

Part 1 General

1.1 SCOPE

- .1 Specification covers the requirements for materials, fabrication and erection of above-grade piping and components for the Return Activated Sludge (RAS) and Waste Activated Sludge (WAS) systems. Erection shall consist of complete installation of piping systems as defined by the piping drawings and documents. It includes installation of all piping, piping components, and related examination, inspection and testing.
- .2 Fabrication and erection of piping shall be in accordance with the applicable requirements of Process Piping ASME B31.3, and Canadian and Provincial Acts and Regulations.
- .3 Contractor shall be responsible for obtaining and providing registrations, data reports, certifications, permits and other authorizations required for compliance with codes and regulations. Contractor shall provide such assistance as may be required to enable The City to obtain certification and acceptance of piping systems by the Authority having Jurisdiction.
- .4 Contractor is to have a current QA/QC pressure piping procedure approved by the Authority having jurisdiction.

1.2 CODES, STANDARDS AND REFERENCES

- .1 The following codes, standards, and references shall apply except as specified in Specification.
 - .1 Provincial Regulations
 - .1 Boiler and Pressure Vessel Act and Associated Regulations
 - .2 American Society of Mechanical Engineers (ASME)
 - .1 B1.20, Pipe Threads (except Dryseal)
 - .2 B16.25, Buttwelding Ends
 - .3 B31.3, Process Piping
 - .3 Canadian Standards Association (CSA)
 - .1 B51, Boiler, Pressure Vessel and Pressure Piping Code
 - .4 Pipe Fabrication Institute (PFI)
 - .1 ES-3, Fabrication Tolerances
 - .2 ES-24, Pipe Bending Tolerances
 - .3 ES-31, Standard for Protection of Ends of Fabricated Piping Assemblies
 - .5 Steel Structures Painting Council (SSPC)
 - .1 SP-6, Commercial Blast Cleaning
 - .2 SP-10, Near White Metal Blast Cleaning
- .2 Unless otherwise specified, the applicable issue dates of codes, standards, and practices shall be the date of issues in the appendices of ASME B31.3. When a document reference is not included in ASME B31.3, the latest revision of that document shall apply unless otherwise specified.

1.3 DOCUMENTATION

- .1 Quality control programs, schedules, procedures, test results, certifications, and affidavits shall be provided as required by the applicable requirements of Process Piping ASME B31.3, and Canadian and Provincial Acts and Regulations.
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1.4 DEFINITIONS

- .1 The term pipespool as used in this Specification means a unit of fabricated piping consisting of pipe, fittings, flanges and other components integral to the assembly. Pipespool numbers are assigned to each pipespool and identify a specific pipespool to be fabricated and/or installed by Contractor.

Part 2 Products

2.1 MATERIAL CONTROL, HANDLING AND STORAGE

- .1 Special precautions shall be taken to ensure that all material used for fabrication and installation of boiler external piping is fully documented and available prior to release to fabrication and installation.
- .2 Precautions shall be taken during handling, fabrication, storage, loading, and installation to protect flange surface finishes and all ends from damage. All ends shall be capped when delivered.
- .3 Piping which has been coated with paint prior to erection shall be handled with care to avoid damage to coatings. Slings protected with fabric or hose sleeves shall be used for lifting.
- .4 Shipping protection provided for pipe, pipespools, and piping components shall be visually inspected by Contractor when material is received at the site before unloading from truck. Any damaged or deficient protection shall be brought to the attention of the Contract Administrator for resolution.
- .5 Pipe fabricated in place shall be provided with temporary protection as recommended by PFI Standard ES-31.
- .6 Pipe fabricated by Contractor in his field shop or work area shall be protected in accordance with the minimum requirements of ES-31.

2.2 NOTCH TOUGHNESS REQUIREMENTS

- .1 Notch toughness requirements shall be in accordance with ASME B31.3.

2.3 SUBSTITUTIONS

- .1 Any material substitution requests shall be submitted in writing to Contract Administrator for approval in accordance with B8. Substitution shall be avoided where the substitution would negate previous weld procedure qualifications accepted by Contract Administrators and/or Authorities having Jurisdiction or would require additional qualification and acceptances.

2.4 RAS PIPING AT HPO REACTOR TANK INLETS

- .1 Pipe, DN500: carbon steel, ASTM A53, ERW, XS wall thickness
 - .2 Fittings, DN500: carbon steel, butt-weld, ASTM A234-WPB, XS wall thickness
 - .3 Flanges, DN500: carbon steel, ASTM A105, B16.5, slip-on, 150#, flat-face
 - .1 Flange gaskets: full face, neoprene, 3 mm thick
 - .2 Flange bolting: ASTM A193-B8M Class 2 Type 316 stainless steel bolts, ASTM A194 8M Type 316 stainless steel heavy hex nuts coated with anti-galling compound.
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- .3 Paddle Blanks and Spacers, DN500: stainless steel, ASTM A240 Gr. 316, Class 150, flat face, to ASME B16.48, with attachment for lifting and rigging.
- .4 Couplings, DN500: flexible coupling, ductile iron, ASTM A536 Gr. 65-45-12, epoxy coated, EPDM flush-type gasket, zinc plated carbon steel bolts and heavy hex nuts, with carbon steel pipe ring adapters.
 - .1 Acceptable product: Victaulic Style 44 with Vic-Ring adapters, or approved equal in accordance with B8.
- .5 Drains and vents, DN50:
 - .1 Thredolet, carbon steel, ASTM A105, 3000#.
 - .2 Pipe, carbon steel, ASTM A106-B, ERW, schedule 160, threaded ends.
 - .3 Ball valve, full port, 2 piece, NPT, 316 SS, RTFE seats, 1000 psi WOG at 200 F, blowout-proof stem, lockable lever handle.
 - .4 316 stainless steel threaded plug in valve outlet.
- .6 Interior finish
 - .1 Carbon steel pipe, fittings and flanges shall be internally lined with shop-applied epoxy coating in accordance with AWWA C210. Holiday testing required.
 - .2 Conform to manufacturer requirements regarding:
 - .1 Surface preparation including sand blasting.
 - .2 Conditions under which painting system can be applied.
 - .3 Prime and final coat thicknesses.
 - .3 Acceptable Products: Two (2) prime coats Devoe Bar Rust 236, 6 mil DFT per coat, with Devoe Devgrip 238 abrasion resistant finish coat, 6 mil DFT. Total lining 18 mil DFT or approved equal in accordance with B8.
 - .4 On mechanically-coupled pipe ends with ring adapters, interior finish shall be continuous over end of pipe and ring adapter, up to and including coupling gasket sealing surface.

2.5 WAS PIPING

- .1 Pipe, DN150-300: carbon steel, ASTM A53, ERW, XS wall thickness
- .2 Fittings: carbon steel, butt-weld, ASTM A234-WPB, XS wall thickness
- .3 Flanges: carbon steel, ASTM A105, B16.5, slip-on, 150#, flat-face
 - .1 Flange gaskets: full face, neoprene, 3 mm thick
 - .2 Flange bolting: ASTM A193-B8M Class 2 Type 316 stainless steel bolts, ASTM A194 8M Type 316 stainless steel heavy hex nuts coated with anti-galling compound.
- .4 Paddle Blanks and Spacers: stainless steel, ASTM A240 Gr. 316, Class 150, flat face, to ASME B16.48, with attachment for lifting and rigging.
- .5 Drains and vents, DN50:
 - .1 Thredolet, carbon steel, ASTM A105, 3000#.
 - .2 Pipe, carbon steel, ASTM A106-B, ERW, schedule 160, threaded ends.
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 - .2 Conform to manufacturer requirements regarding:
 - .1 Surface preparation including sand blasting.
 - .2 Conditions under which painting system can be applied.
 - .3 Prime and final coat thicknesses.
 - .3 Acceptable Products: Two (2) prime coats Devoe Bar Rust 236, 6 mil DFT per coat, with Devoe Devgrip 238 abrasion resistant finish coat, 6 mil DFT. Total lining 18 mil DFT or approved equal in accordance with B8.
 - .4 On mechanically-coupled pipe ends with ring adapters, interior finish shall be continuous over end of pipe and ring adapter, up to and including coupling gasket sealing surface.
 - .5 ***Contractor shall add additional flanged breaks as required to complete internal lining of pipe spools with elbows.***

2.6 WELDED CARBON STEEL SLEEVES FOR CFRP TERMINATIONS AT FLANGES

- .1 Sleeves: Rolled plate or STD schedule pipe with diameter and wall thickness sized per detail drawings provided shall be
 - .1 Piping: ASTM A53 ERW carbon steel pipe
 - .2 Rolled Plate: ASTM A36 hot rolled low-carbon steel plate

2.7 EXTERIOR FINISH AND IDENTIFICATION FOR ALL REPLACED PIPING

- .1 Exterior finish of all piping to be replaced shall be:
 - .1 Apply epoxy finish to the exterior of all carbon steel or ductile iron piping components in accordance with AWWA C210.
 - .2 Provide a 3 year warranty from project substantial performance date for entire painting system.
 - .3 Conform to manufacturer requirements regarding:
 - .1 Surface preparation including sand blasting.
 - .2 Conditions under which painting system can be applied.
 - .3 Prime and final coat thicknesses.
 - .4 Piping shall be identified per existing identification standard indicating the product and direction of flow. Provide white lettering / arrows on piping painted black. Provide black lettering / arrows on all other background colours.
- .2 Colour Legend:
 - .1 The exterior final coat color of all piping to be replaced or refurbished shall match the existing piping. Refer to the below Colour Legend for the Sherwin Williams Paint Code and colour type to match.

ITEM	COLOUR NAME	SHERWIN WILLIAMS PAINT CODE
RAS Train 1	Pineapple Cream	SW 1668
RAS Train 2	Invigorate (Orange)	SW 6886
RAS Train 3	Drift of Mist (Cream)	SW 9166
RAS Trains 1-3 in HPO Gallery	Black – match existing	-
Waste Activated Sludge	Tricorn Black	SW 6258

- .2 Refer to the City of Winnipeg RFP NO. 384-2020, Appendix R, in full, for deviations and WWD standard paint colours of items that are not present in the Colour Legend.
- .3 Acceptable Product: Two (2) coats Devoe Bar Rust 235, 6 mil DFT per coat or approved equal in accordance with B8.

Part 3 Execution

3.1 FABRICATION

- .1 The piping drawings and documents identify the standard components to be included in fabricated piping such as flanges and fittings.
- .2 Drawings
 - .1 Detail drawings made by Contractor for pipespools or assemblies shall include all necessary information, including but not limited to the following:
 - .1 Dimensions
 - .2 Weld Locations
 - .3 Branch Type
 - .4 Integral Attachments
 - .5 List of Materials
 - .6 Welding Processes
 - .7 Welding Procedure Numbers
 - .8 Welding Filler Metal
 - .9 Preheat and Postweld Heat Treatment
 - .10 Special Cleaning
 - .11 Painting Requirements
 - .12 NDT and other Special Requirements
 - .13 ASME B31.3 Identification if applicable
 - .14 Pipespool or Assembly Number
- .3 Accuracy
 - .1 Contractor is responsible for the accuracy of his shop detail drawings and of his fabrication. Contract Administrator approval is not required for shop details.
- .4 Tolerances
 - .1 Pipespool tolerances shall be as defined in PFI Standards ES-3 and ES-24 except as noted below.
 - .2 Alignment of flange faces or ends prepared for welding by others shall not deviate from the indicated position measured across any diameter by more than 0.8 mm (1/32").
- .5 Branch Connections

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- .1 Lines that connect to a main line or header, including instrument connections, vents, and drains, are considered branch lines. The type of branch connections selected shall be in accordance with the piping material specifications.
 - .2 Required reinforcement shall be clearly identified on piping drawings and documents.
 - .3 Material for branch reinforcement shall be of the same composition as the base material of the pipe. It shall meet the notch toughness and other applicable requirements specified for the pipe to which it is attached.
 - .4 Fabricated branch connections shall be directly joined to the header with full penetration welds. Reinforcing pads, if required, shall be added after visual inspection, other required inspections, and completion and acceptance of any repairs.
 - .5 Reinforcing pads or saddles shall be provided with 1/4 NPT vent holes. If the pad or saddle is provided in more than one piece, each piece shall be provided with a 1/4 NPT vent. Insulated piping ventholes shall be fitted with 1/4 inch std wt nipples, length to extend 1" beyond final insulation.
 - .6 Branch connections shall not be installed over girth welds.
 - .7 Particular care shall be taken to provide proper root gaps and welds at weldolets, elbolets, sockolets, and threadolets as recommended by the manufacturers installation procedures.
- .6 Pipe
- .1 Longitudinal seams in adjoining lengths of welded pipe shall be staggered and located to clear openings and external attachments.
 - .2 Pipe lengths used in spool fabrication shall be selected to minimize field welds. When necessary to use more than one length of pipe in a straight section of spool, the shortest length shall not be less than 300 mm (12") or one pipe diameter whichever is greater. Heat affected zones shall not be touching.
- .7 Flanges
- .1 Protection of flange face surface finish is required. Precautions shall be taken throughout handling and fabrication operations to protect the gasket surface finish of the flanges.
- .8 Joint Preparation
- .1 The use of backing rings is strictly prohibited.
 - .2 Threaded Joints
 - .1 Threaded joints shall be tapered pipe threads in accordance with ASME B1.20. Threaded connections in pieces requiring heat treatment shall be protected from damage by heat. Where threaded couplings or nipples are welded to pipespools, the thread must be checked for fit and roundness after welding or heat treatment by using a thread gauge. If threads are not acceptable, chase the threads with a tap or die. Clean the threads with cutting oil and a suitable solvent.
 - .3 Socket Weld Joints
 - .1 Weld dimensions and gaps for socket welding pipe joints shall not be less than the minimum requirements of ASME B31.1 and B31.3. The gap between pipe end and fitting shall not exceed 3 mm (1/8") after welding.
- .9 Welding and Post-Weld Heat Treatment
- .1 Welding and post-weld heat treatment shall be in accordance with this Specification, and satisfy requirements of the codes and regulatory agencies having jurisdiction
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- over the work. Welding shall be in accordance with approved welding procedures registered by or acceptable to the Authority having Jurisdiction.
- .2 Welding shall be performed by certified welders or welding machine operators holding a current pressure welders authorization issued by or acceptable to the Authority having Jurisdiction. The welder or welding machine operator shall not perform welding utilizing procedure for which he has not been duly authorized.
 - .3 Submit Welding Procedure Specifications (WPS), and matching Procedure Qualification Records (PQR), to Contract Administrator for approval. Procedures shall not be submitted for approval until they have been registered with or accepted by the Authority having Jurisdiction. Evidence of this registration or acceptance shall accompany each WPS and PQR submitted to Contract Administrator.
 - .4 Welding shall not be performed on any line that has been postweld heat treated.
- .10 Cleaning
- .1 After completion of fabrication and heat treatment, piping shall be free of loose scale, weld spatter, sand, chips, oil, grease, and other foreign material. Each pipespool shall be visually inspected to ensure proper cleanliness.
- .11 Welded Carbon Steel Sleeves for CFRP Terminations at Flanges
- .1 Welded carbon steel sleeves for termination of the CFRP wrap shall be fabricated and connected to the in-service RAS system piping in accordance with the requirements of ASME PCC-2 Article 2.10, including:
 - .1 Weld Procedures and Welder Qualifications
 - .1 Welding procedures and welders shall be qualified using the setup detailed in Mandatory Appendix I and testing requirements outlined in paragraph 4.2.
 - .2 Examination
 - .1 All in-service welds made in the field shall be examined for hydrogen cracking after welding by magnetic particle or liquid penetrant methods in accordance with ASME B31.3, paragraphs 344.3 or 344.4. Welds shall be examined 24 hr to 72 hr after welding has been completed.

3.2 **INSTALLATION**

- .1 Submit procedure for bolting of flanged joints to Contract Administrator for approval. Contractor shall be responsible for completeness of his procedure, and shall not perform bolting operations until the procedure is approved. Procedure shall include bolt lubrication and preservation proposed for use in assembly.
 - .2 Pipe, pipespools, and in-line components shall be inspected internally for foreign material during final installation. Material shall be removed prior to installation and bolting or welding in place.
 - .3 End protectors shall not be removed from piping and equipment until ready for final connection. Weld end and gasket surfaces shall be inspected for damage when covers are removed. Contract Administrator shall be informed of any damage. Repairs shall not be made without approval of Contract Administrator.
 - .4 Gaskets shall be protected from damage until final installation is completed.
 - .5 Piping shall be properly supported to prevent excessive deflection during handling and installation.
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- .6 Permanent deformation resulting from improper handling shall be brought to the attention of Contract Administrator for resolution.
- .7 Bolting - The use of washers or other packing to use up excessive length of flange bolts is not acceptable. The length of machine and stud bolts shall be such that nuts are fully engaged with a minimum of two full threads protruding and that studs are centered.
- .8 Bolting shall be checked for proper grade and marking prior to installation. Bolting not properly identified with the required ASTM material grade shall not be used.
- .9 Threaded joints shall be made up using thread compounds or teflon tape.
- .10 No thread compounds or teflon tape shall be used on threaded joints which are to be seal welded. Plugged connections shall be checked during erection to ensure the plugs comply with line class requirements.
- .11 Supports, guides, anchors, pads, and other appurtenances shall be installed as required by the piping drawings. Field installed pads on random piping shall be provided with vent holes.

3.3 INSPECTION AND TESTING

- .1 All Inspection and testing shall:
 - .1 Be in accordance with ASME B31.3, Category D fluid service.
 - .2 Be performed by a specialist qualified in accordance with CSA 178.1 and 178.2.
 - .3 Include detailed weld inspection reports to Contract Administrator.
- .2 Acceptance criteria for visual and radiographic weld inspection shall follow ASME B31.3, para. 341.3.2, Table 341.3.2. Any rejected welds shall be repaired or replaced.
- .3 Acceptance criteria for magnetic particle examination shall follow ASME B31.3, para 344.3.2. Any rejected welds shall be repaired or replaced.
- .4 Magnetic particle examination providers shall be certified in accordance with CAN/CGSB-48.9712.
- .5 Shop fabricated pipe spools shall be hydrostatically pressure tested to 1379 kPag (200 psig) at the Contractor's fabrication shop.
- .6 Perform inspection and testing prior to painting.
- .7 Installed piping shall be leak tested and examined in service. Contract Administrator shall be informed of any leaks. Repairs shall not be made without approval of Contract Administrator.

END OF SECTION
