

Part 1 General

1.1 SUMMARY

- .1 Section Includes.
 - .1 Materials and installation for steel piping, valves and fittings for hydronic heating systems.
- .2 Related Sections.
 - .1 Section 21 05 01 - Common Work Results - Mechanical.
 - .2 Section 23 05 05 - Installation of Pipework.
 - .3 Section 23 05 93 - Testing, Adjusting and Balancing for HVAC.
 - .4 Section 23 08 02 - Cleaning and Start-Up of Mechanical Piping Systems.

1.2 REFERENCES

- .1 American Society of Mechanical Engineers (ASME).
 - .1 ASME B16.1, Cast Iron Pipe Flanges and Flanged Fittings.
 - .2 ASME B16.3, Malleable Iron Threaded Fittings.
 - .3 ASME B16.5, Pipe Flanges and Flanged Fittings.
 - .4 ASME B16.9, Factory-Made Wrought Buttwelding Fittings.
- .2 American Society for Testing and Materials International, (ASTM).
 - .1 ASTM A53/A53M-02, Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc Coated Welded and Seamless.
 - .2 ASTM A536, Standard Specification for Ductile Iron Castings.
- .3 Canadian Standards Association (CSA International).
 - .1 CAN/CSA W48, Filler Metals and Allied Materials for Metal Arc Welding (Developed in cooperation with the Canadian Welding Bureau).

Part 2 Products

2.1 PIPE

- .1 Steel pipe: to ASTM A53, Grade B, as follows:
 - .1 To NPS 6, Schedule 40.

2.2 PIPE JOINTS

- .1 NPS 2 and under: threaded fittings with Teflon tape.
- .2 NPS 2½ and over: welding fittings and flanges to CSAW47.1 and CSA W47.1S1. Grooved fittings are also acceptable.
- .3 Flanges: plain or raised face, slip-on or weld neck.

- .4 Flange gaskets: to ANSI/AWWA C111/A21.11.
- .5 Bolts and nuts: to ANSI B18.2.1 and ANSI/ASME B18.2.2.
- .6 Pipe thread: taper.

2.3 FITTINGS

- .1 Screwed fittings: malleable iron, to ANSI/ASME B16.3, Class 150.
- .2 Pipe flanges and flanged fittings:
 - .1 Cast iron: to ANSI/ASME B16.1, Class 125.
 - .2 Steel: to ANSI/ASME B16.5.
- .3 Unions: malleable iron, to ASTM A47M and ANSI/ASME B16.3.
- .4 Butt - welding fittings: steel, to ANSI/ASME B16.9.

2.4 VALVES & ACCESSORIES

- .1 Gate Valve - NPS 2 and under, screwed:
 - .1 Rising stem: to MSS SP-80, Class 125, 860 kPa, bronze body, solid wedge disc.
 - .2 Acceptable material: Toyo 293, Kitz 24 or approved equivalent in accordance with B6.
- .2 Gate Valve - NPS 2½ and over flanged:
 - .1 Rising stem, OS & Y, bolted bonnet, solid wedge, disc flanged end, to MSS SP-70, cast iron body bronze trim.
 - .2 Acceptable material: Toyo 421A, Kitz 72 or approved equivalent in accordance with B6.
- .3 Flow Balance Valves:
 - .1 Size: 13 mm – 63 mm
 - .1 Forged brass body, nickel-plated brass ball, Teflon seals, combination P/T test valves and air vents, memory stop with graduated markings. Valve comes fully assembled.
 - .2 Acceptable Product: “Speedset”, Bell & Gossett, Armstrong or approved equivalent in accordance with B6.
 - .2 Size: 75 mm and over
 - .1 Flanged cast iron body construction, c/w memory stop, differential pressure readout ports.
 - .2 Acceptable Product: “Bell & Gossett”, “Armstrong”
- .4 Ball valves:
 - .1 NPS2 and under:

- .1 TO ASTM B62, 4 MPa WOG, bronze body, screwed ends, TFE seal, hard chrome solid ball, PTFE seats and lever handle.
 - .2 Acceptable Product: “Toyo” Fig. 5044A, “Kitz” 58, or approved equivalent in accordance with B6.
- .5 Automatic Air Vents:
- .1 Brass body and vent head, non-ferrous float. 1034 kPa maximum working pressure, maximum operating temperature of 132 degrees C.
 - .2 Acceptable Product: “Spirotherm”, “Spirotop” VTP-1, or approved equivalent in accordance with B6.
- .6 Chemical Pot Feeder:
- .1 7.6 L bypass feeder, 1380 kPa (200 psig) working pressure, 11 gauge steel tank shell and heads, cast iron with Buna N seal tank cap.
 - .2 Acceptable Product: “BetzDearborn – Neptune Bypass Feeder” Model: BDF-2.
 - .3 Accessories: Provide initial chemical treatment, test kit, and Site inspections as supplied by BetzDearborn.
- .7 Sidestream Filter:
- .1 Filter housing and cartridge, cast iron head, carbon steel shell, 19 mm (3/4”) inlet and outlet, carbon steel capscrew drain.
 - .2 Acceptable Product: “BetzDearborn – Filterite” Model: LMO10 and 30 micron filter cartridge.
- .8 Flow Indicator:
- .1 20 mm flow indicator, 304 stainless steel body and internals, fused glass window, metric and U.S. scales (15-30 LPM and 4-9 GPM), stainless steel return spring, 1082 kPa maximum pressure.
 - .2 Acceptable Product: “BetzDearborn” Model: Filter-Mate $\frac{3}{4}$

2.5 EXPANSION TANK, EXP-1:

- .1 Tank is existing and to be re-used with new design

2.6 EXPANSION TANK, EXP-2:

- .1 Diaphragm expansion tank with pre-charge air connection and 25 mm system connection shall be welded steel construction, tested and stamped in accordance with ASME code. The tank shall include steel saddles for horizontal installation.
 - .1 Volume: 168.1 litres
 - .2 Acceptance Volume: 85.5 litres
 - .3 Fluid: Water
 - .4 Length: 725 mm
 - .5 Diameter: 610 mm.
 - .6 Maximum Working Pressure: 862 kPa
 - .7 Maximum Working Temperature: 115°C

- .8 Shell: Carbon steel
- .9 Diaphragm: Heavy duty Butyl
- .2 Acceptable Product: "Amtrol" extrol model AX-80 or approved equivalent in accordance with B6.

2.7 WATER MAKEUP UNIT, WMU-1,2:

- .1 65 litre storage tank with molded-in level gauge, 125 mm fill/access opening and cover, pump suction hose with inlet strainer and check valve, pressure pump with fuse protection, low fluid level pump cut-out float switch, manual diverter valve for purging air, pressure switch with snubber and two sets of SPST dry contacts each individually adjustable from 55 kPa (8 psig) to 125 kPa (18 psig) cut-out pressure, factory cut-out pressure set to 97 kPa (14 psig) and liquid filled pressure gauge.
- .2 Pump to be self priming up to 1.2 meters.
- .3 Unit to be complete with fused power supply adapter with LED power indicator light, 115/1/60 to 24 VDC 50 Watts AC, supplied loose for field installation.
- .4 Acceptable Product: "Axiom" model MF300 or approved equivalent in accordance with B6.

2.8 DOMESTIC HOT WATER HEAT EXCHANGER, HX-1:

- .1 Performance
 - .1 Domestic Water Side:
 - .1 4°C (40°F) entering water, 54°C (130°F) leaving water, 4 kPa (0.7 psi) pressure drop, 1.89 L/s (30 gpm).
 - .2 Boiler Water Side:
 - .1 60°C (140°F) entering water, 38°C (100°F) leaving water, 30 kPa (4.4 psi) pressure drop, 4.30 L/s (68.2 gpm).
 - .3 Total heat exchanged is 395 kW (1,350,000 Btu/hr). Heat exchanger to be single pass with 10 channels, 21 plates and 4" supply/return connections for both sides.
- .2 Design
 - .1 Units should all be single pass.
 - .2 All connections should be located on the fixed head, frame plate, allowing the movable head, pressure plate, to slide back and plates added, removed, or replaced from the plate pack without disturbing the connections or associated piping.
 - .3 The design should allow for the removal of interior plates without the removal of the preceding plates.
 - .4 The unit shall be ASME Code stamped.
- .3 Frame
 - .1 The frame plate and pressure plate should be carbon steel SA 516 grade 70
 - .2 The frame and pressure plate shall be of sufficient thickness to meet the ASME design pressure. Stiffeners or support brackets are not allowed.
 - .3 Carbon steel frame components shall be painted with gray epoxy paint.

- .4 Units with three-inch or greater connections shall be unlined or alloy lined studded ports to mate with raised face or flat faced ANSI flanges. Rubber liners are not allowed.
- .5 The carry and guide bar plate contact surfaces shall be stainless steel.
- .4 Tightening Bolts
 - .1 Tightening bolts shall be zinc plated carbon steel SA193 B7.
 - .2 The tightening bolt assemblies shall include captive working nuts at the pressure plate, rear head, such that the unit can be opened and closed with one wrench from the front of the unit.
- .5 Plates
 - .1 Plates shall be pressed in a one step stamping process.
 - .2 Plates shall use an integral rolled edge hanging system to provide a rigid hanger device between the plate and carry bar and guide bar. Welded on hanging brackets or stiffeners are not acceptable.
 - .3 The plate pack shall use a positive plate to plate alignment system to ensure proper plate to gasket seals throughout the plate pack. The positive alignment system shall either be a gasket lug which fits within a plate recess on the proceeding plate (tongue in groove) to align successive plates or an extended rolled edge hanger which nests successive plates through direct contact around the entire plate hanger. Plate designs, which only offer alignment through contact with the carry and guide bar, are unacceptable.
 - .4 Plates shall be permanently marked to indicate plate material and thickness.
- .6 Gaskets
 - .1 All gaskets except the gasket on the first plate shall be identical.
 - .2 The gaskets shall be a one-piece construction with a double gasket barrier at the port region. The area isolated by the double gasket shall be vented to the atmosphere, so that a gasket failure is detected by leakage to the exterior prior to any possible cross contamination.
 - .3 When available, glue-free gaskets are preferred to glued-on gaskets. Gasket attachment methods, which break during gasket removal or plate maintenance, thus destroying the gasket are not allowed.
- .7 Acceptable Product: "Bell & Gossett" series GPX model P47-DW or approved equivalent in accordance with B6.

2.9 POOL HEAT EXCHANGER, HX-2

- .1 Performance
 - .1 Tube Side (Boiler Water):
 - .1 60°C (140°F) entering water, 38°C (100°F) leaving water, 8 kPa (1.2 psi) pressure drop, 4.68 L/s (74.2 gpm).
 - .2 Shell Side (Pool Water):

- .1 21°C (70°F) entering water, 38°C (100°F) leaving water, 12 kPa (1.7 psi) pressure drop, 6.2 L/s (98.3 gpm).
- .3 Total heat exchanged is 430 kW (1,467,634 Btu/hr). Heat exchanger to be 4 pass, 100ft² heating surface area 4" supply/return connections for both sides.
- .2 Type: Shell and tube, U-bend with removable tube bundle.
- .3 Materials:
 - .1 Front head: Cast iron (bonnet)
 - .2 Baffles: Steel
 - .3 Tie rods/spacers: Compressed fiber
 - .4 Shell: Steel
 - .5 Tubesheet: Steel
 - .6 Tubes: 19mm (¾") O.D. copper
 - .7 Tube gauge: 20.0 B.W.G.
- .4 Construction: Unit to be constructed in accordance with ASME standards for pressure vessels for 1034 kPa (150 psi) gauge pressure at 191°C (375°F) for both the shell and tube sides.
- .5 Acceptable Product: "Bell and Gossett" model WU108-45 or approved equivalent in accordance with B6.

Part 3 Execution

3.1 PIPING INSTALLATION

- .1 Install pipework in accordance with Section 23 05 05 - Installation of Pipework.
- .2 Connect to equipment in accordance with manufacturer's instruction unless otherwise indicated.
- .3 Install pipe to conserve headroom and space. Run exposed piping parallel to walls. Group piping wherever practical.
- .4 Slope piping in direction of drainage and for positive venting.
- .5 Use eccentric reducers at pipe size change installed to provide drainage or positive venting.
- .6 Provide clearance for installation of insulation and access for maintenance of equipment, valves and fittings.
- .7 Ream pipes, clean scale and dirt, inside and outside, before and after assembly.
- .8 Assemble piping using fittings manufactured to ANSI standards.

3.2 CIRCUIT BALANCING VALVES

- .1 Install flow balancing valves as indicated.

- .2 Install valves with stems upright or horizontal unless approved otherwise by Contract Administrator.
- .3 Install gate valves at all branch take-offs to isolate each piece of equipment as indicated.

3.3 CLEANING, FLUSHING AND START-UP

- .1 In accordance with Section 23 08 02 - Cleaning and Start-Up of Mechanical Piping Systems.

3.4 FILLING OF SYSTEM

- .1 Provide initial chemical treatment.

3.5 START-UP OF HYDRONIC SYSTEMS

- .1 After cleaning is completed and system is filled:
 - .1 Establish circulation and set pressure controls.
 - .2 Ensure all air is removed.
 - .3 Check pumps to be free from air, debris, possibility of cavitation when the system is at design temperature.
 - .4 Clean out strainers and remove start-up strainers.
 - .5 Commission water treatment systems.
 - .6 Check pressurization to ensure proper operation and to prevent water hammer, flashing, cavitation. Eliminate water hammer and all other noises.
 - .7 Adjust pipe supports, hangers, springs as necessary.
 - .8 Monitor pipe movement, performance of expansion joints, loops, guides, anchors.
 - .9 Check operation of drain valves.
 - .10 Adjust valve stem packings as systems settle down.
 - .11 Adjust alignment of piping at pumps to ensure flexibility, adequacy of pipe movement, absence of noise or vibration transmission.

3.6 TESTING

- .1 Test system in accordance with Section 21 05 01 - Common Work Results For Mechanical.
- .2 Test pressure: 621 kPa (90 psi). Isolate equipment not designed to withstand pressure.

3.7 BALANCING

- .1 Refer to Section 23 05 93 - Testing, Adjusting and Balancing for HVAC for applicable procedures.
- .2 Install flow measuring stations and flow balancing valves as indicated.

3.8 AIR VENTS

- .1 Install at ALL system high points. Install air vents with isolation ball valve.

END OF SECTION