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7. Stainless Steel Pipe

This section specifies the requirements of Stainless Steel pipes, fittings, accessories and their joints for the construction to be used in Haya Water STPs wherever specified.

7.1. Applicable Standards and Codes

All materials and workmanship shall comply with the latest edition of the applicable standards and codes, which shall include but are not be limited to the following:

ASME B16.9-2012	Factory made, wrought steel butt welded fittings
ASME B31.3-2012	Process piping
ASME B36.19M - 2004	Stainless steel pipe
ASTM A182/A182M - 12b	Standard Specification for forged or rolled alloy and stainless steel pipe flanges, forged fittings, and valves and parts for high-temperature service.
ASTM A193/A193M - 12b	Standard Specification for alloy-steel and stainless steel bolting for high temperature or high pressure service and other special purpose applications.
ASTM A194/A194M - 12a	Standard Specification for carbon and alloy steel nuts for bolts for high pressure or high temperature service, or both.
ASTM A312/A312M - 12a	Standard Specification for seamless, welded, and heavily cold worked austenitic stainless steel pipes.
ASTM A403/A403M - 12	Standard Specification for wrought austenitic stainless steel piping fittings.
B1.15 - 1995	Unified inch screw threads, (uni-thread form).
B16.11 - 2011	Forged fittings, socket-welding and threaded.
BS 6956-5:1992	Jointing materials and compounds. Specification for jointing compounds for use with water, low pressure saturated steam, 1st family gases (excluding coal gas) and 2nd family gases.
BS EN 1092-1:2007	Flanges and their joints. Circular flanges for pipes, valves, fittings and accessories, PN designated. Steel flanges.
BS EN ISO 9000-1:1994	Quality management and quality assurance standards. Guidelines for selection and use.
ISO 10474	Steel and steel products – inspection documents.
ISO 7005-1:2011	Pipe flanges -- part 1: steel flanges for industrial and general service piping systems.
BS EN 1993 Incorporating Corrigendum July 2009	Eurocode 3: Design of steel structures

7.2. Design Considerations

7.2.1. General

- i. The wall thickness of the piping components shall be determined by the Design Engineer, considering the applicable design conditions of ASME B31.3-2012 code.
- ii. Piping shall be capable to withstand satisfactorily all resultant forces exerted by normal pressures and any surge pressures which may arise from sudden reversal of flow during starting up or shutting down of any portion of the system.
- iii. Material grades, wall thickness, branch connections, and similar elements shall be in accordance with the applicable drawings.
- iv. No corrosion allowance considered for stainless steel pipes and fittings.

7.3. Pipe Sizes

- i. Pipes shall conform to ASTM A312 or A312M-12a TP 316 Seamless quality, unless specifically mentioned otherwise.
- ii. All pipe sizes shall be designated as NPS only. The range of NPS shown in Table 5 shall be used. Outside diameter of pipe shall meet the requirements of ASME B36.19M: 2004.

Table 5. Nominal Pipe Size

Metric (mm)	Imperial (Inch)
DN 15	0.5
DN 20	0.75
DN 25	1
DN 40	1.5
DN 50	2
DN 65	2.5

7.4. Fittings

- i. Fittings shall conform to ASME B16.9-2012 and shall be seamless. Elbows with butt welded ends shall be the long radius type (radius equals 1.5 times the nominal pipe size). Short radius elbows shall not be used. For diameters < DN 40 forged 45°, 90° elbows shall be used.
- ii. The minimum branch connection size on pipelines shall be DN 25. Smaller sizes, if required, shall be reduced from DN 25.
- iii. Threaded fittings may be used where joints must be disconnected such as plugs in vents, drains and clean-out connections to equipment and instruments, and for the first block valve downstream of instrument taps. Threaded joints on the pressure side of the first block valve shall be seal-welded.
- iv. Full length couplings, threaded or with a socket in one end, shall only be used wherever necessary for vents and drains.
- v. Material for elbows, reducers, and tees shall conform to ASTM A182/A182M-12b Type 316. Wall thickness shall be same as the connecting pipe wall thickness.

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- vi. Material for threaded and socket welded fittings shall conform to ASTM A182/A182M-12b Type 316 with a pressure rating of 3,000 lb.
- vii. Elbowlets shall not be used for branch connections, instrument taps, or vent and drain connections unless space considerations dictate. Drain and vent connections shall not be installed in elbows.
- viii. Reducing tees and reducers shall be supplied with butt weld ends with schedules to match the pipe. The allowable size combinations are as shown in ASME B16.9-2012.
- ix. Branch connections shall be made from equal tees, reducing tees, and integral reinforced branch fittings, as approved by Haya Water. If a reducing tee of required combinations is not available, a combination of reducing tee and reducer shall be used.

7.5. Flanges

- i. Flanges shall be welded neck raised face type, with dimensions conforming to BS EN 1092-1:2007 or ISO 7005-1:2011, unless otherwise specified in the approved data sheet. The rating of the flanges shall be in accordance with the approved data sheet.
- ii. The gasket contact surface shall be formed by continuous spiral groove with a surface roughness between Ra 6.3 and 12.5 µm.

7.6. Gaskets and Bolting

- i. Material of gaskets shall be EPDM rubber, having 3 mm thickness, suiting flange dimensions of the applicable standards. The gasket shall extend from the inside diameter of the flange to at least the inside edge of the bolt holes or may be laid beyond the bolt circle to the outside diameter of the flange.
- ii. Bolts and nuts shall refer to Technical Standard Specification – Civil Section 06 – Metalwork, Document No: AM-ENG-SS-02-06 and have regular square and hexagonal dimensions. Bolts and nuts shall be supplied with necessary washers.
- iii. Screw threads shall be UNC for 1 inch and smaller bolt diameters and 8-UN for larger diameters, Class 2 fit, in accordance with ASME B.1.1-2003.

7.7. Inspection and Testing

Contractor / manufacturer shall submit Inspection Test Plan as per specified standard and it shall be implemented after approval of the Engineer.

7.7.1. Workshop Inspection/Testing

- i. Inspection and testing of all pipe, fittings, and flanges shall be in accordance with the applicable ISO, BS, ASME, and ASTM Specifications. All material test certificates shall indicate conformity to the requirements. All materials shall have the manufacturer's and mill test certificates, not letters of conformity.
- ii. Haya Water reserves the right to stage-inspect the material, manufacturing process, testing, and other elements of the Works. Such inspection shall not relieve the Contractor of the responsibility for suitable design and workmanship.
- iii. The Contractor shall submit a detailed ITP or QCP for approval showing manufacturing, inspection, testing activities, and its acceptance criteria prior to commencement of manufacturing. All certification shall be 3.1.B in accordance with ISO 10474. The radiography test and hydrostatic test shall be witnessed by Haya Water.
- iv. The Contractor shall make suitable provisions for testing and inform Haya Water sufficiently (at least 1 month) in advance to enable its representatives to witness the test. If witnessing of any

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tests is not satisfactory, and a retest is required, the cost of the witnessed retest shall be borne by the Contractor.

- v. The manufacturer shall ensure that all the applicable codes and standards are available at their premises for Haya Water's reference during its visit to the manufacturer's premises for workshop inspection/test.
- vi. The test and material certificates for all the items shall be entered in the manufacturing data/project record books. These shall include the witnessed tests, and the documents shall be submitted to Haya Water prior to the despatch of the materials.

7.8. Packing and Shipment

- i. Pipes shall be provided with adequate cushioned support during all stages of handling, transport, and storage to prevent damage.
- ii. Each pipe and fitting shall be indelibly marked over any factory applied coating with the diameter, nominal pipe thickness, class, grade of steel, length of pipe, and factory test pressure and shall, in addition, carry a unique reference number to enable items to be correlated to Works fabrication records, Works test certificates, delivery notes, and the like. It shall be marked with wall thickness and steel grade. Wherever possible, the marks shall be painted on the outside of pipes and fittings close to one end.
- iii. Where there is insufficient smooth surface area to accommodate the previous information, the marking shall be put on rust-proofed metal tags secured to the item with galvanised wire.
- iv. The flanges of pipes and fittings shall be protected by wooden discs attached by means of service bolts or by other approved means. Service bolts shall not be incorporated in the Works.