State University of New York

Purchase College
Residence Halls
Replace LTW Piping/Zones A&B, E&F
Proposal No. 050213 Dated May 02, 2013

Prepared for:

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REVISION A

100% DESIGN REVIEW

Purchase College State University of New York
Residence Halls
Replace LTW Piping / Zones A & B, E & F

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Design Drawings

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PART 1 - GENERAL

1.01 SCOPE OF WORK

A. This specification defines the requirements for the mechanical work required to complete the project.

B. The Contractor shall provide labor and materials required to accomplish the work associated with the removal, furnishing and installation of equipment and mechanical systems as indicated herein and on the Contract Drawings. The Contractor shall furnish and install all components necessary for the installation of mechanical equipment to result in a complete operational system at project completion.

C. The Contractor's bid shall include, but not be limited to the work as described on drawing T-1.

1.02 REFERENCES

A. The specified Codes and Standards may be exceeded by the Contractor, with the Engineer's approval, if superior or more economical designs and/or materials are available.

B. The following documents form a part of the Specifications. Unless otherwise indicated, the issue in effect on date of invitation for bids shall apply.

1. AISC Steel Handbook
2. American National Standards Institute, Inc. (ANSI)
    a. B1.1 Unified Screw Threads
    b. B2.1 Pipe Threads (Except Dryseal)
    c. B2.2 Dryseal Pipe Threads
    d. B16.3 Malleable Iron Threaded Fittings
    e. B16.5 Steel Pipe Flanges and Flanged Fittings
    f. B16.10 Face to Face and End to End Dimensions of Ferrous Valves
    g. B16.11 Forged Steel Fittings, Socket Welding and Threaded
    h. B16.21 Nonmetallic Flat Gaskets For Pipe Flanges
    i. B36.10 Welded and Seamless Wrought Steel Pipe
    j. B1.20.1 Pipe Threads, General Purpose (Inch)
    k. B31.9 Building Services Piping
    l. B40.1 Gauges-Pressure Indicating Dial Type-Elastic Element
3. American Society of Nondestructive Testing (ASNT)
    a. SNT-TC-1A Recommended practice for personnel qualification and certification in nondestructive testing (with supplements)
4. American Society for Testing and Materials (ASTM)
    a. A 27 Mild to Medium Strength Carbon Steel Castings for General Application
    b. E84 Surface Burning Characteristics of Building Materials.
5. American Society of Mechanical Engineers (ASME)

a. Boiler and Pressure Vessel Code

6. Factory Mutual Engineering Corporation (FM)
   a. Factory Mutual Approval Guide
7. Manufacturers Standardization Society (MSS)
   a. SP25 Standard Markings System for Valves, Fittings, Flanges and Unions
   b. SP58 Pipe Support Standards
   c. SP61 Pressure Testing of Steel Valves
   d. SP84 Steel Valves Socket Welding and Threaded Ends
8. National Fire Protection Association (NFPA)
   a. No. 101 Life Safety Code

C. Requirements of Regulatory Agencies - New York State
   1. New York State Energy Conservation Code

D. Standard Compliance
   1. Where components or materials are specified to conform to requirements of the standards of organizations such as American Society of Mechanical Engineers (ASME) or Underwriters Laboratories (UL), that use of label or listing as method of indication compliance, proof of such conformance shall be submitted and approved by the Engineer. The label or listing of the specified organization will be acceptable evidence.
   2. Where reference is made to codes or standards, or to technical or trade specifications (such as ASTM or ANSI), the latest edition and latest addenda shall be used. In event of conflict between the reference documents, the Engineer shall be notified for resolution.

1.03 SCHEDULING WORK

A. The Contractor shall submit a construction schedule at the construction kick-off meeting. All Work shall be performed following the schedule after it has been reviewed and approved by the Engineer and the Facility.

B. The facility is in operation 24 hours per day, 365 days per year. The Contractor shall not secure any utilities without written consent from the facility. The Contractor will be provided with limited shutdown to accomplish the tie-in work to the existing LTW system. The Contractor shall ensure a minimum down time of the respective piping system.

C. The Contractor shall not remove any equipment or system for operation without the consent of the facility and Site Representative. Once work has been initiated on any equipment or system, the Contractor shall work continuously until the equipment or system is operational.

D. On areas of work affected by other contractors, work shall be coordinated to prevent damage to any work being performed in the area or affect operation of the other parts of the system that are in service.

1.04 QUALITY ASSURANCE

A. The manufacturer of all equipment, devices and material furnished under this Contract shall have and maintain a quality control system which will establish that all code and standard requirements including material, design, fabrication, examination, and inspection will be met. The system shall

also include provisions for satisfying any requirements of the manufacturer or Owner that exceed minimum code or standard requirements.

B. All components shall be given the manufacturer's standard series of electrical and mechanical tests to assure that the equipment is free from defects and to establish that the design and construction is satisfactory. Test data shall be submitted to the Engineer at the time of equipment delivery.

C. All equipment devices and material furnished under this Contract shall, at a minimum, be in accordance with the requirements of the specifications, and shall be the manufacturer's standard commercial product. Additional or better features which are not specifically prohibited by the specifications, but which are a part of the manufacturer's standard commercial product, shall be provided. A standard commercial product is a product that has been sold or is being currently offered for sale on the commercial market through advertisements or manufacturer's catalogs or brochures, and represents the latest production model.

D. All equipment constructed or certified to a referenced standard shall bare the label of that standard (i.e. ASTM, UL, etc.)

E. The Contractor shall implement a Quality Assurance Program that will be effective during the contract period. As a minimum, the following controls, methods and procedures should be thoroughly developed in the Contractors program:

1. Procedures to properly identify and control material within the work area to assure that the specified material is used.
2. Controls to ensure that the correct pipe dope compounds are used.
3. Methods and procedures to be used to ensure that fit-up of all joints meet specification requirements.
4. Controls to ensure that all pressure piping is installed using qualified procedures in accordance with ANSI B31.9.
5. Methods and procedures by which the Contractor obtains assurance that all material supplied by sub-vendors meet the requirements of the governing specifications.

1.05 SHIPPING

A. All items shall be suitably packed and protected from damage during shipment. Each item, crate, bag or other container shall, in addition to the address, be durably marked with the manufacturer's mechanical material list and tag number for which it is intended.

B. Surfaces subject to corrosion shall be coated with a corrosion preventative that is readily removed with a commercial solvent. All openings shall be sealed and protected with corrosion-resistant covers or plugs.

PART 2 - PRODUCTS

2.01 GENERAL

A. All mechanical materials shall be free from defects, which adversely affect the performance or maintainability of individual components, or of the overall assembly.

B. Unless otherwise specified herein, all equipment, material, and articles furnished under this Contract shall be factory new and without blemish or defect. Salvage or rebuilt equipment or materials will not be acceptable.

C. Castings shall be sound and free from patching, misplaced coloring, warping, or other defects that may render the casting unsound for use. Repair processes, such as welding, peening, plugging, or filling with cold solder or metallic paste shall not be accepted.

D. All units of the same classifications i.e., strainers, pumps, heaters, transmitters, etc., with similar options shall be identical to the extent necessary to insure interchangeability of component parts, assemblies, accessories, and spare parts. All units of the same classifications shall be furnished by one manufacturer.

E. Unless otherwise indicated, all nuts and bolts supplied with equipment furnished shall be U.S. standard. Metric nuts and bolts will not be acceptable.

PART 3 - EXECUTION

3.01 TESTING

A. After the mechanical work has been completed, the Contractor shall subject all mechanical systems to acceptance tests under normal operational conditions. The mechanical inspection shall meet all Owner requirements to ensure the equipment and/or systems are in perfect working order.

B. The Contractor shall provide sufficient qualified manufacturer representation for starting, testing, and calibration of the Contractor furnished equipment provided and installed within this Section and shall not be relieved until it is to the satisfaction of the Engineer.

C. Tests shall be attended by representatives of the Contractor, Site Representative and the facility.

D. Furnish all labor, materials and instruments and bear any costs in connection with all the tests required for the project. This shall include but not be limited to load banks.

E. Provide written notice (at least 48 hours) to all concerned of the intended date and time of the tests to be conducted.

F. The Contractor shall not allow or cause any of the work to be covered up or enclosed until it has been inspected, tested and approved by the Site Representative and the local inspector (as required). Failure to adhere to this policy will result in the Contractor bearing all costs associated to reopen equipment and systems.

G. The following checks shall be made:

1. Confirm that all necessary valves, etc. whether specifically mentioned in the specifications and/or drawings or not, but understood to be required for complete and correct operation of equipment, are included.

2. Confirm proper operation as to the proper quantities of delivered product for the associated equipment.

H. The Contractor shall furnish all personnel to assist during testing. The Owner's personnel will assist in the operation of the equipment during start-up and testing in cooperation with the Contractor. The Owner shall not assume any responsibility until the Work has been fully accepted by the Engineer.

I. Testing of piping

1. All piping systems shall be subjected to a test before the piping is concealed, covered or insulated.

2. Before testing the piping systems, remove or otherwise protect from damage all gauges and components that are not designed to withstand the pressures used in testing piping.
3. All new piping shall, at minimum, be subjected to a test of 1.5 times the operational pressure, unless otherwise specified.
4. Acceptance shall be zero leakage at all piping and fitting joints, additionally the piping shall hold pressure, after being bottled up, for at least 30 minutes.
5. Contractor shall be responsible to adjust, repair and retest until all testing is completed and accepted.

END OF SECTION

DIVISION 02 – EXISTING CONDITIONS
SECTION 02 41 13 – DEMOLITION

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PART 1 - GENERAL

1.01 SCOPE OF WORK

A. This specification defines the requirements for demolition work as specified herein and on the Contract Drawings. The mechanical demolition work shall include, but not be limited to the following:

1. Demolish and remove sections of the LTW piping system in the existing trench. The work will include the piping from the point where it enters the trench from the MER up to and including the tee at each riser point.

2. Demolish a minimal amount of concrete next to existing access hatch to allow the removal of old pipe and installation of new pipe.

B. The Contractor shall furnish all labor, supervision, material, and equipment required for the work as indicated herein and on the Contract Drawings.

C. Contractor is responsible for removal of all demolished material, not marked as salvage, from the site.

1.02 COORDINATION

A. The Contractor shall phase all demolition work as indicated on the drawings.

B. All demolition work must be coordinated with the Facility and other trades. No demolition work may begin without authorization of the Site Representative.

1.03 SITE CONDITIONS

A. All outages required by the Contractor to perform the Work shall be arranged in advance with the Facility and the Owner's Representative. A minimum of 48 hours advanced notice will be required for an outage of all utilities including heating hot water.

B. The Contractor shall remove all electrical conduit, wiring, and electrical equipment in the area to facilitate the demolition work and/or rigging path of new material.

C. The Contractor shall turn over to the Owner and shall place in designated storage any items "marked" as salvage. Salvage items shall be "marked" prior to any demolition or dismantling by the Owner and shall be confirmed by the Engineer. The Contractor shall not proceed with any demolition work prior to agreement by the Engineer and the Owner of the "marked" items.

D. All "marked" items, or items removed by the Contractor prior to confirmation of their removal status shall be either reinstalled, repaired, or replaced by the Contractor as determined by the Engineer. All such work shall be performed at the expense of the Contractor.

E. Prevent contamination and surface damage of the facilities' equipment, components, and spaces during demolition and contamination producing operations.

1. Plug, blank, wrap, cover, seal, and mask equipment, components, cables, wireways and openings using fire retardant material, and prevent entry of contaminants to machinery, electronic equipment, valves, vents not in use, and other openings.

2. Install fire retardant industrial filter material on the intake of supply and exhaust end of any ventilation systems which will be in use.

3. All protective measures are to be in place prior to start of any contamination producing operations and shall remain in place until the operation is complete.

4. Install double curtain baffles at the entrance of each access hatch where airborne contamination could occur during demolition operations.

F. Inspect the integrity of the protective covering at the beginning of each shift in which contamination producing operations will be accomplished. Ensure that equipment and machinery have not been infiltrated by contaminants.

G. Maintain cleanliness of the work site, including all decks, free from accumulation of industrial debris caused by contractor and/or subcontractor employees on a continuous basis throughout the construction. Workspaces include those areas immediately adjacent, and those areas where service lines run in the vicinity of the work site.

H. Accomplish an initial walk-through of all locations where the contractor is responsible to perform work to observe cleanliness conditions. The inspection shall be made jointly with the Site Representative, and take place prior to the commencement of any work by the contractor.

I. Accomplish a cleanliness inspection on a daily basis whenever work is in progress. The inspection shall be made jointly with the Site Representative. During inspection, the responsible party shall be assigned. A written report shall be prepared by the Contractor and distributed to the Site Representative on the same day. The report shall indicate as found conditions and assign the responsible activity for each area. Corrective action shall take place immediately.

1.04 REFERENCES

A. Where applicable, all work performed under this section shall be in accordance with the latest edition and latest addenda thereto of the applicable codes, standards, specifications, regulations, procedures, and tests of the following organizations:

1. Environmental Protection Agency (EPA)
2. National Fire Protection Association (NFPA)
3. NYS Department of Environmental Conservation (NYSDEC)
4. NYS Department of Labor (NYSDOL)
5. Occupational Safety and health Administration (OSHA)

B. Where reference is made to codes or standards or to technical or trade specifications (such as ASTM or ANSI), the latest edition and latest addenda shall be used. In the event of conflict between the reference documents, the most conservative and stringent requirement shall apply. However, any such conflicts shall be brought to the attention of the Engineer for resolution.

C. The following documents form a part of this Section. Unless otherwise indicated, the issue in effect on the date of invitation for bids shall apply.

1. National Fire Prevention Association (NFPA)
   a. 241 - Safeguarding Construction, Alteration, and Demolition Operations.
2. NYS Department of Labor (NYSDOL)
   a. Industrial Code Rule No. 23 - Protection of Persons Employed in construction and Demolition Work.
3. NYS Building Code
4. U.S. Department of Labor - OSHA
   a. 29 CFR 1910 - Occupational Safety and Health

b. Subpart T - Demolition - Safety and Health Regulations for Construction

PART 2 - PRODUCTS

A. NOT USED

PART 3 - EXECUTION

3.01 GENERAL

A. Requirements

1. The existing equipment and/or materials which shall be removed is indicated herein and on the Contract Drawings, but shall also include any and all other existing materials or equipment necessary to execute the Work identified in the Contract Documents.
2. The Contractor shall obtain all permits and pay all fees where required from all Federal or State Departments, Boards, or Agencies and shall furnish the Engineer with three copies of all permits obtained from regulatory agencies.

B. Removal Specifics

1. The Contractor shall maintain a means of egress from the trench at all times. Work affecting the exits from the trench shall be coordinated with the facility, site representative and other trades.

C. Material Disposal

1. All existing equipment, materials, and fixtures removed from the facility in the execution of this Contract, shall become the property of the Contractor and shall be removed from the site, except for items which shall be identified as salvage prior to demolition. The Contractor shall remove such items and turn it over to the Owner.
2. All debris shall be removed from the work site and the site left in the neat and orderly condition as approved by the Engineer.
3. No new work shall commence in the work area until demolition has been completed and the approval by the Site Representative obtained.

D. Demolition Method

1. Demolition work shall not endanger the integrity of the remaining structures. Demolition shall not proceed until authorized by the Engineer or Owner’s Representative.
2. The use of burning torches shall be permitted only in locations designated by the Owner’s Representative as safe areas. Specific approval shall be obtained for each location.
3. Gas cutting shall be performed in accordance with local building codes, rules, and ordinances. Protection as required shall be applied in the event that noxious fumes are produced from the burning of painted steelwork or equipment.
4. Fire watch shall be maintained for burning and cutting operations.
5. All demolition work shall be executed in a careful and orderly manner, without disturbing the operating equipment and Personnel at the site.

E. Protection

1. Since removal work may occur in the immediate vicinity of operating equipment and personnel, the Contractor shall furnish, erect, and maintain barricades around the entire work area and post appropriate signs "flagging" this area.

2. The Contractor shall furnish, erect, and maintain at the site all bracing, shoring, fire resistant fencing, electric lights, and other safety devices necessary to protect equipment and personnel from damage and injury.

3. The Contractor shall follow all safety requirements specified in applicable federal, state, city and local codes and ordinances.

4. The Contractor shall wet down dust producing operations as necessary, unless otherwise directed by the Engineer.

5. The site of work is an operating facility and will continue operation while the work specified herein is in progress. Accordingly, the Contractor must perform his work so as not to interfere with the continuing operations and as directed by the Field Representative. Any equipment damaged and not in the demolition scope shall be repaired or replaced by the Contractor at his expense.

3.02 HAZARDOUS MATERIAL

A. Asbestos

1. The Contractor shall be aware there is no asbestos in the trench. The Owner has supporting documentation.

3.03 DEMOLITION

A. Protection of Existing Equipment and Components

1. The Contractor shall maintain the structural integrity of the remaining equipment and components exposed or breached by the demolition work.

2. The Contractor shall maintain the required fire exists and passageways or provide substitutions.

3. The Contractor shall provide temporary protection from the elements to the building structure and equipment exposed during the demolition.

4. The Contractor shall provide the means necessary to restore the weatherproof integrity to all buildings in which it has been impaired by the demolition work.

B. Preparatory Operations

1. Where it is necessary to maintain any power or water during demolition, the Contractor shall relocate or protect such lines with substantial coverings to protect them from injury and to afford safety to the workmen.

2. When the demolition is expected to be dusty, the Contractor shall provide a dust-tight enclosure from the floor to above and around all equipment being demolished, which shall be vented outside the building to prevent dust from interfering with the operation of the rest of the Plant.

C. Demolition Operations

1. Use of explosives in the demolition operations shall be prohibited.

2. The Contractor shall provide temporary wood railing sand barriers around all openings and across accessways created by the demolition process. All railings shall be in accordance with OSHA standards. The Contractor shall never leave an opening unprotected.

D. Post Demolition Operations

1. The Contractor shall furnish and install all necessary temporary and permanent caps, plugs and blanks for all remaining piping and ducts, as required.
2. Wherever empty sleeves or openings exist because of piping or conduit removal, the Contractor shall provide permanent coverings as required.
3. Areas where demolition has taken place are to be left in a broom swept clean condition.
4. Supports and hangers for removed piping and ductwork shall be dismantled including miscellaneous support steel attached to the building steel or concrete.
5. When equipment is removed, the support steel, base plates, and anchor studs shall be removed or severed at the floor, foundation, or pedestal level, unless otherwise indicated.
6. The Contractor shall provide equipment to remove any oil or flammable remaining in items being removed and shall purge these systems in accordance with local regulations prior to removing any steel by burning.

3.04 PERSONNEL AND PROPERTY PROTECTION

A. Protection of persons and property shall be provided by the Contractor throughout the progress of work.

B. The Work shall proceed in such a manner as to minimize the spread of dust and flying particles that could damage equipment nearby.

C. Any damage to existing structures or equipment caused by the Contractor's operations shall be repaired by the Contractor at his own expense to the full satisfaction of the Engineer.

END OF SECTION

DIVISION 3 - CONCRETE
03 11 00 – CONCRETE FORMING

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PART 1 - GENERAL

1.01 SCOPE OF WORK

A. Provide all work necessary to layout, assemble and prepare all concrete formwork as required to create the pads, slabs, decking etc. outlined in the Contract Documents.

B. The work of this Section of the Specifications shall include all labor, materials, tools, equipment, appliance or services necessary to complete the work as shown on the Drawings, as specified herein, or as required by the job conditions.

1.02 REFERENCES

A. All work under this section shall conform to the requirements of the "New York State Building Code", and the regulations of governmental authorities having jurisdiction.

B. American Concrete Institute (ACI)

1. ACI 117: Standard Specifications for Tolerances for Concrete Construction and Materials

2. ACI 347R: Guide to Formwork for Concrete

1.03 SUBMITTALS

A. The Contractor shall furnish product data for all proposed material and equipment that will be furnished to complete the work. Submittal type, quantities and distribution shall be in accordance with the General Requirements section of the Contract Documents and this Section.

1.04 QUALITY ASSURANCE

A. Installer Qualifications: An experienced installer, with minimum 5 years experience, who has completed Work similar in material, design, and extent to that indicated for this Project and whose work has resulted in construction with a record of successful in-service performance.

B. Construction Site Quality: Contractor shall maintain, on site, sufficient office, field engineering, and field supervision staff to assure that all materials and layout correspond with the requirements of the Contract Documents and approved drawings.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Materials shall be delivered to the site, ready for use, in the manufacturer's original and unopened containers or packaging. Packaging to contain material description and manufacturer information.

B. All delivered materials, products or equipment shall be stored under cover in a dry, weather-tight, and adequately ventilated location. All materials shall be elevated off of the ground.

C. All wood forming products shall not be stored on site for more than 1 week. Materials on-site for longer than 1 week are to be replaced prior to installation.

PART 2 - PRODUCTS

2.01 FORM MATERIALS

A. Wood: Free from loose knots and suitable to facilitate finishing concrete surfaces required.

B. Plywood: Exterior grade B-B, 5/8" or ¾" thick for unlined contact form.

C. Form Contact Faces, not exposed to view:

1. Lumber shall be stress grade lumber designed and used in accord with "National Design Specification for Wood Construction". Undressed lumber may be used.

2. Plywood for formwork shall be Exterior structural grade.

D. Form Contact, exposed to view:

1. Form-facing panels that will provide continuous, true, and smooth concrete surfaces. Furnish in largest practicable sizes to minimize number of joints.

E. Form-Release Agent: Commercially formulated form-release agent that will not bond with, stain, or adversely affect concrete surfaces and will not impair subsequent treatments of concrete surfaces.

1. Formulate form-release agent with rust inhibitor for steel form-facing materials.

F. Corrugated Metal: Replace with matching corrugated metal strip.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Design, erect, shore, brace, and maintain formwork, according to ACI, to support vertical, lateral, static, and dynamic loads, and construction loads that might be applied, until concrete structure can support such loads.

B. Construct formwork so concrete members and structures are of size, shape, alignment, elevation, and position indicated, within tolerance limits of ACI 117.

C. Limit concrete surface irregularities, designated by ACI 347R as abrupt or gradual, as follows:

1. Class B, 1/4 inch.

D. Construct forms tight enough to prevent loss of concrete mortar.

E. Fabricate forms for easy removal without hammering or prying against concrete surfaces. Provide crush or wrecking plates where stripping may damage cast concrete surfaces.

F. Set edge forms, bulkheads, and intermediate screed strips for slabs to achieve required elevations and slopes in finished concrete surfaces. Provide and secure units to support screed strips; use strike-off templates or compacting-type screeds.

G. Clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, and other debris just before placing concrete.

H. Retighten forms and bracing before placing concrete, as required, to prevent mortar leaks and maintain proper alignment.

I. Coat contact surfaces of forms with form-release agent, according to manufacturer's written instructions, before placing reinforcement.

3.02 REMOVING AND REUSING FORMS

A. General: Formwork, for sides of beams, walls, columns, and similar parts of the Work, that does not support weight of concrete may be removed after cumulatively curing at not less than 50 deg F for 24 hours after placing concrete provided concrete is hard enough to not be damaged by form-removal operations and provided curing and protection operations are maintained.

3.03 FINISHING FORMED SURFACES

A. Smooth-Formed Finish: As-cast concrete texture imparted by form-facing material, arranged in an orderly and symmetrical manner with a minimum of seams. Repair and patch tie holes and defective areas. Remove fins and other projections exceeding 1/8 inch in height.

1. Apply to concrete surfaces exposed to public view or to be covered with a coating or covering material applied directly to concrete, such as waterproofing, dampproofing, veneer plaster, or painting.

B. Related Unformed Surfaces: At tops of walls, horizontal offsets, and similar unformed surfaces adjacent to formed surfaces, strike off smooth and finish with a texture matching adjacent formed surfaces. Continue final surface treatment of formed surfaces uniformly across adjacent unformed surfaces, unless otherwise indicated.

END OF SECTION

DIVISION 3 - CONCRETE
03 20 00 – CONCRETE REINFORCING

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PART 1 - GENERAL

1.01 SCOPE OF WORK

A. Provide all work necessary to layout, assemble and prepare all concrete reinforcement work outlined in the Contract Documents.

B. The work of this Section of the Specifications shall include all labor, materials, tools, equipment, appliance or services necessary to complete the work as shown on the Drawings, as specified herein, or as required by the job conditions.

1.02 REFERENCES

A. All work under this section shall conform to the requirements of the "New York State Building Code", and the regulations of governmental authorities having jurisdiction.

B. American Concrete Institute (ACI):

1. ACI 315: Details and Detailing of Concrete Reinforcement
2. ACI 318: Building Code Requirements for Reinforced Concrete and Commentary

C. American Society for Testing and Materials (ASTM):

1. A82: Standard Specification for Steel Wire, Plain, for Concrete Reinforcement
2. A185: Standard Specification for Steel Welded Wire Fabric, Plain, for Concrete Reinforcement
3. A615: Standard Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement
4. A706: Standard Specification for Low-Alloy Steel Deformed and Plain Bars for Concrete Reinforcement
5. A767: Standard Specification for Zinc-Coated (Galvanized) Steel Bars for Concrete Reinforcement
6. A775 Standard Specification for Epoxy-Coated Reinforcing Steel Bars

1.03 SUBMITTALS

A. The Contractor shall furnish product data for all proposed material and equipment that will be furnished to complete the work. Submittal type, quantities and distribution shall be in accordance with the General Requirements section of the Contract Documents and this Section.

B. Steel Reinforcement Shop Drawings: Details of fabrication, bending, and placement, prepared according to ACI 315, "Details and Detailing of Concrete Reinforcement." Include material, grade, bar schedules, stirrup spacing, bent bar diagrams, arrangement, and supports of concrete reinforcement. Include special reinforcement required for openings through concrete structures.

1.04 QUALITY ASSURANCE

A. Installer Qualifications: An experienced installer, with minimum 5 years experience, who has completed concrete Work similar in material, design, and extent to that indicated for this Project and whose work has resulted in construction with a record of successful in-service performance.

B. Construction Site Quality: Contractor shall maintain, on site, sufficient office, field engineering, and field supervision staff to assure that all materials and layout correspond with the requirements of the Contract Documents and approved drawings.

C. Splices: Reinforcement shall be spliced in strict accord with ACI 318. Where practical stagger splices of adjacent bars.

1. Unless shown specifically to the contrary, all reinforcements shall be lap spliced and all splices shall develop the full tensile capacity of the reinforcement.

2. Lapped splices shall not be used for bars larger than size No. 11.

3. Butt splices shall be detailed in strict accordance with the manufacturer's printed instructions.

4. Lapped bars may be detailed to be placed in contact and securely wired together, or may be separated in accordance with ACI 318 to permit embedment of the entire surface of each bar in concrete.

5. Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products complying with ASTM C 94 requirements for production facilities and equipment.

D. In the presence of the Owner's Representative three mechanical splices may be subjected to testing to confirm design and installation. Testing will not be at contractors' expense.

E. Defective or Non-Conforming Work: Defective work, unsuitable work, or work otherwise failing to conform to the Contract Documents shall be made good by Contractor at no change to the dollar or time amount in the Contract. Contractor shall prepare appropriate details and procedures for brining such work into conformance with the Contract Documents and shall submit such details and procedures for acceptance prior to any corrective actions. Corrective Work; including materials, shall conform strictly to details and procedures accepted by the Owner's Representative. Non-conforming work may be rejected by the Owner's Representative or Engineer at any time, regardless of prior acceptance in shop drawings, prior inspections, inclusion in inspection or test reports, or inclusion in certificates of payment.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Materials shall be delivered to the site, ready for use, in the manufacturer's original and unopened containers or packaging. Packaging to contain material description and manufacturer information.

B. All delivered materials, products or equipment shall be stored under cover in a dry, weather-tight, and adequately ventilated location. All materials shall be elevated off of the ground.

C. Deliver, store, and handle steel reinforcement to prevent bending and damage.

1. Avoid damaging coatings on steel reinforcement.

2. Repair damaged epoxy coatings on steel reinforcement according to ASTM D 3963/D 3963M.

PART 2 - PRODUCTS

2.01 STEEL REINFORCEMENT

A. Plain-Steel Welded Wire Fabric (sizes less than W4.0): ASTM A 185, fabricated from as-drawn steel wire into flat sheets.

2.02 REINFORCEMENT ACCESSORIES

A. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded wire fabric in place. Manufacture bar supports according to CRSI's "Manual of Standard Practice" from steel wire, plastic, or precast concrete or fiber-reinforced concrete of greater compressive strength than concrete, and as follows:

1. For concrete surfaces exposed to view where legs of wire bar supports contact forms, use CRSI Class 1 plastic-protected or CRSI Class 2 stainless-steel bar supports.

B. Tie Wire: 16 gauge or heavier, black annealed wire, conforming to ASTM A82. Tie wire in concrete at exposed surfaces shall be non-corrosive; stainless steel, monel, or plastic coated.

PART 3 - EXECUTION

3.01 INSTALLATION

A. General: Details of concrete reinforcement to be in accordance with ACI 318, and ACI 315, unless otherwise shown.

B. Minimum clear distances between parallel bars, except in columns and multiple layers of bars in beams shall be equal to nominal diameter of bars. Minimum clear spacing in 1 inch or 1-1/3 times the maximum size of the coarse aggregate.

C. Place reinforcement conforming to CRSI DA4, unless otherwise shown. Comply with CRSI's "Manual of Standard Practice" for placing reinforcement.

D. Clean reinforcement of loose rust and mill scale, earth, ice, and other foreign materials.

E. Accurately position, support, and secure reinforcement against displacement. Locate and support reinforcement with bar supports to maintain minimum concrete cover. Do not tack weld crossing reinforcing bars. Tie all intersections and splices with 16 gauge annealed wire.

F. Set wire ties with ends directed into concrete, not toward exposed concrete surfaces.

G. Secure reinforcing bars against displacement during the placing of concrete by spacers, chairs, or other similar supports. Portions of the supports, spacers, and chairs in contact with formwork shall be made of plastic in areas that will be exposed when completed. Type, number, and spacing of supports are to conform to ACI 315.

H. Where concrete slabs are placed on the ground, use concrete blocks or other non-corrodible material of proper height, for support of reinforcement. Use brick or stone supports will not be permitted.

END OF SECTION

DIVISION 3 - CONCRETE
03 30 00 –CAST IN PLACE CONCRETE

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PART 1 - GENERAL

1.01 SCOPE OF WORK

A. Provide all work necessary to construct concrete work outlined in the Contract Documents.

B. The work of this Section of the Specifications shall include concrete design mix, extra materials, labor, materials, tools, equipment, appliance or services necessary to complete the work as shown on the Drawings, as specified herein, or as required by the job conditions.

1.02 REFERENCES

A. All work under this section shall conform to the requirements of the "New York State Building Code", and the regulations of governmental authorities having jurisdiction.

B. American Concrete Institute (ACI):

1. ACI 117: Standard Specifications for Tolerances for Concrete Construction and Materials
2. ACI 211.1 &.2: Standard Practice for Selecting Proportions for Concrete
3. ACI 214: Recommended Practice for Evaluation of Strength Test Results of Concrete
4. ACI 301: Standard Specifications for Structural Concrete
5. ACI 304: Guide for Measuring, Mixing, Transporting, and Placing Concrete
6. ACI 305: Hot Weather Concrete
7. ACI 308: Standard Practice for Curing Concrete
8. ACI 309: Guide for Consolidation of Concrete
9. ACI 318: Building Code Requirements for Reinforced Concrete

C. American Society for Testing and Materials (ASTM):

1. C31: Standard Practice for Making and Curing Concrete Test Specimens in the Field
2. C94: Standard Specification for Ready-Mixed Concrete
3. C150: Standard Specification for Portland Cement
4. C494: Standard Specification for Chemical Admixtures for Concrete

1.03 SUBMITTALS

A. The Contractor shall furnish product data for all proposed material and equipment that will be furnished to complete the work. Submittal type, quantities and distribution shall be in accordance with the General Requirements section of the Contract Documents and this Section.

B. Product Data: For each type of manufactured material and product indicated.

C. Product Samples:

1. Form Ties; one of each type to be used

D. Design Mixes: For each concrete mix. Include alternate mix designs when characteristics of materials, project conditions, weather, test results, or other circumstances warrant adjustments.

1. Indicate amounts of mix water to be withheld for later addition at Project site.

1.04 QUALITY ASSURANCE

A. Installer Qualifications: An experienced installer, with minimum 5 years experience, who has completed concrete Work similar in material, design, and extent to that indicated for this Project and whose work has resulted in construction with a record of successful in-service performance.

B. Construction Site Quality: Contractor shall maintain, on site, sufficient office, field engineering, and field supervision staff to assure that all materials and layout correspond with the requirements of the Contract Documents and approved drawings.

C. Concrete Supplier: A firm experienced in manufacturing ready-mixed concrete products complying with ASTM C 94 requirements for production facilities and equipment.

1. Manufacturer must be certified according to the National Ready Mixed Concrete Association's Certification of Ready Mixed Concrete Production Facilities.

2. Obtain each type or class of cementitious material of the same brand from the same manufacturer's plant, each aggregate from one source, and each admixture from the same manufacturer.

D. Testing Agency: The Owner will engage and pay for the services of an independent testing agency (Testing Agency). The Testing Agency will perform the following functions, inspections and tests. Contractor shall coordinate, and when directed correct items and issues noted by the Testing Agency.

1. Take steps to ascertain that concrete is proportioned and mixed in accordance with the requirements of the Specification and approved submittals;

2. Maintain a presence at the jobsite during the placing of concrete;

3. Examine formwork for general conformance with the requirements of the Specification and approved Shop Drawings;

4. Examine as-placed reinforcing steel for general conformance with the requirements of the Specifications and in accordance with approved Shop Drawings.

5. Perform and evaluate testing of concrete cylinders in accordance with ASTM standards.

E. Defective or Non-Conforming Work: Defective work, unsuitable work, or work otherwise failing to conform to the Contract Documents shall be made good by Contractor at no change to the dollar or time amount in the Contract. Contractor shall prepare appropriate details and procedures for bringing such work into conformance with the Contract Documents and shall submit such details and procedures for acceptance prior to any corrective actions. Corrective Work; including materials, shall conform strictly to details and procedures accepted by the Owner’s Representative. Non-conforming work may be rejected by the Owner’s Representative or Engineer at any time, regardless of prior acceptance in shop drawings, prior inspections, inclusion in inspection or test reports, or inclusion in certificates of payment.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Materials shall be delivered to the site, ready for use, in the manufacturer’s original and unopened containers or packaging. Packaging to contain material description and manufacturer information.

B. All delivered materials, products or equipment shall be stored under cover in a dry, weather-tight, and adequately ventilated location. All materials shall be elevated off of the ground.

C. Aggregates to be used in field mixed concrete or grout shall be stockpiled in separate bins or piles in a manner suitable to minimize segregation and contamination of aggregates. Field mixing is not encouraged and will not be allowed without written approval by the Owner's Representative.

D. Admixture storage tank and dispensing equipment shall be provided and serviced by the admixture manufacturer, at no cost to the owner.

PART 2 - PRODUCTS

2.01 CONCRETE MATERIALS

A. Portland Cement: ASTM C 150, Type I or II.

B. Fly Ash: ASTM C618, Class C or F including supplementary optional requirements relating to reactive aggregates and alkalies, and loss on ignition not to exceed 5 percent.

C. Coarse Aggregates: ASTM C 33 limits deleterious substances in coarse aggregate depending on climate severity and in-service location of concrete.

1. Size #67 may be used for footings and walls over 12 inches thick.

2. Coarse aggregate for applied topping, encasement of steel columns, and metal pan stair fill shall be Size 7.

3. Maximum size of coarse aggregates not more than 1/5 of the narrowest dimension between sides of forms, 1/3 the depth of slabs, nor ¾ of the minimum clear spacing between reinforcing bars.

D. Lightweight Aggregate: ASTM C330, Table 1. Maximum size of aggregate not larger than 1/5 of the narrowest dimension between form, nor ¾ of the minimum clear distance between reinforcing bars. Contractor to furnish certified report to verify that aggregate is sound and durable, and has a durability factor of not less than 80 based on 300 cycles of freezing and thawing when tested in accordance with ASTM C666.

E. Fine Aggregate: ASTM C33 Fine aggregate for applied concrete floor topping shall pass a #4 sieve, 10 percent maximum shall pass a #100 sieve.

F. Water: Potable and complying with ASTM C 94.

2.02 ADMIXTURES

A. General: Admixtures certified by manufacturer to contain not more than 0.1 percent water-soluble chloride ions by mass of cementitious material and to be compatible with other admixtures and cementitious materials. Do not use admixtures containing calcium chloride.

B. Air-Entraining Admixture: ASTM C 260.

C. Water-Reducing Admixture: ASTM C 494, Type A.

D. High-Range, Water-Reducing Admixture: ASTM C 494, Type F.

E. Water-Reducing and Accelerating Admixture: ASTM C 494, Type E.

F. Water-Reducing and Retarding Admixture: ASTM C 494, Type D.

2.03 CONCRETE MIXES

A. Concrete Mix Requirements: Proportions for each mix shall provide for homogeneous, cohesive, workable and dense concrete, suitable in all respects for its intended purpose. Concrete mixes shall be selected to provide an average strength not less than that required by ACI 318, Chapter 5.

Selected mixes shall conform to the specified requirements, Contractor may propose with his bid a cost-savings mix design making use of fly ash, but with a maximum replacement of cement with fly ash equal to 10 percent.

B. Use a qualified independent testing agency for preparing and reporting proposed mix designs for the laboratory trial mix basis.

C. After approval of design mixes no substitution in material or change in proportions of approval mixes may be made without additional tests and approval by the Owner's Representative and Engineer.

D. Contractor shall notify the Owner's Representative of the time and location where each trial mix will be performed to permit the Testing Agency to observe the preparation, batching and testing, should the owner elect to do so.

E. Air Entrainment: Entrained air is not required for concrete for footings. All other concrete shall be air entrained to 5-1/2 percent, except pea gravel and sidewalk concrete with shall be air-entrained to 6-1/2 percent.

F. Cement Factor: Maintain minimum cement factors below regardless of compressive strength developed minimums, for air entrained concrete:

1. 4000 psi – Minimum Cement 550 (lbs/yd) – Max. Water/Cement (.50)

G. Cement Factor: Maintain minimum cement factors below regardless of compressive strength developed minimums, for non-air entrained concrete:

1. 4000 psi – Minimum Cement 550 (lbs/yd) – Max. Water/Cement (.55)

H. Reinforced Footings and Foundation Walls: Proportion normal-weight concrete mix as follows:

1. Compressive Strength (28 Days): 4000 psi.

2. Maximum Slump: 3 inches.

I. Slab-on-Grade: Proportion normal-weight concrete mix as follows:

1. Compressive Strength (28 Days): 4000 psi.

2. Maximum Slump: 4 inches.

J. Suspended Slabs: Proportion normal weight structural concrete mix as follows:

1. Compressive Strength (28 Days): 3500 psi.

2. Maximum Slump: 4 inches.

K. Admixtures: Slump may be increased by the use of the approved high range water-reducing admixture. Tolerances are as established by ASTM C94.

1. Use water-reducing admixture or high-range water-reducing admixture (superplasticizer) in concrete, as required, for placement and workability.

2. Use water-reducing and retarding admixture when required by high temperatures, low humidity, or other adverse placement conditions.

PART 3 - EXECUTION

3.01 EMBEDDED ITEMS

A. Place and secure anchorage devices and other embedded items required for adjoining work that is attached to or supported by cast-in-place concrete. Use Setting Drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.

1. Install anchor bolts, accurately located, to elevations required.

3.02 CONCRETE PLACEMENT

A. Before placing concrete, verify that installation of formwork, reinforcement, and embedded items is complete and that required inspections have been performed.

B. Do not add water to concrete during delivery, at Project site, or during placement, unless approved by Architect.

C. Deposit concrete continuously or in layers of such thickness that no new concrete will be placed on concrete that has hardened enough to cause seams or planes of weakness. If a section cannot be placed continuously, provide construction joints as specified. Deposit concrete to avoid segregation.

D. Deposit concrete in forms in horizontal layers no deeper than 24 inches and in a manner to avoid inclined construction joints. Place each layer while preceding layer is still plastic, to avoid cold joints. Do not deposit concrete vertically more than 60". For deeper forms deposit concrete with a tremie.

1. Consolidate placed concrete with mechanical vibrating equipment. Use equipment and procedures for consolidating concrete recommended by ACI 309R.

2. Do not use vibrators to transport concrete inside forms. Insert and withdraw vibrators vertically at uniformly spaced locations no farther than the visible effectiveness of the vibrator. Place vibrators to rapidly penetrate placed layer and at least 6 inches into preceding layer. Do not insert vibrators into lower layers of concrete that have begun to lose plasticity. At each insertion, limit duration of vibration to time necessary to consolidate concrete and complete embedment of reinforcement and other embedded items without causing mix constituents to segregate.

E. Deposit and consolidate concrete for floors and slabs in a continuous operation, within limits of construction joints, until placement of a panel or section is complete.

1. Consolidate concrete during placement operations so concrete is thoroughly worked around reinforcement and other embedded items and into corners.

2. Maintain reinforcement in position on chairs during concrete placement.

3. Screed slab surfaces with a straightedge and strike off to correct elevations.

4. Slope surfaces uniformly to drains where required.

5. Begin initial floating using bull floats or darbies to form a uniform and open-textured surface plane, free of humps or hollows, before excess moisture or bleedwater appears on the surface. Do not further disturb slab surfaces before starting finishing operations.

3.03 DEFLECTIONS FOR ALL METAL DECK/CONCRETE WORK:

A. It shall be the Contractor's responsibility and choice as to how the proper grades are to be accomplished at the top of the slab. Where concrete is poured over metal deck and steel framing it

must be assumed that the composite deck, beams, and girders will settle as the wet concrete is placed unless shored. The contractor shall provide shoring or additional concrete, or both to bring the slab up to the proper grade at no additional cost to the Owner. Monitor top of slab elevation continuously during pour from a fixed position to assure flatness criteria are met.

3.04 CONCRETE FINISHES

A. Slab Finishes:

1. Comply with recommendations in ACI 302.1R for screeding, restraightening, and finishing operations for concrete surfaces. Do not wet concrete surfaces.

2. Place slabs monolithically. Once slab placement commences, complete finishing operations within the same day. Slope finished slab to floor drains where they occur, whether shown or not.

3. Use straightedges specifically made for screeding, such as hollow magnesium straightedges or power strike-offs. Do not use pieces of dimensioned lumber. Strike off and screed slab to a true surface at required elevations. Use optical or laser instruments to check concrete finished surface grade after strike-off.

4. Scratch Finish: Finish for all base slabs receiving a bonded applied cementitious application. Thoroughly coarse wire broom within two hours after placing to roughen slab surface to insure permanent bond between slab and applied materials.

5. Float Finish: Slabs to receive unbonded toppings, steel trowel finish, fill, mortar setting beds, or a built-up roof, and ramps, stair treads, platforms, and equipment pads shall be floated to a smooth, dense uniform, sandy textured finish. During floating, while surface is still soft, check surface for flatness using a 10 foot straightedge. Correct high spots by cutting down and correct low spots by filling in with material of the same composition as floor finish. Consolidate surface with power-driven floats or by hand floating if area is small or inaccessible to power driven floats.

6. Steel Trowel Finish: Concrete surfaces to receive resilient floor covering or carpet, monolithic floor slabs to be exposed to view in finished work, future floor roof slabs, applied toppings and other interior surfaces for which no other finish is indicated. Steel trowel immediately following floating. During final troweling, tilt steel trowel at a slight angle and exert heavy pressure to compact cement paste and form a dense, smooth surface. Finished surface shall be smooth, free of trowel marks, and uniform in texture and appearance.

7. Broom Finish: Finish exterior slabs, platforms, steps, walks, ramps, and stair treads with a bristle brush moistened with clear water after surfaces have been floated. Bush in a direction transverse to main traffic.

8. Slab Finish Flatness (FF) and Levelness (FL) shall comply with the following minimums:

   a. Areas covered with carpeting, or not otherwise included below:

      (1) Slab on Grade – Overall Value FF 25/ FL 20; Minimum Local FF 17/FL15

      (2) Level suspended slabs - Overall Value FF 25/ FL 20; Minimum Local FF 17/FL15

      (3) Slabs exposed - Overall Value FF 36/ FL 20; Minimum Local FF 24/FL15

      (4) Slabs to be covered - Overall Value FF 36/ FL 20; Minimum Local FF 24/FL15

   b. Level tolerance such that 80 percent of all points fall within a ¾ inch envelop (+3/8 inch, -3/8 inch) from the design elevation.

3.05 MISCELLANEOUS CONCRETE ITEMS

A. Filling In: Fill in holes and openings left in concrete structures, unless otherwise indicated, after work of other trades is in place. Mix, place, and cure concrete, as specified, to blend with in-place construction. Provide other miscellaneous concrete filling indicated or required to complete Work.

3.06 CONCRETE PROTECTION AND CURING

A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Comply with ACI 306.1 for cold-weather protection and with recommendations in ACI 305R for hot-weather protection during curing.

B. Unformed Surfaces: Begin curing immediately after finishing concrete. Cure unformed surfaces, including floors and slabs, concrete floor toppings, and other surfaces, by one or a combination of the following methods:

1. Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 inches (300 mm), and sealed by waterproof tape or adhesive. Cure for not less than seven days. Immediately repair any holes or tears during curing period using cover material and waterproof tape.

    a. Moisture cure or use moisture-retaining covers to cure concrete surfaces to receive floor coverings.

    b. Moisture cure or use moisture-retaining covers to cure concrete surfaces to receive penetrating liquid floor treatments.

    c. Cure concrete surfaces to receive floor coverings with either a moisture-retaining cover or a curing compound that the manufacturer recommends for use with floor coverings.

3.07 CONCRETE SURFACE REPAIRS

A. Defective Concrete: Repair and patch defective areas when approved by Architect. Remove and replace concrete that cannot be repaired and patched to Architect's approval.

B. Patching Mortar: Mix dry-pack patching mortar, consisting of one part portland cement to two and one-half parts fine aggregate passing a No. 16 sieve, using only enough water for handling and placing.

C. Repairing Formed Surfaces: Surface defects include color and texture irregularities, cracks, spalls, air bubbles, honeycombs, rock pockets, fins and other projections on the surface, and stains and other discolorations that cannot be removed by cleaning.

1. Repair defects on concealed formed surfaces that affect concrete's durability and structural performance as determined by Architect.

D. Repairing Unformed Surfaces: Test unformed surfaces, such as floors and slabs, for finish and verify surface tolerances specified for each surface. Correct low and high areas. Test surfaces sloped to drain for trueness of slope and smoothness; use a sloped template.

1. Repair finished surfaces containing defects. Surface defects include spalls, popouts, honeycombs, rock pockets, crazing and cracks in excess of 0.01 inch wide or that penetrate to reinforcement or completely through unreinforced sections regardless of width, and other objectionable conditions.

2. After concrete has cured at least 14 days, correct high areas by grinding.

3. Correct localized low areas during or immediately after completing surface finishing operations by cutting out low areas and replacing with patching mortar. Finish repaired areas to blend into adjacent concrete.
4. Correct other low areas scheduled to receive floor coverings with a repair underlayment. Prepare, mix, and apply repair underlayment and primer according to manufacturer's written instructions to produce a smooth, uniform, plane, and level surface. Feather edges to match adjacent floor elevations.
5. Correct other low areas scheduled to receive a paint coating exposed with a repair topping. Cut out low areas to ensure a minimum repair topping depth of 1/4 inch to match adjacent floor elevations. Prepare, mix, and apply repair topping and primer according to manufacturer's written instructions to produce a smooth, uniform, plane, and level surface.
6. Repair defective areas, except random cracks and single holes 1 inch or less in diameter, by cutting out and replacing with fresh concrete. Remove defective areas with clean, square cuts and expose steel reinforcement with at least 3/4 inch clearance all around. Dampen concrete surfaces in contact with patching concrete and apply bonding agent. Mix patching concrete of same materials and mix as original concrete except without coarse aggregate. Place, compact, and finish to blend with adjacent finished concrete. Cure in same manner as adjacent concrete.
7. Repair random cracks and single holes 1 inch or less in diameter with patching mortar. Groove top of cracks and cut out holes to sound concrete and clean off dust, dirt, and loose particles. Dampen cleaned concrete surfaces and apply bonding agent. Place patching mortar before bonding agent has dried. Compact patching mortar and finish to match adjacent concrete. Keep patched area continuously moist for at least 72 hours.

E. Perform structural repairs of concrete, subject to Architect's approval, using epoxy adhesive and patching mortar.

F. Repair materials and installation not specified above may be used, subject to Architect's approval.

END OF SECTION

DIVISION 23 - HEATING, VENTILATING AND AIR CONDITIONING
SECTION 23 05 23 – GENERAL DUTY VALVES

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PART 1 - GENERAL

1.01 SCOPE OF WORK

A. This Specification defines the requirements for furnishing and installing valves in piping systems as indicated in the Contract Documents. All valves shall be new. Surplus, salvaged or rebuilt valves are not acceptable.

B. The valves shall include all miscellaneous materials, including but not limited to, actuator, handwheels, integral bypass valves, valve tags, position indicators and other components as specified.

C. The Contractor shall furnish all supervision, labor and materials required to accomplish the work associated with the installation of the material specified herein and indicated on the Contract Drawings.

1.02 REFERENCES

A. All work performed and material supplied under this Section shall be in accordance with the latest addenda thereto of the applicable codes, standards, specifications, regulations, procedures, and tests as cited in Section 01 11 00 – “Summary of the Mechanical Work”.

B. The Contractor shall coordinate the material furnished under this section with the work furnished under Section 23 22 13 – “Piping”.

1.03 SUBMITTALS

A. General

1. The Contractor shall furnish shop drawings for all proposed material that will be furnished to complete the work in accordance with the General Requirements section of the Contract Documents and this Section.

2. The Contractor shall furnish a breakdown of the valves that will be furnished. The breakdown shall include manufacturer, model number, ANSI classification, trim and size.

3. Additional submittals, as necessary, for each manufactured item shall include but are not limited to the following: manufacturer's descriptive literature, shop drawings, catalog "cuts", and mill reports.

B. Specific Submittals

1. Valves

2. Valve Tags

PART 2 - PRODUCTS

2.01 GENERAL

A. All valves shall be provided suitable for the service pressures and temperatures of the ANSI standards, to which they are applied and as specified in the Contract Documents.

B. Packing and Glands

1. All valves requiring packing shall be provided with manufacturer's recommended self-lubricating packing that is suitable for the design conditions specified. The packing shall contain provisions for minimizing stem/hinge pin pitting.

2. Gland hold-down shall be by means of stud and nut, or eyebolt and nut. Loose bolt and nut arrangement are not acceptable. Bolting material shall be of the same or more corrosion-resistant generic material type as the valve body/bonnet material.

C. Tests

1. Material Tests

a. All valve and piping materials shall be examined according to the applicable ASTM specification.

b. All castings shall be visually inspected on all accessible surfaces. Visual examination for castings shall be performed in accordance with the requirements of MSS-SP-55, "Quality Standard for Steel Castings - Visual Method."

c. All forgings shall be visually examined and evaluated per acceptance criteria of ASTM A105 or A403, as applicable.

d. Weld repairs shall only be made to bodies, bonnets, discs and plugs.

2. Shop Tests

a. Valves shall be hydrostatically tested in accordance with the requirements of MSS-SP-84, MSS-SP-70 or MSS-SP-61. If any repair to the pressure boundary is necessary, a retest shall be performed.

b. The test fluid shall be fresh water.

c. Seat leakage tests shall be performed in accordance with MSS-SP-70 or MSS-SP-84. Leakage rate shall not exceed the rate specified by MSS-SP-61. If any repair to the valve trim assembly is necessary, a retest shall be performed.

d. All valves shall be operated one full open to full closed cycle (rundown test).

D. Valve Tags

1. Valve tags shall be provided for all valves furnished as part of the Contract.

2. Tags shall be made of 18 gauge brass, 1-1/2" diameter with the service designation 1/4" high and valve tag number 1/2" high, and placed horizontally. The characters shall be indented and filled with durable black compound.

3. Tags shall be securely attached to the valve stem with a brass S-hook. Valve tags shall have the letters designating the piping system on the upper line and the valves tag number on the bottom line.

E. Gaskets

1. Gaskets shall be provided in accordance with the applicable sections of the piping class into which it is to be used.

2. Asbestos containing materials shall not be used.

3. Gaskets shall be made of materials that are not injuriously affected by the fluid or by temperature.

4. Gaskets shall also be supplied in accordance with Table 112 of the B31.1 Power Piping Code.

2.02 BALL VALVES

A. Ball valves shall be of a non-seizing, non-lubricated type provided with Teflon seats.

B. Ball material shall be compatible with the body material.

C. Manufacturer shall confirm that the seating material is compatible with the fluid and service conditions called for in the Contract Drawings.

D. Each valve shall be furnished with integral or mechanical type position indicator and limit stops at open and shut position.

E. Ball vales shall be of the full port type.

F. Ball valves 2-1/2" and smaller shall be threaded of uni-body construction.

G. Ball valves 3" and larger shall be of the top entry type.

H. Acceptable manufacturers are Apollo, McCanna, Grinnell and ITT.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Furnish and install all miscellaneous piping, fittings and components required for the operation of the respective valves. Furnish and install tubing, fittings, valves and components for the operation of the solenoid valves. All materials shall be furnished in accordance with Section 23 22 13 – "Piping".

B. The Contractor shall insulate all valves installed in systems with insulated piping.

C. Manual Valves

1. Clearance between the bottom of valves and floor shall not be less than 3". This distance shall be increased as necessary to permit removal of the valve plug and stem.

2. On valves 4" and larger, when center of valve handwheel is more than 7'-0" above the operating level, a chain operator shall be installed. Chain shall be provided with sprocket rim, chain guide and hook to prevent fouling of chain on equipment and to clear walkway. Chains shall be terminated approximately 3'-6" above the floor, and attached to columns or walls so as not to obstruct passageways. Chain wheels shall not be used on screwed valves.

3. Locate valves which must be used during operation, control valve assemblies, instrument control cases, liquid level controls, gage glasses, orifices, relief valves, and other equipment which must be observed, adjusted, or serviced during operation, so that they are conveniently accessible from operating platform or grade.

4. All butt weld valves shall be installed in accordance with Section 23 22 13 – "Piping". Valves shall be neither fully opened nor fully closed while they are being welded into a system.

3.02 SYSTEM START-UP

A. The Contractor shall remove all control valves from the system prior to initial start-up of the respective system. The valves shall be re-installed after the respective system has been flushed.

B. The Contractor shall clean the control valve station strainer after the system has been in operation for 48 hours continuously.

3.03 TRAINING

A. The Contractor shall secure the services of necessary persons to provide instructions to the Facilities operation personnel in the operation and maintenance for all equipment supplied and

installed within this specification. Training shall be in accordance with the requirements of Section 23 05 00 – "Summary of the Mechanical Work".

3.04 VALVE SPECIFICATION SHEETS

A. The following "Valve Specification Sheets" specify the fabrication requirements for valves and are an integral part of this Specification. The Data Sheets are included in Attachment A at the end of this Section.

END OF SECTION

ATTACHMENT A – VALVE SPECIFICATION SHEETS

VALVE SPECIFICATION 501

(Ball)

Service:	Instrument Air, Plant Air, Domestic Water, City Water, Softened Water
Valve Description	
Type/Style:	Ball
Nominal Size Range:	½" – 2"
Rating:	300 psig WOG, Cold Non-Shock
End Connection:	Threaded ANSI B2.1
Parts Material Specification	
Body:	Bronze ASTM B-62
Bonnet/Cover	NA
Trim:	NA
Ball:	B-16 Chrome Plated
Seat:	Reinforced TFE
Stem:	Bronze, Hard Chrome Plated
Bonnet/Cover Gasket:	NA
Packing:	Stem Seal – Reinforced TFE
Pin:	~

VALVE SPECIFICATION 502

(Ball)

Service:	City Water
Valve Description	
Type/Style:	Ball
Nominal Size Range:	2-1/2” and Larger
Rating:	600 psig CWP
End Connection:	Solder
Parts Material Specification	
Body:	C89836 Bronze
Bonnet/Cover	NA
Trim:	NA
Ball	C27450 Brass
Seat:	Reinforced TFE
Stem:	C27450 Brass
Bonnet/Cover Gasket:	NA
Packing:	Stem Seal – Reinforced TFE
Pin:	~

DIVISION 23 - HEATING, VENTILATING AND AIR CONDITIONING
SECTION 23 07 19 – INSULATION

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PART 1 - GENERAL

1.01 SCOPE OF WORK

A. This specification defines the requirements for mechanical insulation. The Contractor shall furnish and install all insulation, covers and jackets as specified. All new piping and equipment shall be insulated as indicated on the Contract Documents.

B. Unless otherwise indicated, installation of mechanical insulation shall include, but not be limited to the following:

1. LTW Piping

C. The Contractor shall furnish supervision, labor and all tools, equipment, hanger supports and any other material necessary to insulate the piping, valves, fittings and equipment.

1.02 REFERENCES

A. All work performed and material supplied under this Section shall be in accordance with the latest addenda thereto of the applicable codes, standards, specifications, regulations, procedures, and tests as cited in Section 01 11 00 – "Summary of Work".

1.03 SUBMITTALS

A. General

1. The Contractor shall furnish shop drawings for all proposed material that will be furnished to complete the work in accordance with the General Requirements section of the Contract Documents and this Section.

2. The Contractor shall submit to the Engineer for approval a list of insulation data proposed for the work. The data shall include information such as catalog cuts, diagrams, installation recommendations, and other information published by the manufacturer to demonstrate conformance to the specification.

3. The Contractor shall submit a list of the intended insulation materials, thickness, and covering for each system requiring insulation.

B. Specific submittal include the following:

1. Fiberglass insulation.

2. Calcium Silicate Insulation

3. Mineral Wool

4. Elastomeric Insulation

5. PVC Covers

6. Aluminum Covers

1.04 QUALITY ASSURANCE

A. Qualifications

1. The persons installing the Work of this Section and their Supervisor shall be personally experienced in mechanical insulation work and shall have been regularly employed by a company installing mechanical insulation for a minimum of 5 years.

B. Installers Qualification Data:

1. The Contractor shall furnish the name of each person who will be performing the Work, and their employer's name, business address and telephone number.
2. The Contractor shall furnish a list of other projects of similar size and scope of work that demonstrates the insulation installer is competent to complete the work. The list shall include a contact person and phone number.

PART 2 - PRODUCTS

2.01 GENERAL

A. The materials shall be the standard products of manufacturers regularly engaged in the manufacture of such products. Materials shall be compatible and shall not contribute to corrosion, soften, or otherwise attack surfaces to which applied, in either the wet or dry state.

B. All insulation materials, including jackets, facings, adhesives, coatings, and accessories, shall be fire hazard rated and listed by Underwriter's Laboratory, Inc., using the Steiner Tunnel Test Method for Fire hazard Classification of Building Materials, Standard UL 723 (ASTM E-84) and NFPA 255.

1. The Underwriter's Laboratory, Inc., listed Class I flamespread rating shall be a maximum of 25, the fuel contributed and smoke developed rating shall be a maximum of 50.
2. Flameproofing treatments, which are subject to deterioration from moisture or humidity, are not acceptable.

C. Insulating materials shall not contain any asbestos.

2.02 ACCEPTABLE MANUFACTURERS

A. Subject to compliance with the Contract Documents, furnish the products of one of the following manufacturers:

1. Fiberglass Insulation
   a. Owens-Corning Fiberglass Corp.
   b. Knauf Fiber Glass
   c. Certainteed Product Corp.
   d. Schuller International; or approved equal.
2. P.V.C. Jacketing and Sheets
   a. Schuller International
   b. Proto Corp.
   c. Accessible Products; or approved equal.

2.03 INSULATION

A. Fiberglass - Fiberglass insulation shall be woven fibrous inorganic glass in either pre-molded shapes banded with a thermo-setting resin or adhered to a backing. The maximum thermal conductivity shall be:

1. Pipe: K = .26 @ 75º F mean, 3 pcf, ASTM C 547, Class 1
2. Premolded Fitting Insulation: K = .26 @75ºF, 4.0 pcf, ASTM C 547, Class 1.
3. Insulation Inserts for PVC Fitting Jackets: K = .28 @ 75ºF, 1.5 pcf., ASTM C 553, Type III.

4. Duct: K = .27 @ 75º F mean, 3 pcf ,ASTM C 1071, Type II.

2.04 FINISHES

A. All Purpose Jacket (AP)

1. All fiberglass insulation shall be furnished with an all purpose jacket conforming to ASTM C 1136, Types I and II. The all-purpose jacket shall be factory jacketed, comprised of laminated kraft-aluminum-foil combination. The insulation is adhered to the jacket with the end grain of the insulation perpendicular to the jacket surface.

2. HVAC ductwork all purpose jacketing shall be either the white kraft or aluminum foil exterior, as specified.

3. Jacket shall be furnished with integral 1-1/2 inch self sealing longitudinal lap, and separate 3 inch wide adhesive backed butt strips.

B. P.V.C. Jackets

1. PVC jackets shall only be used on systems where the fluid temperature is less than 250ºF, or insulation surface temperature is less than 150ºF. All PVC materials shall carry the 25/50 label. Straight run or roll material shall not be less than 10 mils thick.

2. PVC jackets shall be furnished for all fittings insulated with fiberglass, and shall also carry the 25/50 label and be 20 mils thick.

3. PVC jackets shall be constructed of high impact, UV resistant PVC, conforming to ASTM D 1784, Class 14253-C.

PART 3 - EXECUTION

3.01 GENERAL

A. Except as specified, material shall be installed in accordance with the recommendations of the manufacturer. Insulation materials shall not be applied until all testing such as x-ray, hydrostatic, etc. specified in other sections of these specifications have been completed; foreign material such as rust, scale, or dirt has been removed from surfaces to receive insulation; and the surfaces are clean and dry. Insulation shall be kept clean and dry at all times.

B. All insulation joints shall be butted firmly together and all jackets shall be smoothly and securely installed. Insulate each pipe and duct individually. Do not use scrap pieces of insulation where a full-length section will fit. Insulate entire specified equipment, piping and duct systems, except controls, nameplates etc.

C. Insulation shall be installed in accordance with the Insulation Schedule for the temperatures indicated in the Contract Documents.

D. Insulation shall be molded sectional, segmental or block material of a rigid type capable of retaining its insulating efficiency while continuously exposed to the design temperature without cracking, discoloring, disintegrating, losing its comprehensive strength or otherwise deteriorating.

E. All insulation must in every case fit closely to the surface to which it is applied. In each case of improper fit, the Contractor shall promptly remove and reapply insulation upon request by the Engineer and at no extra cost.

F. All irregular surfaces shall have the insulation applied evenly to a thickness at least equal to and of the same number of layers as adjacent surfaces.

G. Where molded, segmental, or flat block covering is applied, it shall be butted tightly and all joints and unavoidable spaces shall be completely filled and sealed with insulating cement. "Buttering" over the tops of voids shall not be permitted. The finished appearance shall be smooth and neat. All sectional and segmental insulation shall be of uniform thickness throughout. All insulation for which multi-layers are needed shall have all joints, both longitudinal and circumferential staggered and sealed.

H. All insulation shall be held securely in place with wires, studs or adhesive and properly covered.

3.02 PIPING SYSTEMS

A. Insulation passing through sleeves or other openings shall be continuous. Install metal frames to protect edges of openings in insulation. Coordinate insulation densities with the requirements of approved firestop system being installed at all firewall penetrations.

B. Where insulation is required on piping systems that utilize pipe penetrations or sleeves, the penetration shall be large enough to run the insulation continuous.

C. For valves, fitting, flanges and accessories, the insulation shall be of the same thickness and conductivity as the adjoining pipe insulation, either premolded or segmented. The insulation shall be placed around the item abutting the adjoining pipe insulation, or if nesting size insulation is used, overlapping two inches or one pipe diameter. Loose fill mineral wool or insulating cement shall be used to fill the spaces or void between adjoining segments.

D. Provide a minimum of two inches overlap of jacket material on all piping system longitudinal seams. Use circumferential overlaps on all weatherproof jacketing. All non-weatherproof jacketing longitudinal joints shall be located so that they are not visible from normal operating level. For weatherproof jackets, install joint side down, to shed water.

E. Breaks and punctures in the jacket material shall be patched by wrapping a strip of jacket material around the pipe and cementing, stapling, and coating as noted for butt strips. Patch shall extend not less than 1-1/2 inches past the break.

F. Poly-Vinyl Chloride (PVC) fittings and pipe coverings shall be installed over the insulation, as specified, and secured by taping with PVC vapor barrier tape, or metal or plastic tacks made for securing PVC coverings.

G. Aluminum jacketing, as specified, shall be installed over insulation to form a weathertight system. The jacket may be factory installed on insulation. The jacket shall overlap not less than two inches at longitudinal and circumferential joints and shall be secured with bands at not more than 12-inch centers. Circumferential joints shall be sealed with a coating recommended by the insulation manufacturer for weatherproofing seams and joints in aluminum jackets.

H. At all hanger locations, install insulation shields and high density jacketed insulation inserts between shield and pipe. Where insulation is subject to compression at points over 180 degrees apart, e.g. riser clamps, U-bolts, trapezes, etc.; fully encircle pipe with 2 protection shields and 2 high density jacketed fibrous glass insulation inserts within supporting members.

3.03 INSULATION THICKNESS

A. All piping and equipment installed shall be insulated unless otherwise indicated on the Contract Drawings. Unless otherwise indicated, all miscellaneous components associated with the piping systems and/or equipment being insulated shall likewise be considered a part of the system or equipment and shall also be insulated. The Insulation Schedule on the Contract Drawings indicates the maximum operating temperature and the insulation thickness to be applied. Thickness are based on computations using accepted conductivity factors and are intended to be

the most economic thickness for operating conditions, or to achieve a surface temperature of 135°F in an ambient of 80°F, in still air, whichever thickness is greater.

END OF SECTION

DIVISION 23 – HEATING, VENTILATING AND AIR CONDITIONING
SECTION 23 22 13 – PIPING

TABLE OF CONTENTS

PART 1 - GENERAL

1.01 SCOPE OF WORK

A. This Section defines the general requirements for the installation and modification of mechanical systems piping as required by the Contract Documents.

B. The piping systems shall include piping materials, valves, fittings, flanges, gaskets, bolting, welding material, expansion joints, vents, hangers, supports, anchors and other components required for the proper and operational installation.

C. Piping less than 2-1/2” shall be "field-run" by the Contractor following the general guide configuration shown on the Contract Drawings and shall function as intended by the Contract Drawings.

D. The Contractor shall be responsible for the installation of all pipe hangers and supports in all piping systems in accordance with the details furnished with the Contract Documents.

E. Unless otherwise indicated on the Contract Documents, the Contractor shall locate all hangers and supports in accordance with this Section and required submittals.

1.02 REFERENCES

A. All work under this section shall conform to the requirements of the “New York State Building Code”, and the regulations of governmental authorities having jurisdiction.

B. All work performed and material supplied under this Section shall be in accordance with the latest addenda thereto of the applicable codes, standards, specifications, regulations, procedures, and tests as cited in Section 01 11 00 – “Mechanical Summary of Work”.

C. Where components or materials are specified to conform to requirements of the standards of organizations such as American Society of Mechanical Engineers (ASME) or Underwriters Laboratories (UL), that use of label or listing as method of indication compliance, proof of such conformance shall be submitted and approved by the Engineer. The label or listing of the specified organization will be acceptable evidence.

1.03 SUBMITTALS

A. General

1. The Contractor shall furnish shop drawings for all proposed equipment that will be furnished to complete the work in accordance with the General Requirements section of the Contract Documents and this Section.

2. Additional submittals, as necessary, for each manufactured item shall include but are not limited to the following: manufacturer's descriptive literature, shop drawings, catalog "cuts", and mill reports.

3. Piping 2-1/2 inch and smaller shall be shown as single line and 3-inch and larger double line.

B. Specific Submittals:

1. Pipe

2. Pipe Fittings

3. Gaskets

4. Supports and Hangers

5. Pipe Labels

1.04 QUALITY ASSURANCE

A. Installer Qualifications: An experienced installer, with minimum 5 years experience, who has completed Work similar in material, design, and extent to that indicated for this Project and whose work has resulted in construction with a record of successful in-service performance.

B. Construction Site Quality: Contractor shall maintain, on site, sufficient office, field engineering, and field supervision staff to assure that all materials and layout correspond with the requirements of the Contract Documents and approved drawings.

C. Flanged joints shall be provided for sizes larger than two inch at all connections to equipment and where disassembly may be required. For sizes two inches and smaller, flanged joints or unions shall be provided according to the end connection used.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Materials shall be delivered to the site, ready for use, in the manufacturer’s original and unopened containers or packaging. Packaging to contain material description and manufacturer information.

B. All delivered materials, products or equipment shall be stored under cover in a dry, weather-tight, and adequately ventilated location. All materials shall be elevated off of the ground.

PART 2 - PRODUCTS

2.01 GENERAL

A. All steels and steel products shall be from domestic steel mills and written proof as to the steel product's origin shall be submitted.

B. Unless otherwise specified herein, all materials and articles incorporated in the Work covered by this Section shall be factory new and without blemish or defect. Salvage or rebuilt components or materials will not be accepted.

C. Carbon or alloy steel having carbon content of more than 0.35% shall not be used in welded construction or be shaped by oxygen cutting process or other thermal cutting processes.

D. All valves, unions, flanges, etc. shall bear markings in accordance with MSS SP 25 including the manufacturer's name or trademark, the material of construction, and symbols to indicate the service conditions for which the manufacturer rates the valve. Other markings shall be included if required by the applicable standard.

2.02 PIPING/TUBING

A. All piping covered by this Section, unless otherwise indicated, shall be designed in accordance with ANSI/ASME B31.9. The Contractor shall furnish all materials and components as specified in this Section, and on the Contract Drawings. The materials and components shall include, but not be limited to the following:

1. All carbon, stainless and alloy steel pipe and fittings.
2. All non-ferrous piping and fittings (as allowed within the limitations of B31.9).
3. All hangers and supports.
4. All valves and other components required to make the piping system complete.

B. Pipe Fabrication

1. All piping shall be fabricated to the applicable ANSI Dimensional Standard unless otherwise indicated in the Contract Document. Steel pipe shall be seamless. Unless otherwise indicated, all condensate return piping shall be schedule 80 minimum wall thickness.
2. All threaded steel piping connections and nipples shall be made with seamless pipe, with schedule 80 minimum wall thickness.
3. All piping material shall be provided in accordance with the ASME Material Specification indicated on the Contract Drawings.
4. The minimum wall thickness at any point shall not be more than 12.5% under the nominal wall thickness specified.
5. For pipe NPS 1-1/2 inch and under, the outside diameter at any point shall not vary more than 1/16 inch over nor more than 1/32 inch under the standard specified. For pipe NPS 2-inch and over, the outside diameter shall not vary more than + 1% from the standard specified.
6. All steel shall be carbon steel, A-53B/A-106B – Roll or cut grooved-ends as appropriate to pipe material, wall thickness, pressures, size and method of joining. Pipe ends to conform to ANSI/AWWA C-606.

2.03 FITTINGS

A. General

1. All fittings such as elbows, tees, caps, couplings, unions, reducers, flanges, weldolets and threadolets shall be commercially available products.
2. All fittings shall be provided in accordance with ASTM Material Specifications and ANSI Dimensional Standards.
3. Elbows with 1.5 diameter radius shall generally be used in all piping systems. Short radius and reducing elbows shall only be used where required due to space limitations or equipment connections, and only when approved by the Site Representative.
4. All fittings used in the piping systems must be within the material, size, pressure and temperature limitations of the governing standards.
5. The piping shall be mechanically connected grooved coupling piping system.
6. Acceptable manufacturers for mechanically connected grooved fittings are Victaulic, Gruvlok and Viking.
7. Hole cut bolted branch outlets shall be full-bodied outlet (U-bolt outlets will not be permitted) style 920 by Victaulic or approved equal by Gruvlok or Viking.

B. Pipe Couplings

1. Mechanically connected grooved couplings shall be used in piping system.
2. Grooved couplings shall meet the requirements of ASTM F-1476.

C. Dielectric Fittings

1. At connections between piping systems of dissimilar metals, dielectric type insulating fittings or unions shall be furnished. Acceptable manufacturers are Epco Sales, Walter Vallett Company, Atlas Products, Eclipse, Inc., or approved equal.
    a. Dielectric fittings shall be feature female steel pipe thread to solder connection.
    b. Fittings shall be constructed using lead free materials.

c. Fittings shall be rated for 300°F at 50 psi.

D. Strapless Outlet Fittings

1. ½" (DN15) or ¾" (DN20) NPT outlet on 4" (DN100) and larger heater sizes reated for 300 PSI equal to Victaulic style 923.

2.04 JOINTS

1. Mechanical coupling:

a. Grooved couplings shall be of same manufacturer as used for grooved fittings.

b. Malleable iron in conformance with ASTM Specification A47, equal to Victaulic No. 75 or rigid mechanical coupling equal to Victaulic style No. 005, ASTM A-536.

c. Gaskets:

(1) Wet systems: Grade E EPDM gasket, ASTM Specification D2000.

d. Rigid or zero flex type couplings will be used when operating pressures may cause piping to move out of place or sway on hangers. Flexible couplings may be used where piping is properly braced or clamped into rigid position.

2.05 GASKETS

A. General

1. Gaskets shall be provided in accordance with the applicable sections of the piping class into which it is to be used.

2. Asbestos containing materials shall not be used.

3. Gaskets shall be made of materials that are not injuriously affected by the fluid or by temperature.

4. Gaskets shall also be supplied in accordance with B31.9 Building Services Piping Code.

2.06 PIPE HANGERS AND SUPPORTS

A. General

1. The design, materials and installation of pipe supporting elements shall be in accordance with the rules of MSS-SP-69 and MSS-SP-89. Supporting elements shall be capable of carrying the sum of all concurrently acting loads (i.e.; weight, expansion/contraction, pressure etc.) including that of any hydrostatic testing.

2. Piping supports shall be designed to provide the expected supporting effort and allow pipeline movement with thermal changes without causing overstress.

3. All parts of the supporting equipment shall be fabricated and assembled so that they will not be disengaged by movement of the supported piping.

4. The maximum safe loads for bolts, threaded hanger rods, and all other threaded members shall be based on the root area of the threads.

5. All load bearing and protective housing and components for supports, restraints, guides, anchors, etc. used for the support of piping shall be made of steel or wrought iron. Cast iron may be used in compression parts only.

6. All components parts of hangers, supports, anchors, attachments, alignment guides, and secondary structural steel shall be delivered to the job with one shop coat of rust resisting

primer. Threads on bolts and rods shall not be painted, but shall retain a light coat of oil to prevent rust.

7. All auxiliary steel required for the installation or support of piping systems or equipment shall be provided and installed under this Contract, unless otherwise indicated. Auxiliary steel shall be designed on the basis of the allowable stresses as per AISC Steel Handbook or applicable local building codes.
8. Standard component supports that are catalog items shall be used wherever possible and shall be capable of vertical adjustment, if the support is a rod hanger type. Rod couplings are not acceptable.
9. The Contractor shall furnish all pipe supports and shall be responsible for providing and locating all piping supports including those detailed by the Contract Documents.
10. The Contractor shall assure that materials for all pipe supports and appurtenances shall be identifiable to ASTM specification number with clearly established minimum physical properties, in accordance with ANSI/ASME codes, and shall be suitable for the service intended.
11. The allowable stresses for the base material of all parts of supporting and restraint assemblies shall not exceed the appropriate allowable stress at the maximum operating temperature.
12. These specifications list pipe hanger and support systems using information from B-Line Systems, Inc. other manufacturers are approved subject to compliance to these documents. The following are approved manufacturers:
    a. Grinnell Corporation
    b. B Line Systems, Inc.
    c. Carpenter & Paterson, Inc., or approved equal.

B. Wall Supports

1. Pipes 4 inch and smaller:
    a. Carbon steel hook, B3191.
    b. Carbon steel J-Hanger, B3690.
2. Pipes larger than 4 inch:
    a. Welded strut bracket and pipe straps, B3064 and B2000 series.
    b. Welded steel brackets, B3066 or B3067, with roller chair or adjustable steel yoke pipe roll, B3120 or B3110. Use pipe protection shield or saddles on insulated lines.

PART 3 - EXECUTION

3.01 ERECTION OF PIPING SYSTEMS

A. General

1. Although all systems may not be fully described as to every piece of pipe and associated component, the Contractor shall be responsible to completely install the necessary piping to provide a fully operation system.
2. All piping systems and components shall exceed the design pressure and temperature stress allowances outlined in their appropriate ANSI specification.

3. Grooved Mechanical Coupling and Fitting: Install system using mechanics trained by the grooved mechanical coupling manufacturer's representative and conform to latest published Victaulic specifications, ANSI/AWWA C-606, UL, FM, NFPA or other standards as applicable.
4. Unless otherwise specified, fabrication, assembly, threading, welding, soldering, and brazing shall conform to NFPA Z223.1, ANSI B31.9 and the applicable codes and ordinances local to the place of installation, and in accordance with the specifications and standards referred herein for all piping systems.
5. Contract Drawings shall be considered as construction quality, showing general arrangements, positions, locations and connections of equipment, accessories, pipes and ducts. Specific installation details are provided as necessary when specific equipment has been identified in the Contract Documents.
6. The work under this Section shall include obtaining all information and measurements which are required to make the work fit properly and to avoid interference with the work of other trades.
7. If building openings are needed and are not already available for use in receiving shop fabricated or field run piping the Contractor shall be responsible to provide them on approval from the Engineer.

B. Piping Installation

1. All piping shall be run perpendicular and/or parallel to floors, walls, etc, unless otherwise indicated on drawings. Piping and valves shall be grouped neatly and shall be run so as to avoid reducing headroom or passage clearance.
2. Piping shall in no way obstruct doorways, passageways, or operating aisles, or interfere with access to equipment. Sufficient clearance shall be allowed for equipment repairs, servicing, removal and replacement of parts, headroom and walkways.
3. Offsets shall be made in piping where required to avoid interference's with other work, to increase head room beneath, from expansion loops, or changes in direction as may be indicated on the Contract Drawings, or as required to permit freedom of movement during expansion or contraction without causing undue stresses to the pipe or equipment. Offsets shall be installed so as not to interfere with drainage or cause the formation of air pockets.
4. All field run piping shall be accurately cut to measurements established at the construction site. All overhead piping shall be run as high as possible under structural members or as located on the drawings.
5. Provide minimum side clearance of two inches unless otherwise specified, between parallel lines, outside of insulation or between flange and pipe insulation, to permit ready access for removal or maintenance of pipeline. Take into consideration thermal movements in determining side clearances. Minimum unobstructed walkway clearance shall be 3'-0" unless otherwise specified.
6. Lines routed in concrete trenches shall be located to provide at least 2" clearance above the finished trench floor (this includes flanges, fittings or other parts). For screwed piping 4" clearance shall be maintained.
7. Piping shall be installed without springing or forcing, to properly clear all openings and equipment. Cutting or other weakening of structural members to facilitate pipe installation shall be prohibited.

8. Piping subject to expansion shall be installed to permit free expansion and contractions without damage to joints or supports and without interference from other pipes, equipment, and/or structures.
9. Screwed pipe joints shall be made up perfectly tight without the use of any filler except oil, graphite, Teflon tape or approved equal compound. If any leaks occur, the defective parts must be remade with new material and not caulked. Bushings shall not be used in place of reducers. Bushings may be used for gauge tappings and thermometer wells.
10. Mitering of pipe or use of field-fabricated welding fittings is prohibited.
11. Water carrying pipe shall not be installed over switchgear or transformers unless approved by the Engineer.
12. All piping shall be installed in a manner that permits draining of all water and venting of all vapors as necessary i.e. high point vents and low point drains.
13. Reducing fittings shall be used for changes in pipe size; the use of bushings will not be permitted. In horizontal lines, reducing fittings shall be of the eccentric type to maintain the bottom of the lines in the same place for steam lines and to maintain the top of the lines in the same place for water lines.
14. Unless otherwise indicated on the Contract Drawings, condensate and gas piping shall be sloped down, and water piping shall be sloped up in the direction of flow. No slope shall be less than 1/4 inch in 20 feet.
15. The Contractor shall supply and install all required instrument, sampling and control piping, tubing, valves, tops, etc. as required by the Contract Documents.
16. Fabricated piping shall be correctly positioned relative to equipment nozzles before welding.
17. Erection of all equipment piping not furnished as an assembled equipment package, shall be installed in the field in accordance with Contract Documents.

C. Branch Connections

1. No nozzles or branch connections shall be fabricated in the shop or field by attaching directly to the run pipe by welding if the branch is of the same NPS or greater than the run piping.
2. Full size branch connections shall be made with ANSI standard fittings as specified in the applicable parts of this Section.
3. Reduced size branch connections shall be made with fittings specifically designed for such purposes.
4. “O-let” style of connections may not be used.
5. Branch reinforcement is not necessary when the wall thickness of the main run and branch are sufficiently in excess of that required to sustain the design pressure.

D. Threaded Joints

1. Threaded joints may be used with fittings made in accordance with the applicable ANSI standards and within the material size, pressure and temperature limitations of those standards, along with the specified class of the indicated system.
2. All thread on piping and components shall be taper threads in accordance with ANSI B1.20.1 & 3.

3. Pipe with a wall thickness less than that of Schedule 80 steel pipe shall not be threaded, regardless of service.
4. Where steel pipe is threaded and used for steam service at pressure above 250 psig or for water service above 100 psig with water temperature above 220ºF, the pipe shall be seamless.
5. Where permitted, screwed unions shall be of the standard ground joint seat type.
6. Bronze or brass screwed joints shall be made up tight with compound. The use of wicking is prohibited.
7. Where screwed flanges are specified or noted to be used, all pipe after having been fully and finally made up, shall have the ends fall slightly short of the joint faces of the flange so that such joints shall be made with the flange faces only.
8. The Contractor shall submit to the Engineer what kind or type of compound he proposes to use in making up screwed joints. Compounds shall not be used in the event of seal welding a screwed joint; nor should seal welding of a screwed joint be done unless specifically called for on the Contract Drawings or otherwise stated.

E. Curved Segments of Pipe

1. Any pipe bent to form a curved segment shall maintain the normal wall thickness.
2. Any bending of pipe shall not exceed a flattening in excess of 8% of the average measured outside diameter of the pipe before bending.

F. Pipe Sleeves

1. All pipes passing through walls, floors, partitions, or roof construction shall be provided with sleeves furnished and installed by the Contractor. Sleeves shall be of sufficient diameter to accommodate pipe covering where lines are insulated.
2. Sleeves through concrete walls, floors, partitions and roof slabs shall be standard weight galvanized steel pipe. Sleeves through steel platforms and grating shall be standard weight black steel pipe. Space between pipe, tubing, or insulation and the sleeve shall be not less than 1/4”. Sleeves shall be held securely and in proper position during and after construction.
3. Sleeves in exterior walls shall have intermediate waterstop flange, and shall have space between pipe and sleeve caulked watertight. Sleeves in concrete floors shall be of sufficient length to be flush with bottom of slab, extend 1” above the finished floor, and shall be securely anchored to the slab. Sleeves in walls and partitions shall be made flush with each surface, unless otherwise specified. Sleeves through roof construction shall be anchored to the roof construction. Sleeves for pipes passing through steel platforms and gratings shall extend 1” above and 1” below the deck surface, and shall be securely anchored to the platform or grating.
4. Pipe and sleeves passing through roof construction shall be provided with metal flashing, counterflashing and rain hood, in accordance with details when shown on the Contract Drawings.

3.02 INSTALLATION OF HANGERS AND SUPPORTS

A. General

1. Existing structural steel members shall be used as a point of support wherever possible. All hanger attachments to existing, or supplementary steel shall be a manufacturer's standard clamp or made by welding. Industry acceptable standard welding components shall be used.

2. Drilling of structural steel to attach hangers or supports is not permitted.
3. Component support fillet welds shall have a minimum size based upon the thickness of the thicker member to be joined and in accordance with the table below:

Thickness of the Minimum Fillet

Thicker Member (t)	Weld Size
1/4"	1/8"
1/4" to 1/2"	3/16"
1/2" to 3/4"	1/4"
3/4" to 1-1/2"	5/16"

4. No piping shall be permanently supported by wire, rope, wood, or other makeshift devices or from other pipes.
5. Horizontal or vertical pipe runs should be supported preferably at locations of least vertical movement.
6. Pipe supports shall be placed as close as possible to concentrated loads such as flanges, valves, strainers, and on branch lines close to the connection, and to terminal connections.
7. Vertical runs of pipe over 15 feet long shall be supported by hangers placed not less than one foot from the elbows on the connecting horizontal runs.
8. Where practical, riser pipe shall be supported independently of the connected horizontal piping.
9. Pipe support attachments to the riser piping shall be riser clamps of a design equal to Grinnell Hanger Standard 40.
10. The design loads for rigid riser supports shall be as follows:
    a. Water-Filled Lines - Design shall be based on the maximum operating load. Selection of riser clamp stock size shall be based on MSS-SP-58 and ANSI B31.1 Section 121.1.2.
11. Where changes in direction of the piping occur between supports, the distance between supports shall be a maximum of three-fourths the span listed in ANSI B 31.1, or above (whichever is smaller).
12. Rod hanger attachments (clevises, turnbuckles, etc.) shall be secured with locking nuts. At least 1/4" of thread of rod shall be left exposed.
13. Holes in support steel for rods and bolts up to 15/16" diameter shall be 1/16" larger than the rod or bolt diameter, and holes for rods and bolts over 1" diameter shall be 1/8" larger than the rod or bolt diameter, unless otherwise noted.
14. Bolts shall have hexagonal regular heads and conform to ANSI B 18.2.
15. All nuts and jam nuts shall be hexagonal and conform to ANSI B 18.2.
16. All threads on any threaded parts such as hanger rods, nuts, turnbuckles, bolts, etc. shall conform to ANSI B 1.1 for the Coarse Thread Series with a Class 2 fit.
17. Hanger rods shall be subjected to tensile loading only. At hanger locations where lateral or axial movement is anticipated, suitable linkage shall be provided to permit swing.

18. Where horizontal piping movements are such that the hanger rod angularity from the vertical is greater than four degrees from the cold to hot position of the pipe, the hanger pipe and structural attachments shall be offset in such a manner that the rod is vertical in the hot position.
19. Sliding supports shall provide for the expected thermal movement of the pipe. The design of the support shall include the load due to frictional resistance.
20. Small bore piping and instrument tubing, two-inch and under, running in banks shall be supported by tray type assemblies where feasible.
21. Saddles, bases or suitable metal shields shall be used at points of bottom support on insulated pipe and accommodate the full thickness of the insulation. The space between saddles and pipe shall be filled with insulation of the same type and thickness as the adjacent pipe.
22. Flexible piping runs shall be stabilized and controlled by suitable anchors, restraints, and guides preferably located at points of zero thermal movement. Standard U-Bolts shall be used as guides on 2" diameter, and smaller piping. All guides shall have clearance of 1/16 to 1/8 inch.

B. Anchors

1. Piping shall be anchored where noted on the Contract Drawings and where required to localize expansion or to prevent undue strain on piping, branches, or equipment.
2. Pipe anchors shall consist of heavy forged or welded construction of approved design with steel collars, lugs, and bolts for clamping and attaching anchor braces, unless otherwise shown on the Contract Drawings.
3. Anchor braces shall be installed in the most effective manner to obtain the desired results. No supports, anchors, or stays shall be attached in locations where their installation or the weight or expansion of the pipe lines will result in damage to the building construction.
4. Restraining pipe supports shall be provided wherever excessive pipe movement occurs.

C. Concrete Inserts

1. Cast in place spot concrete inserts shall be used where applicable, either steel or malleable iron body, B-Line B2500 or B3014. Spot inserts shall allow for lateral adjustment and have means for attachment to forms. Select inserts to suit threaded hanger rod sizes, N2500 or B3014N series.
2. Continuous concrete inserts shall be used where applicable. Channels shall be 12 gauge, ASTM A570 Grade 33 structural quality carbon steel, complete with styrofoam inserts and end caps with nail holes for attachment to forms. The continuous concrete insert shall have a load rating of 2,000 lbs./ft. in concrete, B-Line B221, B321, or B521. Select channel nuts suitable for strut and rod sizes.

D. Hanger and Support Spacing

1. Unless otherwise shown, specified or calculated hangers for horizontal pipe shall be adjustable clevis type. Hanger spacing and rod sizes for individually supported horizontal straight piping shall be in accordance with the following unless otherwise specified in the Specifications or on the Contract Drawings.
2. Horizontal steel piping shall be supported in accordance with MSS SP-69 Tables 3 and 4, excerpts of which follow below:

NOMINAL PIPE SIZE	ROD DIAMETER	MAXIMUM SPACING
1/2" to 1-1/4"	3/8”	7'
1-1/2”	3/8"	9’
2"	3/8"	10’
2-1/2"	1/2"	11’
3"	1/2"	12’
3-1/2"	1/2"	13'
4"	5/8"	14'
6"	3/4"	17'

3.03 TESTING

A. Tests for all new piping shall be performed by the Contractor in accordance with ANSI B31.9, Power Piping Code, and the requirements noted in this Section of this Specification. All materials and equipment required to perform the hydrostatic test shall be furnished by the Contractor. All tests shall be performed satisfactorily prior to insulation or backfilling.

B. Where water is used for hydrostatic tests, only sanitary water of a potable quality shall be used. Test pressures shall be maintained in the systems for at least 30 minutes with no visible leaks or appreciable loss of pressure.

C. Unless otherwise specified, all piping shall be subjected to a pressure equal to 1-1/2 times the normal working pressure, or to 100 psig, whichever is greater.

D. All tests shall be certified and documented by qualified representatives of the Owner.

E. Fabricated piping shall not be connected to equipment until testing has been completed. Prior to the application of pressure, restraining devices shall be applied to prevent distortion during pressure testing. All chips, dirt and debris shall be removed from piping before testing. All air shall be expelled from lines prior to applying hydrostatic test pressure.

F. Any defective joints in new work shall be repaired and retested by the Contractor.

3.04 INSPECTION AND EXAMINATION

A. General

1. The Owner or his designated representative will provide his own specification compliance inspection and examination of the Contractor's work. This does not relieve the Contractor of his responsibility to fully inspect and examine all of his work prior to the facility's review.

2. At minimum, all portions of materials, components, joints, supports and other piping elements that are assembled or erected during the project shall be given a full visual examination for compliance to the specification and procedures.

3. In addition to the items listed in No. 2 above, the minimum evaluation criteria on the limitations on imperfections in pipe joining indicated in ASME/ANSI B31.9 Chapter VI, Paragraph 936.6 shall be strictly adhered to.

B. Visual Inspection

1. Visual examinations will be performed by the Owner on 100% of all field joints to detect deficiencies in assembly.

3.05 CLEANING

A. The Contractor shall thoroughly clean all new piping systems, equipment and components of all contaminants such as oil, grease, loose mill scale, dirt, corrosion product, or any other foreign substances. The contractor shall install drains with isolation valves on all new piping to permit flushing of the pipe. Temporary strainers shall be furnished at all connected equipment where draining and flushing can not be performed. The Contractor shall remove the temporary strainers after the fluid has been circulated through the system.

B. All cleaning of piping and components shall be performed to the satisfaction of the Owner's designated representative. If not satisfactory, the Contractor shall bear all costs for disassembly, recleaning, and reassembly.

C. Piping shall be clean inside and outside at time of shipment. All waste, such as metal chips and filings, waste, rags, debris, shall be removed from the interior of each piping unit. All mill scale, rust, oil, grease, chalk, crayon, paint marks, sand and other deleterious material shall be removed from interior and exterior surfaces.

D. All ferritic materials shall be descaled on exterior and interior surfaces by mechanical or chemical means. When chemical cleaning is employed, material shall exhibit no evidence of pitting or other excessive attack.

E. The Contractor shall install temporary bypass piping around all control valves, coils and equipment where piping system is not flushed prior to connection. After flushing the Contractor shall remove all temporary piping.

F. All carbon steel piping for lube oil system shall be thoroughly cleaned to remove grit, mill scale, rust, debris and other deleterious material. After cleaning, flushing and dosing, the pipes shall be fogged with lube oil to keep it in a clean, rust-proof condition until installation.

3.06 PIPING IDENTIFICATION

A. General

1. The Contractor shall identify all equipment and material provided under this Contract.

B. Piping Identification

1. All piping shall be provided with identification and flow arrows to further identity the service carried.

2. Positive identification of the contents of a piping system shall be by lettered legend giving the name of the contents in full or abbreviated form.

3. Contents shall be identified by legend with sufficient additional details such as temperature, pressure etc. necessary to identify the hazard.

4. Legend shall be brief, informative, pointed, and simple for greatest effectiveness. Legends shall be applied close to valves or flanges and adjacent to changes in direction, branches, and where pipes pass through walls or floors; and at intervals on straight pipe runs sufficient for identification.

5. Attention shall be given to visibility with reference to pipe markings. Where pipelines are located above or below the normal line of vision, the lettering shall be placed below or above the horizontal centerline of the pipe.

6. Marker Types:

a. Snap-on Marker: One piece wrap around type constructed of precoiled acrylic plastic with clear polyester coating, integral flow arrows, legend printed in alternating directions, 3/4 inch adhesive strip on inside edge, and 360 degree visibility.

b. Strap-On Marker: Strip type constructed of precoiled acrylic plastic with clear polyester coating, integral flow arrows, legend printed in alternating directions, factory applied grommets, and pair of stainless steel spring fasteners.

c. Stick-On Marker: Pressure sensitive adhesive backed type constructed of vinyl with clear polyester coating, and integral flow arrows for applications where flow arrow banding tape is not being used.

d. Banding Tapes: Pressure sensitive adhesive backed type constructed of vinyl with clear polyester coating.

(1) Plain Tape: Unprinted type; color to match pipe marker background.

(2) Flow Arrow Tape: Printed type with integral flow arrows; color to match pipe marker background.

e. Pipe Size Labels: Pressure sensitive adhesive backed type constructed of vinyl with clear polyester coating, vertical reading pipe size in inches, and legend size matching adjacent pipe marker.

7. Contrast shall be provided between color field and legend for readability, legend shall be in English using standard style of letters. Utilize the following tables in determining legend criteria:

Outside Dia. of Pipe or Covering (in)	Legend of Color Field (in)	Letter Size(in)
3/4 - 1-1/4	8	1/2
1-1/2 - 2	8	3/4
2-1/2 - 6	12	1-1/4

8. For identification of materials in pipes of less than 3/4 inch in diameter use permanently legible tags similar to required valve tags.

9. All underground piping shall have a bright colored continuously printed plastic ribbon tape of not less than 6 inch wide by 4 mil thick installed above the pipe and not greater than 8 inches from the surface of the ground.

10. Installation

a. Install the Work of this Section in accordance with the manufacturer's printed installation instructions, unless otherwise specified.

b. Stick-On Pipe Markers:

(1) Install minimum of 2 markers on each run of pipe, 90 degrees apart on visible side of pipe.

(2) Encircle ends of pipe markers around pipe or insulation with banding tape with one inch lap. Use plain banding tape on markers with integral flow arrows, and flow arrow banding tape on markers without integral flow arrows.

c. Pipe Size Labels: Install labels adjacent to each marker and upstream from flow arrow. Install a minimum of 2 pipe size labels on each run of pipe, 90 degrees apart on visible side of pipe.

d. Pipe Service Identification Tags: Attach tags to piping being identified with "S" hooks or jack chains.

11. Piping Identification Schedule

a. Piping Identification Types:

(1) Piping or Insulation under 3/4 inch O.D.: Pipe identification tags.

(2) Piping or Insulation 3/4 inch to 5-7/8 inch O.D.: Snap-on marker or stick-on marker.

(3) Piping or Insulation 6 inch O.D. and Larger: Strap-on marker or stick-on marker.

b. Identify exposed piping, bare or insulated, as to content, size of pipe and direction of flow, with the following exceptions:

(1) Piping in non-walk-in tunnels or underground conduits between manholes.

(2) Piping in furred spaces or suspended ceilings, except at valve access panels where valves and piping shall be identified as specified for exposed piping systems.

(3) Piping in finished spaces such as offices, class rooms, wards, toilet rooms, shower rooms and spaces as specified.

c. Locate piping identification to be visible from exposed points of observation.

(1) Locate piping identification at valve locations; at points where piping enters and leaves a partition, wall, floor or ceiling, and at intervals of 20 feet on straight runs.

(2) Where 2 or more pipes run in parallel, place printed legend and other markers in same relative location.

12. Acceptable Manufacturers of pipe labels and valve tags include W.H. Brady Company and Seton Pipe Marking Products.

C. System Identification

1. The Contractor shall provide 1/2 scale drawings of the flow diagrams at the project completion. The drawings shall represent “as built” drawings of the respective system.

2. The Contractor shall provide the drawings with a matted frame and glare resistant glass.

3.07 PIPING SYSTEM SPECIFICATIONS

A. The following Piping Material Data Sheets specify the piping fabrication requirements and are an integral part of this Specification. The Data Sheets are included in Attachment A at the end of this Section.

1. Valves numbers specified on the Data Sheets refer to Valve Specification Sheets included in Attachment A of in specification Section 23 05 23 – “General Duty Valves”.

END OF SECTION