



Exploration & Production

GENERAL SPECIFICATION

PIPING VALVES VESSELS

GS PVV 145

Flanges

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1. Scope

This specification completes the description given in the requisitions issued by the Engineering Company and stipulates the particular requirements for the fabrication, inspection and shipment of flanges or hub connectors made of carbon steel, alloy steel, stainless steel and copper alloys.

This specification does not apply to flanges made of glass-reinforced plastic materials (GRP).

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.

Standards

Reference	Title
ASME B 1.20.1	Pipe Threads (Except Dry seal)
ASME B 16.5	Steel Pipe Flanges and Flanged Fittings
ASME B 16.11	Forged Steel Fittings, Socket-Welding and Threaded
ASME B 16.36	Steel Orifice Flanges
ASME B 16.47	Large diameter steel flanges (NPS 26 through NPS 60)
ASME B 36.10M	Welded and seamless Wrought Steel Pipe
ASME B 36.19M	Stainless Steel Pipe
ASME B 46.1	Surface Texture
API 5 L	Line Pipe
API 6A	Specification for Wellhead and Christmas Tree Equipment
MSS SP 6	Standard Finishes for Contact Faces of Pipes Flanges and Connecting-ends Flanges of Valves and Fittings
MSS SP 9	Spot Facing for Bronze, Iron and Steel Flanges
MSS SP 25	Standard Marking System for Valves, Fittings, Flanges and Unions
ASTM A 105	Forgings, Carbon Steel, for Piping Components
ASTM A 182	Forged or Rolled Alloy Steel Pipe Flanges, Forged Fittings, and Valves and Parts for High-Temperature Service
ASTM A 350	Forgings, Carbon and Low-alloy Steel, requiring notch toughness testing for Piping Components
ASTM A 370	Mechanical Testing of Steel Products
ASTM A 530	General Requirements for Specialized Carbon and Alloy Steel Pipe
ASTM B 369	Copper-nickel alloy castings



Reference	Title
ASTM B 402 EN 10204	Copper-nickel alloy Plate and Sheet for pressure vessels Metallic products - Type of inspection documents

Professional Documents

Reference	Title
Not applicable	

Regulations

Reference	Title
Not applicable	

Codes

Reference	Title
ASME B 31.3	Process piping

Other documents

Reference	Title
Not applicable	

Total General Specifications

Reference	Title
Not applicable	

3. Materials

3.1 Carbon steel flanges

The carbon steel used for the fabrication of the flanges shall be produced in an electric furnace, or by the basic oxygen process.

All carbon steels, including normalised steels, used for the fabrication of flanges shall have a maximum carbon content of 0.23%.

The carbon equivalent of these materials, calculated using the formula:

$$C_E = C + \frac{Mn}{6} + \frac{Cr + Mo + V}{5} + \frac{Ni + Cu}{15}$$

shall be less than 0.42 (ladle analysis).

If the content of alloying elements other than C or Mn is unknown, the formula to be used shall be:

$$C_E = C + \frac{Mn}{6}$$

and, in this case, the carbon equivalent shall be less than 0.40 (ladle analysis).

All carbon steels materials of thicknesses greater than 12.7 mm (½ inch) must be impact tested at minus 29°C (-20°F) in accordance with [ASME B 31.3](#) (paragraph 323.3) unless more stringent requirements (including lower impact test temperatures) are already required in the product specification.

All carbon steels for low temperature service at -30°C and below, shall undergo toughness testing in accordance with the requirements of the reference codes and standards.

All [ASTM A 350](#) LF2 flanges will be of class 1 material as defined in this standard.

All flanges shall be hot forged and shall undergo an appropriate heat treatment after forging with the following order to preference:

- Quenching and tempering
- Normalisation and tempering
- Normalisation

Each purchase order of carbon steel flanges for service at -30°C and below will be subject to impact tests counter-checks and metallurgical examination by the COMPANY under the following rules:

- The selection of flanges to be tested will be made by the COMPANY representative or the Inspection Agency.
- The welding neck of the selected flanges will be at least 10 mm.
- The impact tests specimens will be cut-off from the welding-neck of finished flanges with the notch axis perpendicular to the main flange axis; the values to be obtained are those of [ASTM A 350](#). Impact testing from prolongations as offered by this standard is not permitted.
- Metallurgical examination will be performed on the cross-section of the material for grain size evaluation and also hardness survey when required; grain size evaluations made from replica on the finished surface are not accepted.
- A minimum of one flange shall be tested for every 500 flanges delivered from the same source of supply, i.e. same manufacturing premises pertaining to the forge-master Supplier to the Vendor or to the Vendor itself, or for one every ten heats from the same manufacturing premises. An intermediary, as defined in paragraph 4 of [EN 10204](#), is not considered as a Manufacturer.

In case of failure, the complete supply will be suspended until further investigation is performed. This can lead to the replacement of the supply, complete or partial.



3.2 Galvanised flanges

Where galvanised flanges are specified, electro-deposited coating of zinc is not acceptable.

3.3 Austenitic stainless steel flanges

Type 321 stainless steel shall have a carbon content greater than or equal to 0.02%.

Austenitic stainless steel flanges shall undergo an annealing heat treatment in accordance with the corresponding ASTM standards.

3.4 Copper alloy flanges

Copper alloy flanges shall undergo heat treatment in accordance with the ASTM standards.

4. Substitution of equivalent materials

Any substitution of materials shall require the prior approval of the COMPANY.

The replacement of flanges of a specified schedule by a higher schedule must be submitted to the Engineering Company for approval. In this case, internal tapering will be necessary to match the specified schedule. The slope of this tapering shall comply with the reference standards.

5. Dimensions

5.1 Thicknesses

The end thicknesses of welding-neck flanges and the bore dimensions of socket-welding flanges for which schedules 10, 40, 80, etc., are specified in the requisitions must be in accordance with [API 5 L](#) or [ASME B 36.10M](#).

The end thicknesses of welding-neck flanges for which schedules 10S, 40S or 80S are specified must be in accordance with [ASME B 36.19M](#).

5.2 Other dimensions

The other dimensions of slip-on flanges, lap-joint flanges, socket-welding flanges, threaded flanges and welding-neck flanges shall comply with [ASME B 16.5](#) for diameters up to 24 inches.

The dimensions of welding-neck flanges and blind flanges 26 inches or more in diameter shall be in accordance with [ASME B 16.47 Serie A](#).

For flanges in diameters and series greater than the limits set by [ASME B 16.5](#) and [ASME B 16.47 Serie A](#), the Manufacturer shall submit a dimensioned document and calculation notes to the Engineering Company for approval.

5.3 5000 and 10 000 psi flanges

The dimensions of 5000 and 10000 psi flanges shall be in accordance with [API 6A](#).

5.4 Hub connectors

Hub connector dimension shall be as per Manufacturer standard. The design shall be supported by design calculations using Finite Element Analysis (FEA). The design shall be in compliance with ASME B16.5 or API 6A whichever is applicable.

6. Ends

6.1 Welding-neck flanges

Welding-neck flanges up to 24" in diameter shall have ends bevelled as per [ASME B 16.5](#).

The ends of flanges 26" or more in diameter shall comply with [ASME B 16.47 Serie A](#).

6.2 Socket-welding flanges

The ends of socket-welding flanges shall comply with [ASME B 16.5](#).

6.3 Threaded, galvanised flanges

Threads of galvanised flanges shall be free of galvanising.

7. Manufacture

After forging, by stamping or circular rolling, all flanges shall undergo the following main machining operations:

7.1 Finishing of gasket contact faces

The gasket contact faces of the flanges may be of three main types:

- Flat face
- Raised face
- Grooved for ring joint.

These contact faces shall undergo finishing machining in accordance with [MSS SP 6](#), as indicated by the table hereafter:

Flange facing	Finish	Average roughness (maximum value)
Flat Face	Concentric serrated or spiral serrated or	150 microns
Raised Face 1/16" (with flat gasket)	"Stock Finish"	(50 microns for the "Stock Finish" type) (1)
Raised Face 1/16" (with spiral wound gasket) or Raised Face 1/4"	Smooth Finish	250 AARH (6.3 microns)
RTJ (2)	Groove: very smooth	63 AARH (1.6 microns)

Note 1: The "stock finish" facing is not defined in [MSS SP 6](#). For Flat Face or Raised Face (stock finish) facing, the roughness average range is 6.3 to 12.5 microns (AARH = 250 to 500 micro inches). Pitch and depth of machining groove shall be per [MSS SP 6](#), Table 1. However, roughness in excess of 12.5 microns (AARH greater than 500 micro inches) is acceptable to a maximum of 50 microns, provided groove parameters per [MSS SP 6](#) table 1 are maintained.

Note 2: The minimum BRINELL hardness of grooves of RTJ flanges shall be:

- 110 for carbon steel flanges
- 160 for alloy steel flanges
- 150 for stainless steel flanges.

7.2 Bore

The bores of flanges, as a function of their diameters, shall comply with [ASME B 16.5](#) or [ASME B 16.47 Serie A](#).

7.3 Internal threading

The internal threading of threaded flanges shall comply with [ASME B 1.20.1](#) (NPT).

7.4 Drilling

Bolt holes shall be made by multi-spindle drills. This drilling shall comply with [ASME B 16.5](#) or [ASME B 16.47 Serie A](#), depending on the flange diameter (24" and less or 26" and above).

The spot facing of the flanges at the bolt holes shall be in accordance with [MSS SP 9](#).

7.5 Repairs of defects

Repairs of defects shall only be permitted if performed fully in accordance with the reference codes and standards.

8. Inspection

8.1 Quality control

The inspection and tests necessary to confirm that the products meet the requirements of the standards, specifications and requisitions shall be carried out in the Manufacturer's plant by personnel of the plant. This personnel, specially-qualified, shall be independent of the production department of the plant.

Products shall be guaranteed by an inspection certificate (conformity, material, etc.).

If the Manufacturer does not have the necessary means of examination, these tests may be carried out by an Inspection Agency and in a place approved by the Engineering Company.

The Inspection Agency shall conduct inspections in the Manufacturer's plant in order to make sure of the proper execution of the order and of the quality controls. It shall also witness final shop acceptance.

8.2 Acceptance

The Inspection Agency shall not grant any acceptance unless the certificates concerning the products submitted have been made available to it in advance.

In addition to reviewing the certificates, the Inspection Agency shall check the quantities presented and shall have checked, by sampling, the following characteristics:

- Shapes and nominal dimensions
- Dimensional tolerances



- Surface treatment and finish conditions
- Marking and finishing conditions.

This sampling shall cover at least 5% of each of the items submitted for acceptance.

The non-conformity of any or all of the products submitted for acceptance may give rise:

- Either to a second submission after the products have been brought up to specifications, if this is possible
- Or to final rejection.

9. Documentation

9.1 Certificates of conformity

The Manufacturer shall submit certificates of conformity with the standards specified in the requisitions for flanges.

9.2 Material certificates

The Manufacturer shall submit [EN 10204](#) 3.1.B material certificates giving the results of the chemical analysis and of the mechanical tests carried out in accordance with the requirements of the reference codes and standards. This documentation shall also include the test report relating to the random check required for carbon steel flanges for service at -30°C and below.

10. Preparation for shipment

10.1 Marking

10.1.1 Identification of material and main characteristics

In addition to the markings required by [MSS SP 25](#), the following information shall be marked by cold stamping on each flange:

- The specification and grade of material
- The heat number
- The batch number
- The rating
- The diameter
- The ring joint number, in the case of RTJ flanges.

10.1.2 Markings specific to the order

All flanges shall be identified by marking with colour marks and code numbers as and if specified in the purchase order.



10.2 Protection

10.2.1 Carbon steel flanges

The threading of threaded flanges shall be oiled or protected by a non-peel varnish.

The bevelled ends and contact faces of the flanges shall be protected by a peel-off varnish.

10.2.2 Austenitic stainless steel flanges

All stainless steel flanges shall be protected against the risk of saline corrosion during cleaning, transport, fabrication and storage.

10.3 Packing

The flanges must be packed in sea packing, which must, in addition, be water-proof in the case of austenitic stainless steels. Packing must be suitable for all stages of transport (rail, road, air, etc.).