



ARMKO PIPE FITTINGS (I) PVT. LTD.

SPLIT HOT TAPPING TEE



www.armkopipefittings.com

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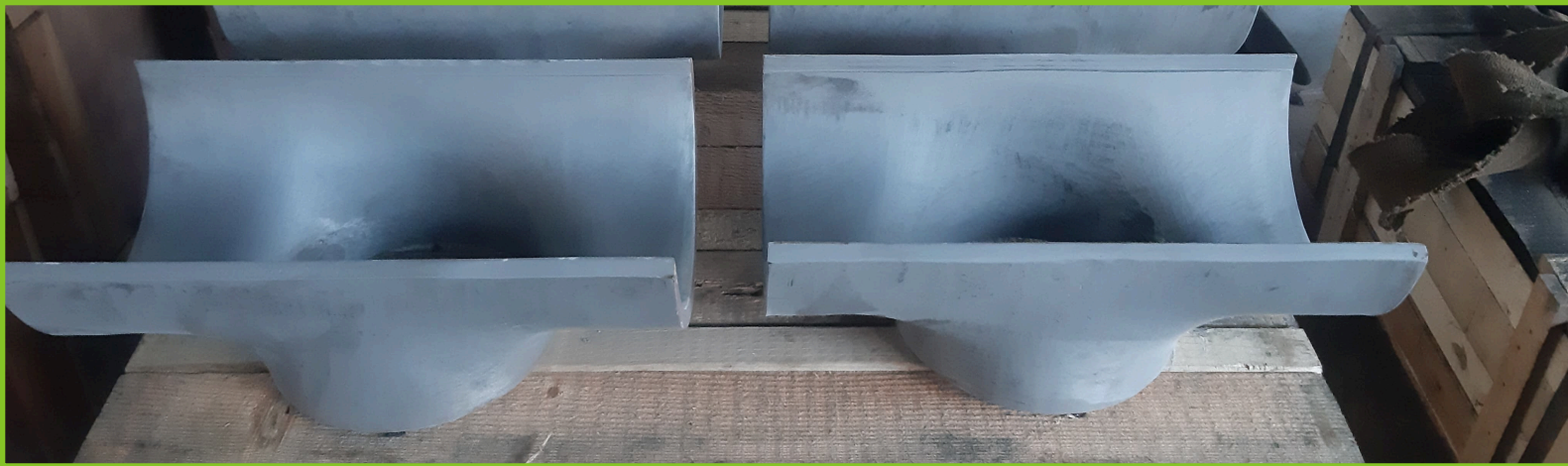


1. About Us.

Introduction

Armko Pipe Fittings (I) Pvt. Ltd is a Leading Manufacturer of piping products for the Oil, Gas, Petrochemical and Nuclear Industries. Armko is the Manufacturer of Split Tee, Butt-weld Fittings, Forged Fittings, Compression Fittings, Outlets, Flanges & Long Radius Bends in Materials like Stainless Steel, Carbon Steel, Alloy Steel, Duplex & Super Duplex Steel, Nickel Alloys etc. We also manufacture and supply non-standard items in any material to customer's specifications.

We are committed to serve your Organization's Sourcing Needs of the above Products with our Quality Products as well as our Service, which is further Strengthened by our well established in-house infrastructure Capabilities and Capacities plus comprehensive stock of raw material and finished products. We are growing organization having strong work force of skilled, experienced and qualified employees.



2. Scope

This document outlines the specifications, materials, design, manufacturing, testing, and installation requirements for Hot Tapping Split Tees used in pipeline systems. The split tee assemblies enable live pipeline operations, allowing modifications or connections to be performed without system shutdown.

3. References

The selection of material and equipment, and the design, construction, maintenance, and repair of equipment and facilities covered by this standard shall comply with the latest edition of the references listed below, unless otherwise noted.

3.1 Normative References

American Petroleum Institute

API SPEC 5L: 2012 "Specification for Line Pipe"

API 1104:2013 "Welding of Pipelines and Related Facilities"

American Society of Mechanical Engineers

ASME B16.5: 2013 "Steel Pipe Flanges and Flanged Fittings"

ASME B16.9: 2007 "Factory-Made Wrought Butt Welding Fittings"

ASME B16.47:2006 "Large Diameter Flanges"

ASME B31.4:2012 "Liquid Petroleum Transportation Piping Systems"

ASME B31.8:2012 "Gas Transmission and Distribution Piping Systems"

ASME B36.10:2004 "Welded and Seamless Wrought Steel Pipe"

ASME Sec II: 2010 "Materials"

ASME Sec V: 2013 "Nondestructive Examination"

ASME Sec VIII 2013 "Rules for Construction of Pressure Vessels"

ASME Sec IX: 2013 "Welding and Brazing Qualification"

American Society for Testing and Materials

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 193: 2012 "Standard Specification for Alloy-Steel and Stainless Steel Bolting for High Temperature or High Pressure Service or both"

ASTM A 194 : 2012 "Standard Specification for Carbon and Alloy Steel Nuts for Bolts for High Pressure or High Temperature or both"

ASTM A 216: 2012 "Specification for Steel Castings"

ASTM A 234 :2011 "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 537:2006 "Specification for Pressure Vessel Plates, Heat-Treated Carbon-Manganese-Silicon Steel"

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

ASTM A 694:2003 "Specification for Forgings, Carbon Steel and Alloy Steel"

ASTM A 860:2000 "Standard Specification for Wrought High-Strength Low-Alloy Steel Butt-Welding Fittings"

ASTM E 92:2000 "Standard Test Method for Vickers Hardness"

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

Manufacturers Standardization Society

MSS SP-44:2001 "Steel Pipeline Flanges"

MSS SP-75:2008 "Specification for High Test Wrought Butt-Welding Fittings"

American Welding Society

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"

4. Terms And Definitions

DFT (Dry Film Thickness)

The thickness of a coating remaining on the surface when the coating has hardened

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 producing the desired shape, dimensions and properties

5. Design

4.1 General

Split tee in general shall appropriately comply with requirements of ASME B16.9 or MSS-SP 75) for any specification not specified in this IGS.

4.1.1 Mechanical calculation of split tee shall be done according to ASME B31.8 (Gas Services) Appendix F or ASME B31.4 (Liquid services) Chapter II with design factor 0.5.

4.1.2 The top half and bottom half of the split tee shall have a longitudinal bevel as figure 2.

4.1.3 Backing strips for the field longitudinal welds shall be supplied. The strips shall be weldable carbon steel with 1.5 mm thickness 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.

4.1.4 Flanges used for branch connection or stopple fittings shall be standard welding neck meeting the requirements of the bolting and seating area (raised faced, serrated finished) of ASME B16.5 for up to 24" or ASME B16.47 (Series A) / MSS SP44 for greater sizes or standard drawings specified in the purchase order.

4.1.5 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.

4.1.6 The circumferential fillet welded of ends to the pipeline shall be in accordance with ASME B31.8, Figure I-3.1.

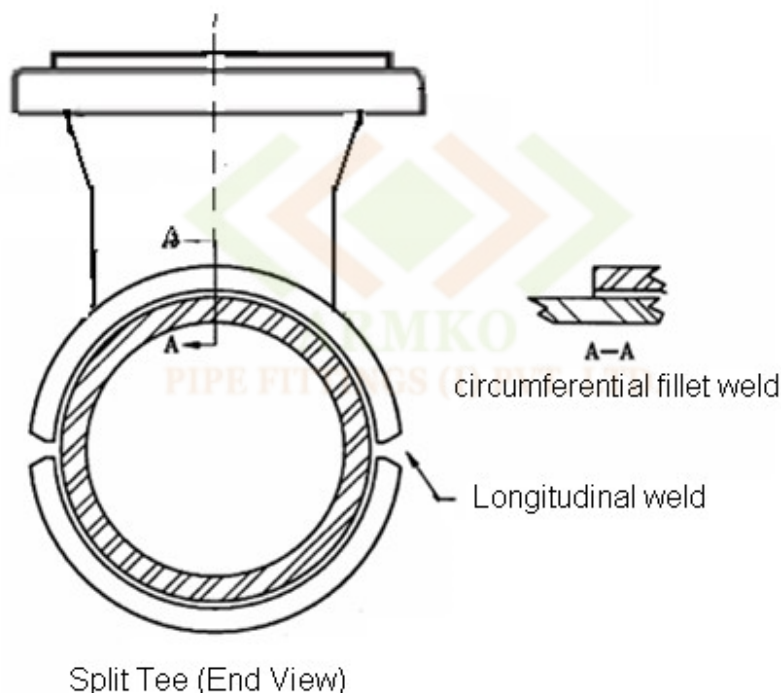


Figure1- Fit-up of Full Circumferential split Tee

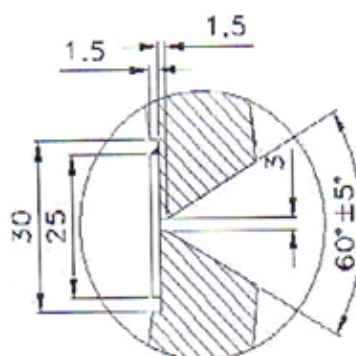


Figure 2- Longitudinal Weld (Dimensions are in mm)

4.1.7 Guide bar and Lock-o-Ring flange should be devised for pipeline requiring pigging when branch size is larger or equal to one half of run pipe diameter.

4.1. 8 Split Tee with Extruded Branch or Welded Branch

Split tee with branch size of 75% of the run size or greater, shall be extruded type. Other sizes shall be welded type or extruded as per end user purchaser order.

The wall thickness of extruded type split tees shall be determined in accordance with the requirements of ASME B31.4 Paragraph 404.3. 3 or ASME B31.8, Paragraph 831. 6.

Weld type split tee shall fully comply with requirements of ASME B31.4 Paragraph 404.3.4 or ASME B31.8 Paragraph 831.4, It shall have all required reinforcements integrated in branch and run pipe (only two pieces).



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6. Material

5.1 General

5.1.1 The material shall be one of the below list as specified in the purchase order. Split tee materials of lower yield strength may be used with the same material group (clause 5.4.2.2 of API 1104) but nominal wall thickness shall not exceed 1.5 times the run pipe thickness or 38 mm whichever is less.

5.2 Grade B or X 42 Pipelines

5.2.1 Materials shall conform to the requirements of ASTM A234/ASTM A234M Grade WPB.

5.2.2 Supplementary requirements S3 shall be included but the carbon equivalent (CE) shall not exceed 0.42% when calculated according to the formula:

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

5.3 Grade X42 through X80 Pipelines

5.3.1 With the exception of the chemical composition requirements in Paragraph 5.3.2 and impact testing requirements in Paragraph 5.3.3 below, the material shall conform to the requirements of MSS SP-75, with supplementary requirements SR-4(for hardness only) and SR-5.(Actual Yield Strength Limitation).

5.3.2 Chemical composition, including carbon equivalent, shall be in accordance with the following table:

Table 1- Chemical Composition Requirement of Grade X42 through X70 Fittings

Chemical Requirements Composition Weight % Product Analysis	
Carbon (C)	0.20
Manganese (Mn)	1.00-1.45
Phosphorus(P)	0.030
Sulfur (S)	0.010
Silicon (Si)	0.15-0.40 c
Nickel (Ni)	0.50 d
Chromium (Cr)	0.30 d
Molybdenum (Mo)	0.25 d
Copper (Cu)	0.35 d
Titanium (Ti)	0.05
Vanadium (V)	0.10e
Columbium (Cb)	0.04e
Aluminum (Al)	0.06
<p>NOTES:</p> <p>a) All values are maximum unless a range is stated.</p> <p>b) The carbon equivalent, as calculated by the formula .5.2.2, shall not exceed 0.42 %.</p> <p>c) If vacuum carbon de-oxidation is used, silicon shall not exceed 0.10 % by heat analysis and 0.12 % by product analysis.</p> <p>d) The sum of Ni + Cr + Mo + Cu shall not exceed 1.0%.</p> <p>e) The sum of V + Cb shall not exceed 0.12%.</p>	

5.3.3 Charpy V- Notch Impact Test

- a) Impact testing is required for all sizes and grades.
- b) The impact tests method shall be conducted -10 C° 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.

5.4 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.

5.5 Materials used for fittings shall be as follow:

- a) Plates: ASTM A 516N (all grades)
- b) Pipe: ASTM A 106 or API SPEC 5L, PSL2 (seamless only).
- c) Forge: ASTM A 105N or ASTM A 694 (F42 through F 70)

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

5.7 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.

7. Fabrication

6.1 Welding

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

6.1.2 All welders shall be qualified in accordance with ASME Sec IX, including tack welders.

6.1.3 Processes

The following processes are approved for use:

- 6.1.3.1 Shielded Metal Arc Welding (SMAW)
- 6.1.3.2 Gas Tungsten Arc Welding (GTAW)
- 6.1.3.3 Submerged Arc Welding (SAW)
- 6.1.3.4 Gas Metal Arc Welding (GMAW) - Short circuiting transfer shall not be used.
- 6.1.3.5 Flux Cored Arc Welding (FCAW) - Shall not be used for the root pass on single sided welds

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

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).

Active submerged arc welding fluxes shall not be used.

6.1.6 Hardness testing conducted in accordance with ASTM E92. Hardness of base metal, weld metal and HAZ shall not exceed 250 HV10 .

6.2 Extruded split tees and full encirclement saddles shall have the outlet hot extruded.

6.3 Split tees with branch welded

Split tees with branch welded to run shall have full penetration welds as indicated in ASME B31.8, Appendix I Figure I-1 and I-2.

6.4 Heat Treatment

6.4.1 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.

6.4.2 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

6.4.3 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/manufacture)

6.4.4 Hot formed high strength fittings shall be cooled below the lower critical temperature prior to heat treatment.

8. Dimensions

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

8.1 Minimum inside diameter of branch outlet "B" shall be in accordance with the table 1 of API 6D. For line stopping, it may be restricted as Table 3:

Table 3-Minimum inside Diameter of outlet

NPS	B(inch)	NPS	B (inch)
4	4-1/16	24	23-1/4
6	6-1/16	30	29-1/4
8	8	36	35-1/4
10	10	40	39
12	12	42	41
16	15-1/4	48	47-1/8
20	19-1/4	56	55-1/8

9. Tolerances

9.1 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

9.2 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.

9.3 inside diameter of branch bore shall have tolerances - 0, +1.6 mm of specified nominal ID.

9.4 Wall thickness shall have tolerances $\pm 12.5\%$ of specified thickness (if considered tolerances in thickness design) or - 0, +12.5% of specified thickness (if do not considered in thickness design).

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

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

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

9.8 The flange face shall be perpendicular to branch bore with angular tolerance of ± 0.50 .

10. INSPECTIONS AND TESTING

10.1 General

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

10.2 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

10.3 Non-Destructive Examination

10.3.1 The plate to be used for the fabrication of high yield strength fittings which have a specified minimum yield strength of 359 MPa (52 000 psi) and higher shall be ultrasonically tested for laminations in accordance with ASTM A 578, acceptance level "C".

10.3.2 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".

10.3.3 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.

10.3.4 All other full penetration groove welds which 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.

10.3.5 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.

10.4.6 All forgings shall be wet magnetic particle examined on 100% of the forged surfaces. Method and acceptance shall comply with MSS-SP-53.

10.4 Hydrostatic Tests

10.4.1 All fittings shall be hydrostatic tested after fabrication and heat treatment by 1.5 times of its design pressure with design factor of 0.5 for one hour.

10.4.2 The Lock-O-Ring plug shall be hydrostatic tested to 1.5 times the design pressure from the underside (header side) of the plug. No leakage of the O-ring seals is allowed.

10.5 Production Hardness Tests

The hardness tests shall be conducted on all fittings and:

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

10.5.2 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 cases, 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.

10.5.4 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.

10.6 Production Tensile Test

A 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.

10.7. Impact Test

Charpy impact test should be conducted as per 5.3.3 of this standard specification.

10.8 Test Certificates

10.8.1. Manufacturer shall submit following certificates to purchaser's representative:

10.8.1.1. 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.

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

10.8.1.3 Hydrostatic tests certificate

10.7.1.4 Test reports on heat treatment carried out.

11. SURFACE PREPARATION AND COATING



The fittings shall be sandblasted internally and externally according to standard SA 2 ½ and coated with two layer red lead epoxy or equivalent with min DFT25micron internally and externally.

12. MARKING

12.1 Marking shall be in accordance with MSS-SP-25. In addition, each fittings 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.

12.2 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

12.3 The top and bottom halves of each fitting shall be low stress die-stamped or dot-peen marked with manufacturer name, sizes, rating and serial No.

13. DOCUMENTATION

13.1 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

13.2 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

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

14. PACKING

Each fitting shall be suitably protected to avoid damage during transport. Metallic or high impact plastic bevel protectors shall be provided for weld ends



15. DATA SHEET

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

Hot tapping tee Data Sheet			
Element	requirement as per this standard specification		Manufactures' comment
DESIGN DATA			
Size(Run× Branch) a			
Quantity a			
Design Code b			
Medium	Natural Gas		
Branch Type	Extruded		
	Welded		
Design pressure a			
Design temperature(°C)	-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	
Guide bar	Yes	No	
Guide bar holder type a			

Hydro Test Pressure(kg/cm ²) c		
Pipeline Details(on which hot	Outside Diameter(inch):	
taping is to be conducted) a	Thickness(mm):	
	Material:	
Connecting Branch Pipeline Detailsa	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 c			
Guide bar Assembly c			
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.			

