GAIL INDIA LIMITED

ANNUAL RATE CONTRACT FOR PROCUREMENT OF BI-DIRECTIONAL PIG LAUNCHER & RECEIVER WITH PIG SIGNALLERS, PSV, VALVES, PIPE, FLANGES, FITTINGS & ACCESSORIES

VOLUME II OF II (TECHNICAL)

(BID DOCUMENT NO - 034/LEPL/GAIL/14-R0)
E-TENDER REF : 8000016237
DOMESTIC COMPETITIVE BIDDING

Lyons Engineering Pvt. Ltd.

www.lyonsengineers.com

	Document Control Index - Pig Launcher / Receiver		
Sr. No.	**Description**	**Document Number**	**Rev. 0**
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GAIL INDIA LIMITED

MATERIAL REQUISITION

FOR

BI-DIRECTIONAL PIG LAUNCHER , RECEIVER , PSV & SIGNALLERS AND ACCESSORIES (INCLUDING PIPES,VALVES, GAUGES, FLANGES AND FITTINGS)

GAIL-034-PI-MR-01A

Rev	Date	Purpose	Prepared By	Checked By	Approved By
2	24.08.2020	Issued For Tender	SR	TR	SB
1	28.05.2020	Issued For Tender	SR	TR	SB
0	30.12.2019	Issued For Review	AP	JR	TR

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1.0 INTRODUCTION

GAIL (India) Limited, is India's flagship Natural Gas company, integrating all aspects of the Natural Gas value chain and its related services. In a rapidly changing scenario, GAIL is spearheading the move to a new era of clean fuel industrialization, creating a quadrilateral of green energy corridors that connect major consumption center in India with major Gas Fields, LNG terminals and other cross border gas sourcing points. GAIL is also expanding its business to become a player in the International Market. M/s. GAIL (India) Limited envisages to strengthen local gas grid network in various parts of India

Lyons Engineering Pvt. Ltd. has been appointed as Engineering Consultant by GAIL for the project "ARC FOR PROCUREMENT OF BI-DIRECTIONAL PIG LAUNCHER & RECEIVER WITH PIG SIGNALLERS, PSV & ACCESSORIES (INCLUDING VALVES, GAUGES, FLANGES AND FITTINGS)".

GAIL India limited intend to create an inventory of BI-DIRECTIONAL PIG LAUNCHER & RECEIVER WITH PIG SIGNALLERS, PSV & ACCESSORIES (INCLUDING PIPES,VALVES, GAUGES, FLANGES AND FITTINGS 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 "BI-DIRECTIONAL PIG LAUNCHER & RECEIVER WITH PIG SIGNALLERS, PSV & ACCESSORIES (INCLUDING PIPES, VALVES, GAUGES, FLANGES AND FITTINGS" 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 PURPOSE

This document is for the Design, manufacturer and purchase of Launcher & Receiver which shall be installed at Dispatch and Receiving stations in different Pipeline projects.

3.0 DEFINITION

Where used in this document, the following terms shall have the meanings indicated below, unless clearly indicated by the context to this order

PROJECT	: ARC FOR PROCUREMENT BI-DIRECTIONAL PIG LAUNCHER & RECEIVER WITH PIG SIGNALLERS, PSV & ACCESSORIES (INCLUDING PIPES, VALVES, GAUGES, FLANGES AND FITTINGS)
OWNER	: GAIL (INDIA) Limited.
CONSULTANT	: Lyons Engineering Private Limited the partyto act for and on behalf of OWNER for the Engineering Services.

MANUFACTURER : The party, which manufactures and supplies equipment and services to the OWNER or to CONTRACTOR

4.0 DOCUMENT PRECEDENCE

It shall be the responsibility of the MANUFACTURER/ VENDOR to inform the PURCHASER of any errors, ambiguities, inconsistencies, discrepancies or conflict of information that may be found to exist in any document, specification or drawing submitted by the PURCHASER.

In case of conflict, the order of precedence shall be as follows:

a. MR

b. Data Sheets

c. Project Specifications d. Basic Documents

e. Codes and Standards

As a general rule in the event of any discrepancy between technical matter and local laws/ regulations (and documents above listed) the most stringent shall be applied.

MANUFACTURER / VENDOR shall notify PURCHASER of any apparent conflicts between MR, specifications, related datasheets, any code and standards and any other specifications noted herein. (Resolution and/ or interpretation precedence shall be obtained from PURCHASER in writing before proceeding with the design/ manufacturer or completion of services.)

5.0 SCOPE OF SUPPLY

Design, Engineering, Manufacture & Fabrication, Procurement of Materials and bought out components, assembly at shop, inspection, testing at manufacturer's works, preparation of shipment / packing, transport / delivery of the Bi-Directional Launcher & receiver suitable for accommodating intelligent pigs & other cleaning / displacement / gauging pigs, fitted with Quick Opening End Closure (QOEC) suitable for horizontal installation including all accessories required to make above Bi- Directional Launcher & Receiver system complete operational and QOEC shall be hand operated by a single lever operation and operable by one operator. Scope of supply shall include but not limited to supply & placement of perforated SS Tray inside the Bi-Directional Launcher & Receiver, supply and mounting of Pig Signaler on the Bi-Directional launcher & receiver with spare seals, supply of Pig Signaler with welded isolation ball valve for mounting on pipeline with spare seals, Supply of Door Seal for Quick Opening End Closure (QOEC) welded on Bi- Directional Launcher/ Receiver as mentioned above, supply of Pig Handling Trolley (insertion / retraction) System including supply of matching flanges for all the flanged end nozzle. Required studs, Nuts, bolts, Gaskets and foundation Bolts for Bi-Directional Launcher & receiver and associated accessories (including supply of Ball valves, Globe Valve, Pressure Gauges, Fittings, Flanges, Pipes, Nipples, Required studs, Nuts, bolts, Gaskets and foundation Bolts etc.) are included in scope of supply for each quantity. Scope of supply shall include supply of all pre-commissioning & commissioning spares & documentation as per the Material Requisition, Notes to Material Requisition, Data sheet, Technical specifications etc. and other codes and standards attached or referred. For details of quantity refer Material Requisition document no. GAIL-034-PI-MR-01A. Also refer P&ID No. STD-001, specification and instructions of Engineer-in-charge and as per all provisions of the CONTRACT DOCUMENT.

Supply of Bi-Directional Pig Launcher/Receiver of Size 4”x 10”NB & ANSI Class 600# along with Quick Opening End closure – 60 nos.

Scope of Supply of Bi-Directional Pig Launcher & Receiver -

Each Launcher / Receiver (L/R) of SOR would include the following items of Table-1 below:

TABLE-1

Item S.No.	Description	Unit	Qty. for each L/R Specified in SOR item no. 1
	SUPPLY PORTION		
	For supply of Bi-Directional size 10" X 4", 600# Pig Launcher & Receiver along with PSV, Pig Signallers and Accessories (Including supply of Ball valves, Globe Valves, Pressure Gauges, Fittings, Flanges, Pipes, Nipples, Required studs, Nuts, bolts, Gaskets and foundation Bolts etc.) which are not covered separately in SOR, As per vendor scope indicated in attached P&ID No. STD-001, Bill of material, specification and instructions of Engineer-in-charge and as per all provisions of the CONTRACT DOCUMENT.		
1.1	Supply of Bi-Directional Pig Launcher/Receiver of Size 4"x 10"NB & ANSI Class 600# along with Quick Opening End closure	Nos	1
1.2	Supply of Pig Signaller without isolation valve mounted on Bi-Directional Launcher/ Receiver mentioned in 1.1 above	Nos	1
1.3	Supply of Pig Signaller welded with isolation valve for mounting on 4" NB Pipeline	Nos	1
1.4	Supply of Door Seal for Quick Opening End Closure (QOEC) welded on Bi- Directional Launcher/ Receiver as mentioned in item no. 1.1 above (@ 2 nos. for each pig launcher and receiver)	Nos	2
1.5	Supply of complete set of spare seals for Pig Signallers as mentioned in item no. 1.2 above (@ 2 sets / pig signaller)	Nos	2
1.6	Supply of complete set of spare seals for Pig Signallers as mentioned in item no. 1.3 above (@ 2 sets / pig signaller)	Nos	2
1.7	Supply of Pig Handling Trolley with insertion / retraction facilities for pulling the SS Tray / Pigs to suit Launcher/ Receiver specified in 1.1 above.	Nos.	2
Valves			
2.0	2", Ball Valve, Flanged End, 600# Body-ASTM A 216 GR. WCB/A234 Gr.WPB, Ball - ASTM A105 + 0,003" ENP, Seat Ring: AISI 4140+0.003" ENP, Full Bore, Above Ground, Flanged End ,B16.5, 125 AARH	Nos.	11
3.0	2", Ball Valve, BW, 600# Body-ASTM A 216 GR. WCB/A234 Gr.WPB, Ball - ASTM A105 + 0,003" ENP, Seat Ring: AISI 4140+0.003" ENP, Full Bore, Above Ground, Butt Weld ASME B16.25, pup piece of 100 mm on both side of valve. (Pup-piece API 5L Grade B / A106 Gr.B)	Nos.	2
4.0	1", Ball Valve, SW, 800# Body - ASTM A105, Ball- SS 316, Seat- RPTFE, ASME B16.11, Full Bore, Above Ground, Socket Weld End, pup-piece of 100 mm on both side of Valves. (Pup piece A106 Gr.B)	Nos.	3

5.0	0.75", Ball Valve, SW, 800# Body - ASTM A105, Ball- SS 316, Seat- RPTFE, ASME B16.11, Full Bore, Above Ground, Socket Weld End, Pup-piece of 100 mm on both side of Valves. (Pup piece A106 Gr.B)	Nos.	4
6.0	2", Globe Valve, BW, 600# Body-ASTM A 216 GR. WCB, Trim - ASTM A182 F6A/SS410/13% Cr., Above Ground, Butt Weld, ASME B 16.25, with pup-pieces of 100 mm on either side of valves.	Nos.	1
7.0	2", Globe Valve, Flanged, 600# Body-ASTM A 216 GR. WCB, Trim - ASTM A182 F6A/SS410/13% Cr., Above Ground, Flanged End, B16.5, 125 AARH	Nos.	2
8.0	2", Globe Valve, Flanged, 150# Body-ASTM A 216 GR. WCB, Trim - ASTM A182 F6A/SS410 / 13% Cr., Above Ground, Flanged End, B16.5, 125 AARH	Nos.	1
9.0	2", Pressure safety Valve, 600#, Outlet line size - vendor to decide, Natural Gas - Safety Relief on Scraper Launcher / Receiver, ASTM A352 LCB, Pressure range 50 to 70 kg/ sq.cm	Nos.	1
10.0	2", Pressure safety Valve, 300#, Outlet line size - vendor to decide, Natural Gas - Safety Relief on Scraper Launcher / Receiver, ASTM A352 LCB, Pressure range 25 to 40 kg/ sq.cm	Nos.	1
11.0	NRV Flanged end, 600#, 2", Body - ASTM A 216 Gr. WCB	Nos.	1
Fittings and Flanges			
12.0	2" x 2", Equal Tee, ASME B16.9, ASTM A234 Gr. WPB, BW Sch XS	Nos.	7
13.0	2" x 1", Reducing Tee, ASME B16.9, ASTM A234 Gr. WPB, BW Sch XS x Sch XS	Nos.	2
14.0	PSV (outlet) Mainline size vendor to decide x 1", Reducing Tee, BW, 150#	Nos.	1
15.0	2" x 0.75", Reducer, ASME B16.9, ASTM A234 Gr. WPB, BW x SW on 600# rating line	Nos.	4
16.0	4", WNRF, 600#, ASME B16.5, ASTM A105, RF 125 AARH, Sch.80	Nos.	1
17.0	2", WNRF, 600#, ASME B16.5, ASTM A105, RF 125 AARH, Sch XS	Nos.	28
18.0	2", WNRF, 150#, ASME B16.5, ASTM A105, RF 125 AARH, Sch XS	Nos.	2
19.0	Line size - Vendor to decide, SWRF, 150#, ASME B16.5, ASTM A105, RF 125 AARH	Nos.	1
20.0	2", Blind Flange, 600#, ASME B16.5, ASTM A105, RF 125 AARH	Nos.	3
21.0	1", Blind Flange, 600#, ASME B16.5, ASTM A105, RF 125 AARH	Nos.	2
22.0	1", Blind Flange, 150#, ASME B 16.5, ASTM A105, RF, 125 AARH	Nos.	1
23.0	4", Spectacle Blind, 600#, ASME B16.48, ASTM A105, RF 125 AARH	Nos.	1
24.0	2", Spectacle Blind, 600#, ASME B16.48, ASTM A105, RF 125 AARH	Nos.	3
25.0	2", Spectacle Blind, 150#, ASME B16.48, ASTM A105, RF 125 AARH	Nos.	1
26.0	10" x 2", Weldolet, A105, MSS SP-97	Nos.	14
27.0	4" x 2", Weldolet, A105, MSS SP-97	Nos.	8
Pressure Gauges			
28.0	Pressure gauge on 0.75 Inches line	Nos.	4
29.0	2", Line Pipe, SMLS, ASTM A106 Grade B,Sch.XS length as per standard	meters	50

6.0 NOTES

1. Major barrel for launchers and receivers shall be designed for the longest intelligent tool plus 10%. Minor barrel length shall be optimized for inspection tool diameter and shall be subjected to COMPANY approval.
2. End closures shall be fitted with a pressure activated locking mechanism to prevent opening while the Launcher & Receiver is pressurized. Launcher & Receiver including QOEC (Quick Opening End Closure) shall be internally coated with liquid epoxy paint with DFT of 30 to 50 microns.

3. The quick opening end closure shall be of band-lock type or equivalent design and shall consists of a safety pressure release system allowing the opening only when there is no pressure in the Launcher & Receiver . End closure shall be hand operated by a single lever operation and operable by one operator. End closures shall be fitted with worm gear operator for the opening of the closure. Hinge of the closure shall be so designed that the weight of the end closure is fully supported without sagging.

4. Launcher & Receiver (including all components) shall be designed and suitable for Natural Gas.

5. Supply of Launcher & Receiver shall include supply of QOEC, PSV, matching flanges for all the flanged end nozzle, Required studs, Nuts, bolts, Gaskets and foundation Bolts

6. Material Test Certificates provided by the MANUFACTURER shall conform to EN 10204 Type 3.2

7. Vendor shall check all calculations of Launcher & Receiver based on design conditions and manufacturing requirements and submit necessary to company for approval.

8. Launcher & Receiver shall be provided with Pig handling system to facilitate handling of latest intelligent tools.

9. Pig launcher & receiver door shall be fitted with all Seal /gasket. The spares are additional to it.

10. All physical and mechanical testing shall be in accordance with the requirements of connected line pipe.
11. Launcher & Receiver material shall be subjected to Charpy V-notch tests @ (-) 29oC & Hardness test. Design Data for the Project is:

    - Pipeline Service : Gas
    - Max Design Temp (Above Ground) : $65^{o}C$
    - Min Design Temp : $(-)29^{o}C$

12. Delivery of fabricated/finished Launcher & Receiver and Pig signaler's shall be at M/s GAIL
    designated storage yard shall be in the Bidder's scope.

13. Bidder shall furnish quotation only in case he can supply material strictly as per this MR and specification/ data sheets forming part of MR.

14. The submission of prices by the bidder shall be construed to mean that he has confirmed compliance with all technical specifications of the corresponding item(s).

15. If the offer contains any technical deviations or clarifications or stipulates any technical specifications (even if in line with MR requirements) and does not include complete scope & Technical/ Performance Data required to be submitted with the offer, the offer shall be liable for rejection.

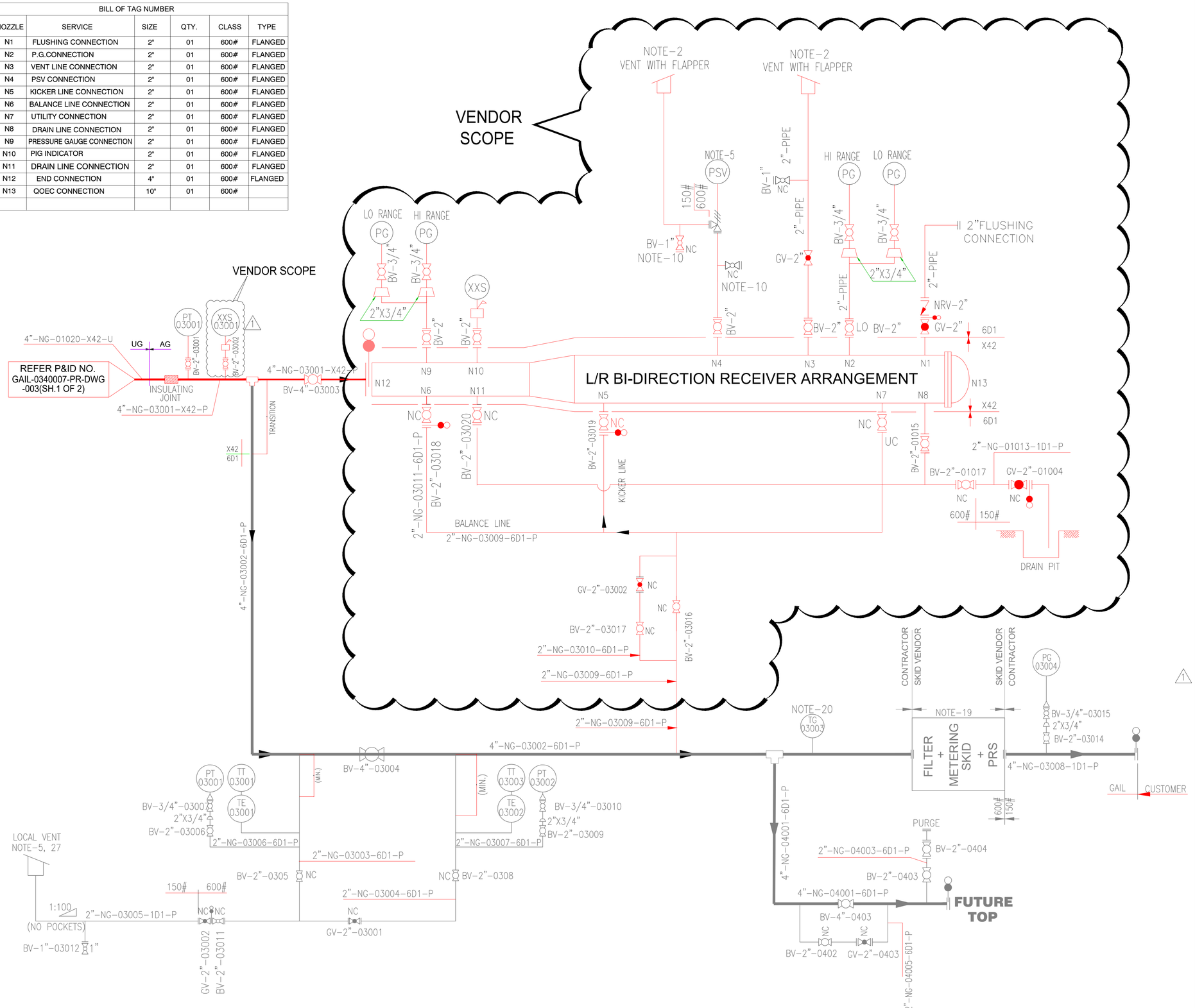
16. Bidder must submit all documents/ drawings/ calculations as specified in relevant specification along with his offer and after award of order.

17. Bidder to procure PSV from Approved manufacturer only & in compliance with attached PSV datasheet, specification and Standards/ Codes. In case bidder proposes PSV Manufacturers other than approved list of preferred Manufacturers, Bidder shall submit in

support of PTR (same as in case of Launcher & receiver), all details/ documents for PSV complying with the requirement of specification and datasheet enclosed. Submitted PTR should contain successful supply record of minimum one number of respective item of same size & rating (or higher) as quoted for.

18. **Bidder to quote for both Items A & B (as shown in above table). Bidder offer is liable for rejection if submitted offer is only for one item.**

BILL OF TAG NUMBER					
NOZZLE	SERVICE	SIZE	QTY.	CLASS	TYPE
N1	FLUSHING CONNECTION	2"	01	600#	FLANGED
N2	P.G.CONNECTION	2"	01	600#	FLANGED
N3	VENT LINE CONNECTION	2"	01	600#	FLANGED
N4	PSV CONNECTION	2"	01	600#	FLANGED
N5	KICKER LINE CONNECTION	2"	01	600#	FLANGED
N6	BALANCE LINE CONNECTION	2"	01	600#	FLANGED
N7	UTILITY CONNECTION	2"	01	600#	FLANGED
N8	DRAIN LINE CONNECTION	2"	01	600#	FLANGED
N9	PRESSURE GAUGE CONNECTION	2"	01	600#	FLANGED
N10	PIG INDICATOR	2"	01	600#	FLANGED
N11	DRAIN LINE CONNECTION	2"	01	600#	FLANGED
N12	END CONNECTION	4"	01	600#	FLANGED
N13	QOEC CONNECTION	10"	01	600#	



NOTES:-

1. QUICK OPENING END CLOSURE ON THE DOOR. TYPE OF QOEC SHALL BE ROTARY/BAND LOCK.
2. ALL VENT LINES SHALL BE HAVE ELEVATION 3 METERS FROM THE HIGHEST OPERATING PLATFORM FLAPPER TYPE VENT CONNECTION SHALL BE PROVIDED.
3. DURING MANUFACTURING, VENDOR SHALL TAKE CARE TO DESIGNATE THE TAG NOS. (INST,VALVE ETC.) & LINE NOS. AS PER THIS P&ID.
4. PIG SIGNALER SHOULD BE SUITABLE FOR BI-DIRECTIONAL FLOW.
5. PSV OUTLET SHALL BE CONFIRMED AFTER FINALIZATION OF PSV SIZE BY CONTRACTOR.
6. STATION PIPING MATERIAL SHALL BE AS PER PIPING MATERIAL SPECIFICATION.
7. PIG LAUNCHER SHALL BE SUITABLE FOR CALIPER & INTELLIGENT PIGGING.
8. TRANSITION PIECE MATERIAL SHALL BE API 5L X42 OR EQUIVALENT TO MATCH CONNECTING PIPE.
9. THE PIG INDICATOR (INTRUSIVE TYPE) WITH POTENTIAL FREE CONTACT SHALL BE SUPPLIED WITH SCRAPPER PACKAGE.
10. LOW POINT DRAIN SHALL BE PROVIDED ON DEPRESSURIZATION LINE AT MIN. DISTANCE FROM RISER PIPE OF VENT.
11. ALL BALL VALVES SHALL BE FULL BORE VALVES.
12. CLOUDED MARKED SECTIONS ARE IN COMPLETE VENDOR PACKAGE.

LEGENDS:-

- FLANGED GLOBE VALVE (GV)
- FLANGED BALL VALVE (BV)
- BUTT WELDED GLOBE VALVE (GV)
- BUTT WELDED BALL VALVE (BV)
- SOCKET WELDED BALL VALVE
- FLANGED NON-RETURN VALVE
- INSULATING JOINT
- ABOVE GROUND PIPELINE
- UNDER GROUND PIPELINE

BILL OF MATERIAL			
S. N	DESCRIPTION	UNIT	TOTAL
01	2" BALL VALVE,FLANGED END,600#	NOS	11
02	2" BALL VALVE,BW END,600#	NOS	2
03	1" BALL VALVE,FLG-SW, END,800#	NOS	3
04	0.75,BALL VALVE,SW,800#	NOS	4
05	2",GLOBE VALVE,BW,600#	NOS	1
06	2",GLOBE FLANGED,600#	NOS	2
07	2",GLOBE VALVE FLANGED,150#	NOS	1
08	2",PRESSURE SAFETY VALVE,OUTLET-LINE SIZE VENDER TO DECIDE), PRESSURE RANGE 50 TO 70 KG/CM^2	NOS	1
09	2",PRESSURE SAFETY VALVE (OUTLET-LINE SIZE VENDER TO DECIDE), PRESSURE RANGE 25 TO 40 KG/CM^2	NOS	1
10	2",NRV,FLANGED END,600#	NOS	1
11	2",x 2",EQUAL TEE,600#	NOS	7
12	2",x 1",REDUCING TEE,BW,600#	NOS	2
13	PSV (OUTLET) MAINLINE SIZE VENDOR TO DECIDE x 1",REDUCING TEE,BW ,150#	NOS	1
14	2",x 0.75",REDUCER, BW,600#	NOS	4
15	4",WNRF,600#	NOS	1
16	2",WNRF, 600#	NOS	28
17	2",WNRF, 150#	NOS	2
18	FLANGE (WNRF), LINE SIZE-VENDOR TO DECIDE, 150#	NOS	1
19	2",BLIND FLANGE, 600#	NOS	3
20	1", BLIND FLANGE, 600#	NOS	2
21	1", BLINDFLANGE, 150#	NOS	1
22	4", SPECTACLE BLIND, 600#	NOS	1
23	2", SPECTACLE BLIND, 600#	NOS	3
24	2", SPECTACLE BLIND, 150#	NOS	1
25	PRESSURE GAUGE ON 0.75" LINE	NOS	3
26	NON INTRUSIVE PIG SIGNALLAR	NOS	1
27	INTRUSIVE PIG SIGNALLAR	NOS	1
28	2" LINE PIPE SMLS API 5L GRADE B, LENGTH AS PER STANDARD INCLUDING FITTING	METER	50

REV.	DATE	DESCRIPTION	PREP.	CHKD.	APPD.
1	24.08.20	ISSUED FOR TENDER	VKS	AP	SB
0	06.11.19	ISSUED FOR REVIEW	VKS	AP	SB

CLIENT: GAIL (INDIA) LIMITED

PMC: LYONS ENGINEERING PVT. LTD.

PROJECT: ARC FOR PROCUREMENT OF PIG TRAPS AND ACCESSORIES

SCALE	TITLE:			
N.T.S.	P&ID FOR BI DIRECTIONAL LAUNCHER/ RECEIVER			
SIZE	JOB NO.	DRAWING NUMBER	SHEET	REV.
A2	034	STD-001	1 OF 1	1

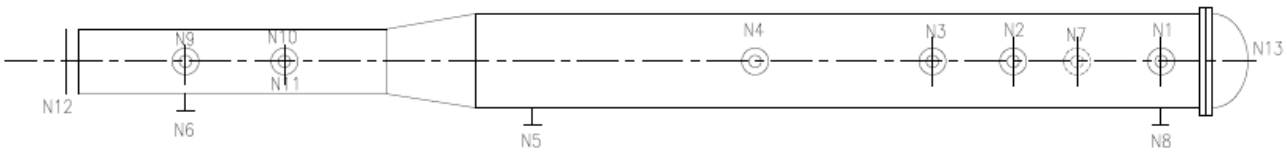
10" x 4" BI -DIRECTIONAL LAUNCHER / RECEIVER DETAILS	
Launcher / Receiver Manufacturer	-------
Launcher / Receiver Specification No.	GAIL-034-PI-DOC-TS-001
Type of Launcher / Receiver	Bi-directional, Pig Launcher/Receiver suitable for Intelligent pig
Design Pressure (kg/cm^2 g)	98
Design Temperature (°C)	-29 to 65
Design Code	ASME B31.8 & ASME Section VIII Division I
Corr. Allowance, mm	3.0
Design Factor	0.5
ANSI Rating	600#
Tag No. (s)	

PIPELINE DETAILS

Pipeline Nominal Diameter, mm (inch)	114.3 (4")	Thickness, mm	7.1 mm
Pipeline Material (PSL-2)	API 5L Gr.X42	Service	Natural Gas

Part No.	Description	Item	Ends/Type	Material (Equiv./Sup.)	SIZE(NB) (Note 6)
1	Body	Major Barrel (Pipe)	BW, Seamless	API 5L GR. X-42 PSL 2,	10"
2	Body	Minor Barrel(Pipe)	Seamless, Flanged, WNRF	API 5L GR. X-42 PSL 2+ ASTM A105 (CHARPY)	4"
3	Reducer	Concentric	BW, Welded	ASTM A105 (CHARPY	10" X 4"
4	End Closure	Forged	Quick Opening	ASTM A 105 (CHARPY)	10" / 600#
5	Supports	Plate	Welded	ASTM A 36	As required
	Filtering Basket			ASTM A 36	
N1	Flushing conn.	Weldolet + Flange	Flanged, WNRF	ASTM A105 (CHARPY)	2"
N2	Pr. gauge conn.	Weldolet + Flange	Flanged, WNRF	ASTM A105	2 "
N3	Vent	Weldolet + Flange	Flanged, WNRF	ASTM A105 (CHARPY)	2"
N4	PSV conn.	Weldolet+ Flange	Flanged, WNRF	ASTM A105 (CHARPY)	2"
N5	Kicker conn.	Weldolet + Flange	Flanged, WNRF	ASTM A105 (CHARPY)	2"

N6	Balance conn.	Weldolet+ Flange	Flanged, WNRF	ASTM A105 (CHARPY)	2”
N7	Utility conn.	Weldolet+ Flange	Flanged, WNRF	ASTM A105 (CHARPY)	2”
N8	Drain conn.	Weldolet + Flange	Flanged, WNRF	ASTM A105 (CHARPY)	2”
N9	PG conn.	Weldolet + Flange	Flanged, WNRF	ASTM A105 (CHARPY)	2”
N10	PIG Indicator	Weldolet + Flange	Flanged, WNRF	ASTM A105 (CHARPY)	2”
N11	Drain conn.	Weldolet + Flange	Flanged, WNRF	ASTM A105 (CHARPY)	2”
N12	End conn.	Weldolet + Flange	Flanged, WNRF	ASTM A105 (CHARPY)	4”
N13	QOEC	Weldolet + Flange	Flanged, WNRF	ASTM A105 (CHARPY)	10”



L/R BI-DIRECTION PLAN VIEW

L/R BI-DIRECTION ELEVATION

DIMENSION DETAILS			
Marking	**Dimension (mm)**	**Marking**	**Dimension (mm)**
A +A1+B	3500	G	1050
		H	300
		I	300
C	178	J	300
D	3500	K	300
E	Note-3	L	Note-3
F	Note-3	M	400

Legend:

BW – Butt Welded, WNRF – Weld Neck Raised Face, SW – Socket welded, LSAW-Longitudinal Seam Submerged Arc Welded

Notes:

1. Orientation of all the nozzles is indicative only and shall be decided by Manufacturer during design and approved by Company.
2. The dimensions shown in table above shall be decided by Manufacturer and approved by Purchaser.
3. The Manufacturer shall check and provide dimensions suitable for accommodating latest online inspection tool. Final dimensions shall be approved by Company.
4. The Launcher / Receiver are bi directional and intend to be used in Natural Gas/RLNG. All requirements as specified for Gas service are applicable.
5. Charpy impact test shall be carried out at -29˚ C as per Specification.
6. Hardness test shall be carried out with as per specification no..
7. Material Test Certificates provided by the MANUFACTURER shall conform to EN 10204 Type 3.2.
8. Manufacturer shall check thickness of the scraper based on pipeline design conditions and manufacturing requirements, and submit necessary calculations to Company for approval.
9. Hydro-test of Launcher / Receiver shall be hydro-tested at 1.5 times of design pressure.
10. Flanges welded on Launcher / Receiver shall have smooth face finish to 125 - 250 AARH.

11. Launcher / Receiver shall be provided with suitable handling system for insertion of pigs including intelligent pigs (such as basket / tray; inserting rod mechanism etc.) into the Launcher / Receiver.
12. All carbon steel fittings/flanges made from ASTM A105 material shall be heat treated by normalizing in accordance with ASTM A961. All carbon steel fittings and flanges made from ASTM A105 material shall be finish forged i.e. forged to be the required shape. Machined fittings and flanges are not acceptable. Machining is permitted for weld end preparation and flange face finish preparation.
13. All Weldolets shall be as per MSS-SP-97 & all Nippolets shall be as per Manufacturer's Standard.
14. End closure gasket shall be self-energized type.
15. End closure shall be designed with ASME B31.8 & ASME Section VIII Division I

PIG SIGNALLER TO BE WELDED ON PIPELINE		
Pig Signaller Manufacturer	----	
Pig Signaller Tag No.	----	
Pig Signaller Specification No.	GAIL-034-PI-DOC-TS-002	
Design Conditions		
Pressure, Kg/cm^2 (g)	98	
Temperature, ⍰C	(-)29 to 65	
Design Code / Design Factor	ASME B 31.8 / 0.5	
ANSI Rating	600 #	
Corrosion Allowance, mm	3.0	
Hydro test Pressure, Kg/cm^2 (g)	147	
Fluid Handled	Natural Gas/RLNG	
End Connections	Welded, Scarfed Base	
Installation	Above Ground	
Electrical Area Classification	ZONE-1, GAS GROUP IIA&IIB, TEMP CLASS-T3	
Pipeline Specification on which Pig Signallar to be welded		
Specified Minimum Yield Strength (SMYS) in psi	**Outer Diameter (OD), mm (inch)**	**Thickness, mm**
42000	4” (114.3)	7.1
Pig Signallar Material Specification (Equivalent or Superior)		
Part	**Specified Material**	**Material offered**
Body	ASTM A 694 Gr. F42	
Internals	SS-316	
Micro Switch Details		
Rating	POTENTIAL FREE CONTACT OF RATING 24V DC, 2A, SPDT	
Enclosure	Weather Proof to IP65 & Flame Proof Exd. Enclosure Certified For Area Classification.	
Cable connection	½” NPTF	

Notes:

1. Pig Signalers with shall be provided with an isolation valve.
2. Pig Signalers shall be Intrusive type.
3. Pig Signalers shall be Bi-Directional type, charpy Impact test shall be carried out at (-) 29 ˚C

PIG SIGNALLER TO BE MOUNTED PIG Launcher / Receiver		
Pig Signaller Manufacturer	----	
Pig Signaller Tag No.	----	
Pig Signaller Specification No.	GAIL-034-PI-DOC-TS-002	
Design Conditions		
Pressure, Kg/cm^2 (g)	98	
Temperature, °C	(-)29 to 65	
Design Code / Design Factor	ASME B 31.8 / 0.5	
ANSI Rating	600 #	
Corrosion Allowance, mm	3.0	
Hydro test Pressure, Kg/cm^2 (g)	147	
Fluid Handled	Natural Gas/RLNG	
End Connections	To be Mounted on pig Launcher / Receiver	
Installation	Above Ground	
Electrical Area Classification	ZONE-1, GAS GROUP IIA & IIB, TEMP CLASS-T3	
Details of Launcher / Receiver on which Pig signaler to be mounted		
Major Barrel Diameter (OD) (inch)	**Minor Barrel Diameter (OD), (inch)**	**Launcher / Receiver Data Sheet No**
10”	4”	GAIL-034-PI-DOC-DS-001
Pig Signaller Material Specification (Equivalent or Superior)		
Part	**Specified Material**	**Material offered**
Body	ASTM A 694 Gr. F42	
Internals	SS-316	
Micro Switch Details		
Rating	Potential free contact of rating 24V DC, 2A, SPDT	
Enclosure	Weather proof to IP65 & Flame proof Exd. Enclosure certified for area classification.	
Cable connection	½” NPTF	

Notes:

1. Pig Signallers shall be non Intrusive type.
2. Pig Signalers shall be bi-directional type. Charpy Impact test shall be carried out at (-) 29˚ C.

PRESSURE SAFETY VALVE						Rev.
GENERAL	1	Tag Number		*		
	2	P&ID Number	Quantity	*		
	3	Line No	Equipment Size	*	4" x 10"	
	4	Inlet Line Size/Sch	Outlet Line Size/Sch	**	**	
	5	Inlet Line Material	Outlet Line Material	**	**	
PROCESS DATA	6	Service		Natural Gas - Safety Relief on Scraper Launcher / Receiver		
	7	Fluid	Phase	Natural Gas	Single	
	8	Corrosive	Erosive	Due to CO2	Due to CO2	
	9	Required Capacity	Max. Oper Pressure	1971 kg/hr	82 kg/cm^2 g **	
	10	Set Pressure	%Allow Overpressure	98 kg/cm^2 g	21%	
	11	Back Pressure	Constant	**		
	12		Variable	**		
	13		Total	1 kg/cm^2 g		
	14	Oper Temperature	Relief Temperature	5 to 50 Deg C	103.41	
	15	SG @ Relief	Visc @ Relief	0.598	0.016 cP	
	16	MW @ Relief	Density @ Relief	17.35	67.89 kg/m^3	
	17	Sp HT Ratio (Cp/Cv)	Compressibility (Z)	1.435	0.9167	
	18	Design Pressure	Design Temperature	98 kg/cm^2 g	- 29 to 65 deg C	
	19	Latent Heat of Vap	Barometric Pressure	NA	NA	

DESIGN BASIS	20	Nozzle		Full Nozzle		
	21	Type		Conventional		
	22	Bonnet Type		Closed		
	23	Design Code		API 520 I/II, API 521, API 526 & API 527		
	24	Sizing Basis		Fire		
	25	Relieves To		Vent to Atmosphere		
	26	Calculated Area	Selected Area	*	*	
	27	Orifice Designation		*		
	28	Calculated Capacity		*		
CONNECTOR				INLET	OUTLET	
	29	Size		*	*	
	30	Type		RF	RF	
	31	Rating		600#	300#	
MATERIAL	32	Body	Bonnet	ASTM A352 LCB	ASTM A352 LCB	
	33	Nozzle (Seat)	Nozzle Ring	SS 316	*	
	34	Spring	Disc	SS 316	SS 316	
	35	Bellows	Guide	N/A	N/A	
	36	Main Valve Seat / Seal		*		
MISC.	37	Cap		Bolted		
	38	Lever	Lever Type	Required	*	
	39	Test Gag	Range	Required	*	
	40	Rupture Disc	Tag No	N/A	-	

	41	Manufacturer	Model No.	*	*	

Notes: * TBD

1. Vendor to specify. *
2. Refer Datasheet - Bi-Directional Scraper Launcher / Receiver for detail information regarding line size, schedule, pipe class and material. **
3. Tag plate (SS 316) stamped with instrument tag number and service in 10mm characters shall be attached via SS wire (1 mm).
4. PSV shall be sized as per API 520 & 526. Vendor to provide sizing calculations and PSV sizing and designation shall be decided during detail engineering.
5. Vendor shall submit detailed catalogue with model de-codification sheet with datasheet.
6. Vendor shall submit detailed GA drawing along with part names and MOC of the parts along with datasheets.
7. Valves shall be 100% radiographed.
8. Vendor to consider co-efficient of discharge as per ASME Section VIII (latest).
9. PSVs shall be supplied with inlet and outlet companion flange of suitable size and rating for mounting on scraper trap.

PRESSURE SAFETY VALVE						Rev.
GENERAL	1	Tag Number		*		
	2	P&ID Number	Quantity	*		
	3	Line No	Equipment Size	*	4" x 10"	
	4	Inlet Line Size/Sch	Outlet Line Size/Sch	**	**	
	5	Inlet Line Material	Outlet Line Material	**	**	
PROCESS DATA	6	Service		Natural Gas - Safety Relief on Scraper Launcher / Receiver		
	7	Fluid	Phase	Natural Gas	Single	
	8	Corrosive	Erosive	Due to CO2	Due to CO2	
	9	Required Capacity	Max. Oper Pressure	1971 kg/hr	40 kg/cm^2 g **	
	10	Set Pressure	%Allow Overpressure	49 kg/cm^2 g	21%	
	11	Back Pressure	Constant	**		
	12		Variable	**		
	13		Total	1 kg/cm^2 g		
	14	Oper Temperature	Relief Temperature	5 to 50 Deg C	103.41	
	15	SG @ Relief	Visc @ Relief	0.598	0.016 cP	
	16	MW @ Relief	Density @ Relief	17.35	67.89 kg/m^3	
	17	Sp HT Ratio (Cp/Cv)	Compressibility (Z)	1.435	0.9167	
	18	Design Pressure	Design Temperature	49 kg/cm^2 g	- 29 to 65 deg C	
	19	Latent Heat of Vap	Barometric Pressure	NA	NA	

DESIGN BASIS	20	Nozzle		Full Nozzle		
	21	Type		Conventional		
	22	Bonnet Type		Closed		
	23	Design Code		API 520 I/II, API 521, API 526 & API 527		
	24	Sizing Basis		Fire		
	25	Relieves To		Vent to Atmosphere		
	26	Calculated Area	Selected Area	*	*	
	27	Orifice Designation		*		
	28	Calculated Capacity		*		
CONNECTOR				INLET	OUTLET	
	29	Size		*	*	
	30	Type		RF	RF	
	31	Rating		300#	300#	
MATERIAL	32	Body	Bonnet	ASTM A352 LCB	ASTM A352 LCB	
	33	Nozzle (Seat)	Nozzle Ring	SS 316	*	
	34	Spring	Disc	SS 316	SS 316	
	35	Bellows	Guide	N/A	N/A	
	36	Main Valve Seat / Seal		*		
MISC.	37	Cap		Bolted		
	38	Lever	Lever Type	Required	*	
	39	Test Gag	Range	Required	*	
	40	Rupture Disc	Tag No	N/A	-	

	41	Manufacturer	Model No.	*	*	

Notes: * TBD

1. Vendor to specify. *
2. Refer Datasheet - Bi-Directional Scraper Launcher / Receiver for detail information regarding line size, schedule, pipe class and material. **
3. Tag plate (SS 316) stamped with instrument tag number and service in 10mm characters shall be attached via SS wire (1 mm).
4. PSV shall be sized as per API 520 & 526. Vendor to provide sizing calculations and PSV sizing and designation shall be decided during detail Engineering.
5. Vendor shall submit detailed catalogue with model de-codification sheet with datasheet.
6. Vendor shall submit detailed GA drawing along with part names and MOC of the parts along with datasheets.
7. Valves shall be 100% radiographed.
8. Vendor to consider co-efficient of discharge as per ASME Section VIII (latest).
9. PSVs shall be supplied with inlet and outlet companion flange of suitable size and rating for mounting on scraper trap.

GAIL INDIA LIMITED

DATASHEET FOR PRESSURE GAUGES (PG)

GAIL-034-PI-DOC-DS-005

0	30.12.2019	Issued for Review	RKS	UNU	TR	
REV	**Date**	**Purpose of Issue**	**Prepared By**	**Checked By**	**Approved By**	**Lyons Engineering Pvt. Ltd**

CLIENT:		**GAIL INDIA LIMITED**					
QUANTITY: AS PER P&ID							
1	Type		Direct		Wetted Parts Material		(*)
2	Mounting		Local		Other Material		(*)
3	Dial Size		150 mm		Process Connection		1/2"
4	Colour		White with black inscription			Size & rating	(*)
5	Case Material		SS 316		Facing & finish		(*)
6	Bezel Ring		Beyonnet type SS 316		Capillary Material		(*)
7	Window Material		Shatterproof glass		Armour Flexible Material		(*)
8	Enclosure		WP to IP 65 as per IEC 60529/IS 2147		Capillary Length		(*)
9	Pressure Element		Bourdon		Flushing/filling connection with		(*)
10	Element Material		SS 316	17	Over range protection		130 % of FSD
11	Socket Material		SS 316	18	Blow out protection		Yes
12	Accuracy		"+/-" 1% of FSD	19	Options		
13	Zero Adjustment		Micropointer - External Type		a)	Scrubber	b) Syphon
14	Connection		1/2" NPT(M)		c)	Gauge Saver	d) Liquid filled casing
		Connection location	Bottom		e)	Vaccum protection	f) Solid front
15	Movement		SS 316		g)	Three valve manifold	Yes (*)
16	Diaphagram Seat		Rigid				
	Type		(*)				

Bill of Material (BOM)

Sl. No.	Tag No.	Range (Barg)	Operating Pressure (Barg)	Maximum Service		Fluid	Service	Options
				Pressure (Barg)	Temperature (°C)			
1		0 ~ 160	10 ~ 19	98	(-) 20 ~ 65°C	Gas	Natural Gas	c, d, f, g

NOTES:-		* Vendor to furnish
	1)	Gauge Saver shall be provide with Low Pressure Gauges on Pig Launcher & Receiver.
	2)	Manifold shall be of Swgelok or Parker Only.
	3)	Contractor shall develop detailed datasheets with all the required information like make/model etc during detailed engineering.

	PRESSURE GAUGE	**DOCUMENT NO.**	**Rev.**
		GAIL-034-PI-DOC-DS-005	**0**
		SHEET 2 of 2	

DATA SHEET FOR BALL VALVES		
Sr. No.	**Description**	**Specification**
GENERAL		
1	Valve Size	2"
2	ANSI Rating	600#
3	Design Standard	BS EN ISO 17292 / API 6D
4	Corrosion allowance	1.5MM
5	Design Factor	0.5
SERVICE CONDITIONS		
6	Service	Natural Gas
7	Design Pressure	98 KG /CM2
8	Design Temperature	-29°C to 65°C
VALVE CONSTRUCTION DESIGN		
9	Location	Above Ground
10	Valve Type	Floating (2" & below)
11	Bore	Full Bore
12	End Connections	Flange (as per ASME B 16.5)
13	Bi- Directional	Required
14	Double Block and Bleed	Required
15	Blow out proof stem	Required
16	Anti-static device	Required
17	Operation	Manual
18	Open and close Ball position indicator	Required
VALVE MATERIAL SPECIFICATION		
	Part	**Specified Material / Equivalent Material**
19	Body	ASTM A 216 Gr.WCB
20	Ball (SOLID)	ASTM A 105 + 0.003" ENP
21	Body seat ring	AISI 4140 + 0.003"ENP / AISI 410
22	Seat Seal (Secondary)	Viton / RPTFE/PEEK
23	Seat Seal (Primary)	Devlon V API
24	Stem	AISI 4140 + 0.003"ENP / AISI 410 (No casting)
25	Stem seals	Viton / RPTFE
26	Stud bolts / Nuts	ASTM A 193 Gr. B7/ASTM A 194 Gr. 2H (Galvanized)
27	Anti-static device	SS302
VALVE TESTING REQUIREMENT		
28	Fire Resistant Design Requirement	As per API 6FA/API 607

29	Hydrostatic Test	Body	As per API 6D Latest Edition
		Seat	As per API 6D Latest Edition
30	Air Seat Test		As per API 6D Latest Edition
31	Anti Static Test		As per API 6D Latest Edition
32	Torque Test		As per relevant code

NOTES:

1. This Valve data sheet shall be read in conjunction with Technical specification of Ball valve/QAP.
2. Vendor to confirm the suitability of material for specified pressure-temperature rating.
3. All Valves Shall be Provided with antistatic feature and antistatic test as per ISO EN 17292 / API 6D shall be performed.
4. All valves shall be provided with anti blowout proof arrangement as per ISO EN 17292 / API 6D.
5. All Inspection and tests shall be carried out as per relevant approved QAP. Unless otherwise specified, all tests shall be witnessed by the approved third party inspection agency.
6. TPIA shall issue EN 10204 3.2 certification for valve.
7. Vendor shall submit cross sectional drawing, catalogues showing the material of construction for each component of the valve as a part of documents.
8. Valve shall have position indicator showing open and close positions.
9. It is vendor's responsibility for detail design of valve assembly during welding process to take care of valve seat material and ensure valve integrity. Vendor to ensure that no leakage from the assembled valve.

DATA SHEET FOR BALL VALVES		
Sr. No.	**Description**	**Specification**
GENERAL		
1	Valve Size	2" – 12”
2	ANSI Rating	600#
3	Design Standard	BS EN ISO 17292 / API 6D
4	Corrosion allowance	1.5MM
5	Design Factor	0.5
SERVICE CONDITIONS		
6	Service	Natural Gas
7	Design Pressure	98 KG /CM2
8	Design Temperature	-29°C to 65°C
VALVE CONSTRUCTION DESIGN		
9	Location	Above Ground
10	Valve Type	Trunnion mounted (4” & above) & Floating (2” & below)
11	Bore	Full Bore
12	End Connections	Butt Weld End (as per ASME B 16.25), pup-piece on either side and length equal to diameter of valve.
13	Bi- Directional	Required
14	Double Block and Bleed	Required
15	Blow out proof stem	Required
16	Anti-static device	Required
17	Operation	Manual
18	Open and close Ball position indicator	Required
VALVE MATERIAL SPECIFICATION		
	Part	**Specified Material / Equivalent Material**
19	Body	ASTM A 216 Gr.WCB
20	Ball (SOLID)	ASTM A 105 + 0.003” ENP
21	Body seat ring	AISI 4140 + 0.003”ENP / AISI 410
22	Seat Seal (Secondary)	Viton / RPTFE/PEEK
23	Seat Seal (Primary)	Devlon V API
24	Stem	AISI 4140 + 0.003”ENP / AISI 410 (No casting)
25	Stem seals	Viton / RPTFE
26	Stud bolts / Nuts	ASTM A 193 Gr. B7/ASTM A 194 Gr. 2H (Galvanized)
27	Anti-static device	SS302
VALVE TESTING REQUIREMENT		

28	Fire Resistant Design Requirement		As per API 6FA/API 607
29	Hydrostatic Test	Body	As per API 6D Latest Edition
		Seat	As per API 6D Latest Edition
30	Air Seat Test		As per API 6D Latest Edition
31	Anti Static Test		As per API 6D Latest Edition
32	Torque Test		As per relevant code

NOTES:

1. This Valve data sheet shall be read in conjunction with Technical specification of Ball valve/QAP.
2. Vendor to confirm the suitability of material for specified pressure-temperature rating.
3. All Valves Shall be Provided with antistatic feature and antistatic test as per ISO EN 17292 / API 6D shall be performed.
4. All valves shall be provided with anti blowout proof arrangement as per ISO EN 17292 / API 6D.
5. All Inspection and tests shall be carried out as per relevant approved QAP. Unless otherwise specified, all tests shall be witnessed by the approved third party inspection agency.
6. TPIA shall issue EN 10204 3.2 certification for valve.
7. Vendor shall submit cross sectional drawing, catalogues showing the material of construction for each component of the valve as a part of documents.
8. Valve shall have position indicator showing open and close positions.
9. It is vendor’s responsibility for detail design of valve assembly during welding process to take care of valve seat material and ensure valve integrity. Vendor to ensure that no leakage from the assembled valve.

DATA SHEET FOR BALL VALVES (BELOW 2” 800#)		
Sr. No.	**Description**	**Specification**
GENERAL		
1	Valve Size	Below 2"
2	ANSI Rating	ANSI 800#
3	Design Standard	BS EN ISO 17292 / API 6D
4	Corrosion allowance	1.5 MM
5	Design Factor	0.5
SERVICE CONDITIONS		
6	Service	Natural Gas
7	Design Pressure	98 Bar-g
8	Design Temperature	-29°C to 65°C
VALVE CONSTRUCTION DESIGN		
9	Location	Above Ground
10	Valve Type	Floating
11	Bore	Full Bore
12	End Connections	Socket welded (as per ASME B 16.11), 100 mm Pup piece in both end of the valve
13	Locking arrangement	Locking facility with stops for both fully open position and fully closed position
14	Welded/ Bolted	Required
15	Bi- Directional	Required
16	Double Block and Bleed	Not Applicable
17	Blow out proof stem	Required
18	Anti-static device	Required
19	Lever operation	Required
20	Open and close Ball position indicator	Required
VALVE MATERIAL SPECIFICATION		
	Part	**Specified Material / Equivalent Material**
21	Body	ASTM A 105
22	Ball (SOLID)	13% Cr Steel / SS-316
23	Seat	RPTFE with secondary metal to metal
24	Stem (ANTI BLOW OUT)	13% Cr Steel / SS-316 (No Casting)
25	Stem seals	Grafoil / PTFE V-RING+Grafoil
26	Stud bolts / Nuts	ASTM A 193 Gr. B7/ASTM A 194 Gr. 2H
27	Anti-static device	SS302
28	Gland Packing	GRAFOIL
VALVE TESTING REQUIREMENT		

29	Fire Resistant Design Requirement		As per API 6FA/API 607
30	Hydrostatic Test	Body	As per API 6D Latest Edition
		Seat	As per API 6D Latest Edition
31	Air Seat Test		As per API 6D Latest Edition
32	Anti Static Test		As per API 6D Latest Edition
33	Torque Test		As per relevant code

NOTES:

1. This Valve data sheet shall be read in conjunction with technical specification of Ball valve/QAP.
2. Vendor to confirm the suitability of material for specified pressure-temperature rating. Valves shall be lever operated.
3. All Valves shall be provided with antistatic feature and antistatic test as per ISO EN 17292 / API 6D shall be performed.
4. All valves shall be provided with anti blowout proof arrangement as per ISO EN 17292 / API 6D.
5. All Inspection and tests shall be carried out as per relevant approved QAP. Unless otherwise specified, all tests shall be witnessed by the approved third party inspection agency.
6. TPIA shall issue EN 10204 3.2 certification for valve.
7. Vendor shall submit cross sectional drawing, catalogues showing the material of construction for each component of the valve as a part of documents.
8. Valve shall have position indicator showing open and close positions.
9. It is vendor's responsibility for detail design of valve assembly during welding process to take care of valve seat material and ensure valve integrity. Vendor to ensure that no leakage from the assembled valve.

Tag No.	:	As per PO	ANSI Rating	:	600#
Owner Specification No.	:		Valve Bore	:	Reduced Opening Port
Design Std	:	BS 1873	Face Finish (Weld End)	:	Butt Weld,
Size	:		End Connection	:	Butt Weld, ASME B 16.25,

VALVE DESIGN CONDITION

Corrosion Allowance	:	1.5 mm	Temperature in °C	:	(-)20 to (+)65
Service	:	Natural Gas (Non-sour)	Installation	:	A/G
Design Factor	:	0.5	Connecting Pipe	:	Carbon Steel

SERVICE CONDITIONS

Service	Natural Gas
Design Pressure	98 Bar-g for 600#
Design temp.	(-)20 to (+)65

VALVE MATERIAL SPECIFICATION (Equivalent or superior)

Description	**Material Specified**	**Material Offered****
Body	ASTM A 216 Gr. WCB	
Bonnet (Welded)	ASTM A 216 Gr. WCB	

Trim	ASTM A 182 F6/ 13% Cr. Steel	
Disc (Loose Plug Type)	HF + Stellited	
Body Seat Rings	13% Cr. Steel / ASTM A 182 F 6	
Stem Packing (Renewable with valve open on stream)	Graphited Asbestos with Sacrificial Corrossion Inhibitor & Inconel Wire Reinforcement.	
Hand Wheel (Rising)	Carbon Steel	
Stud Bolts	ASTM A 193 Gr. B7	
Nuts	ASTM A 194 Gr.2H	

**- To be filled by vendor

TESTING REQUIREMENTS

Charpy Impact	:	Required
Hydrostatic Test	:	As per standard
High Pressure Pneumatic test	:	As per standard
NDE Test	:	Note 9

NOTES:

1. This Valve data sheet shall be read in conjunction with Job specification of Globe valve.
2. Stem height will be furnished / decided during detail engineering for Underground valves only.
3. All Inspection and tests shall be carried out as per relevant approved QAP. Unless otherwise specified, all tests shall be witnessed by the purchase / control authority.
4. Valve shall be OS & Y type.

5. The Final Coat of Painting shall have Oxford Grey-RAL 5005 for valve.
6. TPIA shall issue EN 10204 3.2 certification for valve.
7. Painting of the valves shall be as per Manufacturer’s Standard & shall be suitable for corrosive industrial environment.
8. Each valve shall be tested as per BS EN 12266 (Part-1 & 2).
9. Non Destructive Examination
   - Body castings of all valves shall be 100% radio graphically examined as per ASME B16.34. Procedure and acceptance criteria shall be as per ASME B 16.34. For all sizes, body casting shall be subjected to 100% radiography.
   - All forgings shall be ultrasonically examined in accordance with the procedure and acceptance standard of Annexure E of ASME B 16.34.
   - Full inspection by radiography shall be carried out on all welds of pressure containing parts. Acceptance criteria shall be as per ASME B31.8 and API 1104 as applicable.
   - All finished weld ends subject to welding in field shall be 100% ultrasonically tested for lamination type defects for a distance of 50 mm from the end. Laminations shall not be acceptable.
   - Weld ends of all cast valves subject to welding in field shall be 100% radio graphically examined and acceptance criteria shall be as per ASME B16.34.
   - After final machining, all bevel surfaces shall be inspected by dye penetrate or wet - magnetic particle methods. All defects longer than 6.35 mm shall be rejected. Reject able defects must be removed. Weld repair of bevel surface is not permitted.
10. It is vendor machining, all bevel surfaces shall be inspected by dye penetrate.
11. It is vendor’s responsibility for detail design of valve assembly during welding process to take care of valve seat material and ensure valve integrity. Vendor to ensure that no leakage from the assembled valve.

Tag No.	:	As per PO	ANSI Rating	:	600#
Owner Specification No.	:		Valve Bore	:	Reduced Opening Port
Design Std	:	BS 1873	Face Finish (Flange End)	:	125-250 AARH
Size	:		End Connection	:	ASME B 16.5 (Flanged)

VALVE DESIGN CONDITION

Corrosion Allowance	:	1.5 mm	Temperature in °C	:	(-)20 to (+)65
Service	:	Natural Gas (Non-sour)	Installation	:	A/G
Design Factor	:	0.5	Connecting Pipe	:	Carbon Steel

SERVICE CONDITIONS

Service	Natural Gas
Design Pressure	98 Bar-g for 600#
Design temp.	(-)20 to (+)65

VALVE MATERIAL SPECIFICATION (Equivalent or superior)

Description	**Material Specified**	**Material Offered****
Body	ASTM A 216 Gr. WCB	
Bonnet (Welded)	ASTM A 216 Gr. WCB	
Trim	ASTM A 182 F6/ 13% Cr. Steel	

Disc (Loose Plug Type)	HF + Stellited	
Body Seat Rings	13% Cr. Steel / ASTM A 182 F 6	
Stem Packing (Renewable with valve open on stream)	Graphited Asbestos with Sacrificial Corrossion Inhibitor & Inconel Wire Reinforcement.	
Hand Wheel (Rising)	Carbon Steel	
Stud Bolts	ASTM A 193 Gr. B7	
Nuts	ASTM A 194 Gr.2H	

**- To be filled by vendor

TESTING REQUIREMENTS

Charpy Impact	:	Required
Hydrostatic Test	:	As per standard
High Pressure Pneumatic test	:	As per standard
NDE Test	:	Note 9

NOTES:

1. This Valve data sheet shall be read in conjunction with Job specification of Globe valve.
2. Stem height will be furnished / decided during detail engineering for Underground valves only.
3. All Inspection and tests shall be carried out as per relevant approved QAP. Unless otherwise specified, all tests shall be witnessed by the purchase / control authority.
4. Valve shall be OS & Y type.
5. The Final Coat of Painting shall have Oxford Grey-RAL 5005 for valve.
6. TPIA shall issue EN 10204 3.2 certification for valve.

7. Painting of the valves shall be as per Manufacturer’s Standard & shall be suitable for corrosive industrial environment.
8. Each valve shall be tested as per BS EN 12266 (Part-1 & 2).
9. Non Destructive Examination
   - Body castings of all valves shall be 100% radio graphically examined as per ASME B16.34. Procedure and acceptance criteria shall be as per ASME B 16.34. For all sizes, body casting shall be subjected to 100% radiography.
   - All forgings shall be ultrasonically examined in accordance with the procedure and acceptance standard of Annexure E of ASME B 16.34.
   - Full inspection by radiography shall be carried out on all welds of pressure containing parts. Acceptance criteria shall be as per ASME B31.8 and API 1104 as applicable.
   - All finished weld ends subject to welding in field shall be 100% ultrasonically tested for lamination type defects for a distance of 50 mm from the end. Laminations shall not be acceptable.
   - Weld ends of all cast valves subject to welding in field shall be 100% radio graphically examined and acceptance criteria shall be as per ASME B16.34.
   - After final machining, all bevel surfaces shall be inspected by dye penetrate or wet - magnetic particle methods. All defects longer than 6.35 mm shall be rejected. Reject able defects must be removed. Weld repair of bevel surface is not permitted.
10. It is vendor machining, all bevel surfaces shall be inspected by dye penetrate
11. It is vendor’s responsibility for detail design of valve assembly during welding process to take care of valve seat material and ensure valve integrity. Vendor to ensure that no leakage from the assembled valve.

Tag No.	:	As per PO	ANSI Rating	:	150#
Owner Specification No.	:		Valve Bore	:	Reduced Opening Port
Design Std	:	BS 1873	Face Finish (Flange End)	:	125-250 AARH
Size	:		End Connection	:	ASME B 16.5 (Flanged)

VALVE DESIGN CONDITION

Corrosion Allowance	:	1.5 mm	Temperature in °C	:	(-)20 to (+)65
Service	:	Natural Gas (Non-sour)	Installation	:	A/G
Design Factor	:	0.5	Connecting Pipe	:	Carbon Steel

SERVICE CONDITIONS

Service	Natural Gas
Design Pressure	19 Bar-g for 150#
Design temp.	(-)20 to (+)65

VALVE MATERIAL SPECIFICATION (Equivalent or superior)

Description	**Material Specified**	**Material Offered****
Body	ASTM A 216 Gr. WCB	
Bonnet (Welded)	ASTM A 216 Gr. WCB	
Trim	ASTM A 182 F6/ 13% Cr. Steel	

Disc (Loose Plug Type)	HF + Stellited	
Body Seat Rings	13% Cr. Steel / ASTM A 182 F 6	
Stem Packing (Renewable with valve open on stream)	Graphite Asbestos with Sacrificial Corrosion Inhibitor & Inconel Wire Reinforcement.	
Hand Wheel (Rising)	Carbon Steel	
Stud Bolts	ASTM A 193 Gr. B7	
Nuts	ASTM A 194 Gr.2H	

**- To be filled by vendor

TESTING REQUIREMENTS

Charpy Impact	:	Required
Hydrostatic Test	:	As per standard
High Pressure Pneumatic test	:	As per standard
NDE Test	:	Note 9

NOTES:

1. This Valve data sheet shall be read in conjunction with Job specification of Globe valve.
2. Stem height will be furnished / decided during detail engineering for Underground valves.
3. All Inspection and tests shall be carried out as per relevant approved QAP. Unless otherwise specified, all tests shall be witnessed by the purchase / control authority.
4. Valve shall be OS & Y type.
5. The Final Coat of Painting shall have Oxford GREY-RAL 5005 for valve.
6. TPIA shall issue EN 10204 3.2 certification for valve.

7. Painting of the valves shall be as per Manufacturer’s Standard & shall be suitable for corrosive industrial environment.
8. Each valve shall be tested as per BS EN 12266 (Part-1 & 2).
9. Non Destructive Examination
   - Body castings of all valves shall be 100% radio graphically examined as per ASME B16.34. Procedure and acceptance criteria shall be as per ASME B 16.34. For all sizes, body casting shall be subjected to 100% radiography.
   - All forgings shall be ultrasonically examined in accordance with the procedure and acceptance standard of Annexure E of ASME B 16.34.
   - Full inspection by radiography shall be carried out on all welds of pressure containing parts. Acceptance criteria shall be as per ASME B31.8 and API 1104 as applicable.
   - All finished weld ends subject to welding in field shall be 100% ultrasonically tested for lamination type defects for a distance of 50 mm from the end. Laminations shall not be acceptable.
   - Weld ends of all cast valves subject to welding in field shall be 100% radio graphically examined and acceptance criteria shall be as per ASME B16.34.
   - After final machining, all bevel surfaces shall be inspected by dye penetrate or wet - magnetic particle methods. All defects longer than 6.35 mm shall be rejected. Reject able defects must be removed. Weld repair of bevel surface is not permitted.
10. It is vendor machining, all bevel surfaces shall be inspected by dye penetrate
11. It is vendor’s responsibility for detail design of valve assembly during welding process to take care of valve seat material and ensure valve integrity. Vendor to ensure that no leakage from the assembled valve.

DATA SHEET FOR CHECK VALVES			
Sr. No.	**Description**		**Specification**
GENERAL			
1	Valve Size		2"
2	ANSI Rating		600#
3	Design Standard		API 6D
4	Corrosion allowance		1.5MM
5	Design Factor		0.5
SERVICE CONDITIONS			
6	Service		Natural Gas
7	Design Pressure		92 KG /CM2
8	Design Temperature		-29°C to 65°C
VALVE CONSTRUCTION DESIGN			
9	Location		Above Ground
10	Valve Type		Swing Check
VALVE MATERIAL SPECIFICATION			
	Part		**Specified Material / Equivalent Material**
11	Body		ASTM A 216 Gr.WCB
12	Wedge		ASTM A 216 Gr.WCB
13	Disc		ASTM A 216 Gr.WCB
14	Hinge Pin		ASTM A 182 F6
15	Gasket		Grafoil
16	Stud bolts / Nuts		ASTM A 193 Gr. B7/ASTM A 194 Gr. 2H (Galvanized)
VALVE TESTING REQUIREMENT			
17	Fire Resistant Design Requirement		As per API 6FA/API 607
18	Hydrostatic Test	Body	As per API 6D
		Seat	As per API 6D
19	Air Seat Test		As per API 6D
20	High Pressure Closure Test		API 598
21	Low Pressure Closure Test		API 598
22	Leak Test		API 598

NOTES:

1. This Valve data sheet shall be read in conjunction with Technical specification of Check valve.
2. Vendor to confirm the suitability of material for specified pressure-temperature rating.
3. All Inspection and tests shall be carried out as per relevant approved QAP. Unless otherwise specified, all tests shall be witnessed by the approved third party inspection agency.
4. TPIA shall issue EN 10204 3.2 certification for valve.
5. Vendor shall submit cross sectional drawing, catalogues showing the material of construction for each component of the valve as a part of documents.

CLIENT	**Gail India Limited**	**TAG NO.**	
QUANTITY	Refer MR	**SIZE**	Refer MR
APPLICABLE TO: ☑ PROPOSAL ☐ PURCHASE ☐ AS BUILT			
DESGIN DATA			
DESIGN CLASS :		**600#,**	
DESIGN CODE :		**ASME B 16.9, MSS-SP-97& MSS SP 75**	
FLUID :		Natural Gas / R-LNG	
☑ **SWEET SERVICE** ☐ **SOUR** ☐ **LETHAL**			
DESIGN PRESSURE AND TEMPERATURE:		**98 kg/cm^2, Min. -29 ^{0}C / Max 65 ^{0}C**	
INTERNAL : 98**kg/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.	
☑ PWHT ☑ CHARPY IMPACT TEST			
PWHT REQUIRED FOR ☐ CLIENT ☐ PROCESS ☑ 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: ☑ PROPOSAL ☐ PURCHASE		☐ AS BUILT	
DESGIN DATA			
DESIGN CLASS :		**300#**	
DESIGN CODE :		**ASME B 16.9, MSS-SP-97& MSS SP 75**	
FLUID :		Natural Gas / R-LNG	
☑ **SWEET SERVICE** ☐ **SOUR** ☐ **LETHAL**			
DESIGN PRESSURE AND TEMPERATURE:		**49 kg/cm^2, Min. -29 ^{0}C / Max 65 ^{0}C**	
INTERNAL : 49**kg/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	
☑ PWHT ☑ CHARPY IMPACT TEST			
PWHT REQUIRED FOR ☐ CLIENT ☐ PROCESS ☑ 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: ☑ PROPOSAL ☐ PURCHASE ☐ AS BUILT			
DESGIN DATA			
DESIGN CLASS :		**150#**	
DESIGN CODE :		**ASME B 16.9, MSS-SP-97 & MSS SP 75**	
FLUID :		Natural Gas / R-LNG	
☑ **SWEET SERVICE** ☐ **SOUR** ☐ **LETHAL**			
DESIGN PRESSURE AND TEMPERATURE:		**19 kg/cm^2, Min. -29 ^{0}C / Max 65 ^{0}C**	
INTERNAL : 19**kg/cm^2** @ -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.	
☑ PWHT ☑ CHARPY IMPACT TEST			
PWHT REQUIRED FOR ☐ CLIENT ☐ PROCESS ☑ 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: ☑ PROPOSAL ☐ PURCHASE		☐ AS BUILT	
DESGIN DATA		FLANGE (WELD NECK, BLIND & SPACER/SPECTACLE BLIND)	
DESIGN CLASS :		**600#**	
DESIGN CODE :		B -16.5/B 16.48	
FLUID :		Natural Gas / R-LNG	
☑ **SWEET SERVICE** ☐ **SOUR** ☐ **LETHAL**			
DESIGN PRESSURE AND TEMPERATURE:		**98 kg/cm^{2}g; Min. -29^{0}C/Max 65^{0}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	
☑ PWHT ☑ CHARPY IMPACT TEST			
PWHT REQUIRED FOR ☐ CLIENT ☐ PROCESS ☑ 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: ☑ PROPOSAL ☐ PURCHASE		☐ AS BUILT	
DESGIN DATA		FLANGE (WELD NECK, BLIND & SPACER/SPECTACLE BLIND)	
DESIGN CLASS :		**300#**	
DESIGN CODE :		B -16.5/B 16.48	
FLUID :		Natural Gas / R-LNG	
☑ **SWEET SERVICE** ☐ **SOUR** ☐ **LETHAL**			
DESIGN PRESSURE AND TEMPERATURE:		**49 kg/cm^{2}g; Min. -29^{0}C/Max 65^{0}C**	
INTERNAL : 49**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	
☑ PWHT ☑ CHARPY IMPACT TEST			
PWHT REQUIRED FOR ☐ CLIENT ☐ PROCESS ☑ 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: ☑ PROPOSAL ☐ PURCHASE		☐ AS BUILT	
DESGIN DATA		FLANGE (WELD NECK, BLIND & SPACER/SPECTACLE BLIND)	
DESIGN CLASS :		**150#**	
DESIGN CODE :		B -16.5/B 16.48	
FLUID :		Natural Gas / R-LNG	
☑ **SWEET SERVICE** ☐ **SOUR** ☐ **LETHAL**			
DESIGN PRESSURE AND TEMPERATURE:		**19 kg/cm^{2}g; Min. -29^{0}C/Max 65^{0}C**	
INTERNAL : 19**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	
☑ PWHT ☑ CHARPY IMPACT TEST			
PWHT REQUIRED FOR ☐ CLIENT ☐ PROCESS ☑ CODE			
End Connection THK. (mm) :		Refer MR	
TOTAL MIN. THK :		N.A.	
RADIOGRAPHY AS PER CODE			
ULTRASONIC TESTING **As Per CODE**			

ENGINEERING STANDARD

GAIL INDIA LIMITED

TECHNICAL SPECIFICATION FOR PIG TRAPS

GAIL-034-PI-DOC-TS-001

0	30.12.19	Issued For Review	AP	JR	TR	
Rev	**Date**	**Purpose**	**Prepared By**	**Checked By**	**Approved By**	

CONTENTS

ABBREVIATIONS:

ASME	American Society of Mechanical Engineers
ASTM	American Society for Testing and Materials
API	American Petroleum Institute
BHN	Brinell hardness number
HAZ	Heat Affected Zone
MSS-SP	Manufacturers Standardization Society - Standard Practice
RTJ	Ring Type Joint
SSPC	Steel Structures Painting Council

1.0 SCOPE

This specification covers the minimum requirements for design, manufacture, testing and supply of Pig launching and receiving traps to be installed in onshore pipeline systems transporting non-sour hydrocarbons in liquid or gaseous phase including Liquefied Petroleum Gas (LPG).

2.0 REFERENCE DOCUMENTS

Fabrication, testing and supply of Pig traps shall comply with the applicable sections of the latest edition of the following codes and standards.

AMERICAN PETROLEUM INSTITUTE (API)

5L : Specification For Line Pipe.
1104 : Specification for Welding Pipelines and Related Facilities.

AMERICAN SOCIETY OF MECHANICAL ENGINEERS (ASME)

B31.4 : Pipeline Transportation system for liquid Hydrocarbon & other liquids.

B 31.8 : Gas Transmission and Distribution Piping Systems.

B16.9 : Factory made Wrought Butt Weld Fittings.

B 16.25 : Butt Welding Ends.

BPVC Section VIII : Boiler and Pressure Vessel Code - Rules for Construction of Pressure Vessels, Division 1.

BPVC Section IX : Welding and Brazing Qualifications.

BPVC Section V : Non-Destructive Examination.

B16.5 : Pipe Flanges and Flanged Fittings.

B16.9 : Factory-Made Wrought Butt Welding Fittings.

B16.11 : Forged Steel Fittings, Socket-Welding and Threaded.

B16.20 : Metallic Gaskets for Pipe Flanges: Ring Joint, Spiral Wound and Jacketed.

B16.25 : Butt Welding Ends.

B 16.47 : Large Diameter Steel Flanges.

MANUFACTURERS STANDARDIZATION SOCIETY (MSS)

SP-75: Specification for High Test Wrought Butt Welding Fittings.

SP-53: Quality Standard for Steel Castings and Forgings for Valves, Flanges and Fittings and Other Piping Components - Magnetic Particle Examination Method.

SP-44: Steel Pipeline Flanges.

SP-97: Integrally Reinforced Forged Branch outlet Fittings-Socket Welding, Threaded & Butt Welding Ends.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

A370 : Standard Test Methods and Definitions for Mechanical Testing of Steel Products.

D709 : Laminated Thermosetting Material.

A-490 : Weather resistant High Strength Bolts, Nuts & Washers.

STEEL STRUCTURES PAINTING COUNCIL (SSPC)

VIS-I : Visual Standard.

PC-10 : Sand Blast, Prime and Paint.

OIL INDUSTRY SAFETY DIRECTORATE (OISD)

Std. 141 : Design and Construction Requirements for Cross Country Hydrocarbon Pipelines.

Std. 226 : Natural gas Transmission Pipelines and city gas distribution network.

In case of conflict between various requirements of this specification and reference standards mentioned above, more stringent requirement shall apply unless otherwise agreed by Purchaser.

3.0 MATERIALS

3.1 Material of main components of Pig traps shall be as indicated in the Data Sheet. Material of Components not indicated in data sheets shall be as per Manufacturer's Standard (suitable for the service conditions indicated in Data Sheet) and shall be subject to approval by Company.

In addition, the material shall also meet the requirements specified hereinafter.

3.2 All carbon steel used for fabrication of various components of Pig Traps shall be fully killed steel.

3.3 The carbon equivalent (CE) based on product analysis calculated by the formula shall not exceed 0.45%.

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

3.4 For Pig traps specified to be used for gas service or LPG Service, hardness test shall be carried out as per ASTM A370 for each heat of steel used in the manufacture of pressure containing parts of trap. A full thickness cross section shall be taken for this purpose. The

maximum hardness of base metal, weld metal & HAZ of all the pressure containing parts shall not exceed 248 HV10.

3.5 For Pig Trap Specified to be used for Gas Service or LPG Service. Charpy V-notch test shall be conducted on each heat of steel used in manufacturing of the pressure containing parts in accordance with ASTM A370. The specimens shall be taken in the direction of principal grain flow and notch perpendicular to original sample of plate or forging.

Charpy Impact test shall be carried out at -29°C temperature as stated in data sheet. If not stated in data sheet, the minimum average absorbed impact energy value of the set of three (3) full size specimen tested at 0°C shall be 27J. The minimum impact energy value of any one specimen of three specimen analyzed as above shall not be less than 22J.

In case of low temperature Carbon steel (LTCS) material specified in data sheet or offered manufacturers, the Charpy-V notch test requirement of applicable material standard shall be compiled with.

3.6 Non-metallic seal materials, if provided, shall be resistant to amine based corrosion inhibitors and explosive decompression.

3.7 The Manufacturer shall select materials as indicated in the data sheet along with the operating (Temperature/Pressure) parameters and in accordance with ASME B 31.4 / B 31.8, as applicable and ANSI B 16.25 for butt welding ends. Internal bore of weld joints shall not impede the pigging process or represent potential pig damage. The Manufacturer shall perform post weld heat treatment (PWHT) as/if required by the corresponding approved weld procedures. The Manufacturer shall prove by calculations to ASME VIII Division I that the material supplied satisfies the pressure/temperature rating as specified in data sheet.

4.0 DESIGN AND MANUFACTURE

4.1 GENERAL

a. The Pig traps shall be installed above ground and shall be suitable for handling all kinds of batching and cleaning pigs as well as intelligent pigs used for online Inspection of pipelines.

b. Pig traps furnished under this specification shall be in compliance with the requirements of ASME B31.4/ B31.8, as applicable and OISD 141 / OISD 226.

c. Pig traps shall be provided with quick opening end closure. Screwed type or plug-in types of end closures are not permitted.

d. Quick opening closure manufactured by a third party shall comply with the requirements of this document and a name plate shall be affixed containing all pertinent manufacturers' information. Any removable segments of the quick opening closure shall have similar markings.

The quick opening end closure shall be of clamp ring/band-lock type or equivalent design and shall consists of a safety pressure release system allowing the opening only when there is no pressure in the trap. End closure shall be hand operated by a single lever operation and operable by one operator. End closures of size NB 600 (24") and above shall be fitted with worm gear operator for the opening of the closure. Hinge of the closure shall be so designed that the weight of the end closure is fully supported without sagging.

e. Design factor and corrosion allowance as indicated in data sheet shall be considered in design of wall thickness for all related materials and quick opening end closures.

f. Minimum dimensions (diameter, wall thickness, length, location etc.) of the Pig trap body, neck and other appurtenances, shall be as indicated in the data sheets.

Manufacturer shall verify suitability of indicated information and dimensions according to his requirements. Any alternate shall be clearly presented in the Manufacturers bid package. Subsequent revisions shall require Purchaser approvals.

g. Piping fittings used in fabrication of Pig trap shall be as per following:

Size up to and including DN 40 (1½") : Forged, Seamless fittings as per ASME B 16.11.

Size DN 50 (2") to DN 400 (16") : Forged, Seamless fittings as per ASME B 16.9.

Size DN 450 (18") and above : Forged, Welded fittings as per MSS-SP-75.

All Integrally Reinforced Branch Outlet Fittings : Forged, seamless as per MSS-SP-97

All Pig Trap branch connections shall be in accordance with the data sheet information. Flanged ends, when specified, shall conform to ASME B 16.5 for size up to DN 600 (24") and ASME B 16.47, Series A for size above DN 600 (24").

Flanges shall have raised face as unless otherwise indicated in data sheets.

Generally branch connections shall be orientated as follows:

- Drains - bottom of pig trap.

- Vents, pressure gauges, pig signaler - top of pig trap.

- Kicker line, balance line, bypass line - side (or possibly top quadrant) of pig trap. Not bottom of pig trap.

- The diameter of all branch connections shall be 2 inches minimum.

- Pig signaler connection when required to be welded as per data sheet.

- Pressure indicator connections shall be installed on the major barrel near the end closure and on the minor barrel near the pig trap valve.

h. Connection for pig signaler shall be provided in accordance with the data sheet. Manufacturer to provide details of the proposed pig signaler for Purchaser approvals. Installed assembly to be part of the hydro test factory testing.

Functionality testing to be completed prior to shipping.

i. All Pig traps shall be provided with supports, minimum two, for mounting on concrete foundation with an insert plate. Permanent supports shall be used to fully support and restrain the pig traps throughout their length and these shall be designed to carry the weight of the pig trap system filled with water.

j. The Pig trap supports under the barrel and the neck at the major foundations shall be welded to the trap in accordance with the requirements of this specification prior to final testing. The Manufacturer to provide details of slide plate design for Purchaser approval. The trap assemblies are to be installed unrestrained in a longitudinal direction, and be able to compensate for expansion of the unrestrained part of the pipeline.

4.2 PIG HANDLING

Manufacturer is responsible for designing and supplying a self-contained Pipeline Inspection Gauge (PIG) handling system complete with, baskets/trays, PIG insertion/ retraction devices, supports and rail tracks etc. with the Pig trap assembly. The handling requirements are for the nominal pipeline sizes as specified in data sheets.

The material used in the design of the pig handling system shall be ASTM A36 or equivalent structural steel.

All moving parts of the pig handling system, such as filter basket shall be manufactured from non-sparking materials.

Each Pig Launcher / Receiver shall be provided with suitable Pig Handling System for either inserting the pig into the launcher, or retracting the pig from the receiver.

The pig handling facility, as required in the data sheet, shall consist of the following, as a minimum:

- Perforated filtering basket mounted on wheels / rails or PTFE slides.
- Fabricated trolley support cradle frame for the perforated basket.
- Beam / manual winch to push / pull the basket for insertion and retrieval of pigs.

The pig receiving traps shall be equipped with a half internal removable filtering basket consisting of a punched plate with at least five rows of drain holes. The filtering basket shall slide on guides/rails or wheels and in all cases the material of the parts being in contact with each other shall be of anti-spark type. The filtering basket shall be provided with suitable stops. Lock bracket shall be provided to such that the basket does not slide within the trap. Rear end of the basket shall be provided with suitable lug to enable retrieval of the basket by hooks. The handling system (for inserting and retracting the scraper and instrumented pigs from the trap) shall be complete with handling devices. In case any rails are required for sliding of the handling system, the same shall be provided by the scraper trap manufacturer.

4.3 MANUFACTURE

4.3.1 GENERAL

Pig traps shall be fabricated in accordance with drawings approved by Purchaser. The pipeline connection with the pig trap assembly will be a welded end.

The trap reducers, to be welded between neck and body of pig traps, shall have transition from one diameter to other by constant slope (not ‘bell’ shaped as per ASME B16.9).The Manufacturer may fabricate the reducers from steel plate.

All inside weld beads shall be ground smooth.

Circumferential weld on the body or neck material is not permitted, the welding necessary to join the individual metal sections (body, neck, reducer etc).

4.3.2 WELDING

All welding shall be carried out by welders and welding procedure qualified in accordance with ASME Section IX. The procedure qualification shall also include hardness & impact test when required as per clause 3.4 & 3.5 this specification and shall meet the requirements as specified there in.

No repairs by welding shall be carried out on base metal of pressure containing components of pig traps. Manufacturer shall obtain Purchaser approval prior to carrying out any repair of welds. Repair welding shall be carried out by welders and welding procedures duly qualified as per ASME Sec IX and records for each repair shall be maintained.

All pressure containing welds, except for size DN 40 and below, made for fabrication of Pig traps shall be butt welds. Socket welds shall be permitted for size DN 40 and below only.

All weld ends shall be checked for surface defects using dye penetrate prior to welding

4.3.3 STRESS RELIEVING

When required as per provisions of the design codes, complete pig trap assembly shall be stress relieved after fabrication. Stress relieving shall also be carried out when branch openings are made by extrusion process.

4.3.4 FABRICATION

The pig handling facilities frame will be of fully welded construction and shall be manually operated. All steel parts of the pig handling system shall be hot dip galvanized.

5.0 INSPECTION AND TESTS

The Manufacturer shall ensure all equipment used for testing and inspection purposes is calibrated and certified accordingly. The Manufacturer shall record all inspection and testing activity on the appropriate inspection certificate. The following inspection and testing shall be carried out prior to painting, marking and shipment of pig traps.

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

5.1 TESTING OF MATERIALS

Chemical composition and mechanical tests including yield strength, ultimate tensile strength, impact test, elongation and hardness shall be carried out for each heat of steel used as per the applicable standard as referred to in this specification.

5.2 VISUAL INSPECTION AND DIMENSIONAL CHECK

All pig traps shall be visually inspected for visible surface defects. Bevels at butt weld ends shall show a smooth contour. All dimensions shall be checked for conformance with approved drawings.

5.3 NON-DESTRUCTIVE EXAMINATION

a. Full length of all pressure containing butt welds, including welds that have been repaired, shall be examined by radiography. Acceptance limits shall be as per ASME Section IX.

b. Any other weld that, in Purchaser's opinion, cannot be radiograph shall be inspected by ultrasonic or magnetic particle methods. Acceptance criteria shall be as per ASME Section VIII Appendix U and Appendix VI respectively. Root pass of closure weld shall also be examined by magnetic particle inspection method.

c. 100 percent surface of all forgings shall be wet magnetic particle inspected. Method of inspection and acceptance shall comply MSS-SP-53.

d. All finished wrought weld ends shall be 100% ultrasonically inspected for lamination type defects for a distance of 50mm from the end. Any laminations larger than 6.35 mm shall not be acceptable.

5.4 Company's Inspector reserves the right to perform stage wise inspection and witness tests, including hydrostatic test, as indicated in 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 Company's Inspector.

Inspection and tests performed/witnessed by Company's Inspector shall in no way relieve the Manufacturer's obligation to perform the required inspections and tests and of specific integrity of the pig traps.

5.5 HYDROSTATIC TESTING

A hydrostatic test shall be carried out on each pig trap complete in all respects, including welding of quick opening end closure and pig signaler (if applicable). The test pressure as indicated in data sheets shall be held for a period of 1 hour and the assembly visually inspected for leaks. Any pressure changes must correspond with temperature changes otherwise the test will not be acceptable. Test records to be maintained accordingly by Manufacturer.

5.6 FUNCTIONAL TEST

Proper functioning of quick opening end closure shall be tested by performing at least two closing and opening cycles.

6.0 PAINTING

6.1 SURFACE PREPARATION

Surface preparation for all coated surfaces according to coating Manufacturers recommended or to SSPC-SP-10 surface preparation for coating as a minimum.

6.2 PAINTING

Exterior surfaces of all pig traps shall be painted with a three layer epoxy paint coating system. The Manufacturer to provide paint procedure for approval prior to manufacture

7.0 MARKING

Marking shall be done on a stainless steel plate and affixed to the trap body by means of corrosion resistant fasteners. Marking shall include the following:

- Manufacturer's Name
- Trap/Neck diameter, thickness
- Material
- ASME Class Rating
- Tag Number
- Design Pressure & Design Temperature
- Year of manufacture
- Empty weight of the trap assembly.

8.0 TEST CERTIFICATES

Manufacturer shall furnish the following certificates:

a. Test certificates relevant to the chemical and mechanical properties of the materials used for manufacture of trap as per relevant standards and this specification.
b. Hydrostatic test certificates.
c. Test Reports on radiography, ultrasonic inspection and magnetic particle examination.
d. Test Reports on heat treatment carried out, if any.
e. Welding procedures and welders qualification reports.

The certificates shall be considered valid only when signed by Company's Inspector. Only those traps which have been inspected and certified by the Company's Inspector shall be dispatched from Manufacturer's works.

9.0 PACKING & SHIPPING

All traps shall be provided with suitable protectors for flange faces. All butt weld ends shall be suitably protected to avoid any damage during transit by means of metallic or high impact plastic bevel protectors.

All pig traps shall be cleaned from inside of all foreign materials, grease, rust etc prior to packing. Prior to shipment, parts and equipment which have bare metallic surfaces shall be protected with a rust preventative which will provide protection at temperatures up to 50 ^{0}C. Sealing surfaces and moving parts to have a graphite grease coating applied.

10.0 SPARES

Manufacturer shall furnish list of recommended spares and accessories required during startup and commissioning (with special attention to consumable items such as gaskets, seals, etc. for end closure) and supply of such spares shall be included in the price quoted by Manufacturer.

Manufacturer shall furnish list of recommended spares and accessories and special tools required for two years of normal operation and maintenance of the traps and price for such spares shall be quoted separately.

11.0 CERTIFICATION

All Certification of finished product shall be EN 10204 type 3.2.

12.0 DOCUMENTATION

The Manufacturer shall supply documentation in accordance with the Vendor Data Requirements List (VDRL) as attached with Purchase Order.

ENGINEERING STANDARD

GAIL INDIA LIMITED

TECHNICAL SPECIFICATION FOR PIG SIGNALLARS

GAIL-034-PI-DOC-TS-002

0	30.12.19	Issued For Review	AP	JR	TR	
Rev	**Date**	**Purpose**	**Prepared By**	**Checked By**	**Approved By**	

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ABBREVIATIONS:

ASME	American Society of Mechanical Engineers
ASTM	American Society for Testing and Materials
API	American Petroleum Institute
BHN	Brinell hardness number
HAZ	Heat Affected Zone
MSS-SP	Manufacturers Standardization Society - Standard Practice
RTJ	Ring Type Joint
SSPC	Steel Structures Painting Council

1.0 SCOPE

This specification covers the minimum requirements for the design, manufacture, testing and supply of Pig Signalers (Intrusive type), used for the detection of passage of pig and instrumented gauging pigs, to be installed in onshore pipelines transporting non-sour hydrocarbons in liquid or gaseous phase including Liquefied Petroleum Gas (LPG).

2.0 REFERENCE DOCUMENTS

The design, fabrication and supply of Pig Signalers shall comply with the latest edition of the following codes and standards.

AMERICAN SOCIETY OF MECHANICAL ENGINEERS (ASME)

B31.4 : Pipeline Transportation system for liquid Hydrocarbon & other liquids.

B 31.8 : Gas Transmission and Distribution Piping Systems.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

A370 : Standard Test Methods and Definitions for Mechanical Testing of Steel Products.

STEEL STRUCTURES PAINTING COUNCIL (SSPC)

VIS-I : Visual Standard.

OIL INDUSTRY SAFETY DIRECTORATE (OISD)

Std. 141 : Design and Construction Requirements for Cross Country Hydrocarbon Pipelines.

Std. 226 : Natural gas Transmission Pipelines and city gas distribution network.

MISCELLANEOUS

IEC : International Electro technical Commission

NEMA : National Electrical Manufacturer's Association

NEC : National Electric Code

In case of conflict between various requirements of this specification and reference standards mentioned above, more stringent requirement shall apply unless otherwise agreed by Purchaser.

3.0 MATERIALS

3.1.1 Material for major components of the Pig Signallers shall be as indicated in Pig Signaller Data Sheet. Material of components not specified in data sheet shall be as per Manufacturer's Standard suitable for the service conditions indicated in Data Sheet, which will be subject to approval by Company. In addition, the material shall also meet the requirements specified hereinafter.

3.1.2 Carbon Steel used in the manufacture of Pig Signalers shall be fully killed.

3.1.3 Seal materials used that are exposed to pipeline contents shall be resistant to amine based corrosion inhibitors and explosive decompression.

3.1.4 Scarfed welding base shall have Carbon Equivalent (CE) not greater than 0.45% on check analysis calculated as per the following formula:

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

3.1.5 For Pig Signaller specified to be used for gas service or LPG Service, hardness test shall be carried out as per ASTM A370 for each heat of steel used full thickness cross section shall be taken for this purpose. The maximum hardness of base metal, weld metal & HAZ of all the pressure containing parts shall not exceed 248 HV10.

3.1.6 For Pig Signaller Specified to be used for Gas Service or LPG Service. Charpy V-notch test shall be conducted on each heat of steel used in manufacturing of the pressure containing parts in accordance with ASTM A370. The specimens shall be taken in the direction of principal grain flow and notch perpendicular to original sample of plate or forging.

Charpy Impact test shall be carried out at -29°C temperature as stated in data sheet. If not stated in data sheet, the minimum average absorbed impact energy value of the set of three (3) full size specimen tested at 0°C shall be 27J. The minimum impact energy value of any one specimen of three specimen analyzed as above shall not be less than 22J.

In case of low temperature Carbon steel (LTCS) material specified in data sheet or offered manufacturers, the Charpy-V notch test requirement of applicable material standard shall be compiled with.

4.0 DESIGN AND MANUFACTURE

4.1 Pig Signaller shall be suitable for welding on to pig trap and pipe having material, diameter, wall thickness and service condition indicated in the data sheets.

4.2 Pig Signallers shall be bi-directional type. Plunger type Pig-Signallers is not acceptable.

4.3 All Pig Signallers shall have spring loaded visual indicator with manual reset. Flag shall get locked in down position when reset. In addition, Pig Signallers shall be provided with a micro- switch, duly encased in a weatherproof and explosion proof enclosure, for remote indication when indicated in data sheets. The electrical rating and area classification of micro-switch shall be as per data sheet.

4.4 Aboveground and underground installation shall be as stated in the data sheet. For underground installation Pig Signallers shall be provided with extension, so that visual indicator is located well above the ground. The length of extension shall be as indicated in data sheet and shall be measured from pipe centerline to hinge of the visual indicator. All components connecting visual indicator and trigger mechanism shall be enclosed in weatherproof enclosure.

4.5 The seals used for Pig Signallers shall be able to withstand an internal vacuum of 5-millibar.

4.6 Pig Signallers indicated in data sheets to be installed on pipeline shall be provided with a built- in valve to allow replacement/repair of internals with line under pressure. Pig Signallers indicated to be used on pig traps shall be with or without built in isolation valve as specified in datasheet.

4.7 All welds shall be made by welders and welding procedures qualified in accordance with the provisions of ASME Section IX.

5.0 INSPECTION AND TESTS

The Manufacturer shall perform all inspections and tests as per the requirements of this specification and the relevant codes, standards and specifications, prior to shipment at his Works. Such inspections and tests shall be, but not limited to, the following:-

5.1 CHEMICAL COMPOSITION AND MECHANICAL TEST

Chemical composition and mechanical tests including yield strength, ultimate tensile strength, Impact test, elongation and hardness shall be carried out for each heat of steel used as per the applicable standard referred to in the corresponding Material Specification.

5.2 VISUAL INSPECTION

All Pig Signallers shall be visually inspected. The internal and external surfaces shall be free from any strikes, gouges and other detrimental defects. The surfaces shall be thoroughly cleaned and free from dirt, rust and scales.

5.3 HYDROSTATIC TEST

A hydrostatic test shall be carried out on each Pig Signaller after assembly. The test pressure as indicated in data sheets shall be held for a period of 15 minutes. No visible leakage or drop in pressure permitted.

5.4 NON-DESTRUCTIVE EXAMINATION

a. Full length of all pressure containing welds, including welds that have been repaired, shall be inspected by ultrasonic or magnetic particle methods. Acceptance criteria shall be as per ASME Section VIII Appendix U and Appendix VI.

b. Wet Magnetic Particle Inspection of all bevel surfaces shall be carried out for all Pig Signallers. Any lamination extending into bevel face and having transverse dimension greater than 6.4 mm shall not be acceptable.

5.5 FUNCTIONAL TEST
Manufacturers shall perform functional tests to establish satisfactory performance of both manual and electrical indications.

5.6 Company's Inspector reserves the right to perform stage wise inspection and witness tests, including hydrostatic test, as indicated in 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 Company's Inspector.

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

6.0 PAINTING

6.1 SURFACE PREPARATION

Surface preparation for all coated surfaces according to coating Manufacturers recommended or to SSPC-SP-10 surface preparation for coating as a minimum.

6.2 ABOVE GROUND PAINTING

Pig Signaller exterior surfaces shall be painted with a three layer epoxy paint coating system. The Manufacturer has to provide paint procedure for approval prior to manufacture.

6.3 BELOW GROUND COATING

Pig Signaller exterior surfaces that will be buried below ground shall be coated with three coats of coal tar epoxy resin with a minimum dry film thickness of 400 microns.

7.0 MARKING

All Pig Signallers shall be marked with following information on corrosion resistant metal tag permanently attached to the pig signaler:-

- Manufacturer's name.
- Suitable for Welding on ------- dia pipe.
- Tag Number.
- ANSI Rating.
- Material and grade.
- Test Pressure.
- Year of Manufacture.

8.0 TEST CERTIFICATES

Manufacturer shall submit the following test certificates:

- Test certificates for material compliance as per relevant material standards.
- Test certificates of hydrostatic and functional tests.
- Test reports of NDT.

9.0 PACKING & SHIPPING

All Pig Signallers shall be packed and prepared for shipment/transport in accordance with the procedures included in the request for Quotation (RFQ).

Butt weld ends of all Pig Signallers shall be suitably protected to avoid any damage during transit.

All machined surfaces subject to corrosion shall be well protected by a coat of grease or other suitable materials.

10.0 SPARES AND ACCESSORIES

Manufacturer shall furnish list of recommended spares and accessories for Pig Signallers required during start-up and commissioning and supply of such spares shall be included in the price quoted by Manufacturer.

Manufacturer shall furnish list of recommended spares and accessories (including jacketing bracket) required for two years of normal operation and maintenance of Pig Signallers and price for such spares shall be quoted separately.

11.0 CERTIFICATION

All Certification of finished product shall be EN 10204 type 3.2.

12.0 DOCUMENTATION

The Manufacturer shall supply documentation in accordance with the Vendor Data Requirements List (VDRL) as attached with Purchase Order.

ENGINEERING STANDARD

GAIL INDIA LIMITED

TECHNICAL SPECIFICATION FOR PRESSURE SAFETY VALVE

GAIL-034-PI-DOC-TS-003

0	30.12.19	Issued For Review	AP	JR	TR	
Rev	**Date**	**Purpose**	**Prepared By**	**Checked By**	**Approved By**	

CONTENTS

1.0 INTRODUCTION

1.1 Purpose

This document is intended to provide a specification for pressure safety valve in general.

1.2 Scope

This specification, together with the referenced industry standards, defines the functional, technical and installation requirements for the pressure safety valves installed in the facility.

2.0 DEFINITION

Where used in this document, the following terms shall have the meanings indicated below, unless clearly indicated by the context to this order.

Consultant	Lyons Engineering Private Limited (LEPL) the party to act for and on behalf of OWNER for the Engineering Services
Supplier / Vendor / Manufacturer	The party, which manufactures and supplies equipment and services to the OWNER.
Pressure Safety Device	A pressure relief device designed to open and relieve excess pressure and to reclose and prevent the further flow of fluid after normal conditions have been restored.
Actual discharge area	The minimum net area that determines the flow through a valve
Effective discharge area	A normal or computed area used with an effective discharge coefficient to calculate the minimum required relieving capacity for a pressure relief valve per the preliminary sizing equations contained in this practice.
Accumulation	Accumulation is the pressure increase over the maximum allowable working pressure of the vessel allowed during discharge through the pressure relief device, expressed in pressure units or as a percentage of maximum allowable working pressure or design pressure.
Over pressure	The pressure increase over the set pressure of the relieving device allowed to achieve rated flow.
Set pressure	The inlet gauge pressure at which the pressure relief device is set to open under service conditions.
Back pressure	The pressure that exists at the outlet of a pressure relief device as a result of the pressure in the discharge system. It is the sum of the superimposed and built-up back pressures.
Built-up back pressure	The increase in pressure at the outlet of a pressure relief device that develops as a result of flow after the pressure relief device opens.

Blow down	Difference between the set pressure and the closing pressure of a pressure relief valve, expressed as percentage of the set pressure or in pressure units.

3.0 ORDER OF PRECEDENCE

This specification indicates the minimum requirements and does not relieve the Contractor or Contractor appointed party (Supplier / Vendor) from his responsibilities concerning the design and safe operation of the supplied equipment.

In the event of conflict between this standard Specifications, Datasheets, job specifications, statutory regulations, related standards & codes etc., the following order of priority shall be applicable:

- Statutory Regulations
- Engineering Design Basis
- Datasheets
- Job Specifications
- Standard Specifications
- Related Standards & Codes

If any parameter/specification is not mentioned / defined in higher priority/precedence document, the minimum requirements for same in lower higher priority/precedence document shall prevail.

4.0 REFERENCE DOCUMENTS

The products/services specified herein shall be supplied, installed, and tested in accordance with the latest edition and amendments of the following codes and standards in effect at the time of tender submission.

Code/Std. Ref. No.	Code/Std. Title
ANSI 31.4	Pipeline Transportation Systems for Liquid Hydrocarbons and other Liquids
ANSI B16.34	Valves – Flanged, Threaded and Welding End
ANSI B16.5	Pipe Flanges and Flanged Fittings.
ANSI B31.1	Power Piping
ANSI B31.3	Process Piping
API 2000	Venting Atmospheric and Low-pressure Storage Tanks
API 620	Design and Construction of Large, Welded, Low-pressure Storage Tanks.
API RP 520 – Part 1	Sizing, Selection and Installation of Pressure-relieving Devices in Refineries, Part I – Sizing and Selection
API RP 520 – Part 2	Sizing, Selection and Installation of Pressure-relieving Devices in Refineries, Part II – Installation
API STD 521	Pressure-relieving & De-pressuring Systems
API STD 526	Flanged Steel Safety Relief Valves for use in Petroleum Refineries.
API STD 527	Commercial Seat Tightness of Safety Valves with Metal to Metal Seats
ASME BPCV Section IX	Boiler and Pressure Vessel Code - Welding and Brazing Qualifications.
ASME BPCV Section VIII	Boiler and Pressure Vessel Code – Rules for Construction of Pressure Vessels
ASME BPVC Section V	Boiler and Pressure Vessel Code - Non-destructive Examination

ASTM A269	Standard Specification for Seamless and Welded Austenitic Stainless Steel Tubing for General Service.
EN-10204	Metallic Products - Types of Inspection Documents
MSS SP-55	Quality Standard for Steel Castings for Valves, Flanges, Fittings and Other Piping Components - Visual Method for Evaluation of Surface Irregularities.

5.0 DESIGN REQUIREMENTS

5.1 General

Pressure safety valves shall be provided on pressurized vessels or on piping as required by process conditions. The safety valves shall be conventional or bellows type or pilot operated type depending upon the process requirements as indicated in the project data sheets.

5.2 Environmental Conditions

The equipment considered and the complete installation shall be suitable for continuous operation under the following site conditions:

Description	Indoor (Air Conditioned)	Indoor (Non-Air conditioned)	Outdoor (Under shade)	Outdoor (Open to sky)
Operating Temperature	0 ~ 35 Deg C	-5 ~ 50 Deg C	-5 ~ 50 Deg C	-5 ~ 55 Deg C
Relative Humidity	20% ~ 80%	90%	95%	

The instruments shall be suitable to the ambient conditions provided in the above table.

5.3 Operation and Design Life

Pressure safety valves shall be designed to operate in the site environmental conditions continuously. The life time of the plant is envisaged to be 25 years. However, optimum design life expectancy of a valve shall be 10 years and spare parts availability shall be for 10 years after cease of production.

Vendor shall recommend the maintenance/replacement schedule of the valve in order to run for the required duration and shall train the Company personnel to maintain the valves.

5.4 Proven Life

The valve to be used will be checked, known and field-proven in the industry. The application of experimental and obsolete equipment is not acceptable.

Valve should only be used that has been successfully tried and tested on similar facilities. Where newer technology is proposed adequate provision must be made for the long-term support of the system. New unproven technology should not be used.

6.0 TECHNICAL REQUIREMENTS

6.1 Selection Criteria

Conventional (unbalanced) safety valves shall be normally used when the total back pressure of the downstream piping does not exceed 10% of the set pressure.

Balanced safety valves using balancing bellows shall be used, if the back pressure exceeds 10% and up to 50% of the set pressure or the fluid is corrosive. However, for backpressures greater than 30% the manufacturer shall be consulted. Balancing bellows shall be used, when the super-imposed variable back pressure is more than 5%. Balanced seal type with auxiliary balancing piston shall be used for fouling service.

Pilot operated valves shall be used, if the back pressure exceeds 50% and up to 70% of the set pressure. Pilot operated valves shall also be used for applications which demand very accurate settings, quick opening/closing or when the difference between operating pressure and set pressure is less than 5% of set pressure.

However, pilot operated safety valve shall only be used in clean service such as fuel gas/nitrogen or where the risk of blockage of the pilot pipe work is minimal. Pilots shall be provided with a filter to avoid the dirt entering into the ports.

Thermal relief valves shall be used where required by process conditions and as per the project P&IDs. These shall have flanged end connections with “D” orifice. Flange welded to the body of the screwed end valve is not acceptable.

Direct acting pressure / vacuum relief valves (also known as Breather Valves) shall be used on large storage tanks where the pressure difference between the tank pressure and the ambient pressure is small, negative and near to atmospheric pressure. These valves are to be provided on atmospheric / low pressure tanks typically less than 1.03 barg. These valves prevent the build-up of excessive pressure or vacuum which can unbalance the system or damage the storage tank. These valves also minimize the product evaporation loss in tanks. The valve range includes pressure only, vacuum only or combined pressure / vacuum valves.

The sizing, selection and installation details of these valves shall be as per API 2000 (Sections 1 to Section 3) or API 620 (Section 6) and as per manufacturer standard / recommendations.

6.2 Design

Pressure safety valves shall be generally direct acting, spring loaded, full nozzle / full lift, adjustable blow down high capacity type.

All safety valves shall have flanged end connections, enclosed spring, bolted bonnet, screwed cap, and full one-piece nozzle. Flanges shall be in accordance with ANSI B16.5 requirements.

Flanges shall be integral part of the body. Weld-on flanges shall not be allowed. Bodies and flanges shall be of the same material. Inlet flange shall be of sufficient rating to withstand the reaction force of the pressure relief valve on blow down.

Trim shall be deemed to include the nozzle, the disc and disc holder, stem guide, blow down ring, bushing and all internal parts, except the body, in contact with the process fluid.

Nozzles shall have integral seat and shall be of ample proportions to permit several lapping or re-machining operations.

Material of construction shall be based on the process/design conditions and in reference to the piping material specification, as mentioned in the pressure safety valve datasheet.

Material of construction of the valve shall be as specified in the PSV datasheet. Alloy steel or other materials may be used in accordance with the service requirements. All castings shall be true to form, free from shrinkage defects, strains, scale, lumps, sand holes, or other defects.

The Vendor shall advise the minimum and maximum allowable setting of the springs, furnished with each valve and the spring number.

Valve end connection, size, rating and materials shall be in accordance with API 526.

Nominal inlet and outlet body sizes shall be selected from the following series: 1", 1½", 2", 3", 4", 6", 8", 10" and 12". Sizes 1¼", 2½", 3½" and 5" shall not be used without the Company's approval.

Inlet and outlet flanges shall be sized to withstand the reaction force. Vendor shall indicate the reaction force in the data sheet.

Safety valve sizing shall be carried out based on API RP 520 Part 1 sizing formula. Orifice letter designation shall be in accordance with API STD 526. For blocked discharge case, overpressure shall be 10% above the set pressure. For fire relieving case overpressure shall be 21% above the set pressure.

Thermal relief valve shall be of semi nozzle type unless otherwise specified in the instrument datasheets. Thermal relief valves end connections shall be flanged with “D” orifice designation as minimum. Flange welded to the body of the screwed end valve is not acceptable.

All pressure safety valves, except thermal relief valves shall be ASME „U" code stamped. Vendor shall provide the ASME code stamping and capacity certificates during the inspection and submit them as part of their final documentation.

6.2.1 Pressure Ratings

The pressure ratings for the pressure safety valves shall be in accordance with standard API-526. Leakage class shall be in accordance with API 527.

Safety valves shall be set at 90% of maximum the design pressure of the system being protected by the valve except as permitted by the relevant ASME Codes.

The allowable set pressure tolerance shall be as below:

- ±0.1 barg for set pressure and up to and including 5 barg set pressure;
- ±3% for set pressure above 5 barg.

6.2.2 Discharge Area

The area of discharge of flanged valves operating at set pressures over 19 barg shall not be less than four times the area of the nozzle. The area of discharge includes any place in the valve downstream of the nozzle, including the discharge flange opening. For pressures below 19 barg the discharge area shall be as per relevant codes and standards as indicated in Section 4 and respective project data sheet.

Vendor shall provide noise calculations in accordance to standard API 521.

6.2.3 Lifting Levers

Pressure relief valves in air or steam service and water (above 60ºC) shall generally be fitted with packed lifting levers. Where lifting mechanisms are specified they shall be suitable for the pressure and temperature conditions of the relieving fluid. Where high pressure steam or air and water above 60ºC are being discharged, packed lever lifting assemblies shall be supplied.

Valves in hydrocarbon and chemicals process services shall not be fitted with lifting levers unless specifically stated on the project data sheet.

6.2.4 Springs

Unless otherwise specified, SS316 springs shall be supplied for all flanged pressure safety valves operating in services with relieving temperatures in the range –30°C to 230°C.

Safety valves in corrosive service shall be sealed to avoid corrosion of the spring mechanism.

6.2.5 Bellows/ Bonnet

Bonnet shall be bolted on to the body. The bonnet and cap material shall be same as body material. The bonnet shall be vented separately from the discharge, in bellows-type pressure safety valves.
Bonnet vent connections shall be threaded ½” NPT minimum. Tubing of vents to a safe location shall be by piping.

Bonnet vented safety valves are not acceptable except in bellows sealed valves.

The bonnet shall be of close type with isolated spring chamber and sealable cap. Tapped and plugged vent shall be provided when the bonnet pressure is equal to atmosphere pressure.

Other materials may be proposed by the Vendor for approval by the Company.

6.2.6 Nozzle and Disc

The nozzle shall be one piece with an integral seat at the top, against which the disc will seat when closed. However, for a pilot operated valve the nozzle may also be of the semi-nozzle type without integral flange.
The seat shall be of ample proportions to allow several servicing by re-lapping or re-machining.

Valves shall generally have metal-to-metal seats. Resilient seat seals shall be considered on services where maximum tightness is essential, where the operating pressure is greater than or equal to 90% of the set pressure, and to limit leakage which may be caused by the effects of corrosion or vibration.

The seat disc shall be a one piece piston type loosely connected to the spindle with radial or ball thrust bearing between the disc and spindle. The disc guide shall be symmetrical and independent of the valve body.

6.2.7 Blow down

The blow down (difference between set pressure and reseating pressure expressed as % of set pressure) shall be adjustable between 2.5% and 10% of the set pressure, for pressure safety valves with adjustable blow down (blow down ring). The maximum limit of blow down shall be 7% of set pressure except for valves having seat bore less than 15 mm.

Limits for valves with non-adjustable blow down on gas / vapor services shall be as a maximum 15% of set pressure.

Limits for valves with non-adjustable blow down on incompressible fluid service shall be as a maximum 20% of set pressure.

6.2.8 Test Gags

Test gags shall be provided where specified on the project data sheets to hold the relief valve closed during hydrostatic testing when test pressures are above the set point.

The presence of the test gag shall be obvious to a casual observer.

6.3 Materials

Valve and valve internals material of construction shall be as detailed on the project data sheets, referenced specifications and API 526. When materials are not specified the Vendor may offer his standard material suitable for the fluid service, site environment and operating / design conditions.

It is not the intention of this specification to exclude the substitution of other materials of equal or superior quality. However, the Vendor must obtain written approval from the Company before proceeding with substitution and / or fabrication.

When hard seats (such as stelited seats) are specified, the base material shall be at least as corrosion resistant as the material specified for these parts unless the welded hard material covers the entire surface exposed to the corrosive action of the medium.
Tubing for pilot operated pressure safety valves, shall be SS316, seamless and drawn to ASTM A269. Bolting shall be of like material to the equipment supplied. All bolting materials in pressurized service shall be in accordance with piping class as specified in Piping Material Specification.

All materials shall be new and unused, of current manufacturer and free from defect.

Aluminum shall not be used for any part of the equipment that may come into contact with the process fluid. The use of Aluminum in any component shall be subject to approval by the Company

All materials (including gaskets and sealants) shall be free from the following hazardous substances:

- Asbestos.
- Ceramic fiber.
- Chlorofluorocarbons.
- Poly chloro biphenyls (PCB) and their isomers.
- Radioactive Materials.
- Mercury.

6.3.1 Material Traceability and Certification

All materials used shall have full chemical analysis and mechanical test certification and shall be identifiable by means of certified markings relating to the available authentic material certificates. Material certification requirements shall be in accordance with EN10204 - 3.1.

6.3.2 Protective Coating

All equipment shall be suitable for operation in the environment referenced in this specification. Painting of PSV shall be as follows with a total dry film thickness of min. 130 micron.

- Shot blasting + Zinc phosphate primer (50 micron) + Two coat synthetic enamel (40 micron each);
- Internal lining (epoxy coating) in case of water services.

Alternative paint procedures may be proposed by the Vendor, but shall be subject to the Company‟s approval.

Full technical data of the proposed paint manufacturers' products is to be provided by the Vendor with his tender.

6.3.3 Noise Limits

The maximum allowable noise level at 1 m from the valve under all circumstances shall be typically 110 dB (A) as per international safety practice.

7.0 QUALITY ASSURANCE, INSPECTION AND TESTING

7.1 Quality Assurance

The Vendor shall have in effect at all times, a QA/QC program which clearly establishes the authority and responsibility of those responsible for the quality system.

7.2 Quality Plan

A copy of the Vendor‟s QA/QC program shall be submitted to the Company / Contractor with its quotation for Company‟s review and concurrence prior to award.

7.3 Quality Control

The Vendor shall submit certified reports of production tests as soon as the tests are completed satisfactorily. The Company / Contractor reserves the right to inspect materials and workmanship at all stages of manufacture and to witness any or all tests. The Vendor, 30 days after award but prior to the pre- inspection meeting, shall provide the Company / Contractor with a copy of its Manufacturing and Inspection Plan for review and inclusion of any mandatory Company / Contractor witness points.

7.4 Inspection and Testing

The Vendor shall be responsible for the planning and execution of all inspections and tests, but the Company‟s representative shall have the right to witness any or all of the manufacturing activities, inspections or tests.

The Vendor shall submit an Inspection and Test Plan (ITP) for Company review and mark-up following purchase order placement. The ITP shall list all inspections and tests proposed for the valve by the Vendor, between the date of ordering and the date of delivery.

The Company and the Vendor shall sign off the final version of the ITP, which, thereafter, shall form part of the contract documents.

The Company or its authorized representatives shall be permitted at all times free access to all parts of the Vendor‟s workshops that concern the construction and testing of the pressure safety valves.

Inspection by the Company shall not relieve the Vendor of any guarantees, responsibilities or obligations to furnish equipment / materials to this specification and the appropriate project data sheets.

The Vendor shall devise and execute a test program during all stages of fabrication. Results of such testing shall be fully documented.

All stages of testing may be subject to witness and approval by the Company and / or a third party verifier as identified by the Company in the inspection and test plan.

The quality inspector shall review test records and certification prior to releasing the equipment. All testing shall be carried out at the Vendor‟s test facility.
Test equipment shall be supplied by the Vendor and shall be calibrated within six months of the test date. All test equipment used shall have current certification of accuracy from an approved test authority.

All test equipment shall be calibrated and used in accordance with the Vendor‟s QA system.

The Vendor shall maintain up-to-date documentation at all times reflecting the inspection/testing status of the equipment.

Test certificates shall be provided for each item of valves to prove it has been satisfactorily tested to meet all requirements of its appropriate manufacturing standards, whether or not witnessed by the Company.

Where appropriate, test certificates shall state values for all test results. Tests for which the results are indicated as pass or fail shall be qualified by the relevant acceptance criteria.

The submittal documentation shall not be regarded as the total requirement. The Company may wish to inspect retained documentation such as internal test results, equipment logs and fault/correction records.

7.4.1 Test Requirements

In general the Vendor‟s standard works test procedures shall be followed and shall include the following:

- Visual checking.
- Dimensional checking against Company approved Vendor drawings.
- Flange face finish checking.
- Casting inspection for the valve body.
- Pressure tests.
- Hydrostatic testing (All valves).
- Seat leakage tests to API RP 527.
- Bellows integrity tests (where applicable).
- Set pressure pop test (All Valves).
- Reseat pressure test (Pilot valves).
- Complete assembly internal leak test.
- Complete assembly external leak test.
- Fugitive emission (if specified).
- NDE testing (if specified).
- Material test and traceability reports shall be provided (All valves).
- Paint repair (as necessary).

7.4.2 Hydrostatic Testing

The inlet pressure retaining parts shall be hydrostatically tested at a pressure 1.5 times the maximum set pressure of the valve. No leakage shall be permitted.

The hydro test shall be executed with water containing 1% by volume of biodegradable wetting agent.

The water shall contain, not more than 30 ppm of fluorides & chlorides and shall have a pH value between 6.0 and 8.0. Equipment shall be thoroughly cleaned, drained and air-blown or otherwise thoroughly dried upon completion of testing.

The temperature of test water shall not be less than 7°C.

7.4.3 Set Pressure Pop Test

All valves shall be set and adjusted to the specified set pressure and shall be "popped" pneumatically to check the set pressure. The set pressure adjustment shall be sealed.

7.4.4 Material Testing and NDE

Material testing and non-destructive examination requirements shall be in accordance with PSV datasheet and Piping Material Specification.

7.4.5 Test Certificates

The Vendor shall issue a test certificate covering each valve which shall include the following information, as a minimum (as applicable):

- Set pressure.

- Lift pressure.
- Blow down pressure.
- Cold differential test pressure.
- Percentage increase in spring setting.
- Test fluid type temperature and pressure.
- Ambient conditions at test.
- Rated temperature extremes, and
- Prohibited fluids

The Vendor shall carry out such tests as the Company deems necessary to verify that the equipment offered complies with this Specification. Tests shall be carried out on the whole of the equipment in the Vendor's works and shall conform to the requirements of API RP 520.

8.0 INSTALLATION/ERECTION, COMMISSIONING AND STARTUP

Installation of relief valves shall be of the highest quality craftsmanship and shall conform to the best applicable engineering practices, and, relevant codes such as API 520-Part II. All relief valves and their components shall be installed in a neat workmanlike manner ensuring ease of maintenance.

The installation of pressure safety valve shall in general be according to instrumentation design criteria. Where no possibility of hydrocarbon pollution (such as in water and air service), pressure safety valves may be vented to atmosphere, with due consideration of position and angle of venting.

Pressure safety valve shall be installed after testing/setting for set pressure, blowdown and seat tightness. Discharges from all pressure valves shall be individually routed to a safe location, unless specified otherwise.

All pressure valves discharge lines shall join the relief header from top and shall be at an angle of 30 to 40 degrees with the axis of the header.

All pressure valves discharge and equipment depressurizing lines shall be free draining to vent header and shall have no pockets up to and including header.

Discharge piping shall be designed to avoid liquid collection, backpressure build up, and stress on the valve body under all conditions. A low point discharge drain may only be fitted on relief valves venting to atmosphere.

Inlet piping shall be arranged to ensure that pressure drop at full flow does not exceed 3% of set pressure. Isolation valve provided up-steam of double pressure safety valves should have both lockable open and lockable closed provisions.

Hook-up and installation drawings regarding each tag of pressure safety valve shall be prepared and installation shall be carried out in accordance with these approved drawings.

9.0 GUARANTEE

The Vendor shall guarantee, in accordance with general conditions that the equipment shall meet the performance conditions specified in this specification.

10.0 TRAINING

Vendor contractor shall arrange in depth training for Company personnel at their workshop/ premises. The training shall be detailed in all aspects with Vendor special training aids and laboratories. Site training shall be provided by the Vendor for the basic day to day trouble shooting.

Vendor shall provide training for the Company personnel in all aspects of installation, operation and maintenance.

11.0 SPARE PARTS AND SPECIAL TOOLS

11.1 Spares

Vendor shall provide with his quotation, separate price lists of recommended commissioning and operating spares in accordance with the forms supplied with the material specification.

11.2 Special Tools

Vendor shall submit, with his quotation, his recommendations for one set of special tools required for installation and maintenance of the supplied equipment.

12.0 PACKAGING, PRESERVATION / STORAGE AND PREPARATION FOR SHIPMENT

12.1 Packing

Pressure safety valves or parts, which can be damaged during shipment, shall be packed separately. Each package shall be identified with purchase order number and content list in a weatherproof envelope. All openings shall be sealed. Threaded connections shall be protected with forged steel or molded plastic screwed plugs.

All flanged openings shall be protected with wood or steel closures attached by proper bolting and sealed with a plastic compound to exclude foreign material from the interior and fully protect the flange faces.

All mechanical or machined surfaces subject to atmospheric corrosion prior to installation on site shall be treated with an easily removable rust preventative. A desiccant shall be provided inside all enclosures to prevent moisture damage due to high humidity.

Any item/ component exceeding 40 Kg in weight shall be supplied with lifting lugs or eye bolts. The lugs or eyebolts should be positioned such that the component can be readily slung from a point over its centre of gravity.

The Vendor shall be solely responsible for the adequacy of the preparation for shipment and shall also state in their offer his recommendations for long term storage (up to 12 months) for both indoors and open air storage.

12.2 Preservation / Storage

Receipt and storage of the pressure safety valves shall be in accordance to the vendor recommendations. All the pressure safety valves are to be stored under a covered space and avoid direct exposure of the pressure relief valve/its accessories to the sun rays.

The Vendor shall be solely responsible for the adequacy of the preparation for shipment and shall also state in their offer his recommendations for long term storage (up to 12 months) for both indoors and open air storage.

12.3 Marking

All valves shall be supplied tagged in accordance with the datasheets.

Tag plates shall be manufactured from SS 316. Text and numbering shall be clearly engraved, paint filled and a minimum of 6mm high.

All relief valves shall be clearly and permanently marked by securely attaching a stainless steel nameplate with the pertinent information required by the applicable international codes, including:

- Company's tag number(s).
- Manufacturer's name or trade mark.
- Model number.
- Serial number / complete part number.
- PO number.
- Orifice designation.
- Inlet and outlet size.
- Flange rating.
- Material (with National Standard Specification Number).
- Set pressure and cold differential set pressure.
- Percent overpressure.

- Date of test.
- Governing code stamp/symbol.
- Certified capacity in air or water.
- Maximum relieving capacity.

The Instrument tag number shall be additionally furnished in 6 mm high (minimum) lettering on a separate tag permanently attached to the valve with stainless steel screws. Tags shall not be glued on.

13.0 DOCUMENTATION

The following user documentation shall be produced by the Vendor during the course of this contract. User documentation is to be supplied in electronic and hard copy form.

- Vendor documentation list.
- Production schedule.
- Inspection and test plan.
- Product technical literature.
- Relief valve sizing calculations (including noise calculations).
- Vendor datasheets including model numbers and materials.
- Dimensional drawings.
- Weight data.
- Material certification.
- Paint procedures.
- Test procedures.
- Test results.
- Calibration certificates.
- Installation, operations and maintenance manual (per equipment type).

All correspondence, drawings, instructions, data sheets, design calculations or any other written information shall be in the English language.

GAIL INDIA LIMITED

TECHNICAL SPECIFICATION
FOR
PRESSURE GAUGES

GAIL-034-PI-DOC-TS-004

0	30.12.2019	Issued for Review	RKS	UNU	TR	
Rev	**Date**	**Purpose**	**Prepared By**	**Checked By**	**Approved By**	

TABLE OF CONTENTS

1.0 GENERAL

1.1 Scope

1.1.1 This specification, together with the data sheets attached herewith covers the requirements for the design, materials, nameplate marking, and inspection, testing and shipping of pressure gauges.

1.1.2 The related standards referred to herein and mentioned below shall be of the latest editions prior to the date of the purchaser's enquiry:

ANSI/ASME	American National Standards Institution/American Society of Mechanical Engineers.
B 1.20.1	Pipe Threads General Purpose (Inch)
B 16.5	Pipe Flanges and Flanged Fittings NPS1/2 through NPS24
B 16.20	Metallic Gaskets for Pipe Flanges, Ring Joint, Spiral wound and Jacketed.
EN10204	Inspection Documents for Metallic Products
IEC-60529	Degree of Protection Provided by Enclosures (IP Code)
IS-3624	Specification for Pressure and Vacuum Gauges.

1.1.3 In the event of any conflict between this standard specification, data sheets, statutory regulations, related standards, codes etc., the following order of priority shall govern:

a) Statutory Regulations'

b) Datasheets

c) Standard Specification

d) Codes and Standards

In addition to compliance to purchaser's specifications in totality, vendor's extent of responsibility shall include the following:

a) Purchaser's data sheets specify the type of pressure element. Unless specifically indicated otherwise, alternate type of pressure elements shall also be acceptable provided all the functional and performance requirements specified in the respective data sheets are guaranteed by the vendor.

b) Purchaser's data sheets indicate the minimum acceptable material of construction for pressure element, movement etc. Alternate superior material of construction shall also be acceptable provided vendor assumes complete responsibility for the selected materials for their compatibility with the specified fluid and its operating conditions.

1.2 Drawing and Data

1.2.1 Detailed drawings, data, catalogues and manuals required from the vendor are indicated by the purchaser in vendor data requirement sheets. The required number of reproducible, prints and soft copies shall be dispatched to the address mentioned, adhering to the time limits indicated.

1.2.2 Final documentation consisting of design data, installation manual, operation and maintenance manual etc., submitted by the vendor after placement of purchase, order shall include the following, as a minimum:

a) Specification sheet for each gauges, and its accessories.

b) Certified drawings sheets for each gauges and its accessories, which shall provide dimensional details, internal constructional details, end connection details and materials of construction.

c) Copy of type test certificates.

d) Copy of the test certificates for all tests indicated in clause 4.0 of this specification.

e) Installation procedure for each gauge and its accessories.

f) Calibration and maintenance procedures including replacement of internal parts wherever applicable

2.0 DESIGN AND CONSTRUCTION

2.1 Pressure Elements, Gauge Movement and Socket

2.1.1 The pressure element shall be an elastic element like bourdon tube, bellow, diaphragm etc with material as specified in the data sheet.

2.1.2 In case of bourdon type of gauges, the size of the bourdon tube shall not be less than 75% of the nominal diameter of the dial size.

2.1.3 Gauge construction shall ensure no leakage of process fluid from the sensor elements to atmosphere and between the high pressure and low-pressure side (in case of differential pressure gauges) under normal condition.

2.1.4 The gauge socket shall be in one piece and shall also serve as element anchorage in case of bourdon tube type element, which shall be directly connected to the socket, without any capillary or tube in between. For other types of elements, the anchorage may be integral with the socket or connected with the socket using capillary tube with minimum bore of 3 millimetres.

2.1.5 Any joint in the process wetted system including joint between the element and the anchorage/socket shall be welded type only.

2.1.6 Unless specified otherwise, the pressure gauges shall have an over-range protection of at least 130% of maximum working pressure, as a minimum.

2.1.7 Data sheet indicates the minimum requirement of material of construction. Alternate materials as specified in Annexure 1 to this specification shall also be acceptable subject to meeting process conditions.

2.1.8 The gauge movement material shall be of stainless steel unless specified otherwise in the data sheet. It shall be adjustable for calibration without dismantling the sensor unit. The use of link for calibration of span is not permitted. Guages shall be provided with external zero adjustment.

2.1.9 Vendor shall ensure that the operating pressure falls in the middle 30% of the full working range i.e. operating pressure shall fall between 35% and 65% of the range offered.

2.1.10 Pressure gauges with range as 0 to 100kg/cm^{2}g and above shall have safety type solid front case. All gauges in oxygen and chlorine service shall be thoroughly degreased using reagents like trichloro-ethylene or carbon tetrachloride. All connections shall be plugged after degreasing process in order to avoid entrance of grease or oil particles.

2.2 Cases and Dials

2.2.1 Unless specified otherwise, the gauges shall be weather proof to IP 65 as per IEC 60529, as a minimum.

2.2.2 In general, dial markings and dial color shall be as per IS 3624. Dials of gauges in oxygen service shall additionally have the word 'OXYGEN' or 'CHLORINE' written in black and 'USE NO OIL written in red.

2.2.3 The gauge dial shall be made of a suitable metallic materials so that the finished dial shall be capable of withstanding a dry heat of 85°C for 10 hours and immersion in water-at 85°C for 1 hour without cracking, blistering, warping or discoloration of the dial or paint on the dial.

2.2.4 The pointer stops shall be provided at both ends of the scale to restrict the pointer motion beyond 5% above the maximum of scale and less than 5% below the minimum of the scale.

2.2.5 The dial cover shall be made out of shatter proof glass sheet of thickness 1.5 to 3mm for gauges with dial size less than 100mm while minimum 3.0mm for gauges with dial size 100mm or greater.

2.2.6 All gauges shall be provided with a blow out device i.e. blow out disc of aperture not less than 25mm for gauges with dial size 100mm and above, while 20mm for gauges with dial size less than 100mm.

2.2.7 When safety type solid front type of gauges are specified, they shall consist of a solid partition isolating the pressure element from the dial. In such gauges the total solid partition disc area shall not be less than 75% of the cross sectional area of the inside of the case surrounding the pressure element.

2.3 Diaphragm Seals

2.3.1 Unless otherwise indicated in purchaser's data sheets, gauges specified with diaphragm seals shall have their diaphragms integral with the gauges.

2.3.2 Whenever diaphragm seal gauges are specified with capillary, the size of the capillary shall be selected to ensure response time of the gauge better than 5 seconds.

2.3.3 The sealing liquid for diaphragm seal gauges shall be an inert liquid, compatible with the process fluid and its temperature. For gauges in oxygen and chlorine service, the sealing liquid shall be fluro lube or equivalent compatible with the specified service.

2.3.4 For diaphragm seal pressure gauges with flanged ends, the diaphragm shall be rated for the maximum allowable pressure of the associated flange.

2.4 End Connection

2.4.1 Unless specified otherwise, the following shall govern;

a) Threaded end connections shall be NPT as per ANSI / ASME B. 1.20.1.

b) Flanged end connection shall be as per ANSI / ASME B. 16.5

c) Ring joint flanges shall have octagonal grooves as per ANSI / ASME B16.20.

d) Flange face shall be as per clauses 6.4.4.1, 6.4.4.2 and 6.4.4.3 of ANSI / ASME B16.5. The face finish as specified in the data sheet shall be as follows;

125AARH : 125 to 250 AARH

63 AARH : 32 to 63 AARH

2.5 Performance Requirements

2.5.1 Unless otherwise specified, the accuracy which is inclusive of repeatability and hysteresis of pressure gauges shall meet the following performance requirements:

a) Direct pressure gauge : ±1% of full scale

b) Chemical seal type pressure gauge : ±2% of full scale

c) Differential pressure gauges : ±2% of full scale

2.6 **Accessories**

2.6.1 Gauges shall be supplied with all accessories as specified in the data sheets pre-installed.

2.6.2 For flanged diaphragm seal gauges, spacer ring, isolation valve and plugs shall be provided whenever specified.

2.6.3 Over Range Protector (OPV)

a) Whenever the maximum pressure specified in the data sheet exceeds the over range protection pressure, over range protector shall be supplied.

b) In case of pressure gauges with diaphragm seal, the over-range protector shall be installed between the seal and the gauge.

c) The material of construction of over range protector shall be same as socket material, as a material.

Snubber

a) Whenever the service specified is pulsating type, snubber shall be supplied.

b) The material of construction of snubber shall be same as socket material, as a minimum.

3.0 NAME PLATE

3.1.1 Each gauge shall have a stainless steel nameplate attached firmly to it at a visible place either by riveting or screwed to the case, furnishing the following information:

a) Tag number as per purchaser's data sheets.
b) Vendor's name
c) Model number and manufacturer's serial number.
d) Range of the instrument.
e) MAWP and maximum vacuum rating of element

4.0 INSPECTION AND TESTING

4.1 Unless otherwise specified, purchaser reserves the right to test and inspect all the items at the vendor's works inline with the inspection test plan for pressure gauges.

4.2 Vendor shall submit following test certificates and test reports for purchaser's review:

a) Material test report as per EN10204 clause 2.2 for wetted parts like gauge socket and sensing element
b) Type test report for enclosure.
c) Dimensional test report for all gauges.
d) Performance test reports for all gauges including accuracy, repeatability, over pressure and vacuum test (as applicable)
e) Type test reports for shock test and endurance test as per IS-3624 for each type / model.
f) Type test report for influence of temperature for each type/model.

4.3 Witness Inspection

4.3.1 All pressure gauges shall be offered for pre dispatch inspection for following as a minimum:

a) Physical dimensions verification and workmanship.
b) Performance test including accuracy and repeatability, on representative samples of each type/model number before and after over-pressure and vacuum test.
c) Over-pressure and vacuum test (as applicable) shall be carried out on representative samples of each type / model number without loss of their elastic characteristics.
d) Review of all certificates and test reports as indicated in clause 4.2 of this specification.

4.3.2 In the event when the witness inspection is not carried out by purchaser, vendor shall anyway complete the tests and the test documents for the same shall be submitted to purchaser for scrutiny.

ANNEXURE-I

Material of Construction

S.No.	Item	Specified Material of Construction	Alternate Material of Construction
1.	Sensing Element	SS316	SS316L, SS316Ti
2.	Socket	SS316	SS316L, SS316Ti
		SS304	SS304L, SS316
3.	Case	SS 316	SS316Ti, SS316L,SS
4.	Capillary	SS	SS304, SS316, SS304L, SS316L, SS316Ti
. 5.	Diaphragm	SS316	SS316L, SS316Ti
		SS	SS 302, SS 304, SS 304L, SS316, SS316L, SS316Ti

ENGINEERING STANDARD

GAIL INDIA LIMITED

TECHNICAL SPECIFICATION FOR BALL VALVES

GAIL-034-PI-DOC-TS-005

0	30.12.2019	Issued For Review	AP	JR	TR	
Rev	**Date**	**Purpose**	**Prepared By**	**Checked By**	**Approved By**	

CONTENTS

1.0 SCOPE

This specification covers the minimum requirements for design, manufacture, testing and supply of carbon steel ball valves of size DN 50 mm (2") and above and ANSI pressure rating Class 150# thru 900# for use in onshore pipeline systems handling non-sour hydrocarbons in liquid or gaseous phase including Liquefied Petroleum Gas (LPG).

This specification provides minimum requirement for design, manufacturing, inspection, testing and supply of Carbon steel Ball Valves of ANSI class 150# to 600# and sizes ½" NB to 24"NB for service in non-sour gas pipelines.

Supply of Ball Valve is in scope of owner / client. This specification is for contractor's reference only.

2.0 REFERENCE DOCUMENTS

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

API 6D	:	Specification for Pipeline Valves
API 6FA	:	Specification for Fire Test for Valves
ASME B 16.5	:	Steel Pipe Flanges and Flanged Fittings.
ASME B 16.34	:	Valves - Flanged, Threaded and Welding Ends.
ISO 17292: 2015	:	Metal ball valves for petroleum, petrochemical and allied industries
ASME B 31.8	:	Gas Transmission and Distribution Piping Systems
ASME B 16.5	:	Pipe flanges and flanged fittings
ASMEB 16.10	:	Face-to-face and end-to-end dimensions of valves
ASME B 16.25	:	Butt welding ends
ASME B 16.34	:	Valves – flanged, threaded and welding ends
EN 10204	:	Metallic products: Types of inspection documents
-	:	Data sheet for ball valves
API 598	:	Valve Inspection and Testing
ASME 16.20	:	Metallic gasket for pipe flanges – Ring joint or spiral wounds and jacketed.
ASME 16.21	:	Non Metallic Gaskets for Pipe Flanges.
ASTM A370	:	Standard Test Methods and Definitions for Mechanical Testing of Steel Products.
EN 10204	:	Metallic Materials – Types of Inspection Documents

MSS-SP-6	:	Standard Finishes for Contact Faces of Pipe Flanges and Connecting -end Flanges of Valves and Fittings.
MSS-SP-25	:	Standard marking system for Valves, Fittings, Flanges and Union.
MSS-SP-44	:	Steel Pipeline Flanges.
MSS-SP-53	:	Quality Std for Steel Casting & Forgings for Valves, Flanges & Fittings &Other Piping Components – Magnetic Particle Examination Method.
MSS-SP-55	:	Quality Standard for Steel casting of valves, Flanges, Fittings & other Piping components (Visual Method)
MSS-SP-72	:	Ball Valves with Flanged or Butt welding ends for General Service.
ISO 5208	:	Industrial Valves – Pressure Testing of Valves
ISO 10497	:	Testing of Valves – fire type testing requirements.
ISO 13623	:	Petroleum & Natural Gas Industry – Pipeline Transportation System. Petroleum & Natural Gas Industry. Pipeline Transportation System – Pipeline Valves
ISO 14313	:	NACE TM0177-2005,
SSPC-VIS-1	:	Steel Structures Painting Council Visual Standard. In case of contradiction the most stringent shall apply.
NACE TM0177-2005	:	Standard test method. Laboratory testing of metals for resistance to specific forms of environmental cracking in H2S environments
BS 5351	:	Steel Ball Valves for Petroleum, petrochemical and allied industries
BS EN 331	:	Manually Operated Ball Valves and Closed Taper Plug Valves for Gas Installations
BS 6755-2	:	Testing of Valves. Specification for fire type-testing requirement.

3.0 MATERIALS

3.1 Material for major components of the valves shall be as indicated in Valve Data Sheet. Other components shall be as per Manufacturer's standard (suitable for service conditions as indicated in valve data sheet), which shall be subjected to approval by Purchaser.

3.2 Carbon steel used for the manufacture of valves shall be fully killed.

3.3 The carbon equivalent (CE) of valve end connections which are subject to further field welding by purchaser shall not exceed 0.43% (as calculated by the following formula) on check analysis for each heat of steel used:

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

3.4 The steel used shall be suitable for field welding to pipes, flanges or fittings manufactured under ASTM A -216,A – 694, A – 420, A – 333, and API – 5L etc.

3.5 For all such valves where carbon steel is used as ball material, the ball shall have 75 micrometer (0.003 inch) thick Electroless Nickel Plating (ENP) as per ASTM B733 with following classification : SC2, Type II, Class 2. The hardness of plating shall be minimum 50 RC.

3.6 For valves specified to be used for Gas service or LPG service, Charpy V-notch test, on each heat of base material shall be conducted as per API 6D-Clause 8.5, for all pressure containing parts such as body, end flanges and welding ends as well as bolting material for pressure containing parts. Unless specified otherwise, the Charpy V-notch test shall be conducted at 0°C. Test procedure shall conform to ASTM A 370. The average absorbed energy value of three full sized specimens shall be 27 J. The minimum impact energy value of any one specimen of the three specimens analyzed as above shall not be less than 22 J.

When Low Temperature Carbon Steel (LTCS) materials are specified in Valve Data Sheet or offered by Manufacturer, the Charpy V-notch test requirements of applicable material standard shall be complied with.

3.7 Valves shall be subjected to hardness test on base material for each heat for pressure containing parts. A full thickness cross section shall be taken for this purpose and the maximum hardness of the material of the valve components shall not exceed 248 HV_{10} based on minimum four (4) measurements.

3.8 The ratio of effective YS/UTS of the steel shall not exceed 0.85.

4.0 DESIGN AND CONSTRUCTION

4.1 Valve design shall be as per API 6D and other referred codes and shall be suitable for the process conditions indicated in the valve Data Sheet. The ASME Boiler & Pressure Vessel Code, Section VIII, Division 1 may be used to design the valve body. Allowable stress requirements shall comply with the provisions of B31.3. In addition, corrosion allowance indicated in Valve Data Sheet shall be considered in valve design. However, the minimum wall thickness shall not be less than the minimum requirement of ASME B16.34. The manufacturer shall have valid license to use API monogram on valves manufactured as per API 6D.

4.2 Corrosion Allowance for all valves to be used in sweet gas services shall be considered nil.

4.3 The manufacturer shall have valid license to use API monogram on valves manufactured as per API 6D.

4.4 Valve body design shall be fully welded for underground buried application. For above ground services body design can be either welded or bolted. Threaded body joints shall not be accepted.

4.5 Ball shall be of single piece, solid type construction.

4.6 All valves 4”NB and above shall be trunnion mounting type or as mentioned in the data sheet. Valves below 4” shall be floating type unless specifically mentioned in data sheet otherwise.

4.7 Valve seats shall have metal to metal contact. O - Rings or other seals if used for drip tight sealing shall be encased in a suitable groove in such a manner that it cannot be removed from seat ring and there is

no extrusion during opening or closing operation at maximum differential pressure. The seat rings shall be designed so as to ensure sealing at low as well as high differential pressures. Seat design shall be as per valve data sheet.

4.8 All valves shall have two seating surfaces which in close position blocks the flow from both ends. The cavity between the seating surfaces is vented through a bleed connection provided on the body cavity, i.e., the valves shall be Double Block & Bleed (DBB).

4.9 Valves shall be designed to withstand a sustained internal vacuum of at least 1 (one) milli-bar in both open and closed positions.

4.10 Full bore valves of nominal valve size DN 200 mm (8") & above and Reduced Bore valves of nominal valve size DN 250 mm (10") & above, shall have provision for secondary sealant injection under full line pressure for seat and stem seals. All sealant injection connections shall be provided with an internal non-return valve. Valve design shall have a provision to replace the sealant injection fitting under full line pressure. Valves shall be provided with vent and drain connections. Drain sizes shall be in accordance with API 6D or MSS-SP-45. Drain sizes shall be as specified in MSS-SP-45 for valve size NPS 2 to NPS 24. For sizes larger than NPS 24, manufacturer shall specify suitable drain size for purchaser approval.

4.11 All valves shall be provided with a vent and drain connection. Location and arrangement of vents and drains shall be as per Figure-1. Body vent and drain shall be provided with ball valve. Number and size shall be as per Figure-1.

4.12 Valve design shall ensure repair of stem seals/ packing under full line pressure.

4.14 a) Valve ends shall be either flanged or butt welded or one end flanged and one end butt welded as indicated in the Valve Data Sheet. Flanges of the flanged end cast/ forged body valves shall be integrally cast/ forged with the body of the valve. Face to face/ end to end dimensions shall conform to API 6D. Face-to-face and end-to-end dimensions for valve sizes not specified in API 6D shall be in accordance with ASME B 16.10. Face-to-face and end-to-end dimensions not shown in API 6D or in ASME B 16.10 shall be as per Manufacturer Standard and shall be subject to approval by Purchaser.

b) The length of butt welding ends shall be sufficient to allow welding and heat treatment without damage of the internal parts of the valves. Pup-Piece length shall be as per valve data sheet.Pipe for pup piece shall be seamless type only.

c) Flanged end shall have dimensions as per ASME B 16.5, for valve sizes up to DN 600 mm (24”) excluding DN 550 mm (22”) MSS-SP-44 shall be referred. Flange face shall be either raised face or ring joint type as indicated in Valve Data Sheet. In case of RTJ flanges, the groove hardness shall be minimum 140 BHN. All flanged face shall have concentric serration with 125- 250 AARH finish.

d) Butt welding end preparation shall confirm to ASME B 16.25. In case of difference in thickness of valve body & mating pipelines, the bevel end of valve shall be as per ASME B 31.8. The end preparation shall take care of outside diameter of connecting pipe, wall thickness, material grade, SMYS & Special chemistry of welded material as indicated in the data sheet.

4.13 The temperature and pressure range of the valves shall be in accordance with the indicated values on the relevant piping specification and valve data sheet.

4.14 Wall thickness of parts used for the welding connection with the line pipe shall meet the following requirements:

a) The maximum allowable stress in the material of butt-welds connection for butt welding shall be equal to 50% of the minimum yield strength guaranteed by the specification of steel used.

b) The minimum wall thickness for butt welding connection must be greater than or equal to the largest valve of either the calculated minimum thickness of butt welding connections or the nominal thickness of pipe as indicated on data sheet.

c) If the butt welding connections has a yield strength lower than the yield strength of the pipe to which it is intended to be welded, the wall thickness in each zone of the butt welding connection is at least equal to the specified pipe wall thickness time the ratio of minimum yield strength guaranteed by the specification of the steel of the pipe & minimum yield strength guaranteed by the specification of the steel of the butt welding connection.

d) The specified pipe wall thickness and grade with which the valve is intended to be used is specified in the data sheet.

e) All valves under this specification shall be designed to withstand a field hydrostatic test pressure with non corrosive water. After installation during 24 hours when the ball is partially or fully open at a pressure level.
P = 1.5 X D.P
P = hydrostatic test pressure (bar)
D.P =Design Pressure.

4.15 Valve shall be provided with ball position indicator and stops of rugged construction at the fully open and fully closed positions.

4.16 Full bore valves of nominal valve size DN 200 mm (8") & above and Reduced bore valves of nominal valve size DN 250 mm (10") & above, shall be equipped with support foot and lifting lugs unless specified otherwise. Tapped holes and eyebolts shall not be used for lifting lugs. Height of support foot shall be kept minimum. The location and size of support foot/ lifting lugs shall ensure unrestrictive operation of vent/ drain valves. The lifting lugs shall be stamped with safe working load.

4.17 In order to avoid stress induced crack and soft seat damage during direct field welding operation to valve body, all valves shall be supplied with welded pups at both ends which shall be considered as an integral part of the valves and also the ID of the pup shall match with pipe ID. The pup piece welding shall be carried out in controlled condition of temperature at manufacturer's workshop. Field welding of pup piece shall not be allowed. Material & length of pup piece shall be as per Data sheet.

4.18 When indicated in Material Requisition, valves shall have locking devices to lock the valve either in full open (LO) or full close (LC) positions. Locking devices shall be permanently attached to the valve operator and shall not interfere with operation of the valve. Locking device shall be such that the valve shall operate when the differential pressure across the valve is ≤ 3bar.

4.19 Valve design shall be such as to avoid bimetallic corrosion between carbon steel and high alloy steel components in the assembly. Accordingly, Suitable insulation shall be provided as required.

4.20 The valve stem shall be capable of withstanding the maximum operating torque required to operate the valve against the maximum differential pressure as per the appropriate class.

4.21 The combined stress shall not exceed the maximum allowable stresses specified in ASME Section VIII, Division 1. The design shall take into account a safety factor of 1.5 based on the maximum output torque of the operating mechanism. The valve Manufacturer shall guarantee that the breakaway

torque after long periods of non- movement cannot exceed the normal short term breakaway torque by a factor more than 1.25, and that the safety factor specified above is not compromised.

4.22 When stem extension requirement is indicated in Valve Data Sheet, the valves shall have the following provisions.

a) Valves provided with stem extension shall have water proof outer casing. The Length of stem extension shall be as indicated on the Valve Data Sheet. The length indicated corresponds to the distance between centerline of the valve opening and the centerline of the rim of the hand wheel on vertical shaft or centerline of the hand wheel on a horizontal shaft. In conformity with ISO 17292, valve shall be designed with an anti-blow-out stem so that the stem cannot be fully ejected by pressure inside the valve with the stem packing, gland retainer bolting removed.

b) Manual override devices shall be provided on all valves

c) Vent, drain and sealant connections shall be terminated adjacent to the valve operator by means of suitable piping anchored to the valve body. The pipe used shall be API 5L Gr. B/ ASTM A 106 Gr. B, with Sch 160. Fittings shall be ASTM A105/ASTM A234 Gr. WPB, Socket welded ANSI class 600.

d) The stem extension shall be self-relieving.

e) Stem extension and stem housing design shall be such that the complete assembly will form a rigid unit giving positive drive under all conditions with no-possibility of free movement between valve body, stem extension or its operator.

f) Outer casing of stem extension shall have 3/8” or 1/2" NPT plugs at the top and bottom, for draining and filling with oil to prevent internal corrosion.

4.24 Operating Devices

a) In case of manual operation, valve sizes, 100 mm (NPS 4”) and below shall be wrench/ hand wheel/ lever operated for Valves from 6”-10” shall be gear operated.

Valve design shall be such that damage due to malfunctioning of the operator or its control gear train or power cylinder and other damaged parts can be replaced without the valve cover being removed.

b) The power actuator shall be in accordance with the Purchaser Specification issued for the purpose and as indicated in the Valve and Actuator Data Sheet. Operating time shall be as indicated in Valve Data Sheet. Valve operating time shall correspond to full close to full open/ full open to full close under maximum differential pressure corresponding to the valve rating. For actuated valves, the actuator’s rated torque output shall be 1.25 times the break torque required to operate the ball valve under the maximum differential pressure corresponding to the Valve Class Rating.

c) For the manual operation of all valves, the diameter of the hand wheel or the length of operating wrench shall be such that under the maximum differential pressure, the total force required to operate the valve does not exceed 350N. Manufacturer shall also indicate the number of turns of hand wheel In case of gear operators) required for operating the valve from full open to full close position. The wrench length or hand wheel diameter shall be in accordance with API 6D requirements.

The manufacturer shall indicate the number of turns of the hand wheel (for gear operators), required for operating the valve from fully open to the fully closed position.

d) Direction of operation of hand wheel or wrench shall be in clock-wise direction while closing the valve. Hand wheels shall not have protruding spokes.

e) Gear operators, when provided, shall have a self-locking provision and shall be fully encased in water proof/splash proof enclosure and shall be filled with suitable grease.

f) The direction of closing to be marked on hand wheel.

4.25 Welding including repair welding of pressure controlling parts shall be as per welding procedure qualification specified in ASME Section IX.

4.26 The welders involved in welding shall be qualified in accordance with ASME Section IX.

4.27 Repair by welding is not permitted for forged body valves. However, repair by welding as per ASME B 16.34 is permitted for cast body valves. Repair shall be carried out before any heat treatment of casting is done.

4.28 The tolerance on internal diameter and out of roundness at the ends for welded ends valves shall be as per connected pipe specification as indicated in the Valve Data Sheet.

4.29 When specified on the Valve Datasheet, ball valves shall be “fire safe” in accordance with API 6FA, for which qualifying certificates, covering the range of items offered, shall be supplied by theManufacturer.

4.30 VALVE CONFIGURATION

Valves shall be Full bore (FB) or Reduced bore (RB) as indicated in the Valve Data Sheet.

FULL OPENING VAVE

Full bore valves shall be suitable for the passage of all types of pipeline pigs including instrumented intelligent pigs and regular cleaning, batching and scraper pigs on regular basiswithout causing damage to either the valve component or the pig. The full bore, valve shallprovide an unobstructed profile for pigging operations in either direction. Full bore valves shallbe designed to minimize accumulation of debris in the seat ring region to ensure that valvemovement is not impeded. The bore size of a full bore-valve shall be as per API 6D.

REDUCED OPENING VAVE

The bore size of reduced bore valve shall be as indicated in Table- A below:

TABLE–A

NominalValveSize	**ReducedBoreSizes**	**NominalValveSize**	**ReducedBoreSizes**
DNmm(NPS**inches**)	DNmm(NPS**inches**)	DNmm(NPS**inches**)	DNmm(NPS**inches**)
50(2)	50(2)	600 (24)	500(20)
80(3)	50(2)	650(26)	550(22)
100(4)	80(3)	700(28)	600(24)
150(6)	100(4)	750(30)	600(24)

200(8)	150(6)	800(32)	650(26)
250(10)	200(8)	850(34)	700(28)
300(12)	250(10)	900(36)	750(30)
350(14)	250(10)	950(38)	800(32)
400(16)	300(12)	1000(40)	850(34)
450(18)	350(14)	1050(42)	900(36)
500(20)	400(16)	1200(48)	1050(42)
550(22)	450(18)		

4.31 SEAT DESIGN

Valve seat shall comprise of a hard metallic seat ring energized with bellville or helical spring and shall provide bubble tight shutoff at high pressure. 'O' ring or other seals if used for drip tight sealing shall be encased in a suitable groove in such a manner that it cannot be removed from seat ring and there is no extrusion during opening or closing operation of valve, at maximum differential pressure corresponding to valve class rating.

4.31 Valves shall be designed to withstand a sustained internal vacuum of at least 1 (one) mille-bar in both open and closed positions.

4.32 For valves to be used in liquid service, the body cavity over-pressure shall be prevented by self-relieving seat rings/ assemblies. Self-relieving seat rings shall relieve at a body cavity differential pressure not exceeding 50% of the valve class rating pressure.

5.0 INSPECTION AND TESTS

5.1 All inspection & testing shall be carried out as per QSL3 of API 6D as minimum and QAP provided elsewhere in the Bid.

The valve manufacturer must deliver a Certificate EN 10204 3.2 stating the quality, the mechanical properties (yield strength, tensile strength, and impact test at - 29 ºC), the chemical analysis of the process of manufacture and the marking (for ex: - heat number of material)

A new chemical analysis (up gradation) shall be done on specimen of valve in presence of TPIA.

5.2 All valves shall be visually inspected. The external and internal surfaces of the valves shall be free from any arc strikes, gouges and other detrimental defects.

5.3 Dimensional check on all valves shall be carried out as per the Purchaser approved drawings.

5.4 Chemical composition and mechanical properties shall be checked as per relevant material standards and this specification, for each heat of steel used.

5.5 Pressure containing parts of all valves such as body, bonnet, flange, welding ends and balls etc shall be subjected to impact test on each heat of base material as per API 6D.

5.6 Notch toughness properties Charpy V: The standard impact test temperature is - 29º C. The average value per series of 3 test specimen shall be equal to 35 J/cm². The minimum value per test specimen shall be equal to 35 J/cm²; this value may drop to 28 J/cm² per only test specimen per series. Number of Tests: 2 test sets (3 test specimens constitute one test set). For casting only 1 test set.

5.7 Non Destructive Examination

Non-destructive examination of individual valve material and component consisting of but not limited to castings, forgings, plates and assembly welds shall be carried out by the Manufacturer. All castings shall be wet magnetic particle inspected 100% of the internal surfaces. Method and acceptance shall comply with MSS-SP-53.

a) Body castings of all valves shall be 100% radio graphically examined as per ASME B16.34. Procedure and acceptance criteria shall be as per ASME B 16.34. For all sizes body casting shall be subjected to 100% radiography.

All castings shall be wet magnetic particle inspected 100% of the internal surfaces. Method and acceptance shall, comply with ASME B 16.34.

b) All forgings shall be 100% ultrasonically examined in accordance with the procedure and acceptance standard of Annexure E of ASME B 16.34. All forgings shall be subject to wet magnetic particle inspection on 100% of the internal surfaces. Method and acceptance shall comply with MSS-SP-53.

c) Bodies and bonnets made by welded assembly of segments of castings, forgings, plates or combinations thereof shall be examined, as applicable, by methods of 5.7 (a) for cast components or 5.7 (b) for forged components and plates.

5.8 Full inspection by radiography shall be carried out on all welds of pressure containing parts. Acceptance criteria shall be as per ASME Sec-VIII Div.1, ASME B 31.3 or ASME B31.8 as applicable and API 1104.

5.9 a) All finished weld ends subject to welding in field shall be 100% ultrasonically tested for lamination type defects for a distance of 50 mm from the end. Laminations shall not be acceptable.

b) Weld ends of all cast valves subject to welding in field shall be 100% radio graphically examined and acceptance criteria shall be as per ASME B 16.34.

c) After final machining, all bevel surfaces shall be inspected by dyepenetrateorwet - magnetic particle method. Lamination defects in the bevel are not acceptable irrespective of the length. Rejectable defects must be removed. Weld repair of bevel surface is not permitted.

5.10 All valves shall be tested in compliance with the requirements of API 6D. During pressuretesting, valves shall not have sealant lines and other cavities filled with sealant, grease or other foreign material. The drain, vent and sealant lines shall be included in the hydrostatic shell test. No leakage is permissible during hydrostatic testing.

Following tests shall be performed as per Quality Assurance Plan: -

- High pressure pneumatic (N2), shell and seat testing including extended stem at 1.1 x Design Pressure(600#)
- Air seat test at 7 kg/cm2
- Hyd. Shell Test at 1.5 times of rated design pressure
- High pressure closure test

- Double Block and Bleed Test
- Testing shall be 100% checked and guide line shall be as per API 6D/ ASME B 16.34.
- Antistatic Test shall be with 100% checking and guide line shall be BS EN 17292/ API6D.
- Certificate / records of Fire safe Test shall be as per API 607/ API 6FA.
- Visual inspection shall be 100% as per API 1104 / MSS-SP-55 and Dimension Inspection shall be 100% as per APPR.DRG./ B16.5/ B16.10/ B6.25/ API 6D.

5.11 A supplementary air seat test as per API 6D, Appendix C, Para C3.3 Type II shall be carried out for all valves. A bubble tight seal is required without the use of any sealant. No leakage is allowed. Test pressure shall be held for at least 15 minutes.

5.12 Valves shall be subjected to Operational Torque Test as per Appendix C, Para C.6, API 6D under hydraulic pressure equal to maximum differential pressure corresponding to the valve rating. For manually operated valves, it shall be established that the force required to operate the valve does not exceed the requirements stated in this specification.

5.13 Subsequent to successful testing as specified above, one (1) valve out of the total ordered quantity shall be randomly selected by the Company Representative for cyclic testing as mentioned below:

a) The valve shall be subjected to at least min 100 Nos. Open-Close-Open cycles with maximum differential pressure corresponding to the valve rating.

b) Subsequent to the above, the valve shall be subjected to hydrostatic test and supplementary air seat test.

Previously carried out prototype test of similar nature shall not be considered acceptable in place of this test.

5.15 Purchaser reserves the right to perform stage wise inspection and witness tests as indicated above at Manufacturer's works prior to shipment. Manufacturer shall give reasonable access and facilities required for inspection to the Purchaser/Company's Inspector. Purchaser or Purchaser representative reserves the right to require additional testing at any time to confirm or further investigate a suspected fault. The cost incurred shall be borne to Manufacturer.

In no case shall any action of Purchaser or his inspector shall relieve the Manufacturer of his responsibility for material, design, quality or operation of valves.

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

5.16 Checks shall be carried out to demonstrate that the dissimilar metals used in the valves are successfully insulated as per the requirement of clause 4.19 of this specification.

5.17 Power actuated valves shall be tested after assembly of the valve and actuator, at the valve Manufacturer's works. At least five Open-Close-Open cycles without internal pressure and five Open-Close-Open cycles with maximum differential pressure corresponding to the valve rating shall be performed on the valve actuator assembly. The time for Full Open to Full Close shall be recorded

during testing. If required, the actuator shall be adjusted to ensure that the opening and closing time is within the limits stated in Valve Data Sheet.

Hand operator provided on the actuator shall also be checked after above testing, for satisfactory manual over-ride performance.

These tests shall be conducted on minimum one valve out of a lot of five (5) valves of the same size, rating and the actuator model/ type. In case, the tests do not meet the requirements, retesting/ rejection of the lot shall be decided by the Company's Inspector.

6.0 TEST CERTIFICATES

Manufacturer shall submit the following certificates:

a) Mill test certificates relevant to the chemical analysis and mechanical properties of the materials used for the valve construction as per the relevant standards / QAP.

b) Test certificates of hydrostatic and pneumatic tests complete with records of timing and pressure of each test.

c) Test reports of radiograph and ultrasonic inspection, Visual, Dimensional.

d) All other test reports and certificates as required by API 6D, this specification and data sheets.

e) Fire safe test certificates as per API 6FA.

f) Test report on operation of valves conforming to clause 5.12, 5.17 and 5.13 of thisspecification.

The certificates shall be valid only when signed by Purchaser’s Inspector. Only those valves which have been certified by Purchaser’s Inspector shall be dispatched from Manufacturer’s works.

7.0 PAINTING, MARKING AND SHIPMENT

7.1 Valve surface shall be thoroughly cleaned, freed from rust and grease and applied with sufficient coats of corrosion resistant paint. Surface preparation shall be carried out by shot blasting to SP-6 in accordance with “Steel Structures Painting Council - Visual Standard SSPC-VIS-1”. For the valves to be installed underground, when indicated in Valve Data Sheet, the external surfaces of buried portion of the valve shall be painted with three coats of suitable Polyurethane (PU) epoxy resin with a minimum dry film thickness of 1000 microns for UG Valve,300 microns (epoxy point) for AG Valve.

7.2 All valves shall be marked as per API 6D. The units of marking shall be metric except nominal which shall be in inches.

7.3 Valve ends shall be suitably protected to avoid any damage during transit. All threaded and machined surfaces subject to corrosion shall be well protected by a coat of grease or other suitable material. All valves shall be provided with suitable protectors for flange faces, securely attached to the valves. Bevel ends shall be protected with metallic or high impact plastic bevel protectors.

Design of weld end valves shall be such that during field welding operations, the soft seals or plastic components of the valve (where ever used) is not liable to be damaged. The manufacturer shall

furnish necessary field welding instructions and post-weld test procedureto demonstrate integrity and leak-tightness of valves after field welding operations.

7.4 All sealant lines and other cavities of the valve shall be filled with sealant before shipment.

7.5 Packaging and shipping instructions shall be as per API 6D and procurement documentation. All valves shall be transported with ball in the fully open condition.

7.6 On packages, following shall be marked legibly with suitable marking ink:

a) Order Number
b) Manufacturer's Name and/or make
c) Valve size and rating
d) Tag Number
e) Serial Number
f) API monogram;
g) API class designation;
h) Maximum Operating Pressure;
i) Part number, year of manufacture and/or order number;

8.0 SPARES AND ACCESSORIES

8.1 Manufacturer shall furnish list of recommended spares and accessories for valves required during start-up and commissioning.

8.2 Manufacturer shall furnish list of recommended spares and accessories required for two years of normal operation and maintenance of valves.

8.3 Manufacturer shall quote for spares and accessories as per Material Requisition.

9.0 DOCUMENTATION

9.1 At the time of bidding, Manufacturer shall submit the following documents:

a) Filled in Data Sheet

b) General arrangement/ assembly drawings showing all features and relative positions and sizes of vents, drains, gear operator/ actuator, painting, coating and other external parts together with overall dimension.

c) Sectional drawing showing major parts with reference numbers and material specification. In particular a blow-up drawing of ball-seat assembly shall be furnished complying with the requirements of this specification.

d) Reference list of similar ball valves manufactured and supplied in last five years indicating all relevant details including project, year, client, location, size, rating, service etc.

e) Torque curves for the power actuated valves along with the break torque and maximum allowable stem torque. In addition, sizing criteria and torque calculations shall also be submitted for power actuated valves.

f) Clause wise list of deviations from this specification, if any.

g) Descriptive technical catalogues of the manufacturer.

h) Installation, Operational and Maintenance Manual.

i) Copy of valid API 6D Certificate.

j) Details of support foot including dimensions and distance from valve centerline to bottom of support foot.

9.2 Within three weeks of placement of order, the Manufacturer shall submit four copies of, but not limited to, the following drawings, documents and specifications for Purchaser's approval:

a) Detailed sectional drawings showing all parts with reference numbers and material specifications.

b) Assembly drawings with overall dimensions and features. Drawing shall also indicate the number of turns of hand wheel (in case of gear operators) required for operating the valve from full open to full close position and the painting scheme. Complete dimensional details of support foot (where applicable) shall be indicated in these drawings.

c) Welding, heat treatment and testing procedures.

d) Details of corrosion resistant paint to be applied on the valves.

Manufacturer of valves shall commence only after approval of the above documents. Once the approval has been given by Purchaser, any changes in design, material and method of manufacture shall be notified to Purchaser whose approval in writing of all changes shall be obtained before the valve is manufactured.

9.3 CD containing all docs shall be submitted within 30 days from the approval date, Manufacturer shall submit to Purchaser one reproducible and six copies of the approved drawings, documents and specifications.

9.4 Prior to shipment, Manufacturer shall submit to Purchaser one reproducible and six copies of the following:

a) Test certificates

b) Manual for installation, erection, maintenance and operation instructions including a list of recommended spares for the valves.

9.5 All documents shall be in English language only.

10.0 GUARANTEE

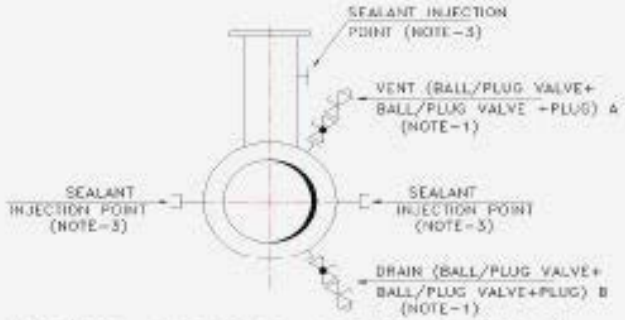
10.1 Manufacturer shall guarantee that the material and machining of valves and fittings comply with the requirements in this specification and in the purchase order.

10.2 Manufacturer is bound to replace or repair all valve parts which should result defective due to inadequate engineering or to the quality of materials and machining.

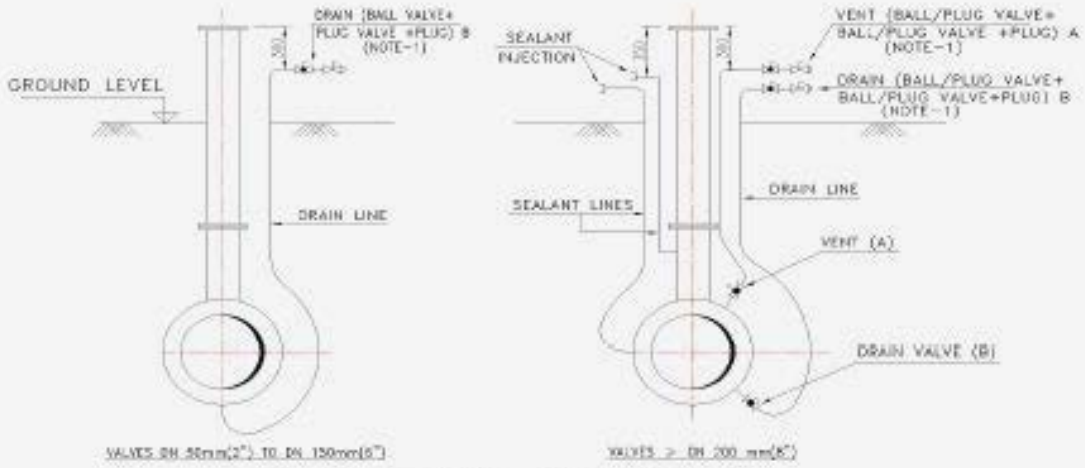
10.3 If valve defect or malfunctioning cannot be eliminated, Manufacturer shall replace the valve without delay.

10.4 Any defect occurring during the period of Guarantee shall be attended to by making all necessary modifications and repair of defective parts free of charge to the Purchaser as per the relevant clause of the bid document.

10.5 All expenses shall be to Manufacturer's account.



ABOVE GROUND INSTALLATION



UNDERGROUND INSTALLATION

SIZES OF VENT & DRAIN CONNECTIONS		
NOM. VALVE SIZE	A, DN(mm)	B, DN(mm)
50 TO 150	-	15
200 TO 600	15	25
750 & ABOVE	15	50 (SEE NOTE-2)

LEGEND:
- BALL VALVE
- PLUG VALVE
- PLUG

NOTES:
1. ALL VALVES (BALL OR PLUG) AND PLUGS FOR A AND B SHALL BE APPROVED BY THE PURCHASER.
2. VALVES OF SIZE 50mm SHALL BE MANUFACTURED AS PER API-6D.
3. SEALANT INJECTION POINTS SHALL BE PROVIDED FOR FULL OPENING VALVES OF NOMINAL VALVE SIZE 200mm (8") & ABOVE AND REDUCED OPENING VALVES OF NOMINAL VALVE SIZE, DN 250mm (10") AND ABOVE ONLY.
3. IN BURIED SECTION, ALL VENT & DRAIN CONNECTION SHALL BE OF WELDED CONSTRUCTION.

FIGURE-1

VENT, DRAIN & SEALANT INJECTION DETAILS

ENGINEERING STANDARD

TECHNICAL SPECIFICATIONS
FOR BALL VALVE (Size Below 2”)

GAIL-034-PI-DOC-TS-006

0	30.12.2019	Issued for Review	AP	JR	TR	
Rev	**Date**	**Purpose**	**Prepared By**	**Checked By**	**Approved By**	

Abbreviations

API	American Petroleum Institute
ASME	American Society of Mechanical Engineers
ASTM	American Society for Testing and Materials
BM	Base Metal
DN	Nominal Size
EPC	Engineering, Procurement and Construction
HAZ	Heat Affected Zone
MSS-SP	Manufacturers Standardization Society–Standard Practice
NDT	Non Destructive Testing
NPS	Nominal Pipe Size
SSPC	Steel Structures Painting Council
WM	Weld Metal

TABLE OF CONTENTS

1.0 SCOPE

This specification covers the minimum requirements for design, manufacture, testing and supply of carbon steel ball valves designed and manufactured to BS EN ISO 17292/API 6D standard for size below DN 50mm (2")and ANSI pressure rating Class 800# (Socket weld end connection) for use in onshore pipeline systems handling non-sour hydrocarbons in gaseous phase.

2.0 REFERENCE DOCUMENTS

2.1 All valves shall be manufactured and supplied in accordance with the BS EN ISO 17292/API 6D Latest edition, Petroleum and Natural Gas Industries – Pipeline Transportation Systems – Pipeline valves, with additions and modifications as indicated in the following sections of this specification.

2.2 Reference has also been made in this specification to the latest edition (edition enforce at the time of issue of enquiry) of the following Codes, Standards and Specifications.

ASME B31.3 - Process Piping.

ASME B31.8 - Gas Transmission and Distribution Piping Systems.

ASME B16.5 - Steel Pipe Flanges and Flanged Fittings.

ASME B 16.10 - Face-To-Face and End-To-End Dimensions of Valves.

ASME B 16.25 - Butt-welding Ends.

ASME B16.34 - Valves - Flanged, Threaded and Welding Ends.

ASME B16.47 - Large Diameter Steel Flanges.

API 1104 - Welding Pipelines and Related Facilities.

ASME Sec VIII - Boiler and Pressure Vessel Code - Rules for Construction of Pressure Vessels

ASME Sec IX - Boiler and Pressure Vessel Code – Welding and Brazing

ASTM A-370 - Standard Test Methods and Definitions for Mechanical Testing of Steel Products.

ASTM B 733 - Auto catalytic Nickel Phosphorous Coating on Metals.

MSS-SP-6 - Standard Finishes for Contact Faces of Pipe Flanges and Connecting-end Flanges of Valves and Fittings.

MSS-SP-44 - Steel Pipeline Flanges.

SSPC-VIS-1 - Steel Structures Painting Council Visual Standard.

SIS 055900 - Pictorial Surface Preparation Standards for Painting Steel Surface (Swedish standard).

2.3 In case of conflict between the requirements of this specification, BS EN ISO 17292/API 6D Latest edition and the Codes, Standards referred in clause 2.2 above, the requirements of this specification shall govern.

3.0 MATERIALS

3.1 Materials for major components of valves shall be as indicated in Valve Data Sheet. Other components shall be as per Manufacturer's standard (suitable for the service conditions indicated in Data Sheet) and shall be subject to approval by Company. In addition, the material shall also meet the requirements specified hereinafter.

3.2 Carbon steel used for the manufacture of valves shall be fully killed.

3.3 The ratio of body yield strength and body ultimate tensile strength of each test valve on which body yield strength and body ultimate tensile strength are determined, shall not exceed 0.90.

3.4 The carbon equivalent (CE) of valve end connections which are subject to further field welding by Company shall not exceed 0.43 on check analysis for each heat of steel used, as calculated by the following formula:

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

3.5 Impact Test Requirement -:

For Carbon Steel material-:

Charpy V-notch test shall be conducted at -20 C. the average absorbed energy value of full sized specimens shall be 35 J. The minimum impact energy value of specimen shall not be less than 28 J.

For LTCS Material:

Charpy v-notch standard shall be conducted as per the applicable Material Standard, however the test temperature shall be no case more than (-) 45 C (i.e test temperature shall be as per material standard or (-) 45 c whichever is less)

Apart from above to (for LTCS material) additional charpy v-notch test shall be conducted at -20 C. the average absorbed energy value of full sized specimens shall be 35J. The minimum impact energy value of specimen shall not be less than 28J.

3.6 Hardness test shall be carried out as per ASTM A370 for each method of manufacture and each heat of steel used in the manufacture of valves. A full thickness cross section shall be taken for this purpose and the maximum hardness of the materials of valve components shall not exceed 248 HV10.

3.7 In case of LTCS Ball material, the ball shall have 75 micrometers thick electroless nickel plating (ENP) as per ASTM B733 with SC 2, Type II, and Class 2. The hardness of plating shall be min. 50 RC.

3.8 For all forge material the fine grained perlitic structure of the steel shall be verified by at least one micrographic examination per lot according to ASTM E 112. The grain size shall be in the range of 8 to 12.

4.0 DESIGN AND CONSTRUCTION REQUIREMENTS

4.1 Valve design shall meet the requirements of BS EN ISO 17292/API 6D and shall be suitable for the service conditions indicated in the Valve Data Sheet. The ASME Boiler & Pressure Vessel Code, Section VIII, Division 1 shall be used to design the valve body. In addition, corrosion allowance indicated in Valve Data Sheet shall be considered in valve design. The ball valves shall be bi-directional.

4.2 For above ground valves, body design shall be either fully welded or bolted type. Valve end connection shall be socket weld end. Valve body joints with threads are not permitted. In the valve body outlets also, threading is not permitted.

4.3 Ball shall be of single piece, solid type construction. And non -lubricating type.

4.4 All ball valve shall be Full bore (FB). Reduced Bore (RB) valves shall not be permitted.

4.5 Ball mounting shall be floating type only for all valves of size 2” & below.

4.6 All valves shall be wrench operated valve. Direction of operation of wrench shall be in clock-wise direction while closing the valve

4.7 Valves shall be designed to withstand a sustained internal vacuum of at least 1 (one) milli-bar (a) in both open and closed positions.

4.8 Valve shall be provided with indicator to show position of ball port

4.9 Valve shall be provided with stops for both fully open and fully closed position.

4.10 Valve bonnets shall be through bolted to body.

4.11 Valve ends shall be socket welded indicated in the Valve Data Sheet. End-to-end dimensions for valve shall be in accordance with ASME B 16.11 shall be as per Manufacturer Standard and shall be subject to approval by Company.

4.12 Valves shall be suitable for above ground installation as indicated in Valve Data Sheet.

4.13 Valve design shall ensure repair of stem seals/packing under full line pressure.

4.14 Valve shall be fire tested design and with anti blow out stem.

4.15 Valve shall be long pattern with anti static features.

4.16 Repair by welding is not permitted for cast body and forged body valves.

4.17 No casting is permitted for stem material of all valves. Valve stem shall be capable of withstanding the maximum operating torque required to operate the valve against the maximum differential pressure corresponding to applicable class rating for a minimum of500 open-close-open cycles for a design life of 40 years. The combined stress shall not exceed the maximum allowable stresses specified in ASME section VIII, Division 1.

5.0 INSPECTION AND TESTS

5.1 The Manufacturer shall perform all inspection and tests as per the requirements of this specification, approved quality assurance plan (QAP) and the relevant codes, prior to shipment, at his Works. Such inspection and tests shall be, but not limited to, the following:

5.1.1 All valves shall be visually inspected. The internal and external surfaces of the valves shall be free from any strikes, gouges and other detrimental defects. The surfaces shall be thoroughly cleaned and free from dirt, rust and scales.

5.1.2 Dimensional check on all valves shall be carried out as per the Company approved drawings.

5.1.3 Chemical composition and mechanical properties shall be checked as per this specification and relevant material standards, for each heat of steel used. All testing frequency shall be as per Inspection & Test Plan/ QAP. Heat treatment chart for forging material shall be witness & start/stop time signed by TPIA.

5.1.4 Valve body and seat shall be hydro test as per ISO 5208/ API 598 latest edition/applicable codes and standard.

In addition to above, pneumatic testing and functional testing shall be carried out at 95 bar (g) for 800# pressure rating valves, using nitrogen for 5 minutes.High pressure shell and seat pneumatic testing shall be submerged in water.

A supplementary air seat test as per API 6D (Annexure H) shall be carried out for all valves. A bubble tight seal is required without the use of any sealant. No leakage is allowed. Test pressure shall be held for at least 15 minutes.

Valves shall be subjected to Operational Torque Test as per API 6D (Annexure H) under hydraulic pressure equal to maximum differential pressure corresponding to the applicable ANSI class rating of valve. It shall be established that the force required to operate the valve does not exceed the requirements stated in this specification.

5.1.5 Non-destructive examination of individual valve material and component consisting of but not limited to castings, forgings, plates and assembly welds shall be carried out by the Manufacturer.

- All valves made by forgings shall be ultrasonically examined in accordance with the procedure and acceptance standard of Annexure E of ASME B16.34. Body fabricated from plates is not acceptable.
- External surfaces of all forgings shall be 100% wet magnetic particle inspected. Method and acceptance shall comply with ASME B16.34.

5.1.6 All body tests to be done before painting.

5.2 Company reserves the right to perform stage wise inspection and witness tests in QAP above at Manufacturer's works prior to shipment. Manufacturer shall give reasonable access and facilities required for inspection to the Company's Inspector. Company reserves the right to require additional testing at any time to confirm or further investigate a suspected fault. The cost incurred shall be to Manufacturer's account.

In no case shall any action of Company or his inspector shall relieve the Manufacturer of his responsibility for material, design, quality or operation of valves.

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

6.0 TEST CERTIFICATES

Manufacturer shall submit the following certificates:

a. Mill test certificates relevant to the chemical analysis and mechanical properties of the materials used for the valve construction as per the relevant standards.

b. Test certificates of hydrostatic and pneumatic tests, helium test complete with records of timing and pressure of each test.

c. Test reports of ultrasonic inspection, if applicable.

d. Test report on operation of valves conforming All other test reports and certificates as required by Standard – BS EN ISO 17292/API 6D latest edition and this specification.

The certificates shall be considered valid only when signed by Company's Inspector. Only those valves which have been certified by Company's Inspector shall be dispatched from Manufacturer's works. TPIA shall issue 3.2 certificates as per EN 10204.

7.0 PAINTING, MARKING AND SHIPMENT

7.1 Valve surface shall be thoroughly cleaned, freed from rust and grease and applied with sufficient coats of corrosion resistant paint. Surface preparation shall be carried out by shot blasting to SP-6 in accordance with "Steel Structures Painting Council - Visual Standard SSPC-VIS-1"/ Sa 2 ½ in accordance with "Swedish standard - SIS- 055900" as per Painting specification.

The external surfaces of all valves as indicated in valve data sheet shall be provided with high build epoxy coating with a min. thickness of 300 microns DFT (dry film thickness).

All above ground valves shall be painted as per Painting specifications suitable for highly/normal corrosive environment as applicable.

7.2 All valves shall be marked as per API 6D. The units of marking shall be metric except nominal diameter, which shall be in inches.

7.3 Valve ends shall be suitably protected to avoid any damage during transit. All threaded and machined surfaces subject to corrosion shall be well protected by Moly coat type grease or other suitable material. Socket Weld Ends shall be protected with metallic or high impact plastic protectors.

7.4 Packaging and shipping shall be as per Specification/ as per Applicable Standards.

7.5 On packages, following shall be marked legibly with suitable marking ink:

a) Order Number
b) Manufacturer's Name
c) Valve size and rating
d) Tag Number
e) Serial Number

8.0 SPARES AND ACCESSORIES

8.1 All spares required for start-up and commissioning of the valve shall be supplied along with the valve.

8.2 Manufacturer shall furnish list of recommended spares and accessories required for two years of normal operation and maintenance of valves and price for such spares shall be quoted separately.

9.0 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.

9.1 EPC shall obtain the following documents from manufacturer and verify before placement of order:

a) General arrangement/ Sectional drawing & blow-up drawing of seat assembly shall be submitted. Number of turns for Gear Operated valves shall be indicated in the GA or shall be furnished separately

b) Reference list of similar ball valves manufactured and supplied in last ten years indicating all relevant details including project, year, client, location, size, rating, service etc.

g) In case of soft seated valves, copy of Fire Safe Test certificate of qualifying valve as per API 607/API 6FA carried out in last 10 years shall be furnished.

9.2 After placement of order, the Manufacturer shall submit the following drawings, documents and specifications for Company's approval:

a) Detailed sectional drawings showing all parts with reference numbers and material specifications.

b) Assembly drawings with overall dimensions and features. Drawing shall also indicate the number of turns of hand wheel (in case of gear operators) required for operating the

valve from full open to full close position and the painting scheme. Complete dimensional details of support foot (where applicable) shall be indicated in these drawings.

Manufacture of valves shall commence only after approval of the above documents. Once the approval has been given by Company, any changes in design, material and method of manufacture shall be notified to Company whose approval in writing of all changes shall be obtained before the valve is manufactured.

9.3 Within 30 days from the approval date, Manufacturer shall submit to Company the approved drawings, documents and specifications as listed in clause 9.2 above.

9.4 Prior to shipment, Manufacturer shall submit to Company following:

a) Test certificates as per this specification.

b) Manual for installation, erection, maintenance and operation instructions including a list of recommended spares for the valves.

9.5 All documents shall be in English language only.

ENGINEERING STANDARD

TECHNICAL SPECIFICATION FOR GLOBE VALVES

GAIL-034-PI-DOC-TS-007

0	30.12.19	Issued for Review	AP	JR	TR	
Rev	**Date**	**Purpose**	**Prepared By**	**Checked By**	**Approved By**	

CONTENTS

1.0 GENERAL

1.1 This specification provides minimum requirement for design, manufacturing, Inspection, Testing and supply of Carbon steel Globe Valves of sizes ½" NB to 12"NB (300mm) for service in non-sour gas pipelines.

1.2 Vendor shall quote in strict accordance with the valve Data / Specification sheets, technical specification and enclosures to this specification. Deviations to the Specification / Data sheets, if any, shall be indicated as per clause 2.0. Vendor shall supply valves along with auxiliaries, if any, such as gear operator, bypasses, drains, etc., specified in the valve specification sheets and this specification.

1.3 All valves shall be manufactured and supplied in accordance with the Design Code BS 1873, with additions and modifications as indicated in the following sections of this specification.

Reference has also been made in this specification to the latest edition (edition enforce at the time of issue of enquiry) of the following Codes, Standards and Specifications.

All codes and standards for manufacturing, testing, inspection etc., shall be of latest editions. Also refer data sheet (attached elsewhere in the bid document) for globe valves.

1.4 **Materials**

1.4.1 Material for major components of the valves shall be as indicated in Valve Data Sheet. In addition, the material shall also meet the requirements specified herein. Other components shall be as Manufacturer's standard (suitable for service conditions as indicated in valve data sheet), which shall be subjected to approval by Purchaser.

All process-wetted parts, metallic and non-metallic, and lubricants shall be suitable for the service specified by the Company. Manufacturer shall confirm that all wetted parts are suitable for treated water/ seawater environment, which may be used during field testing.

Non-metallic parts of the valves intended for hydrocarbon gas service shall be resistant to explosive decompression.

1.4.2 Carbon steel used for the manufacture of valves shall be fully killed. Carbon equivalent (CE) of valve end connections which are subject to further field welding, as calculated by the following formula, shall not exceed 0.43% on check analysis for each heat of steel used.

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

1.4.3 For valves specified to be used for Gas service or LPG service, Charpy V-notch test, on each heat of base material shall be conducted as per standard, for all pressure containing parts such as body, end flanges and welding ends as well as bolting material for pressure containing parts. Unless specified otherwise, the Charpy V-notch test shall be conducted at 0°C. Test procedure shall conform to ASTM A 370. The average absorbed energy value of three full sized specimens shall be 27 J. The minimum impact energy value of any one specimen of the three specimens analyzed as above shall not

be less than 22 J.

When Low Temperature Carbon Steel (LTCS) materials are specified in Valve Data Sheet or offered by Manufacturer, the Charpy V-notch test requirements of applicable material standard shall be complied with.

1.4.5 Impact test for all material shall be carried out as per QAP.

1.4.6 The ratio of effective YS/ UTS of the steel shall not exceed 0.85.

1.4.7 Valves shall be subjected to hardness test on base material for each heat for pressure containing parts. A full thickness cross section shall be taken for this purpose and the maximum hardness shall not exceed 248 HV10 based on minimum four (4) measurements. Grain size shall be 8 or finer as per ASTM E112.

2.0 DOCUMENTATION

2.1 Vendor shall submit with the offer the following:

2.1.1 Manufacturer's complete descriptive and illustrative Catalogue/ Literature.

2.1.2 Detailed dimensioned general arrangement and cross-sectional drawings with Parts/ material lists, weight etc., for valves to manufacturer's standard.

2.1.3 Drawings for valves with accessories like gear operator, extension bonnet, extended stems with stands bypass, etc., giving major salient dimensions.

2.1.4 One copy of the valve technical specification and data sheets signed as "ACCEPTED" by the manufacturer with all deviations marked clearly.

2.1.4 If the valve is regretted or has no deviation, the manufacturer shall write clearly on valve specification sheets as "REGRET" or "NO DEVIATION".

2.1.5 If there is any deviation in the specification, the same shall be listed clause wise. Even clauses which are acceptable shall be categorically confirmed as "ACCEPTED".

2.1.6 On failure to submit document as specified in clauses 2.1.1 to 2.1.5 above, the offer is likely to be rejected.

2.2 Vendor shall submit for approval the drawings mentioned in item no 2.1.2 & 2.1.3 and Detailed Testing procedures, welding procedure specification and NDT Procedure within three weeks of placement of order.

2.2.1 Test reports shall be supplied for all mandatory tests as per the applicable code. Test reports shall also be furnished for any supplementary tests as specified in clause 3.11 to 3.16.

2.2.2 Material test certificates (Physical property, chemical composition, welding and heat treatment report) of the pressure containing parts shall be furnished for the valves supplied. Material test certificates for the other parts shall also be furnished for verification during inspection.

2.2.3 Manufacture of valves shall commence only after approval of the above documents. Once the

approval has been given by Owner/ Owner's Representative, any changes in design, material and method of manufacture shall be notified to Owner/ Owner's Representative whose approval in writing of all changes shall be obtained before the valve is manufactured.

3.0 DESIGN AND CONSTRUCTION

3.1 Valves shall be designed, manufactured, tested, inspected and marked as per the manufacturing standards design codes and standards (Latest editions) indicated in the respective valve specification sheets. Any conflict between the technical specification, specification sheets and referred standard codes shall be brought to the notice of the purchaser for clarifications and more stringent shall apply. No deviation to specification/ standard shall be permitted through vendor drawings approval. Approval of drawings shall be valid only for design features.

Valve design shall meet the requirements of BS 1873 and shall be suitable for the service conditions indicated in the Valve Data Sheet. The valve body and other pressure containing parts shall be designed in compliance with ASME Boiler & Pressure Vessel Code, Section VIII, Div 1. The Corrosion allowance indicated in the Valve Data Sheet shall be considered in the design. However the minimum wall thickness shall not be less than the minimum requirement of ASME B16.34

3.2 Bonnet extension wherever specification the valve sheet to BS: 6364 shall be for "Non Cold Box Application" unless otherwise specified in the requisition. The Cover shall be bolted to the body. Screwed connections are not acceptable. Valve design shall provide for the repair of gland packing under full line pressure.

3.3 Lifting Lug shall be integral part of the valve.

3.4 All flanged valves shall have flanges integral (except forged valves) with the valve body. Flange finish shall be as per valve data sheet. Flanges shall be integrally cast with the body of the Valve. Face to face/end to end dimensions shall conform to the design codes. Flanged ends, if specified, shall have flanges as per ASME B16.5 for valve sizes up to DN 600 mm (24") excluding DN 550 mm (22") and as per MSS-SP-44/ ASME B 16.47 Series A for valve sizes DN 550 mm (22") and for DN 650 mm (26 inches) and above. Flange face shall be either raised face or ring joint type (RTJ) as indicated in Valve Data Sheet. Flange face finish shall be serrated or smooth as indicated in Valve Data Sheet. In case of RTJ flanges, the groove hardness shall be minimum 140 BHN.

3.5 For all weld end valves with bevel end as per ANSI B16. 25. Butt weld end preparation shall be as per ASME B 16.25. The thickness of the pipe to which the valve has to be welded shall be as indicated in the Valve Data Sheet. In case difference exists between thickness of welding ends of valve and connecting pipe, the welding ends of valve shall have bevel preparation as per ASME B31.4 or ASME B31.8 as applicable.

Design of weld end valves shall be such that during field welding operations, the soft seals or plastic components of the valve (where ever used) is not liable to be damaged. The manufacturer shall furnish necessary field welding instructions and post-weld test procedure to demonstrate integrity and leak-tightness of valves after field welding operations.

3.6 If an overlay weld-deposit is used for the body seat ring and seating surface, the seat ring base material shall be at least equal to the corrosion resistance of the material of the shell.

3.7 Valve body/ bonnet shall be forged/ cast as specified. Forging is acceptable in place of casting but not vice-versa.

3.8 Material of construction of yoke shall be minimum equivalent to body/ bonnet material.

3.9 Stem shall be forged or machined from forged / rolled bar. No casting is permitted. The Valve stem shall be capable of withstanding the maximum operating torque requirement to operate the Valve against the maximum differential pressure as per the appropriate class. The combined stress shall not exceed the maximum allowable stresses specified in ASME Section VIII, Division 1. The design shall take into account a safety factor of 1.5 based on the maximum output torque of the operating mechanism.

3.10 Stelliting / hard facing by deposition shall be minimum 1.6 mm. Renewable seat ring may be seal welded.

3.11 As a pre-qualification low temperature carbon steel, (LTCS), 3 ½ Ni steel (CRYO) & austenitic stainless (CRYO) valves shall be subjected to cryogenic test as per BS 6364 and test shall be witnessed and certified by purchaser inspection agency. The vendor has to submit test certificate for prototype valves along with the offer. Prototype test carried on a particular size, rating and design will qualify valves of sizes equal to and below the particular size of the same rating and design.

3.12 Wherever impact test of SS studs/ nuts is called for in the data sheet, the impact value shall be 27J at the intended service temperature specified in the data sheets.

3.13 For all austenitic stainless steel valves Inter Granular Corrosion (IGC) test shall have to be conducted as per following:

- ASTM A 262 practice “B” with acceptance criteria of “60 Mills/ Year (Max.)” – For all materials forged, rolled, wrought and casting.

OR

- ASTM A 262 practice “E” with acceptance criteria of “No cracks as observed form 20x magnification” – For all materials other than castings. “Microscopic structure to be observed form 250x magnification” in addition.

3.14 Spiral wound bonnet gasket is to be provided with inner/ outer ring except when encapsulated gaskets type body- bonnet joints are employed.

3.15 Vendor to provide the list of spares for commissioning and 2 years of operation & maintenances.

4.0 OPERATION

4.1 Valves of 4” (DN100), and below shall be manually operated. Valves of 6" N.B (DN 150), and above, shall be gear operated. Gear operators shall be sized such that their output torque is at least 1.5 times the maximum operating torque of the Valve. The Valve design shall be such, that damage due to malfunctioning of the Operator, or its controls, will only occur in the gear train or power cylinder. Damaged parts should be able to be replaced without the Valve cover being removed.

4.2 Gear operator shall be totally enclosed bevel gear in grease case with grease nipples/ plugs with position indicators for open / close position.

4.3 Where gear operator is not called for as per clause 4.1 but vendor recommends a gear operator, he shall highlight such case/s and quote separate prices for the valve and gear operator.

4.4 Gear operator shall be so designed to operate effectively with the differential pressure across the closed vale equal to the cold non-shock pressure rating.

4.5 The diameter of the hand wheel for manually operated Valves, shall be such that under the maximum differential pressure, the torque required to operate the Valve does not exceed 350 Nm. The Manufacturer shall also indicate the number of turns of the hand wheel required for operating the Valve from the fully open to fully closed position.

Hand wheel diameter shall not exceed 750 mm and lever length shall not exceed 500 mm. on both sides. Effort to operate shall not exceed 35 kgs at hand wheel periphery. However failing to meet the above requirements vendor shall offer gear operated valve and quote as per clause 4.3.

The Direction of operation of the hand wheel, shall be in a clock-wise direction for closing the Valves. Hand wheels shall not have protruding spokes.

Gear operators, where provided, shall have a self-locking provision and shall be fully encased in a water proof/ splash proof enclosure (IP65) and shall be filled with suitable grease.

4.6 Gear used in the gear operated valve shall be of non-sparking type.

The tolerance on internal diameter and out of roundness at the ends for welded ends valves shall be as per connected pipe specification as indicated in the Valve Data Sheet.

Repair by welding is not permitted for forged Valves. However repair by welding as per ASME B 16.34 is permitted for cast Valves. Repairs shall be carried out before any heat treatment of the casting is done. Repair welding procedure qualifications shall include hardness tests and shall meet the requirements of Clause 3.2 of this Specification.

When specified in the Valve Data Sheet, Valves shall have locking devices to lock the Valve either in a fully open (LO) or fully closed (LC) position.

When specified in the Valve Data Sheet, Globe Valves shall be “fire safe” in accordance with API RP6FA, for which qualifying certificates, covering the range of items offered, shall be supplied by the Manufacturer

All Valves and Gear Operators shall have a stainless steel Nameplate permanently affixed with stainless steel pan head screws. Each Nameplate shall have, as a minimum, the following information stamped thereon:

- Manufacturer
- Year of Manufacture
- Serial No.
- Tag no
- Size

Together with all other data required by specification BS 1873.

5.0 INSPECTION AND TESTING

5.1 Every valve shall be subjected to all the mandatory tests and checks called in the respective codes/ QAP.

5.2 Every valve, its components and auxiliaries be subjected to all the mandatory tests and checks called in the respective codes, data sheets etc. by the manufacturer.

5.3 Though the extent of inspection by purchaser or his authorized representative shall be as under, however exact extent with hold points shall be decided by Owner's Representative and recorded in the form of inspection plan. Inspection shall be confirming to EN 10204 3.2 certification. Vendor shall submit QAP for Owner / Owner's Representative's approval before starting the production of valves.

5.4 In case of motor operated or actuator operated valves, functional/operational checks as per the requirements of the specifications shall be made on each valve.

5.5 Pressure containing parts of all valves such as body, bonnet, flange, welding ends and balls etc. shall be subjected to impact test on each heat of base material as per the QAP attached in bid document.

5.6 Manufacturer shall give reasonable access and facilities required for inspection to the Purchaser. Purchaser reserves the right to require additional testing at any time to confirm or further investigate a suspected fault. The cost incurred shall be to Manufacturer's account. In no case shall any action of Purchaser or his inspector shall relieve the Manufacturer of his responsibility for material, design, quality or operation of valves. Inspection and tests performed/witnessed by the Purchaser's Inspector shall in no way relieve the Manufacturer's obligation to perform the required inspection and tests.

5.7 All Welds which in Purchaser's opinion cannot be inspected by radiographic methods, shall be checked by ultrasonic or magnetic particle methods and acceptance criteria shall be as per ASME VIII, Division 1 Appendix 12 and ASME VIII div 2, respectively.

5.8 All finished valve ends subject to welding in field shall be 100% ultrasonically tested for lamination type defects for a distance of 50 mm from the end. Laminations shall not be acceptable.

5.9 Weld ends of all cast valves subject to welding in field shall be 100% radio graphically examined.

5.10 After final machining, all bevel surfaces shall be inspected by dye penetrate or wet -magnetic particle methods. Laminations shall not be acceptable.

5.11 Weld repair of bevel surface is not permitted.

5.12 One (1) valve out of the total ordered quantity shall be randomly selected by the Company Representative for cyclic testing as mentioned below:

a) The valve shall be subjected to at least 500 Open-Close-Open cycles with maximum differential pressure corresponding to the valve rating.

b) Subsequent to the above, the valve shall be subjected to hydrostatic test and Supplementary air seat test in accordance with QAP.

In case this valve fails to pass these tests, the valve shall be rejected and two more valves shall be selected randomly and subjected to testing as indicated above. If both valves pass these tests, all valves manufactured for the order (except the valve that failed) shall be deemed acceptable. If either of the two valves fails to pass these tests, all valves shall be rejected or each valve shall be tested at the option of Purchaser. Previously carried out prototype test of similar nature shall not be considered in place of this test.

5.13 All castings shall be wet magnetic particle inspected 100% of the internal surfaces. Method and acceptance shall comply with ASME B16.34.

5.14 All forgings shall be wet magnetic particle inspected 100% of the internal surfaces. Method and acceptance shall comply with ASME B16.34.

5.15 All valves, with body made by forgings, shall be ultrasonically examined in accordance with the procedure and acceptance standard of Annexure E of ASME B16.34.

5.16 Full inspection by radiography shall be carried out on all welds of pressure containing parts. Acceptance criteria shall be as per ASME B31.8 and API 1104.

5.17 All other tests shall be carried out as per the QAP.

5 INSPECTION & TESTS

Where called for in the Procurement Documents, the Manufacturer shall appoint a reputable Third Party Inspection Agency, to carry out all inspection and tests as per the requirements of this Specification and the relevant codes, at his Works, prior to shipment.
The cost of such Third Party Inspection shall be included in the Tendered Sum; also, the Third Party Inspection Agency shall be approved by the Purchaser prior to his appointment. Such inspection and tests shall be as a minimum, but not be limited to, the following:

- Visual inspection
- A Dimensional checks on all Valves shall be carried out as per the drawings approved by the Purchaser.
- Chemical composition and mechanical properties including hardness shall be checked as per relevant material standards and this Specification, for each heat of steel used.

  - Non-Destructive examination of individual Valve material and components consisting of, but not limited to, castings and forging, shall be carried out by the Manufacturer.
  - Body castings of the Valves shall be radiographically examined on 100% of the surface of critical areas as per ASME B16.34. Procedure and acceptance criteria shall be as per ANSI B16.34. All castings shall be subject to wet magnetic particle inspection on 100% of their internal surfaces. Method and acceptance shall be in accordance with MSS-SP-53.
  - All forgings shall be ultrasonically examined in critical areas in accordance with the procedure and acceptance standard of Annexure-E of ASME B 16.34. All forgings shall be subject to wet magnetic particle inspection on 100% of their forged surfaces. Method and acceptance shall be in accordance with MSS-SP-53.
- Cast Valves subject to field welding shall be 100% radiographically examined on their welding ends and acceptance criteria shall be as per ANSI B16.34.

- All finished wrought welding ends subject to field welding shall be ultrasonically tested on 100% of the welded area for lamination type defects for a distance of 50 mm from the

end. Laminations more than 50 mm shall not be acceptable.

- All the Valves shall be Hydrostatically tested in compliance with the requirements of BS 1873.
- A supplementary Air Seat Test shall be carried out for all Valves with leakage criteria in accordance with the Data Sheets.
- Valves shall be subjected to an Operational Torque Test as per standard under hydraulic pressure equal to the maximum differential pressure corresponding to the Valve rating. For manually operated Valves, it shall be established that the torque required to operate the Valve does not exceed 350 Nm.
- The Purchaser may, at his discretion appoint a Third Party Inspection Agency to carry out inspection on behalf of, or together with, the Purchaser's Inspector

6.0 RADIOGRAPHY OF CAST VALVES

6.1 Valve casting shall undergo radiographic examination as specified hereunder:

Material	Rating	Size Range	Radiography
All	300#	All Sizes	100%

6.2 Radiography procedure, areas of casting to be radiographed shall be as per ANSI B-16.34 and acceptance criteria shall be as per ANSI B-16.34 Annexure-B. However for areas of casting to be radio-graphed for types of valve not covered in ANSI B-16.34, vendor shall enclose details of areas to be radiographed in line with ANSI B-16.34.

6.3 Random radiography wherever specified in individual data sheets, the sampling shall be per size of the quantity ordered for each foundry.

6.4 Radiography wherever specified in the data sheets or as per clause 6.1 shall be done by X-Ray/ Gamma-Ray to get the required sensitivity.

6.5 Over and above the stipulation laid down in clauses 6.1, 6.2, 6.3 & 6.4, all valve castings shall only be procured among the foundries after obtaining approval from Owner / Owner's Representative.

7.0 QUALITY ASSURANCE PLAN (QAP)

7.1 Procurement of Bought Out Materials

All critical materials such as casting, forging, pressure holding parts, electrical and instrument accessories, etc. shall be purchased by the Vendor from Owner / Owner's Representative's approved suppliers meeting Qualification Criteria stipulated if any.

Vendor shall submit a list of bought out materials and sub-vendors for these bought out materials for owner/Owner's Representative approval within 2 weeks from Telefax/ Letter of Intent. Vendor has to submit the Quality Assurance Plan (QAP) at the time of bidding.

7.2 Calibration Records

Vendor shall use only calibrated measuring and test instruments and maintain calibration

records. Vendor shall furnish records of calibration of measuring and test instruments including re calibration records to concerned purchaser inspection engineer.

7.3 Quality Records

Vendor shall maintain quality records as per approved procedures. Inspection, Reports & Test Record. Copies shall be furnished to purchaser inspection engineer.

7.4 Final Documentation

Final drawings/ documents consisting of technical data manual/ mechanical catalogue is a compilation of "as built" certified, drawings and data, manufacturing and test records, installation, operating and maintenance instructions. For drawings where Purchaser's approval is required, the final certified drawings shall be included. Final documents shall be legible photocopies in A4, A3 or A2 size only. The purchase requisition shall also form a part of the final documentation. TPIA shall issue 3.2 certificates as per EN 10204.

7.5 Test Certificates

Manufacturer shall submit the following certificates:

i) Mill test certificates relevant to the chemical analysis and mechanical properties the materials used for the valve construction and Heat treatment chart(if applicable) as per the relevant standards & QAP.
ii) Reports on heat treatment carried out.

ii) Test certificates of hydrostatic and pneumatic tests complete with records of timing and pressure of each test.

All relevant test reports like radiograph Inspection, ultrasonic inspection, MPT/ DPT Inspection, Visual & Dimensional Inspection records as per approved QAP.

iv) All other test reports and certificates as required by BS 1873, this specification and data sheets.

v) Manufacturer / TPIA 3.2 (as per BS EN 10204) confirmation certificate.

The certificates shall be valid only when signed by Purchaser's Inspector. Only those valves which have been certified by Purchaser's Inspector shall be dispatched from Manufacturer's works.

8.0 MARKING

8.1 Valve markings, symbols, abbreviations etc. shall be in accordance with MSS SP- 25 or the standard referred in specification sheet as applicable. Vendors name, valve rating, material designation, nominal size, direction of flow (if any) etc. shall be integral on the body.

8.2 Each valve shall have a corrosion resistant tag giving size, valve tag / code no, securely attached on the valve body.

8.3 Paint or Ink for marking shall not contain any harmful metal or metal salts such as zinc, lead or copper which causes corrosive attack on heating.

8.4 All valves shall be coated / painted as per painting specification/ relevant specification mentioned anywhere in the bid.

8.5 All alloy steel high temp valves shall be painted with heat resistant silicone paint suitable for intended temperature.

9.0 DESPATCH

9.1 Valves shall be dry, clean and free from moisture, dirt and loose foreign materials of any kind.

9.2 Valves shall be protected from rust, corrosion and any mechanical damage during transportation, shipment and storage.

9.3 Rust preventive on machined surfaces to be welded shall be easily removable with a petroleum solvent or not harmful to welding.

9.4 Each end of valves shall be protected with the following materials:

Flange face	: Wood, Metal or Plastic cover
Beveled end	: Wood, Metal or Plastic cover
SW & Scrd. End	: Plastic cap

9.5 End protectors to be used on flange faces shall be attached by at least three bolts or wiring through bolt holes and shall not be smaller than the outside diameter of the flange. However plastic caps for SW & SCRD. End valves shall be press fit type.

9.6 End protectors to be used on beveled end shall be securely and tightly attached.

9.7 For special service valves additional requirement of dispatch shall be prescribed in data sheet.

9.8 All spares required for start-up and commissioning shall be supplied along with the valve.

10.0 GUARANTEE

10.1 Manufacturer shall guarantee that the material and machining of valves and fittings comply with the requirements in this specification and in the purchase order.

10.2 Manufacturer is bound to replace or repair all valve parts which should result defective due to inadequate engineering or to the quality of materials and machining.

10.3 If valve defect or malfunctioning cannot be eliminated, Manufacturer shall replace the valve without delay.

10.4 Any defect occurring during the period of Guarantee shall be attended to by making all necessary modifications and repair of defective parts free of charge to the Purchaser as per the relevant clause of the bid document.

10.5 All expenses shall be to Manufacturer's account.

ENGINEERING STANDARD

GAIL INDIA LIMITED

TECHNICAL SPECIFICATION FOR CHECK VALVE

GAIL-034-PI-DOC-TS-008

0	30.12.19	Issued For Review	AP	JR	TR	
Rev	**Date**	**Purpose**	**Prepared By**	**Checked By**	**Approved By**	

CONTENTS

1.0 SCOPE

This specification covers the minimum requirements for design, manufacture and supply of carbon steel check valves of size DN 50mm (2") and above and ANSI class 150, 300 and 600, for use in natural gas pipeline system and associated facilities.

2.0 REFERENCE DOCUMENTS

2.1 All valves shall be manufactured and supplied in accordance with the latest edition of American Petroleum Institute (API) Specification 6D or British Standard BS:1868, with additions and modifications as indicated in the following sections of this specification.

For Contractual purpose, the edition in force at the time of floating of the enquiry shall be termed as "latest edition".

3.0 MATERIALS

3.1 Material for major components of the valves shall be as indicated in Valve Data Sheet. Other components shall be as per Manufacturer's standards, which will be subject to approval by Purchaser.

3.2 Carbon steel used for the manufacture of valves shall be fully killed.

3.3 The Carbon Equivalent (CE) of valve end connections which are subject to further field welding by Purchaser, shall not exceed 0.45% (as calculated by the following formula) on check analysis for each heat of steel used:

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

3.4 Charpy V-Notch test on each heat of base material shall be conducted as per API 6D, clause 7.5, for all pressure containing parts such as body, end flanges and welding ends as well as bolting material for pressure containing parts. Unless specified otherwise, the Charpy impact test shall be conducted at 0 Deg C. The Charpy impact test specimen shall be taken in the direction of principal grain flow and notched perpendicular to the original surface of plate or forging.

The minimum average absorbed energy per set of three specimens shall be 27 J with an individual minimum per specimen of 22 J. No specimen shall exhibit less than 80 percent shear area.

3.5 All process wetted parts, metallic and non-metallic, shall be suitable for the fluids and service specified by the Purchaser.

4.0 DESIGN AND CONSTRUCTION

4.1 Following types of check valves, meeting the requirements of applicable standards (refer clause 2.1 of this specification) are acceptable:

a) Swing Check Valve
b) Dual Plate Check Valve
c) Axial Flow (Nozzle) Check Valve

Valve design shall be suitable for the service conditions indicated in Valve Data Sheet. Corrosion allowance indicated in Valve Data Sheet shall be considered in valve design.

4.2 In case of swing check valves, the disc hinge shall be mounted on the valve body and shall not be attached to the valve body cover. Valve body cover joint shall be of bolted design. Screwed covers shall not be used.

4.3 Valves shall be provided with non-renewable integral type seats as indicated in Valve Data Sheet. Non-renewable seats shall be of a design which does not require renewal over the design life of the

valve.

4.4 Valves shall be provided with drain connection as per the Manufacturer's standard. Drain tapping shall be provided in a position suitable to completely drain the valve with valve in horizontal position.

4.5 Valve ends shall be either flanged or butt welded or one end flanged and one end butt welded as indicated in Valve Data Sheet. Flanged end shall have dimensions as per ASME B16.5 for sizes upto DN 400mm (16"). Flanges of the flanged end cast body valves shall be integrally cast with the body of the valve.

4.6 Butt weld end preparation shall be as per ANSI B 16.25. The thickness of the pipe to which the valve has to be welded shall be as indicated in Valve Data Sheet. Valves shall be without transition pups. In case difference exists between thickness of valve neck end and connecting pipe, the bevel end of valve shall be prepared as per ANSI B31.8 or ANSI B 31.3, as applicable.

4.7 Valves of size DN 200mm (8") and above shall be equipped with lifting lugs. Tapped holes and eye bolts shall not be used for lifting lugs.

4.8 An arrow indicating the direction of flow shall be embossed or cast on the body of all valves.

4.9 All welds shall be made by welders and welding procedures qualified in accordance with the provisions of ASME Section IX. The welding and repair welding procedure qualification shall include impact test and shall meet the requirements of clause 3.4 of this specification.

4.10 Repair by welding is permitted for cast body valves subject to written approval by Purchaser and shall be carried out as per ANSI B16.34. Repair shall be carried out before any heat treatment of casting is done.

5.0 INSPECTION AND TESTS

5.1 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. Inspection certification shall be confirmed to EN-10204-3.1b. Such inspection and tests shall be, but not limited to, the following:

5.1.1 All valves shall be visually inspected.

5.1.2 Dimensional check on all valves shall be carried out as per the Purchaser approved drawings.

5.1.3 Chemical compositions and mechanical properties shall be checked as per relevant material standards and this specification, for each heat of steel used.

5.1.4 a) Wherever applicable, the body castings of valves shall be radio graphically examined on 100% of the surface of critical areas as per ANSI B16.34. Procedure and acceptance criteria shall be as per ANSI B16.34.

b) Where applicable, valve body made by forging and plate components shall be ultrasonically examined in accordance with procedure and acceptance standard of Annexure E of ANSI B16.34.

c) The extent of radiography/ultrasonic examination shall be as follows :

ANSI Class 150	-	All sizes	-	Nil
ANSI Class 300	-	$\leq$ DN 400mm (16")	-	100%
		$\geq$ DN 450mm (18")	-	100%
ANSI Class 600	-	All sizes	-	100%

5.1.5 All valves shall be tested in compliance with the requirements of applicable standard (refer clause 2.0).

5.2 Purchaser reserves the right to perform stage-wise inspection and witness tests as indicated in clause 5.1 above at Manufacturer's works prior to shipment. Manufacturer shall give reasonable access and facilities required for inspection to the Purchaser's Inspector.

Purchaser reserves the right to require additional testing at any time to confirm or further investigate a suspected fault. The cost incurred shall be to Manufacturer's account.

In no case shall any action of Purchaser or its Inspector relieve the Manufacturer of his responsibility for material, design, quality or operation of valves.

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

6.0 TEST CERTIFICATES

Manufacturer shall submit the following certificates:

a) Mil test certificates relevant to the chemical analysis and mechanical properties of the materials used for the valve construction as per the relevant standards.

b) Hydrostatic test certificates complete with records of timing and pressure of each test.

c) Test reports of radiograph and ultrasonic inspection, as applicable.

d) All other tests reports and certificates as required by applicable standard and this specification.

The certificates shall be valid only when signed by Purchaser's Inspector. Only those valves which have been certified by Purchaser's Inspector shall be dispatched from Manufacturer's works.

7.0 PAINTING, MARKING AND SHIPMENT

7.1 Valve surface shall be thoroughly cleaned, freed from rust and grease and applied with sufficient coats of corrosion resistant paint. Surface preparation shall be carried out by shot blasting to SP-6 in accordance with "Steel Structures Painting Council – Visual Standard SSPC-VIS-1".

7.2 All valves shall be marked as per applicable standard. The units of marking shall be metric except nominal diameter, which shall be in inches.

7.3 Valve ends shall be suitably protected to avoid any damage during transit. All threaded and machined surfaces subject to corrosion shall be well protected by a coat of grease or other suitable material. All valves shall be provided with suitable protectors for flange faces, securely attached to the valves.

7.4 Packaging and shipping instructions shall be as per applicable standard.

7.5 On packages, the following shall be marked legibly with suitable marking ink :

a) Order Number

b) Manufacturer's Name and trade mark.

c) Valve Size and Rating

d) Tag Number.

e) Minimum & maximum operating temperature.

f) Body material designation.

g) Maximum operating pressure.

8.0 SPARES AND ACCESSORIES

8.1 Manufacturer shall recommend and quote separately the spares for valves required for commissioning and two years of normal operation.

9.0 DOCUMENTATION

9.1 At the time of bidding, Manufacturer shall submit the following documents:

a) General arrangement drawings showing all features together with overall dimensions and actual valve bore size.

b) Sectional drawing showing major parts with reference numbers and material specification and Quality assurance plan (QAP).

c) Details of corrosion resistant paint proposed to be applied.

Reference list of similar supplies of check valves, including project, year, client, location, size, rating, the Manufacturer shall furnish services, etc. for the last three years. (The valves shall be proven for service indicated in Valve Data Sheet).

9.2 Within three weeks of placement of order, the Manufacturer shall submit four copies of, but not limited to, the following drawings, documents and specifications for Purchaser's approval.

a) Detailed sectional drawings showing all parts with reference numbers and material specification.

b) Assembly drawings indicating overall dimensions, features and painting scheme.

Once the approval has been given by Purchaser, any changes in design, material and method of manufacture shall be notified to Purchaser whose approval in writing of all changes shall be obtained before the valve is manufactured.

9.3 Within 30 days from the approval date, Manufacturer shall submit to Purchaser one reproducible and six copies of all approved drawings, documents and specifications as listed in clause 9.2 above.

9.4 Prior to shipment, Manufacturer shall submit to Purchaser one reproducible and six copies of the following:

a) Test certificates as listed in clause 6.0 of this specification.

b) Manual for installation, erection, maintenance and operation instructions, including a list of recommended spares for the valves.

9.5 All documents shall be in English language.

10.0 GUARANTEE

10.1 Manufacturer shall guarantee that the materials and machining of valves and fittings comply with the requirements in this specification and in the Purchase Order.

10.2 Manufacturer is bound to replace or repair all valve parts which should result defective due to inadequate engineering or to the quality of materials and machining.

10.3 If valve defect or malfunctioning cannot be eliminated, Manufacturer shall replace the valve without delay.

10.4 Any defect occurring during the period of Guarantee shall be attended to by making all necessary modifications and repair of defective parts free of change to the Purchaser as per the relevant clause of the bid document.

10.5 All expenses shall be to Manufacturer's account.

GAIL INDIA LIMITED

Technical Specification – Fittings

GAIL-034-PI-DOC-TS-009

0	30.12.2019	Issued for Review	VKS	AP	TR	
Rev	**Date**	**Purpose**	**Prepared By**	**Checked By**	**Approved By**	

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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 ^{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 Stub-in 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^{0} 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-PI-DOC-TS-010

0	30.12.2019	Issued For Review	AP	JR	TR	
Rev	**Date**	**Purpose**	**Prepared By**	**Checked By**	**Approved By**	

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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 herein after.

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.

ENGINEERING STANDARD

GAIL INDIA LIMITED

TECHNICAL SPECIFICATION FOR PIPE

GAIL-034-PI-DOC-TS-011

0	30.12.19	Issued For Review	AP	JR	TR	
Rev	Date	Purpose	Prepared By	Checked By	Approved By	

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1. SCOPE

This General Specification defines minimum requirements for the manufacture of line pipes for use in oil / gas operations under non-sour service applications.

This specification is based on API Specification 5L, latest edition and shall be read in conjunction with that document. Clause 4.0 of this Technical Specification makes restrictive amendments to API Specification 5L.

The manufacturer(s) shall have valid license from API authorities to manufacture pipes as per API 5L. The Contractor shall submit to the Company, a copy of valid API 5L license of the manufacturer, prior to procurement. All pipes procured shall be in accordance with this General Specification and shall comply with the requirements of API Specification 5L, as amended and supplemented herein.

2. CODES, REGULATIONS AND STANDARDS

2.1 The Contractor / Vendor shall meet or exceed the requirements of the latest edition of the following codes, regulations and standards, except as superseded herein. In case of more than one code, regulation or standard apply to the same condition most stringent shall be followed.

- American Petroleum Institute (API)

-API Spec 5L (Latest Edition)	Specification for Line Pipe.
-API RP 5L1	Recommended Practice for Railroad Transportation of Steel Line Pipe.
-API Std. 1104	Welding of Pipeline and Related Facilities

- American Society of Mechanical Engineers (ASME)

- ASME B 31.3	Chemical Plants and Petroleum Refinery Piping
- ASME B 31.4	Pipeline Transportation System for liquid Hydrocarbon and other liquids
- ASME B 31.8	Gas Transmission and Distributor Piping systems.

- American Society for Testing and Materials (ASTM)

- ASTM A 370	Standard Test Methods and Definitions for Mechanical Testing of Steel Products
- ASTM E 112	Standard Test Methods for Determining Average Grain Size

- International organization for standardization (ISO)

- ISO 19232	Non-destructive testing -- Image quality of radiographs
- ISO 2566 -1	Steel, Conversion of Elongation Values Part 1 Carbon and low alloy steels.
- ISO 9712	Non-destructive Testing: Qualification and Certification of Personnel
- ISO 10474	Steel and Steel products inspection documents

- Oil Industry Safety Directorate (OISD)

-OISD 141	Design and Construction Requirement for Cross Country Hydrocarbon Pipelines.
-OISD 226	Natural Gas Transmission Pipelines and City Gas Distribution Networks.

2.2 Any deviation from this specification must be approved by the Company prior to the commencement of any work.

3. INFORMATION TO BE SUPPLIED BY THE PURCHASER

TABLE: 3.1

Sl.	Information	Reference
1.	Specification	API 5L latest edition
2.	Product Specification Level	PSL - 2
3.	Outside diameter (mm)	
4.	Quantity (mtrs.)	
5.	Grade	
6.	Manufacturing Process	Seamless/LSAW
7.	Wall thickness (mm)	
8.	Nominal length (mtrs)	Minimum length: 11.5 m Maximum length: 12.5 m Minimum Average length: 12.0 m **Jointers shall not be permitted.**
9.	Delivery Date	

4. AMMENDMENTS / SUPPLEMENTS TO API 5L (LATEST EDITION)

TABLE: 4.1

API Spec 5L reference		*Amendment / Supplement*
Section	**Clause**	
1 Scope	**Add new clause**	***Quality System*** *The line pipe manufacturer shall establish and maintain a quality assurance system in accordance with ISO 9001: 2000 or an equivalent. The Company shall have the right to undertake such audits as it deems necessary to assess the effectiveness of the manufacturer's quality system.*
	Add new clause	***Compliance*** *This specification adopts sampling as a method to determine batch compliance. Nevertheless the manufacturer is responsible to ensure and certify that all pipes meet the requirements of this specification.*
8. Manufacturing	**8.11 Jointers**	*Add to the existing clause:* *Jointers shall not be supplied.*
9.11 Dimensions, mass and tolerances	9.11.3.1	*Delete existing clause and replace with:* *The tolerance in diameter[d] shall be as follows:* *For all pipe size (between 6" to 24") tolerance shall be ± 0.0075D but maximum of ± 3 mm.* *The out of roundness tolerance shall be as follows:* *Pipe except the end[a] 0.020D* *Pipe end[a,c] 0.005D*
	9.11.3.2 Wall Thickness	*Negative tolerance is not permitted.* *The tolerance on specified wall thickness shall be +15% and -0%.*
	9.11.3.3 Length	*Tolerance on length shall be as indicated below:* *Minimum Length: 11.5 m* *Maximum Length: 12.5 m* *Average Length:12.00 m*

12 Coatings and thread protectors	12.2 Thread Protectors	Delete existing section & replace with the following: END PROTECTORS Suitable end caps shall be provided to protect the beveled ends.
Add New Section	First Day Production Tests	Pipe shall be selected on the basis of first day production results of the corresponding heat number.

Note:

1. *This specification is not applicable for sour service.*
2. *For gas service, the pipe shall also comply with Annex. G of API 5L.*

[a] *The pipe end includes a length of 100 mm (4.0 in) at each of the pipe extremities.*

[b] *Deleted.*

[c] *The diameter tolerance and the out of roundness tolerance shall be determined using the calculated inside diameter. The calculated inside diameter is defined as ID = (D-2t) (the specified outside diameter minus two times the specified wall thickness). Diameter measurements shall be taken at both ends of the pipe with a circumferential tape.*

[d] *For determining compliance to the diameter tolerance. The pipe diameter is defined as the circumference of the pipe in any circumferential plane divided by Pi (π)*

5. DOCUMENTATION

In addition to the documents specified at clause no.13 of API 5L and elsewhere in the Bid Document, the Contractor shall obtain and furnish from the manufacturer(s), the complete record of pipes, including purchase order numbers, lists of pipe produced with identification numbers, heat numbers, dimensions, individual pipe lengths, certificates for mill test & third party inspection reports etc.

6. WARRANTY

The Contractor/Vendor shall have final and total responsibility for the design, fabrication and performance of all items supplied under this specification.

The Contractor/ Vendor shall warrant the items furnished by him and the performance of the said items in accordance with this specification and with warranty requirements as specified in the bid package.

ANNEXURE 1 - FIRST DAY PRODUCTION TESTS

Two length of completely finished pipes (in case of only one heat on first day) or two length from the first two heats i.e. one pipe from each heat (in case of more than one heat on first day) of first day's production shall be selected at random for testing to verify that the manufacturing procedure results in the quality of pipes which are in complete compliance with this specification. The pipes thus tested shall be considered to be the test pipes required per heat per lot as per relevant clauses of this specification

These first day's production tests shall be repeated upon any change in the manufacturing procedure or any change in the source of raw material as deemed necessary by the Company's Representative. The first day production test shall be carried out on pipes for each wall thickness, each diameter and each grade of steel.

The contractor shall submit to Company a report giving the results of all tests mentioned below. The report shall be agreed and signed by Company's representative, prior to start of regular production.

In the event of small quantities of pipes ordered against this specification, and like those for bends and other similar applications, as specifically called out in the Purchase Order, the first day production test shall not be carried out. Pipes in such case shall be accepted based on regular production tests. However, the pipes for regular production tests shall be so chosen as the same has satisfied first day production requirements.

The various tests to be conducted on pipe (for the first day production tests) shall be as follows. The test method and acceptance values shall be as per this specification unless specified differently in this Annexure.

a. Visual Examination

All pipes shall be examined visually for dimensional tolerances and apparent surface defects.

b. Ultrasonic Examination

The weld seam were applicable of all pipes shall be examined ultrasonically by automatic ultrasonic equipment. If an automated ultrasonic or electromagnetic inspection system is applied, the weld at any pipe ends that are not covered by the automated inspection system shall be inspected for defects by the manual or semi-automatic ultrasonic angle beam method or by the radiographic method, whichever is appropriate.

c. Mechanical Properties

The mechanical properties of all pipes shall be tested and shall meet the requirements of this specification. The company's representative / TPI will select the places in pipe from where the test specimen shall be removed. The following tests shall be conducted:

i. Two flattening test specimen shall be removed; one specimen shall be tested with weld at 0^0 and other at 90^0.

ii. Two transverse base metal specimens and two transverse weld specimens for tensile test shall be tested. In case transverse base metal specimen is not applicable as per API 5L, longitudinal specimen may be taken.

iii. Six weld cross-section specimens, three from each end of the pipe joint, shall be taken for metallographic examination. Two of these specimens shall be tested for hardness at room temperature after etching.

iv. Fracture toughness testing specimen shall be extracted as follows:

a. Four sets of three transverse specimens each from base metal.
b. One set of 3 transverse specimens with weld in middle.
c. One set of 3 transverse specimens with HAZ in middle.

The base metal specimens shall be tested at -40, -10, 0, +20 ^{0}C for shear area and absorbed energy to produce full transition curve.

v. At points selected by Purchaser twelve (12) Drop Weight tear test specimens shall be removed from base metal in a transverse direction. The sets of 3 base metal specimen shall be tested at -40,-10, 0, +20 ^{0}C for shear area to produce full transition curve.

vi. Four weld guided bend test specimen (only for LSAW) transverse to longitudinal weld shall be removed. Of the four specimens, two specimens shall be used for face bend test and two for root bend test.

d. In addition, all the tests and inspections required to be conducted as per API 5L shall be conducted on all the pipes selected for testing during first day production test.

e. The Contractor/vendor would submit proposal in the specific project to comply to requirements for clients approval.

ENGINEERING STANDARD

GAIL INDIA LIMITED

TECHNICAL SPECIFICATION FOR PAINTING
GAIL-034-PI-DOC-TS-012

0	30.12.2019	Issued for Tender	AP	JR	SB	
Rev	**Date**	**Purpose**	**Prepared By**	**Checked By**	**Approved By**	

TABLE OF CONTENTS

1.0 GENERAL

1.1 These technical specifications shall be applicable for the work covered by the contract, and without prejudice to the provisions of various codes of practice, standard specifications etc. It is understood that contractor shall carry out the work in all respects with the best quality of materials and workmanship and in accordance with the best engineering practice and instructions of Engineer-In-Charge.

Wherever it is stated in the specification that a specific material is to be supplied or a specific work is to be done, it shall be deemed that the same shall be supplied or carried out by the contractor. Any deviation from this standard without written deviation permit from appropriate authority will result in rejection of job.

1.2 SCOPE

1.2.1 Scope of work covered in the specification shall include, without being limited to the following.

1.2.2 This specification defines the requirements for surface preparation, selection and application of primers and paints on external surfaces of equipment, vessels, machinery, piping, ducts, steel structures, external & internal protection of storage tanks for all services, MS Chimney without Refractory lining and Flare lines etc. The items listed in the heading of tables of paint systems is indicative only, however, the contractor is fully responsible for carrying out all the necessary painting, coating and lining on external and internal surfaces as per the tender requirement.

1.2.3 Extent of Work

1.2.3.1 The following surfaces and materials shall require shop, pre-erection and field painting:

a. All uninsulated C.S. & A.S. equipment like columns, vessels, drums, storage tanks(both external & internal surfaces), heat exchangers, pumps, compressors, electrical panels and motors etc.

b. All uninsulated carbon and low alloy piping, fittings and valves (including painting of identification marks), furnace ducts and stacks.

c. All items contained in a package unit as necessary.

d. All structural steel work, pipe, structural steel supports, walkways, handrails, ladders, platforms etc.

e. Flare lines, external surfaces of MS chimney with or without refractory lining and internal surfaces of MS chimney without refractory lining.

f. Identification colour bands on all piping as required including insulated aluminium clad, galvanised, SS and nonferrous piping.

g. Identification lettering/numbering on all painted surfaces of equipment/piping insulated aluminium clad, galvanized, SS and non-ferrous piping.

h. Marking / identification signs on painted surfaces of equipment/piping including hazardous service.

i. Supply of all primers, paints and all other materials required for painting (other than Owner supplied materials)

j. Over insulation surface of equipments and pipes wherever required.

k. Painting under insulation for carbon steel, alloy steel and stainless steel as specified.

l. Painting of pre-erection/fabrication and Shop primer.

m. Repair work of damaged pre-erection/fabrication and shop primer and weld joints in the field/site before and after erection as required.

n. All CS Piping, equipments, storage tanks and internal surfaces of RCC tanks in ETP plant.

1.2.3.2 The following surfaces and materials shall not require painting in general. However, if there is any specific requirement by the owner, the same shall be painted as per the relevant specifications:

a. Uninsulated austenitic stainless steel.
b. Plastic and/or plastic coated materials
c. Non-ferrous materials like aluminum.

1.2.4 Documents

1.2.4.1 The contractor shall perform the work in accordance with the following documents issued to him for execution of work.

a. Bill of quantities for piping, equipment, machinery and structures etc.
b. Piping Line List.
e. Painting specifications including special civil defence requirements.

1.2.5 Unless otherwise instructed, final painting on pre-erection/ shop primed pipes and equipments shall be painted in the field, only after the mechanical completion, testing on systems are completed as well as after completion of steam purging wherever required.

1.2.6 Changes and deviations required for any specific job due to clients requirement or otherwise shall be referred to J P Kenny for deviation permit.

2.0 CODES & STANDARDS

Without prejudice to the specifications of the contract, the following codes and standards shall be followed for the work covered by this contract.

IS: 5	Colors for ready mixed paints and enamels.
IS: 101	Methods of test for ready mixed paints and enamels,
IS: 161	Heat resistant paints.
IS: 2074	Specifications for ready mixed paint, red oxide zinc chrome priming.
IS: 2339	Aluminum paint for general purposes in dual container.
IS: 2379	Color code for identification of pipelines.
IS: 2932	Specification for enamel, synthetic, exterior (a) undercoating. (b) Finishing.

3.0 CONDITIONS OF DELIVERY

Packaging

Every recipient will be fitted with a hermetically-sealed lid with an opening that is sufficiently large to allow the contents to be stirred: the outside and inside are protected against oxidation, and, the lid, are marked with a strip of color identical to the contents.

4.0 COMPOSITION OF THE PAINT PRODUCTS USED

a) Quality

The composition and quality of the products may not differ from batch to batch. A batch is all of the products of a specified manufacture. If the analyses of products bring to light that the composition does not conform to the specifications of the paint manufacturer, the

OWNER may refuse to use this batch of products. The paint products must comply with the following conditions

- They must have the viscosity necessary for the described use and the established condition: use of the brush - paint roller (spray gun only for special cases and in the workshop)

b) Quality control - Sampling

While the works are in progress on the construction site, the OWNER may carry out sampling on the paint being used for the purpose of checking conformity. The paint products must be made available free of charge to the laboratory or the approved supervisory body in sufficient quantities so that all the tests can be carried out on the same batch.

If analyses reveal a non-conformity in the composition of the products used (tolerance of $\pm$ 3 % of the dosage of every component), the OWNER may refuse application of the product under consideration, halt the work and have the nonconforming product already applied removed.

Before proceeding the work, a product that does conform will be required. The only Purpose of the analysis is to reveal any nonconformity of the composition of the products. Their purpose is therefore not to assess the quality of the different components. The analyses concerned are not acceptance tests of the products supplied and in no way affect the obligations of the contractor specified in the contract towards the OWNER.

5.0 IDENTIFICATION

Every recipient will bear the following information:

- Name of the manufacturer
- Date and number of manufacture
- Name of the product type
- Batch no
- Net weight of the produced or the contents of the recipient
- Date of the expiry.

At the time of delivery, this packaging must bear labels in conformity with the legal stipulations in force.

Leaving the site after work

After completion of a job a general clean-up shall be carried out by the Contractor to remove all debris, materials or irregularities that his work has brought to the site so that it is left tidy:

The restoration work includes among other things:

- the removal of abrasives.
- the removal of the different protective coverings.
- the Contractor will make the required repairs to any damage after refitting the supports.
- the removal of paint and cleaning of the stains on the floor.

6.0 SURFACE PREPARATION STANDARDS

Following standards shall be followed for surface preparations:

1 Swedish Standard Institution- SIS-05 5900-1967

2 Steel Structures Painting Council, U.S.A. (Surface Preparation Specifications (SSPC-SP)

3 British Standards Institution (Surface Finish of Blast-cleaned for Painting) BS-4232.

4 National Association of Corrosion Engineers. U.S.A. (NACE).

5. IS-1477-1971 (Part-1) - Code of Practice for Painting of Ferrous metals in Buildings. (Part 1, Pre-treatment)

a) The contractor shall arrange, at his own cost to keep a set of latest edition of above standards and codes at site.

b). The paint manufacturer's instruction shall be followed as far as practicable at all times. Particular attention shall be paid to the following:

- Proper storage to avoid exposure as well as extremes of temperature.
- Surface preparation prior to painting.
- Mixing and thinning.
- Application of paints and the recommended limit on time intervals between coats.

c) Any painting work (including surface preparation) on piping or equipment shall be commenced only after the system tests have been completed and clearance for taking up painting work is given by the OWNER, who may, however, at his discretion authorize in writing, the taking up of surface preparation or painting work in any specific location, even prior to completion of system test.

7.0 PREPARATION OF THE SURFACES

7.1 General Specifications

The cases that occur in practice on building sites, with regard to painted surfaces, can be broken down as follows:

- Material of which the oxide content disappears by natural oxidation.
- Material that has already been covered with a layer of paint in the workshop.
- Material that is covered with old paint layers that show different degrees of weathering.

Good preparation oldie surface is the best guarantee for good anti-corrosion protection.

Paintwork may never begin until the surface to be treated is dry and is independent of the base coat and cleared of dirt, dust, rust, scale, grease, salt attack, cement powder, cement mud-scale, sand, oil, etc.

Based on the environmental conditions of coastal and saline nature, the Painting specification for station pipes defines the complete requirements like:

- Surface preparation standards like NACE etc.
- Sand blasting process
- Color Codes for piping

- Paint materials types and their DFT measurement.
- Selection and application of paints on external surfaces.

The pipeline passes through the coastal and marine environment, the **Table-4** of this specification to be followed for the painting works.

The method of preparation of the surface will be implemented in accordance with the preparation methods described below:

- Cleaning (bright blast-cleaning);
- Mechanical cleaning;
- Manual derusting.

The Contractor should have the required material at his disposal to clean the surfaces to be coated thoroughly in accordance with the preparation methods regardless of the form or the condition of such surfaces. The cleaning devices that might be damaged during the surface preparation shall be screened off by the Contractor.

7.2 Sandblasting

Before beginning cleaning by blasting, the person carrying out the work will take the following measures:

- Clear the steel surface of oil and/or grease;
- Ensure that each flange collar (section where the sealing is applied) is properly screened off against the blasting and the subsequent works;
- Check that no blasting grains can act into the pipes during this process. Any openings not sealed off must be screened off;
- Where there are valves, regulators and other devices, the manufacturer's identification plate will be dismantled so that all surfaces can be treated. The plate will then be put back again.
- Screen off all non-metal structures such as rubber where there is a filter;
- With valves, operators and other devices, care should be taken to ensure that no metal filings or paint get into the apparatus:
- The OWNER reserves the right to carry out part or all of these works himself.

To prevent rust forming quickly as the result of humidity on the blasted surface, cleaning by blasting may only be carried out when the temperature of the steel surface is at least 3°C higher than the dew-point of the ambient air.

Blasting may not be carried out if the relative degree of humidity exceeds 80%. The choice of the type of blasting medium used depends on local circumstances such as the possible presence of gas and the material to be blasted.

The abrasive to be used must conform to the local low i.e. it may contain no carbon and less than 1% free silicon dioxide. The Sa 3 will always be requested and must at least reach Sa 2½ during the initial stage of the paintwork. For blasting followed by metallisation, the surface preparation degree to be achieved is always Sa 3. The degree of cleanliness to be obtained will be inspected in accordance with the Swedish standard SVENSK STANDARD ISO 8501-1-1988 SS 05.5900.

- Sa 3: surface blasted down to the bare metal; when the surface is inspected with a magnifying glass, scale, rust and foreign bodies must be completely removed and it should be possible to raise a metallic -shine on the treated surface.

- Sa 2 1/2: blasted very carefully. Scale, rust and foreign bodies must be removed in such a way that anything left behind will only be visible as nuances (shading) or strips.

The blast-cleaning will be carried out by means of compressed air free of water and oil.

After the blasting and before painting, the surface should be completely cleaned of blasting material and so forth with a soft brush, a dry cloth or dry compressed air.

7.3 Mechanical cleaning

If sandblasting is not permitted or if the metal structures are not easily accessible for blasting or blasting for one reason or another is technically unfeasible, mechanical derusting can be used instead. With mechanical cleaning by means of chipping, rotating steel brushes and sanding discs, a degree of cleanliness St. 3 should be reached.

St 3 : removal of the old paint layers of which the adhesion leaves something to be desired and/or of which the paint layer no longer fulfils the requirements.

If parts are present that are so corroded that St 3 is difficult to achieve, this should be notified to the OWNER representative prior to the start of the works.

N.B:

St. 3 : means removal of every old paint layer. Retouching means local polishing with St. 3 or Sa 3 followed by application of the desired painting system.

After mechanical cleaning, the surface should be made dust-flee with a cloth or a so brush, washed with an organic solvent and thoroughly dried off with a dry cloth (e.g. with 1.1.1. Trichoroethane such as Solvethane, Chloroethene).

7.4 Manual Derusting

Manual derusting with the aid of scrapers. steel brushes, sandpaper etc. shall only be permitted in exceptional cases for local repairs. Any deviation there from must be requested from the OWNER/ OWNER 's Representative.

With manual derusting, a surface preparation degree St 3 must be obtained. The length of the handles of the equipment used may not exceed 50 cm.

7.5 Preparation of a surface covered with a layer of paint in the workshop.

This layer is in general applied by the manufacturer, for example, on valves, regulators etc. Layers of this kind will be checked for their proper adhesion in accordance with ASTM D 3359, method A (Standard Test Method for measuring adhesion by tape test). The adhesion should be at least .

If the paint layer shows less adhesion or is incompatible with the rest of the system it should be completely removed. If the paint layer is not removed, the Contractor accepts it in the state in which the coating is found and the guarantee remains in force. The adhesion does not have to be examined if system 63 has already been applied in the workshop on behalf of the OWNER.

The Contractor, who must provide for the protection on the construction site, must therefore obtain the information regarding the treatment of the surface and the quality of the paint that was used and must, moreover, examine the adhesion of the layer on the construction site, the percentage of damage and weathering as well as the value of the preparation of the surface in the workshop together with the thickness thereof that must be supplemented if necessary.

a) Galvanized surface

Galvanized surfaces, both old and new will be carefully roughened up. Every foreign body (concrete splatters, chalk marks, grease and oil stains, etc.) will be removed. Thereafter, rub the surfaces with abundant water and, if necessary, with cleaning products.

To this end, nylon brushes will be used for every kind of dirt as well as for removing zinc salt residue. Thereafter, the surfaces will be treated in accordance with system 21. Where the zinc layer is lacking, it will be derusted manually to a degree of cleanliness St 3, after which a primer coat will be applied in accordance with system 22.

b) Metallised surfaces treated with an impregnation layer

- degrease with the desired degreasing product:
- clean under high pressure or with a product prescribed by the paint supplier.

If the paint layer adheres well and is applied on a clean base, the painting system described may be continued. If the percentage of damage and weathering does not exceed 5 % m. retouching may be considered. These partial repairs will be carried out.

If on the other hand, the percentage of damage does exceed 5 %/m or if the layer applied in the workshop comes loose the Contractor must draw the attention of the OWNER to this and carry out the complete application system.

7.6 Preparation of surfaces covered with earlier paint layers that show different degrees of weathering.

If the surfaces do not show deep weathering limited to the spread of rust by small pitted areas or non-penetrative rust in spots, it will very often be sufficient to clean the surfaces with abrasives or with an abrasive disc, then to rub them down with steel wool, remove the dust and wash off. If thick rust appears, in spots, scale rust and active rust canker, this should be removed with needle hammers or stripped away directly by blasting, removing the dust and washing oft.

7.7 Preparation of concrete or cement plaster surfaces

Remove unsound paint layers and loose components with scrapers, blades or rotating steel brushes. Thoroughly clean the entire surface with water containing ammonia. Thoroughly remove moss, algae and fungal growths. Where these growths have been removed, treat the area with a fungicide in accordance with the instructions for use.

Once the entire area is completely dry, brush off the dead residue of moss, algae and fungus with a hard brush. In the case of reinforcement steel that has been laid bare, remove as rust, dust and grease as possible and treat with a printer coat. When painting concrete surfaces, they must first be checked for cracks. Cracks larger than 0.3 mm must be repaired with an appropriate system in accordance with the type and extent of the repairs (e.g. injection with epoxy mortar). Repair damage such as cracks and bursts to concrete parts with a two-component mortar or preferably with micro-mortars. Finally check the alkalinity of the surface with the aid of litmus paper and neutralize it if necessary.

7.8 Use of solvents

It is sometimes necessary to use solvents when the surfaces to be painted are streaked with grease or oil. In this case a suitable organic solvent should be applied. The operation should be carried out with the aid of clean brushes or rags and clean solvent.

All the legal specifications in connection with solvents etc. must be adhered to. The OWNER/OWNER's Representative will be informed in advance of any toxicity or flammability. All measures must be taken to prevent any risk of fire and to nick out any possibility of poisoning (ventilation). The Contractor will provide drip collectors to keep the environment free of pollution.

7.9 Condition of the metal after stripping

The Contractor must call in a representative of the OWNER/OWNER's representative or of the Approved supervisory Body responsible for checking the condition of the metal during stripping and informing the OWNER/OWNER's representative immediately of any damage that he might have noticed.

- Deep corrosion of the plates - rivets - bolts
- Faulty welding

- Fittings that appear to be dangerous because of their age.

7.10 Removing coating from surface pipelines

The Contractor must have the equipment necessary for the removal of asphalt from the pipe without damaging the latter (scratching, impact, etc,). The Contractor undertakes to carry out the work in accordance with an approved procedure.

8.0 METALLISATION

8.1 Applying the metallisation

Metallisation must be carried out in accordance with ISO 2063,

Metallisation is carried out as rapidly as possible after blasting in order to limit corrosion of the pipes (max. 3 hours later). With metallisation, a surface preparation degree Sa 3 is compulsory. The roughness of the blasted surfaces should be from 25 to 50µ R_{Max}.

- The metallising is always carried out on dry parts in good weather conditions (maximum relative humidity 80 %);
- For metallisation, a wire composed of 85 % zinc and 15 % aluminum with a minimum guaranteed degree of purity of 99.5 % is used (subject to other specifications). The application thereof is always carried out in accordance with the conditions of the manufacturer and may at all times be submitted to the OWNER's representative.
- The sealant should be applied maximum 3 hours alter metallisation.
- The sealant must be thinned and applied as per the present specifications. A visual inspection whereby the sealant completely covers the metallisation will suffice here.
- When evaluating the metallisation, a negative deviation from the minimum coating thickness, to 80 µ for 20% of the measurements will be permitted.

9.0 CARRYING OUT THE PAINTWORK

9.1 Conditions for carrying out paintwork

Painting may not be carried out in unsuitable conditions.

All preparatory work and painting may only he carried out in dry weather and at a minimum temperature of 10°C, except for special eases requested by the OWNER's Representative.

Unless otherwise stipulated in the specifications of the paint supplier, application of the paint is forbidden if it is forecast that the temperature will fall to below 0°C before the paint is dry. The temperature of-the surface to be painted must be at least 3°C higher than the dew point of the ambient air. Application of the paint is also not permitted if there is a danger that the coat of paint will not be dry before dew or condensation sets in.

The work must be stopped:

- If the temperature of the surface to be painted is higher than that described by the supplier.
- In rain, snow, mist or fog or when the relative humidity is higher than 80 %.

Coats that have not yet dried and have been exposed to frost, mist, snow or rain and might thereby be damaged must be removed after drying and the surfaces must be repainted at the expense of the Contractor.

Working in direct sunlight or in hot weather must be avoided,

The first coat of paint must be applied maximum 3 hours after the preparation of the surface of the relative humidity of the air is between 50% and 80%. This time span may be increased to 6 hours if the relative humidity is less than 50%. In all cases, the preparation of the surface must exhibit degree Sa 3 and at the very least the appearance of degree Sa 2 ½ at the time of painting.

The coats of paint may only be applied on carefully cleaned surfaces that must be dry and free of grease and dust.

9.2 Special conditions

Painting may be carried out when the Contractor can be sure that the instructions of the paint supplier have been scrupulously followed with regard to the parameters in the following (non-exhaustive) list:

- Ambient temperature.
- Surface temperature.
- Relative humidity.
- Dew point.
- Drying times.

The Contractor must in this respect be able to produce the instructions for the paint on the site. The OWNER/CONSULTANT will guarantee 100% supervision in this regard during the execution of the work.

In addition, the paintwork may only be carried out to a minimum ambient temperature of 5°C and/or to a maximum relative degree of humidity of 85 %. Application of the paint is also not permitted if there is a danger that the coat of paint will not be dry before dew or condensation sets in.

9.3 Paint Materials

Manufacturers shall furnish the characteristics of all paints indicating the suitability for the required service conditions. Primer and finish coats shall be of class-I quality and shall conform to the following:

Primer (P-1)

Red oxide Zinc Chromate Primer

Type and Composition	Single pack, Modified phenolic alkyd medium pigmented with red oxide and zinc chromate.
Volume solids	30 - 35%
DFT	25 microns/coat (min)
Covering capacity	12-13 M²/Lit/coat

Primer (P-2)

High build chlorinated rubber zinc phosphate primer

Type and Composition	Single pack, Chlorinated rubber medium Plasticised with unsaponifiableplasticiser pigmented with zinc phosphate
Volume solids	35- 40%
DFT	50 MICRONS/COAT (MIT)
Covering capacity	7-8 M²/Lit/Coat

Primer (P-3)

High build zinc phosphate primer

Type and Composition	Single Pack, Synthetic medium, pigmented with zinc phosphate.
Volume solids	40-45%
DFT	35-50 microns/coat
Covering capacity	10-12 M²/Lit/coat
Heat resistance	Upto 100º C (dry)

Primer (P-4)

Etch Primer / Wash Primer

Type and Composition	Two pack Poly vinyl butyral resin medium cured with phosphoric acid solution pigmented with zinc tetroxy chromate.
Volume solids	7-8%
DFT	8-10 microns/coat
Covering capacity	7-8 M²/lit/coat

Primer (P-5)

Epoxy Zinc Chromate Primer

Type and Composition	Two pack, Polyamide cured epoxy resin medium pigmented with zinc chromate.
Volume solids	40%(min)
DFT	35 microns/coat (min)
Covering capacity	11-12 M2/lit/Coat

f) Primer (P-6)

Epoxy Zinc Phosphate Primer

Type and Composition	Two pack, Polyamide cured Epoxy resin medium pigmented with zinc phosphate.
Volume solids	40% 35 microns / coat (min)
Covering capacity	11-12 M²/lit/coat

g) Primer (P-7)

Epoxy high build M10 Paint (Intermediate Coat)

Type and composition	Two pack Poly Polyamide cured epoxy resin medium pigmented with micaceous iron oxide. Volume solids 7-8%

Volume Solids	50%
DFT	100 microns/coat (min)
Covering capacity	5.0 M²/lit/coat

h) Primer (P-8)

Epoxy Red Oxide zinc phosphate primer

Type and Composition	Two pack. Polyamine cured epoxy resin pigmented with Red oxide and Zinc phosphate.
Volume solids	42%
DFT	30 microns/coat (min)
Covering capacity	13-14 M/lit/coat

i) Primer (P-9)

Epoxy based tie coat (suitable for conventional alkyd based coating prior to application of acrylic polyurethane epoxy finishing coat)

Type and Composition	Two pack, Polyamide cured epoxy resin medium suitably pigmented.
Volume solids	50-60%
DFT	50 microns/coat (min)
Covering capacity	10-12 M²/Lit/Coat

j) Finish Coats (F-1)

Synthetic Enamel

Type and Composition	Single pack, Alkyd medium pigmented with superior quality water and weather resistant pigments
Volume solids	30-40%
DFT	20-25 microns/coat
Covering capacity	16-18 M/²lit/Coat

k) Finish coat (F-2)

Acrylic Polyurethane paint

Type and Composition	Two pack, Acrylic resin and iso-cyanate hardener suitably pigmented.
Volume Solids	40% (min)
DFT	30-40 microns / coat
Covering Capacity	10-12 M²/lit/ coat

l) Finish Coat (F-3)

Chlorinated Rubber Paint

Type and Composition	Single pack, Plasticised chlorinated rubber medium with chemical & weather resistant pigments.
Volume solids	30%
DFT	30 microns/coat (min)
Covering capacity	1 0.0 M² / lit /coat

m) Finish Coat (F-4)

High build chlorinated rubber M10 paint.

Type and Composition	Single pack Chlorinated rubber based high build pigmented with micaceous iron oxide.
Volume solids	40-50%
DFT	65-75 microns/coat
Covering capacity	6.0-7.0 M² / lit / coat

n) Finish coat (F-5)

Chemical Resistant Phenolic based Enamel

Type and Composition	Single pack phenolic medium suitably pigmented.
Volume solids	35-40%
DFT	25 microns/ coat
Covering capacity	15.0 M² /lit/ coat

o) Finish Coat (F-6)

Epoxy High Building Coating

Type and Composition	Two pack. Polyamide cured epoxy resin medium suitably pigmented.
Volume solids	60-65%
DFT	100 microns/coat (min)
Covering capacity	6.0-6.5 M² / lit / coat

p) Finish Coat (F-7)

High build Coal Tar Epoxy

Type and Composition	Two pack, Polyamine cured epoxy resin blended with Coal Tar.
Volume solids	65% (min)
DFT	100-125 microns/coat

Covering capacity	6.0-6.5 M² / lit / coat

q) Finish Coat (F-8)

Self-priming epoxy high build coating (complete rust control coating)

Type and Composition	Two packs. Polyamide-amine cured epoxy resin suitably pigmented. Capable of adhering to manually prepared surface and old coatings.
Volume solids	65-80%
DFT	125-150 microns/coat
Covering capacity	4-5 M² / lit / coat

r) Finish Coat (F-9)

Inorganic Zinc Silicate coating

Type and Composition	Two pack , Self cured Ethyl silicate solvent based Inorganic Zinc coating.
Volume solids	60% (min)
DFT	65-75 microns/coat
Covering capacity	8-9 M² / lit / coat

h) Finish coat (F-10)

High build Black

Type and Composition	Single pack. Reinforced bituminous composition phenol based resin.
Volume solids	55-60%
DFT	100 microns/coat (min)
Covering capacity	5.50-6.0 M ²/ lit / coat

t) Finish Coat (F-11)

Heat Resistant Aluminium Paint Suitable up to 250°C.

Type and Composition	Duel container (paste & medium). Heat resistant spec varnish medium combined with aluminium flakes.
Volume solids	20-25%
DFT	20 microns/coat (min)
Covering capacity	10-12 M² / lit/ coat

u) Finish Coat (F-12)

Heat Resistant Silicon Paint suitable up to 400º C.

Type and Composition	Single pack Silicone resin based with aluminium flakes.

Volume solids	20-25%
DFT	20 microns/coat (min)
Covering capacity	10-12 M²/lit/coat

v) Finish Coat (F-13)

Synthetic Rubber Based Aluminium Paint Suitable up to 150°C.

Type and Composition	Single Pack, Synthetic medium rubber medium combined with leafing Aluminium,
DFT	25 microns/coat
Covering capacity	9.5 M² /lit/ coat

Notes

1 Covering capacity and DFT depends on method of application Covering capacity specified above is theoretical. Allowing the losses during application, min specified DFT should be maintained.

2. All paints shall be applied in accordance with manufacturer's instructions for surface preparation, intervals, curing and application. The surface preparation quality and workmanship should be ensured.

3. Selected chlorinated rubber paint should have resistance to corrosive atmosphere and suitable for marine environment,

4 All primers and finish coats should be cold cured and air-drying unless otherwise specified.

5. Technical data sheets for all paints shall be supplied at the time of submission of quotations.

6. In case of use of epoxy tie coat, manufacturer should demonstrate satisfactory test for inter coat adhesion. In case of limited availability of epoxy tie coat (P-9) alternate system may be used taking into the service requirement of the system.

7. In case of F-6, F-9, F-1 1 & F-1 2 Finish Coats, No Primer are required.

MANUFACTURERS

The paints shall conform to the specifications given above and Class-I quality in their products range of any of the-following manufacturers:

i) Asian Paints (India) Ltd,
ii) Bombay Paints
iii) Berger Paints India ltd.
iv) Gaodlass Nerolac Paints Ltd.
v) Jenson & Nicholson
vi) Shalimar Paints

STORAGE

All paints and painting material shall be stored only in rooms to be provided by contractor and approved by OWNER/ OWNER 's Representative for the purpose. All necessary precautions shall be taken to prevent fire. The storage building shall preferably be separate from adjacent, building.

A signboard bearing the words given below shall be clearly displayed outside:
PAINT STORAGE No NAKED LIGHT highly -inflammable

COLOR CODE FOR PIPING:

i) For identification of pipelines, the color code as per Table -1 shall be used.

ii) The color code scheme is intended for identification of the individual group of the pipeline. The system of color coding consists of a ground color and color bands superimposed on it.

iii) Colors (Ground) as given in Table-2 shall be applied throughout the entire length of uninsulated pipes, on the metal cladding & on surfaces. Ground color coating of minimum 2m length or of adequate length not to he mistaken as color band shall be applied at places requiring color bands. Color bands shall be applied as per approved procedure.

V) Line coating shall meet DIN 30670 standard for external coating and API 5L RP – 2 for internal coating.

VI) The thickness for the epoxy should be 180 microns, adhesive 200 microns and balance should be PE

VII) The minimum coating thickness on weld seam shall be 3.2 mm and minimum coating thickness on body should be 3.2.

VIII) Minimum thickness for liquid epoxy for internal coating should be 100 ± 20 microns. Max design temperature for coating should be considered +80 ºC

COLOR CODE:

A) Ball Valve (Above Ground) : Oxford Blue-RAL 5005, IS-519941005
B) Globe Valve (Above Ground) : Oxford Blue-RAL 5005, IS-519941005
C) Check Valve(Above Ground) : Oxford Blue-RAL 5005, IS-519941005
D) Launcher / Receiver : Yellow Golden
E) Jib Crane / Trolley : Yellow Golden
F) All underground valves shall have epoxy base coating after surface finish of SA 2:5
G) Valves and above ground pipes need to be properly blasted to achieve surface finish of Sa 2:5 before the application of paints.

IDENTIFICATION SIGN

i) Colors of arrows shall be black or white and in contrast to the color on which they are superimposed

i) Product names shall be marked at pump inlet, outlet and battery limit in a suitable size as approved by OWNER.

ii) Size of arrow shall be either of the following:

a) Color Bands

Minimum width of color band shall be as per approved procedure.

b) Whenever it is required by the OWNER to indicate that a pipeline carries a hazardous material, a hazard marking of diagonal stripes of black and golden, yellow as per IS:2379 shall be painted on the ground color.

IDENTIFICATION OF EQUIPMENT

All equipment shall be stenciled in black or white on each vessels, column, equipment, painting as per approved procedure.

INSPECTION AND TESTING

1. All painting materials including primers and thinners brought to site by contractor for application shall be procured directly from manufactures as per specifications and shall be accompanied by manufacturer's test certificates Paint formulations without certificates are not acceptable.

2. The painting work shall be subject to inspection by OWNER/ OWNER's Representative at all times. In particular, following stage wise inspection will be performed and contractor shall offer the work for inspection and approval at every stage before proceeding with the next stage.

In addition to above. record should include type of shop primer already applied on equipment e.g. Red oxide zinc chromate or zinc chromate or Red lead primer etc.

Any defect noticed during the various stages of inspection shall be rectified by the contractor to the entire satisfaction of OWNER/ OWNER's Representative before proceeding further. Irrespective of the inspection, repair and approval at intermediate stages of work. Contractor shall be responsible for making good any defects found during final inspection/guarantee period/defect liability period as defined in general condition of contract. Dry film thickness (DFT) shall be checked and recorded after application of each coat and extra coat of paint should be applied to make-up the DFT specified without any extra cost to OWNER.

PRIMER APPLICATION

i. The contractor shall provide standard thickness measurement instrument with appropriate range(s) for measuring.

   Dry film thickness of each coat, surface profile gauge for checking of surface profile in case of sand blasting. Holiday detectors and pinhole detector and protector whenever required for checking in case of immerse conditions.

ii. At the discretion of OWNER/ OWNER's Representative, contractor has to provide the paint manufacturers expert technical service at site as and when required. For this service, there should not be any extra cost to the OWNER.

iii. Final Inspection shall include measurement of paint dry film thickness, check of finish and workmanship. The thickness should be measured at as many points/ locations as decided by OWNER/ OWNER's Representative and shall be within +10% of the dry film thickness.

iv. The contractor shall produce test reports from manufacturer regarding the quality of the particular batch of paint supplied. The OWNER shall have the right to test wet samples of paint at random for quality of same. Batch test reports of the manufacturer's for each batch of paints supplied shall be made available by the contractor.

PAINT SYSTEMS

The paint system should vary, with type of environment envisaged in and around the plants. The types of environment as given below are considered for selection of paint system. The paint system is also given for specific requirements.

a) Normal Industrial Environment, Table 2.
b) Corrosive industrial Environment, Table3
c) Coastal & Marine Environment, Table 4

Notes 1. Primers and finish coats for any particular paint systems shall be from same manufacturer in order to ensure compatibility.

Table – 1

Colour Coding Scheme for Pipes and Equipment

Sl. No.	Content	Ground Color	First Color Band	Second Color Band
1	**COMPRESSED AIR**			
a)	Plant Air	Sky Blue	Silver Grey	-
b)	Instrument Air	Sky Blue	French Blue	-
2	*GASES*			
a)	Charge Gas	Canary Yellow	Signal Red	Smoke Grey
b)	Regeneration Gas	Canary Yellow	White	Dark Violet
c)	Residue Gas	Canary Yellow	White	French Blue
d)	LPG	Canary Yellow	Brilliant Green	White
e)	Acetylene	Canary Yellow	Dark violet	-
3	*ALL EQUIPMENT*			
a)	Such as vessels. columns, exchangers, etc. containing non-hazardous fluids.	Light Grey		
b)	All equipment containing hazardous fluids	Canary Yellow		
c)	Pipe carrying hazardous fluids	Bar is to be replaced by Hazardous Marking as per IS: 2379 Clause 7.1C		

Table 2

Normal Industrial Environment (Above Ground)

Sl. No.	Description	Temp. Range	Surface Preparation	Primer	Finish Coat	Total DFT	Remarks
1.0	**External surface of equipment's and piping.**						
1.1	-Do-	-10 to 20	SSPC-SP-3	One coat P-2 50 microns / coat (min)	One coat F-4 65 microns/ coat (min) Two coats F-3, 30 Microns/coat (min)	175	Primer and Finish coat can be applied at ambient temp.
1.2	-Do-	21 to 60	SSPC-SP-6	Two coats P-1, 25 microns/ coat (min.)	Two coats of F-1, 20 microns/coat (min)	90	-
1.3	-Do-	61 to 80	SSPC-SP-6	Two coats P-3, 50 microns/ coat (min)	Two coats of F-13, 25 microns/coat (min)	150	-
1.4	-Do-	81 to 250	SSPC-SP-6	Covered in Finish coat	Three coats of F-11, 20 microns/ coat (min)	60	Paint application at ambient temp. curing at elevated temp. during start-up.
1.5	-Do-	251 to 400	SSPC-SP-10	Covered in Finish coat.	Three coats of F-12, 20 microns/ coat (min)	60	-do-

Table- 3

Corrosive Industrial Environment (Above Ground)

Sl. No.	Description	Temp. Range	Surface preparation	Primer	Finish Coat	Total DFT	Remarks
1.0	**External surface of un-insulated and other equipment**						
I.1	- do -	-10 to 20	SSPC-SP-3	Two coat P-2, 50 microns) coat (min.)	Two coat F-3, 30 microns / coat (min.)	160	Primer and paint application at ambient temp.
1.2	- do -	21 to 80	SSPC-SP-10	Two coats P-5, 35 microns / coat (min.)	Two coats F- 6, 100 microns coat (min.)	270	Paint application at ambient temp.
I.3	- do -	81 to 400	SSPC-SP-3	Covered in finish coat	Three coats F- 12, 20 Microns / coat (min.)	60	Paint application. at ambient temp, and curing at 250'C for 4 hours,

Table – 4

Coastal and Marine Environment (Above Ground)

Sl. No.	Description	Temp. Range	Surface Preparation	Primer	Finish Coat	Total DFT	Remarks
1.0	**External surface of equipment's and piping.**						
1.1	-do-	-10 to 60	SSPC-SP-3	Two coats P-2, 50 micron/ coat (min)	Two coats F-3, 30 Microns/coat (min.)	160	Primer and Finish coat application at Ambient temp.
1.2	do -	61 to 80	SSPC-SP-10	Two coats P-5. 35 Microns. coat (Min.)	Two coats of F-6, 100 Microns/Coat (min.)	270	-do-
1.3	- do -	81 to 400	SSPC-SP-I0	One coat F-9, 83 Microns/ Coat(Min.)	-	85	Paint application at Ambient temp. Primer is acting as primer cum finish coat.
1.4	- do -	i) Upto 80	SSPC-SP-10	One coat F-9, 6.5 microns / coat (Min)	One coat of F-2. 30 Microns/coat (min.)	95	Paint application at ambient temp.
		ii) 8l to 400	SSPC-SP-10	-do-	-do-	85	Paint application at ambient temp. Primer is acting as primer cum finish coat.

1.9.4 Precautions to be taken

Neither the environment of the site nor the marking labels of devices may be covered with paint and they must be kept free of paint splashes. To this end, it is advisable to use removable masking tape.

Paint splashes, leaks, etc. on any adjacent installations such as measuring apparatus, valves, pipes. sources of light, insulation, heat insulators, walls, concrete, etc, must immediately be wiped up and the damage repaired before the paint is dry.

Otherwise, the OWNER will be obliged to have the cleaning carried out at the expense of the Contractor. The paint recipient will only be opened at the time of use (unless otherwise specified by the manufacturer).

The product will be mixed in the recipient with the aid of suitable tools and thus homogenized.

1.9.5 Method of application

Normally, three methods of application will be used on the construction site for the paint products. i.e. with a brush, with a roller or with a spray gun.

- The brush method makes it possible to obtain good penetration of the paint over irregularities in the metal.
- Only this method will be used for application of the base coats, for retouching and for protrusions, welded areas, riveted joints or bolted joints:
- The roller method may be used on large flat surfaces for the intermediate and topcoats.
- The spray gun method must be used in accordance with the instructions of the manufacturer and carried out by qualified personnel.

The Contractor must guarantee that all safety measures have been taken for such work. The spray gun method may only he used on site for places that arc difficult to reach with the brush. In this case, a request must be made to the OWNER/ OWNER's Representative for a deviation.

All paintwork will be carried out with good brushes or rollers that are suitable for the type of paint being used and for the form of the material to be painted and fitted with short handles. The maximum length of the brush and roller handles will be 50 cm; longer handles may only be used for places that are absolutely inaccessible. The maximum width of a brush will be 13 cm.

1.9.6 Application of the coating

Application of the paint will be carried out in accordance with best practice in order to obtain a homogeneous and continuous layer. The OWNER or the Approved Supervisory body demands that painting of a layer will only be started after acceptance by them of the surface preparation or of the previous layer of paint.

The layers of paint must have a uniform thickness. They must he spread in such a way that all concave parts are dried out and that the surface is completely covered and has a glossy appearance without leaving brush marks and without exhibiting bubbles, foam, wrinkles, drips, craters, skins or gums that arise from weathered paint,

Each layer must have the color stipulated in the tables of the present specifications, which clearly differs from the previous layer, taking account of the Color of the top layer, all of which for the purpose of being able to identify the number of coats and their order of sequence. If the color of the coats is not mentioned in the tables the color difference in consecutive coats must, if possible, he at least 100 RAL. The color of the top layer is given in the table.

The coating power should be such that the underlying layer is not visible. Only 1 layer per day may be applied, unless otherwise specified by the OWNER or the Approved Supervisory Body.

The drying times prescribed by the paint manufacturer must be strictly observed in relation to the environmental conditions before proceeding with the application of the next layer.

The dry coating thickness indicated in the description of the paint systems are minimum thickness. In this connection, the Contractor is obliged to contact the paint manufacturer and conform to his guidelines. The Contractor must respect the thickness specified by the supplier.

1.9.7 Transporting treated items

In the case of works being carried out in a workshop, the metal structures will be surrounded by ventilated contraction film that prevents damage during transportation. This film may only be applied after complete polymerization of the paint.

1.10 GROUND-LEVEL TRANSITION POINT

1.11 Polyester protection system

The Contractor will provide system 02 over the entire length of the pipes above ground and below ground and up to a height of 20 cm and a depth of 40 cm. perpendicular to the ground level mark. In each case, he must ensure that the jointing below the asphalt is in good condition and assures' faultless adhesion. He will apply the following products over the entire surface area, prepared in accordance with is Sa 3:

1) The primer of system 01.

2) Reinforced polyester ± 20 cm above the ground level marker and ± 5 cm on the asphalt cleaned beforehand (application of reinforced polyester is carried out in accordance with the work method prescribed by the manufacturer). Moreover, in the case of PE, in contrast to asphalt, he will apply a polygon primer to PE immediately before applying the reinforced polyester.

3) He will then apply the other coats of system 01a to the surface section and thus cover the reinforced polyester with about 5 cm.

4) For new constructions, the polygon primer will be applied to PE and then subsequently processed as described under point 2.

1.11.1 USE OF SCAFFOLDING

Mounting, maintenance and dismantling of scaffolding for carrying out adaptation and/or paintwork to surface gas pipes or gas transport installations in use;

- The Contractor will specify the cost of scaffolding in the price list.
- The supplementary rental price for delays attributable to the Contractor will be charged to him:
- In his price quotation the Contractor should present the OWNER with diagrams of the scaffolding that he intends to install for carrying out the works of the OWNER.

1.12 QUALITY CONTROLS AND GUARANTEE

1.12.1 The Contractor is responsible for checking the weather conditions to ascertain whether the paintwork can be carried out within the technical specifications.

The Contractor should have the required calibrated monitoring apparatus for this purpose on site (with calibration certificates). The personnel who will have to use this apparatus should have the training for this purpose.

The OWNER or his representative and possibly the approved supervisory body indicated by the OWNER will maintain supervision during the works and inspect the works with random checks. A daily report will be drawn up in relation to the department that maintains supervision of these works.

The supplementary inspection and the supervision by the OWNER or the approved supervisory body do not diminish in any way the liability of the Contractor. The proper execution of the work and the materials used may be checked at any time.

1.12.2 Reference Surfaces

At the start of the works. the OWNER or the approved supervisory body will indicate a few surfaces that the Contractor will prepare and cover in accordance with the recognized method of operation under the inspection and to the satisfaction of all parties ; the OWNER or his representative, the approved supervisory body. the contractor and possibly the paint manufacturer. These reference surfaces will serve as a point of comparison for the good adhesion of the paint on the installations as a whole. The parties will together work out a system for the identification of these surfaces in order to be able to monitor the conditions of the coatings over time. If the paintwork on a section of the installations is in a worse condition than the reference surfaces, the Contractor may be obliged to treat these parts again.

1.12.3 Measures to be taken in the event of a dispute

If on delivery of the works no agreement can be reached between the Contractor and the OWNER regarding the conformity of the works to the requirements of these specifications, an Approved Supervisory Body will he Called in. The Approved Supervisory Body will then carry out inspections' on site whereby the following assessment criteria wilt be used:

- The Swedish standards ISO 8501-1 1988 SS 05.5900 concerning the degree of cleanliness of the areas derusted by blasting, by machine or by hand.
- The wet film thickness of the paint will be measured in accordance with ISO 2808 or ASTM DI 212;
- The dry layer thickness of the film will be measured electronically, will complete statistical information. in accordance will, ISO 2808 or ASTM D 1186.
- The thickness of each layer will he measured in accordance with ISO 2808. ASTM 4138 or DIN 50986.
- Adhesion tests will be carried out in accordance with ISO 2409. ASTM 3359 or DIN 53151.
- Traction tests will he carried out in conformity with ISO 4624 or ASTM D 4541.
- The rugosity will be measured electronically in accordance with DIN 4768;
- The non-porosity will be measured with a test tension depending on the type of coating, the layer thickness and after consultation with the Paint manufacturer.
- Any defects in the paint film may be inspected visually by means of a magnifying glass or microscope. If necessary a photographic report may be drawn up in accordance with ASTM Standard D 4121-82,

The final judgement of the Approved Supervisory Body is irrevocable and binding for the Contractor and the OWNER. In the event of non-conformity of the works with the criteria of these specifications, all costs arising from the inspection by the Approved Supervisory Body shall be borne by the Contractor.

1.12.4 Guarantee

a) General Principles

The Contractor declares that he is aware of:

- The maximum operating temperature of the surfaces to be covered.
- The maximum permitted degree of humidity of the bearing surface.
- The properties of the environment to which the surfaces to be covered are: subject.

b) Summary of the Guarantee.

The contractor fully guarantees the following without reservation:

- The observance of all stipulations of the specifications for paintwork regarding, among other things:
  - The preparation of the surfaces.
  - The thickness of each layer.

- The total thickness of the covering.

- The uniformity of the materials used.
- The repair of all defects before delivery of the works.

The Contractor will carry out the requested repair work as promptly as possible.

ABBREVIATIONS

CE	Carbon Equivalent	NPSH	Net Positive Suction Head
DFT	Dry Film Thickness	PO	Purchase Order
DPT	Dye Penetrant 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
IC	Inspection Certificate	VDR	Vendor Data Requirement
IGC	Inter Granular Corrosion	WPS	Welding Procedure Specification
MRT	Mechanical Run Test	WPQ	Welders Performance Qualification
NDT	Non Destructive Testing	MPT / MT	Magnetic Particle Testing

1.0 SCOPE:

This Inspection and Test Plan covers the minimum testing requirements of SCRAPER TRAP.

2.0 REFERENCE DOCUMENTS:

PO/PR/ Standards referred there in/ Job specifications /Approved documents.

3.0 INSPECTION AND TEST REQUIREMENTS:

SL. NO.	STAGE/ ACTIVITY	CHARACTERISTICS	QUANTUM OF CHECK	RECORD	SCOPE OF INSPECTION		
					SUB SUPPLIER	SUPPLIER	TPIA
1.0	Procedures						
1.1	Hydrostatic Test, Heat Treatment, NDT and Other Procedures	Documented Procedures	100%	Procedure Documents	~	H	R
1.2	WPS,PQR & WPQ	Documented Procedures	100%	Procedure Documents	~	H	W- New R- Existing
2.0	Material Inspection						
2.1	Plates, Pipes, Tubes, forgings, Fittings, Fasteners, Gaskets, etc.	Chemical, Physical and other properties as per purchase specification	100%	Mill Test Certificates	H	H	R
2.2	Welding Consumables	Chemical and Physical Properties as applicable	100%	Batch Certificates	W	R	R
3.0	In-Process Inspection						

3.1	Material identification for Pressure Parts (Plates, Pipes)	Review of Test Certificates, Markings, Visual and Dimensional inspection, identity co-relation & Transfer of identification marks	100%	Material Clearance Record	~	H	H
3.2	Material identification for Pressure Parts (Forgings, Fittings, Fasteners, Gaskets, etc.)	Review of Test Certificates, Markings, identity co-relation	100%	Material Clearance Record	~	H	R
3.3	Non Pressure Parts (Supports, Internals, etc.)	Review of Test Certificates	100%	Material Test Certificates	~	W	~
3.4	Inspection of Formed Components	NDT of weld seam, as applicable	100%	NDT Report / RT Films	~	W	R
		NDT On knuckle portion after forming - inside & outside	100%	NDT Report	~	W	R
		HT (as applicable)	100%	HT Graph & record	~	W	R
		Test coupon, if applicable	100%	Test Report	~	W	W
3.5	Weld Edge & Set up of pressure parts	Visual & Dimensional Inspection (Min. Thickness, profile, ovality etc.)	100%	Test Report	~	H	W
		Visual & dimensional, Weld edge, root gap, offset, alignment, cleanliness etc	100%	Inspection Report	~	W	~
3.6	Intermediate Inspection of Welds	NDT (as applicable)	100%	Inspection Report	~	W	~
		Visual, Interpass temperature, DPT as applicable	100%	Inspection Report	~	W	~
		Heat Treatment as applicable	100%	HT Graph & record	~	W	R

3.7	Inspection of finished welds	Visual inspection for reinforcement, undercuts, surface defects, etc.	100%	Inspection Report	~	W	~
		Non Destructive Testing	100%	NDT Report /RT Films	~	W	R
3.8	Visual and dimension check before PWHT (as applicable)	Dimensions, Surface defects, Completeness of equipment.	100%	Inspection Report	~	H	R
3.9	Pneumatic Test of RF Pads	Leak Test	100%	Inspection Report	~	H	R
3.10	PMI as applicable	PMI	Each component & weld	Inspection Report	H	W	R
4.0	Final Inspection						
4.1	Visual & Dimensional Inspection after PWHT	Dimensions, Surface defects, Completeness of equipment, Hardness etc.	100%	Inspection Report	~	H	H
4.2	Hydrostatic Test	Leak Check	100%	Inspection Report	~	H	H
5.0	Painting						
5.1	Final painting (As applicable)	Visual inspection (after surface preparation and final painting for workmanship, uniformity) DFT check	100%	Inspection Report	~	H	~
6.0	Documentation & IC						
6.1	Documentation & Inspection Certificate(IC)	Review of Stage Inspection Reports / Test Reports & Issue of IC	100%	Manufacturer TC & IC	~	H	H
6.2	Final Document submission	Compilation of Inspection reports,drawings, etc. as per VDR / PR	100%	Final data folder /Completeness certificate	~	H	H

Legend:

H - Hold (Do not proceed without approval),

P - Perform,

RW - Random Witness (As specified or 10% [min.1 no. of each size and type of Bulk item]),

R - Review,

W - Witness (Give due notice, work may proceed after scheduled date).

NOTES (As applicable):

1. This document describes the generic test requirements. Any additional test or Inspection scope if specified in contract documents shall also be applicable (unless otherwise agreed upon).

2. Acceptance Norms for all the activities shall be as per PO/PR/STANDARDS referred there in /Job Specification /Approved Documents.

GAIL INDIA LIMITED

QAP FOR PIG SIGNALLER
GAIL-034-PI-DOC-QAP-002

0	30.12.2019	Issued for Review	RKS	UNU	TR	
REV	**Date**	**Purpose of Issue**	**Prepared By**	**Checked By**	**Approved By**	**Lyons Engineering Pvt. Ltd**

QUALITY ASSURANCE PLAN FOR PIG SIGNALLER

Sr. No.	Stage / Activity	Characteristics	Quantum of Check	Reference documents	Acceptance norm	Format of Record	Agency			Remarks
							Vendor	TPI	Client/PMC	
A	**Procedures**									
a	Hydrostatic test, NDT, PWHT, Functional test and Visibility test	Documented Procedures	100%	Approved Datasheet / Job Specification	Approved Datasheet / Job Specification	Procedure Documents	P	R	R	
b	Welding Procedure Specification (WPQ), Procedure Qualification Record (PQR), Welders Performance Qualification (WPQ)	Qualification requirements as per ASME Sec.IX and Purchase specification	100%	Approved Datasheet / Job Specification	Approved Datasheet / Job Specification	WPS,POR & WPQ Records	P	W / R (Refer Note-3)	R	
B	**Material Inspection**									
a	Forgings for Trigger,Weldolet, Mounting Nozzle,etc at suppliers works	i) Chemical Properties ii)Tensile/Impact/Hardness/HIC (Hydrogen Induced Cracking) & other applicable tests iii) NDT (Non Destructive Testing) - As Applicable	Approved Datasheet / Job Specification	Approved Datasheet / Job Specification	Approved Datasheet / Job Specification	Material Test Certificates / Lab Test Reports	P	Mech- W, Rest-R	R	
b	Forgings ,Gaskets, Fasteners, Visual Indicator, Limit switch, and other material after receipt at suppliers works	i) Chemical Properties ii)Tensile/Impact/Hardness/HIC (Hydrogen Induced Cracking) & other applicable tests iii) NDT (Non Destructive Testing) - As Applicable	100%	Approved Datasheet / Job Specification	Approved Datasheet / Job Specification	Material test certificates	-	R	R	
C	**In process Inspection**									
a	Machining of Components	Visual & Dimensional	100%	Approved Datasheet / Job Specification	Approved Datasheet / Job Specification	Suppliers Records	P	R	-	
b	Inspection of Welds	i) Visual ii) Applicable NDT	100%	Approved Datasheet / Job Specification	Approved Datasheet / Job Specification	Test Reports	P	W/R (Refer Note-1)	R	
c	Heat Treatment	Heat treatment as applicable	100%	Approved Datasheet / Job Specification	Approved Datasheet / Job Specification	HT Chart/Record	P	R		

D	**Final Inspection**									
a	Functional Test	Satisfactory Performance	100%	Approved Datasheet / Job Specification	Approved Datasheet / Job Specification	Test Reports	P	W	W/R	
b	Hydrostatic Test	Leak Check	100%	Approved Datasheet / Job Specification	Approved Datasheet / Job Specification	Test Reports	P	W	W/R	
c	Visual and Dimensional Inspection	Dimensions & Completeness of Assembly	100%	Approved Datasheet / Job Specification	Approved Datasheet / Job Specification	Inspection Record	P	W	W/R	
E	**Painting**									
a	Corrosion Resistant Painting & / or Antifouling Coating (As Applicable)	i) Painting Scheme ii) Visual Check iii) Final DFT Check	100%	Approved Datasheet / Job Specification	Approved Datasheet / Job Specification	Inspection Record	P	R	R	
F	**Documentation and IC**									
a	Final Documentation & Inspection Certificate(IC)	Issue of IC & Final document completeness certificate	As per PR	Approved Datasheet / Job Specification	Approved Datasheet / Job Specification	IC & Document completeness certificate	H	P	R	
Legend: H- Hold (Do not proceed without approval), Random -10% (min. 1 no.) of each size and type of Bulk item, R-Review, W-Witness (Give due notice, work may proceed after scheduled date).										

Notes:

1). Inspection Engineer shall decide the option to be exercised for the particular stage and Suppliers

2). Forgings for Trigger, Weldolet, Mounting Nozzle, etc Shall be procured duly inspected by TPIA appointed by Supplier.

3). Witness-If New PQR / Applicable PQR is not qualified under reputed TPIA. Review-If Applicable PQR is qualified under reputed TPIA.

4) Supplier's in house procedures may be accepted in case TPIA is satisfied with adequacy of procedures to comply with Purchase Order/Specifications requirements; in case of non availability of suitable procedure s fresh procedures may be qualified under EIL witness.

5). In case of conflict between purchase specification, contract documents and QAP more stringent conditions shall be applicable.

6). This document describes generally the requirements pertaining to all types of the item. Requirements specific to PO and the item are only applicable.

7). Acceptance Norms/ Acceptance Criteria for all the activities shall be as per relevant/ job specification / Standard specifica tion/ data sheets/applicable codes & Standards etc. referred there in /Job Specification /Approved Documents.

GAIL INDIA LIMITED

QAP FOR PRESSURE SAFETY VALVES
GAIL-034-PI-DOC-QAP-003

0	30.12.2019	Issued for Review	RKS	UNU	TR	
REV	**Date**	**Purpose of Issue**	**Prepared By**	**Checked By**	**Approved By**	**Lyons Engineering Pvt. Ltd**

QUALITY ASSURANCE PLAN FOR PRESSURE SAFETY VALVE

Sr No.	Components & Operation	Characteristics	Class	Type of Check	Quantum of Check	Reference document	Acceptance norm	Agency		
								Vendor	TPI	Client/PMC
1	**Raw Materials**									
1.1	Incoming materials like Forgings and castings for body, Bonnet & Nozzle, Springs, Bellows etc.	i. Material Properties (Mechanical & Chemical) ii. Size iii. Rating iv. Make v. Type	Major	Visual	100%	As per clause 3.1 of EN 10204 for each valve body & Bonnet/forging, nozzle and clause 2.2 for stem, disc etc.	Manufacturers certificate of conformity	P	R	R
1.2	Machining of components & their assembly.	Dimensions, Finish	Major	Visual/Physical	100%	Data sheet/Standard specification/Relevant code	Data sheet/Standard specification/Relevant code	P	R	R
1.3	Internal test/Inspection	i. Radiography of valve castings	Major	Visual/Physical	100%	ANSI B16.34	ANSI B16.34 annex.B	P	R	R
		ii. Bend test & Magnetic Particle Inspection of Body & Bonnet casting	Major	Visual/Physical	100%	Data sheet/Standard specification/Relevant code	Data sheet/Standard specification/Relevant code	P	R	R
		iii. Charpy V -notch impact testing (If specified)	Major	Visual/Physical	100%			P	R	R
		iv. Visual check, Verification of tag plate/Marking, Accessories	Major	visual	100%			P	R	R
		v. Helium Leak test	Major	Physical	100%			P	R	R
		vi. Dye Penetrant test of Welds.	Major	Physical	100%			P	R	R
		vii. Hydrostatic test.	Major	Physical	100%			P	R	R
		viii. Cold bench set pressure	Major	Physical	100%			P	R	R
		ix. Seat Leakage test	Major	Physical	100%	API RP 527	API RP 527	P	R	R
		x. Valve lift test.	Major	Visual/Physical	100%	Data sheet/Standard specification/Relevant code	Data sheet/Standard specification/Relevant code	P	R	R
		xi. Blow down/ Reclosing pressure test	Major	Physical	100%			P	R	R
		xii. Capacity test	Major	Physical	100%			P	R	R
		xiii. Post weld Heat treatment of weld joints	Major	Physical	100%			P	R	R
3	**Final Inspection Test**	i. Dimensional, Finish, Visual check, Verification of tag plate/Marking, Accessories.	Major	Visual/Physical	100%	Data sheet/Standard specification/Relevant code	Data sheet/Standard specification/Relevant code	P	W	W/R
		ii. Helium Leak test	Critical	Physical				P	W	W/R
		iii. Dye Penetrant test of Welds.	Major	Physical				P	W	W/R
		iv. Hydrostatic test.	Major	Physical				P	W	W/R
		v. Cold bench set pressure	Major	Physical				P	W	W/R
		vi. Seat Leakage test	Major	Physical		API RP 527	API RP 527	P	W	W/R
		vii. Valve lift test.	Major	Visual/Physical		Data sheet/Standard specification/Relevant code	Data sheet/Standard specification/Relevant code	P	W	W/R
4	Review of Documents	i. Review of IBR certificate & Type test report for valves under IBR regulation (If Applicable)	Critical	Visual	100%	Data sheet/Standard specification/Relevant code	Data sheet/Standard specification/Relevant code	P	R	R
		ii. PWHT report/ Radiography reports/MPI reports	Critical	Visual	100%	Data sheet/Standard specification/Relevant code	Data sheet/Standard specification/Relevant code	P	R	R
		iii. Capacity test as per ASME (Type test report)	Critical	Visual	100%	Data sheet/Standard specification/Relevant code	Data sheet/Standard specification/Relevant code	P	R	R
		iv. Material test certificate	Major	Visual	100%	As per clause 3.1 of EN 10204 for each valve body & Bonnet/forging, nozzle and clause 2.2 for stem, disc etc.	Data sheet/Standard specification/Relevant code	P	R	R

LEGENDS: R: Review of Docs W: Witness P: Perform

Notes:

1). Acceptance Norms/ Acceptance Criteria for all the activities shall be as per specification/ data sheets/ applicable codes & standards etc.

2). GAIL and/or his representative reserve right for inspection at any stage of manufacturing of materails as per approved QAP.

3). All Testing & Measuring Instruments shall have valid Calibration with Calibration Certificates & Traceabilities.

GAIL INDIA LIMITED

QAP FOR PRESSURE GAUGES

GAIL-034-PI-DOC-QAP-004

0	30.12.2019	Issued for Review	RKS	UNU	TR	
Rev.	**Date**	**Purpose of Issue**	**Prepared By**	**Checked By**	**Approved By**	**Lyons Engineering Pvt. Ltd**

QUALITY ASSURANCE PLAN FOR PRESSURE GUAGE

Sr. No.	Component Operation	Characteristics	Category	Type of Check	Quantum of Check	Reference Document	Acceptance Norm	Format of Plan	Agency			Remarks
									Vendor	TPI	Client	
1	Raw Material	a) Dimensions b) Chemical Analysis c) Dial Marking, Unique, Srl. No.	MA MA MA	Mechanical Chemical Visual	100% Sample 100%	PO approved Spec/Drg. Approved Spec/PO	PO approved Spec/Drg. Approved Spec/PO	Test Certificate Material Test Certificate Test Certificate	P P P	R R R	R R R	
2	Internal Test/Inspection	Accuracy Hystresis Repeatability Over range protection	CR CR	Measurement Visual	100% 100%	EN 837-1 EN 837-1	EN 837-1 EN 837-1	Calibration Report Test Report	P P	R R	R R	
3	Final Test/Inspection	Accuracy Hystresis Repeatability Dimension Visual Over range protection	CR CR	Measurement Visual	100% 100%	EN 837-1 EN 837-1	EN 837-1 EN 837-1	Calibration Report Test Report	P P	W W	W/R W/R	
4	Accessories Gauge Saver in SS 316 2-Way Valve Manifold	1) Chemical Analysis 2) Dimensions 3) Leak Tightness	MA MA CR	Chemical Measurement Hydrotest	Sample 100% 100%	Approved Datasheet/ Drawing/Job Specification Approved Datasheet/ Drawing/Job Specification Approved Datasheet/ Drawing/Job Specification	Approved Datasheet/ Drawing/Job Specification Approved Datasheet/ Drawing/Job Specification Approved Datasheet/ Drawing/Job Specification	Material Test Certificate Test Reports/ Certificates Test Reports/ Certificates	P P P	R W W	R W / R W/ R	
5	IRN	TPI Inspection Reports & Inspection Release Note								P	R	

Legends: P - Performance, R - Review, W - Witness, COC - Certificate of Conformance, T&C - Test & Calibration Report, H - Hold

Category: CR - Characteristics affecting safety of equipment and personnel

Notes:

1). Material and Type shall be as per tender specification / datasheet.

2). All Testing & Measuring Instruments shall have valid Calibration with Calibration Certificates & Traceabilities.

3). Acceptance Norms/ Acceptance Criteria for all the activities shall be as per specification/ data sheets/ applicable codes & standards etc.

4). GAIL and/or his representative reserve right for inspection at any stage of manufacturing of materails as per approved QAP.

QUALITY ASSURANCE PLAN– BALL VALVE

0	30.12.2019	ISSUED FOR REVIEW	AP	JR	TR
REV	**DATE**	**DESCRIPTION**	**PREP**	**CHK**	**APPR**

INSPECTION AND TESTREQUIREMENTS:

SL. NO.	COMPONENT& OPERATION	CHARACTERISTICS/METHOD OFCHECK	QUANTUM OFCHECK	REFERENCE DOCUMENT&A CCEPTENCE CRITERIA	FORMATOF RECORD	SCOPE OF INSPECTION	
						SUPPLIER	TPIA
1.0	RAWMATERIAL						
1.1	Casting: Body & Bonnet/ Connector	Chemical: Chemical Analysis	All Heats	Material & Technical Specification	Vendor Test Certificate	P	R
		Mechanical: Mechanical Test	All Heats	Material & Technical Specification	Vendor Test Certificate	P	R
		Impact (@ - 29°C) : Impact Test	All Heats	ASTM A 370	Test Report	P	W
		Non Destructive Examination (NDT): Radiography(100% Critical Area & BW Ends)	100%	ASMEB16.34	RT Report	P	W
		Non Destructive Examination (NDT): Magnetic Particle Examination (100% exterior & accessible interior)	100%	ASMEB16.34	MPI Report	P	W

SL. NO.	COMPONENT & OPERATION	CHARACTERISTICS/ METHOD OFCHECK	QUANTUM OF CHECK	REFERENCE DOCUMENT & ACCEPTENCE CRITERIA	FORMAT OF RECORD	SCOPE OF INSPECTION	
						SUPPLIER	TPIA
1.2	Forging: Ball, Seat Ring & Spindle/ Stem	Chemical: Chemical Analysis	All Heats	Material & Technical Specification	Vendor Test Certificate	P	R
		Mechanical: Mechanical Test	All Heats	Material & Technical Specification	Vendor Test Certificate	P	W
		Impact @ -29 Deg.C Impact Test	All Heats	ASTM A370	Test Report	P	W
		Non Destructive Examination (NDT):Radiography (100% Critical Area & BW Ends)	100%	ASMEB16.34	RT Report	P	W
		Non Destructive Examination (NDT):Magnetic Particle Examination(100% exterior & accessible interior)	100%	ASMEB16.34	MPI Report	P	R
		ENP (For Ball): Visual, Thickness & Hardness	100%	25 microns (min) & 50HRC (min)	Vendor Test Certificate	P	R
2.0	INCOMING/ B.O.ITEMS						
2.1	Stem	Chemical: Chemical Analysis	All Heats	Material & Technical Specification	Vendor Test Certificate	P	R
		Mechanical: Mechanical Test	All Heats	Material & Technical Specification	Vendor Test Certificate	P	W

SL. NO.	COMPONENT & OPERATION	CHARACTERISTICS/ METHOD OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENT & ACCEPTENCE CRITERIA	FORMAT OF RECORD	SCOPE OF INSPECTION	
						SUPPLIER	TPIA
2.2	Fasteners	Chemical: Chemical Analysis	All Heats	Material & Technical Specification	Vendor Test Certificate	P	R
		Mechanical: Mechanical Test	All Heats	Material & Technical Specification	Vendor Test Certificate	P	R
		Impact(@- 29^{O}C):Impact Test	All Heats	ASTM A370	Test Report	P	W
3.0	MACHINED COMPONENTS						
3.1	Body, Connector, Ball & Seat Ring	Surface examination & Dimension Inspection: Visual & Measurement	100%	Manufacturer's Drawing	GRN	P	R
4.0	IN-PROCESS						
4.1	Body & Connector joint welding	Non Destructive Examination (NDT):Magnetic Particle Examination (MPI)	100%	ASME Sec VIII-Appendix V & VI	MPI Report	P	R
4.2	Valve & Pup Piece Bevel Ends joint welding	Non Destructive Examination (NDT):Radiography (100% On weld joint)	100%	ASMEB16.34	RT Report	P	R

SL. NO.	COMPONENT & OPERATION	CHARACTERISTICS/ METHOD OFCHECK	QUANTUM OF CHECK	REFERENCE DOCUMENT & ACCEPTENCE CRITERIA	FORMATOF RECORD	SCOPE OF INSPECTION	
						SUPPLIER	TPIA
5.0	FINAL INSPECTION						
5.1	Finished Valve Assembly: Pressure Test & Final Inspection	Shell Test: Hydrostatic	100%	Approved drawing & API 6D latest Edition	Final Inspection Report Sheet	P	W
		Seat Test: Hydrostatic				P	W
		Seat Test: Pneumatic				P	W
		Functional Test- Actuated Valve @Atm. Pressure & Max. Diff. Pressure: Operation-Open /Close				P	W
		Double Block & Bleed: Hydrostatic				P	W
		Final Inspection: Visual, Dimension, TC Verification, Special Requirements & Marking as per sale order	100%	Approved GA Drawing & API 6D latest Edition	Final Inspection Report Sheet	P	W
		Anti-Static Test	100%	API6D & Technical Specification	Test Record	P	W
		Fire Safe Test	100%	API-6FA/ ISO-10497	Fire safe type test report	P	R
5.2	Painting & Packing	Surface examination & DFT Inspection: Visual& Measurement	100%	As per Tender Specification	Painting Record	100%	W

Legend:

H -Hold(Do not proceed without approval), P -

Perform,

RW- Random Witness [As specified or10% (min.1 no. of each size and type of Bulk items)], R -Review,

W-Witness (Give due notice, work may proceed after scheduled date).

NOTES (As applicable):

1. Supplier Test Certificates to be reviewed by CLIENT/TPIA.

2. This document describes the generic test requirements. Any additional test or Inspection scope if specified/required in contract documents shall also be applicable (unless otherwise agreed upon).

3. Acceptance Norms for all the activities shall be as per PO/PR/STANDARDS referred there in/Job Specification/Approved Documents.

4. For orders placed on stock list, items shall be accepted based on manufacturer's TC with EN310204 type 3.2certification from approved suppliers.

	QUALITY ASSURANCE PLAN– GLOBE VALVE	GAIL-034-PI-DOC-QAP-006

QUALITY ASSURANCE PLAN– GLOBE VALVE

REV	DATE	DESCRIPTION	PREP	CHK	APPR
0	30.12.2019	ISSUED FOR REVIEW	AP	JR	TR

1.0 SCOPE:

This Quality Assurance Plan covers the minimum testing requirements of Globe Valves.

2.0 REFERENCE DOCUMENTS:

PO /PR/Standards referred there in /job specifications/approved documents.

3.0 INSPECTIONANDTESTREQUIREMENTS:

APPLICABLE CODES AND SPECIFICATIONS WITH AMENDMENTS									SCOPE OF INSPECTION	
SL. NO.	STAGE	COMPONENT	CHARACTERI -STICS	METHOD OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENTS	ACCEPTANCE NORMS	RECO RD	Vendor	TPI
1a	Incoming Material	Castings, Forgings & b/o Items	Surface Quality & Dimensions	Visual	Each piece	Applicable PO and Specifications	Applicable PO and Specifications	Inspection Report /B/o Certificates	W	R
1b	Incoming Material	----Do----	Chemical, Mechanical Properties & HT requirements (Note special requirement of heat treatment hardness, impact, Bend, tensile etc. for H_2 Service & NACE)	Review of Documents	All Heats	As per applicable PO and Specifications	As per applicable PO and Specifications	Inspection Report / Vendor TC/ HT Records	R	R

APPLICABLE CODES AND SPECIFICATIONSWITH AMENDMENTS									SCOPE OF INSPECTION	
SL. NO	STAGE	COMPONENT	CHARACTERI -STICS	METHOD OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENTS	ACCEPTANCE NORMS	RECO RD	Vendor	TPI
1c	Incoming Material	Castings/ Forgings of Austenitic Stainless steel	Intergranular Corrosion (IGC) Test &Stabilisation heat treatment	Chart or TC Lab Check	Per solution Annealed lot	As per applicable PO and Specifications	As per applicable PO and Specifications	HT Chart orTC	R	R
1d	Incoming Material	RT Castings	Radiography Examination	Review of RT films	Applicable PO and Specification s	As per applicable PO and Specifications	As per applicable PO and Specifications	Film and report	R	R
2	WPS, PQR, WPQ Previous Qualifications for Overlay/ Stelliting	Body seat ring / Wedge	Thickness of overlay/ stelliting, Hardness	Visual & Hardness	100%	Applicable PO and Specifications	Applicable PO and Specifications	WPS/ PQR/ WPQ	— W	H/ R[1]
3	Hydrostatic Test	Finished Valve	Pressure testing for body and seat	Hydrostatic Test	100% by Manufacturer and at random by LEPL	Approved drawings, Applicable PO and Specifications	Approved drawings, Applicable PO and Specifications	Test Report	W	H
4	Pneumatic Test	Finished Valve	Pressure Testing for seat/ backseat	Approved drawings, Applicable PO and Specifications	100% by manufacturer and at random by LEPL	Approved drawings, Applicable PO and Specifications	Approved drawings, Applicable PO and Specifications	Test Report	—— W	H
5	Functional Test	Finished Valve	Functional / Operation Test	Approved drawings, Applicable PO and Specifications	100% by manufacturer and at random by LEPL	Approved drawings, Applicable PO and Specifications	Approved drawings, Applicable PO and Specifications	Test Report	W	H

APPLICABLE CODES AND SPECIFICATIONS WITH AMENDMENTS									SCOPE OF INSPECTION	
SL. NO.	STAGE	COMPONENT	CHARACTERI -STICS	METHOD OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENTS	ACCEPTANCE NORMS	RECORD	Vendor	TPI
6	NDT Testing	Forgings & Plate components	UT/ MPT/DPT	UT/ MPT/ DPT	100%by manufacturer and at random by LEPL	Approved drawings, Applicable PO and Specifications	Approved drawings, Applicable PO and Specifications	Test Report	W	W
7	PMI Check for SS/ AS Valves	Finished Valve	PMI Check	X-Ray Florescence/ Emission Spectrometer	As per Company specification	Company specification	As per applicable PO and Specifications		W	H
8	Final Inspection	Finished Valve	Visual, Dimensional	Visual & Std measuring instruments	100% by manufacturer and at random by LEPL	Approved drawings, Applicable PO and Specifications	Approved drawings, Applicable PO and Specifications	Inspection Report	W	W
9	Strip Check	Finished Valve	Verify Components	Visual	1 Valve per Type/ Size & Order	Approved drawings, Applicable PO and Specifications	Approved drawings, Applicable PO and Specifications	Inspection Report	W	H
10	Packing	Finished Valve	-----	Packing List as per applicable PO and Specifications	---	Approved drawings, Applicable PO and Specifications	Approved drawings, Applicable PO and Specifications	---	W	R

Legend:

H -Hold(Do not proceed without approval),

P -Perform,

RW- Random Witness [As specified or 10% (min.1 no. of each size and type of Bulk items)],

R -Review,

W - Witness(Give due notice, work may proceed after scheduled date).

NOTES (As applicable):

1. Supplier Test Certificates to be reviewed by CLIENT / TPIA.

2. This document describes the generic test requirements. Any additional test or Inspection scope if specified / required in contract documents shall also be applicable (unless otherwise agreed upon).

3. Acceptance Norms for all the activities shall be as per PO /PR /STANDARDS referred there in/Job Specification /Approved Documents.

4. For orders placed on stock list, items shall be accepted based on manufacturer's TC with EN 310204 type 3.2 certification from approved suppliers.

	PROJECT: ARC FOR PROCUREMENT OF BI-DIRECTIONAL PIG LAUNCHER & RECEIVER WITH PIG SIGNALLERS, PSV & ACCESSORIES CLIENT: GAIL INDIA LIMITED CONSULTANT: LEPL VENDOR	QAP NO: GAIL-034-PI-DOC-QAP-008 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 Isuue 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.

	PROJECT: ARC FOR PROCUREMENT OF BI-DIRECTIONAL PIG LAUNCHER & RECEIVER WITH PIG SIGNALLERS, PSV & ACCESSORIES CLIENT: GAIL INDIA LIMITED CONSULTANT: LEPL				QAP NO: GAIL-034-PI-DOC-QAP-009 ITEM DESCRIPTION/ QUANTITY: FITTINGS PAGE NO: 1 of 1			
		OPERATION	**CHARACTERISTICS**	**REF. DOC. & ACCEPTANCE NORMS**	**FORMAT OF RECORD**	**TYPE OF CHECK**	**INSPECTION**	
							Subvendor	**TPI**	**LEPL**
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 Manufacter'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