



Exploration & Production

GENERAL SPECIFICATION

PIPING VALVES VESSELS

GS EP PVV 111

Piping design specification

09	01/2011	New revision
08	10/2009	Update of reference documents
07	10/2008	General review
06	10/2007	Revision crossed references
00	03/2001	First issue
Rev.	Date	Notes

Owner: EP/TDO/TEC	Managing entity: EP/TDO/TEC/PVV
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Contents

1. Scope	4
2. Reference documents.....	4
3. Materials.....	7
3.1 Tubes.....	7
3.2 Fittings	7
3.3 Connections.....	8
3.4 Flanges	9
3.5 Gaskets and bolts	10
3.6 Valves	10
3.7 Change of piping material class.....	10
4. General design rules.....	11
4.1 Layout of piping	11
4.2 Flexibility of piping	11
4.3 Clearances and access	12
4.4 Installation of valves	14
4.5 Installation of instruments	15
4.6 Vents and drains	16
4.7 Isolation (GS EP ECP 103).....	16
4.8 Utility stations.....	17
4.9 Sample taps.....	17
4.10 Thermal insulation and heat tracing.....	17
5. Special design rules.....	18
5.1 Vessels and columns.....	18
5.2 Storage tanks.....	18
5.3 Reactors	18
5.4 Exchangers.....	19
5.5 Air coolers.....	19
5.6 Heaters	20
5.7 Pumps.....	20
5.8 Compressors	21



6. Supports	21
6.1 General.....	21
6.2 Identification of supports.....	22
6.3 Temporary supports.....	22
7. Principle for the preparation of the main piping drawings, documents and models.....	22
7.1 General appearance of documents	22
7.2 Piping and Instrument Diagrams (P&ID's)	23
7.3 Line list.....	25
7.4 General drawings.....	25
7.5 Piping drawings	27
7.6 Isometric drawings.....	27
7.7 Piping supports	28
7.8 Models	28
8. List of equipment	29
8.1 Characteristics of equipment	29
8.2 Identification of equipment.....	29



1. Scope

This document sets rules for the design of piping systems (process and utilities) of onshore and offshore petroleum installations.

Its scope is essentially the same as that of [ASME B31.3](#). The following are specifically excluded: onshore and offshore pipelines, furnaces and boilers tubes, building heating and ventilation piping.

For high pressure piping class 10 000 API, piping shall be designed according to chapter IX "High Pressure Piping" of [ASME B31.3](#).

2. Reference documents

The reference documents listed below form an integral part of this General Specification. Unless otherwise stipulated, the applicable version of these documents, including relevant appendices and supplements, is the latest revision published at the EFFECTIVE DATE of the CONTRACT.

Any divergence between any of the Contractual Reference Documents, or between this specification and any other Contractual Reference Document, shall be reported to the Company for decision. In such a case, and unless otherwise agreed or decided by the Company, it is understood that the more stringent requirement shall apply.

Exceptions to, or deviations from this specification are not permitted unless previously accepted in writing by the Company. For this purpose, requests for substitutions or changes of any kind shall be complete with all pertinent information required for the Company assessment.

Regulations

If the country of installation has its own regulation, it must be applied wherever more stringent than the Basic Code.

Any Construction Code or Government Regulations, which may be listed in the Project Specifications or in the Contract, shall have precedence except where this Specification is more stringent.

Standards

Reference	Title
API RP 14E	Recommended Practice for Design and Installation of Offshore Production Platform Piping Systems
ASME B1.20.1	Pipe Treads (Except Dryseal)
ASME B16.5	Steel Pipe Flanges and Flanged Fittings
ASME B16.10	Face to Face and End to End Dimensions of Valves
ASME B16.47	Large diameter steel flanges NPS 26 through NPS 60
NACE MR0175 / ISO 15156	Materials for Use in H ₂ S-containing Environments in Oil and Gas Production
MSS SP 6	Standard Finishes for Contact Faces of Pipes Flanges and Connecting-ends Flange of valves and fittings

**Professional Documents**

Reference	Title
API SPEC 6D	Pipeline transportation systems - Pipeline valves

Regulations

Reference	Title
Not applicable	

Codes

Process and utilities piping shall comply with the requirements of ASME B31.3.

The ASME code, Section I, shall be applied for certain sections of piping connected to steam generators. The portions of piping to which this code is applied shall be clearly identified on the flow diagrams.

Reference	Title
ASME B31.3	Code for Pressure Piping. Chemical Plant and Petroleum Refinery Piping
ASME Section I	Boiler and Pressure Vessel

Other documents

Reference	Title
Not applicable	

Total General Specifications

Reference	Title
GS EP COR 170	Materials for Sour Service (Upstream Applications). Specification for design
GS EP COR 350	External protection of offshore and coastal structures and equipment by painting
GS EP COR 354	External protection of onshore structures and equipment by painting
GS EP ECP 103	Process sizing criteria
GS EP EXP 501	Equipment and piping numbering
GS EP PVV 107	Piping Stress Analysis
GS EP PVV 112	Piping material classes



Reference	Title
GS EP PVV 113	Block models
GS EP PVV 114	Design models
GS EP PVV 115	3D electronic models
GS EP PVV 116	Model review check list
GS EP PVV 119	Design and fabrication of metallic piping supports - Standard for piping supports
GS EP PVV 142	Valves
GS EP PVV 143	Metallic pipes
GS EP PVV 144	Fittings
GS EP PVV 145	Flanges
GS EP PVV 146	Bolting for piping
GS EP PVV 147	Gaskets for piping and vessels
GS EP PVV 148	Glass - Reinforced plastic. Piping materials (tubes and accessories)
GS EP PVV 149	Spring hangers and supports
GS EP PVV 150	Valves in cryogenic service
GS EP PVV 171	Steel piping fabrication
GS EP PVV 172	Hot tapping
GS EP PVV 173	Pneumatic testing of above ground piping systems
GS EP PVV 175	Cleaning of piping and vessels
GS EP PVV 178	Design and erection of Glass Reinforced Plastic (GRP) piping system
GS EP PVV 211	Design and fabrication of pressure vessels according to ASME VIII
GS EP PVV 212	Design and fabrication of pressure vessels according to BSI PD 5500
GS EP PVV 771	Thermal insulation (hot service)
GS EP PVV 772	Thermal insulation (cold service)
GS EP PVV 773	Thermal insulation (cyclic service)



3. Materials

3.1 Tubes

3.1.1 Minimum diameter

The minimum diameter used shall be 1/2". This restriction on diameter does not apply to utilities connections, to orifice flanges, drains and vents, tracing, etc.

3.1.2 Standardised diameters

Diameters shall be chosen from the customary series:

1/2", 3/4", 1", 1 1/2", 2", 3", 4", 6", 8", 10", 12", 14", 16", 18", 20", 22", 24", etc.

In particular, tubes having nominal diameters of 1/4", 3/8", 1"1/4, 2"1/2, 5", 7", 9" and 22" shall not be used. If vessels have connections at these diameters, the piping from the vessels shall be increased to the next largest diameter.

For diameters above 24", sizes 30", 36", 42", 48", 56" and 60" are preferred dimensions.

3.1.3 Threaded piping

Threaded carbon-steel piping used for process services shall be at least schedule 80 and 2" maximum diameter.

3.2 Fittings

3.2.1 Fittings up to 1"1/2 in diameter

a) Ends

As a general rule, the fittings used for piping up to 1"1/2 in diameter shall be made of forged steel, of the "socket welding" Type.

This requirement is not applicable to 10 000 API rating classes where "butt welding" type shall apply.

Welding fittings made of malleable cast iron are prohibited.

Threaded fittings made of forged steel may be allowed on water and compressed-air piping, drains, vents, temperature taps, etc., up to 1"1/2 in diameter. The threading shall be NPT, as per [ASME B1.20.1](#).

b) Elbows

Up to 1"1/2 in diameter, bending shall be preferred to elbows; the bending radius shall be equal to five times the nominal diameter of the tube.

c) Tees

Equal and unequal tees shall be used.

3.2.2 Fittings 2" or more in diameter

a) Ends

As a general rule, the fittings used for piping 2" or more in diameter shall be made of the "butt-welding" Type.

b) Elbows

Elbows shall have a large radius ($R = 1.5 d$).

If bends must be used for these diameters, they shall be cold-fabricated for the diameters 2" and 3" and hot-fabricated for diameters 4" or more. The bending radius shall be equal to five times the nominal diameter of the tube.

c) Tees

Equal tees may be used for all connections to piping of the same diameter. The limits within which they may be used shall be specified in the piping material classes specification.

Reduced tees shall be used as indicated in the piping materials classes.

For piping classes 10 000 API ratings, Sockolet, Thredolet and Weldolet branch connection types are not allowed. Only Sweepolet for branch diameter less than 2" is acceptable and reduced tees, equal tees or equal tee plus reducer for larger diameters are acceptable.

d) Reducers

The use of concentric reducers shall be the general rule. The use of eccentric reducers shall be restricted in principle to piping in layers on pipe racks and to pump intakes.

3.3 Connections

Connection shall be made at 90°; oblique connections shall be avoided except as detailed below.

Oblique connections at 45° may be accepted only for flare, vent and drain piping systems with header above 4". Weld fabricated oblique connections are only acceptable for pressure rating up to 150#. They shall be designed and fabricated to a pressure rating of 300#.

Above this pressure rating limit of 150# oblique connections shall be shaped by hot extrusion or forging.

Connections shall be reinforced if service conditions require it (pressure, expansion, vibration). Reinforcements shall be designed in compliance with [ASME B31.3](#).

The types of connections which may be used in each case are shown in [GS EP PVV 112](#).

3.3.1 Small bore connections

Small bore connections should be designed taking into account the following practices:

- The fitting and unsupported length should be as short as possible
- The mass of valves and instrumentation should be minimised
- Any mass at the free end of a cantilever should be supported in both directions perpendicular to the axis of small bore
- Any small bore connection below 3" should be systematically supported in both directions
- Supports should be from the main pipe, to ensure that the small bore connection moves with the main pipe during transients and vibration
- Any fastening shall be designed to be effective under vibration.

3.4 Flanges

3.4.1 Dimensions

Except as otherwise indicated, the dimensions of flanges shall comply with [ASME B16.5](#) for diameters up to 24" inclusive and with standard [ASME B16.47](#) series "A" for diameters over 24".

3.4.2 Ends

For diameters of 2" or more, "welding neck" flanges shall be used exclusively. However, "slip-on" flanges may be used in accordance with the piping material classes for ratings 150 and 300.

3.4.3 Flange facing

Flange facing shall be one of the three main types:

- Flat face (F.F.) for connection to materials made of cast iron (in ratings 125) or to materials made of GRP (glass-fibre reinforced plastic)
- Raised face (R.F.)
- Grooved, for ring joint (R.J.).

The type of flange facing and its finish are specified in the piping materials classes ([GS EP PVV 112](#)).

For piping lines with rating 1500# and higher, the use of Hub connector may be considered as an alternative to ASME flanges.

This shall not apply to equipment connections where ASME flanges shall be used.

The flange facing finishes shall be in conformity with the table below, based on the recommendations of standard [MSS SP 6](#):

Flange facing designation	Flange facing finish (contact face)	Average roughness ("Ra" maximum value)
RF	1/16" raised face Concentric or spiral serrated, or "stock finish"	150 microns 50 microns
RF "smooth finish"	1/4" raised face "smooth finish"	125 AARH (3.2 microns)
RTJ	Groove for ring joint	63 AARH (1.6 microns)

3.4.4 Connection between dissimilar material

Connection between carbon steel piping and corrosion resistant alloy (CRA) piping shall be done by flange or hub connector.

The connection shall be located as far as possible on a vertical pipe.

Connection shall be as follows:

- On carbon steel side, the flange or hub shall be weld overlaid with CRA including seal joint contact surface