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SECTION 05 50 00 - METAL FABRICATIONS

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 metal fabrications for the following:

1. Pivot Gizmos at bocce court bumper gate.
2. Clips for suspended wood framing at Trellis.
3. Steel framing and supports for applications where framing and supports are not specified in other Sections.

B. Products furnished, but not installed, under this Section include the following:

1. Anchor bolts, steel pipe sleeves, slotted-channel inserts, and wedge-type inserts indicated to be cast into concrete or built into unit masonry.

C. Related Requirements:

1. Section 03 30 00 "Cast-in-Place Concrete" for installing anchor bolts, steel pipe sleeves, slotted-channel inserts, wedge-type inserts, and other items cast into concrete.
2. Section 04 20 00 "Unit Masonry" for installing loose lintels, anchor bolts, and other items built into unit masonry.
3. Section 05 12 00 "Structural Steel Framing."
4. Section 06 10 63 "Exterior Rough Carpentry."

1.3 COORDINATION

A. Coordinate installation of metal fabrications that are anchored to or that receive other work. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

1.4 ACTION SUBMITTALS

A. Shop Drawings: Show fabrication and installation details. Include plans, elevations, sections, and details of metal fabrications and their connections. Show anchorage and accessory items. Provide Shop Drawings for the following:

1. Clips for suspended wood framing at Trellis.

1.5 QUALITY ASSURANCE

A. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

B. Welding Qualifications: Qualify procedures and personnel according to the following:

1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."
2. AWS D1.6/D1.6M, "Structural Welding Code - Stainless Steel."

1.6 FIELD CONDITIONS

A. Field Measurements: Verify actual locations of walls and other construction contiguous with metal fabrications by field measurements before fabrication.

PART 2 - PRODUCTS

2.1 MACHINISTS

A. Available Machinists for Pivot Gizmos at bocce court bumper gate: Subject to compliance with requirements, machinists offering metal fabrications that may be incorporated into the Work include, but are not limited to, the following:

1. Rich Tonsetic
   1110 McEwen Avenue
   McMurray, PA 15317
   (724) 747-0225

2.2 PERFORMANCE REQUIREMENTS

A. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes acting on exterior metal fabrications by preventing buckling, opening of joints, overstressing of components, failure of connections, and other detrimental effects.

1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.

2.3 METALS

A. Metal Surfaces, General: Provide materials with smooth, flat surfaces unless otherwise indicated. For metal fabrications exposed to view in the completed Work, provide materials without seam marks, roller marks, rolled trade names, or blemishes.

B. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.

C. Stainless-Steel Sheet, Strip, and Plate: ASTM A 240/A 240M or ASTM A 666, Type 304.

D. Stainless-Steel Bars, Shapes and Tubing: ASTM A 276, Type 304.

2.4 FASTENERS

A. General: Unless otherwise indicated, provide Type 304 stainless-steel fasteners for exterior use and zinc-plated fasteners with coating complying with ASTM B 633 or ASTM F 1941, Class Fe/Zn 5, as indicated. Select fasteners for type, grade, and class required.

1. Provide stainless-steel fasteners for fastening stainless steel.

B. Stainless-Steel Bolts and Nuts: Regular hexagon-head annealed stainless-steel bolts, ASTM F 593; with hex nuts, ASTM F 594; and, where indicated, flat washers; Alloy Group 1.

C. Anchor Bolts: ASTM F 1554, Grade 36, of dimensions indicated; with nuts, ASTM A 563; and, where indicated, flat washers.

1. Hot-dip galvanize or provide mechanically deposited, zinc coating where item being fastened is indicated to be galvanized.

D. Anchors, General: Anchors capable of sustaining, without failure, a load equal to six times the load imposed when installed in unit masonry and four times the load imposed when installed in concrete, as determined by testing according to ASTM E 488/E 488M, conducted by a qualified independent testing agency.

E. Post-Installed Anchors: chemical anchors.

1. Material for Exterior Locations and Where Stainless Steel Is Indicated: Alloy Group 1 stainless-steel bolts, ASTM F 593, and nuts, ASTM F 594.

2.5 MISCELLANEOUS MATERIALS

A. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107/C 1107M. Provide grout specifically recommended by manufacturer for interior and exterior applications.

2.6 FABRICATION, GENERAL

A. Shop Assembly: Preassemble items in the shop to greatest extent possible. Disassemble units only as necessary for shipping and handling limitations. Use connections that maintain structural value of joined pieces. Clearly mark units for reassembly and coordinated installation.

B. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.

C. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.

D. Form exposed work with accurate angles and surfaces and straight edges.

E. Weld corners and seams continuously to comply with the following:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove welding flux immediately.
4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing.

F. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners or welds where possible. Where exposed fasteners are required, use Phillips flat-head (countersunk) fasteners unless otherwise indicated. Locate joints where least conspicuous.

G. Fabricate seams and other connections that are exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate.

H. Cut, reinforce, drill, and tap metal fabrications as indicated to receive finish hardware, screws, and similar items.

I. Provide for anchorage of type indicated; coordinate with supporting structure. Space anchoring devices to secure metal fabrications rigidly in place and to support indicated loads.

J. Where units are indicated to be cast into concrete or built into masonry, equip with integrally welded steel strap anchors, 1/8 by 1-1/2 inches, with a minimum 6-inch embedment and 2-inch hook, not less than 8 inches from ends and corners of units and 24 inches o.c., unless otherwise indicated.

2.7 PIVOT GIZMOS AT BOCCE COURT BUMPER GATE

A. Performance: Operating principles include the following:

1. Gate to be operable by 5 lbs of force applied perpendicular to the face of the gate leaf, at the point furthest from the pivot, by either a wheelchair foot rest being pressed against it, or by being lightly kicked.
2. At rest, the faces and top of the finished gate will align with the adjacent concrete curb and wood bumper as indicated. A detent position at rest will offer moderate resistance, so that the bumper gate can perform as a curb bumper during a game of bocce - as adequately as possible, the ADA 5-lb opening force condition governs.
3. The gate will open a minimum of 90 degrees and a maximum of 110 degrees in either direction when pressed or lightly kicked, and will return to its at-rest position afterwards. When rotating into the open position, the gate will rise vertically via a cam and roller bearing. When closing, gravity will cause the gate to fall vertically and rotate into its at-rest position.
4. The pivot gizmo will serve as an armature for attaching finished wood surfaces as indicated. The armature will support, without permanent deformation, a load of 300 lbs applied vertically to the top surface of the gate leaf, at the point furthest from the pivot. Wood shall be attached to the armature, to the greatest extent possible, by concealed fasteners.

B. Material: Stainless Steel.

2.8 CLIPS FOR SUSPENDED WOOD FRAMING AT TRELLIS

A. Material: Steel, hot-dip galvanized finish.

2.9 MISCELLANEOUS FRAMING AND SUPPORTS

A. General: Provide steel framing and supports not specified in other Sections as needed to complete the Work.

B. Fabricate units from steel shapes, plates, and bars of welded construction unless otherwise indicated. Fabricate to sizes, shapes, and profiles indicated and as necessary to receive adjacent construction.

1. Furnish inserts for units installed after concrete is placed.

C. Galvanize miscellaneous framing and supports where indicated.

2.10 FINISHES, GENERAL

A. Finish metal fabrications after assembly.

B. Finish exposed surfaces to remove tool and die marks and stretch lines, and to blend into surrounding surface.

2.11 STEEL AND STAINLESS STEEL FINISHES

A. Galvanizing: Hot-dip galvanize items as indicated to comply with ASTM A 153/A 153M for steel and iron hardware and with ASTM A 123/A 123M for other steel and iron products.

1. Do not quench or apply post galvanizing treatments that might interfere with paint adhesion.

B. Stainless Steel:

1. Surfaces exposed to view in finished piece(s) to comply with SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
2. As fabricated, or no finish, when metal fabrications are fully concealed from view in finished piece(s).

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing metal fabrications. Set metal fabrications accurately in location, alignment, and elevation; with edges and surfaces level, plumb, true, and free of rack; and measured from established lines and levels.

B. Fit exposed connections accurately together to form hairline joints. Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations. Do not weld, cut, or abrade surfaces of exterior units that have been hot-dip galvanized after fabrication and are for bolted or screwed field connections.

C. Field Welding: Comply with the following requirements:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove welding flux immediately.
4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.

D. Fastening to In-Place Construction: Provide anchorage devices and fasteners where metal fabrications are required to be fastened to in-place construction. Provide threaded fasteners for use with concrete and masonry inserts, toggle bolts, through bolts, lag screws, wood screws, and other connectors.

E. Provide temporary bracing or anchors in formwork for items that are to be built into concrete, masonry, or similar construction.

3.2 INSTALLING MISCELLANEOUS FRAMING AND SUPPORTS

A. General: Install framing and supports to comply with requirements of items being supported, including manufacturers' written instructions and requirements indicated on Shop Drawings.

B. Support steel girders on solid grouted masonry, concrete, or steel pipe columns. Secure girders with anchor bolts embedded in grouted masonry or concrete or with bolts through top plates of pipe columns.

1. Where grout space under bearing plates is indicated for girders supported on concrete or masonry, install as specified in "Installing Bearing and Leveling Plates" Article.

C. Install pipe columns on concrete footings with grouted baseplates. Position and grout column baseplates as specified in "Installing Bearing and Leveling Plates" Article.

1. Grout baseplates of columns supporting steel girders after girders are installed and leveled.

END OF SECTION 05 50 00

SECTION 07 84 13 - PENETRATION FIRESTOPPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Penetrations in fire-resistance-rated walls.

1.3 ACTION SUBMITTALS

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

B. Product Schedule: For each penetration firestopping system. Include location and design designation of qualified testing and inspecting agency.

1. Where Project conditions require modification to a qualified testing and inspecting agency's illustration for a particular penetration firestopping condition, submit illustration, with modifications marked, approved by penetration firestopping manufacturer's fire-protection engineer as an engineering judgment or equivalent fire-resistance-rated assembly.

1.4 INFORMATIONAL SUBMITTALS

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

1.5 QUALITY ASSURANCE

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

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

1. Penetration firestopping tests are performed by a qualified testing agency acceptable to authorities having jurisdiction.
2. Penetration firestopping is identical to those tested per testing standard referenced in "Penetration Firestopping" Article. Provide rated systems complying with the following requirements:

a. Penetration firestopping products bear classification marking of qualified testing and inspecting agency.
b. Classification markings on penetration firestopping correspond to designations listed by the following:

1) UL in its "Fire Resistance Directory."

C. Preinstallation Conference: Conduct conference at Project site.

1.6 PROJECT CONDITIONS

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

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

1.7 COORDINATION

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

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

C. Notify Owner's testing agency at least seven days in advance of penetration firestopping installations; confirm dates and times on day preceding each series of installations.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

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

1. A/D Fire Protection Systems Inc.
2. Grace Construction Products.
3. Hilti, Inc.
4. Johns Manville.
5. Nelson Firestop Products.
6. NUCO Inc.
7. Passive Fire Protection Partners.
8. RectorSeal Corporation.
9. Specified Technologies Inc.
10. 3M Fire Protection Products.
11. Tremco, Inc.; Tremco Fire Protection Systems Group.
12. USG Corporation.

2.2 PENETRATION FIRESTOPPING

A. Provide penetration firestopping that is produced and installed to resist spread of fire according to requirements indicated, resist passage of smoke and other gases, and maintain original fire-resistance rating of construction penetrated. Penetration firestopping systems shall be compatible with one another, with the substrates forming openings, and with penetrating items if any.

B. Penetrations in Fire-Resistance-Rated Walls: Provide penetration firestopping with ratings determined per ASTM E 814 or UL 1479, based on testing at a positive pressure differential of 0.01-inch wg.

1. Fire-resistance-rated walls include fire walls, fire-barrier walls, smoke-barrier walls, and fire partitions.
2. F-Rating: Not less than the fire-resistance rating of constructions penetrated.

C. Accessories: Provide components for each penetration firestopping system that are needed to install fill materials and to maintain ratings required. Use only those components specified by penetration firestopping manufacturer and approved by qualified testing and inspecting agency for firestopping indicated.

1. Collars.
2. Steel sleeves.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Installer present, for compliance with requirements for opening configurations, penetrating items, substrates, and other conditions affecting performance of the Work.

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

3.2 PREPARATION

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

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

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

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

3.3 INSTALLATION

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

B. Install forming materials and other accessories of types required to support fill materials during their application and in the position needed to produce cross-sectional shapes and depths required to achieve fire ratings indicated.

3.4 CLEANING AND PROTECTION

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

B. Provide final protection and maintain conditions during and after installation that ensure that penetration firestopping is without damage or deterioration at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, immediately cut out and remove damaged or deteriorated penetration firestopping and install new materials to produce systems complying with specified requirements.

3.5 PENETRATION FIRESTOPPING SCHEDULE

A. Where UL-classified systems are indicated, they refer to system numbers in UL's "Fire Resistance Directory" under product Category XHEZ.

B. Firestopping for Metallic Pipes, Conduit, or Tubing:

1. UL-Classified Systems: W-L-1333 or approved equivalent.

C. Firestopping for Non-Metallic Pipes:

1. UL-Classified Systems: W-L-2483 or approved equivalent.

END OF SECTION 07 84 13

SECTION 22 00 00 – GENERAL PROVISIONS: PLUMBING AND MECHANICAL

PART 1 - GENERAL

1.1 RELATED REQUIREMENTS

A. The General Provisions, Supplemental General and Special Conditions, Division 1 Specification Section and all relevant documents shall form a part of this Division of the Specifications, and shall be incorporated in this Section and each Division 22 Section hereinafter as if repeated verbatim herein. All conditions imposed by these documents shall be applicable to all portions of the Work under this Division. These references are intended to point out specific items to the Contractor, but in no way relieve the Contractor of the responsibility of reading and complying with all relevant parts of the entire Specification.

B. The Contractor shall examine and coordinate with all Construction Drawings and Specifications, and all Addenda issued. Failure to comply shall not relieve Contractor of responsibility. The omission of details of other portions of the Work from this Division shall not be used as a basis for a request for additional compensation.

C. The specific features and details for other portions of the Work related to the construction in progress or to the existing building shall be determined by examination at the Project site.

1.2 SCOPE OF WORK

A. The requirements contained in this Section apply to all Work performed under Division 22 of these Specifications.

B. The Work covered by this Division of the Specifications comprises the furnishing of labor, material, equipment, transportation, tools and services, and performing operations required for, and reasonably incidental to, the installation of the Work in accordance with the applicable Construction Documents, and subject to the terms and conditions of the Contract.

C. The Work shall include modifications and extensions to existing systems, and the modification of the existing structure as required to accommodate the installation of the Work.

D. Refer to other Divisions of the Specifications for related Work.

E. Provide without extra charge all incidental items required as part of the Work, even though it may not be specifically indicated. If the Contractor has reason for objecting to the use of any material, equipment, device or method of construction as indicated, he shall make report of such objections to the Housing Authority of the City of Pittsburgh (HACP) Project Manager, obtain proper approval and adjustment to the Contract, and shall proceed with the Work.

1.3 MATERIALS, EQUIPMENT AND DEVICE DESCRIPTION

A. Materials, equipment, and devices shall be of the best quality customarily applied in quality commercial practice, and shall be the products of reputable manufacturers. Each major component shall bear a nameplate giving the name and address of the manufacturer, and the catalog number or designation of the component.

B. Materials, equipment and devices furnished under this Division of the Specifications shall be essentially the standard product of the specified manufacturer, or where allowed, an alternate manufacturer. Where two or more units of the same kind or class of a specific item are required, these shall be the products of a single manufacturer; however, the component parts of the item need not be the products of one manufacturer.

C. In describing the various materials, equipment and devices, in general each item will be described singularly, even though there may be a multiplicity of identical items. Also, where the description is only general in nature, exact sizes, duties, space arrangements, horsepower requirements and other data shall be determined by reference to the Construction Documents.

D. Equipment called for on the plans and not listed herein shall be provided and installed as though it were fully described herein.

E. Equipment called for herein shall be completely provided and installed, whether fully detailed or not on the plans, and/or scheduled.

F. All equipment as indicated on the plans and as described herein shall be installed per manufacturer's recommendations to allow for proper operation and maintenance of the equipment.

1.4 QUALITY ASSURANCE

A. Materials, equipment and devices shall be new and of the quality specified, and shall be free from defects at the time of installation. Materials, equipment and devices damaged in shipment or otherwise damaged or found defective prior to acceptance by the HACP Project Manager shall not be repaired at the job site, but shall be replaced with new materials, equipment or devices identical with those damaged, unless specifically approved otherwise by the HACP Project Manager.

B. Wherever a UL standard has been established for a particular type of material, equipment or device, each item of such material, equipment or device provided on this project shall meet the requirements of the UL standard in every way, and shall be UL listed and labeled.

1.5 DRAWINGS AND SPECIFICATIONS

A. The inter-relation of the specifications, the drawings, and the schedules are as follows:

1. The specifications provide the written requirements for the quality, standard, nature of the materials, equipment and construction systems.
2. The drawings establish the quantities, dimensions, details and location of equipment.
3. The schedules give the capacities, characteristics, and components.

B. For any individual project, if there is conflict between the drawings and or specifications, they are equivalent in authority and priority. Should they disagree in themselves, or with each other, prices shall be based on the most expensive combination of quality and quantity of work indicated. In the event of the above-mentioned disagreements the Architect/Engineer (A/E) (Loysen + Kreuthmeier Architects) shall determine the resolution.

C. Contractor is responsible to bring any conflicts in drawings and/or specifications to the attention of the Architect/Engineer (A/E), immediately, prior to any Work being done.

D. Where the specifications do not fully agree with the schedules, the schedules shall govern. Figures given on drawings govern scale measurements and large-scale details govern small scale drawings.

1.6 SUBMITTALS

A. See the material and requirements under the General Conditions and the specific specification sections for indication of submittal data.

B. A submittal shall be provided for review on each item proposed for use hereunder, to include but not limited to the following, as applicable.

1. Valves
2. Hangers/Supports
3. Vibration isolation
4. Insulation
5. Piping Materials/Fittings
6. Plumbing Equipment
7. Plumbing Fixtures/Trim
8. Air Distribution Materials/Devices
9. Heating Equipment
10. Energy Management Systems & Temperature Controls
11. Test and Balance Qualifications
12. Fans
13. Flexible Duct
14. Filters (Include dust-stop efficiencies & MERV ratings per ASHRAE Standard 52-1999)
15. Fire/Smoke Dampers (Include U.L. Detail proposed for use)
16. Duct Fabrication Methods
17. Control/Backdraft Dampers
18. Terminal Boxes

C. Process submittal data to insure that it conforms to the requirements of the Plans and Specifications and that there are no omissions and/or duplications.

D. Each submittal shall designate the exact item offered and be clearly identified to correspond with the construction documents; unidentified items on manufacturer's data sheets are not acceptable. Submittals to include parts list with descriptive part numbers for belts, sheaves, motors, filters, fan blades, terminal and AHU EMS controllers, damper and valve actuators and other similar applicable components.

E. In each case, the various material submissions of related items, procured from a single manufacturer or supplier, shall be assembled in brochures or in other suitable package form and shall not be submitted in a multiplicity of loose sheets.

F. The Contractor shall assemble these brochures, checking them for accuracy and coordination and submit six (6) copies in bound "Project Manuals" to the Architect/Engineer (A/E) for review by the A/E.

G. The Contractor shall submit all submittals in a timely manner to allow 10 working days review period by the A/E unless otherwise agreed upon in advance. After review, the A/E shall retain one (1) copy for its records. Four (4) marked copies shall be returned to the Contractor for distribution. All additional copies submitted shall be returned to the Contractor unmarked.

H. The submittals shall include room-by-room tabulations of air distribution devices, fire dampers, etc. They shall not cover detailed lists of plumbing fixtures, carriers, drains, valves, and similar items.

I. The Contractor shall sign the submittal as an indication of compliance with the Construction Documents. If there are any deviations from the Construction Documents, the Contractor shall so indicate on the submittal. Any deviations not so indicated shall be cause for rejection and removal of the non-complying equipment at the Contractor's expense.

J. Each submittal shall include a readily available 4-inch by 4-inch space for the A/E's submittal review

stamp.

K. Submittals that do not comply strictly with the above format may be returned to the Contractor, without review, at the discretion of the A/E.

1.7 SHOP DRAWINGS

A. See the material under General Conditions.

B. Prepare shop drawings as called for elsewhere herein or directed by the A/E to coordinate this Work with the Work of other Divisions, to illustrate changes in this Work to facilitate its concealment in finished spaces, to avoid obstructions, or to illustrate the installation of a substitute equipment item. Shop drawings shall be provided for the following:

1. Sheet Metal and Duct Systems and plumbing systems, (prepared at a minimum scale of 1/8"=1'-0")
2. Temperature Control Diagrams with Sequence of Operations on same drawing.
3. Piping and equipment systems for chilled water, condenser water, refrigerant, heating water, steam and other HVAC piping systems. At 1/4" = 1' – 0".

1.8 INSTALLATION DRAWINGS

A. Prepare special drawings as called for elsewhere herein or directed by the A/E to coordinate this Work with the Work of other Divisions, to illustrate changes in this Work to facilitate its concealment in finished spaces, to avoid obstructions, or to illustrate the installation of a substitute equipment item.

B. Use these drawings in the field for the installation of the Work. Unless otherwise directed, do not submit these drawings for review, but provide three (3) copies to the A/E for information.

1.9 INSPECTION OF SITE

A. The accompanying drawings do not indicate existing mechanical installations other than to identify modifications of and extensions thereto. The Contractor shall visit the site, inspect the installations and ascertain the conditions to be met and the Work. Failure to comply with this shall not constitute ground for any additional payments in connection with removing or modifying any part of the existing installations and/or installing any new Work under this Division.

1.10 WORKMANSHIP AND INSTALLATION

A. In no case shall the Contractor provide a class of material, equipment, device or workmanship less than that required by the Construction Documents or applicable codes, regulations, ordinances or standards. All modifications which may be required by a local authority having legal jurisdiction over all or any part of the Work shall be made by the Contractor without any additional charge. In all cases where such authority requires deviations from the requirements of the Drawings or Specifications, the Contractor shall report same to the HACP Project Manager and shall secure prior approval before the Work is started.

B. The Work shall be performed by properly licensed technicians skilled in their respective trades. All materials, equipment and devices shall be installed in accordance with the recommendations of the manufacturer and in the best standard practice to bring about results of a first class condition.

1.11 WARRANTY

A. All materials, equipment, devices and workmanship shall be warranted for a period of one year (1.0 year) from the date of acceptance by the HACP Project Manager for beneficial use by the Housing

Authority of the City of Pittsburgh (HACP), except that where specific equipment is noted to have extended warranties. The warranty shall be in accordance with AIA Document A201. The Contractor shall be responsible for the proper registration of these warranties so that the HACP Project Manager can make all proper claims should future need develop.

B. The Contractor shall furnish to the HACP Project Manager for beneficial use by HACP, the names, addresses, and telephone numbers of those persons responsible for service on systems and equipment covered by the warranty.

1.12 OPERATION PRIOR TO ACCEPTANCE

A. When any equipment is operable, and it is to the advantage of the Contractor to operate the equipment, the Contractor may do so provided that the Contractor properly supervises the operation, and retains full responsibility for the equipment operated. Regardless of whether or not the equipment is operating properly, make required adjustments and complete punch list items before final acceptance by the HACP Project Manager.

1.13 INSTRUCTION OF HOUSING AUTHORITY OF THE CITY OF PITTSBURGH (HACP) PERSONNEL

A. Provide the services of competent engineers and/or technicians acceptable to the HACP Project Manager to instruct other representatives of HACP in the complete and detailed operation of each item of equipment or device of all the various electrical and mechanical systems. These instructions shall be provided for whatever periods may be necessary to accomplish the desired results. Upon completion of these instructions, the Contractor shall obtain a letter of release, acknowledged by the HACP Project Manager or HACP Project Manager's authorized representative, stating the dates on which the various kinds of instructions were given, and the personnel to whom the instructions were given.

B. The Contractor shall be fully responsible for proper maintenance of equipment and systems until the instructions have been given to HACP personnel and the letter of release acknowledged.

C. In providing the instructions to HACP personnel, the written operating and maintenance manuals shall be followed in all instances, and HACP personnel shall be familiarized with such manuals. Operating and maintenance manuals used for instructions shall include wiring diagrams, manufacturer's operating and maintenance instructions, parts lists (with sources identified), and other data as appropriate for each system.

1.14 SCHEDULE AND SEQUENCE OF WORK

A. The Contractor shall meet and cooperate with the HACP Project Manager and the Architect/Engineer (A/E), to schedule and sequence this Work so as to insure meeting scheduled completion dates and avoid delaying other portions of the Work. Work requiring special sequencing shall be at no additional cost to HACP, and shall have no impact on the schedule.

1.15 GENERAL

A. If a mandatory pre-bid meeting is required, bidders shall visually examine the existing conditions at the site. The Contractor shall be responsible for installation of the Work as it relates to those conditions.

B. Review all construction details illustrated on the architectural, structural, and construction drawings and be guided thereby

C. Review construction details of the existing portion of the building during the site inspection and include all Work required to modify the existing mechanical installations and install new materials,

comprising a part of the mechanical installation, within the present structure. Review all construction details of the new portion of the building as illustrated on the architectural, structural, and construction drawings and be guided thereby.

D. Except for the layout of the sprinkler system, including heads, test connections, drains, etc., the mechanical drawings diagrammatically show sizes and locations of outlets and equipment items and the sizes of the major interconnecting pipes and ducts, without delineating exact elevations, offsets, control lines, and other installation details. Carefully lay out work at the site to conform to the architectural and structural conditions, to avoid obstructions, and permit proper grading of lines. In cooperation with other Contractors, determine exact locations of outlets, apparatus and connections thereto by reference to the general, detail, equipment and rough-in drawings, and by measurements at the building; in all cases subject to A/E approval. Where necessitated by conditions at the site or directed by the A/E, make minor relocations without additional cost to HACP.

E. Run all ducts and pipes concealed in suspended ceilings where they occur and in furrings and chases where shown, except for those connections to plumbing fixtures and equipment items which must necessarily be exposed. Wherever conditions exist which would cause any normally concealed materials to be exposed in finished spaces, immediately call the situation to the attention of the A/E and stop work in those areas until the A/E directs the resumption of the work and the procedures to be followed.

1. Install all concealed pipes and ducts as required by the pace of the general construction.

F. In areas where there are no suspended ceilings, run all ducts and pipes parallel to building surface planes, except grade lines, for proper flow.

G. These Specifications and the accompanying drawings are intended to describe and illustrate systems which will not interfere with the building structure and which will fit into the available spaces. Prepare an installation drawing for any critical area, illustrating the installation of the work in this Division as related to the work of all other Divisions, and correct interferences with the other trades or with the building structure before the Work proceeds.

1.16 INSTALLATION INSPECTIONS AND CERTIFICATIONS

A. Obtain timely inspections of the installation by the constituted authorities. Remedy any deficiencies to the satisfaction of the inspecting authority.

B. Upon final completion of the Work, obtain certificates of acceptance from the constituted authorities. Deliver the certificates to the A/E for transmission to HACP Project Manager.

1.17 LARGE APPARATUS

A. Where any piece of apparatus is too large for ingress through normal building openings, it shall be placed in its containing space before the enclosing structure is completed.

1.18 PROTECTION OF APPARATUS

A. At all times take every precaution to properly protect apparatus from damage. Include erecting temporary shelters to protect apparatus shored at the site, cribbing of apparatus above the floor of the construction, and covering of apparatus in the incomplete building with plastic sheeting or other protective coating. Failure on the part of the Contractor to comply with the above to the satisfaction of the A/E will be sufficient cause for the rejection of the pieces of apparatus in question.

B. Responsibility for the protection of apparatus shall extend to presently installed apparatus. Erect temporary sheltering structures, provide temporary bracing and supports, or cover equipment as

required or directed to afford proper protection.

1.19 SCHEDULE OF WORK

A. Work schedules and completion dates as established must be rigidly adhered to. Cooperate in establishing these schedules and perform the Work under this Division at such times as directed so as to insure meeting scheduled dates and avoid delaying any other Contractor.

B. Should the Work in the designated areas affect any services to the areas to remain in use, new permanent or temporary services or a combination of both shall be installed as required to enable those occupied areas to function properly.

C. Perform no Work in the present building, which would interfere with its use during normal hours of occupancy, unless special permission is granted by the HACP Project Manager. Included are operations, which would cause objectionable noise or service interruptions. Each discipline shall coordinate its Work with the established phases of construction.

D. Any Work involving a service suspension shall be scheduled in advance with the HACP Project Manager.

1.20 TEMPORARY HEATING AND COOLING

A. The mechanical contractor shall purchase the necessary temporary heating and cooling equipment for spaces that require continued use.

B. Should the Work in the designated areas affect any services to areas that are to remain in use, the mechanical contractor shall provide temporary services as required to enable those occupied areas to function properly.

1.21 SALVAGED MATERIALS

A. Reuse no salvaged material except as noted on the Drawings, specified herein, or directed by the A/E. Remove from the premises all present materials falling under this Division, which are removed from the existing building. Upon completion, leave no "dead" line or equipment installed in any portion of the area being remodeled.

1.22 CUTTING AND PATCHING

A. Contractor shall, under the A/E's direction, drill or cut openings as required to install a new Work or to repair or replace defective Work; use core drills or power driven saws. Include channeling in walls as required for the installation of wall mounted material and equipment.

B. In cutting masonry walls, provide and install lintels and/or other structural members to provide adequate protective support for the remaining masonry. Structural members, supports, etc. shall be of the size and shape and installed as directed by the A/E.

C. Do not cut any structural member in a way to lessen its strength, without specific permission.

D. Openings cut in the existing building to install new materials covered by this Division of the Specifications, will be patched as a part of the Contractor’s Work.

E. Openings cut in the building to install materials covered by this Division of the Specifications or to repair or replace defects which may appear up to the expiration of the guarantee, or to repair damage to the Work of other trades occasioned by those cutting operations, shall be repaired by the trade whose Work is disturbed, but payment therefore shall be by the Contractor cutting the opening or

causing the damage.

F. Cut all openings required to install the Work or to repair any defective Work. Do all of this cutting under the HACP Project Manager's direction and exercise due diligence to avoid cutting openings larger than required or in the wrong locations.

G. No cutting or drilling of any sort will be permitted in the webs of prestressed, precast concrete structural elements. Use core drills or power driven saws to cut openings in the flanges of other such elements; the use of reciprocating drills will not be permitted. The cutting of structural members without first having received written permission from the HACP Project Manager is prohibited.

H. Where openings are cut in fire-rated walls or floors, seal the annular space between the Work installed and the fire-rated construction. Sealant, as applied, shall be fire rated to maintain the fire rating of the construction penetrated. Sealant shall be re-enterable (before fire) to alter penetrations. Apply in strict accordance with manufacturer's instructions.

1.23 CONCRETE FOUNDATIONS

A. Unless otherwise noted, concrete foundations, furnished under this Division of the Specifications, shall be not less than 4 inches high, poured in forms built of new dressed lumber with corners chamfered using sheet metal or triangular wood strips nailed to the form. Use 6x6 No. 3 mesh for reinforcing. Use Decatur Engineering Company's heavy-duty adjustable anchor bolts or A/E's approved equal; set in the form and positioned using templates, prior to placing concrete. Allow at least one inch between equipment bases and foundations for alignment, leveling and grouting. Use non-shrinking grout equal to Embeco Pre-Mixed Grout or A/E's approved equal. After grouting, remove the forms and hand-rub the foundation with carborundum.

B. Concrete foundations or pads will be required for all floor-mounted equipment.

C. Internally isolated air handling units to have 6-inch high concrete pads to allow a deep condensate trap.

1.24 CONCRETE WORK

A. Do all concrete work for concrete structures specified to be provided under this Division in strict accordance with the applicable provisions of Division 03, CONCRETE.

1.25 BURIAL DEPTH FOR EXTERIOR PIPING

A. Except as otherwise indicated or required by conditions at the site, the minimum cover from the top of the pipe to the finished grade for underground, exterior piping shall be: 42 inches for storm, sanitary drain, and sewer lines; and 48 inches for water and gas lines unless otherwise directed by the A/E.

1.26 EXCAVATION AND BACKFILLING

A. Do all excavating and backfilling required in installing the Work under this Division; generally use procedures and materials as described in Division 02, EXISTING CONDITIONS.

B. The Contractor shall be responsible for submitting a site-specific trench safety system prepared by an engineer registered in the Commonwealth of Pennsylvania, which meets United States Department of Labor Occupational Safety and Health Administration (US DoL OSHA), standards and any additional state and local standards.

1.27 EXTERIOR EXCAVATING

A. Perform all exterior excavating of whatever substances encountered and to the depths required.

B. During excavation, stack material suitable for backfilling in an orderly manner a sufficient distance from the banks of the trenches to prevent slides or cave-ins. Remove all excavated material not required or suitable for backfill, or waste as directed.

C. Control grading to prevent surface water from flowing into excavations and remove any water accumulating therein by pumping.

D. Use open cut grading and make trenches the necessary width for proper installation of the line, with banks as nearly vertical as practicable. Provide sheeting and shoring as necessary for the proper protection of the Work and the safety of personnel.

E. Use open cut grading except that short sections of a trench may be tunneled if, in the A/E's opinion, the line can be safely and properly installed and the tunnel can be suitably backfilled and tamped. Make trenches the necessary width for proper installation of the line, with banks as nearly vertical as practicable. Provide sheeting and shoring as necessary for the proper protection of the work and the safety of personnel.

F. Dig trenches not less than 12 inches nor more than 16 inches wider than the diameter of the pipe to be installed and excavate true to line so that the pipe may be centered therein. This trench width applies at and below the level of the top of the pipe. Dig the trench above that level as wide as necessary for proper installation of the Work and protection of personnel.

G. Grade trench bottoms to provide uniform bearing and support for the pipe on undisturbed soil as every point along its length except for lines excavated in rock and in soil incapable of supporting the pipe and except for excavation for bell holes and for proper sealing of pipe joints. Following grading of the trench bottom, create a depression at each joint as required to assemble the joint in accordance with its manufacturer's recommendations and to provide space to physically accommodate the joint. Remove stones to prevent point bearing. Round bottoms of trenches excavated for sewers so that at least 1/3 of the circumference of the pipes will rest firmly on undisturbed soil.

H. Where rock excavation is required, remove the rock to a minimum overdepth of 8 inches. Backfill the overdepth excavation with sand, 3/4-inch crushed rock, the equivalent in gravel, or other approved backfill material, prior to installing the pipe.

I. Where trenches are inadvertently over excavated, fill to the bottom level of the pipe with backfill material as specified above, prior to installing the pipe.

J. Whenever soil is determined to be unstable by the A/E, (incapable of properly supporting the pipe) remove such soil to a depth required and for the lengths and widths designated by the A/E and backfill the trench to bottom grade with backfill material, as specified above, prior to installing the pipe.

K. Excavation for underground structures shall be sufficient to leave at least 12 inches clear between outer surface and embankment or timber that may be used to hold and protect banks. Any overdepth excavation below that may be used to hold and protect banks. Any overdepth excavation below such appurtenances will be considered unauthorized and shall be refilled with sand, rock, gravel, or concrete, as directed at the expense of the Contractor.

1.28 BRACING, SHORING AND SHEETING

A. Whenever necessary, support sides and ends of all excavations with braces, sheeting, shores and stringers of quality and character as required. All timbering shall be put in place or driven by workers skilled in such Work and shall be so arranged that it may be withdrawn as refilling proceeds, without injury to any structures, roadbeds, or property; all shoring and sheeting shall be in accordance with

applicable codes and regulations.

B. Whenever required by soft ground, or for protection of any person, structure, or property, sheeting shall be driven, without extra compensation, to such a depth below bottom of trench as may be required or directed.

C. Bracing, shoring and sheeting shall be in compliance with the requirements of the Commonwealth of Pennsylvania Safety Code.

1.29 BACKFILLING OF EXTERIOR EXCAVATIONS

A. Do not backfill a trench until the piping system is installed in conformance with specified requirements and has been tested and accepted.

B. Except as directed otherwise, bracing, shoring and sheeting shall be removed in a manner to avoid damage or disturbances to Work, and excavations shall be free of forms and cleaned of trash. Backfill shall be brought up evenly on each side of a pipe and shall not be placed on surfaces that are muddy, frozen or that contain frost.

C. Backfill material shall be free from trash, refuse, ash, large stones, and material. Except as otherwise specified, all backfill shall be uniformly deposited and carefully compacted in layers not exceeding 8 inches in loose thickness by use of vibratory compaction equipment to at least 90% of maximum density at a moisture content within 2% of optimum in accordance with AASHO Standard T99.

D. Trenches Under Pavement: All trenches beneath existing or proposed roadways, shoulders, parking areas, curbs, sidewalks or similar use pavements shall be backfilled as specified above, except that all backfill material shall be compacted to at least 95% of maximum density at a moisture content within 2% of optimum in accordance with AASHO Standard T99.

E. The top 6 inches of backfill in areas outside of pavements shall be topsoil that is free of weeds and other unwanted materials.

F. Settling of granular non-cohesive backfill material with water in trenches lying outside of pavements will be permitted, and will be a requirement when so directed.

G. Trenches improperly backfilled, or where settlement occurs, shall be reopened to depth required for proper compaction, then refilled and compacted as specified, or otherwise corrected as permitted by the A/E.

1.30 OPENING AND RECLOSING PAVEMENT

A. Where excavation requires the opening of existing walks, streets, drives or other existing pavement, including "black topping", cut the pavement as required to install new lines and to make new connections to existing lines. Hold the size of the cut to a minimum consistent with the work to be accomplished. After completing the piping installation, backfill the excavation as hereinbefore specified; replace both the base and surface courses using materials to match those removed, both in degree of compaction and kind of material; replace any reinforcing and splice to existing reinforcing. New finished surfaces shall be level with the original surfaces and thoroughly bond with them.

1.31 INTERIOR TRENCHES AND BACKFILLING

A. For trenches of lines installed below a floor to be poured on grade, follow in general the procedures set out for exterior lines except install with a minimum amount of cover. Backfill with a suitable material and compact to no less than 95% Standard Proctor density immediately prior to the pouring of the floor.

B. Dispose of all surplus materials occasioned by these trenching operations as directed by the A/E.

C. Scoop out trenches in the underhouse areas as required to accommodate all equipment lines, ducts and piping, except waste, drain and sewer lines. Make these trenches adequate in width and depth to keep any such lines or duct a minimum of 6 inches from finished earth grade, and slope the sides of such trenches so that there will be no possibility of the trench walls caving or appreciably sloughing.

D. Waste, drain, and sewer lines run in crawl spaces below the floor, may either be suspended from the construction above or supported by the ground in trenches, using procedures set out for exterior lines.

E. Sub-soil drain lines installed in underhouse areas shall be laid true to grade and shall be backfilled using crushed rock completely surrounding the lines as indicated.

F. For trenches of all other lines to be installed below floors, which are to be poured concrete on grade, follow in general the procedures set out for exterior lines except install with a minimum amount of cover. Backfill with a suitable material and compact to not less than 95% Standard Proctor density immediately prior to the pouring of the floor.

G. Dispose of all surplus materials occasioned by the trenching operations as directed by the A/E.

1.32 PIPE SLEEVES

A. Where a pipe passes through a floor in a pipe chase which is not a slab on grade, use a galvanized steel pipe sleeve, extending to a height of 2 inches above the floor slab and cemented watertight; make the inside diameter of the sleeve at least 1/2 inch greater than the outside diameter of either the insulation on a covered pipe or of any bare pipe.

B. Except where a pipe passes through a floor on grade or where noted to the contrary, provide a pipe passing through a floor and exposed in any space with a standard weight galvanized steel pipe sleeve set to extend to a height of 3 inches above the floor. Make the inside diameter of the sleeve at least 1/2 inch greater than the outside diameter of either the insulation on a covered line or of any bare pipe.

C. Where a line penetrates a floor that is provided with a waterproof membrane, provide a two piece standard weight galvanized steel pipe and a cast iron riser sleeve with anchor lugs, flashing clamping device and inside threads on both ends. The riser sleeve shall be set in the lower part of the floor and clamped onto the membrane. The steel sleeve members shall extend through the floor, finishing flush with the underside of any floor above grade and extending to a height of 3 inches above the floor.

1. The inside diameter of the above sleeve shall be 1/2 inch greater than the outside diameter of the pipe. Following installation of the pipe, fill the annular space between the sleeve and the pipe using packing and then filling the sleeve with mastic, which shall set and form a watertight seal under normal use conditions.

D. Provide a pipe passing through an interior concrete beam or wall with a standard weight galvanized steel pipe sleeve. Make the inside diameter of the sleeve at least 1/2 inch greater than the outside diameter of either the insulation on a covered line or of any bare pipe.

E. Provide a pipe passing through an exterior wall with a standard weight galvanized pipe having an inside diameter 2 inches larger than the outside diameter of the carrier pipe. Fill the annular space between the pipe and its sleeve with a synthetic rubber mechanical seal; Thunderline "Link-Seal",

Mason-Dallas "InnerLinx", or approved A/E equal. Stainless steel bolts should be used.

1.33 FLOOR AND CEILING PLATES

A. Except as otherwise noted, provide and install a concealed hinge, chrome plated steel floor and ceiling plate with a spring catch around each pipe passing exposed through any wall, floor or ceiling in any space, except in mechanical rooms and except where steel pipe sleeves extend above the floor line. Size the plate to fit snugly against the outside of the pipe or against the outside of insulation on an insulated line.

1.34 ACCESS PANELS

A. Furnish an access panel for each location where mechanical equipment such as a manual valve, automatic control valve, automatic damper mechanism, (fire damper, etc. is installed behind a furring, chase, or non-removable suspended ceiling). These panels will be installed in the walls or ceilings by the trade involved under the applicable Division of the general specifications. Size and position each access panel so that the concealed equipment can be properly serviced, with the exact location subject to the approval of the A/E.

B. Access panels shall be Milcor, Elmdor or A/E's approved equal steel access panels with hinged doors with latching devices. In fire rated location UL 12-hour B labeled door; minimum size to 12 inch by 12 inch. In unrated surfaces they shall be in accordance with the following:

BUILDING SURFACE	MILCOR STYLE	MINIMUM SIZE INCHES
Masonry & Ceramic Tile walls	M	16 x 20
Metal Lath & Plaster Walls	K	16 x 20
Gypsum Board Walls	DW	14 x 14
Plaster Ceilings	K	12 x 12
Acoustical Tile Ceilings	AT	12 x 12
Gypsum Board Ceilings	DW	14 x 14

C. For ceiling access, through non-accessible ceilings, to terminal boxes, humidifiers, heating coils and other similar equipment, provide a minimum of one 24-inch by 24-inch access door suitable for accessing, servicing and removal of the largest section of the equipment.

1.35 PAINTING

A. Where machinery and equipment has been shipped with an enameled factory finish, touch up to repair any damage to the finish.

B. Suitably prepare all surfaces before painting. Remove all oil, rust, scale, dirt and other foreign materials. Make surfaces smooth by grinding, filling, brushing or other approved method.

C. Clean all uninsulated steel lines, support and hangers in underfloor spaces and apply two coats of asphalt varnish. Clean copper and cast iron lines in these areas but do not paint.

D. For painting of insulated lines in underfloor spaces, see the INSULATION Section of these Specifications.

E. All other finish painting will be accomplished under Division 09 of the Specifications.

F. Ceiling and wall grilles, diffusers and registers shall be factory painted as scheduled. If field painting is necessary it shall be in a color directed by the A/E and/or the HACP Project Manager.

G. All new piping shall be painted to match the existing color scheme in the existing facility. This shall apply to all chilled water, condenser water, steam, condensate returns, domestic hot and cold water, and drain piping.

H. All exterior bare ferrous piping shall be painted.

1.36 IDENTIFICATION

A. Identify each run of piping exposed in any space, including machinery space, attic areas, and underfloor areas, by means of Seton, Brady, Westline, or A/E approved equal plastic markers with pressure sensitive backing. Identify each system using black or white lettering with an arrow to indicate direction of flow on a background color coded to conform to ANSI A13.1. Use legends designed for parallel marking along length of pipe and sized as follows:

O.D. OF LINE OR COVERING (INCHES)	LENGTH OF COLOR BAND (INCHES)	HEIGHT OF LETTERS (INCHES)
Less than 3/4	8	1/2
3/4 to 2	8	3/4
2 1/2 thru 6	12	1 1/2
Over 6	24	2 1/2

B. Legends shall be installed following completion of all painting of piping and insulation finishes.

C. Place pipe legends on piping at each connection to an item of equipment, on each drop to an outlet, and on each run of piping at intervals not exceeding 50 feet, except that in no case shall an exposed line enter a room without being identified as specified herein. Locate markers so as to be readily visible.

D. Secure identification markers to piping by firmly pressing markers in place, following removal of protective covering. Additionally secure by banding ends of markers in place using 1/2-inch wide aluminum bands of the type normally used to secure insulation in place.

E. Provide a nameplate for each motor starter and each piece of equipment (pump, fan, AHU, Fan-Coil Unit, RTU, boiler, water heater, chiller, expansion tank, heat exchanger, etc.) furnished under this Division, identifying its specific function. Fabricate nameplates of laminated phenolic plastic with black surface and white core with beveled edges and with machine engraved lettering not less than ½ inch high cut through the black surface to the white core. Fasten nameplate to starter enclosures with epoxy resin glue or stainless steel screws. Punched plastic tape will not be acceptable.

F. Provide identification for all fire damper or smoke damper access openings; stencil the words "FIRE DAMPER" or "SMOKE DAMPER" on access doors that are in sheet metal ducts; engrave the words "FIRE DAMPER" or "SMOKE DAMPER" on plastic plates with letters not less than ½ inch high and secure the plates using an epoxy resin glue on access doors that are in walls or ceiling where such doors conceal fire damper access plates, or on the T-bars of removable ceilings immediately below the location of fire damper access openings above. Fabricate these plates of laminated phenolic plastic with a brown simulated wood grain finish exterior surface, a white core and beveled edges.

G. All valves shall be equipped with a 1-inch diameter brass tag with indented numerals. Tags shall be provided with adequate link chain with which to secure them to the valves. Provide a valve number chart suitable for framing relating to the valve tags within a plastic sheet protector.

1.37 ELECTRIC WIRING

A. All electric wiring will be done under Division 26, except for such equipment items as are prewired at their point of manufacture and so delivered to the project, and except for the following:

1. Temperature Control Wiring and Power Wiring provided by controls contractor.

B. Prepare and submit for review wiring diagrams for all equipment furnished under this Division. Show on these diagrams all power, interlock, and control circuits. When the A/E takes no exception to these drawings, they shall become installation drawings for the Contractor.

C. All chilled water, condenser water piping, domestic cold and hot water piping, and wet fire protection system shall be heat traced when routed external to the building or in areas susceptible to freezing conditions.

1.38 MOTORS

A. Furnish motors as required for all equipment provided under this Division. Motors shall conform to the following requirements unless noted or specified otherwise.

1. Capacity: Be able to start and operate the driven equipment without exceeding full load current nameplate rating at speed specified, or at the speed and load imposed by the drive actually furnished. In the case of a hermetic motor with water or refrigerant cooling, actual motor running current may exceed nameplate full load current by not more than 25% at specified operating conditions.
2. Motor 3/4 Horsepower and Larger: 3-phase, drip-proof, squirrel cage induction type; suitable for the current characteristics scheduled; NEMA Design B.
3. Motor Less than 3/4 Horsepower: Single-phase, unless scheduled different, drip-proof; of the type normally used for the intended service, except where capacitor type is called for; suitable for current characteristics scheduled.
4. Design and Service Factors: In accordance with current NEMA, IEEE, ANSI and Anti-Friction Bearing Manufacturers Association Codes, Standards and Specifications; rated for continuous duty at 40^{o}C ambient temperature at a standard service factor of 1.15.
5. Motors 3 HP and greater shall be of the premium efficiency type and shall conform to the following minimum full load efficiencies:

MOTOR SIZE HP	PERCENT EFFICIENCY
1	84.0
1 1/2	85.0
2	86.0
3 to 5	89.5
7 1/2 to 15	91.0
20 to 30	93.5
40 to 60	94.5
75 to 100	95.0
Above 100	95.4

B. Where a motor is mounted integrally with an item of mechanical equipment, erect the entire assembly. Where a motor is separately delivered, provide the motor foundation, set the foundation bolts and make all other provisions for installing the motor, and the final motor setting will be under this Division 22.

C. Motors shall be manufactured by Baldor, Magnetek (Century), General Electric or Reliance, or as

approved by the A/E.

D. Any motor installed to operate on a variable frequency drive (invertor) shall meet the requirements of NEMA MG-1 Part 31.40.4.2. These motors shall be designed to handle voltage spikes due to IGBT switching.

E. Motor enclosures as a minimum shall be open drip proof type indoors and TEFC type outdoors. As a minimum the motor enclosure shall be as recommended by the manufacturer for the application. For fan motors installed in the air stream by the fan manufacturer the motor enclosure shall be TEAO unless otherwise recommended by the manufacturer. For NEC hazardous locations motor enclosures shall be rated for the division, class and group indicated or required.

1.39 STARTER AND MOTOR CONTROLS

A. Provide a suitable starter, one per motor, for control of each motor furnished under this Division. All motors 3/4 horsepower and larger require magnetic or electronic starters, no exceptions. All motors of any size that are automatically controlled require "Hand-Auto" or "Hand-off-Auto" magnetic or electronic starters, no exceptions. All magnetic and electronic starters shall have H-O-A switches.

B. Provide each motor that does not require a starter, a manual starting switch with thermal overload protection with identifying nameplate, green pilot light and stainless steel cover plate equal to Westinghouse Type MS, General Electric, Square D, Siemens, or as approved by the A/E. Switches installed on finished walls shall be flush type.

C. Starter shall have overload protection on all phases. This will require three overload relays for three phase motors and one overload relay for one phase/line voltage motor. Provide NEMA 1B control voltage transformer, "on" green pilot light, and 1-normally open and 2-normally closed auxiliary contacts on each starter, unless otherwise noted.

D. Certain starters and motor controls for motors furnished under this Division are scheduled on the Drawings to be elements of motor control centers provided under Division 26. Except for those scheduled starters, provide a suitable starter for control of each motor furnished under this Division.

E. Each starter shall have a capacity rating within the required limits of the motor, which it serves; it shall have overload elements selected to provide protection for the motor.

F. Where a combination starter and disconnect switch or starter and circuit breaker in a common enclosure is scheduled, provide auxiliary contacts on the switch or breaker as required to assure that, when the disconnecting means is open, there are no "live" contact points on the starter.

G. Where a holding coil voltage differs from line voltage, install a transformer with secondary fusing in the starter enclosure.

H. Unless otherwise indicated, furnish starters mounted indoors with NEMA Type 1 enclosures; and furnish those exposed to the weather with NEMA Type 3R enclosures.

I. Where starters are not installed in heated and cooled spaces, the heater elements shall be of the ambient temperature-compensated, bimetallic type.

J. All motor starters and control devices shall be of make and manufactured by one of the following: General Electric, Square D, Siemens, Westinghouse, or as approved by the A/E.

1.40 SAFETY GUARDS

A. Provide and install a belt guard covering the entire drive assembly for each belt drive equipment item

provided under this Contract. Use factory assembled belt guards when they are available. Where a guard must be fabricated, rigidly construct it with a sheet metal rim and aside panel of sheet metal or 2 inch metal hardware cloth, with openings for tachometer insertion. Size each guard to permit full travel of the motor slide rails for belt tightening and install each guard so as to permit removal for servicing the drive.

B. Guards shall also be installed to protect all projecting shafts and all rotating shafts, couplings, keyways, etc. Generally, these shall be formed of not lighter than 18-gauge galvanized steel bent to the proper shape and secured in place using removable fastening devices.

1.41 OPERATING INSTRUCTIONS

A. Instruct the HACP operations and maintenance personnel in the proper operation of all equipment items of systems.

1.42 OPERATION PRIOR TO COMPLETION

A. When any piece of mechanical or electrical equipment is operable and it is to the advantage of the Contractor to operate the equipment, Contractor may do so with permission of the Housing Authority of the City of Pittsburgh (HACP), providing that Contractor properly supervises the operation and protects against dirt accumulations during operation. The warranty period shall, however, not commence until such time as the equipment is operated for the beneficial use of HACP, or until final acceptance by HACP.

B. Regardless of whether or not the equipment has or has not been operated, Contractor shall properly clean the equipment, install clean filter media, and properly adjust the operation of the equipment before final acceptance by HACP.

1.43 MANUALS

A. Upon completion of the Work, provide to the A/E for delivery to the HACP Project Manager, four (4) copies of a bound manual or manuals of equipment, machinery and/or apparatus furnished under this Division of the Specifications. This shall include revised material from shop drawing submittals showing numbers, sizes and ratings of equipment actually installed together with any descriptions as to methods of installation. It shall also include manufacturer's service and maintenance data, warranties, guarantees, etc.

B. Bind data in loose leaf, hardback ring binders sized for 8 1/2 by 11 inch sheets. Provide sufficient binders so that no binder will be over 3 1/2 inches thick and no more than 67% full.

1.44 RECORD DRAWINGS

A. The Contractor shall record up to date information at least once a week and retain the set of prints on site for periodic review by the A/E. The record drawings shall indicate the location of all equipment and devices, and the routing of all systems. If the Contractor prepared large-scale installation drawings of mechanical rooms, pipe routing, duct routing, etc., these drawings or reproducible sepias therefrom shall be revised as required to accurately illustrate the actual installation. All pipe buried below concrete slab, walls and below grade shall be located by dimension; both horizontally and by vertical elevation.

1. Should the Contractor prepare large-scale installation drawings of mechanical rooms, these drawings or reproducible sepias therefrom shall be revised as required to accurately illustrate the actual installation.

2. All pipes buried in the ground or beneath floors on grade shall be accurately located both

horizontally and vertical elevations.

3. Upon completion of the Work, the record drawings shall be delivered to the A/E.

B. Upon anticipated completion of the Work, the Contractor shall accumulate and compile in duplicate hard copies, all construction related documentation.

1. The hard copy shall consist of the following:

a. Two (2) complete reproducible sets of the original drawings on which to neatly, legibly, and accurately transfer from the working set of bluelines described above all project related notations to accurately reflect the as-built condition. The second, and any subsequent copies, may be made from the reproducible copy. These record drawings shall be delivered to the A/E for review and subsequent delivery to the HACP Project Manager at job completion. This information shall be delivered prior to final acceptance and final payment.

b. Three (3) indexed 3-ring looseleaf, hard-back sets of binders sized for 8 ½ inch by 11 inch (and folded 11 inch by 17 inch) sheets. No binder shall exceed 3 ½ inches thick. The data shall be turned over to the A/E for review and subsequent delivery to the HACP Project Manager. The information shall be delivered prior to final acceptance and final payment. The data within the binder shall include the following:

1) Warranties, guarantees, and manufacturer's directions on material, equipment and devices covered by the Contract.
2) Approved wiring diagrams and control diagrams.
3) Copies of approved submittals and shop drawings.
4) Operating instructions and recommended maintenance procedures for major apparatus.
5) Copies of all other data and drawings required during construction.
6) Repair parts list of major apparatus, including name, address, and telephone number of local supplier or representative.
7) Tag charts and diagrams hereinbefore specified.

END OF SECTION 22 00 00

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SECTION 22 05 00 – BASIC MATERIALS AND METHODS: PLUMBING AND MECHANICAL

PART 1 - GENERAL

1.1 SUMMARY

A. Refer to other Sections of the Specifications for related Work, materials and procedures that are applicable hereunder.

B. This Section is pertinent to labor, material, equipment, and service involved in the installation of basic materials.

C. Each piping system shall be complete with pipe, fittings, joining materials, valves, cocks, hangers, supports, and other accessories; prove tight under test; repair leaks; clean.

D. All items shall be suitable for the pertinent system's pressures and temperatures and the fluid within including chemical treatments.

PART 2 - PRODUCTS

2.1 PIPE AND FITTINGS

A. The following tabulates the description of various piping materials and applicable standards:

DESCRIPTION	STANDARD
Cast iron water pipe for 250 PSI internal pressure, thickness per ANSI A21.50 for laying condition "B" with 8 feet of cover.	ANSI A21.6 or ANSI A21.8
Cast or ductile iron water pipe fittings Class 250	ANSI A21.10
Rubber gaskets for joining cast or ductile iron water lines	ANSI A21.11
Cast iron bell and spigot or bell and plain end soil pipe and fittings	ASTM A-74
Steel pipe, black and galvanized	ASTM A-120
Steel welding fittings	ANSI B16.9
PVC, SDR-26, Class 160 and SDR-21, Class 200	ASTM D-2241 and ASTM D-1784
PVC Schedule 40, DWV	ASTM D-2665

Cast iron drainage fittings, threaded	ANSI B16.12
Brass or bronze flanges and flanged fittings (150 and 300 pounds)	ANSI B16.24
Seamless copper water tube, Type K, L, and M	ASTM B-88
Seamless copper drainage tube, Type DWV	ASTM B-306
Pipe threads	ANSI B2.1

2.2 UNIONS

A. Brass: Screwed, ground joint.

B. Dielectric Type: As hereinafter specified.

2.3 FLANGES

A. In cold water lines flanges shall be flanged nipples with 125 pound cast iron flanges. Provide 250 pound flanges where required.

B. In piping assembled using screwed joints, use 125 pound screwed-on cast iron flanges. Provide 250 pound flanges where required.

C. In welded piping systems, flanges shall be 125 pound forged steel welding neck pattern. Provide 250 pound flanges where required.

D. Where the above flanges connect to flat-faced flanges on valves, items of equipment, etc., the companion flange shall be flat faced and where the flanges on items of equipment are raised face flanges, the companion flanges shall have raised faces.

E. Flanges in copper lines shall be solder-joint type brass flanges.

2.4 GASKETING

A. Rubber: Garlock No. 24 Wire Insertion Red Rubber Sheet, Johns-Manville Rubber Sheet, or Architect/Engineer (A/E) approved equal: 1/16" thick.

B. Non-Asbestos: Johns-Manville compressed sheet, Garlock compressed sheet, or A/E approved equal: 1/16" thick.

C. Dielectric: As furnished with the flange for this application.

D. Other Material: As provided and/or recommended for the duty.

2.5 MECHANICAL COUPLINGS

A. No-Hub Cast Iron Joint: Neoprene sealing sleeve, corrugated stainless steel shield and attached bands with individual tightening device; complying with CISPI 310.

2.6 VACUUM BREAKER

A. Watts No. 800, anti-siphon pressure type, Zurn, or A/E approved equal (for continuous pressure) with test cocks and gate valves on each side.

2.7 SHOCK ARRESTOR

A. Plumbing Drainage Institute (PDI) rated shock arrestor (absorber) of Josam, Smith, Wade; Zurn; or A/E approved equal.

B. Acceptable Substitution: Arrestor of Precision Plumbing Products, Inc.; Zurn; or A/E approved equal.

2.8 PIPE SEALS

A. Mason-Dallas "Pipe Linx" ; Thunderline "Link-Seal"; or A/E approved equal, mechanical type.

2.9 PIPE FLASHING FOR BUILT-UP ROOFS

A. Sheet lead; minimum weight of 4 pounds per square foot.

2.10 VALVES

A. Model numbers listed are to establish quality and type.

B. Acceptable manufacturers are:

1. Iron body valves: Nibco; KITZ; Crane; Combination Pump and Valve (CPV) Company; or Architect/Engineer (A/E) approved equal.

2. Bronze body valves: Nibco; KITZ; Milwaukee; Kennedy; Combination Pump and Valve (CPV) Company; or A/E approved equal.

3. Ball valves: Nibco; KITZ; Apollo; Watts; Milwaukee; or A/E approved equal.

C. Butterfly Valves:

1. Acceptable Manufacturers: Nibco; KITZ; Crane; Centerline; Grinnell; and Hammond; or A/E approved equal.

2. General: Valves shall be Nibco LD 2000 or KITZ 6122 Series, or A/E approved equal, full lug or grooved body style manufactured in accordance with MSS-SP67 rated at least 200 psig non-shock cold water working pressure. Body to have 2 inch extended neck for insulating and to be ductile iron. Valve to have aluminum bronze alloy disc with EPDM rubber seat and seal; or EPDM rubber encapsulated disc with polymer-coated body. Stem shall be 400 series stainless steel. Lug-style and grooved style shall be capable for use as isolation valves and recommended by manufacturer for dead-end service at full pressure without the need for downstream flanges.

D. Rising Stem Gate Valves:

1. General:

a. Sizes 2½ inches and smaller: Acceptable manufacturers: Nibco, KITZ, or Milwaukee; or A/E approved equal. Shall be Nibco No. T-134, KITZ #42 Bronze, screwed ends and Nibco No. S-134, KITZ #43 solder joint ends. Valves shall be suitable for 150 psig steam - 300 psig W.O.G. working pressure.
b. Sizes 3 inches and larger, Water Service: Acceptable manufacturers: Nibco, KITZ, Crane, Milwaukee; or A/E approved equal. Shall be Nibco No. F-617-0, KITZ #72 iron body, bronze mounted, flanged ends. Valves shall be suitable for 125 psig steam and 250 psig W.O.G.
c. Sizes 3 inches and larger, Steam Service: Acceptable manufacturers: Nibco, Crane, Grinnell, Milwaukee; or A/E approved equal. Shall be Class 150, Nibco No. F-637-31 and have B-61 bronze trim and seat with a ductile iron body and flanged ends. Cast steel class 150 valves with 13% cr/hard faced trim may be substituted KITZ 150 SCLS.

E. Globe Valves:

1. Sizes 2½ inches and smaller: Acceptable manufacturers: Nibco, KITZ, Milwaukee, Kennedy; or A/E approved equal. Shall be bronze body. Bronze with stainless steel trim Nibco No. T-256AP, and KITZ #17S suitable for 200 psig steam - 400 psig W.O.G. threaded ends and No. S-235Y, solder joint ends.

2. Sizes 3 inches and larger: Acceptable manufacturers: Nibco, Crane, KITZ, Milwaukee; or A/E approved equal. Shall be iron body, bronze mounted. Iron body valves for steam service shall be Nibco No. F-738-31 and have B-61 bronze trim and seat with a ductile iron body and valves shall be Class 150. Cast steel class 150 valves with 13% cr/hard faced trim may be substituted KITZ 150 SCJS.

F. Ball Valves:

1. General: Acceptable manufacturers: Nibco, KITZ, Apollo, Watts, Milwaukee; or A/E approved equal. Valves shall be full port with stainless steel ball and stem and rated for 150 psig steam and 600 psig w.o.g. working pressure. Bronze valves with more than 15% zinc are not acceptable.

a. Sizes 2½ inches and smaller: Shall be Nibco T-585-70-66, KITZ 68M screwed ends; No. S-585-70-66, KITZ 69M solder joint ends; or A/E approved equal.
b. Sizes 3 inches and 4 inches: Shall be Nibco F-515 CSF-66 flanged ends; KITZ 150 SCT BZM; or A/E approved equal.

G. Non-Slam Check Valves:

1. Sizes 2 inches and smaller: Combination Pump Valve (CPV) Company No. 36; Watts; or A/E approved equal, with bronze body, nylon disc and stainless steel guide, retainer and spring.

2. 2½ inches and larger: Combination Pump Valve (CPV) Company No. 10D-R or 20D-R; Watts with iron body, or A/E approved equal, bronze trim and stainless steel spring. Valves shall be bolted lug pattern type and suitable for 200 psig W.O.G. working pressure.

H. Swing Check Valves

1. Sizes 2 inches and Smaller: Acceptable manufacturers: Nibco, KITZ, and Milwaukee; or A/E approved equal. Bronze valve suitable for 200 psig steam and 400 psig w.o.g. working pressure. Nibco T453-B, KITZ #19 threaded ends or Nibco S-433-Y, KITZ #30 solder ends; suitable for 150 psig steam - 300 psig w.o.g.

2. 2½ inches and Larger: Acceptable manufacturers: Nibco, KITZ, Crane, and Milwaukee; or A/E approved equal. Valve shall be equal to Nibco F-918-31; Zurn; or A/E approved equal ductile iron body, bronze trimmed and flanged ends. Valves shall be suitable for 150 psig steam and 250 psig w.o.g. working pressure.

I. Fire Protection Line Valves: UL listed, FM approved, 175 psig cold water, non-shock. Gate valves 2½ inches and larger: Nibco; Crane; or A/E approved equal; iron body, bronze fitted, screwed pattern. Check valves 2½ inches and larger: Nibco; Crane; or A/E approved equal; iron body, bronze fitted, flanged pattern. Ball drip ½-inch; brass, screwed pattern.

J. Balancing Valves: Griswold; Flow Design, Inc. Model 'AS'; or A/E approved equal, flow balance valves with combination ball valve, pressure taps, with Bronze housing.

K. Medical Gas Systems: Ohio Medical Products; Zurn; or A/E approved equal; complying with NFPA Standards; 300 pound with bronze body, Buna-N or Teflon seats and stem seals; bubble tight seating chrome plated brass ball; swing away center; ½-inch turn to open or shut; 10-inch Type K copper tubing extensions, both ends; washed and capped for Oxygen service; color coded label for gas controlled.

L. For control applications, ball valves shall be used to a maximum of 4 inches with butterfly valves on 6 inches and above. For service applications, ball valves shall be used on lines 4 inches and smaller, rising-stem gate valves or butterfly valve with gear operator on 6 inches and larger.

M. All valves shall be equipped with a 1-inch diameter brass tags with indented numerals. Tags shall be provided with adequate link chain with which to secure them to valves. A chart shall be provided with valve numbers and reference service.

2.11 COCKS

A. Manufacturer's names and numbers are to set standards. Valves to be suitable for 150 psig steam and 600 psig W.O.G.

B. Plug Cocks

PLUG TYPE	SIZE (INCHES)	MANUFACTURER
Screwed Ends	½-inch and smaller	Crane; Grinnell; Rockwell; Or A/E approved equal
Lubricated, Screwed Ends	1 inch to 2 inches	Rockwell; Zurn; Crane Or A/E approved equal
Lubricated, Flanged Ends	2 inches and larger	Rockwell; Zurn; Crane Or A/E approved equal

1. Fill lubricated plug cocks with proper lubricant for application and furnish with wrench with setscrew.

C. Pet Cocks: Crane; Rockwell; or A/E approved equal; bronze, lever handle.

D. Gauge Cocks: Jomar ¼-inch Model 82 ball valves, Rockwell; or A/E approved equal.

2.12 STRAINERS

A. Full flow, Wye type; minimum 150 PSIG working pressure; iron body with blow-off; 2 inches and smaller threaded, and 2½ inches and larger flanged; stainless steel screen that is standard material and perforation sizes for the duty, or A/E approved equal.

2.13 SNUBBERS

A. Weksler No. RS-1 bronze, pressure type; Miljoco No. 1200; Dwyer Instruments Series PS; or A/E approved equal.

2.14 SIPHON FITTING

A. Weksler Type AO3B; Miljoco No. 1300, threaded brass pipe with full loop; or A/E approved equal.

2.15 EXPANSION JOINTS

A. Expansion joints shall be Pathways; Miljoco; Rockwell; or A/E approved equal; with flanged end, self-equalizing type stainless steel joints with stainless steel liners and monel sleeves.

2.16 AIR VENTS

A. Manual shall be as manufactured by Armstrong; Crane; or A/E approved equal.

2.17 FLEXIBLE PIPE CONNECTIONS

A. Flexible pipe connections shall be equivalent to metraplex metrasphere style R; Zurn; or A/E approved equal, suitable for 225 PSI and 240°F. Flexible connector shall be constructed of neoprene and nylon with cadmium plated solid plated steel flanges.

B. Connectors in pipes 8 inches and larger shall be provided with rods.

C. Provide only where indicated.

2.19 PIPING HANGERS AND SUPPORTS

A. General: Pipe hanger and support materials, including accessories, are to be, unless otherwise specified, in accordance with the Manufacturers Standardization Society (MSS) Standard Practice Manual SP-58, Pipe hangers and Supports-Materials, Design and Manufacture, and where possible, MSS designations are indicated with each product specified below. Conform to the following requirements:

1. unless otherwise specified, all ferrous hanger and support products are to be electro-galvanized;

2. hangers and supports for insulated piping are to be sized to fit around the insulation and the insulation jacket.

B. Horizontal Suspended Piping: Hangers and supports are to be:

3. adjustable steel clevis hanger – Anvil Fig. 260 – MSS Type 1; or A/E approved equal

4. adjustable swivel ring band type hanger – Anvil Fig. 69 – MSS Type 10; or A/E approved equal

C. Horizontal Pipe On Vertical Surfaces: Supports are to be:

5. steel offset pipe clamp – Anvil Fig. 103; Myatt Fig. 170; or A/E approved equal

6. heavy-duty steel pipe bracket – Anvil Fig. 262; Myatt Fig. 161 – MSS Type 26; or A/E approved equal

7. single steel pipe hook - Myatt Fig. 156; or A/E approved equal

PART 3 - EXECUTION

3.1 INSTALLATION OF PIPING

A. Piping shall be installed by skilled mechanics using designated basic materials plus any required supplementary materials.

B. Run each line straight and true; minimum grade noted (or required by code); where exposed run parallel to building planes grading for proper drainage and venting.

C. Install each run essentially as indicated as to location, direction and size. Cut to measurements established at the site and work into place without forcing or springing.

D. Anchor lines to the building where indicated or required to prevent excessive movement or vibrations.

E. Provide each piping system with loops, bends, expansion joints and/or flexible connections as required to compensate for expansion and/or contraction in that piping system.

3.3 JOINING PIPING

A. Use manufacturer's recommended procedures and follow all code requirements in joining piping materials. Make square end cuts using proper tools and aligning devices. Ream and deburr pipe ends; smooth rough surfaces; clean mating parts.

B. Change sizes using properly sized fittings and/or reducers (or increasers); use no long screws or bushings. Change materials using suitable connectors or adapters.

C. Joining mitered pipe ends to form an elbow or connecting into a notched opening in a pipe run to form a tee shall not be permitted.

D. Threaded Joints: Full cut threads; assemble using an approved compound applied to male threads only; not more than 3 threads shall remain exposed when the joint is completed.

E. Welded Joints: All joints shall be fusion welded by a metallic arc or gas welding process. Pipe ends shall be beveled 37½°. All welding operations shall conform to the latest recommendations of the American Welding Society or to the applicable provisions of the Code for Pressure Piping, ANSI B31.1, latest edition, amended to date.

1. Weld rods shall be of the proper type for each application to match the line materials.

2. Written certification shall be provided that every welder employed on the job has passed qualification tests as prescribed by the National Pipe Welding Bureau or other reputable testing laboratory acceptable to the Housing Authority of the City of Pittsburgh (HACP) using qualification procedures as set forth in the ASME Boiler Construction Code, Section IX, or American Welding Society Standard B3.0-41T. If the A/E so requests, each welder shall prepare test coupons which shall be tested in an approved independent testing laboratory and any defects found shall be cause for dismissal of the welder from the Project. All cost of such tests shall be borne by the Contractor.

3. Branch takeoffs not larger than 2/3 of the main may be made using shaped nipples, Weldolets, or Threadolets to match branch line fabrication methods.

F. Bolted Joints: Pull up evenly all around on bolts or nuts to secure uniform tightening; use torque wrenches where recommended.

G. Rubber Gasket Joint: Force gasket in place; Rockwell; Zurn; or A/E approved equal.

H. Tongue and Groove Pipe: Apply a non-asbestos based primer, then apply Ram-Nek; Weksler; or A/E approved equivalent plastic joint sealing compound and press tongue and groove joint ends together; alternatively prime with Talcote No. 041 primer; Weksler; or A/E approved primer, and seal with Talcote No. 052 cold plastic; Weksler; or A/E approved sealant, and press together per American Petrofina recommendations.

I. No-Hub Cast Iron: Join using a neoprene sealing sleeve, stainless steel corrugated shield, and stainless steel bands with tightening device for each band; bands fastened to shield. Joint fabrication to comply with CISPI Standard 301.

J. Soldered and Brazed Joints: Use solders joint fittings in copper tubing lines; take care not to anneal tubing and fittings.

1. Medical Gas Lines: Use Pre-cleaned tubing and fittings; assemble using Handy & Harmon's Sil-Fos; equivalent make B Cup-5 brazing material; or A/E approved equal.

a. Oxygen, Nitrous Oxide, Clinical Compressed Air and Nitrogen Lines: If a flux is desired, use Handy & Harmon's "Handy" borax mixed with water; Zurn; or A/E approved equal
b. Clinical Vacuum Lines: If a flux is desired, use Handy & Harmon's "Handy" borax mixed with water; Zurn; or A/E approved equal.
c. Other Copper Piping Systems: Make all other joints in copper tubing systems using solid string or wire solder and a non-acid paste flux of the proper type for each application. Drain lines and compressed air lines for temperature regulation shall be joined using a non-lead solder. Water lines shall be jointed using 95-5 tin-antimony. "Sil-Fos" solder, Rockwell, or A/E approved equal shall be utilized on all copper line joints that are installed below the floor slab.

2. Copper Tubing Joints shall be made with solder-joint fittings. Tubing shall be cut square, and burrs shall be removed. Insides of fittings and outsides of tubing shall be well cleaned with steel wool, steel brushes, and/or emery cloth before assembly. Care shall be taken to prevent annealing or fittings and hard drawn tubing. Installation shall be made by skilled mechanics in accordance with the material manufacturer's recommendations. Mitering of joints for elbows and notching of straight runs for tees will not be permitted. All joints shall be made with solid string or wire solder. Fluxes shall be non-corrosive pastes of the proper type. Solder shall be lead free. No cored solder will be permitted.

K. Miscellaneous Joints: Make special joints as recommended by the manufacturer of pipe and fittings to connect dissimilar materials, to connect to items of equipment, etc.

3.4 PIPING MATERIALS

A. Materials to be utilized in each piping system shall conform to the standards established in this Section, but the particular application shall generally be as described in other Sections.

B. Materials and applications that may be used in multiple disciplines may also be described herein and apply to more than one subsequent section.

3.5 COPPER FITTINGS

A. Use wrought copper solder joint type in all patterns and sizes available. Use long radius copper elbows wherever available and space will permit.

3.6 WELDING FITTINGS

A. Welding Fittings: All fittings in welded lines shall be factory-fabricated welding fittings. They shall be of the same material and the same weight or Schedule as the piping. All elbow tees, caps and special fittings including connections into headers shall be standard butt welding fittings, conforming to ANSI B16.9, with the following exception: Branch take-offs from lines 2½ inches and larger and where the size of the takeoff does not exceed 2/3 of the normal diameter of the mains to which connected, may be made with shaped nipples or with Bonney Weldolets; Threadolets; Rockwell; or A/E approved equal, as required by the class of fabrication. Mitering of pipe to form elbows, notching of straight runs to form tees, or any similar construction will not be permitted.

3.7 FLANGES

A. At connections to flanged valves and equipment outlets in steel piping systems using welding neck, slip on welding flanges, screwed steel, or cast iron companion flanges.

1. It will be permissible to use cast iron flanged fittings at connections to equipment items.

B. In grooved end piping systems use matching flanged adapter nipples.

C. In copper lines use brass flanges.

D. Connecting flanges shall have matching flat or raised faces. Faces shall be free of imperfections that would prevent proper seating.

E. Tighten bolts uniformly all around to prevent any stress.

3.8 GASKETS

A. Cut from proper materials as hereinafter listed, full-faced type for flat-faced flanges and ring type for raised-faced flanges.

1. Water Lines: Red rubber sheeting.

2. Steam and Condensate Return Lines: Non-asbestos sheeting.

3. Dielectric Flanges: As provided with the flanges.

4. Other Lines: As recommended for the duty.

3.9 UNIONS

A. Provide in ferrous and brass screwed piping systems where indicated and/or as required to permit installation and removal of equipment, valves, specialties, etc. In copper lines, install only where shown or specified.

3.10 PIPE CAPS

A. Provide Swage lock fittings; Rockwell; or A/E approved equal, for all capped pipes in medical gas lines.

3.11 PIPE GRADING

A. General: Grade each system in accordance with good established practice to avoid air pockets, to relieve liquids and vent gases. Grade uniformly between indicated elevations or at indicated slope. Slopes shown on plans shall take precedence over any listed herein.

B. Steam and Condensate Return Lines: Grade to insure steam delivery to and discharge of condensate from utilizing devices. Minimally grade steam and condensate return lines down 1 inch in 40 feet when graded down in the direction of flow. Grade steam lines down 1 inch in 20 feet when back-graded. Do not back grade steam piping without permission of the A/E. Where horizontal mains change size, keep the bottom of the coupled pipes on the same level using eccentric couplings. Grade steam relief and vent lines back to receiver or other device installed to eliminate tapping float trap.

C. Heating, Chilled and Dual Temperature Water Circulating Lines: Lay on an even slope; grade to drain at a valve at the circulating pump whenever possible; where other low points are unavoidable, provide service drains. Where horizontal mains change size, keep the tops of the coupled pipes on the same level using eccentric couplings.

D. Above Ground Fire Protection Piping: Grade to drain in accordance with NFPA standards.

E. Domestic Water Lines: Grade so that systems can be drained through fixtures or to valved drains at low points.

F. Sanitary Waste and Drain Lines: Grade down in the direction of flow with a uniform grade conforming to the requirements of the Plumbing Code, but not less than 1/8-inch per foot.

G. Vent Lines: Grade each up to a terminal, but not less than 10 inches above the roof and as indicated.

H. Sanitary Vent Lines: Grade each up to a terminal, but not less than 10 inches above the roof.

I. Gas Lines: Run in accordance with the requirements of the Plumbing Code and Gas Company.

J. Gas Relief and Vent Lines: Grade up from the device to the point of discharge.

K. Compressed Air Lines: Grade downward to the system receiver and outlets wherever possible. Where another slope must be used, grade down to a scale pocket and drain at low point.

L. Oxygen and Nitrous Oxide Lines: Lay as level as possible; elevation changes are permissible.

M. Clinical Vacuum Lines: Grade back to receiver wherever possible. Where another slope must be used, drain down to a valved drip leg discharging open site.

N. Nitrogen Lines: Lay as level as possible; elevation changes are permissible.

O. Equipment Drains: Each line from a relief valve, air vent valve, separator or a boiler, drip pan elbow, exhaust head, heat exchanger, compression tank, receiver, pump base, air conditioning unit pan, air washer overflow and drain, evaporator pan, and similar drain shall grade down to a point of open sight discharge and/or as indicated on the Drawings.

3.12 TESTING

A. All test results shall be submitted to the HACP Project Manager and to the A/E. Provide all tests required by acceptable codes.

B. Test piping prior to backfilling, concealing, insulating or painting; isolate pressure sensitive equipment from tests.

1. Test portions as required by construction schedule. When previously tested sections are expanded, retest at connections.

2. Test new portions as required by construction schedule; test new connections into existing lines.

C. If pressure losses occur during tests, use suitable procedures to discover leaks, correct and retest. Repeat until system is tight.

D. All other systems shall be tested hydraulically using water as the fluid for a 4-hour period.

E. Furnish all compressed air, vacuum, and water pumps; tanks of compressed air, nitrogen, carbon dioxide, refrigerant, gauges, plugs, seals, etc., as required to obtain, maintain and measure pressures during tests.

F. Pressure tests shall be applied to the various systems per governing codes, or if not addressed in the codes, shall be as scheduled below:

PIPING SYSTEM	TEST PRESSURE (PSIG) (Minimum 1½ times Working Pressure)
High Pressure Steam (Above 15 PSIG)	200
Low Pressure Steam (15 PSIG & Below	100
Gravity Steam Condensate Returns	100
Heating, Chilled and Condenser Water	150
Fire Protection	200
Domestic Water	150
Clinical Vacuum	150

PIPING SYSTEM	TEST PRESSURE (PSIG) (Minimum 1½ times Working Pressure)
Nitrogen	300
Gas, Between Gas Co's and HACP's Regulators	50
Compressed Air	150
Gas, On Load Side of HACP's Regulator	15
Gravity Waste Drain and Vent	5

Pumped Steam Condensate Return	200
Refrigerant	450
Oxygen, Nitrous Oxide and Carbon Dioxide, and Clinical Compressed Air pressure.	1½ times working Minimum: 150 PSIG. See NFPA No. 99F.

3.13 REPAIRS

A. Effect repairs as recommended by the manufacturer of the pipe and fittings materials; replace any defective materials. When procedures involve additional work on a joint and they fail, remake the joint. Repair operations shall include:

1. Screwed Joints: Additionally tighten.
2. Caulked Joints: Additionally caulk.
3. Welded Joints: Chip out old weld metal and reweld.
4. Compression Joints: Reclean; replace seal, compression rings, couplings, etc.
5. Mechanical Joints: Reclean; additionally tighten.
6. Fused Joints: Additionally fuse, with clamping.
7. Soldered or Brazed Joints: Remake joint, no additional soldering or brazing allowed.
8. Solvent Weld Joints: Cut out material and replace entirely.

3.14 CLEANING

A. Clean all previously existing and new piping systems and components prior to putting into service.

B. Heating and Dual Temperature Water Systems: Fill the entire system with a solution consisting of one pound of caustic soda or 3 pounds of trisodium phosphate per 100 gallons of water; heat to 150^{o}F and circulate for 48 hours over at least a 3 day period; drain, flush with fresh water and refill with fresh water to which adequate amounts of suitable chemicals have been added.

C. Chilled and Condenser Water Systems: Fill the entire system with a solution consisting of one pound caustic soda or 3 pounds of trisodium phosphate per 100 gallons of water; circulate for 60 hours over at least a 5 day period; drain, flush with fresh water and refill with fresh water to which adequate amounts of suitable chemicals have been added.

D. Steam and Condensate Return System: Clean all fittings and pipes before installation. After installation, blow out all steam lines with steam and repeat as necessary to insure all foreign particles are removed.

E. Blow off all strainers.

F. Domestic Water Lines: Flush with fresh water, opening and closing flush valves and faucets until water runs clear.

G. Waste and Drain Lines: Swab out lines; flush with fresh water.

H. Compressed Air and Clinical Vacuum: Swab out when installing where size and arrangements will permit; blow clean using nitrogen or oil free compressed air.

I. Oxygen, Nitrous Oxide, Clinical Compressed Air and Nitrogen and Carbon Dioxide: Swab out when installing, where size and arrangements will permit; blow clean using nitrogen.

J. Repetition: Repeat the above procedures until all parts of each piping system is thoroughly cleaned of all foreign materials.

3.15 PURGING

A. When systems for medical gases, natural gas, and compressed air have been tested and proven tight, disconnect sources of test gases and connect proper sources. Proceeding from the nearest to the most remote outlet on each system, open the outlets until the proper gas flows, then close the outlet.

B. Run tests on each outlet to confirm the presence of the desired gas; use an oxygen analyzer to confirm proper purity in the oxygen system.

3.16 FLEXIBLE PIPE CONNECTORS

A. Provide where shown on the Drawings but generally in suction and discharge lines to all base mounted pumps, at supply and return connections to all cooling and heating coils.

3.17 VALVES

A. All valves shall be installed to be accessible to HACP operations and maintenance personnel.

B. All valves shall be installed in accordance with manufacturer's installation instructions

1. Before installation, check line of flow through valve so that valve will function properly
2. Before installation, review manufacturer's installation instructions to prevent damage to valve and to ensure maximum efficiency
3. Close valve completely before installation
4. For cut tubes, ream, burr, and size as appropriate
5. Use sand cloth or steel wire brush to clean tube ends to a bright metal finish. Do not use steel wool.
6. Flux, braze, and/or solder as necessary. Remove excess solder

END OF SECTION 22 05 00

SECTION 22 07 00 – PLUMBING INSULATION

PART 1 - GENERAL

1.1 SCOPE OF WORK

A. Provide labor, materials, equipment, tools and services, and perform operations required for, and reasonably incidental to, the providing of insulation, including all related systems and accessories.

1.2 RELATED REQUIREMENTS

A. Comply with other Division 22 Sections, as applicable. Refer to other Divisions for coordination of Work.

1.3 REFERENCE STANDARDS

A. Insulation, jackets, coatings, etc., shall be manufactured in accordance with the following standards:

1. All insulation systems (insulation, mastic, jacket or facing, finishes and adhesive) shall have composite fire and smoke hazard ratings as tested by Procedure ASTM E-84, NFPA 255 and UL 723 not exceeding the indices: Flame Spread of 25 and Smoke Developed of 50. Accessories, such as adhesives, plastics and cements, shall be UL listed, non-flammable when wet with component fire and smoke hazard ratings not exceeding the above indices.
2. Insulation thickness and values shall be in compliance with all applicable Energy Code.

1.4 SUBMITTALS

A. Submit product data and shop drawings in accordance with Section 00 60 00, PRODUCT REQUIREMENTS.

B. Submit for review the types and thicknesses of insulation proposed for use on the various piping systems, vessels and equipment items specified to be covered. Include substantiation of the various thicknesses offered and manufacturer's data sheets on insulating materials, jackets, facings, finishes and accessories indicating compliance with specified composite and component fire and smoke hazard ratings.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Owens-Corning

B. Johns-Manville

C. Pittsburgh-Corning

D. Certain Teed Manson

E. Knauf Fiberglass

F. Or as approved by the Architect/Engineer (A/E).

2.2 BASIC INSULATION MATERIALS, FITTINGS, FINISHES

A. Insulation materials shall conform to the following requirements:

	Type	Maximum K Factor @ 75°F	Temp. Limit-°F	Density Lb.Per Cubic Foot	Federal Spec. Compliance
1.	Calcium Silicate	0.38	1200	14	HH-I-523C
2.	Fiberglass (Rigid)	0.23	450	3	HH-I-558B
3.	Fiberglass Flexible Duct Wrap	0.25	250	3/4	HH-I-558B
4.	Foamed Glass (Cellular)	0.36	850	9	HH-I-1751/3A
5.	Foamed Plastic (Flexible)	0.25	220	5	HH-I-573
6.	High Temperature Fiberglass	0.23	850	3	HH-I-558B
7.	Insulating Cement	0.70	1700		SS-C-160
8.	Mineral Wool Rigid Wrap w/ASJ (Paroc Basalt)	1050			

B. Fittings & Valves (Types)

1. Fiberglass: Preformed PVC fitting covers with flexible inserts for 2" and smaller piping and with rigid one piece (half-shell) preformed fiberglass fitting of the same or greater material thickness for 2½" and larger piping, density and conductivity as the adjoining pipe covering equal to Pro-Tec-T-Kote fittings, Benjamin Foster, or A/E approved equal.
2. Fiberglass: Field fabricated fitting covers of same or similar material as pipe covering with preformed rigid inserts as specified above.
3. Cellular glass: Use mitered sections of cellular glass.

C. Finishes (Types)

1. 8-ounce glass cloth.
2. Insulation cement.
3. 0.016 aluminum, plain, up through 12" pipe size; 0.016 aluminum, corrugated, for pipe sizes 14" and larger.
4. 15-mil PVC.
5. Foil/reinforced/kraft jacket (vapor barrier).
6. 1/4-inch weatherproof mastic with glass mesh reinforcement.
7. 1/16" vapor barrier mastic (0.05 perm rating) with glass mesh reinforcement.
8. White all-service jacket (vapor barrier) with self-sealing lap, or taped joints.
9. Two coats vinyl lacquer type white paint.
10. Canvas jacketing of 6 oz. Minimum, 100% cotton woven fabric with 25/50 flame/smoke rating and equal to Fattal's Thermocanvas Recovery jacket; Rockwell; or A/E approved equal.

2.3 MISCELLANEOUS MATERIALS

A. Adhesives: Benjamin Foster 85-10 or 85-15; Insul-Coustic I-C 201; or A/E approved equal.

B. Linear Attaching Devices: Graham weld pins; Benjamin Foster Stic-clips and sheet metal clips; or A/E approved equal

C. Mastic: Benjamin Foster 30-60; Insul-Coustic 110; or A/E approved equal.

PART 3 - EXECUTION

3.1 GENERAL

A. Materials shall be applied by a qualified insulation applicator/workman skilled in this trade. Insulation shall be installed in accordance with the manufacturers written instructions and in accordance with recognized industry standards. Mechanical fasteners shall be used whenever possible to assure permanent construction. Unsightly work shall be cause for rejection.

B. Materials shall be applied only after surfaces have been tested and cleaned.

C. Non-compressible insulation material shall be installed at hanger supports on cold piping to prevent damage to insulation and vapor barrier.

D. Insulation of cold surfaces shall be vapor-sealed to prevent condensation.

E. Minimum thickness of insulation shall be as scheduled; however, sufficient insulation shall be provided to eliminate condensation on the cold surfaces, and to maintain a maximum exterior insulation surface temperature of 125^{o}F on the hot surfaces.

F. Where piping system insulation is specified, cover valves, strainers, unions, flanges, and fittings.

G. Install protective metal shields where pipe hangers bear on the outside of insulation. Provide wood blocking from the shield through the insulation using O.C. Kaylo; Crane; or A/E approved equal, (minimum 24" long) to prevent crushing of the insulation.

H. Extend piping insulation without interruption through walls, floors and similar piping penetrations, there shall be no exceptions.

I. Prior to installation of any insulation materials to ferrous piping systems, the piping surfaces shall be thoroughly cleaned of all mill scale, grease and dirt.

J. All new insulation shall be stenciled with the notation, “ASBESTOS FREE”.

3.2 APPLICATION TYPES

A. Equipment

1. E1: Cut insulation to fit contour of equipment, and secure by means of bands, stick-clips, weld-pins and lugs or adhesives as required for each individual piece of equipment. Provide vapor barrier and finish as required for each specific application. Provide new cold surfaces of pumps with accessible boxes that easily separate coincidental with parting line of evaporator heads and pump casings. Resulting insulation joints shall be covered with a self-sealing, vapor-barrier tape. Seal all laps and penetrations in vapor barrier jacket with an approved vapor barrier mastic.

B. Piping

1. P1: Butt insulation together and securely staple in place with outward-clinching staples on 3" centers. Install factory-furnished laps at the butt joints. Neatly bevel and finish insulation where it terminates. Use of double tape self-sealing adhesives systems will negate requirements for staples.

2. P2: Butt insulation together and securely staple in place with outward- joints. Neatly bevel and finish insulation where it terminates. Seal all laps and penetrations in vapor barrier

jacket with an approved vapor barrier mastic. Use of double tape self-sealing adhesive systems will negate requirement for staples.

3. P3: Butt insulation together and secure with mechanical fasteners. Fill joints with insulation cement prior to insulation finish.

4. P4: Same as P2, except install insulation over heat trace tape. Finish with metal jacket.

5. P5: Same as P4, except there is no heat trace tape.

6. P6A: Insulation for Straight Runs (Cellular Glass in Mechanical Rooms)

    a. Insulation shall be applied to the pipe with joints tightly butted. The ends of fibrous insulation shall be sealed off with vapor barrier coating at intervals not to exceed 15 feet.
    b. Longitudinal laps of the jacket material shall overlap not less than 1-1/2 inches (1.5 inches). Butt strips 3 inches wide shall be provided for circumferential joints.
    c. Laps and butt strips shall be secured with adhesive and staples on 4-inch centers.
    d. Staples and seams shall be coated with a vapor barrier coating.
    e. Breaks and punctures in the jacket material shall be patched by wrapping a strip of jacket material around the pipe and securing it with adhesive, stapling, and coating as specified for butt strips. The patch shall extend not less than 1-1/2 inches (1.5 inches) past the break.
    f. At penetrations such as thermometers, the voids in the insulation shall be filled and sealed with vapor barrier coating.

7. P6A1 and P6B1 (Cellular Glass indoors and not in mechanical rooms): Same as P6A and P6B, respectively, except do not field apply an all service jacket (ASJ), and do not apply a PVC jacket at fittings. Seal all joints and seams and non-cellular-glass areas with vapor barrier mastic.

8. P6A2 and P6B2: Cellular Glass outdoors: Same as P6A1 and P6B1, respectively, except do not field apply an all service jacket (ASJ). Apply metal jacketing on pipes and fittings as specified in this section for outdoor piping.

9. P6A3 and P6B3: Cellular Glass outdoors with heat trace: Same as P6A1 and P6B1, respectively, except do not field apply an all service jacket (ASJ) Apply metal jacketing on pipes and fittings as specified in this section for outdoor piping.

10. P6B: Insulation for Fittings and Accessories:

    a. Pipe insulation shall have ends thoroughly coated with a vapor barrier coating not more than 6 inches from each flange, union, valve, anchor, or fitting in all directions.
    b. Insulation shall be premolded or segmented. Insulation of the same thickness and conductivity as the adjoining pipe insulation shall be used. If nesting size insulation is used, the insulator should be overlapped 2 inches or one pipe diameter. Insulation or insulating cement shall be used to fill the voids. Insulation for elbows less than 3-inch size shall be premolded. Insulation for elbows 3-inch size and larger shall be either premolded or segmented. Elbows insulated using segments shall not have less than 3 segments per elbow. Insulation may be secured by wire or tape until finish is applied.
    c. Upon completion of installation of insulation on flanges, unions, valves, anchors, fittings and accessories, all terminations and all insulation not protected by factory

vapor barrier jackets or PVC fitting covers shall be protected with two coats of vapor barrier coating with a minimum total thickness of 1/16th inch, applied with glass tape embedded between coats. Tape seams shall overlap 1 inch. The coating shall extend out onto the adjoining pipe insulation 2 inches.

d. Insulation terminations shall be tapered to unions at a 45-degree angle. The ends of the insulation shall be coated and taped as above.

e. Anchors attached directly to the pipe shall be insulated for a sufficient distance to prevent condensation but not less than 6 inches from the insulation surface.

f. PVC Fitting Covers: One or two piece PVC fitting covers shall be applied. The covers shall be secured by PVC vapor barrier tape, adhesive, seal welding or with tacks made for securing PVC covers. All seams in the cover, and tacks and laps to adjoining pipe insulation jacket, will be sealed with vapor barrier tape to ensure that the assembly has a continuous vapor seal.

C. Ductwork

1. D1: Apply fiberglass board insulation to ducts with mechanical fasteners such as stick-clips or weld-pins (with tape and mastic) spaced as required to install full pieces of board insulation. Space on 12-inch centers (maximum) on the bottom of each duct and plenum. Cover joints and seams in vapor barrier facings with 3-inch wide matching tape. Provide an additional layer of insulation board where duct-standing seams exceed the insulation thickness. Seal all laps and penetrations in vapor barrier jacket with an approved vapor barrier mastic.

2. D2: Wrap flexible fiberglass insulation around ducts and secure with outward-clinching staples. Additionally, ducts 24 inches wide and larger shall secure insulation with stick clips on 18-inch centers. Lap insulation a minimum of four (4) inches, and seal seams and penetrations with an approved mastic reinforced with 3 inches foil/vapor-barrier tape. Seal raw glass to duct where insulation terminates. Seal all laps and penetrations in vapor barrier jacket with an approved vapor barrier mastic.

3.

PIPES						
				INSULATION FINISH		
				INDOOR		
	INSULATION TYPE	THICKNESS	APPLICATION TYPE	CONCEALED	EXPOSED	OUTDOOR
Domestic cold water; bottom of roof drains and overflow drains; horizontal storm drains and overflow drains within building; waste piping conveying cooling coil condensate; cooling condensation drains; waste from chilled drinking water fountains.						
Indoor:	2	1/2 inch	P2	8	8	--
Outdoor:	2	1”	P4	--	--	8 & 3
Domestic hot water supply & recirculation.	2	*N_1	P1	8	8	8 & 3

Heating water supply and return; steam condensate return and pumped return piping.						
Indoor:	2	*N_2	P1	8	8	--
Outdoor:	2	*N_2	P1	--	--	8 & 3
Runouts for chilled water supply and return.	2	*N_3	P2	8	8	--
Mains and branches for chilled water supply and return.						
Indoor In Mech. Room:	4	*N_5	P6A	--	--	--
Indoor not in Mech rm.	4	*N_5	P6A1	--	--	--
Outdoor:	2	*N_5	P6A3	--	--	--
Condenser water supply and return.						
Outdoor:	4	*N_5	P6A3	--	--	--
Refrigerant suction piping.						
Indoor:	2	*N_3	P2	8	8	--
Outdoor:	2	*N_3	P5	--	--	8 & 3

* See "Schedule Notes", this Section.
** Provide insulation where piping is heat traced.

	PIPE FITTINGS					
	FITTING TYPE			FITTING FINISH TYPE		
	INDOOR CONCEALED	INDOOR EXPOSED	OUTDOOR	INDOOR CONCEALED	INDOOR EXPOSED	OUTDOOR
Domestic cold water; bottom of roof drains & overflow drains; horizontal storm drains & overflow drains within building; waste piping conveying cooling coil condensate; cooling condensation drains; waste from chilled drinking water fountains.	1	1	1	8	8	8 & 3
Domestic hot water supply & recirculation	1	1	1	8	8	8 & 3
Heating water supply & return; steam, condensate return, pumped return.	1 or 2	1 or 2	1 or 2	8	8	8 & 3
Mains & branches for chilled water supply & return; condenser water supply & return; refrigerant suction piping.	Refer to Table "PIPES" and to Table N4. Use methods P6B, P6B1, P6B3.					
Indoor:	1	1	1	8	8	--
Outdoor:	1	1	1	--	--	8 & 3
H/C lavatory & sink tailpiece, offset trap & trap arm.	1	1	1	--	4	--

	DUCTS (N_4)				
				INSULATION FINISH	
	INSULATION TYPE	THICKNESS	APPLICATION TYPE	INDOOR	OUTDOOR
Outside air and, supply air ducts and plenums.	2	2”	D1	5	1 & 2
Concealed supply and, outside air ducts.	3	2”	D2	5	--
Exposed supply, return and outside air ducts and plenums:					
In mechanical equipment rooms and other non-conditioned areas.	2	2”	D1	5	--
Exposed supply & outside air ducts & plenums:					
In air-conditioned areas	2	1”	D1	5	--

* See "Schedule Notes", this Section.
** Includes Relief Air Ducts, Recirculated Air Ducts, Mixed Air Ducts.

SCHEDULE NOTES:

N^1: Refer to Article 3.3, "Domestic Hot Water Systems".
N^2: Refer to Article 3.3, "Heating Water and Steam Systems".
N^3: Refer to Article 3.3, "Cooling Systems".
N^4: Unless specifically noted to the contrary, all supply air ducts and plenums shall be externally insulated.

3.3 PIPE INSULATION THICKNESS SCHEDULES

DOMESTIC HOT WATER SYSTEMS (N_1)				
		CIRCULATING MAINS AND BRANCHES		
SUPPLY WATER TEMPERATURE	NON-CIRCULATING RUNOUTS UP TO 1”	UP TO 1 ¼”	1 ½” & 2”	OVER 2”
170 - 180°F	½”	1”	1 ½”	2”
140 - 160°F	½”	½”	1”	1 ½”
100 - 130°F	½”	½”	½”	1”

HEATING WATER AND STEAM SYSTEMS (N_2) INSULATION THICKNESS FOR PIPE SIZES						
FLUID TEMP.	RUNOUTS UP TO 2"	1" & LESS	1 ¼" TO 2"	2 ½" TO 4"	5" & 6"	8" AND LARGER
High Pressure/Temp. 306-450°F (Includes HPS)	2.5"	2.5"	2.5"	3.0"	3.5"	3.5"
Medium Pressure/Temp. 251-305°F (Includes HPR, BF)	2.0"	2.0"	2.5"	2.5"	3.5"	3.5"
Low Pressure/Temp. 201-250°F (Includes LPS, LPR)	1.5"	1.5"	1.5"	2.0"	2.0"	3.5"
Low Temp. 120-200°F (Includes HS, HR)	1.5"	1.5"	1.5"	1.5"	1.5"	1.5"
Vents, Drains, Blowdowns, Relief's All Temp.	--	1.0"	1.5"	2.0"	2.0"	2.0"

* Runouts to individual units, less than 48" in length.

COOLING SYSTEMS (N_3)

INSULATION THICKNESS FOR PIPE SIZES

FLUID TEMPERATURE	RUNOUTS UP TO 2"	1" & LESS	1 ¼" TO 2"	2 ½" TO 4"	5" & 6"	8" AND LARGER
Refrigerant						
40°F and above	0.5"	0.5"	1.0"	1.0"	2.0"	2.0"
Below 40°F	1.0"	1.0"	1.5"	1.5"	2.0"	2.0"

---

* Runouts to individual units, not exceeding 12' in length.

COOLING SYSTEMS (N_5) (Cellular Glass)

INSULATION THICKNESS FOR PIPE SIZES

FLUID TEMPERATURE	RUNOUTS UP TO 2"	1¼" & LESS	1½" TO 3"	4" AND LARGER
Chilled Water Condenser Water	0.5"	1.5"	1.5"	2"

---

* Runouts to individual units, not exceeding 12' in length.

3.4 INSTALLATION OF PRE-FABRICATED HANGER SHIELDS

A. Refer to Section 22 20 00, Basic Materials and Methods – Plumbing and Mechanical, for metal-jacketed insulation inserts at the various locations described.

B. Provide the following insulation work: Coat butt ends of insulation and inset with a vapor barrier adhesive; cover butt joints with vapor barrier jacket butt strips; and, apply vapor barrier tape on longitudinal overlap of metal jacket for insulation insert.

END OF SECTION 22 07 00

SECTION 22 40 00 – PLUMBING FIXTURES

PART 1 - GENERAL

1.1 EXTENT OF WORK

A. Related work and materials are specified under Section 22 00 00, General Provisions – Plumbing and Mechanical; Section 22 20 00, Basic Materials and Methods – Plumbing and Mechanical; and other appropriate Sections of this Division.

B. This Section of the Specification pertains to all other labor, material, equipment, and service necessary for and incidental to the plumbing fixtures as shown on the drawings and/or specified herein.

C. Provide plumbing fixtures and trim as indicated.

D. Many items of furniture requiring water and waste services and various items of trim will be provided under other Divisions of these specifications. As a part of this Work, install all sinks and trim, including faucets, strainers, tailpieces. Provide and install traps, vacuum breakers, shut-off valves, backflow preventers, and other required appurtenances necessary for a complete installation.

1.2 SUBMITTALS

A. Product Data: Submit product data and installation instructions for each fixture, faucet, specialties, accessories, and trim specified. Clearly indicate rated capacities of selected models of water coolers.

B. Shop Drawings: Submit rough-in drawings. Detail dimensions, rough-in requirements, required clearances and methods of assembly of components and anchorages. Coordinate requirements with Architectural Woodwork shop drawings specified in Division 06, Wood, Plastics, and Components, for fixtures installed in countertops and cabinets. Furnish templates for use in woodwork shop.

C. Wiring Diagrams: Submit manufacturer's electrical requirements and wiring diagram for power supply to units. Clearly differentiate between portions of wiring that are factory installed and field installed portions.

1.3 QUALITY ASSURANCE

A. Codes and Standards

1. ASHRAE Standard 18: "Method of Testing for Rating Drinking Water Coolers with Self-Contained Mechanical Refrigeration Systems."
2. ARI Standard 1010: "Drinking Fountains and Self-Contained Mechanically Refrigerated Drinking Water Coolers."
3. ANSI Standard A117.1: "Specifications for Making Buildings and Facilities Accessible To and Usable by Physically Handicapped People."
4. Public Law 90-480: "Architectural Barriers Act of 1968."
5. UL Standard 399: "Drinking Water Coolers."
6. Americans with Disabilities Act of 1990.
7. Water closets of the wall hung type to be tested to 500 lb. Loading per the ANSI Std. A112.19.2 (1998).

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Zurn, or approved equivalent.

2.2 PLUMBING FIXTURES

A. Basis of design Product: Z1396 Yard Hydrant.

PART 3 - EXECUTION

3.1 FIXTURES FURNISHED UNDER THIS DIVISION

A. Plumbing fixtures and equipment shall be set in place, leveled and connected as indicated on the drawings or if not indicated, in accordance with manufacturer's printed instructions. Use china caps to conceal mounting bolts, and grout between all vitreous china fixtures and finished wall and floor surfaces with plaster of paris or portland cement.

B. Do not install metal fittings until adjoining tile work has been acid-cleaned. The mechanical contractor shall be responsible for the proper protection of fixtures after installation.

C. All valves shall be located in a serviceable location, or access doors shall be furnished.

3.2 ADJUSTING AND CLEANING

A. Prior to final acceptance of the Work, inspect all faucets, flush valves, stop valves, backflow preventers, etc., to determine whether they operate properly and discharge proper quantities of water. Correct any deficiencies to the satisfaction of the Architect/Engineer (A/E), and the HACP Project Manager.

B. Thoroughly clean all plumbing fixtures, trim and accessories of all tape, adhesives and other foreign materials prior to final acceptance.

3.3 PROTECTION

A. Provide protective covering for installed fixtures and fittings.

B. Do not allow use of fixtures for temporary facilities, except when approved in writing by the HACP Project Manager.

3.4 MOUNTING HEIGHT

A. Verify location and mounting height of all fixtures with Architect prior to installation.

END OF SECTION 22 40 00

SECTION 26 05 00 – BASIC MATERIALS AND METHODS: ELECTRICAL

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

B. This section is hereby made part of all other sections of Division 26.

1.2 SUMMARY

A. Scope: The work specified in this Section includes, but shall not be limited to, providing labor, material, equipment, and services necessary for electrical work as shown on the drawings and as herein specified.

B. Section Includes: The Work specified in this Section includes, but shall not be limited to, providing the following:

1. Building Wire and Cables
2. Raceways and Boxes
3. Wire Connections
4. Wiring Devices.
5. Motor and Equipment Connections
6. Electrical Identification.
7. Hangers and Supports.
8. Equipment Bases.

1.3 DEFINITIONS

A. EMT: Electrical metallic tubing

B. RMC: Rigid metallic conduit

C. RNC-40: Rigid nonmetallic conduit, Schedule 40 PVC

D. RNC-80: Rigid nonmetallic conduit, Schedule 80 PVC

E. FMC: Flexible metallic conduit

F. LFMC: Liquid-tight flexible metallic conduit

1.4 SUBMITTALS

A. General

1. Submittals shall include, but shall not be limited to, equipment specifications sheets, schematic diagrams, wiring diagrams, sizes, mounting details (with required elevations), technical descriptions of components, and proper calculations to ensure specified performance of the systems.

2. Submittals shall be required for the following products listed in this specification:

a. Wires and Cables
b. Wiring Devices

3. See other Division 26 Sections for additional submittal requirements.

B. Product Data: Submit manufacturer's product information showing material proposed. Submit sufficient information to determine compliance with the drawings and specifications.

C. Shop Drawings: Submit complete shop drawings as required to determine acceptability.

1.5 QUALITY ASSURANCE

A. Contractor's Quality Assurance Responsibilities: The Contractor shall be solely responsible for quality control of the Work.

B. Manufacturer's Qualifications: Firms shall be engaged in the manufacture of products and materials of types and sizes required, and whose products have been in satisfactory use in similar service for not less than five years.

C. Contractor's Qualifications: Firms shall have at least five years of successful installation experience with projects utilizing products and materials similar to that required for this Project.

D. Regulatory Requirements: Comply with applicable requirements of the laws, codes, ordinances, and regulations of Federal, State, and Municipal authorities having jurisdiction. Obtain approvals from such authorities.

E. Installation: Comply with NECA National Electrical Installation standards for electrical construction methods.

1.6 DELIVERY, STORAGE AND HANDLING

A. Deliver products and materials properly packaged in factory-fabricated containers and mounted on shipping skids.

B. Store products and materials in clean, dry, heated space. Protect from dirt, fumes, water, construction debris, and traffic. Where necessary to store outdoors, store above grade and enclose with watertight wrapping.

C. Handle products and materials carefully to prevent internal damage, breakage, denting, and scoring enclosure finish. Do not install damaged products or materials. Replace and return damaged products or materials to manufacturer.

1.7 PROJECT CONDITIONS

A. Field Measurements: Verify that field measurements are as indicated on the shop drawings and as shown on the drawings.

B. Project Location Environment. Furnish and install materials suitable for the altitude, weather, and seismic requirements of the project location.

1.8 COORDINATION

A. Coordinate chases, slots, inserts, sleeves, and openings with general construction work and arrange in building structure during progress of construction to facilitate the electrical installations that follow.

1. Set inserts and sleeves in poured-in-place concrete, masonry work, and other structural components as they are constructed.

B. Sequence, coordinate, and integrate installing electrical materials and equipment for efficient flow of the Work. Coordinate installing large equipment requiring positioning before closing in the building.

C. Coordinate electrical service connections to components furnished by utility companies.

1. Coordinate installation and connection of exterior underground and overhead utilities and services, including provision for electricity-metering components.
2. Comply with requirements of authorities having jurisdiction and of utility company providing electrical power and other services.

D. Coordinate location of access panels and doors for electrical items that are concealed by finished surfaces.

E. Where electrical identification devices are applied to field-finished surfaces, coordinate installation of identification devices with completion of finished surface.

F. Where acoustical ceilings and similar finishes will conceal electrical identification markings and devices, coordinate installation of these items before ceiling installation.

PART 2 - PRODUCTS

2.1 QUALITY

A. Electrical equipment, devices and associated materials used on this Project (such as security screws) shall be UL listed and/or labeled.

B. Equipment and devices installed under this Division and not constructed with enclosure suited for mounting and protecting all live parts shall be installed in approved metal cabinets.

C. All fixtures installed for this Project must be suitable for and/or exceed the requirements for a residential facility environment.

2.2 WIRE AND CABLE (600V OR LESS)

A. Wire and cable used in this installation shall be copper and shall have 600-volt insulation unless otherwise noted.

B. The wires used in this installation shall be run in conduits or approved raceways, unless specifically indicated otherwise.

C. Conductors shall conform to the latest requirements of the Code and meet ICEA Specifications. Submit the name of manufacturer for the approval of the Housing Authority of the City of Pittsburgh, HACP (the Project Owner) Project Manager; Loysen + Kreuthmeier Architects (Project Architect); and Multi-Lynx Companies, Inc. (Project Engineer), before Work is started.

D. Acceptable Wire and Cable Manufacturers are:

1. General Cable Corporation (BICC).
2. Southwire.
3. Okonite.
4. Rome.
5. Or Project Architect/Engineer (A/E) approved equal

E. Wire and cable shall be delivered to the Project site in complete coils with the manufacturer's name and approval tag attached thereto, indicating wire size and type of insulation, and be labeled and listed.

F. Unless otherwise noted, conductors for lighting and power circuits shall be #12 AWG minimum size.

G. Wire for control circuits may be #14 AWG.

H. Wire of #8 AWG size and larger shall be stranded. Wire of #10 and smaller shall be solid

I. All conductors shall be rated 90 degrees C for dry/wet locations.

J. Insulation Types shall be as follows:
1. All conductors shall be dual listed THHN/THWN-2 unless specifically noted on the electrical drawings.

K. A.C. branch circuit wiring shall be installed with color-coded conductors throughout the installation as specified in the identification Sections of this Specification.

2.3 WIRE CONNECTIONS

A. All wire connections shall be made by means of solderless connectors.

B. Clean conductor surfaces before installing lugs and connectors. Apply a no-ox compound, or the A/E approved equal.

C. Branch circuit joints or splices for wires #10 and smaller shall be made with 3M Scotchlok, Thomas and Betts, or A/E approved equal electrical spring connectors. No splices shall be made in a conductor except at outlet boxes, junction boxes, or in splice boxes.

D. Control wires shall be made by 3M Scotchlok, Thomas and Betts, or A/E approved equal crimp connectors.

E. Use high press long barrel, cast copper, compression connectors for splices and joints for wires #8 and higher.

F. Wires and cables that terminate onto a bus bar shall be made by cast copper, two hole, long barrel lug, two crimps of fifteen (15) ton compression, hex lugs. Lug bolts shall have lock washers.

G. Acceptable manufacturers for compression barrel connectors and lugs:

1. Thomas and Betts
2. Hy-Press Corporation
3. FCI Burndy Products
4. Or A/E approved equal

H. The phases of all feeders shall be marked at all taps, joints, splices, and near the lugs at each end with permanently colored tapes. Tapes shall be 3M #35 vinyl tape, Thomas and Betts, or A/E approved equal. Tape un-insulated conductors to 150% of insulation rating of conductor.

2.4 FISH WIRE

A. Conduits that are left empty shall contain fish wire of such a gauge required to pull in wire or cable to fill the conduit as determined by Code.

B. Each length of conduit which is to be used for the telephone system shall contain a #l4 gauge nylon fish wire.

C. Terminations of empty conduits shall be properly tagged.

2.5 CONDUIT

A. EMT: ANSI C80.3, zinc-coated steel, with compression fittings (no set screws).

B. FMC: Zinc Coated Steel, insulated squeeze type connectors

C. RMC: ANSI C80.1, hot dip galvanized, with threaded fittings.

D. RNC-40: NEMA TC-2, Schedule 40 PVC, with NEMA TC3 fittings.

E. RNC-80: NEMA TC-2, Schedule 80 PVC, with NEMA TC3 fittings.

F. LFMC: Zinc-coated steel with sunlight-resistant and mineral-oil-resistant plastic jacket.

2.6 SURFACE AND TELE/POWER POLE RACEWAYS

A. Surface mounted power and data raceways shall be as manufactured by the following:
1. Power Raceways: Wiremold AL 7320, 3 channel aluminum raceway, Rockwell, or A/E approved equal.

2. Data Raceways: Wiremold Al 3300, 1 channel aluminum raceway, Rockwell, or A/E approved equal.

B. Wireways shall be metallic and provided complete with all necessary fittings for a proper installation.

C. Mount all surface raceways plumb and level in the space indicated on the architectural and/or electrical detail drawings.

2.7 PULL BOXES

A. Provide pull boxes as shown on the plans and where necessary to meet code and specification requirements for proper installation of associated wiring systems.

B. Pull boxes shall be sized in accordance with the Code and assembled with security screws.

C. Boxes indicated on the plans are not intended to be drawn to scale.

D. Conduit runs of more than 100 feet or with more than the equivalent of three 90-degree bends shall have suitable pull boxes installed in convenient intermediate locations. Such pull boxes shall be shown on the shop drawings and construction record drawings.

E. Pull boxes over 100 cubic inches shall be supported independently of the conduits.

F. Pull boxes shall be accessible after completion of installation.

2.8 OUTLET BOXES

A. Provide galvanized steel outlet boxes and covers as manufactured by:

1. Steel City
2. Appleton
3. Raco
4. Or A/E approved equal

B. Floor Boxes and Trim, basis of design product: Provide the following or approved equivalent:

1. Legrand On-Grade Rectangular Floor Box: RPSFB-OG.
2. Legrand Single Service Floor Box Cover Kit: RPAMD4CTCBK, black flange, black cover.

C. Boxes for Suspended or Bracket Mounted Lighting Fixtures: Ceiling outlets and bracket outlets which are to support lighting fixtures shall be equipped with a 3/8-inch malleable iron fixture stud securely fastened into the outlet box.

D. Flush Mounted Boxes (in plaster, drywall, poured concrete, smooth tile):

1. Outlet boxes for duplex receptacles, single and two-gang toggle switches, shall be a minimum of 4-inches square by 1 1/2-inches deep.
2. Outlet boxes for other devices installed under similar conditions shall be a minimum of 4-inches square 1 1/2-inches deep.
3. Where more than two conduits enter an outlet box, a 2 1/8-inch deep box shall be used, except in columns.
4. Where three or more gangs of devices are required, solid gang boxes a minimum of 4 1/2-inches high by 1 5/8-inch deep shall be used.
5. Provide suitable plaster rings as required.
6. Provide minimum of 1/2-inch deep tile covers as required.

E. Flush Mounted Data/Telephone Outlet Boxes: Outlet boxes which are to be used as data/telephone outlets shall conform to the requirements of switch and receptacle outlets, except a minimum of 2 1/8 inches deep, employing a single gang opening in the plaster cover, unless noted otherwise on the electrical drawings. Where two (2) conduits enter the same box, a 1 1/4-inch deep raised plaster cover shall be installed.

F. Capped Outlet Boxes: Outlet boxes, which are indicated as capped outlet boxes shall employ flat metal cover plates, fastened to the outlet box with screws.

G. Surface Mounted Outlet Boxes: Where outlet boxes are to be installed exposed on ceiling or wall surfaces, the boxes shall be specifically designed for such a type of installation and shall be square or rectangular as required. Device plates shall match the contour of the boxes and shall be of the type manufactured for these particular type boxes. In finished areas, all boxes shall be flush mounted unless specifically noted otherwise.

H. Suspended Ceiling Outlet Boxes:

1. Where outlet boxes are installed in suspended ceiling cavities for the purpose of splicing fixture wire, branch circuit conductors and for connecting flexible metallic conduit between this box and the lighting fixtures, such boxes shall be of the size required by code requirements pertaining to the number of conductors entering and leaving the box.

2. Each box shall be secured to the ceiling channel irons or building structure and shall have its opening facing the nearest recessed lighting fixture.

3. All boxes shall have covers or device plates as required.

2.9 SWITCHES AND RECEPTACLES

A. Provide the various switches and receptacles shown on the plans.

B. In general, the color of all devices shall be white except as follows:

1. UPS protected receptacles shall be blue
2. Isolated ground receptacles (S) shall be orange
3. Emergency receptacles (E) shall be red.
4. Dirty receptacles (D) shall be brown.
5. Tool receptacles (T) shall be ivory.

C. All devices shall be Underwriters' Laboratories listed, Federal specification listed, heavy-duty type. Receptacles shall be grounding type.

D. Devices shall be manufactured by the following:

1. Duplex receptacles, 20 Ampere, 125 Volt

a. Standard duplex
1) P&S/Legrand #5362I
2) Hubbell #HBL5352I
3) Leviton #5362I
4) Cooper #5362V
5) Or A/E approved equal

b. UPS or Isolated Ground
1) P&S/Legrand #IG6300
2) Hubbell 5352IG
3) Leviton 8300IG
4) Cooper #IG8300RN
5) Or A/E approved equal

c. Ground Fault Circuit Interrupter (GFCI)
1) P&S/Legrand #1591I
2) Hubbell #GF5362I

3) Leviton #6899-HGI
4) Cooper #GF20V
5) Or A/E approved equal

2. Toggle switches 20A, 120-277V

a. Single Pole
1) Hubbell 1221I.
2) P&S/Legrand #20AC1-I
3) Leviton #1221I
4) Cooper #2221V
5) Or A/E approved equal

b. Double Pole
1) Hubbell 1222I.
2) P&S/Legrand #20AC2-I
3) Leviton #1222I
4) Cooper #2222V
5) Or A/E approved equal

c. Three Way:
1) Hubbell 1223I.
2) P&S/Legrand #20AC3-I
3) Leviton #1223I
4) Cooper #2223V
5) Or A/E approved equal

d. Four Way: HBL1224I
1) Hubbell 1224I.
2) P&S/Legrand #20AC4-I
3) Leviton #1224I
4) Cooper #2224V
5) Or A/E approved equal

3. Special purpose receptacles shall be heavy duty, specification grade as manufactured by Hubble, P&S, Leviton, Cooper, or A/E approved equal.

2.10 DEVICE PLATES

A. Device plates shall be of same manufacture as device, and shall be flat surface type.

B. Device plates in mechanical and electrical equipment rooms and unfinished areas shall be cadmium-plated steel.

C. Plates in offices and general areas shall be PVC.

D. All multi-gang plates shall be one piece.

E. Device plates for outlet boxes that are installed exposed along surfaces shall be as described under "Outlet Boxes" of this Section.

F. Plates for outlet boxes shall contain a label identifying circuit number and panel source. See section on identification for additional information.

2.11 MOTORS

A. All motors will be furnished and installed under other sections of the specification.

B. All motors shall be connected under this section.

1. Final connection shall be made with suitable length of liquid-tight flexible metallic conduit.
2. All motors shall be grounded with green grounding conductor as required.

C. Electrical characteristics of motors shall be as follows:

1. Motors 1/3 horsepower and smaller shall be rated for operation at 120 Volt, Single Phase, 60 Hertz.
2. Motors 1/2 horsepower and larger shall be rated for operation at 460 volts, 3 Phase, 60 Hertz.

2.12 ELECTRICAL IDENTIFICATION

A. Identification Devices: A single type of identification product for each application category. Use colors prescribed by ANSI A13.1, NFPA 70, and these Specifications.

B. Raceway and Cable Labels: Comply with ANSI A13.1, Table 3, for minimum size of letters for legend and minimum length of color field for each raceway and cable size.

1. Type: Pretensioned, wraparound plastic sleeves. Flexible, preprinted, color-coded, acrylic band sized to suit the diameter of the item it identifies.
2. Type: Preprinted, flexible, self-adhesive, vinyl. Legend is over laminated with a clear, weather- and chemical-resistant coating.
3. Color: Black letters on orange background.
4. Legend: Indicates voltage.

C. Colored Adhesive Marking Tape for Raceways, Wires, and Cables: Self-adhesive vinyl tape, not less than 1 inch wide by 3 mils thick (25 mm wide by 0.08 mm thick).

D. Underground Warning Tape: Permanent, bright-colored, continuous-printed, vinyl tape with the following features:

1. Not less than 6 inches wide by 4 mils thick (150 mm wide by 0.102 mm thick).
2. Compounded for permanent direct-burial service.
3. Embedded continuous metallic strip or core.
4. Printed legend that indicates type of underground line.

E. Tape Markers for Wire: Vinyl or vinyl-cloth, self-adhesive, wraparound type with preprinted numbers and letters.

F. Color-Coding Cable Ties: Type 6/6 nylon, self-locking type. Colors to suit coding scheme.

G. Engraved-Plastic Labels, Signs, and Instruction Plates: Engraving stock, melamine plastic laminate punched or drilled for mechanical fasteners 1/16-inch (1.6-mm) minimum thickness for signs up to 20 sq. in. (129 sq. cm) and 1/8-inch (3.2-mm) minimum thickness for larger sizes. Engraved legend in black letters on white background for normal systems and white letters on red background for emergency systems.

H. Interior Warning and Caution Signs: Comply with 29 CFR, Chapter XVII, Part 1910.145. Preprinted, aluminum, baked-enamel-finish signs, punched or drilled for mechanical fasteners, with colors, legend, and size appropriate to the application.

I. Exterior Warning and Caution Signs: Comply with 29 CFR, Chapter XVII, Part 1910.145. Weather-resistant, non-fading, preprinted, cellulose-acetate butyrate signs with 0.0396-inch (1-mm), galvanized-steel backing, with colors, legend, and size appropriate to the application. 1/4-inch (6-mm) grommets in corners for mounting.

J. Fasteners for Nameplates and Signs: Self-tapping, stainless-steel screws or No. 10/32 stainless-steel machine screws with nuts and flat and lock washers. Self-adhesive backing alone is not allowed.

2.13 SUPPORTING DEVICES

A. Surface Mounted Cabinets: Secure cabinets directly to wall using suitable wall anchors, or provide a suitable frame for mounting and supporting the cabinets using "Unistrut" type supports or the A/E approved equal, as required.

B. Free Standing Motor Starters and Safety Switches: Provide suitable "Unistrut" racks, or the A/E approved equal, with sheet steel mounting plates for this equipment.

C. Hanger Rods:

1. Provide hanger rods of proper length for electrical items requiring same.
2. Minimum rod diameter shall be 5/8 inches for cable trays, and racks supporting more than 8" of total conduit diameter.
3. Hanger rods shall be zinc plated or galvanized steel.

D. Cable Supports: Riser cables shall be supported by means of O.Z./Gedney Company, Thomas and Betts, Joslyn, or A/E approved equal cable supports at each panel and pull box in accordance with Code requirements.

E. Conduit Supports and Hangers:

1. Individually suspended conduits shall be supported with galvanized pipe clamps, from threaded steel rods, spaced 5'-0" on centers.

2. The steel rods shall be affixed to the building structure by means of inserts in concrete slab or beam clamps affixed to the steel structure.

3. Where multiple conduits are installed adjacent to each other, a trapeze hanger consisting of galvanized P-l000 Unistrut suspended from at least two threaded steel rods, shall be used. The conduits shall be affixed to the Unistrut with galvanized split pipe clamps, Nos. P-1109 through P-1126, for rigid conduit and Nos. P-l425 through P-1431, for EMT.

4. Hangers and clamps shall be as manufactured by Unistrut, B-Line, or A/E approved equal.

2.14 EQUIPMENT BASES

A. The Contractor shall provide concrete pedestals, bases, pads, curbs, anchor blocks, anchor bolts, slab inserts, hangers, channels, cradles, saddles, etc., for installation of equipment and apparatus shown on the drawings.

B. Concrete pads shall be 4 inches (102 mm) high, unless otherwise indicated, complete with steel reinforcing and necessary bolts, anchors, etc. Where concrete pad is set directly on concrete floor, provide dowels in floor to tie base to floor. These pads shall be extended at least 4 inches (102 mm) beyond the equipment outlined on all four sides.

C. Concrete mix shall conform to the requirements of appropriate Sections of Division 3, CONCRETE. However, if no specification is available, the mix shall not be less than 3,500 psi (20 684 kPa), metal reinforced, and pad shall be level to 1/8 inch per 3 foot in any direction.

2.15 EQUIPMENT TOUCH-UP PAINT

A. The Contractor shall provide the types and brands furnished by manufacturers for all components. Furnish a minimum of one (1) gallon of the manufacturer’s paint for future touch up painting to the Housing Authority of the City of Pittsburgh (HACP).

B. Repair damage to factory applied paint finishes with the appropriate touch-up paint.

PART 3 - EXECUTION

3.1 CONDUIT APPLICATION

A. Use the following conduits for outdoor installations:

1. Exposed: RMC.
2. Concealed: RMC
3. Underground, Concrete Encased beyond 5'0" of building: RNC.40
4. Underground, Non-Encased beyond 5'0" of building: RNC.80
5. Connection to Vibrating Equipment: LFMC.
6. Boxes and Enclosures: NEMA 250, Type 3R or Type 4.

B. Use the following conduit for indoor installations:

1. Exposed, Dry Locations: EMT
2. Exposed, Wet Locations: RMC
3. Concealed in Interior Partition or above 16ft.: EMT
4. Concealed in Concrete or Block Walls: RMC
5. Connection to Vibrating Equipment: LFMC
6. Mechanical Rooms and Damp or Wet Locations: RMC
7. Boxes and Enclosures: NEMA 250, Type 1, unless otherwise indicated.

C. Conceal conduit, unless otherwise indicated, within finished walls, ceilings, and floors.

D. Install conduit at least 6 inches (150 mm) away from parallel runs of flues and steam or hot-water pipes. Locate horizontal conduit runs above water and steam piping.

E. Use temporary conduit caps to prevent foreign matter from entering during construction.

F. Make conduit bends and offsets so inside diameter is not reduced. Keep legs of bends in the same plane and straight legs of offsets parallel, unless otherwise indicated.

G. Conduit bends shall be made in accordance with code limits.

H. Where drawing calls for conduit to be installed in new slab, install raceways embedded in slabs in middle third of slab thickness where practical, and leave at least 2 inches (50 mm) concrete cover.

1. Secure raceways to reinforcing rods to prevent sagging or shifting during concrete placement.

2. Space raceways laterally to prevent voids in concrete.

3. Install conduit larger than 1 inch trade size (DN27) parallel to or at right angles to main reinforcement. Where conduit is at right angles to reinforcement, place conduit close to slab support.

4. Transition from nonmetallic tubing to rigid steel conduit, before rising above floor or grade.

5. Make bends in exposed parallel or banked runs from same centerline to make bends parallel. Use factory elbows only where elbows can be installed parallel; otherwise, provide field bends for exposed parallel raceways. All 90 degree bends in PVC conduit runs shall be rigid steel bends.

6. Do not place conduits in fill below slab unless specifically noted on plans.

I. Connect motors, transformers, and equipment subject to vibration, noise transmission or movement with a minimum of 18 inches and a maximum of 72 inches (1830 mm) with LFMC.

J. Minimum size conduit shall be 3/4 inches.

K. Bushings:

1. Provide bushings wherever RMC, or EMT conduit is terminated, including stub-outs, and locations not provided with connection fittings or boxes.

2. Insulated Bushings:

   a. Provide insulated bushings or connectors for RMC, or EMT conduit terminations.
   b. Insulated bushings shall be OZ/Gedney Company, Type PBP for rigid conduit or Type "SBT" for EMT; Grinnell; Rockwell; or A/E approved equal.

3. Grounded Type Insulated Bushings:

   a. Provide grounded type insulated bushings for all electric service and distribution feeder conduits, including stub-outs.
   b. Bushings shall be properly grounded and/or bonded.
   c. Ground type insulated bushings shall be OZ/Gedney Company Type "BLG"; Grinnell; Rockwell; or A/E approved equal.

4. Insulating Bushings:
   a. Provide insulating bushings where cables pass through walls of metal enclosures. Bushings shall be OZ/Gedney Company Type "BBL", "ABB"; Grinnell; Rockwell; or A/E approved equal.
   b. Insulated bushings shall be used at ends of threaded rigid conduits and threaded fittings. Provide double locknuts when terminated in enclosure.
   c. Bushings shall be OZ/Gedney Company Type "A"; Grinnell; Rockwell; or A/E approved equal.

L. Rigid Conduit Fittings and Couplings:

1. Running threads shall not be used on conduit for connection at couplings.

2. RMC conduits shall be joined by approved threaded couplings.
   a. Threadless couplings and connectors are not acceptable.
   b. Set screw couplings are not acceptable.
   c. Split couplings are not acceptable.

3. Joints in conduit, which are installed under or in the floor slab, or in exterior walls shall be made watertight by using Thomas & Betts Kopr-shield thread compound; Grinnell; or A/E approved equal, on each joint.

M. Electric Metallic Tubing (EMT) Conduit Fittings and Couplings:

1. Only insulated throat type compression fittings shall be used.
2. Only compression type fittings shall be used, set screw fittings and couplings are not acceptable. EMT compression fittings shall be steel compression.

N. Couplings and unions shall be mechanically strong and shall be so installed to make a continuous bond between the conduits connected.

3.2 PULLING COMPOUND

A. If it is desired to use a pulling compound on wire and cable, first obtain the approval of the A/E before employing such compounds. Compound shall be U.L. listed and compatible with conductor insulation covering.

B. Conduits shall be swabbed until moisture and dirt are removed and before wires are pulled or cables are installed.

3.3 MOTOR CONNECTIONS AND INSTALLATIONS

A. Building utility motors such as fans, etc., and certain starting and controlling equipment for same, as indicated on the drawings, will be furnished under Division 22 of the Specifications for the Mechanical Work and delivered to the Project site.

B. Motors which are delivered to the Project site independent of their driven equipment shall be set, aligned and secured under Division 22 of the Specifications.

C. Motors and electrical apparatus which are delivered to the Project site factory set, assembled and attached to their driven machinery or apparatus:

1. The machinery or apparatus will be moved into position along with its attached electrical apparatus under the responsible Mechanical trade Section of the Specifications.

2. The necessary line side electrical connections shall be provided under this Section of the Specifications. Furnish all labor and material to place all necessary Electrical equipment in satisfactory operating condition.

D. Furnish all branch circuits for motors to the starting equipment and then to the motors, complete with control wiring for automatic and remote control where required. Conduits to motors shall terminate in the conduit fittings on the motors, the final connection being made with short length of flexible conduit. Motors shall be bonded with a green equipment-grounding conductor.

E. Consult the Specifications for the various branches of the Mechanical Work and ascertain the exact requirements of the various systems of automatic control. Install and connect up same to leave in satisfactory operating condition.

F. Provide all necessary labor and material to completely connect all ventilation equipment including motors, controls, etc., including all alarm and shutdown systems, as specified here and in the Mechanical Section.

G. The temperature control panel and components shall be provided under Division 22 of the Specifications, including the connection of Electrical items. Provide adequate slack wire for this purpose as required.

3.4 PHASE SEQUENCE, ROTATION AND IDENTIFICATION

A. Transformers, switchgear, feeders, panelboards, motor branch circuits, etc., shall be completely phased out for sequence and motor rotation. Phase identification shall be permanently identified in all equipment including conductors by use of all temperature adhesive markers or colored tape similar to 3M #35 vinyl tape; Crane; or A/E approved equal.

B. Phase sequence shall be A-B-C (viewed from front):

1. Left to right.
2. Top to bottom.
3. Front to rear.

3.5 SLEEVES AND OPENINGS

A. Provide openings and sleeves in walls and floor as required for this Work.

B. Sleeves shall be galvanized steel conduit or Schedule 40 black steel pipe, unless otherwise noted. Aluminum conduit shall not be used. Sleeves through concrete slab may be Schedule 40 PVC.

C. Unless specific sizes are indicated on the drawings, sleeves shall be sized to provide one-half (l/2) inch clearance around outside surface of the item for which they are installed.

D. Annular space between sleeve and surface of item protruding shall be suitably provided with fire stop as hereinafter specified.

E. Sleeves shall be cut flush with wall surfaces and shall extend 1 1/2 inches above finished floors unless otherwise indicated.

3.6 CORING, CUTTING AND PATCHING

A. Necessary coring or cutting in walls, floors, and ceilings shall be neatly and carefully done and repaired in an approved and workmanlike manner.

B. No cutting into the structural work of the building shall be done without the approval of the A/E.

3.7 FIRE STOPPING

A. Provide fire and cold smoke stopping construction, as specified, for all through-penetrations in rated fire construction (and smoke barriers) in accordance with UL fire resistance directory under categories XHCR and XHEZ. These guides have specific requirements for core and opening sizes based on the size of the penetrating item.

B. Fire and smoke stopping compounds shall be by 3M; Rockwell; or A/E approved equal.

C. Conduit penetrations through fire rated gypsum and concrete construction shall be filled with 3M Fire Barrier CP 25WB+ Caulk; Rockwell; Grinnell; or A/E approved equal, according to UL guides

3.8 TRENCHING

A. Provide excavating of materials encountered and as necessary for the installation of Work.

B. Provide and maintain bracing, shoring, or sheeting necessary to support the walls of excavations and protect personnel.

1. Where roots of live trees are encountered in excavations, they shall be carefully protected during construction.

2. Earth excavation is comprised of materials that may include, but shall not be limited to, clay, silt, sand, muck, gravel, hardpan, loose shale, and loose stone.

C. Trenches shall be minimum width for the proper laying of the pipe, with sides vertical to a depth of 5 feet (1524 mm) only.

1. Beyond 5 feet (1524 mm) depth, the sides of the trench shall be sloped at a 2 to 1 ratio.

2. Trench walls in firm soil shall be braced every 15 feet (4572 mm), in loose or unstable soil every 5 feet (1524 mm).

3. Slope ratio shall start at the top of the duct banks or conduits.

4. Except where rock is encountered, care shall be taken not to excavate below the depths indicated.

D. Where rock excavations are required, the rock shall be excavated to a minimum overdepth of 4 inches (102 mm) below the required trench depths. Overdepths in the rock excavation and unauthorized overdepths shall be backfilled with 1/4 inch (6 mm) or smaller granular material, thoroughly compacted to 90 percent of maximum density of the backfill material.

E. Whenever wet or otherwise unstable soil (incapable of properly supporting the pipe) is encountered in the bottom of the trench, such soil shall be removed to the depth required and the trench backfilled to the proper grade with coarse sand, fine gravel, or other suitable material, as approved by the A/E.

F. Existing utility lines shall be protected from damage during excavation and backfilling and, if damaged, shall be repaired at no additional cost to the Housing Authority of the City of Pittsburgh (HACP)..

G. After installation and test of duct banks, conduit, and equipment has been completed and review is given by the HACP Project Manager; the A/E; and authorities having jurisdiction, then backfill excavations carefully.

1. Backfill material for trenches under paving and within building walls shall be compacted sand backfill.

2. Backfill material for work outside building walls shall consist of the material removed from the excavation, if acceptable to the A/E.

3. Backfill for over excavation, on sides and for 6 inches (152 mm) above duct bank or conduit shall be lake or bank run sand.

H. Backfill shall be deposited in 6-inch (152 mm) layers and thoroughly and carefully tamped until the duct bank or conduit has a cover of not less than 3 feet (914 mm).

1. The remainder of the backfill material shall then be carefully placed in the trench in 1-foot (305 mm) layers and tamped.

2. Settling the backfill with water shall be permitted and shall be a requirement when directed by the A/E.

3. The surface shall be graded to a reasonable uniformity and the mounding over the trenches left in a uniform and neat condition as acceptable to the A/E, and the HACP Project Manager.

I. Excess from excavations shall be piled on the Project site in locations as directed by the HACP Project Manager. Where existing surfacing and base course material is removed or damaged during these operations, they shall be replaced after the backfill has settled sufficiently, with material to match existing work, of the same respective thickness, type, and densities as the material removed.

J. Where curbs, gutters, and sidewalks are removed or damaged, they shall be replaced with materials and construction to match existing Work.

K. The above Work shall be performed as reviewed by the HACP Project Manager; the A/E; and other local and municipal authorities having jurisdiction.

3.9 ELECTRICAL IDENTIFICATION

A. Install at locations for most convenient viewing without interference with operation and maintenance of equipment.

B. Coordinate names, abbreviations, colors, and other designations used for electrical identification with corresponding designations indicated in the Construction Documents or required by codes and standards. Use consistent designations throughout Project.

C. Self-Adhesive Identification Products: Clean surfaces before applying.

D. Identify raceways and box covers with color banding or painting as follows:

1. Bands: Pre-tensioned, snap-around, colored plastic sleeves or colored adhesive marking tape. Make each color band 2 inches (51 mm) wide, completely encircling conduit, and place adjacent bands of two-color markings in contact, side by side.

2. Conduit Band Locations: At changes in direction, at penetrations of walls and floors, at 20-foot maximum intervals in straight runs, and at 10-foot maximum intervals in congested areas.

3. Junction boxes and pull boxes: Paint only the outside of boxes and covers, with the identifying color.

4. Colors as follows:

Krylon Cat. # Or A/E Approved Equal	Color	Raceway System
2410	Popsicle Orange	Life Safety Emergency
2201	Bright Copper	480/277 Volts Normal Power
2012	Clover Green	Ground
2116	Scarlet Red	Fire Alarm Systems
2116/1910	Scarlet Red/True Blue (Stripe)	Voice Command Systems
2116/2002	Scarlet Red/Pastel Aqua (Stripe)	Duct Smoke System
2116/2110	Scarlet Red/Hot Pink (Stripe)	Door Holders & Dampers
2116/1501	Scarlet Red/Glossy White (Stripe)	Tamper Valve System
1910	True Blue	Communications/Telephone
2105	Leather Brown	CRT and Computer
1929	Plum	Security Alarms
2002	Pastel Aqua	HVAC Controls
2110	Hot Pink	Signal Alarms

E. Tag and label circuits designated to be extended in the future. Identify source and circuit numbers in each cabinet, pull and junction box, and outlet box. Color-coding may be used for voltage and phase identification.

F. Install continuous underground plastic markers during trench backfilling, for exterior underground power, control, signal, and communication lines located directly above power and communication lines. Locate 6 to 8 inches (150 to 200 mm) below finished grade. If width of multiple lines installed in a common trench or concrete envelope does not exceed 16 inches (400 mm), overall, use a single line marker. Where the common trench exceeds 16 inches, a line marker shall be installed for every 12 inches, or part thereof, of trench width (e.g. a 25 inch trench requires three line markers).

G. Color-code 208/120-V system secondary service, feeder, and branch-circuit conductors throughout the secondary electrical system as follows:

1. Phase A: Red.
2. Phase B: Blue.
3. Phase C: Black.

4. Neutral: White
5. Equipment Ground: Green

H. Color-code 480/277-V system secondary service, feeder, and branch-circuit conductors throughout the secondary electrical system as follows:

1. Phase A: Yellow
2. Phase B: Brown.
3. Phase C: Orange
4. Neutral: Gray
5. Equipment Ground: Green

I. For conductors not manufactured with integral color, use conductors with black insulation or jacket and then use color coding tape at intervals not exceeding 5 feet, and at all terminations and splices.

J. Install warning, caution, and instruction signs where required to comply with 29 CFR, Chapter XVII, Part 1910.145, and where needed to ensure safe operation and maintenance of electrical systems and of items to which they connect. Install engraved plastic-laminated instruction signs with approved legend where instructions are needed for system or equipment operation. Install metal-backed butyrate signs for outdoor items.

K. Install engraved-laminated emergency-operating signs with white letters on red background with minimum 3/8-inch (9-mm) high lettering for emergency instructions on power transfer, load shedding, and other emergency operations.

L. Provide identification and markings for various items furnished and installed under this Division of the Specifications as follows:

1. White Phenolic nameplate with black cut letters 3/8-inch high:

    a. Disconnect switches and individually mounted starters with number or designation of equipment served.
    b. Panelboards. Identification on the outside of the cabinet door.
    c. Switchboards & Switchgear. Name, sections, breaker and switch designations.
    d. Individual starter housing.
    e. Transformers.
    f. Non-emergency transfer switches.
    g. Remote Status Panels.

2. White Phenolic nameplate with black cut letters 1/8-inch high:

    a. Pilot light identification.
    b. Toggle switch identification.
    c. Hand-Off-Auto selector switch identification.

3. Red Phenolic nameplate with white cut letters 3/8-inch high:

    a. Fire Alarm Equipment
    b. Emergency Generator and Transfer Switches.
    c. UPS

4. Tape labels:

    a. Light fixtures.
    b. Light Switches.
    c. Receptacles.

d. Disconnects.
e. Where otherwise specifically indicated.
f.

M. Provide “ “DANGER - 480 VOLTS” warning signs on all 480-volt equipment.

N. Provide “Flash Protection” labels per NFPA 70E.

O. Voltage characteristics shall be indicated on each piece of equipment, and at each panel.

P. All panelboards shall be provided with a typed panel board schedule. Include source of power (upstream panel source and breaker or switch).

Q. For special ground systems provide engraved brass nameplates for all ground conductors at both terminations.

END OF SECTION 26 05 00

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SECTION 26 05 19 – LOW VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following:

1. Building wires and cables rated 600 V and less.
2. Connectors, splices, and terminations rated 600 V and less.

B. Related Sections include the following:

1. Division 26 Sections for cabling used for voice and data circuits.

1.3 DEFINITIONS

A. EPDM: Ethylene-propylene-diene terpolymer rubber.

B. NBR: Acrylonitrile-butadiene rubber.

1.4 ACTION SUBMITTALS

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

1.5 QUALITY ASSURANCE

A. Testing Agency Qualifications: An independent agency, with the experience and capability to conduct the testing indicated, that is a member company of the International Electrical Testing Association or is a nationally recognized testing laboratory (NRTL) as defined by OSHA in 29 CFR 1910.7, and that is acceptable to the Housing Authority of the City of Pittsburgh, HACP (the Project Owner); Loysen + Kreuthmeier Architects (the Project Architect); and Multi-Lynx Companies, Inc. (the Project Engineer), and other local and municipal authorities having jurisdiction.

1. Testing Agency's Field Supervisor: Person currently certified by the International Electrical Testing Association or by a testing agency acceptable to the Housing Authority of the City of Pittsburgh, HACP (the Project Owner); Loysen + Kreuthmeier Architects (the Project Architect); Multi-Lynx Companies, Inc. (the Project Engineer); and other local and municipal authorities having jurisdiction.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to the Housing Authority of the City of Pittsburgh, HACP (the Project Owner); Loysen + Kreuthmeier Architects (the Project Architect); and Multi-Lynx Companies, Inc. (the Project Engineer), and other local and municipal authorities having jurisdiction, and marked for intended use.

C. Comply with NFPA 70.

PART 2 - PRODUCTS

2.1 CONDUCTORS AND CABLES

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

1. Alcan Products Corporation; Alcan Cable Division.
2. American Insulated Wire Corporation; a Leviton Company.
3. General Cable Corporation.
4. Senator Wire & Cable Company.
5. Southwire Company.
6. Or as approved by the Project Architect (A/E).

B. Copper Conductors: Comply with NEMA WC 70.

C. Conductor Insulation: Comply with NEMA WC 70 for Types THHN-THWN, XHHW.

2.2 CONNECTORS AND SPLICES

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

1. AFC Cable Systems, Inc.
2. Hubbell Power Systems, Inc.
3. O-Z/Gedney; EGS Electrical Group LLC.
4. 3M; Electrical Products Division.
5. Tyco Electronics Corporation.
6. Or as approved by the A/E.

B. Description: Factory-fabricated connectors and splices of size, ampacity rating, material, type, and class for application and service indicated.

PART 3 - EXECUTION

3.1 CONDUCTOR MATERIAL APPLICATIONS

A. Feeders: Copper. Solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.

B. Branch Circuits: Copper. Solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.

3.2 CONDUCTOR INSULATION AND MULTICONDUCTOR CABLE APPLICATIONS AND WIRING METHODS

A. Exposed Branch Circuits, Including in Crawlspaces: Type THHN-THWN, single conductors in raceway Metal-clad cable, Type MC, Nonmetallic-sheathed cable, Type NM.

B. Branch Circuits Concealed in Ceilings, Walls, and Partitions: Type THHN-THWN, single conductors in raceway.

C. Class 1 Control Circuits: Type THHN-THWN, in raceway.

D. Class 2 Control Circuits: Type THHN-THWN, in raceway, Power-limited cable, concealed in building finishes, Power-limited tray cable, in cable tray.

3.3 INSTALLATION OF CONDUCTORS AND CABLES

A. Conceal cables in finished walls, ceilings, and floors, unless otherwise indicated.

B. Use manufacturer-approved pulling compound or lubricant where necessary; compound used must not deteriorate conductor or insulation. Do not exceed manufacturer's recommended maximum pulling tensions and sidewall pressure values.

C. Use pulling means, including fish tape, cable, rope, and basket-weave wire/cable grips that will not damage cables or raceway.

D. Install exposed cables parallel and perpendicular to surfaces of exposed structural members, and follow surface contours where possible.

E. Support cables according to appropriate Division 26 Sections

F. Identify and color-code conductors and cables according to appropriate Division 26 Sections.

G. All conductors and cables shall be in conduit or raceway.

3.4 CONNECTIONS

A. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

B. Make splices and taps that are compatible with conductor material and that possess equivalent or better mechanical strength and insulation ratings than un-spliced conductors.

1. Use oxide inhibitor in each splice and tap conductor for aluminum conductors.

C. Wiring at Outlets: Install conductor at each outlet, with at least 6 inches of slack.

3.5 SLEEVE AND SLEEVE-SEAL INSTALLATION FOR ELECTRICAL PENETRATIONS

A. Install sleeves and sleeve seals at penetrations of exterior floor and wall assemblies. Comply with requirements in appropriate Division 26 Sections.

3.6 FIRESTOPPING

A. Apply firestopping to electrical penetrations of fire-rated floor and wall assemblies to restore original fire-resistance rating of assembly according to appropriate Division 07 Sections.

END OF SECTION 26 05 19

SECTION 26 05 26 – GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Provide labor, materials, equipment, tools and services, and perform operations required for, and reasonably incidental to, the providing of the grounding systems.

B. Exposed metallic parts of the electrical system which are not intended to carry current, including system components such as busducts, switchboards, panelboards, and raceway systems, and including grounding conductors and neutral conductors of the various wiring systems, shall be grounded in accordance with NEC requirements.

C. Comply with Division 26 Sections, as applicable. Refer to other Divisions for coordination of Work.

1.2 GOVERNING AUTHORITIES

A. All grounding system shall comply with applicable State and Local Codes and Ordinances, with the requirements of other authorities having jurisdiction, with NEC and applicable NFPA Standards.

1.3 SUBMITTALS

A. Submit product data and shop drawings in accordance with Section 01 33 00 – Submittal Procedures, for products specified under PART 2 - PRODUCTS.

PART 2 - PRODUCTS

2.1 GROUNDING CONDUCTORS

A. Grounding conductors shall be annealed copper standard conductors. Conductor shall be bare or insulated, as required or indicated, and of the sizes indicated or required by the NEC.

2.2 GROUNDING CONNECTORS

A. Provide exothermic type chemical welded type connectors for joining of grounding electrode conductors to ground rods, grounding plates, and splicing of conductors. Provide compression connectors for joining of grounding electrode conductors to ground bars.

B. Provide mechanical type connectors for joining of all equipment and isolated ground conductors.

PART 3 - EXECUTION

3.1 POWER SYSTEMS GROUNDING

A. Provide adequate and permanent service neutral and equipment grounding in accordance with the National Electric Code and subject to the following additional requirements.

B. Size grounding conductors in accordance with Tables 250.122 of the NEC.

C. Assure the electrical continuity of all metallic raceway systems, pulling up all conduits and/or locknuts wrench-tight. Where expansion joints or telescoping joints occur, provide bonding jumpers. Wherever flexible metallic conduit is employed, provide a green insulated ground jumper installed in the flexible conduit.

D. Provide grounding bushings on all raceways terminating within all electrical enclosures constructed of separate enclosure panels, which are not integrally welded together. Provide grounding conductors from such bushings to the frame of the enclosure, ground bus, and equipment grounding strap where one occurs.

E. Provide a separate green-insulated equipment grounding conductor, with insulation of the same rating as the phase conductors, for all feeders and branch circuits. Install the grounding conductors in the raceway with related phase and neutral conductors. Where parallel conductors in separate raceways occur, provide a grounding conductor in each raceway.

F. Connect all grounding conductors to ground terminals at each end of the run, to the end that there will be no uninterrupted grounding circuit from the point of ground fault back to a point of connection of the equipment ground and system neutral.

3.2 GROUNDING SYSTEM TESTING

A. Perform the following testing:

1. Test the continuity of, and the proper connection of, each ground conductor and system, to assure that the grounding system is complete and uninterrupted. Testing shall be performed using laboratory-accuracy test instruments of suitable design for the tests to be performed.

2. Test grounding conductors, phase conductors and neutral conductors for continuity and for possible damage to insulation. Each such conductor shall be tested for insulation from ground and from other conductors.

B. Any portions of the installations, which fail to pass these tests shall be replaced, repaired or otherwise corrected completely, and retested to show proper conformity.

END OF SECTION 26 05 26

SECTION 26 05 29 – HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Provide labor, material, equipment, tools and services, and perform operations required for, and reasonably incidental to, the providing of supporting devices, including related systems and accessories.

B. Comply with Division 26 Sections, as applicable. Refer to other Divisions for coordination of Work.

1.2 SUBMITTALS

C. Submit product data in accordance with Section 01 33 00 – Submittal Procedures.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Unistrut Corporation

B. B-Line Systems, Inc.

C. Midland Ross-Kindorf

D. Or as approved by the Project Architect/Engineer (A/E).

2.2 MATERIALS

A. Suspension Hangers; Suspension hangers for individual conduit runs shall be zinc plated formed steel type.

B. Vertical Supports; Malleable iron one hole pipe straps shall be used for vertical runs.

C. Clamps; Beam clamps shall be used for bar joists and beams.

D. Anti-Vibration Hangers; Anti-vibration hangers shall be combination type having a double deflection neoprene element in series with a steel coil spring; double deflection of 0.30"; steel coil spring shall be selected from a 1" static deflection series with a minimum additional travel to solid of 1/2"; spring diameters shall be large enough to permit 15 degree angular misalignment of the rod connecting the hanger to the ceiling support without rubbing the hanger box.

E. Light Fixture Hangers; Refer to other Division 26 Sections.

F. Corrosive Areas: PVC; at factory apply a minimum of 10-mil-thick PVC coating, bonded to metal, inside and outside.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Hangers:

1. Approved hangers and stiff leg supports shall be installed in quantity and size as required to carry the weight of raceway and contents and shall be arranged to prevent vibration transmission to the building and allow for raceway movement.

2. Hangers shall be supported by means of uncoated solid steel rods, which are threaded to allow vertical adjustments. Lock nuts shall be provided in sufficient number and location to lock all rod adjustments permanently at the adjusted height. Two lock nuts shall be used unless the nut tightens against a threaded socket. Minimum rod diameters shall be as follows:

NOMINAL CONDUIT SIZE	ROD DIAMETER
1/2" through 2"	1/4"

3. Hanger spacing shall be as required for proper and adequate support raceway, but in no case shall be less than one hanger per 8'-0" of raceway length except that conduit less than 1" diameter shall be supported at least every 6'-0".

4. Where numerous conduits are run parallel to one another, they may be supported from a trapeze type hanger arrangement with strut bottom.

5. Anti-vibration type hangers shall be provided for equipment as required to minimize vibration and/or as directed by the A/E.

B. Supports:

1. Support of hangers shall be by means of sufficient quantities of individual after set steel expansion shields, or beam clamps attached to structural steel.

2. Stiff-legs shall be furnished and installed in cases where support from overhead structure is not possible.

3. Ceiling mounted lighting fixtures shall be supported from the building structure at two opposite corners. Provide fixture hangers to properly interface with the ceiling system.

4. Furnish and install complete any additional structural support steel, brackets, fasteners, etc., as required to adequately support all raceway and equipment.

5. Support of hangers from concrete slabs shall be by means of sufficient quantity of "U" brackets attached with after set expansion shields and bolts.

6. Support of hangers from concrete tees shall be by means of sufficient quantity of angle iron brackets attached with after set expansion shields and bolts.

END OF SECTION 26 05 29

SECTION 26 05 33 – RACEWAYS AND BOXES FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Metal conduits, tubing, and fittings.
2. Nonmetal conduits, tubing, and fittings.
3. Metal wireways and auxiliary gutters.
4. Nonmetal wireways and auxiliary gutters.
5. Surface raceways.
6. Boxes, enclosures, and cabinets.
7. Handholes and boxes for exterior underground cabling.

B. Related Requirements:

1. Division 02 Sections
2. Division 26 Sections

1.3 DEFINITIONS

A. ARC: Aluminum rigid conduit.

B. GRC: Galvanized rigid steel conduit.

C. IMC: Intermediate metal conduit.

1.4 ACTION SUBMITTALS

A. Product Data: For surface raceways, wireways and fittings, floor boxes, hinged-cover enclosures, and cabinets.

B. Shop Drawings: For custom enclosures and cabinets. Include plans, elevations, sections, and attachment details.

1.5 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Conduit routing plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of items involved:

1. Structural members in paths of conduit groups with common supports.
2. HVAC and plumbing items and architectural features in paths of conduit groups with common supports, as applicable.

B. Qualification Data: For Project Architect/Engineer (A/E).

C. Source quality-control reports.

PART 2 - PRODUCTS

2.1 METAL CONDUITS, TUBING, AND FITTINGS

A. Manufacturers: Subject to compliance with requirements, provide products by the following available manufacturers offering products that may be incorporated into the Work include:

1. AFC Cable Systems, Inc.
2. Allied Tube & Conduit; a Tyco International Ltd. Co.
3. Anamet Electrical, Inc.
4. Electri-Flex Company.
5. O-Z/Gedney; a brand of EGS Electrical Group.
6. Picoma Industries, a subsidiary of Mueller Water Products, Inc.
7. Republic Conduit.
8. Robroy Industries.
9. Southwire Company.
10. Thomas & Betts Corporation.
11. Western Tube and Conduit Corporation.
12. Wheatland Tube Company; a division of John Maneely Company.
13. Or as approved by the A/E.

B. Listing and Labeling: Metal conduits, tubing, and fittings shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

C. GRC: Comply with ANSI C80.1 and UL 6.

D. ARC: Comply with ANSI C80.5 and UL 6A.

E. IMC: Comply with ANSI C80.6 and UL 1242.

F. PVC-Coated Steel Conduit: PVC-coated rigid steel conduit.

1. Comply with NEMA RN 1.
2. Coating Thickness: 0.040 inch, minimum.

G. EMT: Comply with ANSI C80.3 and UL 797.

H. FMC: Comply with UL 1; zinc-coated steel.

I. LFMC: Flexible steel conduit with PVC jacket and complying with UL 360.

J. Fittings for Metal Conduit: Comply with NEMA FB 1 and UL 514B.
1. Conduit Fittings for Hazardous (Classified) Locations: Comply with UL 886 and NFPA 70.

2. Fittings for EMT:

a. Material: Steel.
b. Type: compression.

3. Expansion Fittings: PVC or steel to match conduit type, complying with UL 651, rated for environmental conditions where installed, and including flexible external bonding jumper.

4. Coating for Fittings for PVC-Coated Conduit: Minimum thickness of 0.040 inches, with overlapping sleeves protecting threaded joints.

K. Joint Compound for IMC, GRC, or ARC: Approved, as defined in NFPA 70, by authorities having jurisdiction for use in conduit assemblies, and compounded for use to lubricate and protect threaded conduit joints from corrosion and to enhance their conductivity.

2.2 NONMETALLIC CONDUITS, TUBING, AND FITTINGS

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

1. AFC Cable Systems, Inc.
2. Anamet Electrical, Inc.
3. Arnco Corporation.
4. CANTEX Inc.
5. CertainTeed Corporation
6. Condux International, Inc.
7. Electri-Flex Company.
8. Kraloy.
9. Lamson & Sessions; Carlon Electrical Products.
10. Niedax-Kleinhuis USA, Inc.
11. RACO; a Hubbell company.
12. Thomas & Betts Corporation.
13. Or as approved by the A/E.

B. Listing and Labeling: Nonmetallic conduits, tubing, and fittings shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

C. ENT: Comply with NEMA TC 13 and UL 1653.

D. RNC: Type EPC-40-PVC, complying with NEMA TC 2 and UL 651 unless otherwise indicated.

E. LFNC: Comply with UL 1660.

F. Rigid HDPE: Comply with UL 651A.

G. Continuous HDPE: Comply with UL 651B.

H. Coilable HDPE: Preassembled with conductors or cables, and complying with ASTM D 3485.

I. RTRC: Comply with UL 1684A and NEMA TC 14.

J. Fittings for ENT and RNC: Comply with NEMA TC 3; match to conduit or tubing type and material.

K. Fittings for LFNC: Comply with UL 514B.

L. Solvent cements and adhesive primers shall have a VOC content of 510 and 550 g/L or less, respectively, when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

M. Solvent cements and adhesive primers shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

2.3 METAL WIREWAYS AND AUXILIARY GUTTERS

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

1. Cooper B-Line, Inc.
2. Hoffman; a Pentair company.
3. Mono-Systems, Inc.
4. Square D; a brand of Schneider Electric.
5. Or as approved by the A/E.

B. Description: Sheet metal, complying with UL 870 and NEMA 250, Type 1 unless otherwise indicated, and sized according to NFPA 70.

1. Metal wireways installed outdoors shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

C. Fittings and Accessories: Include covers, couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings to match and mate with wireways as required for complete system.

D. Wireway Covers: Hinged type unless otherwise indicated.

E. Finish: Manufacturer's standard enamel finish.

2.4 BOXES, ENCLOSURES, AND CABINETS

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

1. Adalet.
2. Cooper Technologies Company; Cooper Crouse-Hinds.
3. EGS/Appleton Electric.
4. Erickson Electrical Equipment Company.
5. FSR Inc.
6. Hoffman; a Pentair company.
7. Hubbell Incorporated; Killark Division.
8. Kraloy.
9. Milbank Manufacturing Company.
10. Mono-Systems, Inc.
11. O-Z/Gedney; a brand of EGS Electrical Group.
12. RACO; a Hubbell Company.
13. Robroy Industries.
14. Spring City Electrical Manufacturing Company.
15. Stahlin Non-Metallic Enclosures; a division of Robroy Industries.
16. Thomas & Betts Corporation.
17. Wiremold / Legrand.
18. Or as approved by the A/E.

B. General Requirements for Boxes, Enclosures, and Cabinets: Boxes, enclosures, and cabinets installed in wet locations shall be listed for use in wet locations.

C. Sheet Metal Outlet and Device Boxes: Comply with NEMA OS 1 and UL 514A.

D. Cast-Metal Outlet and Device Boxes: Comply with NEMA FB 1, ferrous alloy, Type FD, with gasketed cover.

E. Nonmetallic Outlet and Device Boxes: Comply with NEMA OS 2 and UL 514C.

F. Metal Floor Boxes:

1. Material: Cast metal.
2. Type: Semi-adjustable.
3. Shape: Rectangular.
4. Listing and Labeling: Metal floor boxes shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

G. Luminaire Outlet Boxes: Nonadjustable, designed for attachment of luminaire weighing 50 lb. Outlet boxes designed for attachment of luminaires weighing more than 50 lb shall be listed and marked for the maximum allowable weight.

H. Small Sheet Metal Pull and Junction Boxes: NEMA OS 1.

I. Cast-Metal Access, Pull, and Junction Boxes: Comply with NEMA FB 1 and UL 1773, galvanized, cast iron with gasketed cover.

J. Box extensions used to accommodate new building finishes shall be of same material as recessed box.

K. Device Box Dimensions: 4 inches square by 2 1/8 inches deep.

L. Gangable boxes are prohibited.

M. Hinged-Cover Enclosures: Comply with UL 50 and NEMA 250, Type 1 with continuous-hinge cover with flush latch unless otherwise indicated.

1. Metal Enclosures: Steel, finished inside and out with manufacturer's standard enamel.
2. Nonmetallic Enclosures: Fiberglass.
3. Interior Panels: Steel; all sides finished with manufacturer's standard enamel.

N. Cabinets:

1. NEMA 250, Type 1 galvanized-steel box with removable interior panel and removable front, finished inside and out with manufacturer's standard enamel.
2. Hinged door in front cover with flush latch and concealed hinge.
3. Key latch to match panelboards.
4. Metal barriers to separate wiring of different systems and voltage.
5. Accessory feet where required for freestanding equipment.
6. Nonmetallic cabinets shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

PART 3 - EXECUTION

3.1 RACEWAY APPLICATION

A. Outdoors: Apply raceway products as specified below unless otherwise indicated:

1. Exposed Conduit: GRC.
2. Concealed Conduit, Aboveground: EMT.
3. Underground Conduit: RNC, Type EPC-40-PVC, concrete encased.
4. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): LFMC.
5. Boxes and Enclosures, Aboveground: NEMA 250, Type 3R.

B. Indoors: Apply raceway products as specified below unless otherwise indicated:

1. Exposed, Not Subject to Physical Damage: EMT.
2. Exposed, Not Subject to Severe Physical Damage: EMT.
3. Exposed and Subject to Severe Physical Damage: GRC. Raceway locations include the following:

    a. Mechanical rooms.
    b. Gymnasiums.
    c. Insert designations of applicable spaces or locations.

4. Concealed in Ceilings and Interior Walls and Partitions: EMT.
5. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): FMC, except use LFMC in damp or wet locations.
6. Damp or Wet Locations: GRC.
7. Boxes and Enclosures: NEMA 250, Type 1, except use NEMA 250, Type 4 stainless steel in institutional and commercial kitchens and damp or wet locations.

C. Minimum Raceway Size: 3/4-inch trade size.

D. Raceway Fittings: Compatible with raceways and suitable for use and location.

1. Rigid and Intermediate Steel Conduit: Use threaded rigid steel conduit fittings unless otherwise indicated. Comply with NEMA FB 2.10.
2. PVC Externally Coated, Rigid Steel Conduits: Use only fittings listed for use with this type of conduit. Patch and seal all joints, nicks, and scrapes in PVC coating after installing conduits and fittings. Use sealant recommended by fitting manufacturer and apply in thickness and number of coats recommended by manufacturer.
3. EMT: Use compression, cast-metal fittings. Comply with NEMA FB 2.10.
4. Flexible Conduit: Use only fittings listed for use with flexible conduit. Comply with NEMA FB 2.20.

E. Install nonferrous conduit or tubing for circuits operating above 60 Hz. Where aluminum raceways are installed for such circuits and pass through concrete, install in nonmetallic sleeve.

F. Do not install aluminum conduits, boxes, or fittings in contact with concrete or earth.

G. Install surface raceways only where indicated on Drawings.

H. Do not install nonmetallic conduit where ambient temperature exceeds 120 degrees F.

3.2 INSTALLATION

A. Comply with NECA 1 and NECA 101 for installation requirements except where requirements on Drawings or in this article are stricter. Comply with NECA 102 for aluminum conduits. Comply with NFPA 70 limitations for types of raceways allowed in specific occupancies and number of floors.

B. Keep raceways at least 6 inches away from parallel runs of flues and steam or hot-water pipes. Install horizontal raceway runs above water and steam piping.

C. Complete raceway installation before starting conductor installation.

D. Comply with requirements in other Division 26 Sections.

E. Arrange stub-ups so curved portions of bends are not visible above finished slab.

F. Install no more than the equivalent of three 90-degree bends in any conduit run except for control wiring conduits, for which fewer bends are allowed. Support within 12 inches of changes in direction.

G. Conceal conduit and EMT within finished walls, ceilings, and floors unless otherwise indicated. Install conduits parallel or perpendicular to building lines.

H. Support conduit within 12 inches of enclosures to which attached.

I. Raceways Embedded in Slabs:

1. Run conduit larger than 1-inch trade size, parallel or at right angles to main reinforcement. Where at right angles to reinforcement, place conduit close to slab support. Secure raceways to reinforcement at maximum10-foot intervals.
2. Arrange raceways to cross building expansion joints at right angles with expansion fittings.
3. Arrange raceways to keep a minimum of 1 inch of concrete cover in all directions.
4. Do not embed threadless fittings in concrete unless specifically approved by the A/E for each specific location.
5. Change from ENT to RNC, Type EPC-40-PVC before rising above floor.

J. Stub-ups to Above Recessed Ceilings:

1. Use EMT, IMC, or RMC for raceways.
2. Use a conduit bushing or insulated fitting to terminate stub-ups not terminated in hubs or in an enclosure.

K. Threaded Conduit Joints, Exposed to Wet, Damp, Corrosive, or Outdoor Conditions: Apply listed compound to threads of raceway and fittings before making up joints. Follow compound manufacturer's written instructions.

L. Coat field-cut threads on PVC-coated raceway with a corrosion preventing conductive compound prior to assembly.

M. Raceway Terminations at Locations Subject to Moisture or Vibration: Use insulating bushings to protect conductors including conductors smaller than No. 4 AWG.

N. Terminate threaded conduits into threaded hubs or with locknuts on inside and outside of boxes or cabinets. Install bushings on conduits up to 1 1/4-inch trade size and insulated throat metal bushings on 1 1/2-inch trade size and larger conduits terminated with locknuts. Install insulated throat metal grounding bushings on service conduits.

O. Install raceways square to the enclosure and terminate at enclosures with locknuts. Install locknuts hand tight plus 1/4 turn more.

P. Do not rely on locknuts to penetrate nonconductive coatings on enclosures. Remove coatings in the locknut area prior to assembling conduit to enclosure to assure a continuous ground path.

Q. Cut conduit perpendicular to the length. For conduits 2-inch trade size and larger, use roll cutter or a guide to make cut straight and perpendicular to the length.

R. Install pull wires in empty raceways. Use polypropylene or monofilament plastic line with not less than 200-lb tensile strength. Leave at least 12 inches of slack at each end of pull wire. Cap underground raceways designated as spare above grade alongside raceways in use.

S. Surface Raceways:

1. Install surface raceway with a minimum 2-inch radius control at bend points.
2. Secure surface raceway with screws or other anchor-type devices at intervals not exceeding 48 inches and with no less than two supports per straight raceway section. Support surface raceway according to manufacturer's written instructions. Tape and glue are not acceptable support methods.

T. Install raceway-sealing fittings at accessible locations according to NFPA 70 and fill them with listed sealing compound. For concealed raceways, install each fitting in a flush steel box with a blank cover plate having a finish similar to that of adjacent plates or surfaces. Install raceway-sealing fittings according to NFPA 70.

U. Install devices to seal raceway interiors at accessible locations. Locate seals so no fittings or boxes are between the seal and the following changes of environments. Seal the interior of all raceways at the following points:

1. Where conduits pass from warm to cold locations, such as boundaries of refrigerated spaces.
2. Where an underground service raceway enters a building or structure.
3. Where otherwise required by NFPA 70.

V. Comply with manufacturer's written instructions for solvent welding RNC and fittings.

W. Expansion-Joint Fittings:

1. Install in each run of aboveground RNC that is located where environmental temperature change may exceed 30 degrees F and that has straight-run length that exceeds 25 feet. Install in each run of aboveground RMC and EMT conduit that is located where environmental temperature change may exceed 100 degrees F and that has straight-run length that exceeds 100 feet.
2. Install type and quantity of fittings that accommodate temperature change listed for each of the following locations:

    a. Outdoor Locations Not Exposed to Direct Sunlight: 125 degrees F temperature change.
    b. Outdoor Locations Exposed to Direct Sunlight: 155 degrees F temperature change.
    c. Indoor Spaces Connected with Outdoors without Physical Separation: 125 degrees F temperature change.
    d. Attics: 135 degrees F temperature change.

3. Install fitting(s) that provide expansion and contraction for at least 0.00041 inch per foot of length of straight run per degree F of temperature change for PVC conduits. Install fitting(s) that provide

expansion and contraction for at least 0.000078 inch per foot of length of straight run per degree F of temperature change for metal conduits.

4. Install expansion fittings at all locations where conduits cross building or structure expansion joints.
5. Install each expansion-joint fitting with position, mounting, and piston setting selected according to manufacturer's written instructions for conditions at specific location at time of installation. Install conduit supports to allow for expansion movement.

X. Flexible Conduit Connections: Comply with NEMA RV 3. Use a maximum of 72 inches of flexible conduit for recessed and semi-recessed luminaires, equipment subject to vibration, noise transmission, or movement; and for transformers and motors.

1. Use LFMC in damp or wet locations subject to severe physical damage.
2. Use LFMC or LFNC in damp or wet locations not subject to severe physical damage.

Y. Mount boxes at heights indicated on Drawings. If mounting heights of boxes are not individually indicated, give priority to ADA requirements. Install boxes with height measured to center of box unless otherwise indicated.

Z. Recessed Boxes in Masonry Walls: Saw-cut opening for box in center of cell of masonry block, and install box flush with surface of wall. Prepare block surfaces to provide a flat surface for a raintight connection between box and cover plate or supported equipment and box.

AA. Horizontally separate boxes mounted on opposite sides of walls so they are not in the same vertical channel.

AB. Locate boxes so that cover or plate will not span different building finishes.

AC. Support boxes of three gangs or more from more than one side by spanning two framing members or mounting on brackets specifically designed for the purpose.

AD. Fasten junction and pull boxes to or support from building structure. Do not support boxes by conduits.

AE. Set metal floor boxes level and flush with finished floor surface.

AF. Set nonmetallic floor boxes level. Trim after installation to fit flush with finished floor surface.

3.3 SLEEVE AND SLEEVE-SEAL INSTALLATION FOR ELECTRICAL PENETRATIONS

A. Install sleeves and sleeve seals at penetrations of exterior floor and wall assemblies. Comply with requirements in other Division 26 Sections.

3.4 FIRESTOPPING

A. Install firestopping at penetrations of fire-rated floor and wall assemblies. Comply with requirements in Division 07 Sections.

3.5 PROTECTION

A. Protect coatings, finishes, and cabinets from damage and deterioration.

1. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.
2. Repair damage to PVC coatings or paint finishes with matching touchup coating recommended by manufacturer.

END OF SECTION 26 05 33

SECTION 26 24 13 – DISCONNECT SWITCHES

PART 1 - GENERAL

1.1 SUMMARY

A. Provide labor, materials, equipment, tools and services, and perform operations required for, and reasonably incidental to, the providing of disconnect switches, including all related systems and accessories.

B. Comply with Division 26 Sections, as applicable. Refer to other Divisions for coordination of Work.

1.2 REFERENCE STANDARDS

A. Switches shall be manufactured in accordance with the following standards:

1. UL 98 - Enclosed and Dead Front Switches
2. NEMA KS1 - Enclosed Switches
3. NEMA 250 - Enclosures for Electrical Equipment

1.3 SUBMITTALS

A. Submit product data and shop drawings in accordance with Section 01 33 00 – Submittal Procedures, for products specified under PART 2 - PRODUCTS.

B. Provide outline drawings with dimensions, and equipment ratings for voltage, amperage, horsepower, and short circuit.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Square D Company.

B. General Electric.

C. Westinghouse.

D. Or as approved by the Project Architect (A/E)

2.2 GENERAL

A. Switches shall be heavy-duty type.

2.3 SWITCH INTERIOR

A. Switches shall have switchblades, which are visible when the switch is OFF and the cover is open.

B. Lugs shall be front removable and UL listed for 60°C or 75°C conductors 30-100 ampere, 75°C conductors 200 ampere and up.

C. Current carrying parts shall be plated to resist corrosion.

D. Switches shall have removable arc suppressor to facilitate easy access to line side lugs.

E. Switches shall have provisions for a field installable electrical interlock.

2.4 SWITCH MECHANISM

A. Switch operating mechanism shall be quick-make, quick-break such that, during normal operation of the switch, the operation of the contacts shall not be capable of being restrained by the operating handle after the closing or opening action of the contacts has started.

B. The operating handle shall be an integral part of the box, not the cover.

C. Provisions for padlocking the switch in the OFF position with at least three padlocks shall be provided.

D. The handle position shall travel at least 90° between OFF and ON positions to clearly distinguish and indicate handle position.

E. Switches shall have a dual cover interlock mechanism to prevent unintentional opening of the switch cover when the switch is ON and prevent turning the switch ON when the cover is open. The cover interlock mechanism shall have an externally operated override but the override shall not permanently disable the interlock mechanism. The tool used to override the cover interlock mechanism shall not be required to enter the enclosure in order to override the interlock.

2.5 SWITCH ENCLOSURES

A. Switch covers shall be attached with welded pin-type hinges (Type 1) or top-hinged, attached with removable screws and securable in the open position (Type 3R).

B. The enclosure shall be finished with gray baked enamel paint which is electrodeposited on cleaned, phosphate pre-treated steel (Type 1) or gray baked enamel paint which is electrodeposited on cleaned, phosphate pre-treated galvannealed steel (Type 3R).

C. The enclosure shall have ON and OFF markings stamped into the cover.

D. The operating handle shall be provided with a dual colored, red/black position indication.

E. Switches shall have provisions to accept up to three 3/8" hasp padlocks to lock the operating handle in the OFF position.

F. Tangential knockouts shall be provided to facilitate ease of conduit entry (Type 1).

G. Type 3R enclosure shall contain no knockouts. Supply watertight hubs.

2.6 SWITCH RATINGS

A. Switches shall be horsepower rated.

B. The UL listed short circuit current rating of the switches shall be: 200,000 rms symmetrical amperes when used with or protected by Class R or Class J fuses 30-600 ampere employing appropriate fuse rejection schemes.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install disconnect switches where indicated.

B. Install fuses in fusible disconnect switches.

END OF SECTION 26 24 13

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SECTION 26 29 00 – LOW VOLTAGE CONTROLLERS: CONTACTORS

PART 1 - GENERAL

1.1 SUMMARY

A. Provide labor, materials, equipment, tools and services, and perform operations required for, and reasonably incidental to, the providing of contactors, including all related systems and accessories.

B. Comply with Division 26 Sections, as applicable. Refer to other Divisions for coordination of Work.

1.2 REFERENCE STANDARDS

A.	ANSI/NEMA ICS 6	Enclosures for Industrial Controls and Systems
B.	NEMA ICS 2	Industrial Control Devices, Controllers, and Assemblies
C.	ANSI/NFPA 70	National Electrical Code

1.3 SUBMITTALS

A. Submit product data and shop drawings in accordance with Section 01 33 00 – Submittal Procedures, for products specified under PART 2 - PRODUCTS.

B. Product Data: Include dimensions, size, voltage ratings, and current ratings.

C. Maintenance Data: Include instructions for replacing and maintaining coil and contacts.

1.4 REGULATORY REQUIREMENTS

A. Furnish products listed and classified by Underwriters' Laboratories.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Square D Company

B. General Electric

C. Siemens/ITE

D. Automatic Switch Company (ASCO)

E. Or Project Architect (A/E) approved equal

2.2 LIGHTING CONTACTORS

A. Description: Magnetic lighting contactor.

B. Configuration: Electrically held with continuously rated, encapsulated coils. Standard coil clearing contacts are to be provided so that the contactor coils shall be normally closed.

C. Coil Voltage: 120 volts, 60 Hz, as indicated or required.

D. Poles: As indicated.

E. Contact Rating: Amperes required for all types of ballast and tungsten lighting of resistive heating, and motor loads.

F. Contacts: Totally enclosed, double-break silver-cadmium-oxide power contacts. Contact inspection and replacement shall be possible without disturbing line or load wiring.

G. Wiring: Straight-through wiring with all terminals clearly marked.

H. Enclosure: ANSI/NEMA ICS 6, Type 1 or 3R, as required to meet conditions of installation.

I. Accessories:

1. Selector Switch: HAND-OFF-AUTOMATIC

2. Auxiliary Contacts: Two, normally open and normally closed, field convertible, field convertible.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install in accordance with manufacturer's instructions.

END OF SECTION 26 29 00

SECTION 26 51 00 – INTERIOR LIGHTING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Interior lighting fixtures, lamps, and ballasts.
2. Emergency lighting units.
3. Exit signs.
4. Lighting fixture supports.
5. Retrofit kits for fluorescent lighting fixtures.

B. Related Sections:

1. Other Division 26 Sections.

1.3 DEFINITIONS

A. BF: Ballast factor.

B. CCT: Correlated color temperature.

C. CRI: Color-rendering index.

D. LER: Luminaire efficacy rating.

E. Lumen: Measured output of lamp and luminaire, or both.

F. Luminaire: Complete lighting fixture, including ballast housing if provided.

1.4 ACTION 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, including BF.
4. Energy-efficiency data.

5. Air and Thermal Performance Data: For air-handling lighting fixtures. Furnish data required in Division 22 Sections.
6. Life, output (lumens, CCT, and CRI), and energy-efficiency data for lamps.
7. Photometric data and adjustment factors based on laboratory tests, complying with IESNA Lighting Measurements Testing & Calculation Guides, of each lighting fixture type. The adjustment factors shall be for lamps, ballasts, and accessories identical to those indicated for the lighting fixture as applied in this Project.

    a. Testing Agency Certified Data: For indicated fixtures, photometric data shall be certified by a qualified independent testing agency satisfactory to the Housing Authority of the City of Pittsburgh, HACP (the Project Owner); Loysen + Kreuthmeier Architects (the Project Architect), Multi-Lynx Companies, Inc. (the Project Engineer), and other local and municipal authorities having jurisdiction. Photometric data for remaining fixtures shall be certified by manufacturer.
    b. Manufacturer Certified Data: Photometric data shall be certified by a manufacturer's laboratory with a current accreditation under the National Voluntary Laboratory Accreditation Program for Energy Efficient Lighting Products.

1.5 INFORMATIONAL SUBMITTALS

A. Product Certificates: For each type of ballast for bi-level and dimmer-controlled fixtures, from manufacturer.

B. Field quality-control reports.

C. Warranty: Sample of special warranty.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For lighting equipment and fixtures to include in emergency, operation, and maintenance manuals.

1. Provide a list of all lamp types used on Project; use ANSI and manufacturers' codes.

1.7 MATERIALS MAINTENANCE SUBMITTALS

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

1. Lamps: one for every 10 of each type and rating installed. Furnish at least one of each type.
2. Plastic Diffusers and Lenses: One for every 10 of each type and rating installed. Furnish at least one of each type.
3. Fluorescent-fixture-mounted, emergency battery pack: One for every 10 emergency lighting unit.
4. Ballasts: One for every 10 of each type and rating installed. Furnish at least one of each type.
5. Globes and Guards: One for every 10 of each type and rating installed. Furnish at least one of each type.

1.8 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. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

C. Comply with NFPA 70.

D. FM Global Compliance: Lighting fixtures for hazardous locations shall be listed and labeled for indicated class and division of hazard by FM Global.

1.9 COORDINATION

A. Coordinate layout and installation of lighting fixtures and suspension system with other construction that penetrates ceilings or is supported by them, including HVAC equipment, fire-suppression system, and partition assemblies.

1.10 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.

1. Warranty Period for Emergency Lighting Unit Batteries: Five years from date of Beneficial Occupancy. Full warranty shall apply for first year, and prorated warranty for the remaining four years.
2. Warranty Period for Emergency Fluorescent Ballast and Self-Powered Exit Sign Batteries: Five years from date of Beneficial Occupancy. Full warranty shall apply for first year, and prorated warranty for the remaining four years.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Products: Subject to compliance with requirements, provide one of the products indicated on Drawings.

2.2 GENERAL REQUIREMENTS FOR LIGHTING FIXTURES AND COMPONENTS

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. Housing should be 16ga metal. Provide wire guards to all light fixtures.

C. Sheet Metal Components: Stainless steel or galvanized 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 re-lamping without use of tools. Designed to prevent doors, frames,

lenses, diffusers, and other components from falling accidentally during re-lamping and when secured in operating position.

E. Factory-Applied Labels: Comply with UL 1598. Include recommended lamps and ballasts. Labels shall be located where they will be readily visible to service personnel, but not seen from normal viewing angles when lamps are in place.

1. Label shall include the following lamp and ballast characteristics:

a. "USE ONLY" and include specific lamp type.
b. Lamp diameter code (T-4, T-5, T-8, T-12, etc.), tube configuration (twin, quad, triple, etc.), base type, and nominal wattage for fluorescent and compact fluorescent luminaires.
c. Lamp type, wattage, bulb type (ED17, BD56, etc.) and coating (clear or coated) for HID luminaires.
d. Start type (preheat, rapid start, instant start, etc.) for fluorescent and compact fluorescent luminaires.
e. ANSI ballast type (M98, M57, etc.) for HID luminaires.
f. CCT and CRI for all luminaires.

2.3 EXIT SIGNS

A. General Requirements for Exit Signs: Comply with UL 924; for sign colors, visibility, luminance, and lettering size, comply with authorities having jurisdiction.

B. Internally Lighted Signs:

1. Lamps for AC Operation: Fluorescent, two for each fixture, 20,000 hours of rated lamp life.
2. Lamps for AC Operation: LEDs, 50,000 hours minimum rated lamp life.
3. Self-Powered Exit Signs (Battery Type): Integral automatic charger in a self-contained power pack.

a. Battery: Sealed, maintenance-free, nickel-cadmium type.
b. Charger: Fully automatic, solid-state type with sealed transfer relay.
c. 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.
d. Test Push Button: Push-to-test type, in unit housing, simulates loss of normal power and demonstrates unit operability.
e. LED Indicator Light: Indicates normal power on. Normal glow indicates trickle charge; bright glow indicates charging at end of discharge cycle.
f. 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 a flashing red LED.

2.4 LIGHTING FIXTURE SUPPORT COMPONENTS

A. Comply with Division 26 Sections for channel- and angle-iron supports and nonmetallic channel and angle supports.

B. Single-Stem Hangers: 1/2-inch galvanized steel or tubing with swivel ball fittings and ceiling canopy. Finish same as fixture.

C. Twin-Stem Hangers: Two, 1/2-inch galvanized steel or tubes with single canopy designed to mount a single fixture. Finish same as fixture.

D. Rod Hangers: 3/16-inch minimum diameter, cadmium-plated, threaded galvanized steel or rod.

E. Hook Hangers: Integrated assembly matched to fixture and line voltage and equipped with threaded attachment, cord, and locking-type plug.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Lighting fixtures:

1. Set level, plumb, and square with ceilings and walls unless otherwise indicated.
2. Install lamps in each luminaire.

B. Temporary Lighting: If it is necessary, and approved by the Project Architect (A/E) to use permanent luminaires for temporary lighting, install and energize the minimum number of luminaires necessary. When construction is sufficiently complete, remove the temporary luminaires, disassemble, clean thoroughly, install new lamps, and reinstall.

C. Remote Mounting of Ballasts: Distance between the ballast and fixture shall not exceed that recommended by ballast manufacturer. Verify, with ballast manufacturers, maximum distance between ballast and luminaire.

D. Lay-in Ceiling Lighting Fixtures Supports: Use grid as a support element.

1. Install ceiling support system rods or wires, independent of the ceiling suspension devices, 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.

E. 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.
4. Do not use grid as support for pendant luminaires. Connect support wires or rods to building structure.

F. Connect wiring according to other Division 26 Sections.

3.2 IDENTIFICATION

A. Install labels with panel and circuit numbers on concealed junction and outlet boxes. Comply with requirements for identification specified in other Division 26 Sections.

3.3 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.

3.4 ADJUSTING

A. Occupancy Adjustments: When requested within six months of date of Beneficial Occupancy, provide on-site assistance in adjusting aimable luminaires to suit actual occupied conditions. Provide up to two visits to Project during other-than-normal occupancy hours for this purpose. Some of this Work may be required after dark.

1. Adjust aimable luminaires in the presence of the Housing Authority of the City of Pittsburgh Project Manager, and the A/E.

END OF SECTION 26 51 00

SECTION 26 60 00 – ELECTRICAL WORK IN EXISTING FACILITIES

PART 1 - GENERAL

1.1 SUMMARY

A. Provide labor, materials, equipment, transportation, tools and services, and perform operations required for, and reasonably incidental to the provision or modification of electrical work and systems in existing facilities.

B. Comply with Division 26 Sections, as applicable. Refer to other Divisions for coordination of Work.

C. Refer to Section 02 41 19 – Selective Demolition, for additional requirements.

D. Refer to Architectural and Electrical Demolition Drawings for more information.

1.2 SUBMITTALS

A. Submit the following in accordance with Section 01 33 00 – Submittal Procedures.

B. Show the joining of new Work with existing, illustrating the actual existing conditions.

PART 2 - PRODUCTS (NOT USED)

PART 3 – EXECUTION

3.1 SITE INSPECTION

A. The Construction Documents do not propose to show all existing systems material or equipment. Obtain information related to existing facilities from existing documents, measurements, notations, photographs, surveys, and other observations at the site.

3.2 TEMPORARY WORKING ACCESS

A. Remove existing wire, conduit, equipment, fixtures, and other items as required to provide access for Work in existing facilities.

B. Reinstall and refinish items removed, or otherwise damaged, to match existing adjacent conditions upon completion of the work.

C. Access: Access to and use of the existing facilities and site will be restricted, and shall be under the direction and control of the Housing Authority of the City of Pittsburgh, HACP (the Project Owner), and Loysen + Kreuthmeier Architects (the Project Architect).

3.3 SALVAGE, DEMOLITION AND RELOCATION

A. General:

1. Modify, remove, or relocate materials, equipment and devices as indicated or required by the installation of new facilities.

2. Working jointly with the HACP Project Manager, establish and mark salvage and demolition items before commencing Work. Report items scheduled for relocation, reinstallation or reuse, which are found to be in damaged condition. Await further instructions from the HACP Project Manager and/or the Project Architect (A/E), before commencing with Work.

3. Demolition material shall be removed from the site and disposed of in a legal manner. Salvaged equipment and devices shall be the property of the HACP unless noted otherwise. Store salvaged items in locations as directed by the HACP Project Manager.

B. Relocations:

4. Make minor relocations necessitated by the conditions at the site or as directed by the HACP Project Manager, without additional cost to the HACP.

5. Repair and restore to good functional condition, equipment, materials and items scheduled for relocation, which are damaged during dismantling or reassembly operations.

6. New materials and items of similar design and quality may be substituted for existing materials and items indicated to be relocated upon approval of the HACP and the A/E.

7. Remove carefully, in reverse order to original assembly or placement, items, which are to be relocated.

8. Protect items until relocation is complete.

9. Clean and repair items to be relocated, and provide new materials, fittings, and appurtenances required to complete the relocations and to restore to good operating order.

10. Perform the relocation Work in full compliance with this Division of the Specifications, utilizing skilled workers.

C. Relocating Devices: Remove existing wiring devices, fixtures, equipment, other devices and associated wire and conduit required for the operation of the various systems that are installed in existing-to-be-removed construction, and reinstall in locations indicated as required to return the various systems to working order.

END OF SECTION 26 60 00

SECTION 32 14 00 - UNIT PAVING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Stone pavers set in mortar setting beds.

B. Related Sections:

1. Section 32 13 13 "Concrete Paving" for concrete base under unit pavers.

1.3 ACTION SUBMITTALS

A. Samples for Verification:

1. Stone pavers.
2. Joint materials.

1.4 QUALITY ASSURANCE

A. Source Limitations: Obtain each type of unit paver, joint material, and setting material from single source with resources to provide materials and products of consistent quality in appearance and physical properties.

B. Mockups: Build mockups to verify selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.

1. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Store cementitious materials on elevated platforms, under cover, and in a dry location. Do not use cementitious materials that have become damp.

1.6 PROJECT CONDITIONS

A. Cold-Weather Protection: Do not use frozen materials or materials mixed or coated with ice or frost. Do not build on frozen subgrade or setting beds. Remove and replace unit paver work damaged by frost or freezing.

B. Weather Limitations for Mortar and Grout:

1. Cold-Weather Requirements: Comply with cold-weather construction requirements contained in ACI 530.1/ASCE 6/TMS 602.
2. Hot-Weather Requirements: Comply with hot-weather construction requirements contained in ACI 530.1/ASCE 6/TMS 602. Provide artificial shade and windbreaks and use cooled materials as required. Do not apply mortar to substrates with temperatures of 100 deg F and higher.

PART 2 - PRODUCTS

2.1 STONE PAVERS

A. Belgian Block: Match existing unit size, coloration, and paving pattern.

2.2 MORTAR SETTING-BED MATERIALS

A. Portland Cement: ASTM C 150, Type I or Type II.

B. Hydrated Lime: ASTM C 207, Type S.

C. Water: Potable.

D. Reinforcing Wire Fabric: Galvanized, welded wire fabric, 2 by 2 inches by 0.062 inch in diameter; comply with ASTM A 185/A 185M and ASTM A 82/A 82M except for minimum wire size.

2.3 GROUT MATERIALS

A. Sand-Portland Cement Grout: ANSI A108.10, composed of white or gray cement and white or colored aggregate as required to produce color indicated.

B. Standard Cement Grout: ANSI A118.6, sanded.

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. Boiardi Products; a QEP company.
b. Bostik, Inc.
c. C-Cure.
d. Custom Building Products.
e. Jamo Inc.
f. Laticrete International, Inc.
g. MAPEI Corporation.
h. Mer-Krete System, ParexLahabra, Inc.
i. ProSpec.
j. Southern Grouts & Mortars, Inc.
k. Summitville Tiles, Inc.
l. TEC, Specialty Construction Brands, Inc.

C. Water: Potable.

2.4 MORTAR AND GROUT MIXES

A. General: Comply with referenced standards and with manufacturers' written instructions for mix proportions, mixing equipment, mixer speeds, mixing containers, mixing times, and other procedures needed to produce setting-bed and joint materials of uniform quality and with optimum performance characteristics. Discard mortars and grout if they have reached their initial set before being used.

B. Portland Cement-Lime Setting-Bed Mortar: Type M complying with ASTM C 270, Proportion Specification.

C. Job-Mixed Portland Cement Grout: Proportion and mix job-mixed portland cement and aggregate grout to match setting-bed mortar except omit hydrated lime and use enough water to produce a pourable mixture.

D. Packaged Grout Mix: Proportion and mix grout ingredients according to grout manufacturer's written instructions.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas indicated to receive paving, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance.

B. Where pavers are to be installed over waterproofing, examine waterproofing installation, with waterproofing Installer present, for protection from paving operations, including areas where waterproofing system is turned up or flashed against vertical surfaces.

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

3.2 PREPARATION

A. Remove substances from concrete substrates that could impair mortar bond, including curing and sealing compounds, form oil, and laitance.

B. Sweep concrete substrates to remove dirt, dust, debris, and loose particles.

3.3 INSTALLATION, GENERAL

A. Do not use unit pavers with chips, cracks, voids, discolorations, or other defects that might be visible or cause staining in finished work.

B. Mix pavers from several pallets or cubes, as they are placed, to produce uniform blend of colors and textures.

C. Cut unit pavers with motor-driven masonry saw equipment to provide clean, sharp, unchipped edges. Cut units to provide pattern indicated and to fit adjoining work neatly. Use full units without cutting where possible. Hammer cutting is not acceptable.

D. Joint Pattern: Match and continue existing unit paver joint pattern.

E. Tolerances: Match and continue existing unit paving tolerances.

3.4 MORTAR SETTING-BED APPLICATIONS

A. Saturate concrete subbase with clean water several hours before placing setting bed. Remove surface water about one hour before placing setting bed.

B. Apply mortar-bed bond coat over surface of concrete subbase about 15 minutes before placing mortar bed. Limit area of bond coat to avoid its drying out before placing setting bed. Do not exceed 1/16-inch thickness for bond coat.

C. Place reinforcing wire over concrete subbase, lapped at joints by at least one full mesh and supported so mesh becomes embedded in the middle of mortar bed. Hold edges back from vertical surfaces approximately 1/2 inch.

D. Place mortar bed with reinforcing wire fully embedded in middle of mortar bed. Spread and screed mortar bed to uniform thickness at subgrade elevations required for accurate setting of pavers to finished grades indicated.

E. Mix and place only that amount of mortar bed that can be covered with pavers before initial set. Before placing pavers, cut back, bevel edge, and remove and discard setting-bed material that has reached initial set.

F. Place pavers before initial set of cement occurs. Immediately before placing pavers on mortar bed, apply uniform 1/16-inch-thick bond coat to mortar bed or to back of each paver with a flat trowel.

G. Tamp or beat pavers with a wooden block or rubber mallet to obtain full contact with setting bed and to bring finished surfaces within indicated tolerances. Set each paver in a single operation before initial set of mortar; do not return to areas already set or disturb pavers for purposes of realigning finished surfaces or adjusting joints.

H. Spaced Joint Widths: Match and continue existing unit paver joint widths.

I. Grouted Joints: Grout paver joints complying with ANSI A108.10.

J. Grout joints as soon as possible after initial set of setting bed.

1. Force grout into joints, taking care not to smear grout on adjoining surfaces.
2. Clean pavers as grouting progresses by dry brushing or rubbing with dry burlap to remove smears before tooling joints.
3. Tool exposed joints slightly concave when thumbprint hard, using a jointer larger than joint thickness unless otherwise indicated.
4. If tooling squeezes grout from joints, remove excess grout and smears by dry brushing or rubbing with dry burlap and tool joints again to produce a uniform appearance.

K. Cure grout by maintaining in a damp condition for seven days unless otherwise recommended by grout or liquid-latex manufacturer.

3.5 REPAIRING, POINTING, AND CLEANING

A. Remove and replace unit pavers that are loose, chipped, broken, stained, or otherwise damaged or that do not match adjoining units. Provide new units to match adjoining units and install in same manner as original units, with same joint treatment and with no evidence of replacement.

B. Pointing: During tooling of joints, enlarge voids or holes and completely fill with grout. Point joints at sealant joints to provide a neat, uniform appearance, properly prepared for sealant application.

C. Cleaning: Remove excess grout from exposed paver surfaces; wash and scrub clean.

END OF SECTION 32 14 00

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