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| Version | Date | Description of Revisions |
| 1 | August 30, 2006 | Approved final document. |
| 2 | November 16, 2009 | Modified ‘Related Sections’ |
| 3 | August 19, 2014 | First Draft Review (AV) |
| 4 | June 8, 2015 | Second Draft for Review (AV) |
| 5 | September 16, 2015 | Updated, Finalized Specification – Reference eDOCS #5823654-v5 (AV) |
| **6** | **March 19, 2016** | **Updated ASTM, ASME, AWWA Standards** |
| 7 | May 19, 2017 | Updated ASTM, ASME, AWWA Standards. Added reference to O. Reg 220/01 and Section 1.8 Approvals. (AAM) |

NOTE:

This is a CONTROLLED Document. Any documents appearing in paper form are not controlled and should be checked against the on-line file version prior to use.

**Notice:** This Document hardcopy must be used for reference purpose only.

**The on-line copy is the current version of the document.**

# GENERAL

## Related Sections

### *[Under "Related Sections", identify other Sections that are related to, and/or dependent on, the work results or information specified elsewhere. The list should be limited to Sections with specific information that the reader might expect to find in this Section, but is specified elsewhere. For example, if hardware for aluminum entrances is specified in the aluminum entrance Section, a cross-reference would be appropriate in the finish hardware Section. The purpose of this cross-referencing is for information only, to aid in finding those other requirements—not to define the scope of the Section.*

### *Cross-referencing here may also be used to coordinate assemblies or systems whose components may span multiple Sections and which must meet certain performance requirements as an assembly or system.*

### *Contractor is responsible for coordination of the Work.*

### *This Section is to be completed/updated during the design development by the Consultant. If it is not applicable to the section for the specific project it may be deleted.]*

### *List Sections specifying installation of products supplied but not installed under this Section and indicate specific items.]*

### Section [\_\_\_\_\_\_ – \_\_\_\_\_\_\_\_\_\_\_\_]: Execution requirements for ...[item]... specified under this Section.

### *[List Sections specifying products installed but not supplied under this Section and indicate specific items.]*

### Section [\_\_\_\_\_\_ – \_\_\_\_\_\_\_\_\_\_\_\_]: Product requirements for ...[item]... for installation under this Section.

### *[List Sections specifying related requirements.]*

### Section [\_\_\_\_\_\_ – \_\_\_\_\_\_\_\_\_\_\_\_]: [Optional short phrase indicating relationship].

### Section 01600 – Material and Equipment

### Section 01640 – Manufacturers' Services

### Section 02315 – Excavation, Trenching and Backfilling

### Section 02511 – Watermains

### Section 03200 – Concrete Reinforcement

### Section 03300 – Cast in Place Concrete

### Section 05503 – Metal Fabrications Mechanical

### Section 09900 – Paintings and Protective Coatings

### Section 15080 – Process Piping Insulation

### Section 15201 – Piping Support Systems

### Section 15204 – Process Piping Specialties

### Section 15955 – Piping Leakage Testing

## Standards

### Comply with the latest edition of the following statutes, codes, standards, and all amendments thereto:

#### American Association of State Highway and Transportation Officials (AASHTO):

##### AASHTO HB-17, Standard Specifications for Highway Bridges, 17th Edition.

#### American Society of Mechanical Engineers (ASME)

##### ANSI/ASME B1.1-2003(R2008) / ANSI/ASME B1.2-1983 (R2007) ANSI/ASME B1.20.1-2013 - Unified Screw and Pipe Threads Package

##### ASME B16.1-2015, Gray Iron Pipe Flanges and Flanged Fittings: Classes 25, 125, and 250.

##### ASME B16.3-2016, Malleable Iron Threaded Fittings: Classes 150 and 300.

##### ASME B16.5-2013, Pipe Flanges and Flanged Fittings: NPS ½ through NPS 24 Metric/Inch Standard.

##### ASME B16.9-2012, Factory Made Wrought Steel Buttwelding Fittings.

##### ASME B16.11-2016, Forged Fittings, Socket-Welding and Threaded.

##### ASME B16.15-2013, Cast Copper Alloy Threaded Fittings, Classes 125 and 250.

##### ASME B16.21-2016, Nonmetallic Flat Gaskets for Pipe Flanges.

##### ASME B16.22-2013, Wrought Copper and Copper Alloy Solder-Joint Pressure Fittings.

##### ASME B16.24-2016, Cast Copper Alloy Pipe Flanges and Flanged Fittings Class 150, 300, 400, 600, 900, 1500 and 2500.

##### ASME B16.25-2007, Buttwelding Ends.

##### ASME B16.42-2016, Ductile Iron Pipe Flanges and Flanged Fittings: Classes 150 and 300.

##### ASME B1.20.1-2013, Pipe Threads, General Purpose, Inch

##### ASME B31.1-2016, Power Piping.

##### ASME B31.3-2016, Process Piping.

##### ASME B31.9-2014, Building Services Piping.

##### ASME B36.10M-2015, Welded and Seamless Wrought Steel Pipe.

##### ASME Criteria of the ASME Boiler and Pressure Vessel Code, Section VIII, Rules for Construction of Pressure Vessels.

##### ASME Boiler and Pressure Vessel Code, 2017 Edition, Section IX, Welding, Brazing, and Fusing Qualifications

#### American Petroleum Institute (API):

##### API SPEC 5L, Specification for Line Pipe, 45th Edition December 2012.

#### American Society for Nondestructive Testing (ASNT):

##### ASNT Standard for Qualification and Certification of Nondestructive Testing Personnel (ANSI/ASNT CP-189-2016) & ASNT Std. Topical Outlines for Qualification of NDT Personnel (ANSI/ASNT CP-105-2011)

#### American Society for Testing and Materials (ASTM):

##### ASTM A47/A47M-99(2014), Standard Specification for Ferritic Malleable Iron Castings.

##### ASTM A53/A53M-12, Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.

##### ASTM A105/A105M-14, Standard Specification for Carbon Steel Forgings for Piping Applications.

##### ASTM A106A106M-15, Standard Specification for Seamless Carbon Steel Pipe for High-Temperature Service.

##### ASTM A126-04(2014), Standard Specification for Gray Iron Castings for Valves, Flanges, and Pipe Fittings.

##### ASTM A135/A135M-09(2014), Standard Specification for Electric-Resistance Welded Steel Pipe.

##### ASTM A139/A139M-16 Standard Specification for Electric-Fusion (Arc)-Welded Steel Pipe (NPS 4 and Over).

##### ASTM A153/A153M-16a, Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.

##### ASTM A181/A181M-14, Standard Specification for Carbon Steel Forgings, for General-Purpose Piping.

##### ASTM A182/A182M-16a, Standard Specification for Forged or Rolled Alloy Steel Pipe Flanges, Forged Fittings, and Valves and Parts for High-Temperature Service.

##### ASTM A183-14, Standard Specification for Carbon Steel Track Bolts and Nuts.

##### ASTM A193/A193M-16, Standard Specification for Alloy-Steel and Stainless Steel Bolting Materials for High Temperature OR High Pressure Service and Other Special Purpose Applications.

##### ASTM A194/A194M-17, Standard Specification for Carbon and Alloy Steel Nuts for Bolts for High Pressure or High Temperature Service, or Both.

##### ASTM A197/A197M-00(2015), Standard Specification for Cupola Malleable Iron.

##### ASTM A216/A216M-16, Standard Specification for Steel Castings, Carbon, Suitable for Fusion Welding, for High Temperature Service.

##### ASTM A234/A234M-16, Standard Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service.

##### ASTM A240/A240M-16a, Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications.

##### ASTM A276-17, Standard Specification for Stainless Steel Bars and Shapes.

##### ASTM A283/A283M-13, Standard Specification for Low and Intermediate Tensile Strength Carbon Steel Plates.

##### ASTM A285/A285M-12, Standard Specification for Pressure Vessel Plates, Carbon Steel, Low and Intermediate Tensile Strength.

##### ASTM A307-14e1, Standard Specification for Carbon Steel Bolts, Studs AND Threaded Rod, 60,000 PSI Tensile Strength.

##### ASTM A312/A312M-17, Standard Specification for Seamless, Welded, and Heavily Cold Worked Austenitic Stainless Steel Pipes.

##### ASTM A320/A320M-17a, Standard Specification for Alloy-Steel and Stainless Steel Bolting for Low-Temperature Service.

##### ASTM A395/A395M-99(2014), Standard Specification for Ferritic Ductile Iron Pressure-Retaining Castings for Use at Elevated Temperatures.

##### ASTM A403/A403M-16, Standard Specification for Wrought Austenitic Stainless Steel Piping Fittings.

##### ASTM A409/A409M-15, Standard Specification for Welded Large Diameter Austenitic Steel Pipe for Corrosive or High-Temperature Service.

##### ASTM A536-84(2014), Standard Specification for Ductile Iron Castings.

##### ASTM A563-15, Standard Specification for Carbon and Alloy Steel Nuts.

##### ASTM A587-96(2012), Standard Specification for Electric-Resistance-Welded Low-Carbon Steel Pipe for the Chemical Industry.

##### ASTM A774/A774M-14, Standard Specification for As-Welded Wrought Austenitic Stainless Steel Fittings for General Corrosive Service at Low and Moderate Temperatures.

##### ASTM A778-16, Standard Specification for Welded, Unannealed Austenitic Stainless Steel Tubular Products.

##### ASTM B32-08(2014), Standard Specification for Solder Metal.

##### ASTM B43-15, Standard Specification for Seamless Red Brass Pipe, Standard Sizes.

##### ASTM B75/B75M-11, Standard Specification for Seamless Copper Tube.

##### ASTM B88-16, Standard Specification for Seamless Copper Water Tube.

##### ASTM B98/B98M-13, Standard Specification for Copper-Silicone Alloy Rod, Bar and Shapes.

##### ASTM C582-09(2016), Standard Specification for Contact-Molded Reinforced Thermosetting Plastic (RTP) Laminates for Corrosion-Resistant Equipment.

##### ASTM D412-16, Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers - Tension.

##### ASTM D413-98(2013), Standard Test Methods for Rubber Property - Adhesion to Flexible Substrate.

##### ASTM D1248-16, Standard Specification for Polyethylene Plastics Extrusion Materials for Wire and Cable.

##### ASTM D1330-04(2015)e1, Standard Specification for Rubber Sheet Gaskets.

##### ASTM D1784-11, Standard Specification for Rigid Poly(Vinyl Chloride) (PVC) Compounds and Chlorinated Poly(Vinyl Chloride) (CPVC) Compounds.

##### ASTM D1785-15, Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120.

##### ASTM D2000-12, Standard Classification System for Rubber Products in Automotive Applications.

##### ASTM D2310-06(2012), Standard Classification for Machine-Made “Fiberglass” (Glass-Fiber-Reinforced Thermosetting-Resin) Pipe.

##### ASTM D2464-15, Standard Specification for Threaded Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80.

##### ASTM D2466-15, Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40.

##### ASTM D2467-15, Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80.

##### ASTM D2564-12, Standard Specification for Solvent Cements for Poly(Vinyl Chloride) (PVC) Plastic Piping Systems.

##### ASTM D2996-15, Standard Specification for Filament-Wound “Fiberglass” (Glass-Fiber-Reinforced Thermosetting-Resin) Pipe.

##### ASTM D3222-05(2015), Standard Specification for Unmodified Poly(Vinylidene Fluoride) (PVDF) Molding Extrusion and Coating Materials.

##### ASTM D3261-16, Standard Specification for Butt Heat Fusion Polyethylene (PE) Plastic Fittings for Polyethylene (PE) Plastic Pipe and Tubing.

##### ASTM D3350-14, Standard Specification for Polyethylene Plastics Pipe and Fittings Materials.

##### ASTM D4101-14e2, Standard Specification for Propylene Injection and Extrusion Materials.

##### ASTM F437-15, Standard Specification for Threaded Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Pipe Fittings, Schedule 80.

##### ASTM F439-13, Standard Specification for Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Pipe Fittings, Schedule 80.

##### ASTM F441/F441M-15, Standard Specification for Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Pipe, Schedules 40 and 80.

##### ASTM F493-14, Standard Specification for Solvent Cements for Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Pipe and Fittings.

##### ASTM F714-13, Standard Specification for Polyethylene (PE) Plastic Pipe (DR-PR) Based on Outside Diameter.

#### American Water Works Association (AWWA):

##### AWWA C104/A21.4-16, Cement-Mortar Lining for Ductile-Iron Pipe and Fittings.

##### AWWA C105/A21.5-10, Polyethylene Encasement for Ductile-Iron Pipe Systems

##### AWWA C110/A21.10-12, Ductile-Iron and Gray-Iron Fittings.

##### AWWA C111/A21.11-12, Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.

##### AWWA C115/A21.15-11, Flanged Ductile-Iron Pipe with Ductile-Iron or Gray-Iron Threaded Flanges.

##### AWWA C116/A21.16-15, Protective Fusion-Bonded Coatings for the Interior and Exterior Surfaces of Ductile-Iron and Gray-Iron Fittings

##### AWWA C151/A21.51-09, Ductile-Iron Pipe, Centrifugally Cast.

##### AWWA C153/A21.53-11, Ductile-Iron Compact Fittings.

##### AWWA C200-12, Steel Water Pipe, 6 Inches (150 mm) and Larger.

##### AWWA C205-12, Cement-Mortar Protective Lining and Coating for Steel Water Pipe - 4 Inches (100 mm) and Larger - Shop Applied. AWWA C206-11, Field Welding of Steel Water Pipe

##### AWWA C207-13, Steel Pipe Flanges for Waterworks Service, Sizes 4 Inches Through 144 Inches (100 mm Through 3,600 mm).

##### AWWA C208-12, Dimensions for Fabricated Steel Water Pipe Fittings.

##### AWWA C209-13, Cold-Applied Tape Coatings For Steel Water Pipe, Special Sections, Connections And Fittings

##### AWWA C210-15, Liquid Epoxy Coatings And Linings For Steel Water Pipe And Fittings

##### AWWA C213-15, Fusion-Bonded Epoxy Coating for the Interior and Exterior of Steel Water Pipelines.

##### AWWA C214-14, Tape Coatings for Steel Water Pipe

##### AWWA C604-11, Installation of Buried Steel Water Pipe 4 In. (100 mm) and Larger

##### AWWA C606-15, Grooved and Shouldered Joints.

##### AWWA M11-2004, Steel Pipe - A Guide for Design and Installation, Fourth Edition.

#### Canadian Standards Association (CSA):

##### [Consultant to add appropriate CSA standards pertaining to welding in conjunction with AWS requirements].

#### American Welding Society (AWS):

##### AWS A5.8M/A5.8:2011 AMD1, Specification for Filler Metals for Brazing and Braze Welding.

##### AWS QC 1:2007, Standard for AWS Certification of Welding Inspectors.

#### Manufacturers Standardization Society of the Valve and Fittings Industry, Inc. (MSS):

##### MSS SP43-2013, Wrought and Fabricated Butt-Welding Fittings for Low Pressure, Corrosion Resistant Applications.

#### National Fire Protection Association (NFPA):

##### NFPA 24 (2016 Edition), Standard for the Installation of Private Fire Service Mains and Their Appurtenances.

#### NEMA

##### NEMA LI 1-1998 (R2011), Industrial Laminating Thermosetting Products

#### Technical Standards and Safety Act, 2000, S. O. 2000 c16

##### O. Reg 220/01 Boilers and Pressure Vessels

## Definitions

### Submerged or Wetted:

#### Zone below elevation of:

##### [Top face of channel walls and cover slabs.]

##### [Top face of aeration basin walkways.]

##### [Top face of clarifier walkways.]

##### [Roof of digester, including structure piping penetrations.]

##### [Liquid surface or within [     ] feet above top of liquid surface.]

##### [Top of tank wall or under tank cover.]

##### [     ].

## Measurement and Payment

*[Choose one of the following payment language provisions that best suits the individual project.*

*If this Section is not specifically referenced by an item in the Bid Form, please use the following language:*

.1 The work of this Section will not be measured separately for payment. All costs associated with the work of this Section shall be included in the Contract Price.

*OR If this Section is specifically referenced in the Bid Form, use the following language and identify the relevant item in the Bid Form:*

.1 All costs associated with the work of this Section shall be included in the price(s) for Item No(s). \_\_\_ in the Bid Form.

*If the work of this Section is to be measured and paid for by several different methods, please amend the standard wording given above to reflect the different methods of measurement and payment.]*

## Design Requirements

### Where pipe diameter, thickness, pressure class, pressure rating, or thrust restraint is not shown or specified, design piping system in accordance with the following:

#### [Boiler and Steam Piping: ASME B31.1-2016.]

#### [B: Process Piping: ASME B31.3-2016.]

#### [C: Building Service Piping: ASME B31.9-2014, as applicable.]

#### [Sanitary Building Drainage and Vent Systems: [ICBO/IAPMO Uniform Plumbing Code] [BOCA Uniform Plumbing Code] [Local plumbing code].

#### *[Consultant to review and amend as appropriate]*

#### Buried Piping: H20 S16 traffic load with 1.5 impact factor, AASHTO Standard Specifications for Highway Bridges, as applicable and AWWA C604-11

#### Thrust Restraints:

##### Design for test pressure shown in the Piping Schedule attached as a supplement to this Specification Section. *[Consultant to confirm Pipe Schedule is appropriately filled out]*

##### Allowable Soil Pressure: [50] [     ] kPa.

##### Low Pressure Pipelines:

###### When bearing surface of the fitting against soil provides an area equal to or greater than area required for thrust restraint, concrete thrust blocks will not be required.

###### Determine bearing area for fittings without thrust blocks by projected area of 70 percent of internal diameter multiplied by chord length for fitting centreline curve.

###### All welding to be TIG (tungsten inert gas) type and not MIG (metal inert gas) type. *[Consultant to review requirements with Region]*

## Submittals

### Shop Drawings:

#### [A: Shop Fabricated Piping:

##### Detailed pipe fabrication or spool drawings showing special fittings and bends, dimensions, coatings, and other pertinent information.

##### Layout drawing showing location of each pipe section and each special length; number or otherwise designate laying sequence on each piece.]

#### [Pipe Wall Thickness: Identify wall thickness and rational method or standard applied to determine wall thickness for each size of each different service including exposed, submerged, buried, and concrete-encased installations for Contractor-designed piping.]

#### [Hydraulic Thrust Restraint for Restrained Joints: Details including materials, sizes, assembly ratings, and pipe attachment methods.]

#### [Thrust Blocks: Concrete quantity, bearing area on pipe, and fitting joint locations.]

#### [Dissimilar Buried Pipe Joints: Joint types and assembly drawings.]

### Quality Control Submittals:

#### Manufacturer's Certification of Compliance (including Mill Test Reports as applicable).

#### [Laboratory Testing Equipment: Certified calibrations, manufacturer's product data, and test procedures.]

#### [Certified welding inspection and test results.]

#### Qualifications:

##### Weld Inspection and Testing Agency: Certification and qualifications in accordance with the American Welding Society AWS QC1:2007.

##### Welding Inspector: Certification and qualifications in accordance with the American Welding Society AWS QC1:2007.

##### Welders:

###### List of qualified welders and welding operators.

###### Current test records for qualified welder(s) and weld type(s) for factory and field welding.

#### Weld Procedures: Records in accordance with ASME Boiler and Pressure Vessel Code, 2017 edition, Section IX for weld type(s) and base metal(s).

#### Nondestructive inspection and testing procedures.

#### [Manufacturer's Certification of Compliance:]

##### [Pipe and fittings.]

##### [Welding electrodes and filler materials.]

##### [Factory applied resins and coatings.]

#### Certified weld inspection and test reports.

#### Test logs.

#### [Pipe coating applicator certification.]

#### [     ].

## Qualifications

### Independent Inspection and Testing Agency:

#### Ten years' experience in the field of welding and welded pipe and fittings' testing required for the Contract Work.

#### Calibrated instruments and equipment, and documented standard procedures for performing specified testing.

#### Certified in accordance with ASNT Standard for Qualification and Certification of Nondestructive Testing Personnel (ANSI/ASNT CP-189-2016) and ASNT Std. CP-105-2011 for testing procedures required for the Contract Work.

#### Testing Personnel: Qualified for non-destructive test methods to be performed.

#### Inspection Services: Qualified welding inspector.

### Welding Inspector: AWS certified, AWS QC 1:2007 Standard for AWS Certification of Welding Inspectors, qualified, with prior inspection experience of welds specified.

### Welder and Welding Operator Qualifications:

#### Qualified by accepted inspection and testing agency before starting Work in accordance with Section IX, Article III of the ASME Boiler and Pressure Vessel Code (2017).

#### Qualified to perform groove welds in Positions 2G and 5G for each welding process and pipe material specified.

#### Qualification tests may be waived by the [Consultant] based on evidence of prior qualification.

#### [Retesting: Upon the Consultant's written request, retest qualified welder(s).]

### [Solvent Welder For Double Wall Containment Piping: Qualified in accordance with Chapter VII of the ASME B31.3-2016 Code, Part 9, Paragraph A328.]

### [Provide services of] [Tests to be provided by Region and performed by] independent inspection and testing agency for welding operations.

## Approvals

### The Contractor shall be responsible for registering the design of all required parts with the Director in accordance with O.Reg. 220/01, s.4(1). The Contractor must comply fully with all conditions in O.Reg. 220/01.

### All defects identified in accordance with O. Reg. 220/01, s.4 shall be rectified to meet the design pressure limits at no additional cost.

### The Contractor shall be responsible obtaining all required valid certificates of inspection in accordance with O. Reg. 220/01, s.5.

## Delivery, Storage and Handling

### In accordance with Section 01600 - Material and Equipment, and:

#### Flanges: Securely attach metal, hardboard, or wood protectors over entire gasket surface.

#### Threaded or Socket Welding Ends: Fit with metal, wood, or plastic plugs or caps. Piping used for potable water services shall be protected from entry of foreign material or debris that may impact water quality after installation.

#### Linings and Coatings: Prevent excessive drying.

#### Cold Weather Storage: Locate products to prevent coating from freezing to the ground.

#### Handling: Use heavy canvas or nylon slings to lift pipe and fittings.

# PRODUCTS

## Piping

### As specified on the Piping Data Sheet(s) [and Piping Schedule] located at the end of this Section as Supplement [and on Piping Schedule located on Drawings].

### Diameters Shown:

#### Standardized Products: Nominal size.

#### Fabricated Steel Piping (Except Cement-Lined): Outside diameter, ASME B36.10M-2015.

#### Cement-Lined Steel Pipe: Lining inside diameter.

## Joints

### Grooved End System:

#### [Rigid, except where joints are used to correct misalignment, to provide flexibility, or where shown, furnish flexible type.]

#### Flanges: When required, furnish with grooved type flange adapters of same manufacturer as grooved end couplings.

### Flanged Joints:

#### Flat-faced carbon steel or alloy flanges when mating with flat-faced cast or ductile iron flanges.

#### Higher pressure rated flanges as required to mate with equipment when equipment flange is of higher pressure rating than required for piping.

### Threaded Joints: NPT taper pipe threads in accordance with ASME B1.20.1-2013.

### Thrust Tie-Rod Assemblies: NFPA 24; tie-rod attachments relying on clamp friction with pipe barrel to restrain thrust are unacceptable.

### Mechanical Joint Anchor Gland Follower:

#### Ductile iron anchor type, wedge action, with breakoff tightening bolts.

#### Manufacturer and Product:

##### [Consultant to provide names of three approved products]

##### Approved Equivalent

### Flexible Mechanical Compression Joint Coupling:

#### Stainless steel, ASTM A276-17, Type 305 bands.

#### Manufacturers:

##### [Consultant to provide names of three approved products]

##### Approved Equivalent

### Mechanical connections of high density polyethylene pipe to auxiliary equipment such as valves, pumps, tanks, and other piping systems shall be through flanged connections consisting of the following:

#### A polyethylene stub end thermally butt-fused to end of pipe.

#### ASTM A240/A240M-16a, Type 304 stainless steel backing flange, 863 kPag, ASME B16.1-2015 standard. Insulating flanges shall be used where shown on the Drawings.

#### Bolts and nuts of sufficient length to show a minimum of three complete threads when the joint is made and tightened to the manufacturer's standard. Re-torque nuts after 4 hours.

#### Gaskets as specified on Data Sheet. *[Consultant to confirm Data Sheets have all required specifications for gaskets incorporated]*

## Gasket Lubricant

### When gasket lubrication is specified by gasket manufacturer, the Contractor shall ensure that the lubricant used is approved by gasket manufacturer.

## Double Wall Containment Piping System

### All system components shall be pre-engineered, factory fabricated, tested, and assembled such that field assembly is minimized to primarily that of straight joints.

## Pipe Corrosion Protection

### Coatings: See Section 09900 – Painting and Protective Coatings for details of coating requirements.

### Heat Shrink Wrap:

#### Type: Cross-linked polyolefin wrap or sleeve with mastic sealant.

#### Manufacturer and Product:

##### [Consultant to provide names of three approved products]

##### Approved Equivalent

### Polyethylene Encasement (Bagging):

#### Encasement Tube: Black polyethylene encasement tube, 8 mils minimum thickness, conforming to the requirements of AWWA C105/A21.5-10, Class C, free of gels, streaks, pinholes, foreign matter, undispersed raw materials, and visible defects such as tears, blisters, and thinning at folds.

#### Securing Tape: Thermoplastic tape, 8 mils minimum thickness, 1 inch wide, pressure sensitive adhesive face capable of bonding to metal, bituminous coating, and polyethylene encasement tube.

### Insulating Flanges, Couplings, and Unions:

#### Materials:

##### In accordance with applicable piping material specified in Pipe Data Sheet. Complete assembly shall have ASME [31.1-2016] [B31.9-2014] [     ] rating equal to or higher than that of the joint and pipeline.

##### Galvanically compatible with piping.

##### Resistant for intended exposure, operating temperatures, and products in pipeline.

#### Union Type, 2 Inches and Smaller:

##### Screwed or solder-joint.

##### O-ring sealed with molded and bonded insulation to body.

#### Flange Type, 2.5 Inches and Larger: Flanged, complete with bolt insulators, dielectric gasket, bolts, and nuts.

#### Flange Insulating Kits:

##### Gaskets:

###### Full-face, Type E with O-ring seal.

###### Supplemented with neoprene facing on each side to accomplish seal.

##### Insulating Sleeves: Full-length [mylar] [fibreglass reinforced epoxy (NEMA LI 1-1998 (R2011), G-10 grade)].

##### Insulating Washers: [High strength phenolic.] [Fibreglass reinforced epoxy (NEMA LI 1-1998, G-10 grade).]

##### Steel Washers: Plated, hot-rolled steel, 1/8 inch thick.

#### Manufacturers and Products:

##### [Consultant to provide names of three approved products]

##### Approved Equivalent

### Insulating Couplings:

#### *[Consultant to provide names of three approved products]*

#### Approved Equivalent

### Concrete Encase Pipes:

#### Ensure the pipe and utility material is compatible with concrete.

#### Paint galvanized metal surfaces encased in concrete with rust inhibitive epoxy.

##### Manufacturer:

##### [Consultant to provide names of three approved products]

##### Approved Equivalent

#### Coat aluminum surfaces encased in concrete with bituminous casing.

### Buried Pipes:

#### Stainless steel pipes shall be protected with protective tape applied over the entire pipe surface in accordance with the manufacturer’s written instructions.

##### Manufacturer:

##### [Consultant to provide names of three approved products]

##### Approved Equivalent

## Thrust Blocks

### Concrete: As specified in Section 03300 - Cast in Place Concrete and Section 03200 – Concrete Reinforcement.

## Vent and Drain Valves

### Pipeline 50 mm Diameter and Smaller: [13 mm vent, 25 mm drain,] [ mm vent, mm drain,] unless shown otherwise on the Drawings.

### Pipelines 65 mm Diameter and Larger: [19 mm vent, 25 mm drain,] [ inch vent, inch drain,] unless shown otherwise on the Drawings.

## Fabrication

### Mark each pipe length on the outside with the following information:

#### Size or diameter and class.

#### Manufacturer's identification and pipe serial number.

#### Location number on laying drawing.

#### Date of manufacture.

### Code markings according to approved shop drawings.

### Flanged pipe shall be fabricated in the shop, not in the field, and delivered to the site with flanges in place and properly faced. Threaded flanges shall be individually fitted and machine tightened on matching threaded pipe by the manufacturer.

## Finishes

### Factory prepare, prime, and finish coat in accordance with the Pipe Data Sheet(s) and Piping Schedule attached as supplements to this Specification Section.

### Galvanizing:

#### Hot-dip applied, meeting the requirements of ASTM A153/A153M-16a.

#### Electroplated zinc or cadmium plating is unacceptable.

#### [Stainless steel components may be substituted where galvanizing is specified.]

# EXECUTION

## Examination

### Verify size, material, joint types, elevation, horizontal location, and pipe service of existing pipelines to be connected to new pipelines or new equipment.

### Inspect the size and location of structure penetrations to verify adequacy of wall pipes, sleeves, and other openings.

### Welding Electrodes: Verify proper grade and type, free of moisture and dampness, and coating is undamaged.

## Preparation

### Notify the Consultant a minimum of two weeks prior to field fabrication of pipe or fittings.

### Inspect pipe and fittings before installation, clean ends thoroughly, remove foreign matter and dirt from inside, and ensure that no dirt or other foreign matter enters the pipe during assembly.

### Damaged Coatings and Linings: Repair using original coating and lining materials in accordance with the manufacturer's instructions [except for damaged glass-lined pipe or PVDF-lined pipe that is to be promptly removed from the Site.]

## Welding

### Perform in accordance with Section IX, ASME Boiler and Pressure Vessel Code 2017 edition and ASME [B31.1-2016] [B31.3-2016] [B31.9-2014] for Pressure Piping, as may be specified on Piping Data Sheets, and if recommended by the piping or fitting manufacturer.

### Weld Identification: Mark each weld with symbol identifying welder.

### Pipe End Preparation:

#### Machine Shaping: Preferred.

#### Oxygen or Arc Cutting: Smooth to touch, true, and slag removal by chipping or grinding.

#### Beveled Ends for Butt Welding: ASME B16.25-2007.

### Surfaces:

#### Clean and free of paint, oil, rust, scale, slag, or other material detrimental to welding.

#### [Clean stainless steel joints with stainless steel wire brushes or stainless steel wool prior to welding.]

#### Thoroughly clean each layer of deposited weld metal, including final pass, prior to the deposition of each additional layer of weld metal with a power-driven wire brush.

### Alignment and Spacing:

#### Align ends to be joined within existing commercial tolerances on diameters, wall thicknesses, and out of-roundness.

#### Root Opening of Joint: As stated in the qualified welding procedure.*[Consultant to add appropriate CSA standards pertaining to welding in conjunction with AWS requirements]*

#### Minimum Spacing of Circumferential Butt Welds: Minimum four times pipe wall thickness or 1 inch, whichever is greater.

### Climatic Conditions:

#### Do not perform welding if there is impingement of any rain, snow, sleet, or high wind on the weld area, or if the ambient temperature is below 0 degrees Celsius.

#### [Stainless Steel and Alloy Piping: If the ambient temperature is less than 0 degrees Celsius, local preheating to a temperature warm to the hand is required.]

### Tack Welds:

#### Shall be performed by a qualified welder using the same procedure as for completed weld, made with electrode similar or equivalent to electrode to be used for first weld pass.

#### Welding rods to be confirmed not to be defective prior to tack welding.

#### Remove welding rods that do not meet the Contract requirements prior to commencing the welding procedures.

### Surface Defects: Chip or grind out those affecting soundness of weld.

### Weld Passes: As required in the welding procedure.

### Weld Quality: Free of cracks, incomplete penetration, weld undercutting, excessive weld reinforcement, porosity slag inclusions, and other defects in excess of limits shown in the applicable piping code. *[Consultant to amend in such a way as to refer to AWS, CSA and other applicable standards and codes with respect to weld quality].*

## Installation - General

### Join pipe and fittings in accordance with the manufacturer's instructions, unless otherwise shown or specified on the Drawings.

### Remove foreign objects prior to assembly and installation.

### All submerged bolts and nuts shall be of stainless steel 304 unless otherwise indicated in the Contract Documents.

### Underground bolted joint assemblies shall be protected with protective mastic and tape applied over the entire fastener assembly in accordance with the manufacturer’s printed instructions.

#### Manufacturer:

##### [Consultant to provide names of three approved products]

##### Approved Equivalent

### Apply protective paste to all bolt threads at field joints.

#### Manufacturer:

##### [Consultant to provide names of three approved products]

##### Approved Equivalent

### Flanged Joints:

#### Install perpendicular to pipe centreline.

#### Bolt Holes: Straddle vertical centrelines, aligned with connecting equipment flanges or as shown on the Drawings.

#### Use torque-limiting wrenches to ensure uniform bearing and proper bolt tightness.

#### Plastic Flanges: Install annular ring filler gasket at joints of raised-face flange.

#### Raised-Face Flanges: Use flat-face flange when joining with flat-faced ductile or cast iron flange.

#### Verify compatibility of mating flange to adapter flange gasket prior to selecting grooved adapter flanging.

#### Threaded flanged joints must be shop fabricated and delivered to the Site with flanges in place and properly faced.

#### Manufacturer:

##### [Consultant to provide names of three approved products]

##### Approved Equivalent

### Threaded and Coupled Joints:

#### Conform to the requirements of ASME B1.20.1-2013.

#### Produce sufficient thread length to ensure full engagement when screwed home in fittings.

#### Countersink pipe ends, ream and clean chips and burrs after threading.

#### Make connections with a maximum of three threads exposed.

#### Lubricate male threads only with thread lubricant or tape as specified on Piping Data Sheets.

### Grooved-End Joints:

#### Type:

##### [Rigid, except where joints are used to correct misalignment, to provide flexibility, and where shown otherwise, in which case provide flexible type.]

##### [Flexible, except where shown as rigid type.]

##### [     ].

### Soldered Joints:

#### Use only solder specified for particular service.

#### Cut pipe ends square and remove fins and burrs.

#### After thoroughly cleaning pipe and fitting of oil and grease using solvent and emery cloth, apply noncorrosive flux to the male end only.

#### Wipe excess solder from exterior of joint before hardened.

#### Before soldering, remove stems and washers from solder joint valves.

### Pipe Connections at Concrete Structures: As specified in the Piping Flexibility provisions in Section 15204 - Process Piping Specialties.

### PVC and CPVC Piping:

#### Provide Schedule 80 threaded nipple where necessary to connect to threaded valve or fitting.

#### Use strap wrench for tightening threaded plastic joints. Do not over-tighten fittings.

#### Do not thread Schedule 40 pipe.

### Ductile Iron, Cement-Lined Ductile Iron, and Glass-Lined Ductile Iron Piping:

#### Cutting Pipe: Cut pipe with milling type cutter, rolling pipe cutter, or abrasive saw cutter. Do not flame cut.

#### Dressing Cut Ends:

##### General: As required for the type of joint to be made.

##### Rubber Gasketed Joints: Remove sharp edges or projections.

##### Push-On Joints: Bevel, as recommended by the pipe manufacturer.

##### Flexible Couplings, Flanged Coupling Adapters, and Grooved End Pipe Couplings: As recommended by the coupling or adapter manufacturer.

### PVDF-Lined Steel Pipe Installation:

#### Cut, make up, and install pipe in accordance with the pipe manufacturer's written instructions.

#### Weld vent extension half-couplings in place prior to lining pipe.

#### Do not weld on pipe after lining is installed.

#### Prevent plugging of vent extensions with insulation or paint.

### High Density Polyethylene Piping:

#### Join pipes, fittings, and flange connections by means of thermal butt-fusion.

#### Butt-fusion shall be performed in accordance with the pipe manufacturer's recommendations as to equipment and technique.

#### Special Precautions at Flanges: Polyethylene pipe connected to heavy fittings, manholes, and rigid structures shall be supported in such a manner that no subsequent relative movement between polyethylene pipe at flanged joint and rigid structures is possible.

### Fiberglass Reinforced Piping:

#### Cut, fabricate, and install in accordance with manufacturer's written instructions.

#### Provide manufacturer's representative for instructing workers on proper installation and jointing methods.

#### Installation shall be made by workers experienced in FRP pipe lay-up techniques.

## Installation- Exposed Piping

### Piping Runs:

#### Parallel to building or column lines and perpendicular to floor, unless shown otherwise on the Drawings.

#### Piping upstream and downstream of flow measuring devices shall provide straight lengths as required for accurate flow measurement.

### Supports: As specified in Section 15201 - Piping Support Systems.

### Group piping wherever practical at common elevations; install to conserve building space and not interfere with use of space and other work.

### Unions or Flanges: Provide at each piping connection to equipment or instrumentation on equipment side of each block valve to facilitate installation and removal.

### Install piping so that no load or movement in excess of that stipulated by equipment manufacturer will be imposed upon equipment connection; install to allow for contraction and expansion without stressing pipe, joints, or connected equipment.

### Piping clearance, unless otherwise shown on the Drawings:

#### Over Walkways and Stairs: Minimum of 2,200 mm, measured from walking surface or stair tread to lowest extremity of piping system including flanges, valve bodies or mechanisms, insulation, or hanger/support systems.

#### Between Equipment or Equipment Piping and Adjacent Piping: Minimum of 1,000 mm, measured from equipment extremity and extremity of piping system including flanges, valve bodies or mechanisms, insulation, or hanger/support systems.

#### From Adjacent Work: Minimum of [25] mm from nearest extremity of completed piping system including flanges, valve bodies or mechanisms, insulation, or hanger/support systems.

#### Do not route piping in front of or to interfere with access ways, ladders, stairs, platforms, walkways, openings, doors, or windows.

#### Headroom in front of openings, doors, and windows shall not be less than the top of the opening.

#### Do not install piping containing liquids or liquid vapors in transformer vaults or electrical equipment rooms.

#### Do not route piping over, around, in front of, in back of, or below electrical equipment including controls, panels, switches, terminals, boxes, or other similar electrical work.

## Installation- Double Wall Containment Piping System

### [Installation shall be performed by the manufacturer of the Double Wall Containment system, in accordance with ASME B31.3-2016 for normal fluid service requirements.] [Install according to the manufacturer's instructions.]

### All valves and equipment shall be supported independently from the piping system. Anchor valves such that turning moment resulting from their operation will not be transmitted to pipe.

### Centering Devices for Double Wall Containment Piping:

#### Centre and support carrier pipe within the containment pipe with centering devices. Locate not less than every [3] metres, or within 600 mm of the termination of the containment pipe on all fabricated pieces.

#### Install centering devices such that leak detection cable (if specified) will be unrestricted and such that the system maintains free drainage.

### Following Installation and Testing:

#### Flush clean carrier and containment piping system.

#### Purge annular space of moisture with clean, dry [nitrogen gas] [air].

## Leak Detection System for Double Wall Containment Piping

### Install in strict accordance with the system manufacturer's instructions and recommendations.

## Installation- Buried Pipe

### Joints:

#### Dissimilar Buried Pipes:

##### Provide flexible mechanical compression joints for pressure pipe.

##### Provide concrete closure collar for [gravity] [and] [low pressure (maximum 70 kPa)] piping or as shown.

#### Concrete Encased or Embedded Pipe: Do not encase joints in concrete unless specifically shown on the Drawings.

### Placement:

#### Keep trench dry until pipe laying and joining are completed.

#### Pipe Base and Pipe Zone: As specified in Section 02315 – Excavation, Trenching and Backfilling.

#### Exercise care when lowering pipe into trench to prevent twisting or damage to pipe.

#### Measure for grade at pipe invert, not at top of pipe.

#### Excavate trench bottom and sides of ample dimensions to permit visual inspection and testing of entire flange, valve, or connection.

#### Prevent foreign material from entering pipe during placement.

#### Close and block open end of last laid pipe section when placement operations are not in progress and at close of day's work.

#### Lay pipe upgrade with bell ends pointing in direction of laying.

#### [Install closure sections and adapters for gravity piping at locations where pipe laying changes direction.]

#### Deflect pipe at joints for pipelines laid on a curve using unsymmetrical closure of spigot into bell. If joint deflection of standard pipe lengths will not accommodate horizontal or vertical curves in alignment, provide:

##### Shorter pipe lengths.

##### Special mitered joints.

##### Standard or special fabricated bends.

#### After joint has been made, check pipe alignment and grade.

#### Place sufficient pipe zone material to secure pipe from movement before next joint is installed.

#### Prevent uplift and floating of pipe prior to backfilling.

### [PVC, CPVC, or HDPE Pipe Placement:]

#### [Lay pipe snaking from one side of trench to other.

#### Offset: As recommended by the manufacturer for maximum temperature variation between time of solvent welding and during operation.

#### Do not lay pipe when temperature is below 5 degrees Celsius, or above 32 degrees Celsius when exposed to direct sunlight.

#### Shield ends to be joined from direct sunlight prior to and during the laying operation.]

### Tolerances:

#### Deflection From Horizontal Line [, Except PVC, CPVC, or HDPE]: Maximum [50] mm.

#### Deflection From Vertical Grade: Maximum [6] mm.

#### Joint Deflection: Maximum of 75 percent of manufacturer's recommendation.

#### Horizontal position of pipe centerline on alignment around curves maximum variation of [500] mm from position shown on the Drawings.

#### Pipe Cover: Minimum [1000] mm, unless otherwise shown on the Drawings.

## Installation - Concrete Encased

### Provide reinforced concrete pipe encasement where shown on the Drawings and where otherwise required. Some piping may be required to be concrete encased for pipe strength requirements that are included in the Contract Documents. Piping under and within the influence of buildings, utility trenches, vaults, slabs and other structures shall be concrete encased. See details on Drawings for encasement requirements.

### Where concrete encased piping crosses structure construction and expansion joints, provide flexible piping joints to coincide with structure joints to prevent excessive pipe stress and breakage.

## Thrust Restraint

### Location:

#### Buried Piping: Where shown on the Drawings and where required to restrain force developed at pipeline tees, plugs, caps, bends, and other locations where unbalanced forces exist due to hydrostatic testing and normal operating pressure.

#### Exposed Piping: At all joints in piping.

### Thrust Ties:

#### Steel Pipe: Attach with fabricated lugs.

#### Ductile Iron Pipe: Attach with socket clamps against a grooved joint coupling or flange.

#### Flanged Coupling Adapters: For exposed installations, install manufacturer's anchor studs through the coupling sleeve.

### Mechanical Joint Valve Restraint in Proprietary Restrained Joint Piping:

#### Install pipe joint manufacturer's adapter gland follower and pipe end retainer, or thrust tie-rods and socket clamps.

### Thrust Blocking:

#### Place between undisturbed ground and fitting to be anchored.

#### Quantity of Concrete: Sufficient to cover bearing area on pipe and provide required soil bearing area as shown.

#### Place blocking so that pipe and fitting joints will be accessible for repairs.

#### Place concrete in accordance with Section 03300 - Cast in Place Concrete and Section 03200 - Concrete Reinforcement.

## Slab, Floor Wall, and Roof Penetrations

### Application and Installation: As specified in Section 15204 - Process Piping Specialties.

## Branch Connections

### Do not install branch connections smaller than 13 mm nominal pipe size, including instrument connections, unless shown otherwise on the Drawings.

### When line of lower pressure connects to a line of higher pressure, requirements of Piping Data Sheet for higher pressure rating prevails up to and including the first block valve in the line carrying the lower pressure, unless otherwise shown on the Drawings.

### Threaded Pipe Tap Connections:

#### Ductile Iron Piping: Connect only with service saddle or at a tapping boss of a fitting, valve body, or equipment casting.

#### Welded Steel or Alloy Piping: Connect only with welded threadolet or half-coupling as specified on Piping Data Sheet.

#### Limitations: Threaded taps in pipe barrel are unacceptable.

## Vents and Drains

### Vents and drains at high and low points in piping required for completed system may or may not be shown on the Drawings. Install vents on high points and drains on low points of pipelines [only where shown] [as shown] [at all low and high point locations].

## Cleaning

### Following assembly and testing, and prior to [disinfection and] final acceptance, flush pipelines (except as stated below) with water at 76 mps minimum flushing velocity until foreign matter is removed.

### Blow clean of loose debris [plant process air,] [natural gas,] [dry chlorine gas or liquid,] [and] instrument air-lines with compressed air at [     ] [     ]; do not flush with water.

### Immediately after cleaning [dry chlorine gas or liquid,] [and] [     ], service piping, dry to minus 5 degrees Celsius dew point with dry compressed instrument air or compressed commercial grade nitrogen.

### If impractical to flush large diameter pipe at 76 mps *[Consultant to confirm velocity and measurement units]* or blow at [1200] mpm *[Consultant to confirm velocity and measurement units]* velocity, clean in place from inside by brushing and sweeping, then flush or blow line at lower velocity.

### Insert cone strainers in flushing connections to attached equipment and leave in place until cleaning is complete.

### Remove accumulated debris through drains 50 mm and larger or by removing spools and valves from piping.

## Insulation

### See Section 15080 - Process Piping Insulation.

## Heat Tracing

### See Section [      ] - Pipe Heat Tracing.

## Disinfection

### See Section 02511 - Watermains.

## Field Finishing

### Notify the Consultant a minimum of three Days prior to start of any surface preparation or coating application work.

### As specified in Section 09900 – Painting and Protective Coatings.

## Pipe Identification

### As specified in Section 02315 – Excavation, Trenching and Backfilling, 09900 – Painting and Protective Coatings.

## Field Quality Control

### Pressure Leakage Testing: As specified in Section 15955 - Piping Leakage Testing.

### Minimum Duties of Welding Inspector:

#### Job material verification and storage.

#### Qualification of welders.

#### Certify conformance with approved welding procedures.

#### Maintenance of records and preparation of reports in a timely manner.

#### Notify the Consultant of unsatisfactory weld performance within 24 hours of weld test failure.

### Required Weld Examinations:

#### Perform examinations in accordance with Piping Code [ASME B31.1-2016] [ASME B31.3-2016] [for Category M fluids] [except that] [\_\_\_\_ percent of the circumferential butt welds shall be random radiographed.]

#### Perform examinations for every pipe thickness and for each welding procedure, progressively, for all piping covered by this Section.

#### Examine a minimum of one of each type and position of weld made by each welder or welding operator.

#### For each weld found to be defective under the acceptance standards or limitations on imperfections contained in the applicable Piping Code, examine two additional welds made by the same welder that produced the defective weld. Such additional examinations are in addition to the minimum required above. Examine, progressively, two additional welds for each tracer examination found to be unsatisfactory.

### [Test the leak detection system in accordance with the system manufacturer's instructions and recommendations to verify proper operation.]

## Manufacturer’s Services

### Provide the manufacturer's representative at Site [in accordance with Section 01640 - Manufacturers' Services,] to assist with unloading of the double wall containment piping system, system tests, containment pipe joint closure, installation and testing of leak detection system, and training of [the Region's] personnel in operation and maintenance of leak detection system. Ensure that the manufacturer's representative completes a Manufacturer's Certificate of Proper Installation. Inspection and examination practices shall be in accordance with ASME B31.3-2016 for normal fluid service.

## Supplements

### Piping Schedule.

### Data Sheets as indicated by Section Number below:

|  |  |
| --- | --- |
| Section Number | Title |
| 15200-01 | **[Cement-Mortar] [, Glass] [and] [Asphaltic]**-Lined Ductile Iron Pipe and Fittings |
| 15200-02 | Carbon Steel Pipe and Fittings-Special Service |
| 15200-03 | Carbon Steel Pipe and Fittings-General Service |
| 15200-04 | Welded Steel Pipe and Fittings |
| 15200-05 | **[Glass,] [Rubber,] [and] [Polypropylene]-**Lined Carbon Steel Pipe and Fittings |
| 15200-06 | PVDF-Lined Steel Pipe and **[Ductile Iron]** Fittings |
| 15200-07 | Galvanized Steel Pipe and Malleable Iron Fittings |
| 15200-08 | Stainless Steel Pipe and Fittings-General Service |
| 15200-09 | Stainless Steel Pipe and Fittings-Digester Gas Service |
| 15200-10 | Stainless Steel Pipe and Fittings-Special Service |
| 15200-11 | Polyvinyl Chloride (PVC) Pipe and Fittings |
| 15200-12 | Chlorinated Polyvinyl Chloride (CPVC) Pipe and Fittings |
| 15200-13 | Fiberglass Reinforced Plastic (FRP) Pipe and Fittings |
| 15200-14 | Copper and Copper Alloy Pipe, Tubing, and Fittings |
| 15200-15 | High Density Polyethylene (HDPE) Pipe and Fittings |
| 15200-16 | Double Wall Containment Piping |
| 15200-17 | PTFE-Lined Steel Pipe and Fittings |
| 15200-18 | Alloy 20 Pipe and Fittings |

**END OF SECTION**

**PIPING SCHEDULE LEGEND**

**SERVICE**

A Air

AHP Air-High Pressure

ALP Air-Low Pressure

RD Roof Drain

SD Storm Drain

SS Sanitary Sewer

V Vents

W1 Water-Potable

W2 Water-[    ]

W3 Water-[    ]

[    ] [    ]

**EXPOSURE**

BUR Buried

EXP Exposed

SUB Submerged

ENC Concrete Encased

**MATERIAL**

CISP Cast Iron Soil Pipe

CLDI Cement-Lined Ductile Iron

CMP Corrugated Metal Pipe

COP Copper

CPVC Chlorinated PVC

DI Ductile Iron

FRPX Fiberglass Reinforced Plastic Pipe (X = 1 to 6)

GLDI Glass-Lined Ductile Iron

GSP Galvanized Steel Pipe

HDPE High Density Polyethylene

PCCP Pre-stressed Concrete Cylinder Pipe

PSTL PVDF-Lined Steel

PTFE Polytetrafluoroethylene

PVC Polyvinyl Chloride

PVDF Polyvinylidene Fluoride

RCP Reinforced Concrete Pipe

RSTL Rubber-Lined Steel

SST or ss Stainless Steel

STL Steel

VC Vitrified Clay Pipe

**PRESSURE TEST**

H Hydrostatic

I In Service

P Pneumatic

NA Not Applicable

**PIPING SCHEDULE**

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Service | Legend | Size(s) (mm) | Exposure | Piping Material | Specification Section | Operating Pressure (kPag) | Test Type | Test Pressure and Type (kPag-x), where x = H for Hydrostatic, x = P for Pneumatic | Pipe Colors and Labels | Remarks |
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