N PIPING SYSTEMS PVT LTD
TOTAL PIPING SOLUTIONS
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SPLIT HOT TAPPING TEE

TECHNICAL SPECIFICATION & PRODUCT CATALOG — Full Encirclement Split Fittings for Live Pipeline Interventions & Branch Connections



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1. ABOUT US

N PIPING SYSTEMS PRIVATE LIMITED is a leading global manufacturer and exporter of high-integrity piping products tailored for critical applications in the Oil & Gas, Petrochemical, Offshore, Power Generation, and Nuclear Industries.

Our product range encompasses a comprehensive suite of engineered piping components manufactured to stringent international codes and customer project specifications:

- **Full Encirclement Split Tees:** Standard and customized Split Hot Tapping Tees and Stopple Tees for live pipeline branch connections.
- **Butt-Weld Fittings:** Seamless and Welded Elbows, Equal/Reducing Tees, Concentric/Eccentric Reducers, Caps, and Crosses.

- **Forged Fittings & Flanges:** High-pressure Socket Weld / Threaded Fittings, Outlets (Weldolets, Sockolets, Threadolets), Weld Neck, Slip-On, Blind, and Spectacle Flanges.
- **Compression Fittings & Spools:** Precision compression fittings and custom pre-fabricated piping spools.
- **Material Capabilities:** Carbon Steel, High-Yield Low Alloy Steel (X42 to X80), Stainless Steel, Duplex & Super Duplex Steel, Nickel Alloys (Inconel, Monel, Hastelloy), and Titanium.

INFRASTRUCTURE & QUALITY

Our advanced manufacturing facilities are equipped with state-of-the-art hydraulic forming presses, heavy-duty lathe machining centers, automated welding stations, and calibrated heat treatment furnaces. Supported by EIL & IBR approvals and an ISO 9001:2015 quality management system, N PIPING SYSTEMS guarantees total reliability.

2. SCOPE

This technical specification outlines the design, material selection, fabrication, non-destructive examination (NDE), hydrostatic testing, surface preparation, marking, and packaging requirements for Hot Tapping Split Tees manufactured by N PIPING SYSTEMS PVT LTD.

Hot Tapping Split Tee assemblies are specialized full-encirclement pressure-containing fittings designed to enable live pipeline tapping, modifications, or branch connection tie-ins without interrupting system flow, shutting down line pressure, or causing environmental product discharge.

3. REFERENCES

The design, materials, construction, testing, and inspection of Hot Tapping Split Tees shall strictly comply with the latest editions of the normative standards listed below:

Standard Code	Organization	Title / Specification Description
API SPEC 5L: 2012	American Petroleum Institute	Specification for Line Pipe
API 1104: 2013	American Petroleum Institute	Welding of Pipelines and Related Facilities
ASME B16.5: 2013	ASME	Steel Pipe Flanges and Flanged Fittings (NPS 1/2 through NPS 24)
ASME B16.9: 2007	ASME	Factory-Made Wrought Butt Welding Fittings
ASME B16.47: 2006	ASME	Large Diameter Steel Flanges (NPS 26 through NPS 60)
ASME B31.4: 2012	ASME	Pipeline Transportation Systems for Liquids and Slurries
ASME B31.8: 2012	ASME	Gas Transmission and Distribution Piping Systems
ASME B36.10: 2004	ASME	Welded and Seamless Wrought Steel Pipe
ASME Sec II: 2010	ASME	Materials (Part C - Welding Rods, Electrodes, and Filler Metals)
ASME Sec V: 2013	ASME	Nondestructive Examination
ASME Sec VIII: 2013	ASME	Rules for Construction of Pressure Vessels (Division 1)
ASME Sec IX: 2013	ASME	Welding, Brazing, and Fusing Qualifications
ASTM A 105: 2012	ASTM	Specification for Carbon Steel Forgings for Piping Applications
ASTM A 106: 2011	ASTM	Seamless Carbon Steel Pipe for High-Temperature Service
ASTM A 193 / A 194	ASTM	Alloy-Steel / Stainless Steel Bolting and Nuts for High Pressure
ASTM A 216: 2012	ASTM	Steel Castings, Carbon, Suitable for Fusion Welding
ASTM A 234: 2011	ASTM	Piping Fittings of Wrought Carbon Steel and Alloy Steel
ASTM A 350: 2012	ASTM	Carbon and Low Alloy Steel Forging Requiring Notch Toughness
ASTM A 370: 2012	ASTM	Standard Test Methods and Definitions for Mechanical Testing
ASTM A 516: 2004	ASTM	Pressure Vessel Plates, Carbon Steel, Moderate & Lower Temp
ASTM A 537: 2006	ASTM	Pressure Vessel Plates, Heat-Treated, Carbon-Manganese-Silicon
ASTM A 578: 2007	ASTM	Straight-Beam Ultrasonic Examination of Plain and Clad Plates
ASTM A 694: 2003	ASTM	Carbon and Alloy Steel Forgings for Pipe Flanges & Fittings
ASTM A 860: 2000	ASTM	Wrought High-Strength Low-Alloy Steel Butt-Welding Fittings
ASTM E 92 / E 165	ASTM	Vickers Hardness Testing / Liquid Penetrant Examination
MSS SP-44: 2001	MSS	Steel Pipeline Flanges
MSS SP-75: 2008	MSS	Specification for High Test Wrought Butt-Welding Fittings
AWS A5.1 / A5.5	American Welding Society	Carbon Steel & Low-Alloy Steel Electrodes for SMAW

4. TERMS AND DEFINITIONS

Term	Full Title	Technical Definition
DFT	Dry Film Thickness	The thickness of a protective coating remaining on the substrate surface after the liquid coating has completely cured and hardened.
NPS	Nominal Pipe Size	A North American standard set of designations for pipe sizes used for high or low pressures and temperatures (in inches).
PSL	Product Specification Level	Quality specification level established by API Spec 5L (e.g., PSL 1 vs PSL 2 containing stricter chemical and mechanical limits).
SAWL	Submerged Arc Welded Longitudinal	Tubular product having one longitudinal straight seam produced by an automatic double submerged-arc welding process.
SMLS	Seamless Pipe	Wrought tubular product produced without a weld seam via hot forming, followed by cold finishing or sizing to exact dimensions.

5. DESIGN REQUIREMENTS

5.1 General Construction

Split tees shall generally comply with the design and dimensional requirements of ASME B16.9 or MSS SP-75 for any specific parameter not explicitly specified herein.

5.1.1 Mechanical Calculations: Structural and pressure containment calculations shall be performed in strict accordance with ASME B31.8 Appendix F (for Gas Transmission) or ASME B31.4 Chapter II (for Liquid Transportation) using a design factor of $F = 0.50$.

5.1.2 Longitudinal Bevel Geometry: The top half and bottom half of the split tee sleeve shall be precision-machined with longitudinal weld preparation bevels ($60° \pm 5°$ bevel angle with $1.5\ mm$ land).

5.1.3 Backing Strips: Backing strips for field longitudinal seam welding shall be provided with each fitting. Backing strips shall be weldable carbon steel with a thickness of 1.5 mm and a width of approximately 25 mm, matching the total run length. Matching recessed grooves shall be precision-machined into each sleeve half, and backing strips shall be tack welded to the top half.

5.1.4 Branch Flanges: Flanges attached to the branch outlet (or stopple fittings) shall be standard Welding Neck flanges meeting ASME B16.5 (for sizes up to 24") or ASME B16.47 Series A / MSS SP-44 (for sizes > 24"). Flange faces shall be Raised Face (RF) with a smooth serrated finish.

5.1.5 Lifting Lugs & Serialization: Heavy-duty lifting lugs shall be welded on both sides of the bottom half for fitting sizes 10 inches and larger. Top and bottom halves of each split tee shall be serialized with individual matching identification numbers to ensure perfect alignment during field fit-up.

5.1.6 End Fillet Welds: Circumferential fillet welding of split sleeve ends to the run pipeline shall comply with ASME B31.8 Figure I-3.1.

5.1.7 Piggable Pipeline Devices: Guide bars and Lock-O-Ring (LOR) flanges shall be incorporated for pipelines requiring pigging operations whenever the branch outlet diameter is equal to or greater than 50% of the run pipe diameter.

5.1.8 Extruded vs. Welded Branch Construction: Split tees with branch outlet diameter equal to or greater than 75% of the run pipe size shall be of the EXTRUDED branch type. Smaller branch sizes may be Welded or Extruded type as specified in the Purchase Order.

BRANCH INTEGRITY

Extruded split tee wall thickness is determined per ASME B31.4 (Para 404.3.3) or ASME B31.8 (Para 831.6). Welded branch split tees must fully comply with ASME B31.4 (Para 404.3.4) or ASME B31.8 (Para 831.4), with all required pressure reinforcement fully integrated into the branch and run sleeve body (two-piece assembly).

6. MATERIAL SPECIFICATIONS

6.1 Material Selection & Carbon Equivalent

Materials shall be supplied as specified in the Purchase Order. Split tee materials of lower yield strength relative to the line pipe may be used provided they belong to the same material group (Clause 5.4.2.2 of API 1104) and nominal wall thickness does not exceed 1.5 times the run pipe thickness or 38 mm (whichever is less).

Grade B or X42 Pipelines: Materials shall conform to ASTM A234 Grade WPB with Supplementary Requirement S3. The Carbon Equivalent (CE) shall not exceed 0.42% calculated via the IIW formula:

$$CE\ (IIW) = C + (Mn / 6) + (Cr + Mo + V) / 5 + (Ni + Cu) / 15 \leq 0.42\ \%$$

6.2 High-Strength Pipeline Materials (Grade X42 through X80)

High-strength split tees shall comply with MSS SP-75 with supplementary requirements SR-4 (Hardness limitation) and SR-5 (Actual Yield Strength limitation). Chemical composition limits on product analysis are detailed in Table 1 below:

Table 1: Chemical Composition Limits (% Max / Range)

Chemical Element	Symbol	Product Analysis Weight %
Carbon	C	0.20 % max
Manganese	Mn	1.00 – 1.45 %
Phosphorus	P	0.030 % max
Sulfur	S	0.010 % max
Silicon	Si	0.15 – 0.40 % (Vacuum Carbon Deoxidized ≤ 0.12%)
Nickel	Ni	0.50 % max
Chromium	Cr	0.30 % max
Molybdenum	Mo	0.25 % max
Copper	Cu	0.35 % max
Titanium	Ti	0.05 % max
Vanadium	V	0.10 % max
Columbium (Niobium)	Cb	0.04 % max
Aluminum	Al	0.06 % max

Notes on Chemistry: 1) Sum of Ni + Cr + Mo + Cu shall not exceed 1.0%. 2) Sum of V + Cb shall not exceed 0.12%. 3) Carbon Equivalent CE(IIW) ≤ 0.42%.

6.3 Mechanical Impact Testing & Material Product Forms

Charpy V-Notch Impact Testing: Conducted at -10°C in accordance with ASTM A370 for all sizes and grades. Average energy of 3 transverse specimens shall be ≥ 50 Joules, with no single specimen lower than 45 Joules.

- **Plates:** ASTM A 516 Grade 60 / 65 / 70 Normalized (A 516N) for all plate-formed split tees.
- **Seamless Pipe:** ASTM A 106 Grade B/C or API SPEC 5L PSL2 (Seamless SMLS only).
- **Forgings:** ASTM A 105N or ASTM A 694 (Grades F42, F52, F60, F65, F70).
- **O-Rings:** Molded elastomeric O-rings supplied for LOR plugs. Spliced cord joints are strictly prohibited.

7. FABRICATION & WELDING

All welding procedures (WPS) and procedure qualification records (PQR) shall be documented in English and qualified in accordance with ASME Section IX. Welders and welding operators shall be qualified per ASME Section IX.

- **Approved Welding Processes:** Shielded Metal Arc Welding (SMAW), Gas Tungsten Arc Welding (GTAW), Submerged Arc Welding (SAW), and Gas Metal Arc Welding (GMAW - short circuiting transfer mode prohibited).
- **FCAW Prohibition:** Flux Cored Arc Welding (FCAW) shall not be used for root passes on single-sided welds.
- **Filler Metals:** Electrodes and filler wires shall conform to ASME Sec II Part C (AWS A5.XX series). Active SAW fluxes are prohibited.
- **Hardness Limitation:** Vickers hardness testing per ASTM E92 shall not exceed 250 HV10 in base metal, weld metal, and HAZ.

7.1 Heat Treatment Matrix

All split tee fittings shall undergo full post-forming heat treatment prior to final machining and non-destructive testing as outlined in Table 2:

Table 2: Heat Treatment Requirements

Fitting Construction Type	Mandatory Heat Treatment Process
Extruded Branch Split Tee	Normalize, Normalize & Temper, or Quench & Temper
Welded Branch Split Tee	Post-Weld Heat Treatment (PWHT) / Stress Relieving
Flange-to-Tee Attachment Weld	PWHT if required by governing code or sour service specification

8. DIMENSIONS & SIZING

Fitting dimensions shall be established by N PIPING SYSTEMS and submitted for end-user approval. Table 3 specifies the minimum inside diameter of branch outlet bore 'B' for line stopping operations in accordance with API 6D / standard hot tapping machine cutter clearances:

Table 3: Standard Branch Outlet Bore Dimensions

Nominal Pipe Size (NPS)	Min Outlet Bore B (Inches)	Min Outlet Bore B (mm)
4"	4-1/16"	103.2 mm
6"	6-1/16"	154.0 mm
8"	8.00"	203.2 mm
10"	10.00"	254.0 mm
12"	12.00"	304.8 mm
16"	15-1/4"	387.4 mm
20"	19-1/4"	489.0 mm
24"	23-1/4"	590.6 mm
30"	29-1/4"	743.0 mm
36"	35-1/4"	895.4 mm
40"	39.00"	990.6 mm
42"	41.00"	1041.4 mm
48"	47-1/8"	1197.0 mm
56"	55-1/8"	1400.2 mm

9. MANUFACTURING TOLERANCES

- **Sleeve Inside Radius Gap:** Gap between fitting inside radius and nominal run pipe outside radius: Max 3.2 mm for NPS ≤ 24"; Max 6.4 mm for NPS ≥ 30".
- **Longitudinal Seam Root Gap:** 3.2 mm to 8.0 mm when fitted onto nominal run pipe.
- **Branch Outlet Inside Diameter:** Tolerances of - 0 mm, + 1.6 mm of specified nominal ID.
- **Wall Thickness Tolerance:** + 12.5% / - 0% of specified nominal thickness.
- **Overall Sleeve Length:** ± 10 mm of specified drawing length.
- **Center Run to Top Flange Face:** ± 6.0 mm of specified dimension.
- **Centerline Offset:** Maximum 1.6 mm offset between branch centerline and run centerline.
- **Flange Face Perpendicularity:** Angular tolerance within ± 0.5° relative to branch axis.

10. INSPECTION AND TESTING

N PIPING SYSTEMS executes exhaustive quality control testing prior to dispatch:

10.1 Visual & Dimensional Inspection: 100% visual examination per ASME Sec V Article 9. Base metal welding repairs are strictly prohibited. Weld repairs require written purchaser consent.

10.2 Plate Ultrasonic Testing (UT): 100% UT lamination check per ASTM A578 Level C for high-yield plates (SMYS ≥ 359 MPa / 52,000 psi).

10.3 Extruded & Weld Seam NDE: 100% UT lamination examination on extruded neck zones and branch-to-run welds. 100% Radiographic Testing (RT) per ASME Sec VIII Div 1 UW-51 on all butt welds. Non-radiographed groove welds subjected to 100% UT or MT per ASME Sec VIII App 12 / App 6.

10.4 Bevel NDE: Field weld bevels 100% UT or MT examined for laminations across 50 mm end distance.

10.5 Forgings Examination: 100% Wet Magnetic Particle Examination (MT) per MSS SP-53.

10.6 Hydrostatic Testing: Every fabricated tee is hydrostatically pressure tested to 1.5 times Design Pressure for a minimum duration of 1 hour with a design factor of 0.5. Lock-O-Ring plugs tested to 1.5x design pressure from header side with zero O-ring leakage.

10.7 Hardness Production Testing: Minimum 3 hardness indentations on base metal and 3 along weld seams per ASTM E92 (Max limit 250 HV10).

11. SURFACE PREPARATION & COATING

All internal and external surfaces of split tees shall be abrasive sandblasted to SA 2.5 cleanliness standard in accordance with ISO 8501-1. Following surface cleaning, fittings are coated with two coats of red lead primer / epoxy coating providing a minimum Dry Film Thickness (DFT) of 25 microns internally and externally.

12. MARKING & IDENTIFICATION

Marking shall be executed in full compliance with MSS SP-25. A 50 mm wide painted color band is applied around top and bottom sleeve halves at one end to facilitate exact matching during field fit-up.

Top and bottom halves are low-stress die-stamped or dot-peen marked with: Manufacturer Name, Nominal Size (D x d), Run and Branch Thickness (T x t), Material Grade, Flange Rating, Design Pressure (psig), and Unique Heat / Serial Number.

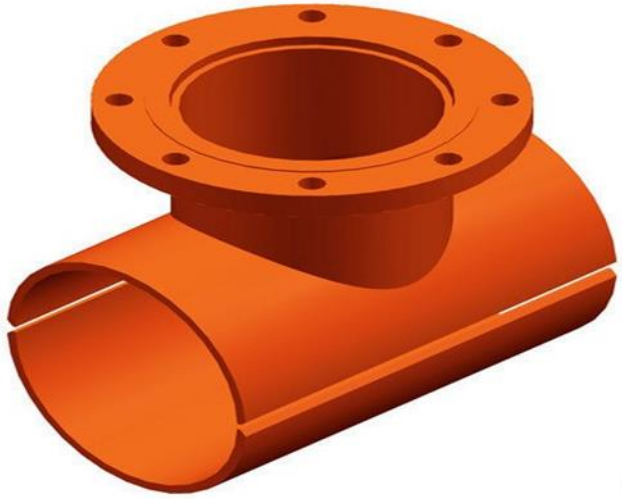
13. DOCUMENTATION & QUALITY DOSSIER

N PIPING SYSTEMS provides complete QA/QC documentation compiled into 3 bound final dossiers in English:

- **Pre-Fabrication Submittals:** Manufacturing Process Specification (MPS), Inspection and Test Plan (ITP), Mechanical Calculations, Fabrication Drawings, WPS, PQR, and WQT records.
- **Post-Fabrication Dossier:** Certified Material Test Reports (MTR/MTC), Visual & Dimensional Inspection Reports, NDE Reports (RT, UT, MT, PT), Heat Treatment Charts & Graphs, Hardness Test Reports, Hydrostatic Test Certificate, Coating Inspection Report, and Final Release Note.

14. PACKAGING & TRANSPORT PROTECTION

Each Hot Tapping Split Tee assembly is packaged inside heavy-duty, seaworthy wooden crates with internal timber bracing to prevent shifting during transit. Metallic or high-impact plastic bevel protectors are securely fitted to all pipe weld ends and flange faces.







15. HOT TAPPING TEE INQUIRY DATA SHEET

The following data sheet shall be completed by the purchaser / engineering consultant and attached to technical inquiries:

Design Parameter / Item	Standard Requirement / Range	Purchaser / Vendor Data
Size (Run x Branch)	As per PO Specification	e.g., 24" x 20"
Quantity	As required	_____Pcs
Design Code	ASME B31.4 / B31.8 / ASME VIII	ASME B31.8
Medium / Fluid Service	Natural Gas / Crude Oil / Refined	Natural Gas
Branch Construction Type	Extruded (≥75%) / Welded	Extruded Type
Design Pressure	As per line rating	_____psig / bar
Design Temperature	-29°C to +60°C (or custom)	-29°C to +60°C
Design Factor (F)	0.50 Design Factor	0.50
Flange Standard & Rating	ASME B16.5 / B16.47 / MSS SP-44	Class 600 RF
Flange Facing & Finish	Raised Face (RF) Serrated Finish	Serrated Finish
Lock-O-Ring (LOR) Flange	Yes / No (per pigging spec)	Yes [ ] No [ ]
Guide Bar Assembly	Yes / No (if Branch ≥ 50% Run)	Yes [ ] No [ ]
Hydro Test Pressure	1.5 x Design Pressure	_____kg/cm²
Run Pipeline Details	Outside Diameter / Thickness / Grade	OD: _____Thk: _____Grade: _____
Branch Pipeline Details	Outside Diameter / Thickness / Grade	OD: _____Thk: _____Grade: _____
Top Half Sleeve Material	ASTM A516N / ASTM A106 / A234	_____
Bottom Half Sleeve Material	ASTM A516N / ASTM A106 / A234	_____
Branch Material	ASTM A106 / A516N / Forged	_____
Flange / LOR Flange Material	ASTM A105N / ASTM A694 (F42-F70)	_____
O-Ring Material	Molded Elastomer (Nitrile / Viton)	Nitrile / Viton