

PART 1 - GENERAL

<u>1.1 Related Sections</u>	.1	Section 01 00 10 - General Instructions.
	.2	Section 01 33 00 - Submittal Procedures.
	.3	Section 01 35 29.06 - Health and Safety Requirements.
	.4	Section 01 74 21 - Construction/Demolition Waste Management And Disposal.
	.5	Section 01 78 00 - Closeout Submittals.
	.6	Section 21 05 01 - Common Work Results - Mechanical.
<u>1.2 References</u>	.1	Canadian General Standards Board (CGSB).
	.1	CAN/CGSB-1.181-1999, Ready-Mixed Organic Zinc-Rich Coating.
<u>1.3 Quality Assurance</u>	.1	Health and Safety:
	.1	Do construction occupational health and safety in accordance with Section 01 35 29.06 - Health and Safety Requirements.
<u>1.4 Waste Management and Disposal</u>	.1	Separate and recycle waste materials in accordance with Section 01 74 21 - Construction/Demolition Waste Management And Disposal, and Section 21 05 01 Common Work Results Mechanical.
<u>1.5 Delivery, Storage and Handling</u>	.1	While delivering materials to site follow requirements of Section 01 00 10 - General Instructions and Section 21 05 01 - Common Work Results Mechanical.

PART 2 - PRODUCTS

<u>2.1 Not Used</u>	.1	Not used.
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PART 3 - EXECUTION

- 3.1 Connections to Equipment
- .1 In accordance with manufacturer's instructions unless otherwise indicated.
 - .2 Use valves and either unions or flanges for isolation and ease of maintenance and assembly.
 - .3 Use double swing joints when equipment mounted on vibration isolation and when piping subject to movement.
 - .4 Review Section 23 65 10 - Condensers, Coolers and Cooling Towers, for data and information for piping connection requirements for pre-purchasing equipment.
- 3.2 Clearances
- .1 Provide clearance around systems, equipment and components for observation of operation, inspection, servicing, maintenance and as recommended by manufacturer.
 - .2 Provide space for disassembly, removal of equipment and components as recommended by manufacturer or as indicated (whichever is greater) without interrupting operation of other system, equipment, components.
- 3.3 Drains
- .1 Install piping with grade in direction of flow except as indicated or specified otherwise.
 - .2 Install drain valve at low points in piping systems, at equipment and at pipe sections isolating by valves.
 - .3 Pipe each drain valve discharge separately to above floor drain. Discharge to be visible. Review mechanical drawings. If such a floor drain is not shown allow provision for new drain and piping.
 - .4 Drain valves: 18 mm gate or globe valves unless indicated otherwise, with hose end male thread, cap and chain.
- 3.4 Dielectric Couplings
- .1 General: Compatible with system, to suit pressure rating of system.
 - .2 Locations: Where dissimilar metals are joined.
 - .3 50 mm and under: isolating unions or bronze valves.
 - .4 Over 50 mm: Isolating flanges.
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3.5 Pipework Installation

- .1 Screwed fittings to be jointed with Teflon tape.
- .2 Protect openings against entry of foreign material.
- .3 Install so that equipment can be isolated and removed without interruption to operation of any other equipment or systems.
- .4 Assemble piping using fittings manufactured to standards.
- .5 Install exposed piping, equipment, rectangular cleanouts and similar items parallel or perpendicular to building lines.
- .6 Except where indicated otherwise, slope piping in direction of flow for positive drainage and venting.
- .7 Except where indicated, install so as to permit separate thermal insulation of each pipe.
- .8 Ream pipes, remove scale and other foreign material before assembly.
- .9 Use eccentric reducers at pipe size changes to ensure positive drainage and venting.
- .10 Provide for thermal expansion as indicated and specified, or as per good practice and industry standards.
- .11 Valves:
 - .1 Install in accessible locations.
 - .2 Remove interior parts before soldering.
 - .3 Install with stems above the horizontal position unless otherwise indicated.
 - .4 Valves to be accessible for maintenance without removing adjacent piping.
 - .5 Ball Valves:
 - .1 Install on branch take-offs for isolating purposes except where otherwise specified.
 - .6 Check Valves:
 - .1 Install as indicated.
- .12 Install concealed pipework so as to minimize furring space, maximize headroom, conserve space.
- .13 Group piping wherever possible and as indicated.
- .14 Provide detailed site specific interference drawings indicating location, elevation and sizes of: existing services, equipment and structural features. Indicate proposed layout of new services indicating location, elevation and sizes. Obtain information from other trades and indicate on the drawings location of their services. Mark up any possible interference between services, submit to the Departmental Representative and await instruction.
 - .1 The drawings show in diagrammatical form existing piping layout and sizes. Contractor to verify pipe, valves and accessories sizing prior to commencing work.
 - .2 Scope of work involve removal and replacement of existing cooling towers and condensate cooling water supply and return pipe connection to the new towers along with make-up water piping and chemical treatment system.

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- 3.5 Pipework Installation (Cont'd) .14 (Cont'd)
 .2 (Cont'd)
 Pipe replacement to include replacement of all required fittings, valves and accessories. Pipework to start at mains entering cooling towers wells. Provide new isolating valve for each pipe entry.
- 3.6 Sleeves .1 General: Install where pipes pass through masonry, concrete structures, fire rated assemblies, and elsewhere as indicated.
 .2 Material: Schedule 40 black steel pipe.
 .3 Sizes: 6 mm minimum clearance all round between sleeve and uninsulated pipe or between sleeve and insulation.
 .4 Installation:
 .1 Concrete, masonry walls and concrete floors on grade: Terminate flush with finished surface.
 .2 Other floors: Terminate 25 mm above finished floor.
 .3 Before installation, paint exposed exterior surfaces with heavy application of zinc-rich paint to CAN/CGSB-1.181.
 .5 Sealing:
 .1 All locations: Provide space for firestopping. Maintain fire rating integrity.
 .2 Sleeves installed for future use: Fill with lime plaster or other easily removable filler.
 .3 Ensure no contact between copper pipe or tube and sleeve.
- 3.7 Escutcheons .1 Install on pipes passing through walls, partitions, floors, and ceilings in finished areas.
 .2 Construction: One piece type with set screws. Chrome or nickel plated brass or type 302 stainless steel.
 .3 Sizes: Outside diameter to cover opening or sleeve. Inside diameter to fit around pipe or outside of insulation if so provided.
- 3.8 Preparation for Firestopping .1 Material and installation within annular space between pipes, ducts, insulation and adjacent fire separation to Section 07 84 00 - Firestopping.
 .2 Uninsulated un-heated pipes not subject to movement: No special preparation.
 .3 Uninsulated heated pipes subject to movement: Wrap with non-combustible smooth material to permit pipe movement without damaging firestopping material or installation.
 .4 Insulated pipes and ducts: Ensure integrity of insulation and vapour barriers.
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- 3.9 Flushing out of Piping Systems
- .1 Before start-up, clean interior of piping systems in accordance with requirements as specified in relevant sections of each Division.
 - .2 Unless otherwise noted follow the following procedure:
 - .1 Flush after pressure test for a minimum of 4h.
 - .2 Fill with solution of water and non-foaming, phosphate-free detergent 3% solution by weight. Circulate (for closed systems) or hold (for open systems) for minimum of 8h.
 - .3 Refill system with clean water. Circulate (for closed systems) or flush (for open systems) for at least 4 hours. Clean out strainer screens/baskets regularly. Drain entire system.
 - .3 Preparatory to acceptance, clean and refurbish equipment and leave in operating condition, including replacement of filters in piping systems.
- 3.10 Pressure Testing of Equipment and Pipework
- .1 Advise Departmental Representative 48 hours minimum prior to performance of pressure tests.
 - .2 Pipework: Test as specified in relevant sections of each Division, otherwise:
 - .1 Maintain test pressures as indicated below unless specified for higher pressures in relevant sections of each Division.
 - .2 Hydraulically test hydronic piping systems at 1-1/2 times system operating pressure or minimum 860 kPa, whichever is greater.
 - .3 Maintain specified test pressure without loss for four (4) hours minimum unless specified for longer period of time in relevant sections of Division. 23.
 - .4 Prior to tests, isolate equipment and other parts which are not designed to withstand test pressure or media.
 - .5 Provide written tests report.
 - .6 Test with presence of Departmental Representative.
 - .7 Bear costs for repairs or replacement, retesting, and making good. Departmental Representative to determine whether repair or replacement is appropriate.
 - .8 Insulate or conceal work only after approval and certification of tests by Departmental Representative.

PART 1 - GENERAL

- 1.1 Related Sections
- .1 Section 01 00 10 - General Instructions.
 - .2 Section 01 33 00 - Submittal Procedures.
 - .3 Section 01 35 29.06 - Health and Safety Requirements.
 - .4 Section 01 74 21 - Construction/Demolition Waste Management And Disposal.
 - .5 Section 01 78 00 - Closeout Submittals.
 - .6 Section 21 05 01 - Common Work Results - Mechanical.
- 1.2 References
- .1 American National Standards Institute/American Society of Mechanical Engineers (ANSI/ASME)
 - .1 ANSI/ASME B31.1-2010, Power Piping.
 - .2 ANSI/ASME B31.3-2010, Process Piping Addenda A.
 - .3 ANSI/ASME B31.3-2010, Process Piping Addenda B.
 - .4 ANSI/ASME Boiler and Pressure Vessel Code:
 - .1 Section I: Power Boilers - 2010.
 - .2 Section V: Nondestructive Examination - 2010.
 - .3 Section IX: Welding and Brazing Qualifications - 2010.
 - .2 American National Standards Institute/American Water Works Association (ANSI/AWWA)
 - .1 ANSI/AWWA C206-2011, Field Welding of Steel Water Pipe.
 - .3 American Welding Society (AWS)
 - .1 AWS C1.1-2000(R2006), Recommended Practices for Resistance Welding.
 - .2 ANSI/AWS Z49.1-2005, Safety Welding, Cutting and Allied Process.
 - .3 AWS WI-2000, Welding Inspection Handbook.
 - .4 Canadian Standards Association (CSA International)
 - .1 CSA W47.2-M1987(R2008), Certification of Companies for Fusion Welding of Aluminum.
 - .2 CSA W48-2006, Filler Metals and Allied Materials for Metal Arc Welding.
 - .3 CSA B51-2009, Boiler, Pressure Vessel and Pressure Piping Code, Supplement 1.
 - .4 CSA-W117.2-2006(R2006), Safety in Welding, Cutting and Allied Processes.
 - .5 CSA W178.1-2008, Certification of Welding Inspection Organizations.
 - .6 CSA W178.2-2008, Certification of Welding Inspectors.
- 1.3 Qualifications
- .1 Welders
 - .1 Welding qualifications in accordance with CSA B51.
 - .2 Use qualified and licensed welders possessing certificate for each procedure performed from authority having jurisdiction.
 - .3 Furnish welder's qualifications to Departmental Representative.
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- 1.3 Qualifications (Cont'd)
- .1 (Cont'd)
 - .4 Each welder to possess identification symbol issued by authority having jurisdiction.
 - .5 Certification of companies for fusion welding of aluminum in accordance with CSA W47.2.
 - .2 Inspectors
 - .1 Inspectors qualified to CSA W178.2.
- 1.4 Quality Assurance
- .1 Health and Safety:
 - .1 Do construction occupational health and safety in accordance with Section 01 35 29.06 - Health and Safety Requirements.
 - .2 Registration of welding procedures in accordance with CSA B51.
 - .3 Copy of welding procedures available for inspection.
 - .4 Safety in welding, cutting and allied processes in accordance with CSA-W117.2.
- 1.5 Submittals
- .1 Submittals in accordance with Section 01 33 00 - Submittal Procedures, and Section 21 05 01 - Common Work Results Mechanical.
- 1.6 Closeout Submittals
- .1 Provide maintenance data for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.
- 1.7 Waste Management and Disposal
- .1 Separate and recycle waste materials in accordance with Section 01 74 21 - Construction/Demolition Waste Management And Disposal, and Section 21 05 01 Common Work Results Mechanical.
- 1.8 Delivery, Storage and Handling
- .1 While delivering materials to site follow requirements of Section 01 00 10 - General Instructions and Section 21 05 01 - Common Work Results Mechanical.
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PART 2 - PRODUCTS

2.1 Electrodes .1 Electrodes: in accordance with CSA W48 Series.

PART 3 - EXECUTION

3.1 Workmanship .1 Welding to be in accordance with ANSI/ASME B31.1 B31.3, ANSI/ASME Boiler and Pressure Vessel Code, Sections I and IX and ANSI/AWWA C206, using procedures conforming to AWS B3.0, AWS C1.1. and all applicable requirements of provincial authority having jurisdiction.

3.2 Installation Requirements .1 Identify each weld with welder's identification symbol.

.2 Backing rings:

.1 Where used, fit to minimize gaps between ring and pipe bore.

.2 Do not install at orifice flanges.

.3 Fittings:

.1 50 mm and smaller: install welding type sockets.

.2 Branch connections: install welding tees or forged branch outlet fittings.

3.3 Inspection and Test - General Requirements .1 Review weld quality requirements and defect limits of applicable codes and standards with Departmental Representative before work is started.

.2 Formulate "Inspection and Test Plan" in co-operation with Departmental Representative.

.3 Cover all costs for all inspections required.

.4 Do not conceal welds until they have been inspected, tested and approved by Inspector.

.5 Provide for Inspector to visually inspect welds during early stages of welding procedures in accordance with Welding Inspection Handbook. Repair or replace defects as required by codes and as specified.

.6 Submit inspection report and include copy in O&M Manuals.

3.4 Specialist Examination and Test .1 General

.1 Perform examinations and tests by specialist qualified in accordance with CSA W178.1 and CSA W178.2 and approved by Departmental Representative.

.2 To ANSI/ASME Boiler and Pressure Vessels Code, Section V, CSA B51 and requirements of authority having jurisdiction.

.3 Inspect and test 25% of welds in accordance with "Inspection and Test Plan" by non-destructive visual examination.

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| <u>3.4 Specialist Examination and Test (Cont'd)</u> | .2 Hydrostatically test welds to requirements of ANSI/ASME B31.1. |
| | .3 Visual examinations: include entire circumference of weld externally and wherever possible internally. |
| | .4 Failure of visual examinations:
.1 Upon failure of welds by visual examination, perform additional testing as directed by Departmental Representative of total of up to 10% of welds, selected at random by Departmental Representative. |
| <u>3.5 Defects Causing Rejection</u> | .1 As described in ANSI/ASME B31.1 and ANSI/ASME Boiler and Pressure Vessels Code. |
| | .2 In addition, chilled water systems:
.1 Under cutting greater than 0.8 mm adjacent to cover bead on outside of pipe.
.2 Under cutting greater than 0.8 mm adjacent to root bead on inside of pipe.
.3 Under cutting greater than 0.8 mm at combination of internal surface and external surface.
.4 Incomplete penetration and incomplete fusion greater than total length of 38 mm in any 1500 mm length of weld depth of such defects being greater than 0.8 mm.
.5 Repair all cracks and defects in excess of 0.8mm in depth.
.6 Repair defects whose depth cannot be determined accurately on the basis of visual examination or radiographic tests. |
| <u>3.6 Repair of Welds Which Failed Tests</u> | .1 Re-inspect and re-test repaired or re-worked welds at Contractor's expense. |
| | .2 Claims for delays in completion of project will not be entertained for reasons of failures of welds to pass examinations. |

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<u>1.1 Related Sections</u>	.1	Section 01 00 10 - General Instructions.
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	.5	Section 01 78 00 - Closeout Submittals.
	.6	Section 21 05 01 - Common Work Results - Mechanical.
	.7	Section 23 05 05 - Installation of Pipework.
	.8	Section 23 21 16 - Hydronic Systems: Steel.
<u>1.2 References</u>	.1	American National Standards Institute (ANSI)/ American Society of Mechanical Engineers (ASME).
	.1	ANSI/ASME B1.20.1-1983(R2006), Pipe Threads, General Purpose (Inch).
	.2	American Society for Testing and Materials International, (ASTM).
	.1	ASTM B 62-2009, Specification for Composition Bronze or Ounce Metal Castings.
	.3	Manufacturers Standardization Society of the Valve and Fittings Industry, Inc. (MSS).
	.1	MSS-SP-80-2008, Bronze Gate Globe, Angle and Check Valves.
<u>1.3 Submittals</u>	.1	Submittals in accordance with Section 01 33 00 - Submittal Procedures, and Section 21 05 01 - Common Work Results Mechanical.
<u>1.4 Closeout Submittals</u>	.1	Provide maintenance data for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.
<u>1.5 Waste Management and Disposal</u>	.1	Separate and recycle waste materials in accordance with Section 01 74 21 - Construction/Demolition Waste Management And disposal, and Section 21 05 01 - Common Work Results Mechanical.

1.6 Delivery, Storage and Handling .1 While delivering materials to site follow requirements of Section 01 00 10 - General Instructions and Section 21 05 01 - Common Work Results Mechanical.

PART 2 - PRODUCTS

2.1 General .1 Except for specialty valves, all valves under this contract to be of single manufacturer.

2.2 End Connections .1 Connection into adjacent piping/tubing:
.1 Steel pipe systems: Screwed ends.
.2 Copper tube systems: Solder ends.

2.3 Gate Valves .1 Requirements common to all gate valves, unless specified otherwise:(see Section 23 21 16 Hydronic Systems: Steel)
.1 Standard specification: MSS SP-80.
.2 Bonnet: union with hexagonal shoulders.
.3 Connections: screwed with hexagonal shoulders.
.4 Inspection and pressure testing: to MSS SP-80. Tests to be hydrostatic.
.5 Packing: high grade non-asbestos packing.
.6 Handwheel: non-ferrous. Nut: bronze to ASTM B62.
.1 Handwheel Nut: bronze to ASTM B 62.

.2 NPS 2 and under, non-rising stem, solid wedge disc:
.1 Body: with long disc guides, screwed bonnet with stem retaining nut.
.2 WP = 1.03 MPa steam, 2.07 MPa WOG.
.3 Operator: Handwheel.
.4 Pressure ratings:
.1 Steam and condensate Class 150.
.2 Chilled water Class 300.

.3 NPS 2 and under, rising stem, solid wedge disc:
.1 Body: with long disc guides, screwed union bonnet.
.2 WP = 1.03 MPa steam, 2.07 MPa WOG.
.3 Operator: Handwheel.
.4 Pressure ratings:
.1 Steam and condensate Class 150.
.2 Chilled water Class 300.

2.4 Globe Valves .1 Requirements common to globe valves, unless specified otherwise:
.1 Standard specification: MSS SP-80.
.2 Bonnet: union with hexagonal shoulders.
.3 Connections: screwed with hexagonal shoulders.
.4 Pressure testing: to MSS SP-80. Tests to be hydrostatic.
.5 Stuffing box: threaded to bonnet with gland follower, packing nut, high grade non-asbestos packing.

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- 2.4 Globe Valves (Cont'd) .1 (Cont'd)
- .4 Pressure ratings:(Cont'd)
 - .6 Handwheel: non-ferrous.
 - .7 Handwheel Nut: bronze to ASTM B 62.
 - .2 NPS 2 and under, composition disc, Class 150:
 - .1 Body and bonnet: union bonnet.
 - .2 Disc and seat: renewable rotating PTFE disc in easily removable disc holder, regrindable bronze seat, loosely secured to bronze stem to ASTM B 505.
- 2.5 Check Valves .1 Requirements common to all check valves, unless specified otherwise:
- .1 Standard specification: MSS SP-80.
 - .2 Connections: with hex. shoulders.
 - .2 NPS 2 and under, swing type, composition disc:
 - .1 Body: Y-pattern with integral seat at 45°, screw-in cap with hex head. WP = 1.4 MPa cold water.
 - .2 Disc: renewable rotating disc of number 6 composition to suit service conditions, bronze two-piece hinge disc construction.
 - .3 Pressure ratings:
 - .1 Steam and condensate Class 150.
 - .2 Chilled water Class 300.
- 2.6 Ball Valves .1 NPS 2 and under:
- .1 Body and cap: cast high tensile bronze to ASTM B62.
 - .2 Pressure rating: Class 150, WP = 1.03 MPa steam, 2.07 MPa WOG.
 - .3 Connections:
 - .1 screwed with hexagonal shoulders.
 - .2 solder ends to ANSI
 - .4 Stem: tamperproof ball drive.
 - .5 Stem packing nut: external to body.
 - .6 Ball and seat: replaceable hard chrome solid ball and teflon seats.
 - .7 Stem seal: TFE with external packing nut.
 - .8 Operator: removable lever handle.

PART 3 - EXECUTION

- 3.1 Installation .1 Install rising stem valves in upright position with stem above horizontal.
- .2 Remove internal parts before soldering.
 - .3 Install by-pass globe valve on each control valve. Size of by-pass valve :
 - .1 Valves NPS 2 and under: line size.
 - .2 Valves NPS 2 1/2 and over: NPS 2.
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3.2 Commissioning .1 As part of commissioning activities, develop schedule of valves and record thereon identifier, location, service, purchase order number and date, manufacturer, identification data specified above.

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- 1.1 Related Sections
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 - .4 Section 01 74 21 - Construction/Demolition Waste Management And Disposal.
 - .5 Section 01 78 00 - Closeout Submittals.
 - .6 Section 21 05 01 - Common Work Results - Mechanical.
 - .7 Section 23 05 05 - Installation of Pipework.
 - .8 Section 23 21 16 - Hydronic Systems: Steel.
- 1.2 References
- .1 American National Standards Institute (ANSI)/American Society of Mechanical Engineers (ASME).
 - .1 ANSI/ASME B16.5-2009, Pipe Flanges and Flanged Fittings.
 - .2 ANSI/ASME B16.10-2009, Face-to-Face and End-to-End Dimensions Valves.
 - .3 ANSI/ASME B16.25-2007, Butt welding Ends.
 - .4 ANSI/ASME B16.34-1996, Valves - Flanged, Threaded and Welding End.
 - .2 American Petroleum Institute (API).
 - .1 API Std 598-2009 , Valve Inspection and Testing, Ninth Edition
 - .3 American Society for Testing and Materials International, (ASTM).
 - .1 ASTM A 49-01(2006), Specification for Heat-Treated Carbon Steel Joint Bars.
 - .2 ASTM A 193/A 193M-2010, Specification for Alloy-Steel and Stainless Steel Bolting Materials for High-Temperature Service.
 - .3 ASTM A 194/A 194M-2010, Specification for Carbon and Alloy Steel Nuts for Bolts for High-Pressure and High-Temperature Service.
 - .4 ASTM A 216/A 216M-2008, Specification for Steel Castings, Carbon Suitable for Fusion Welding for High-Temperature Service.
 - .5 ASTM B 85-2010, Specification for Aluminum-Alloy Die Castings.
 - .4 Manufacturers Standardization Society of the Valve and Fittings Industry, Inc. (MSS).
 - .1 MSS SP-25-2008, Standard Marking System for Valves, Fittings, Flanges and Unions.
 - .2 MSS SP-61-2009, Pressure Testing of Steel Valves.
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- 1.3 Quality Assurance .1 Health and Safety:
.1 Do construction occupational health and safety in accordance with Section 01 35 29.06 - Health and Safety Requirements.
- 1.4 Submittals .1 Submittals in accordance with Section 01 33 00 - Submittal Procedures, and Section 21 05 01 - Common Work Results Mechanical.
.2 Submit data for following:
.1 Valves.
- 1.5 Closeout Submittals .1 Provide maintenance data for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.
- 1.6 Waste Management and Disposal .1 Separate and recycle waste materials in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal, and Section 21 05 01 Common Work Results Mechanical.
- 1.7 Delivery, Storage and Handling .1 While delivering materials to site follow requirements of Section 01 00 10 - General Instructions and Section 21 05 01 - Common Work Results Mechanical.

PART 2 - PRODUCTS

- 2.1 Material .1 Valves:
.1 Except for specialty valves, all valves under this contract to be of single manufacturer.
.2 Valves to be individually tested.
.3 Pressure rating: all valves Class 150.
- .2 Requirements common to valves, unless specified otherwise:
.1 Pressure-temperature ratings: to ANSI B16.34.
.2 Inspections and tests: to API 598.
.3 Pressure Testing: to MSS SP-61.
.4 Flanged valves:
.1 Face-to-face dimensions: to ANSI B16.10.
.2 Flange dimensions: to ANSI B16.5 with 1.6 mm raised face.
.5 Butt-weld valves:
.1 End-to-end dimensions: to ANSI B16.10.
.2 End dimensions: to ANSI B16.25 bored for standard pipe schedule.
.6 Handwheel: non-heating type with raised rim of die-cast aluminum alloy to ASTM B 85 or malleable iron to ASTM A 49.
.7 Markings: to MSS SP-25.
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- 2.1 Material (Cont'd) .2 (Cont'd)
- .8 Identification:
 - .1 Plate showing catalogue number, size, material of body disc, stem seat, fluid, pressure-temperature rating.
 - .2 Body markings: manufacturer, size, primary service rating, material symbol.
 - .9 CRN registration number required for all products.
- 2.2 Butterfly Valves - Resilient Seat 200 PSIG
- .1 Except to specialty valves, to be of single manufacturer.
 - .2 To be suitable for dead-end service.
 - .3 CRN registration number required for products.
 - .4 Sizes:
 - .1 Lug type: NPS 2 to 30
 - .5 Pressure rating for tight shut-off at temperatures up to maximum for seat material.
 - .1 NPS 2 - 16: 200 psig.
 - .6 Minimum seat temperature ratings to 121 degrees C.
 - .7 Application: on-off operation.
 - .8 Full lug body (threaded).
 - .9 Operators:
 - .1 NPS 2 - 6: handles capable of locking in any of ten (10) positions - 0 degrees to 90 degrees. Handle and release trigger - ductile iron. Return spring and hinge pin: carbon steel. Latch plate and mounting hardware: cadmium plated carbon steel. Standard coating: black lacquer.
 - .2 NPS 8 - 30: manual enclosed gear operator
 - .10 Designed to comply with MSS SP-67 and API 609.
 - .11 Compatible with ANSI Class 150 flanges.
 - .12 Construction:
 - .1 Body ductile iron.
 - .2 Discs material 316 stainless steel. Disc edge shall be machined and polished 360 degrees to assure leak-tight shut-off . Positive, disc-to-shaft connection with precision Taper pin: 316 SS.
 - .3 Seat: Phenolic or aluminum backed, non-collapsible, resilient seat shall be mechanically secured to provide the full pressure rating. Seats shall be EPDM, Buna-N or Viton.
 - .4 One-piece shaft: 316 stainless steel.
 - .5 Key: stainless.
 - .6 O-Ring: EPDM.
 - .7 Bushings: Teflon
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- 2.3 Gate Valves .1 Sizes: NPS 21/2-16, rising stem, OS&Y, solid wedge disc, flanged or butt-weld ends, Class 150:
- .1 Body and multiple-bolted integral yoke and bonnet: cast steel to ASTM A 216/A 216M WCB, with full length disc guides designed to ensure correct re-assembly.
 - .2 Body/bonnet joint: Male-female face with corrugated metallic gasket.
 - .3 Bonnet studs: to ASTM A 193/A 193M Type B7.
 - .4 Bonnet nuts: to ASTM A 194/A 194M Type 2H.
 - .5 Stuffing box: including non-galling two-piece ball jointed packing gland, with swing-type eye bolts and nuts.
 - .6 Gland packing: containing corrosion inhibitor to prevent stem pitting.
 - .7 Yoke sleeve: Ni-Resist, minimum melting point above 954 degrees C.
 - .8 Hydraulic grease fitting: for lubrication of yoke sleeve bearing surfaces.
 - .9 Disc: with disc stem ring to connect to stem, guided throughout its travel.
 - .1 Solid corrosion and heat resistant 13% chromium steel with minimum hardness of 350 HB.
 - .10 Seat ring: seamless carbon steel with hard-faced cobalt-chromium-tungsten alloy seating surface, slipped in, seal welded, ground to match disc.
 - .11 Stem: heat treated corrosion and heat resistant 13% chromium steel with accurately-cut precision-machined Acme or 60 degrees V threads, top screwed for handwheel nut, T-head disc-stem connection.
 - .12 Operator: Handwheel.
- 2.4 Globe Valves .1 Sizes: NPS 21/2-16, rising stem, OS&Y, flanged or butt-weld ends, Class 150:
- .1 Body and multiple-bolted integral yoke and bonnet: cast steel to ASTM A 216/A 216M WCB.
 - .2 Body/bonnet joint: Male-female face with corrugated metallic gasket.
 - .3 Bonnet studs: to ASTM A 193/A 193M Type B7.
 - .4 Bonnet nuts: to ASTM A 194/A 194M Type 2H.
 - .5 Stuffing box: including non-galling two-piece ball-jointed packing gland, with swing-type eye bolts and nuts.
 - .6 Gland packing: containing corrosion inhibitor to prevent stem pitting.
 - .7 Yoke bushing: Ni-Resist, minimum melting point above 954 degrees C.
 - .8 Hydraulic grease fitting: for lubrication of yoke sleeve bearing surfaces.
 - .9 Disc: Plug type with 15 degrees taper seat and bottom guide or ball type with 35 degrees taper seat.
 - .10 Seat rings: with 1.6 mm thick cobalt-chromium-tungsten alloy facings with minimum hardness of 375 HB (cold), slipped in, seal welded, ground to match disc.
 - .11 Stem: heat treated corrosion and heat resistant 13% chromium steel with bonnet bushing, long engagement with yoke bushing for accurate seating, accurately-cut precision-machined Acme or 60 degrees V threads, top screwed for handwheel nut.
 - .12 Operator: Handwheel.
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- 2.5 Check Valves .1 Sizes:NPS 21/2-16, flanged or butt-weld ends, Class 150: swing check.
- .1 Body and multiple-bolted cap: cast steel to ASTM A 216/A 216M WCB.
 - .2 Cap studs: to ASTM A 193/A 193M Type B7.
 - .3 Cap nuts: to ASTM A 194/A 194M Type 2H.
 - .4 Body/cap joint: male-female face with corrugated metallic gasket.
 - .5 Disc: heat treated corrosion and heat resistant 13% chromium steel.
 - .6 Seat rings: heat treated corrosion and heat resistant 13% chromium steel, slipped in, seal welded, ground to match disc.
 - .7 Hinge pin, bushings: renewable bronze to ASTM B 62.
- 2.6 Circuit Balancing Valve CBV .1 Sizes:NPS 21/2-16:
- .1 Valves are to be of the "Y" pattern, equal percentage globe-style and provide three functions:
 - .1 Precise flow measurement.
 - .2 Precision flow balancing.
 - .3 Positive drip-tight shut-off.
 - .2 Valve shall provide multi-turn, 360° adjustment with micrometer type indicators located on the valve handwheel and shall have a minimum of five full 360° handwheel turns.
 - .3 Valve handle shall have hidden memory feature, which will provide a means for locking the valve position after the system is balanced.
 - .4 Valve body shall be either cast iron with integrated cast iron flanges NPS 21/2-16 or ductile iron with industrial standard grooved ends NPS 21/2-16. Valve stem and plug disc shall be bronze with ergonomically designed handwheel that permits multi-turn adjustments.
- PART 3 - EXECUTION
- 3.1 Installation .1 Install in accordance with manufacturer's recommendations in upright position with stem above horizontal.
- .2 Review Section 23 65 10 - Condensers, Coolers and Cooling Towers, for data and information for isolation and operation requirements for pre-purchased equipment. Drawings show piping and valves in diagrammatical form Contractor to provide additional devices as required.
- 3.2 CBV .1 The valve shall be installed with flow in the direction of the arrow on the valve body and installed at least five pipe diameters downstream from any fitting, and at least ten pipe diameters downstream from any pump. Two pipe diameters downstream from the CBV should be free of any fittings. When installed, easy and unobstructed access to the valve handwheel and metering ports for adjustment and measurement are to be provided. Mounting of valve in piping must prevent sediment build-up in metering ports.
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3.3 Commissioning .1 As part of commissioning activities, develop schedule of valves and record thereon identifier, location, service, purchase order number and date, manufacturer, identification data specified above.

PART 1 - GENERAL

- 1.1 Related Sections
- .1 Section 01 00 10 - General Instructions.
 - .2 Section 01 33 00 - Submittal Procedures.
 - .3 Section 01 35 29.06 - Health and Safety Requirements.
 - .4 Section 01 74 11 - Cleaning.
 - .5 Section 01 74 21 - Construction/Demolition Waste Management And Disposal.
 - .6 Section 01 78 00 - Closeout Submittals.
 - .7 Section 03 30 00 - Cast-in-place Concrete.
 - .8 Section 05 50 00 - Metal Fabrications.
 - .9 Section 21 05 01 - Common Work Results - Mechanical.
- 1.2 References
- .1 American National Standards Institute/ American Society of Mechanical Engineers (ANSI/ASME)
 - .1 ANSI/ASME B31.1-2010, Power Piping.
 - .2 Health Canada, Workplace Hazardous Materials Information System (WHMIS)
 - .1 Material Safety Data Sheets (MSDS).
 - .3 Manufacturer's Standardization Society of the Valves and Fittings Industry (MSS)
 - .1 MSS SP58-2009, Pipe Hangers and Supports - Materials, Design and Manufacture.
- 1.3 Section Includes
- .1 Design Requirements.
 - .1 Construct pipe hanger and support to manufacturer's recommendations utilizing manufacturer's regular production components, parts and assemblies.
 - .2 Base maximum load ratings on allowable stresses prescribed by ASME B31.1 or MSS SP58.
 - .3 Ensure that supports, guides, anchors do not transmit excessive quantities of heat to building structure.
 - .4 Design hangers and supports to support systems under all conditions of operation, allow free expansion and contraction, prevent excessive stresses from being introduced into pipework or connected equipment.
 - .5 Provide for vertical adjustments after erection and during commissioning. Amount of adjustment in accordance with MSS SP58.
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- 1.4 Quality Assurance .1 Health and Safety:
.1 Do construction occupational health and safety in accordance with Section 01 35 29.06 - Health and Safety Requirements.
- 1.5 Submittals .1 Submittals in accordance with Section 01 33 00 - Submittal Procedures, and Section 21 05 01 - Common Work Results Mechanical.
.2 Submit shop drawings and product data for following items:
.1 Bases, hangers and supports.
.2 Connections to equipment and structure.
.3 Structural assemblies.
- 1.6 Closeout Submittals .1 Provide maintenance data for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.
- 1.7 Waste Management and Disposal .1 Separate and recycle waste materials in accordance with Section 01 74 21 - Construction/Demolition Waste Management And Disposal, and Section 21 05 01 Common Work Results Mechanical.
- 1.8 Delivery, Storage and Handling .1 While delivering materials to site follow requirements of Section 01 00 10 - General Instructions and Section 21 05 01 - Common Work Results Mechanical.

PART 2 - PRODUCTS

- 2.1 General .1 Fabricate hangers, supports and sway braces in accordance with ANSI B31.1 and MSS SP58.
.2 Use components for intended design purpose only. Do not use for rigging or erection purposes.
- 2.2 Pipe Hangers .1 Finishes:
.1 Hangers and supports: galvanized.
.2 Ensure steel hangers in contact with copper piping are copper plated or epoxy coated.
- 2.3 Upper Attachments .1 Concrete:
.1 Inserts for cast-in-place concrete: galvanized steel wedge to MSS-SP-58, type 18. ULC listed for pipe 18 mm to 203 mm.
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| <u>2.3 Upper Attachments (Cont'd)</u> | .1 Concrete:(Cont'd)
.2 Carbon steel plate with clevis, for surface mount: malleable iron socket and expansion case and bolt. Minimum two expansion cases and bolts for each hanger. |
| | .2 Upper attachment structural: suspension from lower flange of I-Beam:
.1 Cold piping 50 mm and under: malleable iron C clamp to MSS-SP-58, type 19. UL listed.
.2 Cold piping NPS 63 mm and larger and all hot piping: malleable iron beam clamp to MSS-SP-58, type 28 or 29. UL listed. |
| | .3 Steel beam:
.1 Cold piping 50 mm and under: malleable iron "top of beam" C clamp to MSS-SP-58, type 19. UL listed.
.2 Cold piping 63 mm and larger and all hot piping: steel jaw, hook rod with nut, spring washer and plain washer, to MSS-SP-58, type 25. UL listed. |
| <u>2.4 Middle Attachment (rod)</u> | .1 Carbon steel threaded rod black electro-galvanized finish. |
| <u>2.5 Pipe Attachment</u> | .1 Cold piping, steel with less than 25 mm horizontal movement with more than 300mm middle attachment (rod) length: adjustable clevis to MSS-SP-58, type 1. UL listed.
.2 Bottom supported hot piping, steel and copper; pipe roller stand to MSS-SP-58, type 45. |
| <u>2.6 Riser Clamps</u> | .1 Steel or cast iron pipe: black carbon steel to MSS-SP-58, type 42. UL listed.
.2 Copper pipe: carbon steel copper finished to MSS-SP-58, type 42. |
| <u>2.7 Saddles and Shields</u> | .1 Cold piping 32 mm and over: protection shield with high density insulation under shield with uninterrupted vapor barrier.
.2 Oversize pipe hangers and supports. |
| <u>2.8 Supplementary Structural Steel Members</u> | .1 Provide all required supplementary structural steel members required to achieve suitable hanger and support system. See structural drawings and specification for details. |
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<u>2.9 Equipment Anchor Bolts and Templates</u>	.1	Provide templates to ensure accurate location of anchor bolts.
<u>2.10 House-keeping Pads</u>	.1	For base-mounted equipment: Concrete, at least 75 mm high and minimum 75 mm larger all around than equipment, and with chamfered edges. Pads provided by General Contractor.
<u>PART 3 - EXECUTION</u>		
<u>3.1 Manufacturer's Instructions</u>	.1	Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions and data sheet.
<u>3.2 Installation</u>	.1	Install in accordance with: .1 Manufacturer's instructions and recommendations.
	.2	Clamps on riser piping: .1 Support independent of connected horizontal pipework using riser clamps and riser clamp lugs welded to riser. .2 Bolt-tightening torques to industry standards. .3 Steel pipes: install below coupling or shear lugs welded to pipe. .4 Cast iron pipes: install below joint.
	.3	Clevis plates: .1 Attach to structure with 4 minimum inserts, one at each corner.
	.4	Provide supplementary structural steelwork. .1 Support from structural members. Where structural bearing does not exist or inserts are not in suitable locations, provide at no additional cost supplementary structural steel members.
<u>3.3 Hanger Spacing</u>	.1	Spacing and middle attachment (rod) diameter as specified. .1 Plumbing piping: most stringent requirements of National Plumbing Code, Provincial Code, or authority having jurisdiction. .2 Within 300 mm of each horizontal elbow.
<u>3.4 Hanger Installation</u>	.1	Install hanger so that rod is vertical under operating conditions.
	.2	Adjust hangers to equalize load.
	.3	Support from structural members. Where structural bearing does not exist or inserts are not in suitable locations, provide supplementary structural steel members.

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- 3.5 Horizontal Movement
- .1 Angularity of rod hanger resulting from horizontal movement of pipework from cold to hot position not to exceed 4° from vertical.
 - .2 Where horizontal pipe movement is less than 13 mm, offset pipe hanger and support so that rod hanger is vertical in the hot position.
- 3.6 Final Adjustment
- .1 Adjust hangers and supports:
 - .1 Ensure that rod is vertical under operating conditions.
 - .2 Equalize loads.
 - .2 Adjustable clevis:
 - .1 Tighten hanger load nut securely to ensure proper hanger performance.
 - .2 Tighten upper nut after adjustment.
 - .3 C-clamps:
 - .1 Follow manufacturer's recommended written instructions and torque values when tightening C-clamps to bottom flange of beam.
 - .4 Beam clamps:
 - .1 Hammer jaw firmly against underside of beam.
- 3.7 Field Quality Control
- .1 Manufacturer's Field Services:
 - .1 Obtain written report from manufacturer verifying compliance of Work, in handling, installing, applying, protecting and cleaning of product and submit Manufacturer's Field Reports.

PART 1 - GENERAL

- 1.1 References .1 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
.1 Material Safety Data Sheets (MSDS).
- 1.2 Submittals .1 Product Data:
.1 Submit manufacturer's printed product literature, specifications and data sheet in accordance with Section 01 33 00 - Submittal Procedures. Include product characteristics, performance criteria, and limitations.
.1 Submit two copies of Workplace Hazardous Materials Information System (WHMIS) Material Safety Data Sheets (MSDS) in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Quality assurance submittals: submit following in accordance with Section 01 33 00 - Submittal Procedures.
.1 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.
- .3 Instructions: submit manufacturer's installation instructions.
.1 Departmental Representative will make available 1 copy of systems manufacturer's installation instructions.
- 1.3 Quality Assurance .1 Health and Safety:
.1 Construction occupational health and safety in accordance with Section 01 35 29.06 - Health and Safety Requirements.
- 1.4 Delivery, Storage and Handling .1 Packing, shipping, handling and unloading:
.1 Deliver, store and handle in accordance with manufacturer's written instructions and Section 01 00 10 - General Instructions.
- .2 Waste Management and Disposal:
.1 Construction/Demolition Waste Management and Disposal: separate waste materials for reuse and recycling in accordance with Section 01 74 21 Construction/Demolition Waste Management and Disposal.
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PART 2 - PRODUCTS

- 2.1 Pipe/Tank Tracing Heating Cables
- .1 Self regulating cable for above ground heat tracing cable for use on make-up water and water treatment piping having 50mm of fiberglass insulation in lengths as indicated. in lengths as indicated.
 - .1 Heating capacity : 27 W/m; for use on a 120 V ground fault emergency power supply.
 - .2 Cable design: 16 AWG copper bus wire, self-regulating conductive core, modified polyolefin jacket,tinned copper braid and a fluoropolymer outer jacket.
- 2.2 Controls and Accessories
- .1 Thermostat: remote bulb type, weatherproof enclosure rated 20 Amp at 120 Volts. Line or ambient sensing. Bulb sensor with 760mm capillary. Set point fixed at 9°C.
 - .2 Accessories: for type A provide quick connect power connection, end seals, splice kits and electric traced identification tags.

PART 3 - EXECUTION

- 3.1 Manufacturer's Instructions
- .1 Refer to the requirements of the manufacturer's written recommendations or specifications,including product technical bulletins, handling, storage installation instructions, and data sheets.
- 3.2 Installation
- .1 Install heating cables in accordance with manufacturer's instructions. Distribute and fasten cable evenly on drain pipe using pipe strap or tape at maximum spacing 0.5 m. Ensure that heating cables do not touch or cross each other. Run only cold leads in conduit and ensure sensing bulb does not touch cable. Ground shield to building ground. Coordinate cable installation with insulation application. Loop additional cable at fittings and valves.
 - .2 Make power and control connections.
- 3.3 Field Quality Control
- .1 Perform tests in accordance with Section 26 05 00 - Common Work Results - Electrical.
 - .2 Use 500 V Megger to test cables for continuity and insulation value and record readings before, during and after installation.
 - .3 Where resistance of 50 megohms or less is measured, stop work and advise Engineer.
 - .4 Submit verification form for review prior to testing. Record all measurements on the approved form and include copies in maintenance manuals.

PART 1 - GENERAL

- 1.1 Related Sections
- .1 Section 01 00 10 - General Instructions.
 - .2 Section 01 33 00 - Submittal Procedures.
 - .3 Section 01 35 29.06 - Health and Safety Requirements.
 - .4 Section 01 74 21 - Construction/Demolition Waste Management And Disposal.
 - .5 Section 01 78 00 - Closeout Submittals.
 - .6 Section 01 91 13 - General Commissioning (Cx) Requirements.
 - .7 Section 21 05 01 - Common Work Results - Mechanical.
 - .8 Section 23 05 93 - Testing, Adjusting and Balancing of HVAC.
- 1.2 References
- .1 National Building Code of Canada 2010
- 1.3 Definitions
- .1 Priority Two (P2) Buildings: buildings in which life safety is paramount concern. It is not necessary that P2 buildings remain operative during or after an earthquake.
 - .2 SRS: acronym for Seismic Restraint System.
- 1.4 Limitations
- .1 Each trade shall be responsible for all applicable seismic restraint systems for all systems and equipment forming part of their respective contracts. All trades shall coordinate SRS design and implementation.
- 1.5 System Description
- .1 This section covers design, supply and installation of complete SRS for all systems, equipment specified for installation on this project. This includes cooling towers, piping, auxiliary mechanical equipment and systems, both vibration isolated and statically supported.
 - .2 SRS to be fully integrated into, compatible with:
 - .1 Noise and vibration controls specified elsewhere in this project specification.
 - .2 Structural, mechanical, electrical design of project.
 - .3 During seismic event, SRS to prevent systems and equipment from causing personal injury and from moving from normal position.
-

<u>1.5 System Description (Cont'd)</u>	.4	Review Section 23 65 10 - Condensers, Coolers and Cooling Towers, for data, dimensions, weight and information for seismic restrain requirements for pre-purchasing equipment.
	.5	Design to be by Professional Engineer specializing in design of SRS and registered in Province of Ontario.
<u>1.6 Quality Assurance</u>	.1	Health and Safety: .1 Do construction occupational health and safety in accordance with Section 01 35 29.06 - Health and Safety Requirements.
<u>1.7 Submittals</u>	.1	Submittals in accordance with Section 01 33 00 - Submittal Procedures, and Section 21 05 01 - Common Work Results Mechanical. .1 Submittals to include: Full details of design criteria and system components and installation.
	.2	Submit additional copy of shop drawings and product data to Departmental Representative for review by all parties having interest in SRS design.
<u>1.8 Closeout Submittals</u>	.1	Provide maintenance data for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.
<u>1.9 Waste Management and Disposal</u>	.1	Separate and recycle waste materials in accordance with Section 01 74 21 - Construction/Demolition Waste Management And Disposal, and Section 21 05 01 Common Work Results Mechanical.
<u>1.10 Delivery, Storage and Handling</u>	.1	While delivering materials to site follow requirements of Section 01 00 10 - General Instructions and Section 21 05 01 - Common Work Results Mechanical.
<u>PART 2 - PRODUCTS</u>		
<u>2.1 SRS Manufacturer</u>	.1	SRS to be from one manufacturer regularly engaged in production of same.
<u>2.2 General</u>	.1	SRS to provide gentle and steady cushioning action and avoid high impact loads.
	.2	SRS to restrain seismic forces in all directions.
	.3	Fasteners and attachment points to resist same load as seismic restraints.

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- 2.2 General (Cont'd)
- .4 SRS of Piping systems to be compatible with:
 - .1 Expansion, anchoring and guiding requirements.
 - .2 Equipment vibration isolation and equipment SRS.
 - .5 SRS utilizing cast iron, threaded pipe, other brittle materials not permitted.
 - .6 Attachments to RC structure:
 - .1 Use high strength mechanical expansion anchors.
 - .2 Drilled or power driven anchors not permitted.
- 2.3 SRS for Static Equipment, Systems
- .1 Floor and roof mounted equipment, systems:
 - .1 Anchor equipment to equipment supports.
 - .2 Anchor equipment supports to structure.
 - .3 Use size of bolts scheduled in approved shop drawings.
 - .2 Suspended equipment, systems:
 - .1 Use one or combination of following methods:
 - .1 Install tight to structure.
 - .2 Cross-brace in all directions.
 - .3 Brace back to structure.
 - .4 Slack cable restraint system.
 - .2 SRS to prevent sway in horizontal plane, "rocking" in vertical plane, sliding and buckling in axial direction.
 - .3 Hanger rods to withstand compressive loading and buckling.
- 2.4 SRS for Vibration Isolated Equipment
- .1 Suspended equipment, systems:
 - .1 Use one or combination of following methods:
 - .1 Slack cable restraint system.
 - .2 Brace back to structure via vibration isolators and snubbers.

PART 3 - EXECUTION

- 3.1 Installation
- .1 Attachment points and fasteners:
 - .1 To withstand same maximum load that seismic restraint is to resist and in all directions.
 - .2 Install SRS at least 25 mm from equipment, systems, services.
 - .3 Miscellaneous equipment not vibration-isolated:
 - .1 Bolt to structure.
 - .4 Co-ordinate design and execution of SRS with actual building conditions and building elements installation.
 - .5 Co-ordinate connections with all disciplines.
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- 3.2 Inspection and Certification .1 SRS to be inspected and certified by Departmental Representative upon completion of installation.
- .2 Provide written report to Departmental Representative with certificate of compliance.
- 3.3 Commissioning Documentation .1 Upon completion and acceptance of certification, hand over to Departmental Representative complete set of construction documents, revised to show "as-built".

PART 1 - GENERAL

<u>1.1 Related Sections</u>	.1	Section 01 00 10 - General Instructions.
	.2	Section 01 33 00 - Submittal Procedures.
	.3	Section 01 35 29.06 - Health and Safety Requirements.
	.4	Section 01 74 21 - Construction/Demolition Waste Management And Disposal.
	.5	Section 01 78 00 - Closeout Submittals.
	.6	Section 01 91 13 - General Commissioning (Cx) Requirements.
	.7	Section 09 97 19 - Painting Exterior Metal Surfaces.
	.8	Section 21 05 01 - Common Work Results - Mechanical.
<u>1.2 References</u>	.1	Canadian General Standards Board (CGSB)
	.1	CAN/CGSB-24.3-92, Identification of Piping Systems.
	.2	National Fire Protection Association
	.1	NFPA 13-2010, Installation of Sprinkler Systems.
<u>1.3 Quality Assurance</u>	.1	Health and Safety:
	.1	Do construction occupational health and safety in accordance with Section 01 35 29.06 - Health and Safety Requirements.
<u>1.4 Submittals</u>	.1	Submittals in accordance with Section 01 33 00 - Submittal Procedures, and Section 21 05 01 - Common Work Results Mechanical.
<u>1.5 Closeout Submittals</u>	.1	Provide maintenance data for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.
<u>1.6 Waste Management and Disposal</u>	.1	Separate and recycle waste materials in accordance with Section 01 74 21 - Construction/Demolition Waste Management And Disposal, and Section 21 05 01 Common Work Results Mechanical.

- 1.7 Delivery, Storage and Handling .1 While delivering materials to site follow requirements of Section 01 00 10 - General Instructions and Section 21 05 01 - Common Work Results Mechanical.

PART 2 - PRODUCTS

- 2.1 Manufacturer's Equipment Nameplates .1 Metal or plastic laminate nameplate mechanically fastened to each piece of equipment by manufacturer. Where nameplates are not provided by manufacturer Division 23 to supply the nameplates. See para 2.2 for required information.
 .1 All identification components to be suitable for outdoor installation and shall be weather resistant.
 .2 Information to include, as appropriate:
 .1 Equipment: Manufacturer's name, model, size, serial number, capacity.
 .2 Motor: voltage, Hz, phase, power factor, duty, frame size.

- 2.2 System Nameplates .1 Colours:
 .1 Hazardous: red letters, white background.
 .2 Elsewhere: black letters, white background (except where required otherwise by applicable Codes).
 .2 Construction:
 .1 3 mm thick laminated plastic, matte finish, with square corners, letters accurately aligned and machine engraved into core.
 .3 Sizes:
 .1 Conform to following table:
- | Size # | mm | Sizes (mm) | No. of Lines | Height of Letters (mm) |
|--------|----|------------|--------------|------------------------|
| 1 | | 10 x 50 | 1 | 3 |
| 2 | | 13 x 75 | 1 | 5 |
| 3 | | 13 x 75 | 2 | 3 |
| 4 | | 20 x 100 | 1 | 8 |
| 5 | | 20 x 100 | 2 | 5 |
| 6 | | 20 x 200 | 1 | 8 |
| 7 | | 25 x 125 | 1 | 12 |
| 8 | | 25 x 125 | 2 | 8 |
| 9 | | 35 x 200 | 1 | 20 |
- .2 Use maximum of 25 letters/numbers per line.
 .3 Locations:
 .1 Equipment in Mechanical Rooms: Use size #9.
 .4 Identification for Preventive Maintenance Support System (PMSS):
 .1 Use arrangement of Main identifier, Source identifier, Destination identifier.

2.2 System Nameplates (Cont'd)

- .4 (Cont'd)
 - .2 Equipment in Mechanical Room:
 - .1 Main identifier: Size #9.
 - .2 Source and Destination identifiers: Size #6.
 - .3 Terminal cabinets, control panels: Size #5.
 - .3 Equipment elsewhere: Sizes as appropriate.

2.3 Identification of Piping Systems

- .1 Identify contents by background colour marking, pictogram (as necessary), legend; direction of flow by arrows. To CAN/CGSB 24.3 except where specified otherwise.
- .2 Legend:
 - .1 Block capitals to sizes and colours listed in CAN/CGSB-24.3.
- .3 Arrows showing direction of flow:
 - .1 Outside diameter of pipe or insulation less than 75 mm: 100 mm long x 50 mm high.
 - .2 Outside diameter of pipe or insulation 75mm and greater: 150 mm long x 50 mm high.
 - .3 Use double-headed arrows where flow is reversible.
- .4 Extent of background colour marking:
 - .1 To full circumference of pipe or insulation.
 - .2 Length to accommodate pictogram, full length of legend and arrows.
- .5 Materials for background colour marking, legend, arrows:
 - .1 Pipes and tubing 20 mm and smaller: Waterproof and heat-resistant pressure sensitive plastic marker tags.
 - .2 All other pipes: Pressure sensitive plastic-coated cloth or vinyl with protective overcoating, waterproof contact adhesive undercoating, suitable for ambient of 100%RH and continuous operating temperature of 150°C and intermittent temperature of 200°C.
- .6 Colours and Legends:
 - .1 Where not listed, obtain direction from Departmental Representative.
 - .2 Colours for legends, arrows: To following table:

Background colour:	Legend, arrows:
Yellow	BLACK
Green	WHITE
Red	WHITE

- .3 Background colour marking and legends for piping systems:

Contents	Background colour marking	Legend
Make-up water supply	Green	MAKE UP WATER
Chemical treatment	Yellow	CHEMICAL TREATMENT
Condensate Water Supply	Green	CONDENSATE SUPP
Condensate Water Return	Green	CONDENSATE RET

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|--|----|---|
| <u>2.4 Identification Ductwork Systems</u> | .1 | 50 mm high stencilled letters and directional arrows 150 mm long x 50 mm high. |
| | .2 | Colours: Black, or co-ordinated with base colour to ensure strong contrast. |
| | | |
| <u>2.5 Valves</u> | .1 | Brass tags with 12mm stamped identification data filled with black paint. Secure tags with non-ferrous chains or closed "S" hooks. |
| | .2 | Include flow diagrams for each new system, of approved size, showing charts and schedules with identification of each tagged item, valve type, service, function, normal position, location of tagged item. |
| | .3 | Number valves in each system consecutively. |
| | | |
| <u>2.6 Language</u> | .1 | Identification to be in English and French. |
| | | |
| <u>PART 3 - EXECUTION</u> | | |
| | | |
| <u>3.1 Timing</u> | .1 | Provide identification only after all painting specified in Division 09. |
| | | |
| <u>3.2 Installation</u> | .1 | Perform work in accordance with CAN/CGSB-24.3 except as specified otherwise. |
| | .2 | Provide ULC and CSA registration plates as required by respective agency. |
| | .3 | Identify systems, equipment to conform to PWGSC PMSS. Provide detailed list of equipment and systems installed under this contract and obtain numbering list from the Departmental Representative. |
| | | |
| <u>3.3 Nameplates</u> | .1 | Locations: |
| | .1 | In conspicuous location to facilitate easy reading and identification from operating floor. |
| | .2 | Protection |
| | .1 | Do not paint, insulate or cover in any way. |
| | | |
| <u>3.4 Location of Identification on Piping and Ductwork Systems</u> | .1 | On long straight runs in open areas: At not more than 17 m intervals and more frequently if required to ensure that at least one is visible from any one viewpoint in operating areas and walking aisles. |
| | .2 | Adjacent to each change in direction. |
| | .3 | On both sides of visual obstruction or where run is difficult to follow. |
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3.4 Location of
Identification on
Piping and Ductwork
Systems
(Cont'd)

- .4 Identification to be easily and accurately readable from usual operating areas and from access points.
- .1 Position of identification to be approximately at right angles to most convenient line of sight, considering operating positions, lighting conditions, risk of physical damage or injury and reduced visibility over time due to dust and dirt.

3.5 Valves

- .1 Valves, except at plumbing fixtures, radiation, or where in plain sight of equipment they serve: Secure tags with non-ferrous chains or closed "S" hooks.
- .2 Install one copy of flow diagrams, valve schedules mounted in frame behind non-glare glass where directed by Departmental Representative. Provide one copy (reduced in size if required) in each operating and maintenance manual.
- .3 Number valves in each system consecutively.

PART 1 - GENERAL

- 1.1 Related Sections
- .1 Section 01 00 10 - General Instructions.
 - .2 Section 01 33 00 - Submittal Procedures.
 - .3 Section 01 35 29.06 - Health and Safety Requirements.
 - .4 Section 01 74 21 - Construction/Demolition Waste Management And Disposal.
 - .5 Section 01 78 00 - Closeout Submittals.
 - .6 Section 01 91 13 - General Commissioning (Cx) Requirements.
 - .7 Section 21 05 01 - Common Work Results - Mechanical.
- 1.2 General
- .1 TAB means to test, adjust and balance to perform in accordance with requirements of Contract Documents and to do other work as specified in this section.
- 1.3 Purpose of TAB
- .1 Test to verify proper and safe operation, determine actual point of performance, evaluate qualitative and quantitative performance of equipment, systems and controls at design, average and low loads using actual or simulated loads
 - .2 Adjust and regulate equipment and systems so as to meet specified performance requirements and to achieve specified interaction with other related systems under normal and emergency loads and operating conditions.
 - .3 Balance systems and equipment to regulate flow rates to match load requirements over full operating ranges.
- 1.4 Exceptions
- .1 TAB of systems and equipment regulated by codes, standards to be to satisfaction of authority having jurisdiction.
- 1.5 Co-ordination
- .1 Schedule time required for TAB (including repairs, re-testing) into project construction and completion schedule so as to ensure completion before acceptance of project.
 - .2 Do TAB of each system independently and subsequently, where interlocked with other systems, in unison with those systems.
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- 1.6 Pre-TAB Review .1 Review contract documents before project construction is started and confirm in writing to Departmental Representative adequacy of provisions for TAB and other aspects of design and installation pertinent to success of TAB.
- .1 As soon as they are completed, obtain from the Contractor copy of approved Shop Drawings for all equipment involved in TAB. Re-verify that equipment can be test,adjust and balance to perform to design parameters. Advise in writing any concerns and discrepancies.
- .2 Review specified standards and report to Departmental Representative in writing all proposed procedures which vary from standard.
- .3 During construction, co-ordinate location and installation of TAB devices, equipment, accessories, measurement ports and fittings.
- .1 Provide written statement that that all requirements to allow TAB performance are meet.
- 1.7 Start-up .1 Follow start-up procedures as recommended by equipment manufacturer unless specified otherwise.
- .2 Follow special start-up procedures specified elsewhere in each Division.
- 1.8 Operation of Systems During TAB .1 Operate systems for length of time required for TAB and as required by Departmental Representative for verification of TAB reports.
- 1.9 Start of TAB .1 Notify Departmental Representative 20 days prior to start of TAB.
- .2 Start TAB when system is essentially completed, including:.
- .1 All provisions for TAB installed and operational.
- .3 Start-up, verification for proper, normal and safe operation of mechanical and associated electrical and control systems affecting TAB including but not limited to:
- .1 Proper thermal overload protection in place for electrical equipment.
- .2 Liquid systems:
- .1 Flushed, filled, vented.
- .2 Strainers in place, baskets clean.
- .3 Isolating and balancing valves installed, open.
- .4 Calibrated balancing valves installed, at factory settings.
- .5 Chemical treatment systems complete, operational.
- 1.10 Application Tolerances .1 Do TAB to following tolerances of design values:
- .1 Hydronic systems: plus or minus 10%
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- 1.11 Accuracy Tolerances .1 Measured values to be accurate to within plus or minus 2% of actual values.
- 1.12 Instruments .1 Prior to TAB, submit to Departmental Representative list of instruments to be used together with serial numbers.
- .2 Calibrate in accordance with requirements of most stringent of referenced standard for either applicable system or HVAC system.
- .3 Calibrate within 3 months of TAB. Provide certificate of calibration to Departmental Representative.
- 1.13 Submittals .1 Submit, prior to commencement of TAB:
- .1 Proposed methodology and procedures for performing TAB if different from referenced standard.
- .2 Submittals in accordance with Section 01 33 00 - Submittal Procedures, and Section 21 05 01 - Common Work Results Mechanical.
- 1.14 Preliminary TAB Report .1 Submit for checking and approval of Departmental Representative, prior to submission of formal TAB report, sample of rough TAB sheets. Include:
- .1 Details of instruments used.
- .2 Details of TAB procedures employed.
- .3 Calculations procedures.
- .4 Summaries.
- .5 Copy of all documents required in para 1.6.
- 1.15 TAB Report .1 TAB report to show results in SI units and to include:
- .1 Project record drawings.
- .2 System schematics.
- .2 Submit 6 copies of TAB Report to Departmental Representative for verification and approval, in English in D-ring binders, complete with index tabs.
- 1.16 Verification .1 Reported results subject to verification by Departmental Representative.
- .2 Provide manpower and instrumentation to verify up to 100% of reported results.
- .3 Number and location of verified results to be at discretion of Departmental Representative.
- .4 Bear costs to repeat TAB as required to satisfaction of Departmental Representative.
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- 1.17 Settings .1 After TAB is completed to satisfaction of Departmental Representative, replace drive guards, close access doors, lock devices in set positions, ensure sensors are at required settings.
- .2 Permanently mark settings to allow restoration at any time during life of facility. Markings not to be eradicated or covered in any way.
- 1.18 Completion of TAB .1 TAB to be considered complete when final TAB Report received and approved by Departmental Representative.
- 1.19 Hydronic Systems .1 Meet requirements as specified for hydronic systems.
- .2 Definitions: for purposes of this section, to include, condenser water, cooling systems.
- .3 Standard: TAB to be to most stringent of this section or TAB standards of AABC, NEBB, SMACNA or ASHRAE.
- .4 Qualifications: personnel performing TAB to be qualified to standards of AABC or NEBB.
- .5 Quality assurance: Perform TAB under direction of supervisor qualified to standards of AABC or NEBB.
- .6 Measurements: to include, but not limited to, following as appropriate for systems, equipment, components, controls: Flow rate, static pressure, pressure drop (or loss), temperature, specific gravity, density, RPM, electrical power, voltage, noise, vibration.
- .7 Locations of equipment measurement: to include, but not be limited to, following as appropriate:
- .1 Inlet and outlet of chillers (in regular and "free cooling" mode.
 - .2 Inlet and outlet of pumps, PRV, control valve, other equipment causing changes in conditions.
 - .3 Inlet and outlet of Cooling Towers.
 - .4 At controllers, controlled device.
- .8 Locations of systems measurements to include, but not be limited to, following as appropriate: Supply and return of primary and secondary loops (main, main branch, branch, sub-branch) of all hydronic systems, inlet connection of make-up water.
- 1.20 Quality Assurance .1 Health and Safety:
- .1 Do construction occupational health and safety in accordance with Section 01 35 29.06 - Health and Safety Requirements.
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1.21 Closeout Submittals .1 Provide maintenance data for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.

1.22 Waste Management and Disposal .1 Separate and recycle waste materials in accordance with Section 01 74 21 - Construction/Demolition Waste Management And Disposal, and Section 21 05 01 Common Work Results Mechanical.

1.23 Delivery, Storage and Handling .1 While delivering materials to site follow requirements of Section 01 00 10 - General Instructions and Section 21 05 01 - Common Work Results Mechanical.

PART 2 - PRODUCTS

2.1 Not Used .1 Not used.

PART 3 - EXECUTION

3.1 Not Used .1 Not used.

PART 1 - GENERAL

- 1.1 Related Sections
- .1 Section 01 00 10 - General Instructions.
 - .2 Section 01 33 00 - Submittal Procedures.
 - .3 Section 01 35 29.06 - Health and Safety Requirements.
 - .4 Section 01 74 21 - Construction/Demolition Waste Management And Disposal.
 - .5 Section 01 78 00 - Closeout Submittals.
 - .6 Section 01 91 13 - General Commissioning (Cx) Requirements.
 - .7 Section 21 05 01 - Common Work Results - Mechanical.
 - .8 Section 21 07 20 - Thermal Insulation for Piping.
- 1.2 References
- .1 American Society for Testing and Materials, (ASTM).
 - .1 ASTM A 278M-01(2006), Specification for Gray Iron Castings for Pressure-Containing Parts for Temperatures up to 650 degrees F (345 degrees C).
 - .2 ASTM A 516/A516M-2010, Specification for Pressure Vessel Plates, Carbon Steel, for Moderate - and Lower - Temperature Service.
 - .3 ASTM B 62-09, Specification for Composition Bronze or Ounce Metal Castings.
- 1.3 Quality Assurance
- .1 Health and Safety:
 - .1 Do construction occupational health and safety in accordance with Section 01 35 29.06 - Health and Safety Requirements.
- 1.4 Submittals
- .1 Submittals in accordance with Section 01 33 00 - Submittal Procedures, and Section 21 05 01 - Common Work Results Mechanical.
 - .2 Shop Drawings:
 - .1 Submit shop drawings to indicate materials, finishes, method of anchorage, number of anchors, dimensions construction and assembly details, manufacturer's installation instructions and associate accessories.
 - .3 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.
 - .4 Product Data:
 - .1 Submit manufacturer's printed product literature, specifications and data sheet for fixtures and equipment.
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- 1.5 Closeout Submittals .1 Provide maintenance data for incorporation into manual specified in Section 01 78 00 - Closeout Submittals and include following:
.1 Special servicing requirements.
- 1.6 Waste Management and Disposal .1 Separate and recycle waste materials in accordance with Section 01 74 21 - Construction/Demolition Waste Management And Disposal, and Section 21 05 01 Common Work Results Mechanical.
- 1.7 Delivery, Storage and Handling .1 While delivering materials to site follow requirements of Section 01 00 10 - General Instructions and Section 21 05 01 - Common Work Results Mechanical.

PART 2 - PRODUCTS

- 2.1 Flexible Connection .1 Application: to suit motion, as indicated.
.2 Minimum length in accordance with manufacturer's recommendations to suit offset.
.3 Inner hose: stainless steel corrugated.
.4 Braided wire mesh stainless steel outer jacket.
.5 Diameter and type of end connection: as indicated.
.6 Operating conditions:
.1 Working pressure: 1100 kPa.
.2 Working temperature: 94°C.
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PART 3 - EXECUTION

- 3.1 General
- .1 Install as indicated and to manufacturer's recommendations.
 - .2 Maintain proper clearance to permit service and maintenance.
 - .3 Should deviations beyond allowable clearances arise, request and follow Departmental Representative's directive.
 - .4 Check shop drawings for conformance of all tappings for ancillaries and for equipment operating weights.
 - .5 Install expansion joints and flexible connections in accordance with manufacturer's instructions.

PART 1 - GENERAL

- 1.1 Related Sections
- .1 Section 01 00 10 - General Instructions.
 - .2 Section 01 33 00 - Submittal Procedures.
 - .3 Section 01 35 29.06 - Health and Safety Requirements.
 - .4 Section 01 74 21 - Construction/Demolition Waste Management And Disposal.
 - .5 Section 01 78 00 - Closeout Submittals.
 - .6 Section 01 91 13 - General Commissioning (Cx) Requirements.
 - .7 Section 21 05 01 - Common Work Results - Mechanical.
 - .8 Section 23 05 05 - Installation of Pipework.
 - .9 Section 23 05 22 - Valves - Bronze.
 - .10 Section 23 05 24 - Valves - Cast Steel.
 - .11 Section 23 05 93 - Testing, Adjusting and Balancing for HVAC.
- 1.2 References
- .1 American Society of Mechanical Engineers (ASME).
 - .1 ASME B16.1-2010, Cast Iron Pipe Flanges and Flanged Fittings.
 - .2 ASME B16.3-2006, Malleable Iron Threaded Fittings.
 - .3 ASME B18.2.1-2010, Square and Hex Bolts and Screws (Inch Series).
 - .4 ASME B18.2.2-2010, Square and Hex Nuts (Inch Series).
 - .2 American Society for Testing and Materials International, (ASTM).
 - .1 ASTM A 47/A47M-99(2009), Standard Specification for Ferritic Malleable Iron Castings.
 - .2 ASTM A 53/A53M-2010, Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc Coated Welded and Seamless.
 - .3 ASTM B 62-2009, Specification for Composition Bronze or Ounce Metal Castings.
 - .3 American National Standards Institute (ANSI)/ American Water Works Association (AWWA).
 - .1 ANSI/AWWA C111/A21.11-2007, Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings
- 1.3 Quality Assurance
- .1 Health and Safety:
 - .1 Do construction occupational health and safety in accordance with Section 01 35 29.06 - Health and Safety Requirements.
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- 1.4 Submittals .1 Submittals in accordance with Section 01 33 00 - Submittal Procedures, and Section 21 05 01 - Common Work Results Mechanical.
- .2 Submit data for following:
- .1 Pipes.
 - .2 Fittings.
 - .3 Valves.
- 1.5 Closeout Submittals .1 Provide maintenance data for incorporation into manual specified in Section 01 78 00 - Closeout Submittals and include following:
- .1 Special servicing requirements.
- 1.6 Waste Management and Disposal .1 Separate and recycle waste materials in accordance with Section 01 74 21 Construction/Demolition Waste Management And Disposal, and Section 21 05 01 Common Work Results Mechanical.
- 1.7 Delivery, Storage and Handling .1 While delivering materials to site follow requirements of Section 01 00 10 - General Instructions and Section 21 05 01 - Common Work Results Mechanical.

PART 2 - PRODUCTS

- 2.1 Pipe .1 Steel pipe: to ASTM A 53/A 53M-01, Grade B, as follows:
- .1 NPS 1/2 to 1-1/2: Schedule 80.
 - .2 NPS 2 to 10: Schedule 40.
 - .3 NPS 12 and over: Standard wall (9.525 mm wall thickness)
- 2.2 Pipe Joints .1 NPS 2 and under: screwed fittings with teflon tape or pulverized lead paste.
- .2 NPS 2 1/2 and over:
- .1 Welded.
 - .2 Flanges: plain or slip-on.
 - .1 Flange gaskets: to ANSI/AWWA C111/A21.11.
 - .2 Bolts and nuts: to ANSI B18.2.1 and ANSI/ASME B18.2.2.
- 2.3 Fittings - Condenser Cooling Water System .1 Supply and Return:
- .1 Screwed fittings: malleable iron, to ANSI/ASME B16 Class 125.
 - .2 Butt welded fittings: steel to ASME B16.9 Class 150.
 - .3 Pipe flanges and flanged fittings:
 - .1 Cast iron: to ANSI/ASME B16.1, Class 150.
 - .4 Unions: malleable iron, to ASTM A 42M.6 and ANSI/ASME B16.3.
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- 2.4 Valves -
Condenser Cooling
Water System
- .1 Connections:
 - .1 NPS 2 and smaller: screwed ends.
 - .2 NPS 2 1/2 and larger: flanged ends.
 - .2 Ball Valves:
 - .1 NPS 2 and under to Section 23 05 22 - Valves - Bronze.
 - .3 Butterfly Valves:
 - .1 NPS 2 1/2 and larger to Section 23 05 24 - Valves - Cast Steel.
 - .4 Gate valves:
 - .1 NPS 2 and under to Section 23 05 22 - Valves - Bronze.
 - .2 NPS 2 1/2 and larger to Section 23 05 24 - Valves - Cast Steel.
 - .5 Globe valves: Application: bypass around control valves.
 - .1 NPS 2 and under to Section 23 05 22 - Valves - Bronze.
 - .6 Check Valves - swing type, composition disc:
 - .1 NPS 2 and under to Section 23 05 22 - Valves - Bronze.
 - .2 NPS 2 1/2 and larger to Section 23 05 24 - Valves - Cast Steel.

PART 3 - EXECUTION

- 3.1 Piping
Installation
- .1 Install pipework in accordance with Section 23 05 05 - Installation of Pipe Work.
 - .2 Connect to equipment in accordance with manufacturer's instruction unless otherwise indicated.
 - .3 Install concealed pipes close to building structure to keep furring space to minimum. Install to conserve headroom and space. Run exposed piping parallel to walls. Group piping wherever practical.
 - .4 Use eccentric reducers at pipe size change installed to provide positive drainage or positive venting.
 - .5 Provide clearance for installation of insulation and access for maintenance of equipment, valves and fittings.
 - .6 Ream pipes, clean scale and dirt, inside and outside, before and after assembly.
 - .7 Assemble piping using fittings manufactured to ANSI standards.
 - .8 Saddle type branch fittings may be used on mains if branch line is no larger than half the size of main. Hole saw or drill and ream main to maintain full inside diameter of branch line prior to welding saddle.
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- 3.2 Valves Installation
- .1 Install rising stem valves in upright position with stem above horizontal.
 - .2 Install ball or butterfly valves at branch take-offs and to isolate each piece of equipment, and as indicated.
 - .3 Install globe valves for balancing and in by-pass around control valves as indicated.
- 3.3 Cleaning, Flushing and Start-up
- .1 According to Section 23 05 05 - Installation of Pipework.
- 3.4 Testing
- .1 Test system in accordance with Section 23 05 01 - Common Work Results - Mechanical
 - .1 Flush after pressure test.
 - .2 Refill system with clean water adding water treatment as specified.
- 3.5 Balancing
- .1 Refer to Section 23 05 93 - Testing, Adjusting and Balancing for HVAC for applicable procedure.

PART 1 - GENERAL

- 1.1 Related Sections
- .1 Section 01 00 10 - General Instructions.
 - .2 Section 01 33 00 - Submittal Procedures.
 - .3 Section 01 35 29.06 - Health and Safety Requirements.
 - .4 Section 01 74 21 - Construction/Demolition Waste Management And Disposal.
 - .5 Section 01 78 00 - Closeout Submittals.
 - .6 Section 01 91 13 - General Commissioning (Cx) Requirements.
 - .7 Section 21 05 01 - Common Work Results - Mechanical.
- 1.2 References
- .1 American Society of Mechanical Engineers (ASME)
 - .1 ASME Boiler and Pressure Vessel Code, Section VII-2010.
 - .2 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
 - .1 Material Safety Data Sheets (MSDS).
- 1.3 Quality Assurance
- .1 Health and Safety:
 - .1 Do construction occupational health and safety in accordance with Section 01 35 29.06 - Health and Safety Requirements.
 - .2 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.
- 1.4 Submittals
- .1 Submittals in accordance with Section 01 33 00 - Submittal Procedures, and Section 21 05 01 - Common Work Results Mechanical.
 - .2 Submit data for following:
 - .1 Submit copies of Workplace Hazardous Materials Information System (WHMIS) Material Safety Data Sheets (MSDS).
- 1.5 Closeout Submittals
- .1 Provide maintenance data for incorporation into manual specified in Section 01 78 00 - Closeout Submittals and include following:
 - .1 Special servicing requirements.
 - .2 Log sheets as recommended by manufacturer.
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1.6 Waste Management and Disposal .1 Separate and recycle waste materials in accordance with Section 01 74 21 - Construction/Demolition Waste Management And Disposal, and Section 21 05 01 - Common Work Results - Mechanical.

1.7 Delivery, Storage and Handling .1 While delivering materials to site follow requirements of Section 01 00 10 - General Instructions and Section 21 05 01 - Common Work Results - Mechanical.

PART 2 - PRODUCTS

2.1 System Description .1 Water Treatment system shall utilize the existing Magnor System

- .1 There is an existing Magnor treatment system installed at L'Esplanade Laurier. All materials must be selected to ensure full compatibility with the existing system.
- .2 Hire and pay all cost for the services of Magnus Group to complete the work of all water treatments.
- .3 General:
 - .1 Employ services of Chemical Treatment Company to review existing system and proposed modifications.
 - .2 Dismantle, service and reinstate existing equipment and modify piping to complete water treatment systems which meet the requirements for control and prevention of fouling and corrosion in condenser water systems.
 - .3 Upon completion, the modified chemical treatment system shall consist and perform as described in para 2.4.

2.2 Chemical Feed Piping .1 Same as the system.

- .1 Beside installation of new piping as shown on the drawings and requested by Chemical Treatment Company, allow for replacement of:
 - .1 25m of 1/2 PVC piping and hangers (allow for reasonable number of fittings)
 - .2 25m of 3/4 PVC piping and hangers (allow for reasonable number of fittings)
 - .3 35m of 2 Copper L piping and hangers (allow for reasonable number of fittings)

2.3 Open Cooling System .1 As indicated on the drawings, provide chemical treatment system and distribution piping as follows.

.2 Chemical water system shall consist of but not limited to:

- .1 One (1) microprocessor based conductivity controller having the following characteristics;
 - .1 Power input: 100-240 VAC @ 50/60Hz 30 VA;
 - .2 Back-up power supply: 9V battery;
 - .3 Control Output: Line voltage @ 600 VA (5A @ 120VAC) per relay
 - .4 High impact resistant ABS designed to NEMA 4X (IP65)

2.3 Open
Cooling System
(Cont'd)

- .2 (Cont'd)
 - .1 (Cont'd)
 - .5 Display: 64 X 128 Pixels dot matrix backlit display (full graphics display)
 - .6 Power switch: Internal
 - .7 H/O/A switches: Front panel keypad
 - .8 Environment: Ambient temperature -17.8°C to 50°C
 - .9 Outputs: 4 relays (1 alarm and 3 selectable)
 - .10 Timers: Two (2) programmable
 - .11 Isolated 4-20 mA output
 - .12 2-year warranty
 - .2 Three (3) electronic diaphragm pumps with the following characteristics:
 - .1 The chemical metering pump(s) shall be electronically-driven, simplex, solenoid-driven, reciprocating, mechanically actuated diaphragm style. Manual Control is to be performed by on line adjustable stroke length. To prevent damage to pump from over-heating, the solenoid shall have automatic-reset thermal overload protection. For overpressure conditions, pump shall automatically stop pulsating when discharge pressure exceeds pump pressure by not more than 35% when pump is set at maximum stroke length
 - .3 The pumps, water meter, conductivity sensor and controller, flow switch, solenoid valve and piping shall be factory assembled on the polypropylene wall mounting backboard ready to be connected to the system.
- .3 Cooling tower filters shall consist but not limited to:
 - .1 Two (2) automatic cooling tower filters. The filters will be installed in a parallel manner. Each filter shall include the following items:
 - .1 Each vessel shall have
 - .1 Composite construction;
 - .2 A gauge connection with pressure gauge 690kPa;
 - .3 An upper distribution system, ensuring a uniform distribution of water on the surface of the media;
 - .4 A lower plastic type distribution system center hub with side slits to ensure uniform collection of filtered water and optimal distribution.
 - .5 Two union coupling connections for inlet and outlet, to ease the separation of the shell to the facade of piping;
 - .1 Drain connection with strainer to restraint the loss of media;
 - .2 A composite support base included.
 - .2 Two layers of filtration sand;
 - .3 One (1) centrifugal pump 2Hp motor
 - .4 Four (4) motorized ball valves in PVC sch80
 - .5 The operational characteristics of each filter shall be:
 - .1 Filtration flow rate: 4.73 l/s
 - .2 Minimum backwash flow: 4.73 l/s (city water);
 - .3 Maximum operating pressure: 517kPa
 - .4 Maximum operating temperature: 50 C
 - .5 Overall dimensions of the filter are: 1200 mm W x 1050 mm L x 1300 mm H;

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- 2.4 Make-up water Feed
- .1 BFP Back Flow Preventer: to CSA-B64 Series, application at each domestic water connection to any mechanical system, double check valve assembly back flow preventer with intermediate vacuum breaker.
 - .2 PRV Pressure Reducing Valve.
 - .1 Capacity: to suit the flow.
 - .2 Inlet pressure: 1034 kPa.
 - .3 Outlet pressure: 413 kPa.
 - .4 NPS 2 and over, semi-steel bodies, Class 125, flanged: to ASTM A 126.
 - .5 Semi-steel spring chambers with bronze trim.

PART 3 - EXECUTION

- 3.1 Manufacturer's Instructions
- .1 Compliance: comply with manufacturer's written recommendations or specifications, obtain new copies of product technical bulletins, handling, storage and installation instructions, and data sheet.
 - .1 The manufacturer of the system shall visit the facility to assess existing conditions and provide all necessary services and material for "turn key" system.
 - .1 It shall provide but not be limited to:
 - .1 Full engineering of water treatment and filtration system with maximum utilization of existing components;
 - .2 Service and modification to existing system components;
 - .3 Positioning the filter on a level surface and providing all piping connections;
 - .4 Installation of additional required chemical treatment components.
 - .5 All electrical connections;
 - .6 Pre-start Inspection to validate the installation and connection of the device;
 - .7 The filter media fill-up;
 - .8 The commissioning of the filter;
 - .9 Training staff on operations and maintenance.
- 3.2 Installation
- .1 Install open system cooling tower treatment systems in accordance with ASME Boiler Code Section VII, and requirements and standards of authorities having jurisdiction, except where specified otherwise.
 - .2 Ensure adequate clearances to permit performance of servicing and maintenance of equipment.
 - .3 Extend all piping from and to termination point of chemical treatment system. Provide isolating valves at inlet and outlet to the chemical treatment system. Provide isolating valves and back flow preventer at city water connection to the chemical treatment system.
 - .4 All piping to cooling towers system outside mechanical room shall be heat traced, insulated and pipe cover with aluminum jacketing.
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- 3.3 Water Treatment Services .1 Provide water treatment monitoring and consulting services for period of one year after system start-up. Service to include:
- .1 Initial liquid analysis and treatment recommendations.
 - .2 System start-up assistance.
 - .3 Operating staff training.
 - .4 Visit plant every 60 days during period of operation and as required until system stabilizes, and advise on treatment system performance.
 - .5 Provide necessary recording charts and log sheets for one year operation.
 - .6 Provide necessary laboratory and technical assistance.
 - .7 Instructions and advice to operating staff to be clear, concise and in writing.
- 3.4 Start-up .1 Advise Departmental Representative in writing on all matters regarding installed water treatment systems
- .2 Certificates:
- .1 Upon completion, furnish certificates confirming satisfactory installation and performance.

PART 1 - GENERAL

- 1.1 Related Sections
- .1 Section 01 00 10 - General Instructions.
 - .2 Section 01 33 00 - Submittal Procedures.
 - .3 Section 01 35 29.06 - Health and Safety Requirements.
 - .4 Section 01 74 21 - Construction/Demolition Waste Management And Disposal.
 - .5 Section 01 78 00 - Closeout Submittals.
 - .6 Section 01 91 13 - General Commissioning (Cx) Requirements.
 - .7 Section 21 05 01 - Common Work Results - Mechanical.
 - .8 Section 23 05 05 - Installation of Pipework.
 - .9 Section 23 05 22 - Valves - Bronze.
 - .10 Section 23 05 24 - Valves - Cast Steel.
 - .11 Section 23 05 93 - Testing, Adjusting and Balancing for HVAC.
- 1.2 References
- .1 American Society of Mechanical Engineers (ASME).
 - .1 ASME B16.1-2010, Cast Iron Pipe Flanges and Flanged Fittings.
 - .2 American National Standards Institute (ANSI)/ American Water Works Association (AWWA).
 - .1 ANSI/AWWA C111/A21.11-2007, Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings
- 1.3 Quality Assurance
- .1 Health and Safety:
 - .1 Do construction occupational health and safety in accordance with Section 01 35 29.06 - Health and Safety Requirements.
- 1.4 Submittals
- .1 Obtain from Departmental Representative copy of shop drawings and Maintenance Manuals of pre-purchased equipment. Distribute shop drawings for pre-purchased equipment to assure contractor and sub-contractors familiarize themselves with material information and installation requirements.
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- 1.5 Delivery Storage and Handling
- .1 Cooling Tower modules and rest of pre-purchasing accessories are stored at Departmental Representative storage facility.
 - .1 Storage facility address: 1770 Pink Rd Gatineau, Quebec, QC J9J 3T2
 - .2 The tower and rest of pre-purchasing accessories shall be inspected for general acceptance by the Contractor and Departmental Representative. Any items of concern related to damage or lifting operations shall be documented and reported (in writing) to the Departmental Representative. The Contractor or his crane operator shall inspect all corner lifting brackets and their bolting to the tower.
 - .3 Prior to lifting and transport of the tower, all weather protective tarpaulins and shrink wrap shall be removed, excess water should be removed from basin.
 - .4 Contractor is responsible to pick up and transport of all pre-purchased equipment to the construction site and hoist to work area for installation. All pre-purchased equipment shall be cover by liability insurance for whole duration of the project.
 - .5 Should tower need to be temporarily placed on the ground prior to its final position, the tower shall be stored on sound and level surface. Care shall be taken at all times not to distort or rack the tower modules envelope.
 - .6 After all pre-purchased equipment is moved, Contractor is responsible for clean up of Departmental Representative storage facility and surface restoration damaged by moving activity.

PART 2 - PRODUCTS

- 2.1 General Requirements
- .1 Install as shown on the plans modular Cooling Tower.
 - .2 Cooling Tower is pre-purchased by the Departmental Representative.

PART 3 - EXECUTION

- 3.1 Installation
- .1 Install in accordance with drawings, specifications and manufacturer's installation, operation, and maintenance manuals.
 - .2 Provide all required supports, attachments devices, and accessories needed to insure quiet operation.
 - .3 Employ services of tower manufacturer representative for installation review and start up, pay all costs.
 - .4 Owner training shall be provided by manufacturer's representative and coordinated by Departmental Representative.
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3.2 Auxiliary valves and piping .1 Provide all service valves and pipe interconnections within tower as recommended by manufacturer and shown in installation manual.