



TECHNICAL SPECIFICATIONS FOR FLANGES

DOCUMENT NO.: GGL/TS/STEEL/SUPPLY/FLANGES/TECH. SPEC.

Approved

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1 SCOPE

This specification covers the minimum requirement for the design, manufacture, inspection, testing and supply of Carbon Steel Flanges of size NPS 24" and smaller for ASME pressure class 150 and higher for use in natural gas pipeline and City Gas Transmission and Distribution Piping System including terminal piping, compressor stations, metering and pressure regulating stations.

This specification is applicable for below mentioned flange types:

- Weld neck flanges
- Blind flanges
- Spectacle blinds
- Spacers and blinds
- Slip on flanges

This specification covers the minimum requirements for materials, chemical & mechanical properties, heat treatment, notch toughness properties, design & manufacturing, inspection, testing, marking and supply of high strength carbon steel flanges. This specification is limited to flanges with NPS 24 inches and below in compliance with latest editions of ASME B16.5, ASME B16.9, ASME B16.11, MSS SP 75 and MSS SP 97.

All requirements contained in the above standards shall be fully valid unless cancelled, replaced or amended by more requirements as stated in this specification.

2 DEFINITIONS:

Purchaser/Owner: The Company which makes purchase order.

Manufacturer: Manufacturer who receives the purchase order.

TPI: "Third Party Inspection Agency" appointed by Manufacturer and approved by Purchaser/Owner

Shall: This verbal form indicates requirements strictly to be followed in order to confirm to the standards and form in which no deviation is permitted.

Should: This verbal form indicates that among several possibilities one is particularly suitable without mentioning or excluding others or that a certain course of action is preferred but not necessarily required.

May: This verbal form indicates a course of action permissible within the limits of this standard.

Can: This verbal form used for statements of possibility & capability, whether material, physical or casual.

3 REFERENCE STANDARDS AND DOCUMENTS

The following Codes and Standard includes provision which, through reference in this text constitute provision of this Standard. Latest revision of this standard shall be used unless otherwise specified.

ASME B 31.3	-	Process Piping
ASME B 31.8	-	Gas Transmission and Distribution Piping Systems
ASME B 16.5	-	Pipe Flanges and Flanged Fittings NPS ½" through NPS 24"
ASME B 16.48	-	Steel Line Blanks
ASME B 16.20	-	Metallic Gaskets for Pipe Flanges
ASME Sec VIII/IX	-	Boiler and Pressure Vessel Code
ASTM A 370	-	Standard Test Methods and Definitions for Mechanical Testing of Steel Products
MSS SP 6	-	Standard Finishes for Contact Faces of Pipe Flanges and Connecting-End Flanges of Valves and Fittings
MSS SP 25	-	Standard Marking System for Valves, Fittings, Flanges and Unions
MSS SP 44	-	Steel Pipeline Flanges
ASTM A 105	-	Carbon Steel Forgings for Piping Applications
ASTM A 350	-	Standard Specification for Carbon and Low-Alloy Steel Forgings, Requiring Notch Toughness Testing for Piping Components
ASTM A 694	-	Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service
PNGRB T4S	-	T4S for City or Local Natural Gas Distribution Networks
ASTM A 153	-	Standard Specification for Zinc Coating (Hot Dip) on Iron and Steel Hardware

In case of codes indicated without the year of publication, the latest edition of the code shall be taken into consideration. In case of conflict between the requirements of this specification and reference standard mentioned above, the more stringent requirement shall apply.

4 SUBMITTALS BY MANUFACTURER

Prior to start of fabrication, the Manufacturer shall submit the following document for approval to OWNER / TPI s within 15 days after receipt of PO:

- Detailed fabrication drawing and calculations
- Fabrication and control procedures
- Material list
- Heat treatment procedures
- Non-Destructive testing procedures
- Any other relevant drawing/ Document required by OWNER.
- Once the approval has been given by Purchaser, no change in material, method of manufacture and quality control procedure shall be allowed.

Prior to shipment, the Manufacturer shall submit for approval to OWNER / TPI the following documents:

- Test Certificates relevant to the Chemical composition and mechanical properties including hardness test of the materials used for manufacturing of flanges as per relevant standards and this specification.
- Test reports on Non-Destructive Examination.
- Test Reports of heat treatment carried out as per the specification.
- Test certificates for each flange stating that it is capable of withstanding, without leakage, a test pressure which results in a hoop stress equivalent to at least 100 % of the specified minimum yield strength (SMYS) for the pipe with which the flanges are to be attached without impairment of serviceability.
- Test Report on Proof Test of each size & type of item.

Note: The certificates shall be valid only when approved / certified by **OWNER / TPI**. Only those flanges which have been certified by **OWNER / TPI**, shall be dispatched from **Manufacturer's** works. All documents shall be in English language only.

- Test certificates relevant to the chemical analysis and mechanical properties including notch toughness of the materials used for construction as per this specification and relevant standards
- Test Reports on radiography, ultrasonic inspection and magnetic particle examination.
- Test reports of heat treatment carried out as per the specification.
- Welding procedures and welder's qualification reports if applicable.
- EN 10204 3.2 Certificate stating the quality of relevant Flanges.

5 MATERIALS

- 5.1 Steel used shall be fully killed and fine grain structure.
- 5.2 Flange materials used shall comply with requirement defined in ASME B 16.5 & MSS SP 44 (Latest Edition).
- 5.3 The chemical composition of each heat of steel on product analysis shall be in accordance with the standard to which MOC is complying.
- 5.4 If the Carbon Content is greater than 0.12 %, then Carbon Equivalent (IIW) shall not exceed 0.43 for each heat of steel used, as calculated the following formula:

$$CE (IIW) = C + \frac{Mn}{6} + \frac{(Cr + Mo + V)}{5} + \frac{(Ni + Cu)}{15}$$

If carbon content is less than or equal to 0.12% in product analysis; the CE (Pcm) shall not exceed 0.25%.

$$CE (Pcm) = C + \frac{Ni}{60} + \frac{Si}{30} + \frac{(Mn + Cu + Cr)}{20} + \frac{Mo}{15} + \frac{V}{10} + 5B$$

CE (Pcm) value shall be $\leq 0.25\%$

Unless specified otherwise, Charpy V-notch test shall be conducted for each heat of steel, in accordance with the impact test provisions of ASTM A 370 at temperatures specified in standards relevant to which MOC is complying. If not mentioned in MOC standard, impact test shall be carried out at 0° C and absorbed energy value shall be 35 J (avg.). The minimum impact energy value of any one specimen of the three specimens analyzed as above shall not be less than 80% of the above-mentioned average value.

- 5.5 Hardness testing shall be carried out by Manufacturer in accordance with applicable material standard. A full thickness cross section shall be taken for this purpose and if hardness is not mentioned then maximum hardness shall not exceed 248 HV10. For welded portion maximum difference in hardness of base material, weld material and heat affected zone shall be less than 80 points in Vickers HV10.

6 DESIGN AND MANUFACTURE

- 6.1 Flanges such as weld neck flanges and blind flanges shall conform to the requirements of ASME B16.5 up to sizes NPS 24" excluding NPS 22".
- 6.2 Flanges manufactured from bar stock are not acceptable. Flanges shall be manufactured as one piece in accordance with the applicable material specification. Assembly of multiple pieces into the finished product by welding or other means is not permitted as per ASME B16.5.
- 6.3 The temperature and pressure range shall be as per the applicable Piping Material Specification and material data sheet.
- 6.4 All welds shall be made by welders and welding procedures qualified in accordance with provisions of ASME Sec. IX. The procedure qualification shall include Charpy V-notch test for weld/heat affected zone and hardness test.
- 6.5 Repair by welding on flanges and parent metal of Flanges is not permitted. Repair of weld seam by welding shall be carried out by welders and welding procedures duly qualified as per ASME

Section IX and records for each repair shall be maintained. Repair welding procedure qualification shall include all tests, which are applicable for regular production welding procedure qualification.

- 6.6 Type, face and finish of flange Type, face and face finish of flanges shall be as specified in Data sheet and PO.
- 6.7 All flanges shall be furnished in the heat-treated condition. Hot formed flanges shall be cooled below the lower critical temperature prior to heat treatment.
- 6.8 Minimum Wall Thickness of all flanges shall be as per PNGRB T4S (Technical Standards and Specifications including Safety Standards for City or Local Natural Gas Distribution Networks) requirements-latest version.
- 6.9 Type and end of flange shall be as specified in data sheet and purchase order.

7 Dimensions, Workmanship and Defects

7.1 Dimensions

Dimensional check shall be carried out on finished products as per ASME B16.5 and B16.48 as applicable and as per this specification. Flanges not covered in the specifications stated above shall be checked as per Manufacturer's standard which shall be approved by TPI before starting of production.

Dimensional tolerance on flanges shall be as per the applicable standard.

7.2 Workmanship and Defects

All flanges shall be free of injurious defects and shall have workmanlike finish. Injurious defects are defined as those having a depth in excess of 5 % of specified wall thickness. Each flange in which injurious defects are found during plant or field fabrication shall be rejected and Manufacturer shall be notified. Manufacturer shall replace the flanges at no extra cost to Owner.

The unfinished product arriving at Manufacturer's shop shall be verified & tested for full compliance with the required specification.

8 INSPECTION AND TESTS

The Manufacturer shall perform all inspection and tests as per the requirement of this specification and the relevant codes, prior to shipment at his works. Such inspection and tests shall be, but not limited to, the following:

- 8.1 All flanges shall be visually inspected. The internal and external surfaces of the flanges shall be free from any earth strikes, gauges and other detrimental defects.
- 8.2 Dimensional checks shall be carried out on finished products as per ASME B 16.5/MSS-SP-44 as applicable for flanges, ASME B 16.48 for spacers and blinds. The wall thickness shall be as per applicable design codes and standards.
- 8.3 All flanges shall be furnished in the heat-treated condition. Hot formed flanges shall be cooled below the lower critical temperature prior to heat treatment.
- 8.4 Chemical composition and mechanical properties, notch toughness and hardness shall be checked as per relevant material standards and this specification, for each heat of steel used.

The entire surface of the flanges shall be checked by ultrasonic method for cracks and any material defects, which shall be witnessed by the TPI.

- 8.5 Hot Dip Galvanized Flanges shall comply to the testing requirements defined as per the ASTM A 153.
- 8.6 All other tests not specifically listed but are required as per applicable standard/ specification.
- 8.7 Purchaser's Inspector reserves the right to perform stage wise inspection and witness tests, as indicated in clause 6.1 of this specification at Manufacturer's Workshop prior to shipment.
- 8.8 Manufacturer shall give reasonable notice of time and shall provide, without charge, reasonable access and facilities required for inspection, to the Purchaser's Inspector. Inspection and tests performed/witnessed by Purchaser's Inspector shall in no way relieve the Manufacturer's obligation to perform the required inspection and tests.

Note: NDE inspector & procedures shall be qualified in accordance with ASME Sec. V, Article 5. The evidence of such records shall be furnished by **Manufacturer** to **OWNER / TPI** on request. Minimum qualification of NDE Inspector shall be ASNT Level-II certification.

9 PAINTING, MARKING & SHIPMENT

- 9.1 All Flanges shall be marked as per MSS SP 25
- 9.2 Flanges shall be Hot Dip Galvanized as and when specified in the purchase order.
- 9.3 All loose material and foreign material i.e. rust, grease etc shall be removed from inside and outside of the flanges
- 9.4 Ends of all flanges shall be suitably protected to avoid any damage during transit. Metallic or high impact plastic bevel protectors shall be used for flanges and each item shall be marked with indelible paint with the following data
- Manufacturer's name and trade mark
 - Type of flange
 - Nominal dia. & wall thickness/ schedule
 - Material specification
 - Heat Number
- 9.5 Package shall be marked legibly with suitable marking ink to indicate the following:
- Order Number
 - Package number
 - Manufacturer's Name/trademark
 - Type of flange
 - Size and Class

10 WARRANTY**Warranty Type**

Manufacturer shall give warranty stating that the flanges comply with the requirements stated in this specification and the other relevant standard & codes. **Manufacturer** is bound to replace or repair all flanges, which are found defective due to inadequate engineering or to the quality of materials and machining or any other reasons at no extra cost to GGL.

If flanges defects cannot be eliminated, **Manufacturer** shall replace the same without any delay.

Manufacturer will reimburse GGL for any flange furnished on the order that fails under field hydrostatic test if such failure is caused by a defect in the flange, which is outside the acceptance limits of this specification. The reimbursement cost shall include flange, labor and equipment rental for finding, excavation, cutting out, and installation of replaced flange in position. The field hydrostatic pressure will not exceed that value which will cause a calculated hoop stress equivalent to 100% of SMYS for the pipe with which the flange is to be attached without impairing its serviceability.

Warranty validity

The above warranty shall be valid for any defect occurring during the first year of operation, but not later than 24 months from the date of shipment from Manufacturer's works. All expenses shall be to Manufacturer's account

11 Enclosure:

- Annexure -1: Data Sheet
- Annexure -2: Quality Assurance Plan

Annexure-1:**DATA SHEET FLANGE**

Sr. No.	Description	Specification
GENERAL		
1	Size	0.5" to 24" NPS
2	Class Rating	150# 300# 600#
SERVICE CONDITIONS		
3	Service Fluid	Natural Gas
4	Temperature	-10 °C to 65 °C
5	Design Pressure	19 Bar-g/ 49 Bar-g/ 98 Bar-g
6	Operating Pressure Maximum	19 Bar-g/49 Bar-g/ 98 Bar-g
CONSTRUCTION DESIGN		
7	Design Standard	ASME B 16.5/ASME B 16.47/ASME B 16.48 (Latest Edition)
8	Allowable Stress	ASME B 31.3 (Latest Edition)
9	Flange Type	Weld Neck Raised Face (WNRF) Blind Flange Raised Face (BLRF) Slip On Raised Face (SORF) Spacer & Blind/Spectacle Blind
10	Flange Facing	Raised face (Serration 125-250 AARH) / Ring Type
11	Bevel End & Bevel Angle for WNRF	32.5° ± 2.5°
MATERIAL SPECIFICATION		
	Part	Specified Material
12	Material of Construction Refer material details specified in Purchase Order	<ul style="list-style-type: none"> ASTM A 105, ASTM A 350 Gr. LF2 MSS SP 44 Gr. F52
TESTING & INSPECTION		
13	Charpy Impact Test	ASTM A 370 Shall be as per the requirements defined in applicable material standard In case Charpy test not specified in relevant material standard than Charpy test shall be carried out at 0° C and absorbed energy value shall be average 35 J and minimum 28 J respectively.
14	Hardness test	<ul style="list-style-type: none"> ASTM A 105 - 187 HBW maximum ASTM A 350 Gr. LF2 – 197 HBW maximum MSS SP 44 Gr. F52 – 187 HBW minimum
15	Tensile test	<ul style="list-style-type: none"> ASTM A 105 - 485 MPa minimum ASTM A 350 Gr. LF2 – 485 to 655 MPa MSS SP 44 Gr. F52 -455 MPa minimum
16	Yield Strength (minimum)	<ul style="list-style-type: none"> ASTM A 105 - 250 MPa Minimum ASTM A 350 Gr. LF2 – 250 MPa Minimum

		<ul style="list-style-type: none"> MSS SP 44 Gr. F52 – 359 MPa minimum
17	Elongation	As per the applicable material standard
18	Reduction Ratio	As per the applicable material standard
19	UT	100% Surface
20	MPT	100% at Bevel Ends
21	DPT (if thickness less than 6MM)	100%
22	Hot Dip Galvanization (*) Thickness and Adherence of the coating <i>*Applicable only for flanges to be used in PE-PNG works and will be specified in Purchase Order</i>	ASTM A 153
22	Marking	MSS SP 25

NOTES: -

1. Inspection and testing shall be carried out as per the data sheet, Technical specifications and applicable standards and codes. Requirement of material supply shall be read in conjunction with approved Piping Material Specification and material description specified in Purchase Order.
2. Manufacturer to prepare Quality Assurance Plan (QAP) in line with Technical Specifications, Data sheet and sample QAP and submit for approval. Material testing shall be carried out at Manufacturer premises according to requirement defined in approved QAP and inspection to be carried out by Third Party Inspection Agency. Scope for appointment of TPIA shall be as per the Purchase Order / Contract.
3. All the Test to be witnessed / reviewed by TPIA as per the requirement defined in approved QAP.
4. Bidder shall clearly mention deviation, if any prior to start the work for GGL approval.
5. Manufacturer to provide valid calibration report of all the measuring instruments and same shall be reviewed by TPIA.

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