



GAIL INDIA LIMITED

**ARC INVENTORY CREATION PROJECT FOR LAST MILE
CONNECTIVITY**

**VOLUME II OF II (TECHNICAL)
BID DOCUMENT FOR PROCUREMENT OF FLANGES AND FITTINGS
(BID DOCUMENT NO - 034/LEPL/GAIL/11-R0)
E-TENDER REF: 8000015478
OPEN DOMESTIC COMPETITIVE BIDDING**



Lyons Engineering Pvt. Ltd.



GAIL INDIA LIMITED

SUPPLY OF CS FITTINGS & FLANGES FOR GAIL ARC - INVENTORY CREATION FOR LAST MILE CONNECTIVITY PROJECT

Rev	Date	Purpose	Prepared By	Checked By	Approved By
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1.0 INTRODUCTION

GAIL India limited intend to create an inventory of fittings and flanges for last mile connectivity for 02 (two) years annual rate contract.

Lyon Engineering Pvt. Ltd. (LEPL) is now inviting tenders on open domestic competitive bidding basis for procurement of “CS fittings and flanges” for this project.

The present document covers the technical specifications for this procurement enquiry. It forms an integral part and is to be read in conjunction with ‘Volume I of II’ Commercial.

2.0 TECHNICAL SPECIFICATIONS

The technical specifications for this present tender enquiry are as listed in material Requisition (No. GAIL-034-PL-MR-01A)

GAIL (INDIA) LTD.
ANNUAL RATE CONTRACT
MATERIAL REQUISITION (MR)
CS FITTING & FLANGES

DESCRIPTION OF GOODS ADD/OR SERVICES

Item	Qty /Unit	Description	Identification Number
		<u>For size and quantity of fitting and flanges refer Table #1</u>	

TABLE-1

Sr. No.	ITEM	SIZE	SCH/THK	DMNN STD	MATERIAL	DESCRIPTION	UNIT	TOTAL QTY.	REMARK
GROUP- GROUP – A (FLANGES)									
WNRF FLANGE									
1	WNRF FLANGE	12"	600#	ASME B 16.5	ASTM A 105	600# , RF 125 AARH	NOS	50	12" NB x 600# WNRF Flange to match API 5L X70 WT 8.4 mm
2	WNRF FLANGE	10"	600#	ASME B 16.5	ASTM A 105	600# , RF 125 AARH	NOS	30	10" NB x 600# WNRF Flange to match API 5L X60, BE WT 7.8 mm
3	WNRF FLANGE	8"	600#	ASME B 16.5	ASTM A 105	600# , RF 125 AARH	NOS	300	8" NB x 600# WNRF Flange to match API 5L X52 WT 9.53 mm
4	WNRF FLANGE	6"	600#	ASME B 16.5	ASTM A 105	600# , RF 125 AARH	NOS	50	6" NB x 600# WNRF Flange to match API 5L X52 WT 6.4 mm
5	WNRF FLANGE	4"	600#	ASME B 16.5	ASTM A 105	600# , RF 125 AARH	NOS	600	4" NB x 600# WNRF Flange to match API 5L X42 WT 7.1 mm
6	WNRF FLANGE	4"	300#	ASME B 16.5	ASTM A 105	300# , RF 125 AARH	NOS	200	4" NB x 300# WNRF Flange to match API 5L X42 WT 7.1 mm
7	WNRF FLANGE	4"	150#	ASME B 16.5	ASTM A 105	150# , RF 125 AARH	NOS	50	4" NB x 150# WNRF Flange to match API 5L X42 WT 7.1 mm
8	WNRF FLANGE	2"	600#	ASME B 16.5	ASTM A 105	600# , RF 125 AARH	NOS	1200	2" NB x 600# WNRF Flange to match A106 Gr. B, Sch. 80 Seamless Pipe
9	WNRF FLANGE	2"	300#	ASME B 16.5	ASTM A 105	300# , RF 125 AARH	NOS	400	2" NB x 300# WNRF Flange to match A106 Gr. B, Sch. 80 Seamless Pipe

SWRF FLANGE									
10	SWRF FLANGE	1.5"	600#	ASME B 16.5	ASTM A 105	600# , RF 125 AARH	NOS	500	1.5" NB x 600# x SWRF Flange to match 1.5", A106 Gr. B Sch XS Seamless Pipe
11	SWRF FLANGE	1"	600#	ASME B 16.5	ASTM A 105	600# , RF 125 AARH	NOS	500	1" NB x 600# x SWRF Flange to match 1", A106 Gr. B Sch XS Seamless Pipe
12	SWRF FLANGE	3/4"	600#	ASME B 16.5	ASTM A 105	600# , RF 125 AARH	NOS	1200	0.75" NB x 600# x Sch 160 WNRF Flange
BLIND FLANGE									
13	BLIND FLANGE	36"	600#	ASME B 16.47A	ASTM A 105	600# , RF 125 AARH	NOS	15	
14	BLIND FLANGE	30"	600#	ASME B 16.47A	ASTM A 105	600# , RF 125 AARH	NOS	15	
15	BLIND FLANGE	24"	600#	ASME B 16.5	ASTM A 105	600# , RF 125 AARH	NOS	20	
16	BLIND FLANGE	20"	600#	ASME B 16.5	ASTM A 105	600# , RF 125 AARH	NOS	15	
17	BLIND FLANGE	18"	600#	ASME B 16.5	ASTM A 105	600# , RF 125 AARH	NOS	15	
18	BLIND FLANGE	16"	600#	ASME B 16.5	ASTM A 105	600# , RF 125 AARH	NOS	15	
19	BLIND FLANGE	12"	600#	ASME B 16.5	ASTM A 105	600# , RF 125 AARH	NOS	30	
20	BLIND FLANGE	10"	600#	ASME B 16.5	ASTM A 105	600# , RF 125 AARH	NOS	20	
21	BLIND FLANGE	8"	600#	ASME B 16.5	ASTM A 105	600# , RF 125 AARH	NOS	50	
22	BLIND FLANGE	6"	600#	ASME B 16.5	ASTM A 105	600# , RF 125 AARH	NOS	20	
23	BLIND FLANGE	4"	600#	ASME B 16.5	ASTM A 105	600# , RF 125 AARH	NOS	200	
24	BLIND FLANGE	4"	300#	ASME B 16.5	ASTM A 105	300# , RF 125 AARH	NOS	80	
25	BLIND FLANGE	2"	600#	ASME B 16.5	ASTM A 105	600# , RF 125 AARH	NOS	200	

26	BLIND FLANGE	1.5"	600#	ASME B 16.5	ASTM A 105	600# , SWRF 125 AARH	NOS	100	
27	BLIND FLANGE	1"	600#	ASME B 16.5	ASTM A 105	600# , SWRF 125 AARH	NOS	100	
28	BLIND FLANGE	3/4"	600#	ASME B 16.5	ASTM A 105	600# , SWRF 125 AARH	NOS	200	
SPECTACLE BLIND									
29	SPECTACLE BLIND	12"	600#	ASME B 16.48	ASTM A 105	600# , RF 125 AARH	NOS	20	
30	SPECTACLE BLIND	10"	600#	ASME B 16.48	ASTM A 105	600# , RF 125 AARH	NOS	20	
31	SPECTACLE BLIND	8"	600#	ASME B 16.48	ASTM A 105	600# , RF 125 AARH	NOS	30	
32	SPECTACLE BLIND	6"	600#	ASME B 16.48	ASTM A 105	600# , RF 125 AARH	NOS	20	
33	SPECTACLE BLIND	4"	600#	ASME B 16.48	ASTM A 105	600# , RF 125 AARH	NOS	200	
34	SPECTACLE BLIND	4"	300#	ASME B 16.48	ASTM A 105	300# , RF 125 AARH	NOS	60	
35	SPECTACLE BLIND	2"	600#	ASME B 16.48	ASTM A 105	600# , RF 125 AARH	NOS	200	
GROUP- B (CONCENTRIC REDUCER/ELBOW/SOCKOLET/WELDOLET/EQ.TEE/UNEQ.TEE)									
REDUCER (CONCENTRIC)									
36	REDUCER (CONCENTRIC)	36" x 24"	600#	MSS-SP 75	WPHY-80	B.W, ASME B16.25	NOS	20	36" (API 5L X70 WT 11.9 mm) x 24" NB (API 5L X70 15.9 mm)
37	REDUCER (CONCENTRIC)	30" x 24"	600#	MSS-SP 75	WPHY-70	B.W, ASME B16.25	NOS	20	30" (API 5L X70 WT 17.5 mm) x 24" NB (API 5L X70 15.9 mm)
38	REDUCER (CONCENTRIC)	24" x 12"	600#	MSS-SP 75	WPHY-70	B.W, ASME B16.25	NOS	20	24" (X70) (API 5L X70 WT 15.9 mm) x 12" (X60) NB (API 5L X60 10.3 mm)
39	REDUCER (CONCENTRIC)	20" x 12"	600#	MSS-SP 75	WPHY-70	B.W, ASME B16.25	NOS	20	20" (API 5L X70 WT 9.5 mm) x 12" NB (API 5L X60 10.3 mm)
40	REDUCER (CONCENTRIC)	18" x 12"	600#	MSS-SP 75	WPHY-65	B.W, ASME B16.25	NOS	20	18" (X65) (API 5L X65 WT 14.3 mm) x 12" (X60) NB (API 5L X60 10.3 mm)
41	REDUCER (CONCENTRIC)	16" x 12"	600#	MSS-SP 75	WPHY-65	B.W, ASME B16.25	NOS	20	16" (X65) (API 5L X65 WT 12.7 mm) x 12" (X60) NB (API 5L X60 10.3 mm)
42	REDUCER (CONCENTRIC)	12" X 8"	600#	MSS-SP 75	ASTM A 234 GR. WPB	B.W, ASME B16.25	NOS	60	12" (X70) (API 5L X70 WT 8.4 mm) x 8" (X52) NB (API 5L X52 9.53 mm)

43	REDUCER (CONCENTRIC)	10" x 8"	600#	ASME B 16.9	ASTM A 234 GR. WPB	B.W, ASME B16.25	NOS	50	10" (API 5L X60) WT 7.8 mm x 8" (API 5L X52) NB x WT 9.53 mm
44	REDUCER (CONCENTRIC)	8" X 4"	600#	ASME B 16.9	ASTM A 234 GR. WPB	B.W, ASME B16.25	NOS	200	8" (API 5L X52) NB WT 9.53 mm x 4" (API 5L X42) NB WT 7.1 mm
45	REDUCER (CONCENTRIC)	6" x 4"	600#	ASME B 16.9	ASTM A 234 GR. WPB	B.W, ASME B16.25	NOS	50	6" (X52 WT 6.4 mm) X 4" (X42 WT 7.1 mm)
46	REDUCER (CONCENTRIC)	4" X 2"	600#	ASME B 16.9	ASTM A 234 GR. WPB	B.W, ASME B16.25	NOS	300	4" API 5L X42 WT 7.1 mm x 2" NB API 5L Grade B Sch. XS
47	REDUCER (CONCENTRIC)	4" X 2"	300#	ASME B 16.9	ASTM A 234 GR. WPB	B.W, ASME B16.25	NOS	50	4" API 5L X42 WT 7.1 mm x 2" NB API 5L Grade B Sch. XS
48	REDUCER (CONCENTRIC)	2" X 1"	600#	ASME B 16.9	ASTM A 234 GR. WPB	B.W, ASME B16.25	NOS	100	2" NB API 5L Grade B Sch. XS x 1" NB API 5L Grade B Sch XS
49	REDUCER (CONCENTRIC)	2" X 3/4"	600#	ASME B 16.9	ASTM A 234 GR. WPB	B.W, ASME B16.25	NOS	500	2" NB API 5L Grade B Sch. XS x 3/4" NB x Sch 160, A106 Gr. B
ELBOW									
50	ELBOW 90°	12"	600#	ASME B 16.9	ASTM A 234 GR. WPB	BW, 1.5 D	NOS	40	12" NB 1.5D 90 deg Elbow CS SMLS BW ASTM A234 Gr. WPB ASME B16.9 to match 12" NB API 5L X70 8.4 mm WT
51	ELBOW 45°	12"	600#	ASME B 16.9	ASTM A 234 GR. WPB	BW, 1.5 D	NOS	30	12" NB 1.5D 45 deg Elbow CS SMLS BW ASTM A234 Gr. WPB ASME B16.9 to match 12" NB API 5L X70 8.4 mm WT
52	ELBOW 22.5°	12"	600#	ASME B 16.9	ASTM A 234 GR. WPB	BW, 1.5 D	NOS	10	12" NB 1.5D 22.5 deg Elbow CS SMLS BW ASTM A234 Gr. WPB ASME B16.9 to match 12" NB API 5L X70 8.4 mm WT
53	ELBOW 90°	10"	600#	ASME B 16.9	ASTM A 234 GR. WPB	BW, 1.5 D	NOS	20	10" NB 1.5D 90 deg Elbow CS SMLS BW ASTM A234 Gr. WPB ASME B16.9 to match 10" NB API 5L X60 7.8 mm WT
54	ELBOW 45°	10"	600#	ASME B 16.9	ASTM A 234 GR. WPB	BW, 1.5 D	NOS	10	10" NB 1.5D 45 deg Elbow CS SMLS BW ASTM A234 Gr. WPB ASME B16.9 to match 10" NB API 5L X60 7.8 mm WT
55	ELBOW 22.5°	10"	600#	ASME B 16.9	ASTM A 234 GR. WPB	BW, 1.5 D	NOS	10	10" NB 1.5D 22.5 deg Elbow CS SMLS BW ASTM A234 Gr. WPB ASME B16.9 to match 10" NB API 5L X60 7.8 mm WT
56	ELBOW 90°	8"	600#	ASME B 16.9	ASTM A 234 GR. WPB	BW, 1.5 D	NOS	80	8" NB 1.5D 90 deg Elbow, CS, SMLS, BW, ASTM A234 Gr. WPB ASME B16.9 to match 8" NB API 5L X52 9.53 mm WT

57	ELBOW 45°	8"	600#	ASME B 16.9	ASTM A 234 GR. WPB	BW, 1.5 D	NOS	60	8" NB 1.5D 45 deg. Elbow, CS, SMLS, BW, ASTM A234 Gr. WPB ASME B16.9 to match 8" NB API 5L X52 9.53 mm WT
58	ELBOW 22.5°	8"	600#	ASME B 16.9	ASTM A 234 GR. WPB	BW, 1.5 D	NOS	20	8" NB 1.5D 22.5 deg. Elbow, CS, SMLS, BW, ASTM A234 Gr. WPB ASME B16.9 to match 8" NB API 5L X52 9.53 mm WT
59	ELBOW 90°	6"	600#	ASME B 16.9	ASTM A 234 GR. WPB	BW, 1.5 D	NOS	50	6" NB 1.5D 90 deg Elbow, CS, SMLS, BW, ASTM A234 Gr. WPB ASME B16.9 to match 8" NB API 5L X52 9.53 mm WT
60	ELBOW 45°	6"	600#	ASME B 16.9	ASTM A 234 GR. WPB	BW, 1.5 D	NOS	50	6" NB 1.5D 45 deg. Elbow, CS, SMLS, BW, ASTM A234 Gr. WPB ASME B16.9 to match 8" NB API 5L X52 9.53 mm WT
61	ELBOW 22.5°	6"	600#	ASME B 16.9	ASTM A 234 GR. WPB	BW, 1.5 D	NOS	50	6" NB 1.5D 22.5 deg. Elbow, CS, SMLS, BW, ASTM A234 Gr. WPB ASME B16.9 to match 8" NB API 5L X52 9.53 mm WT
62	ELBOW 90°	4"	600#	ASME B 16.9	ASTM A 234 GR. WPB	BW, 1.5 D	NOS	1000	4" NB 1.5D 90 deg Elbow CS SMLS BW ASTM A234 Gr. WPB ASME B16.9 to match 4" NB API 5L X42 7.1 mm WT
63	ELBOW 45°	4"	600#	ASME B 16.9	ASTM A 234 GR. WPB	BW, 1.5 D	NOS	500	4" NB 1.5D 45 deg Elbow CS SMLS BW ASTM A234 Gr. WPB ASME B16.9 to match 4" NB API 5L X42 7.1 mm WT
64	ELBOW 22.5°	4"	600#	ASME B 16.9	ASTM A 234 GR. WPB	BW, 1.5 D	NOS	100	4" NB 1.5D 22.5 deg. Elbow, CS, SMLS, BW, ASTM A234 Gr. WPB ASME B16.9 to match 4" NB API 5L X42 7.1 mm WT
65	ELBOW 90°	4"	300#	ASME B 16.9	ASTM A 234 GR. WPB	BW, 1.5 D	NOS	600	4" NB 1.5D 90 deg Elbow CS SMLS BW ASTM A234 Gr. WPB ASME B16.9 to match 4" NB API 5L X42 7.1 mm WT
66	ELBOW 45°	4"	300#	ASME B 16.9	ASTM A 234 GR. WPB	BW, 1.5 D	NOS	20	4" NB 1.5D 45 deg Elbow CS SMLS BW ASTM A234 Gr. WPB ASME B16.9 to match 4" NB API 5L X42 7.1 mm WT
67	ELBOW 22.5°	4"	300#	ASME B 16.9	ASTM A 234 GR. WPB	BW, 1.5 D	NOS	50	4" NB 1.5D 22.5 deg. Elbow, CS, SMLS, BW, ASTM A234 Gr. WPB ASME B16.9 to match 4" NB API 5L X42 7.1 mm WT

68	ELBOW 90°	2"	600#	ASME B 16.9	ASTM A 234 GR. WPB	BW, 1.5 D	NOS	2000	2" NB 1.5D 90 deg Elbow CS SMLS BW ASTM A234 Gr. WPB ASME B16.9 to match 2" NB API 5L Gr. B Sch XS
69	ELBOW 90°	1"	600#	ASME B 16.11	ASTM A 105	SW, 1.5 D	NOS	100	1" NB 1.5D 90 deg Elbow CS SMLS BW ASTM A 105 ASME B16.11 to match 1" NB API 5L Gr. B Sch XS
70	ELBOW 90°	3/4"	600#	ASME B 16.11	ASTM A 105	SW, 1.5 D	NOS	100	3/4" NB 1.5D 90 deg Elbow CS SMLS BW ASTM A 105 ASME B16.11 to match 3/4" NB API 5L Gr. B Sch 160
TEE									
71	EQ. TEE	12" X 12"	600#	ASME B 16.9	MSS SP 75 Gr. WPHY-60	B.W	NOS	30	12" x 12" NB Equal Tee CS SMLS BW MSS-SP-75 Gr. WPHY-60 ASME B16.9 to match 10.3 mm WT API 5L X60 line pipe
72	EQ. TEE	8" X 8"	600#	ASME B 16.9	ASTM A 234 GR.WPB	B.W	NOS	100	8" x 8" NB Equal Tee CS SMLS BW ASTM A234 Gr.WPB ASME B16.9 to match 9.53 mm API 5L X52 line pipe
73	EQ. TEE	6" X 6"	600#	ASME B 16.9	ASTM A 234 GR.WPB	B.W	NOS	30	6" x 6" NB Equal Tee CS SMLS BW ASTM A234 Gr. WPB ASME B16.9 to match 6.4 mm WT API 5L X52 line pipe
74	EQ.TEE	4" X 4"	600#	ASME B 16.9	ASTM A 234 GR.WPB	B.W	NOS	800	4" x 4" NB Equal Tee CS SMLS BW ASTM A234 Gr. WPB ASME B16.9 to match 7.1 mm WT API 5L X42 line pipe
75	EQ.TEE	4" x 4"	300#	ASME B 16.9	ASTM A 234 GR.WPB	B.W	NOS	100	4" x 4" NB Equal Tee CS SMLS BW ASTM A234 Gr. WPB ASME B16.9 to match 7.1 mm WT API 5L X42 line pipe
76	EQ.TEE	2" X 2"	600#	ASME B 16.9	ASTM A 234 GR.WPB	B.W	NOS	400	2" x 2" NB Equal Tee CS SMLS BW ASTM A234 Gr. WPB ASME B16.9 to match Sch XS API 5L grade B/ A106 Gr. B
77	UNEQ.TEE	24" x 12"	600#	MSS-SP 75	MSS SP 75 Gr. WPHY-70	B.W	NOS	20	24" x 12" NB Unequal Tee CS SMLS BW ASTM A234 Gr. WPB ASME B16.9 to match 24 Inch 15.9 mm WT API 5L X70 and 12 Inch 10.3 mm WT API 5L X60

78	UNEQ.TEE	20" x 12"	600#	MSS-SP 75	MSS SP 75 Gr. WPHY-70	B.W	NOS	10	20" x 12" NB UnEqual Tee CS SMLS BW ASTM A234 Gr. WPB ASME B16.9 to match 20 Inch 9.5 mm WT API 5L X70 and 12 Inch 10.3 mm WT API 5L X60
79	UNEQ.TEE	18" x 12"	600#	MSS-SP 75	MSS SP 75 Gr. WPHY-65	B.W	NOS	5	18" x 12" NB UnEqual Tee CS SMLS BW ASTM A234 Gr. WPB ASME B16.9 to match 18 Inch 14.3 mm WT API 5L X65 and 12 Inch 10.3 mm WT API 5L X60
80	UNEQ.TEE	16" x 12"	600#	MSS-SP 75	MSS SP 75 Gr. WPHY-65	B.W	NOS	15	16" x 12" NB UnEqual Tee CS SMLS BW ASTM A234 Gr. WPB ASME B16.9 to match 16 Inch 12.7 mm WT API 5L X65 and 12 Inch 10.3 mm WT API 5L X60
81	UNEQ.TEE	12" x 8"	600#	ASME B 16.9	ASTM A 234 GR.WPB	B.W.	NOS	25	12" x 8" NB Unequal Tee CS SMLS BW ASTM A234 Gr. WPB ASME B16.9 to match 12" API 5L X70 8.4 mm WT x 8" API 5L X52 9.53 mm WT
82	UNEQ.TEE	10" x 8"	600#	ASME B 16.9	ASTM A 234 GR.WPB	B.W.	NOS	20	10" (to match 7.8 mm WT API 5L X60 line pipe) x 8" (to match 9.53 mm WT API 5L X52 line pipe), Unequal Tee CS SMLS BW ASTM A234 Gr. WPB ASME B16.10
83	UNEQ.TEE	8" x 4"	600#	ASME B 16.9	ASTM A 234 GR.WPB	B.W.	NOS	50	8" (to match 9.53 mm WT API 5L X52 line pipe) x 4" (to match 7.1 mm WT API 5L X42 line pipe) Unequal Tee CS SMLS BW ASTM A234 Gr. WPB ASME B16.11
84	UNEQ.TEE	6" x 4"	600#	ASME B 16.9	ASTM A 234 GR.WPB	B.W.	NOS	20	6" (to match 6.4 mm WT API 5L X52 line pipe) x 4" (to match 7.1 mm WT API 5L X42 line pipe) Unequal Tee CS SMLS BW ASTM A234 Gr. WPB ASME B16.11
85	UNEQ.TEE	4" X 2"	600#	ASME B 16.9	ASTM A 234 GR.WPB	B.W	NOS	2000	4" (to match 7.1 mm WT API 5L X42 line pipe) x 2" NB API 5L grade / A106 Gr. B Sch XS Unequal Tee CS SMLS BW ASTM A234 Gr. WPB ASME B16.9
86	UNEQ.TEE	4" X 2"	300#	ASME B 16.9	ASTM A 234 GR.WPB	B.W	NOS	500	4" (to match 7.1 mm WT API 5L X42 line pipe) x 2" NB API 5L grade / A106 Gr. B Sch XS Unequal Tee CS SMLS BW ASTM A234 Gr. WPB ASME B16.9
87	UNEQ.TEE	2" x 1"	600#	ASME B 16.9	ASTM A 234 GR.WPB	B.W x S.W	NOS	200	SCH.XS x SCH.160

88	UNEQ.TEE	2" x 3/4"	600#	ASME B 16.9	ASTM A 234 GR.WPB	B.W x S.W	NOS	200	SCH.XS x SCH.160
SOCKOLET									
89	SOCKOLET	12" x 1.5"	6000#	MSS-SP-97	ASTM A 105	S.W,	NOS	50	12" (to match 12" API 5L X70 8.4 mm WT) x 1.5", Sch XS
90	SOCKOLET	12" x 1"	6000#	MSS-SP-97	ASTM A 105	S.W,	NOS	100	12" (to match 12" API 5L X70 8.4 mm WT) x 1", Sch XS
91	SOCKOLET	12" x 0.75"	6000#	MSS-SP-97	ASTM A 105	S.W,	NOS	50	12" (to match 12" API 5L X70 8.4 mm WT) x 0.75", Sch 160
92	SOCKOLET	8" x 1"	6000#	MSS-SP-97	ASTM A 105	S.W,	NOS	50	8" (to match 9.53 mm WT API 5L X52 line pipe) x 1", Sch XS
93	SOCKOLET	8" x 0.75"	6000#	MSS-SP-97	ASTM A 105	S.W,	NOS	100	8" (to match 9.53 mm WT API 5L X52 line pipe) x 0.75", Sch 160
94	SOCKOLET	4" x 1.5"	6000#	MSS-SP-97	ASTM A 105	S.W,	NOS	100	4" (to match 7.1 mm WT API 5L X42 line pipe) x 1.5", Sch XS
95	SOCKOLET	4" x 1"	6000#	MSS-SP-97	ASTM A 105	S.W,	NOS	200	4" (to match 7.1 mm WT API 5L X42 line pipe) x 1", Sch XS
96	SOCKOLET	4" X 0.75"	6000#	MSS-SP-97	ASTM A 105	S.W,	NOS	200	4" (to match 7.1 mm WT API 5L X42 line pipe) x 0.75", Sch 160
WELDOLET									
97	WELDOLET	36" x 8"	XS	MSS-SP-97	WPHY-80	B.W	NOS	10	36" (API 5L X70 WT 11.9mm) x 8", 8 Inch pipe match to WT 9.53 mm
98	WELDOLET	36" x 4"	XS	MSS-SP-97	WPHY-80	B.W	NOS	15	36" (API 5L X70 WT 11.9 mm)x 4", 4 Inch pipe match to WT 7.1 mm
99	WELDOLET	30" x 8"	XS	MSS-SP-97	WPHY-70	B.W	NOS	10	30" (API 5L X70 WT 17.5 mm) x 8", 8 Inch pipe match to WT 9.53 mm
100	WELDOLET	30" x 4"	XS	MSS-SP-97	WPHY-70	B.W	NOS	20	30" (API 5L X 70 WT 17.5 mm) x 4", 4 Inch pipe match to WT 7.1 mm
101	WELDOLET	24" x 4"	XS	MSS-SP-97	WPHY-70	B.W	NOS	20	24" (API 5L X 70 WT 15.9 mm) x 4", 4 Inch pipe match to WT 7.1 mm

102	WELDOLET	20" x 4"	XS	MSS-SP-97	WPHY-70	B.W	NOS	20	20" (API 5L X 70 WT 9.5 mm) x 4", 4 Inch pipe match to WT 7.1 mm
103	WELDOLET	18" x 4"	XS	MSS-SP-97	WPHY-65	B.W	NOS	20	18" (API 5L X65 WT 14.3 mm) x 4", 4 Inch pipe match to WT 7.1 mm
104	WELDOLET	16" x 4"	XS	MSS-SP-97	WPHY-65	B.W	NOS	20	16" (API 5L X65 WT 12.7 mm) x 4", 4 Inch pipe match to WT 7.1 mm
105	WELDOLET	12" x 2"	XS	MSS-SP-97	ASTM A 105	B.W	NOS	50	12" x 2", 2 Inch pipe match to Sch XS
106	WELDOLET	8" x 2"	XS	MSS-SP-97	ASTM A 105	B.W	NOS	200	8" x 2", 2 inch pipe match to Sch XS
107	WELDOLET	4" x 2"	XS	MSS-SP-97	ASTM A 105	B.W	NOS	500	4" x 2", 1 Inch to match to Sch XS
GROUP- C (FLOW TEE)									
108	FLOW.TEE	12" x 8"	600#	ASME B 16.9	MSS-SP-75, Gr. WPHY-70	B.W	NOS	40	12" (to match 12" API 5L X70 8.4 mm WT) x 8", (to match 9.53 mm WT API 5L X52 line pipe)
109	FLOW.TEE	10" x 8"	600#	ASME B 16.9	MSS-SP-75, Gr. WPHY-60	B.W	NOS	30	10" (to match 7.8 mm WT API 5L X60 line pipe) x 8" (to match 9.53 mm WT API 5L X52 line pipe)
110	FLOW.TEE	8" x 8"	600#	ASME B 16.9	MSS-SP-75, Gr. WPHY-52	B.W	NOS	50	8" x 8" (to match 9.53 mm WT API 5L X52 line pipe)
111	FLOW.TEE	8" x 4"	600#	ASME B 16.9	MSS-SP-75, Gr. WPHY-52	B.W	NOS	50	8" (to match 9.53 mm WT API 5L X52 line pipe) x 4" (to match 7.1 mm WT API 5L X42 line pipe)
112	FLOW.TEE	4" X 4"	600#	ASME B 16.9	MSS-SP-75, Gr. WPHY-42	B.W	NOS	200	4" x 4" (to match 7.1 mm WT API 5L X42 line pipe)
GROUP- D (BEND)									
113	Bends (R = 6D) Angle - 90°	12"	600#	ASME B 16.10	MSS SP-75 Gr. WPHY-60	B.W, ASME B16.25	NOS	30	12" WT 7.9 mm, tangent length of 500 mm at each end
114	Bends (R = 6D) Angle - 45°	12"	600#	ASME B 16.10	MSS SP-75 Gr. WPHY-60	B.W, ASME B16.25	NOS	20	12" WT 7.9 mm, tangent length of 500 mm at each end
115	Bends (R = 6D) Angle - 22.5°	12"	600#	ASME B 16.10	MSS SP-75 Gr. WPHY-60	B.W, ASME B16.25	NOS	20	12" WT 7.9 mm, tangent length of 500 mm at each end
116	Bends (R = 6D) Angle - 90°	8"	600#	ASME B 16.10	MSS SP-75 Gr. WPHY-60	B.W, ASME B16.25	NOS	40	8" WT 7.9 mm, tangent length of 500 mm at each end
117	Bends (R = 6D) Angle - 45°	8"	600#	ASME B 16.10	MSS SP-75 Gr. WPHY-60	B.W, ASME B16.25	NOS	40	8" WT 7.9 mm, tangent length of 500 mm at each end

118	Bends (R = 6D) Angle - 22.5°	8"	600#	ASME B 16.10	MSS SP-75 Gr. WPHY-60	B.W, ASME B16.25	NOS	20	8" WT 7.9 mm, tangent length of 500 mm at each end
119	Bends (R = 6D) Angle - 90°	4"	600#	ASME B 16.10	MSS SP-75 Gr. WPHY-42	B.W, ASME B16.25	NOS	1000	4" 6.4 mm, tangent length of 500 mm at each end
120	Bends (R = 6D) Angle - 45°	4"	600#	ASME B 16.10	MSS SP-75 Gr. WPHY-42	B.W, ASME B16.25	NOS	500	4" 6.4 mm, tangent length of 500 mm at each end
121	Bends (R = 6D) Angle - 22.5°	4"	600#	ASME B 16.10	MSS SP-75 Gr. WPHY-42	B.W, ASME B16.25	NOS	200	4" 6.4 mm, tangent length of 500 mm at each end
122	Bends (R = 3D) Angle - 90°	12"	600#	ASME B 16.10	MSS SP-75 Gr. WPHY-60	B.W, ASME B16.25	NOS	20	12" WT 7.9 mm, tangent length of 500 mm at each end
123	Bends (R = 3D) Angle - 45°	12"	600#	ASME B 16.10	MSS SP-75 Gr. WPHY-60	B.W, ASME B16.25	NOS	20	12" WT 7.9 mm, tangent length of 500 mm at each end
124	Bends (R = 3D) Angle - 22.5°	12"	600#	ASME B 16.10	MSS SP-75 Gr. WPHY-60	B.W, ASME B16.25	NOS	20	12" WT 7.9 mm, tangent length of 500 mm at each end
125	Bends (R = 3D) Angle - 90°	8"	600#	ASME B 16.10	MSS SP-75 Gr. WPHY-60	B.W, ASME B16.25	NOS	40	8" WT 7.9 mm, tangent length of 500 mm at each end
126	Bends (R = 3D) Angle - 45°	8"	600#	ASME B 16.10	MSS SP-75 Gr. WPHY-60	B.W, ASME B16.25	NOS	30	8" WT 7.9 mm, tangent length of 500 mm at each end
127	Bends (R = 3D) Angle - 22.5°	8"	600#	ASME B 16.10	MSS SP-75 Gr. WPHY-60	B.W, ASME B16.25	NOS	10	8" WT 7.9 mm, tangent length of 500 mm at each end
128	Bends (R = 3D) Angle - 90°	4"	600#	ASME B 16.10	MSS SP-75 Gr. WPHY-42	B.W, ASME B16.25	NOS	400	4" 6.4 mm, tangent length of 500 mm at each end
129	Bends (R = 3D) Angle - 45°	4"	600#	ASME B 16.10	MSS SP-75 Gr. WPHY-42	B.W, ASME B16.25	NOS	250	4" 6.4 mm, tangent length of 500 mm at each end
130	Bends (R = 3D) Angle - 22.5°	4"	600#	ASME B 16.10	MSS SP-75 Gr. WPHY-42	B.W, ASME B16.25	NOS	100	4" 6.4 mm, tangent length of 500 mm at each end

B. REMARKS/COMMENTS

1.0 GENERAL NOTES

VENDOR's/SUPPLIER compliance

Compliance with this material requisition in any instance shall not relieve the Vendor of his responsibility to meet the specified performance.

2.0 COMPLIANCE WITH SPECIFICATION

The Vendor shall be completely responsible for the design, materials, fabrication, testing, inspection, preparation for shipment and transport of the above equipment strictly in accordance with the Material Requisition and all attachments thereto.

All items shall be provided with EN – 10204 3.2 certificates.

3.0 VENDOR's/SUPPLIER SCOPE

Vendor scope of work is included the equipment with all internals and accessories shown on the data sheets, specifications and all unmentioned parts necessary for a satisfactory operation and testing except those which are indicated to be out of the Vendor's supply.

4.0 INSPECTION

Vendor shall appoint a TPIA anyone of the following for inspection purpose without any extra cost to the owner, as set out and specified in the codes and particular documents forming this MR. Vendor has to propose minimum 2 nos. of below listed agencies to be approved by owner/owner's representative.

- a) Lloyd Register of Industrial Services
- b) Technische Ulierwachungs Verein (TUV) - NORD
- c) Det Norske Veritas (DNV) – GL
- d) Bureau Veritas
- e) SGS
- f) American Bureau services
- g) APPLUS VELOSI
- h) Certification Engineers international Limited (CEIL)

In addition to the above, owner also reserves the right to inspect and witness any tests during manufacturing at their own or through authorized representative.

5.0 APPLICABLE DOCUMENTS

General prescriptions, requirements and information are listed in annex C of this Material Requisition.

6.0 VENDOR's documents

Vendor shall submit the documents as listed under point D of this material requisition. All documents shall be submitted in english language only.

7.0 DOCUMENTS NUMBERING AND FORMAT

Vendor shall strictly follow the document numbering procedure in their document as instructed by the owner.

C. LIST OF ATTACHMENTS

<p>The table here below lists the documents which are integral part of this material requisition. The applicable revision index of each document is mentioned in the column below the current material requisition revision index. When the material requisition revision index is A” or “I”, all listed documents are attached. For other material requisition revision index, only modified or new documents are attached.</p>	Material Requisition revision							
	0	1	2	3				
Documents	Revision of documents							
Technical specification - Fittings Doc. No. GAIL--034-PL-SPE-001	0							

Technical Specification – Flanges Doc. No. GAIL--034-PL-SPE-002	0							
Technical Specification – Flow Tee Doc. No. GAIL--034-PL-SPE-003	0							
Technical Specification – Long Radius Bends Doc. No. GAIL--034-PL-SPE-004	0							
Data Sheet – Fitting Doc. No. GAIL-034-PL-DS-001	0							
Data Sheet – Flanges Doc. No. GAIL-034-PL-DS-002	0							
Data Sheet – Flow Tee Doc. No. GAIL-034-PL-DS-003	0							
Data Sheet – Flow Tee Doc. No. GAIL-034-PL-DS-004	0							
Data Sheet – Flow Tee Doc. No. GAIL-034-PL-DS-005	0							
Data Sheet – Flow Tee Doc. No. GAIL-034-PL-DS-006	0							
Data Sheet – Flow Tee Doc. No. GAIL-034-PL-DS-007	0							
Quality Assurance Plan – Flanges Doc. No. GAIL-034-PL-QAP-001	0							
Quality Assurance Plan– Fittings Doc. No. GAIL-034-PL-QAP-002	0							
Quality Assurance Plan – Flow Tee Doc. No. GAIL-034-PL-QAP-003	0							
Quality Assurance Plan – Long Radius Bends Doc. No. GAIL-034-PL-QAP-004	0							

D. DOCUMENTS & DATA REQUIREMENTS

The table hereunder specifies the quantities and the nature of the documents to be submitted by the Contractor / Vendor / Supplier to the Engineer.

The documents required at the inquiry stage and to be included in the bid are listed under column A.

The documents required after award of the Agreement and subject to the written approval of the Engineer are listed under column B.

The final and certified documents are listed under column C.

Any document, even when preliminary, shall be binding and therefore duly identified and signed by the Contractor/Vendor/Supplier. It shall bear the Engineer’s project reference, the Material Requisition number and the identification number.

The documents are fully part of the supply which shall be complete only if and when the documents complying fully with the material requisition requirements are received by the engineer.

Item	Document and Data	Document Index No.	A	B		C	
			No. of copies	No. of copies	Required date	No. of copies	Required date
1	Completed data sheet for fittings & flanges	CDS	3	6	2 weeks	6	2 weeks + with final tech. file
2	Drawing / data submittal list / schedule	DLS	3	6	2 weeks + monthly	6	2 weeks
3	Progress report	PRT	-	6	2 weeks + monthly	6	2 weeks
4	Outline drawing + material specification + unit weight + Bill of materials (on drawings)	OMS	-	6	2 weeks	6	2 weeks + with final tech. file
5	Code compliance certificate	CCC	-	6	2 weeks	6	2 weeks + with final tech. file
6	Welding procedure specification and records WPS/PQR	WPS	-	6	2 weeks	6	2 weeks + with final tech. file
7	QA/QC program*	QAP	3	6	2 weeks	6	2 weeks + with final tech. file
8	Inspection and test procedures	ITP	3	6	2 weeks	6	2 weeks + with final tech. file
9	List of fabrication and control operations (LOFC)	LOF	-	6	2 weeks	6	2 weeks + with final tech. file
10	Test reports	TRS	-	6	1 week after test	6	2 weeks + with final tech. file
11	NDE reports	NOR	-	6	1 week after test	6	2 weeks + with final tech. file
12	Heat treatment reports	HTT	-	6	1 week after test	6	2 weeks + with final tech. file
13	Hydro-test and air test report	HTR	-	6	1 week after test	6	2 weeks + with final tech. file
14	Packing/shipping list with weights and dimensions	PLD	-	6	2 weeks before shipping	6	2 weeks + with final tech. file
15	Material certificate 3.2 as per EN 10204	MCT	-	6	1 week after test	6	2 weeks + with final tech. file

16	Painting system description	PSD	3	6	2 weeks	6	2 weeks + with final tech. file
17	Final technical file, preliminary copy for approval	FTP	-	6	2 weeks	6	2 weeks + with final tech. file
18	Final technical file (In soft & hard copy)	FTF	-	6	2 weeks	6	2 weeks + with final tech. file

***QA/QC program shall comprise of in-house testing facilities, resources and quality procedure being followed by the vendor to ensure quality of product in line with tender requirement.**

NOTES

1. Durations in column B (required date) are weeks after LOA or as indicated in table. Duration in column C (Required date) are weeks after document approval or as indicated in Table. Due date of each document may be proposed.
2. Latest submittal time for:
 - a. Test procedure : 2 weeks before test
 - b. Test report : 2 weeks after test
3. Final technical file shall be applied in hard copy as indicated, and in electronic format (.pdf Acrobat files) on six (6) CD-ROMs.



GAIL INDIA LIMITED

Technical Specification – Fittings

GAIL-034-PL-SPE-001

Rev	Date	Purpose	Prepared By	Checked By	Approved By
0	12.10.2019	Issued for Tender	VKS	AP	SB




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1.0 SCOPE

1.1 This specification covers the minimum requirements for the design, manufacture and supply of following fittings in size NB 2" to 12" to be installed in natural gas or liquid hydrocarbon pipelines and piping system.

1.1.1 Fittings such as tees, elbows, caps, etc. shall conform to the requirements of MSS-SP-75, latest edition.

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

This specification does not cover the abovementioned items, which are to be installed in pipeline handling sour hydrocarbon (liquid/gas) service as defined in NACE standard MR017598.

2.0 REFERENCE DOCUMENTS

2.1 Reference has also been made in this specification to the latest edition of the following codes, standards and specifications:

- a) ASME B31.8: Gas Transmission and Distribution Piping System.
- b) ASME B31.4: Liquid transportation system for hydrocarbon liquid petroleum gas, anhydrous ammonia and alcohols.
- c) ANSI B16.25: Butt – Welding Ends.
- d) ANSI B16.9 Factory made wrought steel butt welding fittings.
- e) ASTM A 370: Mechanical testing of steel products
- f) ASTM Part1: Steel Piping, Tubing, Fittings
- g) MSS SP 25 Standard marking system for valves, fittings, flanges and unions.
- h) MSS SP 75 Specification for high test wrought butt welding fittings.
- i) MSS SP 97: Forged carbon steel branch outlet fittings – socket welding, threaded and butt welding ends.

In case of conflict between the requirement of MSS SP 75, and above reference documents and this specification, the requirement of this specification shall govern.

3.0 MANUFACTURE'S QUALIFICATION

Manufacturer who intends bidding for fittings must possess the records of a successful proof test in accordance with the provision of relevant MSS-SP-97, MSS-SP-75 and/or ANSI B16.9 as applicable. These records shall be submitted at the time of bidding.

4.0 MATERIAL

4.1 The basic material for fittings shall be indicated in the purchase requisition. Additionally, the material shall also meet the requirements specified hereinafter.

4.2 Steel shall be fully killed.

4.3 Each heat of steel used for the manufacture of fittings shall have carbon equivalent (CE) not greater than 0.45 calculated from check analysis in accordance with the following formula:

$$C.E = C + (Mn/6) + ((Cr+Mo+V)/5) + ((Ni+Cu)/15)$$

Carbon content on check analysis shall not exceed 0.22%.

- 4.4 Unless specified otherwise, Charpy V-notch test shall be conducted for each heat of steel, in accordance with the impact test provisions of ASTM A370 at temperature of 0 °C. The average absorbed impact energy values of three full-sized specimens shall be 27 Joules.

The minimum impact energy value of any one specimen of the three specimens analyzed as above, shall not be less than 80% of the above-mentioned average value.

- 4.5 Hardness testing shall be carried out by manufacturer in accordance with applicable ASTM code; the maximum hardness shall not exceed 248 HV10.

5.0 DESIGN AND MANUFACTURE

- 5.1 Fittings such as tees, elbows and reducers shall be seamless type and shall conform to ASME B16.9 for sizes 50 mm (2") NB and above. Fittings such as Weldolets, Sockolets, etc shall not be used in the manufacture in accordance with MSS-SP-97.

- 5.2 Stubin or pipe to pipe connection shall not be used in the manufacture of tees. Tees shall be manufactured by forging or extrusion methods. The longitudinal weld seam shall be kept at 90° from the extrusion. Fittings shall not have any circumferential joints.

- 5.3 All but weld ends shall be beveled as per ASME B16.25.

- 5.4 Repair by welding on parent metal of the fittings is not allowed.

6.0 INSPECTION AND TESTS

- 6.1 The manufacturer shall perform all inspection and tests as per the requirements of this specification and the relevant codes, prior to shipment, at his works. Such inspection and tests shall be, but not limited to the following;

6.1.1 Visual inspection

6.1.2 Dimensional checks as applicable standards.

6.1.3 Chemical composition, mechanical properties and hardness examination.

6.1.4 All finished wrought weld ends shall be 100% ultrasonically tested for lamination type defects. Any lamination larger than 6.35 mm shall not be acceptable.

6.1.5 All other tests not specifically listed but are required as per applicable standard/specification.

6.2 Purchaser's Inspector may also perform stage wise inspection and witness tests as indicated in para 6.1 at manufacturer's work prior to shipment. Manufacturer shall give reasonable notice of time and shall provide without charges reasonable access and facilities required for inspection to the purchaser inspector.

6.3 Inspection and tests performed/witnessed by purchaser's inspector shall in no way relieve the manufacturer's obligation to perform the required inspection and test.

7.0 TEST CERTIFICATES

Manufacturer shall produce the certificates (in original) for all, including, but not limited, the following tests:

A. Certificates of chemical analysis and mechanical properties of the material used for construction as per this specification and relevant standards.

B. Certificates of required non-destructive tests inspections.

- C. Certificates of all other tests as required in this specification.
- D. In case any of the said certificates is not available during the final test, the supply shall be considered incomplete.

8.0 PAINTING, MARKING AND SHIPMENT

- 8.1 All fittings shall be marked as per MSS-SP-25.
- 8.2 All loose material and foreign material i.e. rust, grease, etc. shall be removed from the inside and outside of the fittings.
- 8.3 Ends of all fittings shall be suitably protected to avoid any damage during transit. Metallic bevel protectors shall be used for fittings of size 18" and larger each item shall be marked with indelible paint with the following data:
 - A. Manufacturer marking
 - B. Material Specification
 - C. Size & Sch.
 - D. Heat No.
- 8.4 Package shall be marked legibly with suitable marking ink to indicate the following:
 - A. Order Number
 - B. Package Number
 - C. Manufacturer's Name
 - D. Type of Fitting
 - E. Size (inches) and Wall Thickness (mm)

9.0 WARRANTY

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

10.0 DOCUMENTATION

- 10.1 All documents shall be in English Language.
- 10.2 At the time of bidding bidder shall submit the following documents:
 - a) Reference list of previous supplies of similar fittings of similar specification.
 - b) Clause wise list of deviation from this specification, if any.
 - c) Brief description of the manufacturing and quality control facilities of the Manufacturer's work.
 - d) Manufacturer's qualification requirement as per section 3.0 of this specification.
 - e) Quality Assurance Plan (QAP).
- 10.3 Within two weeks of placement of order, the manufacturer shall submit four copies of method of manufacture and quality control procedure for raw material and finished product.

- 10.4 Once the approval has been given by Purchaser, any change in material, method of manufacture and quality control procedure shall be notified to Purchaser whose approval in writing of all changes shall be obtained before the fittings are manufactured.
- 10.5 Within four weeks from the approval date, Manufacturer shall submit six copies of the approved documents as stated in Para 10.3 of this specification.
- 10.6 Prior to shipment, Manufacturer shall submit six copies of test certificates as listed in Para 7.0 of this specification.



GAIL INDIA LIMITED

Technical Specification – Flanges

GAIL-034-PL-SPE-002

Rev	Date	Purpose	Prepared By	Checked By	Approved By
0	12.10.2019	Issued For Tender	VKS	AP	SB




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1.0 SCOPE

This specification covers the minimum requirements for the design, manufacture and supply of following carbon steel flanges of size NB 2" to 12" to be installed in pipeline and/or piping systems handling hydrocarbons in liquid or gaseous phase including Liquefied Petroleum Gas (LPG):

Hence, scope of flanges includes weld neck flanges, blind flanges, spectacle blinds, spacers and blinds, etc.

This specification does not cover the above-mentioned items, which are to be installed in pipeline system handling sour hydrocarbons (liquid/gas) service as defined in NACE standard MR017598.

2.0 REFERENCE DOCUMENTS

Reference has been made in this specification to the latest edition of the following codes, standards and specifications:

CODES AND STANDARDS:

ASME B31.3	-	Process Piping
ASME B31.4	-	Pipeline Transportation System for Liquid Hydrocarbons and Other Liquids
ASME B31.8	-	Gas Transmission and Distribution Piping Systems
ASME B16.5	-	Pipe Flanges and Flanged Fittings
ASME B16.9	-	Factory Made Wrought Steel Butt Welding Fittings (1/2" to 24")
ASME B16.25	-	Butt-welding Ends
ASME B16.47	-	Large Diameter Steel Flanges (26" to 60")
ASME B16.48	-	Steel Line Blanks
ASME Sec VIII/IX	-	Boiler and Pressure Vessel Code
ASTM A370	-	Standard Test Methods and Definitions for Mechanical Testing of Steel Products.
MSS-SP-25	-	Standard Marking System for Valves, Fittings, Flanges and Unions
MSS-SP-75	-	Specification for High Test Wrought Welded Fittings.
MSS-SP-97	-	Forged Carbon Steel Branch Outlet Fittings- Socket Welding, Threaded and Butt Welding Ends.

In case of conflict between various requirements of this specification and reference standard mentioned above, the more stringent requirement shall apply.

3.0 MANUFACTURER'S QUALIFICATION

Manufacturer, who intends bid for flanges, must possess the records of a successful proof test, in accordance with the provisions of ANSI/ MSS standards. These records shall be submitted at the time of bidding.

4.0 MATERIALS

- 4.1 The basic material for flanges shall be as indicated in the material requisition additionally; the material shall also meet the requirements specified hereinafter.
- 4.2 The Carbon steel used for the manufacture of flanges shall be fully killed.
- 4.3 Each heat of steel used for the manufacture of flanges shall have carbon equivalent (CE) not greater than 0.45% calculated from check analysis in accordance with following formula:

$$CE=C+(Mn/6)+(Cr+Mo+V)/5+(Ni+Cu)/15$$

Carbon contents on check analysis shall not exceed 0.22%.

- 4.4 Unless specified otherwise, Charpy V-notch test shall be conducted for each heat of steel, in accordance with the impact test provision of ASTM A370 at 0°C temperature. The average absorbed impact energy values of three full- sized specimens shall be 35 joules.

The minimum impact energy value of any one specimen of the three specimens analyzed as above, shall not be less than 80% of the above- mentioned average value.

For flanges specified to be used for other hydrocarbon service, the Charpy V-notch test requirements as stated above are not applicable, unless required by the specified material standard as a mandatory requirement.

When Low Temperature Carbon Steel (LTCS) materials are specified in Purchase Requisition for flanges, the charpy V-notch test requirements of applicable material standard shall be complied with.

- 4.5 For flanges specified to be used for Gas service or High Vapor Pressure (HVP) liquid service, hardness test shall be carried out in accordance with ASTM A 370. Hardness testing shall cover at least 10% per item, per size, per heat, per manufacturing method. A full thickness cross section shall be taken for this purpose and the maximum hardness shall not exceed 248 HV10.

For welded portion maximum difference in hardness of base material, weld material and heat affected zone shall be less than 80 points in Vickers HV10.

In case of RTJ flanges, the groove hardness shall be minimum 140 BHN

5.0 DESIGN AND MANUFACTURE

- 5.1 Flanges such as weld neck flanges and blind flanges shall conform to the requirements of ASME B16.5 upto sizes DN 600 mm (24") excluding DN 550 mm (22"), and for sizes DN 550 mm (22"), DN 650mm (26") and above ASME B 16.47 (Series B) shall be used.
- 5.2 Type, face and face finish of flanges shall be as specified in purchase requisition.
- 5.3 All butt weld ends shall be beveled as per ASME B16.25.
- 5.4 Repair by welding on flanges is not allowed.
- 5.5 Flanges shall be of forged construction and designed and manufactured in accordance with relevant ANSI/MSS standards.

6.0 INSPECTION AND TESTS

- 6.1 The Manufacturer shall perform all inspection and tests as per the requirement of this specification and the relevant codes, prior to shipment at his works. Such inspection and tests shall be, but not limited to, the following:
- 6.1.1 All flanges shall be visually inspected. The internal and external surfaces of the fittings shall be free from any earth strikes, gauges and other detrimental defects.
- 6.1.2 Dimensional checks shall be carried out on finished products as per ASME B16.5/MSS-SP-44/ASME B16.47 as applicable for flanges, ASME B 16.48 for spacers and blinds and ASME B16.9/MSS-SP-75/MSS-SP-97 as applicable for fittings and as per this specification.
- 6.1.3 Chemical composition and mechanical properties shall be checked as per relevant material standards and this specification, for each heat of steel used.
- 6.2 Purchaser's Inspector reserves the right to perform stage wise inspection and witness tests, as - indicated in clause 6.1 of this specification at Manufacturer's Works prior to shipment.

Manufacturer shall give reasonable notice of time and shall provide, without charge, reasonable access and facilities required for inspection, to the Purchaser's Inspector.

Inspection and tests performed/witnessed by Purchaser's Inspector shall in no way relieve the Manufacturer's obligation to perform the required inspection and tests.

7.0 TEST CERTIFICATES

Manufacturer shall submit following certificates to Purchaser's Inspector:

- a) Test certificates relevant to the chemical analysis and mechanical properties of the materials used for construction as per this specification and relevant standards
- b) Test Reports on radiography, ultrasonic inspection and magnetic particle examination.
- c) Test reports of heat treatment carried out as per the specification.
- d) Welding procedures and welders qualification reports.
- e) EN 10204 3.2 Certificate stating the quality of relevant Flanges.

8.0 MARKING

All Flanges shall be marked with:

- P.O Number/Item code
- Manufacturer/supplier's Name
- Nominal diameter in inches
- Rating of the flange
- Material
- Tag Number

9.0 DOCUMENTATION

- 9.1 Prior to shipment, the manufacturer shall submit six copies of the test certificates as listed in clause 7.0 of this specification.
- 9.2 All documents shall be in English language only


10.0 PACKING, SHIPPING & HANDLING

- 10.1 After all inspection and tests required have been carried out; all external surfaces shall be thoroughly cleaned to remove grease, dust and rust and shall be applied with standard mill coating for protection against corrosion during transit and storage. The coating shall be easily removable in the field.
- 10.2 Ends of all weld neck flanges shall be suitably protected to avoid any damage during transit. Metallic or high impact plastic bevel protectors shall be provided for fittings and flange. Flange face shall be suitably protected to avoid any damage during transit.



**TECHNICAL SPECIFICATION FOR
FLOW TEE**

GAIL-034-PL-SPE-003

0	12.10.2019	Issued for Tender	AP	JR	TR	
Rev	Date	Purpose	Prepared By	Checked By	Approved By	

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1.0 SCOPE

1.1 This specification covers the basic requirements for design, manufacture, testing and supply of carbon steel flow tees to be installed in onshore pipeline of natural gas services.

1.2 Compliance

Compliance by the contractor with this specification shall not relieve him of his responsibilities to supply flow tee suited to meet the specified requirements and/or local codes governing health and safety.

The CONTRACTOR shall notify the consultant in writing, of any proposed deviation from this specification. The Consultant's decision in respect of concession requests will be final.

The CONTRACTOR shall continually verify the quality and fitness for purpose of the flow tee, and shall propose appropriate actions/measures if any aspects of manufacture are found to be unsatisfactory.

1.3 Quality Conformance

The CONTRACTOR shall demonstrate to the satisfaction of owner/consultant that his activities within the scope of this document are in accordance with the relevant section of BS EN ISO 9001. The CONTRACTOR shall submit to the CONSULTANT for review and approval, a quality plan and procedural specifications prior to commencement of work. The Quality plan shall define all sub contractors' involvement in the work. The review in this specification shall only indicate a general requirement and shall not relieve the CONTRACTOR of his obligation to comply with the requirement of the contract.

1.4 Safety

Safety is paramount. All work shall be performed in accordance with the safety requirement listed in the contract documentation.

2.0 REFERENCE DOCUMENTS

2.1 Reference has been made in this specification to the latest edition of the following codes, standards

ASME Section VIII	Boiler & pressure Vessel Code
ASME B 16.9	Factory made wrought steel butt welding fittings
ASME B 31.8	Gas Transmission & Distribution piping System
ASTM A 370	Mechanical testing of Steel Product
API 1104	Standard for welding pipelines and related facilities
MSS-SP-53	Quality standard for steel castings and forgings for valves flanges and fittings and other piping components - magnetic particle examination method
MSS-SP-75	Specification for High Test Wrought welding fittings
ASME Section IX	Qualification standard for Welding and brazing procedures PNGRB Petroleum & Natural Gas Regulatory Board

OIL INDUSTRY SAFETY DIRECTORATE (OISD STANDARDS)

OISD 106:	Process design and operating philosophies on pressure relief and disposal system.
OISD 113:	Classification of Area for electrical installation at hydrocarbon and handling Facilities
OISD 115:	Guidelines on fire fighting, equipment and appliance in petroleum industry
OISD 163:	Process control room safety
OISD 226:	Natural gas transmission pipelines and city gas distribution networks

In case of conflict between the requirements of this specification and any code, Standard or Specification referred to in this Specification, the requirements of this specification shall govern.

3.0 MANUFACTURER'S QUALIFICATION

Manufacturers who intend bidding for flow tees must possess the records of a successful proof test for tees used in the fabrication of flow tees, in accordance with the provisions of ASME B 16.9/MSS-SP-75. These records shall be submitted at the time of bidding

4.0 MATERIALS

- 4.1 Material for the pressure containing parts of the flow tees shall be as indicated in the data sheets. Other part shall be as per Manufacturer's standard suitable for the service condition and shall be subject to approval by purchaser.
- 4.2 Flow Tees which are exceeding 0.45 based formula; subject to field welding by purchaser, shall have carbon equivalent (CE) not on check analysis for each heat of steel calculated according to the following formula:

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

- 4.3 When specified in the data sheet, charpy V-notch test shall be conducted on each heat of base material, weld metal and heat affected zone of all pressure containing parts such as body, welding ends in accordance with the impact test provisions of ASTM A 370 at a temperature of -29 °C. The charpy impact test specimens shall be taken in the direction of principal grain flow and notched perpendicular to the original surface of the plate of forging. Average impact energy value of three full sized specimens shall be 35 joules. Minimum impact energy value of individual specimen shall be 27 joules. No specimen shall exhibit less than 80% shear area.

When low temperature carbon steel (LTCS) materials are specified in data sheet or offered by manufacturer, the charpy V-notch test requirement of applicable material standard shall be complied with.

- 4.4 Carbon steel used for the manufacture shall be fully killed.
- 4.5 When specified in data sheet, hardness test shall be carried out as per ASTM A370 for each heat of steel used. The maximum hardness of base metal, weld metal and heat affected zone of all pressure parts shall be 248 HV₁₀, unless otherwise specified.

5.0 DESIGN & CONSTRUCTION REQUIREMENTS

- 5.1 Flow tees shall be designed and manufactured in accordance with the provisions of Codes and Standards referred in Section 2.0 of this specification. In addition, design factor and corrosion allowance, as indicated in the Data Sheet, shall also be taken into account for design of Flow tees.
- 5.2 Flow tees shall generally conform to the figure shown in the Data Sheet and shall meet the following requirements:
- a) An internal pipe having the same internal diameter as the connecting pipeline allowing the passage of scrapper/instrumented pigs, provided with holes/slots located in the centre line of the branch. The slots shall be designed to prevent the pig getting stuck or damaged without affecting the flow

through the branch line. The area of the holes/slots shall be at least equal to the internal area of branch size.

- b) A forged/submerged arc welded “tee” as per ASME B 16.9/MSS-SP-75, enclosing internal pipe and fixed to it by suitably shaped forged steel rings. Machined steel rings shall not be used. Circumferential welding on the branch outlet is not acceptable.

Butt weld ends shall be beveled as per MSS-SP-75.

- 5.3 All flow tees shall be completely stress relieved as per MSS-SP-75.
- 5.4 Stub-in or pipe-to-pipe connection shall not be used in the manufacture of flow tees. Tees used for manufacturing of flow tees shall be manufactured by forging or extrusion methods. In case flow tees are manufactured using welded tees, the longitudinal weld seam shall be at least 90 deg to the branch connection
- 5.5 All welds shall be made by welders and welding procedures qualified in accordance with ASME Section IX. The procedure qualification shall include impact test and hardness test and shall meet the requirements of clause 4.3 and 4.5 of this specification respectively.
- 5.6 Repair by welding on parent metal is not permitted. Repair of welds shall be carried out only after specific approval by Purchaser’s Inspector for each repair. The repair welding shall be carried out by the welders and welding procedures duly qualified as per ASME Section IX and include all tests, which are applicable for regular production welding procedure qualification.
- 5.7 The tolerance on internal diameter and out of roundness at the ends for welded flow tees shall be as per applicable connected pipe specification as indicated in the Data Sheet.

6.0 INSPECTION & TESTS

- 6.1 The Manufacturer shall perform all inspections and tests as per the requirements of this specification and the relevant codes, prior to shipment at his works. Such inspections and tests shall be, but not limited to, the following.
 - 6.1.1 All flow tees shall be visually inspected. The internal and external surfaces of the flow tees shall be free from any strikes, gauges and other detrimental defects.
 - 6.1.2 Dimensional checks shall be carried out as per the purchaser approved drawings.
 - 6.1.3 Chemical composition and mechanical properties including hardness shall be checked as per relevant material standards and this specification, for each heat of steel used.
 - 6.1.4 Non-destructive inspection of flow tees shall be carried out as given below:
 - a) 100% radiography shall be carried out on all butt & repair welds of pressure containing parts. Acceptance limits shall be as per API 1104. Welds, which in purchaser's representative opinion cannot be inspected by radiographic methods, shall be checked by ultrasonic or magnetic particle methods. Acceptance criteria shall be as per ASME SEC VIII Appendix 12 and Appendix 6, respectively.
 - b) All finished weld ends shall be 100% ultrasonically tested for lamination type defects for a distance of 25mm from the ends. Any lamination larger than 6.35 mm shall not be acceptable.
 - c) All forgings shall be wet magnetic particle inspected on 100% of forged surfaces. Method and acceptance shall comply MSS-SP-53.

- d) MPI/D.P inspection for cold formed butt welding with extruded outlet that are subjected to extreme fiber elongation of 5% or more as per MSS-SP-53.

6.2 Purchaser's Inspector shall also perform stage wise inspection and witness tests as indicated in clause 6.1 at Manufacturer's works prior to shipment. Manufacturer shall give reasonable notice of time and shall provide without charge reasonable access and facilities required for inspection to the Purchaser's Inspector.

Inspection and tests performed/witnessed by Purchaser's Representative shall in no way relieve the manufacturer's obligation to perform the required inspection and tests.

7.0 TEST CERTIFICATES

7.1 Manufacturer shall submit following certificates to Purchaser's Representative.

- a) Test certificates relevant to the chemical analysis and mechanical properties including hardness of the materials used for construction of flow tee as per this specification and relevant standards.
- b) Test reports on non-destructive testing (radiography, ultrasonic inspection, wet MPI and etc).
- c) Test certificates for each flow tee stating that it is capable of withstanding without leakage test pressure which results in a hoop stress equivalent to 95% of the specified minimum yield strength for the pipe with which the flow tee is to be attached without impairing its serviceability.
- d) Test reports on heat treatment carried out.

8.0 PAINTING, MARKING AND SHIPMENT.

8.1 Flow Tee surface shall be thoroughly cleaned, freed from rust and grease and applied with sufficient coats of corrosion resistant paint, after all the required tests have been performed and accepted by purchaser's representative. Surface preparation shall be carried out by shot blasting to SP-6 in accordance with "steel structures painting council - Visual standard SSPCVISI."

8.2 Manufacturer shall indicate the type of corrosion resistant paint used, in the drawings submitted for approval.

8.3 Flow Tee shall be marked with indelible paint with the following data:-

- a. Manufacturer's name
- b. Suitable for- inch nominal diameter pipeline
- c. End thickness in mm T1 X T2.
- d. Material
- e. Design Pressure
- f. ANSI Class Rating
- g. Tag No.
- h. PO No.

8.4 Flow Tee shall be suitably protected to avoid any damage during transit. Metallic bevel protectors shall be provided to weld ends.

8.5 Only those flow tees, which have been inspected and certified by Purchaser, shall be shipped.

9.0 DOCUMENTATION

9.1 All documents shall be in English Language.

9.2 At the time of bidding, Bidder shall submit the following documents:-

- a) General arrangements drawing of flow tee along with cross sectional view, overall dimensions and details of flow tee materials recommended.

- b) Reference lists of previous supplies of flow tee of similar specification.
- c) Clause wise list of deviation from this specification, if any.
- d) Records of successful proof test for tees used for fabrication of flow tees, qualifying the range of sizes quoted.
- e) Brief description of the manufacturing, heat treatment and quality control facilities of the manufacturer's Works.

9.3 Within two weeks of placement of order, the Manufacturer shall submit four copies of but not limited to the following drawings, documents and specifications for approval.

- a) Fabrication drawings and relevant calculations for pressure containing parts.
- b) Calculations for the number of holes/slots size/flow area.
- c) Method of manufacture, welding procedure and heat treatment details.
- d) Quality Assurance Plan (QAP)
- e) Once the approval has been given by purchaser any changes in design, material and method of manufacture shall be notified to the Purchaser whose approval in writing of all changes shall be obtained before the flow tee are manufactured.

9.4 Within four weeks from the approval date Manufacturer shall submit one reproducible and six copies of the approved drawings, documents and specifications as listed in 9.3 of this specification.

9.5 Prior to shipment, the manufacturer shall submit one reproducible and three copies of the test certificates as listed in Clause 7.0 of this specification.



**TECHNICAL SPECIFICATION FOR
LONG RADIUS BENDS**

GAIL-034-PL-SPE-004

0	12.10.2019	Issued For Tender	AP	JR	TR	
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1. SCOPE

This Specification covers the minimum requirements for manufacture and supply of long radius bends made from carbon steel line pipes for use in onshore pipeline systems handling hydrocarbons in liquid or gaseous phase including liquefied petroleum gas (LPG).

2. REFERENCE DOCUMENTS

Reference has also been made in this specification to the latest edition of the following codes, standards and specifications:

ASME B31.4	:	Liquid transportation systems for hydrocarbons, liquid petroleum gas, anhydrous ammonia and alcohols
ASME B 31.8	:	Gas Transmissions and Distribution Piping System
ASME B 16.9	:	Factory made wrought steel Butt-welding
ASME B16.25	:	Butt welding ends
API-5L	:	Specification for Line Pipe
ASTM A370	:	Standard Test Methods and Definitions for Mechanical Testing of Steel Products.
MSS-SP-75	:	Specification for high test wrought butt welding fittings

In case of conflict between the requirements of this specification and the codes, standards and specification referred above, the requirement of this specification shall govern.

3. MATERIALS

Bend shall be fabricated from steel line pipe manufactured in accordance with the latest revision of API 5L. The type of pipe to be used for fabrication of bends shall be as indicated in purchase order. Pipes with positive wall thickness tolerance shall be used for fabrication of bends.

Unless specified otherwise in purchase order, the line pipes for fabrication of bend shall be provided by the manufacturer.

The finished product shall be evaluated for mechanical properties and micro structural stability.

Mechanical testing of test bends performed during the bend manufacturing procedure qualification as per section 9.0 of this specification shall ensure that all bends made according to the company approved bend manufacturing procedure have the required mechanical properties. Destructive testing of production bend is not required. However, company reserve the right to require destructive testing whenever production bending parameters or heat treatment parameters deviate from those established in the company approved bend manufacturing procedure.

4. MANUFACTURE

- 4.1 Material grade, bend size, bend radius and bend angle shall be as indicated in the purchase order. Unless specified otherwise, the bending radius for bends shall be minimum three times the specified outside diameter.
- 4.2 Bends shall be manufactured by high frequency induction heating and forming method. Once the bending operation has commenced no stoppage shall be permitted until the entire bend has been completed. If bending temperature, bending rate, cooling medium volume or heat treatment temperature depart from the company approved bend manufacturing procedure, then the pipe shall be discarded and another bend shall be made in its place.
- 4.3 Heat treatment shall be carried out for all finished bends. Post hot bending heat treatment shall be carried out to the same cycle that the original material received for its production in order to bring the metallurgical condition back to its original state and heat treatment procedure shall be such that the

mechanical properties and steel microstructure of the finished bends comply with the minimum requirements specified in the applicable line pipe specification referred under clause 2.0. Heat treatment procedure shall be submitted and prior approval of company shall be obtained on heat treatment procedure.

When TMCP and OLAC steels are used, specific approval of the proposed heat treatment shall be obtained before bending process is employed. Heat treatment shall be carried out for all finished bends in case it is established during bending procedure qualification that heat treatment is required to meet the specification requirements.

4.4 When bending SAW or electric welded pipes, the longitudinal seam shall be located in the plane of minimum deformation or neutral axis. Acceptance tolerance on location of the longitudinal weld seam shall be $\pm 5^\circ$.

4.5 All bends shall be provided with a tangent length at both ends. Tangent length shall be 500 mm or pipe outside diameter whichever is more.

4.6 Unless otherwise specified differently in the purchase order, the bevels at the ends shall be as per the relevant pipe specification.

Bend shall not have any circumferential joint.

4.7 No repair by welding is allowed on any part of the bends.

4.8 Bulges, dents and flat areas shall not appear within 100 mm front end of the bend. For the remaining part of the bend these deviations from the original contour of the pipe are permitted provided these deviations do not exceed 6.0 mm. The same shall not extend (in any direction) over a distance of more than 25% of nominal diameter of the bend.

4.9 The excess weld material at the inside of the bend in case of bends made from SAW pipes shall be removed over a distance of 100 mm at both ends.

4.10 Tolerances

The dimensions of bends shall be controlled to make sure that they are manufactured according to tolerances indicated below, in addition to the requirements of MSS SP-75. However, the ends of finished pipe bend shall meet the dimensional tolerances of the relevant pipe specification referred in clause 2.0.

4.10.1 Following tolerances shall be applicable for bend angle and bend radius.

Bend Angle: ± 0.5 degree from the specified angle.

Bend radius: = 1% of bending nominal radius (radius as indicated in clause 4.1 above).

4.10.2 The manufacturer shall measure the wall thickness of the pipe before bending along both the inside and outside radii of the bend between and including the start and stop points of the bend arc angle, at interval, at intervals approximately equal to pipe diameter or 300 mm whichever is less. The wall thickness shall be measured ultrasonically after bending at the same location as measured before bending. In addition, the wall thickness of the tangents shall also be measured. These measurements shall be taken at four equally spaced locations around the pipe circumference. The measured wall thickness shall be at least equal to:

$$t_{\min} = 0.95(t_{\text{actual}} - \Delta t)$$

where

t_{actual} = actual wall thickness of pipe used for bending

Δt = 0.35 mm for a wall thickness < 10 mm

0.5 mm for a wall thickness > 10 mm

4.10.3 When the pipes are free issue (or thickness of the pipe is specified in MR) the thickness of finished bend shall comply with the requirement of 4.10.2. When pipes for manufacturing LR bends are to be procured by manufacturer and thickness of finished LR bends is specified in the MR, thickness specified of the bends shall be the minimum thickness achieved after bending with tolerance as ± 0.0 . Manufacturer shall procure pipes to achieve tmin. Of LR bends as described in 4.10.2 above.

4.10.4 Out of roundness tolerance on the body and ends of the bend shall be as follows:

Body

Measurements of the outside diameter shall be taken in the plane of the bend at locations where wrinkles are present (OD_{max.}) and at locations where wrinkles are not present (OD_{min.}). Out of roundness shall be considered acceptable, if the value of $((OD_{max.} - OD_{min.})/OD_{nom.})$ does not exceed 0.2%.

The measurements shall be made over the circumference of bend either at distances approximately equal to pipe diameter or 300 mm whichever is less. Minimum three measurements shall be taken for each bend.

Ends

Out of roundness over a length of 100 mm from the end shall comply with the requirement of relevant company specification referred in clause 2.0.

4.10.5 Off Plane

Off plane of bends shall not exceed $(\theta/90) \times 10\text{mm}$, where θ is the bend angle in degree or the tolerance limit specified in MSS-SP-75, whichever is less. The measurement shall be in accordance with MSS-SP-75.

4.10.6 Squareness

Bevel and squareness of bend ends shall comply with the requirements of relevant specification referred in clause 2.0.

5. INSPECTION AND TESTS

5.1 The manufacturer shall perform all inspection and tests as per the requirements of this specification and MSS-SP-75 prior to shipment, at his works. Inspection/ material certificate shall confirm to EN 10204 3.2 certification. Such inspection and tests shall be as a minimum, but not limited to, the following:

- a. Verify that the unfinished product arriving at manufacturer's shop is in full compliance with the pipe specification as referred in clause 2.0 of this specification.
- b. Visual inspection.
- c. Dimensional and tolerance check as per MSS-SP-75 and requirements of section 4.0 of this specification.
- d. Check heat treatment, if carried out, as required and maintain its records.
- e. Temperature against time recorder charts for each induction heating.
- f. The non-destructive inspection on the finished bend shall be carried out as given below;
 - All seam welds of bends manufactured from SAW pipes shall be 100% radiographed and seam welds of bends manufactured from EW pipe shall be 100% ultrasonically tested. The acceptance criteria shall be same as given in applicable pipe specification referred under clause 2.0 of this specification.
 - The full circumference of both ends of each bend after beveling shall be ultrasonically tested for lamination over a length of 25 mm.
 - The finished bends shall be magnetic particle inspected on the outside and inside radii to include the area encompassed 30 degrees either side of the line passing through the plane of the bend. Acceptance criteria shall be as per ASME Sec. VIII Appendix 6.

- g. A check shall be performed on each bend by passing a gauging pig consisting of two discs having a diameter equal to 95% of the inside diameter of the pipe, connected rigidly together at a distance equal to 500 mm. Details of the gauging pig, including its dimension shall be approved by company.

5.1.1 Hydrostatic testing

All induction bends shall be hydrostatically tested at the manufacturer's work in accordance with the requirement of API 5L. The test pressure shall be 100% SMYS with a hold time of 30 min.

The manufacturer shall submit hydrostatic test pressure calculations to the owner / consultant for approval.

All gauges used for measurement of pressure during hydrostatic testing of bends shall be calibrated against a dead weight tester to the satisfaction of the owner / consultant before and after the test. All pressure gauges used shall have an upper range of 1.5 to 2 times the minimum test pressure.

All hydrostatic pressure tests shall be chart recorded. The identification number of the induction bends being tested shall be clearly recorded on the hydrostatic pressure charts.

Orientation of the weld seam of the pipe bends fabricated from welded pipes shall be such that any pin hole leak in the seam area shall be clearly visible to hydrostatic testing operators and inspection personnel.

5.2 Non-destructive examination

5.2.1 Manufacturer shall submit a detailed procedure for all non-destructive tests to be performed on the bend. The NDT procedure shall, as a minimum, include the following;

1. Equipment details and calibration techniques.
2. Qualification of NDT operators (shall be minimum ASNT-TC-1A level 2)
3. Scanning techniques (100% coverage)
4. Examination techniques
5. Testing evaluation method
6. Preparation of reports

5.2.2 All bends shall be subjected to non-destructive testing in accordance with the requirements of specification.

5.2.3 Non destructive examination shall be performed on all bends that have passed the hydrostatic testing.

5.2.4 The surface of the bends to be examined shall be clean and smooth, free from dirt, paint or any other foreign matter which would affect / influence the results of testing.

5.2.5 The entire outer surface of each bend and bevels shall be inspected for laminations and cracks by magnetic particle inspection in accordance with ASME section V, article 7.

5.2.6 The manufacturers shall ultrasonically examine the weld areas of all induction bends for defects. Also full body surface shall be examined ultrasonically for bends made by SMLS / welded pipes

5.2.7 The full circumference of both ends of each bend after beveling shall be ultrasonically tested for laminations over a length of 25 mm and acceptance limits shall be as per specification as referred in clause 2.0 of this specification.

5.2.8 Acceptance levels for MPI, UT, and RT inspections shall be in accordance with specification.

5.2.9 The entire outer surface included extrados surface of each bend and bevel ends shall be inspected for lamination by MPI in accordance with ASME Sec V.

5.3 Residual Magnetism

Manufacturer shall use a digital or analogue gauss meter with directional probe with an accuracy of 0.1 gauss to determine the residual magnetism of the induction bend.

No residual magnetism in either longitudinal or transverse direction to the pipe axis shall be greater than 15 gauss.

Demagnetization shall be applied if the magnetic measurement shows values greater than the acceptable limit of 15 gauss.

The manufacturer shall include the procedure for degaussing in the manufacturing procedure specification.

5.4 Surface Finish

Any irregularities in the surface contour of the bend caused by the bending operation shall be rejected.

Manufacturer shall include a description of how surface irregularities shall be avoided and the methods proposed to inspect such irregularities in the MPS.

- 5.5 Owner/ consultant's representative reserves the right to perform stage wise inspection and witness inspection tests on all bends as indicated in 5.1 and 5.2 at manufacturer's work, prior to shipment.

Manufacturer shall give reasonable notice of time and shall provide without charge reasonable access and facilities for inspection, to the Company's inspector. Inspection and tests performed or witnessed by company's inspector shall in no way relieve the manufacturer's obligation to perform the required inspection and tests. Under no circumstances any action of company's inspector shall relieve the manufacturer of his responsibility for the material and quality of the bends.

6. TEST CERTIFICATES

The manufacturer shall submit the following certificates:

- a. Test certificates of chemical analysis, mechanical tests, heat treatment, NDT, dimensional inspection and hydro-test carried out on pipe used for fabrication of bend. These test certificates are not required when pipe is supplied as free issue by the company.
- b. Certificates of non-destructive test/examination carried out on bends.
- c. Records of heat treatment, if carried out for bends.
- d. Certified reports of dimensional tolerance of bends.
- e. Certificates of all other tests as required in this specification.

The certificate shall be valid only when signed by company's inspector. Only those bends which have been certified by company's inspector shall be dispatched from manufacturer's work.

7. MARKING, PACKING AND SHIPMENT

- 7.1 All bends shall be marked as per MSS-SP-75
- 7.2 All loose and foreign material i.e. rust, grease, etc. shall be removed from inside and outside of the bends.
- 7.3 A coat of antirust paint shall be applied on the bends for protection during transit and storage.
- 7.4 Type of paint shall be as agreed upon with the company.
- 7.5 Both ends of all bends shall be suitably protected to avoid any damage during transit by means of metallic or high impact plastic bevel protectors.
- 7.6 Package shall be marked legibly with suitable marking ink to indicate the following;
 - A. Order Number
 - B. Package number

- C. Manufacturer's Name
- D. Size (inches) and wall thickness (mm)
- E. Radius of bend (mm)

8. DOCUMENTATION

Documentation to be submitted by manufacturer to company is summarized below. Number of copies (hard copies/soft copies, etc.) shall be as indicated in contract document.

- 8.1 All documents shall be in English language.
- 8.2 At the time of bidding, bidder shall submit the following documents:
 - a. Reference list of previous supplies of bends of similar specifications.
 - b. Brief description of the manufacturing, heat treatment and quality control facilities of the manufacturer's work.
- 8.3 Within two weeks of placement of order, the manufacturer shall submit bend manufacturing procedure including manufacturing, inspection, testing procedures, quality control manual and quality plans.

The Bend manufacturing procedure shall detail the following, as a minimum;

- a. Sequence of operation.
- b. Induction forming process including bending temperature, temperature control, bending rate, cooling rate and cooling procedure.
- c. Temperature measurement and calibration
- d. Post bend heat treatment procedure including temperature and time.
- e. Dimensional control procedures.
- f. Pipe materials used for bend manufacture.
- g. NDT procedures
- h. Quality control and quality plans.

Upon successful completion of the bend manufacturing procedure qualification as per section 9.0 of this specification, Manufacturer shall submit the qualified procedure to company for approval. Regular production of bends shall commence only after the bend manufacturing procedure has been qualified and approved by company.

Once the approval has been given by company any change in material and method of manufacture and quality control shall be notified to company whose approval in writing of all such changes shall be obtained before the bends are manufactured.

- 8.4 Within two weeks from the approval date, manufacturer shall submit to company the approved drawings, documents and specification as listed in clause 8.3 above.
- 8.5 Prior to shipment, the manufacture shall submit test certificates as listed in section 6.0 of this specification.

9. BEND MANUFACTURING PROCEDURE QUALIFICATION

- 9.1 Prior to start of production bending, manufacturer shall demonstrate the suitability of the proposed manufacturing procedures for producing pipe bends including the post-bending host cycle, that meet the requirement of this specification, by mechanical testing additional bend(s) (test bends). The bending procedure shall be qualified in the presence of company representative.
- 9.2 Test bends shall be made by using the pipe supplied by the owner. One test bend is required per 'heat lot' where a heat lot is deemed to include all bends of the same diameter, wall thickness, mill heat number and bend forming parameters such as, bending temperature, bending rate, cooling medium volume and heat treatment temperature (excluding bend angle). The test bend shall be bent to an angle of 90⁰.
- 9.3 Inspection and Testing of Bends
 - 9.3.1 All finished test bends shall meet the requirement of dimensional tolerances, inspection and non destructive resting requirements specified in section 4.0 and 5.0 of this specification.

9.3.2 In addition, all finished test bends shall be subjected to following mechanical testing to confirm that the bends manufactured meet all mechanical property. The test specimen shall be taken from the bent portion of the bend only.

a. Tensile test

One tensile test shall be conducted on the base material of finished test bend, to establish yield strength, ultimate tensile strength and elongation. The specimen shall be taken longitudinal or traverse to the axis as specified in the relevant pipe specification. In case of bends of 450 mm (18") NB and larger, the specimen shall be taken at inside radius and one at outside radius of the bend.

b. All Weld tensile test

In case of bends fabricated from SAW pipes, an all weld tensile test shall be conducted to establish yield strength, ultimate tensile strength and elongation of weld material on bend.

c. Guided Bend Test/Reverse Bend Test

For bends manufactured from SAW pipes one face and one root guided bend test shall be performed. For bends manufactured from EW pipes, reverse bend test shall be carried out. Test method and acceptance criteria shall be same as given in applicable pipe specification referred under clause 2.0 of this specification.

d. Hardness Test

Hardness testing shall be performed "thru thickness" on a test ring removed from the middle of the bend. Four specimens shall be prepared one from each quadrant. In case of bends fabricated from SAW/EW pipes, one specimen shall have longitudinal weld seam in the middle. Hardness shall be checked for base metal, weld metal and HAZ. In addition, hardness test shall be performed at spots where dents, bulges or wrinkles have been formed on the bends.

e. Fracture toughness test

Unless specified otherwise, Charpy V notch test shall be conducted for each heat of steel, in accordance with the impact test provision of ASTM A370 at temperature of 0°C. The average absorbed impact energy values of three full-sized specimens shall be 35 joules.

The minimum impact energy values of any one specimen of the three specimens analyzed as above shall not be less than 80% of the above mentioned average value.

If bends are manufactured from pipes, Charpy V-notch test temperature shall be the same as specified in the relevant pipe specifications/test certificates.

Three base material specimens shall be taken longitudinal or transverse to the axis.

In case of bends fabricated from SAW and EW pipes, three transverse weld material specimens shall be taken with weld in the middle.

In case of bends of 450 mm (18") NB and larger, the base material specimens shall be taken at the outside radius of the bend.

f. Hydrostatic test

Bends shall be hydrostatically tested to test pressure that shall result in hoop stress corresponding to 90% of SMYS of pipe material. Test pressure shall be held for a minimum period of fifteen (15) seconds.

Should test bends fail to comply with the above requirements, the bend manufacturing procedure shall be disqualified. The manufacturer shall revise the manufacturing procedure and re-qualify the same at his own cost and time.

Upon completion of the successful procedure qualification, manufacture shall provide a written bending procedure for each test bend. The submitted procedure shall indicate in addition to the details as per clause 8.3. tolerances on various controlling parameters.

CLIENT	Gail India Limited	TAG NO.	
QUANTITY	Refer MR	SIZE	Refer MR
APPLICABLE TO: <input checked="" type="checkbox"/> PROPOSAL <input type="checkbox"/> PURCHASE <input type="checkbox"/> AS BUILT			
DESIGN DATA			
DESIGN CLASS :		600#	
DESIGN CODE :		ASME B 16.9, MSS-SP-97& MSS SP 75	
FLUID :		Natural Gas / R-LNG	
<input checked="" type="checkbox"/> SWEET SERVICE <input type="checkbox"/> SOUR <input type="checkbox"/> LETHAL			
DESIGN PRESSURE AND TEMPERATURE:		98 kg/cm², Min. -29 °C / Max 65 °C	
INTERNAL : 98kg/cm ² @ -29 to 65°C			
EXTERNAL :ATM @ 45°C			
HYDRO TEST PRESSURE		147 Kg/cm ² g @ AMBIENT temp	
MATERIAL OF CONSTRUCTION :		A 234 Gr.WPB for Tees ,Reducers ,Elbows for sizes 2 Inches and above And A 105 for sizes below 2 inches. A 105 for sockolet, weldolet.	
<input checked="" type="checkbox"/> PWHT <input checked="" type="checkbox"/> CHARPY IMPACT TEST			
PWHT REQUIRED FOR <input type="checkbox"/> CLIENT <input type="checkbox"/> PROCESS <input checked="" type="checkbox"/> CODE			
RADIOGRAPHY AS PER CODE			
ULTRASONIC TESTING As Per CODE			
HYDROTEST As Per CODE			
End Connection THK. (mm) :		Refer MR	
Body Construction :		Seamless	

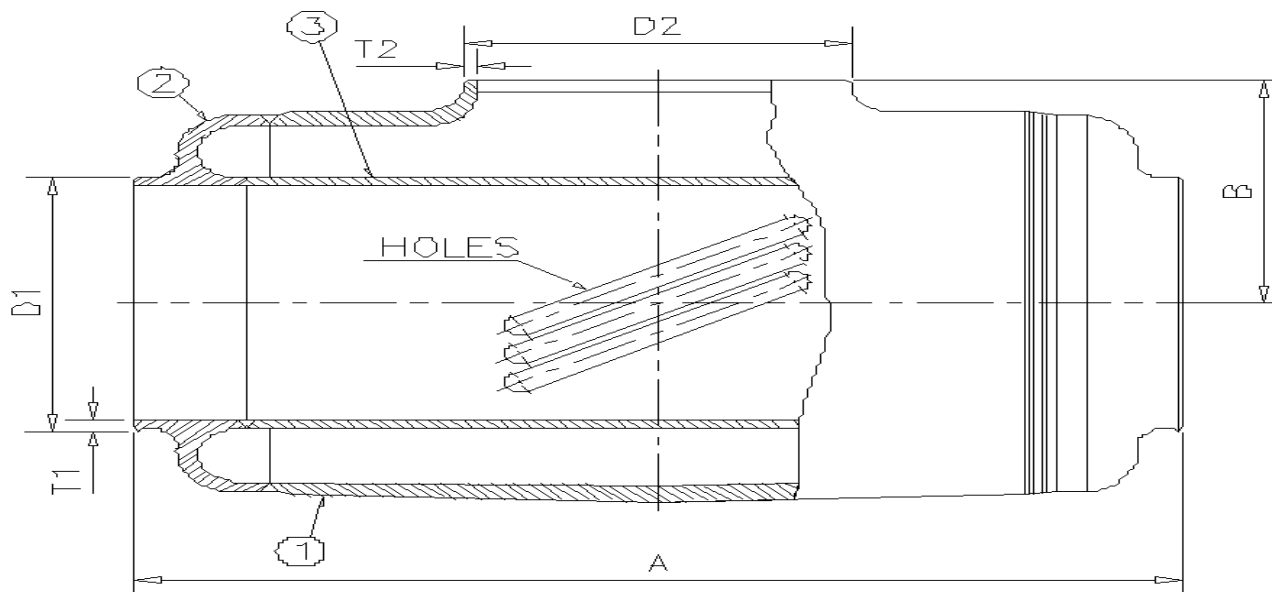
CLIENT	Gail India Limited	TAG NO.	
QUANTITY	Refer MR	SIZE	Refer MR
APPLICABLE TO: <input checked="" type="checkbox"/> PROPOSAL <input type="checkbox"/> PURCHASE <input type="checkbox"/> AS BUILT			
DESIGN DATA			
DESIGN CLASS :		300#	
DESIGN CODE :		ASME B 16.9, MSS-SP-97& MSS SP 75	
FLUID :		Natural Gas / R-LNG	
<input checked="" type="checkbox"/> SWEET SERVICE <input type="checkbox"/> SOUR <input type="checkbox"/> LETHAL			
DESIGN PRESSURE AND TEMPERATURE:		49 kg/cm², Min. -29 °C / Max 65 °C	
INTERNAL : 49kg/cm ² @ -29 to 65°C			
EXTERNAL : ATM @ 45°C			
HYDRO TEST PRESSURE		73.5 Kg/cm ² g @ AMBIENT temp	
MATERIAL OF CONSTRUCTION :		A 234 Gr.WPB for Tees ,Reducers ,Elbows for sizes 2 Inches and above And A105 for sizes below 2 Inches. A105 for Sockolet, Weldolet	
<input checked="" type="checkbox"/> PWHT <input checked="" type="checkbox"/> CHARPY IMPACT TEST			
PWHT REQUIRED FOR <input type="checkbox"/> CLIENT <input type="checkbox"/> PROCESS <input checked="" type="checkbox"/> CODE			
RADIOGRAPHY AS PER CODE			
ULTRASONIC TESTING As Per CODE			
HYDROTEST As Per CODE			
End Connection THK. (mm) :		Refer MR	
Body Construction :		Seamless	

CLIENT	Gail India Limited	TAG NO.	
QUANTITY	Refer MR	SIZE	Refer MR
APPLICABLE TO: <input checked="" type="checkbox"/> PROPOSAL <input type="checkbox"/> PURCHASE <input type="checkbox"/> AS BUILT			
DESIGN DATA			
DESIGN CLASS :		150#	
DESIGN CODE :		ASME B 16.9, MSS-SP-97 & MSS SP 75	
FLUID :		Natural Gas / R-LNG	
<input checked="" type="checkbox"/> SWEET SERVICE <input type="checkbox"/> SOUR <input type="checkbox"/> LETHAL			
DESIGN PRESSURE AND TEMPERATURE:		19 kg/cm², Min. -29 °C / Max 65 °C	
INTERNAL : 19kg/cm² @ -29 to 65°C			
EXTERNAL : ATM @ 45°C			
HYDRO TEST PRESSURE		28.5 Kg/cm ² g @ AMBIENT temp	
MATERIAL OF CONSTRUCTION :		A 234 Gr.WPB for Tees ,Reducers ,Elbows for sizes 2 Inches and above And A105 for sizes 2 Inches and below A 105 for Sockolet, Weldolet.	
<input checked="" type="checkbox"/> PWHT <input checked="" type="checkbox"/> CHARPY IMPACT TEST			
PWHT REQUIRED FOR <input type="checkbox"/> CLIENT <input type="checkbox"/> PROCESS <input checked="" type="checkbox"/> CODE			
RADIOGRAPHY AS PER CODE			
ULTRASONIC TESTING As Per CODE			
HYDROTEST As Per CODE			
End Connection THK. (mm) :		Refer MR	
Body Construction :		Seamless	

CLIENT	Gail India Limited	TAG NO.	
QUANTITY	Refer MR	SIZE	Refer MR
APPLICABLE TO: <input checked="" type="checkbox"/> PROPOSAL <input type="checkbox"/> PURCHASE <input type="checkbox"/> AS BUILT			
DESIGN DATA		FLANGE (WELD NECK, BLIND & SPACER/SPECTACLE BLIND)	
DESIGN CLASS :		600#	
DESIGN CODE :		B -16.5/B 16.48	
FLUID :		Natural Gas / R-LNG	
<input checked="" type="checkbox"/> SWEET SERVICE <input type="checkbox"/> SOUR <input type="checkbox"/> LETHAL			
DESIGN PRESSURE AND TEMPERATURE:		98 kg/cm²g; Min. -29°C/Max 65°C	
INTERNAL : 98 kg/cm ² g @ -29 to 65°C			
EXTERNAL : ATM @ 45°C			
MATERIAL OF CONSTRUCTION :		ASTM A 105	
FLANGE TYPE:		WELD NECK FLANGE, BLIND, & SPACER/SPECTACLE BLIND	
FLANGE FACING		RAISED FACE 125 AARH	
<input checked="" type="checkbox"/> PWHT <input checked="" type="checkbox"/> CHARPY IMPACT TEST			
PWHT REQUIRED FOR <input type="checkbox"/> CLIENT <input type="checkbox"/> PROCESS <input checked="" type="checkbox"/> CODE			
End Connection THK. (mm) :		Refer MR	
TOTAL MIN. THK :		N.A.	
RADIOGRAPHY AS PER CODE			
ULTRASONIC TESTING As Per CODE			

CLIENT	Gail India Limited	TAG NO.	
QUANTITY	Refer MR	SIZE	Refer MR
APPLICABLE TO: <input checked="" type="checkbox"/> PROPOSAL <input type="checkbox"/> PURCHASE		<input type="checkbox"/> AS BUILT	
DESIGN DATA		FLANGE (WELD NECK, BLIND & SPACER/SPECTACLE BLIND)	
DESIGN CLASS :		300#	
DESIGN CODE :		B -16.5/B 16.48	
FLUID :		Natural Gas / R-LNG	
<input checked="" type="checkbox"/> SWEET SERVICE		<input type="checkbox"/> SOUR	
		<input type="checkbox"/> LETHAL	
DESIGN PRESSURE AND TEMPERATURE:		49 kg/cm²g; Min. -29⁰C/Max 65⁰C	
INTERNAL : 49kg/cm ² g @ -29 to 65°C			
EXTERNAL :ATM @ 45°C			
MATERIAL OF CONSTRUCTION :		ASTM A 105	
FLANGE TYPE:		WELD NECK FLANGE, BLIND, & SPACER/SPECTACLE BLIND	
FLANGE FACING		RAISED FACE 125 AARH	
<input checked="" type="checkbox"/> PWHT		<input checked="" type="checkbox"/> CHARPY IMPACT TEST	
PWHT REQUIRED FOR <input type="checkbox"/> CLIENT <input type="checkbox"/> PROCESS <input checked="" type="checkbox"/> CODE			
End Connection THK. (mm) :		Refer MR	
TOTAL MIN. THK :		N.A.	
RADIOGRAPHY AS PER CODE			
ULTRASONIC TESTING As Per CODE			

CLIENT	Gail India Limited	TAG NO.	
QUANTITY	Refer MR	SIZE	Refer MR
APPLICABLE TO: <input checked="" type="checkbox"/> PROPOSAL <input type="checkbox"/> PURCHASE		<input type="checkbox"/> AS BUILT	
DESIGN DATA		FLANGE (WELD NECK, BLIND & SPACER/SPECTACLE BLIND)	
DESIGN CLASS :		150#	
DESIGN CODE :		B -16.5/B 16.48	
FLUID :		Natural Gas / R-LNG	
<input checked="" type="checkbox"/> SWEET SERVICE		<input type="checkbox"/> SOUR	
		<input type="checkbox"/> LETHAL	
DESIGN PRESSURE AND TEMPERATURE:		19 kg/cm²g; Min. -29°C/Max 65°C	
INTERNAL : 19kg/cm²g @ -29 to 65°C			
EXTERNAL : ATM @ 45°C			
MATERIAL OF CONSTRUCTION :		ASTM A 105	
FLANGE TYPE:		WELD NECK FLANGE, BLIND, & SPACER/SPECTACLE BLIND	
FLANGE FACING		RAISED FACE 125 AARH	
<input checked="" type="checkbox"/> PWHT		<input checked="" type="checkbox"/> CHARPY IMPACT TEST	
PWHT REQUIRED FOR <input type="checkbox"/> CLIENT <input type="checkbox"/> PROCESS <input checked="" type="checkbox"/> CODE			
End Connection THK. (mm) :		Refer MR	
TOTAL MIN. THK :		N.A.	
RADIOGRAPHY AS PER CODE			
ULTRASONIC TESTING As Per CODE			

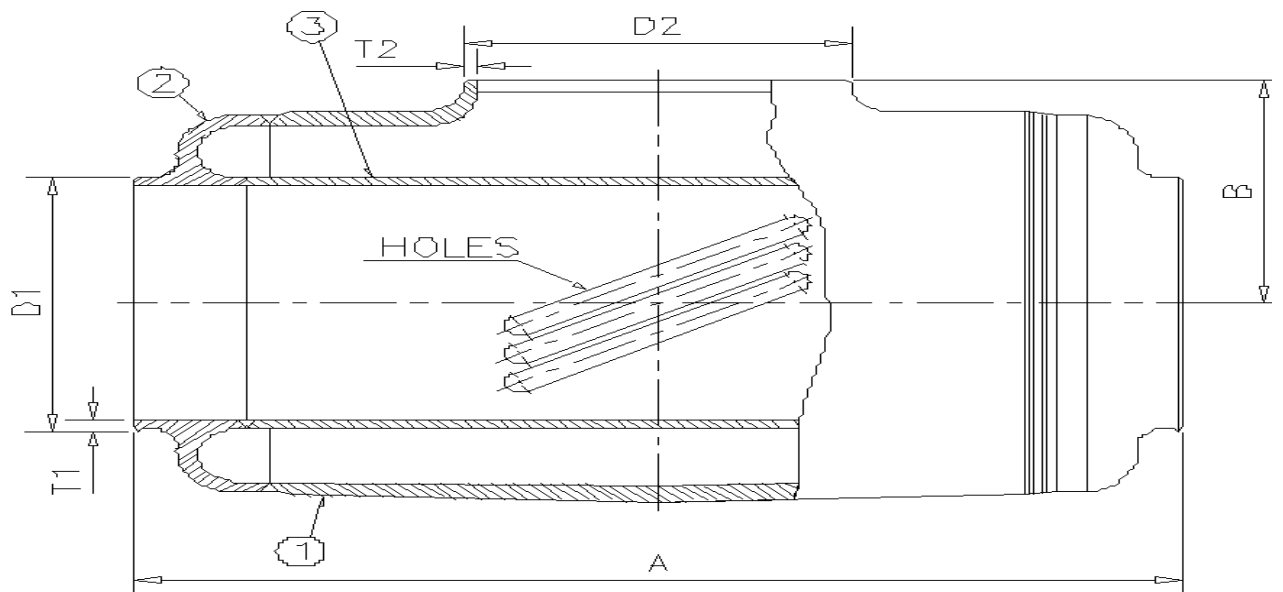


DESIGN DATA			
Design Standard	ANSI B 31.8 for Tee and internal Sleeve ASME Sec VIII Div I for End Piece		
Dimension Standard	ANSI B 16.9 & ASME B 16.25		
Service	Natural Gas(NG)		
Installation	Above Ground/ Under Ground		
ANSI Class	600#		
Design Pressure	98 barg		
Design Temperature (°C)	-29 to 65 (Above Ground) -29 to 60 (Under Ground)		
Corrosion Allowance(mm)	0.5 mm 3.0 mm for End Piece. 1.6 mm for Tee & Internal Sleeves		
Design Factor (F)	0.5		
Hydrostatic Test Pressure	1.5 x Design Pressure(For 15 Mins)		
Suitability of Flow Tee	FOR ALL TYPES OF PIGS		
Flow Direction	Bi-directional		
Hardness Test	As per specification		
Charpy Impact Test	At -29 deg C		
FLOW TEE MATERIAL (Equivalent or superior)			
Part No.	Description	Material of Construction	
		Specified	Offered
1	Tee	MSS-SP-75, GR.WPHY-70 (Charpy)	
2	End Pieces/Forged Rings	ASTM A 694 Gr.F70 (Charpy)	

3	Internal sleeve		API 5L Gr X70 PSL 2			
S.NO	CONNECTING PIPELINE DETAILS					
	RUNNING PIPE DETAILS			BRANCH PIPE DETAILS		
	O.D.(inch)	MATERIAL	O.D.(inch)	MATERIAL	Loc.	Qty.
1	12"	API 5L Gr X 70 (PSL-2) 8.4 mm Thk.	8"	API 5L X52, (PSL-2) WT 9.53 mm	AG	

NOTES:

1. Manufacturer to indicate dimensions A, B, T1 and T2 marked in the sketch above.
2. Documents of successful Proof Test & Type Test shall be verified by TPIA.
3. All flow tees shall be completely stress relieved as per MSS SP-75 (After welding).
4. Vendor has to submit all required design & thickness calculations for client approval.
5. Holes/ Slots in the sleeve shall be arranged at 45 deg to the center line of Flow Tee.
6. For the welding end, the maximum out of roundness (i.e. difference between maximum and minimum ID at pipe end) shall be less than 5.0 mm and tolerance on internal diameter at pipe ends shall be same as diameter tolerance for the pipe ends indicated in API 5L Table 8.
7. Bevel end preparation shall be as per ANSI B 16.25.
8. The wall thickness of ends of Flow Tee shall match with run pipe and branch pipe thickness.
9. Manufacturer shall ensure that the wall thickness (W.T.) of all parts of flow tee shall be adequate to sustain design pressure and selected wall thickness shall be suitable for welding with wall thickness of connecting Pipeline/Piping.
10. Manufacturer shall furnish details of slots in internal sleeve. The area of slot shall be 1.5 times the area of branch internal diameter and relevant calculations have to be furnished.
11. All testing shall be carried out as per approved QAP.
12. TPIA shall issue 3.2 certificates as per EN 10204.

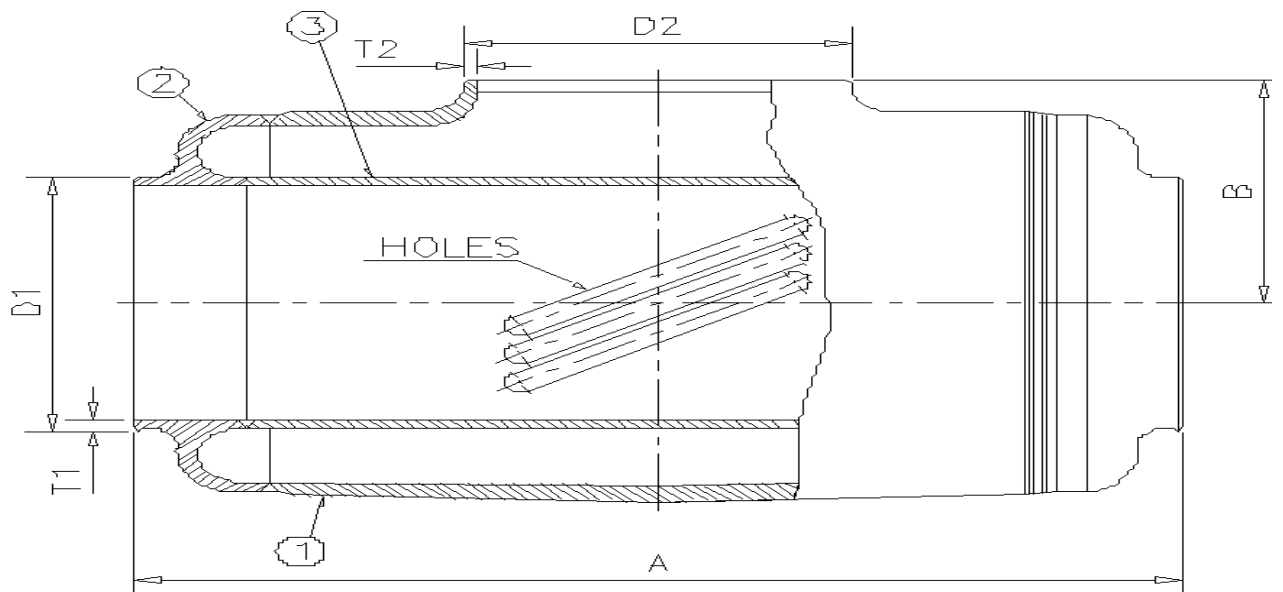


DESIGN DATA			
Design Standard	ANSI B 31.8 for Tee and internal Sleeve ASME Sec VIII Div I for End Piece		
Dimension Standard	ANSI B 16.9 & ASME B 16.25		
Service	Natural Gas(NG)		
Installation	Above Ground/ Under Ground		
ANSI Class	600#		
Design Pressure	98 barg		
Design Temperature (°C)	-29 to 65 (Above Ground) -29 to 60 (Under Ground)		
Corrosion Allowance(mm)	0.5 mm 3.0 mm for End Piece. 1.6 mm for Tee & Internal Sleeves		
Design Factor (F)	0.5		
Hydrostatic Test Pressure	1.5 x Design Pressure(For 15 Mins)		
Suitability of Flow Tee	FOR ALL TYPES OF PIGS		
Flow Direction	Bi-directional		
Hardness Test	As per specification		
Charpy Impact Test	At -29 deg C		
FLOW TEE MATERIAL (Equivalent or superior)			
Part No.	Description	Material of Construction	
		Specified	Offered
1	Tee	MSS-SP-75, GR.WPHY-60 (Charpy)	
2	End Pieces/Forged Rings	ASTM A 694 Gr.F60 (Charpy)	

3	Internal sleeve	API 5L Gr X-60, PSL-2				
S.NO	CONNECTING PIPELINE DETAILS					
	RUNNING PIPE DETAILS		BRANCH PIPE DETAILS			
	O.D.(inch)	MATERIAL	O.D.(inch)	MATERIAL	Loc.	Qty.
1	10"	API 5L Gr X 60 (PSL-2) 7.8 mm Thk.	8"	API 5L X52 WT 9.53 mm (WPHY-52)	AG	

NOTES:

1. Manufacturer to indicate dimensions A, B, T1 and T2 marked in the sketch above.
2. Documents of successful Proof Test & Type Test shall be verified by TPIA.
3. All flow tees shall be completely stress relieved as per MSS SP-75 (After welding).
4. Vendor has to submit all required design & thickness calculations for client approval.
5. Holes/ Slots in the sleeve shall be arranged at 45 deg to the center line of Flow Tee.
6. For the welding end, the maximum out of roundness (i.e. difference between maximum and minimum ID at pipe end) shall be less than 5.0 mm and tolerance on internal diameter at pipe ends shall be same as diameter tolerance for the pipe ends indicated in API 5L Table 8.
7. Bevel end preparation shall be as per ANSI B 16.25.
8. The wall thickness of ends of Flow Tee shall match with run pipe and branch pipe thickness.
9. Manufacturer shall ensure that the wall thickness (W.T.) of all parts of flow tee shall be adequate to sustain design pressure and selected wall thickness shall be suitable for welding with wall thickness of connecting Pipeline/Piping.
10. Manufacturer shall furnish details of slots in internal sleeve. The area of slot shall be 1.5 times the area of branch internal diameter and relevant calculations have to be furnished.
11. All testing shall be carried out as per approved QAP.
12. TPIA shall issue 3.2 certificates as per EN 10204.

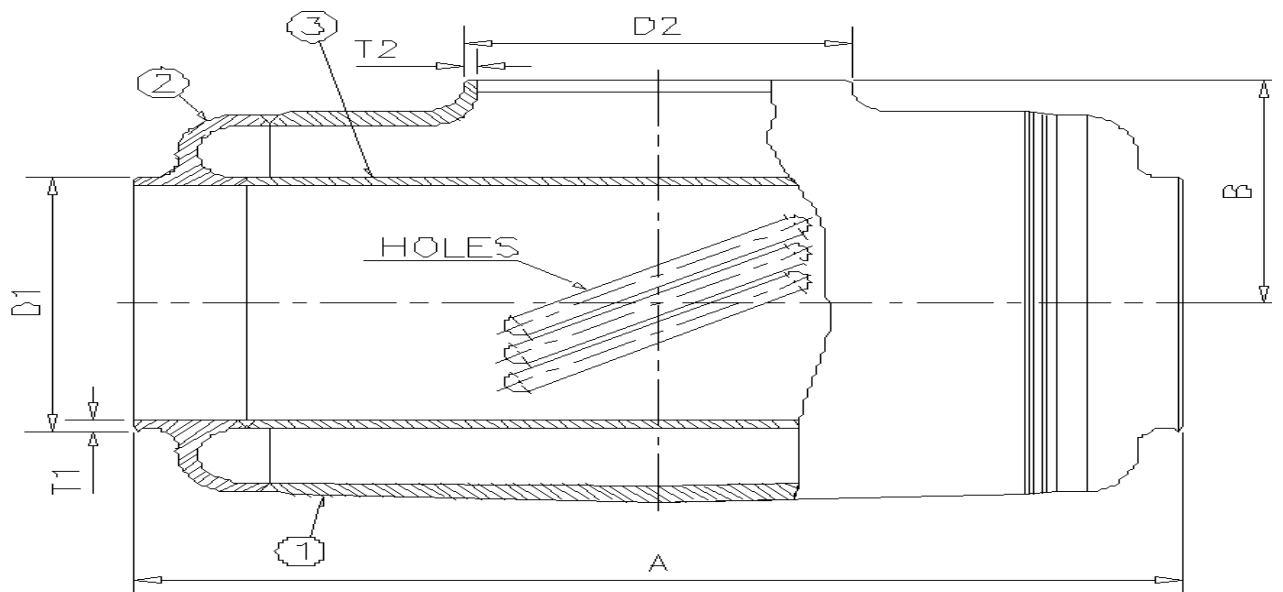


DESIGN DATA			
Design Standard	ANSI B 31.8 for Tee and internal Sleeve ASME Sec VIII Div I for End Piece		
Dimension Standard	ANSI B 16.9 & ASME B 16.25		
Service	Natural Gas(NG)		
Installation	Above Ground/ Under Ground		
ANSI Class	600#		
Design Pressure	98 barg		
Design Temperature (°C)	-29 to 65 (Above Ground) -29 to 60 (Under Ground)		
Corrosion Allowance(mm)	0.5 mm 3.0 mm for End Piece. 1.6 mm for Tee & Internal Sleeves		
Design Factor (F)	0.5		
Hydrostatic Test Pressure	1.5 x Design Pressure(For 15 Mins)		
Suitability of Flow Tee	FOR ALL TYPES OF PIGS		
Flow Direction	Bi-directional		
Hardness Test	As per specification		
Charpy Impact Test	At -29 deg C		
FLOW TEE MATERIAL (Equivalent or superior)			
Part No.	Description	Material of Construction	
		Specified	Offered
1	Tee	MSS-SP-75, GR.WPHY-52 (Charpy)	
2	End Pieces/Forged Rings	ASTM A 694 Gr.F52 (Charpy)	

3	Internal sleeve		API 5L Gr X52, PSL 2			
S.NO	CONNECTING PIPELINE DETAILS					
	RUNNING PIPE DETAILS		BRANCH PIPE DETAILS			
	O.D.(inch)	MATERIAL	O.D.(inch)	MATERIAL	Loc.	Qty.
1	8"	API 5L Gr X 52 (PSL-2) 9.53 mm Thk.	8"	API 5L Gr. X52, WT 9.53 mm, (WPHY-52)	AG	

NOTES:

1. Manufacturer to indicate dimensions A, B, T1 and T2 marked in the sketch above.
2. Documents of successful Proof Test & Type Test shall be verified by TPIA.
3. All flow tees shall be completely stress relieved as per MSS SP-75 (After welding).
4. Vendor has to submit all required design & thickness calculations for client approval.
5. Holes/ Slots in the sleeve shall be arranged at 45 deg to the center line of Flow Tee.
6. For the welding end, the maximum out of roundness (i.e. difference between maximum and minimum ID at pipe end) shall be less than 5.0 mm and tolerance on internal diameter at pipe ends shall be same as diameter tolerance for the pipe ends indicated in API 5L Table 8.
7. Bevel end preparation shall be as per ANSI B 16.25.
8. The wall thickness of ends of Flow Tee shall match with run pipe and branch pipe thickness.
9. Manufacturer shall ensure that the wall thickness (W.T.) of all parts of flow tee shall be adequate to sustain design pressure and selected wall thickness shall be suitable for welding with wall thickness of connecting Pipeline/Piping.
10. Manufacturer shall furnish details of slots in internal sleeve. The area of slot shall be 1.5 times the area of branch internal diameter and relevant calculations have to be furnished.
11. All testing shall be carried out as per approved QAP.
12. TPIA shall issue 3.2 certificates as per EN 10204.



DESIGN DATA

Design Standard	ANSI B 31.8 for Tee and internal Sleeve ASME Sec VIII Div I for End Piece
Dimension Standard	ANSI B 16.9 & ASME B 16.25
Service	Natural Gas(NG)
Installation	Above Ground/ Under Ground
ANSI Class	600#
Design Pressure	98 barg
Design Temperature (°C)	-29 to 65 (Above Ground) -29 to 60 (Under Ground)
Corrosion Allowance(mm)	0.5 mm 3.0 mm for End Piece. 1.6 mm for Tee & Internal Sleeves
Design Factor (F)	0.5
Hydrostatic Test Pressure	1.5 x Design Pressure(For 15 Mins)
Suitability of Flow Tee	FOR ALL TYPES OF PIGS
Flow Direction	Bi-directional
Hardness Test	As per specification
Charpy Impact Test	At -29 deg C

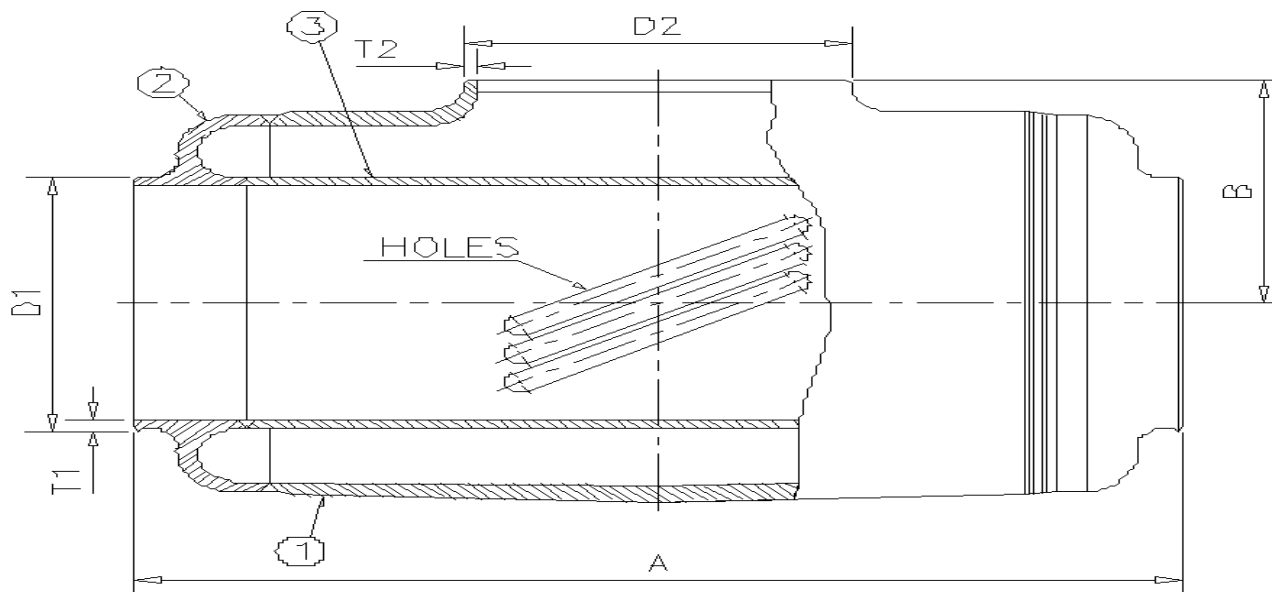
FLOW TEE MATERIAL (Equivalent or superior)

Part No.	Description	Material of Construction	
		Specified	Offered
1	Tee	MSS-SP-75, GR.WPHY-52 (Charpy)	
2	End Pieces/Forged Rings	ASTM A 694 Gr.F52 (Charpy)	

3	Internal sleeve		API 5L Gr X52, PSL 2			
S.NO	CONNECTING PIPELINE DETAILS					
	RUNNING PIPE DETAILS		BRANCH PIPE DETAILS			
	O.D.(inch)	MATERIAL	O.D.(inch)	MATERIAL	Loc.	Qty.
1	8"	API 5L Gr X 52 (PSL-2) 9.53 mm Thk.	4"	API 5L X42, WT 7.1 mm (WPHY-42)	AG	

NOTES:

1. Manufacturer to indicate dimensions A, B, T1 and T2 marked in the sketch above.
2. Documents of successful Proof Test & Type Test shall be verified by TPIA.
3. All flow tees shall be completely stress relieved as per MSS SP-75 (After welding).
4. Vendor has to submit all required design & thickness calculations for client approval.
5. Holes/ Slots in the sleeve shall be arranged at 45 deg to the center line of Flow Tee.
6. For the welding end, the maximum out of roundness (i.e. difference between maximum and minimum ID at pipe end) shall be less than 5.0 mm and tolerance on internal diameter at pipe ends shall be same as diameter tolerance for the pipe ends indicated in API 5L Table 8.
7. Bevel end preparation shall be as per ANSI B 16.25.
8. The wall thickness of ends of Flow Tee shall match with run pipe and branch pipe thickness.
9. Manufacturer shall ensure that the wall thickness (W.T.) of all parts of flow tee shall be adequate to sustain design pressure and selected wall thickness shall be suitable for welding with wall thickness of connecting Pipeline/Piping.
10. Manufacturer shall furnish details of slots in internal sleeve. The area of slot shall be 1.5 times the area of branch internal diameter and relevant calculations have to be furnished.
11. All testing shall be carried out as per approved QAP.
12. TPIA shall issue 3.2 certificates as per EN 10204.



DESIGN DATA			
Design Standard	ANSI B 31.8 for Tee and internal Sleeve ASME Sec VIII Div I for End Piece		
Dimension Standard	ANSI B 16.9 & ASME B 16.25		
Service	Natural Gas(NG)		
Installation	Above Ground/ Under Ground		
ANSI Class	600#		
Design Pressure	98 barg		
Design Temperature (°C)	-29 to 65 (Above Ground) -29 to 60 (Under Ground)		
Corrosion Allowance(mm)	0.5 mm 3.0 mm for End Piece. 1.6 mm for Tee & Internal Sleeves		
Design Factor (F)	0.5		
Hydrostatic Test Pressure	1.5 x Design Pressure(For 15 Mins)		
Suitability of Flow Tee	FOR ALL TYPES OF PIGS		
Flow Direction	Bi-directional		
Hardness Test	As per specification		
Charpy Impact Test	At -29 deg C		
FLOW TEE MATERIAL (Equivalent or superior)			
Part No.	Description	Material of Construction	
		Specified	Offered
1	Tee	MSS-SP-75, GR.WPHY-42 (Charpy)	
2	End Pieces/Forged Rings	ASTM A 694 Gr.F42 (Charpy)	

3	Internal sleeve		API 5L Gr X42, PSL 2			
S.NO	CONNECTING PIPELINE DETAILS					
	RUNNING PIPE DETAILS		BRANCH PIPE DETAILS			
	O.D.(inch)	MATERIAL	O.D.(inch)	MATERIAL	Loc.	Qty.
1	4"	API 5L Gr X 42 (PSL-2) 7.1 mm Thk.	4"	API 5L X42, WT 7.1 mm (WPHY-42)	AG	

NOTES:

1. Manufacturer to indicate dimensions A, B, T1 and T2 marked in the sketch above.
2. Documents of successful Proof Test & Type Test shall be verified by TPIA.
3. All flow tees shall be completely stress relieved as per MSS SP-75 (After welding).
4. Vendor has to submit all required design & thickness calculations for client approval.
5. Holes/ Slots in the sleeve shall be arranged at 45 deg to the center line of Flow Tee.
6. For the welding end, the maximum out of roundness (i.e. difference between maximum and minimum ID at pipe end) shall be less than 5.0 mm and tolerance on internal diameter at pipe ends shall be same as diameter tolerance for the pipe ends indicated in API 5L Table 8.
7. Bevel end preparation shall be as per ANSI B 16.25.
8. The wall thickness of ends of Flow Tee shall match with run pipe and branch pipe thickness.
9. Manufacturer shall ensure that the wall thickness (W.T.) of all parts of flow tee shall be adequate to sustain design pressure and selected wall thickness shall be suitable for welding with wall thickness of connecting Pipeline/Piping.
10. Manufacturer shall furnish details of slots in internal sleeve. The area of slot shall be 1.5 times the area of branch internal diameter and relevant calculations have to be furnished.
11. All testing shall be carried out as per approved QAP.
12. TPIA shall issue 3.2 certificates as per EN 10204.




PROJECT: GAIL ARC - INVENTORY CREATION PROJECT FOR LAST MILE
CONNECTIVITY
CLIENT: GAIL INDIA LIMITED
CONSULTANT: LEPL
VENDOR

QAP NO: GAIL-034-PL-QAP-001
ITEM DESCRIPTION: FLANGES (WNRF & SPACER BLIND)
PAGE NO: 1 of 1

OPERATION	CHARACTERISTIC	TYPE/ METHOD CHECK	EXTENT OF CHECK	REFERENCE DOCUMENTS	ACCEPTANCE NORMS	FORMAT OF RECORD	INSPECTION		
							Subvendor	TPI	LEPL
Review of PO/ TDC/ DRG	Review of PO/ DOC./ DRG & TD	Scrutiny/ Varification	Each doc of	Appl. Spec./ Std			P	R	R
RAW MATERIAL	Manufacturing Process of Steel	Verification with M.T.C.	Each Heat	ASTM A 105	Material Spec/ Std/ Customer Spec	Material Test Cert. / RMI Register	P	R	R
	Chemical Composition	Spectro Analysis	Each Heat						
FORGINGS	Reductino Ratio	Measurements	Minimum 1 per size	CHW Standard Manufacturing Procedure FFD	Std. Procedure	Forging Process Record/ Internal Register	P	W	R
	Temperature during Forging	Optical Pyrometer							
	Forging Dimensions	Measurements	100%		Forging Drwg ANSI B16.5				
Heat Treatment (Quenching and Tempering)	Heat Treatment Cycle	Verification of Heat Treatment Cycle	HT one Lot	ASTM A 105	ASTM A 105	T.P.M Sheet, Heat Treatment Graph	P	R	R
MECHANICAL TESTING	Tensile Test (TS,YS,EL%)	Tensile Testing	One Lot	ASTM A 105 ASTM E-112	YS-485 MPA min TS-565 MPA min %EL - 18 Grain Size ASTM 5 to 8	Mechanical Test Report & T.C.	P	W	R
	Hardness *								
	Micro Test								

	Impact Test				20 J min (one specimen) 27 J avg				
FINAL									
	Overall Dimension		100%	As per Grade	IIR		P	W	R
	Visual Check		FFD - 100%				P	W	R
	Marking	Visual	Logo, Matl. Specn., Size, Sch/ Rating, Lot No.	P.O.	Specified in T.C.		P	R	R
	Review of Manufacturer's Documents	LR	Correlation of TC				P	R	R
	Preparation of Documentation and Issue of Release Note	LR					P	R	R
CTC/MTC: Check /Mill Test Cert. P: Perform, IIR: Internal Report, W: Witness, R - Review, FFD: Free from defects, TPIA: Third party inspection agency.									
H: Hold, LR: Lab Reports, RMI: Raw material indent									
* Hardness - 248 HV10									
RMI - Raw Material Indent									
NOTE:TPI TO ISSUE 3.2 CERTIFICATE AS PER EN10204.									

		OPERATION	CHARACTERISTICS	REF. DOC. & ACCEPTANCE NORMS	FORMAT OF RECORD	TYPE OF CHECK	INSPECTION		
							Subvendor	TPI	LEPL
		PROJECT: GAIL ARC- INVENTORY CREATION PROJECT FOR LAST MILE CONNECTIVITY CLIENT: GAIL INDIA LIMITED CONSULTANT: LEPL VENDOR				QAP NO: GAIL-034-PL-QAP-002 ITEM DESCRIPTION/ QUANTITY: FITTINGS PAGE NO: 1 of 1			
RAW MATERIAL INSPECTION									
Pipes/ Plates		Chemical	Correlation with Mill Test Certificate & Check Test Cert. as per TS	Applicable Codes	Mill T.C. or Check T.C.	Verification of marking with MTC & Check test if any	P	R	R
Electrodes			Batch Test Certificate	ASME Sec II Part C	Test Cert.		P	R	R
IN PROCESS									
1	HEAT TREATMENT		Quenching, Normalising and Tempering	ASTM A 234 Gr.WPB	HT Records	Visual & Review of T.C.	P	R	R
DESTRUCTIVE TESTING - PRODUCT									
2	MECHANICAL TEST		Testing - per heat	ASTM A 234 Gr.WPB	LR	Witness/ Scrutiny of the Report	P	W	R
3	HARDNESS TEST		Testing - per heat	350 HV 10	LR	Witness/ Scrutiny of the Report	P	R	R
4	Impact Test at 0 deg C (Base Material, Weld, & Haz)		Testing - one set per heat	AVG - 27 J IND - 20J (for one specimen)	LR	Witness/ Scrutiny of the Report	P	W	R
5	NDT (Whichever applicable)		U.T.	ASME Sev V	LR	Witness/ Scrutiny of the Report	P	R	R
			M.P.I at Bevel Ends THK>= 6MM, D.P> at Bevel if t<= 6 MM, 100%	ASME Sec V	LR	Witness/ Scrutiny of the Report	P	R	R
FINAL									
6	Overall Dimension		100%	As per Code	IIR		P	R	R
7	Visual Check		FFD - 100%						
8	MARKING		Logo, Matl. Specn., Size, Sch/ Rating, Lot No.	P.O. Spec.	SPECIFIED IN T.C	Visual	P	R	R
9	Review of Manufacturer's		Correlation of TC			LR	P	R	R
10	Preparation of documentation and issue of Release Note				Standard	LR	P	R	R
CTC/ MTC : CHECK/ MILL TEST CERT., P: PERFORM, IIR: INTERNAL INSPECTION REPORT, W: WITNESS, FFD: FREE FROM DEFECTS, TPI: THIRD PARTY INSPECTION AGENCY, H: HOLD, LR: LAB REPORTS									
NOTE 1 : ALL FITTINGS 18" & ABOVE SHALL BE IN WELDED CONSTRUCTION - EXISTING WPS, PQR SHALL BE REVIEWED BY TPI									
NOTE 2 : TPI TO ISSUE CERTIFICATE AS PER EN 10204 3.2 FORMAT									



PROJECT: GAIL ARC - INVENTORY CREATION PROJECT FOR LAST MILE CONNECTIVITY
CLIENT: GAIL INDIA LTD.
CONSULTANT: LEPL
VENDOR:

QAP No.: GAIL--034-PL-QAP-003
ITEM DESCRIPTION/QUANTITY: FLOW TEE
Prepared: AP
Checked: JR
Approved: SB

Sr. No.	Operation	Characterstics	Extent of Check	Reference Document	Acceptance Criteria	Format Of Records	Inspection By			Remarks
							Sub Supliar	Suppliar	TPIA	
1	Procedure									
1.1	Heat Treatment, NDTand Other Procedures	Documented Procedures	100%	Refer Note-6	Refer Note-5	Procedure Documents	-	H	R	
1.2	WPS,PQR & WPQ	Welding Parameters & Qualification Record	100%	Refer Note-6	Refer Note-5	WPS,PQR & WPQ	-	H	W- New R- Existing	
1.3	Design Proof Test*(To be conducted under TPI appointed by supplier)	Hydrostatic proof test	100%	Refer Note-6	Refer Note-5	Proof test record		H*-New R- Already qualified	R	
2	Material Inspection									
2.1	Pipes / Fittings / Forgings (Pressure containing parts)	Chemical, tensile, impact, hardness, NDT, Heat treatment and other applicable Properties	100%	Refer Note-6	Refer Note-5	Test Certificates	H	H	Chem & Mech testing of raw material - W	
3	In Process Inspection									
3.1	Raw material Identification of pressure containing parts	Verification of marking & correlation with MTC	100%	Refer Note-6	Refer Note-5	MTC, Inspection Report	-	H	W	
3.2	Raw Material Identification of non pressure parts	Chemical & mechanical properties	100%	Refer Note-6	Refer Note-5	MTC, Inspection Report	-	H	R	
3.3	Welding	Welding Parameters as per WPS / PQR	100%	Refer Note-6	Refer Note-5	Inspection Reports	-	H	R	



PROJECT: GAIL ARC - INVENTORY CREATION PROJECT FOR LAST MILE CONNECTIVITY
CLIENT: GAIL INDIA LTD.
CONSULTANT: LEPL
VENDOR:

QAP No.: GAIL--034-PL-QAP-003
ITEM DESCRIPTION/QUANTITY: FLOW TEE
Prepared: AP
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Sr. No.	Operation	Characterstics	Extent of Check	Reference Document	Acceptance Criteria	Format Of Records	Inspection By			Remarks
							Sub Suppliar	Suppliar	TPIA	
3.4	Heat Treatment as applicable	Heat treatment temperature and time	100%	Refer Note-6	Refer Note-5	HT chart / Record	-	H	START & STOP TEMP. CHART SHALL BE SIGNED BY TPIA, ALSO POWER FAILURE LOG SHALL BE MAINTAINED	
3.5	RT of pressure containing butt welds	Defects	100%	Refer Note-6	Refer Note-5	RT Film / Report	-	H	R	
3.6	UT/LPT/MPT as applicable	Lamination / Defects	100%	Refer Note-6	Refer Note-5	NDT Report	-	H	UT- W , rest – R.	
4	Final Inspection									
4.1	Visual and Dimensional Inspection (VDI)	Surface Condition / Dimensions, Marking, etc	100% By Supplier & At RandomBy TPIA	Refer Note-6	Refer Note-5	Inspection Report	-	H	H	
4.2	Final Stamping	Stamping of accepted flow tees	100%	Refer Note-6	Refer Note-5	Inspection Report	-	H	H	
5	Painting									
5.1	Corrosion protection painting & Color Coding as applicable	Visual Inspection & Color Coding	100%	Refer Note-6	Refer Note-5	Inspection Report	-	H	R	
6	Documentation & IC									
6.1	Documentation & Inspection Certificate(IC)	Review of Stage Inspection Reports / Test Reports & Issue of IC	100%	Refer Note-6	Refer Note-5	Manufacturer TC & IC	-	H	H	
6.2	Final Document submission	Compilation of Inspection reports, drawings, etc as per VDR / PR	100%	Refer Note-6	Refer Note-5	Final data folder/Completeness certificate	-	H	H	

LEGENDS:

H- Hold (Do not proceed without approval), **R-** Review, **RW-** Random Witness, **W-** Witness (Give due notice, work may proceed after scheduled date).



PROJECT: GAIL ARC - INVENTORY CREATION PROJECT FOR LAST MILE CONNECTIVITY
CLIENT: GAIL INDIA LTD.
CONSULTANT: LEPL
VENDOR:

QAP No.: GAIL--034-PL-QAP-003
ITEM DESCRIPTION/QUANTITY: FLOW TEE
Prepared: AP
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Sr. No.	Operation	Characterstics	Extent of Check	Reference Document	Acceptance Criteria	Format Of Records	Inspection By			Remarks
							Sub Suppliar	Suppliar	TPIA	

NOTES:

1. Wherever W/R is indicated, Inspection Engineer shall decide the option to be exercised for the particular stage and supplier.
2. Supplier's in house procedures may be accepted in case TPI is satisfied with adequacy of procedures to comply with Purchase Order/Specifications Requirements. In case of non availability of suitable procedures, fresh procedures may be qualified under TPI witness.
3. In case of conflict between purchase specification, contract documents and QAP, more stringent conditions shall be applicable.
4. This document describes generally the requirements pertaining to all types of the item. Requirements specific to PO and the item are only applicable.
5. Acceptance Norms/ Acceptance Criteria for all the activities shall be as per relevant specification/ data sheets/applicable codes & standards etc. referred there in /Job Specification /Approved Documents.
6. Reference documents are relevant Specifications/ Data sheets/ Applicable Codes & Standards.
7. For all forging materials, The specimen shall br taken from the integral part of the forging.
8. TPIA shall issue 3.2 certificate as per BS EN 10204

Abbreviations:

CCE or CCOE	: Chief Controller of Explosives	MPT/MT	: Magnetic Particle Testing
CEIL	: Certification Engineers International Limited	MRT	: Mechanical Run Test
CIMFR	: Central Institute of Mining & Fuel Research	MTC	: Material Test Certificate
CE	: Carbon Equivalent	NPSH	: Net Positive Suction Head
DFT	: Dry Film Thickness	NDT	: Non Destructive Testing
DT	: Destructive Testing	PO	: Purchase Order
DPT	: Dye Penetrate Testing	PESO	: Petroleum Explosive Safety Organization
DHT	: De-hydrogen Heat Treatment	PQR	: Procedure Qualification Record
ERTL	: Electronics Regional Test Laboratory	PR	: Purchase Requisition
FCRI	: Fluid Control Research Institute	PMI	: Positive Material Identification
HT	: Heat Treatment	RT	: Radiography Testing
HIC	: Hydrogen Induced Cracking	SSCC	: Sulphide Stress Corrosion Cracking
ITP	: Inspection and Test Plan	TC	: Test Certificate
IP	: Ingress Protection	TPI or TPIA	: Third Party Inspection Agency
IHT	: Intermediate Heat Treatment	UT	: Ultrasonic Testing
ISR	: Intermediate Stress Relieving	VDR	: Vendor Data Requirement
IC	: Inspection Certification	WPS	: Welding Procedure Specification
IGC	: Inter Granular Corrosion	WPQ	: Welders Performance Qualification
LPT	: Liquid Penetrate Testing		



PROJECT: GAIL ARC - INVENTORY CREATION PROJECT FOR LAST MILE CONNECTIVITY	QAP NO : GAIL-034-PL-QAP-004
CLIENT : GAIL INDIA LIMITED	ITEM DESCRIPTION / QUANTITY: LR BENDS
CONSULTANT : LYONS ENGINEERING PVT. LTD	
VENDOR :	

SR.NO.	CONTROL TEST / INSP.DESCRPTION	REFERENCE DOC. / APPLICABLE SPEC.	EXTENT OF CHECK	ACCEPTANCE CRITERIA	FORMET OF RECORD	INSPECTION		
						VENDOR	TPIA	Owner /Consultant

FIRST DAY PRODUCTION TEST - MINIMUM 3 DIFFERENT HEAT TO BE SELECTED OUT OF WHICH AT LEAST 2 PIPES PER HEAT TO BE SELECTED FOR TESTING FOR EACH SIZE, EACHGRADE OF STEEL AND EACH WALL THICKNESS

1 RAW MTERIAL

1.1	Material	Technical Specification LR Bends Doc. No. GAIL-034-PL-SPE-004 Clause No. 3	EACH PIPE	As per owner's specification for line pipe.	Test Certificate	--	--	--
1.2	Inspection of Bare Pipes	Technical Specification LR Bends Doc. No. GAIL-034-PL-SPE-004	EACH PIPE	As per owner's specification for the line pipes and material test certificate, pipe receiving report shall be reviewed. Pipes with positive wall thickness shall be used for fabrication of bends.	Inspection Report	P	R	--
1.3	Weld Position	Technical Specification LR Bends Doc. No. GAIL-034-PL-SPE-004 Clause no. 4.5	-	The longitudinal seam shall be located in the plane of minimum deformation or neutral axis. Acceptable tolerance on location of the longitudinal weld seam shall be +/- 5°	-	P	R	--
1.4	Chemical Composition	Linepipe / Pipe specification	1 PER HEAT	Hot induction bends shall be fabricated from carbon steel material as specified in MR.	INSPECTION REPORT	P	R	--
1.5	Tensile tests (YS, UTS, YS/UTS, %EL, RA, Bends, etc. as applicable) (remark: marking transfer by TPIA)	Linepipe / Pipe specification	1 PER HEAT		INSPECTION REPORT	P	W	--
1.6	Charpy-test at as per material specification (Impact energy & shear area) (remark: marking transfer by TPIA)	Linepipe / Pipe specification	1 PER HEAT		INSPECTION REPORT	P	W	--

2 FORMING OF BENDS

2.1	Temperature	As per approved manufacturing procedure	EACH BEND	As per approved manufacturing procedure	Manufacturer's Report	P	RW	
2.2	Speed	As per approved manufacturing procedure	EACH BEND	To be frozen after test bend result, variation allowed +/- 2,,2 mm/minute.	Manufacturer's Report	P	RW	--



PROJECT: GAIL ARC - INVENTORY CREATION PROJECT FOR LAST MILE CONNECTIVITY

QAP NO : GAIL-034-PL-QAP-004

CLIENT : GAIL INDIA LIMITED

ITEM DESCRIPTION / QUANTITY: LR BENDS

CONSULTANT : LYONS ENGINEERING PVT. LTD

VENDOR :

SR.NO.	CONTROL TEST / INSP.DESCRPTION	REFERENCE DOC. / APPLICABLE SPEC.	EXTENT OF CHECK	ACCEPTANCE CRITERIA	FORMET OF RECORD	INSPECTION		
						VENDOR	TPIA	Owner /Consultant
2.3	Heating	As per approved manufacturing procedure	EACH BEND	Heating coil configuration, induction heating frequency (tolerance +/-20%)	Manufacturer's Report	P	RW	--
2.4	Cooling	As per approved manufacturing procedure	EACH BEND	Instant cooling with air & water jet distributed uniformly across the circumference to heated parameter annular zone.. -Coolant flow rate and pressure variation allowed is +/- 10%. -Coolant temperature variation allowed is +/- 15 °C	Manufacturer's Report	P	RW	--
2.5	Bend radius	Technical specification for LR Bends Doc. No. GAIL-034-PL-SPE-004 Clause No. 4.12.1	EACH BEND	±1% nominal bending radius (where nominal radius shall be 6D)	Manufacturer's Report	P	RW	--
2.6	Pyrometer Setting	As per approved manufacturing procedure	EACH BEND	Temperature against speed record chart.	Manufacturer's Report	P	RW	--
2.7	Post Bending Heat treatment/stress relieving (loading and unloading shall be witnessed by TPIA, Power failure log shall be maintained)	As per approved manufacturing procedure	-	Bends shall be supplied in as bend condition i.e. without post bend heat treatment.	--	P	RW	--
2.8	Sizing (Internal/External)	As per approved manufacturing procedure	EACH BEND	Cold forming or sizing without subsequent heat treatment is permitted provided the induced permanent strain does not exceed 1.5%.	Log Book	P	RW	--
2.9	Pig gauge trial	Technical specification for LR Bends Doc. No. GAIL-034-PL-SPE-004 Clause No. 6.1.g	EACH BEND	By 2 gauging plates of diameter equal to 95% of the nominal internal diameter of the pipe, connected rigidly together at a distance equal to 500 mm.	Inspection Report	H	W	--
3	NDT INSPECTION							



PROJECT: GAIL ARC - INVENTORY CREATION PROJECT FOR LAST MILE CONNECTIVITY
 CLIENT : GAIL INDIA LIMITED
 CONSULTANT : LYONS ENGINEERING PVT. LTD
 QAP NO : GAIL-034-PL-QAP-004
 ITEM DESCRIPTION / QUANTITY: LR BENDS

SR.NO.	CONTROL TEST / INSP.DESCRPTION	REFRENCE DOC. / APPLICABLE SPEC.	EXTENT OF CHECK	ACCEPTANCE CRITERIA	FORMET OF RECORD	INSPECTION		
						VENDOR	TPIA	Owner /Consultant
3.1	Manual Ultrasonic testing on bend ends	As per approved manufacturing procedure	EACH BEND	<p>Ref. . STD.: Total 6 nos N5 notches, 1) Longitudinal notches: 2 each at inside and outside weld seam edges, 1 each at inside and outside weld seam center. 2) Three 1.6 mm radially drill hole one at the center & one at each edge of the weld. Acceptance criteria :100% of reference stadard for weld, any imperfection that produces a signal greater than applicable acceptance limit signal shall be considered, as defect and final decision shall be taken after performing MUT. Pipe weld seam covering lack of fusion, crack, pin hole shall not be permitted irrespective of any size and length.</p> <p>Ref. Std.: Circumferential slot of 6 mm width x ½ T depth for calibration acceptance criteria :100% of reference STD for pipe body. Imperfection that produces a signal greater than applicable acceptance limit signal shall be considered, As defect and final decision shall be taken after performing MUT. Pipe weld seam covering lack of fusion, crack, pin hole shall not be permitted irrespective of any size</p>	Inspection Report	H	W	--
3.2	Magnetic Particle testingon bend body and weld	As per approved manufacturing procedure	EACH BEND	<p>-: On the extrados & intrados to include the area encompassed 30 deg. either side of the line passing through the plane of the bend. -All bevel Ends -Acceptance in accordance with WI for MPI/ASME Sec.VIII Appendix 6.</p>	Inspection Report	H	W	--
3.3	Repair	As per approved manufacturing procedure	EACH BEND	No repair by welding is allowed on any part of bends.	Inspection Report	H	R	--
3.4	RESIDUAL MAGNETISM	As per approved manufacturing procedure	EACH BEND	THE RESIDUAL MAGNETISM SHALL NOT EXCEED 15 GAUSS .	MPI REPORT	P	W	W
4	VISUAL INSPECTION AND DIMENSIONAL INSPECTION							
4.1	Bend Angle	As per approved manufacturing procedure	Each Bend	+/- 0.5 from the specified angle.	INSPECTION REPORT	H	W	RW



PROJECT: GAIL ARC - INVENTORY CREATION PROJECT FOR LAST MILE CONNECTIVITY

QAP NO : GAIL-034-PL-QAP-004

CLIENT : GAIL INDIA LIMITED

ITEM DESCRIPTION / QUANTITY: LR BENDS

CONSULTANT : LYONS ENGINEERING PVT. LTD

VENDOR :

SR.NO.	CONTROL TEST / INSP.DESCRPTION	REFRENCE DOC. / APPLICABLE SPEC.	EXTENT OF CHECK	ACCEPTANCE CRITERIA	FORMET OF RECORD	INSPECTION		
						VENDOR	TPIA	Owner /Consultant
4.2	Wall thickness	As per approved manufacturing procedure	Each Bend	<p>Minimum wall thickness shall be equal to $t_{min} = 0.95 (t_{actual} - dt)$ where: t_{actual} = Actual wall thickness of pipe used for bending. $Dt = 0.35$ mm for a wall thickness < 10 mm 0.5 mm for a wall thickness ≥ 10 mm.</p> <p>Wall thickness shall be measured along both the inside and outside radii of bend between and including the start and stop points of the bend arc, at interval approximately equal to pipe diameter or 300 mm whichever is less. Wall thickness shall be measured ultrasonically after bending at the same locations as measured before bending. In addition the wall thickness of the tangents shall also be measured.</p>	INSPECTION REPORT	H	W	RW
4.3	Out of Roundness	As per approved manufacturing procedure	Each Bend	<p>At End: 3.0 mm max. (Out-of roundness over a length of 100 mm from the end). At Body: 5.0 mm max.</p>	INSPECTION REPORT	H	W	RW
4.4	Bend Radius	As per approved manufacturing procedure	Each Bend	<p>$\pm 1\%$ of nominal bending radius (where nominal radius shall be $3D / 6D$).</p>	INSPECTION REPORT	H	RW	RW
4.5	Off-plane (Plane of bends)	As per approved manufacturing procedure	Each Bend	<p>Off-Plane of bends shall not exceed $(\theta/90) \times 10$ mm , where θ is the bend angle in degree or the tolerance limit specified in MSS-SP-75, whichever is less.</p>	INSPECTION REPORT	H	W	RW
4.6	Tangent length	As per approved manufacturing procedure	Each Bend & both ends	<p>500 mm or 1 pipe OD whichever is more.</p>	INSPECTION REPORT	H	W	RW
4.7	End Preparation	--	Each Bend	<p>Bend shall be supplied with plane ends. Bevel angle - $30 (+5^{\circ}, -0^{\circ})$ Root Face - 1.6 mm (± 0.8 mm) Squareness - 1.6 mm Max.</p>	INSPECTION REPORT	H	W	RW




PROJECT: GAIL ARC - INVENTORY CREATION PROJECT FOR LAST MILE CONNECTIVITY	QAP NO : GAIL-034-PL-QAP-004
CLIENT : GAIL INDIA LIMITED	ITEM DESCRIPTION / QUANTITY: LR BENDS
CONSULTANT : LYONS ENGINEERING PVT. LTD	
VENDOR :	

SR.NO.	CONTROL TEST / INSP.DESCRPTION	REFRENCE DOC. / APPLICABLE SPEC.	EXTENT OF CHECK	ACCEPTANCE CRITERIA	FORMET OF RECORD	INSPECTION		
						VENDOR	TPIA	Owner /Consultant
4.8	End Protection	As per approved manufacturing procedure	Each Bend	Both ends of all bends shall be suitably protected to avoid any damage during transit by means of metallic or high impact plastic bevel protectors.	--	P	M	RW
5	WORKMANSHIP							
5.1	Bend irregularities	-	Each Bend, if any	Bulges, dent and flat areas shall not appear within 100 mm front end of the bend. For the remaining part these deviations from the original contour of the pipe are permitted provided these deviations do not exceed 6.0 mm. The same shall not extend (in any direction) over a distance of more than 25% of nominal diameter of the bend.	Inspection Report	H	RW	--
5.2	End flushing	-	Each Bend	External and internal reinforcement of longitudinal welds shall be ground flush for a distance of 100 mm from the ends of the standard bend.	Inspection Report	H	RW	--
6	Manufacturing Procedure Qualification Test							
6.1	Hydrostatic Test		Test Bend	On minimum bend wall thickness at pressure as per MTC of mother pipe with holding time of 15 minutes	INSPECTION REPORT	H	W	--
	A) TENSILE TEST	Technical specification	Test Bend	As per material specification	INSPECTION REPORT	H	W	--



PROJECT: GAIL ARC - INVENTORY CREATION PROJECT FOR LAST MILE CONNECTIVITY
 CLIENT : GAIL INDIA LIMITED
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 QAP NO : GAIL-034-PL-QAP-004
 ITEM DESCRIPTION / QUANTITY: LR BENDS

SR.NO.	CONTROL TEST / INSP.DESCRPTION	REFRENC DOC. / APPLICABLE SPEC.	EXTENT OF CHECK	ACCEPTANCE CRITERIA	FORMET OF RECORD	INSPECTION		
						VENDOR	TPIA	Owner /Consultant
6.2	B) CROSSWELD TENSILE TEST	Technical specification	Test Bend	As per material specification	INSPECTION REPORT	H	W	--
	C) CHARPY V-Notch -Base Material - 2 sets of 3 specimen per lot. -Weld & HAZ - 1 sets of 3 specimen per lot.	Technical Specificatin	Test Bend	: at 0 °C. for base /weld /HAZ - 35 J/cm ² (Avg.), 28 J/cm ² (Ind.).	INSPECTION REPORT	H	W	--
	D) Hardness Test			Shall not exceed 248 HV10	INSPECTION REPORT	H	W	--
6.2	E) Guided bend test	Technical Specificatin	Test Bend	As per material specification	INSPECTION REPORT	H	W	--
6.2	F) Metallographic Test	Technical Specificatin	Test Bend	Grain size shall be 7 or finer	INSPECTION REPORT	R	W	--
	G) Chemical Test	Technical Specificatin	Test Bend	As per pipe specification.	INSPECTION REPORT	H	R	--

		PROJECT: GAIL ARC - INVENTORY CREATION PROJECT FOR LAST MILE CONNECTIVITY			QAP NO : GAIL-034-PL-QAP-004				
		CLIENT : GAIL INDIA LIMITED			ITEM DESCRIPTION / QUANTITY: LR BENDS				
		CONSULTANT : LYONS ENGINEERING PVT. LTD							
		VENDOR :							
SR.NO.	CONTROL TEST / INSP.DESRIPTION	REFERENCE DOC. / APPLICABLE SPEC.	EXTENT OF CHECK	ACCEPTANCE CRITERIA	FORMET OF RECORD	INSPECTION			
						VENDOR	TPIA	Owner /Consultant	
7	MARKING	Technical specification Doc. No. GAIL--034-PL-SPE-004 Clause No. 8.5	EACH BEND ON THE INSIDE SURFACE AT ONE END	--Package shall be marked legibly with suitable marking ink to indicate the following: a) Order Number. b) Package Number c) Manufacturer's Name. d) Size (inches) and wall thickness (mm). e) Radius of bend (mm)	-	P	M	--	
8	Coating	Technical specification Doc. No. GAIL--034-PL-SPE-004 Clause No. 8.3	EACH BEND	One coat of anti rust paint shall be applied on outer surface of bends. Type of paint shall be as agreed upon with the company.	-	P	M	--	
9	Documentation / Certification	Technical specification Doc. No. GAIL--034-PL-SPE-004 Clause No. 9	--	All documentation shall be done as per specification Doc. No. GAIL--034-PL-SPE-004 Clause no. 8.	MTC/ Test Reports/ IRN, 3.2 certificate as per EN 10204	P	R	--	
Legend:		P-Perform, R-Review, W-Witness, H-Hold RW - Random 10% Witness TPIA-Third Party Inspection Agency, M: Monitor, W: Witness, RT - Radiographic test							
TPIA: Third Party Inspection Agency		Control Authority: Owner/Engineer or their authorised inspection agency							
	(*)	Tests to be specified by the vendor for approval of owner/owner's representative while submission of QAP.							
NOTE :		1. The above testing and acceptance criteria are minimum requirements, however , manufacturer shall ensure and also comply to the additional requirements as per technical specifications.							
		2.The supplier shall submit their own detailed QAP prepared on the basis of above for approval of owner/owner's representative and TPIA.							
		3.Supplier shall submit calibration certificates of all instruments/equipment to be used for inspection and testing with relevant procedures and updated standards for TPIA review/Approval.							
		4.TPIA will have to inspect all manufacturing activities on eah day or as specified above..							
		5.TPIA along with Owner/Owner's representative shall review/approve all the documents related to QAP/Quality manuals/Drawings, etc. submitted by supplier.							
		6. Manufacutrer shall submit detailed production and inspection schedule.							
		7.Certification requirements to comply with EN 10204 - 3.2 to be issued by TPIA appointed by manufacturer.							
		8. Vendor has to submit detailed QAP for bend manufacturing procedure qualification production test and routine production separately.							