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Approved	مصوب

شرکت ملی گاز ایران

مدیریت پژوهش و فنآوری

امور تدوین استانداردها

IGS

مشخصات فنی خرید

اتصال سه راهی انشعاب گرم

Hot Tapping Split Tee

ابلاغ مصوبه هیأت مدیره

مدیر محترم پژوهش و فناوری

باسلام،

به استحضار می‌رساند در جلسه ۱۹۴۸ مورخ ۱۴۰۰/۰۹/۰۱ هیات مدیره، نامه شماره گ۹/۹۱۸۴۶/۰۰۰ مورخ ۱۴۰۰/۰۷/۲۶ مدیر پژوهش و فناوری درمورد تصویب نهایی مقررات فنی شرکت ملی گاز ایران به شرح زیر مطرح و مورد تصویب قرار گرفت.

۱-مشخصات فنی کاتالیست های واحد مرکاپتان زدا IGS-M-CH-052(0)

۲-مشخصات فنی کاتالیست های واحد بازیافت گوگرد IGS-M-CH-054(1)

۳-مشخصات فنی خرید تجهیزات گرم کننده گاز غیرمستقیم آبی نوع مشعل دمنده دار IGS-M-PM-106(2)

۴-مشخصات فنی خرید کنتورهای نوع توربینی IGS-M-IN-102(3)

۵-مشخصات فنی خرید اتصال سه راهی انشعاب گرم IGS-M-PL-033(2)

۶-مشخصات فنی خرید اتصالات جوش لب به لب در اندازه های ۱/۲ الی ۵۶ اینچ IGS-M-PL-022(2)

۷- مشخصات فنی و نقشه های اجرایی انشعابات در شبکه های توزیع گازرسانی پلی اتیلن IGS-C-DN-011(0)

الهام ملکی

دبیر هیات مدیره

رونوشت : مدیرعامل محترم شرکت ملی گاز ایران و رئیس هیات مدیره
اعضای محترم هیات مدیره
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Foreword

This standard specification is intended to be mainly used by N.I.G.C. and contractors , and has been prepared base on interpretation of recognized standards and technical documents, as well as knowledge, backgrounds and experiences in gas industries at national and international levels.

Iranian Gas Specification (IGS) are prepared, reviewed and amended by technical standard committees within NIGC standardization division of research and technology management and submitted to "the standards council of NIGC" for approval.

IGSs are subjected to revision, amendment or withdrawal, if required, and thus the latest edition of IGS shall be checked / inquired by NIGC'S users.

This standard must not be modified or altered by NIGC employees or its contractors. Any deviation or conflicts between this specification and other applicable standards, codes, procedure or well-known manufacturer's specifications must be resolved in writing by the user or its representative through Manager, Engineering Department or standardization division of NIGC.

The technical standard committee welcomes comments and feedbacks from concerned or interested corporate and individuals 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 IGS specification 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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0. INTRODUCTION

This specification defines NIGC's mandatory requirements for design, material selection, and fabrication, testing and marking of split tees used for hot tapping on natural gas service, for sizes 4 inches through 56 inches, concerning pressure class rating of 150, 300 and 600.The standard contain three parts:

Part 1: Split Tee.

Part 2: Lock-O-Ring Flanges with stopple fitting Connection.

Part 3: Double Hub Flange Connection

Note: Each enquiry consists of two parts. First part is split tee requirements and the other part pertaining to requirements for end branch connections according to part 2 or part3.

PART ONE

SPLIT TEE

Contents

1.1 Scope

This part of specification covers general requirements for design, material, fabrication, testing and marking of split tees furnished with the one of end connection specified in part 2 or Part3 used for hot tapping on sweet natural gas pipeline, for sizes 4 inches through 56 inches, class rating of 150, 300 and 600.

1.2 REFERENCES

Throughout this specification the following codes and standards are referred to. The applicability of changes in codes and standards that occur after the date of these standards shall be mutually agreed upon by the purchaser and manufacturer and/or supplier

API SPEC 5L: 2018 ”Specification for Line Pipe**”**

API 1104:2021”Welding of Pipelines and Related Facilities**”**

American Society of Mechanical Engineers

ASME B16.9:2012 " Factory-Made Wrought Butt welding Fittings"

ASME B31.8:2014 ”Gas Transmission and Distribution Piping Systems**”**

ASTM A 105:2012 ”Specification for Forgings Carbon Steel for Piping Components**”**

ASTM A 106:2011 ”Standard Specification for Seamless Carbon Steel Pipe for High-Temperature Service**”**

ASTM A 234 :2019”Standard Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service**”**

ASTM A 350:2012 ”Standard Specification for Carbon and Low Alloy Steel Forging**”**

ASTM A 370:2012 ”Standard Test Methods and Definitions for Mechanical Testing of Steel Products**”**

ASTM A 516:2004 ”Specification for Pressure Vessel Plates, Carbon Steel**”**

ASTM A 578 :2007”Standard Specification for Straight-Beam Ultrasonic Examination of Plain and Clad Steel Plates for Special Applications**”**

ASTM A 694:2016 ”Specification for Forgings, Carbon Steel and Alloy Steel**”**

ASTM E 92:2000 ”Standard Test Method for Vickers Hardness**”**

ASTM E 165 :2002"Standard Test Method for Liquid Penetrant Examination**"**

MSS SP-75:2019 "Specification for High Test Wrought Butt-Welding Fittings**"**

AWS A5.1:1993 "Specifications for Carbon Steel Electrodes for Shielded Metal Arc Welding

AWS A5.5:2006 "Specifications for Low-Alloy Steel Electrodes for Shielded Metal Arc Welding"

IGS-M-PL-022(2): 2021"Carbon Steel Butt Welding Fittings in sizes NPS1/2 through NPS 56**"**

IGS-M-TP-020 (2): 2015"External Liquid Polyurethane Coating for Rehabilitation and Rrepair of Buried Steel Pipelines, Coating of Field Joints, Buried Steel Piping and new Coating of Valves and Fittings and other Piping Components,

IGS-M-TP-027(1): 2019"External Liquid Epoxy Coating for Rehabilitation and repair of Buried Steel Pipelines, Bends, Field Joints, Valves and Fittings.

1.3 TERMS AND DEFINITIONS

NPS
Nominal Pipe Size (in)
PSL
Product Specification Level
SAWL
Tubular product having one longitudinal / straight seam produced by double submerged-arc welding
SMLS
Pipe without any weld seam, produced by a hot-forming process, which can be followed by cold sizing or cold finishing to produce the
NIGC
National Iranian Gas Company

1.4 DESIGN

1.4.1 Split tees design and mechanical calculation shall fully comply with the requirements of ASME B31.8 Paragraphs 831.3, 831.4 and 831.6.It shall have all mandatory Appendix F with design factor 0.5.

Split tees with branch size of 75% of the run size or greater, shall be extruded type. It shall appropriately comply with of ASME B16.9 or MSS-SP 75 (regarding its size).

1.4.2 The top half and bottom half of the split tee shall have a longitudinal bevel as figure2.

1.4.3 Backing strips for the field longitudinal welds shall be supplied. The strips shall be weld able carbon steel with 1.5 mm thick and approximately 25 mm width. The length shall be the same as the length of the run of the split tee. A matching recess shall be machined into each half of the split tee. The backing strips shall be tack welded to the top half of the split tee.

1.4.4 Flanges used for branch connection shall be standard welding neck meeting the requirements of the bolting and seating area (raised faced ,serrated finished) of ASME B16.5 (NPS≤ 24")or ASME B16.47 (Series A) / MSS SP44 (NPS›24) and standard drawings specified in the purchase order(as part 2/ Part 3).

1.4.5 Lifting lugs shall be provided on both sides of the bottom half of all fittings size 10 in and larger. The top and bottom half of each fitting shall be identified with an individual number.

1.4. 6 The circumferential fillet weld of ends to the pipeline shall be in accordance with ASME B31.8 Figure I-3.1.

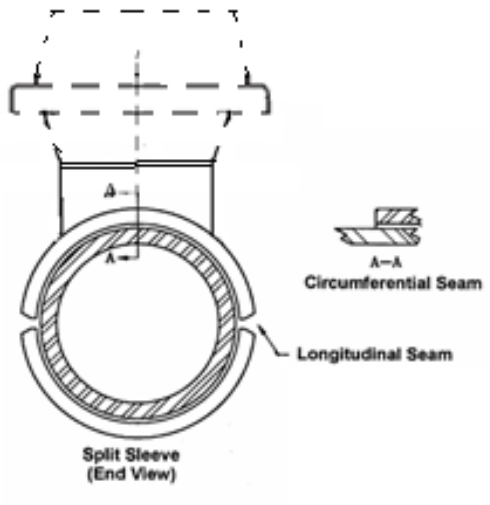


Figure1- Fit-up of Full Circumferential split Tee

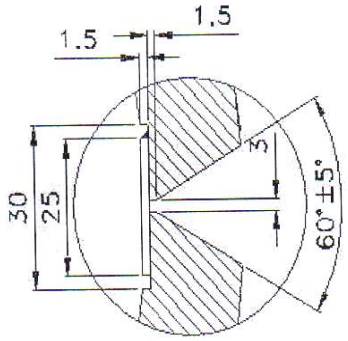


Figure 2- Longitudinal seam weld beveling(Dimensions are in mm**)**

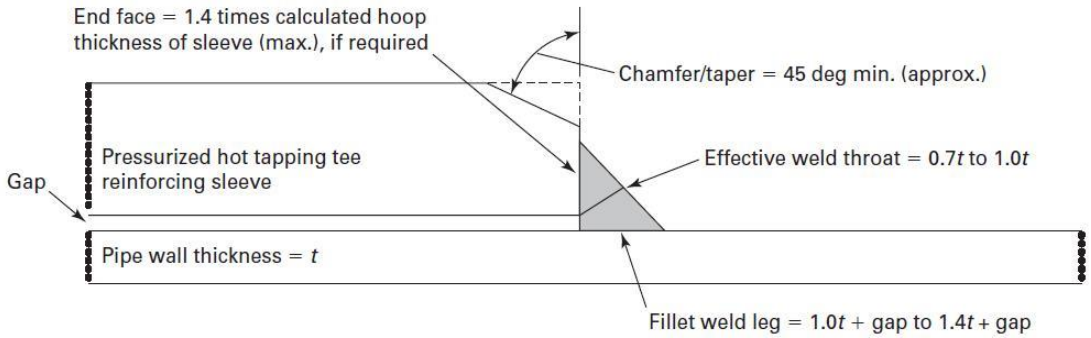


Figure 3- Circular fillet weld (A-A)

1.4. 7 Guide bars should be devised for pipeline requiring pigging when branch size is larger or equal to one half of run pipe diameter according to IGS-M-PL-022,Appendix-A.

1.4.8 Flange Connection

Flange connection (as per request) shall be:

a) Standard weld neck flange (IGS-M-PL-040);or

b) Lock-O-ring Flange as per Part 2, for Classes 150,300,600, sizes 2 inches through 56 or;

c) Double hub flange as per Part 3, only for Class 300 with branch pipes NPS ≤24 or Class 150 with branch pipes NPS ≤12:

1.5 MATERIAL

1.5.1 General

Split tee shall be as below as specified in the purchase order. Other materials may be used by agreement between purchaser and manufacturer base on the piping design code and weld ability.

1.5.2 The vendor shall provide a certified material test report listing the actual results of the chemical analysis, mechanical properties, notch toughness properties, heat treatment, non-destructive examination, and any special tests required by the Purchased Order.

1.5.3 Materials used for manufacturing shall be as follow:

a) Plates: ASTM A 516N (all grades)
b) Pipe: ASTM A 106 or API SPEC 5L, PSL2 (SMLS/SAWL).
c) Forge: ASTM A 105N or ASTM A 694 (F42 through F 70)
d) Fittings: ASTM A234 (WPB) or MSS SP75 (WPHY 42 through WPHY 70)
/ IGS-M-PL-022

1.5.4 All other non-pressure containing components shall be as per vendor's standard material.

1.5.5 All O-rings supplied for use on LOR plugs shall be the molded type. O-rings with joints (including those made by joining O-ring cord) are not acceptable. The materials shall be specified by manufacturer and approved by NIGC.

1.6. WELDING

1.6.1 Welding Procedure Specifications and Procedure Qualification Records shall be written in English and conform to ASME Sec IX.

1.6. 2 Welders shall be qualified in accordance with ASME Sec IX, including tack welders.

1.6.3 Processes
The following processes are approved for use:

1.6.1.3.1 Shielded Metal Arc Welding (SMAW)

1.6.1.3.2 Gas Tungsten Arc Welding (GTAW)

1.6.1.3.3 Submerged Arc Welding (SAW)

1.6.1.3.4 Gas Metal Arc Welding (GMAW) - Short circuiting transfer shall not be used.

1.6.1.3.5 Flux Cored Arc Welding (FCAW) - Shall not be used for the root pass on single sided welds

1.6.1.4 Welding without the addition of filler material is not permitted.

1.6.1.5 Welding Consumables.

Electrodes, filler wires, and fluxes shall conform to the requirements of the ASME Sec II, part C (identical to the AWS A5.XX specification series). Other consumables may be used only with the specific approval by NIGC.Active submerged arc welding fluxes shall not be used.

1.7 HEAT TREATMENT

1.7.1 All fittings shall be heat treated after all forming and welding processes are completed. Flanges may be welded to the heat treated tee without reheat treating provided that the heat treatment of the flange to tee weld is not required by the governing code.

1.7. 2 All fittings supplied in accordance with this specification shall be heat treated as follows:

Table 2 – Heat Treatment of Extruded Tee and Branch Welds

Extruded Tee or Branch Weld	Heat Treatment
Extruded Tee	Normalize, Normalize and temper, or quench and temper
Welded Tee	Post-weld Heat Treatment (PWHT)
Flange to Tee	PWHT if required by governing code or service requirement

1.7.3 Stress relieved, or normalized, or normalized and tempered, or quenched and tempered shall be as defined in ASTM A 234, MSS SP-75 or ASME SEC. VIII Div.1. (Heat treatment report and Graph shall be issued by vendor/manufacturer)

1.8. DIMENSIONS

Dimensions of the fitting shall be specified by manufacturer/suppler and drawings shall be approved by end user.

1.8.1 Tolerances

1.8.1.1 Fittings shall have tolerances such that they provide the following gap between inside radius of fitting (sleeve) and nominal outside radius of run pipe:

NPS 24 and smaller: maximum 3.2 mm
NPS 30 and Larger: maximum 6.4 mm

1.8.1.2 The fittings dimensions shall provide a root gap on the longitudinal joint of 3.2 to 8.0 mm when fit onto the specified nominal size pipe.
1.8.1.3 Inside diameter of branch bore shall have tolerances - 0, +1.6 mm of specified nominal ID.
1.8.1.4 Wall thickness shall have tolerances ±12.5% of specified thickness (if considered tolerances in thickness design) or - 0, +12.5% of specified thickness (if do not considered in thickness design).

1.8.1.5 Length of fitting shall have tolerances ± 10 mm of specified length.

1.8.1.6 Center run to top outlet: ± 6.0 mm of specified distance**.**

1.8.1.7 Intersection of centerline of branch with centerline of run: 1.6 mm max. Offset.

1.8.1.8 The flange face shall be perpendicular to branch bore with angular tolerance of $\pm 0.5^0$**.**

1.9. INSPECTIONS AND TESTING

1.9.1 General

The manufacturer shall perform all inspection and tests as per requirement of this standard specification and the relevant codes prior to shipment.

1.9.2 Visual Examination and Dimensional Check

General appearance shall show good workmanship and fit-up. Weld surfaces shall show a smooth contour. Welds shall be visually inspected in accordance with ASME Sec. V article 9. Dimensions of the fitting shall be checked against approved vendor's drawings and specified dimensions and tolerances in paragraphs 7 & 8 of this standard.
Repairs by welding on parent metal are not permitted. Repairs of weld shall be carried out only after specific approval by purchaser's representative for each repair. The repair welding shall be carried out by the welders and welding procedures only qualified as per ASME Section-IX and records for each repair shall be maintained.

1.9.3 Non-Destructive Examination

1.9.3.1 The plate to be used for the fabrication of high yield strength fittings which have a specified minimum yield strength of 359 MPa (52000 psi) and higher shall be ultrasonically tested for laminations in accordance with ASTM A 578,acceptance level"C".

1.9.3.2 The fitting shall be 100% UT examined for laminations at extruded area (extruded type) and branch to run weld (welded type) in accordance with ASTM A 578,acceptance level"C".

1.9.3.3 All butt welds in fabricated fittings, regardless of strength level, shall be 100% radio graphed in accordance with ASME Sec VIII Div. 1, UW-51.

1.9.3.4 All other full penetration groove welds cannot be inspected by radiographic methods shall be checked by ultrasonic or magnetic particle methods. Acceptance criteria shall be as per ASME Section VIII Appendix-12 and Appendix-6 respectively.

1.9.3.5 The bevels prepared for field welding shall be 100% ultrasonically or magnetic particle method tested for lamination in accordance with ASTM A 578 for a distance of 50mm from the end.
1.9.3.6 All forgings shall be wet magnetic particle examined on 100% of the forged surfaces. Method and acceptance shall comply with MSS-SP-53.

1.9.4 Hydrostatic Tests
Split Tee shall be hydrostatic tested after final fabrication and heat treatment by following procedure:

1.9.4.1 End caps shall be welded on end of both Split Tee ends for performing hydrostatic test pressure.

1.9.4.2 The locking part of the flange shall be assembled and a blank flange shall be installed.

1.9.4.3 The locking parts of the flange and the whole body of Split Tee shall be tested with 1.5 times of the design pressure for one hour.

1.9.5 Production Hardness Tests

1.9.5.1 Hardness testing shall be conducted in accordance with ASTM E 92.

1.9.5.2 A minimum of three hardness indentations shall be made on the parent metal of each fitting, with the test locations spaced evenly across the piece being tested.
For extruded fittings one of the hardness shall be in the outlet section.
For fabricated fittings, an additional three hardness indentations shall be made, evenly spaced, along the weld. Where accessible, the weld metal hardness should be measured on the I.D. surface of the fittings. In all case, the hardness shall not exceed 250 HV10. If any single indentation exceeds the allowable hardness limit, two additional hardness indentations shall be taken within 25 mm of the first reading, and the three hardness values shall be averaged. If the average exceeds the allowable limit, the fitting shall be rejected, and all the other fittings from the same heat shall be 100% hardness tested.

1.9.5.3 At the manufacturer's option, all fittings that have failed the hardness test requirements in paragraphs 9.5.2 may be re-heat treated and hardness tested again. The second heat treatment shall be equivalent to the original heat treatment unless additional production test coupons are made to verify all the required mechanical properties are met. Any second heat treatment must still comply with the original welding procedure essential and supplementary essential variables. Fittings that pass the hardness test requirements and the strength requirements after re-heat treatment may be accepted. Fittings that fail a second time shall be permanently rejected.

1.9.6 Production Tensile Test
Tensile test shall be performed on one specimen per lot (10 pcs) of extruded fitting production and shall meet the requirements of the basic specification.

1.9.7. Impact Test

a) Impact testing is required for all sizes and grades.
b) The impact tests method shall be conducted -10 Cº in accordance with ASTM A 370.
c) Welding procedure qualifications shall include impacts tests of the base metal, weld metal, and heat-affected zone (HAZ).
d) The average of three specimens shall not be less than 50J. Single value shall not be less than 45J.

1.9.8 Test Certificates

1.9.8.1. Manufacturer shall submit following certificates to purchaser‹s representative:

1.9.8.1.1. Test certificates relevant to the chemical analysis and mechanical properties of the materials used for the construction as per this standard specification and relevant standards.

1.9.8.1.2 Test reports on radiographic and ultrasonic inspection and magnetic particle examination.

1.9.8.1.3 Hydrostatic tests certificate

1.9.7.1.4 Test reports on heat treatment carried out.

1.10. SURFACE PREPARATION AND COATING

External surface preparation and coating shall be in accordance with IGS-M-TP-027(1) or IGS-M-TP-020(2) as per request.

1.11. MARKING

1.11.1 Marking shall be in accordance with MSS-SP-25. In addition, each fitting shall be marked with a 50 mm wide painted band around top and bottom half at one end in order to facilitate matching during field installation.

1.11.2 Top and bottom halves shall be marked with following data:

- Manufacturer’s Name
- Design Pressure in psig
- Nominal Diameter in inch, D X d
- Run and Branch Thickness in inch or mm, T X t
- Run/Branch and Flange Material Designation

1.11.3 The top and bottom halves of each fitting shall be low stress die-stamped or dot-peen marked, with the manufacturer name, Size and Serial No.

1.12. DOCUMENTATION

1.12.1 Below document shall be submitted for purchaser/NIGC approval before fabrication:

MPS (Manufacturing Process Specification)

- Inspection and Test Plan
- Mechanical Calculation
- Fabrication Drawing
- WPS, PQR

1.12.2 Below document shall be submitted after fabrication:

- Material Test Certificate
- Visual and Dimensional Check Report
- WQT (Welder Qualification Test)
- RT, UT, MT and PT Reports
- Heat Treatment Report and Graph
- Hardness Test Report
- Hydrostatic Test Report
- Surface Preparation and Coating Report
- Release Note

1.12.3 All above documents (before and after fabrication) shall be in English Language and to be issued to purchaser in 3 final books.

1.13. PACKAGING

Each fitting shall be suitably protected to avoid damage during transport. Packing procedure shall be specified by manufacturer and approved by N.I.G.C. Metallic or high impact plastic bevel protectors shall be provided for weld ends.

APPEDIX 1- DATA SHEET

The following data sheet shall be filled by end user and attached to inquire.

Hot tapping tee Data Sheet		
Element	NIGC.S requirement as per this standard specification	Manufactures' comment
DESIGN DATA		
Size(Run× Branch) [a]		
Quantity [a]		
Design Code [b]		
Medium	Natural Gas	
Split Tee Manufacturing method	□ Extruded □ Welded	
Design pressure [a]		
Design temperature(ºC)	-29 to 60	
Design factor(F)	0.5	
Flange Standard	□ ASME B16.5 □ ASME B 16.47/series A □ MSS SP 44	
Flange Size & Rating [a]		
Flange Facing	Raised Face □	
Flange Finish	Serrated finished □	
Lock – O-Ring flange	□ Yes □ No	
Double Hub Flange	□ Yes □ No	
Hydro Test Pressure(kg/cm^2) [c]		

Pipeline Details(on which hot taping is to be conducted)[a]	Outside Diameter(inch): Thickness(mm): Material:	
Connecting Branch Pipeline Details[a]	Outside Diameter(inch): Thickness(mm): Material	
Inside diameter of run. (mm) [c]		
thickness of run (mm) [c]		
Overall length of run (mm) [c]		
Minimum branch inside [c] diameter. (mm)		
Minimum branch thickness(mm) [c]		
Fitting Height (Center line of run to the top face of flange)-(mm) [c]		
Weight (kg) [c]		
Tapping Machine Specification [a]		
MATERIAL REQUIREMENT		
Part Description		
Top half Portion [c]		
Bottom half Portion [c]		

Branch [c]		
Flange/Lock – O-Ring flange /Double Hub Flange		
Lock – O-Ring Retaining Device [c]		
O-Ring [c]		

Notes:

a) shall be specified by end user

b) as per this standard

c) shall be specified by manufacturer

1- This data sheet shall be filled for each item.

2- Clause wise deviation shall be specified by manufacturer/supplier.

3- This data sheet shall be signed and sealed by manufacturer's authorized person.

PART TWO

LOCK-O-RING FLANGE

2.1. Scope

This specification covers minimum requirements of Lock-O-Ring welding neck forged carbon steel flanges with rating classes 150, 300 and 600 in sizes NPS 2 through NPS 56 which are used for hot taping on gas transmission and distributing pipeline systems

2.2. 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

ASME B 16.5: 2017, "Pipe Flanges and Flanged Fittings"

ASME B 16.47: 2017, "Large Diameter Steel Flange"

ASME: B 31.8: 2014, "Gas transmission and distributing piping system".

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

ASTM A275:2008," Standard Test Method for Magnetic Particle Examination of Steel Forgings**"**

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

ASTM A 694: 2016, "Specification for forgings, carbon and alloy steel for pipe flanges, fitting, valves and parts for high pressure transmission service "

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

ASTM A961:2019,"Standard Specification for Common Requirements for Steel Flanges, Forged Fittings, Valves, and Parts for Piping Applications"

ASTM E23:2016,"Standard Test Methods for Notched Bar Impact Testing of Metallic Materials”

ASTM E110:2014," Standard test method for indentation hardness of metallic materials by portable hardness tester"

ASTM A788:2018,"Standard Specification for Steel Forgings, General Requirements"

ASTM A388:2019," Standard Practice for Ultrasonic Examination of Steel Forgings"

Vacuum-Treated Carbon and Alloy Steel Forgings for Pressure Vessels"

ASTM E112:2013," Standard test method for Determining Average Grain Size"

ASTM E165:2018,"Standard test method for Liquid Penetrant Examination"

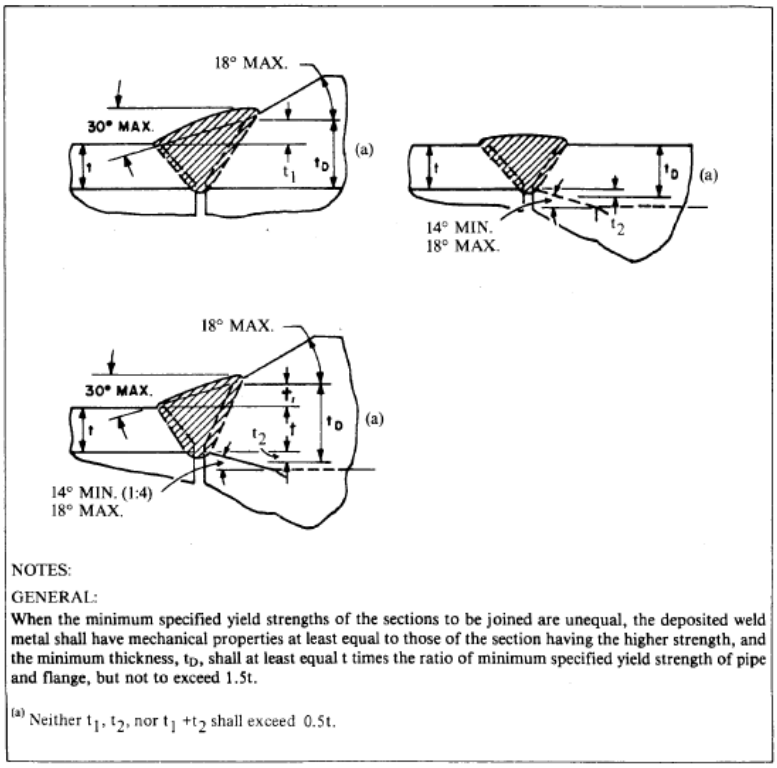
2.3 Design

2.3.1 Generally Lock-O-Ring welding neck flanges with shall be designed, manufactured and supplied in accordance with ASME B 16.5(for NPS ≤24) or ASME B 16.47(for NPS >24).

2.3.2 When the minimum yield strength of the flange is equal to or higher than the matching branch, hub dimensions may be the same as those of ASM B 16.5(for NPS 24 and smaller) or are designed in accordance with Appendix 2 of ASME Section VIII (for larger sizes).

2.3.3 When the minimum yield strength of the flange is less than of matching bevel, the minimum thickness of the hub at the welding end shall be such that the product of its thickness times its yield strength (at welding end) shall at Least equal the product of the matching wall thickness times minimum its specified yield strength at welding bevel.

2.3.4 When the hub thickness at the welding end is greater than the adjoining thickness, the joint design shall be as shown in any of the three sketches in Figure 1



NOTES:

GENERAL:

When the minimum specified yield strengths of the sections to be joined are unequal, the deposited weld metal shall have mechanical properties at least equal to those of the section having the higher strength, and the minimum thickness, t_D, shall at least equal t times the ratio of minimum specified yield strength of pipe and flange, but not to exceed 1.5t.

(a) Neither t_1, t_2, nor $t_1 + t_2$ shall exceed 0.5t.

FIGURE 1 — ACCEPTABLE DESIGNS FOR UNEQUAL WALL THICKNESS(1)

2.3.5 The body of Lock-O-Ring welding neck flanges shall be manufactured as one piece. Assembly of multiple pieces in to the finished product by welding is not permitted. The assembly of Luck- O-Ring plug should be done mechanically

2.4 Material

Lock-O-Ring welding neck flanges shall be made of hot worked forging carbon steel

O-rings used in Lock-O-Ring welding neck flanges assembly shall be Buna N type.

Material of retainer segment ring and bolts as jack screw shall be ASTM A29 Grade 4140 (AISI SAE 4140). Retainer segment ring thickness shall have enough strength for shear and bending stress.

The carbon steel used for lock-O-Ring welding neck 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 Table1:

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
Note: Forging to other standard may be used if subjected to the purchaser approval.				

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

2.5 Dimensions

Flanges dimensions shall be in accordance with APPENDIX 2(These dimensions are in accordance with TDW's Tapping Machines. Other dimension may be issued by the supplier and approved by the purchaser). The flange inside diameter (B) shall be uniformly bored to suit size as specified in purchase order.

2.6 Contact Face

Flanges shall be furnished raised face serrated finished.

2. 7 Inspection and Testing

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.

2. 7.1 Visual and Dimensional Inspection

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

Dimensions and tolerances shall be checked against this specification approved manufacturer drawings and relevant standard.

2. 7.2 Chemical Composition

Chemical analyses shall be conformed to Clause 2.4 giving satisfactory weld transition of flange hub to the matching end.

2. 7.3 Tensile Test

Material for flanges shall have minimum tensile strength mentioned in this specification.

2. 7.4 Fracture Toughness Test

Notch toughness properties shall be determined with full size Charpy type A V-notch specimens in accordance with ASTM A370. 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. Tests shall be carried out at – 10^0C and the average obtained value from three tests shall not be less than 2.1 Kgf and no individual test result being less than 1.4 Kgf

2. 7.5 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.

2. 7.6 Hydrostatic Test

Split tee shall be hydrostatic tested as per 1.9.4. No leakage of the O-ring seals are permitted.

2. 7.7 Non Destructive Tests

- 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. 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**.**

- Each 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**.**

-The butt weld of flange neck shall be 100% radio graphed in accordance with ASME Sec VIII Div. 1, UW-51.

2. 8 Documentation

The manufacturer/supplier shall furnish the purchaser with the followings:

- 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
- Data sheet & QCP

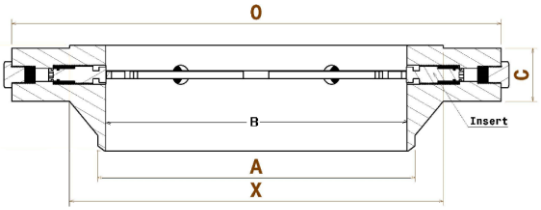
2.9 Marking

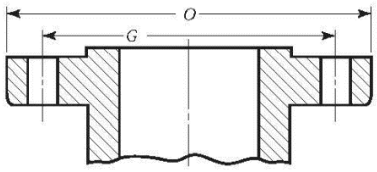
Marking shall be applied to the flange edge by dot peen or die stamp methods with the following minimum information:

- Manufacturer name or trademark
- Designation (ASTM B 16.5/16.47)
- Rating pressure or class

Appendix 2(only for Informative)

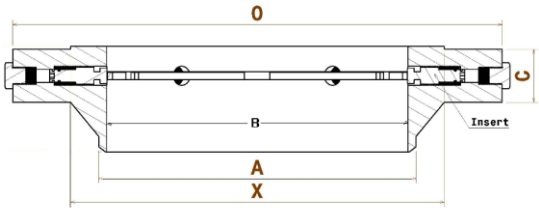
Dimensions of Lock-O-ring Welding Neck Raised Face Flanges - Class 150

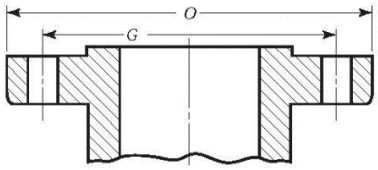




Size		O	A	C_{min}	Y	X	Drilling			Retainer segment	O-ring Size
DN	NPS						NO.	G(mm)	D(in)	NO.	
50	2	150	60.3	17.5	62	78	4	120.7	3/4	2	7
100	4	230	114.3	22.3	75	135	8	190.5	3/4	4	8
150	6	241	168.3	23.9	87	192	8	241.3	3/4	4	8
200	8	345	219.1	27.0	100	246	8	298.5	3/4	4	8
250	10	405	273	30.2	100	305	12	362.0	7/8	4	8
300	12	485	323.8	31.8	113	365	12	431.8	7/8	6	10
350	14	535	355.6	35	125	400	12	476.3	1	6	12
400	16	595	406.4	36.6	125	457	16	539.8	1	8	14
500	20	700	508	41.3	143	559	20	635.0	11/8	10	14
600	24	815	610	46.1	151	663	20	749.3	11/4	10	16
650	26	870	660	66.7	119	676	24	806.4	13/8	8	16
700	28	925	711	69.9	124	727	28	863.6	1 3/8	14	16
750	30	985	762	73.1	135	781	28	914.4	1 3/8	14	20
800	32	1060	813	79.4	143	832	28	977.9	1 5/8	14	20
850	34	1110	864	81.0	148	883	32	1028.7	1 5/8	16	20
900	36	1170	914	88.9	156	933	32	1149.4	1 5/8	16	20
1050	42	1345	1066.8	95.3	170	1092	36	1257.3	1 5/8	12	20
1200	48	1510	1219.2	106.4	191	1248	44	1422.4	1 5/8	11	20
1400	56	1745	1422.4	122.3	227	1457	48	1651.0	1 7/8	12	20

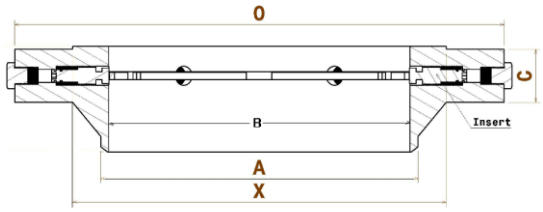
Dimensions of Lock-O-ring Welding Neck Raised Face Flanges - Class 300

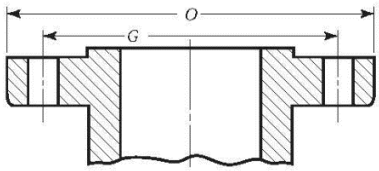




Size		O	A	C_{min}	Y	X	Drilling			Retainer segment	O-ring size
DN	NPS						NO.	G(mm)	D(in)	NO.	
50	2	165	60.3	20.7	68	84	8	127	3/4	4	8
100	4	255	114.3	30.2	84	146	8	200	7/8	4	8
150	6	320	168.3	36.6	97	206	12	269.9	7/8	4	8
200	8	380	219.1	41.3	110	260	12	330.2	1	4	8
250	10	445	273	47.7	116	321	16	387.4	1 1/8	8	10
300	12	520	323.8	50.8	129	375	16	450.8	1 1/4	8	12
350	14	585	355.6	54	141	425	20	514.4	1 1/4	10	14
400	16	650	406.4	57.2	144	483	20	571.5	1 3/8	10	14
500	20	775	508	63.5	160	587	24	685.8	1 3/8	8	16
600	24	915	610	69.9	167	702	24	812.8	1 5/8	8	16
650	26	970	660	77.8	183	721	28	876.3	1 3/4	14	16
700	28	1035	711	84.2	195	775	28	939.8	1 3/4	14	20
750	30	1090	762	90.5	208	824	28	997.0	1 7/8	14	20
800	32	1150	813	96.9	221	881	28	1054.1	2	14	20
850	34	1205	864	100.1	230	937	28	1104.9	2	14	20
900	36	1270	914	103.2	240	991	32	1168.4	2 1/8	16	20
1050	42	1290	1066.8	117.5	198	1099	32	1206.2	1 3/4	16	20
1200	48	1465	1219.2	131.8	222	1254	32	1371.6	2	16	20
1400	56	1710	1422.4	152.4	259	1464	28	1600.2	2 3/8	14	20

Dimensions of Lock-O-ring Welding Neck Raised Face Flanges - Class 600





Size		O	A	C_{min}	Y	X	Drilling			Retainer segment	O-ring size
DN	NPS						NO.	G	D	NO.	
50	2	165	60.3	25.4	73	84	8	127	3/4	4	8
100	4	275	114.3	38.1	102	146	8	215.9	1	4	8
150	6	355	168.3	47.7	117	206	12	292.1	1 1/8	4	8
200	8	420	219.1	55.6	133	260	12	349.2	1 1/4	4	10
250	10	510	273	63.5	152	321	16	431.8	1 3/8	8	12
300	12	560	323.8	66.7	156	375	20	489.0	1 3/8	10	14
350	14	605	355.6	69.9	165	425	20	527.0	1 1/2	10	14
400	16	685	406.4	76.2	178	483	20	630.2	1 5/8	10	16
500	20	815	508	88.9	190	587	24	723.9	1 3/4	8	16
600	24	940	610	101.6	203	702	24	838.2	2	8	16
650	26	1015	660	108.0	222	748	28	914.4	2	14	20
700	28	1075	711	111.2	235	803	28	965.2	2 1/8	14	20
750	30	1130	762	114.3	248	862	28	1022.4	2 1/8	14	20
800	32	1195	813	117.5	260	918	28	1079.5	2 3/8	14	20
850	34	1245	864	120.7	270	973	28	1130.3	2 3/8	14	20
900	36	1315	914	123.9	283	1032	28	1193.8	2 5/8	14	20
1050	42	1405	1066.8	168.3	279	1127	28	1282.7	2 5/8	14	20
1200	48	1595	1219.2	189.0	316	1289	32	1460.5	2 7/8	16	20
1400	56	1855	1422.4	217.5	362	1502	28	1695.4	3 3/8	14	20

Note: The minimum Size "B" is based on full opening valve as per API 6D, Table1. The employer can order required schedule.

PART THREE

DOUBLE HUB FLANGE

3.1 Scope

This specification covers minimum requirements of double hub welding neck forged carbon steel flanges with rating class 150 for branch connections in sizes NPS 2 through NPS 12 and rating class 300 in sizes NPS 2 through NPS 24 which are used for hot taping on gas distributing pipeline.

3.2 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

ASME B 16.5: 2017, "Pipe Flanges and Flanged Fittings"

ASME B 16.47: 2017, "Large Diameter Steel Flange"

ASME: B 31.8: 2014, "Gas transmission and distributing piping system"

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

ASTM A275:2008," Standard Test Method for Magnetic Particle Examination of Steel Forgings**"**

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

ASTM A 694: 2016, "Specification for forgings , carbon and alloy steel for pipe flanges, fitting ,valves and parts for high pressure transmission service "

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

ASTM A388:2019," Standard Practice for Ultrasonic Examination of Steel Forgings"

Vacuum-Treated Carbon and Alloy Steel Forgings for Pressure Vessels"

ASTM A788:2018,"Standard Specification for Steel Forgings, General Requirements"

ASTM A961:2019,"Standard Specification for Common Requirements for Steel Flanges, Forged Fittings, Valves, and Parts for Piping Applications"

ASTM E23:2016,"Standard Test Methods for Notched Bar Impact Testing of Metallic Materials"

ASTM E110:2014," Standard test method for indentation hardness of metallic materials by portable hardness tester"

ASTM E112:2013," Standard test method for Determining Average Grain Size"

ASTM E165:2018,"Standard test method for Liquid Penetrant Examination"

3.3 Design

3.3.1 Generally double hub flanges shall be designed, manufactured and supplied in accordance with ASME B 16.5.

3.3.2 When the minimum yield strength of the flange is equal to or higher than the matching branch, hub dimensions may be the same as those of ASM B 16.5 .

3.3.3 When the minimum yield strength of the flange is less than of matching bevel, the minimum thickness of the hub at the welding end shall be such that the product of its thickness times its yield strength (at welding end) shall at Least equal the product of the matching wall thickness times minimum its specified yield strength at welding bevel.

3.3.4 When the hub thickness at the welding end is greater than the adjoining thickness, the joint design shall be as shown in any of the three sketches in Figure 1

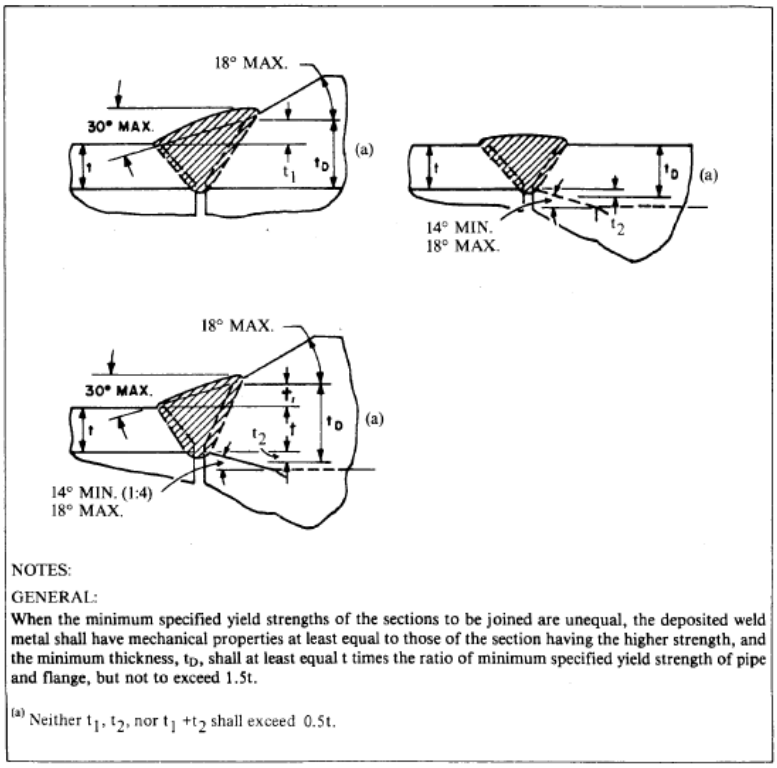


FIGURE 1 — ACCEPTABLE DESIGNS FOR UNEQUAL WALL THICKNESS[1]

2.3.5 The body of double hub flanges shall be manufactured as one piece. Assembly of multiple pieces in to the finished product by welding is not permitted.

3.4 Material

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

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

- The carbon steel used for double hub welding neck 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 Table1

TABLE 1. TENSILE REQUIREMENTS

Standard	Grade	Yield point Min ksi	Tensile strength Min ksi	Elongation Min,%
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

Note: Forging to other standard may be used if subjected to the purchaser approval.

3.5 Dimensions

Flanges dimensions shall be in accordance with APPENDIX 3(These dimensions are in accordance with TDW's Tapping Machines. Other dimension may be issued by the supplier and approved by the purchaser). The tolerances shall be in accordance with ASME B 16.5.

The flange inside diameter (B) shall be uniformly bored to suit size as specified in purchase order.

3.6 Contact Face

Flanges contact surface shall be furnished raised face serrated finish.

3. 7 Inspection and Testing

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.

3. 7.1 Visual and Dimensional Inspection

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

Dimensions and tolerances shall be checked against this specification approved manufacturer drawings and relevant standard.

3. 7.2 Chemical Composition

Chemical analyses shall be conformed to Clause 3.4 giving satisfactory weld transition of flange hub to the matching end.

3. 7.3 Tensile Test

Material for flanges shall have minimum tensile strength mentioned in this specification.

3. 7.4 Fracture Toughness Test

Notch toughness properties shall be determined with full size Charpy type A V-notch specimens in accordance with ASTM A370. 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. Tests shall be carried out at -10^0C and the average obtained value from three tests shall not be less than 2.1 Kgf and no individual test result being less than 1.4 Kgf

3. 7.5 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.

3. 7.6 Hydrostatic Test

Split tee shall be hydrostatic tested as per 1.9.4.

3. 7.7 Non Destructive Tests

- 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. 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**.**

- Each 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**.**

-The butt weld of flange neck shall be 100% radio graphed in accordance with ASME Sec VIII Div. 1, UW-51.

3. 8 Documentation

The manufacturer/supplier shall furnish the purchaser with the followings:

- 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
- Data sheet & QCP

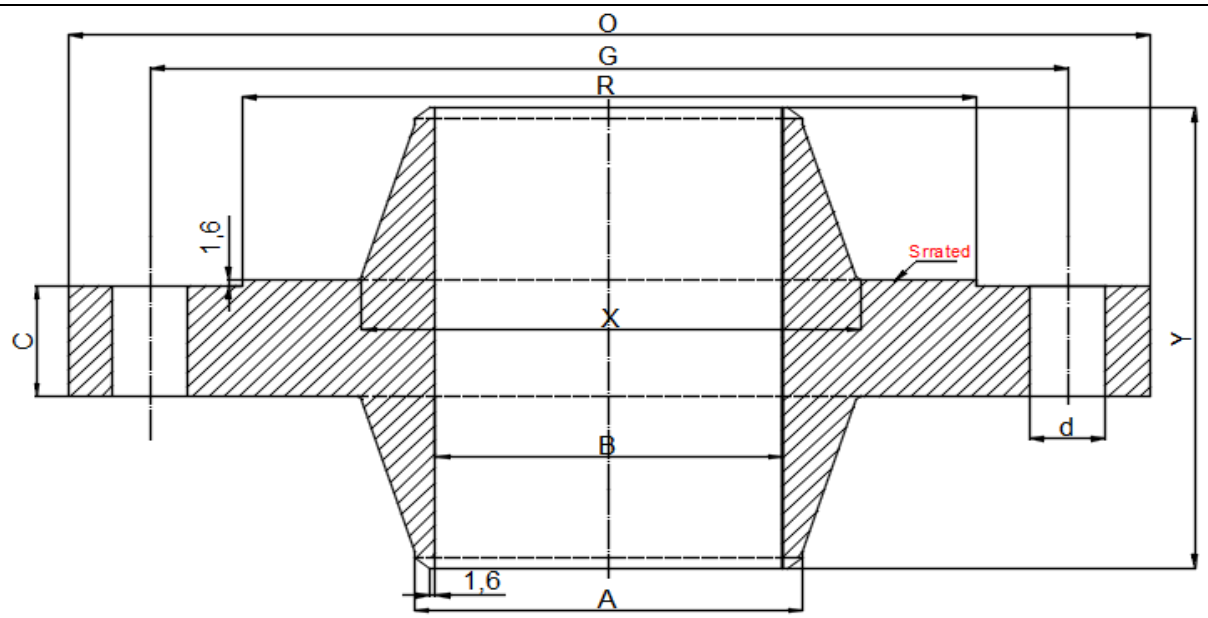
3.9 Marking

Marking shall be applied to the flange edge by dot peen or die stamp methods with the following minimum information:

- Manufacturer name or trademark
- Designation (ASTM B 16.5)
- Rating pressure or class

APPENDIX 3-DIMENSIONS OF DOUBLE HUB FLANGES (only for Informative)

Double Hub Welding Neck Raised Face Flanges Class 150

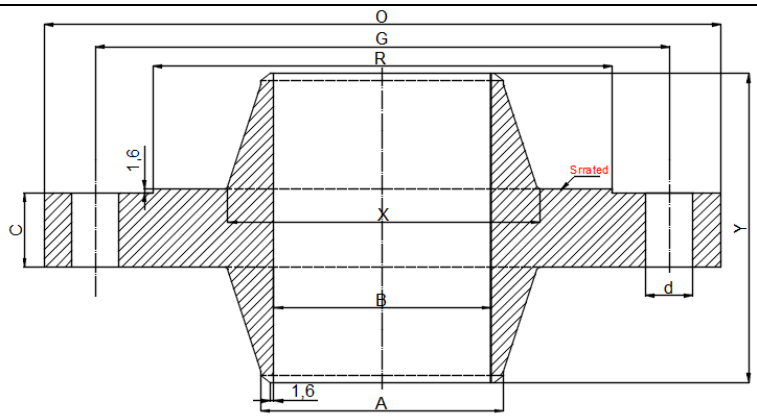


NPS 2" to 12" ASME / ANSI B 16.5

SIZE	O	A	C min	Y	X	R	B*min	Drilling		
NPS	mm	mm	mm	mm	mm	mm	mm	No	G mm	d mm
2	229	60.3	23.9	111.7	78	157.2	49	8	190.5	19
4	279	114.3	25.4	129.6	135	215.9	100	8	241.3	22.2
6	343	168.3	28.5	155.7	192	269.9	150	8	298.4	22.2
8	406	219.1	30.2	117.2	246	323.8	201	12	362.0	25.4
10	483	273.0	31.8	175.4	303	381.0	252	12	431.8	25.4
12	597	323.9	36.6	201.0	365	469.9	303	16	539.8	28.5

Note (B*) : Size inside table Minimum value based on full opening valve, The employer can order all schedule

Double Hub Welding Neck Raised Face Flanges , Class 300



SIZE	O	A	C min	Y	X	R	B* min	Drilling		
NPS	mm	mm	mm	mm	mm	mm	mm	No	G mm	d mm
2	254	60.3	31.8	127	84	157.2	49	8	200	22.2
4	318	114.3	36.6	145	146	215.9	100	12	269.9	22.2
6	381	168.3	41.1	163.9	206	269.9	150	12	330.2	25.4
8	444	219.1	47.8	187.6	260	323.8	201	16	387.4	28.5
10	584	273	53.8	192.2	320	412.8	252	20	514.4	31.8
12	648	323.9	57.2	215.6	375	469.9	303	20	571.5	35
14	711	355.6	60.5	238.9	425	533.4	334	24	628.6	35
16	775	406.4	63.5	241.1	483	584.2	385	24	685.8	35
20	914	508	69.9	266.9	587	692.2	487	24	812.8	41.1
24	1092	610	91.9	288.1	701	857.2	589	28	996.9	47.7

Note (B*) : Size inside table Minimum value based on full opening valve, The employer can order all schedule