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شرکت ملی گاز ایران
مدیریت پژوهش و فناوری
امور تدوین استانداردها

IGS

مشخصات فنی خرید

فلنج های فولادی ، کلاس ۱۵۰ تا ۹۰۰

Carbon Steel Flanges , Class 150 up to 900



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شرکت ملی گاز ایران



دفتر مدیر عامل

ابلاغ مصوبه هیأت مدیره

مدیر محترم پژوهش و فناوری

باسلام،

به استحضار می‌رساند در جلسه ۱۸۰۲ مورخ ۱۳۹۷/۸/۲۰ هیأت مدیره، نامه شماره گ/۰۰۰/۱۰۳۳۵ مورخ ۱۳۹۷/۸/۱۴ آن مدیریت در مورد تصویب نهایی استاندارد به شرح زیر:

۱- مشخصات فنی خرید فلنج های فولادی کلاس ۱۵۰ تا ۹۰۰

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۲- مشخصات فنی خرید ترانس های اندازه گیری جریان

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۳- مشخصات فنی خرید ترانس های اندازه گیری ولتاژ

IGS-M-EL-032(0)

مطرح و مورد تصویب قرار گرفت .

این مصوبه در حکم مصوبه مجمع عمومی شرکت‌های تابعه محسوب و برای کلیه شرکت‌های تابعه لازم الاجرا می‌باشد .

الهام ملکی

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FOREWORD

This standard is intended to be mainly used by NIGC and contractors, and has been prepared based on interpretation of recognized standards, technical documents, knowledge, backgrounds and experiences in natural gas industry at national and international levels. Iranian Gas Standards (IGS) are prepared, reviewed and amended by technical standard committees within NIGC Standardization division and submitted to the NIGC's "STANDARDS COUNCIL" for approval. IGS Standards are subject to revision, amendment or withdrawal, if required. Thus the latest edition of IGS shall be checked/inquired by NIGC employees and contractors. This standard must not be modified or altered by NIGC employees or its contractors. Any deviation from normative references and / or well-known manufacturer's specifications must be reported to Standardization division. The technical standard committee welcomes comments and feedbacks about this standard, and may revise this document accordingly based on the received feedbacks.

GENERAL DEFINITIONS:

Throughout this standard the following definitions, where applicable, should be followed:

- 1- "STANDARDIZATION DIV." is organized to deal with all aspects of industry standards in NIGC. Therefore, all enquiries for clarification or amendments are requested to be directed to mentioned division.
- 2- "COMPANY": refers to National Iranian Gas Company (NIGC).
- 3- "SUPPLIER": refers to a firm who will supply the service, equipment or material to NIGC whether as the prime producer or manufacturer or a trading firm.
- 4- "SHALL ": is used where a provision is mandatory.
- 5- "SHOULD": is used where a provision is advised only.
- 6- "MAY": is used where a provision is completely discretionary.

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1. Scope

This specification covers minimum requirements for the manufacturing, inspection, testing, marking and shipping of the forged carbon steel flanges with rating class 150, 300, 600 and 900 in sizes NPS 1/2 through NPS 56 which used in non – sour service gas transmission pipeline and distributing piping system which generally conform to ASME B 31.8.

This specification is including of:

- Welding neck forged carbon flanges and blind carbon steel flanges in sizes NPS 1/2 through NPS 56
- Slip on forged carbon steel flanges in sizes NPS 1 1/2 through NPS 24.
- Threaded/Screw on forged carbon steel flanges in sizes 1/2 through 4.
- Socket weld forged carbon steel flanges in sizes NPS 1/2 through NPS 4

2. References

Throughout this standard specification the following standards and codes are referred to. The edition of these standards and codes those are in effect at the time of issuing of this standard specification.

The applicability of changes in standards and codes that occur after the date of standards that referred shall be mutually agreed upon by purchaser and supplier and /or manufacturer

2.1. API 5L: 2012, " Specification for Line Pipe"

2.2. ASME B.1.20.1: 2013, "Pipe Threads, General Purpose"

2.3. ASME B 16.5: 2013, "Pipe Flanges and Flanged Fittings"

2.4. ASME B 16.47: 2017, "Large Diameter steel flanges"

2.5. ASME B 16.25: 2012 , "Butt welding Ends"

2.6. ASTM B16.34:2013, "Valves- Flanged, Threaded, and Welding End"

2.7. ASME: B 31.8: 2012, "Gas transmission and distributing piping system"

2.8. ASTM: A 105: 2014, "Specification for forgings, carbon steel for piping components"

2.9. ASTM A275:2003, " Standard Test Method for Magnetic Particle Examination of Steel Forgings"

2.10. ASTM A350:2012, " Standard Specification for Carbon and Low-Alloy Steel Forgings, Requiring Notch Toughness Testing for Piping Components"

2.11. ASTM A 370 (2012), "Standard Test Method and Definitions for Mechanical Testing of Steel Products"

2.12. ASTM A388:2011," Standard Practice for Ultrasonic Examination of Steel Forgings" Vacuum-Treated Carbon and Alloy Steel Forgings for Pressure Vessels"

2.13. ASTM A 694: 2003, "Specification for forgings , carbon and alloy steel for pipe flanges, fitting ,valves and parts for high pressure transmission service "

2.14. ASTM A788:2006,"Standard Specification for Steel Forgings, General Requirements"

2.15. ASTM A961:2002,"Standard Specification for Common Requirements for Steel Flanges, Forged Fittings, Valves, and Parts for Piping Applications"

2.16. ASTM E23:2012,"Standard Test Methods for Notched Bar Impact Testing of Metallic Materials"

2.17. ASTM E110:2002," Standard test method for indentation hardness of metallic materials by portable hardness tester"

2.18. ASTM E112:2012," Standard test method for Determining Average Grain Size"

2.19. ASTM E165:2002,"Standard test method for Liquid Penetrant Examination"

2.20. ISO 10474: 2013, "Steel and steel product inspection documents"

2.21. MSS-SP-25 :1996, "Standard Marking System for Valves, Fittings, Flanges and Unions"

2.22. MSS-SP-44 :1996, "Steel pipeline flanges"

3 Definitions

3.1. Killed steel

Thoroughly deoxidized steel. For example by addition of aluminum or silicon in which the reaction between carbon and oxygen during solidification is suppressed

3.2. Type Test

Testing performed on typical sample to prove that material, design, manufacturing and etc is capable of conforming to the requirements given in the relevant standard. Type test certificate is valid until the material, designation or production methods remain unchanged.

4. Symbols & Abbreviated Terms

Carbon Equivalent, base upon the international institute of welding calculated by the following equation:

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

4.1. NPS

Nominal pipe size, a dimensionless number for the purpose of flange end connection size identification.

5. Design

Except as supplemented or amended by this specification flanges shall be designed, manufactured and supplied in accordance with:

1. ASME B 16.5 for carbon steel flanges with NPS ½ to NPS 24
2. ASME B 16.47 (series A) for carbon steel flanges with NPS 26 to NPS 60

6. Material

-All flanges shall be made of hot worked forging carbon materials. Forging process shall be specified by manufacturer and approved by end user.

- Blind flanges may be made of either forged carbon steel or from carbon steel plate.

- Flanges shall be manufactured as one piece. Assembly of multiple pieces in to the finished product by welding or other mean is not permitted.

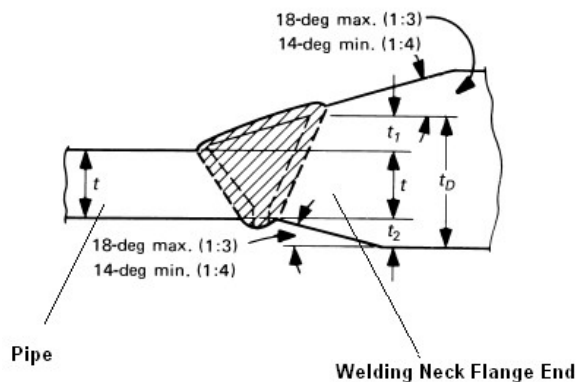
- All flanges shall be furnished in a heat – treated condition. Heat treatment shall be consisting of normalizing, normalizing and tempering or quenching and tempering.

- Flange material shall be killed steel.

- Flanges with NPS 36 and larger sizes of the 300 and higher classes of welding flanges shall have 42 ksi minimum yield strength in the ring section.
- The carbon steel used for welding flanges shall have:
 - a) The maximum carbon content shall not exceed 0.23%.
 - b) Carbon equivalent shall not exceed 0.42%.
- The carbon steel used shall have tensile properties conforming to the requirements prescribed in Table 1 and capable of meeting the properties of the fitting, pipe or flange which to be connected and the flange manufacturer's design conditions.

TABLE 1. TENSILE REQUIREMENTS				
Standard	Grade	Yield point Min	Tensile strength Min	Elongation Min,%
		ksi	ksi	
ASTM A105		36	70	20
ASTM A350- LF2 (Class 1)		36	70	30
ASTM A694	F42	42	60	20
	F52	52	66	20
	F60	60	75	20
	F65	65	77	20
	F70	70	82	18
Note: Forging to other standard may be used if subjected to the purchaser approval.				

- When a welding neck flange is jointed to a higher strength pipe, the material of the flange shall be substituted by a forged carbon steel material with higher yield strength if t_1 , t_2 or (t_1+t_2) exceed $0.5 t$



7. Dimensions

Flanges dimensions and tolerances shall be in accordance with relevant standard (ASME B 16.5 or B 16.47). The flange inside diameter (B) shall be uniformly bored to suit mating pipe as specified in purchase order.

8. Threads

The thread of screw-on flanges shall be NPT type in accordance with ASME B.1.20.1

9. Contact Face

9.1. Raised face

Flanges with classes 150,300 shall be furnished with 2 mm raised face and flanges with class 600 with 7mm raised face with concentric serrated finish as per ASME B 16.5.

9.2. Ring Joint

Flanges with classes 900 shall be furnished with Ring Joint Type facing. The sidewall surface of gasket groove shall not exceed 1.6 μm roughnesses.

9.3. Facing Imperfections

Permissible imperfections in flange facing up to NPS12 shall be in accordance with ANSI B16.5, Table3. For larger sizes it shall not exceed the dimensions shown in Table 2

Table 2-Permissible Imperfections in Flange Facing				
NPS	Maximum Radial Projection of Imperfections That Are No Deeper Than The Bottom of The Serration		Maximum Depth and Radial Projection of Imperfections That Are Deeper Than Bottom of The Serration	
	mm	inch	mm	inch
12-14	8.0	0.31	4.5	0.18
16	10.0	0.38	4.5	0.18
18-24	12.0	0.50	6.0	0.25
26-36	12.5	0.50	6.0	0.25
38-48	14.0	0.56	7.0	0.28
50-60	16.0	0.62	8.0	0.31
NOTES: a) Imperfections less than half the depth of the serrations shall not be cause for rejection b) A radial projection shall be measured by the deference between an inner radius and an outer radius encompassing the imperfection where the radius is struck from the center line of bore				

10. Repair of Injurious Defects

Repair to defective parts shall be made strictly according to a repair procedure submitted by manufacturer and approved by the purchaser before starting work.

Notes:

- Repair by welding of defects is not permitted for any flange covered by this specification.
- No repair shall be carried out after heat treatment

11. Ordering Data

The purchaser shall specify flange requirement with the purchaser order including:

- Quantity
- Nominal size (NPS)
- Pressure rating / class
- Material designation
- Manufacturing standard
- Flange facing and end finish
- Flange bore diameter
- Matching pipe wall thickness & grade (for welding neck flanges)
- Weld end preparation bevel

- Heat treatment type (for flanges above class 300)
- Temperature Service

12. Testing and Inspection

All testing shall be carried out at final stage after heat treatment and rough machining process. Test specimens shall be identified and traceable to test reports.

If specified in purchase order, testing shall be done in the presence of NIGC Inspector or authorized third party inspector. The purchaser representative shall have full access to the manufacturer's facilities and property to assure that these specifications are being followed.

12.1. Visual and Dimensional Inspection

All forging surfaces shall be visually inspected, Examination and acceptance shall be in accordance with ASTM A961, Para 15.

Dimensions, tolerances and threads shall be checked against the purchase order description, approved manufacturer drawings and relevant standard (ASME B16.5 or B16.47).

12.2. Chemical Composition

Chemical analysis shall be performed upon each heat for all elements specified in the respective standard. Welding flanges shall conform to Clause 6 giving satisfactory weld transition of flange hub to the matching pipe.

12.3. Tensile Test

Material for flanges shall have minimum tensile strength mentioned in this specification. For flanges with NPS 36 and larger sizes of the class 300 and higher of welding neck flanges two tensile specimens shall be taken from the disc of the flange, one specimen having its lengthwise axis directionally normal to flange bore and second specimen taken with its lengthwise axis directionally at right angles to the equivalent axis of the first specimen.

12.4. Fracture Toughness Test

Notch toughness properties shall be determined with full size charpy type A V-notch specimens in accordance with ASTM A370. Sub size specimens shall be used only when material to be tested is of insufficient thickness. All specimens shall be taken from the hub and as near the weld end with their lengthwise axis tangential to the flange bore and equi-space around the hub. If it is not practicable, test specimens shall be taken from a suitable extension of the parent material.

The average impact energy of one set (three specimens) at -29 °C shall not be less than 27 J and show at least 50% shear on fractured surface.

For A350- LF2 (Class 1), the values shall meet the relevant standard.

12.5. Hardness Testing

Hardness testing and acceptance criteria shall conform to the requirements prescribe in the product specification but the base material and beveled end hardness shall not be more than 280 HV10.

12.6. Hydrostatic Test

The manufacturer/supplier shall be responsible for all injuries and defects in the flanges after being installed in the pipeline that may be detected during the strength and leak test.

The pipeline strength and leak test will be performed at 110% and 90% of specified minimum yield strength respectively. Strength and leak tests will be held for 8 and 6 hours respectively.

12.7. Metallographic Examination

Grain-size shall be determined in accordance with ASTM E 112. The photomicrographs shall demonstrate that the manufacturing process and any subsequent heat treatment have produced a consistent microstructure without separations in base metal. Forged flanges shall have an average grain-size number of 7 or finer.

12.8. Non Destructive Tests

12.8.1 Magnetic particle testing (MT) shall be performed on all accessible surfaces by a wet fluorescent method in accordance with ASTM A275. Flange bores and other surfaces shall be inspected in two directions, axial and circumferential. Acceptance criteria shall be in accordance with ASTM A788, S18.

12.8.2. Dye Penetrant Testing (PT) may be substituted for flanges with NPS ≤ 8 by agreement. Testing shall be carried out in accordance with ASTM E165. Acceptance criteria shall be in accordance with ASTM A788, S19.

12.8.3. Each weld neck flange with NPS ≥ 20 in diameter shall be ultrasonically examined over 100% of the area within 2 in (50mm) of the welding end using angle beam method in accordance with ASTM A788, S20.

12.8.3.1 For flanges with classes ≥ 300, after rough machining The whole body shall be ultrasonically examined over 100% of the surface area in accordance with ASTM A388. The discontinuities acceptance criteria shall be in accordance with ASME B16.34, Appendix IV.

13. Coating

Flange exposed machined facing surface shall be protected by suitable method (rust temporary coating, painting, plating or etc) by agreement between purchaser and supplier.

14. Documentation

The manufacturer/supplier shall furnish the purchaser with the followings and as specified in the purchase order:

- Certificate of manufacturer.
- Certificate reports giving chemical analysis and mechanical properties of material.
- Stress relieves and heat treatment certificate and chart
- Non destructive test certificates
- Catalogs. –
- Data sheet (Appendix A) & QCP
- Client inspector or authorized third party inspection agency released notes for each consignment

15. Marking

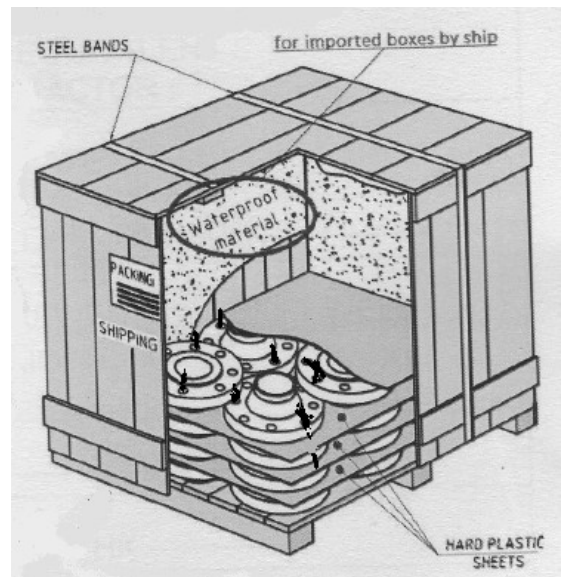
Marking shall be applied to the flange edge as per MSS-SP-25 by dot peen or die stamp methods with the following minimum information:

- Manufacturer name or trademark
- Designation (ASTM B 16.5 or B16.47)
- Rating pressure or class
- Heat number
- Size
- Wall thickness of weld end or Schedule No
- ASTM materiel identification (steel grade)

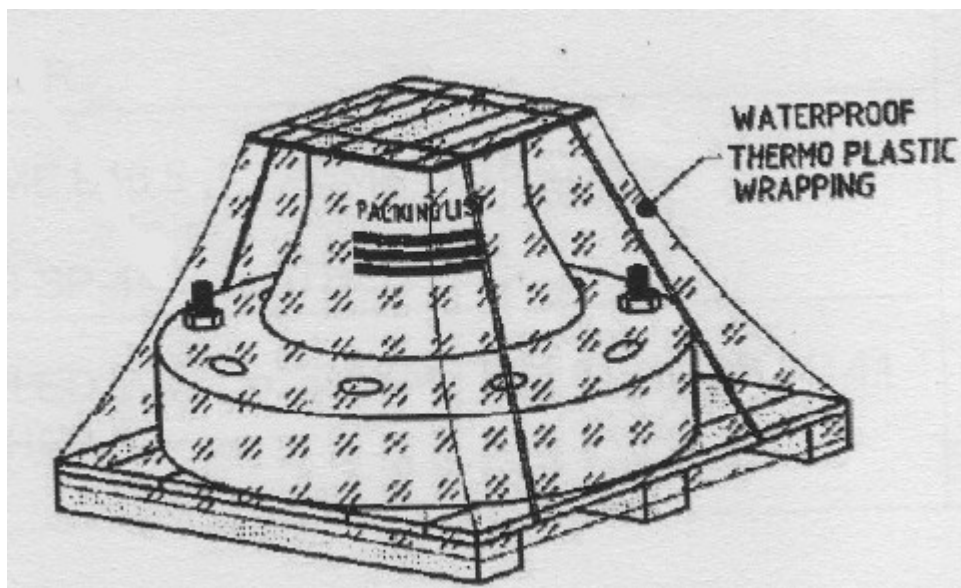
16. Packing and Shipment

Flanges shall be dry, clean, free form any defect and dirt prior to packing. The packing shall be easy for loading / unloading capable to withstand loading / unloading operations. The packing of flanges is done according to their sizes:

16.1. Flanges up to NPS 20, shall be fixed by at least two bolts placed in the bolt holes of flanges and finally placed in wooden box. Flange opening shall be protected with plywood /hard plastic sheet. Finally the flanges are packed through shrinking.



16.2. Flanges with NPS greater than 20 are placed on pallets. Flange opening shall be covered with plywood with minimum thickness 6mm. Provision shall be taken to prevent movement during transportation, at least three bolts placed in the bolt holes of flanges and finally the flanges are pack through shrinking.



16.3 The shipping mark (in English) shall be stenciled with black color include of:

- Manufacturer name
- Order number
- Name of purchaser
- Description of goods (size, class, Quantity, etc)
- Weight
- Destination

Appendix A	
FORGED CARBON STEEL FLANGE DATA SHEET	
MANUFACTURE : DRWG . NO:	INQUIRY NO : ORDER / JOB NO:
ITEM NO: QUANTITY : NOMINAL SIZE :	DESIGNE PRESS.(PSI) : DESIGNE TEMP : CARBON EQUIVALENT :
PROCESS OF MANUFACTURE	<input type="checkbox"/> FORGE <input type="checkbox"/> PLATE <input type="checkbox"/> CAST <input type="checkbox"/> OTHERS.....
FLANGE TYPE	<input type="checkbox"/> WELD NECK <input type="checkbox"/> SLIP ON <input type="checkbox"/> SCREWED <input type="checkbox"/> SOCKET WELD
FLANG FACING	<input type="checkbox"/> RAISED FACE <input type="checkbox"/> SERRATED FINISH <input type="checkbox"/> RING JOINT
MATERIAL	<input type="checkbox"/> ASTM A105 <input type="checkbox"/> ASTM A350 - LF2 <input type="checkbox"/> ASTM A694: <input type="checkbox"/> F42 <input type="checkbox"/> F52 <input type="checkbox"/> F60 <input type="checkbox"/> F65 <input type="checkbox"/> F70 <input type="checkbox"/> OTHERS
HEAT TREATMENT	<input type="checkbox"/> NORMALIZING <input type="checkbox"/> NORMALIZING & TEMPERING <input type="checkbox"/> QUENCH & TEMPERING <input type="checkbox"/> OTHERS
INSPECTIONAND TEST	<input type="checkbox"/> ASME B16.5 <input type="checkbox"/> ASME B16.47-A <input type="checkbox"/> VT <input type="checkbox"/> MT <input type="checkbox"/> UT <input type="checkbox"/> PT <input type="checkbox"/> OTHERS
DIMENSIONS:	<input type="checkbox"/> ASME B16.5 <input type="checkbox"/> ASME B16.47-A <input type="checkbox"/> MSS-SP-44 <input type="checkbox"/> OTHERS.....
END PREPARATION	<input type="checkbox"/> ASME B31.8 <input type="checkbox"/> ASME B16.25 <input type="checkbox"/> MSS SP 44 <input type="checkbox"/> OTHERS.....
THREAD	<input type="checkbox"/> ASME B 1.20.1 <input type="checkbox"/> OTHERS.....
MARKING	<input type="checkbox"/> ASME B16.5 <input type="checkbox"/> ASME B16.47-A <input type="checkbox"/> MSS-SP-25 <input type="checkbox"/> OTHERS.....
DEVIATIONS	
Notes 1- This Data Sheet Form should be completed for each item by manufacturer. 2- Any deviation from this specification shall clearly specified by manufacturer. 3- This Data Sheet Form shall be signed and stamped by manufacturer, authorized employee.	