OMAN WASTEWATER SERVICES COMPANY S.A.O.C

الشركة العمانية لخدمات الصرف الصحي ش.م.ع.م

SECTION 06

PIPING AND ACCESSORIES

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6. Piping and accessories

6.1 Design Criteria

The pipe work shall be designed, fabricated, erected, inspected and tested on the basis of the applicable standards and codes, and the additional requirements as set out below.
Submit full specification for pipe work as regards standards, type of pipes, pressure class, nomina1 sizes, wall thicknesses, material qualities, welding, post-treatment, type of conations, etc for the approval of the Engineer.
Design the pipe work for the highest possible pressure likely to occur, including for instance water hammer effects or pumping against closed valves.

Nominal diameters (DN), nominal pressure (PN) and wall thickness shall be standardized.

The design pressure must be determined according the special technical requirements for each system.

The design temperature is the highest possible fluid temperature occurring in the length of line concerned. Possible tolerances of the temperature control system and any temperature allowances provided by the requirements of the standards shall be considered.

In addition to the required wall thickness in accordance with calculations, a corrosion allowance of 3 mm shall be added for unprotected carbon steel, 1.5 mm for alloy steel, and 0.5 mm by stainless steel.

In pipe work for certain chemicals PVC in accordance with ISO 4422 for sizes up to about 90 mm diameter only. PVC has to be used for indoor installations in fireproof areas only.

6.2 Guidelines for the design and construction of pipe work and accessories

- Minimize the use of expansion boxes or bellows as well as dismantling boxes. Wherever possible, give the pipe work itself sufficient flexibility to allow for thermal expansion and contraction also for easy dismantling. Do not use stainless steel for pipe systems buried in ground.
- Use elbows with even curvature and a bending radius of 1.5 times the nominal diameter. Do not use the mitred type of elbows. In pipe work for dewatered sludge use elbows with longest possible bending radius, but as a minimum 2.5 times the nominal diameter.
- For pipe work supports and anchors use hot dip galvanized steel. For members welded on to stainless steel pipe walls, use stainless steel of same grade.
- Provide the pipe work with facilities for emptying and cleaning.
- Arrange pipe work to avoid clogging.

- Design and construction of all parts of the pipelines and accessories should correspond to the present state of the art and shall be based on the latest standards.
- The pipe work and its accessories shall be designed and arranged so that all parts subject to operation and maintenance can be operated, inspected, maintained and replaced without difficulty and with a minimum of effort. All important parts must be accessible.
- The nominal bore of gate valves shall be the same as the nominal diameter of the pipeline in which they are installed.
- None of the forces and moments transmitted by the pipes to connected machines, apparatus and other components must exceed the maximum permissible values, given by the manufacturers of these items.
- As far as expansion joints and other parts of pipe work are concerned it shall be borne in mind that differential settlement can occur. The reaction forces and moments of the piping system to be withstood by fixed points, walls, foundations and other civil structures shall be reduced to the utmost minimum by suitable means (e.g. expansion joints shall be provided where required).
- The installed pipe work with its supports and other components shall not obstruct gangways (min. 1000 mm wide), maintenance, escape routes etc. Overhead piping shall have a minimum vertical clearance of 2.3 meters and 6 meters above roadways.
- All steel pipes ≥ DN 400 shall be cleaned internally prior to delivery by shot blasting at the workshop with iron particles to SA2 ½ or by acid cleaning, and shall be properly protected against corrosion.
- Pipe ends and branch connections of underground piping shall be sealed temporarily during installation if the connecting pipe is not immediately installed.
- OWSC reserves the right to require the Contractor to modify any of his cleaning procedures if found necessary to obtain acceptable results. The Contractor shall furnish, install and dismantle all temporary pipes, hangers, anchors, etc. required for cleaning all piping systems.
- All welding shall be carried out according to relevant standards. For quality reasons as many welds as possible are to be carried out in the workshop.
- The Contractor shall provide suitable thimbles and flashing where pipelines pass through floors and walls. Floor thimbles shall be installed to provide 90 mm projection above the finished floor surface.
- Pipe materials, bends and fittings shall be tested in accordance with the applicable material standards.

6.3 Noise abatement measures

The Contractor shall take all necessary measures to limit noise in accordance with the latest developments in technology. On no account shall the sound level exceed the values as mentioned under the relevant subsection.

If this requirement cannot be met by adequate construction of the pipe work and valves concerned, sound absorbing housing or insulation have to be provided.

6.4 Pipe supporting elements

As used herein, the term “hangers and supports” shall include all hanger assemblies, support assemblies, constant support hangers, anchors, guides, sway braces, vibration dampers, trays, brackets, attachments, miscellaneous structural steel and other items required to support the piping in a proper manner.

Constant support type spring assemblies shall be provided at all locations where it is necessary to avoid transfer of stress from that support to another support or to an equipment terminal, and at other support locations where vertical movements of the piping are too large to be properly handled by variable support springs. Constant support spring assemblies shall be of a design that will compensate for the normal variation in the supporting force of the helical coil springs, thus providing constant supporting force throughout a total travel range which shall be at least 20 mm greater than the actual maximum movement of the piping.

Constant support assemblies shall be equipped with a means of locking the spring(s) against movement during erection, hydrostatic testing etc. The use of counterweights in substitution for support spring assemblies will not be permitted.

All pipe hangers and support stands shall be attached to the piping and structural supports such that they will be vertical when the piping is at operating condition. So far as practicable, hangers and supports shall be of the same type and component assembly.

All hangers shall be carefully adjusted. After plant start-up checks shall confirm that all hangers and supports are in the correct position.

The Contractor shall prepare a complete documentation of all pipe hangers and supporting elements. These documents shall contain the following information:

- Loads, forces and moments, and their directions at all supports, hangers at normal operating conditions, etc.
- Magnitude and directions of the movements at the loading points

- Measurements of the loading points referred to the axes of the buildings
- Item No. Of the supports, hangers etc. according to the piping group
- Material specification for the supporting parts.

6.5 Sealing

Sealing have to be selected in accordance to the pipe material, flange form and operation medium. Flat flange sealing shall be preferable finished with an inner and outer edging, sized that, that during the installation a self alignment takes place.

6.6 Stainless steel pipes

Pickling and neutralization of piping sections and welding locations of stainless steel

Following welding, all stainless steel piping sections shall be pickled. If, despite the use of shield gas, burn discoloration has formed, the welds shall also be pickled on the inside. The Tenderer shall specify the most suitable pickling procedure and the pickling agent used. The pickling specifications for the applied pickling procedure as well as the safety regulations for the use of pickling agents and disposal of rinsing water shall be submitted to the Client following contract award and shall be approved by him.

The welded components together with their welds shall, following pickling, present a uniform, silver-gray appearance.

When cleaning welds and piping sections using wire brushes, only brushes of stainless steel may be used, and never the usual steel wire brushes.

After rinsing the pickled components with water, no pickling residues may be left on the steel.

The rinsing water shall be disposed of in consultation with the local waste water authority. If it is not possible to guarantee that all acid residues will be removed by the rinsing operation, this will be followed by neutralization, using 1 kg caustic soda to 20 l water.

The passivity of the treated surface shall be demonstrated by means of chemical spot checks. The procedure shall be agreed with the Client.

The safety measures and regulations of the pickling agent manufacturer shall be strictly observed during the pickling procedure. Relevant regulations for handling nitric acid and hydrofluoric acid shall be observed.

6.7 Ductile Iron Pipes and Fittings

General

Pipes and fittings in ductile iron for use with sewerage and wastewater shall conform to the standard BS EN 598 and shall withstand successfully any test described therein.

The standard wall thickness of pipes and fittings shall be determined by the following classification:

Pipes - Class K9

Fittings, excluding tees - Class K12

Tees - Class K14

Pipes, fittings and accessories must not have any defects likely to be detrimental to their use.

Pipes, fittings and accessories showing small imperfections inseparable from the method of manufacture and in no way affecting their use, shall not be rejected. The Manufacturer may, on his own responsibility, remedy such slight surface imperfections in a suitable manner.

All buried pipes shall, unless otherwise specified, required or indicated, be of the socket and spigot type with the manufacturer's standard rubber gasket.

All flanges shall conform to BS4504 Section 3.1 and BS EN 1092: Part 2. Flanges shall be drilled to PN16 unless otherwise specified or required.

Socket and Spigot Pipes and Fittings

All buried pipes shall, unless otherwise specified, required or indicated, be of the socket and spigot type with the manufacturer's standard rubber gasket.

Flanged Pipes and Fittings

All flanges shall conform to BS4504 Section 3.1 and BS EN 1092: Part 2. Flanges shall be drilled to PN16 unless otherwise specified or required.

Flanged joints shall be made, unless specified otherwise, with full face rubber joint gaskets; bolts and nuts which shall include two washers per bolt shall be stainless steel grade to BS 970 Grade 316 S31. Joint gaskets shall be made from 3mm thick rubber and of such physical properties as to be capable of forming permanent watertight joints in accordance with BS4865: Part 1 and BS EN 681:Part 1. The use jointing paste or grease

will not be permitted. No jointing material shall be left protruding into the bore of the pipe work.

Coatings and Linings

All pipes and fittings shall be supplied with factory-applied coatings and linings.

Coatings shall be in accordance with ISO 8179-1 and ISO 8179-2. Cement mortar linings shall comply with ISO 4179.

Pipes shall be externally coated with zinc spray and bituminous coating.

Pipes shall be internally lined with high alumina cement mortar. Socket areas that come into contact with sewage or wastewater shall receive a reinforced coating of epoxy paint.

Fittings shall be coated and lined with epoxy powder to 150 microns DFT (minimum).

All non-buried flanged pipes and fittings (in pumping stations, etc.) shall be with internal coatings as specified above. The external coating shall be as specified above, including zinc spray, supplemented by with a finishing coat of a color to be specified by the Engineer.

6.8 Flange Adaptors and Flexible Coupling

General

In addition to the types of joints typically designated for each type of pipe, flange adaptors and flexible couplings may be designated particularly for pressure pipelines.

Flange adaptors and flexible couplings shall:
(a) Be manufactured from rolled steel or other approved materials
(b) Be capable of withstanding the pressure test of the pipeline in which they are incorporated
(c) Permit not less than 4º deflection between adjacent pipes in any direction
(d) Be capable of accommodating a movement of 10 mm between ends of pipes they connect.

Adaptors and couplings shall be joined as recommended by the manufacturer.

Where necessary, end movement of pipes and relative movement of flange adaptors and flexible couplings flange adaptors shall be restrained by a steelwork harness fabricated to the details shown on the Drawings or to the Engineer's approval. On completion the harness shall be cleaned and painted with two coats of bituminous paint or nylon coating bonded on.

Flange Adapters

Flange adapters shall be used on PVC-U, GRP, cast and ductile iron, and joints between each of the materials as designated. Flanges shall be PN 16 rating and gaskets shall be to BS 3063.

Flexible Couplings

Flexible couplings shall be used with PVC-U, GRP, cast and ductile iron, and between joints between pipes manufactured from each of the materials.