Mechanical Specifications

Trillium Lakelands District School Board
1271 Cedar Lane, Bracebridge, ON P1L 1N4

TLDSB - Bracebridge SS - Domestic Booster Pump Replac. - EP 06226

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Northstar Project #06226 - TLDSB - Bracebridge SS - Domestic Booster Pump Replac. - EP

SPECIFICATION - LIST OF SECTIONS

Section 22 05 00 - Common Work Results for Plumbing

PART 1. GENERAL

1.1 Plumbing Installation (22 05 00)

.1 Supply & install complete plumbing systems including all necessary labour, services, products, materials & equipment. Plumbing systems to be fully functioning operating to the satisfaction of the owner & the design provided.

.2 Construction & installation methods shall comply with the current edition of the Applicable Building Code, the Regional Municipality & Local Building & Fire Department By-laws. All work shall also comply with other Codes, Standards & Regulations referred to in the manufacturer's installation manuals & documents and adopted by the Authorities Having Jurisdiction.

.3 Provide all labour, materials, plant, tools, transportation, testing and put into proper operation a complete plumbing and drainage system to the full intent of the drawings and/or specifications.

.4 In general, the major divisions of the work are as follows:

.5 Plumbing fixtures i.e. floor drains, roof hoppers and other plumbing fittings and equipment.

.1 Storm drainage system.

.2 Sanitary drainage and vent systems (routed and capped at locations indicated on drawings).

.3 Domestic hot and cold water piping.

.4 System of natural gas piping.

.5 Thermal insulation relating to this Section.

.6 Miscellaneous plumbing work as specified herein or shown on the mechanical drawings.

.7 Connections to incoming services (storm, sanitary and water) terminated 3 ft. (1m) outside the building foundation. This contractor shall be responsible for exact termination points, inverts and identification markers.

1.2 Drawings & Specifications (22 05 00)

.1 Drawings are diagrammatic and show approximate locations of equipment/ fixtures and connecting services. Any information regarding accurate measurement of the building is to be taken at the site. Do not scale the drawings, and do not use the drawings for prefabrication work.

.2 Read the plumbing drawings in conjunction with all other structural, architectural, site civil, landscape, sprinkler, mechanical, electrical etc., drawings and all other Division Drawings applicable to the Contract. Properly plan, coordinate, and establish the locations and routing of services with all subcontractors affected prior to installation

such that the services will clear each other as well as any obstructions, including structural components of the building.

.3 The drawings are intended to convey the scope of work & do not show architectural & structural details. Plumbing contractor shall provide, at plumbing contractor's cost, all offsets, fittings, and similar products required as a result of obstructions and other architectural & structural details but not shown on the drawings.

.4 The drawings and specifications are complementary and intended to be cooperative. Perform all work that is shown, specified, or reasonably implied on the drawings but not mentioned in the specification, or vice-versa, as though fully covered by both.

.5 All Contract drawings are to be read as a complete set. Any item or subject not indicated on a drawing sheet , but included on the other sheet within the drawing set shall be deemed properly specified and included in the contract.

.6 Should there be a conflict or inconsistency within the drawings, the contractor shall notify the engineer in a timely manner within the tender period. No cost variation shall be entertained for instances raised post tender. Wherever differences occur in the Contract drawings, the maximum conditions will govern and be allowed for in the Tender price.

1.3 Permits, Fees, and Certificates (22 05 00)

.1 Contractor to obtain all permits required, arrange for inspection of the work by inspection authority & pay all fees. Provide a final certificate to the owner.

1.4 Examination Of The Site (22 05 00)

.1 Prior to submitting their tender, the plumbing contractor shall carefully examine the site & ascertain all conditions, which shall affect his trade. Report to the consultant, prior to bid submission, any existing site condition that will or may affect performance of the work as per the drawings & specifications. Failure to do so will not be grounds for additional costs.

1.5 Standard Of Material and Workmanship (22 05 00)

.1 All materials and equipment, fixtures shall be new, CSA approved, bear CSA stamp and be of the best commercial quality obtainable for the purpose. All items required to provide a complete working system - including items not specified or shown, shall be included.

.2 All items furnished will be free from defects that would adversely affect the performance, maintainability and appearance of individual components and overall assembly.

.3 All work shall be executed in a neat and workmanlike manner by journeyman tradesmen who perform only the work that their certificates permit, or by apprentice tradesmen under direct on site supervision of an experienced journeyman tradesman.

.4 Workmanship shall be of the highest standards throughout & shall be minimum of the current trade practices for plumbing installations in this building.

.5 Unless otherwise specified all equipment, fixtures to be installed in accordance with the equipment manufacturer’s recommendations and instructions, and requirements of Governing Codes, Standards, and Regulations. Governing Codes, Standards, and Regulations take precedence over manufacturer’s instructions.

.6 Ensure that proper access and service clearances are maintained around equipment, and where applicable, access space for future equipment removal or replacement is not impeded. Remove and replace any equipment which does not meet this requirement.

.7 The plumbing contractor shall be responsible for correcting all work completed contrary to the intent of the drawings and specifications. Plumbing contractors shall be responsible for any damage caused to the owner or any of the other trades by improper location or carrying out of his work.

.8 Provide a certificate of guarantee of workmanship and material for one year from date of acceptance.

1.6 Coordination Of The Work (22 05 00)

.1 Review all the contract documents and coordinate the work with the work of all other trades.

.2 Properly plan, coordinate, and establish the locations and routing of services with all subcontractors affected prior to installation such that the services will clear each other as well as any obstructions, including structural components of the building.

.3 Coordinate the locations of the plumbing fixtures with the architectural, millwork and building interior drawings. The contractor shall review the architectural drawings, sections, and elevations for locations prior to rough-in. The contractor shall notify the architect and engineer of any discrepancies.

1.7 Delivery, Storage And Handling (22 05 00)

.1 Equipment and material placed on the job site will remain in the custody of the Contractor until phased acceptance, whether or not the Government has reimbursed the Contractor for the equipment and material. The Contractor is solely responsible for the protection of such equipment and material against any damage or theft.

.2 Damaged equipment will be replaced with an identical unit as determined and directed by the owner. Such replacement will be at no additional cost or additional time to the owner.

.3 Interiors of new equipment and piping systems will be protected against entry of foreign matter. Both inside and outside will be cleaned before painting or placing equipment in operation.

.4 Existing equipment and piping being worked on by the Contractor will be under the custody and responsibility of the Contractor and will be protected as required for new work.

.5 Protect plastic piping and tanks from ultraviolet light (sunlight) while in pre-construction. Plastic piping and tanks will not be installed exposed to sunlight without metal jacketing to block ultraviolet rays.

1.8 Penetrations (22 05 00)

.1 Any or all cutting, coring and patching shall be verified with the owner prior to performing work. Payment for such services shall be the responsibility of the contractor. Any penetration of structural members, floors or ceilings to be approved in writing by the structural engineer of record.

.2 This division shall prepare sleeving drawings indicating the size and locations of openings required in concrete floor slabs, roof slabs decks and walls for review by the structural engineer & architect.

.3 Contractors shall notify the owner or general contractor (and other contractors who are involved) of all openings, foundation work, hangers, inserts, anchors, or other provisions necessary in their work for the installation of his work, and shall furnish all information and necessary materials in ample time so that proper provisions can be made for same, and shall supply & correctly, accurately place all inserts, sleeves, anchors, etc.

.4 Failure to comply with these requirements on the part of this contractor will render him responsible for the cost of cutting openings, installing hangers and other provisions at a later date, and the subsequent patching, etc., thereby required.

.5 No cutting shall be done without permission. all such work shall be done by tradesmen skilled in and certified for this particular trade.

.6 All penetrations to be approved by the architect or landlord in writing.

.7 Any exterior penetration to be appropriately flashed and weather proofed with approved sealing methods.

.8 Pipe penetration sleeve materials will comply with all firestopping requirements for each penetration.

1.9 Access Doors (22 05 00)

.1 Supply access doors to give access to all plumbing work which may need maintenance, repair or shut off valves, cleanouts locations but which is concealed in inaccessible construction, except as otherwise specified herein or on the drawings.

.2 Access doors in fire rated construction are to be ULC listed and labeled and of a rating to maintain the fire separation integrity.

1.10 Fire Stopping (22 05 00)

.1 Where plumbing work penetrates fire rated construction, provide ULC listed and labeled firestopping and smoke seal materials installed in accordance with requirements of CAN-S115 (Ratings f, ft, fh, and fth as required), CAN/ULC-S101, and all other Governing Authorities to seal the penetrations.

1.11 Mounting Heights (22 05 00)

.1 If mounting height of plumbing fixtures are not specified or indicated, verify before proceeding with installation.

.2 For Barrier-free mounting heights for fixtures, conform to requirements of the Governing Code or Regulation.

.3 Coordinate and confirm the mounting heights with the architect prior to rough-in. Install plumbing fixtures at following heights unless indicated otherwise.

.1 Lavatory - wall hung - barrier free: 33" (840 mm) from finished floor to front rim of basin

.2 Lavatory - wall hung - standard: 31" (787 mm) to 33" (840 mm) from finished floor to front rim of basin

.3 Urinal - wall hung - barrier free: max. 17" (430 mm) from finished floor to front rim of basin, 19-3/8" (1000 mm) to center of basin

.4 Urinal - wall hung - standard: max. 24" (610 mm) from finished floor to front rim of basin

.5 Shower control - barrier free: 42" (1067 mm) from finished floor to center of valve

.6 Shower control - standard: 42" (1067 mm) from finished floor to center of valve

.7 Drinking fountain - barrier free: 30" (762 mm) from finished floor to orifice

.8 Drinking fountain - standard: 33" (838 mm) from finished floor to orifice

.9 Emergency eyewash station: water flow pattern is positioned between 33" (838 mm) & 53" (1346 mm) from finished floor

.10 Hose bib: 36" (914 mm) to 42" (1066 mm) from finished floor/ grade

.11 Non-freeze hydrant: 36" (914 mm) to 42" (1066 mm) from finished floor/ grade

1.12 Construction Schedule (22 05 00)

.1 Owner (or owner's representative) to provide the engineer with accurate construction schedule at the outset of construction and include updates as applicable.

.2 This contractor shall schedule & perform his work to meet the completion schedule, noted above, as set out by the client.

1.13 Changes Or Revisions & Extras (22 05 00)

.1 No additional money over the contract price shall be paid unless an approved change order is issued by the engineer.

.2 Officially issued Site Instructions (SI) are not subject to pricing from the Contractor. If the Contractor feels that the Item warrants an additional cost to the project, the contractor shall notify the engineer in writing prior to pricing the item.

.3 Contractor to provide pricing on all official Change Orders in the format requested based on the specific Item numbers listed on the official change request document.

One price for each Item Listed. Pricing to include all labour and materials required for the scope requested. Claims for extras shall be submitted with a complete breakdown of material, labour, hourly rates, etc.

.4 The engineer will not necessarily approve pricing based upon industry price guides such as "Allpriser" or similar method. Pricing will be reviewed based on fair market conditions. Contractor to provide change order pricing in a timely manner for engineer's review. No work shall proceed until official written acceptance is issued by the engineer.

.5 There shall be no extra claim for relocation of any equipment, fixtures within 10 feet from the original location.

.6 Whenever the consultant proposes in writing to make a change or revision to the design, arrangement, quantity or type of any work from that required by the contract documents, prepare and submit to the consultant for approval, a quotation being the plumbing contractor's proposed cost for executing the change or revision.

1.14 Shop Drawings (22 05 00)

.1 Based on the contract with the owner, the engineer will review shop submission drawings from the contractor to review the items for general conformity to the design drawings.

.2 These shop drawings shall include but not limited to plumbing fixtures, plumbing devices, piping & accessories. Allow a minimum of 5 business days to return reviewed shop drawings. (Based on complexity).

.3 The plumbing contractor shall be responsible for verifying all dimensions. The engineer's review of shop drawings shall be for general design only & shall not relieve the plumbing contractor or supplier from their responsibility for errors, proper fitting, and construction of the work and furnishing of materials. The review shall not be construed as approving departures from the contract document requirements if such departures are not specifically noted in a covering letter accompanying such drawings.

.4 Failure to comply with shop drawings review procedure resulting in the contractor taking full responsibility for the system performance, durability and permit closure acceptance.

.5 Although every effort has been made to quantify the number of elements & fixtures required for the complete installation, the shop drawing review does not constitute any qualification of quantity required.

1.15 Substitutions (22 05 00)

.1 Fixture / Equipment substitutions, if initiated by the contractor, shall be made so as to ensure operating performance is not reduced. Re-review of specifications for substituted equipment may result in additional charges by this consultant. All correspondence for clarification of design features, specifications, and equipment substitutions shall be made in writing including approved shop drawings of new products. Allow for a 1 week response time from the consultant. Any additional costs related to equipment substitutions to be absorbed by the contract.

1.16 Plumbing Work Testing Requirements (22 05 00)

.1 Piping, fixtures or equipment shall not be concealed or covered until inspected & approved by the Authorized Inspection Agency & the Engineer. Provide written notice (two working days) to the consultant before tests.

.2 Satisfactorily perform all testing required by Governing Authorities, Codes and Regulation. Results of such tests shall conform to the requirements of the applicable Building Code and shall be to the satisfaction of the Authorized Inspection Agency & the Engineer.

.3 Any test results that do not meet the minimum requirements of the manufacturer, applicable Building Code, Authorized Inspection Agency & the Engineer shall be repaired in a method approved by the Engineer & retested at the expense of the contractor.

.4 Submit all test results to the engineer for approval.

.5 Refer to section 22 08 00 Commissioning of Plumbing

1.17 Cleaning And Waste Removal (22 05 00)

.1 Clean all plumbing fixtures, piping that has been exposed to construction dust & dirt, inside and out, prior to turn over to the owner. Equipment is subject to review by the engineer's representative and/or owner.

.2 Contractor is responsible for removing their own waste from the site. All re-usable materials shall be recycled

1.18 Demonstration Of The System (22 05 00)

.1 Demonstrate the function and operation of each system to the owner.

1.19 Project Closeout Submittals (22 05 00)

.1 Prior to application for substantial performance, submit all required items and documentation specified, including the following:

.1 Record "as-built" drawings: as-built drawings shall be clearly marked in red including all changes to the original tender drawings covered by addenda, change orders, field changes, job conditions, etc.

.2 All plumbing test reports required as described herein and in section 22 08 00 Commissioning of Plumbing

.3 Authority Having Jurisdiction inspection reports.

.4 A written warranty to be provided for a minimum of one year from the date of acceptance by the owner. Provide labour, material & services to correct all faults reported during the guarantee period.

PART 2. PRODUCTS

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Not Applicable

PART 3: EXECUTION

Not Applicable

END OF SECTION

Section 22 05 23 - General-Duty Valves For Plumbing Piping

PART 1. GENERAL

1.1 Scope of Work (22 05 23)

This section describes the requirements for general-duty valves for domestic water and sewer systems.

Gate valves.

Globe or angle valves.

Ball valves.

Check valves.

Plug cocks.

Eccentric plug valves.

Butterfly valves.

Drain valves.

Hose bibbs.

Strainers.

1.2 Reference Standards (22 05 23)

.1 Conform to the requirements of ANSI, ASTM, ASME, and applicable MSS standards.

1.3 General Design Specifications (22 05 23)

.1 See dwg schedules for valve specifications

.2 Valve Materials

.1 Bronze: to ASTM B62

.2 Brass : to ASTM B283 C3770

.3 Cast Iron: to ASTM A126, Class B

.4 Forge Steel: to ASTM A105N

.5 Cast Steel: to ASTM A216WCB

.6 Stainless Steel: to ASTM A351 CF8M

.7 Lead Free to : ASTM C89530 (Bronze), ASTM C46750 (Brass), ASTM DS-561 C28500AB (Brass) to > .25% lead content (NSF-61 / 372)

.3 Valve Markings: All pressure ratings, manufacturers trademark and size to conform as per MSS-SP-25

1.4 Manufacturer (22 05 23)

.1 Provide valves of the same type by the same manufacturer throughout.

.2 Provide valves with manufacturer's name and pressure rating clearly marked on the outside of the valve body.

.3 Product shall carry valid CRN (Canadian Registration Number) issued by respective Provinces

1.5 End Connections (22 05 23)

.1 Threaded Ends to: ASME B1.20.1 Solder ends to: ASME B16.18

.2 Flanged ends to: ASME B16.1 (Class 125) Face to Face dimensions to: ASME B16.10

.3 Flanged ends to: ASME B16.5 Butt Weld Ends to: ASME B.16.11

.4 Socket Weld Ends to: ASME B.16.11 Pex Ends ASTM F1807-08

.5 Pex F1960 Barb Ends

1.6 Testing and Design (22 05 23)

.1 MSS-SP-80-Bronze, Gate & Check Valves

.2 MSS-SP-110-Ball Valves

.3 MSS-SP-70,85,71-Cast Iron Gate, Globe & Check Valve MSS-SP-72-American Valve

.4 MSS-SP-67-Kitz, Toyo, Demco & WKM E, Butterfly Valves. API 602 - Forge Steel Valves (Design)

.5 API 598 - Cast Steel Valves, Forge Steel Valves (Testing) API 609 - WKM High Performance BFV

.6 API 600 - Cast Steel Valves (Design) NSF/ANSI61 - Drinking water Components

.7 NSF/ANSI 372 - Lead free (0.25% Max Lead Components) CSA/CGA 125G/3.16

1.7 Shop Drawings (22 05 23)

.1 Submit copies of valves "ordering schedule" for review before ordering valves.

.2 Submit detailed shop drawings clearly indicating make, model, size, pressure rating, materials of construction and intended service.

PART 2. PRODUCTS

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2.1 Domestic Hot & Cold-Water Service up to 200PSIG - Up to 50mm (2") (22 05 23)

Valve Type	Rating/Body	Products		
		Soldered	Threaded	Others
Gate Valves (Isolation Services)	860KPA (125PSIG) / 200 WOG Rating Bronze Body to ASTM - B62 Solid Wedge Disc, Bronze Trim	Non-Rising Stem: Kitz 41 Toyo 281 Rising Stem: Kitz 44 Crane Classic #154	Non-Rising Stem: Kitz 40 Toyo 280 Rising Stem: Kitz 24 Toyo 293 Crane classic #151	
Globe Valves (Throttling Service) - Lock Shields Available	860KPA (125PSIG) / 200WOG Rating Bronze Body to ASTM B62, Rising Stem Bronze Disc	Kitz 12 Toyo 212A Crane #155	Kitz 11 Toyo 211A Crane #152	

Globe Valves (Throttling Service) - Lock Shields Available	860KPA (125PSIG) / 200WOG Rating Bronze Body to ASTM B62, Rising Stem Composition Disc (PTFE)	Kitz 10	Kitz 03 Toyo 220	
Balancing Valves	2070KPA (300wog), Dezincification Brass Body ASTM C5330, Fixed orifice design, High- & Low-pressure metering points, Precision Position Indicators, Topset Handwheel Assembly	RWV 9519	RWV 9517	
Check Valves (Backflow Prevention) Horizontal & Vertical Service	860KPA (125PSIG) / 200 WOG Rating Bronze Body to ASTM B62, Bronze Trim, and Y Pattern Y - Pattern Swing	Kitz 23 Toyo 237 Crane #1342	Kitz 22 Toyo 236 Crane #37	EZ-PRESS: 200WOG MAX - Female Ends RWV #250EZ

Check Valves (Backflow Prevention) Horizontal & Vertical Service	860KPA (125PSIG) / 200 WOG Rating Bronze Body to ASTM B62, Bronze Trim, and Y Pattern Spring Loaded Checks	Kitz 26	Mass 700 Kitz 36	
Ball Valves (Isolation & Balancing)	1034KPA (150PSIG) / 600WOG Rating Brass and or Bronze Body, Full Port, PTFE Seats, Double O-Ring Design, or PTFE Packing, Chrome Plated Solid Bronze Ball, Lever Handle	Kitz 59 Toyo 5049A MAS B-2F MAS B-4 MAS BZ-4 MAS B-4-LL MAS B-4-SS-LL Kitz 68AM-LL Toyo 5044A-LH MAS B-4SE Kitz 58SE Toyo 5044SE Crane Capri ball valves	Kitz 58 Toyo 5044A MAS B-1F MAS B-3 MAS BZ-3 MAS B-3-LL MAS B-3-SS-LL MAS B-3-LL MAS B-3-SS-LL MAS B-3SE	Ez-press - 200wog - Max Female End RWV 5020, 2 1/2" To 4" 5020xlc Male Ends RWV 5023 Locking Han Kitz 69AM-LL Toyo 5049A-LH Stem Extens Kitz 59SE

Ball Valves (Isolation & Balancing)		#9322 or #9302		Toyo 5049SE
	Stainless Steel Ball & Stem	MAS BZ-4-SS (Bronze)	Kitz 68AM-LL MAS B-3-SS-LL MAS BZ-3-SS-250 (Bronze)	Kitz 68AM-LL (Note Lever Lock) MAS B-4-SS-LL
	Balancing Memory Stop	Kitz 59MS Toyo 5049MS MAS B-4MS	Kitz 58MS Toyo 5049MS MAS B-3MS	
	Wing Handles	Kitz 59W Toyo 5049W MAS B-2FW MAS B-4W	Kitz 58W Toyo 5044W MAS B-1FW MAS B-3W	
	Drain Ports	Kitz 69AD MAS B4D	Kitz 68AD MAS B3D	
	Compression End Services			MAS B5C
	Pex End (Astm F1807-08)			MAS B-1 PEX MAS B-1D PEX (Drain)

				MAS B-2PEX (copper x PEX)
	Pex End (F1960)			RWV 5070 (EZ Press)
	Cap & Chain	Kitz 69C	Kitz 68AC Toyo 5046 Kitz 16	

2.2 Domestic Hot & Cold-Water Service up to 200PSIG - 65mm (2-½" and Over) (22 05 23)

Valve Type	Body/Rating	Products		
Gate Valve	Cast Iron body to ASTM A126 Class B, Bronze Trim, OS & Y, Flanged 860KPA	Rising Stem Kitz 72 Toyo 421	Non Rising Stem: Kitz 75 Toyo 415	
Globes (Throttling Service)	Cast Iron Body to ASTM A126, Bronze	Rising Stem: Kitz 76 Toyo 400A		

65mm (2 1/2") & Over	Trim , OS & Y, Flanged 860KPA (125PSIG) /200 WOG Rating			
Balancing Valves	ANSI Class 125, 200wog, Flanged, Variable orifice Cast Iron Acrylic coating double regulating valve, provided plugged thread drains (1/4") for test points, (given unmounted)			RWV 9574P
Checks (Backflow Prevention)	Cast Iron body, to ASTM A126 Bronze Trim, Bolted Bonnet, Flanged 860KPA (125PSIG) /200 WOG Rating			Toyo 435A Kitz 78
Wafer Checks	Cast Iron Body, 316 SS Trim with Viton - A seat ring			Moygro W12A-16V

	860KPA (125PSIG) / 200 WOG Rating			
Double Door Check Valve 65mm (2 1/2") & Over	Cast Iron Body, SS Trim, Buna Seat, Double Disc Assembly 860KPA (125PSIG) / 200 WOG Rating			Mueller 71-AHH-3-H
Silent Check 65mm (2 1/2") & Over	Class 125, 200wog, Cast Iron Body, SS Trim, SS Seat, Spring Loaded Center Guided Disc.			Mueller: 101MAT Mueller: 105MAT (Globe Style)
Butterfly Valves (Isolation & Balancing) In Lieu Of Gate Valves 65mm (2 1/2") & Over	Butterfly valves shall be Lug style, Cast or ductile Iron Body, Aluminum Bronze disc, EPDM, linear, Stainless Steel stem, Valves shall have bubble tight shut-off to 200PSI when downstream Flanged	Lug: Kitz 6122EL Kitz 6122EG MAS L-D-4-A-E-LH MAS L-D-A-E-G Toyo 918BESL Toyo 918BESG	Wafer: Kitz 5122EL Kitz 5122EG MAS W-D-4-A-LH Toyo 917BESL Toyo 917BESG	

	is removed (full dead-end service). Valves 150mm (6") and smaller shall have lever operator, valves 1380KPA (200WOG) Pressure rating 200mm (8") and larger shall have manual gear operator.	DEMCO NE-SERIES 222XX-5-11435 1(285PSIG)		
Ball Valves In Lieu Of Gate Valves & Retrofits	2 1/2" To 10" Class 125, 200 WOG Flanged Ball Valves, Cast Iron, ASTM A126 CLASS B Body, epoxy coated, 316 SS Stem, PTFE Fused Ball, RPTFE seats, seals and packing. Full port up to 6" ISO 5211 actuator mounting, locking lever operated, or gear operated.			American Valve 4000

	2 1/2" To 8", same as above but full port, EPDM O-Ring packing. Tapped & plugged boss for venting or draining downstream side.			American Valve 3700
	Cast Iron Body, Bolted Cover, Y-Pattern, S.S. Screen with 1/32 Perforation, Flanged 860KPA (125PSIG) / 200 WOG Rating			Mueller 758 Kitz 80 Toyo 381

2.3 Compressed Air (22 05 23)

Valve Type	Body/Rating	Products
Ball Valves Isolation & Balancing	1034KPA(150PSIG)/600WOG Brass and or Bronze body, Full Port,PTFE Seats, Double "o" Ring design or	Threaded: Kitz 58 Toyo 5044A MAS B1F MAS B-3

Up To 50mm(2")	PTFE packing, Chrome plated, Solid Bronze ball, Lever handle.	MAS BZ-3-250*
Auto Relief Ball Valve Complete With Locking Handle	Flanged ball valves 2 1/2" to 10" with Cast Iron Body, Epoxy coated, Class 125/200WOG, Teflon Fused ball, RPTFE Seats, Seals and packing. Full port up to 6" ISO actuator mounting. Locking lever and Gear operated .	Toyo 5042 Kitz 68S American Valve 4000
	CLASS 150, Carbon Steel A216WCB Body, Stainless steel ball and stem, PTFE Seats and packing, Flanged , Lever or Gear operated	Kitz 150SCTDZM 2 Piece Body, Full Port Kitz 150SCTAZM 1 Piece Body, Reduced Port MAS F-150-CS-F-SS-FS-N 2 Piece Body, Full Port, Graphite Packing & Gasket MAS F-150-CS-R-SS-FS-N 1 Piece Body, Reduced Port , Graphite
Check Valves	1034KPA (150PSIG)/300WOG , Brass And Or Bronze Body, Spring Loaded	Threaded: MAS 700 Kitz 36

Cga Ball Valves	Up to 50mm (2") 1034kpa(150PSIG)/600WOG Rating, Brass and or Bronze body, Full port, PTFE seats, Double-o-Ring design, or PTFE packing, Chrome plated solid Bronze ball CSA/CGA 125G /3.16 Approved and lever handle	Threaded: Kitz 58 Toyo 5044A MAS B3
	65mm(2 1/2") & over Class 150, Carbon Steel A216WCB Body, S.S. Ball and Stem, RPTFE Packing and Gaskets, CSA/CGA 125G /3.16 Approved, Locking Lever and or Gear Flanged	Kitz 150SCTDZM 2 Piece Full Port Kitz 150SCTAZM 1 piece

2.4 Potable Water, Hot & Cold (Lead Free) Service – Up to 200 PSIG (22 05 23)

Valve Type	Body/Rating	Products		
		Soldered	Threaded	Others
Gate Valves - Up To 50mm (2”)	Non-MSS-SP 80, alternate option if Gate valves are not required, 860KPA (125PSIG) /200WOG Rating Non rising Stem, lead free less than .25%, cast Bronze, screwed over bonnet	Kitz 827 Toyo 207A-LF	Kitz 828 Toyo 206A-LF	
Globe Valves Lock Shields Available - Up To 50mm (2”)	860 KPA (125PSIG), 200WOG Rating, lead free less than .25%, cast Bronze, metal disc	Kitz 812 Toyo 212-LF	Kitz 811 Toyo 211-LF	
Balancing Valves - Up To 50mm (2”)	860KPA(125PSIG), 300WOG Rating, lead free less than .25% brass body, fixed orifice design,	RWV 9519-AB	RWV 9517-AB	

	Precision Adjustable Handwheel, Integral Memory Stop			
Check Valves - Up To 50mm (2”)	860KPA(125PSIG), 200WOG Rating, lead free less than .25%, Bronze body, swing type metal disc	Kitz 823, 823T (PTFE DISC) Toyo 237A-LF	Kitz 822,822T (PTFE DISC) Toyo 236A-LF 236T-LF (PTFE DISC)	
Check Valves For 65mm (2 1/2") And Over	Class 150 Stainless Steel A531 CF8M bodies and Trim, PTFE gaskets, bolted cover Flanged ends.			Kitz 150UOAM
Wafer Checks	Single Flapp			MOYGRO W15A-666
	Double Door			Mueller 72-HHH-H-H POWELL 3070YMO
Silent Check Valves -				MUELLER 101MHT

Center Guided				(Wafer) MUELLER 105MHT (Globe Style)
Ball Valves (Isolation And Balancing) Up To 50mm(3")	1034KPA (150PSIG) 600WOG, Lead free less than .25% brass body, Full port, PTFE packing or Double"O" Ring design, Blow Out proof stem, Solid vented Ball, lever handle	Kitz 859, 859W (Wing Handle only only to 2"), Toyo 5049-LF	Kitz 858, 858W (Wing Handle only to 2"), Toyo 5044-LF	
	Ptfe Packing, Chrome Plated Solid Ball	MAS B-4LF	MAS B-3LF	
	Stainless Steel , Solid Ball, Locking Lever Handle	Kitz 869AM-LL	Kitz 868AM-LL	
	Cap And Chain	Kitz 869C	Kitz 868C Toyo 5046-LF	
	Drain Ports	Kitz 869AD	Kitz 868AD	
	Compression End			MAS B5C-LF

	Pex End Astm F1807-08			MAS B-1PEX-LF MAS B-1DPEX-LF (Drain)
	Pex F1960 Barb End	RWV 5017AB, 5017AB-W (Wing Handle)	RWV 5015-AB, 501AB-W (Wing Handle)	
	Ez Press System (Dual Crimp Ends)			RWV 5020-AB
	Ez Grip Push Fit			RWV 5070-AB
Ball Valves	2 1/2" to 10" Class 125, 200 WOG, Lead Free Flanged Full Port Ball Valves, Cast Iron ASTM A126 epoxy coated, 316 S.S.Stem, PTFE Fused Ball, RPTFE seats, EPDM O-Ring packing, Tapped & plugged boss Class B Body,for venting or			American Valve 3700

	draining downstream side, lever operated or gear operated.			
Butterfly Valves 65mm (2 1/2") And Over Nsf 372 Certified	1380 KPA (200WOG) Pressure rating, Butterfly valves shall be Lug style, Cast or ductile Iron Body, Aluminum Bronze Disc, EPDM linear, Stainless Steel Stem. Valves shall have bubble tight shut-off to 200psi when downstream flange is removed (full dead-end service). Valves 150mm(6") and smaller shall have lever operator, valves 200mm(8") and larger shall have manual gear operator.			Lever handle to 150mm(6") Kitz 6122EL MAS L-D-4-A-E-LH Gear Operator 200mm(8") and over Kitz 6122EG MAS L-D-4-A-E-G

2.5 Potable Water, Hot & Cold (Lead Free Alternative) – From 1380 KPA (200PSI) to 3440KPA (500PSIG) Working Pressure (22 05 23)

Valve Type	Body/Rating	Products	
Gate Valves	Class 300, 720 PSIG, Stainless Steel A351 CF8M Body and Trim, OS & Y, PTFE packing and gasket	1/2" to 2" (Threaded Ends) Kitz AK300Umm	2 1/2" and over (Flanged Ends) Kitz 300UMHAM
Globe Valves	Class 300, 720PSIG, Stainless Steel A351 CF8M Body and Trim, OS & Y, PTFE packing and gasket	1/2" to 2" (Threaded Ends) Kitz AK300UPM	2 1/2" and over (Flanged Ends) Kitz 300UPAM
Check Valves	Class 300, 720PSIG, Stainless Steel A351 CF8M Body and bolted cover, PTFE gasket, Swing type	1/2" to 2" (Threaded Ends) Kitz AK300UOM	2 1/2" and over (Flanged Ends) Kitz 300UOAM
Wafer Checks		Single Flapper : MOYGRO W30A-666	Double Door: Mueller 74-HHH-H-H POWELL 3070YMO

Silent Check - Center Guided		Wafer: Mueller 103MHT	Globe Style: Mueller 109MHT
Ball Valves	1/2" TO 3" , 1000PSIG, full port 2 piece Stainless Steel A351CF8M Body & Ball, Full Port, RPTFE Packing and seats, Threaded Ends.	MAS G-2E	
	Class 300, 720PSIG, 2-piece Stainless Steel A351CF8M Body & Ball, Full Port, Hypatite Seat or PTFE, PTFE Packing and gasket, 2 1/2" and over (Flanged)	Kitz 300UTDZM MAS F-300-SS-FS-N	
High Performance, Butterfly Valves (For Isolation And	Class 300, 720PSIG, Lug Style, Double offset eccentric design, Stainless Steel A351CF8M Body and Disc, RPTFE Seat, Packing and gasket. Valve	WKM B5323-02-S02-11-HL (Lever Handle) WKM B5323-02-S02-11-G (Gear Operated)	

Balancing) In Lieu Of Gate, Ball And Globe Valves	shall be (Bi-directional), bubble tight shut-off to the full ANSI Rating, with the downstream flange removed	POWELL 3072QMRT	

2.6 Natural Gas Systems (22 05 23)

.1 Plug Cocks: Class 125 non-lubricated parallel-plug valve, cast iron body and plug, short pattern, regular port, full bore, threaded or flanged ends, CGA approved.

.2 Ball valves up to 50 mm: Class 125 non-lubricated ball valves suitable for outdoor use, brass body, CGA approved Section 3.16 threaded ends, Kitz Fig. #68 (AKTAF).

.3 Ball valves 65 mm and larger: Flanged, carbon steel body, stainless steel trim, lever operated, Teflon seats and seals. Kitz Fig. 150SCTB-N.

2.7 Valve Operators (22 05 23)

.1 Provide suitable hand wheels for gate, globe or angle, radiation and drain valves and inside hose bibbs.

.2 Provide one plug cock wrench for every ten plug cocks sized 50 mm and smaller, minimum of one. Provide each plug cock sized 65 mm and larger with a wrench, with set screw.

.3 Provide valves larger than 100 mm located more than 2.1 m from floor in equipment rooms with chain operated sheaves. Extend chains to 1.5 m above floor and hook to clips to arrange to clear walking aisles.

2.8 Strainers (22 05 23)

.1 Size 50 mm and under: Screwed brass or iron body, Y pattern with 0.75 mm stainless steel perforated screen.

.2 Size 65 mm to 100 mm: Flanged iron body, Y pattern with 1 mm stainless steel perforated screen.

.3 Size 125 mm and larger: Flanged iron body, Y pattern with 3 mm stainless steel perforated screen.

.4 Screen free area shall be minimum three times area of inlet pipe.

2.9 Triple Duty Valve (22 05 23)

.1 For base mounted or vertical inline pump discharge application, performs the functions of a nonslam check valve, throttling valve, shut-off valve and calibrated balancing valve. Equip with brass readout valves (with integral check valves) to read differential pressure across valve. Cast iron, bronze seat, replaceable bronze disc with EPDM insert.

.1 Up to 50 mm: NPT connections, 1200 kPa working pressure, brass stem, chatter preventing SS spring.

.2 Over 50 mm: Flanged connections, 860 kPa rated, stainless steel stem and chatter preventing spring.

2.10 Suction Diffuser (22 05 23)

.1 For base mounted or floor mounted vertical inline pumps where scheduled. Cast iron construction; NPT connections up to 50 mm: flanged connections. Over 65 mm: cast iron straightening fitting, stainless steel combination diffuser -strainer - orifice cylinder with 4.8 mm perforations, and permanent magnet. Provided complete with a 16 mesh bronze strainer.

PART 3. EXECUTION

3.1 Installation and Application (22 05 23)

.1 Install valves with stem upright or horizontal, not inverted.

.2 Provide threaded lug type butterfly valves for equipment isolation service. Provide wafer or threaded lug type valves for zone shut-off service.

.3 Where permitted by codes, butterfly valves may be used in fire protection systems.

.4 Use eccentric plug valves in water systems for throttling/balancing service.

.5 Use memory radiator balancing valves in water and glycol systems terminal heat transfer unit balancing service. Radiant panels provide "circuit setter" valves on the return line for each central zone; and a ball valve for shut off service.

.6 Provide drain valves at main shut-off valves, low points of piping and apparatus and terminal units.

.7 Size drain lines and drain valves equal to size of apparatus drain connection.

.8 For pipe sizes 20 mm and over, minimum drain size to be 20 mm

.9 Provide hose thread connection with cap and chain for 20 mm drain valves located in ceiling and public areas.

.10 Provide male NPT nipples with threaded pipe cap for drain sizes over 20 mm where not piped directly to floor drains.

.11 Provide valved drain and hose connections off the bottom of all strainers.

3.2 Joint Construction (22 05 23)

.1 Grooved Joints: Assemble joints with keyed coupling housing, gasket, lubricant, and bolts according to coupling and fitting manufacturer's written instructions.

.2 Soldered Joints: Use ASTM B 813, water-flushable, lead-free flux; ASTM B 32, lead-free-alloy solder; and ASTM B 828 procedure, unless otherwise indicated.

3.3 Adjusting (22 05 23)

.1 Adjust or replace valve packing after piping systems have been tested and put into service but before final adjusting and balancing. Replace valves if persistent leaking occurs.

END OF SECTION

Section 22 05 29 - Hangers and Supports for Plumbing Piping and Equipment

PART 1. GENERAL

1.1 Scope of Work (22 05 25)

.1 Pipe hangers and supports.

.2 Pipe anchors.

1.2 Related Sections (22 05 25)

.1 Section 22 10 00 - Plumbing Piping and Pipe Fittings

1.3 Referenced Codes & Standards (22 05 25)

.1 Pipe supports shall meet the requirements of current edition of ANSI B31.3, Process Piping.

1.4 General Requirements (22 05 25)

.1 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.

.2 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.

.3 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.

.4 Fasten hangers and supports to building steel or inserts in concrete construction.

.5 Provide and set sleeves required for equipment, including openings required for placing equipment. Provide sleeves for all pipe penetrations through walls, ceilings, floors and footings.

.6 Dielectrically isolate dissimilar metals.

.7 Obtain approval from the Consultant prior to drilling for inserts and supports for piping systems.

.8 Obtain approval from the Consultant prior to using percussion type fastenings.

.9 Use of piping or equipment for hanger support is not permitted.

.10 Use of perforated band iron, wire or chain as hangers is not permitted.

.11 Do not weld piping or equipment supports to building metal decking or building structural steel supports unless prior written approval has been obtained from the Consultant and Structural Consultant.

.12 Use components for intended design purpose only. Do not use for rigging or erection purposes.

.13 Where deemed necessary by the Consultant the contractor shall, at his own cost, employ a structural consultant to design equipment supports and/or pipe anchors.

1.5 Submittals (22 05 25)

.1 Submit shop drawings of each factory-manufactured component.

PART 2. PRODUCTS

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2.1 Inserts (22 05 25)

.1 Install inserts required for attachment of hangers, either for suspension of piping or equipment.

2. For masonry or poured concrete construction use expansion type units. Insert into concrete after concrete has cured. Anchors or inserts installed by explosive means shall not be used.

.3 Inserts shall be malleable iron case or galvanized steel shell and expander plug for threaded connection with lateral adjustment, top slot for reinforcing rods, lugs for attaching to forms.

.4 Size inserts to suit threaded hanger rods.

2.2 Pipe Hangers and Supports (22 05 25)

.1 Hangers: Pipe sizes 15 mm to 40 mm: Adjustable wrought steel ring.

.2 Hangers: Pipe sizes 50 mm to 100 mm and Cold Pipe Sizes 150 mm and Over: Adjustable wrought steel clevis.

.3 Hangers: Hot Pipe Sizes 150 mm and Over: Adjustable steel yoke and cast iron roll.

.4 Multiple or Trapeze Hangers: Steel channels with welded spacers and hanger rods, cast iron roll and stand for hot pipe sizes 150 mm and over.

.5 Wall Support: Pipe Sizes to 80 mm: Cast iron hook.

.6 Wall Support: Pipe Sizes 100 mm and Over: Welded steel bracket and wrought steel clamp, adjustable steel yoke and cast iron roll for hot pipe sizes 150 mm and over.

.7 Vertical Support: Steel riser clamp.

.8 Floor Support: Pipe Sizes to 100 mm and All Cold Pipe Sizes: Cast iron adjustable pipe saddle, locknut nipple, floor flange and concrete pier to steel support.

.9 Floor Support: Hot Pipe Sizes 125 mm and over: Adjustable cast iron roll and stand, steel screws and concrete pier or steel support.

.10 Install hangers so they cannot become disengaged by movements of supported pipe.

.11 Provide copper plated hangers and supports for copper piping or provide sheet lead packing between hanger or support and piping. Provide galvanized hangers and supports for galvanized piping.

.12 Support all piping below grade and under floor slabs in 3.2 mm continuous cadmium plated channel. Support channel with cadmium plated clevis hangers and rods. Install supports on centres as specified in 3.2. Extend cadmium-plated hanger rods 450 mm above slab rebar and bend back over rebar so as to provide a minimum of 450 mm of support in slab. Do not stress the rod when bending.

2.3 Hanger Rods (22 05 25)

.1 Provide steel hanger rods, threaded both ends, threaded one end, or continuous threaded.

2.4 Sleeves (22 05 25)

.1 Pipes through Floors: Form with 1.2 mm galvanized steel.

.2 Pipes through Beams, Walls, Fire Proofing, Footings, Potentially Wet Floor: Form with steel pipe or 1.2 mm thickness galvanized steel.

.3 Ducts: Form sleeves with galvanized steel.

.4 Size large enough to allow for expansion with continuous insulation.

2.5 Pipe Seals (22 05 25)

.1 Provide a “Link-seal” pipe sealing system when passing through room foundation walls.

2.6 Finishes on Hanger Rods, Hangers and Supports (22 05 25)

.1 All steel hanger rods, hangers and supports shall be galvanized or factory primed with alkyd red oxide primer to CGSB 1-GP-40m.

2.7 Miscellaneous Steel (22 05 25)

.1 Supply and install miscellaneous structural supports, platforms and braces as may be required to hang or support piping unless Drawings or other Sections of Specifications state otherwise

.2 Use welded construction wherever practicable, with bolted joints allowed for field assembly using high strength steel bolts. Chip welds to remove slag, and grind smooth.

PART 3. EXECUTION

3.1 General Construction Requirements (22 05 25)

.1 Use welding studs of size not larger than 10 mm (3/8") for attaching miscellaneous materials and equipment to building steel. If the weight of materials or equipment require bolts or studs larger than 10 mm (3/8") dia, use steel clips or brackets, secured to building steel by welding or bolting method of attachment as approved by Consultant.

.2 Use self drilling expansion type concrete inserts for securing miscellaneous equipment and materials to masonry or concrete construction already in place, of sufficient number and size to prevent concrete from breaking away. Use of powder or power actuated fasteners will not be allowed unless prior written approval is obtained from Consultant.

.3 Support rods for any suspended item must not be attached to or extended through steel pan type roofs or through concrete slab roofs.

.4 Provide beam clamps of 2-bolt design and of such type that rod load is transmitted only concentrically to beam web centreline. Use of "C" and "I" beam side clamps and other similar items will not be allowed without written consent of Consultant.

.5 Where roof or floor framing consists of open web or long span steel joists, ensure that hangers are located at or within 150 mm (6") of joist top or bottom chord panel points, otherwise provide additional structural steel as required where hanger spacing does not coincide with joist spacing. Design suspension assembly such that hanger load is transmitted only concentrically to supporting joist. Do not use "C" and

"I" beam side clamps, brackets and other similar, without written consent of the Consultant.

3.2 Inserts (22 05 25)

.1 Use inserts for suspending hangers from reinforced concrete slabs and sides of reinforced concrete beams wherever practicable.

.2 Set inserts in position in advance of concrete work. Provide reinforcement rod in concrete for inserts carrying piping over 100 mm or ducts over 1500 mm wide.

.3 Where concrete slabs form finished ceiling, finish inserts flush with slab surface.

.4 Where inserts are omitted, drill through concrete slab from below and provide rod with recessed square steel plate and nut above slab.

3.3 Pipe Hangers and Supports (22 05 25)

.1 Support horizontal steel and copper piping as follows:

Nominal Pipe Size	Distance Between Supports		Hanger Rod Diameter
	Steel	Copper	
15 mm	1.8 m	1.5 m	10 mm
20 mm to 40 mm	2.1 m	1.8 m	10 mm
50 mm & 65 mm	3.0 m	2.4 m	10 mm
80 mm & 100 mm	3.6 m	3.0 m	16 mm
150 mm to 300 mm	4.2 m	4.0 m	22 mm
350 mm to 450 mm	6.0 m		25 mm

.2 Install hangers to provide minimum 12 mm clear space between finished covering and adjacent work.

.3 Place a hanger within 300 mm of each horizontal elbow.

.4 Use hangers which are vertically adjustable 40 mm minimum after piping is erected.

.5 Support horizontal soil pipe near each hub with 1.5 m maximum spacing between hangers.

.6 Support vertical piping at every other floor. Support vertical soil pipe at each floor at hub.

.7 Where several pipes can be installed in parallel and at the same elevation, provide multiple or trapeze hangers.

.8 Where practical, support riser piping independently of connected horizontal piping.

.9 Use oversized hangers to accommodate pipe insulation thickness. For pipes up to 50 mm use high density rigid pipe insulation at hanger location, with an insulation protection shield. For pipes 65 mm and over, use an insulation protection saddle.

3.4 Sleeves (22 05 25)

.1 Set sleeves in position in advance of concrete work. Provide suitable reinforcing around the sleeve.

.2 Extend sleeves through potentially wet floors 25 mm above finished floor level. Caulk sleeves are full depth and provide floor plates.

.3 Piping and ductwork passing through floor, ceiling or wall, close off space between duct and sleeve and non-combustible insulation. Provide tight fitting metal caps on both sides and caulk.

.4 Piping passing through the mechanical room floor, roof or wall, closes off space between pipe and sleeve with synthetic rubber compound mechanical type seals.

.5 Sleeves provided through walls or floors where liquids could potentially pass from one side to the other, provide sleeves with a 25 mm "flange" welded to the external face of the sleeve at the mid point of the thickness of the structure to provide a water stop.

.6 Install chrome-plated escutcheons where piping passes through finished surfaces.

3.5 Anchors and Guides (22 05 25)

.1 Supply and install anchors where indicated on Drawings and/or as required to maintain permanent location of pipelines. Construct anchors for steel or galvanized pipe of approved steel straps and/or rods and for anchoring copper lines use copper plated anchors or provide insulation bands between tubing and clamps if steel straps or rods are used. Install anchors and guides in an approved manner.

.2 Acceptable Materials:

Crinnell

Myatt

Crane

Adsco

Hunt

Approved Alternate

END OF SECTION

Section 22 05 53 - Identification For Plumbing Piping And Equipment

PART 1: GENERAL

1.1 Scope of Work (22 05 53)

.1 Equipment labels.

.2 Pipe labels.

.3 Valve tags.

.4 Warning tags.

1.2 General Requirements (22 05 53)

.1 Conform To Section 01 00 00, General Requirements.

.2 Conform To Section 01 33 23, Shop Drawings, Product Data, And Samples.

.3 Conform To Section 22 00 00, Plumbing General

.4 Conform To Section 22 11 00, Facility Water Distribution

.5 Conform To Section 22 13 00, Facility Water Sanitary Sewerage

.6 Conform To Section 22 14 00, Facility Storm Drainage

.7 Conform To Section 22 40 00, Plumbing Fixtures

1.3 References (22 05 53)

.1 ASME A13.1 - Scheme for the Identification of Piping Systems.

1.4 Submittals (22 05 53)

.1 Submittals, including number of required copies, shall be submitted in accordance with Section 01 33 23, Shop Drawings, Product Data, And Samples.

.2 Information and material submitted under this section shall be marked “Submitted Under Section 22 05 53, Identification for Plumbing Piping and Equipment, with applicable paragraph identification.

.3 Manufacturer's Literature and Data including: Full item description and optional features and accessories. Include dimensions, weights, materials, applications, standard compliance, model numbers, size, and capacity.

.4 All items listed in Part 2 - Products.

.5 Complete operating and maintenance manuals including wiring diagrams, technical data sheets and information for ordering replacement parts:

.1 Include a complete list indicating all components of the systems.

.2 Include complete diagrams of the internal wiring for each item of equipment.

.3 Diagrams shall have their terminals identified to facilitate installation, operation and maintenance.

1.5 Quality Assurance (22 05 53)

.1 Manufacturer Qualifications: Company specializing in manufacturing products specified in this section with minimum five years documented experience

.2 Installer Qualifications: Company specializing in performing Work of this section with minimum five years documented experience.

.3 ASME Standards: Comply with ANSI/ASME A13.1 for color scheme, lettering size, length of color field, and viewing angles of identification devices.

1.5 Coordination (22 05 53)

.1 Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.

.2 Coordinate installation of identifying devices with locations of access panels and doors.

.3 Install identifying devices before installing acoustical ceilings and similar concealment.

1.6 Work Included (22 05 53)

.1 Furnish and install nameplates, valve tags, valve charts, and pipe markers on all Plumbing equipment, and piping.

.2 Provide nameplates with the unit number and service designation on all plumbing equipment.

.3 Indicate all valve tag numbers on Record Drawings and submit framed under glass valve tag charts including valve service and location.

.4 Install color coded ceiling tacks in acoustical tile ceilings or color coded tape on ceiling grid to identify location of equipment, valves and dampers that require regular maintenance or are part of a life safety system (fire dampers, smoke dampers, sprinkler valves or main isolation valves).

.5 Concealed fire protection valves shall be marked by red label triangles (3" equilateral) and circle dots (1" diameter). Triangles shall be placed on the wall nearest the valve with the apex pointing toward the ceiling tile. Dots shall be placed on the border of ceiling tile.

.6 Provide underground plastic pipe markers 6 to 8 inches below finish grade, directly above buried pipes.

.7 Prepare valve charts and frame under glass. All valves and the tag numbers shall be shown on the Record As-Built Drawings.

.8 Provide valve computer database to match chart.

.9 Prepare and install exterior protected brass plaques indicating underground service entrances.

PART 2: PRODUCTS

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2.1 General (22 05 53)

.1 Acceptable manufactures contingent on compliance with the specification.

.1 Seton

.2 Brady Corporation

.3 Marking Services Canada

2.2 Equipment Nameplates (22 05 53)

.1 Equipment nameplates shall be 3” x 6” long, 0.02” aluminum with a black enamel background with engraved natural aluminum letters similar to Seton Style 2065-20. Nameplate shall have pressure sensitive taped backing.

.2 The nameplate shall contain the unit or equipment designation (“AHU” for air handling unit, “P” for circulating pump, etc.), unit number and area or system served.

.3 Nameplates for exterior equipment shall be applied with waterproof adhesive.

2.3 Pipe Identification And Valve Tags (22 05 53)

.1 All piping, except that piping which is within inaccessible chases, shall be identified with semirigid plastic identification markers equal to Seton Setmark pipe markers.

.1 Direction of flow arrows are to be included on each marker.

.2 Each marker background shall be appropriately color coded with a clearly printed legend to identify the contents of the pipe in conformance with the “Scheme for the Identification of Piping Systems” (ASME A13.1).

.3 Setmark snap-around markers shall be used for overall diameters up to 6” and strap around markers shall be used above 6” overall diameters.

.4 Markers shall be located:

.1 Adjacent to each valve

.2 At each branch

.3 At each cap for future

.4 At each riser takeoff,

.5 At each pipe passage through wall (each side)

.6 At each pipe passage at 20’ – 0” intervals maximum.

.7 At each piece of equipment.

.8 At all access doors.

.9 A minimum of one (1) marker shall be provided at each room.

.5 Underground pipe markers:

.1 Provide detectable tape on all underground piping:

.2 Labels shall be color coded and labeled the same as indoors.

.2 Valve tags

.1 All valves shall be designated by distinguishing numbers and letters carefully coordinated with a valve chart. Valve tags shall include what room(s) the valve serves and piece of equipment served.

.2 Valve tags shall be color coded 0.032” anodized aluminum tags, with engraved letters similar to Seton S Type 250-BL or approved equal.

.1 HVAC tags shall be round 2” diameter, similar to Seton 15426.

.2 Plumbing tags shall be square 2” x 2” similar to Seton 42769.

.3 Fire Protection tags shall be square 2” x 2” similar to Seton 42769 RED.

.4 Lettering shall be ¼” high for type service and ½” for valve number. Tag shall indicate service and valve number.

.5 Each service shall be a different color.

.3 Tag shall be attached to valves with chains similar to Seton No 16 stainless steel jack chain.

.4 Whenever a valve is above a hung ceiling, the valve tag shall be located immediately above the hung ceiling.

.5 Provide a tag for every value except:

.1 Perimeter radiation shut-off valves that are located at the finned tube radiation element within the accessible (from the space) heating enclosure

.3 Furnish a minimum of two (2) typed valve lists

.1 Each framed under glass or Plexiglas. Each chart shall be enclosed in an approved 0.015” thick plastic closure for permanent protection.

.2 Valve numbers shall correspond to those indicated on the Record Drawings and on the printed valve lists.

.3 The printed list shall include the valve number, location and purpose of each valve.

.4 It shall state other necessary information such as the required opening or closing of another valve when one valve is to be opened or closed.

.5 Printed framed valve lists shall be displayed in each Mechanical Room or in a location designated by Northwestern University.

.4 Valve database.

.1 Provide a valve data base for all valves to operate on the building computer.

.2 Every valve shall include:

Tag Number

Service (Hot water, Chilled water, Sprinkler, etc.)

Size

Operation

Location

Manufacture

Model number

Submittal reference

2.4 Utility Entrance Designations (22 05 53)

.1 Provide a brass wall plaque, minimum 0.020” thickness, secured to the exterior wall just above the grade line for all buried service entrances or exits. Samples are: Water Service Below; Gas Service Below; Sanitary Sewer Below; Storm Sewer Below; Irrigation Water Below; etc.

.2 Ceiling Tacks or Tape.

.3 Provide steel color coded 3/4 inch diameter ceiling tacks in acoustical tile ceilings or color coded tape applied to ceiling grid to locate equipment, valves or dampers that require regular maintenance or are part of a Life Safety System.

.4 The tacks or tapes shall be color codes as follows:

Yellow – HVAC

Red – Life Safety (fire dampers, sprinkler valves, etc.)

Green - Plumbing Valves.

Blue – Heating/Cooling Valves.

PART 3. EXECUTION

3.1 Preparation (22 05 53)

.1 All surfaces shall be cleaned and insulated (if applicable) prior to installing any identification.

.2 Exterior surfaces of outdoor equipment shall be dry and prepared to accept the specified identification.

3.2 Installation (22 05 53)

.1 Install nameplates with corrosive-resistant mechanical fasteners, or adhesive. Apply with sufficient adhesive to ensure permanent adhesion. Seal with clear lacquer.

.2 Install valve tags with chains.

.3 Install plastic pipe markers in accordance with manufacturer’s Instructions.

.4 Install plastic tape markers complete around the pipe in accordance with the manufacturer's instructions.

.5 Install underground plastic pipe markers 6 to 8 inches below finished grade, directly above buried pipe.

.6 Identify air handling units, pumps, domestic hot water heaters, fire pumps, heat transfer equipment tanks, water treatment devices, etc. with plastic nameplates. Small devices, such as in-line pumps, may be identified with tags.

.7 Identify control panels and major control components outside panels with plastic nameplates.

.8 Install detector tape on all underground services in accordance with the manufacturer's recommendations.

.9 Identify thermostats relating to air handling equipment serving multiple spaces.

.10 Identify valves in main and branch piping with valve tags.

.11 Tag automatic controls, instruments and relays. Key to control schematic.

.12 Identify piping, concealed or exposed, with pipe markers or where buried using plastic tape pipe markers. Use tags on piping ¾ inch diameter and smaller. Identify service, flow direction and pressure. Install in clear view and align with axis of piping. Locate identification not to exceed 20 feet on straight runs including risers and drops, adjacent to each valve and Tee, at each side of penetration of structure or enclosure, and at each obstruction.

3.3 Disinfection (22 05 53)

.1 After tests have been successfully completed, thoroughly flush and sterilize the interior domestic water distribution system in accordance with AWWA C651.

.2 Use liquid chlorine or hypochlorite for sterilization.

.3 Flush out, disinfect, rinse and chlorinate system to requirements of authority having jurisdiction approval of Consultant and Local Plumbing Inspector. Provide laboratory test reports on water quality for Consultant approval.

3.4 Testing & Quality Assurance (22 05 53)

.1 Test all pipes and joints in accordance with Applicable Building Code - Plumbing Code and to local Authority requirements.

.2 Pressure test buried system before backfilling.

.3 Refer to section 22 08 00 - Commissioning of Plumbing

END OF SECTION

Section 22 07 19 - Plumbing Piping Insulation

PART 1. GENERAL

1.1 Scope of Work (22 07 19)

Piping insulation.

Adhesives, tie wires, tapes.

Recovering.

1.2 Related Section (22 07 19)

.1 Section 22 10 00 - Plumbing Piping and Pipe Fittings.

1.3 Job Conditions (22 07 19)

.1 Deliver material to the job site in original non-broken factory packaging, labeled with manufacturer's density and thickness.

.2 Perform work at ambient and equipment temperatures as recommended by the adhesive manufacturer. Make good separation of joints or cracking of insulation due to thermal movement or poor workmanship.

1.4 Quality Assurance (22 07 19)

.1 Insulation shall be installed by skilled workmen regularly engaged in this type of work.

.2 Materials shall meet or exceed fire and smoke hazard ratings as stated in this section and defined in applicable building codes.

1.5 Alternatives (22 07 19)

.1 Alternative insulations are subject to review and acceptance by the Consultant. Alternatives shall provide the same or better thermal resistance at normal conditions as material specified.

1.6 Submittals (22 07 19)

.1 Shop Drawings: Before ordering any insulating materials, submit to the Consultant a list of proposed insulation materials, exterior jackets and adhesive for the various services and equipment on the project. Deviation from the approved list will not be allowed.

.2 Samples: Before ordering any insulation materials, prepare a sample board with a cross- section sample of all types of insulation, including exterior jacket, properly identified for the various services and equipment on the project and state types of adhesives used. Submit the sample board to the for his review and, after review and acceptance, the sample board will be kept in the site office for the duration of the project for reference. Deviation from the accepted samples will not be allowed.

PART 2. PRODUCTS

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2.1 Domestic Cold Water & Non-potable Water Piping (22 07 19)

.1 Fibrous glass split sectional pipe insulation of 25 mm (1") thickness with factory applied vapour barrier jacket and self-seal lap joint. Acceptable Products:

Manufacture	Products
Owens Corning Canada Inc.	High Temp 1200
Manson	Alley K with all purpose APT jacket
Fibrex Insulations Inc.	Fibrex Coreplus 1200

.2 Fire retardant elastomeric closed cell foam or neoprene tubing of 10 mm (3/8") nom. thickness may be used instead of fibrous glass insulation on cold water runouts to plumbing fixtures, not exceeding 1.5 m (5'-0") in length, applied in accordance with the manufacturer's printed instructions using the recommended adhesive. Acceptable Products:

Manufacture	Products

Armstrong	AP/Armaflex
Nomaco	Therma-Cel
Rubatex	R-1800

2.2 Domestic Hot Water, Domestic Hot Water Recirc (22 07 19)

.1 Fibrous glass split sectional pipe insulation of the thickness hereinafter specified with factory applied vapour barrier jacket and self-seal lap joint. Acceptable Products:

Manufacture	**Products**
Owens Corning Canada Inc.	High Temp 1200
Manson	Alley K with APT jacket
Fibrex Insulations Inc	Fibrex Coreplus 1200

.2 Hot Water Piping – Pipe Insulation Thickness

Fluid Design Operating	Insulation Conductivity	Pipe Size (mm and Insulation Thickness (mm)

Temperature °C	Conductivity W/m-K	Mean Rating Temp. °C	<25	25 to <40	40 to <100	100 to <200	>200
>177	0.046-0.049	121	64	76	76	102	102
122-177	0.042-0.046	93	38	64	76	76	76
94-121	0.039-0.043	66	38	38	51	51	51
61-93	0.036-0.042	52	25	25	25	38	38
41-60	0.032-0.040	38	13	13	13	25	25

.3 Fire retardant elastomeric closed cell foam or neoprene tubing of 10 mm (3/8") nom. thickness may be used instead of fibrous glass insulation on hot water runouts to plumbing fixtures, not exceeding 1.5 m (5'-0") in length, applied in accordance with the manufacturer's printed instructions using the recommended adhesive.
Acceptable Products:

Armstrong AP/Armaflex

Nomaco Therma-Cel

2.3 Sanitary, Storm Drain Piping & Condensate Drain (22 07 19)

.1 Insulate above floor storm and sanitary drain piping within the building, with fibrous glass split sectional pipe insulation of 25 mm (1") thickness with factory applied vapour barrier jacket and self-seal lap joint.

.2 Insulate vertical sections of rainwater conductors between the body of the roof drain and the horizontal section of the pipe in the same way, also any exposed vertical piping in high humidity areas such as locker and shower rooms.

Insulate exposed waste pipe of all handicapped lavatories with fibrous glass split sectional .3 pipe insulation of 25 mm (1") thickness with factory applied vapour barrier jacket and self-seal lap joint. Acceptable Products:

Manufacture	Products
Owens Corning Canada Inc.	High Temp 1200
Manson	Alley K all purpose with APT jacket
Fibrex Insulations Inc.	Fibrex Coreplus 1200

2.4 Equipment Drain Lines, Safety Valve Vents, Etc. (22 07 19)

.1 Insulate equipment drains carrying liquids at 38 C (100 F) or higher temperature, and safety valve vent piping to a height of 2.4 m (8 ft.) above any floor, step, catwalk,

or platform from which personnel would be within reach of such piping with 25 mm (1") thick insulation. Insulate heat pumps condensate drain lines with 25 mm thick pipe insulation. Acceptable Products:

Manufacture	Products
Owens Corning Canada Inc.	850 with ASJ
Manson	Alley K with APT jacket
Fibrex Insulations Inc.	Fibrex Coreplus 1200
Knauf	
Mineral Wool	
Owens Corning Canada Inc.	SSL II pipe Insulation
Fibrex Insulations Inc.	Fibrex Coreplus 1200 (metal jacket)

PART 3. EXECUTION

3.1 Installation (22 07 19)

.1 Perform insulation work using qualified insulation applicators, in accordance with latest trade application methods and to the Consultant approval.

.2 All coverings shall be applied in a neat, workmanlike manner so that the finished job is uniform in diameter, smooth in finish and all longitudinal seams shall be placed so as to be invisible. Insulation shall be applied and finished in strict accordance with insulation manufacturer's recommendations.

.3 All insulation shall be applied in a manner to facilitate replacing and/or servicing of equipment. All fittings, flanges, and valves on cold pipes shall be insulated to give a thickness equivalent to that on adjoining pipes.

.4 All insulation, wrappings, and vapor barriers shall be treated to reduce their combustibility, such that the flame spread, fuel contributed, smoke developed, etc., shall be in accordance with all regulations of governing authorities.

.5 Clean all surfaces to be insulated to remove grime, grease, oil, moisture or other matter to ensure that insulation is applied to clean dry surfaces.

.6 Pack solid around all pipes, whether covered or uncovered where they pass through sleeves, walls, floor slabs, etc., For the thickness of the floor or wall. Cover all piping where necessary to keep pipes from contact with concrete or masonry. All covered pipes shall pass through walls, floors, etc., with continuous covering. Pipe sleeves through walls, floors etc., shall be large enough to accommodate the full thickness of the insulation. All flanges at fittings and valves shall be covered neatly using "box" type flange insulation for piping 1” size and over.

.7 Apply insulation under ambient temperature conditions in accordance with insulation or adhesive manufacturer's recommendations.

.8 Do not apply insulation until piping and heat tracing, has been tested, inspected, verified, and accepted.

.9 Apply insulation neatly and tightly in unbroken lengths and with ends of sections firmly and squarely butted or engaged together. Lap canvas or other specified wrapping over all joints and thoroughly cement down with adhesive. Extend insulation through sleeves in walls (except fire walls) or other openings in buildings to make insulation and vapour barrier continuous and of uniform diameter.

.10 Terminate insulation at each side of fire walls and pack the space between wall sleeve and duct or pipe.

.11 Where asbestos-containing insulation has been removed from existing piping, reinsulate (to the same extent as removal work) or (to extent as indicated on Drawings). Maintain the same thermal value as existing.

.12 Replace insulation removed from existing piping to make tie-in connections with new insulation. Cut back existing insulation a sufficient distance to make a neat and firm butt joint between old and new insulation.

.13 At expansion joints in piping, apply insulation over a sleeve of 1.6 mm (16 gauge) metal, fabricated to fit around the expansion joint without restricting its movement. Fabricate sleeve so it can be removed to allow for the repacking and lubrication of expansion joints without damaging the adjoining insulation. Extend sleeves a minimum of 75 mm (3") longer than expansion joint, fit with insulation retaining flanges and with a means of maintaining the position of sleeve over expansion joint.

.14 Where piping is specified to be heat traced, provide oversized insulation to accommodate tracing cable specified in Electrical Specifications.

3.2 Insulation Protection Bearing Plates (22 07 19)

.1 Each mechanical trade will supply and install bearing plates and temporary spacers at each hanger and support on insulated cold piping or tubing.

.2 Remove temporary spacers and install a section of asbestos-free calcium silicate insulation extending at least 150 mm (6") beyond each end of the bearing plate.

.3 Bond insulation to the bearing plate with Foster 85-20 or Bakor 230-39 or polymer waterproof adhesive and finish and seal the complete assembly with Foster 60-38 or Bakor 130-11 or polymer to form an unbroken vapour barrier.

.4 Reinstall or readjust any hanger or support which has been moved in any way to carry out the above work.

3.3 Equipment Drain Lines & Safety Valve Vents (22 07 19)

.1 Insulate flanges, valves, and fittings with segments of insulation of the same type and thickness as the insulation on the pipe, secured in place with soft annealed galvanized wire. Finish with Partek Hilcote insulating and finishing cement, and cotton wrapping applied while the cement is still wet.

3.4 Hot & Cold Water Piping (22 07 19)

.1 Apply 75 mm (3") wide butt strips of the same material as the factory applied jacket. Seal both longitudinal and butt joint strips with Foster 85-20 or Bakor 230-39 or

polymer vapour barrier fire resistive lap sealer, or secure with self seal lap joints where provided.

.2 Insulate fittings, flanges and valves with fibrous glass insulation of same thickness as adjoining pipe insulation and finish with a pre-moulded PVC cover, securely fastened and sealed to adjoining pipe covering with Foster 85-75 or Bakor 230-39 or polymer to form a vapour proof joint.

.3 Do not insulate screwed unions and final connections to fixtures.

.4 Terminate insulation at each end of unions with Partek Hilcote insulating and finishing cement, trowelled on bevel.

3.5 Storm & Sanitary Drain Piping (22 07 19)

.1 Build up insulation at joints and fittings with two or more layers of insulation to form an unbroken surface over joint, coupling or fitting.

3.6 Surface Finishes (22 07 19)

.1 Cover exposed insulated piping, valves and fittings in Boiler Rooms, Mechanical Rooms, Equipment Rooms, and areas where vehicular traffic, etc. could damage the insulation, with 220 g/m2 (6 oz.) canvas.

.2 Do not apply canvas to elastomeric closed cell foam or neoprene insulation, and piping which will be concealed or furred in.

.3 Securely paste canvas on with a two coat application of Foster 30-36 or Bakor 120-18 fire resistive lagging adhesive over the entire surface. Apply canvas between

coats of adhesive, while the first coat is still wet. Stretch canvas tight and smooth with overlapping seams located where least visible. Apply a second coat of adhesive immediately following application of canvas. Do not use metal bands.

.4 Finish piping, valves and fittings indoors and outdoors insulated with elastomeric closed cell foam or neoprene with a full coating of white acrylic latex as recommended by the insulation manufacturer.

.5 Finish all other insulated piping installed outdoors with a field or factory applied metal jacket of 0.4 mm (26 ga.) aluminum, with longitudinal "snap-lock" or lapped joints and caulked and strapped butt joints secured with sheetmetal screws. Alternatively, finish pipe and fittings with glass fabric and Foster 65-07 or Bakor 110-26 or polymer fire resistive mastic as previously specified. Locate longitudinal joints in the bottom sector of horizontal lines and with laps positioned to shed any moisture.

.6 On single ply roofs extreme care must be taken when applying mastic sealers to piping to ensure that no surplus mastic material remains in contact with the roof membrane. Any accidental spills must be cleaned up immediately. Provide temporary plastic drop sheets to protect roof around work area. Remove drop sheets on completion and clean-up of insulation work.

.7 Seal canvas with off-white sizing to leave a smooth non-porous surface ready to receive paint application.

.8 Finished exposed insulated piping within 2.4 m of finished floor level of clean process areas with an exterior metal jacket of 0.4 mm (26 ga.) aluminum, with

longitudinal "snap-lock" joints and strapped butt joints. Conceal longitudinal joints from view. The metal jacket may be field or factory applied.

END OF SECTION

Section 22 08 00 - Commissioning Of Plumbing

PART 1. GENERAL

1.1 Scope of Work (22 08 00)

.1 The requirements of this Section apply to all sections of Division 22.

.2 Testing and commissioning of domestic water piping systems.

.3 Testing and commissioning of sanitary sewer piping system.

.4 Testing and commissioning of storm sewer piping system.

.5 Testing and commissioning of natural gas piping systems.

.6 Backflow Preventer Test

.7 Balancing and Adjusting of Domestic Water Systems

1.2 Testing Requirements (22 08 00)

.1 Test equipment and material where required by specification and Authority Having Jurisdiction to demonstrate its proper and safe operation.

.2 Required tests shall be made in the presence of each governing authority's authorized inspector and certified by him.

.3 Test procedures in accordance with the current applicable portions of ASME, ASHRAE, and other recognised test codes as far as field conditions permit.

.4 Perform tests on site to the satisfaction of the Consultant.

.5 Piping, fixtures or equipment shall not be concealed or covered until inspected and approved by the Engineer. Provide written notice (two working days) to the Consultant before tests. After completion of the test, submit a written report to the Engineer, summarizing complete test data and results.

.6 Coordinate with the Consultant at the start of the project, those tests that will require witnessing by the Consultant.

.7 Use factory trained representatives and submit manufacturer's check sheets for starting the specialty equipment.

.8 Prior to starting, testing, balancing, adjusting and cleaning processes, verify with the Engineer any tests required to be witnessed. Provide sufficient notice to the Engineer prior to commencement of procedures. Engineers shall be allowed to witness any testing, adjusting, starting, balancing and cleaning procedures.

.9 Contractor is responsible for all costs associated with starting and testing, including the supply of testing or cleaning medium.

.10 Prior to starting equipment or systems, secure and review manufacturer's installation, operation and starting instructions. Read in conjunction with procedures defined herein.

.11 Use manufacturer's or supplier's starting personnel where required to ensure integrity of manufacturer's warranty.

.12 Compare installations to published manufacturer's data and record discrepancies. Items proving detrimental to equipment performance shall be corrected prior to equipment starting.

.13 Some processes involved in starting procedures defined in this section may be duplications of authorities' verification. To facilitate expedient completion of the project, arrange for authorities to assist or witness these procedures. (Gas inspectors)

.14 All starting, testing procedures shall be in accordance with applicable portions of the latest, current ASME, ASHRAE, AABC, CSA, ASTM, ASPE, applicable building codes and standards.

.15 Personnel involved in starting, testing, balancing and adjusting procedures shall be experienced in the design and operation of equipment and systems being checked and shall be able to interpret the results of the reading and tests.

.16 Assume all liabilities associated with starting, testing and balancing procedures.

1.3 Submittals (22 08 00)

.1 Obtain certificates of approval, acceptance, and comply with current rules and regulations from Authorities Having Jurisdiction and include in Operating and Maintenance Manuals.

.1 Submit copies of authorities-having-jurisdiction inspection and test reports, including:

.2 Piping pressure test reports (domestic hot and cold water, sanitary, storm)

.3 Plumbing and drainage municipal inspection reports from AHJ.

.4 Backflow Preventer testing and maintenance reports.

.5 TSSA pressure vessel and piping inspection reports

.2 Perform tests as specified and upon completion of mechanical installation. Provide certification of tests with detailed data as required. Itemize each test as to time performed and personnel responsible. Included in Operating and Maintenance Manuals.

PART 2. PRODUCTS

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Not Applicable

PART 3. EXECUTION

3.1 Piping System Tests (22 08 00)

.1 Provide equipment, materials and labour for tests and pay expenses. Use test instruments from approved laboratory or manufacturer and furnish a certificate showing degree of accuracy. Install permanent gauges and thermometers used for tests just prior to tests to avoid possible changes in calibration.

.2 Carry out tests and maintain pressure with no appreciable pressure drop. Where leakage occurs, repair and re-test and pay necessary costs for re-witnessing.

Drainage and Venting Systems:

.3 Every pipe in a drainage system, except an external leader or fixture outlet pipe, shall be capable of withstanding without leakage a water test, air test and final test.

.4 Every venting system shall be capable of withstanding without leakage a water test, air test and final test.

.5 Water Test: all joints shall be tested with a water column of not less than 3 m. Every opening except the highest shall be tightly closed with a testing plug or a test cap, and the system or the section shall be kept filled with water for 15 min.

.6 Air Test: conducted in accordance with the manufacturer’s instructions for the piping materials, and air shall be forced into the system until a gauge pressure of 35 kPa (5 PSI) is created, and this pressure shall be maintained for at least 15 min without a drop in pressure.

.7 Final Test: every trap shall be filled with water, the bottom of the system being tested shall terminate at the building trap, test plug or cap. Smoke from smoke-generating machines shall be forced into the system. When the smoke appears from all roof terminals they shall be closed, and a pressure equivalent to a 25 mm water column shall be maintained for 15 min without the addition of more smoke.

.8 Ball Tests: a hard ball dense enough not to float shall be rolled through the pipe. The diameter of the ball shall be not less than 50 mm where the size of the pipe is 4 in. or more

Potable Water Systems:

.9 A test may be applied to each section of the system or to the system as a whole

.10 Where a prefabricated system is assembled off the building site in such a manner that it cannot be inspected and tested on site, off-site inspections and tests shall be conducted

.11 Every potable water system shall be capable of withstanding without leakage a water pressure that is at least 1 000 kPa (145 PSI) for at least 1 hour

.12 Or withstanding for at least 2 h without a drop in pressure an air pressure that is at least 700 kPa (100 PSI)

Natural Gas:

.13 Test as required by current edition of CAN/CGA 149.1, and authority having jurisdiction.

.14 Check systems during application of test pressure including visual check for leakage of water test medium, soap bubble test for air.

.15 When using water as a test medium for a system not using water, evacuate and dehydrate the piping and certify the lines are dry. Use an agency specializing in this type of work.

.16 Should tests indicate defective work or variance with specified requirements, make changes immediately to correct the defects. Correct leaks by re-making joints in screwed fittings, cutting out and re-welding welded joints, re-making joints in copper lines. Do not caulk.

3.2 Testing of Soldered Copper Joints (22 08 00)

.1 Submit two (2) sample soldered copper pipe joints prepared by each tradesmen to be used on the project, to the Consultant within two (2) months of contract award. These samples may be subjected to radiographic testing to verify quality of workmanship.

.2 Rejection of a sample will require re-test of adjacent joints at the Contractor's expense.

3.3 Balancing and Adjusting of Domestic Water Systems (22 08 00)

.1 Adjust PRV on the main line to 413 kPa (60 PSI) maximum.

.2 Balance domestic hot water recirculating system piping to ensure flow from all points in the system. Ensure all hot and cold supply shut off valves are fully open.

.3 Submit balancing report to consultant.

3.4 General (22 08 00)

.1 Conduct performance tests to demonstrate equipment and systems meet specified requirements after mechanical installations are completed and pressure tested. Conduct tests as soon as conditions permit. Make changes, repairs, and adjustments required prior to operating tests.

.2 Where required by the Authority having jurisdiction, gas fired appliances rated in excess of 117 kW shall be subjected to an operational test established by the Authority and shall pass this test before being approved for operation.

.3 Meet with Division 26 manufacturers, suppliers, and other specialists as required to ensure all phases of work are properly coordinated prior to the commencement of each particular testing procedure. Establish all necessary manpower requirements.

.4 Failure to follow instructions pertaining to correct starting procedures may result in re-evaluation of equipment by an Independent Testing Agency selected by Owner at Contractor's expense. Should results reveal equipment has not been properly started, equipment may be rejected, removed from site, and replaced. Replacement equipment shall also be subject to full starting procedures, using the same procedures specified on the originally installed equipment.

3.5 Procedures (22 08 00)

.1 Procedures shall be identified in the following five (5) distinct phases:

.1 Pre-Starting: Visual inspection.

.2 Starting: Actual starting procedure.

.3 Post-Starting: Operational testing adjusting or balancing, and equipment run-in phase.

.4 Pre-Interim Acceptance of the Work: Final cleaning, re-testing, balancing and adjusting, and necessary maintenance.

.2 Post-Interim Acceptance of the Work: Repeat tests and fine-tuning resulting from corrective action of deficiency clean-up.

.3 Check specified and shop drawing data against installed data.

.4 Check the installation is as defined by the contract documents and as per manufacturer's recommendations including manufacturer's installation check sheets.

3.6 Deficiencies (22 08 00)

.1 Immediately report to the Consultant, any deficiencies in the systems or equipment performance resulting in design requirements being unobtainable.

3.7 Additional Testing (22 08 00)

.1 The Consultant may request such additional testing in connection with this project as he deems necessary.

3.8 Construction Inspections (22 08 00)

.1 Commissioning of the Building Plumbing Systems will require inspection of individual elements of the Plumbing construction throughout the construction period. The Contractor shall coordinate with the Commissioning Agent in accordance with Section 01 91 00 and the Commissioning Plan to schedule inspections as required to support the commissioning process.

3.9 Prefunctional Checklists (22 08 00)

.1 The Contractor shall complete Pre-Functional Checklists to verify systems, subsystems, and equipment installation is complete and systems are ready for Systems Functional Performance Testing. The Commissioning Agent will prepare Pre-Functional Checklists to be used to document equipment installation. The Contractor shall complete the checklists. Completed checklists shall be submitted to the engineer and to the Commissioning Agent for review. The Commissioning Agent may spot check a sample of completed checklists. If the Commissioning Agent determines that the information provided on the checklist is not accurate, the Commissioning Agent will return the marked-up checklist to the Contractor for correction and resubmission. If the Commissioning Agent determines that a significant number of completed checklists for similar equipment are not accurate, the Commissioning Agent will select a broader sample of checklists for review. If the Commissioning Agent determines that a significant number of the broader sample of checklists is also inaccurate, all the checklists for the type of equipment will be returned to the Contractor for correction and resubmission.

3.10 Contractors Tests (22 08 00)

.1 Contractor tests as required by other sections of Division 22 shall be scheduled and documented in accordance with Section 01 00 00 GENERAL REQUIREMENTS. . All testing shall be incorporated into the project schedule. Contractor shall provide no less than 7 calendar days' notice of testing. The Commissioning Agent will witness selected Contractor tests at the sole discretion of the Commissioning Agent. Contractor tests shall be completed prior to scheduling Systems Functional Performance Testing.

3.11 Systems Functional Performance Testing (22 08 00)

.1 The Commissioning Process includes Systems Functional Performance Testing that is intended to test systems functional performance under steady state conditions, to test system reaction to changes in operating conditions, and system performance under emergency conditions. The Commissioning Agent will prepare detailed Systems Functional Performance Test procedures for review and approval by the Resident Engineer. The Contractor shall review and comment on the tests prior to approval. The Contractor shall provide the required labor, materials, and test equipment identified in the test procedure to perform the tests. The Commissioning

Agent will witness and document the testing. The Contractor shall sign the test reports to verify tests were performed.

END OF SECTION

SECTION 22 10 10 - PACKAGED DOMESTIC WATER BOOSTER PUMP - ARMSTRONG DESIGN ENVELOPE (INCLUDING PERMANENT MAGNET) 6800 BOOSTER

PART 1. GENERAL

1.1 Scope of Work

.1 Section Includes:

.1 The basic requirements for the design, materials, fabrication, inspection and testing, and handling of Design Envelope (Permanent Magnet) 6800 Boosters.

.2 Domestic water Booster systems shall be verified by the manufacturer to provide the required duty point as specified on the submittals/drawings.

1.2 Related requirements

.1 Section 01 33 00 - Submittal Procedures.

.2 Section 01 45 00 - Quality Control.

.3 Section 01 77 00 - Closeout Procedures.

.4 Section 01 78 23 - Operations and Maintenance Data.

.5 Section 23 25 00 - HVAC Water Treatment Systems.

1.3 References

.1 Canadian Standards Association (CSA International)

.1 CAN/CSA-B125.1, Plumbing Supply Fittings

.2 CAN/CSA-B125.3, Plumbing Fittings

.2 Health Canada/Workplace Hazardous Materials Information System (WHMIS) .1 Material Safety Data Sheets (MSDS).

1.4 Submittals

.1 Submittals in accordance with Section 01 33 00 - Submittal Procedures.

.2 Product Data:

.1 Submit manufacturer's printed Product literature, specifications and data sheet for fixtures and equipment.

.3 Shop Drawings.

.1 Submit Shop Drawings to indicate:

.1 Equipment, including connections, fittings, control assemblies and ancillaries. Identify whether factory or field assembled.

.2 Wiring and schematic diagrams.

.3 Dimensions and recommended installation.

.4 Pump performance and efficiency curves.

.4 Certificates: submit certificates signed by manufacturer certifying that Materials comply with specified performance characteristics and physical properties.

.5 Instructions: submit manufacturer's installation instructions.

.6 Manufacturers' Field Reports: manufacturers' field reports specified.

.7 Closeout submittals: submit maintenance and engineering data for incorporation into manual specified in Section 01 78 23 – Operations and Maintenance Data, include:

.1 Manufacturers name, type, model year, capacity and serial number.

.2 Details of operation, servicing and maintenance.

.3 Recommended spare parts list with names and addresses.

1.5 DELIVERY, STORAGE AND HANDLING

.1 Deliver materials to site in original factory packaging, labelled with manufacturer's name, address and ULC markings.

.2 Protect from weather and construction traffic.

.3 Protect from damage from any source.

.4 Store at temperatures and conditions recommended by manufacturer.

.5 Store pumps in a dry location. Retain shipping flange protective covers and protective coatings during storage. Protect bearings and couplings against damage from sand, grit, and other foreign matter. Comply with manufacturers' rigging instructions for handling.

1.6 QUALITY ASSURANCE

.1 The manufacturer shall take single-source responsibility for complete package. The manufacturer shall have at least 15 years' experience in the design, manufacturer, servicing, and support of variable speed booster packages. The entire package shall be part of the manufacturer's standard offering. Custom packages shall not be accepted without validations of the manufacturer's experience (as per above) with said packages.

1.7 DESIGN CRITERIA

.1 The drawings indicate the requirements as it relates to the components, capacity, and profiles of the booster package. Booster packages having equal performance characteristics by other manufacturers may be considered, if deviations from weight, connection type and size and dimensions, do not change, as judged by the engineer. The burden of proof for equality is on the proposer. The cost to accommodate deviations from the requirements is on the proposer.

PART 2. PRODUCTS

2.1 DOMESTIC BOOSTER PUMPS

.1 All materials shall meet or exceed all applicable referenced standards, federal, state, and local requirements, and conform to codes and ordinances of authorities having jurisdiction.

.2 Provide an Armstrong Design Envelope (Permanent Magnet) 6800 Booster Package model NVS-232021-10D-7.5. The design envelope shall encompass an initial design point of 266 USgpm at 65 psi head, confirm efficiency levels with an approved Armstrong supplier. This design point shall be within the best efficiency region of the package between 100% and 80% nominal speed.

.3 Refer to the Manufacturers information for dimensional sizes and weights. The booster package shall be delivered with both suction and discharge header shipped loose, to minimize damage and maximize ease during transport of the booster package into mechanical room.

.4 Pumps

Each Vertical Multistage (VMS) pump will have the following pump characteristics:

.1 Rising heads to shut off to supply required hydrostatic lift in low flow conditions.

.2 Low axial thrust impeller to enable long motor bearing life.

.3 Air vent in casing cover allowing for proper venting to prevent air entrapment and dry run.

.4 Fill port in casing cover to allow for water fill, as well as installation of sensors, gauges, and other measuring devices.

.5 Self-Aligning liner ring, floating design constructed to prevent swelling at high temperatures.

.6 Keyed, direct drive pump and motor shafts for positive, reliable power transmission with no adjustments necessary

.7 “Flexible” floating outer casing allowing for thermal expansion in hot water applications, preventing deformation due to pressure fluctuations.

.8 Square-edge four spline shaft providing positive location and drive of impellers, eliminating wear.

.9 Cartridge mechanical seal design, enabling replacement of the shaft seal without disassembling the motor bracket.

.10Spacer coupling allowing easy maintenance without having to remove heavy motors over 7 ½ HP.

.5 Motors & Drives

Each pump shall be supplied with a 7.5hp, 575v/3/60,

.1 Permanent Magnet Motors: TEFC, Ultra High Efficiency IE5 (better than NEMA Super Premium) permanent magnet motor and a IP55 enclosure. Ultra-High Efficiency IE5 permanent magnet motors shall be supplied with ECM drives with the following features: Power factor that varies between 0.5

and 0.8, with speed and load without the need for power factor correction circuits and C-UL Listed and CE Marked, EMI/EMC filters incorporated within the drive to ensure it meets the emission and immunity requirements of EN61800-3 to the 1st Environment Class C1 (EN55011 unrestricted sales class B).

.2 Induction Motors: _____ODP (TEFC), NEMA Premium® efficiency motor and an Armstrong UL Type-12 enclosure variable speed drive, which shall be integrated with the motor. Drives shall not be enclosed within the control panel. NEMA Premium efficiency motors shall be supplied with variable speed drives with the following features: VVC-PWM type providing near unity displacement power factor (cos ø) without the need for external power factor correction capacitors at all loads and speeds, DC link chokes for the reduction of mains borne harmonic currents to reduce the DC link ripple current thereby increasing the DC link capacitors lifetime, UL and C-UL Listed and CE Marked showing compliance with both the EMC directive 89/336/EEC and the Low Voltage directive 72/23/EEC, RFI filters incorporated within the drive to ensure it meets the emission and immunity requirements of EN61800-3 to the 1st Environment Class C1 (EN55011 unrestricted sales class B), VFD and motor protection shall include: motor phase to phase fault, motor phase to earth fault, loss of supply phase, over voltage, under voltage, motor over temperature, inverter overload, over current.

.3 Integrated controls and motor protection shall include:

.1 Motor phase to phase fault

.2 Motor phase to earth fault

.3 Loss of supply phase

.4 Over voltage, under voltage

.5 Motor over temperature

.6 Inverter overload, over current

.6 Materials of construction

.1 Pump

.1 Pump casing:

.1 Vertical Multistage pumps (VMS 5, VMS 10, VMS 15, VMS 20) shall be of full 304 stainless steel construction. Vertical Multistage pumps (VMS 32, VMS 45, VMS 64) shall have 304 stainless steel intermediate and outer casing with cast iron bottom casing and casing cover. Pump connection shall be:

ANSI-250 flanges for working pressure to 370psig (25bar) at 250°F (120°C)

ANSI-150 flanges for working pressures to 232psig (16bar) at 250°F (120°C)

ANSI-300 flanges for working pressures to 400psig (27bar) at 250°F (120°C).

.2 Impeller: 304 stainless steel, fully enclosed type.

.3 Shaft: stainless steel pump shaft.

.4 Coupling: Rigid spacer type of brass or steel. Coupling to be designed to allow removal of all mechanical seal components for servicing without removal of the pump.

.5 Mechanical seals: Mechanical shaft seal with FPM® secondary seal, carbon rotating face and silicon carbide stationary seat.

.6 Bearing: Tungsten carbide lower pump bearings and sleeves providing maximum operating life.

Packaging

.1 Headers: 304 stainless steel.

.2 Base: Stainless steel.

.3Panel support: Stainless steel.

.2 Control panel

.1 The control panel shall be of the programmable logic controller (PLC) type. The complete control panel assembly and all internal devices shall be UL508 and/or CSA labelled. The panel shall be

complete with a NEMA Type 4 Painted Steel Enclosure (STD), allowing for both indoor and outdoor use, and as such, will remain undamaged by ice formation on the enclosure. The panel shall include a door interlocked main disconnect, a watertight colour graphic touchscreen display, windblown dust and falling dirt protection, fused drive connections, adjustable time delays, Hand-Off-Auto selector for each pump, and minimum run timers. The control circuit shall include a fault relay circuit to turn on the next pump should the lead pump fail. The controller must be capable of controlling up to 5 pumps, with a 4-20 mA analogue signal using pressure as the control variable.

.2 On-screen alarm display with alarm identification shall be incorporated with the following alarms included: low and high system pressure shutdown, low suction pressure or level shutdown, pump failure, drive fault, and suction and discharge pressure sensor failures. The controller shall include on-screen fault description and possible cause information with alarm horn for alarms.

The on-screen display will provide graphic representation of the booster package and include the following information: total flow, flow per pump, operating speed per pump, pump status. Flow information shall be provided including Maximum flow in GPM, Current flow in GPM, Curves to illustrate consumption over time. Energy information shall be provided including Monthly/yearly KWH consumption, Instantaneous kw, Capacity to reset, Data charts for illustration on energy consumption versus time.

.3 Non-volatile factory set parameters must be capable of being restored at any time in the field without requiring any programming device or connection to an external source. The controller must hold software in FLASH memory storage which prevents accidental loss of data due to voltage surge or spike.

All controls to be factory pre-wired and tested in accordance with provisions of the national electrical code. All control wires shall be individually numbered, and each component shall be labelled accordingly. All internal wiring shall be Copper stranded, A.W.G. with a minimum 90°F rating. The controller shall bear the UL508 label for industrial controls.

.3 Pump sequencing

.1 The pump designated as the lead pump shall start following a 5 second On-Delay time after sensing a drop in the system pressure 5 PSI below the desired set point value. The pump controller shall compare a signal from the discharge pressure transducer to the set point value and the lead pump speed shall ramp up to satisfy the set point pressure. The lag pump shall start following a 60 second On-Delay time, when the lead pump exceeds its best operating point (BOP), and a minimum run timer shall ensure that the lag pump runs for a minimum of 60 seconds. The lag pump shall ramp down in speed and turn off when the pumps that are running are operating at a point below the BOP and the lag pump minimum run timer has expired. The lead pump shall continue to operate and meet system requirements

based on the set point value. The lead pump shall alternate every 24 hrs of operation where the second pump shall start and run for a period of 5 seconds, both pumps shall operate, the first pump on shall ramp down and the new lead pump shall continue to operate as above to meet system requirements.

.4 Pump shutdown controls

.1 All systems are equipped with a 'No-Flow' shutdown that will stop the pumps when the pump controller determines there has been a 'No-Flow' condition for a continuous 5-minute period. The lead pump will start again once a drop in pressure of at least 5 psi is measured on the discharge of the system. To minimize maintenance cost, footprint, and single point of failure (for no flow shut) controls algorithms shall be capable of determining no flow conditions without requiring the presence of pressurized tanks.

.5 Other Controls

.1 Controller design shall include provisions for energy savings and maximum reliability:

.2 Conformance to ASHRAE 90.1, 201 Section 10.4.

.3 Soft fill mode that automatically senses the need to fill plumbing systems and decreases ramp up and ramp down speeds to minimize hydraulic shock.

.4 Pressure setback which eliminates the need for remote pressure transducer and associated cost by simulating remote sensing via local

discharge sensor (per ASHRAE 90.1) and automatically reduces pressure setpoint as a function of flow.

.5 Tank fill mode that enhances no flow shutdown by increasing pressure before system shutdown to fill hydro-pneumatic tanks, thus maximizing tank acceptance volume.

.6 Emergency power mode to optimize emergency power scenarios by reducing total power draw from backup power sources.

.7 Alternate setpoints to accommodate changes in design requirements i.e., overnight pressure washing, and cooling tower make-up.

.8 Best-operating-point (BOP) sequencing

.9 End of pump curve protection

.10 24hr operation, automatic alternation of pumps and built-in pump on-delay and minimum run timers, re-settable pump elapsed run time meters,

.11 On-screen field modifiable control and alarm parameters

.12 High suction pressure shutdown.

.13 The system may be manually operated by means of the virtual Hand-off-Auto (HOA) selector buttons provided on the operator interface.

.6 Instrumentation

Pump system shall be supplied with a manifold mounted with liquid-filled pressure gauges for indicating suction and discharge pressure.

2.2 FACTORY PREFABRICATION

.1 The system shall be factory prefabricated, including isolation valves on the suction and discharge of each pump, silent check valves, and isolation valves on the discharge allowing for maintenance of individual pumps. Valves without the need to disable entire booster, system piping shall connect to 2", 2.5", 3", 4", 6", 8" or 10" stainless steel headers with flanged connections which can be re-oriented from left to right side to maximize installation flexibility, steel base and panel support. All interconnecting piping shall be stainless steel. The only field connections required shall be piping to the system headers and one incoming power connection at the control panel.

.2 The booster system and its parts shall undergo a complete operational flow test from zero to 100% design flow rate and design head under the specified suction pressure conditions. The system certification shall include copies of the test data as certified by a factory engineer. Performance test certifications should be placed inside the control panel, and extra copies with an installation manual.

.3 The entire system shall be third-party certified by Underwriters Laboratories Inc. (UL) in accordance with OSHA 29 CFR, with references to nationally recognized testing laboratories and to the National Sanitation Foundation (NSF) standard NSF 61 (pending for VMS 5 boosters). Full stainless-steel construction or certification to NSF for individual components shall not be considered an adequate substitute for package certification to NSF-61 (pending for VMS 5 Boosters).

.4 The booster package shall be free from defects in material and workmanship under normal use and service for 18 months from installation but no more than 24 months from date of shipping, when registered with manufacturer and installed and used in accordance with manufacturer’s printed instructions (normal wear and tear excepted).

.5 The above specification describes equipment manufactured by Armstrong Fluid Technology, North Tonawanda, NY, USA. Alternate manufacturers of equipment will be considered if they are completely equal as to type, capacity, and efficiency of pumps and controls. Alternate manufacturers' submittals must be certified by an officer of the company who is proposing that their system complies with the specifications in every detail.

PART 3. EXECUTION

3.1 MANUFACTURER'S INSTRUCTIONS

.1 Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and data sheet.

3.2 INSTALLATION

.1 Make piping and electrical connections to pump and motor assembly and controls as indicated.

.2 Ensure pump and motor assembly do not support piping.

.3 Align vertical pit mounted pump assembly after mounting and securing cover plate.

.4 All penetrations into sump pit to be properly

.1 The packaged booster system must be installed by a qualified installer/service technician.

.2 The packaged booster system shall be installed in accordance with the relevant requirements of the local authority having jurisdiction, as required to meet the performance requirements and function specified for the system.

.3 The packaged booster system must be installed and operated strictly in accordance with the terms set out in both the Installation and Operation and Maintenance Manuals supplied.

.4 The system must be installed in a way that it is not stressed by the pipe work.

.5 Fluid temperature limitations are 122 deg F (50 deg C) to 14 deg F (-10 deg C). Maximum ambient temperature surrounding the pump shall be between 32 deg F (0 deg C) to 104 deg F (40 deg C).

.6 Inlet pressure shall not exceed 145 psi (10 Bar). Minimum inlet pressure shall be 3 feet static water column height above the inlet of the pump.

.7 Make piping and electrical connections to pump and motor assembly and controls as indicated. .8 Ensure pump and motor assembly do not support piping.

3.4 FIELD QUALITY CONTROL

.1 Site Tests/Inspection:

.1 Check power supply.

.2 Check starter protective devices.

.2 Start-up, check for proper and safe operation.

.3 Check settings and operation of hand-off-auto selector switch, operating, safety and limit controls, audible and visual alarms, over-temperature and other protective devices.

.4 Adjust flow from water-cooled bearings.

.5 Adjust impeller shaft stuffing boxes, packing glands.

3.5 DOMESTIC WATER BOOSTER SYSTEM FIELD QUALITY CONTROL

.1 Site Tests/Inspection:

.1 Check power supply.

.2 Check starter protective devices.

.2 Upon receipt and prior to commissioning the packaged booster system should be inspected for any sign of visible damage.

.3 Prior to commissioning the packaged booster system, the system connections should be complete and leak free. The system should be filled and purged as per instructions in the IOM manuals.

.4 Following fill and purge, the system should undergo a pressure test, followed by a run-through of the sequence of operations listed in the IOM manuals.

.5 Start-up, check for proper and safe operation.

.6 Check settings and operation of hand-off-auto selector switch, operating, safety and limit controls, audible and visual alarms, over-temperature and other protective devices.

.7 Adjust flow from water-cooled bearings.

.8 Adjust impeller shaft stuffing boxes, packing glands.

.1 General:

.1 In accordance with Section 01 77 00 - Closeout Procedures: General Requirements, supplemented as specified herein.

.2 Procedures:

.1 Check power supply.

.2 Check starter O/L heater sizes.

.3 Start pumps, check impeller rotation.

.4 Check for safe and proper operation.

.5 Check settings, operation of operating, limit, safety controls, over-temperature, audible/visual alarms, other protective devices.

.6 Test operation of hands-on-auto switch.

.7 Test operation of alternator.

.8 Adjust leakage through water-cooled bearings.

.9 Adjust shaft stuffing boxes.

.10 Adjust leakage flow rate from pump shaft stuffing boxes to manufacturer's recommendations.

.11 Check base for free-floating, no obstructions under base.

.12 Run-in pumps for 12 continuous hours.

.13 Check installation, operation of mechanical seals, packing gland type seals.

Adjust as necessary.

.14 Adjust alignment of piping and conduit to ensure full flexibility.

.15 Eliminate causes of cavitation, flashing, air entrainment.

.16 Measure pressure drop across strainer when clean and with flow rates as finally set.

.17 Replace seals if pump used to degrease system or if pump used for temporary heat.

.18 Verify lubricating oil levels.

END OF SECTION

Section 22 11 00 - Facility Water Distribution

PART 1. GENERAL

1.1 Scope of Work (22 11 00)

.1 Domestic water systems, including piping, equipment and all necessary accessories as designated in this section.

.2 Water Hammer Arresters

.3 Backflow Preventer Assemblies

.4 Vacuum Breaker Assemblies

.5 Trap Seal Primers

.6 Pressure Reducing Valves

.7 Water Meters

.8 Make-up Water Valves

.9 Non-Freeze Wall Hydrants

.10 Hose Bibbs And Sediment Faucets

1.2 General Requirements

.1 Conform To Section 01 00 00, General Requirements.

.2 Conform To Section 01 33 23, Shop Drawings, Product Data, And Samples.

.3 Conform To Section 01 81 13, Sustainable Construction Requirements.

.4 Conform To Section 07 84 00, Firestopping.

.5 Conform To Section 07 92 00, Joint Sealants.

.6 Conform To Section 09 91 00, Painting.

.7 Conform To Section 22 00 00, Plumbing General

.8 Conform To Section 22 07 19, Plumbing Piping Insulation

.9 Conform To Section 22 08 00, Commissioning Of Plumbing Systems.

1.3 References (22 11 00)

.1 ANSI B16.18-[1984], Cast Copper Alloy Lead Free Solder Joint Pressure Fittings.

.2 ASTM B88M-[89], Specification for Seamless Copper Water Tube (Metric).

.3 MSSCAN/CSA-B137.5, “Crosslinked Polyethylene (PEX) Tubing Systems for Pressure Applications”

.4 SP-80-[1987], Bronze Gate, Globe, Angle and Check Valves.

1.4 Submittals (22 11 00)

.1 Submittals, including number of required copies, shall be submitted in accordance with Section 01 33 23, Shop Drawings, Product Data, And Samples.

.2 Information and material submitted under this section shall be marked “Submitted Under Section 22 11 00, Facility Water Distributions”, with applicable paragraph identification.

.3 Manufacturer's Literature and Data including: Full item description and optional features and accessories. Include dimensions, weights, materials, applications, standard compliance, model numbers, size, and capacity.

.4 All items listed in Part 2 - Products.

.5 Complete operating and maintenance manuals including wiring diagrams, technical data sheets and information for ordering replacement parts:

Include a complete list indicating all components of the systems.

Include complete diagrams of the internal wiring for each item of equipment.

Diagrams shall have their terminals identified to facilitate installation, operation and maintenance.

1.5 Quality Assurance (22 11 00)

.1 A certificate shall be submitted prior to welding of steel piping showing the Welder's certification. The certificate shall be current and no more than one year old. Welder's qualifications shall be in accordance with ASME BPVC Section IX.

.2 All grooved joint couplings, fittings, valves, and specialties shall be the products of a single manufacturer. Grooving tools shall be by the same manufacturer as the groove components.

.3 All pipe, couplings, fittings, and specialties shall bear the identification of the manufacturer and any markings required by the applicable referenced standards.

1.6 As-Built Documentation (22 11 00)

.1 Submit manufacturer's literature and data updated to include submittal review comments and any equipment substitutions.

.2 Submit operation and maintenance data updated to include submittal review comments, substitutions and construction revisions shall be in electronic version or inserted into a three-ring binder. All aspects of system operation and maintenance procedures, including piping isometrics, wiring diagrams of all circuits, a written description of system design, control logic, and sequence of operation shall be included in the operation and maintenance manual. The operations and maintenance manual shall include troubleshooting techniques and procedures for emergency situations. Notes on all special systems or devices shall be included. A list of recommended spare parts (manufacturer, model number, and quantity) shall

be furnished. Information explaining any special knowledge or tools the owner will be required to employ shall be inserted into the As-Built documentation.

.3 The installing contractor shall maintain as-built drawings of each completed phase for verification; and, shall provide the complete set at the time of final systems certification testing. As-built drawings are to be provided, and a copy of them in pdf and Auto-CAD version. Should the installing contractor engage the testing company to provide as-built or any portion thereof, it shall not be deemed a conflict of interest or breach of the 'third party testing company' requirement.

.4 Certification documentation shall be provided to the engineer 10 working days prior to submitting the request for final inspection. The documentation shall include all test results, the names of individuals performing work for the testing agency on this project, detailed procedures followed for all tests, and certificate if applicable that all results of tests were within limits specified. If a certificate is not available, all documentation shall be on the Certifier's letterhead.

PART 2. PRODUCTS

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2.1 Materials (22 11 00)

.1 Material or equipment containing a weighted average of greater than 0.25 percent lead are prohibited in any potable water system intended for human consumption and shall be certified in accordance with NSF 61 or NSF 372. Endpoint devices used to dispense water for drinking shall meet the requirements of NSF 61, Section 9.

.2 Plastic pipe, fittings, and solvent cement shall meet NSF 14 and shall be NSF listed for the service intended.

2.2 Underground Water Service Connections To Buildings (22 11 00)

.1 From the inside face of the exterior wall to approximately 1000 mm (3 feet) outside of the building and underground inside the building, material to be the same for the size specified inside the building.

.2 75 mm (3 inch) Diameter and Greater: Ductile iron, AWWA C151, 2413 kPa (350 psig) pressure class, exterior bituminous coating, and cement lined. Bio-based materials shall be utilized when possible. Provide flanged and anchored connection to interior piping.

.3 Under 75 mm (3 inch) Diameter: Copper tubing, ASTM B88, Type K, seamless, annealed. Fittings are as specified in paragraph “Above Ground (Interior) Water Piping”. Use brazing alloys, AWS A5.8M/A5.8, Classification BCuP.

.4 Use in areas with expansive soils and seismic conditions:

.5 Flexible Expansion Joint: Ductile iron with ball joints rated for 1725 kPa (250 psig) working pressure conforming to AWWA C153, capable of deflecting a minimum of 20 degrees in each direction. Flexible expansion joint size shall match the pipe size it is connected to and shall have the expansion capability designed as an integral part of the ductile iron ball castings. Pressure containing parts shall be lined with a minimum of 15 mils of fusion bonded epoxy conforming to the applicable requirements of AWWA C213 and shall be factory tested with a 1500-volt spark test. Flexible expansion joints shall have flanged connections conforming to AWWA C110. Bolts and nuts shall be 316 stainless steel and gaskets shall be neoprene. The flexible expansion fitting shall not expand or exert an axial thrust under internal water pressure. Provide piping joint restraints at each mechanical joint end connection and piping restraints at the penetration of the building wall. The restraints shall be provided to address the developed thrust at the change of piping direction.

2.3 Above Ground (Interior) Water Piping (22 11 00)

.1 Pipe: Copper tube, ASTM B88, Type K or L, drawn. For pipes 150 mm (6 inches) and larger, stainless steel, ASTM A312, schedule 10 shall be used.

.2 Fittings for Copper Tube:

.1 Wrought copper or bronze castings conforming to ASME B16.18 and B16.22. Unions shall be bronze, MSS SP-72, MSS SP-110, solder or braze joints. Use 95/5 tin and antimony for all soldered joints.

.2 Grooved fittings, 50 to 150 mm (2 to 6 inch) wrought copper ASTM B75/B75M C12200, 125 to 150 mm (5 to 6 inch) bronze casting ASTM B584, C84400.

Mechanical grooved couplings, 2070 kPa (300 psig) minimum ductile iron, ASTM A536 Grade 448-310-12 (Grade 65-45-12), or malleable iron, ASTM A47/A47M Grade 22410 (Grade 32510) housing, with EPDM gasket, steel track head bolts, ASTM A183, coated with copper colored alkyd enamel.

.3 Mechanical press-connect fittings for copper pipe and tube are prohibited. See Plumbing Design Manual for additional information.

.4 Mechanically formed tee connection: Form mechanically extracted collars in a continuous operation by drilling pilot holes and drawing out tube surface to form collar, having a height of not less than three times the thickness of tube wall. Adjustable collaring devices shall ensure proper tolerance and complete uniformity of the joint. Notch and dimple join the branch tube in a single process to provide free flow where the branch tube penetrates the fitting. Braze joints.

.5 Flanged fittings, bronze, class 150, solder-joint ends conforming to ASME B16.24.

.3 Fittings for Stainless Steel:

.1 Stainless steel butt-welded fittings, Type 316, Schedule 10, conforming to ASME B16.9.

.2 Grooved fittings, stainless steel, Type 316, Schedule 10, conforming to ASTM A403/A403M. Segmentally fabricated fittings are not allowed. Mechanical grooved couplings, ductile iron, 4138 kPa (600 psig), ASTM A536 Grade 448-310-12 (Grade 65-45-12), or malleable iron, ASTM A47/A47M Grade 22410 (Grade 32510) housing, with EPDM gasket, steel track head bolts, ASTM A183, coated with copper colored alkyd enamel.

.4 Adapters: Provide adapters for joining pipe or tubing with dissimilar end connections.

.5 Solder: ASTM B32 alloy type Sb5, HA or HB. Provide non-corrosive flux.

.6 Brazing alloy: AWS A5.8M/A5.8, brazing filler metals shall be BCuP series for copper to copper joints and BAg series for copper to steel joints.

.7 Reagent Grade Water Piping and Dialysis Water Piping:

.1 Polypropylene, ASTM F2389, Schedule 80 pressure pipe without additions of modifiers, plasticizers, colorants, stabilizers or lubricants. Bio-based materials shall be utilized when possible. This virgin unplasticized pipe and fittings shall transport 10 megohm water with no loss of purity. Provide socket or butt end fittings with ASTM D2657 heat fusion joints.

.2 Polyethylene, ASTM F2769, Schedule 80, food and medical grade, capable of transporting 10 megohm water with no loss of purity. Processed by continuous compression molding without the addition of fillers, polymer modifiers or processing aids. Uniform color with no cracks, flaws, blisters or other imperfections in appearance. Provide ASTM D2657 or ASTM F2620 heat fusion butt welded joints. In accordance with manufacturer's recommendations, provide continuous channel support under all horizontal piping.

.3 Reverse Osmosis (RO) Water Piping:

.1 Low Pressure Feed, Reject and Recycle Piping: Less than or equal to 520 kPa (75 psig): ASTM D1785, Schedule 80 PVC, ASTM D2855 socket welded and flanged.

.2 RO Product Tubing from each Membrane Housing: ASTM D1785, Schedule 80 PVC, ASTM D2855 socket welded and flanged.

.3 Low Pressure Control and Pressure Gage Tubing: Polyethylene.

.4 High Pressure Reject and Recycle Piping: Greater than 520 kPa (75 psig): ASTM A269/A269M, Type 304 schedule 10 stainless steel with butt welded joints.

.5 High Pressure Control and Pressure Gage Tubing: 6895 kPa (1000 psig) burst nylon.

2.4 Trap Primer Water Piping (22 11 00)

.1 Pipe: Copper tube, ASTM B88, type K, hard drawn.

.2 Fittings: Bronze castings conforming to ASME B16.18 Solder joints.

.3 Solder: ASTM B32 alloy type Sb5. Provide non-corrosive flux.

2.5 Dielectric Fittings (22 11 00)

.1 Provide dielectric couplings or unions between pipes of dissimilar metals.

2.6 Strainers (22 11 00)

.1 Provide on high pressure side of pressure reducing valves, on suction side of pumps, on inlet side of indicating and control instruments and equipment subject to sediment damage and where shown on drawings. Strainer element shall be removable without disconnection of piping.

.2 Water: Basket or "Y" type with easily removable cover and brass strainer basket.

.3 Body: Less than 75 mm (3 inches), brass or bronze; 75 mm (3 inches) and greater, cast iron or semi-steel.

2.7 Gate Valves (22 11 00)

.1 NPS 2 and under:

.1 Bronze body 1034 kpa, ball valves full port, TFE seats, double O ring or teflon packing, chrome plated solid bronze valve lever handle.

.1 NPS 2½ and one, screwed:

.1 Rising stem: to MSS SP-80, Class 125, 860 kPa, bronze body, screw-in bonnet, solid wedge disc.

.2 Acceptable material: Crane, Toyo, Red & White, or Approved Alternate

2.8 Globe Valves (22 11 00)

.1 NPS 2 and under, soldered:

.2 To MSS SP-80, Class 125, 860 kPa, bronze body, renewable composition disc, screwed over bonnet.

.1 Lockshield handles: as indicated.

.2 Acceptable material: Crane, Toyo, Red & White or Approved Alternate

2.9 Swing Check Valves (22 11 00)

.1 NPS 2 and under, soldered:

.2 To MSS SP-80, Class 125, 860 kPa, bronze body, bronze swing disc, screw in cap,regrindable seat.

.3 Acceptable material: Crane, Toyo, Red & White or Approved Alternate

2.10 Ball Valves (22 11 00)

.1 NPS 2 and under, soldered:

.1 To ANSI B16.18, Class 150.

.2 Bronze body, chrome plated brass ball, PTFE Teflon adjustable packing, brass gland and [PTFE Teflon] seat, steel lever handle, with NPT to copper adaptors.

.3 Acceptable material: Crane, Toyo, Red & White or Approved Alternate

2.11 Circuit Balancing Valve (22 11 00)

.1 Tour & Anderson (or approved equal) Model 786 complete with check and shutoff valve.

2.12 Water Hammer Arresters (22 11 00)

.1 Fit water supply to each fixture or group of fixtures with an air chamber. Provide air chambers same size as supply line or 20 mm minimum, and minimum 450 mm long.

.2 Closed copper tube chamber with permanently sealed 413 kPa (60 psig) air charge above a Double O-ring piston. Two high heat Buna-N 0-rings pressure packed and lubricated with FDA approved silicone compound. All units shall be designed in accordance with ASSE 1010. Access shall be provided where devices are concealed within partitions or above ceilings. Size and install in accordance with PDI-WH 201 requirements. Provide water hammer arrestors at:

All solenoid valves.

All groups of two or more flush valves.

All quick opening or closing valves.

All medical washing equipment.

2.13 Backflow Preventer Assemblies (22 11 00)

.1 Provide backflow preventer assembly complete with shut-off valves before and after check valves and test cocks. Assembly shall meet current AWWA requirements and CSA B64 standards.

.2 Provide complete reduced pressure principle type assembly, consisting of pressure differential relief valve, located between two (2) positive seating replaceable check valves with stainless steel or bronze seats Watts No. 909. Provide strainer between gate valve and first check valve on units 50 mm and smaller.

.3 Provide complete double check valve type assembly consisting of two (2) positive sealing replaceable check valves with stainless steel or bronze seats. Provide a check valve on units 50 mm and smaller. Watts No. 709.

.4 Provide complete atmospheric vent backflow preventer assembly, consisting of two (2) positive sealing replaceable check valves with bronze seats, integral stainer and threaded vent connection. Watts No. 9D.

2.14 Vacuum Breaker Assemblies (22 11 00)

.1 Provide pressure type vacuum breaker assembly complete with shut-off valves before and after check valves and test cocks. Assembly shall consist of one (1)

positive sealing check valve and one (1) atmospheric vent disk with stainless steel or bronze seats complete with shut-off valves before and after check valves and test cocks. Assembly shall meet AWWA requirements and CSA B64 standards. Watts No. 800.

.2 Provide atmospheric type vacuum breaker assembly complete with shut-off valve before assembly. Assembly shall consist of one (1) free floating poppet to seal the atmospheric vent under flow conditions. Watts No. 288A. For bottom inlet and outlet, Watts No. 388ASC.

.3 Provide hose connection type vacuum breaker assembly, consisting of a check valve disc assembly to be vandal proof and drainable. Watts No. 8A. For freezing conditions, Watts No. NF8.

2.15 Trap Seal Primers (22 11 00)

.1 Install for all floor drains and each trap.

.2 Trap Primer: The trap seal primer system shall be electronic type conforming to ASSE 1044.

.3 The controller shall have a 24-hour programmable timer, solid state, 6 outlet zones, minimum adjustable run time of 1 minute for each zone, 12-hour program battery backup, manual switch for 120VAC power, 120VAC to 24VAC internal transformer, fuse protected circuitry, UL listed, 120VAC input-24VAC output, constructed of enameled steel or plastic.

.4 The cabinet shall be recessed mounting with a stainless steel cover.

.5 The solenoid valve shall have a brass body, suitable for potable water service, normally closed, 861 kPa (125 psig) rated, 24VAC.

.6 The control wiring shall be copper in accordance with the National Electric Code (NFPA 70), Article 725 and not less than 18 gauge. All wiring shall be in conduit and in accordance with Division 26 of the specifications.

.7 The vacuum breaker shall conform to ASSE 1001.

.8 Trap Primer: The trap seal primer valve shall be hydraulic, supply type with a pressure rating of 861 kPa (125 psig) and conforming to ASSE Standard 1018.

.9 The inlet and outlet connections shall be 15 mm or DN15 (NPS 1/2 inch)

.10 The trap seal primer valve shall be fully automatic with an all brass or bronze body.

.11 The trap seal primer valve shall be activated by a drop in building water pressure, no adjustment required.

.12 The trap seal primer valve shall include a manifold when serving two, three, or four traps.

.13 The manifold shall be omitted when serving only one trap.

2.16 Pressure Reducing Valves (22 11 00)

.1 25 mm and smaller: Bronze body, SS integral strainer, renewable SS seat, high temperature rated diaphragm suitable for hot or cold water. Rated at maximum inlet pressure of 2100 kPa, maximum reduced pressure 175 kPa, maximum temperature 90°C.

.2 30 mm and larger: Pilot operated, cast iron body, modified globe design, threaded ends to 50 mm, flanged ends 65 m and larger. Maximum inlet pressure *1225 kPa *2100 kPa. Maximum temperature 90°C. Bronze trim. Pilot control system: bronze with SS trim, hydraulically operated, diaphragm actuated.

.3 Size to suit flow capacities and service.

.4 Provide with gate valve and union on inlet and outlet, globe valve bypass, pressure gauge on inlet and outlet and pressure relief valve on reduced pressure side.

.5 Located in domestic water lines where pressure is more than 552 kPa.

.6 Provide pressure gauge on upstream and downstream side of PRV, complete with pet-cock.

.7 Provide a pressure relief valve suitably sized and pipe to drain.

2.17 Water Meters (22 11 00)

.1 Comply with AWWA and as approved by local utility.

.2 Size: (See plans and schedules) compound for incoming main

.3 Accessories:

.1 4–20 million pulse reader for B.M.S.

.2 Backflow preventer

.3 Pressure reducing valveNew King Township Municipal Centre .

.4 Shutoff valves at inlet and outlet

.5 Valve bypass line

2.18 Make-up Water Valves (22 11 00)

.1 Provide in domestic water lines to systems where shown c/w reduce pressure backflow preventer.

2.19 Non-Freeze Wall Hydrants (Exterior 19 Mm Hose Bibb) (22 11 00)

.1 Recessed with integral vacuum breaker encased box, NPS 3/4 hose outlet, removable operating key. Polished bronze finish.

2.20 Hose Bibbs And Sediment Faucets (22 11 00)

.1 Bronze construction complete with integral backflow preventer, hose thread spout, replaceable composition disc, and chrome plated in finished areas.

PART 3. EXECUTION

3.1 Installation (22 11 00)

.1 Provide new water service complete with a water meter with by-pass valves [and sand strainer]. Provide necessary thrust blocks on underground water piping as required and detailed. [Provide sleeve in wall for service main and adequately support at wall with reinforced concrete bridge. Caulk enlarged sleeve and make watertight with pliable material. Securely anchor service main inside to concrete wall. Provide [1.2 mm] galvanized sheet metal sleeve around service main to 150 mm above floor and 1800 mm above floor and 1800 mm minimum below grade. Size for minimum of 50 mm of loose fill insulation.

.2 Install in accordance with Building Code local authority having jurisdiction and Manufacturer's requirements.

.3 Bury outside water and drainage pipe minimum [1200 mm] [1800 mm], unless noted otherwise.

.4 Cut square, ream and clean tubing and tube ends, clean recesses of fittings and assemble without binding.

.5 Install the water meter approved by the local water authority in accordance with their requirements.

.6 Install the water meter with a valved bypass line with inlet and outlet shutoff valves , reduce pressure valve as required.

.7 All pipe runs shall be laid out to avoid interference with other work/trades.

.8 Install union and shut-off valve on pressure piping at connections to equipment.

.9 Assemble all piping using fittings manufactured to ANSI standards.

.10 Install chrome plated cast brass escutcheon with set screw at each wall, floor and ceiling penetration in exposed finished locations and within cabinets and millwork.

.11 Install tubing close to building structure to minimize furring, conserve headroom and space. Group exposed piping and run parallel to walls.

.12 Connect to fixtures and equipment in accordance with manufacturer's instructions unless otherwise indicated.

.13 Buried tubing:

.1 Lay in well compacted washed sand in accordance with AWWA Class B bedding.

.2 Bend tubing without crimping or constriction. Minimize use of fittings.

.3 Provide all required excavation and backfill.

.14 Penetrations:

.1 Firestopping: Where pipes pass through fire partitions, fire walls, smoke partitions, or floors, install a firestop that provides an effective barrier against the spread of fire, smoke, and gases as specified in Section 07 84 00, FIRESTOPPING. Completely fill and seal clearances between raceways and openings with the firestopping materials.

.2 Waterproofing: At floor penetrations, completely seal clearances around the pipe and make watertight with sealant as specified in Section 07 92 00, Joint Sealants. Bio-based materials shall be utilized when possible.

.3 Acoustical sealant: Where pipes pass through sound rated walls, seal around the pipe penetration with an acoustical sealant that is compliant with ASTM C919.

.15 Install backflow prevention devices on plumbing lines, to code requirements, where contamination of domestic water may occur. Generally necessary on boiler make-up lines, hose bibbs and flush valves.

.16 Install trap primers on all floor drains.

.17 Install pressure reducing valves to limit maximum static pressure at plumbing fixtures to 550 kPa.

.18 Provide PRV in hot water supply to the dishwasher.

.19 Provide a heat trap loop in domestic hot water supply piping at domestic hot water storage tank.

3.2 Valves (22 11 00)

.1 Support all overhung pipes to approval.

.2 Isolate equipment, fixtures and branches with ball valves.

.3 Balance recirculation system using circuit balancing valves. Mark settings and record on as-built drawings on completion.

3.3 Disinfection (22 11 00)

.1 After tests have been successfully completed, thoroughly flush and sterilize the interior domestic water distribution system in accordance with AWWA C651.

.2 Use liquid chlorine or hypochlorite for sterilization.

.3 Flush out, disinfect, rinse and chlorinate system to requirements of authority having jurisdiction approval of Consultant and Local Plumbing Inspector. Provide laboratory test reports on water quality for Consultant approval.

3.4 Testing & Quality Assurance (22 11 00)

.1 Test all pipes and joints in accordance with Applicable Building Code - Plumbing Code and to local Authority requirements.

.2 Pressure test buried system before backfilling.

.3 Refer to section 22 08 00 - Commissioning of Plumbing

END OF SECTION

Section 22 13 00 - Facility Sanitary Sewerage

PART 1. GENERAL

1.1 Scope of Work (22 13 00)

.1 This section pertains to sanitary sewer and vent systems, including piping, equipment and all necessary accessories as designated in this section.

.2 Cleanouts.

.3 Floor Drains and Hub Drains

.4 Area Drains

.5 Equipment Drains

.6 Sump

.7 Backwater Valve Assemblies

.8 Roof Flashings

1.2 General Requirements (22 13 00)

.1 Conform To Section 01 00 00, General Requirements.

.2 Conform To Section 01 33 23, Shop Drawings, Product Data, And Samples.

.3 Conform To Section 01 81 13, Sustainable Construction Requirements.

.4 Conform To Section 07 84 00, Firestopping.

.5 Conform To Section 07 92 00, Joint Sealants.

.6 Conform To Section 09 91 00, Painting.

.7 Conform To Section 22 00 00, Plumbing General

.8 Conform To Section 22 07 19, Plumbing Piping Insulation

.9 Conform To Section 22 08 00, Commissioning Of Plumbing Systems.

1.3 References (22 13 00)

.1 CSA B67, Lead Service Pipe, Waste Pipe, Traps, Bends and Accessories.

.2 CAN/CSA-B70, Cast Iron Soil Pipe, Fittings and Means of Joining.

.3 CAN/CSA-B125, Plumbing Fittings.

.4 CAN/CSA-B181.2 PVC Drain, Waste, and Vent Pipe and Pipe Fittings

1.4 Submittals (22 13 00)

.1 Submittals, including number of required copies, shall be submitted in accordance with Section 01 33 23, Shop Drawings, Product Data, And Samples.

.2 Manufacturer's Literature and Data including: Full item description and optional features and accessories. Include dimensions, weights, materials, applications, standard compliance, model numbers, size, and capacity.

.3 All items listed in Part 2 - Products.

.4 Complete operating and maintenance manuals including wiring diagrams, technical data sheets and information for ordering replacement parts:

Include a complete list indicating all components of the systems.

Include complete diagrams of the internal wiring for each item of equipment.

Diagrams shall have their terminals identified to facilitate installation, operation and maintenance.

1.5 Quality Assurance (22 13 00)

.1 All grooved joint couplings, fittings, valves, and specialties shall be the products of a single manufacturer. Grooving tools shall be by the same manufacturer as the groove components.

.2 All pipe, couplings, fittings, and specialties shall bear the identification of the manufacturer and any markings required by the applicable referenced standards.

1.6 As-Built Documentation (22 13 00)

.1 Submit manufacturer's literature and data updated to include submittal review comments and any equipment substitutions.

.2 Submit operation and maintenance data updated to include submittal review comments, substitutions and construction revisions shall be in electronic version or inserted into a three-ring binder. All aspects of system operation and maintenance procedures, including piping isometrics, wiring diagrams of all circuits, a written description of system design, control logic, and sequence of operation shall be included in the operation and maintenance manual. The operations and maintenance manual shall include troubleshooting techniques and procedures for emergency situations. Notes on all special systems or devices shall be included. A list of recommended spare parts (manufacturer, model number, and quantity) shall be furnished. Information explaining any special knowledge or tools the owner will be required to employ shall be inserted into the As-Built documentation.

.3 The installing contractor shall maintain as-built drawings of each completed phase for verification; and, shall provide the complete set at the time of final systems certification testing. As-built drawings are to be provided, and a copy of them in pdf and Auto-CAD version. Should the installing contractor engage the testing company to provide as-built or any portion thereof, it shall not be deemed a conflict of interest or breach of the 'third party testing company' requirement.

.4 Certification documentation shall be provided to the engineer 10 working days prior to submitting the request for final inspection. The documentation shall include all test results, the names of individuals performing work for the testing agency on this project, detailed procedures followed for all tests, and certificate if applicable that all results of tests were within limits specified. If a certificate is not available, all documentation shall be on the Certifier's letterhead.

PART 2. PRODUCTS

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2.1 Cast iron waste, drain, and vent pipe and fittings. (22 13 00)

.1 Cast iron waste, drain, and vent pipe and fittings shall be used for the following applications:

Pipe buried in or in contact with earth.

Sanitary pipe extensions to a distance of approximately 1500 mm (5 feet) outside of the building.

Interior waste and vent piping above grade.

.2 Cast iron Pipe shall be bell and spigot or hubless (plain end or no-hub or hubless).

.3 The material for all pipe and fittings shall be cast iron soil pipe and fittings and shall conform to the requirements of CISPI 301, ASTM A888, or ASTM A74.

.4 Cast iron pipe and fittings shall be made from a minimum of 95 percent post-consumer recycled material.

.5 Joints for hubless pipe and fittings shall conform to the manufacturer's installation instructions. Couplings for hubless joints shall conform to CISPI 310. Joints for hub and spigot pipe shall be installed with compression gaskets conforming to the requirements of ASTM C564.

2.2 Copper Tube, (DWV) (22 13 00):

.1 Copper DWV tube sanitary waste, drain and vent pipe may be used for piping above ground, except for urinal drains.

.2 The copper DWV tube shall be drainage type, drawn temper conforming to ASTM B306.

.3 The copper drainage fittings shall be cast copper or wrought copper conforming to ASME B16.23 or ASME B16.29.

.4 The joints shall be lead free, using a water flushable flux, and conforming to ASTM B32.

2.3 Polyvinyl Chloride (PVC) (22 13 00)

.1 Polyvinyl chloride (PVC) pipe and fittings are permitted where the waste temperature is below 60 degrees C (140 degrees F).

.2 PVC piping and fittings shall NOT be used for the following applications:

.1 Waste collected from steam condensate drains.

.2 Spaces such as mechanical equipment rooms, kitchens, Sterile Processing Services, sterilizer areas, and areas designated for sleep.

.3 Vertical waste and soil stacks serving more than two floors.

.4 Exposed in mechanical equipment rooms.

.5 Exposed inside of the ceiling return plenums.

.3 Polyvinyl chloride sanitary waste, drain, and vent pipe and fittings shall be solid core sewer piping conforming to ASTM D2665, sewer and drain series with ends for solvent cemented joints.

.4 Fittings: PVC fittings shall be solvent welded socket type using solvent cement conforming to ASTM D2564.

2.4 Combustible DWV Pipe and Fittings in Non-Combustible Construction (22 13 00)

.1 Provide pipes and fittings as required and specified in the following information. Approval must be confirmed by local Plumbing and Building Authorities (prior to installation) for the systems as indicated. Where combustible materials are specified, the manufacturer (IPEX Inc.) shall be contacted for proper installation, joining methods and firestopping recommendations. Pipe, fittings and cements shall be supplied by one manufacturer.

2.5 Low Rise* Buildings (22 13 00)

.1 (*If building is not classified as High Building as per Sec. 3.2.6 or for piping installations not in areas defined as Plenums as per Sec. 3.5.4.3)

.2 Sizes 1-1/2” and larger sanitary and vent piping shall be IPEX 'System 15' DWV certified to CAN/CSA-B181.2 and listed by ULC, ITS or other accredited test agency to Standard CAN/ULC-S102.2-10 exhibiting a Flame Spread Rating not exceeding 25. Pipe, fittings and solvent cement shall be gray in color and be supplied from one manufacturer and any deviations from this shall be as approved only by the pipe manufacturer.

2.6 Plenums and High Building Construction (22 13 00)

.1 For areas of a non-combustible building defined as Plenums or High Buildings, both as defined above, sizes 1½” and larger sanitary, storm and vent piping shall be System XFR DWV. Products must be certified to CSA B181.2 and be listed to exhibit a Flame Spread Rating not greater than 25 and a Smoke Developed Classification not greater than 50 when tested in accordance with CAN/ULC S102.2 test methods. Pipe, fittings and solvent cement shall be gray in color and be supplied from one manufacturer and any deviations from this shall be as approved only by the pipe manufacturer.

2.7 Pump Discharge Piping (22 13 00)

.1 Galvanized steel pump discharge pipe and fittings:

.2 Galvanized steel pipe shall be Schedule 40 weight class conforming to ASTM A53/A53M, with square cut grooved or threaded ends to match joining method.

.3 Fittings shall be Class 125, gray-iron threaded fittings conforming to ASME B16.4.3.

.4 Unions shall be Class 150 hexagonal-stock body with ball and socket, metal to metal, bronze seating surface, malleable iron conforming to ASME B16.39 with female threaded ends.

.5 Flanges shall be Class 125 cast iron conforming to ASME B16.1.

.1 Flange gaskets shall be full face, flat nonmetallic, asbestos free conforming to ASME B16.21.

.2 Flange nuts and bolts shall be carbon steel conforming to ASME B18.2.1.

.6 Copper pump discharge pipe and fittings:

.7 Copper tube shall be hard drawn Type L conforming to ASTM B88.

.8 Fittings shall be cast copper alloy conforming to ASME B16.18 or wrought copper conforming to ASME B16.22 with solder joint ends.

.9 Unions shall be copper alloy, hexagonal stock body with ball and socket, metal to metal seating surface conforming to MSS SP-123 with female solder-joint or //threaded ends//.

.10 Flanges shall be Class 150, cast copper conforming to ASME B16.24 with solder-joint end.

.1 Flange gaskets shall be full face, flat nonmetallic, asbestos free conforming to ASME B16.21.

.2 Flange nuts and bolts shall be carbon steel conforming to ASME B18.2.1.

.11 Solder shall be lead free, water flushable flux conforming to ASTM B32 and ASTM B813.

2.8 Specialty Pipe Fittings (22 13 00)

.1 Transition pipe couplings shall join piping with small differences in outside diameters or different materials. End connections shall be of the same size and compatible with

the pipes being joined. The transition coupling shall be elastomeric, sleeve type reducing or transition pattern and include shear and corrosion resistant metal, tension band and tightening mechanism on each end. The transition coupling sleeve coupling shall be of the following material:

.1 For cast iron soil pipes, the sleeve material shall be rubber conforming to ASTM C564.

.2 For PVC soil pipes, the sleeve material shall be elastomeric seal or PVC, conforming to ASTM F477 or ASTM D5926.

.3 For dissimilar pipes, the sleeve material shall be PVC conforming to ASTM D5926, or other material compatible with the pipe materials being joined.

.2 The dielectric fittings shall conform to ASSE 1079 with a pressure rating of 861 kPa (125 psig) at a minimum temperature of 82 degrees C (180 degrees F). The end connection shall be solder joint copper alloy and threaded ferrous.

.3 Dielectric flange insulating kits shall be of non-conducting materials for field assembly of companion flanges with a pressure rating of 1035 kPa (150 psig). The gasket shall be neoprene or phenolic. The bolt sleeves shall be phenolic or polyethylene. The washers shall be phenolic with steel backing washers.

.4 The di-electric nipples shall be an electroplated steel nipple complying with ASTM F1545 with a pressure rating of 2070 kPa (300 psig) at 107 degrees C (225 degrees F). The end connection shall be male threaded. The lining shall be inert and noncorrosive propylene.

2.9 Solvent Cement Material and Procedures (22 13 00):

.1 For sizes 1 ½” through 6”, solvent cement shall be CSA certified IPEX System 15/XFR DWV One-Step Cement. For sizes larger than 6” (150 mm), or in temperatures below 5°C, IPEX ‘System 15’ Two-Step Cement and primer shall be used. Cements and primers shall have a shelf life of maximum of 3 years from the manufacturing date printed on the container. The use of cement products other than what is supplied by pipe manufacturers is prohibited unless approved by pipe manufacturers.

.2 Ends of cut pipe must be squarely cut with all burrs and loose materials removed. Chamfering of the pipe end is done to maximize distribution of cement inside the joint. Preferred tool for this procedure in sizes up to 100 mm (4") is the DEB No.4 made by Reed Manufacturing, or other tool as approved by pipe manufacturers. Installer shall use the proper sized applicator when applying solvent cement and primer, typically sized at ½ of the pipe diameter being joined.

.3 After application of primer (if required) and cement, the pipe end shall be inserted into the fitting socket until fully bottomed in the socket. A one-quarter turn during insertion shall be done with the pipe then held in position for 10-15 seconds until the solvent cement begins to set and cure. Pipe manufacturers shall have complete installation instructions available to installers with respect to proper sized applicators, exact cementing procedure and recommended set and cure times.

2.10 Mechanical Joint Couplings (22 13 00)

.1 For sizes 8"-12", an optional joining method for pipe and fittings shall be Mechanical Joint Couplings. The couplings shall be certified to CSA B602 and shall be listed to CAN/ULC S102.2-10 to exhibit a Flame Spread Rating of not greater than 25 and a Smoke Developed Classification of not greater than 50. Product shall be labeled to clearly display CSA certification and ULC listings. Products shall be supplied by pipe manufacturer and be designed for use on pipe manufacturer's products only. Couplings shall be 'MJ Grey' by IPEX.

2.11 Slopes And Grades (22 13 00)

.1 Unless otherwise noted, water, drains and waste piping shall grade down in direction of flow as follows:

Up to and including 3" size - 2 percent (unless otherwise noted) 100 mm size and larger - 1 percent (unless noted otherwise).

Grade vent piping up from fixtures so it is self draining. Minimum grades shall conform to plumbing codes.

2.12 Firestopping (22 13 00)

When the DWV piping system partly or wholly penetrates a fire separation, a firestopping system listed to the Standard CAN/ULC4-S115 with a pressure

differential of 50 Pascals must be installed at the penetration. Firestop listings for all piping materials shall have an F-Rating equal to the Fire Resistance rating of the separation being penetrated, typically 2 hours. For penetrations between parkades and main level, firestop systems must have a 2 hour FT-Rating.

2.13 Transitions (22 13 00)

Transitions between both System 15 and System XFR shall be permitted without limitations

2.14 Clean-Outs and Clean-Out Access Covers (22 13 00)

.1 Install cleanouts whether shown or not, as required by code or by authorities having jurisdiction, on sanitary drains.

.2 Bring below floor cleanouts up to finished floor level with a 'Y' and l/8th bend. Locate all cleanouts for ready access and in areas of least traffic. Indicate cleanouts on record/as-built drawings.

.3 Cleanouts behind walls shall be installed so that the bolted cover on the cleanout ferrule will be within 1” of the finished wall. Where they are concealed behind tiled walls, access shall be provided by Ancon, round stainless steel plate and slotted flat head screw.

.4 Cleanouts shall be the same size as the pipe, up to 100 mm (4 inches); and not less than 100 mm (4 inches) for larger pipe. Cleanouts shall be easily accessible and shall be gastight and watertight. Minimum clearance of 600 mm (24 inches) shall be provided for clearing a clogged sanitary line.

.5 Provide Barret type cleanouts at the base of all soil stacks and rainwater leaders. Where cleanouts are furred in, provide access doors.

.6 Floor cleanouts shall be gray iron housing with clamping device and round, secured, scoriated, gray iron cover conforming to ASME A112.36.2M. A gray iron ferrule with hubless, socket, inside calk or spigot connection and counter sunk, taper-thread, brass or bronze closure plug shall be included. The frame and cover material and finish shall be nickel-bronze copper alloy with a square shape. The cleanout shall be vertically adjustable for a minimum of 50 mm (2 inches). When a waterproof membrane is used in the floor system, clamping collars shall be provided on the

cleanouts. Cleanouts shall consist of wye fittings and eighth bends with brass or bronze screw plugs. Cleanouts in the resilient tile floors, quarry tile and ceramic tile floors shall be provided with square top covers recessed for tile insertion. In the carpeted areas, carpet cleanout markers shall be provided. Two way cleanouts shall be provided where indicated on drawings and at every building exit. The loading classification for cleanouts in sidewalk areas or subject to vehicular traffic shall be heavy duty type.

.7 Cleanouts shall be provided at or near the base of the vertical stacks with the cleanout plug located approximately 600 mm (24 inches) above the floor. If there are no fixtures installed on the lowest floor, the cleanout shall be installed at the base of the stack. The cleanouts shall be extended to the wall access cover. Cleanout shall consist of sanitary tees. Nickel bronze square frame and stainless steel cover with minimum opening of 150 by 150 mm (6 by 6 inches) shall be furnished at each wall cleanout. Where the piping is concealed, a fixture trap or a fixture with integral trap, readily removable without disturbing concealed pipe, shall be accepted as a cleanout equivalent providing the opening to be used as a cleanout opening is the size required.

.8 In horizontal runs above grade, cleanouts shall consist of cast brass tapered screw plug in fitting or caulked/hubless cast iron ferrule. Plain end (hubless) piping in interstitial space or above ceiling may use plain end (hubless) blind plug and clamp.

2.15 Floor Drains and Hub Drains (22 13 00)

.1 Floor drains and Hub drains shall have lacquered cast iron body with double drainage flange, weep holes combined two piece body reversible clamping device and adjustable nickel/bronze strainer. Shower and washroom floor drains shall have a removable perforated sediment bucket.

.2 Floor drains in equipment rooms shall have polished bronze funnel type strainer [, and extension for floating floor].

.3 Floor drain shall comply with ASME A112.6.3. A caulking flange, inside gasket, or hubless connection shall be provided for connection to cast iron pipe, screwed or no hub outlets for connection to steel pipe. The drain connection shall be the bottom outlet. A membrane clamp and extensions shall be provided, if required, where installed in connection with waterproof membrane. Puncturing membrane other than

for drain opening is prohibited. Double drainage pattern floor drains shall have integral seepage pan for embedding into floor construction, and weep holes to provide adequate drainage from pan to drain pipe.

.4 Medium duty (non-traffic) floor drain shall comply with ASME A112.6.3. Floor drain shall be constructed of galvanized cast iron with medium duty nickel bronze grate, double drainage pattern, clamping device, without sediment bucket but with secondary strainer in bottom for large debris. The grate shall be square, 175 mm (7 inches) minimum.

.5 Medium duty (non-traffic) floor drain shall comply with ASME A112.6.3. Floor drain shall have a cast iron body, double drainage pattern, clamping device, light duty nickel bronze adjustable strainer with round or square grate of 150 mm (6 inches) width or diameter minimum for toilet rooms, showers and kitchens. Grates shall have vandal-proof screws.

.6 Medium duty (non-traffic) floor drain shall comply with ASME A112.6.3. Floor drain shall have a cast iron body, shallow type with double drainage flange and removable, perforated aluminum sediment bucket. The type G drain shall have all interior and exposed exterior surfaces coated with acid resistant porcelain enamel finish. The floor drain shall have a clamping device. The frame and grate shall be nickel bronze. The grate shall be approximately 200 mm (8 inches) in diameter. The space between the body of the drain and basket shall be sufficient for free flow of wastewater.

.7 Medium duty (non-traffic) floor drain shall comply with ASME A112.6.3. Floor drain shall have a cast iron body, nickel bronze adjustable funnel strainer and clamping device. Funnel strainer shall consist of a perforated floor level square or round grate and funnel extension for indirect waste. Cut-out grate below funnel. Minimum dimensions as follows:

.1 Area of strainer and collar – 23,000 square mm (36 square inches).

.2 Height of funnel – 95 mm (3 3/4 inches).

.3 Diameter of lower portion of funnel – 50 mm (2 inches).

.4 Diameter of top portion of funnel – 100 mm (4 inches).

.5 Provide paper collars for construction purposes.

.8 Floor sink shall comply with ASME A112.6.3. Floor sink shall be constructed from Type 304 stainless steel and shall be 300 mm (12 inches) square, and 200 mm (8 inches deep). The interior surface shall be polished. The double drainage flange shall be provided with weep holes, internal dome strainer, and heavy duty non-tilting loose set grate. A clamping device shall be provided.

2.16 Area Drains (22 13 00)

.1 Area drain shall have lacquered cast iron body with adjustable collar and galvanized ductile iron locking grate.

2.17 Equipment Drains (22 13 00)

.1 Provide a sloped connection from packaged equipment drain pans to the nearest sanitary sewer trapped connection. Slope at minimum of 0.5% grade. Drain sizes to be *20 *25 mm complete with 100 mm deep trap at unit.

.2 Provide in each section of a built-up air handling unit which maintains water carry over a *galvanized waterproof drain pan *waterproof concrete plenum with a minimum of 50 mm sides and a floor sloped to a 50 mm floor drain, to be full width of the plenum and a rim of 1/2 the plenum height in length. Drain is to be flashed into the waterproof floor and is to slope to an open trapped sanitary connection at a rim of 0.5% grade. Floor drain trap is to be deep enough to ensure a water seal at a maximum pressure of the fan system with a rim depth of 100 mm.

2.18 Traps (22 13 00)

.1 Traps shall be provided on all sanitary branch waste connections from fixtures or equipment not provided with traps. Exposed brass shall be polished brass chromium plated with nipple and set screw escutcheons. Concealed traps may be rough cast brass or the same material as the piping they are connected to. Slip joints are prohibited on the sewer side of the trap. Traps shall correspond to fittings on cast iron soil pipe or steel pipe respectively, and size shall be as required by connected service or fixture.

2.19 Sump (22 13 00)

.1 Reinforced concrete sumps shall have necessary drainage fittings, 10 mm checkered steel plate covers with gasket seal frames anchor bolts.

.2 Provide grated cover over one sump compartment when used for area drain.

2.20 Backwater Valve Assemblies (22 13 00)

.1 Provide complete assembly, epoxy coated, cast-iron body, bronze flapper check valve, bolted access cover with neoprene gasket *extended floor access and neoprene gasketed heavy-duty nickel-bronze cover *heavy gauge steel epoxy coated access housing and neoprene gasketed heavy-duty nickel-bronze cover.

2.21 Venting (22 13 00)

.1 Fixtures shall be vented according to the Applicable Building Codes and in conformance with regulations and the latest regulation of National Plumbing Code.

.2 Vents smaller than 3” in diameter shall be increased to 3” before the same pass through the roof. Vent lines shall be connected into the soil stack above the highest fixture or separately carried through roof to a height 12” above the roof line and properly flashed. Soil stacks shall end 12” above the roof.

.3 For other than building piping systems, vents shall be installed at the high points to permit venting any system without breaking a joint.

2.22 Roof Flashings (22 13 00)

.1 This contractor supplies (and locates) to the roofing contractor all washroom vent flashings required for the plumbing system.

2.23 Penetration Sleeves (22 13 00)

.1 A sleeve flashing device shall be provided at points where pipes pass through membrane waterproofed floors or walls. The sleeve flashing device shall be manufactured, cast iron fitting with clamping device that forms a sleeve for the pipe floor penetration of the floor membrane. A galvanized steel pipe extension shall be included in the top of the fitting that will extend 50 mm (2 inches) above finished floor

and galvanized steel pipe extension in the bottom of the fitting that will extend through the floor slab. A waterproof caulked joint shall be provided at the top hub.

PART 3. EXECUTION

3.1 Installation (22 13 00)

.1 Provide new sanitary sewer connections to site services. Before commencing work, check invert elevations required for sewer connections with Civil Site Servicing plan, confirm inverts and ensure that these can be properly connected with sufficient slope for drainage and adequate cover to avoid freezing.

.2 All sanitary drainage and venting to be Installed in accordance with Applicable Plumbing Code and local authority having jurisdiction. Support all overhead pipes to approval.

.3 Bury outside drainage pipe minimum [1200 mm] [1800 mm], unless noted otherwise.

.4 Drainage lines shall be properly graded as indicated on drawings or mentioned in this specification.

.5 Pipe shall be round and straight. Cutting shall be done with proper tools. Pipe shall be reamed to full size after cutting.

.6 All pipe runs shall be laid out to avoid interference with other work.

.7 The piping shall be installed above accessible ceilings where possible.

.8 The piping shall be installed to permit valve servicing or operation.

.9 The piping shall be installed free of sags and bends.

.10 Changes in direction for soil and waste drainage and vent piping shall be made using appropriate branches, bends and long sweep bends. Sanitary tees and short sweep quarter bends may be used on vertical stacks if change in direction of flow is from horizontal to vertical. Long turn double wye branch and eighth bend fittings shall be used if two fixtures are installed back to back or side by side with common drain pipe. Straight tees, elbows, and crosses may be used on vent lines. Do not change direction of flow more than 90 degrees. Proper size of standard increaser

and reducers shall be used if pipes of different sizes are connected. Reducing size of drainage piping in direction of flow is prohibited.

.11 Buried soil and waste drainage and vent piping shall be laid beginning at the low point of each system. Piping shall be installed true to grades and alignment indicated with unbroken continuity of invert. Hub ends shall be placed upstream. Required gaskets shall be installed according to manufacturer's written instruction for use of lubricants, cements, and other installation requirements.

.12 Unless otherwise indicated, all necessary excavating and backfilling shall be done by this contractor.

.13 Excavations are to be kept free of water.

.14 Backfill inside the building and under paved areas with pit run gravel or sand properly tamped in 12" layers.

.15 Lay all piping on a bed of solid un-disturbed earth or where this is not obtainable, on concrete pads, supported by concrete piers extended down to un-disturbed bearing.

.16 Where any excavating is necessary in close proximity to or below any footing level, backfill with 1,500 lb. concrete to the level of the top of the highest adjacent footing.

.17 At the completion of the project fill-in and level off exterior excavations

.18 Provide a vent line to each fixture and trap to Building Code requirements and pass through the roof.

.19 Vent lines thru their roof shall have very minimum penetrations. Terminate through the roof at a pre approved location.

.20 Lubricate clean-out plugs with mixture of graphite and linseed oil. Prior to building turnover remove clean-out plugs, re-lubricate and reinstall using only enough force to ensure permanent leak proof joints.

.21 Where floor drains are located over occupied areas, provide waterproof installation.

.22 Install trap primers on all floor drains.

.23 Locate plumbing vents minimum 5 m from air intakes.

3.2 Pipe Hangers, Supports And Accessories (22 13 00)

.1 All piping shall be supported according to the National Plumbing Code of Canada , Section 22 00 00 Plumbing General Requirements, and these specifications. Where conflicts arise between these the code and Section 22 00 00 Plumbing General Requirements the most restrictive or the requirement that specifies supports with highest loading or shortest spacing shall apply.

.2 Hangers, supports, rods, inserts and accessories used for pipe supports shall be painted according to Section 09 91 00, PAINTING. Electroplated copper hanger rods, hangers and accessories may be used with copper tubing.

.3 Horizontal piping and tubing shall be supported within 300 mm (12 inches) of each fitting or coupling.

.1 Horizontal cast iron piping shall be supported with the following maximum horizontal spacing and minimum hanger rod diameters:

.2 40 mm or DN40 to 50 mm or DN50 (NPS 1-1/2 inch to NPS 2 inch): 1500 mm (60 inches) with 10 mm (3/8 inch) rod.

.3 75 mm or DN75 (NPS 3 inch): 1500 mm (60 inches) with 15 mm (1/2 inch) rod.

.4 100 mm or DN100 to 125 mm or DN125 (NPS 4 inch to NPS 5 inch): 1500 mm (60 inches) with 18 mm (5/8 inch) rod.

.5 150 mm or DN150 to 200 mm or DN200 (NPS 6 inch to NPS 8 inch): 1500 mm (60 inches) with 20 mm (3/4 inch) rod.

.6 250 mm or DN250 to 300 mm or DN300 (NPS 10 inch to NPS 12 inch): 1500 mm (60 inch) with 23 mm (7/8 inch) rod.

.4 The maximum spacing for plastic pipe shall be 1.22 m (4 feet).

.5 Vertical piping and tubing shall be supported at the base, at each floor, and at intervals no greater than 4.6 m (15 feet).

.6 In addition to the requirements in Section 22 05 11, COMMON WORK RESULTS FOR PLUMBING, Floor, Wall and Ceiling Plates, Supports, Hangers shall have the following characteristics:

.1 Solid or split unplated cast iron.

.2 All plates shall be provided with set screws.

.3 Height adjustable clevis type pipe hangers.

.4 Adjustable floor rests and base flanges shall be steel.

.5 Hanger rods shall be low carbon steel, fully threaded or threaded at each end with two removable nuts at each end for positioning rod and hanger and locking each in place.

.6 Riser clamps shall be malleable iron or steel.

.7 Rollers shall be cast iron.

.7 Miscellaneous materials shall be provided as specified, required, directed or as noted on the drawings for proper installation of hangers, supports and accessories. If the vertical distance exceeds 6.1 m (20 feet) for cast iron pipe additional support shall be provided in the center of that span. All necessary auxiliary steel shall be provided to provide that support.

.8 Cast escutcheon with set screw shall be provided at each wall, floor and ceiling penetration in exposed finished locations and within cabinets and millwork.

.9 Penetrations:

.1 Fire Stopping: Where pipes pass through fire partitions, fire walls, smoke partitions, or floors, a fire stop shall be installed that provides an effective barrier against the spread of fire, smoke and gases as specified in Section 07 84 00, FIRESTOPPING. Clearances between raceways and openings shall be completely filled and sealed with the fire stopping materials.

.2 Water proofing: At floor penetrations, clearances shall be completely sealed around the pipe and make watertight with sealant as specified in Section 07 92 00, Joint Sealants.

.3 Coordinate all roof penetrations with architectural design details.

3.3 Performance Verification (22 13 00)

.1 Cleanouts:

Ensure accessible and that access doors are correctly located.

Open, cover with linseed oil and re-seal.

Verify that cleanout rods can probe as far as the next cleanout, at least.

.2 Test to ensure traps are fully and permanently primed.

.3 Ensure that fixtures are properly anchored, connected to the system and effectively vented.

.4 Affix applicable label (storm, sanitary, vent, pump discharge etc.) c/w directional arrows every floor or 4.5 m (whichever is less).

3.4 Testing & Quality Assurance (22 13 00)

.1 Pressure test buried systems before backfilling.

.2 Hydraulically test to verify grades and freedom from obstructions.

.3 Test the system in accordance with the Applicable Building Code, National Plumbing Code of Canada and to local Authority requirements.

.4 Sanitary waste and drain systems shall be tested either in its entirety or in sections.

.5 Waste System tests shall be conducted before trenches are backfilled or fixtures are connected. A water test or air test shall be conducted, as directed.

.6 If entire system is tested for a water test, tightly close all openings in pipes except highest opening, and fill system with water to point of overflow. If the waste system is tested in sections, tightly plug each opening except highest opening of section under test, fill each section with water and test with at least a 3 m (10 foot) head of water. In testing successive sections, test at least upper 3 m (10 feet) of next preceding section so that each joint or pipe except upper most 3 m (10 feet) of system has been submitted to a test of at least a 3 m (10 foot) head of water. Water shall be kept in the system, or in portion under test, for at least 15 minutes before inspection starts. System shall then be tight at all joints.

.7 For an air test, an air pressure of 34 kPa (5 psig) gage shall be maintained for at least 15 minutes without leakage. A force pump and mercury column gage shall be used for the air test.

.8 After installing all fixtures and equipment, open water supply so that all p-traps can be observed. For 15 minutes of operation, all p-traps shall be inspected for leaks and any leaks found shall be corrected.

.9 Refer to section 22 08 00 - Commissioning of Plumbing

END OF SECTION

Section 22 40 00 - PLUMBING FIXTURES

PART 1: GENERAL

1.1 Scope of Work (22 40 00)

.1 Plumbing fixtures, associated trim and fittings necessary to make a complete installation from wall or floor connections to rough piping, and certain accessories.

1.2 General Requirements (22 40 00)

.1 Conform to Section 01 00 00, General Requirements.

.2 Conform to Section 01 33 23, Shop Drawings, Product Data, And Samples.

.3 Conform to Section 01 81 13, Sustainable Construction Requirements.

.4 Conform to Section 01 91 00, General Commissioning Requirements.

.5 Conform to Section 07 92 00, Joint Sealants: Sealing between fixtures and other finish surfaces.

.6 Conform to Section 08 31 13, Access Doors And Frames: Flush panel access doors.

.7 Conform to Section 22 00 00 - Plumbing General

.8 Conform to Section 22 08 00, Commissioning Of Plumbing Systems

.9 Conform to Section 22 11 00, Water Distribution.

.10 Conform to Section 22 13 00, Facility Sanitary And Vent Piping.

1.3 References (22 40 00)

.1 Conform to the latest edition of the Applicable Building Code, the Regional Municipality & Local Building & Fire Department By-laws.

.2 Canadian Standards Association (CSA)

.1 CAN/CSA-B45 Series, CSA Standards on Plumbing Fixtures.

.2 CAN/CSA-B125, Plumbing Fittings.

.3 CAN/CSA-B651, Barrier-Free Design.

1.4 Submittals (22 40 00)

.1 Shop Drawings - Submit shop drawings for engineer review.

.2 Manufacturer's Literature and Data Including: Full item description and optional features and accessories. Include dimensions, weights, materials, applications, standard compliance, model numbers, size, and capacity.

.3 Operation and Maintenance Data

.4 Submit printed operation instructions and maintenance data.

1.5 As-Built Documentation (22 40 00)

.1 Submit manufacturer’s literature and data updated to include submittal review comments and any equipment substitutions.

.2 Submit operation and maintenance data updated to include submittal review comments, substitutions and construction revisions shall be in electronic version or inserted into a three-ring binder. All aspects of system operation and maintenance procedures, including piping isometrics, wiring diagrams of all circuits, a written description of system design, control logic, and sequence of operation shall be included in the operation and maintenance manual. The operations and maintenance manual shall include troubleshooting techniques and procedures for emergency situations. Notes on all special systems or devices shall be included. A list of recommended spare parts (manufacturer, model number, and quantity) shall

be furnished. Information explaining any special knowledge or tools the owner will be required to employ shall be inserted into the As-Built documentation.

.3 The installing contractor shall maintain as-built drawings of each completed phase for verification; and, shall provide the complete set at the time of final systems certification testing. As-built drawings are to be provided, and a copy of them in pdf and Auto-CAD version. Should the installing contractor engage the testing company to provide as-built or any portion thereof, it shall not be deemed a conflict of interest or breach of the 'third party testing company' requirement.

.4 Certification documentation shall be provided to the engineer 10 working days prior to submitting the request for final inspection. The documentation shall include all test results, the names of individuals performing work for the testing agency on this project, detailed procedures followed for all tests, and certificate if applicable that all results of tests were within limits specified. If a certificate is not available, all documentation shall be on the Certifier's letterhead.

1.6 General Requirements (22 40 00)

.1 Provide new fixtures, CSA approved, free from flaws and blemishes with finished surfaces clear, smooth and bright.

.2 Provide CSA approved plumbing fittings. Visible parts of fixture brass and accessories shall be heavily chrome plated.

.3 Fixtures shall be products of one manufacturer. Fittings of the same type shall be the product of one manufacturer.

.4 Protect fixtures against use and damage during construction.

.5 Comply with the current water saving ratings of the Applicable Building Code, and ASHRAE/IEEE 90.1. Fixtures to have maximum flow rates as follows:

Lavatories	1.9 LPS
Shower heads	5.7 LPM

Urinals	0.5 LPF
Water closets	4.2 LPF
Sinks	5.7 LPM

.6 Verify each fixture with millwork provided by another Section. No extra will be allowed if revisions are required due to millwork provided by another Section.

.7 Provide floor supported chair carrier for all wall mounted units.

.8 Verify mounting height of all fixtures with Architect Before Rough-in. Adjust flush valves to provide adequate flush with minimum water. Provide all wiring to electrically operated units from outlets provided by Division 26.

PART 2: PRODUCTS

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Refer to Plumbing Fixture Schedules

PART 3: EXECUTION

3.1 Installation (22 40 00)

.1 Furnish, install and connect up completely all plumbing fixtures according to the following specifications. Fixtures shall be piped complete in a first class manner and every part shall be furnished to make the fixture complete in every respect, whether particularly called for or not. Each fixture shall be separately trapped and the traps placed as near the fixture as possible and of the same size as the piping. The Contractor shall furnish all the necessary piping, supports, brackets, lugs, and bolts, etc., that are necessary or required to properly set and support the fixture.

.2 Install each fixture to Manufacturer's directions. Provide all accessories as required including electric wiring.

.3 Adjust to provide specified water flow rate based on manufacturers calibration data for valve open vs. inlet water pressure.

.4 All fixtures shall be set level and square with relation to interior finish, floor and wall lines.

.5 Provide trap and vent line to each fixture.

.6 At completion thoroughly clean plumbing fixtures and equipment.

.7 Fixture hangers, support and fittings shall be of the best suited for the fixture concerned and the surface against which it is mounted.

.8 Install water supply piping to each fixture requiring water supply connection. Provide stops on each supply in a readily-serviced location. Fasten supply piping to supports or substrate.

.9 Provide chrome plated rigid or flexible supplies to fixtures with screwdriver stops, reducers and escutcheons.

.10 Install wall mounted lavatories and urinals and water closets with approved wall carriers. Carriers shall be furnished for all wall hung water closets, urinals and lavatories and shall be floor mounted and suitable for each particular fixture.

.11 Run all services concealed in the wall. Do not run any exposed pipes.

.12 All visible parts of the trimmings of the fixtures including faucets, wastes, traps, pipe, etc., shall be chrome plated.

.13 Seal joints between fixtures and walls, floors, and countertops with mildew-resistant silicone sealant.

.14 Supports and Fastening: Secure all fixtures, equipment and trimmings to partitions, walls and related finish surfaces. Exposed heads of bolts and nuts in finished rooms will be hexagonal, polished chrome plated brass with rounded tops.

.15 Tightly cover and protect fixtures and equipment against dirt, water and chemical or mechanical injury.

.16 Where the water closet waste pipe has to be offset due to beam interference, provide correct and additional piping necessary to eliminate relocation of the water closet.

3.2 Fixtures Piping Rough-In Schedule (22 40 00)

.1 Rough-in fixture piping connections in accordance with the following table of minimum sizes.

	Hot Water	Cold Water	Waste	Vent
Lavatories	½”Ø (13mm)	½”Ø (13mm)	1-½”Ø (38mm)	1-½”Ø (38mm)
Service Sink	½”Ø (13mm)	½”Ø (13mm)	2”Ø (50mm)	1-½”Ø (38mm)
Kitchen Sink	½”Ø (13mm)	½”Ø (13mm)	1-½”Ø (38mm)	1-½”Ø (38mm)
Drinking Fountain		½”Ø (13mm)	1-½”Ø (38mm)	1-½”Ø (38mm)
Water Closet (Flush Valve)		1”Ø (25mm)	3”Ø (75mm)	1-½”Ø (38mm)
Water Closet (Tank Type)		½”Ø (13mm)	3”Ø (75mm)	1-½”Ø (38mm)
Urinals (Flush Valve)		3/4”Ø (19mm)	2”Ø (50mm)	1-½”Ø (38mm)

Bath Tub		½"Ø (13mm)	1-½"Ø (38mm)	1-½"Ø (38mm)
Shower (Single Stall)	½"Ø (13mm)	½"Ø (13mm)	1-½"Ø (38mm)	1-½"Ø (38mm)
Laundry Tub	½"Ø (13mm)	½"Ø (13mm)	1-½"Ø (38mm)	1-½"Ø (38mm)
Floor Drains			See Plumbing Schedule	1-½"Ø (38mm)

3.3 Cleaning And Protection (22 40 00)

.1 Repair or replace defective work, including damaged fixtures and components.

.2 Clean unit surfaces, test fixtures, and leave in ready-to-use condition.

3.4 Testing And Adjusting (22 40 00)

.1 Set field-adjustable temperature set points of temperature-actuated water mixing valves. Adjust the set point within the allowable temperature range.

.2 Test and adjust installation.

.3 Remove and replace malfunctioning thermostatic mixing valves and retest.

END OF SECTION