SECTION 23 21 13 - HYDRONIC PIPING

PART 1 -GENERAL

1.1 SUMMARY

A. Section Includes:

1. Heating water piping, above ground.
2. Chilled water piping and condenser water piping, above grade.
3. Equipment drains and over flows.
4. Unions and flanges.

1.2 REFERENCES

A. American Society of Mechanical Engineers:

1. ASME B16.3 - Malleable Iron Threaded Fittings.
2. ASME B16.4 - Gray Iron Threaded Fittings.
3. ASME B16.18 - Cast Copper Alloy Solder Joint Pressure Fittings.
4. ASME B16.22 - Wrought Copper and Copper Alloy Solder Joint Pressure Fittings.
5. ASME B31.1 - Power Piping.
6. ASME B31.9 - Building Services Piping.
7. ASME Section IX - Boiler and Pressure Vessel Code - Welding and Brazing Qualifications.

B. ASTM International:

1. ASTM A53 / A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.
2. ASTM A234 / A234M - Standard Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service.
3. ASTM A395 / A395M - Standard Specification for Ferritic Ductile Iron Pressure-Retaining Castings for Use at Elevated Temperatures.
4. ASTM A536 - Standard Specification for Ductile Iron Castings.
5. ASTM B32 - Standard Specification for Solder Metal.
6. ASTM B88 - Standard Specification for Seamless Copper Water Tube.
7. ASTM B584 - Standard Specification for Copper Alloy Sand Castings for General Applications.

C. American Welding Society:

1. AWS A5.8 - Specification for Filler Metals for Brazing and Braze Welding.
2. AWS D1.1 - Structural Welding Code - Steel.

1.3 SYSTEM DESCRIPTION

A. Where more than one piping system material is specified, provide compatible system components and joints. When joining dissimilar metals piping use Brass ball valve and 6 inch long Brass nipples for 1-1/2" inch and larger. Provide flanges, union, and couplings at locations requiring servicing. Use unions, flanges, and couplings downstream of valves and at equipment or apparatus connections. Do not use direct welded or threaded connections to valves, equipment or other apparatus.

B. Provide pipe hangers and supports in accordance with these specifications and drawings.

C. Flexible Connectors: Use at or near pumps and motor driven equipment where piping configuration does not absorb vibration.

1.4 SUBMITTALS

A. Product Data:

1. Piping: Submit data on pipe materials, fittings, and accessories. Submit manufacturers catalog information.

B. Welding certificates.

C. Qualification Data: For installer.

1.5 QUALITY ASSURANCE

A. Qualification for Welders: Welders performing work under this Contract shall be certified and qualified in accordance with tests prescribed by the National Certified Welding Bureau (NCWB) or by other approved test procedures using methodology and procedures covered in the ASME Boiler and Pressure Vessel Code, Section IX, "Qualification Standard for Welding and Brazing Procedures, Welders, Brazers, and Welding and Brazing Operators."

1. Submit for approval the names, identification, and welder's assigned number, letter or symbol of welders assigned to this project.
2. The assigned identification symbol shall be used to identify the work of each welder and shall be indelibly stamped immediately upon completion of each weld.
3. Welders shall be tested and certified for all positions.
4. Submit identifying stenciled test coupons made by each operator.
5. Any or all welders may be required to retake welding certification tests without additional expense.
6. When so requested, a welder shall not be permitted to work as a welder on this project until he has been recertified in accordance with NCWB.
7. Recertification of the welder shall be made after the welder has taken and passed the required tests.
8. When piping 1-1/2 in. and smaller is butt or socket welded, submit three samples of test welds for approval.

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

1. Comply with provisions in ASME B31 Series, "Code for Pressure Piping."
2. Certify that each welder has passed AWS qualification tests for welding processes involved and that certification is current.

PART 2 - PRODUCTS

2.1 HEATING WATER PIPING, ABOVE GROUND

A. Steel Pipe: ASTM A53 / A53M, Schedule 40, 0.375 inch wall for sizes 12 inch and larger, black.

1. Fittings: ASME B16.3, malleable iron or ASTM A234 / A234M, forged steel welding type.
2. Joints: Threaded for pipe 2 inches and smaller; welded for pipe 2-1/2 inches and larger.

B. Steel Pipe: ASTM A53 / A53M, Schedule 40, 0.375 inch wall for sizes 12 inch and larger, black, grooved ends.

1. Fittings: ASTM A234 / A234M carbon steel, grooved ends.
2. Joints: Grooved mechanical couplings meeting ASTM F1476.
    a. Housing Clamps: ASTM A395 / A395M and ASTM A536 ductile iron, compatible with steel piping sizes.
    b. Gasket: Elastomer composition for operating temperature range from -30 degrees F to 230 degrees F.
    c. Accessories: Steel bolts, nuts, and washers.

C. Copper Tubing: ASTM B88, Type L drawn.

1. Fittings: ASME B16.18, cast brass, or ASME B16.22 solder wrought copper.
2. Joints: Solder, lead free, ASTM B32, Braze, AWS A5.8 BCuP silver/phosphorus/copper alloy with melting range 1190 to 1480 degrees F.

2.2 CHILLED WATER PIPING, ABOVE GROUND

A. Steel Pipe: ASTM A53 / A53M, Schedule 40, black, 0.375 inch wall for sizes 12 inch and larger, black.

1. Fittings: ASME B16.3, malleable iron or ASTM A234 / A234M, forged steel welding type.
2. Joints: Threaded for pipe 2 inches and smaller; welded for pipe 2-1/2 inches and larger.

B. Steel Pipe: ASTM A53 / A53M Schedule 40, black, cut rolled grooved ends.

1. Fittings: ASTM A395 / A395M and ASTM A536 ductile iron, or ASTM A234 / A234M carbon steel, grooved ends.

2. Joints: Grooved mechanical couplings meeting ASTM F1476.
    a. Housing Clamps: ASTM A395 / A395M and ASTM A536 ductile iron, compatible with steel piping sizes, rigid type.
    b. Gasket: Elastomer composition for operating temperature range from -30 degrees F to 230 degrees F.
    c. Accessories: Steel bolts, nuts, and washers.

C. Copper Tubing: ASTM B88, Type L drawn.
1. Fittings: ASME B16.18, cast brass, or ASME B16.22, solder wrought copper.
2. Joints: Solder, lead free, ASTM B32, Braze, AWS A5.8 BCuP silver/phosphorus/copper alloy with melting range 1190 to 1480 degrees F.

2.3 EQUIPMENT DRAINS AND OVERFLOWS

A. Steel Pipe: ASTM A53 / A53M Schedule 40, galvanized.
1. Fittings: ASME B16.3, malleable iron or ASME B16.4, cast iron.
2. Joints: Threaded for pipe 2 inches and smaller; flanged for pipe 2-1/2 inches and larger.

B. Steel Pipe: ASTM A53 / A53M Schedule 40, galvanized, grooved ends.
1. Fittings: ASTM A395 / A395M and ASTM A536 ductile iron, grooved ends.
2. Joints: Grooved mechanical couplings meeting ASTM F1476.
    a. Housing Clamps: ASTM A395 / A395M and ASTM A536 ductile iron, compatible with steel piping sizes, rigid type.
    b. Gasket: Elastomer composition for operating temperature range from -30 degrees F to 230 degrees F.
    c. Accessories: Steel bolts, nuts, and washers.

C. Copper Tubing: ASTM B88, Type DWV, drawn.
1. Fittings: ASME B16.18, cast brass, or ASME B16.22 solder wrought copper.
2. Joints: Solder, lead free, ASTM B32.

2.4 UNIONS AND FLANGES

A. Unions for Pipe 2 inches and Smaller:
1. Ferrous Piping: Class 150, malleable iron, threaded.
2. Copper Piping: Class 150, bronze unions with soldered joints.
3. Dissimilar Materials: Brass ball valve and 6 inch long Brass nipple.

B. Flanges for Pipe 2-1/2 inches and Larger:
1. Ferrous Piping: Class 150, forged steel, slip-on flanges.

2. Copper Piping: Class 150, slip-on bronze flanges.
3. Gaskets: 1/16 inch thick preformed neoprene gaskets.
4. Dissimilar Materials: Brass ball valve and 6 inch long Brass nipple.

PART 3 - EXECUTION

3.1 INSTALLATION - INSERTS

A. Provide inserts for placement in concrete forms.

B. Provide inserts for suspending hangers from reinforced concrete slabs and sides of reinforced concrete beams.

C. Provide hooked rod to concrete reinforcement section for inserts carrying pipe 4 inches and larger.

D. Where concrete slabs form finished ceiling, locate inserts flush with slab surface.

3.2 INSTALLATION - PIPE HANGERS AND SUPPORTS

A. Support horizontal piping per table - Copper & Steel.

B. Install hangers to provide minimum 1/2 inch space between finished covering and adjacent work.

C. Place hangers within 12 inches of each horizontal elbow.

D. Use hangers with 1-1/2 inch minimum vertical adjustment. Design hangers for pipe movement without disengagement of supported pipe.

E. Support vertical piping at every floor. Support riser piping independently of connected horizontal piping.

F. Where installing several pipes in parallel and at same elevation, provide multiple pipe hangers or trapeze hangers.

G. Provide clearance in hangers and from structure and other equipment for installation of insulation and access to valves and fittings.

3.3 INSTALLATION - ABOVE GROUND PIPING SYSTEMS

A. Route piping parallel to building structure and maintain gradient.

B. Install piping to conserve building space, and not interfere with use of space.

C. Group piping whenever practical at common elevations.

D. Sleeve pipe passing through partitions, walls and floors.

E. Install firestopping at fire rated construction perimeters and openings containing penetrating sleeves and piping.

F. Install pipe identification.

G. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.

H. Provide access where valves and fittings are not exposed.

I. Slope hydronic piping and arrange systems to drain at low points. Use eccentric reducers to maintain top of pipe aligned.

J. Where pipe support members are welded to structural building framing, scrape, brush clean, and apply one coat of zinc rich primer to welds.

K. Prepare unfinished pipe, fittings, supports, and accessories, ready for finish painting.

L. Install valves with stems upright or horizontal, not inverted.

M. Insulate piping as required.

3.4 FIELD QUALITY CONTROL

A. Test all piping to at least 150% of working pressure for minimum of two hours.

3.5 FIELD QUALITY CONTROL

A. Perform the following tests on hydronic piping:

1. Verify that pipe cleaning has been completed.
2. Use ambient temperature water as a testing medium unless there is risk of damage due to freezing. Another liquid that is safe for workers and compatible with piping may be used.
3. While filling system, use vents installed at high points of system to release air. Use drains installed at low points for complete draining of test liquid.
4. Isolate expansion tanks and determine that hydronic system is full of water.
5. Subject piping system to hydrostatic test pressure that is not less than 1.5 times the system's working pressure. Test pressure shall not exceed maximum pressure for any vessel, pump, valve, or other component in system under test. Verify that stress due to pressure at bottom of vertical runs does not exceed 90 percent of specified minimum yield strength or 1.7 times "SE" value in Appendix A in ASME B31.9, "Building Services Piping."
6. After hydrostatic test pressure has been applied for at least 2 hours, with system valves capped and pressure apparatus disconnected, and no change in test pressure, examine

piping, joints, and connections for leakage. Eliminate leaks by tightening, repairing, or replacing components and repeat hydrostatic test until there are no leaks.

7. Prepare written report of testing.

3.6 ADJUSTMENT AND CLEANING

A. Cleaning:

1. During construction, prevent entry of foreign matter, clean pipe, fittings, and valves internally and hammer welds to remove all loose dirt, mill scale, metal chips, weld beads rust and harmful substances. Flush piping system with clear water prior to connection to coils, control valves and equipment. Install temporary by-pass piping around factory cleaned components such as coils, control valves and equipment where piping system is hot flushed prior to connection.
2. After erection, flush with clear water and seal ends after cleaning.
3. Water Systems:
    a. Open all valves, drains, vents and strainers at all system levels.
    b. Remove plugs, caps, spool pieces and components to facilitate early debris discharge from system.
    c. Isolate or protect clean systems components including pumps and pressure vessels and remove any component that may be damaged. Install temporary strainer where necessary.
    d. Flush bottoms of risers.
    e. After start-up flushing, fill with clean water, add products recommended by water treatment supplier to remove adherent organic soil, hydrocarbon flux, pipe mill varnish, joint compounds, rust and harmful substances not removed by initial flushing.
    f. Circulate water of each system at respective design flow rates for at least 8 hours.
    g. At end of 8 hour period, remove and clean strainers and blow off low point, then completely drain out entire systems of cleaning solution and clean out cooling tower basins and hose down for final flushing.
    h. Refill systems with clean water and circulate for an additional 4 hour period and, at the end of that interval, completely drain systems, operate all valves to dislodge debris.
    i. Drain, refill with clear water and circulate, and provide water treatment as directed by the water treatment company.
4. Do not circulate water to the Central Utility Plant (CUP) until the CUP water treatment contractor has certified the water quality in both, the CUP and the water distribution systems.

END OF SECTION 23 21 13