions.
 - b. Proper mold and associated equipment shall be used for each connection.
 - c. All materials used (molds, weld material, tools, and accessories) shall be the product of one manufacturer to insure compatibility.
9. Neutral Grounding: Neutral conductors shall be grounded where indicated. Ground wires shall be not less than No. 1/0 AWG, except that where the rated phase current exceeds 400 amperes, the size of neutral ground wires shall be increased to not less than one-half the size of the cross-sectional area of the individual phase conductors. Neutral ground wires shall be protected by conduit where such wires run exposed above grade in nonfence-enclosed areas or are run through concrete construction. Where concrete penetration is necessary, nonmetallic conduit shall be cast flush with the points of concrete entrance and exit so as to provide an opening for the ground wire and the opening shall be sealed with a su

GROUNDING

itable compound after installation of the ground wire. Bends greater than 45 degrees in ground wire connections to the ground rods or are not permitted.

10. Equipment Grounding: Equipment frames of metal-enclosed equipment, medium-voltage cable shields at cable joints and terminations, metal splice boxes, chain-link fencing, and other noncurrent-carrying metal items in close proximity to electric circuits, shall be grounded unless otherwise indicated. Connections to earth shall be made in the same manner as required for neutral grounding. Equipment or devices operating at less than 750 volts may be connected to secondary neutral grounds. Equipment operating at more than 750 volts to ground shall be provided with grounds separate from secondary neutral grounds, but both grounds shall be bonded together below grade at the ground rods.
11. System Grounding
 - a. Secondary service neutrals ground at the supply side of the secondary disconnecting means at the related transformers.
12. Switchgear, Switchboards, and Unit Substations
 - a. Connect the various feeder green grounding conductors to the ground bus in the enclosure with suitable pressure connectors.
 - b. Connect the grounding electrode conductor to the ground bus.
 - c. Connect the neutral to the ground bus (main bonding jumper).
 - d. Connect metallic conduits, which terminate without mechanical connection to the housing, by grounding bushings and ground wire to the ground bus.
13. All conduit systems shall contain a grounding conductor.

PART 3 - EXECUTION

3.01 EXAMINATION

GROUNDING

- A. Examine areas and conditions under which electrical grounding and bonding connections are to be made and notify Design Professional in writing of conditions detrimental to proper completion of work. Do not proceed with work until unsatisfactory conditions have been corrected in a manner acceptable to Design Professional.

3.02 INSTALLATION OF ELECTRICAL GROUNDING AND BONDING SYSTEMS

- A. General: Install electrical grounding and bonding systems as indicated, in accordance with manufacturer's instructions and applicable portions of the NEC, NECA's "Standard of Installation", and in accordance with recognized industry practices to ensure that products comply with requirements.
- B. Weld grounding conductors to underground grounding electrodes.
- C. Ground electrical service system neutral at each service entrance switch to grounding electrodes.
- D. Connect together system neutral, service equipment enclosures, exposed noncurrent carrying metal parts of electrical equipment, metal raceway systems, grounding conductor in raceways and cables, receptacle ground connectors.
- E. Terminate feeder and branch circuit insulated equipment grounding conductors with grounding lug, bus, or bushing.
- F. Connect grounding electrode conductors to 1-inch diameter, or greater, metallic cold water pipe using a suitably sized ground clamp. Provide connections to flanged piping to street side of flange.
- G. Tighten grounding and bonding connectors and terminals, including screws and bolts, in accordance with manufacturer's published torque tightening values for connectors and bolts. Where manufacturer's torquing requirements are not indicated, tighten connections to comply with tightening torque values specified in UL 486A to assure permanent and effective grounding.
- H. Install braided type bonding jumpers with code-sized ground clamps on water meter piping to electrically bypass water meters.
- I. Route grounding connections and conductors to ground and protective devices in shortest and straightest paths as possible to minimize transient voltage rises.

GROUNDING

- J. Apply corrosion-resistant finish to field-connections, buried metallic grounding and bonding products, and places where factory applied protective coatings have been destroyed, which are subjected to corrosive action.
- K. Install clamp-on connectors on clean metal contact surfaces, to ensure electrical conductivity and circuit integrity.

3.03 FIELD QUALITY CONTROL

- A. Upon completion of installation of electrical grounding and bonding systems, test ground resistance with ground resistance tester. Where tests show resistance-to-ground is over 5 ohms, take appropriate action to reduce resistance to 5 ohms, or less, by driving additional ground rods; then retest to demonstrate compliance. Equipment rated at more than 1000 KVA shall be handled similarly except that maximum ground resistance shall be 3 OHMS.

3.04 ACCEPTANCE TEST

- A. Division of Responsibility
 - 1. Contractor – The Contractor shall provide the testing organization with the following, at no extra cost to the Owner:
 - a. A short-circuit analysis, a coordination study, and a protective device setting sheet as described in Section 6.
 - b. A complete set of electrical plans and specifications, including all change orders.
 - c. Drawings and instruction manuals applicable to the scope of work.
 - d. An itemized description of equipment to be inspected and tested.
 - e. A determination of who shall provide a suitable and stable source of electrical power to each test site.
 - f. A determination of who shall perform certain preliminary low-voltage insulation-resistance, continuity, and low-voltage motor rotation tests prior to and in addition to tests specified herein
 - g. Notification of when equipment becomes available for acceptance tests. Work shall be coordinated to expedite project scheduling.
 - h. Site-specific hazard notification

GROUNDING

2. The Testing Organization – The testing organization shall provide the following:
 - a. All field technical services, tooling, equipment, instrumentation, and technical supervision to perform such tests and inspections.
 - b. Specific power requirements for test equipment.
 - c. Notification to the Owner's representative prior to commencement of any testing.
 - d. A timely notification of any system, material, or workmanship that is found deficient based on the results of the acceptance tests.
 - e. A written record of all tests and a final report.

B. General

1. Safety and Precautions – All parties involved must be cognizant of industry-standard safety procedures. This document does not contain any procedures including specific safety procedures. It is recognized that an overwhelming majority of the tests and inspections recommended in these specifications are potentially hazardous. Individuals performing these tests shall be qualified and capable of conducting the tests in a safe manner and with complete knowledge of the hazards involved.
 - a. Safety practices shall include, but are not limited to, the following requirements:
 - 1) All applicable provisions of the Occupational Safety and Health Act, particularly OSHA 29 CFR Part 1910 and 29 CFR Part 1929.
 - 2) ANSI/NFPA 70E, Standard for Electrical Safety in the Workplace.
 - 3) Applicable state and local safety operating procedures.
 - 4) Owner's safety practices.
 - b. The testing organization shall have a designated safety lead person on site to supervise operations with respect to safety.
 - c. A job hazard analysis and a safety briefing shall be conducted prior to the commencement of work.
 - d. All tests shall be performed with the apparatus de-energized and grounded except where otherwise specifically required

GROUNDING

to be ungrounded or energized for certain tests.

- e. The testing organization shall have a designated safety representative on the project to supervise operations with respect to safety. This individual may be the same person described above.

2. Suitability of Test Equipment

- a. All test equipment shall meet the requirements and be in good mechanical and electrical condition.
- b. Field test metering used to check power system meter calibration must be more accurate than the instrument being tested.
- c. Accuracy of metering in test equipment shall be appropriate for the test being performed.
- d. Waveshape and frequency of test equipment output waveforms shall be appropriate for the test to be performed and the equipment to be tested.

3. Test Instrument Calibration

- a. The testing organization shall have a calibration program which assures that all applicable test instruments are maintained within rated accuracy for each test instrument calibrated.
- b. The firm providing calibration service shall maintain up-to-date instrument calibration instructions and procedures for each test instrument calibrated.
- c. The accuracy shall be directly traceable to the National Institute of Standards and Technology (NIST).
- d. Instruments shall be calibrated in accordance with the following frequency scheduled:
 - 1) Field instruments: Analog and Digital, 12 months maximum.
 - 2) Laboratory instruments: 12 months maximum.
 - 3) Leased specialty equipment: 12 months maximum.
- e. Dated calibration labels shall be visible on all test equipment.
- f. Records which show date and results of instruments calibrated or tested must be kept up to date.
- g. Calibrating standard shall be of better accuracy than that of the instrument tested.

GROUNDING

4. Test Report

- a. The test report shall include the following:
 - 1). Summary of project.
 - 2) Description of equipment tested.
 - 3) Description of tests.
 - 4) Test data.
 - 5) Analysis and recommendations.
- b. Test data records shall include the following minimum requirements:
 - 1) Identification of the testing organization.
 - 2) Equipment identification.
 - 3) Humidity, temperature, and other conditions that may affect the results of the test and/or calibrations.
 - 4) Date of inspections, tests, maintenance, and/or calibrations.
 - 5) Identification of the testing technician.
 - 6) Indication of inspections, tests, maintenance, and/or calibrations to be performed and recorded.
 - 7) Indication of expected results when calibrations are to be performed.
 - 8) Indication of as-found and as-left, as applicable.
 - 9) Identification of all test results outside of specified tolerances.
 - 10) Sufficient spaces to allow all results and comments to be indicated.
- c. The testing organizations shall furnish a copy or copies of the complete report as specified in the acceptance testing contract.

5. Test Decal

- a. The testing organization shall affix a test decal on the exterior of equipment or equipment enclosure of protective devices after performing electrical tests.
- b. The test decal shall be color-coded to communicate the condition of maintenance for the protective device. Color scheme for condition of maintenance or overcurrent protective device shall be:

GROUNDING

- 1) White: electrically and mechanically acceptable.
- 2) Yellow: minor deficiency not affecting fault detection and operation, but minor electrical or mechanical condition exists.
- 3) Red: deficiency exists affecting performance, not suitable for service.

c. The decal shall include:

- 1) Testing organization
- 2) Project number
- 3) Test date
- 4) Technician name

C. Required Acceptance Test

1. Testing as per NETA Standards for acceptance testing Section – 7.1.3 Grounding System.

END OF SECTION

FASTENERS, ATTACHMENTS AND SUPPORTING DEVICES

260529 FASTENERS, ATTACHMENTS AND SUPPORTING DEVICES

PART 1 - GENERAL

1.01 SUBMITTALS

- A. Shop Drawings: Show support details if different from methods specified or shown on the drawings.
- B. Product Data: Catalog sheets, specifications and installation instructions.

PART 2 - PRODUCTS

2.01 ANCHORING DEVICES

- A. Sleeve Anchors: Molly/Emhart's Parasleeve Series, Phillips' Red Head AN, HN, FS Series, or Ramset's Dynabolt Series.
- B. Wedge Anchors: Hilti's Kwik Bolt Series, Molly/Emhart's Parabolt Series, Phillips' Red Head WS, or Ramset's Trubolt Series.
- C. Self-Drilling Anchors: Phillips' Red Head Series S or Ramset's Ram Drill Series.
- D. Non-Drilling Anchors: Hilti's Drop-In Anchor Series, Phillips' Red Head J Series, or Ramset's Dynaset Series.
- E. Stud Anchors: Phillips' Red Head JS Series.

2.02 CAST-IN-PLACE CONCRETE INSERTS

- A. Continuous Slotted Type Concrete Insert, Galvanized:
 - 1. Load Rating 1300 lbs./ft.: Kindorf's D-986.
 - 2. Load Rating 2400 lbs./ft.: Kindorf's D-980.
 - 3. Load Rating 3000 lbs./ft.: Hohmann & Barnard Inc.'s Type CS-H.
 - 4. Load Rating 4500 lbs./ft.: Hohmann & Barnard Inc.'s Type CS-HD.
- B. Threaded Type Concrete Insert: Galvanized ferrous castings, internally threaded.

260529-1 Fasteners, Attachments and Supportinding Devices

FASTENERS, ATTACHMENTS AND SUPPORTING DEVICES

- C. Wedge Type Concrete Insert: Galvanized box-type ferrous castings, designed to accept bolts having special wedge shaped heads.

2.03 MISCELLANEOUS FASTENERS

- A. Except where shown otherwise on the Drawings, furnish type, size, and grade required for proper installation of the Work, selected from the following: Furnish galvanized fasteners for exterior use, or for items anchored to exterior walls, except where stainless steel is indicated.
 - 1. Standard Bolts and Nuts: ASTM A 307, Grade A, regular hexagon head.
 - 2. Lag Screws: ASME B18.2.1.
 - 3. Machine Bolts: ASME B18.5 or ASME B18.9, Type, Class, and Form as required.
 - 4. Wood Screws: Flat head, ASME B18.6.1.
 - 5. Plain Washers: Round, ASME B18.22.1.
 - 6. Lock Washers: Helical, spring type, ASME B18.21.1.
 - 7. Toggle Bolts: Spring Wing Type; Wing AISI 1010, Trunion Nut AISI1010 or Zamac Alloy, Bolt Carbon Steel ANSI B18.6.3.
- B. Stainless Steel Fasteners: Type 302 for interior Work; Type 316 for exterior Work; Phillips head screws and bolts for exposed Work unless otherwise specified.

2.04 TPR (THE PEEL RIVET) FASTENERS

- A. 1/4 inch diameter, threadless fasteners distributed by Subcon Products.

2.05 POWDER DRIVEN FASTENER SYSTEMS

- A. Olin Corp.'s Ramset Fastening Systems, or Phillips Drill Company Inc.'s Red Head Powder Actuated Systems.

2.06 HANGER RODS

- A. Mild low carbon steel, unless otherwise specified; fully threaded or threaded each end, with nuts as required to position and lock rod in place. Unless galvanized or cadmium plated, provide a shop coat of red lead or zinc chromate primer paint.

2.07 "C" BEAM CLAMPS

- A. With Conduit Hangers:

260529-2 Fasteners, Attachments and Supportindg Devices

FASTENERS, ATTACHMENTS AND SUPPORTING DEVICES

1. For 1 Inch Conduit Maximum: B-Line Systems Inc.'s BG-8, BP-8 Series, Caddy/Erco Products Inc.'s BC-8P and BC-8PSM Series, or GB Electrical Inc.'s HIT 110-412 Series.
 2. For 3 Inch Conduit Maximum: Appleton Electric Co.'s BH-500 Series beam clamp with H50W/B Series hangers, Kindorf's 500 Series beam clamp with 6HO-B Series hanger, or OZ/Gedney Co.'s IS-500 Series beam clamp with H-OWB Series hanger.
 3. For 4 Inch Conduit Maximum: Kindorf's E-231 beam clamp and E-234 anchor clip and C-149 series lay-in hanger; Unistrut Corp.'s P2676 beam clamp and P-1659A Series anchor clip with J1205 Series lay in hanger.
- B. For Hanger Rods:
1. For 1/4 Inch Hanger Rods: B-Line Systems Inc.'s BC, Caddy/Erco Products Inc.'s BC, GB Electrical Inc.'s HIT 110, Kindorf's 500, 510, or Unistrut Corp.'s P1648S, P2398S, P2675, P2676.
 2. For 3/8 Inch Hanger Rods: Caddy/Erco Products Inc.'s BC, Kindorf's 231-3/8, 502, or Unistrut Corp.'s P1649AS, P2401S, P2675, P2676.
 3. For 1/2 Inch Rods: Appleton Electric Co. BH-500 Series, Kindorf's 500 Series, 231-1/2, OZ/Gedney Co.'s IS-500 Series, or Unistrut Corp.'s P1650AS, P2403S, P2676.
 4. For 5/8 Inch Rods: Unistrut Corp.'s P1651AS beam clamp and P1656A Series anchor clip.
 5. For 3/4 Inch Rods: Unistrut Corp.'s P1653S beam clamp and P1656A Series anchor clip.

2.08 CHANNEL SUPPORT SYSTEM

- A. Channel Material: 12 gage steel.
- B. Finishes:
1. Phosphate and baked green enamel/epoxy.
 2. Pre-galvanized.
 3. Electro-galvanized.
 4. Hot dipped galvanized.
 5. Polyvinyl chloride (PVC), minimum 15 mils thick.
- C. Fittings: Same material and finish as channel.
- D. UL Listed Systems:

FASTENERS, ATTACHMENTS AND SUPPORTING DEVICES

1. B-Line Systems Inc.'s B-22 (1-5/8 x 1-5/8 inches), B-12 (1-5/8 x 2-7/16 inches), B-11 (1-5/8 x 3-1/4 inches).
2. Grinell Corp.'s Allied Power-Strut PS 200 (1-5/8 x 1-5/8 inches), PS 150 (1-5/8 x 2-7/16 inches), PS 100 (1-5/8 x 3-1/4 inches).
3. Kindorf's B-900 (1-1/2 x 1-1/2 inches), B-901 (1-1/2 x 1-7/8 inches), B-902 (1-1/2 x 3 inches).
4. Unistrut Corp.'s P-3000 (1-3/8 x 1-5/8 inches), P-5500 (1-5/8 x 2-7/16 inches), P-5000 (1-5/8 x 3-1/4 inches).
5. Versabar Corp.'s VA-1 (1-5/8 x 1-5/8 inches), VA-3 (1-5/8 x 2-1/2 inches).

2.09 MISCELLANEOUS FITTINGS

- A. Side Beam Brackets: B-Line Systems Inc.'s B102, B103, B371-2, Kindorf's B-915, or Versabar Corp.'s VF-2305, VF-2507.
- B. Pipe Straps:
 1. Two Hole Steel Conduit Straps: B-Line Systems Inc.'s B-2100 Series, Kindorf's C-144 Series, or Unistrut Corp.'s P-2558 Series.
 2. One Hole Malleable Iron Clamps: Kindorf's HS-400 Series, or OZ/Gedney Co.'s 14-G Series, 15-G Series (EMT).
- C. Deck Clamps: Caddy/Erico Products Inc.'s DH-4-T1 Series.
- D. Fixture Stud and Strap: OZ/Gedney Co.'s SL-134, or Steel City's FE-431.
- E. Supporting Fittings for Pendent Mounted Industrial Type Fluorescent Fixtures on Exposed Conduit System:
 1. Ball Hanger: Appleton Electric Co.'s AL Series, or Crouse-Hinds Co.'s AL Series.
 2. Flexible Fixture Hanger: Appleton Electric Co.'s UNJ-50, UNJ-75, or Crouse-Hinds Co.'s UNJ115.
 3. Flexible (Hook Type) Fixture Hanger: Appleton Electric Co.'s FHFF, or Crouse-Hinds Co.'s UNH-1.
 4. Eyelet: Unistrut Corp.'s M2250.
 5. Eyelet with Stud: Kindorf's H262, or Unistrut Corp.'s M2350.
 6. Conduit Hook: Appleton Electric Co.'s FHSN, or Crouse-Hinds Co.'s UNH-13.
- F. Supporting Fasteners (Metal Stud Construction): Metal stud supports, clips and accessories as produced by Caddy/Erico Products Inc.

FASTENERS, ATTACHMENTS AND SUPPORTING DEVICES

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Where specific fasteners are not specified or indicated for securing items to in-place construction, provide appropriate type, size, and number of fasteners for a secure, rigid installation.
- B. Install anchoring devices and other fasteners in accordance with manufacturer's printed instructions.
- C. Make attachments to structural steel wherever possible.

3.02 FASTENER SCHEDULE

- A. Material:
 - 1. Use cadmium or zinc coated anchors and fasteners in dry locations.
 - 2. Use hot dipped galvanized or stainless steel anchors and fasteners in damp and wet locations.
 - 3. For corrosive atmospheres or other extreme environmental conditions, use fasteners made of materials suitable for the conditions.
- B. Types and Use: Unless otherwise specified or indicated use:
 - 1. Cast-in-place concrete inserts in fresh concrete construction for direct pull-out loads such as shelf angles or fabricated metal items and supports attached to concrete slab ceilings.
 - 2. Anchoring devices to fasten items to solid masonry and concrete when the anchor is not subjected to pull out loads, or vibration in shear loads.
 - 3. Toggle bolts to fasten items to hollow masonry and stud partitions.
 - 4. TPR fasteners to fasten items to plywood backed gypsum board ceilings.
 - 5. Metallic fasteners installed with electrically operated or powder driven tools for approved applications, except:
 - a. Do not use powder driven drive pins or expansion nails.
 - b. Do not attach powder driven or welded studs to structural steel less than 3/16 inch thick.
 - c. Do not support a load, in excess of 250 lbs from any single welded or powder driven stud.
 - d. Do not use powder driven fasteners in precast concrete.

260529-5 Fasteners, Attachments and Supportindng Devices

FASTENERS, ATTACHMENTS AND SUPPORTING DEVICES

3.03 ATTACHMENT SCHEDULE

- A. General: Make attachments to structural steel or steel bar joists wherever possible. Provide intermediate structural steel members where required by support spacing. Select steel members for use as intermediate supports based on a minimum safety factor of 5.
 - 1. Make attachments to steel bar joists at panel points of joists.
 - 2. Do not drill holes in main structural steel members.
 - 3. Use "C" beam clamps for attachment to steel beams.
- B. Where it is not possible to make attachments to structural steel or steel bar joists, use the following methods of attachment to suit type of construction unless otherwise specified or indicated on the drawings:
 - 1. Attachment to Steel Roof Decking (No Concrete Fill):
 - a. Decking With Hanger Tabs: Use deck clamps.
 - b. Decking Without Hanger Tabs:
 - 1) Before Roofing Has Been Applied: Use 3/8 inch threaded steel rod welded to a 4 x 4 x 1/4 inch steel plate and installed through 1/2 inch hole in roof deck.
 - 2) After Roofing Has Been Applied: Use welding studs, or self-drilling/tapping fasteners. Exercise extreme care when installing fasteners to avoid damage to roofing.
 - 2. Attachment to Concrete Filled Steel Decks (Total thickness, 2-1/2 inches or more):
 - a. Before Fill Has Been Placed:
 - 1) Use thru-bolts and fish plates.
 - 2) Use welded studs. Do not support a load in excess of 250 pounds from a single welded stud.
 - b. After Fill Has Been Placed: Use welded studs. Do not support a load in excess of 250 lbs from a single welded stud.
 - 3. Attachment to Cast-In-Place Concrete:
 - a. Fresh Concrete: Use cast-in-place concrete inserts.
 - b. Existing Concrete: Use anchoring devices.
 - 4. Attachment to Cored Precast Concrete Decks:
 - a. New Construction: Use thru-bolts and fish plates before Construction Work Contractor has placed concrete fill over decks.
 - b. Existing Construction: where toggle bolts are to be installed in cells contractor to provide loading calculations by a licensed structural engineer.

260529-6 Fasteners, Attachments and Supporting Devices

FASTENERS, ATTACHMENTS AND SUPPORTING DEVICES

5. Attachment to Hollow Block or Tile Filled Concrete Deck:
 - a. New Construction: Use cast-in-place concrete inserts by having Construction Work Contractor omitting blocks and pouring solid blocks with insert where required.
6. Attachment to Waffle Type Concrete Decks:
 - a. New Construction:
 - 1) Use cast-in-place concrete inserts in fresh concrete.
 - 2) If concrete fill has been applied over deck, thru-bolts and fish plates may be used where additional concrete or roofing is to be placed over the deck.
7. Attachment to Precast Concrete Planks: Use anchoring devices, except do not make attachments to precast concrete planks less than 2-3/4 inches thick.
8. Attachment to Precast Concrete Tee Construction:
 - a. New Construction:
 - 1) Use tee hanger inserts between adjacent flanges.
 - 2) Use thru-bolts and fish plates, except at roof deck without concrete fill.
 - b. Existing Construction:
 - 1) Use anchoring devices installed in webs of tees. Install anchoring devices as high as possible in the webs.
 - c. Do not use powder driven fasteners.
 - d. Exercise extreme care in drilling holes to avoid damage to reinforcement.
9. Attachment to Wood Construction: Use side beam brackets fastened to the sides of wood members to make attachments for hangers.
 - a. Under 15 lbs Load: Attach side beam brackets to wood members with 2 No. 18 x 1-1/2 inch long wood screws, or 2 No. 16 x 1-1/2 inch long drive screws.
 - b. Over 15 lbs Load: Attach side beam brackets to wood members with bolts and nuts or lag bolts. Do not use lag bolts in wooden members having a nominal thickness (beam face) under 2 inches in size. Install bolts and nuts or lag bolts in the side of wood members at the mid-point or slightly above. Install plain washers under all nuts.

LOAD	LAG BOLT SIZE	BOLT DIAMETER
15 lbs to 30 lbs	3/8 x 1-3/4 inches	3/8 inch
31 lbs to 50 lbs	1/2 x 2 inches	1/2 inch

260529-7 Fasteners, Attachments and Supporting Devices

PHOTO LAB – DARKROOM RENOVATION

PURCHASE COLLEGE SUNY | 735 ANDERSON HILL RD. | VISUAL ARTS BUILDING | LA PLLC Project 2306

FASTENERS, ATTACHMENTS AND SUPPORTING DEVICES

Over 50 lbs to load limit of structure.	Use bolt & nut.	5/8 inch
---	-----------------	----------

- c. Bottom chord of wood trusses may be utilized as structural support, but method of attachment must be specifically approved.
- d. Do not make attachments to the diagonal or vertical members of wood trusses.
- e. Do not make attachments to the nailing strips on top of steel beams.
- 10. Attachment to Metal Stud Construction: Use supporting fasteners manufactured specifically for the attachment of raceways and boxes to metal stud construction.
 - a. Support and attach outlet boxes so that they cannot torque/twist. Either:
 - 1) Use bar hanger assembly, or:
 - 2) In addition to attachment to the stud, also provide far side box support.

3.04 CONDUIT SUPPORT SCHEDULE

- A. Provide number of supports as required by National Electrical Code. Exception: Maximum support spacing allowed is 4'-0" for conduit sizes 3 inches and larger supported from wood trusses.
- B. Use pipe straps and specified method of attachment where conduit is installed proximate to surface of wood or masonry construction.
 - 1. Use hangers secured to surface with specified method of attachment where conduit is suspended from the surface.
- C. Use "C" beam clamps and hangers where conduit is supported from steel beams.
- D. Use deck clamps and hangers where conduit is supported from steel decking having hanger tabs.
 - 1. Where conduit is supported from steel decking that does not have hanger tabs, use clamps and hangers secured to decking, utilizing specified method of attachment.
- E. Use channel support system supported from structural steel for multiple parallel conduit runs.

260529-8 Fasteners, Attachments and Supporting Devices

PHOTO LAB – DARKROOM RENOVATION

PURCHASE COLLEGE SUNY | 735 ANDERSON HILL RD. | VISUAL ARTS BUILDING | LA PLLC Project 2306

FASTENERS, ATTACHMENTS AND SUPPORTING DEVICES

- F. Where conduits are installed above ceiling, do not rest conduit directly on runner bars, T-Bars, etc.
 - 1. Conduit Sizes 2-1/2 Inches and Smaller: Support conduit from ceiling supports or from construction above ceiling.
 - 2. Conduit Sizes Over 2-1/2 Inches: Support conduit from beams, joists, or trusses above ceiling.

3.05 LIGHTING FIXTURE SUPPORT SCHEDULE

- A. General: Do not support fixtures from ceilings or ceiling supports unless it is specified or indicated on the drawings to do so.
 - 1. Support fixtures with hanger rods attached to beams, joists, or trusses. Hanger rod diameter, largest standard size that will fit in mounting holes of fixture.
 - a. Where approved, channel supports may span and rest upon the lower chord of trusses and be utilized for the support of lighting fixtures.
 - b. Where approved, channel supports may span and be attached to the underside of beams, joists, or trusses and be utilized for the support of lighting fixtures.
 - 2. Use 2 nuts and 2 washers on lower end of each hanger rod to hold and adjust fixture (one nut and washer above top of fixture housing, one nut and washer below top of fixture housing).
 - a. Where specified that an adequately supported outlet box is to support a fixture or be utilized as one point of support, support the box so that it may be adjusted to bring the face of the outlet box even with surface of ceiling.
- B. Specific Installations Where Fixtures May Be Supported From New Ceilings Being Installed By Construction Work Contractor:
 - 1. Support surface mounted fluorescent fixtures and incandescent fixtures directly from plywood backed gypsum board ceilings.
 - 2. Support surface mounted fluorescent fixtures and incandescent fixtures directly from framing or furring members of fire rated suspended ceilings (double gypsum board).
 - 3. Support recessed mounted fluorescent fixtures and incandescent fixtures directly from furring members of furred gypsum board ceilings.
 - 4. Support recessed mounted fluorescent fixtures and incandescent fixtures directly from the suspension system of suspended acoustical ceilings. Exception: Support each fixture weighing more than 50 pounds (including lamps) independent of the suspended ceiling grid.

260529-9 Fasteners, Attachments and Supporting Devices

FASTENERS, ATTACHMENTS AND SUPPORTING DEVICES

5. Deliver documents that state actual fixture weights and indicate fixture locations to the Construction Work Contractor (thru the Director's Representative).
- C. Number of Supports For Ceiling Mounted Lighting Fixtures: Provide at least the following number of supports. Provide additional supports when recommended by fixture manufacturer, or shown on the drawings.
 1. Commercial and Industrial Lighting Fixtures:
 - a. Support individual lighting fixtures less than 2 feet wide at 2 points.
 - b. Support continuous row LED fixtures less than 2 feet wide at points equal to the number of fixtures plus one. Uniformly distribute the points of support over the row of fixtures.
 - c. Support individual LED fixtures 2 feet or wider at 4 corners.
 - d. Support continuous row LED fixtures 2 feet or wider at points equal to twice the number of fixtures plus 2. Uniformly distribute the points of support over the row of fixtures.
 - e. An adequately supported outlet box may be utilized as one point of support for fixtures weighing less than 50 pounds.
 2. Vandal Resistant, and Minimum Security Lighting Fixtures:
 - a. Support individual lighting fixtures less than 2 feet wide at 4 corners.
 - b. Support continuous row lighting fixtures less than 2 feet wide at points equal to twice the number of fixtures. Uniformly distribute the points of support.
 - c. Support individual lighting 2 feet or wider at each corner and one support midway along each side of longest axis (6 supports total).
 - d. Support continuous row lighting fixtures 2 feet or wider at points equal to 4 times the number of fixtures. Uniformly distribute the points of support.
 - e. An adequately supported outlet box may be utilized as one point of support for fixtures weighing less than 50 pounds.
 3. Medium Security Lighting Fixtures: Support each fixture at minimum of 6 points (each corner and midway along each side of longest axis). Outlet box shall not be counted as a point of support.
 4. Maximum Security Lighting Fixtures: Support each fixture at minimum of 8 points (each corner, and 2 supports spaced equally along each side of longest axis). Outlet box shall not be counted as a point of support.

260529-10 Fasteners, Attachments and Supportindng Devices

FASTENERS, ATTACHMENTS AND SUPPORTING DEVICES

5. Mercury Vapor, Metal Halide, and High Pressure Sodium Fixtures:
 - a. Commercial Style: Support fixture at 2 points.
 - b. Industrial Style: Support individual fixtures at one point.
 - c. Vandal Resistant Style: Support fixture at 4 points.
 - d. An adequately supported outlet box may be utilized as one point of support for fixtures weighing less than 50 pounds.
 6. Commercial and Industrial Incandescent Fixtures: Support fixture from adequately supported outlet box, to suit fixture design (fixture weight less than 50 pounds).
 7. Vandal Resistant Incandescent Fixtures: Support fixture from adequately supported outlet box to suit fixture design, plus 2 fasteners through back of fixture into suitable construction behind fixture.
- D. Number of Supports For Wall Mounted Lighting Fixtures: Provide at least the following number of supports. Provide additional supports when recommended by fixture manufacturer, or shown on the drawings.
1. Commercial and Industrial Lighting Fixtures:
 - a. Support individual lighting fixtures 2 feet long or less at 2 points.
 - b. Support individual lighting fixtures over 2 feet long at 3 points.
 - c. Support continuous row lighting fixtures at points equal to twice the number of fixtures. Uniformly distribute the points of support.
 - d. An adequately supported outlet box may be utilized as one point of support for fixtures weighing less than 50 pounds.
 2. Vandal Resistant, and Minimum Security Lighting Fixtures:
 - a. Support individual lighting fixtures 2 feet long or less at 4 points (each corner).
 - b. Support individual lighting fixtures over 2 feet long at 6 points (each corner and midway along each side of longest axis).
 - c. Support continuous row lighting fixtures at points equal to 6 times the number of fixtures. Uniformly distribute the points of support.
 - d. An adequately supported outlet box may be utilized as one point of support for fixtures weighing less than 50 pounds.
 3. Medium Security, and Maximum Security Lighting Fixtures:
 - a. Support each lighting fixture 2 feet long or less at minimum of 4 points (each corner).

FASTENERS, ATTACHMENTS AND SUPPORTING DEVICES

- b. Support each lighting fixture over 2 feet long, to 3 feet long at a minimum of 6 points (each corner and midway along each side of longest axis).
- c. Support each lighting fixture over 3 feet long, to 8 foot long at minimum of 8 points (each corner, and 2 supports spaced equally along each side of longest axis).
- d. Outlet box shall not be counted as a point of support.
- 4. Mercury Vapor, Metal Halide, and High Pressure Sodium Fixtures:
 - a. Commercial and Industrial Style: Support fixture at 2 points (Support arm mounted style at 4 points).
 - b. Vandal Resistant Style: Support fixture at 4 points.
 - c. An adequately supported outlet box may be used as one point of support for fixtures weighing less than 50 pounds.
- 5. Commercial and Industrial Incandescent Fixtures: Support fixture from adequately supported outlet box, to suit fixture design (fixture weight less than 50 pounds).
- 6. Vandal Resistant Incandescent Fixtures: Support fixture from adequately supported outlet box to suit fixture design, plus 2 fasteners through back of fixture into suitable construction behind fixture.

3.06 CHANNEL SUPPORT SYSTEM SCHEDULE

- A. Use channel support system where specified or indicated on the drawings.
- B. Channel supports may be used, as approved, to accommodate mounting of equipment.
- C. Material and Finish:
 - 1. Dry Locations: Use 12 gage steel channel support system having any one of the specified finishes.
 - 2. Damp Locations: Use 12 gage steel channel support system having any one of the specified finishes except green epoxy/enamel.
 - 3. Wet Locations: Use 12 gage steel channel support system having hot dipped galvanized, or PVC finish.

END OF SECTION

260529-12 Fasteners, Attachments and Supportindng Devices

CONDUIT RACEWAYS

260530 CONDUIT RACEWAYS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification Sections, apply to this Section.
- B. Requirements of the following Division 26 Sections apply to this Section:
 - 1. Section 260100 - Basic Mechanical and Electrical Requirements.
 - 2. Section 260500 - Basic Electrical Materials and Methods.
 - 3. Section 260519 - Wires and Cables – Below 600 Volts.
 - 4. Section 260532 - Electrical Boxes and Fittings.
 - 5. Section 260529 – Fasteners, Attachments and Supporting Devices.
 - 6. Section 260553 - Electrical Identification.
- C. Contractor shall refer to Section 011200 - "Summary", Section 015000 - "Temporary Facilities and Controls" and Contract Drawings inclusive, for the sequencing required to accomplish the work.

1.02 SUMMARY

- A. This Section includes raceways for electrical wiring. Types of raceways in this section include the following:
 - 1. Liquid-tight flexible conduit. (Final Connections only).
 - 2. Rigid Galvanized Steel Conduit (RGS) (for outdoors and service feeders and inside buildings).
 - 3. Underground non-metallic conduits (Schedule 40 PVC).
 - 4. Electrical metallic tubing (EMT).
 - 5. Intermediate metal conduit (IMC).
- B. Related Sections: The following Division 26 Sections contain requirements that relate to this Section:
 - 1. "Wires and Cables" for other wiring methods.
 - 2. "Supporting Devices" for raceway supports.
 - 3. "Electrical Boxes and Fittings" for boxes used with conduit and tubing systems.
 - 4. "Electrical Identification" for raceways cables and conductors.

1.03 SUBMITTALS

260530-1

Conduit Raceways

CONDUIT RACEWAYS

- A. General: Submit the following in accordance with Conditions of Contract and Division 1 Specification Sections.
- B. Product Data for the following products:
 - 1. Surface raceway and fittings.
 - 2. Wireway and fittings.
- C. Samples, 12 inches long of each type and size of surface raceway requested with required finish.
- D. Installation Instructions: Manufacturer's written installation instructions for wireway, surface raceway, and nonmetallic raceway products.

1.04 QUALITY ASSURANCE

- A. Electrical Component Standard: Components and installation shall comply with:
 - 1. National Electric Code.
 - 2. Underwriters Laboratories Inc. (U.L)
- B. National Fire Protection Association (NFPA):
 - No. 70 National Electrical code, the following Articles:
 - 342 Intermediate metal conduit
 - 344 Rigid galvanized steel conduit.
 - 358 Electric metallic tubing
 - 350 Liquidtight flexible metal conduit.
 - 355 Reinforced thermosetting resin conduit.
- C. UL Compliance and Labeling: Comply with applicable requirements of UL standards pertaining to electrical raceway systems. Provide raceway products and components listed and labeled by UL, ETL, or CSA:
 - UL 1,
 - UL 6, Rigid galvanized steel conduit.
 - UL 360, Liquidtight Flexible Steel conduit, Electrical
 - UL 514B, Fittings for conduit and Outlet Boxes.
 - UL 870, 1985 Electrical Wireways, Auxiliary Gutters, and Associated Fittings.
- D. ANSI Compliance: Provide raceways which comply with the following:
 - ANSI-C80.1, Specification for rigid Steel Conduit, Zinc-Coated.
 - ANSI-C80.3 Electrical metallic tubing (EMT), zinc-coated.

CONDUIT RACEWAYS

ANSI-C80.6 Intermediate Metal Conduit (IMC).

E. American Society for Testing and Materials (ASTM):

ASTM F 512 Standard Specification for Smooth Wall Poly (Vinyl Chloride) (PVC) Conduit and Fitting for Underground Installation.

1.5 COORDINATION

A. Coordinate with other Work, as necessary to interface installation of electrical raceways and components with other Work.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

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

1. Metal Conduit and Tubing:
 - a. Alflex Corp.
 - b. Anamet, Inc.; Anaconda Metal Hose.
 - c. Anizter Brothers, Inc.
 - d. Carol Cable Co., Inc.
 - e. Cole-Flex Corp.
 - f. Electri-Flex Co.
 - g. Flexcon, Inc.; Colemena Cable Systems, Inc.
 - h. Grinnell Co.; Allied Tube and Conduit Div.
 - i. Monogram Co.; AFC.
 - j. Spiraduct, Inc.
 - k. Triangle PWC, Inc.
 - l. Wheatland Tube Co.
2. Conduit Bodies:
 - a. Appleton Electric Co.
 - b. Carlon
 - c. Hubbell, Inc.
 - d. O-Z/Gedney
 - e. Spring City Electrical Mfg. Co.
3. Wireway:
 - a. Hoffman Engineering Co.
 - b. Keystone/Rees, Inc.
 - c. Square D Co.
4. Non-metallic (PVC) Conduit and Tubing
 - a. Appleton Electric Co.

CONDUIT RACEWAYS

- b. Carlon
- c. Hubbell, Inc.

2.02 CONDUIT

- A. Rigid Galvanized Steel Conduit
 - 1. Galvanized, threaded, full weight steel conduit, minimum size 3/4 inch., except as otherwise noted.
- B. Electric Metallic Tubing (EMT)
 - 1. Galvanized, threadless, thin wall conduit, with compression fittings, minimum size 3/4 inch. It shall be installed concealed above hung ceiling and in drywalls.
- C. Intermediate Metal Conduit (IMC)
 - 1. Galvanized, threaded steel conduit, minimum size 3/4 inch shall be used for feeder runs indoors.
- D. Liquid-tight Flexible Conduit
 - 1. Galvanized flexible metal conduit of circular cross section having as outer liquid-tight non-metallic, sunlight resistant covering, for use in wet locations. (Use only for final connections only 2'-0" maximum.)
- E. PVC (Polyvinyl Chloride Conduit) Schedule 40 – Provide only underground and as indicated on Drawings.
 - 1. Conduit shall be approved by Underwriters Laboratories for use as rigid non-metallic conduit. The conduit shall have the following properties:

Defective Strength	1215 volts/mil
Tensile Strength	6000 psi
Compressive Strength	8600 psi
Flexural Strength	11,500 psi
Flammability	Self-extinguishing

and shall be corrosive-resistant to an 80% concentrate of sulfuric acid at 73°F.
 - 2. All PVC conduit shall be Schedule 40, rigid, heavy wall, Federal Specification No. W-C-1094, as manufactured by Carlon, Triangle Conduit Cable Company, or Harvel Plastics, Inc.
 - 3. Bending of conduit may be accomplished in the field by using a heat bender. Heat shall be applied to the conduit evenly. Overheated conduit that has a brown appearance shall not be

CONDUIT RACEWAYS

used.

- F. Conduit shall be run concealed in hung or furred ceilings, in finished areas, bar-joint construction, masonry, metal and drywall partitions.
- G. Branch circuit wiring for light and power wiring of non-emergency system installed concealed in metal stud partitions or above hung ceilings shall be metal-clad type cable, rated 90 degrees C with THHN insulation, insulated ground conductor and comply with UL Standard 1569. Coordinate with Engineer regarding the acceptance armor-clad cable for this application.
- H. Branch circuit wiring for light and power of emergency system concealed in metal stud partitions or above hung ceilings shall be installed in EMT.
- I. The route of conduits indicated on the drawings is diagrammatic. Before installing any work, examine the working layouts and shop drawings of the other trades to determine the exact locations and clearance.
- J. BreathSaver XW 2-Hour Rated Conduit /Cable Systems for EUL FHIT 25C Systems.
 - 1. Description and Listing
 - a. Description – This specification outlines the requirements for the design, construction and performance of the Extra Heavy Wall (XW) BreathSaver Reinforced Thermosetting Resin Conduit (RTRC) and fittings.
 - b. Product application & use – Conduits and fittings are Class 1, Division 2 which can be subject to physical damage per NEC.
 - c. Materials – Conduits and fittings shall consist of continuous E or E-CR glass roving in a cured corrosion resistant phenolic resin system pigmented with UV inhibiting carbon black dispersed homogeneously manufactured for use at temperatures ranging from -40°F (-40°C) to 1850°F (1010°C). No resorcinol resin based system shall be allowed. Phenolic resin system shall be impervious to a wide spectrum of chemicals. Conduit shall contain no halogens as chlorine and shall not contain other toxic materials in excess of trace levels limits compliant with OSHA requirements.
 - d. Joining Method – Each length of conduit is supplied with an integral bell on one end and spigot on the other end. All joints shall be adhesive bonded inside a bell end of even socket depth throughout the raceway. Adhesive shall be supplied by the manufacturer of the conduit and shall have

CONDUIT RACEWAYS

a minimum joint pull out load of 1 000 lb. (454 kg) per inch diameter trade size.

- e. Fittings – All fittings, adapters and elbows shall be constructed in the same manner as the conduit (filament wound) and shall have a socket depth and an inside bell design consistent with the conduit.

2. Dimensions –

- a. Sizes and wall thickness - Conduits and fittings shall be manufactured with nominal wall thickness as outlined below:

2.1 Sizes & wall thicknesses

Conduits and fittings shall be manufactured with nominal wall thicknesses as outlined below:

IPS IRON PIPE SIZE			
Diameter		Wall thickness	
in	mm	in	mm
¾	21	0.250	6.4
1	27	0.250	6.4
1 ¼	34	0.250	6.4
1 ½	41	0.250	6.4
8*	203	0.250	6.4

ID TUBULAR SIZE			
Diameter		Wall thickness	
in	mm	in	mm
2	53	0.250	6.4
2½	63	0.250	6.4
3	78	0.250	6.4
3½	91	0.250	6.4
4	103	0.250	6.4
5	129	0.250	6.4
6	155	0.250	6.4

3. Requirements

- a. Workmanship – Conduit and fittings shall be free from defects and commercially practicable in color, opacity, density and other physical properties. The exterior surface finish shall be smooth per acceptable industry practices.
- b. Marketing – Conduits and fittings shall be marked with a suitable mark printed on the outside of the product. Such marking shall contain: (1) RTRC (2) for use -40°F (40°C) to 1850°F (1010°C) (3) trade size (4) manufacturer's name or trademark (5) part number (6) degrees and radii (elbows only) (7) date of manufacture.

2.03 FITTINGS AND ACCESSORIES

A. Raceway

1. Rigid Steel: Hot dipped galvanized, threaded, malleable iron exposed or in concrete, lock nuts, grounding lugs with cable connectors. Threadless connectors will not be acceptable.
2. Flexible Steel Conduit: Metallic fittings with nylon insulated throat bushing, locknuts and external grounding lugs.
3. Liquid-tight Flexible Conduit: Liquid-tight fittings with nylon insulated throat bushing, locknuts and external grounding lugs.

CONDUIT RACEWAYS

4. Provide all PVC fittings including couplings, adapters, reducers, expansion couplings, elbows, bell ends, plugs and caps required for the installation.
5. PVC conduits shall be joined by means of couplings, PVC cleaner and solvent cement. The ends of conduit shall be cut square using a fine cloth tooth handsaw and ends deburred.
6. Electric metallic tubing: Steel, compression connectors and coupling for dry locations.
7. Intermediate metal conduit: Galvanized threaded fittings, malleable iron exposed or in concrete, locknuts, grounding lugs with cable connectors.

2.04 CONDUIT BODIES (CONDULETS)

- A. General: Types, shapes, and sizes as required to suit individual applications and NEC requirements. Provide matching gasketed covers secured with corrosion-resistant screws.
 1. Metallic Conduit and Tubing: Use metallic conduit bodies. Use bodies with threaded hubs for threaded raceways.
 2. Nonmetallic Conduit and Tubing: Use nonmetallic conduit bodies conforming to UL 514 B.
 3. Conduit bodies 1 inch and smaller: Use bodies with compression-type EMT connectors.

2.05 WIREWAYS

- A. General: Electrical wireways shall be of types, sizes, and number of channels as indicated. Fittings and accessories including but not limited to couplings, offsets, elbows, expansion joints, adapters, hold-down straps, and end caps shall match and mate with wireway as required for complete system. Where features are not indicated, select to fulfill wiring requirements and comply with applicable provisions of the NEC.
- B. Wireway covers shall be hinged type.

PART 3 - EXECUTION

3.01 WIRING METHOD

- A. Outdoors: Use the following wiring methods:
 1. Exposed or Concealed: Rigid galvanized steel.
 2. Underground: Rigid PVC Schedule 40 conduit encased in reinforced concrete envelope forming duct bank.

CONDUIT RACEWAYS

3. Connection to Vibrating Equipment: Including transformers and hydraulic, pneumatic, or electric solenoid or motor-driven equipment: Liquid-tight flexible metal conduit minimum 12". A grounding conductor shall be installed.

Hot dipped rigid galvanized conduit encased in reinforced concrete envelope forming duct where indicated on Drawings.

- B. Indoors: Use the following wiring methods:
 1. Galvanized rigid Steel (GRS): For fire alarm power circuits and power feeders.
 - a. GRS conduits are permissible including mechanical rooms building exterior and all locations unless otherwise specified below.
 - b. GRS Conduit shall be used in areas below 10 foot above finished floors in: Mechanical rooms, Fire Pump rooms and loading docks.
 2. Intermediate Metal Conduit (IMC): Below hung ceiling and in public spaces except wet and hazardous areas as defined in the NEC.
 3. Electrical Metallic Tubing (EMT): For fire alarm power circuits and power feeders.
 - a. Concealed as branch circuit conduits above suspended ceilings where conduit does not support fixtures or other equipment.
 - b. Concealed as branch circuit conduits in hollow areas in dry locations.
 - c. Exposed a branch conduits in dry, non-hazardous locations at elevations over 10'-0" above finished floor in all dry areas, where conduit does not support fixtures or other equipment and is not subjected to physical damage.
 4. Liquidtight Flexible Metal Conduit (LFMC): Final connections to vibrating equipment. Length of conduit not to exceed 24".

3.02 INSTALLATION

- A. General: Install electrical raceways in accordance with manufacturer's written installation instructions, applicable requirements the NEC, and as follows:
 1. The raceways and wiring shall be run concealed in new concrete slabs and chopped into and buried in existing slabs. Where raceways are run exposed, they shall be neatly arranged on pipe hangers and supports, as specified, together with fittings designed for the purpose. Raceways in close proximity of existing equipment shall be so arranged as to allow for proper clearance for servicing, hea

CONDUIT RACEWAYS

- droom and the like. Work run exposed shall be installed parallel to walls, floors and ceilings in a neat workmanlike manner.
2. Complete installation of electrical raceways before starting installation of conductors within raceways.
 3. Provide supports for raceways as specified elsewhere in Division 26.
 4. Prevent foreign matter from entering raceways by using temporary closure protection.
 5. Protect stub-ups from damage where conduits rise from floor slabs. Arrange so curved portion of bends is not visible above the finished slab. Provide in all areas at all locations where exposed conduit work enters the floor slab from panels or other equipment, a raised solid concrete "enclosure", minimum 4" height and thickness, with top leveled.
 6. Make bends and offsets so the inside diameter of the raceway is not effectively reduced. Unless otherwise indicated, keep the legs of a bend in the same plane and the straight legs of offsets parallel.
 7. Use raceway fittings that are of types compatible with the associated raceway and suitable for the use and location.
 8. Run concealed raceways with a minimum of bends in the shortest practical distance considering the type of building construction and obstructions except as otherwise indicated. This does not apply to conduits in crawl spaces.
 9. Raceways Embedded in Slabs and Cut into Existing Floors: Install in middle third of the slab thickness where practical and leave at least 1 inch concrete cover. Tie raceways to reinforcing rods or otherwise secure them to prevent sagging or shifting during concrete placement. Space raceways laterally to prevent voids in the concrete. Run conduit larger than 1-inch trade size, parallel with or at right angles to the main reinforcement; where at right angles to the reinforcement, the conduit shall be close to one of the supports of the slab.
 10. Conduit shall not be installed in slabs of less than 4" thickness; maximum size conduit installed in slabs shall be 1-1/4" trade size.
 11. Route conduits, which are installed in concrete slabs, in a manner not to interfere with placement of reinforcing steel, insets for setting of equipment supports, door bucks, and the like and which will permit placement of the full concrete cover above reinforcement and/or conduits within the designed structural slab elevations.
 12. The routing of conduits as indicated on the plans is diagrammatic. Before installing any work, determine exact location and clearances required. Modifications to conduit runs, as found necessary from the above, shall be made without additional cost to the Owner and shall be subject to the approval of the Design Professional.

CONDUIT RACEWAYS

13. Install exposed raceways parallel and perpendicular to nearby surfaces or structural members and follow the surface contours as much as practical.
14. Run exposed, parallel, or banked raceways together. Make bends in parallel or banked runs from the same center line so that the bends are parallel. This requires that there be a change in the plane of the run such as from wall to ceiling and that the raceways be of the same size. In other cases, provide field bends for parallel raceways.
15. Join raceways with fittings designed and approved for the purpose and make joints tight. Where joints cannot be made tight, use bonding jumpers to provide electrical continuity of the raceway system. Make raceway terminations tight. Where subject to vibration or dampness, use insulating bushings to protect conductors.
16. Terminations: Where raceways are terminated with locknuts and bushings, align the raceway to enter squarely and install the locknuts with dished part against the box. Where terminations cannot be made secure with one locknut, use two locknuts, one inside and one outside the box.
17. Where terminating in threaded hubs, screw the raceway or fitting tight into the hub so the end bears against the wire protection shoulder. Where chase nipples are used, align the raceway so the coupling is square to the box, and tighten the chase nipple so no threads are exposed.
18. Install pull wires in empty raceways. Flat woven, polyester tape with four insulated metallic conductors for detection of cables and empty conduits. Tape shall be pre-lubricated for easy installation and reduced friction. Footage and/or meter markings shall be durable printed throughout the length of the tape. Four #22 gauge tinned coated copper corrosion-resistant conductors shall be woven into tape, conductors shall be capable of handling a wide range of frequencies (maximum resistivity of 4.4 ohms/mft.) at a maximum of 300-volts for locating and detecting. Tape shall have a tensile strength of 50,000 psi nominal, a break strength of 25lbs nominal, an elongation factor of 20% and a maximum pulling strength of 1250lbs.
19. Install raceway sealing fittings according to manufacturer's written instructions. Locate fittings at suitable, approved, and accessible locations and fill them with UL-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 at the following points:
 - a. Where conduits pass from warm to cold locations, such as the

CONDUIT RACEWAYS

- boundaries of refrigerated spaces.
- b. Where otherwise required by NFPA 70.
- 20. Stub-up Connections: Extend conduits through concrete floor for connection to freestanding equipment with an adjustable top or coupling threaded inside for plugs and set flush with the finished floor. Extend conductors to equipment with rigid steel conduit; liquidtight flexible metal conduit may be used 6 inches above the floor.
- 21. Flexible Connections: Use short length (maximum of 6 ft.) of liquid-tight flexible conduit for equipment subject to vibration, noise transmission, or movement; and for all motors. Install separate ground conductor across flexible connections.
- 22. Where conduits pass through cavity wall construction, install a 2" diameter steel flange around conduit, located in center of cavity, to prevent the transmission of moisture to the inside wall construction.
- 23. Conduits, 1-1/4" and larger, shall be fitted with insulated bushings, where they terminate in pull boxes, panelboards, or wiring troughs.
- 24. Running threads will not be permitted. Conduit unions will not be acceptable.
- 25. Conduits passing through building expansion joints shall be fitted with expansion-deflection fittings complete with bonding jumpers.
- 26. Conduits passing through wall or floor membrane waterproofing shall be provided with cast iron sleeves having integral flashing and clamping devices and pressure rings. Sleeves shall extend a minimum of 6" above the finished floor.
- 27. Identify and color code raceways as specified in Section 260553.

3.03 ADJUSTING AND CLEANING

- A. Upon completion of installation of raceways, inspect interiors of raceways; clear all blockages and remove burrs, dirt, and construction debris.

3.04 EXISTING CONDUITS AND RACEWAYS

- A. Use of existing conduits.
 - 1. Existing conduits run in existing concrete floors and existing exposed raceways to be altered, or modified for reuse with cables, shall be only at locations where called for only the drawings. No other existing conduits may be reused.

END OF SECTION

CABINETS, BOXES AND FITTINGS

260532 CABINETS, BOXES AND FITTINGS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.
- B. Requirements of the following Division 26 Sections apply to this section:
 - 1. Section 260100- Basic Electrical Requirements.
 - 2. Section 260500 - Basic Electrical Materials and Methods.
 - 3. Section 260530 – Conduit Raceways
 - 4. Section 260519 – Wires and Cables – Below 600 Volts

1.02 SUMMARY

- A. This Section includes cabinets, boxes, and fittings for electrical installations and certain types of electrical fittings not covered in other sections. Types of products specified in this Section include:
 - 1. Outlet and device boxes.
 - 2. Pull and junction boxes.
 - 3. Cabinets.
 - 4. Hinged door enclosures.
- B. Conduit-body-type electrical enclosures and wiring fittings are specified in Division 26 Section "Raceways "

1.03 DEFINITIONS

- A. Cabinets: An enclosure designed either for surface or for flush mounting and having a frame, or trim in which a door or doors may be mounted.
- B. Device Box: An outlet box designed to house a receptacle device or a wiring box designed to house a switch.
- C. Enclosure: A box, case, cabinet, or housing for electrical wiring or components.
- D. Hinged Door Enclosure: An enclosure designed either for surface or flush mounting and having swinging doors or covers secured directly to and telescoping with the walls of the box.

CABINETS, BOXES AND FITTINGS

- E. Outlet Box: A wiring enclosure where current is taken from a wiring system to supply utilization equipment.
- F. Wiring Box: An enclosure designed to provide access to wiring systems or for the mounting of indicating devices or of switches for controlling electrical circuits.

1.04 SUBMITTALS

- A. General: Submit the following in accordance with Conditions of Contract and Division 1 Specification Sections.
- B. Product data for cabinets and enclosures with classification higher than NEMA 1.
- C. Shop drawings for boxes, enclosures and cabinets that are to be shop fabricated, (nonstock items). For shop fabricated junction and pull boxes, show accurately scaled views and spatial relationships to adjacent equipment. Show box types, dimensions, and finishes.

1.05 QUALITY ASSURANCE

- A. UL Listing and Labeling: Items provided under this section shall be listed and labeled by UL.
- B. National Electrical Code Compliance: Components and installation shall comply with NFPA 70 "National Electrical Code."
- C. NEMA Compliance: Comply with NEMA Standard 250, "Enclosures for electrical Equipment (5000 Volts Maximum)."

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated in the Work include, but are not limited to, the following:
 - 1. Cabinets, Boxes and Fittings:
 - a. Appleton.
 - b. OZ/Gedney.
 - c. Spring City Electrical Mfg. Co.
 - d. Thomas & Betts Corp.

CABINETS, BOXES AND FITTINGS

2.02 CABINETS, BOXES, AND WIRING TROUGHS FITTINGS, GENERAL

- A. Electrical Cabinets, Boxes, Wiring Troughs and Fittings: Of indicated types, sizes, and NEMA enclosure classes. Where not indicated, provide units of types, sizes, and classes appropriate for the use and location. Provide all items complete with covers and accessories required for the intended use. Provide gaskets for units in damp or wet locations.

2.03 MATERIALS AND FINISHES

- A. Sheet Steel: Flat-rolled, code-gage, galvanized steel.
- B. Fasteners for General Use: Corrosion resistant screws and hardware including cadmium and zinc plated items.
- C. Fasteners for Damp or Wet Locations: Stainless steel screws and hardware.
- D. Cast Metal for Boxes, Enclosures, and Covers; Copper-free aluminum, brass, or cast iron, except as otherwise specified.
- E. Exterior Finish: Gray baked enamel for items exposed in finished locations except as otherwise indicated.
- F. Painted Interior Finish: Where indicated, white baked enamel.
- G. Fittings for Boxes, Cabinets, and Enclosures: Conform to UL 514B. Malleable iron or zinc plated steel for conduit hubs, bushings and box connectors.

2.04 METAL OUTLET, DEVICE, AND SMALL WIRING BOXES

- A. General: Conform to UL 514A, "Metallic Outlet Boxes, Electrical," and UL 514B, "Fittings for Conduit and Outlet Boxes." Boxes shall be of type, shape, size, and depth to suit each location and application.
- B. Steel Boxes: Conform to NEMA OS 1, "Sheet Steel Outlet Boxes, Device Boxes, Covers, and Box Supports." Boxes shall be galvanized sheet steel with stamped knockouts, threaded screw holes and accessories suitable for each location including mounting brackets and straps, cable clamps, exterior rings and fixture studs.
- C. Cast-Aluminum Boxes: Copper free aluminum threaded raceway entries, and features and accessories suitable for each location including mounting ear

CABINETS, BOXES AND FITTINGS

s, threaded screw holes for devices and closure plugs.

- D. Cast-Iron Boxes: Iron alloy, waterproof, with threaded raceway entries and features and accessories suitable for each location, including mounting ears, threaded screw holes for devices and closure plugs.

2.05 PULL AND JUNCTION BOXES

- A. General: Comply with UL 50, "Electrical Cabinets and Boxes", for boxes over 100 cubic inches volume. Boxes shall have screwed or bolted on covers of material same as box and shall be of size and shape to suit application.
- B. Steel Boxes: Sheet steel with welded seams. Where necessary to provide a rigid assembly, construct with internal structural steel bracing.
- C. Hot-Dipped Galvanized Steel Boxes: Sheet steel with welded seams. Where necessary to provide a rigid assembly, construct with internal structural steel bracing. Cover shall be gasketed.
- D. Cast-Aluminum Boxes: Molded of copper free aluminum, with gasketed cover and integral threaded conduit entrances.
- E. Cast-Iron Boxes: Molded of cast iron alloy with gasketed cover and integral threaded conduit entrances.
- F. Cable troughs shall be provided where indicated, and shall be of special shapes, design, and construction required to install, support and enclose feeder cable throughout the routing indicated. Troughs shall be constructed as specified above for junction and pull boxes, with required reinforcing, for rigidity, and insulating supports and clamping for the cable installation. Cable shall be continuous throughout the troughs, and shall be racked in distributed phase groupings arranged with phase cables surrounding the neutral conductors.

2.06 CABINETS

- A. Comply with UL 50, "Electrical Cabinets and Boxes."
- B. Construction: Sheet steel, NEMA 1 class except as otherwise indicated. Cabinet shall consist of a box and a front consisting of a one piece frame and a hinged door.

Arrange door to close against a rabbet placed all around the inside edge of the frame, with a uniformly close fit between door and frame. Provide

CABINETS, BOXES AND FITTINGS

concealed fasteners, not over 24-inches apart, to hold fronts to cabinet boxes and provide for adjustment. Provide flush or concealed door hinges not over 24-inches apart and not over 6-inches from top and bottom of door. For flush cabinets, make the front approximately 3/4 inch larger than the box all around. For surface mounted cabinets, make front same height and width as box.

- C. Doors: Double doors for cabinets wider than 24-inches.
- D. Locks: Combination spring catch and key lock, with all locks for cabinets keyed as per the University Physical Plant. Locks may be omitted on cabinets located within electrical rooms. Locks shall be of a type to permit doors to latch closed without locking.

2.07 STEEL ENCLOSURES WITH HINGED DOORS

- A. Comply with UL 50, "Cabinets and Enclosures" and NEMA ICS 6, "Enclosures for Industrial Controls and Systems."
- B. Construction: Sheet steel, 16 gage, minimum, with continuous welded seams. NEMA class as indicated; arranged for surface mounting.
- C. Doors: Hinged directly to cabinet and removable, with approximately 3/4-inch flange around all edges, shaped to cover edge of box. Provide handle operated, key locking latch. Individual door width shall be no greater than 24-inches. Provide multiple doors where required.
- D. Mounting Panel: Provide painted removable internal mounting panel for component installation.
- E. Enclosure: NEMA I except as indicated. Where door gasketing is required, provide neoprene gasket attached with oil-resistant adhesive, and held in place with steel retaining strips. For all enclosures of class higher than NEMA 1, use hubbed raceway entrances.

2.08 CAST METAL ENCLOSURES WITH HINGED DOORS

- A. Copper free aluminum with bolted, hinged doors. Cast brass or cast iron enclosures are also acceptable.

PART 3 - EXECUTION

3.01 INSTALLATION, GENERAL

260532-5

Cabinets, Boxes & Fittings

CABINETS, BOXES AND FITTINGS

- A. Locations: Install items where indicated and where required to suit code requirements and installation conditions.
- B. Cap unused knockout holes where blanks have been removed and plug unused conduit hubs.
- C. Support and fasten items securely in accordance with Division 26 Section "Supporting Devices."
- D. Sizes shall be adequate to meet NEC volume requirements, but in no case smaller than sizes indicated.
- E. Remove sharp edges where they may come in contact with wiring or personnel

3.02 APPLICATIONS

- A. Cabinets: Flush mounted, NEMA enclosure Type 1 except as otherwise indicated.
- B. Hinged Door Enclosures: NEMA Type I enclosure except as indicated.
- C. Hinged Door Enclosures Outdoors: NEMA Type 3R, Install drip hood, factory tailored to individual units.
- D. Hinged Door Enclosures in Corrosive Locations: NEMA Type 4X metal enclosure.
- E. Outlet Boxes and Fittings: Install outlet and device boxes and associated covers and fittings of materials and NEMA types suitable for each location and in conformance with the following requirements:
- F. Interior Dry Locations: Galvanized sheet steel, NEMA Type 1.
- G. Locations Exposed to Weather or Dampness: Cast metal, NEMA Type 3R.
- H. Wet Locations: NEMA Type 4 enclosures.
- I. Corrosive Locations: NEMA Type 4X enclosures.
- J. Pull and Junction Boxes: Install pull and junction boxes of materials and NEMA types suitable for each location except as otherwise indicated.

3.03 INSTALLATION OF OUTLET BOXES

CABINETS, BOXES AND FITTINGS

- A. Locations in Special Finish Materials: For outlet boxes for receptacles and switches mounted in concrete block, brick, or stone, use rectangular shaped boxes with square corners and straight sides. Install such boxes without plaster rings. Saw cut all recesses for outlet boxes in exposed masonry walls. Where more than one wiring device is indicated, use gang or tandem boxes.
- B. Gasketed Boxes: At the following locations use cast metal, threaded hub type boxes with gasketed weatherproof covers:
 - 1. Exterior locations.
 - 2. Where surface mounted on unfinished walls, columns or pilasters.
 - 3. Where exposed to moisture laden atmosphere.
 - 4. Where indicated.
- C. Cast-Iron Boxes: Iron alloy, waterproof, with threaded raceway entries and features and accessories suitable for each location, including mounting ears, threaded screw holes for devices and closure plugs.
- D. Mounting: Mount outlet boxes for switches with the long axis vertical or as indicated. Mount boxes for receptacles either vertically or horizontally but consistently either way. Three or more gang boxes shall be mounted with the long axis horizontal. Locate box covers or device plates so they will not span different types of building finishes either vertically or horizontally.
- E. Ceiling Outlets: For fixtures, where wiring is concealed, use outlet boxes 4-inches square by 1-1/2-inches deep, minimum.
- F. Cover Plates for Surface Boxes: Use plates sized to box front without overlap.
- G. Protect outlet boxes to prevent entrance of plaster, and debris. Thoroughly clean foreign material from boxes before conductors are installed.
- H. Concrete Boxes: Use extra deep boxes to permit side conduit entrance without interfering with reinforcing, but do not use such boxes with over 6-inch depth.
- I. Existing Outlet Boxes: Where extension rings are required to be installed, drill new mounting holes in the rings to align with the mounting holes on the existing boxes where existing holes are not aligned.
- J. Outlet boxes shall be securely fastened in place flush with finished wall and cei

CABINETS, BOXES AND FITTINGS

ling surfaces. Boxes at all fixture outlets shall be provided with 3/8" fixture studs, securely fastened to same.

3.04 INSTALLATION OF PULL AND JUNCTION BOXES

- A. Box Selection: For boxes in main feeder conduit runs, use sizes not smaller than 8-inches square by 4-inches deep. Handholes shall be as indicated on drawings. Do not exceed 6 entering and 6 leaving raceways in a single box. Quantities of conductors (including equipment grounding conductors) in pull or junction box shall not exceed the following:

Size of Largest Conductors in Box No. 4/0 AWG	Maximum No. of Conductors in Box
250 MCM	30
500 MCM	20
Over 500 MCM	15
	10

- B. Cable Supports: Install clamps, grids, or devices to which cables may be secured. Arrange cables so they may be readily identified. Support cable at least every 30-inches inside boxes.
- C. Mount pull boxes in inaccessible ceilings with the covers flush with the finished ceiling.

3.05 INSTALLATION OF CABINETS AND HINGED DOOR ENCLOSURES

- A. Mount with fronts straight and plumb.
- B. Install with tops 78-inches above floor.
- C. Set cabinets in finished spaces flush with walls.

3.06 GROUNDING

- A. Electrically ground metallic cabinets, boxes, and enclosures. Where wiring to item includes a grounding conductor, provide a grounding terminal in the interior of the cabinet, box or enclosure.

3.07 CLEANING AND FINISH REPAIR

- A. Upon completion of installation, inspect components. Remove burrs, dirt, and construction debris and repair damaged finish including chips, scratches, abrasions and weld marks.

CABINETS, BOXES AND FITTINGS

- B. Galvanized Finish: Repair damage using a zinc-rich paint recommended by the manufacturer.
- C. Painted Finish: Repair damage using matching corrosion inhibiting touch-up coating.

END OF SECTION

ELECTRICAL IDENTIFICATION

260553 ELECTRICAL IDENTIFICATION

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.
- B. Requirements of the following Division 26 Sections apply to this section:
 - 1. Section 260100 - Basic Electrical Requirements.
 - 2. Section 260500 - Basic Electrical Materials and Methods.

1.02 SUMMARY

- A. This Section includes identification of electrical materials, equipment, and installations. It includes requirements for electrical identification components including, but not limited to, the following:
 - 1. Identification labeling for raceways, cables, and conductors.
 - 2. Warning and caution signs.
 - 3. Equipment labels and signs.
 - 4. Warning signs for interior and exterior electric room doors.
- B. Related Sections: The following Sections contain requirements that relate to this Section:
 - 1. Division 9 Section "Painting" for related identification requirements.
 - 2. Division 26 Section "Wires and Cables" for requirements for color coding of conductors for phase identification.
- C. Refer to other Division 26 sections for additional specific electrical identification associated with specific items.

1.03 SUBMITTALS

- A. General: Submit the following in accordance with Conditions of Contract and Division 1 Specification Sections.
- B. Product Data for each type of product specified.
- C. Samples of each color, lettering style, and other graphic representation required for identification materials; samples of labels and signs.

ELECTRICAL IDENTIFICATION

- D. Schedule of identification nomenclature to be used for identification signs and labels.

1.04 QUALITY ASSURANCE

- A. Electrical Component Standard: Components and installation shall comply with NFPA 70 "National Electrical Code."

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated in the Work include, but are not limited to, the following:
 - 1. American Labelmark Co.
 - 2. Calpico, Inc.
 - 3. Cole-Flex Corp.
 - 4. Emed Co., Inc.
 - 5. George-Ingraham Corp.
 - 6. Ideal Industries, Inc.
 - 7. Kraftbilt
 - 8. LEM Products, Inc.
 - 9. Markal Corp.
 - 10. National Band and Tag Co.
 - 11. Panduit Corp.
 - 12. Radar Engineers Div., EPIC Corp.
 - 13. Seton Name Plate Co.
 - 14. Standard Signs, Inc.
 - 15. W.H. Brady, Co.

2.02 ELECTRICAL IDENTIFICATION PRODUCTS

- A. Adhesive Marking Labels for Raceway Cable: Pre-printed, flexible, self-adhesive labels with legend indicating voltage and service.
- B. Label size shall be 1-1/2 inches high by 8 inches long.
- C. Color:
 - 1. White legend on red background for emergency power
 - 2. White legend on black background for normal power
- D. Pretensioned Flexible Wraparound Colored Plastic Sleeves for Raceway and

ELECTRICAL IDENTIFICATION

Cable Identification: Flexible acrylic bands sized to suit the raceway diameter and arranged to stay in place by pretensioned gripping action when coiled around the raceway or cable.

- E. Wire/Cable Designation Tape Markers: Vinyl or vinyl-cloth, self-adhesive, wraparound, cable/conductor markers with preprinted numbers and letters.
- F. Engraved, Plastic-Laminated Labels, Signs, and Instruction Plates: Engraving stock melamine plastic laminate, 1/16-inch minimum thick for signs up to 20 square inches, or 8 inches in length; 1/8-inch thick for larger sizes. Engraved legend in white letters on black face and punched for mechanical fasteners.
- G. Fasteners for Plastic-Laminated and Metal Signs: Self-tapping stainless steel screws or number 10/32 stainless steel machine screws with nuts and flat and lock washers.
- H. Cable Ties: Fungus-inert, self-extinguishing, one-piece, self-locking nylon cable ties, 0.18-inch minimum width, 50-lb minimum tensile strength, and suitable for a temperature range from minus 50 deg F to 350 deg F. Provide ties in specified colors when used for color coding.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Lettering and Graphics: Coordinate names, abbreviations, colors, and other designations used in electrical identification work with corresponding designations specified or indicated. Install numbers, lettering, and colors as approved in submittals and as required by code.
- B. Install identification devices in accordance with manufacturer's written instructions and requirements of NEC.
- C. Sequence of Work: Where identification is to be applied to surfaces that require finish, install identification after completion of finish work.
- D. Conduit Identification
 - 1. Identify feeder conduits by feeder branch with branch and circuit number in black letters 2 inches high, at 10-foot intervals on entire surface of exposed conduits.
 - 2. Apply identification to areas as follows:
 - a. Clean surface of dust, loose material, and oily films before painting.

ELECTRICAL IDENTIFICATION

nting.

- E. Identify Junction, Pull, and Connection Boxes: Code-required caution sign for boxes shall be pressure-sensitive, self-adhesive label indicating system voltage in black, preprinted on orange background. Install on outside of box cover. Also label box covers with identity of contained circuits. Use pressure-sensitive plastic labels at exposed locations and similar labels or plasticized card stock tags at concealed boxes.
- F. Underground Electrical Line Identification: During trench backfilling, for exterior underground power lines, install dual continuous underground plastic line markers, located directly above line 12 inches below finished grade. Where multiple lines installed in a common trench or concrete envelope that do not exceed an overall width of 16 inches; install a single line marker.
- G. Install line marker for all underground wiring.
- H. Conductor Color Coding: Provide color coding for service, feeder, and branch circuit conductors throughout the project secondary electrical system as follows:

120/208 Volts	Phase	277/480 Volts
Black	A	Yellow
Red	B	Brown
Blue	C	Orange
White	Neutral	White
Green	Ground	Green

Use conductors with color factory-applied the entire length of the conductors except as follows:

- 1. The following field-applied color-coding methods may be used in lieu of factory-coded wire for sizes larger than No. 10 AWG.
 - a. Apply colored, pressure-sensitive plastic tape in half-lapped turns for a distance of 8 inches from terminal points and in boxes where splices or taps are made. Apply the last two laps of tape with no tension to prevent possible unwinding. Use 1-inch-wide tape in colors as specified. Do not obliterate cable identification markings by taping. Tape locations may be adjusted slightly to prevent such obliteration.
 - b. In lieu of pressure-sensitive tape, colored cable ties may be use

ELECTRICAL IDENTIFICATION

d for color identification. Apply three ties of specified color to each wire at each terminal or splice point starting 3 inches from the terminal and spaced 3 inches apart. Apply with a special tool or pliers, tighten for snug fit, and cut off excess length.

- I. Power Circuit Identification: Securely fasten identifying metal tags or aluminum wraparound marker bands to cables, feeders, and power circuits in pull boxes, junction boxes, and switchboard rooms with 1/4-inch steel letter and number stamps with legend to correspond with designations on Drawings. If metal tags are provided, attach them with approximately 55-lb test monofilament line or one-piece self-locking nylon cable ties.
- J. Tag or label conductors as follows:
 - 1. Future Connections: Conductors indicated to be for future connection or connection under another contract with identification indicating source and circuit numbers.
 - 2. Multiple Circuits: Where multiple branch circuits are present in the same box or enclosure (except for three-circuit, four-wire home runs), label each conductor or cable. Provide legend indicating source, voltage, circuit number, and phase for branch circuit wiring. Phase and voltage of branch circuit wiring may be indicated by means of coded color of conductor insulation. For control and communications/signal wiring, use color coding or wire/cable marking tape at terminations and at intermediate locations where conductors appear in wiring boxes, troughs, and control cabinets. Use consistent letter/number conductor designations throughout on wire/cable marking tapes.
 - 3. Match identification markings with designations used in panelboards shop drawings, Contract Documents, and similar previously established identification schemes for the facility's electrical installations.
- K. Apply warning, caution, and instruction signs and stencils as follows:
 - 1. Install warning, caution, or instruction signs where required by NEC, where indicated, or where reasonably required to assure safe operation and maintenance of electrical systems and of the items to which they connect. Install engraved plastic-laminated instruction signs with approved legend where instructions or explanations are needed for system or equipment operation. Install butyrate signs with metal backing for outdoor items and in manholes.
 - 2. Install warning, caution signs as required by NEC or where required to assure safe maintenance for all electric room doors, both from the building side and from the exterior side.

ELECTRICAL IDENTIFICATION

- L. Install equipment/system circuit/device identification as follows:
 - 1. Apply equipment identification labels of engraved plastic-laminate on each major unit of electrical equipment in building, including central or master unit of each electrical system. This includes communication/signal/alarm systems, unless unit is specified with its own self-explanatory identification. Except as otherwise indicated, provide single line of text, with 1/2-inch-high lettering on 1-1/2-inch-high label (2-inch-high where two lines are required), white lettering in black field. Text shall match terminology and numbering of the Contract Documents and shop drawings. Apply labels for each unit of the following categories of electrical equipment.
 - a. Panelboards, electrical cabinets, and enclosures.
 - b. Electrical switchgear and switchboards.
 - c. Electrical substations.
 - d. Transformers.
 - e. Electrical rooms.
 - f. Receptacles branch circuit number.
 - g. Junction boxes branch circuit number
- M. Apply circuit/control/item designation labels of engraved plastic laminate for disconnect switches, and similar items for power distribution.
- N. Install labels at locations indicated and at locations for best convenience of viewing without interference with operation and maintenance of equipment.

END OF SECTION

ELECTRICAL COMMISSIONING

260800 ELECTRICAL COMMISSIONING

PART 1 - GENERAL

1.01 SUMMARY

- A. This Section includes the systems to be commissioned installed by the Contractor.
- B. Refer to Section 240100 for the contractor's responsibilities in the commissioning process.

1.02 SYSTEMS TO BE COMMISSIONED

- A. The following electrical systems will be commissioned in this project.
 - 1. Main distribution board, MDB-VA
 - 2. Panel boards
 - 3. Transformers
 - 4. Variable frequency drives
 - 5. Motor starters
 - 6. Electronic circuit breakers
 - 7. Zone Selective interlocking System
 - 8. Fire Alarm System
 - 9. Lighting Controls

END OF SECTION

LIGHTING CONTROL DEVICES

260923 LIGHTING CONTROL DEVICES

PART 1 - GENERAL

1.01 DESCRIPTION

- A. Provide all materials, equipment and perform all operations for complete installation of lighting control devices and related Work as indicated on the Drawings and specified herein, including but not limited to the following:

1. Time switches.
2. Photoelectric relays.
3. Occupancy sensors.
4. Multi-pole lighting relays.

1.02 RELATED SECTIONS

- A. Section 260100- "Electrical General Requirements" applies to Work specified in this section.

1.03 REFERENCES

- A. All materials and Work shall conform to the latest industry standards, all applicable requirements included in the below references, specification requirements, and all applicable codes and requirements of the local authorities having jurisdiction, whichever are more stringent. In each of the publications referred to herein, consider the advisory provisions to be mandatory, as though the word "shall" had been substituted for "should" wherever it appears.

1. IEEE C62.41 - Recommended Practice for Surge Voltages in Low Voltage (1000 Volt and less) Power Systems.
2. NEMA ICS 1 - Industrial Control and Systems: General Requirements.
3. NEMA ICS 2 - Industrial Control and Systems: Controllers, Contactors, and Overload Relays Rated 600 Volts.
4. NEMA ICS 6 - Industrial Control and Systems: Enclosures.
5. NFPA 70 - National Electrical Code (NEC).
6. UL 508 - Industrial Control Equipment.
7. UL 508A - Industrial Control Panels.
8. UL 773A - Nonindustrial Photoelectric Switches for Lighting Control.
9. UL 917 - Standard for Safety for Clock-Operated Switches.
10. UL 1449, 2nd Edition - Transient Voltage Surge Suppressors.

260923-1

Lighting Control Devices

LIGHTING CONTROL DEVICES

11. 47 CFR - FCC Part 15.

1.04 SUBMITTALS

- A. Submit manufacturer's latest published literature for approval under the provisions of Section 260100 - "Electrical General Requirements".
- B. Product Data: Submit product data including dimensions and features, components, and ratings for lighting control devices. Refer to drawings.
- C. Field Test Certification: Submit certification that required field tests have been performed and that the installation complies with the field test requirements.
- D. Operations and Maintenance Data: Submit maintenance data, including a "trouble shooting" maintenance guide to be included in the Operating and Maintenance Instruction Manuals. Include requirements for setting and adjusting devices.
- E. Installation Instructions: Prior to shipping the equipment to the Project site, submit manufacturer's detailed installation instructions indicating application conditions and limitations of use. Include instructions for handling, protection, preparation and step-by-step installation procedures, including illustrations.

1.05 QUALITY ASSURANCE

- A. Manufacturer's Qualifications: Firms regularly engaged in manufacture of lighting control devices, of types, sizes, and ratings required, whose products have been in satisfactory use in similar service for not less than 10 years. When requested by the Design Professional, an acceptable list of installations with similar equipment shall be provided demonstrating compliance with this requirement.
- B. Comply with the requirements of IEEE, NEMA, and NFPA.
- C. UL Compliance: Provide products that are UL-listed and labeled for the installed environment and comply with the listed UL standards.
- D. Source Limitations: Obtain lighting control devices from a single source with total responsibility for compatibility of lighting control system components specified.
- E. Comply with 47 CFR 15, Subparts A and B, for Class A digital devices.
- F. Coordinate features of devices with systems and components specified in other Sections to form an integrated system of compatible components. Match components and interconnections for optimum performance of specified functions.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering electrical lighting control devices which may be incorporated in the Work include the following:

260923-2

Lighting Control Devices

PHOTO LAB - DARKROOM RENOVATION

PURCHASE COLLEGE SUNY | 735 ANDERSON HILL RD. | VISUAL ARTS BUILDING | LA PLLC Project 2306

LIGHTING CONTROL DEVICES

1. Contactors and Relays:
 - a. Lutron
 - b. Eaton
 - c. Douglas
2. Time Switches:
 - a. Lutron.
 - b. Eaton
 - c. Douglas
3. Photoelectric Relays:
 - a. Lutron
 - b. Eaton
 - c. Douglas
4. Occupancy Sensors:
 - a. Lutron
 - b. Eaton
 - c. Douglas
5. Control Switches:
 - a. Lutron
 - b. Eaton
 - c. Douglas

2.02 SURGE SUPPRESSION

- A. Provide line voltage surge protection on all 120 volt and 277 volt solid-state equipment. Comply with UL 1449 and with ANSI C62.41.

2.03 TIME SWITCHES

- A. Solid-state Programmable Type: Provide alphanumeric display, two 30 A, 277 VAC contacts, two 2A, 240 VAC pilot-duty contacts, eight-day program uniquely programmable for each weekday and holidays and skip-day mode. Unit shall comply with UL 917.

LIGHTING CONTROL DEVICES

- B. Electro-mechanical Type: Provide astronomic dial, two 30 A at 277 VAC contacts, two 2A, 240 VAC pilot-duty contacts and skip-day mode.

2.04 PHOTOELECTRIC RELAYS

- A. Provide solid state, single-pole, double-throw dry contacts rated to operate connected relay or contactor coils or microprocessor input as applicable, and complying with UL 773A.
- B. Light-level Monitoring Range: 0 to 3500 foot-candles with an adjustment for turn-on/turn-off levels and a time delay to prevent false operation.
- C. Indoor units shall be calibrated to detect adequacy of day-lighting in perimeter locations, and arranged to turn artificial illumination on and off to suit varying intensities of available day-lighting.
- D. Outdoor units shall be sealed with a weather-tight housing, resistant to high temperatures and equipped with sun-glare shield and components to prevent ice accumulation.

2.05 OCCUPANCY SENSORS

- A. Passive-Infrared Type: Unit shall detect occupancy by a combination of heat and movement in zone of coverage. Each sensor shall detect occupancy anywhere in an area of 1000 sq. ft. by detecting occurrence of 6 inch minimum movement of any portion of a human body that presents a minimum target of 36 square inches to the sensor. Sensor shall turn lights "on" when covered area is occupied and "off" when unoccupied. Units shall have an adjustable time delay for turning lights "off". Set delay for 10 minutes.
- B. Ultrasonic Type: Unit shall emit a beam of ultrasonic energy and detect occupancy through use of Doppler's principle in discerning movement in zone of coverage by sensing a change in pattern of reflected ultrasonic energy. Sensor shall turn lights "on" when covered area is occupied and "off" when unoccupied. Units shall have an adjustable time delay for turning lights "off". Set delay for 10 minutes.
- C. Dual-Technology Type: Unit shall use a combination of passive-infrared and ultrasonic detection methods to distinguish between occupied and unoccupied conditions for area covered. Particular technology or combination of technologies that controls each function (on or off) shall be field selectable by operating controls on unit. Sensor shall turn lights "on" when covered area is occupied and "off" when unoccupied. Units shall have an adjustable time delay for turning lights "off". Set delay for 10 minutes.
- D. Ceiling mounted units shall receive control power from a separately mounted auxiliary power and control unit which operate power switching contacts. Sensor shall turn lights "on" when covered area is occupied and "off" when unoccupied. Units shall have an adjustable time delay for turning lights "off". Set delay for 10 minutes.
- E. Switch box mounted units shall receive power directly from switch leg of the 120 VAC or 277 VAC circuit it controls which shall operate integral power switching contacts

LIGHTING CONTROL DEVICES

rated for the load supplied but not less than 800 watts at 120 VAC, and 1000 watts at 277 VAC. Provide manual override switch to allow lights to be turned off regardless of elapsed time delay. Sensor shall turn lights "on" when covered area is occupied and "off" when unoccupied. Units shall have an adjustable time delay for turning lights "off". Set delay for 10 minutes.

- F. Auxiliary Power and Control Units shall have relays rated for a minimum of 20 amperes normal ballast load and 13 amperes for tungsten filament or high-inrush ballast load. The unit shall be rated to supply the number of connected sensors.
- G. Refer to drawings for devices and cat. numbers.

2.06 MULTIPOLE CONTACTORS AND RELAYS

- A. Provide electrically operated and mechanically held units complying with UL 508 and NEMA ICS 2. Unit shall be mounted in a NEMA 1 enclosure.
- B. Current Rating for Switching: UL listing or rating consistent with type of load served, including tungsten filament, inductive, and high-inrush ballast (less than 15 percent THD), but not less than 30 amps for ballast lighting and 20 amps for tungsten lighting. Control coil voltage shall match power source.
- C. Provide number of poles as required to control the quantity of circuits indicated on the Drawings with 50 percent spare capacity, but not less than one spare contact. Use additional contactors where necessary to meet pole requirements.
- D. The unit shall have a minimum short circuit rating that matches the branch circuit breaker feeding the load.
- E. Provide solid state control accessories on the contactor for two wire control or three wire control as required for the switching indicated. The control accessory shall be UL listed and be suitable for an operating voltage range or +/- 20 percent of the nominal voltage. For three wire configurations provide three-way momentary contact toggle type control station with center neutral position. For two wire configurations, use on-off toggle switch.
- F. Refer to drawings for devices and cat. numbers.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Install equipment level and plumb and according to manufacturer's written instructions.
- B. Install wiring between sensing and control devices according to manufacturer's written instructions and as shown on the details.
- C. Install all wiring in raceway as elsewhere specified but the minimum conduit size shall be ½ inch. Where specifically noted, wiring may be run above accessible ceilings if

LIGHTING CONTROL DEVICES

properly secured and plenum rated. Ground all equipment and 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.

- D. Install low voltage wiring in ½ inch flexible metal conduit.
- E. Ceiling mounted sensors shall be located at least 4 feet from air diffusers.

3.02 CONNECTIONS

- A. Ground and bond all lighting control devices.
- B. Tighten connector and terminal bolts according to the manufacturer's published torque-tightening values. Where manufacturer's torque values are not indicated, use those specified in UL 486A.

3.03 FIELD QUALITY CONTROL

- A. Schedule visual and mechanical inspections and electrical tests with Owner at least seven days' advance notice.
- B. Engage the services of the sensor manufacturer to coordinate the sensitivity, calibration and adjustment of all sensors immediately prior to demonstration.
- C. Inspect control components for defects and physical damage, testing laboratory labeling, and nameplate compliance with the Contract Documents.
- D. Verify settings of photoelectric devices with photometer calibrated within previous six months.
- E. Electrical Tests: Perform the following according to manufacturer's written instructions:
 - 1. Perform continuity tests of circuits.
 - 2. Set, operate and test devices to demonstrate their functions and capabilities in a methodical sequence that simulates actual operating functions. Record control settings, operations, cues, and functional observations.
 - 3. Correct deficiencies, make necessary adjustments, and retest. Verify that specified requirements are met.
 - 4. After satisfactory completion of tests and inspections, apply a label to tested components indicating test results, date, and responsible agency and representative.
 - 5. Prepare written reports of tests and observations. Record defective materials and workmanship and unsatisfactory test results. Record repairs and adjustments.

3.04 CLEANING

LIGHTING CONTROL DEVICES

- A. Cleaning: Clean equipment and devices internally and externally using methods and materials recommended by manufacturers, and repair damaged finishes.

END OF SECTION

CABINETS AND ENCLOSURES

262716 CABINETS AND ENCLOSURES

PART 1 - GENERAL

1.01 DESCRIPTION

- A. Provide all materials, equipment and perform all operations for complete installation of cabinets and enclosures and related Work as indicated on the Drawings and specified herein, including but not limited to the following:
1. Cabinets.
 2. Enclosures.
 3. Hinged door enclosures.

1.02 RELATED SECTIONS

- A. Section 260100- "Electrical General Requirements" applies to Work specified in this section.

1.03 REFERENCES

- A. All materials and Work shall conform to the latest industry standards, all applicable requirements included in the below references, specification requirements, and all applicable codes and requirements of the local authorities having jurisdiction, whichever are more stringent. In each of the publications referred to herein, consider the advisory provisions to be mandatory, as though the word "shall" had been substituted for "should" wherever it appears.
1. NEMA ICS 1 - Industrial Control and Systems: General Requirements.
 2. NEMA ICS 6 - Industrial Control and Systems: Enclosures.
 3. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum).
 4. NFPA 70 - National Electrical Code (NEC).
 5. UL 50 - Standard for Safety for Enclosures for Electrical Equipment.
 6. UL 886 - Standard for Safety for Outlet Boxes and Fittings for Use in Hazardous (Classified) Locations.

1.04 SUBMITTALS

- A. Submit manufacturer's latest published literature for approval under the provisions of Section 260100 - "Electrical General Requirements".
- B. Product Data: Submit manufacturer's product data and installation instructions on each type enclosure and component. Include all connectors, joints, cover plates and all other components provided within this scope. Submission shall include but not be limited to:

CABINETS AND ENCLOSURES

1. Cabinets and enclosures.
 2. Hinged door enclosures.
 3. Enclosures for hazardous locations.
- C. Shop Drawings: Submit shop drawings for enclosures and cabinets that are to be shop fabricated, (non-stock items). For shop fabricated junction and pull boxes, show accurately scaled views and spatial relationships to adjacent equipment. Show box types, dimensions, and finishes.
- D. Installation Instructions: Prior to shipping the equipment to the Project site, submit manufacturer's detailed installation instructions indicating application conditions and limitations of use. Include instructions for handling, protection, preparation and step-by-step installation procedures, including illustrations.

1.05 QUALITY ASSURANCE

- A. Manufacturer's Qualifications: Firms regularly engaged in manufacture of boxes, enclosures and cabinets of sizes, types and ratings required, whose products have been in satisfactory use in similar service for not less than 5 years. When requested by the Design Professional, an acceptable list of installations with similar equipment shall be provided demonstrating compliance with this requirement.
- B. Comply with the requirements of NEMA, and NFPA.
- C. UL Compliance: Provide products that are UL listed and labeled for the installed environment and comply with the listed UL standards.

1.06 DEFINITIONS

- A. Cabinet: An enclosure designed either for surface or for flush mounting and having a frame, or trim in which a door or doors may be mounted.
- B. Enclosure: A box, case, cabinet, or housing for electrical wiring or components.
- C. Hinged Door Enclosure: An enclosure designed either for surface or flush mounting and having swinging doors or covers secured directly to and telescoping with the walls of the box.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Subject to compliance with requirements, manufacturers offering products that may be incorporated in the Work include, but are not limited to, the following:
1. Fittings:
 - a. Appleton.
 - b. Steel City.

262716-2

Cabinets and Enclosures

CABINETS AND ENCLOSURES

- c. Thomas & Betts.
- 2. Cabinets and Enclosures::
 - a. Erickson Electrical Equipment Co.
 - b. Hoffman Engineering Co.
 - c. Spring City Electrical Mfg. Co.

2.02 CABINETS AND ENCLOSURES, GENERAL

- A. Provide electrical cabinets and enclosures of indicated types, sizes, and NEMA enclosure classes. Where not indicated, provide units of types, sizes, and classes appropriate for the use and location. Provide all items complete with covers and accessories required for the intended use. Provide gaskets for units in damp or wet locations.

2.03 MATERIALS AND FINISHES

- A. Fasteners for General Use: Corrosion-resistant screws and hardware including cadmium and zinc plated items.
- B. Fasteners for Damp or Wet Locations: Stainless steel screws and hardware.
- C. Exterior Finish: Gray baked enamel for items exposed in finished locations except as otherwise indicated.
- D. Painted Interior Finish: Where indicated, white baked enamel.
- E. Fittings for Boxes, Cabinets, and Enclosures: Conform to UL 514B. Malleable iron or zinc plated steel for conduit hubs, bushings and box connectors.

2.04 CABINETS

- A. Comply with UL 50 and ISC 6.
- B. Construction: Galvanized sheet steel. Cabinet shall consist of a box and a front consisting of a one-piece frame and cover. For flush cabinets, make the front approximately 3/4 inch larger than the box all around. For surface mounted cabinets make front same height and width as box.

2.05 STEEL ENCLOSURES WITH HINGED DOORS

- A. Comply with UL 50 and NEMA ICS 6.
- B. Construction: Sheet steel, 16 gauge, minimum, with continuous welded seams. NEMA class as indicated; arranged for surface mounting. Arrange door to close against a rabbet placed all around the inside edge of the frame, with a uniformly close fit between door and frame. Provide concealed fasteners, not over 24-inches apart, to hold fronts to cabinet boxes and provide for adjustment. Provide flush or concealed door hinges not over 24 inches apart and not over 6 inches from top and bottom of door.

CABINETS AND ENCLOSURES

- C. Doors: Hinged directly to cabinet and removable, with approximately 3/4 inch flange around all edges, shaped to cover edge of box. Provide handle operated, key locking latch. Individual door width shall be no greater than 24 inches. Provide multiple doors where required.
- D. Mounting Panel: Provide painted removable internal mounting panel for component installation.
- E. Enclosure: NEMA 1 except as indicated. Where door gasketing is required, provide neoprene gasket attached with oil-resistant adhesive, and held in place with steel retaining strips. For all enclosures of class higher than NEMA 1, use hubbed raceway entrances.

2.06 CAST METAL ENCLOSURES WITH HINGED DOORS

- A. Copper free aluminum with bolted, gasketed, hinged doors. Where located in hazardous (classified) locations, enclosures shall conform to UL and shall be listed and labeled for the classification of hazard involved. Cast brass or cast iron enclosures are also acceptable.

PART 3 - EXECUTION

3.01 INSTALLATION, GENERAL

- A. Install boxes in accordance with NECA "Standard of Installation".
- B. Locations: Install items where indicated and where required to suit code requirements and installation conditions and as required for splices, taps, wire pulling and equipment connections.
- C. Cap unused knockout holes where blanks have been removed and plug unused conduit hubs.
- D. Support and fasten items securely in accordance with Division 26 Section "Supporting Devices." Support boxes independently to building structure and surfaces.
- E. Sizes shall be adequate to meet NEC requirements, but in no case smaller than sizes indicated.
- F. Remove sharp edges where they may come in contact with wiring or personnel.
- G. Enclosures are shown on the Drawings in approximate locations unless dimensioned. Adjust location as required to accommodate clearance requirements.
- H. Maintain maximum headroom and present a neat workmanlike appearance.

3.02 APPLICATIONS

- A. Cabinets, Indoors: Flush mounted, NEMA enclosure Type 1 except as otherwise indicated.
- B. Hinged Door Enclosures, Indoors: NEMA Type 1 enclosure except as indicated.

CABINETS AND ENCLOSURES

- C. Hinged Door Enclosures, Damp and Wet Locations: NEMA Type 3R, with drip hood, factory tailored to individual units.
- D. Hinged Door Enclosures, Corrosive Locations: NEMA Type 4X metal enclosure.

3.03 INSTALLATION OF CABINETS AND HINGED DOOR ENCLOSURES

- A. Mount with fronts straight and plumb.
- B. Install with tops 72 inches above floor.
- C. Set cabinets in finished spaces flush with walls.

3.04 CONNECTIONS

- A. Electrically ground enclosures to conduit. Where wiring to item includes a grounding conductor; also provide a grounding terminal in the interior of the cabinet, box or enclosure.
- B. Tighten connector and terminal bolts according to the manufacturer's published torque-tightening values. Where manufacturer's torque values are not indicated, use those specified in UL 486A.

3.05 ADJUSTING AND CLEANING

- A. Upon completion of installation, inspect components. Remove burrs, dirt, and construction debris and repair damaged finish including chips, scratches, abrasions and weld marks.
- B. Galvanized Finish: Repair damage using a zinc-rich paint recommended by the manufacturer.
- C. Painted Finish: Repair damage using matching corrosion-inhibiting touch-up coating.

END OF SECTION

WIRING DEVICES-UNDER 600 VOLTS

262726 WIRING DEVICES – UNDER 600 VOLTS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.
- B. Requirements of the following Division 26 Sections apply to this section:
- C. Contractor shall refer to Section 011200 - "Summary", Section 015000 - "Temporary Facilities and Controls" and the Contract Drawings inclusive, for the sequencing required to accomplish the work.

1.02 SUMMARY

- A. This Section includes the following: (Commercial grade receptacles only).
 - 1. Receptacles.
 - 2. Ground Fault Circuit Interrupter Receptacles.
 - 4. Snap Switches.
 - 5. Wall Plates.
- B. Related Sections: The following sections contain requirements that relate to this section:
 - 1. Division 26 Section 262816 - "Circuit Disconnects – Below 600 Volts" for devices other than snap switches and plug/receptacle sets used as disconnects for motors.
 - 2. Division 26 Section 260553 - "Electrical Identification" for requirements for legends to be engraved on wall plates.
- C. All receptacles shall meet the Commercial grade standards. For emergency use red receptacles.

1.03 SUBMITTALS

- A. Product data for each type of product specified.
 - 1. Receptacles
 - 2. Switches
- B. Samples of those products indicated for sample submission in Design Professional comments on product data submittal. Include color and finish samples of device plates and other items per Architect's request.

262726-1

Wiring Devices-Under 600 Volts

WIRING DEVICES-UNDER 600 VOLTS

1.04 QUALITY ASSURANCE

- A. Regulatory Requirements: Comply with provisions of the following codes.
 - 1. NFPA 70 "National Electrical Code".
 - a. UL and NEMA Compliance: Provide wiring devices which are listed and labeled by UL and comply with applicable UL and NEMA standards.
- B. NETA Standard for acceptance testing Section – 7.14 Ground-Fault Protection Systems, Low-Voltage, 7.3.2 Cables, Low-Voltage, 600V Maximum.

1.05 SEQUENCE AND SCHEDULING

- A. Schedule installation of finish plates after the surface upon which they are installed has received final finish.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products which may be incorporated in the work include, but are not limited to, the following:
 - 1. Hubbell Inc.
 - 2. Arrow Hart
 - 3. Leviton

2.2 WIRING DEVICES

- A. General: Provide wiring devices, in types, characteristics, grades, colors, and electrical ratings for applications indicated which are UL listed and which comply with NEMA WD 1 and other applicable UL and NEMA standards. Provide color devices and wall plates except as specified. Verify color selections with Design Professional.
- B. Receptacles: As scheduled in Table 1 in Part 3 below. Comply with UL 498 and NEMA WD1
 - 1. All receptacles installed shall be grounding type, with grounding pin slot connected to device ground screw for ground wire connection to conduit system.

WIRING DEVICES-UNDER 600 VOLTS

- C. Receptacles, Heavy Duty: Provide pin and sleeve design receptacles conforming to UL 498. Comply with UL 1010 where installed in hazardous locations. Duplex convenience receptacles shall be parallel blade, totally enclosed in moulded composition base, third leg grounded to conduit system.
- D. Ground-Fault Interrupter (GFI) Receptacles: As indicated in Table 1 in Part 3 below. Provide unit designed for installation in a 2-3/4 inch deep outlet box without adapter, grounding type, Class A, Group 1, per UL Standard 943. Device shall be capable of detecting a current leak of 25 milliamperes. Provide feed thru terminals.
- E. Local Switches: Comply with UL 20 and NEMA WD1. Switches shall be toggle type, A.C. rated 20 amperes, 120/277 volts, quiet-type with silent operating mechanism, totally enclosed in a moulded composition base and side wired. Switches shall be single pole, three or four-way as indicated. Where lock type local switches are indicated, these shall be similar to above specification with key operator; provide, to Owner, one (1) key for each switch installed. See Table 2 in Part 3 below.
- F. Where receptacles are indicated on the drawings for connection of specific equipment, provide "Specification Grade" receptacles, of ampere and voltage characteristics, and required number of poles, indicated by data on the drawings. All receptacles shall be triple wipe, copper contacts. For each special receptacle installed, furnish a suitable cord-grip-type attachment cap. These attachment caps shall be connected, under this Section, to the cords when so directed by the Design Professional. It is the intention of this specification to provide connections for, leave systems completely connected and in operating condition.

Therefore, ascertain the particular means of attachment for all portable or permanently mounted electrical devices or equipment, as outlined above, and provide a solid or receptacle connection as determined by the equipment supplied, provide and attach suitable plugs, as specified above and leave equipment ready for operation.
- G. Weatherproof Receptacles: Provide corrosion-resistant receptacle in a cast metal box with a gasketed, weatherproof, cast-metal cover plate and a gasketed cap over each receptacle opening. The cap(s) shall be provided with a spring-hinged flap. Receptacle shall be UL approved for use in "wet location". All weatherproof receptacles shall be protected by a GFC broken whether or not indicated on drawings.

2.03 WIRING DEVICE ACCESSORIES

WIRING DEVICES-UNDER 600 VOLTS

- A. Wall Plates: Single and combination, of types, sizes, and with ganging and cutouts as indicated. Provide plates which mate and match with wiring devices to which attached. Provide metal screws for securing plates to devices with screw heads to match finish of plates. Provide wall plate to match wiring devices except as otherwise indicated. Provide wall plates with engraved legend where indicated. Conform to requirements of Section "Electrical Identification." Provide plates possessing the following additional construction features:
 - 1. Material and Finish: Steel plate, galvanized.

PART 3 - EXECUTION

3.01 INSTALLATION OF WIRING DEVICES AND ACCESSORIES

- A. Install wiring devices and accessories as indicated, in accordance with manufacturer's written instructions, applicable requirements of NEC and in accordance with recognized industry practices to fulfill project requirements.
- B. Coordinate with other Work, including painting, electrical boxes and wiring installations, as necessary to interface installation of wiring devices with other Work.
- C. Install wiring devices only in electrical boxes which are clean; free from building materials, dirt, and debris.
- D. Install galvanized steel wallplates in unfinished spaces.
- E. Install wiring devices after wiring work is completed.
- F. Tighten connectors and terminals, including screws and bolts, in accordance with equipment manufacturer's published torque tightening values for wiring devices. Where manufacturer's torquing requirements are not indicated, tighten connectors and terminals to comply with tightening torques specified in UL Standard 486A. Use properly scaled torque indicating hand tool.

3.02 PROTECTION

- A. Protect installed components from damage. Replace damaged items prior to final acceptance.

3.03 FIELD QUALITY CONTROL

- A. Testing: Prior to energizing circuits, test wiring for electrical continuity, and for

262726-4

Wiring Devices-Under 600 Volts

WIRING DEVICES-UNDER 600 VOLTS

short-circuits. Ensure proper polarity of connections is maintained. Subsequent to energizing, test wiring devices and demonstrate compliance with requirements, operating each operable device at least six times.

- B. Test ground fault interrupter operation with both local and remote fault simulations in accordance with manufacturer recommendations.

3.04 TABLE 1

RECEPTACLES

DESIGN- NATION (1)	CURRENT RATING AMPS	VOLTAGE RATING	SINGLE/ DUPLEX NOTES	CONFIG- URATION	<u>HOSPITAL</u> <u>UL</u> <u>GRADE</u> <u>ILLUMINATED</u>
-	20	125	DUPLEX	5-20R	HEAVY DUTY
WP	20	125	DUPLEX	5-20R	HEAVY DUTY WEATHERPRO OF
WP GFI	20	125	DUPLEX	5-20R	HEAVY DUTY INTEGRAL GFI (2)

NOTES

- (1) Letter designations are used where symbols alone do not clearly designate on plans locations where specific receptacle types are used.
- (2) Protects downstream receptacles on same circuit.

3.05 TABLE 2

LOCAL SWITCHES

DESIGN- NATION (1)	APPLICATION	TYPICAL RATING	VOLTAGE RATING (AC)	POLES UL NOTES	GRADE
S	CONTROL	20A	120/277	1	HEAVY DUTY

WIRING DEVICES-UNDER 600 VOLTS

-	LIGHTS					
S ³	CONTROL	20A	120/277	3-way	HEAVY	DUTY
	LIGHTS			-		

NOTES

- (1) For Local switches, designation is the same as the symbol used on plans for the device. Type of switch is determined from plan context including type of device or circuit being controlled.

END OF SECTION

FUSES

262813 FUSES

PART 1 - GENERAL

1.01 DESCRIPTION

- A. Provide all materials, equipment and perform all operations for complete installation of fuses and related Work as indicated on the Drawings and specified herein, including but not limited to the following:
 - 1. Cartridge fuses.
 - 2. Spare fuse cabinet.

1.02 RELATED SECTIONS

- A. Section 260100- "Electrical General Requirements" applies to Work specified in this Section.

1.03 REFERENCES

- A. All materials and Work shall conform to the latest industry standards, all applicable requirements included in the below references, specification requirements, and all applicable codes and requirements of the local authorities having jurisdiction, whichever are more stringent. In each of the publications referred to herein, consider the advisory provisions to be mandatory, as though the word "shall" had been substituted for "should" wherever it appears.
 - 1. IEEE 242 -Recommended Practice for Protection and Coordination of Industrial and Commercial Power Systems (Buff Book).
 - 2. NEMA Standard FU1 - Low Voltage Cartridge Fuses.
 - 3. NFPA 70 - National Electrical Code (NEC).
 - 4. UL 198C - Standard for Safety for High-Interrupting-Capacity Fuses, Current-Limiting Type (*for Class L fuses*).
 - 5. UL 198E - Standard for Safety for Class R Fuses.

1.04 SUBMITTALS

- A. Submit manufacturer's latest published literature for approval under the provisions of Section 260100 - "Electrical General Requirements".
- B. Product Data: Submission shall include descriptive data and time-current curves for all fuses and let-through current curves for those with current limiting characteristics.
- C. Shop Drawings: Submit spare fuse cabinet showing dimensions and features including storage provision for fuse cartons.

FUSES

- D. Coordination Study: Where fuses of a manufacturer other than those specified are utilized, subject to prior approval, submit a full coordination study showing graphically that the substitute fuses coordinate selectively with both upstream and downstream components. Prepare the study under the supervision of a registered Professional Engineer in accordance with ANSI/IEEE 242. Include single line diagram, coordinated time/current characteristics, fuse performance curves, and fault current calculations adequate to demonstrate satisfactory component protection and selective coordination of protective devices.

1.05 QUALITY ASSURANCE

- A. Manufacturer's Qualifications: Firms regularly engaged in manufacture of fuses, of types, sizes, and ratings required, whose products have been in satisfactory use in similar service for not less than 10 years. When requested by the Design Professional, an acceptable list of installations with similar equipment shall be provided demonstrating compliance with this requirement.
- B. Installer's Qualifications: A firm with at least 5 successful installation experiences on projects utilizing fuses similar to those required for this Project. When requested by the Design Professional, an acceptable list of installations with similar equipment shall be provided demonstrating compliance with this requirement.
- C. Comply with the requirements of IEEE, NEMA, and NFPA.
- D. UL Compliance: Provide products that are UL-listed and labeled for the installed environment and comply with the listed UL standards.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Deliver spare fuses stored in locked spare fuse cabinet after cabinet has been installed.

1.07 SPARE MATERIALS

- A. Provide spare fuses for each type and rating utilized on the Project, amounting to one unit for every five (5) installed units, but not less than one set of three (3) of each kind.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Subject to compliance with requirements, manufacturers offering products that may be incorporated in the Work include, but are not limited to, the following:
 - 1. Bussmann Div., Cooper Industries, Inc.
 - 2. Shawmut Inc.

262813-2

Fuses

FUSES

3. Gould, Inc.

2.02 FUSES

- A. General: Provide fuses of types, classes, and current ratings as indicated. Voltage ratings shall be consistent with the circuits on which used.
- B. All fuses shall be of the same manufacturer. Fuses shall not be installed until equipment is to be energized. All fuses shall have a 200,000 ampere RMS symmetrical interrupting rating unless specified otherwise.
- C. Where branch disconnects to motors are fused, 1.15 service factor motors fuses shall be sized not to exceed 125 percent of motor full load amperes for fuses up to 600 ampere. Fuses above 600 ampere rating for all motors shall be sized up to 150 percent of motor full load amperes. Abnormal motor starting conditions requiring oversizing shall be referred to the Design Professional.
- D. All branch disconnects to packaged mechanical equipment shall be fused when the unit manufacturer's maximum overcurrent protection device listing indicates "Fuse Only". Fuses for these items shall be sized not to exceed the manufacturer's recommendation.
- E. Fuses for motor circuits 0-600 amperes shall be UL Class RK5, dual-element, time delay.
- F. Fuses protecting all other circuit loads 0-600 amperes shall be UL Class RK1, dual-element, time delay.
- G. Fuses for loads above 600 amperes shall be UL, Class L, time delay.
- H. Comply with ANSI/IEEE Standard FU1. Provide nonrenewable-cartridge-type fuses except as indicated.
 - 1. Class L Fuses: Comply with UL 198.
 - 2. Class RK1 and RK5, Dual Element, Time Delay Fuses: Comply with UL 198E.

2.03 SPARE FUSE CABINET

- A. Cabinet: Wall-mounted, 18 gauge minimum steel unit with full-length, recessed piano-hinged door with key coded cam lock and pull. Finish shall be gray baked enamel.
- B. Size: Provide for orderly storage of all spare fuses of this Project plus 10 percent spare capacity, minimum.
- C. Cabinet Door: Bear the legend in stenciled 1-1/2 inch high letters, "Spare Fuses."

FUSES

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Install fuses in all fusible devices.
- B. Upon completion of the job, furnish a complete set of spare fuses for each type fuse utilized on the Project. Spare fuses shall be placed in the spare fuse cabinets located as directed by the Owner.
- C. Coordination Study: Where coordination study recommends changes in types, classes, features, or ratings of fuses or fusible devices from those indicated, and those changes are approved, make them with no change to the Contract price or time of completion.

END OF SECTION

CIRCUIT DISCONNECTS

262816 CIRCUIT DISCONNECTS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.
- B. Requirements of the following Division 26 Sections apply to this section:
 - 1. Section 260500 - Basic Electrical Materials and Methods
 - 2. Section 260553 - Electrical Identification.
- C. Contractor shall refer to Section 011200 - "Summary", Section 015000 - "Temporary Facilities and Controls" and the Contract Drawings inclusive, for the sequencing required to accomplish the work.

1.02 SUMMARY

- A. This Section includes circuit disconnects and related wiring.
- B. Related Sections: The following sections contain requirements that relate to this section:
 - 1. Section 260553 - "Electrical Identification".
 - 2. Section 260500 - "Basic Electrical Materials and Methods".

1.03 SUBMITTALS

- A. Product data for each type of product specified.
- B. Maintenance data for circuit disconnects for inclusion in Operation and Maintenance Manual specified in Division 1 and Division 26 Section "Basic Electrical Requirements."

1.04 QUALITY ASSURANCE

- A. Electrical Component Standards: Provide components complying with, NFPA 70 "National Electrical Code" and which are listed and labeled by UL. Comply with UL Standard 98, UL-869, UL-894 and UL-977, and NEMA Standard KS 1.

1.05 SEQUENCING AND SCHEDULING

CIRCUIT DISCONNECTS

- A. Sequence and coordinate the work of this section of the Project Manual with the scheduling requirements set forth in the Contract Documents. Review the approved schedule with the Design Professional, sub-contractors, manufacturers, vendors, suppliers and all other Contractors. Schedule and sequence all work with the adjoining work, and work of others such that the all work can be accomplished concurrently during the same time period.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products which may be incorporated in the work include, but are not limited to, the following:
 - a. Eaton
 - b. Square D
 - c. General Electric by ABB
 - d. Siemens

2.02 CIRCUIT DISCONNECT SWITCHES

- A. General: Provide where shown, or as required, heavy-duty, metal enclosed, externally-operated fused, or unfused, safety switches, of such type and size as required to properly protect or disconnect the load for which they are intended. The operating mechanism shall be so designed that the switches may be locked in the "on" or "off" positions. Provide NEMA rated enclosures as called for by paragraph 2.04 of this specification section. Provide units with horsepower ratings suitable to the loads served.
- B. Fusible Switches: Heavy duty switches, with fuses of current ratings indicated. Each fused safety switch shall be left equipped with a complete set of class RK1 fuses.
- C. Non-fusible Disconnects: Heavy duty switches of classes and current ratings as indicated.
- D. Bolted Pressure Switches: Bolted pressure switches conforming to and lis

CIRCUIT DISCONNECTS

ted under UL Standard 977; single or double-throw arrangement as indicated. For fusible units provide fuses as indicated.

- E. Service Switches: Heavy duty fusible switches. UL listed for use as service equipment under UL Standard 98 or 869.

2.03 CIRCUIT DISCONNECT BREAKERS

- A. Circuit breakers shall be operated by a toggle-type handle and shall have a quick-make, quick-break over-center switching mechanism that is mechanically trip-free. Automatic tripping of the breaker shall be clearly indicated by the handle position. Contacts shall be non-welding silver alloy and arc extinction shall be accomplished by means of DE-ION arc chutes. A push-to-trip button on the front of the circuit breaker shall provide a local manual means to exercise the trip mechanism.
- B. Circuit breakers shall have a minimum symmetrical interrupting capacity, Voltage rating, current rating, and number of poles as indicated on the drawings.
- C. Breakers shall be Electronic trip molded case full function 100% rated circuit breakers.
 - 1. All electronic circuit breakers shall have the following time/current response adjustments: Long Time Pickup, Long Time Delay, (for 480V systems) Short Time Pickup, Short Time Delay, Ground Fault Pickup (for 480V systems), Ground Fault Delay and Instantaneous settings. Each adjustment shall have discrete settings (fully adjustable) and shall be independent of all other adjustments.
 - 2. Circuit breaker trip system shall be a microprocessor-based true rms sensing designed with sensing accuracy through the thirteenth (13th) harmonic. Sensor ampere ratings shall be as indicated on the associated schedule and/or drawing.
 - 3. Local visual trip indication for overload, short circuit and ground fault trip occurrences.
 - 4. Long Time Pickup indication to signal when loading approaches or exceeds the adjustable ampere rating of the circuit breaker shall be provided.
 - 5. Trip units shall be able to provide real time metering. Metering functions include current, voltage, power and frequency.
 - 6. Communications capabilities for remote monitoring of circuit breaker trip system, to include phase and ground fault currents, pre-trip alarm indication, switch settings, and trip history information shall be provided. . Trip units shall be pre-wired at the

CIRCUIT DISCONNECTS

factory for communications to the main Circuit Monitor and Power Monitoring System see Section 260913.

7. Circuit breaker shall be provided with Zone selective Interlocking (ZSI) communications capabilities on the short-time and ground fault functions compatible with all other electronic trip circuit breakers and external ground fault sensing systems as noted on schedules and/or drawings.

2.04 ENCLOSURES

1. Provide enclosures suitable for locations as indicated on the drawings and as described below:
 - a. NEMA 1 surface or flush-mounted general purpose enclosures intended for indoor use.
 - b. NEMA 12 dust-tight enclosures intended for indoor use to provide protection against circulating dust, falling dirt and dripping non-corrosive liquids
 - c. NEMA 3R rain-tight enclosures intended for outdoor use to provide protection against rain, sleet and damage from external ice formation
 - d. NEMA 4/4X watertight stainless steel intended for indoor or outdoor use to provide protection against windblown dust and rain, splashing rain, hose-directed water, damage from external ice formation, and corrosive agents
 - e. NEMA 7, Class I, Group C and D hazardous location cast aluminum intended for indoor use in locations classified as Class I, Group C and D as defined in the National Electrical Code
 - f. NEMA 9, Class II, Groups E, F and G hazardous location cast aluminum intended for indoor use in locations classified as Class II, Groups E, F and G as defined in the National Electrical Code

2.05 ACCESSORIES

- A. Electrical Interlocks: Provide number and arrangement of interlock contacts in switches as indicated.
- B. Captive Fuse Pullers: Provide built-in fuse pullers arranged to facilitate fuse removal.
- C. Provide handle mechanisms that are pad-lockable in the "OFF" position.
- D. Each incoming section shall be provided with GracePort#R-1A003W-NPLPH voltage indicator connected to load side of breaker/switch.

CIRCUIT DISCONNECTS

PART 3 - EXECUTION

3.01 INSTALLATION OF CIRCUIT AND MOTOR DISCONNECTS AND WIRING

- A. General: Provide circuit disconnect switches as indicated and where required by the above Code. Comply with switch manufacturers' printed installation instructions.
- B. Provide all required conduit, wiring and safety switches for all electrical equipment installed or connected under this Division.
- C. All of the aforementioned devices and equipment, where so indicated, shall be arranged in groups, as shown on the drawings. The equipment shall be neatly wired through rigid conduit or with wiring trough having hinged or screw-on covers. If screw-on covers are used, they shall be in sections which can be easily handled. Submit shop drawings of supports and equipment arrangement for approval, before fabrication and installation.

3.02 ADJUSTING AND CLEANING

- A. Protective devices and Settings: Adjust circuit breaker settings and/or install fuses in accordance with the parameters indicated in short circuit coordination study. Where discrepancies are found, recommend final relay settings for approval before making final adjustments.
- B. Level equipment with all vertical sections plumb and horizontal sections level at 0-degrees
- C. Adjust doors and handles for fluid operation.
- D. Where minor scratches and dents occurred during installation and or shipping contractor shall pull dents, clean and paint scratches with manufacturer provided touch-up paint.
- E. Coordinate door hardware and locks with facility and install equipment to match the facilities standard.
- F. ARC-FLASH WARNING LABELS
 - 1. Comply with requirements in Section 260553 "Identification for Electrical Systems." Produce a 3.5-by-5-inch thermal transfer

CIRCUIT DISCONNECTS

- label of high-adhesion polyester or engraved plaque for each work location included in the analysis.
2. The label shall have an orange header with the wording, "WARNING, ARC-FLASH HAZARD," and shall include the following information taken directly from the arc-flash hazard analysis:
 - a. Location designation.
 - b. Nominal voltage.
 - c. Flash protection boundary.
 - d. Hazard risk category.
 - e. Incident energy.
 - f. Working distance.
 - g. List of required PPE to be used during energized service.
 - h. Engineering report number, revision number, and issue date.
 3. Labels shall be machine printed or engraved, with no field-applied markings.
 4. Apply one arc-flash label on the front face of each disconnect.

3.03 MANUFACTURERS WARRANTY

- A. The equipment shall be warranted by the manufacturer for five years or 20,000 hours, whichever occurs first, from the date of the site start-up after the Owner has accepted the equipment. The warranty shall cover any repair or replacement of components that fail in materials or workmanship within the warranty period and shall include all expenses and travel time.

3.04 SERVICE REPRESENTATION

- A. Manufacturer shall have an established network of factory-direct service technicians capable of servicing the equipment.
- B. All field service personnel shall be factory employed and trained by the manufacturer and certified in the maintenance and repair of the specified equipment. Furthermore, the manufacturer must demonstrate that experienced factory personnel are available on a 24 hour/day, 7 days/week basis, for service from a location within 4 hours from the installation.
- C. Post-warranty service contracts shall be made available to the owner by the manufacturer to provide scheduled maintenance and/or emergency repair of the equipment.

CIRCUIT DISCONNECTS

- B. The manufacturer shall maintain records of each switch, by serial number, for a minimum of 20 years.

3.05 ACCEPTANCE TEST

- A. The contractor shall retain the services of an independent third party testing company to be approved by the engineer and NH and the contractors expense.
- B. Division of Responsibility
 - 1. Contractor – The Contractor shall retain the services of a certified testing organization with the following at no extra cost:
 - a. A short-circuit analysis, a coordination study, and a protective device setting sheet as described in Section 6.
 - b. A complete set of electrical plans and specifications, including all change orders.
 - c. Drawings and instruction manuals applicable to the scope of work.
 - d. An itemized description of equipment to be inspected and tested.
 - e. A determination of who shall provide a suitable and stable source of electrical power to each test site.
 - f. A determination of who shall perform certain preliminary low-voltage insulation-resistance, continuity, and low-voltage motor rotation tests prior to and in addition to tests specified herein
 - g. Notification of when equipment becomes available for acceptance tests. Work shall be coordinated to expedite project scheduling.
 - h. Site-specific hazard notification
 - 2. The Testing Organization – The testing organization shall provide the following:
 - a. All field technical services, tooling, equipment, instrumentation, and technical supervision to perform such tests and inspections.
 - b. Specific power requirements for test equipment.
 - c. Notification to the Owner's representative prior to commencement of any testing.
 - d. A timely notification of any system, material, or workmanship that is found deficient based on the results of the acceptance tests.
 - e. A written record of all tests and a final report.

- B. General

CIRCUIT DISCONNECTS

1. Safety and Precautions – All parties involved must be cognizant of industry-standard safety procedures. This document does not contain any procedures including specific safety procedures. It is recognized that an overwhelming majority of the tests and inspections recommended in these specifications are potentially hazardous. Individuals performing these tests shall be qualified and capable of conducting the tests in a safe manner and with complete knowledge of the hazards involved.
 - a. Safety practices shall include, but are not limited to, the following requirements:
 - 1) All applicable provisions of the Occupational Safety and Health Act, particularly OSHA 29 CFR Part 1910 and 29 CFR Part 1929.
 - 2) ANSI/NFPA 70E, Standard for Electrical Safety in the Workplace.
 - 3) Applicable state and local safety operating procedures.
 - 4) Owner's safety practices.
 - b. The testing organization shall have a designated safety lead person on site to supervise operations with respect to safety.
 - c. A job hazard analysis and a safety briefing shall be conducted prior to the commencement of work.
 - d. All tests shall be performed with the apparatus de-energized and grounded except where otherwise specifically required to be ungrounded or energized for certain tests.
 - e. The testing organization shall have a designated safety representative on the project to supervise operations with respect to safety. This individual may be the same person described above.
2. Suitability of Test Equipment
 - a. All test equipment shall meet the requirements and be in good mechanical and electrical condition.
 - b. Field test metering used to check power system meter calibration must be more accurate than the instrument being tested.
 - c. Accuracy of metering in test equipment shall be appropriate for the test being performed.
 - d. Waveshape and frequency of test equipment output waveforms shall be appropriate for the test to be performed and the equipment to be tested.
3. Test Instrument Calibration
 - a. The testing organization shall have a calibration program which assures that all applicable test instruments are

CIRCUIT DISCONNECTS

- maintained within rated accuracy for each test instrument calibrated.
 - b. The firm providing calibration service shall maintain up-to-date instrument calibration instructions and procedures for each test instrument calibrated.
 - c. The accuracy shall be directly traceable to the National Institute of Standards and Technology (NIST).
 - d. Instruments shall be calibrated in accordance with the following frequency scheduled:
 - 1) Field instruments: Analog and Digital, 12 months maximum.
 - 2) Laboratory instruments: 12 months maximum.
 - 3) Leased specialty equipment: 12 months maximum.
 - e. Dated calibration labels shall be visible on all test equipment.
 - f. Records which show date and results of instruments calibrated or tested must be kept up to date.
 - g. Calibrating standard shall be of better accuracy than that of the instrument tested.
 - 4. Test Report
 - a. The test report shall include the following:
 - 1) Summary of project.
 - 2) Description of equipment tested.
 - 3) Description of tests.
 - 4) Test data.
 - 5) Analysis and recommendations.
 - b. Test data records shall include the following minimum requirements:
 - 1) Identification of the testing organization.
 - 2) Equipment identification.
 - 3) Humidity, temperature, and other conditions that may affect the results of the test and/or calibrations.
 - 4) Date of inspections, tests, maintenance, and/or calibrations.
 - 5) Identification of the testing technician.
 - 6) Indication of inspections, tests, maintenance, and/or calibrations to be performed and recorded.
 - 7) Indication of expected results when calibrations are to be performed.
 - 8) Indication of as-found and as-left, as applicable.
 - 9) Identification of all test results outside of specified tolerances.
 - 10) Sufficient spaces to allow all results and comments

CIRCUIT DISCONNECTS

- to be indicated.
 - c. The testing organizations shall furnish a copy or copies of the complete report as specified in the acceptance testing contract.
- 5. Test Decal
 - a. The testing organization shall affix a test decal on the exterior of equipment or equipment enclosure of protective devices after performing electrical tests.
 - b. The test decal shall be color-coded to communicate the condition of maintenance for the protective device. Color scheme for condition of maintenance or overcurrent protective device shall be:
 - 1) White: electrically and mechanically acceptable.
 - 2) Yellow: minor deficiency not affecting fault detection and operation, but minor electrical or mechanical condition exists.
 - 3) Red: deficiency exists affecting performance, not suitable for service.
 - c. The decal shall include:
 - 1) Testing organization
 - 2) Project number
 - 3) Test date
 - 4) Technician name
- C. Required Acceptance Test
 - 1. Retain the services of a certified testing company as per NETA Standards for acceptance testing Sections at no cost to the owner:
 - a. Switches, Air-Low voltage NETA ATS Section 7.5.1.1
 - b. Thermographic Survey NETA ATS Section 9

END OF SECTION

INTERIOR LIGHTING

SECTION 265100 - 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. This Section includes the following:
 - 1. Interior lighting fixtures, lamps, and ballasts.
 - 2. Exit signs.
 - 3. Lighting fixture supports.
- B. Related Sections include the following:
 - 1. Division 26 Section "Lighting Control Devices" for automatic control of lighting, including time switches, photoelectric relays, occupancy sensors, and multiple lighting relays and contactors.

1.3 DEFINITIONS

- A. BF: Ballast factor.
- B. CRI: Color-rendering index.
- C. CU: Coefficient of utilization.
- D. HID: High-intensity discharge.
- E. LER: Luminaire efficacy rating.
- F. Luminaire: Complete lighting fixture, including ballast, housing if provided.
- G. RCR: Room cavity ratio.
- H. THD: Total Harmonic Distortion

265100-1

Interior Lighting

INTERIOR LIGHTING

1.4 SUBMITTALS

- A. Product Data: For each type of lighting fixture, arranged in order of fixture designation. Include data on features, accessories, finishes, and the following:
1. Physical description of lighting fixture including dimensions.
 2. Emergency lighting units including battery and charger.
 3. Ballast.
 4. Energy-efficiency data.
 5. Manufacturer, life, output, and energy-efficiency data for lamps.
 6. Photometric data, in IES format, based on laboratory tests of each lighting fixture type, outfitted with lamps, ballasts, and accessories identical to those indicated for the lighting fixture as applied in this Project.
 - a. For indicated fixtures, photometric data shall be certified by a qualified independent testing agency. Photometric data for remaining fixtures shall be certified by the manufacturer.
 - b. Photometric data shall be certified by a manufacturer's laboratory with a current accreditation under the National Voluntary Laboratory Accreditation Program (NVLAP) for Energy Efficient Lighting Products.
- B. Shop Drawings: Show details of nonstandard or custom lighting fixtures. Indicate dimensions, weights, methods of field assembly, components, features, and accessories.
1. Wiring Diagrams: Power and control wiring.
- C. Coordination Drawings: Reflected ceiling plan(s) and other details, drawn to scale, on which the following items are shown and coordinated with each other, based on input from installers of the items involved:
1. Lighting fixtures.
 2. Suspended ceiling components.
 3. Structural members to which suspension systems for lighting fixtures will be attached.
 4. Other items in finished ceiling including the following:
 - a. Air outlets and inlets.
 - b. Speakers.
 - c. Sprinklers.
 - d. Smoke and fire detectors.
 - e. Occupancy sensors.
 - f. Access panels.
 - g. Security cameras.
 5. Perimeter moldings.
- D. Samples for Verification: Interior lighting fixtures designated for sample submission in Interior Lighting Fixture Schedule. Each sample shall include the following:

265100-2

Interior Lighting

INTERIOR LIGHTING

1. Lamps: Specified units installed.
2. Accessories: Cords and plugs, 120 volts.

- E. Product Certificates: For each type of ballast for bi-level and dimmer-controlled fixtures, signed by product manufacturer.
- F. Qualification Data: For agencies providing photometric data for lighting fixtures.
- G. Field quality-control test reports.
- H. Operation and Maintenance Data: For lighting equipment and fixtures to include in emergency, operation, and maintenance manuals.
- I. Warranties: Special warranties specified in this Section.

1.5 QUALITY ASSURANCE

- A. Luminaire Photometric Data Testing Laboratory Qualifications: Provided by manufacturers' laboratories that are accredited under the National Volunteer Laboratory Accreditation Program for Energy Efficient Lighting Products.
- B. Luminaire Photometric Data Testing Laboratory Qualifications: Provided by an independent agency, with the experience and capability to conduct the testing indicated, that is an NRTL as defined by OSHA in 29 CFR 1910.7. Provide IES formatted photometric data for any substitutions.
- C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- D. Comply with NFPA 70.
- E. FMG Compliance: Lighting fixtures for hazardous locations shall be listed and labeled for indicated class and division of hazard by FMG.
- F. Mockups: Provide interior lighting fixtures for room or module mockups, complete with power and control connections, as indicated by Architect, Section 088413.
 1. Obtain Architect's approval of fixtures for mockups before starting installations.
 2. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.
 3. Approved fixtures in mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.6 COORDINATION

- A. Coordinate layout and installation of lighting fixtures and suspension system with other construction that

265100-3

Interior Lighting

PHOTO LAB – DARKROOM RENOVATION

PURCHASE COLLEGE SUNY | 735 ANDERSON HILL RD. | VISUAL ARTS BUILDING | LA PLLC Project 2306

INTERIOR LIGHTING

penetrates ceilings or is supported by them, including HVAC equipment, fire-suppression system, and partition assemblies.

1.7 WARRANTY

- A. Special Warranty for Emergency Lighting Batteries: Manufacturer's standard form in which manufacturer of battery-powered emergency lighting unit agrees to repair or replace components of rechargeable batteries that fail in materials or workmanship within specified warranty period.

INTERIOR LIGHTING

1. Warranty Period for Emergency Lighting Unit Batteries: 15 years from date of Substantial Completion. Full warranty shall apply for first year, and prorated warranty for the remaining fourteen years.
 2. Warranty Period for Emergency Fluorescent Ballast and Self-Powered Exit Sign Batteries: Seven years from date of Substantial Completion. Full warranty shall apply for first year, and prorated warranty for the remaining six years.
- B. Special Warranty for Ballasts: Manufacturer's standard form in which ballast manufacturer agrees to repair or replace ballasts that fail in materials or workmanship within specified warranty period.
1. Warranty Period for Electronic Ballasts: Five years from date of Substantial Completion.
 2. Warranty Period for Electromagnetic Ballasts: Three years from date of Substantial Completion.
- C. Special Warranty for T5 and T8 Fluorescent Lamps: Manufacturer's standard form, made out to Owner and signed by lamp manufacturer agreeing to replace lamps that fail in materials or workmanship, f.o.b. the nearest shipping point to Project site, within specified warranty period indicated below.
1. Warranty Period: One year(s) from date of Substantial Completion.

1.8 EXTRA MATERIALS

- A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
1. Lamps: One for every 40 of each type and rating installed. Furnish at least one of each type.
 2. Plastic Diffusers and Lenses: One for every 30 of each type and rating installed. Furnish at least one of each type.
 3. Battery and Charger Data: One for each emergency lighting unit.
 4. Ballasts: One for every 30 of each type and rating installed. Furnish at least one of each type.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Refer to Lighting Product Descriptions at the end of this Section
- B. In Interior Lighting Fixture Schedule where titles below are column or row headings that introduce lists, the following requirements apply to product selection:
1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, manufacturers specified.
 2. Manufacturers: Subject to compliance with requirements, provide products by one of the

265100-5

Interior Lighting

INTERIOR LIGHTING

- manufacturers specified.
3. Basis-of-Design Product: The design for each lighting fixture is based on the product named. Subject to compliance with requirements, provide either the named product or a comparable product by one of the other manufacturers specified.

INTERIOR LIGHTING

2.2 LIGHTING FIXTURES AND COMPONENTS, GENERAL REQUIREMENTS

- A. Recessed Fixtures: Comply with NEMA LE 4 for ceiling compatibility for recessed fixtures.
- B. Metal Parts: Free of burrs and sharp corners and edges.
- C. Sheet Metal Components: Steel, unless otherwise indicated. Form and support to prevent warping and sagging.
- D. Doors, Frames, and Other Internal Access: Smooth operating, free of light leakage under operating conditions, and designed to permit relamping without use of tools. Designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally during relamping and when secured in operating position.
- E. Reflecting surfaces shall have minimum reflectance as follows, unless otherwise indicated:
 - 1. White Surfaces: 85 percent.
 - 2. Specular Surfaces: 83 percent.
 - 3. Diffusing Specular Surfaces: 75 percent.
 - 4. Laminated Silver Metallized Film: 90 percent.
- F. Plastic Diffusers, Covers, and Globes:
 - 1. Acrylic Lighting Diffusers: 100 percent virgin acrylic plastic. High resistance to yellowing and other changes due to aging, exposure to heat, and UV radiation.
 - a. Lens Thickness: At least 0.125 minimum unless different thickness is indicated.
 - b. UV stabilized.
 - 2. Glass: Annealed crystal glass, unless otherwise indicated.
- G. Electromagnetic-Interference Filters: Factory installed to suppress conducted electromagnetic-interference as required by MIL-STD-461 E. Fabricate lighting fixtures with one filter on each ballast indicated to require a filter.
 - 1. Transient Voltage Protection: IEEE C62.41, Category A or better.
 - 2. Lamp Current Crest Factor: 1.5 or less.
 - 3. Power Factor: .90 or higher.
 - 4. Interference: Comply with 47 CFR, Chapter 1, Part 18, Subpart C, for limitations on electromagnetic and radio-frequency interference for non-consumer equipment.
 - 5. Protection: Class P thermal cutout.
 - 6. Retain subparagraph and associated subparagraphs below for bi-level ballasts.

2.3 EXIT SIGNS

265100-7

Interior Lighting

INTERIOR LIGHTING

- A. Fixture Type Exit Sign:
1. Basis-of-Design Product:
 - a. Manufacturer:
 - 1) Encore Lighting
 - a) RC-1-C-UNO Series
 - b. Alternate Manufacturers:
 - 1) Cooper Lighting
 - 2) Acuity Lighting
 - 3) Prescolite
 2. Description: Recessed ceiling mounted exit sign with housing to be 18-gauge steel with conduit knockouts. Adjustable hanger bars - Connectors facilitate quick installation and maintenance - Convenient 1/2" knockouts provided in top and end of surface mounted housing Trim/Housing Plate - Injection molded high-impact acrylic panel - NFPA 101 compliant chevron directional indicators (to be coordinated by Contractor). Extruded trim plate in White with red 8". To have torsion springs to secure trim plate to housing - no visible mounting hardware.
 - a. Comply with UL 924; for sign colors, visibility, luminance, and lettering size, comply with authorities having jurisdiction.
 - b. Lamps for AC Operation: LEDs, 70,000 hours minimum rated lamp life.
 - c. Self-Powered Exit Signs (Battery Type): Integral automatic charger in a self-contained power pack.
 - 1) Battery: Sealed, maintenance-free, nickel-cadmium type.
 - 2) Charger: Fully automatic, solid-state type with sealed transfer relay.
 - 3) Operation: Relay automatically energizes lamp from battery when circuit voltage drops to 80 percent of nominal voltage or below. When normal voltage is restored, relay disconnects lamps from battery, and battery is automatically recharged and floated on charger.
 - 4) Test Push Button: Push-to-test type, in unit housing, simulates loss of normal power and demonstrates unit operability.
 - 5) LED Indicator Light: Indicates normal power on. Normal glow indicates trickle charge; bright glow indicates charging at end of discharge cycle.
 - 6) Remote Test: Switch in hand-held remote device aimed in direction of tested unit initiates coded infrared signal. Signal reception by factory-installed infrared receiver in tested unit triggers simulation of loss of its normal power supply, providing visual confirmation of either proper or failed emergency response.
 - 7) Integral Self-Test: Factory-installed electronic device automatically initiates code-required test of unit emergency operation at required intervals. Test failure is annunciated by an integral audible alarm and flashing red LED.

2.4 INSTALLATION

- A. Lighting fixtures: Set level, plumb, and square with ceilings and walls. Install lamps in each fixture.
- B. Support for Lighting Fixtures in or on Grid-Type Suspended Ceilings: Use grid as a support element.

265100-8

Interior Lighting

PHOTO LAB – DARKROOM RENOVATION

PURCHASE COLLEGE SUNY | 735 ANDERSON HILL RD. | VISUAL ARTS BUILDING | LA PLLC Project 2306

INTERIOR LIGHTING

1. Install a minimum of four ceiling support system rods or wires for each fixture. Locate not more than 6 inches from lighting fixture corners.
2. Support Clips: Fasten to lighting fixtures and to ceiling grid members at or near each fixture corner with clips that are UL listed for the application.
3. Fixtures of Sizes Less Than Ceiling Grid: Install as indicated on reflected ceiling plans or center in acoustical panel, and support fixtures independently with at least two 3/4-inch metal channels spanning and secured to ceiling tees.
4. Install at least one independent support rod or wire from structure to a tab on lighting fixture. Wire or rod shall have breaking strength of the weight of fixture at a safety factor of 3.

C. Suspended Lighting Fixture Support:

1. Pendants and Rods: Where longer than 48 inches, brace to limit swinging.
2. Stem-Mounted, Single-Unit Fixtures: Suspend with twin-stem hangers.
3. Continuous Rows: Use tubing or stem for wiring at one point and tubing or rod for suspension for each unit length of fixture chassis, including one at each end.

D. Air-Handling Lighting Fixtures: Install with dampers closed and ready for adjustment.

E. Adjust aimable lighting fixtures to provide required light intensities.

F. Connect wiring according to Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

2.5 FIELD QUALITY CONTROL

- A. Test for Emergency Lighting: Interrupt power supply to demonstrate proper operation. Verify transfer from normal power to battery and retransfer to normal.
- B. Prepare a written report of tests, inspections, observations, and verifications indicating and interpreting results. If adjustments are made to lighting system, retest to demonstrate compliance with standards.

2.6 GENERAL

- A. Fixture locations as indicated on the Electrical Drawings are generalized and approximate. Carefully verify locations with Architect's plans, reflected ceiling plans and other reference data, prior to installation. Check for adequacy of headroom and non-interference with other equipment, such as ducts, pipes, conduit, or openings. Bring conflicts to Architect's/Engineer's attention before proceeding with work.
- B. Although the location of equipment may be shown on the Contract Drawings in certain places, actual construction may disclose that the work does not make its position easily and quickly accessible. In such cases, call Architect's/Lighting Designer's attention to this situation before installing this work, and comply with the installation instructions.

INTERIOR LIGHTING

- C. Lamp disposal shall be provided by the Contractor following all rules/guidelines set by SUNY Purchase.
- D. Verify ceiling conditions and ceiling types. Furnish appropriate luminaire mounting accessories for each fixture. Architect/Lighting Designer shall accept such mounting details.
- E. Install fixtures in mechanical areas after ductwork and piping installation. Locate and mount fixtures as indicated on Drawings unless mechanical equipment prohibits or makes it impractical to do so. In such cases, chain or wall mounted fixtures so that serviceable equipment is illuminated.
- F. Install fixtures complete with lamps, as indicated, and with equipment, materials, parts, attachments, devices, hardware, hangers, cables, supports, channels, frames and brackets necessary to make a safe, complete, and fully operative installation.
- G. Verify and provide fixtures that are appropriate for the ceiling mounting conditions of the project.
- H. Reject and do not install blemished, damaged or unsatisfactory fixtures. Replace imperfect or unsatisfactory fixtures, if installed, as directed by the Architect/Lighting Designer.
- I. When installed, fixture shall be free of light leaks, warps, dents, or other irregularities. No light leaks are permitted at the ceiling line or from any visible part or joint of the fixtures.
- J. Provide finish for exposed parts or trims as specified or indicated on the Drawings. If finish for exposed parts is not indicated, provide a finish as directed by the Architect/Lighting Designer.
- K. Do not install reflector cones, aperture plates, lenses, diffusers, louvers, and decorative elements of fixtures until completion of wet work, plastering, painting and general clean-up in the area of the fixtures.
- L. Mount fixtures at heights and locations indicated on the Contract Drawings, or as requested by Architect/Lighting Designer.
- M. Adequately protect the housing of recessed lighting fixtures during installation by internal blocking or framing to prevent distortion of sides, or dislocation of threaded lugs, which, upon completion, shall be in perfect alignment and match the corresponding holes in frames and rims. Holding screws shall be inserted freely without forcing, and shall remain easily removable for servicing. Threads intended to receive holding screws shall be chased after plating and finished to insure easy installation and removal of knurled headed screws.
- N. Parabolic luminaires shall be installed with mylar cover over louvers; cover shall be U.L. listed for temporary lighting. Upon completion of work, remove mylar cover with white gloves.
- O. Fixture supports shall be adequate to support the weight of the fixtures.
- P. Provide visible hanging devices that are finished to match the fixture finish, unless indicated otherwise.
- Q. Where necessary to meet fire resistance requirements of Building Code authorities, provide enclosure

265100-10

Interior Lighting

PHOTO LAB – DARKROOM RENOVATION

PURCHASE COLLEGE SUNY | 735 ANDERSON HILL RD. | VISUAL ARTS BUILDING | LA PLLC Project 2306

INTERIOR LIGHTING

housings for recessed fixtures that are constructed to provide required fire resistance rating.

- R. Provide attachment devices, including brackets, plaster rings, saddle hanger and tie bars, made of formed, rolled, or cast metal shapes with the requisite rigidity and strength to maintain continuous alignment of installed fixtures. Attach fixtures to ceiling supporting members, and do not depend upon lathing, plaster or ceiling tile for alignment or support.
- S. Provide fixtures mounted in suspended ceilings that are supported by saddle hangers or the bars attached to runners or between crossbars of ceiling systems. Provide mounting splines or other positive means of maintaining alignment and rigidity.
- T. Provide pendant or surface mounted fixtures with required mounting devices and accessories, including hickey, stud-extensions, ball aligners, canopies, and stems. Make mounting stems of pendant fixtures of the correct length to uniformly maintain the fixture heights shown on the Contract Documents or established in the field. The allowable tolerance in mounting individual fixtures shall not exceed 1/8 inch and may not vary more than 1/8 inch from the floor mounting height shown on the Drawings. Install fixtures hung in continuous runs absolutely level, and in line with each other. Hanging devices shall comply with code requirements.
- U. Provide hanging devices, which, if visible from normal viewing angles, exactly match fixture finishes, unless otherwise requested by the Architect/Lighting Designer.
- v. Place stems to be vertical.
- w. Fixtures shall be secured to the steel outlet box where used. Where additional support is needed for fixtures on suspended ceilings, a steel support framework shall be used. Fixtures and appliances shall not be supported by or attached to ceiling tiles, sheet rock, or plaster.
- X. All light fixtures shall be connected to the branch circuit wiring system by means of a flexible connection. Each fixture shall be served by a single flexible connection from a junction box in the branch circuit raceway system. "Daisy Chain" connections from fixture to fixture shall only be allowed in spaces above hard ceiling and under no circumstances shall more than two cables be installed into a single fixture connection box.

2.7 ACCESSIBILITY

- A. Install equipment such as junction and pull boxes, fixture housings, transformers, ballasts, switches and controls, and other apparatus that requires occasional access for operation and maintenance, to be easily accessible and appropriate for mounting and ceiling conditions.