

PART 1.0 GENERAL MECHANICAL CONDITIONS

- 1.1 Provide complete, fully tested and operational mechanical systems to meet requirements described in these specifications and on the drawings, and in complete accord with all applicable codes and ordinances.
- 1.2 Contract documents are diagrammatic and approximately to scale unless detailed otherwise. They establish scope, material and installation quality and are not detailed installation instructions.
- 1.3 Install equipment generally in locations and routes shown, close to building structure with minimum interference with other services or free space.
- 1.4 Furnish a written guarantee stating that all work executed in this contract will be free from defective workmanship and materials for a period of one (1) year from the date of final acceptance of work. The Contractor shall, at his own expense, repair and replace any work which fails or becomes defective during the term of the guarantee/warranty, providing such work is not due to improper usage. The period of guarantee specified shall not, in any way, supplant any other guarantees of a longer period but shall be binding on work not otherwise covered.
- 1.5 Give all required notices, obtain all necessary permits and pay all fees in order that work herein specified may be carried out. Furnish any certificates necessary as evidence that the work installed conforms with the laws and regulations of all authorities having jurisdiction. This must be done before final certificates will be issued.
 - .1 Changes and alterations required by any authorized inspector or any authority having jurisdiction, shall be carried out at no additional cost.
- 1.6 Provide holes and sleeves, cutting and fitting required for mechanical work. Relocate improperly located holes and sleeves.
 - .1 Obtain written approval from the Structural Engineer before coring, cutting, or burning structural members.
 - .2 Patch the building where damaged from equipment installation, improperly located holes, etc. Use matching materials as specified in the respective Section.
- 1.7 Fire-stop all pipe and duct penetrations through floors and walls, designated as fire and/or smoke separations. Fire-stopping materials to meet ULC CAN4-S115.

1.8 Quality Control

- .1 Follow manufacturer's recommended installation details and procedures for equipment, supplemented by requirements of Contract Documents.
- .2 Remove and replace improperly installed equipment to the satisfaction of the Engineer at no additional cost.
- .3 Replace material or workmanship below specified quality and relocate work wrongly placed, to the satisfaction of the Engineer, at no additional cost.
- .4 Provide labour and materials required to install test and place mechanical systems into operation. Provide additional material for modifications required to correct any incorrect installations.

1.9 Review of Site

- .1 Prior to submitting bid:
 - .1 examine the site and the local conditions affecting work of this Contract; and,
 - .2 examine carefully the mechanical, electrical, structural, and architectural drawings and be satisfied that the Work can be satisfactorily carried out as shown on these plans without changes to the building.
- .2 Before commencing the Work:
 - .1 examine the Work of the other trades and report at once any defect or interference affecting the Work, or the Guarantee of this Work.
 - .3 No extras will be subsequently allowed to cover any such error, omission or oversight on the thorough inspection of the grounds, building, existing conditions, etc.

1.10 Cooperate and co-ordinate with other trades on the project.

- .1 Make reference to electrical, mechanical, structural, and architectural drawings when setting out work.

1.11 Materials and Equipment

- .1 Materials and equipment installed shall be new and of quality specified. Use same brand or manufacturer for each specific application.
- .2 Use products of one manufacturer for material and equipment of same type or classification unless otherwise specified.
- .3 Statically and dynamically balance rotating equipment for minimum vibration and low operating noise level.
- .4 Each major component of equipment shall bear manufacturer's name, address, catalogue and serial number in a conspicuous place.
- .5 All materials brought onto the construction site shall, where applicable, have the supplier's WHMIS label attached, material safety data sheets available, and ensure all persons in contact with hazardous material are informed of such and have information readily available.

1.12 Shop Drawings and Submittals

- .1 Before fabrication of any materials or equipment, submit through the General Contractor one (1) complete set of shop drawings and data sheets covering all items of equipment furnished by him and intended for installation under this Contract, for review by the Engineer. Maximum sheet size 8.5"x14". Do not order equipment or material until the Engineer has approved and returned shop drawing. These may be submitted in PDF format (with Contractor Review stamps included), or hard copy. One electronic copy (in PDF format) will be returned to the General Contractor.
 - .1 Prior to submission to the Engineer, the Contractor shall review all shop drawings. By this review, the Contractor certifies that he has determined and verified all field measurements, field construction criteria, materials, catalogue numbers and similar data, and certifies that he has checked and coordinated each shop drawing with the requirements of the work of the contract documents. The Contractor's review of each shop drawing shall be indicated by stamp, date and signature of a responsible person.

- 1.13 Protect equipment and materials in storage on site during and after installation until final acceptance. Leave factory covers in place. Take special precautions to prevent entry of foreign material into working parts of piping and duct systems.

- .1 Thoroughly clean piping, ducts, and equipment of dirt, cuttings, and other foreign substances.
- 1.14** Provide services of qualified and experienced personnel to prepare proper documentation and to instruct the Owner's personnel in the operation of the systems. Submit three (3) hard copies of Operation and Maintenance Manuals which include manufacturers' recommended maintenance and operating instructions of all pieces of equipment, including controls. O&M manuals to be each bound in a 215 x 280 mm (8 ½" x 11") capacity extension type binders.
 - .1 In addition to the three hard copies listed above, provide one electronic copy in PDF format.
 - .2 Submit documents to the Engineer for approval prior to being turned over.
- 1.15** At completion of project, hold a Seminar to instruct the Owner in operation and preventative maintenance of each piece of equipment and system supplied and installed.
 - .1 Refer to Controls section of this specification for additional information on Owner's instructions on the controls systems.
- 1.16** Provide as-built drawings which identify location of smoke and fire dampers, major control lines, access doors, tagged valves, and actual room names or numbers. As well, deviations that are to be recorded shall include in general, items that are significant or are hidden from view (including all items in ceiling spaces) and items of major importance to future operations and maintenance, and to future alterations and additions including clean-outs and isolation valves.
 - .1 Mechanical record drawings shall be provided by the Contractor in PDF format, as well as one set of hard copy drawings.
- 1.17** Identify piping and equipment throughout with labels and direction of flow arrows. Apply name and arrow labels at 15 metre (50 foot) intervals, before and after pipes pass through walls or floors, at access door openings, adjacent to all valves, or at intervals closer than 15 metres (50 feet) in equipment rooms as required for ease of tracing systems. Painted piping to be provided with commodity name and direction of flow arrows in black on light coloured piping, and white on dark coloured piping, with bands each side.
 - .1 Piping and equipment identification to match existing.

- 1.18 Touch up any factory painted finish with matching colours where same has been damaged during shipment or installation, subject to the approval of the Engineer and if not acceptable, replace.
- 1.19 Provide access doors for maintenance or adjustment purposes for all mechanical system components.
- .1 Steel frame access panel with stainless steel piano-type hinge, channel reinforced steel door panel, three "Symmons" fasteners per door. Door panel recessed to receive ceiling or wall material to give finished appearance showing only hinge and fasteners. Provide acoustic gasket between door panel perimeter and steel frame.
- .2 Provide rated doors where penetrating fire separations. Rated access doors shall be UL-listed.
- 1.20 Motors to be complete with O.D.P. enclosure and shall operate at 1800 RPM unless otherwise specified. Provide motors rated for continuous duty with 1.15 service factor unless specified otherwise in the driven equipment specifications. Provide all motors with thermal overload protection and grease or oil lubricated anti-friction type ball or roller bearings.
- .1 Provide all mechanical motorized equipment (unless otherwise specified) with motors equal to Gould "E-Plus" energy efficient motors.

PART 2.0 SERVICE PROVIDERS, MATERIALS, AND EQUIPMENT

- .1 The price submitted for this Contract shall be based on the use of service providers, materials, and equipment as indicated on the drawings or in the specifications.
- .2 If the Contractor wishes to quote on other service providers, materials, or equipment which has been specified and not included in the 'Approved Alternate List' he must, prior to quoting on such items, obtain written approval from the Engineer.
- .1 Requests for approval for tendering purposes of equivalent service providers, materials, or equipment shall be submitted in duplicate, to the Engineer no later than seven (7) working days prior to the closing date of tender for mechanical trade, complete with all applicable technical data, including performance curves and physical details. Approval of requests shall only be given by addendum.

- .2 The Contractor at his discretion may submit to the Engineer a request for approval on equipment or materials which has been included in the 'Approved Alternate List' but for which the Contractor is uncertain will meet the specification requirements. In this case the Contractor shall identify specifically his uncertainties with the request.
- .3 Requests for approval for tendering purposes shall be submitted by fax to the Engineer. Applicable technical data will not be reviewed by the Engineer unless specifically requested by the Engineer.
- .3 Where only one manufacturer or service supplier listed in the Approved Alternate List, this is not an indication of the Owner's desire to base bid one service supplier or manufacturer (unless specifically noted otherwise as "Base Bid"). The Contractor is encouraged to submit requests for other service suppliers or manufacturers.
 - .1 If the term "Base Bid" is used in the Approved Alternative List, this indicates that this service provider, material, or equipment is to be sole sourced. No alternatives will be acceptable.
- .4 The Contractor shall be fully responsible for any additional work or materials required by the mechanical trade or by other trades to accommodate approved equivalent services, materials, or equipment. Extras will not be approved to cover such work. This shall also apply to services, equipment, and materials listed in the 'Approved Alternate List'.
- .5 A list of approved manufacturers and service suppliers has been included in the "Approved Alternate List". The Contractor may quote on the listed services, materials, and equipment without prior written approval by the Engineer. However, the Contractor shall be fully responsible that the equipment and materials meet all the requirements of the equipment specified. The Engineer may reject shop drawings on any equipment and materials which do not comply with the specification, even though the manufacturers name has been included in the 'Approved Alternate List'.
- .6 Equipment shall not exceed space limitations in any dimension.
- .7 The Contractor shall replace any equipment or apparatus which does not meet the specification at no cost to the Owner. The Contractor shall assume full responsibility for the expense of redesign and adjustment to other parts of the project when tendering on approved equal or alternate equipment.

2.2 APPROVED ALTERNATE LIST

Product	Manufacturer
Air and Water Balancing	Airflo Enterprises, Quality Air, Air MD
Valves (General Service) Gate, Globe, Swing Check, Ball	Grinnell, Crane, Jenkins, Kitz
Line Strainers	Armstrong, Crane, Mueller, Kitz, Sarco
Grooved Mechanical Piping	Vitaulic, Gruvlok
Gauges & Indicators (Water pressure and temperature)	Ashcroft, Terice, Weiss
In-Line Pumps Triple Duty Valves Suction Diffusers	Armstrong, Bell & Gossett, Aurora, Taco
Side-stream Filters	Axiom, Sumco, GESL
Pipe and Equipment Insulation	Fiberglas Canada, Manville, Manson, Krauf
Relief Valves	Watts, Singer
Vacuum Breakers	Febco, Watts
Hose Bibbs	Watts, Zurn
Chemical Treatment	Mogul, Bird Archer
Steam Traps and Steam Air Vents	Bell & Gossett, Sarco, Taco, Armstrong
Condensate Return Units	Bell & Gossett, Armstrong
Expansion Tanks	Bell & Gossett, Taco, Amtrol
Air Separator	Armstrong, Bell & Gossett, Taco
Brazed Plate Heat Exchanger	Bell & Gossett, Armstrong, Taco
Circuit Balancing Valves	Tour & Anderson, Armstrong
Radiant Panel Manifold	Rahau, Caleffi
Control System	BASE BID: Honeywell - DMA Controls

PART 3.0 BALANCING

- .1 Balance, adjust and test air and water systems and equipment, and submit reports.
- .2 Procedures in general shall comply with the NEBB Procedural Standards for Testing, Adjusting and Balancing of Environmental Systems. Accuracy of measurements shall be in accordance with NEBB standards.
- .3 If it is found that the specified air flows cannot be achieved on portions of the system, the actual conditions shall be reported to the Engineer for consideration of corrective action before continuing the balancing procedure on the affected system.
- .4 If report is rejected, systems shall be re-balanced and a new certified report submitted at no extra cost to the Owner.
- .5 Permanently mark, by stick-on labels, settings on valves, splitters, dampers, and other adjustment devices.
- .6 Balancing shall be performed to the following accuracies:
 - .1 Hydronic-terminal outlets $\pm 10\%$
 - .2 Hydronic-pumps and central equipment $\pm 5\%$

PART 4.0 PIPE AND PIPE FITTINGS

- 4.1 Welding materials, fabrication standards and labour qualifications must conform to ANSI/ASME B31.1, ANSI B16.25, ASME Section IX, and the Provincial Board of Labour Regulations. Use welders fully qualified and licensed by Provincial Authorities.
- 4.2 All below grade steel piping shall be yellow jacketed.
- 4.3 Non specified pipe joining and pipe fitting methods such as T-drill and Press-fit are not permitted in any piping system covered under this specification.
- 4.4 Provide valves of same manufacturer throughout where possible.
- 4.5 Use factory fabricated butt welded fittings for welded steel pipes.

- 4.6 Use long radius elbows for steel and cast iron water piping, including grooved mechanical fittings.
- 4.7 Where permitted by the Engineer, use grooved mechanical couplings to engage and lock grooved or shouldered pipe ends and to allow for some angular deflection, contraction and expansion. Couplings consist of malleable iron housing-clamps, C-shaped composition sealing gasket EPDM Grade 'E' (unless otherwise specified) and steel bolts.
- 4.8 All piping, valves, fittings, and accessories are to be rated for the operating conditions and media (pressure, temperature, and fluid).

4.9 Domestic Cold Water Piping

ITEM	SIZES	GENERAL DESCRIPTION
Pipe	75 mm & smaller (3" & smaller)	Type L copper
	100 to 250 mm (4" to 10")	Ductile Iron. No steel piping allowed for domestic hot water.
Fittings	75 mm & smaller (3" & smaller)	Wrought copper.
	100 to 250 mm (4" to 10")	Schedule 40, grooved mechanical couplings.
Joints	50 mm & smaller (2" & smaller)	Soldered with lead-free tin-nickel-silver-antimony-copper alloy.
	65 to 75 mm (2 1/2" to 3")	Threaded
Couplings	100 to 250mm (4" to 10")	Grooved coupling, Victaulic style 71 with Type E gasket.
Unions	100 mm & smaller (4" & smaller)	1380 kPa bronze, ground joint.
Flanges	100 to 250mm (4" to 10")	Victaulic Style 741 with Type E gasket.
Shut Off Valves	50 mm & smaller (2" & smaller)	Ball Valves : Bronze body, chrome plated bronze ball, threaded or solder ends, PTFE seat and packing. Grinnell figure 171N and 171S.

ITEM	SIZES		GENERAL DESCRIPTION
	65 to 75 mm (2 ½" to 3")		Butterfly Valves: Cast iron wafer full-lug body, 300 Series stainless steel shaft, bronze disc, replaceable EPDM seat., lever lock handle operator with multiple position lock plate for valve sizes to 100 mm (4"), heavy duty gear hand-wheel operator with position indicator for valve sizes 150mm (6") and over. Grinnell figure LC-1281-3 and LC-1282-3.
	100 mm & larger (4" & larger)		Gate Valves: See below.
Other Valves (use only where specified)	Gate Valves	50 mm & smaller (2" & smaller)	Bronze body, inside screw, travelling stem, solid wedge, threaded bonnet, threaded ends. Grinnell figure 3010.
		65 mm & larger (2 ½" & larger)	Cast iron body, bronze trim, OS&Y, rising stem, solid wedge, flanged ends. Grinnell figure 6020A.
	Globe Valves	50 mm & smaller (2" & smaller)	Bronze body, threaded bonnet, threaded ends. Grinnell figure 3240
		65 mm & larger (2 ½" & larger)	Cast iron body, flanged ends, OS&Y, renewable seat ring, no. 294-S renewable composition disc. Jenkins Figure 142.
Swing Check Valves	50 mm & smaller (2" & smaller)		Bronze body threaded cap, renewable Teflon disc, threaded ends Grinnell Figure 3310.
	65 mm & larger (2 ½" & larger)		Cast iron body, regrind-renew swing check, bolted cover, flanged ends, bronze disc and seat ring. Grinnell figure 6300A.
Silent Check Valves for Pump Discharge	50mm to 100 mm (2" to 4")		Wafer style, cast iron body, stainless steel disc and seat, 304ss spring, stainless steel bushing, stainless steel set screw, threaded ends. Grinnell 400 series.
	150 mm & larger (6" & larger)		Flanged globe style, cast iron body, stainless steel seat, plug, spring and bushing, stainless steel set screws. Grinnell 500 series.

ITEM	SIZES	GENERAL DESCRIPTION
Hose Bibbs	All sizes	Bronze or red brass, replaceable hexagonal disc, hose thread spout, chrome plated where exposed. Non-freeze type with polished bronze wall plate, recessed box, hose thread spout, removable key.

- .1 Grooved mechanical couplings or joints shall be used only in mechanical rooms. Provide soldered fittings in other locations.
- .2 For domestic hot water systems, all composition disc valves shall be fitted with discs suitable for hot water.

4.10 Sanitary, Storm, and Plumbing Vent Piping

ITEM	SIZES		GENERAL DESCRIPTION	
Pipe	SAN STORM	200 mm & smaller (8" & smaller)	Above Ground: cast iron DWV or Copper Tube* DWV hard Below Ground: PVC DWV	
		Vent	75 mm & larger (3" & larger)	Above Ground: cast iron or Copper Tube DWV hard Below Ground: PVC DWV
	50 mm & smaller (2" & smaller)		hard copper, DWV above grade only.	
	Fittings		SAN STORM	200 mm & smaller (8" & smaller)
		Vent		75 mm & larger (3" & larger)
			50 mm & smaller (2" & smaller)	Copper: CSA B158.1 or ANSI B16.29

ITEM	SIZES		GENERAL DESCRIPTION
Joints	SAN STORM	All sizes	Mechanical joint coupling - neoprene sleeve with centre rib; stainless steel shield and clamps Copper: CSA B158.1 or ANSI B16.29
	Vent	75 mm & larger (3" & larger)	Mechanical joint coupling - neoprene sleeve with centre rib; stainless steel shield and clamps Copper: CSA B158.1 or ANSI B16.29
		50 mm & smaller (2" & smaller)	Soldered 50/50 lead/tin. Copper: CSA B158.2 or ANSI B16.29

* Not permitted for the fixture drain or the portion of the vent below the floor level rim of a flush valve operated urinal.

4.11 Hot Water Heating Piping, including Glycol Mixes

ITEM	SIZES		GENERAL DESCRIPTION
Pipe	50mm & smaller		schedule 40 steel, Type 'L' Hard copper (above ground), or Type 'K' Soft copper (below ground - no joints permitted)
	65mm & larger (2 1/2" & larger)		schedule 40 steel.
Fittings	steel	50 mm & smaller (2" & smaller)	Cast Iron, threaded with Teflon steel tape.
		65mm & larger(2 1/2" & larger)	Carbon Steel, standard weight butt weld.
	copper	all sizes- (above ground only)	Threaded or Soldered with lead-free tin-nickel-silver-antimony-copper alloy
Flanges	65mm & larger (2 1/2" & larger)		1000 kPa raised face, standard weight, butt weld. 3.1 mm thick SS/ASB SP WD, 1000 kPa (150 psi) gaskets.

ITEM	SIZES	GENERAL DESCRIPTION
Gate Valves	50 mm & smaller (2" & smaller)	Bronze body, inside screw, traveling stem, solid bronze wedge, threaded bonnet. Grinnell figure 3010 and 3010SJ.
	65mm & larger (2 1/2" & larger)	Cast iron body, flanged ends, OS&Y, rising stem, bronze trim, solid bronze or cast iron (with bronze facings) wedge. Grinnell 6020A.
Butterfly Valves	All sizes	Cast iron wafer full-lug, 300 series stainless steel shaft, bronze disc, replaceable EPDM seat, lever lock handle operator with multiple position lock plate for valve sizes to 100mm (4"), heavy duty gear hand-wheel operator with position indicator for valve sizes 150mm (6") and over. Grinnell figure LC-1281-3 and LC-1282-3.
Globe Valves	50mm & smaller	Bronze body, threaded bonnet, threaded ends. Grinnell figure 3240 and 3240 SJ.
	65mm & larger (2 1/2" & larger)	Cast iron body, flanged ends, OS&Y, renewable bronze seat and disk. Grinnell Figure 6200A.
Ball Valves	50 mm & smaller (2" & smaller)	Bronze body, chrome plated bronze ball, threaded ends, twin-seal PTFE seats and seals, "O" ring, lever handle. Grinnell figure 171N.
Swing Check Valves	50 mm & smaller (2" & smaller)	Bronze body and disc, regrinding swing check, threaded cap, threaded ends. Grinnell figure 3300.
	65mm & larger (2 1/2" & larger)	Cast iron body, regrind-renew swing check, bolted cover, flanged ends, bronze disc and seat ring. Grinnell figure 6300A.
Silent Check Valves for Pump Discharge	50mm to 100mm (2" to 4")	Wafer style, cast iron body, Teflon disc and seat, 304ss spring, stainless steel bushing, stainless steel set screw. Grinnell 400 series.
	150mm & larger (6" & larger)	Flanged globe style, cast iron body. Stainless steel seat, plug, spring and bushing. Stainless steel set screws. Grinnell 500 series.
Strainers	50 mm & smaller (2" & smaller)	Threaded brass or iron body, Y pattern with 0.8mm stainless steel perforated screen.
	65 mm to 100 mm (2 1/2" to 4")	Flanged iron body, Y pattern with 1.0mm stainless steel perforated screen.

ITEM	SIZES	GENERAL DESCRIPTION
	150 mm & larger (6" and larger)	Flanged iron body, Y pattern with 3.2mm stainless steel perforated screen.
Circuit Balancing Valves	All sizes	Suitable for throttling. All metal parts non-ferrous, die cast non-porous copper alloy. Flow measuring accuracy $\pm 2\%$. Positive shut-off, drain connection with cap. Memory balancing feature. Fittings for connection of portable differential pressure meter. Tour & Anderson circuit balancing valve.

- .1 Grooved mechanical couplings may be used in mechanical rooms only.

4.12 Low Pressure Steam Piping & Steam Relief Venting

ITEM	SIZES	GENERAL DESCRIPTION
Pipe	Low Pressure - 50mm (2") & smaller	ASTM A53, standard weight ERW, schedule 40
	65mm (2½") and larger	ASTM A53, grade B, standard weight ERW, schedule 40 steel.
Fittings	50mm (2") & smaller	Cast Iron, ASTM A126, 860 kPa (125 psi), threaded with Teflon steel tape.
	65mm (2½") and larger	Wrought Steel, ASTM A234 grade WPB, standard weight butt weld.
Flanges	65mm (2½") and larger	1000 kPa (150 psi) raised face, standard weight, butt weld. 3.1 mm thick SS/ASB SP WD, 1000 kPa (150 psi) gaskets.
Gate Valves	50mm (2") & smaller	Bronze body, inside screw, travelling stem, solid bronze wedge, stainless steel seats, threaded bonnet, threaded ends. Rated 2060 kPa (300 psi) steam, 4130 kPa (600 psi) WOG. Grinnell 3135.
	65mm (2½") & larger	Cast iron body, flanged ends, OS&Y, rising stem, bronze trim, solid bronze (or cast iron with bronze facings) wedge. Rated 860 kPa (125 psi) steam, 1370 kPa (200 psi) WOG. Grinnell figure 6020A.

ITEM	SIZES	GENERAL DESCRIPTION
Globe Valves	50mm (2") & smaller	Bronze body, rising stem, bronze disc holder, Teflon disc, threaded bonnet, threaded ends. Rated 1030 kPa (150 psi) steam, 2060 kPa (300 psi) WOG. Grinnell figure 3240.
	65mm (2½") & larger	Cast iron body, bronze trimmed, bolted bonnet, flanged ends, OS&Y, renewable bronze disc and seat. Rated 860 kPa (125 psi) steam, 1370 kPa (200 psi) WOG. Grinnell figure 6200A.
Ball Valves	50mm (2") & smaller	Bronze body, chrome plated bronze ball, threaded ends, twin-seal PTFE seats and seals, O-ring, lever handle, rating 4130 kPa (600 psi) WOG. Grinnell figure 171N.

4.13 Low Pressure Condensate Piping

ITEM	SIZES	GENERAL DESCRIPTION
Pipe	50mm (2") & smaller	ASTM A53, XS weight, schedule 80 steel, continuous ERW or seamless
	65mm (2½") & larger	ASTM A53, standard weight, schedule 40 steel, continuous ERW or seamless
Fittings	50mm (2") & smaller	ASTM A105, 1030 kPa (150 psi), threaded with Teflon
	65mm (2½") & larger	ASTM A234 grade WPB, standard weight butt weld.
Flanges	50mm (2") to 250mm (10")	1000 kPa (150 psi) raised face, standard weight, butt weld. 3.1 mm thick SS/ASB SP WD, 1000 kPa (150 psi) gaskets.
Gate Valves	50mm (2") & smaller	Bronze body, inside screw, travelling stem, solid bronze wedge, stainless steel seats, threaded bonnet, threaded ends. Rated 2060 kPa (300 psi) steam, 4130 kPa (600 psi) WOG. Grinnell 3135.

ITEM	SIZES	GENERAL DESCRIPTION
	65mm (2½") & larger	Cast iron body, flanged ends, OS&Y, rising stem, bronze trim, solid bronze (or cast iron with bronze facings) wedge. Rated 860 kPa (125 psi) steam, 1370 kPa (200 psi) WOG. Grinnell figure 6020A.
Globe Valves	50mm (2") & smaller	Bronze body, rising stem, full plug stainless steel disc with stainless steel seat ring, threaded bonnet, threaded ends. Rated 2060 kPa (300 psi) steam, 4130 kPa (600 psi) WOG. Grinnell figure 3270.
	65mm (2½") & larger	Cast iron body, bronze trimmed, bolted bonnet, flanged ends, OS&Y, renewable bronze disc and seat. Rated 860 kPa (125 psi) steam, 1370 kPa (200 psi) WOG. Grinnell figure 6200A.
Ball Valves	50mm (2") & smaller	Bronze body, chrome plated bronze ball, threaded ends, twin-seal PTFE seats and seals, "O" ring, lever handle, rating 4130 kPa (600 psi) WOG. Grinnell figure 171N.

- 4.14 Strainer screen free area shall be minimum three times area of inlet pipe.
- 4.15 Use grooved mechanical couplings and mechanical fasteners only in mechanical rooms, and only on piping systems only where specifically noted as acceptable in this specification. Use galvanized couplings with galvanized pipe, and copper couplings on copper pipe.
- .1 All areas of the Central Heating Plant are considered to be mechanical room.
- 4.16 Provide dielectric type connections wherever joining dissimilar metals in open systems. Brass adapters and valves are acceptable.
- 4.17 Use insulating plastic spacers for copper pipe installation in metal studs.
- 4.18 Route piping in orderly manner to maintain proper grades. Install to conserve headroom and interfere as little as possible with use of space. Run exposed piping parallel to walls. Group piping wherever practical at common elevations. Install concealed pipes close to the building structure to keep furrings to a minimum.

- 4.19 Slope pressure water piping at 0.2% upward in direction of flow and arrange to drain at low points and vent at high points.
- 4.20 Grade horizontal drainage and vent piping 2% down in direction of flow unless specifically noted otherwise.
- 4.21 Install piping to allow for expansion and contraction without unduly stressing pipe or equipment connected.
- 4.22 Provide clearance for proper installation of insulation and for access to valves, air vents, drains and unions.
- 4.23 Provide drain valves at main shut-off valves, all low points of piping, and all apparatus and terminal units.
- 4.24 Provide handle extensions of all valves installed on insulated piping.

PART 5.0 SUPPORTS ANCHORS AND SEALS

- 5.1 Pipe supports shall meet the requirements of ANSI B31.1, Power Piping.
- 5.2 Provide hangers and supports to secure equipment in place, prevent vibration, maintain grade, provide for expansion and contraction, and to accommodate insulation. Provide insulation protection saddles.
- 5.3 Install supports of strength and rigidity to suit loading without unduly stressing building. Locate adjacent to equipment to prevent undue stresses in piping and equipment.
- 5.4 Provide oversize hangers for insulated pipes such that pipe insulation is between support hangar and pipe. Provide 12 gauge saddle between hangar and insulation. On larger pipes, provide calcil insulation saddle between pipe and hangar.

Pipe Size	Sheet Metal Saddle	Calcil Insulation Saddle
Up to 38mm (up to 1½")	12 ga – 300mm long (12 ga – 12" long)	no
50mm to 75mm (2" to 3")	12 ga – 300mm long (12 ga – 12" long)	yes
100mm and larger (4" and larger)	12 ga – 300mm long (12 ga – 12" long)	yes

- 5.5 Select hangers and supports for the service and in accordance with the manufacturer's recommended maximum loading. Hangers shall have a safety factor of 5 to 1.
- 5.6 Dielectrically isolate dissimilar metals.
- 5.7 Obtain written approval from the Structural Engineer prior to drilling for inserts and supports, prior to using percussion type fastenings, and prior to welding piping, duct-work or equipment supports to building metal decking or building structural steel supports.
- 5.8 Use of piping or equipment for hanger supports is not permitted.
- 5.9 Use of perforated band iron, wire or chain as hangers is not permitted.
- 5.10 Flash and counter-flash where mechanical equipment passes through weather or waterproofed walls, floors, and roofs.
- 5.11 Where piping or duct-work passes through floor, ceiling or wall, close off space between pipe or duct and construction with non-combustible insulation.
- .1 Where piping or ductwork penetrates a fire rated assembly, close off space between pipe or duct and construction with one component ceramic fibre based putty. Material to be UL listed rated and applied in sufficient thickness to maintain fire rating.
- .2 Piping passing through mechanical room floor, roof or wall, close off space between pipe and sleeve with synthetic rubber compound mechanical type seals.

PART 6.0 INSULATION

- 6.1 Materials shall meet fire and smoke hazard ratings as stated in this Section and defined in Saskatchewan Building Code.
- 6.2 Adhesives, insulation materials, vapour barrier facings, tapes and recovery jackets: Composite fire and smoke hazard ratings shall not exceed 25 for Flame Spread and 50 for Smoke Developed. Adhesives shall be waterproof.

- 6.3 Ensure insulation is continuous through inside non-fire rated walls. Pack around pipes and ducts with fire proof self supporting insulation materials, properly sealed.
- 6.4 Stagger butt joints where multi-layered insulation is used.
- 6.5 Provide recovering jackets on exposed insulation throughout, including equipment rooms. Insulation located in crawlspaces, pipe shafts and suspended ceiling spaces is not considered exposed. Make smooth uneven insulated surfaces before recovering.
- 6.6 Recovering jackets:
- .1 On indoor hot water heating piping and domestic water piping is to be PVC.
 - .2 On Indoor steam and condensate piping to be aluminium with pebbled finish to match existing.
- 6.7 Provide insulation of the following equipment listed below. Insulation is to be of the same specification as mineral fibre insulation for piping (pre-formed or insulation board).
- .1 Heat Exchanger
- 6.8 **Piping Insulation**
- .1 Mineral Fibre Insulation for Hot Pipes : mineral fibre insulation to CGSB 51-GP-9M/10M/11M. (For Pipes : Factory applied all-purpose jacket of a white kraft bonded to a metalized polyester, reinforced with glass scrim). Maximum "k" value at 24°C to be 0.035 W/m.°C, with service temperature up to 150°C.
 - .2 Mineral Fibre Insulation for Cold Pipes : mineral fibre insulation sleeving to CGSB 51-GP-9M/10M/11M. Factory applied vapour barrier jacket to CGSB 51-GP-52M, Type 1, with longitudinal lap seal. Maximum "k" value at 24°C to be 0.035 W/m.°C, with -14°C to 100°C service temperature.
 - .3 Insulate fittings and valves. Do not insulate unions, flanges, and strainers except on chilled water and steam lines. Do not insulate flexible connections and expansion joints. Terminate insulation neatly with plastic material towelled on a bevel.
 - .4 Insulate fittings, flanges, and valve bodies with preformed insulated fittings.

- .5 Insulate the following with Mineral Fibre Insulation :

MINIMUM PIPE INSULATION						
COMMODITY	NOMINAL PIPE DIAMETER					
		25mm (1") & smaller	30mm to 50mm (1¼" to 2")	65mm to 100mm (2½" to 4")	150mm (6")	200mm (8") & larger
Hydronic Htg Steam Condensate Steam Vent		38mm (1½")		50mm (2")		90mm
Domestic Cold Water		25mm (1")	25mm (1") **	38mm (1½") **	38mm (1½")	

- .6 Flare out staples may be used to secure jacket laps on hot systems. Staples are to be applied on 100mm (4") centres.
- .7 Insulate 3 metres (10 feet) portion of plumbing vents measured from roof outlet back, and through all cold spaces. Do not insulate remaining vent piping.

6.9 VALVES

- .1 Insulate fittings and valves.
- .1 Do not insulate unions or flanges.
- .2 Do not insulate flexible connections or expansion joints.
- .3 For valves 50mm and larger, insulate valve bodies with removable insulating valve jackets.

PART 7.0 PLUMBING GENERAL

7.1 Cleanouts

- .1 Provide bolted cover plate clean-outs on vertical rainwater leaders only.
- .2 Ensure ample clearance at clean-out for rodding of drainage system.

- .3 Not all clean-out locations are shown on the drawings. Provide clean-outs as required by the Plumbing Code and the Authority having Jurisdiction.
- 7.2 Install back-flow prevention devices on plumbing lines to code requirements and where contamination of domestic water may occur. Generally necessary on boiler/chiller/condenser make-up lines, hose bibs, and flush valves.
- 7.3 Install vacuum breakers on hose bibbs.

PART 8.0 HOT WATER SPECIALTIES

- 8.1 Provide manual type air vent at all system high points. Construct manual air vent from short section (150mm (6") minimum) of vertical line diameter pipe (25mm (1") minimum pipe size) to form air chamber. Provide 3 mm (1/8") brass needle valve at top of chamber.
- 8.2 Provide cleaning and chemical treatment of all piping systems prior to final fill. Cleaning and chemical treatment is to be done by a qualified chemical treatment agency.
- 8.3 Provide side-stream filters and flow indicators as shown.
- 8.4 Provide an additional 50 gallons of premixed glycol and turn over to owner at completion of project.

PART 9.0 STEAM SPECIALTIES

9.1 Steam Traps

- .1 Furnish and install steam traps on all steam equipment. In addition to locations shown on the drawings, float and thermostatic drip traps shall be installed at the end of all steam lines, at the base of all risers, ahead of all steam temperature and pressure regulators, on all steam headers, at all steam system low points, where condensate may collect, and at least every 90 m along the length of the steam mains.
- .2 When traps discharge into wet return line, or have a lift in the discharge piping, a check valve shall be installed in the trap discharge line between the trap outlet and the shut off valve. Lifts will not be allowed in the trap discharge piping for equipment having a modulating temperature regulator.

- .3 Size steam traps as follows:
 - .1 Float and Thermostatic, low pressure: 1.5:1 safety factor.
 - .2 Float and Thermostatic, high pressure: 2:1 safety factor.
 - .3 Bucket: 2:1 safety factor.
 - .4 The trap seat pressure rating must be equal to or greater than the steam supply to the equipment.
 - .5 The trap capacity must be determined at the minimum possible differential pressure.
 - .6 When used on equipment having a modulating temperature regulator the trap capacity shall be determined at 3.5 kPa differential.
 - .4 The trap discharge piping must drain by gravity to a dry return line.
 - .5 Install thermostatic elements in traps only after system has been operated and dirt pocket cleaned.
 - .6 Float and Thermostatic Traps**
 - .1 Fully modulating float and thermostatic traps suitable for continuous operation. Cap and body: cast iron, rated to 1200 kPa. Float and mechanism: stainless steel. Valve: heat treated chrome steel. Vent: balanced pressure phosphor bronze disc, diaphragm type, stainless steel valve and seat.
 - .2 Pipe connections shall be in the body and the entire trap mechanism attached to the cap.
 - .7 Bucket Traps**
 - .1 Inverted bucket trap suitable for intermittent operation.
 - .2 Body and cover: cast iron rated to 1700 kPa.
 - .3 Bucket, linkages, pins, seats: stainless steel.
- 9.2 Steam Air Vents**
- .1 Balanced pressure thermostatic air vents rated at 860 kPa. Body: cast bronze. Thermostatic element: charged multi-convolution phosphor bronze bellows caged in stainless steel. Valve and seat: stainless steel, renewable.

- .2 Install as shown on drawings, and at highest point of steam chambers, with inlet connections to the vents higher than the highest points of the chambers.

9.3 Steam Relief Valves

- .1 Safety valve with ANSI 1720 kPa raised face flanged inlet, threaded outlet. Body: bronze or cast iron. Trim: bronze/brass with stainless steel disc and semi-nozzle. Provide drip pan elbow.
- .2 Terminate relief valve vent lines to outdoors unless specifically noted otherwise.
 - .1 Headers may be used to connect more than one relief valve vent, only with the written approval of the Engineer. Where headers are permitted, the header area cross section shall be no less than the sum of the cross sectional areas of all pipes feeding into the header.
 - .2 Extend drains from drip pan elbows to floor drain or trench drain.

PART 10.0 CONTROLS

- 10.1 Provide a complete and fully operational system of full DDC automatic controls, including all materials and labour.
 - .1 Tie new controls into existing Honeywell DDC system. Provide new network control panel for the system.
- 10.2 Operator Training
 - .1 Connect new control system into existing BMS System (Honeywell by DMA Controls).
 - .2 At completion of the project, provide a 3 hour training session in the operation of the control system.
 - .3 After 3 month, allow for an additional 2 hour training session.
- 10.3 This contractor is to provide all 120V and lower control wiring unless specifically noted otherwise. This includes wiring from breaker panels to Control Panels, SCU's and Central Computer Equipment.
- 10.4 Coordinate with the electrical contractor to provide all wiring above 120V.

- 10.5 Fully cooperate with other trades for compatibility and installation location of all devices.
- 10.6 Install all components in accordance with the latest regulations of the Canadian Electrical Code, applicable Municipal and Provincial Codes and Regulations, and latest CSA Electrical Bulletins.
- 10.7 Mount control panels on vibration free wall or free standing angle iron supports. Provide engraved lamecoid nameplates for instruments and controls inside cabinet and on cabinet face.
- 10.8 Provide an individual switch for disconnection and a fuse for isolation of all panel mounted instruments requiring a 120V supply.
- 10.9 Identify all wiring by means of stamped markings on heat shrinkable tubing. Install all wiring neatly and laced or bunched into cable form using plastic wire clips, where practical, contained in plastic wiring channels with covers. Maximum 25 conductors to each wire bundle.
- 10.10 Provide and install all necessary transducers, interposing relays, interface devices, contractors, starters, and any other devices to perform control functions required.
- 10.11 It is the responsibility of the Contractor to identify, at the time of tender submission, all additional items not specified that are required to meet the operational intent specified.
- .1 Items required but not identified at the time of tender acceptance shall be the Contractor's responsibility.
- 10.12 Verify location of all exposed control sensors with drawings before installation.
- 10.13 The control sequences noted below contain a general description of the intent of the operation of the systems to be controlled. The Contractor shall review individual systems to ensure equipment and life safety interlocks are not overridden.
- .1 The relationships between the points, systems and building are described in the control sequences.
- .2 Consult with the Consultant during the shop drawing stage to finalize the control sequences for each system.
- .3 All set-points noted are to be operator adjustable at the BMS operator interface.

10.14 Control Valves

- .1 Provide valves in accordance with general valve specification. Provide position indicators on valves and pilot positioners on sequenced valves.
- .2 Valves shall "fail safe" in normally open or closed position as dictated by freeze, humidity, fire or temperature protection.
- .3 Two-way valves for liquids shall have equal percentage characteristics. Three-way valves shall have linear characteristics. Size valve operators to close valves against pump shut-off head. Size for maximum 20 kPa drop.
- .4 Capacities for two valves in parallel shall have 1/3 to 2/3 load capacities sequenced so that smaller valve opens first. This also applies to multi-valves in parallel.

10.15 Nomenclature

- .1 AI Analogue Input
- .2 AO Analogue Output
- .3 DI Digital Input
- .4 DO Digital Output
- .5 PP Pseudo point (i.e. internal to the computer software)

10.16 In-Slab Heating System

- .1 All heating system controls are to be on the emergency power system.
- .2 Install two (2) slab temperature sensors to monitor slab temperature. In-slab sensor shall be Caleffi 605020A removable in-slab temperature/moisture sensor, brass body, brass holding socket. One to be installed in the upper loading dock slab, and one in the lower loading dock slab.
- .3 When the outdoor temperature rises above 36°F, the system shall be de-energized (valves closed and pumps off).
- .4 When the outdoor temperature drops below 33°F, the system shall be energized.
 - .1 One of the two pumps shall energize in lead-lag fashion. If the lead pump does not energize, the lag pump shall energize.

- .2 The two way steam control valves shall modulate to maintain the supply water temperature set-point. The valves shall sequence, with the small valve modulating until fully open, then the large valve opening.
- .3 When the system is energized but not calling for heat, the supply water temperature set-point shall be 50°F (operator adjustable).
- .4 When the system is energized and calling for heat from either sensor, the supply water temperature set-point shall be per the following:

Outdoor Air Temperature	Hot Water Supply Temperature
-34°F or less	110°F
-34°F to 33°F	Ramp from 110°F to 90°F
33°C and above	(system off)

- .5 Points List : The following points, as a minimum, shall be provided associated with the heating system. Each point shall also be shown on the heating system BMS system graphic.

- .1 System Energize / De-Energize PP
- .2 Lower Slab temperature/moisture sensor DI
- .3 Upper Slab temperature/moisture sensor DI
- .4 Pump P-1A Start/Stop DO
- .5 Pump P-1A Status DI
- .6 Pump P-1B Start/Stop DO
- .7 Pump P-1B Status DI
- .8 Lead Pump PP
- .9 1/3 Steam Heating Valve Command AO
- .10 2/3 Steam Heating Valve Command AO

- | | | |
|-----|---|----|
| .11 | Steam Pressure - Upstream of Control Valves | AI |
| .12 | Steam Pressure - Downstream of Control Valves | AI |
| .13 | Condensate Tank High Level | DI |
| .14 | Supply Water Temperature | AI |
| .15 | Supply Water Temperature Set-Point | PP |
| .16 | Supply Water Temperature Set-Point on Idle | PP |
| .17 | Return Water Temperature | AI |
| .18 | Glycol Tank Low Level | DI |
| .19 | Outdoor Air Dry Bulb Temperature | AI |
- .5 Condensate Return Tank COND-1
- .1 Condensate return tank has an integral control package which provides control of the two pumps. Lead lag control is implemented within the control package.
 - .2 The tank has a high level alarm contact to tie into BMS (see above points list).

- END OF SECTION -