

HAR KAAM DESH KE NAAM



GAIL INDIA LIMITED

**ARC TENDER FOR PROCUREMENT OF BALL VALVES FOR
LAST MILE CONNECTIVITY**

**VOLUME II OF II (TECHNICAL)
BID DOCUMENT FOR PROCUREMENT OF BALL VALVES
(BID DOCUMENT NO - 40/LEPL/GAIL/2-R0)
E-TENDER REF: 8000018265
OPEN DOMESTIC COMPETITIVE BIDDING**



Lyons Engineering Pvt. Ltd.



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Procurement of Valves**



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GAIL INDIA LIMITED

**SUPPLY OF VALVES FOR GAIL ARC - INVENTORY CREATION FOR
LAST MILE CONNECTIVITY PROJECT**



						
0	11.01.2021	Issued For Tender	SR	HA	SB	
Rev	Date	Purpose	Prepared By	Checked By	Approved By	

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1.0 INTRODUCTION


GAIL India limited intend to create an inventory of valves 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 “valves” for this project.

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

2.0 TECHNICAL SPECIFICATIONS


The technical specifications for this present tender enquiry are as listed in material Requisition (No.)

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GAIL (INDIA) LTD.
ANNUAL RATE CONTRACT

MATERIAL REQUISITION (MR) VALVES (3/4" TO 36")

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A. DESCRIPTION OF GOODS ADD/OR SERVICES

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


TABLE-1

GROUP A – BALL VALVES (ACTUATED) – AS PER API 6D

S. No.	Item	Si ze	Rating	DMNN STD	Material Description	Unit	Qty
1.0	BALL VALVE (ACTUATED)	8"	600#	ASME B 16.10	Body-ASTM A 216 GR. WCB/A234 Gr.WPB, Ball - ASTM A105 + 0,003" ENP, Seat Ring: AISI 4140+0.003 ENP, STD:API 6D , Full Bore, Above Ground, Gas actuated, Butt Weld ASME B16.25, pup piece of 100 mm on both side of valve. Pup-piece (API 5L X42, 7.1 mm WT)	NOS	10

GROUP B – MANUAL BALL VALVES - AS PER API 6D

S. No.	Item	Size	Rating	DMNN STD	Material Description	Uni t	Qty.
2.0	BALL VALVE	36"	600#	ASME B 16.10	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 manual, Butt Weld, ASME B16.25, STD:API 6D , pup piece on both side and of length equal to dia. of valve. (Pup-piece API 5L X70, 20.00 mm WT)	Nos.	2.0
3.0	BALL VALVE	30"	600#	ASME B16.10	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 manual, Butt Weld, ASME B16.25, STD:API 6D , pup piece on both side and of length equal to dia. of valve. (Pup-piece API 5L X70, 19.00 mm WT)	Nos.	2.0

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4.0	BALL VALVE	24"	600#	ASME B16.10	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 manual, Butt Weld, ASME B16.25, STD:API 6D , pup piece on both side and of length equal to dia. of valve. (Pup-piece API 5L X70, 15.9 mm WT)	Nos.	2.0
5.0	BALL VALVE	3/4"	800#	BS EN ISO 17292	Body - ASTM A105, Ball- SS 316, Seat- RPTFE, SW, ASME B16.11, STD:API 6D , Full Bore, Above Ground manual, Socket Weld End,Pup piece of 100 mm min.as per A106 Grade B Sch.160)	Nos.	2000
6.0	BALL VALVE	8"	300#	ASME B 16.10	Body-ASTM A 216 GR. WCB/A234 Gr.WPB, Ball - ASTM A105 + 0,003" ENP, Seat Ring: AISI 4140+0.003" ENP, STD:API 6D , Full Bore,Above Ground manual, Butt Weld, ASME B16.25, STD:API 6D , pup piece on both side and of length equal to dia. of valve. (Pup-piece API 5L Grade X52 WT 9.53 mm)	Nos	5
7.0	BALL VALVE	6"	300#	ASME B 16.10	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 manual, Butt Weld ASME B16.25, STD:API 6D , pup piece of length equal to dia of valve on both side of valve. (Pup-piece API 5L Grade X52, 6.4 mm WT)	Nos	5
8.0	BALL VALVE (LTCS)	3/4"	800#	BS EN ISO 17292	ASTM A350 Gr. LF2, Ball ASTM A182 Gr. F316 / ASTM A350 Gr. LF2 CI 1 + 75 micron ENP, Seat ring ASTM A182 Gr. F316 / A350 Gr. LF2 + 75micron ENP, STD:API 6D , Socket weld end.Above Ground, Manually operated (Pup-piece as per A333 Gr.6 Sch.160 length 100 mm min.)	Nos	200

B. REMARKS/COMMENTS

1.0 GENERAL NOTES

VENDOR's/SUPPLIER compliance

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

2.0 COMPLIANCE WITH SPECIFICATION

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

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

3.0 VENDOR's/SUPPLIER SCOPE

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

4.0 INSPECTION

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

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

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

5.0 APPLICABLE DOCUMENTS


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

6.0 VENDOR's documents

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

7.0 DOCUMENTS NUMBERING AND FORMAT

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

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C. DOCUMENTS & DATA REQUIREMENTS

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

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


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

The final and certified documents are listed under column C.

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

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

Item	Document and Data	Document Index No.	A		B		C	
			No. of copies	No. of copies	Required date	No. of copies	Required date	
1	Completed data sheet for Valves	CDS	3	6	2 weeks	6	2 weeks + with final tech. file	
2	Drawing / data submittal list / schedule	DLS	3	6	2 weeks + monthly	6	2 weeks	
3	Progress report	PRT	-	6	2 weeks + monthly	6	2 weeks	
4	Outline drawing + material specification + unit weight + Bill of materials (on drawings)	OMS	-	6	2 weeks	6	2 weeks + with final tech. file	
5	Code compliance certificate	CCC	-	6	2 weeks	6	2 weeks + with final tech. file	
6	Welding procedure specification and records WPS/PQR	WPS	-	6	2 weeks	6	2 weeks + with final tech. file	
7	QA/QC program*	QAP	3	6	2 weeks	6	2 weeks + with final tech. file	
8	Inspection and test procedures	ITP	3	6	2 weeks	6	2 weeks + with final tech. file	
9	List of fabrication and	LOF	-	6	2 weeks	6	2 weeks +	


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	control operations (LOFC)						with final tech. file
10	Test reports	TRS	-	6	1 week after test	6	2 weeks + with final tech. file
11	NDE reports	NOR	-	6	1 week after test	6	2 weeks + with final tech. file
12	Heat treatment reports	HTT	-	6	1 week after test	6	2 weeks + with final tech. file
13	Hydro-test and air test report	HTR	-	6	1 week after test	6	2 weeks + with final tech. file
14	Packing/shipping list with weights and dimensions	PLD	-	6	2 weeks before shipping	6	2 weeks + with final tech. file
15	Material certificate 3.2 as per EN 10204	MCT	-	6	1 week after test	6	2 weeks + with final tech. file
16	Painting system description	PSD	3	6	2 weeks	6	2 weeks + with final tech. file
17	Final technical file, preliminary copy for approval	FTP	-	6	2 weeks	6	2 weeks + with final tech. file
18	Final technical file (In soft & hard copy)	FTF	-	6	2 weeks	6	2 weeks + with final tech. file

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

NOTES

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

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**DATA SHEET FOR BUTT
WELD END GAS ACTUATED
BALL VALVE (SIZE 8",600#
/300 #)**



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DATA SHEET FOR BALL VALVES		
Sr. No.	Description	Specification
GENERAL		
1	Valve Size	8"
2	ANSI Rating	600# /300#
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 /cm ² / 49 Kg/cm ²
8	Design Temperature	-29°C to 65°C
VALVE CONSTRUCTION DESIGN		
9	Location	Above Ground
10	Valve Type	Gas Actuated (Trunnion mounted)
11	Bore	Full Bore
12	End Connections	Butt Weld (as per ASME B 16.25), Pup Piece 100 mm long required.
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 or as per SOR
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

1	14.11.19	Client Comments Incorporated	AP	JR	SB
0	20.09.19	Issued For Approval	AP	JR	SB
Rev.	Date	Purpose	Prepared By:	Checked By:	Approved By:



**DATA SHEET FOR BUTT
WELD END GAS ACTUATED
BALL VALVE (SIZE 8",600#
/300 #)**



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		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.

1	14.11.19	Client Comments Incorporated	AP	JR	SB
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**DATA SHEET FOR BUTT
WELD END BALL VALVE
(SIZE 2"- 36",600#)**



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DATA SHEET FOR BALL VALVES					
Sr. No.	Description		Specification		
GENERAL					
1	Valve Size	2" – 36"			
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 or as per SOR		
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					
1	14.11.19	Client Comments Incorporated	AP	JR	SB
0	20.09.19	Issued For Approval	AP	JR	SB
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**DATA SHEET FOR BUTT
WELD END BALL VALVE
(SIZE 2"- 36",600#)**



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28	Fire Resistant Design Requirement	As per API 6FA/API 607
29	Hydrostatic Test	Body
		Seat
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.

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**DATA SHEET FOR SOCKET
WELDED BALL VALVE (SIZE
BELOW 2"- 800#)**



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GAIL-034-PI-DOC-DS-005

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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)
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

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**DATA SHEET FOR SOCKET
WELDED BALL VALVE (SIZE
BELOW 2''- 800#)**



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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.

1	14.11.19	Client Comments Incorporated	AP	JR	SB
0	19.09.19	Issued For Bid	AP	JR	SB
Rev.	Date	Purpose	Prepared By:	Checked By:	Approved By:



**DATA SHEET FOR BUTT
WELD END BALL VALVE
(SIZE 8", 6" & 2",300#)**



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DATA SHEET FOR BALL VALVES					
Sr. No.	Description		Specification		
GENERAL					
1	Valve Size	8", 6" & 2"			
2	ANSI Rating	300#			
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	49 kg /cm ²			
8	Design Temperature	-29°C to 65°C			
VALVE CONSTRUCTION DESIGN					
9	Location	Above Ground			
10	Valve Type	Trunnion mounted for 8" and 6" and floating type for (2")			
11	Bore	Full Bore			
12	End Connections	Butt Welded Ends (as per ASME B 16.25), Pup Piece length equal to dia. Of valve (for 8" and 6") and 100 mm pup-pieces on either side of 2 Inch 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)		
1	14.11.19	Client Comments Incorporated	AP	JR	SB
0	20.09.19	Issued For Approval	AP	JR	SB
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**DATA SHEET FOR BUTT
WELD END BALL VALVE
(SIZE 8", 6" & 2", 300#)**



GAIL-034-PI-DOC-DS-006

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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.

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**DATA SHEET FOR SOCKET
WELDED BALL VALVE (SIZE
BELOW 2''- 800#) (LTCS)**



Lyons Engineering Pvt. Ltd.

Doc No. GAIL-034-PI-DOC-
DS-009

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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		-20°C to 65°C		
VALVE CONSTRUCTION DESIGN					
9	Location		Above Ground		
10	Valve Type(Floating/Trunnion mounted)		Floating		
11	Bore(Full/Reduced)		Full Bore		
12	End Connections		Socket welded (as per ASME B 16.11)		
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 Required		
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 350 LF2		
22	Ball (SOLID)		ASTM A479 Gr. SS 316/ASTM A 351 CF8M /ASTM A 182 Gr. F316 / ASTM A350 GR LF2 CL1 + ENP 75 micron		
23	Seat		RPTFE		
24	Stem (ANTI BLOW OUT)		SS316 (NO CASTING)		
25	Stem seals		As per Manufacturer's recommendation		
26	Stud bolts / Nuts		ASTM A 320 L7/ A 194 Gr 7/ ASTM A153(HDG)		
1	14.11.19	Client Comments Incorporated	AP	JR	SB
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**DATA SHEET FOR SOCKET
WELDED BALL VALVE (SIZE
BELOW 2”- 800#) (LTCS)**



Lyons Engineering Pvt. Ltd.

Doc No. GAIL-034-PI-DOC-
DS-009

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27	Anti-static device	SS302
28	Gland Packing	GRAFOIL
VALVE TESTING REQUIREMENT		
29	Fire Resistant Design Requirement	As per API 6FA/API 607 / BS : 6755 (Part - II) BS EN ISO 10497/API-RP-6FA
30	Hydrostatic Test	Body
		Seat
31	Air Seat Test	7 Bar-g
32	Anti Static Testing Requirement	Direct current <12V and resistance on dry valves shall not exceed 10 Ohms
33	Charpy Impact Test	As per QAP/specification
34	Hardness test	As per Material of construction standard
35	NDE Test	Refer Note.13
36	Marking & Painting Spec.	SSPC-SP/MSS SP-25 and BS 5351
37	Functional Test	Required
38	Antistatic Test	Required
39	Torque Test	Required

NOTE:-

1. Inspection and Testing shall be as per this QAP/Data Sheet, BS EN ISO 17292, and API 598
2. Valve shall be long pattern with anti static features.
3. Valves shall be lever operated
4. Test Certificates shall be reviewed by client/TPIA as per approved QAP, GA drawing, Inspection & Test certificates including NDE.
5. Bidder shall clearly mention deviation, if any.
6. 100% of valve shall undergo hydro test. After that all valves shall be air tested.
7. 100% valve component (Body/Ball) castings shall be subjected to radiography test.
8. This Data Sheet shall be read in conjunction with the job specification of Ball Valves.
9. All valves shall be provided with anti blowout proof arrangement as per ISO EN 17292/API 6D
10. Pup piece shall be conforming to the connecting LTCS pipe specification.
11. Thickness of pup piece shall be determined by the vendor as per code requirements. The pipe end of the pup piece shall match the connecting pipe. The connecting pipe details shall be taken as mentioned in the valve data sheet.
12. Valve design shall be fire safe as per API 6FA /API 607.

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**DATA SHEET FOR SOCKET
WELDED BALL VALVE (SIZE
BELOW 2”- 800#) (LTCS)**



Lyons Engineering Pvt. Ltd.

Doc No. GAIL-034-PI-DOC-DS-009

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Note 13: Non Destructive Examination

- 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 B 31.3 or ASME B31.8 as applicable and API 1104.
 - 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.
 - External surface of all forging shall be 100% wet magnetic particle inspected. Method and acceptance shall comply with ASME B16.34.
- 14 . Vendor shall submit cross sectional drawing, catalogues showing the material of construction for each component of the valve as a part of documents.
- Valve shall have position indicator showing open and close positions.
15. 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.

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**DATA SHEET
FOR GAS OVER OIL
ACTUATOR**



GAIL-034-PI-DOC-DS-013

Page 1 of 3

DATA SHEET FOR GAS OVER OIL ACTUATOR

1. Actuator Manufacturer :
2. Specification for Gas Powered Actuator :
3. Service : NATURAL GAS
4. Actuator Shut off pressure : 98 bar g
5. Minimum Gas Pressure : 15 bar g
6. Corrosion Allowance : 1.5 mm
7. Power Gas : NATURAL GAS
8. Actuator Type : Gas over Oil Type
9. Gas feed from Connection from Mainline : As per P&iD
10. Actuator Remote Operation :
Required (for open/close)
11. Valve Position Limit Switch : Required (DPDT contact for open and DPDT contact for close positions separately)
12. Local/ Remote Selector Switch : Required
and its Status contact (shall be wired upto junction box as per circuit diagram)
13. Pneumatic Limit Valves and :
Required solenoid, pilot valves to shut off **gas supply to actuator when valve reaches one of its end positions**
14. Self-Retaining System for retaining :
Required momentary open and close signals

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**DATA SHEET
FOR GAS OVER OIL
ACTUATOR**





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in the control circuit

15. Electrical Conduit connection : ½" NPT, 6nos. spare entries to be **plugged**
(cable entry to junction box for Purchaser's cable)
16. Operating Voltage
a) Solenoid Valves : 24 V DC, Intrinsically safe type.
b) Relays
17. Contact Rating
a) Limit Switches : 2 Amp at 24 V DC (Refer Limit switch **& Datasheet no.**)
b) L/R switch (status)
18. Pad Lock with L/R Switch : Required
19. Enclosure for
a) Actuator : Certified Weather Proof as per IP65
b) Electrical Items like Switches, Solenoid : Certified Weather Proof as per IP65 Limit
c) and Flame Proof certified suitable for Valves, Junction Boxes : IEC Zone-1, Gas Group II A & IIB, Relays, Cable Glands Temp. Class T3
20. Area Classification : IEC Zone-I, Gas Group II A & IIB, Temp. Class T3
21. Material of Construction for all **tubing, valves, piping and fittings** : **SS316**
22. Accessories Required : Required as per Specification
23. Manual/Hydraulic Override : Required as per Specification
24. Diff. Pressure switch : Required. Integrally mounted on **GOOV**

1	14.11.19	Client Comments Incorporated	AP	JR	SB
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	DATA SHEET FOR GAS OVER OIL ACTUATOR	
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1 NOTE:

1. Complete actuator including control panel/ systems shall be manufactured and supplied by actuator manufacturer only. All circuit diagram/ documents/ drawings pertaining to actuator shall be furnished by actuator manufacturer. All inspection and testing shall be carried out at actuator manufacturer's shop.

2. The Design & manufacturing of Gas over Oil Actuator shall take care of the details in the P&IDs including details for interlocks.


1	14.11.19	Client Comments Incorporated	AP	JR	SB
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ENGINEERING STANDARD

TECHNICAL SPECIFICATIONS FOR BALL VALVE (Size Below 2")

GAIL-034-PI-DOC-TS-001

1	14.11.19	Client Comments Incorporated	AP	JR	SB	
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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



Technical Specification for Ball Valve (Size Below 2")	Doc No.	Rev	 43/216
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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.

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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.

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- 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 clockwise 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.

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- 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 of 500 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.

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- 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:

- Mill test certificates relevant to the chemical analysis and mechanical properties of the materials used for the valve construction as per the relevant standards.
- Test certificates of hydrostatic and pneumatic tests, helium test complete with records of timing and pressure of each test.
- Test reports of ultrasonic inspection, if applicable.
- 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.

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- 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

Technical Specification for Ball Valve (Size Below 2")	Doc No.	Rev	
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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.

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ENGINEERING STANDARD



GAIL INDIA LIMITED

TECHNICAL SPECIFICATION FOR BALL VALVES

GAIL-034-PI-DOC-TS-002

Rev	Date	Purpose	Prepared By	Checked By	Approved By	
1	14.11.19	Clients Comments Incorporated	AP	JR	SB	
0	21.06.2019	Issued For Approval	AP	JR	SB	

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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
ASME B 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

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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 H ₂ S 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:

$$CE = \%C + \%Mn + \%Cr + \%Mo + \%V + \%Ni + \%Cu$$

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- 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 HV₁₀ 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


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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 conform 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:

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- 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.
- $P = 1.5 \times D.P$
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 ≤ 3 bar.
- 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

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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.

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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(NPSinches)	DNmm(NPSinches)	DNmm(NPSinches)	DNmm(NPSinches)
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)

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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-barin 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 °C), 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 - 29° 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 28 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.

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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 dyepenetratorwet - 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 pressure testing, 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

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- 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

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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 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". 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

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furnish necessary field welding instructions and post-weld test procedure to 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.

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- 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.

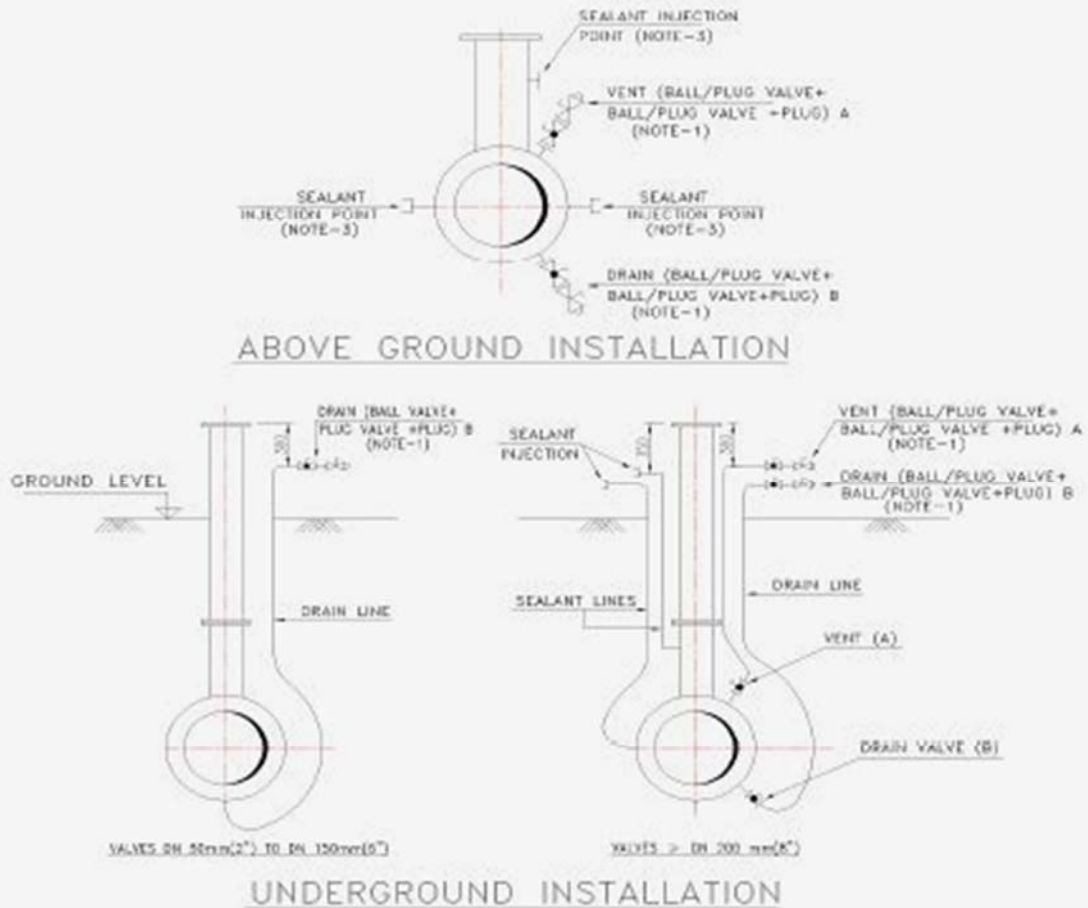
10.0 GUARANTEE

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.

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- 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.

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SIZES OF VENT & DRAIN CONNECTIONS		
NOM. VALVE SIZE	A, DN(mm)	B, DN(mm)
50 TO 150	-	15
200 TO 800	15	25
750 & ABOVE	15	30 (OR MORE)

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-003

1	14.11.19	Clients Comments Incorporated	AP	JR	SB	
0	19.09.2019	Issued For Approval	AP	JR	SB	
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



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1.0 SCOPE

This specification covers the minimum requirements for design, manufacture, testing and supply of low temperature 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.

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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.

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- 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 below 2”.
- 4.6 All valves shall be wrench operated valve. Direction of operation of wrench shall be in clockwise 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.

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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 of 500 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.

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- 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:

- Mill test certificates relevant to the chemical analysis and mechanical properties of the materials used for the valve construction as per the relevant standards.
- Test certificates of hydrostatic and pneumatic tests, helium test complete with records of timing and pressure of each test.
- Test reports of ultrasonic inspection, if applicable.
- 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.

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- 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.

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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.

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ENGINEERING STANDARD

TECHNICAL SPECIFICATIONS FOR BALL VALVE (Size 2" & Above)

GAIL-034-PI-DOC-TS-004

Rev	Date	Purpose	Prepared By	Checked By	Approved By
1	14.11.19	Clients Comments Incorporated	AP	JR	SB
0	19.09.2019	Issued for Approval	AP	JR	SB



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


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1.0 SCOPE

This specification covers the minimum requirements for design, manufacture, testing and supply of low temperature carbon steel ball valves of size (DN 50mm) 2" and above and ANSI pressure rating Class 150#, 300#, 600# 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 American Petroleum Institute (API) Specification 6D, Latest Edition / ISO 14313:2007, 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 B16.10 - 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.

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

- 2.3 In case of conflict between the requirements of this specification, API 6D and the Codes, Standards and Specifications 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.

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 (including O-rings, soft seals etc.) intended for hydrocarbon gas service shall be resistant to explosive decompression.


- 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 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, ball, seat, stem, end flanges and welding ends as well as bolting material for pressure containing parts. The Charpy V-notch test requirements of applicable material standard shall be conducted. The impact test temperature shall be lower of the temperature specified in material standard and -45 C.

In addition to above the Charpy V-notch test shall be conducted at -20C. Test procedure shall conform to ASTM A 370. The average absorbed energy value of three full sized specimens shall be 35 J. The minimum impact energy value of any one specimen of the three specimens analyzed as above, shall not be less than 28 J.

- 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

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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 electro less 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 All studs and nuts shall be hot dip zinc coated.
- 3.9 For all forge material the fine grained prelatc 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 API Specification 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. Allowable stress requirements shall comply the provisions of above code. In addition, corrosion allowance indicated in Valve Data Sheet shall be considered in valve design. The manufacturer Shall have valid license to use API monogram on valves manufactured as per API 6D. The ball valves shall be bi-directional.


4.2 For above ground valves, body design shall be either fully welded or bolted type. For buried valves, valve body design shall be fully welded type only. 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.

4.4 All ball valve shall be Full bore (FB). Reduced Bore (RB) valves shall not be permitted. 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 basis without causing damage to either the valve component or the pig. The full bore valve shall provide an unobstructed profile for pigging operations in either direction. Full bore valves shall be designed to minimize accumulation of debris in the seat ring region to ensure that ball movement is not impeded. Also, when the full bore ball valve is in fully open position, the ball shall not obstruct the passage of flow/pig run. Manufacturer shall demonstrate the same through manual and actuated operation.

4.5 Ball mounting shall be trunnion or pivot type type only for all valves of size 4" and above. Valve design shall minimize the possibility of debris ingress into the trunnion as far as practicable. For valve size below 4" shall be floating or trunnion mounting design.

4.6 For valves with primary metal to metal and secondary soft seats, 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 of valve at maximum differential pressure corresponding to valve class rating.

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The seat rings shall be so designed as to ensure sealing at low as well as high differential pressures.

For soft seated valves seat rings may be provided with soft insert. The same shall be positively locked in position. All such ball valves shall comply fire safe design and qualified by fire testing as per API 6FA/API 607 specifications for Fire test for valves.

- 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 Valves shall have double block and bleed feature to facilitate complete flush, drain and venting of the valve body cavity. Valves shall have antistatic feature and antistatic test as per BS EN 17292/ API 6D shall be performed. Valves shall be provided with anti blowout proof arrangement as per BS EN 17292 / API 6D
- 4.9 Full Bore valves of nominal valve size DN 200 mm (8") & 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 a block valve and internal non- return valve. Valve design shall have a provision to replace the sealant injection fitting under full line pressure. Location and arrangement of sealant point shall be as per Fig. 4.9.
- 4.10 Valves shall be provided with vent and drain connections.

Vent and drain connections and sealant injection lines shall be terminated adjacent to the valve operator by means of suitable piping anchored to the valve body. The pipe used shall be ASTM A 333 Gr. 6, with Sch. 160 for sizes 0.5 to 1.5 inch. Fittings shall be ASTM A 350 LF2 Cl.1 Socket welded ANSI class 6000.

For above Ground valve: Drain connection shall be provided for valve size 2" and above and vent connection shall be provided for valve size 6" and above. Drain/vent connection for above ground equipped with one ball valve and one needle valve and one plug assembly with bleed screw.

For Under Ground valve:


Location and arrangement of vents and drains shall be as per Fig.1.

Body vent and drain shall be provided with valves (Ball or Plug type) and Number of valve shall be as per Fig. 1.

Size of drain, vent & sealant connection to be finalized during detail engineering.

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

- 4.12 Full Bore valves of nominal valve size DN 200 mm (8") & above shall be equipped with support foot and lifting lugs. Tapped holes and eyebolts shall not be used for lifting lugs. Height of support foot shall be kept as minimum as possible. The location and size of support foot/lifting lugs shall ensure unrestrictive operation of vent/drain valves.

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4.13 Valve design shall be such as to avoid bimetallic corrosion between carbon steel and high alloy steel components. Suitable insulation shall be provided, if required.

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 Company.

b. Flanged ends, if specified, shall have flanges as per ASME B16.5 for valve sizes upto 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 raised face. Flange face finish shall be serrated or smooth as indicated in Valve Data Sheet.

c. Butt weld end preparation shall be as per ASME B31.8 & ASME B16.25.

4.15 Design of weld end valves shall be such that during shop welding of pup piece with valve and during field welding operations of the pup pieces with the connecting pipe , the soft seals/seats or other soft components of the valve (where ever used) are not liable to change its properties and also ensure no damage. The manufacturer shall demonstrate integrity and leak-tightness of valves after welding of pup piece. There shall not be any damage to the soft seals/seats during post weld heat treatment.

4.16 PUP pieces of Butt weld end valves:


Butt welded end valves shall be supplied with pup pieces on either side of valve and length of pup piece shall be finalize during detail engineering with details as indicated in the data sheets. Length of pup piece shall be finalized by manufacturer so as to avoid damage to seats during field welding or post weld heat treatment. Pup piece thickness.

a. Shall be calculated for class rating. Vendor shall provide test rings (500 mm long) from pup piece material for each type of pup piece (considering size, grade and thickness of the pup pieces) used for all offered valves, for field weld procedure qualification. Valves shall be tested along-with pup piece. Thickness calculation and detail drawing of End connection of valve shall be submit during detail engineering for client approval.

b. No repair is permitted on pup pieces. 100 % area of UT shall be performed on pup pieces.


c. The pipe material, grade & thickness for pup piece shall be as per data sheet. The pipe material for pup piece shall be as per piping specification.

d. The minimum actual yield strength requirement of the valve body (if specified), thickness of the valve and material grade and wall thickness for the pup pieces indicated in valve

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data sheet are based on the acceptable limits for weld joints for unequal thickness and material grades in accordance with ASME B31.8. Manufacturer to comply with the requirements of the above code and provide the valve end thickness and pup pieces accordingly.

- e. The Charpy V-notch impact testing of pup piece (for API 5L material) as indicated in data sheet shall be carried out at -20°C & the energy values shall be as per Line Pipe specification (API 5L).
 - f. The Charpy V-notch impact testing of pup piece (for low temp. carbon steel material) as indicated in data sheet shall be carried out at -20 c & -45 c as per piping material specification.
 - g. The pup piece shall be subjected to all the testing (Charpy, Tensile, Hardness, NDT etc.) Requirements as mentioned in QAP. Inspection frequency, acceptance criteria & reference standards shall be as per applicable specifications/QAP.
- 4.17 Valve shall be provided with ball position indicator and stops of rugged construction at the fully open and fully closed positions.
- 4.18 Valves shall be suitable for either buried or above ground installation as indicated in Valve Data Sheet.
- 4.19 All buried valves shall have stem extensions. When stem extension requirement is in Valve Data Sheet, the valves shall have the following provisions.
- a. Stem extension material shall be equivalent to stem material or as indicated in the data sheets for below ground valves. Stem shall be single piece construction & no joints are permitted. The length of stem extension shall be as indicated in the valve Data sheet.
 - b. Valves provided with stem extension shall have water proof outer casing. Length of stem extension shall be as indicated in Valve Data Sheet. The length indicated corresponds to the distance between centerline of the valve opening and the top of mounting flange for valve operating device (gear operator/power actuator as applicable).
 - c. 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.

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- d. Outer casing of stem extension shall have $\frac{3}{8}$ " or $\frac{1}{2}$ " NPT plugs at the top and bottom, for draining and filling with oil to prevent internal corrosion. Outer casing material shall be ASTM A333 Gr. 6 & thickness shall be minimum Sch160 for 2" and below.

4.20 Operating Devices

- a. Valves shall have a Gas over Oil (GOO) actuator or manual operator or hydraulic operator as indicated in the Valve Data Sheet. All mainline valves shall be equipped with Gas over Oil (GOO) actuators except where specifically indicated otherwise. Valves of size, DN upto 100 mm (4") shall be wrench operated, valves of size DN 150 mm (6") to DN 300 mm (12") shall be gear operated and valves of sizes above DN 300 mm (12") shall be hydraulic operated unless otherwise indicated in the valve data sheets. Actuated valve shall also have hand wheel for manual operation. Each wrench-operated valve shall be supplied with wrench. Valve design shall be such that damage due to malfunctioning of the operator or its controls will only occur in the operator gear train or power cylinder and that damaged parts can be replaced without the valve cover being removed.

The Gas over Oil (GOO) actuator shall be in accordance with the specification issued for the purpose and as indicated in the Valve and Actuator Data Sheet. Operating time shall be as indicated in Process Data Sheets for valves / Material Requisition. 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


- b. 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.

For the manual operator 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. However, failing to meet above requirement, vendor shall offer Gear operated valves. Manufacturer shall also indicate the number of turns of hand wheel in case of gear operators (along with their offer) required for operating the valve from full open to full close position. The number of turns shall not exceed 250 for valve sizes up-to 24" and 450 for valve sizes above 24".

All hydraulic operated valves shall be as per specification issued for purpose and as indicated in the data sheets.

- c. 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.
- d. 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.


- 4.21 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.

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- 4.22 When indicated in Data sheet, 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.
- 4.23 All welds shall be made by welders and welding procedures qualified in accordance with the provisions of ASME Section IX. The procedure qualification shall also include impact test and hardness test when required as per Clause 3.4 and 3.5 of this specification and shall meet the requirements as specified therein.
- 4.24 Repair by welding is not permitted for cast body and forged body valves.
- 4.25 No casting is permitted for stem and stem extension 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 of 500 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. For power actuated valves, the valve stem shall be designed for maximum output torque of the selected power actuator (including gear box, if any) at valve stem.
- 4.26 Wherever specified for the parts of valve in valve datasheets, minimum thickness of stellite shall be 1.6 mm.
- 4.27 Stress Relieving and PWHT shall be carried as per API6D, ASME B31.8 and API 1104, as referred and as applicable.

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 Quality Assurance Plan (QAP). Heat treatment chart for forging material shall be witness & start/stop time signed by TPIA.
- 5.1.4 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.

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- a. Body castings of all valves shall be radio graphically examined as per ASME B16.34. Procedure and acceptance criteria shall be as per ASME B16.34. The extent of the radiography shall be 100% for all class rating of all sizes.

Pressureclass Rating&Size	ExtentofRadiography
ANSI150#Classforall sizes	100 %
ANSI300#Classforall sizes	100 %
ANSI600#Classforall sizes	100 %

Radiography shall be performed after the final heat treatment also.

External surfaces for all castings shall be 100% wet magnetic particle inspected. Method and acceptance shall comply with ASME B16.34.

- b. 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.

- c. Bodies and bonnets made by welded assembly of segments of castings, forgings or combinations thereof shall be examined, as applicable, by methods of 5.1.4 (a) for cast components or 5.1.4 (b) for forged components.

5.1.5 Full inspection by radiography shall be carried out on all welds of pressure containing parts including 100% radiography of the weld joint between valve and pup pieces. Acceptance criteria shall be as per ASME B31.8 and API 1104.

5.1.6 Welds & valve body weld joints, which in Company'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 Sec. VIII, Division 1, Appendix 12 and Appendix 6 respectively.

5.1.7

- a. All Finished wrought weld ends subject to welding at shop (valve end with pup piece) and subject to welding at field (pup piece with connecting pipe) 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 shall be 100% radiographically examined and acceptance criteria shall be as per ASME B16.34.
- c. After final machining, all bevel surfaces shall be inspected by dye penetrate or wet magnetic particle methods. All defects longer than 6.35 mm are rejected, as are the defects between 6.35 mm and 1.59 mm that are separated by a distance less than 50 times their greatest length. Rejectable defects must be removed. Weld repair of bevel surface is not permitted.

5.1.8 Weld end valves shall be tested after welding of pup pieces. All valves shall be tested in compliance with the requirements of API 6D. During pressure testing, valves shall not have sealant lines and other cavities filled with sealant, grease or other foreign material. The pressure testing of valve shall also include pup pieces. The drain, vent and sealant lines shall be either included in the hydrostatic shell test or tested independently. Test pressure shall be held for at least 30 minutes for both Shell & Seat test. No leakage is permissible during hydrostatic testing.

In addition to above, pneumatic testing and functional testing shall be carried out at 95 bar (g) for 600# pressure rating valves, using nitrogen for 5 minutes. High pressure shell and seat pneumatic testing shall be submerged in water.

5.1.9 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.

In addition to above the helium leak test shall be carried out as per ASME Sec. V, Subsection A, Article 10 (Detector Probe Technique), Appendix IV. The test pressure of helium leak test shall be 25% of rated pressure. The duration & test procedure shall be as per applicable code or as per client requirement. Helium Test to be carried out for all size & class rating of valve.

5.1.10 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 clause 4.20 of this specification.


5.1.11 GOO actuated & Hydraulic operated 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 Data Sheets for valves.

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

The above tests shall be conducted on all valves.

5.1.12 Subsequent to successful testing as specified in clause 5.1.10 and 5.1.11 above, one (1) valve per size per class rating out of the total ordered quantity (only applicable for 600# size 8" & above) shall be randomly selected by the Company Representative for cycle testing as mentioned below:

- a. The valve shall be subjected to at least 100 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 clause 5.1.8 and 5.1.9.

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In case this valve fails to pass these tests, the valve shall be rejected and two more valves of same size shall be selected randomly and subjected to testing as indicated above. If both valves pass these tests, all valves manufactured for that size (except the valve that failed) shall be deemed acceptable. If either of the two valves fails to pass these tests, all valves of that size shall be rejected or each valve shall be tested at the option of manufacturer. Previously carried out test of similar nature shall be considered acceptable if the same has been carried out by Manufacturer in last two years. Valves of same size and rating previously tested shall be qualified.

5.1.13 Checks shall be carried out to demonstrate that the dissimilar metals used in the valves are successfully insulated as per the requirement of clause 4.13 of this specification.

5.2 Company 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 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 radiograph and ultrasonic inspection.
- d. Test report on operation of valves conforming to clause 5.1.10, 5.1.11 and 5.1.12 of this specification.
- e. All other test reports and certificates as required by API 6D 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.

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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 buried portion of all buried valves as indicated in valve data sheet shall be provided with high build epoxy coating with a min. thickness of 500 microns DFT (dry film thickness) or PU coating of 1000 microns DFT (min.).

All above ground valves shall be painted as per Painting specifications suitable for highly/normal corrosive environment as applicable. The final paint DFT shall be minimum 300 microns.

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. 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.

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

7.5 Packaging and shipping shall be as per standard procedure and same shall be submit to client for review before start shipping.

7.6 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.


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- 9.1 Contractor 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.
 - c) Torque curves for the power actuated valves along with the break torque and maximum allowable stem torque.
 - e) Copy of valid API 6D Certificate.
 - g) In case of soft seated valves, copy of Fire Safe Test certificate of qualifying valve as per API 6FA carried out in last 10 years shall be furnished.
 - g) Details of support foot including dimensions and distance from valve centreline to bottom of support foot.
- 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 clause 6.0 of this specification.

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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.

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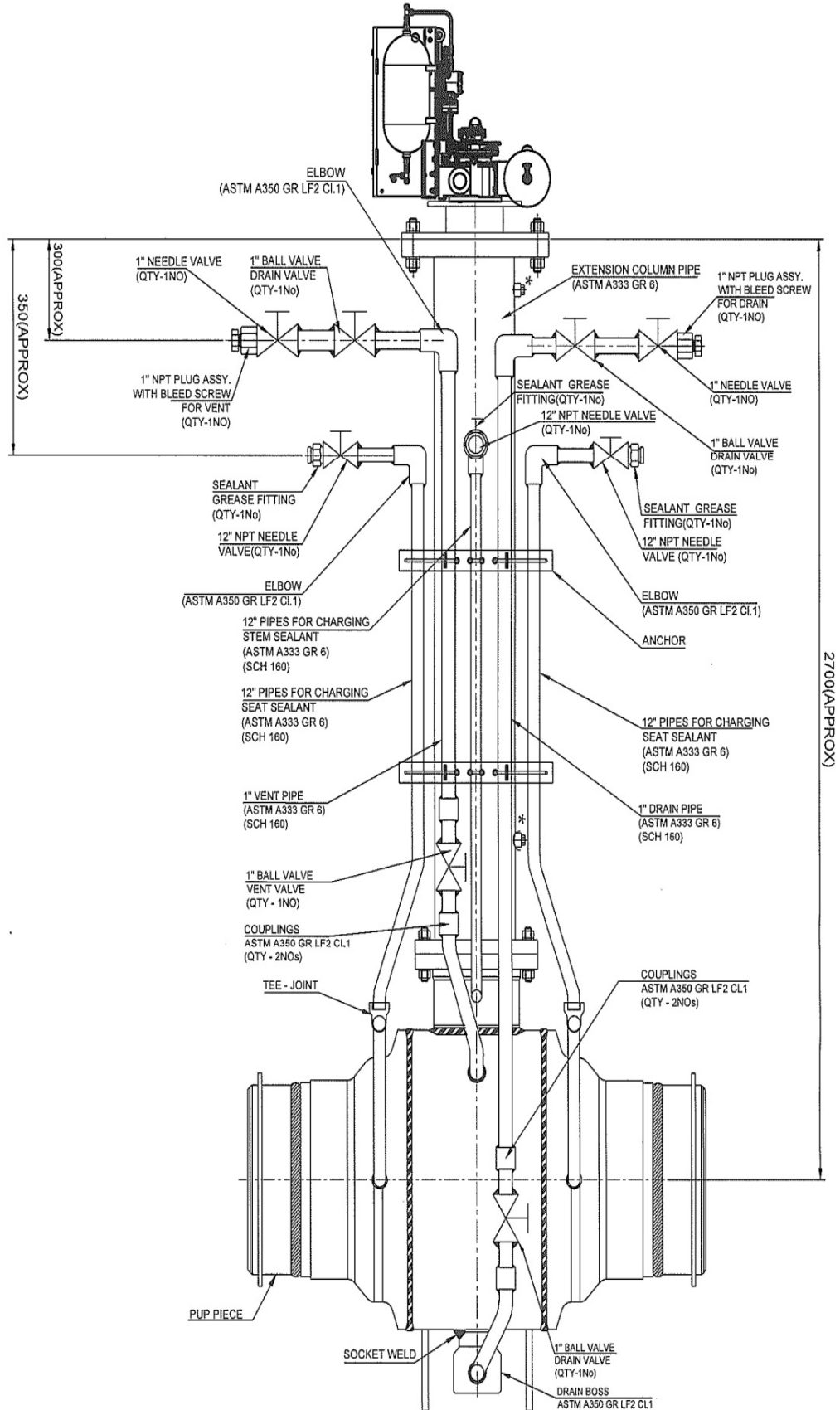




Figure No: 1**Note:**

1. For above Ground installation: all drain & vent connection shall be equipped with one ball Valve + one needle valve + one depressurizing plug at the terminating end. No threaded Connections are permitted.
2. For Under Ground installation: all drain & vent connection shall be equipped with one ball Valve at body tap + one ball valve + one needle valve + one depressurizing plug at the terminating end. No threaded connections are permitted. All buried drain & vent ball valve at body tap shall be kept in open position at the time of installation.
3. The drain line in underground valves shall be protected by steel grating/guard plate so that they are not damaged during transportation or installation.
4. All pipes & fittings shall be sch. 160 & 6000# respectively for all drain, vent & Sealant connections.
5. Size of drain / vent connection shown in fig. are indicative and shall be finalized during detail engineering.

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ENGINEERING STANDARD



TECHNICAL SPECIFICATION FOR GLOBE VALVES


GAIL-034-PI-DOC-TS-005

1	14.11.19	Issued for Tender	AP	JR	SB
0	19.09.19	Issued for Approval	AP	JR	SB
Rev	Date	Purpose	Prepared By	Checked By	Approved By



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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

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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

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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

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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 Stellite / 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 20 x 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

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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 valve 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


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- 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 s 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% radiographically examined.
- 5.10 After final machining, all bevel surfaces shall be inspected by dye penetrant 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

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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 the 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.

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- 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 radiographed 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.

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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 the 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 number, 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

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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.

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ENGINEERING STANDARD



TECHNICAL SPECIFICATION FOR GLOBE VALVES

GAIL-034-PI-DOC-TS-006

1	14.11.19	Issued for Tender	AP	JR	SB
0	19.09.19	Issued for Approval	AP	JR	SB
Rev	Date	Purpose	Prepared By	Checked By	Approved By



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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 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.
- 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 Charpy V-Notch test on each heat of base material shall be for all pressure containing parts such as body, end flanges and welding ends as well as bolting material. Unless specified otherwise, the Charpy impact test shall be conducted at -20°C & -46°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.
- 1.4.4 The minimum average absorbed energy per set of three specimens shall be 35 J with a n individual minimum per specimen of 28J at -20°C and minimum average absorbed energy per set of three specimens shall be as per material Specification at -46°C. No specimen shall exhibit less than 85 percent shear area.
- 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.


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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.
- 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.
- 3.3 Lifting Lug shall be integral part of the valve.

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- 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.
- 3.5 For all weld end valves with bevel end as per ANSI B16. 25.
- 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.
- 3.10 Stellite / 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 20 x 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 Generally the valves are hand wheel or lever operated. Gear operation shall be provided as under:

Class	Size	Requiring- Gear Operator
300#		6” and Larger


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For sizes lower than these ranges, hand wheel shall be provided.

- 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 valve equal to the cold non-shock pressure rating.
- 4.5 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.
- 4.6 Gear used in the gear operated valve shall be of non-sparking type.

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

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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% radiographically 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.

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.

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- 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 recalibration 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) Test certificates of hydrostatic and pneumatic tests complete with records of timing and

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pressure of each test.

- iii) 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.

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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.

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GAIL INDIA LIMITED

**TECHNICAL SPECIFICATION
FOR
ACTUATOR**


GAIL-034-PI-DOC-TS-008

Rev	Date	Purpose	Prepared By	Checked By	Approved By
1	14.11.19	Client Comments Incorporated	AP	JR	SB
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1.0 SCOPE

- 1.1** This specification, together with applicable data sheets covers, the minimum requirements for design, manufacture, inspection and testing of quarter turn gas over oil (GOO) actuators complete with accessories suitable for operation of ball valves in pipeline/piping systems handling hydrocarbons in gaseous phase.
- 1.2** This specification indicates the minimum supply requirements and does not relieve the Vendor from his responsibilities concerning the design and the safe operation of the supplied equipment.
- 1.3** The valve manufacturer shall also be responsible for proper operation of the actuator that shall develop a torque or a thrust sufficient to conveniently open and close the valve always within the limits established by the resistance of the mechanical elements of the valve itself.
- 1.4** Valve and actuator shall be supplied as a single assembly complete in all respect and ready for installation at site.
- 1.5** **The make of the actuator shall be as follows;**

1	Rotex Automation
2	Schuck
3	Biffi
4	Limatorque / Flowserve


This specification shall be read in conjunction with Owner's data sheets and specifications for pipeline ball valves.

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

- a) API 6DX - Standard for Actuator Sizing and Mounting Kits for Pipeline Valves. - 1st edition
- b) ISO 5211 - Industrial valves -- Part-turn actuator Attachments
- c) ISO 12490:2011 - Petroleum and natural gas industries - Mechanical integrity and sizing of actuators and mounting kits for pipeline valves
- d) API 6D - Petroleum and natural gas industries - Pipeline transportation systems - Pipeline Valves


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- e) ASME B 31.3 - Process Piping
- f) ASME B31.8 - Gas Transmission & Distribution Piping Systems.
- g) ASME B 16.5 - Steel Pipe Flanges and Flanged Fittings
- h) ASME B16.47 - Large dia Steel Flanges: NPS 26 through NPS 60
- i) MSS SP 44 - Steel pipeline flanges
- j) ASME Sec VIII - Boiler and Pressure Vessels Code
- k) ANSI B 1.20.1 - Pipe Threads, General Purpose
- l) NEC - National Electric Code
- m) IEC - International Electro Technical Commission & Sec IX
- n) MSS-SP-101 - Part-Turn Valve Actuator Attachment - Flange and Driving Component Dimensions and Performance Characteristics
- o) SSPC-VIS-1 - Steel Structures Painting Council Visual Standard
- p) IEC-60079 - Electrical apparatus for explosive gas atmosphere
- q) IEC-60529 - Degree of protection provided by enclosure
- r) A286-000-11-42-SP-0010 - Piping Material Specification (EIL)

3.0 ACTUATOR SIZING

3.1 For sizing the actuator, Valve manufacturer shall furnish to the actuator manufacturer the following information:

- a) The maximum break-away torque or thrust required at the valve stem with manual/remote operation to open and close a valve at the shut off pressure in the line. The actuator shall be sized for min15 kg/cm²g & maximum of 95 kg/cm²g operating pressure gas pressure and meeting the safety factor of 1.25 as required by the valve operation at the shut-off pressure in the line.
- b) The temperature correction factor.
- c) The pressure correction factor.
- d) As a result of points (a) to (c) the minimum required torque or thrust output of the actuator.

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e) Maximum allowable torque or thrust output of the actuator depending on the type and size of valve.

3.2 The maximum time required to open and close a ball valve shall be as indicated in the data sheet.

3.3 Actuator manufacturer shall provide the complete model number decoding for actuators, limit switches and solenoid valves.

3.4 Complete details of Gas & Oil (Hydraulic) circuit with complete sequencing of port from open to close and close to open position shall be furnished in the offer for review.

3.5 Manufacturer shall furnish the detailed calculation for actuator sizing after placement of order. The calculation so furnished by manufacturer shall satisfy the sizing criteria as per above clauses. Manufacturer shall agree to upgrade the actuators offered to meet the sizing criteria without any price and schedule impact.

3.6 Actuators shall be supplied with SS 316 stainless steel trim. Materials of all parts and seals shall be compatible with the operating hydraulic fluid (Oil). All materials shall be suitable for the ambient conditions and operating conditions as indicated in the Actuator Data Sheets.

4.0 DESIGN AND CONSTRUCTION

4.0 Gas over Oil (GOO) actuator shall be of rotary vane type mechanism or double acting scotch yoke type mechanism with pistons and shall maintain the selected valve position fully open or closed with pressure equalized. If there is no gas pressure available to actuators it shall be possible to actuate the gas over oil actuators by means of hydraulic oil/gas or other similar source. The actuator manufacturer shall furnish the capacity & set pressure of gas/oil tanks for at least two strokes (One open & one close).

4.1 The gas to be used for actuation purpose shall be sourced from main pipeline. Vendor shall indicate the minimum pressures required for gas pressure. Actuators shall be suitable for gas operating conditions & ambient temperature as specified in data sheet(s). Presence of methanol in the gas shall not affect the service of actuators.


4.2 All materials in contact with natural gas shall be suitable for gas composition attached with this specification.

4.3 Actuator body shall be designed to ASME B31.3 and all body joints shall be in accordance with ASME Section VIII, Division 1.

4.4 Actuator shall be suitable for direct mounting on the ball valves without changing the standard top works of the valve and shall have the capability to be mounted or removed from the valve when the valve is in service. Insulating gasket shall be provided on valve body at stem location & actuator connection.

4.5 All pressure and load carrying components in the actuator shall be designed to withstand the maximum output thrust without affecting valve performance.


4.6 Actuator shall be sized considering the break-away thrust corresponding to maximum

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differential pressure of valve ASME/ANSI Rating required at the valve stem to open and close the valve. A factor of safety of 1.25 shall be considered in the actuator design. Due correction factor shall be applied for the temperature and pressure rating.

- 4.7** Actuator maximum thrust shall be limited such that the allowable stress values of valve stem is not exceeded during valve operation.
- 4.8** Actuator / valve interface shall meet the applicable requirements of MSS-SP-101. To assure geometrically accurate valve/actuator alignment, a centering ring as required may be provided.
- 4.9** Actuator shall be capable of opening or closing the valves within the operating time indicated in the Actuator Data Sheet(s). Provision shall be made for slower actuation during maintenance and field testing activities.
- 4.10** Actuator shall be provided with valve position switch/indicator which shall clearly show whether the valve in open, close or in partially open position.
- 4.11** Mechanical stops shall be provided to limit the actuator travel independently from any valve stops.
- 4.12** Threading connection shall be NPT as per ANSI B 1.20.1 and flange connection shall be as per ASME B 16.5, ASME 16.47A & MSS SP 44 (as applicable). The tubing, fitting and valves shall be SS 316 stainless steel. All the fittings should be of dielectric type. All tubing shall be properly supported and shielded from damage by a suitable protective cover.
- 4.13** Each actuator shall be provided with a manual hydraulic module incorporating a positive displacement piston pump, directional control valve etc. In addition, by- pass for high speed operation shall also be provided. This manual hydraulic pump module shall be mounted as an integral component of actuator.
- 4.14** Positive displacement hand pump to be provided as a part of the manual hydraulic pump module shall eliminate cavitations or sucking air. It shall be possible to stroke the hand-pump at any speed without drawing a vacuum into the pumping chamber. The hand pump shall be provided with an individual suction filter, block valves, pressure gauge, relief valve and check valve.
- 4.15** Hydraulic fluid used shall be oil based and shall have a cleanliness level of NAS 1638, Class 6/ SAE AS4059. The actuator shall be supplied filled with hydraulic fluid approved by Owner/ Consultant.
- 4.16** Actuator and its accessories shall be weather proof protected to IP-65 as per IEC- 600529.
- 4.17** All compartments and housing containing electrical devices such as switches, etc. shall be intrinsic safe suitable for Zone- 2, group IIA/IIB, Temp. Class T3 as per IEC/IS.


All electrical / electronic components of the Gas Over Oil Actuator, to be intrinsically certified by the statutory authorities suitable for hazardous area specified. The requirement of the statutory approvals for usage of equipment/ Instruments/ Systems in the electrically hazardous areas shall be as follows:

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A copy of approval for items such as limit switches, Solenoid valves, electro- pneumatic converters, smart positioned, whenever specified from local statutory authority, as applicable, such as Petroleum & Explosive Safety Organization (PESO) / Chief Controller of Explosives, Nagpur (CCOE) or Director General of Mines Safety (DGMS) in India, Along with:


- i. Test certificate from recognized test house like CIMFR / ERTL etc. for flameproof enclosure and / or intrinsic safety, as specified in the data sheet, as per relevant Indian Standard for all Indian manufactured equipments.
- ii. Certificate of conformity from agencies like LCIE, Baseefa, PTB, CSA, UL etc. for compliance to ATEX directives or equivalent recognized standards for all equipments manufactured outside India.

- 4.18** Provision shall be made to prevent accidental pressure build up in the actuator.
- 4.19** The construction of the actuator and its controls shall be such that proper manual operation and maintenance can be carried out by skilled personnel without the risk of being injured e.g. by moving parts.
- 4.20** Bearings shall be factory packed with grease and shall not require additional lubrication for the life of the actuator.
- 4.21** Unless specified otherwise in the data sheet, the actuator shall be equipped with limit valves which immediately shut off the gas supply to actuator when the valve reaches one of its end positions.
- 4.22** Actuator shall be provided with pressure gauges for pneumatic and hydraulic systems. The pressure gauges for the hydraulic system shall be in circuit with the pressure relief system. The Pressure gauges shall be liquid filled type with dial size of 150 mm and case material of SS304.
- 4.23** A high pressure dehydrating filter cartridge shall be provided to remove condensate, moisture, foreign particles and any corrosive contaminants from pipeline gas.
- 4.24** The sound level of the gas escaping into the atmosphere when the actuator is in operation shall not exceed 85 dBA, measured at a distance of 10 meters.
- 4.25** The actuator shall be operated by either of the following two methods:
 - a) For the remote control, the actuator shall have a solenoid valve, limit switches, relays, etc. and shall be suitable for remote and local operation as per description in the attached Actuator Data Sheet(s). Electrical signal supplied is a momentary type with 1 sec duration signal. Actuator shall have a self-retaining system of the above signal in its control circuit. The Solenoid valve (SOV) shall be 24 VDC with intrinsic safe type. The body of SOV shall be SS and solenoid coil continuously rated for specified voltage with class F rating.
 - b) For the local-control the actuator shall be suitable for local operation with line gas over oil cylinders or through nitrogen bottles. The devices and accessories, which do not require the electricity for their operation, shall be provided in the actuators as per this specification. The actuator shall have a hand pump in conjunction with the oil circuit to achieve local control with hydraulic shock

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functionality.

- 4.26** Actuators shall be provided with intrinsically safe mechanical type (DPDT Type) limit switches for open and close positions.
- 4.27** The limit switches shall be wired in the actuator control circuit by the vendor so as to cut off power to the actuator once the end positions of the valve are reached. This is required to de-energize the solenoid valves in the steady state condition and failure of electrical power will not affect the valve position.
- 4.28** The stroke of the Actuator shall be easily adjustable in steps of maximum 0.5° for Ball valves.
- 4.29** Speed control nozzles for adjusting the valve speed over a wide range shall be provided.
- 4.30** If remote control is required, a local/remote switch of flame proof type shall be installed to prevent remote control during maintenance work. This switch shall be provided with a hole 12mm in diameter for locking with pad lock in either position. This local/remote switch shall be wired up to the junction box as per circuit diagram.
- 4.31** All control accessories, pneumatic and hydraulic, shall be mounted in an enclosure and shall be fully wired and tube. The enclosure shall be weatherproof as per IP 65.
- 4.32** All bleed and vent connections wherever required shall be piped outside the actuator cabinet so as to prevent gas pocketing inside the actuator cabinet. The actuator will be of an automatic self-purging design such that any gas pocket in the actuator will be eliminated.
- 4.33** Vendor shall be responsible for integrating the potential free NO or NC contacts of Remote Telemetry Unit (RTU's) for open and close command in interlock circuit. These commands will be of momentary type with 1 sec. duration.
- 4.34** All mounting accessories needed for installing the actuator, tanks etc. are in manufacturer's scope of supply.
- 4.35** The interconnecting cabling, interconnecting pipe work between the actuator and the valve, adapters, tubing, cable glands, junction box are in manufacturer's scope of supply.
- 4.36** The actuator shall be supplied totally self-contained, wired, tube and mounted on ball valve. In case of a separate control box, wiring and tubing between control box and actuator is in the vendor's scope. 3/4" tubing including all connectors between the actuator and control box and interconnecting piping work upstream & downstream of the valve and the control box shall be provided. Owner shall provide 20 mm (3/4") SW tapping on process main line for line gas tapping.
- 4.37** Threading connections shall be NPT as per ANSI B 1.20.1 and flange connection as per ANSI B 16.5/ANSI B 16.47-A Series. The tubing, fittings and valves shall be stainless steel with Swage Lock / Parker fittings & Sandvik tubing.
- 4.38** All mounting accessories needed for installing the actuator and its accessories are in manufacturer's scope of supply.

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4.39 The interconnecting cabling, interconnecting pipe work between the actuator and the manual hydraulic module, adapters, tubing, cable glands, junction box as required are in manufacturer's scope of supply.

4.40 The Instruments junction boxes for flame proof instruments shall be provided with flame proof junction boxes with weather proof protection of IP-65. Also for intrinsically safe instruments weather proof to IP-65 junction boxes to be provided.

5.0 INSPECTION AND TESTS

The actuator Manufacturer shall perform all inspection and tests as per the requirements of this specification and the relevant codes at his Works, such inspection and tests shall be, but not limited to, the following:

5.1 Tests at the Actuator Manufacturer's Shop:


- a) Electrical and mechanical operating tests.
- b) Seal test of hydraulic circuits.
- c) Check of required functions.
- d) Check of operating time control.
- e) Check of limiting device operation.
- f) Check of the actuator torque or thrust.
- g) Entire functional test with actual condition by operation of solenoid valves, Limit switches, Differential pressure switch, L/R selector switch and TLD shall be carried out.

5.2 Tests at the Valve Manufacturer's Shop

- a) Test and check after assembly with valve.
- b) No load test (DP=0) or load (DP max) Operations with the minimum required feeding pressure (10 kg/cm²g).
- c) Check of the limiting device operation.
- d) Various tests on the valve according to provisions of specific documentation.
- e) Testing shall conform to actual field operating conditions.

5.3 All actuators shall be visually inspected.

5.4 Dimensional check on actuators shall be carried out as per the Owner/ Consultant approved drawings.

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- 5.5** Chemical and mechanical properties as per relevant materials standards and this specification shall be checked.
- 5.6** Complete actuator housing with internals including the open/close gas over oil circuits of all actuators shall be subjected to a hydrostatic pressure test by applying 1.5 times the actuator design pressure for a minimum period of 2 hours. Chart recorder shall monitor pressure. No leakage shall be permitted during the hydrostatic test.
- 5.7** Actuator functional test shall be carried out by mounting the actuator on a test rig, and applying the hydraulic fluid pressure. The actuator shall be successfully stroked five times for open and close by suitably applying the hydraulic fluid pressure through hand provided. Actuator position indication shall be checked for correct operations during the test.
- 5.8** Non-destructive examination of individual actuator material and components consisting of but not limited to castings, forgings, plate and assembly welds shall be carried out by the Manufacturer. As a minimum, the following shall be carried out as applicable
- i) All casting of pressure containing parts shall be radio graphically examined as per ASTM E-94 and E-186/E-280 or E-446 as applicable, at quality level 2-2T. Category A, B or C defects shall not exceed the severity level for Class 2. Category D, E, F or G defects shall not be accepted.
 - ii) All forgings shall be ultrasonically examined to ASTM E-609. Quality 1 will be the minimum level of acceptance.
 - iii) All machined surfaces shall be liquid penetrant examined as per ASTM E-165. Surface discontinuities shall not be acceptable.
 - iv) Sealing areas within the actuator body shall be completely inspected by magnetic particle methods in accordance with ASTM E-709. Surface discontinuities shall not be acceptable.


5.9 Valve/Actuator Assembly Test:

After testing of individual actuators has been completed, the actuators shall be mounted on valves. Integrated valve and actuator tests shall be carried out at the Valve Manufacturer's Works, in compliance with the requirements stated in

5.10 Owner reserves the right to perform stage wise inspection and witness tests at Valve Manufacturer's works prior to shipment/Actuator manufacturer's shop. Manufacturer shall give reasonable access and facilities required for inspection to the Owner's Inspector.

Owner 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 Owner's Inspector relieve the Manufacturer of his responsibility for material, design, quality or operation of the actuators. Inspection and tests performed/witnessed by the Owner's Inspector shall in no way relieve the Manufacturer's obligation to perform the required inspection and tests.

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6.0 SHIPPING

- 6.1 All threaded and flanged opening shall be suitably protected to prevent entry of foreign material.
- 6.2 The actuator shall be supplied pre-assembled except piping/tubing, actuator, actuator control unit, tanks and other accessories shall be packed separately.
- 6.3 Protective grease oil coating shall be applied on the surface to protect them from rusting.

Package shall be marked legibly with suitable marking ink the following:

- a) Order number
- b) Package number
- c) Manufacturer's name
- d) Model No. & Thrust
- e) Tag number
- f) Inspection agency name or logo

7.0 TEST CERTIFICATES/REPORTS


Manufacturer shall submit the following certificates, duly certified by TPI as per EN 10204 (latest edition) and indicating project code (A286):

- a) Mill test certificates relevant to the chemical analysis and mechanical properties of the materials used for the actuator pressure containing parts as per the relevant standards and specifications.
- b) NDT reports for radiography, ultrasonic, magnetic particle and liquid penetrant inspection.
- c) Test report on operation of actuators including operating time.
- d) Test report on hydrostatic test of actuators.
- e) Test report on actuator/valve assembly tests.
- f) All other actuator test reports and certificates as required by this specification.

The certificates shall be valid only when signed by Owner's Representative or TPIA appointed by the Contractor at the discretion of Owner. IRN to be issued by TPI for dispatch from Manufacturer's works.

8.0 PAINTING AND MARKING

- 8.1 Actuator surface shall be thoroughly cleaned, freed from rust and grease and applied with sufficient coats of corrosion resistant paint suitable for marine/industrial environment as indicated in the Actuator Data Sheet. Surface preparation shall be carried out by shot blasting to SP-6/ SA 2.5 in accordance with "Steel Structures Painting Council-Visual Standard SSPC-VIS-1". Manufacturer shall indicate the type of corrosion resistant paint used in the drawings submitted for approval.

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8.2 All actuators shall be marked as per Manufacturer’s standard and shall have a permanently attached stainless steel plate with the following, as a minimum, detail:

- Tag Nos.
- Manufacturer’s Name
- Actuator Type, Model No., Serial No.
- Suitable for mounting on Valve_____” Size,_____ANSI Rating of Ball Valve
- Max. Allowable operating pressure or voltage.
- Area Classification in which the equipment can be used.
- Actuator characteristics data.
- Inspection agency name or logo

8.3 All threaded and flanged opening shall be suitably protected to prevent entry of foreign material. The actuator shall be supplied pre-assembled.

9.0 SPARES AND SPECIAL TOOLS

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


9.2 Manufacturer shall recommend and quote separately the spares for actuators required for two years of normal operation and maintenance.

9.3 In addition, Manufacturer shall recommend and quote unit price separately for the special tools required for the operation and maintenance of the actuators.

10.0 DOCUMENTATION

10.1 At the time of bidding, Manufacturer shall submit the following documents for approval:

- a) General arrangement drawings (GAD) and sectional drawings with materials list for actuators clearly showing all design features.
- b) Technical catalogs giving technical specification and other information for each type of actuators and its accessories.
- c) Schematic diagrams showing the complete actuator control circuit.
- d) Typical installation drawings complete with valve assembly.
- e) Actuator sizing calculations.
- f) Details of gas over oil circuit with complete sequencing of port from open to close and close to open position.
- g) Details of the hydraulic (oil) fluid proposed for filling the actuators.
- h) Details of corrosion resistant paint to be applied on the actuator surface.
- i) Reference list of similar supplies of actuators with all relevant details including Project, Year, Client, Location, Size, Rating of valve, Model Number, Type, Torque out put details, Service, etc. wherein the actuators have been installed in the last

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five years.

- j) A detailed specification sheet for valve actuator providing all the details regarding type, materials of construction for various parts etc.
- k) Installation drawing complete with valve assembly.
- l) Actuator sizing calculations including relation between required torque of valve and actuator output torque.
- m) Information asked for vide section 3.0 of this specification and actuator sizing as per Actuator Data Sheet.
- n) Drawing showing connections by Purchaser (piping, electrical etc.).
- o) Wiring diagram (actuator electrical circuitry) incorporating latching of momentary signals, remote/local switch, limit switches.
- p) Junction box terminal block nos. for I/O signals.
- q) Parts list.
- r) Recommended spare parts with prices.
- s) Assembly details (Valve & Actuator).
- t) Traceability report for hydrotest of gas / hydraulic cylinder shall be provided.

10.2 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 Owner/ Consultant's approval.

- u) All Documents
- v) Welding procedures, testing procedures and QA/QC Procedures.


Test certificates and certificates from statutory bodies.

Manufacture of actuators shall commence only after approval of the above documents. Once Owner/ Consultant has given the approval, any change in design, material and method of manufacture shall be notified to Owner/ Consultant whose approval in writing of all changes shall be obtained before the actuator is manufactured.

10.3 Within 30 days from the approval date, Manufacturer shall submit to Owner/ Consultant one reproducible and six copies of all approved drawings, documents and specifications.


10.4 Prior to shipment, Manufacturer shall submit to Owner/ Consultant one reproducible and six copies of the following:

- w) Test certificates/reports
- x) Manual for installation, erection instructions, and maintenance & operation

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instructions including a list of recommended spares for the actuators.

- y) Complete assembly drawing of the ball valve matching with the actuator offered.
- 10.5 The approval of these drawings/documents will not absolve vendor of the responsibility with respect to correct operation of the actuator.
- 10.6 Manufacturer's documentation, catalogues, drawings, operating and maintenance manuals etc. shall be in English language.

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ENGINEERING STANDARD



GAIL INDIA LIMITED

TECHNICAL SPECIFICATION FOR PAINTING GAIL-034-PI-DOC-TS-009


1	14.11.19	Client Comments Incorporated	AP	JR	SB	
0	19.09.2019	Issued for Bid	AP	JR	SB	
Rev	Date	Purpose	Prepared By	Checked By	Approved By	

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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.

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- 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 client's 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

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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 ± 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 non conformity 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.

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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 of the 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

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- 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 law 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.

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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-free with a cloth or a soft brush, washed with an organic solvent and thoroughly dried off with a dry cloth (e.g. with 1.1.1. Trichloroethane 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.

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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 off.

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 primer 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 check 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

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- 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 50 μ 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 % aluminium 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 after 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 be carried out in dry weather and at a minimum temperature of 10°C, except for special cases 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 fore cast 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,

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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 M ² /Lit/coat

Primer (P-2)

High build chlorinated rubber zinc phosphate primer

Type and Composition	Single pack, Chlorinated rubber medium Plasticised with unsaponifiable plasticiser pigmented with zinc phosphate
Volume solids	35- 40%
DFT	50 MICRONS/COAT (MIT)
Covering capacity	7-8 M ² /Lit/Coat

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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 M ² /Lit/coat
Heat resistance	Upto 100° 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 M ² /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 M ² /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 M ² /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%
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Volume	Solids	50%	
DFT		100 microns/coat (min)	
Covering capacity		5.0 M ² /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		10-1	2 M ² /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	20-2		5 microns/coat
Covering capacity		16-1	8 M ² /lit/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	30-4		0 microns / coat
Covering Capacity		10-1	2 M ² /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

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	Covering capacity	6.0-6.5 M ² / 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 M ² / 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 M ² / 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	Dual 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 M ² / lit/ coat
u)	Finish Coat (F-12)	
	Heat Resistant Silicon Paint suitable up to 400° 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 M ² /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 M ² /lit/ coat

Notes

1. Covering capacity and DFT depends on method of application. Covering capacity specified above is the theoretical. Allowing the losses during application, minimum 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-11 & F-12 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) Goadlass 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

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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 be 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 °C

COLOR CODE:

- A) Ball Valve (Above Ground) : Off White
- 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.

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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.


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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	<i>GASES</i>			
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	<i>ALL EQUIPMENT</i>			
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						
1.1	- 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.
1.3	- 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-10	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) 81 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.

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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 be used on site for places that are 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 be 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, be 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 a 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

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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 \pm 20 cm above the ground level marker and \pm 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.

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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 be Called in. The Approved Supervisory Body will then carry out inspections on site whereby the following assessment criteria will 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 with, ISO 2808 or ASTM D 1186.
- The thickness of each layer will be 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 be 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.

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- 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.

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ENGINEERING STANDARD




PIPING MATERIAL SPECIFICATION

GAIL-034-PI-DOC-TS-010

0	23.09.2019	Issued for Bid	AP	JR	SB	
REV	DATE	Purpose	Prepared BY	Checked By	Approved By	

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1.0 GENERAL NOTES


This specification describes the minimum requirements for the design, furnishing of materials, fabrication, and inspection and testing of pipes, fittings and valves.

All material shall conform to ASTM, API or BS standards. Design and fabrication shall conform to ANSI / ASME for pressure piping, ANSI B 31.3 – Chemical Plant and petroleum Refinery Piping, and ANSI B 31.8 – Gas transmission and Distribution piping system.

2.0 CODES AND STANDARDS

The latest revision of the following shall be considered as part of this specification.

ASME B 16.5	Steel Pipe Flanges and Flanged Fittings
ASME B 16.9	Factory made Wrought Steel Buttwelding Fittings
ASME B 16.11	Forged Steel Fittings, Socket Welding and Threaded
ASME B 16.20	Metallic Gaskets for Pipe Flanges.
ASME B 16.21	Non-Metallic Flat Gasket for Pipe Flanges
ASME B 16.47	Large Diameter Steel Flanges (26" thru 60")
ASME B 31.3	Process Piping
ASME B 31.4	Pipeline Transportation system for Liquid hydrocarbons & other Liquids
ASME B 31.8	Gas Transmissions and Distribution Piping System
ASME B 36.10	Welded and Seamless Wrought Steel Pipe
ASME B 46.1	Surface Texture
API 5L	Line Pipe
API 6D	Pipeline Valves
API 590	Steel Line Blank
API 600	Steel Gate Valves Flanges and Buttwelding Ends
API 602	Compact Steel Gate Valves
MSS SP 44	Steel Pipe line Flanges
MSS SP 75	Specification for High Test Wrought Butt Welding Fittings
MSS SP 97	Integrally Reinforced Forged Branch Outlet Fitting – Socket Welding, Threaded and Buttwelding Ends
ASTM A 105	Forging, Carbon Steel for Piping Components
ASTM A 193	Alloy Steel and Stainless Steel bolting Materials for High temp Service.

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ASTM A 194	Carbon and Alloy Steel Nuts for Bolts for High Pressure and High Temperature Service
ASTM A 320	Standard Specification for Alloy Steel and Stainless Steel Bolting Materials
ASTM A 216	Steel Casting, Carbon, Suitable for Fusion Welding, for High Temperature Service.
ASTM A 234	Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and Elevated Temperature
ASTM A 285	Pressure Vessel Plates, Carbon Steel, Low and Intermediate Tensile Strength.
ASTM A 694	Forging, Carbon and Alloy Steel, for Pipe Flanges, Fitting, Valves and Parts for High Pressure Transmission Service.
ASTM A 333	Low temperature service seamless pipe.
ASTM A 350	Forged Carbon and Low Alloy Steel requiring Notch Toughness Testing for Piping Components
ASTM A 420	Piping Fittings of Wrought Carbon Steel and Alloy Steel for Low Temperature Service.
ASTM A 860	Standard Specification for Wrought High Strength Low Alloy Steel Butt Welding Fittings

3.0 ABBREVIATIONS

3.1 Flange Facing


RTJ	-	Ring Type Joint
FF	-	Flat Face
RF	-	Raised Face

3.2 Fittings

PE	-	Plain End
BE	-	Bevel End
BW	-	Butt Weld
PBE	-	Plain Both End
POE	-	Plain One End
TBE	-	Threaded Both End
TOE	-	Threaded One End
LR	-	Long Radius
SR	-	Short Radius

3.3 Connections

BW	-	Butt-Weld
FLGD	-	Flanged
SCRD	-	Screwed
SO	-	Slip-On

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- SW - Socket Weld
- THRD - Threaded
- WN - Weld Neck

3.4 Wall Thickness

- SCH - Schedule in accordance with ANSI B 36.10 or B 36.19
- STD - Standard Weight Wall Thickness
- XS - Extra Strong Wall Thickness
- XXS - Double Extra Strong Wall Thickness

3.5 Valve Description

- BC - Bolted Cap
- BB - Bolted Bonnet
- ES - Extension Stem
- FB - Full Bore
- MO - Motor Operated
- GO - Gear Operated
- NRS - Non-Rising Stem (with inside screw)
- OS&Y - Outside Screw and Yoke
- RB - Reducer Bore
- RS - Rising Stem
- SC - Screwed Cap
- UB - Union Bonnet
- UC - Union Cap
- WB - Welded Bonnet

3.6 Pipes Description

- BE - Beveled End
- CS - Carbon Steel
- ERW - Electric Resistance Welded
- EFW - Electric Fusion Welded
- FS - Forged Steel
- HFI - High Frequency Induction
- KCS - Killed Carbon Steel
- KFS - Killed Forged Steel
- OH - Open Hearth
- SAW - Submerged Arc Welded
- SMLS - Seamless

4.0 PIPING CLASSES DESCRIPTION

Piping Classes assigned for the project are based on the following 2-digit system.

First Digit


Numerical, denoting the basic system rating or flange class

- i.e. 1 = ASME Class 150
- 3 = ASME Class 300
- 6 = ASME Class 600
- 9 = ASME Class 900

Second Digit

Letter, denoting the material

- A - Carbon Steel
- C - Stainless Steel

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- F - Fiberglass Reinforced plastic/epoxy (FRP)
- G - Galvanized
- P - Plastic (PEHD)
- S - Stainless Steel
- V - PVC

Third Digit

Sequential number to differentiate two or more piping classes of the same rating and same material but presenting some difference related to the handled fluid.

5.0 PIPES


- 5.1 Carbon steel pipe shall be made by open hearth, electric furnace or basic oxygen process only. The steel used shall be fully killed and made with fine grain structure. The grade and wall thickness of various sizes of pipes shall be as per piping material specification for the applicable class.
- 5.2 Pipe dimensions shall be in accordance with ASME B 36.10 for carbon steel ASTM standard pipes & API 5L for carbon steel API 5L grade pipes.
- 5.3 All pipe threads shall conform to American Standard taper as per ASME B 1.20.1 NPT, unless otherwise specified.
- 5.4 For butt weld end, bevel shall be in accordance with API specification 5L or ASME B16.25 as applicable.

6.0 FITTINGS

- 6.1 Fully killed carbon steel shall be used in the manufacture of fittings. The fitting shall have carbon equivalent not exceeding 0.45, based on check analysis.
- 6.2 Threaded joints, if used, shall conform to American Standard taper as per ASME B1.20.1 NPT.
- 6.3 Dimensions of socket welded/screwed fittings shall conform to ASME B 16.11. Swage shall be as per BS 3799.
- 6.4 Dimensions of steel butt welded fittings shall be as per ASME B 16.9.
- 6.5 Bore of socket welded fittings shall suit outside diameter (OD) of pipe and its thickness.
- 6.6 Butt welding ends shall conform to API specification 5L or ASME B 16.25 as applicable. In case of difference in thickness of matching ends, requirements of ASME B 31.8 shall apply.
- 6.7 Integrally reinforced forged branch fittings such as Sockolet, Weldolet etc. shall be as per MSS-SP-97. Fittings not covered in ASME B16.9 and MSS-SP-97 shall conform to manufacturer's standard.
- 6.8 Fittings thickness tolerances shall match pipe thickness tolerance.

7.0 BENDS

- 7.1 Unless otherwise specified for process piping, elbow of radius $R = 1.5 D$ shall only be used.

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7.2 In order to accommodate changes in vertical and horizontal alignment in piggable section of pipeline, Elastic bends/ Cold field bends/ Hot formed long radius bends shall be used.

D = Specified Outside Diameter

Long Radius Bend shall be used only when indicated in AFC drawing.

7.3 Miters shall not be used.

8.0 FLANGES

8.1 Pressure Temperature rating of flanges shall conform to B16.5/ MSS-SP44/ B16.47 Series A, as applicable.

8.2 Dimensions of flanges shall be in accordance with B16.5/ MSS-SP44/ B16.47 Series A, as applicable.

8.3 Neck of weld neck (WN) flanges shall suit pipe bore and thickness.

8.4 Bore of socket welded (SW) flanges shall suit pipe O.D. and its thickness.

8.5 Threads for screwed flanges, if used, shall conform to American Standard taper as per ASME B 1.20.1 NPT.

8.6 Sizes for blind flanges shall be indicated by nominal pipe size.

8.7 Unless specified otherwise in Piping Material Specification the flange face finish shall be as per ASME B16.5.

8.8 Butt welding ends of WN flanges shall conform to ASME B 16.25.

8.9 Spectacle blind/spacer & blinds shall be in accordance with ASME B 16.48/ manufacturer's standard.

9.0 GASKETS

9.1 Spiral wound metallic gasket with Graphite filled winding with SS304 inner ring and CS outer ring and shall conform to ASME B 16.20/ API 601.

9.2 Spiral wound gasket shall be self-aligning type.

10.0 BOLTING & THREADS

10.1 Nuts for stud bolts shall be American Standard Hexagon Heavy Series and double chamfered.

10.2 Dimension and tolerances for stud bolts and nuts shall be as per ASME B 18.2.1 and 18.2.2 with full threading to ASME B 1.1 Class 2A thread for bolts and Class 2B for nuts. Diameter and length of stud bolts shall be as per ASME B 16.5/ASME B16.47 with full threading.

10.3 Threads for nuts shall be as per ASME B 1.1 as follows :

Nuts for stud bolts dia ¼" to 1" : UNC-2B

Nuts for stud bolts dia 1⅝" to 3¼" : 8UN-2B

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10.4 Threads for stud bolts shall be as per ASME B 1.1, as follows:

Stud bolts dia ¼" to 1" : UNC-2A
Stud bolts dia 1⅛" to ¾" : 8UN-2A

10.5 Threads for threaded pipe, fitting, flanges and valve shall be in accordance with B 1.20.1 taper threads, unless specified otherwise.

10.6 Heads of jack screws shall be heavy hexagonal type. Jack screw end shall be rounded. Stud bolts shall be fully threaded with two hexagonal nuts.

11.0 THREAD SEALANT

Threaded joints shall be made with 1" wide PTFE jointing tape.

12.0 VALVES

12.1 Valve ends shall be as per valve data sheets for various piping class.

12.2 Sectionalizing valves, Block valves and other isolation valves installed on the main pipeline shall be ball valves with butt welding ends. All inline isolation valves on the mainline (pipeline) shall be full bore valves to allow smooth passage of cleaning as well as intelligent pigs.

12.3 All buried valves shall be provided with stem extension, sealant, vent/drain and shall have butt welded ends as per relevant specification/ data sheet.

12.4 Flange dimensions and face finish of flanged end valves shall conform to clause 9.0 of this specification.

12.5 Butt welding ends of Butt Welded valves shall conform to ASME B 16.25.

12.6 Face to face and end to end dimensions shall conform to applicable standards.

12.7 Valves shall conform to following standards unless specified otherwise in piping material specification for various piping class.


Flanged/Socket Welded end valves (1½" and below :

Design STD. for Process lines

Gate Valves	:	API 602
Globe Valves	:	BS EN ISO 15761
Check Valves	:	BS EN ISO 15761
Ball Valves	:	BS EN ISO 17292
Plug Valves	:	BS 5353

Flanged/Butt Welded end valves (2" and above)

Design STD. for Process Lines

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Gate Valves	:	API 6D
Globe Valves	:	BS 1873
Check Valves	:	API 6D
Ball Valves	:	API 6D
Plug Valves	:	API 6D

12.8 All manual operated valves shall be provided with wrench / hand wheel or gear operator as specified here in below.

12.8.1 **Gate Valves**

- For ANSI class 150 and 300 - Hand wheel operated for size ≤ 12" NB.
Gear operated for size ≥ 14" NB.
- For ANSI class 600 - Hand wheel operated for size ≤ 10" NB.
Gear operated for size ≥ 12" NB.

12.8.2 **Globe Valves**

- For ANSI class 150, 300, 600 and 900 - Hand Wheel operated for all size

12.8.3 **Ball valves & Plug Valves**

- For all ANSI class - Wrench operated for size ≤ 4" NB.
Gear operated for size ≥ 6" NB.

12.8.4 **Actuated Valves**

Actuated valves shall be as per P & IDs. The actuator shall have provision for remote operation as per P & IDs. All Actuated valves shall have additional provision of hand wheel operation .

13.0 **HYDROTESTING VENTS AND DRAINS**

In terminal piping, high point vents and low point drains required for the purpose of hydrotesting shall be of size 0.75". These vents & drains shall consist of gate valves with blind flange assembly.


14.0 **PIPELINE SPECIALTY ITEMS**

Pipeline specialty items viz. scraper traps, flow tees, insulating joints, LR bends etc. shall be as per data sheets and specification.

For Mainline Items, corrosion allowance shall be 1.0 mm except for scraper traps where 3 mm corrosion allowance shall be taken.

15.0 **INSULATING GASKET, SLEEVE AND WASHER**

The insulating gasket shall consist of a PTFE (Teflon) spring-energized face seal, or an elastomeric O-ring, seated in an isolating laminate, which shall be permanently bonded to a high strength metal gasket core. Due to this unique pressure activated sealing mechanism, the gasket requires far less bolt stress to seal than any other gasket. The gasket inner diameter shall be exactly matched to the flange bore to eliminate turbulent flow and flange face erosion/ corrosion. The seal elements shall be replaceable in the reusable gasket retainer. The core of gasket shall be made of annealed 316 stainless steel or other metals

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including duplex and Inconel etc.

Insulating gasket shall include the following applications,

- Flange isolation in conjunction with cathodic protection.
- Isolation between dissimilar metals to prevent galvanic corrosion.
- Mating mismatched ring-joint to raised –face flanges.
- Eliminate fluid trap corrosion between ring-joint (RTJ) flanges where high concentrations of Co₂, H₂S and other aggressive hydrocarbon media are present.
- Eliminate turbulence and flow induced erosion between ring-joint (RTJ) flanges.
- Protect against coating impingement on coated flange faces.
- To seal between flanges subjected to vibration/ cavitation.

15.1 Insulating Gasket, sleeves and washers material properties :

Compressive strength	:	65000 PSI
Average Dielectric strength	:	15 KV
Electrical resistance	:	> 1 Mega Ohm (When tested with 500-1000 V DC megger)
Max. Operating temp.	:	302°F (150°C)
Min. Operating temp.	:	(minus) -200°F
Water absorption	:	5%
Flexural strength	:	70000 PSI
Tensile strength	:	50000 PSI
Bond strength	:	2600 lb
Shear strength	:	22000 lb.

15.2 Seal Material

The sealing elements shall intended to provide an impervious barrier through which no contained media or other substance can penetrate. The composite retainer backing material behind the seal remains uncontaminated and thus permanently holds the seal in place in a static, fully encapsulated manner.

Viton as a seal material shall consist following properties,


- General purpose oilfield elastomer.
- Excellent resistance to aliphatic hydrocarbons, glycols and H₂S.
- Good resistance to aromatic hydrocarbons.

Isolation Sleeve

Mylar as a seal material shall consist following properties,

- Spiral wound Mylar is a general purpose material recommended for bolting application with flange temperatures below 250°F.
- Material shall be fair resistance to crushing, cracking, breaking and thread pinch.

Isolating washer: 1/8" (0.125) Thick washer.

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Steel Washer: ZPS standard – Zinc plated steel washers.

Butt weld (BW) ends of the insulating assembly shall be protected by metallic or high impact plastic bevel protectors.

The dimensions of insulating components (gaskets, sleeves and washers) shall be as indicated in Data Sheet. The insulating gasket and washers shall have adequate compressive strength to permit proper tightening of flange bolts for leak proof joint.

The insulating material shall be suitable for pressure and temperature indicated in Data Sheet under connecting pipeline details and shall be resistant to the fluid to be handled through the pipeline.


I.D. and O.D. of insulating washers shall be designed to fit over insulating sleeves and within spot faces on flanges.


After the hydrostatic test, insulating flange assembly shall be tested with air at 5 kg/cm² for 10 minutes. The tightness shall be checked by immersion or with a frothing agent. No leakage shall be accepted.

Insulating gasket, sleeve and washer after the field hydrostatic test shall be tested for dielectric integrity at 5000 V A.C., 50 Hz for one minute and the leakage current before and after shall be equal. Testing time, voltage and leakage shall be recorded and certified. The test shall be carried out in dry conditions.

16.0 CHARPY V-NOTCH TEST

All piping material like valves, fittings, flanges bolting etc. shall be Charpy impact tested. Charpy V-notch impact tests are required for the base metal, weld metal and heat-affected Zone (HAZ)

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PIPING SPECIFICATION			Service :	Natural Gas, Utilities (water,Inst. Air,plant air,nitrogen, carbon dioxide)			RATING :	150#	
PIPE CLASS : 1A1			Corrosion Allowance	1.5 MM			CODE :	ASME B 31.3	
TEMPERATURE : 0 TO 65 °C			Special Requirement	Non-IBR			BASE MATERIAL:		
PRESSURE : 19 bar g							Carbon Steel		
ITEM	SHORT CODE	SIZE FROM-THRU	DESCRIPTION	RATING AND/OR SCHED.	DIMENSION STANDARD	MATERIAL	REMARKS		
PIPES	P	0.50" - 0.750"	PE, SEAMLESS	S160	ASME B36-10	ASTM A 106 Gr.B			
		0.10" - 1.5"	PE, SEAMLESS	XS	ASME B36-10	ASTM A 106 Gr.B			
		2"	BE, SEAMLESS	XS	ASME B36-10	ASTM A 106 Gr.B (Charpy)			
		3"-24"	BE, SEAMLESS	STD.	ASME B36-10	ASTM A 106 Gr.B (Charpy)			
NIPPLES	NIPPLE	0.5" - 1.5"	PBE, SEAMLESS	M	ASME B36-10	ASTM A 106 Gr.B			
FITTINGS									
ELBOWS 90 LR	E	0.50" - 1.50"	SW	6000#	ASME B16.11	ASTM A105			
		2" - 24"	BW, 1.5D	M	ASME B16.9	ASTM A 234 Gr WPB(Charpy)			
ELBOWS 45 LR	E45	0.50" - 1.50"	SW	6000#	ASME B16.11	ASTM A105			
		2" - 24"	BW, 1.5D	M	ASME B16.9	ASTM A 234 Gr WPB(Charpy)			
REDUCERS CONCENTRIC	RC	2" - 24"	BW	M X M	ASME B16.9	ASTM A 234 Gr WPB(Charpy)			
REDUCERS ECCENTRIC	RE	2" - 24"	BW	M X M	ASME B16.9	ASTM A 234 Gr WPB(Charpy)			
TEES EQUAL	T	0.50" - 1.50"	SW	6000#	ASME B16.11	ASTM A105			
		2" - 24"	BW	M	ASME B16.9	ASTM A 234 Gr WPB(Charpy)			
TEES RED	TR	0.50" - 1.50"	SW	6000#	ASME B16.11	ASTM A105			
		2" - 24"	BW	M X M	ASME B16.9	ASTM A 234 Gr WPB(Charpy)			
SOCKOLET	S	0.50"-0.750"	SCRF	6000#	MSS-SP97	ASTM A105			
SOCKOLET	S	1.0" - 1.50"	SW	3000#	MSS-SP97	ASTM A105			
WELDOLETS	W	2" - 6"	BW	M X M	MSS-SP97	ASTM A105 (Charpy)			
CAPS	C	0.50" - 0.750"	SCRF	6000#	ASME B16.11	ASTM A105			
		1.0"-1.5"	SCRF	3000#	ASME B16.11	ASTM A105			
		2" - 24"	BW	M	ASME B16.9	ASTM A 234 Gr WPB(Charpy)			
PLUG	PG	0.50" - 0.750"	SCRM	6000#	ASME B16.11	ASTM A105			
CONC. SWAGE	CS	0.50" - 3.0"	PBE	MXM	BS-3799	ASTM A105 (Charpy)			
ECC. SWAGE	CS	0.50" - 3.0"	PBE	MXM	BS-3799	ASTM A105 (Charpy)			
FLANGES									
FLANGE,WN	FL	0.5"-1.5"	RF/125AARH	150#	ASME B16.5	ASTM A105			
FLANGE,WN	FL	2"-24"	RF/125AARH	150#	ASME B16.5	ASTM A105 (Charpy)			
FLANGE,BLIND	FL	0.5"-1.5"	RF/125AARH	150#	ASME B16.5	ASTM A105			
FLANGE,BLIND	FL	2"-24"	RF/125AARH	150#	ASME B16.5	ASTM A105 (Charpy)			
FLANGE,FIG.8	FL	0.5"-8"	FF/125AARH	150#	ASME B16.48	ASTM A105 (Charpy)			
SPCR & BLIND	FL	10"-24"	FF/125AARH	150#	ASME B16.48	ASTM A105 (Charpy)			
VALVES									
VLV.GLOBE	GV	0.5"-1.5"	SW	800#	BS EN ISO 15761	BODY- ASTM A105,TRIM-STELLITED,STEM-13% CR,STEEL			
VLV.GLOBE	GV	2"-18"	FLANGE END	150#	BS-1873	BODY- ASTM A216 GR.WCB,TRIM-13% CR,STEEL			
VLV.CHECK	CV	0.5"-1.5"	SW	800#	BS EN ISO 15761	BODY- ASTM A105,TRIM-STELLITED,STEM-13% CR,STEEL			
VLV.CHECK	CV	2"-24"	FLANGE END	150#	API-6D	BODY- ASTM A216 GR.WCB,TRIM-13% CR,STEEL			
VLV.BALL	BV	0.5"-1.5"	SW	800#	BS EN ISO 17292	BODY- ASTM A105,TRIM-STELLITED,STEM-13% CR,STEEL,SEAT-RPTFE			
VLV.BALL	BV	2"-24"	FLANGE END	150#	API-6D	BODY- ASTM A216 GR.WCB,BALL-AISI4140+0.0003" ENP/AISI 410			
VLV.PLUG	PV	0.5"-1.5"	SW	800#	BS-5353	BODY- ASTM A105,PLUG-A105+0.003" ENP			
BOLTS									
STUD-BOLT		0.5"-24"		150#	ASME-B18.2	BOLT: ASTM A193 GR.B7, NUT: ASTM A194 GR.2H			
GASKET									
GASKET		0.5"-24"		150#	ASME-B16.20	SPIRAL WOUND WITH GRAPHITE FILLER			
NOTE: 1) M=THICKNESS TO MATCH PIPE WALL THICKNESS. 2) FOR VALVE MATERIALS, REFER VALVE DATA SHEET ALONG WITH THIS SPECIFICATION.									
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BRANCH TABLE
FOR 150#

		B R A N C H S I Z E															
		1/2"	3/4"	1"	1.1/2"	2"	3"	4"	6"	8"	10"	12"	14"	16"	18"	20"	24"
H E A D E R S I Z E	1/2"	T															
	3/4"	T	T														
	1"	T	T	T													
	1.1/2"	T	T	T	T												
	2"	S	T	T	T	T											
	3"	S	S	S	S	T	T										
	4"	S	S	S	S	T	T	T									
	6"	S	S	S	S	W	T	T	T								
	8"	S	S	S	S	W	W	T	T	T							
	10"	S	S	S	S	W	W	T	T	T	T						
	12"	S	S	S	S	W	W	W	T	T	T	T					
	14"	S	S	S	S	W	W	W	T	T	T	T	T				
	16"	S	S	S	S	W	W	W	T	T	T	T	T	T			
	18"	S	S	S	S	W	W	W	W	W	T	T	T	T	T	T	T
	20"	S	S	S	S	W	W	W	W	W	T	T	T	T	T	T	T
	24"	S	S	S	S	W	W	W	W	W	T	T	T	T	T	T	T

LEGEND

T : TEE


S: SOCKOLET - SW

W : WELDOLET - BW

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SPECIFICATION**

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PIPING SPECIFICATION		Service :	Natural Gas, Utilities (water,Inst. Air,plant air,nitrogen, carbon dioxide)				RATING : 300#
PIPE CLASS : 3A1		Corrosion Allowance	1.5 MM				CODE : ASME B 31.3
TEMPERATURE : 0 TO 65 °C		Special Requirement	Non-IBR				BASE MATERIAL:
PRESSURE : 49 bar g							Carbon Steel
ITEM	SHORT CODE	SIZE FROM-THRU	DESCRIPTION	RATING AND/OR SCHED.	DIMENSION STANDARD	MATERIAL	REMARKS
PIPES	P	0.50" - 0.750"	PE, SEAMLESS	S160	ASME B36-10	ASTM A 106 Gr.B	
		01.0" - 1.5"	PE, SEAMLESS	XS	ASME B36-10	ASTM A 106 Gr.B	
		2"	BE, SEAMLESS	XS	ASME B36-10	ASTM A 106 Gr.B (Charpy)	
		3"	BE, SEAMLESS	STD.	ASME B36-10	ASTM A 106 Gr.B (Charpy)	
		4"-6"	BE, SEAMLESS	XS	ASME B36-10	ASTM A 106 Gr.B (Charpy)	
		8"-12"	BE, SEAMLESS	S40	ASME B36-10	ASTM A 106 Gr.B (Charpy)	
NIPPLES	NIPPLE	0.5" - 1.5"	PBE, SEAMLESS	M	ASME B36-10	ASTM A 106 Gr.B	
FITTINGS							
ELBOWS 90 LR	E	0.50" - 1.50"	SW	6000#	ASME B16.11	ASTM A105	
		2" - 12"	BW, 1.5D	M	ASME B16.9	ASTM A 234 Gr WPB(Charpy)	
ELBOWS 45 LR	E45	0.50" - 1.50"	SW	6000#	ASME B16.11	ASTM A105	
		2" - 12"	BW, 1.5D	M	ASME B16.9	ASTM A 234 Gr WPB(Charpy)	
REDUCERS CONCENTRIC	RC	2" - 12"	BW	M X M	ASME B16-9	ASTM A 234 Gr WPB(Charpy)	
REDUCERS ECCENTRIC	RE	2" - 12"	BW	M X M	ASME B16-9	ASTM A 234 Gr WPB(Charpy)	
TEES EQUAL	T	0.50" - 1.50"	SW	6000#	ASME B16.11	ASTM A105	
		2" - 12"	BW	M	ASME B16.9	ASTM A 234 Gr WPB(Charpy)	
TEES RED	TR	0.50" - 1.50"	SW	6000#	ASME B16.11	ASTM A105	
		2" - 12"	BW	M X M	ASME B16.9	ASTM A 234 Gr WPB(Charpy)	
SOCKOLET	S	0.50" - 0.750"	SCRFL	6000#	MSS-SP97	ASTM A105	
SOCKOLET	S	1.0" - 1.50"	SW	3000#	MSS-SP97	ASTM A105	
WELDOLETS	W	2" - 6"	BW	M X M	MSS-SP97	ASTM A105 (Charpy)	
CAPS	C	0.50" - 0.750"	SCRFL	6000#	ASME B16.11	ASTM A105	
		1.0"-1.5"	SCRFL	3000#	ASME B16.11	ASTM A105	
		2" - 12"	BW	M	ASME B16-9	ASTM A 234 Gr WPB(Charpy)	
PLUG	PG	0.50" - 0.750"	SCRM	6000#	ASME B16.11	ASTM A105	
CONC. SWAGE	CS	0.50" - 3.0"	PBE	MXM	BS-3799	ASTM A105 (Charpy)	
ECC. SWAGE	CS	0.50" - 3.0"	PBE	MXM	BS-3799	ASTM A105 (Charpy)	
FLANGES							
FLANGE,WN	FL	0.5"-1.5"	RF/125AARH	300#	ASME B16.5	ASTM A105	
FLANGE,WN	FL	2"-12"	RF/125AARH	300#	ASME B16.5	ASTM A105 (Charpy)	
FLANGE,BLIND	FL	0.5"-1.5"	RF/125AARH	300#	ASME B16.5	ASTM A105	
FLANGE,BLIND	FL	2"-12"	RF/125AARH	300#	ASME B16.5	ASTM A105 (Charpy)	
FLANGE,FIG.8	FL	0.5"-8"	FF/125AARH	300#	ASME B16.48	ASTM A105 (Charpy)	
SPCR & BLIND	FL	10"-12"	FF/125AARH	300#	ASME B16.48	ASTM A105 (Charpy)	
VALVES							
VLV.GLOBE	GV	0.5"-1.5"	SW	800#	BS EN ISO 15761	BODY- ASTM A105,TRIM-STELLITED,STEM-13% CR-STEEL	
VLV.GLOBE	GV	2"-12"	FLANGE END	300#	BS-1873	BODY- ASTM A216 GR.WCB,TRIM-13% CR-STEEL	
VLV.CHECK	CV	0.5"-1.5"	SW	800#	BS EN ISO 15761	BODY- ASTM A105,TRIM-STELLITED,STEM-13% CR-STEEL	
VLV.CHECK	CV	2"-12"	FLANGE END	300#	API-6D	BODY- ASTM A216 GR.WCB,TRIM-13% CR-STEEL	
VLV.BALL	BV	0.5"-1.5"	SW	800#	BS EN ISO 17292	BODY- ASTM A105,TRIM-STELLITED,STEM-13% CR-STEEL,SEAT-RPTFE	
VLV.BALL	BV	2"-12"	FLANGE END	300#	API-6D	BODY- ASTM A216 GR.WCB,BALL- AISI4140+0.0003" ENP/AISI 410	
VLV.PLUG	PV	0.5"-1.5"	SW	800#	BS-5353	BODY- ASTM A105,PLUG- A105+0.003" ENP	
BOLTS							
STUD-BOLT		0.5"-12"		300#	ASME-B18.2	BOLT: ASTM A193 GR.B7, NUT: ASTM A194 GR.2H	
GASKET							
GASKET		0.5"-12"		300#	ASME-B16.20	SPIRAL WOUND WITH GRAPHITE FILLER	
NOTE:1) M=THICKNESS TO MATCH PIPE WALL THICKNESS. 2) FOR VALVE MATERIALS, REFER VALVE DATA SHEET ALONG WITH THIS SPECIFICATION.							
PIPING MATERIAL SPECIFICATION	DOCUMENT NO.				Rev		
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BRANCH TABLE
FOR 300#

		B R A N C H S I Z E															
		1/2"	3/4"	1"	1.1/2"	2"	3"	4"	6"	8"	10"	12"	14"	16"	18"	20"	24"
H E A D E R S I Z E	1/2"	T															
	3/4"	T	T														
	1"	T	T	T													
	1.1/2"	T	T	T	T												
	2"	S	T	T	T	T											
	3"	S	S	S	S	T	T										
	4"	S	S	S	S	T	T	T									
	6"	S	S	S	S	W	T	T	T								
	8"	S	S	S	S	W	W	T	T	T							
	10"	S	S	S	S	W	W	T	T	T	T						
	12"	S	S	S	S	W	W	W	T	T	T	T					
	14"	S	S	S	S	W	W	W	T	T	T	T	T				
16"	S	S	S	S	W	W	W	T	T	T	T	T	T				
18"	S	S	S	S	W	W	W	W	W	T	T	T	T	T	T	T	
20"	S	S	S	S	W	W	W	W	W	T	T	T	T	T	T	T	
24"	S	S	S	S	W	W	W	W	W	T	T	T	T	T	T	T	

LEGEND

T : TEE

S: SOCKOLET - SW


W : WELDOLET - BW

**PIPING MATERIAL
SPECIFICATION**

DOCUMENT NO.

GAIL-034-PI-DOC-TS-010



PIPING SPECIFICATION			Service :	Natural Gas, Utilities (water,Inst. Air,plant air,nitrogen, carbon dioxide)			RATING :	600#
PIPE CLASS : 6A1			Corrosion Allowance	1.5 MM			CODE :	ASME B 31.3
TEMPERATURE : 0 TO 65 °C			Special Requirement	Non-IBR			BASE MATERIAL:	
PRESSURE : 98 bar g							Carbon Steel	
ITEM	SHORT CODE	SIZE FROM-THRU	DESCRIPTION	RATING AND/OR SCHED.	DIMENSION STANDARD	MATERIAL	REMARKS	
PIPES	P	0.50" - 0.750"	PE, SEAMLESS	S160	ASME B36-10	ASTM A 106 Gr.B		
		0.750" - 1.000"	PE, SEAMLESS	XS	ASME B36-10	ASTM A 106 Gr.B		
		1.000" - 1.500"	BE, SEAMLESS	XS	ASME B36-10	ASTM A 106 Gr.B (Charpy)		
		1.500" - 2.000"	BE, SEAMLESS	S40	ASME B36-10	ASTM A 106 Gr.B (Charpy)		
NIPPLES	NIPPLE	0.5" - 1.5"	PBE, SEAMLESS	M	ASME B36-10	ASTM A 106 Gr.B		
FITTINGS								
ELBOWS 90 LR	E	0.50" - 1.50"	SW	6000#	ASME B16.11	ASTM A105		
		2" - 12"	BW, 1.5D	M	ASME B16.9	ASTM A 234 Gr WPB(Charpy)		
ELBOWS 45 LR	E45	0.50" - 1.50"	SW	6000#	ASME B16.11	ASTM A105		
		2" - 12"	BW, 1.5D	M	ASME B16.9	ASTM A 234 Gr WPB(Charpy)		
REDUCERS CONCENTRIC	RC	2" - 12"	BW	M X M	ASME B16-9	ASTM A 234 Gr WPB(Charpy)		
REDUCERS ECCENTRIC	RE	2" - 12"	BW	M X M	ASME B16-9	ASTM A 234 Gr WPB(Charpy)		
TEES EQUAL	T	0.50" - 1.50"	SW	6000#	ASME B16.11	ASTM A105		
		2" - 12"	BW	M	ASME B16.9	ASTM A 234 Gr WPB(Charpy)		
TEES RED	TR	0.50" - 1.50"	SW	6000#	ASME B16.11	ASTM A105		
		2" - 12"	BW	M X M	ASME B16.9	ASTM A 234 Gr WPB(Charpy)		
SOCKOLET	S	0.50" - 0.750"	SCRF	6000#	MSS-SP97	ASTM A105		
SOCKOLET	S	1.0" - 1.50"	SW	3000#	MSS-SP97	ASTM A105		
WELDOLETS	W	2" - 6"	BW	M X M	MSS-SP97	ASTM A105 (Charpy)		
CAPS	C	0.50" - 0.750"	SCRF	6000#	ASME B16.11	ASTM A105		
		1.0" - 1.5"	SCRF	3000#	ASME B16.11	ASTM A105		
		2" - 12"	BW	M	ASME B16-9	ASTM A 234 Gr WPB(Charpy)		
PLUG	PG	0.50" - 0.750"	SCRM	6000#	ASME B16.11	ASTM A105		
CONC. SWAGE	CS	0.50" - 3.0"	PBE	MXM	BS-3799	ASTM A105 (Charpy)		
ECC. SWAGE	CS	0.50" - 3.0"	PBE	MXM	BS-3799	ASTM A105 (Charpy)		
FLANGES								
FLANGE,WN	FL	0.5"-1.5"	RF/125AARH	600#	ASME B16.5	ASTM A105		
FLANGE,WN	FL	2"-12"	RF/125AARH	600#	ASME B16.5	ASTM A105 (Charpy)		
FLANGE,BLIND	FL	0.5"-1.5"	RF/125AARH	600#	ASME B16.5	ASTM A105		
FLANGE,BLIND	FL	2"-12"	RF/125AARH	600#	ASME B16.5	ASTM A105 (Charpy)		
FLANGE,FIG.8	FL	0.5"-6"	FF/125AARH	600#	ASME B16.48	ASTM A105 (Charpy)		
SPCR & BLIND	FL	10"-12"	FF/125AARH	600#	ASME B16.48	ASTM A105 (Charpy)		
VALVES								
VLV.GLOBE	GV	0.5"-1.5"	SW	800#	BS EN ISO 15761	BODY- ASTM A105,TRIM-STELLITED,STEM-13% CR,STEEL		
VLV.GLOBE	GV	2"-12"	FLANGE END	600#	BS-1873	BODY- ASTM A216 GR,WCB,TRIM-13% CR,STEEL		
VLV.CHECK	CV	0.5"-1.5"	SW	800#	BS EN ISO 15761	BODY- ASTM A105,TRIM-STELLITED,STEM-13% CR,STEEL		
VLV.CHECK	CV	2"-12"	FLANGE END	600#	API-6D	BODY- ASTM A216 GR,WCB,TRIM-13% CR,STEEL		
VLV.BALL	BV	0.5"-1.5"	SW	800#	BS EN ISO 17292	BODY- ASTM A105,TRIM-STELLITED,STEM-13% CR,STEEL,SEAT-RPTFE		
VLV.BALL	BV	2"-12"	FLANGE END	600#	API-6D	BODY- ASTM A216 GR,WCB,BALL-AISI4140+0.0003" ENP/AISI 410		
VLV.PLUG	PV	0.5"-1.5"	SW	800#	BS-5353	BODY- ASTM A105,PLUG-A105+0.003" ENP		
BOLTS								
STUD-BOLT		0.5"-12"		600#	ASME-B18.2	BOLT: ASTM A193 GR.B7, NUT: ASTM A194 GR.2H		
GASKET								
GASKET		0.5"-12"		600#	ASME-B16.20	SPIRAL WOUND WITH GRAPHITE FILLER		
NOTE: 1) M=THICKNESS TO MATCH PIPE WALL THICKNESS. 2) FOR VALVE MATERIALS, REFER VALVE DATA SHEET ALONG WITH THIS SPECIFICATION.								
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BRANCH TABLE
FOR 600#

		B R A N C H S I Z E															
		1/2"	3/4"	1"	1.1/2"	2"	3"	4"	6"	8"	10"	12"	14"	16"	18"	20"	24"
H E A D E R S I Z E	1/2"	T															
	3/4"	T	T														
	1"	T	T	T													
	1.1/2"	T	T	T	T												
	2"	S	T	T	T	T											
	3"	S	S	S	S	T	T										
	4"	S	S	S	S	T	T	T									
	6"	S	S	S	S	W	T	T	T								
	8"	S	S	S	S	W	W	T	T	T							
	10"	S	S	S	S	W	W	T	T	T	T						
	12"	S	S	S	S	W	W	W	T	T	T	T					
	14"	S	S	S	S	W	W	W	T	T	T	T	T				
	16"	S	S	S	S	W	W	W	T	T	T	T	T	T			
	18"	S	S	S	S	W	W	W	W	W	T	T	T	T	T	T	T
	20"	S	S	S	S	W	W	W	W	W	T	T	T	T	T	T	T
	24"	S	S	S	S	W	W	W	W	W	T	T	T	T	T	T	T

LEGEND

T : TEE

S: SOCKOLET - SW

W : WELDOLET - BW

**PIPING MATERIAL
SPECIFICATION**

DOCUMENT NO.
GAIL-034-PI-DOC-TS-010



ENGINEERING STANDARD



TECHNICAL SPECIFICATION FOR PIPING MATERIAL SPECIFICATION

GAIL-034-PI-DOC-TS-011

Rev	Date	Purpose	Prepared By	Checked By	Approved By
0	21.09.19	Issued For Approval	AP	JR	SB



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1.0 SCOPE

This specification covers the requirements of various piping materials used in piping/ pipeline system handling Natural Gas/ Re-gasified Liquid Natural Gas (RLNG) and associated utilities in the pipeline. This specification describes the minimum requirements for the design, furnishing of materials, fabrication, inspection, testing of pipes & fittings and valves.

2.0 CODES AND STANDARDS

All materials shall conform to ASTM, API or BS Standards.

Pipeline and terminal facilities envisaged as a part of this project shall be designed and engineered primarily in accordance with the provisions of ASME B 31.8 – “Gas Transmission & Distribution Piping System”, ASME B 31.3 Pressure Piping, “Chemical Plant and petroleum Refinery Piping” and PNGRB, Regulation 2009 -“ T4S Regulation, Petroleum and Natural Gas Regulatory Board .

All codes standards and specifications referred herein shall be the latest edition of such documents.

2.1 PIPING CLASS DESIGNATION CODE

The piping class designation consist of three digits numbering system made up of number, letter and number e. g. 6D1, 3D1, 1D1 etc as follows:

6D1 - ASTM A333, Gr.6 (600 #)

3D1 - ASTM A333, Gr.6 (300 #)

1D1 - ASTM A333, Gr.6 (150 #)

First letter indicates ASME class rating, e.g.,

1-150 Class

3-300 Class

6-600 Class


The Second letter indicates different material, e.g.

“D” indicates – Carbon Steel Material i.e ASTM A333, Gr.6

The last letter indicates ground position of pipeline, e.g.,

1: Above Ground

2: Under ground


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3.0 PIPING

- 3.1 Carbon steel pipe shall be made by open hearth, electric furnace or basic oxygen process only. The steel used shall be fully killed and made with fine grain structure. The grade and wall thickness of various sizes of pipes shall be as specified in the P&ID or other bid documents.
- 3.2 Pipe dimensions shall be in accordance with ANSI B 36.10 or API 5L for carbon steel pipes.
- 3.3 For butt weld end, bevel shall be in accordance to ANSI B 16.25/ API 5L as applicable.
- 3.4 Test reports shall be supplied for all mandatory tests as per the applicable material specifications.
- 3.5 Material test certificates (physical property, chemical composition and heat treatment report) shall also be furnished for the pipes supplied.
- 3.6 Pipes shall not have any circumferential seam joint in a random length.
- 3.7 All pipes shall be hydrostatically tested and the test pressure shall be as per QAP or as specified.
- 3.8 Threads for threaded pipes in accordance with ANSI B1.20.1 taper threads, unless otherwise specified.
- 3.9 All pipe size 2" and below shall be minimum thickness Sch 160 and material shall be seamless Low Temperature Carbon Steel (LTCS).
- 3.10** All pipe and their dimensions, tolerances, chemical compositions, physical properties, heat treatment, hydro test and other testing and marking shall confirm to the codes and standards. Selected Pipe wall thickness have been based on Design Pressure, Temperatures, Corrosion allowance and matching to fitting/flange schedule and thickness.
- 3.11 Marking And Despatch**
- 3.11.1 All pipes shall be marked in accordance with the applicable codes, standards and specifications.
- 3.11.2 Pipes shall be dry, clean and free from moisture, dirt and loose foreign materials of any kind.
- 3.11.3 Pipes shall be protected from rust, corrosion and mechanical damage during transportation, shipment and storage.
- 3.11.4 Steel end protectors to be used on galvanized pipes.
- 3.11.5 Both ends of the pipe shall be protected with the following material:
- a) Plain end: Plastic cap,
 - b) Bevel end: Wood, metal or plastic cover.
- 3.11.6 End protectors to be used on beveled ends shall be securely and tightly attached with belt or wire.

4.0 BENDS


Unless otherwise specified for terminal piping, the elbow of radius $R = 1.5 D$ shall only be used.

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5.0 FITTINGS

When piping class and specification changes occur at branch, Tee/sock-o-let/weld-o-let shall follow the class & specification of run pipe. In case of piping class and specification changes occur at reducer/expander, piping class and specification of reducer/expander shall be of higher size piping.

- 5.1 Fully killed carbon steel shall be used in the manufacture of fittings.
- 5.2 Dimension of socket weld/ screwed fittings shall conform to ASME B 16.11
- 5.3 Fittings thickness tolerances shall match pipe thickness tolerance.
- 5.4 ID of socket welded fittings shall suit the O. D. of pipe and thickness.
- 5.5 For reducing butt weld fittings having different wall thickness at each end, the greater wall thickness of the fittings shall be employed and inside bore at each end shall be matched with the specified inside diameter of connecting pipe.
- 5.6 Chemical composition, physical properties, tests; dimensions and tolerance, heat treatment and marking shall conform to the applicable codes / standards / specifications as specified.
- 5.7 All unequal tees are reducing in branch only.
- 5.8 No repair welding is permitted.
- 5.9 All fittings shall be seamless in construction unless otherwise specified and as directed by Owner.
- 5.10 Dimensions of butt welded carbon steel fittings shall be as per ASME B 16.9 / MSS-SP-75, as applicable.
- 5.11 Butt welding ends shall conform to ANSI B 16.25/ API 5L. In case of difference in thickness of matching ends, requirements of ASME B 31.8 shall apply.
- 5.12 Integrally reinforced forged branch fittings such as sockolet, threadolet, weldolet, nipple etc. shall be as per MSS-SP-97. Fittings not covered in ASME B 16.9 and MSS-SP-97 shall conform to manufacturer's standard.
- 5.13 All fittings MSS-SP Grade to meet LTCS properties at -20 °C and -46 °C or as mentioned in the respective material code and tested accordingly.
- 5.14 **Marking And Despatch**
- 5.14.1 Each fitting shall be legibly and conspicuously marked in accordance with the requirements of applicable standards.
- 5.14.2 Steel die marking shall not be permitted on body of butt weld fittings, except for low stress round nose die stamping.
- 5.14.3 Fittings shall be dry, clean and free of moisture, dirt and loose foreign materials of any kind.
- 5.14.4 Fittings shall be protected from rust, corrosion and mechanical damage during transportation, shipment and storage.
- 5.14.5 Rust preventive used on machined surfaces to be welded shall be easily removable with petroleum solvent of the same shall not be harmful to welding.

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- 5.14.6 Each end of fitting shall be protected with a wood, metal or plastic cover.
- 5.14.7 Each size of fitting shall be supplied in separate packaging marked with the purchase order no., item code no., material specification, size and schedule / thickness / rating, etc.

6.0 FLANGES

- 6.1 Flange rating shall be same as ANSI B 16.5/ MSS-SP-44/ B 16.47 Series A as specified.
- 6.2 Dimensions of flanges shall be in accordance with ANSI B 16.5/ B 16.47 Series A, as applicable.
- 6.3 Neck of Weld Neck (WN) flanges to suit pipe bore and thickness.
- 6.4 Bore of Socket Welded (SW) flanges shall suit pipe O.D. and its thickness.
- 6.5 Sizes for blind flanges shall be indicated by nominal pipe sizes.
- 6.6 Carbon steel flanges faces shall have smooth finish as indicated in the material specification. Flanges faces shall have smooth finish to 125-250 micro inches AARH as per MSS-SP-6.
- 6.7 Wherever face finish is not mentioned, it shall be serrated spiral / concentric.
- 6.8 In place of spectacle blinds of size 14" NB and above, a pair of spacer and blind may be used.
- 6.9 All flanges of size 2" NB & above shall have Butt Weld ends unless otherwise specified.
- 6.10 Flanges of size 1.5" NB and below shall have socket weld ends unless otherwise specified.
- 6.11 Butt welding ends of WN flanges shall conform to ANSI B 16.25.
- 6.12 Spectacle blind/ spacer & blinds shall be in accordance with ASME B 16.48/ Manufacturer's Standard.
- 6.13 Two jack screws 180° apart shall be provided for all spectacle blind assemblies. The jack screws shall be as per CONSULTANT/ OWNER's standard.
- 6.14 No repair welding is permitted.
- 6.15 Material test certificate (physical property, chemical composition & heat treatment report, etc.) shall also be furnished for flanges supplied.
- 6.16 **Marking & Despatch**
All flanges shall be properly marked with item code no. and size and shall be securely placed in wooden boxes for dispatch

7.0 GASKETS

Gaskets or seals, when provided for end closure shall be self sealing & suitable for service conditions. Spiral wound metallic gaskets (SS 316 – Pure Graphite, Spiral Wound) shall conform to B 16.20. All spiral wound gaskets shall be provided with inner and outer (centering) ring.

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8.0 BOLTING

- 8.1 Nuts for stud bolts shall be American Standard Hexagonal Heavy series and double chamfered.
- 8.2 Stud bolt shall be fully threaded with two heavy hex nuts as per the relevant material standard.
- 8.3 Dimension and tolerances for stud bolts and nuts shall be as per ANSI B 18.2.1 and 18.2.2 with full threading to ANSI B 1.1 Class 2A thread for bolts and Class 2B for nuts. Diameter and length of stud bolts shall be as per ANSI B 16.5/ ASME B 16.47 with full threading.
- 8.4 Threads for nuts shall be as per ANSI B 1.1, as follows:
- | | | |
|--|---|--------|
| Nuts for stud dia ¼" to 1" | : | UNC-2B |
| Nuts for stud bolts dia 1 ^{1/8} " to 3 ^{1/4} " | : | 8UN-2B |
- Threads for stud bolts shall be as per ANSI B 1.1, as follows.
- | | | |
|---|---|--------|
| Studs bolts dia ¼" to 1" | : | UNC-2A |
| Stud bolts dia 1 ^{1/8} " to 3 ^{1/4} " | : | 8UN-2A |
- 8.5 Heads of jack screws shall be heavy hexagonal type. Jack screw end shall be rounded. Stud bolts shall be fully threaded with two hexagonal nuts.
- 8.6 The hydraulic bolt tensioning shall be applied for bolt diameters of 2" & above.

9.0 VALVES

Unless specified otherwise, valves shall conform to the latest edition of following standards:

Socket welded (Below 2")

Ball Valves	-	BS EN ISO 17292
Globe Valves	-	BS EN ISO 15761


Flanged / Butt weld end Valves (2" and above)

Ball Valves	-	API 6D
Globe Valves	-	BS 1873

All valves with non-metallic seats and seals shall be fire safe type. Fire safe test shall be as per API-607 (latest) or API-6FA (latest). Fire safe test certificates duly certified by a recognized Third Party Inspection Agency shall be furnished to the Owner for approval.

The face to face dimensions of flange valves shall be as per ANSI B16.10 and flanges on the steel flange valves shall conform to ASME B16.5 and ASME B 16.47 as applicable

Butt welding ends of Butt Welded valves shall conform to ANSI B 16.25.

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Valve ends shall be as per valve data sheets attached with bid for various piping class.

Buried valves on mainline shall be provided with stem extension, sealant, vent/drain & shall have butt welded ends.

Casting of valves shall be radio graphically examined as per the procedure and acceptance criteria specified in ASME B 16.34 Annexure - B. All valves of ANSI 300# , 600# & 800 # rating shall be 100% tested by radiography irrespective of the valve size.

Valve castings shall be requiring radiography and radiographic quality as per ANSI B16.34 Annexure 'B', Radiography for these valve castings shall be carried out by the manufacturer as per his standard quality control procedure.

Valve body thickness, wherever not specified in the standard, shall be as per ANSI B16.34.

Flange shall be integral with valve body, valves with flanges welded to the body shall not be accepted.

Socket weld end ball valves with non-metallic seats or seals shall be provided with 100mm long nipples having material and thickness equivalent to that specified in the piping material class. These nipples shall be welded to the valve by the supplier on both ends before fitting packing seats and seals.

Ball position indicator shall be provided.

Ball shall be solid in construction.

Ball valves shall be provided with antistatic device.

Ball valves shall be field serviceable.

Valves of trunion mounted type shall be double block and bleed type and shall be equipped with a device through which sealant can be injected into the sealant area.

Gear operator shall be totally enclosed i.e. helical worm gear in grease case.

Valve shall be provided anti blow out proof stem design.


Valve shall be bi-directional

9.1 Globe Valves

Globe valve shall be of type BS 1873, bolted bonnet, hard faced stellited conical sheet, taper disc with either flanged ends according to ASME B 16.5/ ASME B 16.47 (as applicable), or welded ends.

The Valve shall be design for maximum pressure of 98 bar/ 49 bar (as specified by owner) and a temperature of -20°C to $+65^{\circ}\text{C}$.

The Material of construction of body will be as per data sheet and the same should be certified according to the EN 10204 3.2.

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All underground valves shall be of extended stem type and Height of the stem shall be decided during detail engineering. Also, refer QAP and Data sheet attached elsewhere in the bid document.

9.2 Ball Valves

Ball of class 600#/ 300# shall be used with full bore, fully welded design / bolted Side entry design, anti-static tested as per clause B.5 of annexure-B of API 6D, Double block & Bleed having drain & vent device fire safety, gear operated with hand wheel, local position indicator, ex-switch for opening and closing suitable for either butt weld ends or flanged connections according to ASME B 16.34, ASME B 16.5 or ASME B 16.47 as applicable.

The ball shall be design for maximum pressure of 98 bar (g)/ 49 bar (g) (as specified by owner) and a temperature of -20°C to $+65^{\circ}\text{C}$.

The Material of construction of body will be as per data sheet and the same should be certified according to the EN 10204 3.2.

All underground valves shall be of extended stem type and Height of the stem shall be decided during detail engineering.

Also refer QAP and data sheet.

Manual Valve operation shall be as indicated below, unless specified otherwise in the P&ID.

For ANSI class 150, 300, 600 – Lever /Hand wheel operated for size 4" & below.

Gear operated / MOV/HOV for size 6"& above.

10.0 QUICK OPENING END CLOSURE


Quick opening end closure to be installed on scrapper traps (if specified elsewhere in the bid) shall be equipped with safety locking devices in compliance with section VIII, division 1, UG-35.2 of ASME Boiler and Pressure Vessel code.

11.0 HYDRO TESTING VENTS AND DRAINS

High point vents and low point drains required for the purpose of hydro testing shall be of size 1" and consist of sockolet, globe & ball valve for vent, Globe & Ball Valve for drain, flange & blind flange.

12.0 PIPELINE SPECIALITY ITEMS

Pipeline Specialty items viz., Scrapper Traps, Flow Tee, LR bends, QOEC and Insulating Joint shall be as per respective data sheets, specifications and Project Specific drawing showing Mainline & Terminal materials.

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PIPING CLASS: 1D1

- CLASS RATING : 150
- BASIC MATERIAL: CARBON STEEL
- CORROSION ALLOWANCE: 1.6 MM
- DESIGN CODE: ASME B 31.8
- DESIGN PRESURE: 19 BAR (g)
- DESIGN TEMPRATURE: -20 TO 65 C
- SERVICE: NATURAL GAS
- PRESSURE (Kg/Sq. cm g) AND TEMPERATURE (Deg. C) RATINGS

TEMP	-45	38	50	100	150
PRESS	18.76	18.76	18.55	17.74	16.11

NOTES

- NDT OF WELD: RADIOGRAPHY ALL BUTT WELDS 100%.

PIPING CLASS: 3D1

- CLASS RATING : 300
- BASIC MATERIAL: CARBON STEEL
- CORROSION ALLOWANCE: 1.6 MM
- DESIGN CODE: ASME B 31.8
- DESIGN PRESURE: 49 BAR (g)
- DESIGN TEMPRATURE: -20 TO 65 C
- SERVICE: NATURAL GAS
- PRESSURE (Kg/Sq. cm g) AND TEMPERATURE (Deg. C) RATINGS

TEMP	-45	38	93	120
PRESS	48.86	48.86	46.05	45.54

NOTES

- NDT OF WELD: RADIOGRAPHY ALL BUTT WELDS 100%.

PIPING CLASS: 6D1

- CLASS RATING : 600
- BASIC MATERIAL: CARBON STEEL
- CORROSION ALLOWANCE: 1.6 MM
- DESIGN CODE: ASME B 31.8
- DESIGN PRESURE: 98 BAR (g)
- DESIGN TEMPRATURE: -20 TO 65 C
- SERVICE: NATURAL GAS
- PRESSURE (Kg/Sq. cm g) AND TEMPERATURE (Deg. C) RATINGS


TEMP	-45	38	93	149
PRESS	104.05	104.05	94.91	92.45

NOTES

- NDT OF WELD: RADIOGRAPHY ALL BUTT WELDS 100%.

PIPING CLASS -1D1

PIPELINE/PIPING DESIGN CODE		ASME B 31.8						DESIGN FACTOR 0.5									
ITEM	NOMINAL DIAMETER (INCHES)	0.50	0.75	1.00	1.50	2.00	3.00	4.00	6.00	8.00	10.0						
	WALL THICKNESS (MM/SCH)	S80	S80	S80	S80	S80	S40	S40	S40	S40							
PIPE	MATERIAL	ASTM A333 GR.6															
	DIMENSION STD.	B36.10															
	METHOD OF MANUFACTURE, ENDS	SEAMLESS PE						SEAMLESS BE									
	MATERIAL AND GRADE	ASTM A 350 GR. LF2, CL-1															
FLANGE	TYPE, FLANGE FACING	SW. RF 125AARH						WN. THICKNESS TO MATCH PIPE THICKNESS RF 125AARH									
	DIMENSION STD.	B16.5															
	MATERIAL AND GRADE	ASTM A 350 GR. LF2, CL-1															
BLIND FLANGE	FLANGE FACING	RF 125AARH															
	DIMENSION STD.	B16.5															
	MATERIAL AND GRADE	ASTM A 350 GR. LF2, CL-1															
SPECTACLE BLIND	FLANGE FACING	FF 125AARH															
	DIMENSION STD.	B16.48															
	TYPE	FIG.8 FLANGE						SPACER BLIND									
	MATERIAL AND GRADE	ASTM A 350 GR. LF2, CL-1															
BOLTING	STUD BOLTS (FULLY THREADED)	A 320 GR L7, B-18.2.2															
	NUTS (HEAVY HEXAGONAL)	A 194 GR 4/7, B-18.2.1															
GASKET	TYPE, MATERIAL AND Dmn. STD.	SPIRAL, SP.WND SS316+GRAPHITE FILLED, B-16.20, ANSI B16.5															
ELBOW-90 ELBOW-45	MATERIAL	SW FOR 0.5" TO 1.5" ASTM A350 GR.LF2						BW FOR 2" AND ABOVE ASTM A 420 GR.WPL6									
	END DETAIL	SW,3000#						BW, 1.5D									
	DIMENSION STD.	B-16.11						B-16.9									
T-EQUAL T-RED	MATERIAL	ASTM A350 GR.LF2						ASTM A 420 GR.WPL6									
	END DETAIL	SW,3000#						BW									
	DIMENSION STD.	B-16.11						B-16.9									
CAP & PLUG (UPTO 1.5")	MATERIAL	ASTM A350 GR.LF2						ASTM A 420 GR.WPL6									
	END DETAIL	SCRF,3000#						BW, THK TO MATCH PIPE THICKNESS									
	DIMENSION STD.	B-16.11						B-16.9									
FITTING	MATERIAL	ASTM A350 GR.LF2						ASTM A 420 GR.WPL6									
	END DETAIL	SW,3000#						BW, THICKNESS TO MATCH PIPE THICKNESS									
	DIMENSION STD.	B-16.11						B-16.9									
	TYPE	COUPLING FULL, HALF LH., RED.						RED. CON. RED. ECC.									
O'LET	MATERIAL	ASTM A350 GR.LF2															
	END DETAIL	SW,3000#						BW									
	DIMENSION STD.	MSS-SP97						MSS-SP97									
	TYPE	SOCKOLET						WELDOLET									

0	21.09.2019	ISSUED FOR APPROVAL	VKS	JR	UN
REV. NO.	DATE	SUBJECT OF REVISION	PREP	CHKD	APPD
 LYONS ENGINEERING PVT. LTD. NEW DELHI		PIPING MATERIAL SPECIFICATION FOR 150#	SCALE: NTS (SHEET 1 OF 6)		REV 0
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PIPING CLASS -150#

ANSI CLASS: 150#	TEMP °C	-20	to	65		
	PRESS. BAR (g)	19		19		

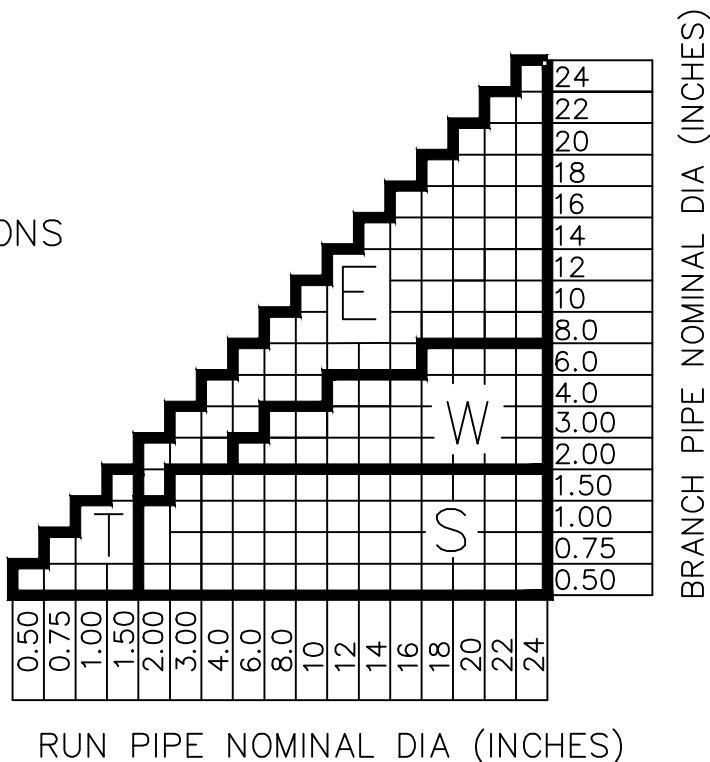
SERVICE : NATURAL GAS


NOTES: -

1. BRANCH CONNECTIONS SHALL BE AS PER BRANCH CONNECTION TABLE
2. ALL BUTT WELDS SHALL BE 100% RADIOGRAPHED.
3. 100% OF SOCKET WELD SHALL BE SUBJECTED TO MPT/DPT OR AS DIRECTED BY OWNER.
4. PRESSURE-TEMPERATURE RATING OF VALVE BODY SHALL BE AS PER API 6D.

BRANCH CONNECTIONS


E	TEES BW
S	SOCKOLET
T	TEES SW
W	WELDOLETS



0	21.09.2019	ISSUED FOR APPROVAL	VKS	JR	UN
REV. NO.	DATE	SUBJECT OF REVISION	PREP	CHKD	APPD
 LYONS ENGINEERING PVT. LTD. NEW DELHI		PIPING MATERIAL SPECIFICATION FOR 150#	SCALE: NTS (SHEET 2 OF 6)		REV 0
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PIPING CLASS - 3D1

PIPELINE/PIPING DESIGN CODE		ASME B 31.8						DESIGN FACTOR 0.5						
ITEM	NOMINAL DIAMETER (INCHES)	0.50	0.75	1.00	1.50	2.00	3.00	4.00	6.00	8.00	10.0	12.0		
PIPE	WALL THICKNESS (MM/SCH)	S80	S80	S80	S80	S80	S40	S40	S40	S40	S40	S40		
	MATERIAL	ASTM A333 GR.6												
	DIMENSION STD.	B36.10												
	METHOD OF MANUFACTURE, ENDS	SEAMLESS PE						SEAMLESS BE						
FLANGE	MATERIAL AND GRADE	ASTM A 350 GR. LF2, CL-1												
	TYPE, FLANGE FACING	SW. RF 125AARH						WN. THICKNESS TO MATCH PIPE THICKNESS RF 125AARH						
	DIMENSION STD.	B16.5												
BLIND FLANGE	MATERIAL AND GRADE	ASTM A 350 GR. LF2, CL-1												
	FLANGE FACING	RF 125AARH												
	DIMENSION STD.	B16.5												
SPECTACLE BLIND	MATERIAL AND GRADE	ASTM A 350 GR. LF2, CL-1												
	FLANGE FACING	FF 125AARH												
	DIMENSION STD.	B16.48												
	TYPE	FIG.8 FLANGE						SPACER BLIND						
BOLTING	STUD BOLTS (FULLY THREADED)	A 320 GR L7, B-18.2.2												
	NUTS (HEAVY HEXAGONAL)	A 194 GR 4/7, B-18.2.1												
GASKET	TYPE, MATERIAL AND Dmn. STD.	SPIRAL, SP.WND SS316+GRAPHITE FILLED, B-16.20, ANSI B16.5												
ELBOW-90 ELBOW-45	MATERIAL	SW FOR 0.5" TO 1.5" ASTM A350 GR.LF2						BW FOR 2" AND ABOVE ASTM A 420 GR.WPL6						
	END DETAIL	SW,3000#						BW, 1.5D						
	DIMENSION STD.	B-16.11						B-16.9						
T-EQUAL T-RED	MATERIAL	ASTM A350 GR.LF2						ASTM A 420 GR.WPL6						
	END DETAIL	SW,3000#						BW						
	DIMENSION STD.	B-16.11						B-16.9						
CAP & PLUG (UPTO 1.5")	MATERIAL	ASTM A350 GR.LF2						ASTM A 420 GR.WPL6						
	END DETAIL	SCRF,3000#						BW, THK TO MATCH PIPE THICKNESS						
	DIMENSION STD.	B-16.11						B-16.9						
FITTING	MATERIAL	ASTM A350 GR.LF2						ASTM A 420 GR.WPL6						
	END DETAIL	SW,3000#						BW, THICKNESS TO MATCH PIPE THICKNESS						
	DIMENSION STD.	B-16.11						B-16.9						
	TYPE	COUPLING FULL, HALF LH., RED.						RED. CON. RED. ECC.						
O'LET	MATERIAL	ASTM A350 GR.LF2												
	END DETAIL	SW,3000#						BW						
	DIMENSION STD.	MSS-SP97						MSS-SP97						
	TYPE	SOCKOLET						WELDOLET						

0	21.09.2019	ISSUED FOR APPROVAL	VKS	JR	UN
REV. NO.	DATE	SUBJECT OF REVISION	PREP	CHKD	APPD
 LYONS ENGINEERING PVT. LTD. NEW DELHI		PIPING MATERIAL SPECIFICATION FOR 300#	SCALE: NTS (SHEET 3 OF 6)		REV 0
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PIPING CLASS -3D1

ANSI CLASS: 300#	TEMP °C	-20	to	65		
	PRESS. BAR (g)	49		49		

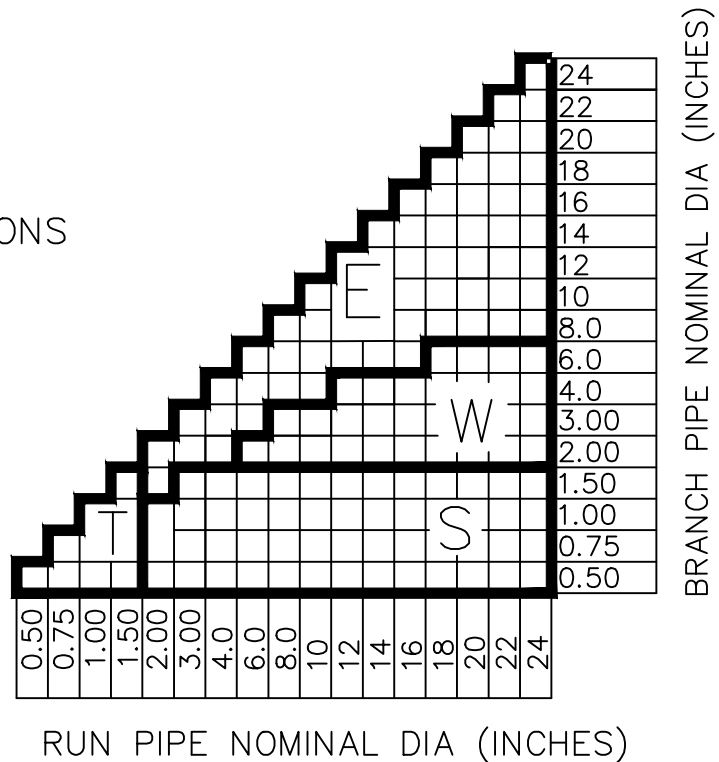
SERVICE : NATURAL GAS


NOTES: -

1. BRANCH CONNECTIONS SHALL BE AS PER BRANCH CONNECTION TABLE
2. ALL BUTT WELDS SHALL BE 100% RADIOGRAPHED.
3. 100% OF SOCKET WELD SHALL BE SUBJECTED TO MPT/DPT OR AS DIRECTED BY OWNER.
4. PRESSURE-TEMPERATURE RATING OF VALVE BODY SHALL BE AS PER API 6D.

BRANCH CONNECTIONS


E	TEES BW
S	SOCKOLET
T	TEES SW
W	WELDOLETS



0	21.09.2019	ISSUED FOR APPROVAL	VKS	JR	UN
REV. NO.	DATE	SUBJECT OF REVISION	PREP	CHKD	APPD
 LYONS ENGINEERING PVT. LTD. NEW DELHI		PIPING MATERIAL SPECIFICATION FOR 300#		SCALE: NTS (SHEET 4 OF 6)	REV
				PMS- 300#	0
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PIPING CLASS -6D1

PIPELINE/PIPING DESIGN CODE		ASME B 31.8						DESIGN FACTOR 0.5					
ITEM	NOMINAL DIAMETER (INCHES)	0.50	0.75	1.00	1.50	2.00	3.00	4.00	6.00	8.00	10.0	12.0	
PIPE	WALL THICKNESS (MM/SCH)	S160	S160	S160	S160	S160	S80	S80	S80	S80	80	80	
	MATERIAL	ASTM A333 GR.6											
	DIMENSION STD.	B36.10											
	METHOD OF MANUFACTURE, ENDS	SEAMLESS PE						SEAMLESS BE					
FLANGE	MATERIAL AND GRADE	ASTM A 350 GR. LF2, CL-1											
	TYPE, FLANGE FACING	SW. RF 125AARH					WN. THICKNESS TO MATCH PIPE THICKNESS, RF 125AARH						
	DIMENSION STD.	B16.5											
BLIND FLANGE	MATERIAL AND GRADE	ASTM A 350 GR. LF2, CL-1											
	FLANGE FACING	RF 125AARH											
	DIMENSION STD.	B16.5											
SPECTACLE BLIND	MATERIAL AND GRADE	ASTM A 350 GR. LF2, CL-1											
	FLANGE FACING	FF 125AARH											
	DIMENSION STD.	B16.48											
	TYPE	FIG.8 FLANGE						SPACER & BLIND					
BOLTING	STUD BOLTS (FULLY THREADED)	A 320 GR L7, B-18.2.2											
	NUTS (HEAVY HEXAGONAL)	A 194 GR 4/7, B-18.2.1											
GASKET	TYPE, MATERIAL AND Dmn. STD.	SPIRAL, SP.WND SS316+GRAPHITE FILLED, B-16.20-ANSI B16.5											
ELBOW-90 ELBOW-45	MATERIAL	SW FOR 0.5" TO 1.5"					BW FOR 2" AND ABOVE						
	END DETAIL	ASTM A350 GR.LF2					ASTM A 420 GR.WPL6						
	DIMENSION STD.	SW,3000#					BW, 1.5D						
T-EQUAL T-RED	MATERIAL	ASTM A350 GR.LF2					ASTM A 420 GR.WPL6						
	END DETAIL	SW,3000#					BW						
	DIMENSION STD.	B-16.11					B-16.9						
CAP & PLUG (UPTO 1.5")	MATERIAL	ASTM A350 GR.LF2					ASTM A 420 GR.WPL6						
	END DETAIL	SW,3000#					BW, THK TO MATCH PIPE THICKNESS						
	DIMENSION STD.	B-16.11					B-16.9						
FITTING	MATERIAL	ASTM A350 GR.LF2					ASTM A 420 GR.WPL6						
	END DETAIL	SW,3000#					BW, THICKNESS TO MATCH PIPE THICKNESS						
	DIMENSION STD.	B-16.11					B-16.9						
	TYPE	COUPLING FULL,HALF LH.,RED.					RED. CON./RED. ECC.						
O'LET	MATERIAL	ASTM A350 GR.LF2											
	END DETAIL	SW,3000#					BW						
	DIMENSION STD.	MSS-SP97					MSS-SP97						
	TYPE	SOCKOLET					WELDOLET						

0	21.09.2019	ISSUED FOR APPROVAL	VKS	JR	UN
REV. NO.	DATE	SUBJECT OF REVISION	PREP	CHKD	APPD
 LYONS ENGINEERING PVT. LTD. NEW DELHI		PIPING MATERIAL SPECIFICATION FOR 600#	SCALE: NTS (SHEET 5 OF 6) PMS- 600#		REV 0
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PIPING CLASS -6D1

ANSI CLASS: 600#	TEMP °C	-20	to	65			
	PRESS. BAR (g)	98		98			

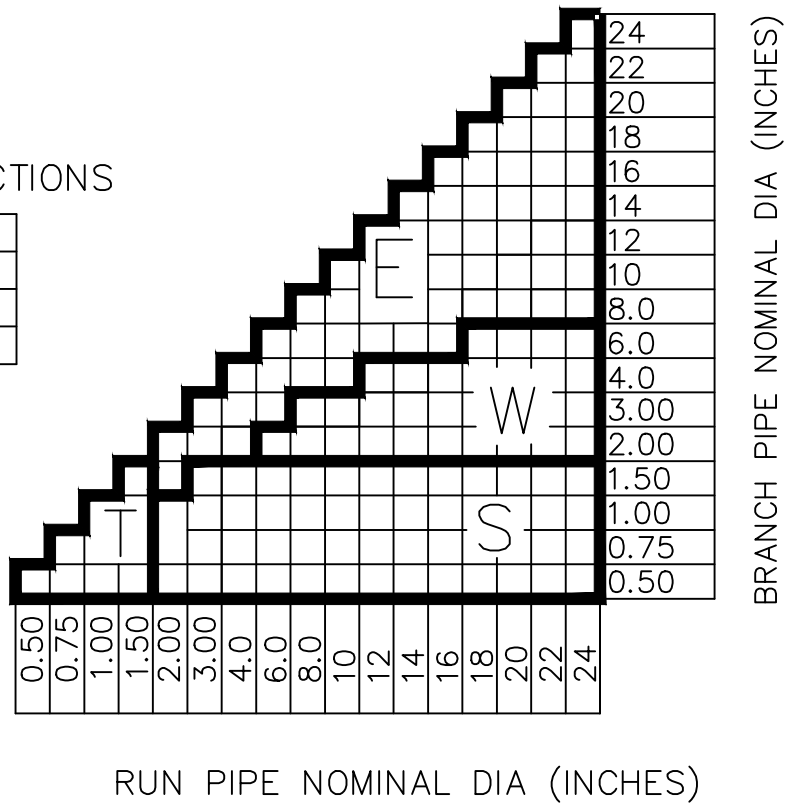
SERVICE : NATURAL GAS


NOTES: -

1. BRANCH CONNECTIONS SHALL BE AS PER BRANCH CONNECTION TABLE
2. ALL BUTT WELDS SHALL BE 100% RADIOGRAPHED.
3. 100% OF SOCKET WELD SHALL BE SUBJECTED TO MPT/DPT OR AS DIRECTED BY OWNER.
4. PRESSURE-TEMPERATURE RATING OF VALVE BODY SHALL BE AS PER API 6D.

BRANCH CONNECTIONS

E	TEES BW
S	SOCKOLET
T	TEES SW
W	WELDOLETS



0	21.09.2019	ISSUED FOR APPROVAL	VKS	JR	UN
REV. NO.	DATE	SUBJECT OF REVISION	PREP	CHKD	APPD
 LYONS ENGINEERING PVT. LTD. NEW DELHI		PIPING MATERIAL SPECIFICATION FOR 600#	SCALE: NTS (SHEET 6 OF 6) PMS-600#	REV 0	© This drawing is an exclusive property of LYONS ENGINEERING PVT. LTD.(LEPL). It is not to be copied or reproduced without explicit permission of LEPL.



**QUALITY ASSURANCE PLAN
BALL VALVE (CS)**

**DOC.No.
GAIL-034-PI-DOC-QAP-001
Rev. 0**



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0	27.02.2021	ISSUED FOR APPROVAL	AP	JR	SB
REV	DATE	DESCRIPTION	PREP	CHK	APPR



**QUALITY ASSURANCE PLAN
BALL VALVE (CS)**

DOC.No.
GAIL-034-PI-DOC-QAP-001
Rev. 0



INSPECTION AND TEST REQUIREMENTS:

SL. NO.	COMPONENT & OPERATION	CHARACTERISTICS/METHOD OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENT & ACCEPTANCE CRITERIA	FORMAT OF RECORD	SCOPE OF INSPECTION		
						SUPPLIER	SUPPLIER TPIA	CLIENT / PMC
1.0	RAW MATERIAL							
1.1	Casting: Body & Bonnet/ Connector	Chemical: Chemical Analysis	All Heats	Material & Technical Specification	Vendor Test Certificate	P	R	R
		Mechanical: Mechanical Test	All Heats	Material & Technical Specification	Vendor Test Certificate	P	R	R
		Impact (@ - 29°C) : Impact Test	All Heats	ASTM A 370	Test Report	P	W	RW
		Non Destructive Examination (NDT): Radiography(100% Critical Area & BW Ends)	100%	ASME B16.34	RT Report	P	W	R
		Non Destructive Examination (NDT): Magnetic Particle Examination (100% exterior & accessible interior)	100%	ASME B16.34	MPI Report	P	W	R



**QUALITY ASSURANCE PLAN
BALL VALVE (CS)**

DOC.No.
GAIL-034-PI-DOC-QAP-001
Rev. 0



SL. NO	COMPONENT & OPERATION	CHARACTERISTICS/ METHOD OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENT & ACCEPTANCE CRITERIA	FORMAT OF RECORD	SCOPE OF INSPECTION		
						SUPPLIER	SUPPLIER TPIA	CLIENT / PMC
1.2	Forging: Ball, Seat Ring & Spindle/Stem	Chemical: Chemical Analysis	All Heats	Material & Technical Specification	Vendor Test Certificate	P	R	R
		Mechanical: Mechanical Test	All Heats	Material & Technical Specification	Vendor Test Certificate	P	W	R
		Impact(@ - 29 C: Impact Test	All Heats	ASTM A370	Test Report	P	W	RW
		Non Destructive Examination (NDT): Radiography (100% Critical Area & BW Ends)	100%	ASME B16.34	RT Report	P	W	R
		Non Destructive Examination (NDT): Magnetic Particle Examination (100% exterior & accessible interior)	100%	ASME B16.34	MPI Report	P	R	R
		ENP(For Ball): Visual, Thickness & Hardness	100%	25 microns (min) & 50 HRC (min)	Vendor Test Certificate	P	R	R
2.0	INCOMING/ B.O. ITEMS							
2.1	Stem	Chemical: Chemical Analysis	All Heats	Material & Technical Specification	Vendor Test Certificate	P	R	R
		Mechanical: Mechanical Test	All Heats	Material & Technical Specification	Vendor Test Certificate	P	W	R



**QUALITY ASSURANCE PLAN
BALL VALVE (CS)**

DOC.No.
GAIL-034-PI-DOC-QAP-001
Rev. 0



SL. NO.	COMPONENT & OPERATION	CHARACTERISTICS/ METHOD OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENT & ACCEPTANCE CRITERIA	FORMAT OF RECORD	SCOPE OF INSPECTION		
						SUPPLIER	SUPPLIER TPIA	CLIENT / PMC
2.2	Fasteners	Chemical: Chemical Analysis	All Heats	Material & Technical Specification	Vendor Test Certificate	P	R	R
		Mechanical: Mechanical Test	All Heats	Material & Technical Specification	Vendor Test Certificate	P	R	R
		Impact(@- 29 ⁰ C):Impact Test	All Heats	ASTM A370	Test Report	P	W	R
3.0	MACHINED COMPONENTS							
3.1	Body, Connector, Ball & Seat Ring	Surface examination & Dimension Inspection: Visual & Measurement	100%	Manufacturer's Drawing	GRN	P	R	R
4.0	IN-PROCESS							
4.1	Body & Connector joint Welding	Non Destructive Examination (NDT):Magnetic Particle Examination	100%	ASME Sec VIII-Appendix V & VI	MPI Report	P	R	R
4.2	Valve & Pup Piece Bevel Ends joint welding	Non Destructive Examination (NDT):Radiography (100%	100%	ASMEB16.34	RT Report	P	R	R



**QUALITY ASSURANCE PLAN
BALL VALVE (CS)**

DOC.No.
GAIL-034-PI-DOC-QAP-001
Rev. 0



SL. NO.	COMPONENT & OPERATION	CHARACTERISTICS/ METHOD OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENT & ACCEPTANCE CRITERIA	FORMAT OF RECORD	SCOPE OF INSPECTION		
						SUPPLIER	SUPPLIER TPIA	CLIENT / PMC
5.0	FINAL INSPECTION							
5.1	Finished Valve Assembly: Pressure Test &	Shell Test: Hydrostatic	100%	Approved drawing & API 6D latest Edition	Final Inspection Report Sheet	P	W	RW
		Seat Test: Hydrostatic				P	W	RW
		Seat Test: Pneumatic				P	W	RW
		Functional Test- Actuated Valve @Atm. Pressure & Max. Diff. Pressure: Operation-Open/ Close				P	W	RW
		Double Block & Bleed: Hydrostatic				P	W	RW
		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	W
		Anti-Static Test	100%	API6D & Technical Specification	Test Record	P	W	RW
		Fire Safe Test	100%	API-6FA/ ISO-10497	Fire safe type test report	P	R	R
5.2	Painting & Packing	Surface examination & DFT Inspection: Visual& Measurement	100%	As per Tender Specification	Painting Record	p	W	RW



**QUALITY ASSURANCE PLAN
BALL VALVE (CS)**

**DOC.No.
GAIL-034-PI-DOC-QAP-001
Rev. 0**



6	FINAL DOCUMENTS:							
	FINAL DOCUMENTS	1. QAP / PO / MTC / IR / Compliance Certificate	100%	AS PER TENDER SPEC / AS PER APPR. DRG. & QAP	Compliance Certificates	P	R	R
		2. Inspection Release note	100%	AS PER TENDER SPEC / AS PER APPR. DRG. & QAP	Compliance Certificates	H	P	R



**QUALITY ASSURANCE PLAN
BALL VALVE (CS)**

**DOC.No.
GAIL-034-PI-DOC-QAP-001
Rev. 0**



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 EN310204 type 3.2 certification from approved suppliers.
5. **Manufacturer/ vendor shall give the inspection call to Client/PMC (prior 7 days) at every stage as per QAP.**
6. TPIA shall issue 3.2 certificates as per BS EN10204.
7. All test shall be witnessed by vendor TPIA.
8. In case of conflict between specifications, QAP, Data Sheet, more stringent condition shall be applicable



QUALITY ASSURANCE PLAN BALL VALVES (LTCS)

DOC.No.
GAIL-034-PI-DOC-QAP-002
Rev. 0



SR. NO	COMPONENTS & OPERATIONS	TYPES OF CHECK	QUANTAM OF CHECK	REFERENCE DOCUMENTS	ACCEPTANCE NORMS	FORMET OF RECORD	INSPECTION		CLIENT/PMC	
							VENDOR	VENDER TPIA		
1	RAW MATERIAL									
1	1. BODY & SIDE PIECE	1. CHEMICAL TEST	PER HEAT	Relevant Material Specification specified in Data sheet	Relevant Material Specification specified in Data sheet	FOUNDRY T.C. REPORT 3.1	P	R	R	
		2. MECHANICAL TEST (YS, UTS, YS/UTS, %EL, MICRO, HARDNESS)	PER HEAT	Relevant Material Specification specified in Data sheet	Relevant Material Specification specified in Data sheet	FOUNDRY T.C. REPORT 3.2	P	W	R	
		3. VISUAL	100%	API 1104 / MSS-SP-55	API 1104 / MSS-SP-55	INSPECTION REPORT 3.2	P	W	R	
		4. IMPACT TEST	AT - 20° C	PER HEAT	ASTM A 370	AVG 35J & IND 28J / Tender Spec.	INSPECTION REPORT 3.2	P	W	RW
			AT - 46° C	PER HEAT	ASTM A 370	AVG 27J & IND 20J / Tender Spec.	INSPECTION REPORT 3.2	P	W	RW
		5. MPT OF EXTERNAL SURFACE	EXTERNAL SURFACE	ASME B16.34 ANNEX C	ASME B16.34 ANNEX C / ASTM A275	INSPECTION REPORT 3.2	P	W	R	
		6. RADIOGRAPHY FOR CASTINGS	100%	ASME B16.34 ANNEX B	ASME B16.34 ANNEX B	INSPECTION REPORT 3.1	P	R	R	
7. ULTRASONIC TEST FOR FORGING	100%	ASME B16.34 ANNEX E	ASME B16.34 ANNEX E	INSPECTION REPORT 3.2	P	W	R			
2	2. BALL & SEAT RING	1. CHEMICAL TEST	PER HEAT	Relevant Material Specification specified in Data sheet	Relevant Material Specification specified in Data sheet	SUPPLIER T.C. REPORT 3.1	P	R	R	
		2. MECHANICAL TEST (YS, UTS, YS/UTS, %EL, MICRO, HARDNESS)	PER HEAT	Relevant Material Specification specified in Data sheet	Relevant Material Specification specified in Data sheet	SUPPLIER T.C. REPORT 3.2	P	W	R	
		3. VISUAL	100%	API 1104 / MSS-SP-55	API 1104 / MSS-SP-55	INSPECTION REPORT 3.2	P	W	R	
		4. RADIOGRAPHY FOR CASTINGS	100%	ASME B16.34 ANNEX B	ASME B16.34 ANNEX B	INSPECTION REPORT 3.1	P	R	R	
		5. ULTRASONIC TEST FOR FORGING	100%	ASME B16.34 ANNEX E	ASME B16.34 ANNEX E	INSPECTION REPORT 3.2	P	W	R	
		6. IMPACT TEST	AT - 20° C	PER HEAT	ASTM A 370	AVG 35J & IND 28J / Tender Spec.	INSPECTION REPORT 3.2	P	W	RW
AT - 46° C	PER HEAT		ASTM A 370	AVG 27J & IND 20J / Tender Spec.	INSPECTION REPORT 3.2	P	W	RW		
3	3. STEM	1. CHEMICAL TEST	PER HEAT	Relevant Material Specification specified in Data sheet	Relevant Material Specification specified in Data sheet	LAB T.C. REPORT 3.1	P	R	R	
		2. MECHANICAL TEST (YS, UTS, YS/UTS, %EL, MICRO, HARDNESS)	PER HEAT	Relevant Material Specification specified in Data sheet	Relevant Material Specification specified in Data sheet	LAB T.C. REPORT 3.1	P	R	R	
		4. IMPACT TEST at -20 C. & -46 C	PER HEAT	ASTM A 370	AVG 35J & IND 28J / Tender Spec.	INSPECTION REPORT 3.2	P	W	R	
			PER HEAT	ASTM A 370	AVG 27J & IND 20J / Tender Spec.	INSPECTION REPORT 3.2	P	W	R	
4	4. PUP PIECE	1. CHEMICAL TEST	PER PIPE	ASTM A 333 GR.6	ASTM A 333 GR.6	SUPPLIER T.C. AS PER 3.1	P	R	R	
		2. MECHANICAL TEST (YS, UTS, YS/UTS, %EL, MICRO, HARDNESS)	PER PIPE	ASTM A 333 GR.6	ASTM A 333 GR.6	LAB T.C. AS PER 3.2	P	W	RW	
		3. VISUAL	100%	ASTM A 333 GR.6	ASTM A 333 GR.6	INSPECTION REPORT 3.2	P	W	RW	
		4. IMPACT TEST	AT -20° C	PER PIPE	ASTM A 370 / A 333 GR.6	AVG 35J & IND 28J / Tender Spec.	INSPECTION REPORT 3.2	P	W	RW
			AT -46° C	PER PIPE	ASTM A 370 / A 333 GR.6	AVG 18J & IND 14J / Tender Spec.	INSPECTION REPORT 3.2	P	W	RW
5. ULTRASONIC TEST OF PIPE	100% Area	Relevant Material Specification specified in Data sheet	Relevant Material Specification specified in Data sheet	INSPECTION REPORT 3.2	P	W	R			



**QUALITY ASSURANCE PLAN
BALL VALVES (LTCS)**

**DOC.No.
GAIL-034-PI-DOC-QAP-002
Rev. 0**



SR. NO	COMPONENTS & OPERATIONS	TYPES OF CHECK	QUANTAM OF CHECK	REFERENCE DOCUMENTS	ACCEPTANCE NORMS	FORMET OF RECORD	INSPECTION		CLIENT/PMC	
							VENDOR	VENDER, TPIA		
2	INPROCESS INSPECTION.									
	1. BODY & SIDE PIECE	1.TRANSFER OF HEAT NO.	100%	API 6D	API 6D	INSPECTION REPORT 3.2	P	W	R	
		2. DIMENSIONS	100%	APPR.VENDOR DRG.	APPR.VENDOR DRG.	DIMENSION REPORT 3.1	P	R	R	
	2.BALL	1. DIMENSIONS	100%	APPR.VENDOR DRG.	APPR.VENDOR DRG.	DIMENSION REPORT 3.1	P	R	R	
	3.STEM	1. DIMENSIONS	100%	APPR.VENDOR DRG.	APPR.VENDOR DRG.	DIMENSION REPORT 3.1	P	R	R	
	4. PUP PIECE WELDING	1.REVIEW OF WPS & POR	AS APPLICABLE FOR EACH SIZE	ASME SEC.IX	AS PER APPROVED DRG/APPLICABLE WELD.	WPS &PQR	P	R	R	
		2. RT/UT of Weld Body Joint	1000%	Relevant Material Specification specified in Data sheet	Relevant Material Specification specified in Data sheet	INSPECTION REPORT 3.2	P	W	R	
		3.RT OF PUP PIECE BUTT JOINTS	100%	ASME SEC-V DIV.I	ASME SEC-V DIV.I	INSPECTION REPORT 3.1	P	R	R	
		4. DP OF BUTT WELD JOINT	100%	ASME B 16.34 ANNEX D	ASME B 16.34 ANNEX D	INSPECTION REPORT 3.2	P	W	R	
	3	BOUGHT OUT ITEM								
		1. FASTNERS	1. CHEMICAL TEST	PER LOT	A 320 L7 & A 194 GR. 7	A 320 L7 & A 194 GR.7	SUPPLIER T.C./ INSPECTION REPORT 3.1	P	R	R
2. MECHANICAL TEST (YS, UTS, YS/UTS, %EL, MICRO, HRA)			PER LOT	A 320 L7 & A 194 GR. 7	A 320 L7 & A 194 GR.7	SUPPLIER T.C./INSP. REPORT 3.1	P	R	R	
3. DIMENSIONS			10%	APPR.VENDOR DRG	APPR.VENDOR DRG	INSPECTION REPORT 3.1	P	R	R	
4. IMPACT TEST AT -101° C			PER LOT / PER SIZE	ASTM A 370	AVG 27J & IND 20J / Tender Spec.	SUPPLIER T.C./INSP. REPORT 3.2	P	W	RW	
5. HEAT TREATMENT			100%	A 320 L7 & A 194 GR. 7	A 320 L7 & A 194 GR. 7	SUPPLIER T.C. REPORT 3.1	P	R	R	
4	PERFORMANCE TEST									
	1.PERFORMANCE TEST	1. HYD. SHELL TEST AT (1.5X Design Pressure)	100%	API 6D / ASME B16.34	API 6D / ASME B16.34	INSPECTION REPORT 3.2	P	100% W	RW	
		2. HIGH-PRESSURE CLOSURE TEST AT 1.1 X Design Pressure (Double Block & Bleed Test)	100%	API 6D / ASME B16.34	API 6D / ASME B16.34	INSPECTION REPORT 3.2	P	100% W	RW	
		3. AIR SEAT TEST AT 7 KG/CM²	100%	API 6D / ASME B16.34	API 6D / ASME B16.34	INSPECTION REPORT 3.2	P	100% W	RW	
		4. HIGH PRE.PNEUMATIC(N2) SHELL & SEAT TEST INCLUDING EXTENDED STEM AT Design Pressure (SUBMERGE IN WATER)	100%	API 6D / ASME B16.34	API 6D / ASME B16.34	INSPECTION REPORT 3.2	P	100%W	RW	
		5. HELIUM LEAK TEST	100%	ASME SEC. V ART. 10, APPENDIX IV	ASME SEC. V ART. 10, APPENDIX IV	INSPECTION REPORT 3.2	P	100%W	RW	
		6. PERFORMANCE TEST(OPENNING & CLOSING)	MIN. 10 CYCLE	API 6D / TENDER DOC.	API 6D / ASME B16.34	INSPECTION REPORT 3.2	P	100% W	RW	
		7. FUNCTIONAL TEST WITH ACTUATOR, IF ANY (OPENNING & CLOSING)	MIN. 10 CYCLE	API 6D / TENDER DOC.	API 6D / ASME B16.34	INSPECTION REPORT 3.2	P	100% W	RW	
		8. ANTISTATIC TEST	100%	BS EN 17292/ API 6D	BS EN 17292	INSPECTION REPORT 3.2	P	5%W	RW	
		9. FIRE SAFE TEST	TYPE TEST	API 607 / API 6FA	API 607 / API 6FA	FIRE SAFE TEST CERTIFICATE	P	R	R	
		10.TORQUE TEST	100%	API 6D	API 6D	INSPECTION REPORT 3.2	P	5%W	RW	
		11. CYCLE TEST (only applicable for 600# size 8" & above)	ONE VALVE /SIZE OF TOTAL ORDER QTY	AS PER SPECIFICATION	AS PER SPECIFICATION	INSPECTION REPORT 3.2	P	W	RW	



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							VENDOR	VENDER TPIA	CLIENT/PMC
5	PAINTING								
	1.PAINTING	1. SURFACE PREPARATION	100%	TENDER SPEC.	TEND ER SPEC.	INSPECTION REPORT	P	RW	RW
		2. FINAL COAT & VISUAL INSPECTION	MEASUREMENT OF DFT	TENDER SPEC.	TEND ER SPEC.	PAINT INSPECTION REPORT/ 3.2 CERTIFICA	P	RW	RW
6	FINAL INSPECTION								
	1.FINAL INSPECTION	1. VISUAL\ TAGGING \ MARKING	100%	API 1104 / MSS-SP-55	API 1104 / MSS-SP-55	INSPECTION REPORT 3.2	P	100% W	RW
		2. DIMENSIONS	100%	APPR. DRG./ ASME B16.10 / ASME B16.5/ B16.25 / API 6D	APPR. DRG./ ASME B16.10 / ASME B16.5/ B16.25/ API 6D	INSPECTION REPORT 3.2	P	100% W	RW
7	FINAL DOCUMENTS								
	1.FINAL DOCUMENTS	1. OAP / PO / MTC / IR / COMPLIANCE CERTIFICATES	100%	AS PER TENDER SPEC / AS PER APPR.	AS PER TENDER SPEC / AS PER APPR. DRG.	COMPLIANCE CERTIFICATE	P	R	R
		2. INSPECTION RELEASE NOTE	100%	AS PER TENDER SPEC / AS PER APPR.	AS PER TENDER SPEC / AS PER APPR. DRG.	COMPLIANCE CERTIFICATE	H	P	R

Legend: P-Perform, R-Review, W-Witness, H-Hold, TPIA-Third Party Inspection Agency RW- 10% Random Witness

NOTE :	1.DRAIN & VENT VALVES,PIPES AND AUXILLARY CONNECTIONS AS PER APPROVED GAD OF VALVES TO BE REVIEWED BY TPIA.
	2.WPS / PQR FOR MAIIN BODY JOINT&PUP PIECE TO VALVE END CONNECTION JOINT TO BE REVIEWED BY TPIA
	3.TPIA SHALL ISSUE 3.2 CERTIFICATE AS PER EN 10204 FOR BALL VALVE.
	4.FOR ALL FORGING MATERIALS, THE SPECIMEN SHALL BE TAKEN FROM THE INTEGRAL PART OF THE FORGING.
	5.DELETED
	6.MATERIAL & TYPE SHALL BE AS PER TENDER SPECS/DATA SHEET
	7.IF ANY ACTUATOR WITH VALVE, ADDITIONAL DOCUMENT TO BE SUBMITTED FOR ACTUATOR LIKE QAP, DATASHEET, WIRING DIAGRAM, OPERATION DIAGRAM, TEST PROCEDURE FOR CLIENT/PMC APPROVAL.
	8.THIS QAP SHALL BE READ IN CONJUNCTION WITH BALL VALVE DATA SHEET & SPECIFICATION.
	9.SAMPLE FROM ANY ONE LOT/HEAT SHALL BE TESTED BY CLIENT (GIGL) UNDER THEIR WITNESS THIRD PARTY LAB AT DISCRETION
	10. FOR ALL FORGING MATERIAL MICRO & HARDNESS TEST SHOULD BE CARRIED OUT AS PER SPECIFICATION AND SAME TO BE WITNESS BY TPIA.
	11. IN CASE OF CONFLICT BEEWTWEEN SPECIFICATION , QAP , DAATASHEET , MORE STRAIGENT CONDITION SHLL BE APPLICABLE.
	12. Manufacturer/ vendor shall give the inspection call to Client/PMC (prior 7 days) at every stage as per QAP.

PREPARED BY:	APPROVED BY:	REVIEWED & ACCEPTED BY	
		CONSULTANT:	CLIENT:



QUALITY ASSURANCE PLAN GAS OVER OIL ACTUATOR

DOC.No.
GAIL-034-PI-DOC-QAP-
006



Sr. No.	Stage /Activity	Characterstics	Quantum of Check	Reference Document	Acceptance Norms	Format Of Records	Inspection By			Remarks
							suppliar	TPI	Client/PMC	
1	Procedures	--	--			--	--	--	--	
2	Material Description									
2.1	Incoming material like Control Valves, Solenoid Valves, Gaskets, Junction Boxes, Flow regulators, Hydraulic filters, Gas Filters, Limit Switches, Instrument tubing,Cables,Hydraulic Pumps,Limit Valves, Pressure Gauges, etc.	1. Material Identification & Chemical Composition 2. Mechanical & Physical propserities 3. Operational Checks 4. Caliberation Checks (As applicable)	100% by Supplier	Refer note -6	Refer note -5	Material test Certificate	p	R	R	
2.2	Oil Tanks	Hydrostatic Pressure test	100% by Sub Supplier	Refer note -6	Refer note -5	Material test Certificate	p	H	H	
2.3	Gas Buffer Tanks	Hydrostatic Pressure test	100% by Sub Supplier			Material test Certificate	p	H	H	
2.4	Hydraulic Fluid	1.Chemical Composition 2. Cleanliness Levels	100% by Sub Supplier	Refer note -6	Refer note -5	Material test Certificate	p	H	H	
3	In Process Inspection									
3.1	Castings of pressure Contating Parts	Radiography test	100% by Supplier	Refer note -6	Refer note -5	Supplier's test record	-	H	H	
3.2	Forgings	Ultrasonic testing	100% by Supplier	Refer note -6	Refer note -5	Supplier's test record	-	H	H	
3.3	Machined Surface	Liquid Penetrent test	100% by Supplier	Refer note -6	Refer note -5	Supplier's test record	-	H	H	
	Sealing areas within the actuator body	Magnetic particle Testing	100% by Supplier	Refer note -6	Refer note -5	Supplier's test record	-	H	H	
	Actuator body	Pressure test for Flame proff Enclosuere	100% by Supplier	Refer note -6	Refer note -5	Supplier's test record	-	H	H	
	Complete Assembly	1. Visual, Dimensional & BOM 2.Operation Checks	100% by Supplier	Refer note -6	Refer note -5	Supplier's test record	-	H	H	
4	Final Inspection									



QUALITY ASSURANCE PLAN GAS OVER OIL ACTUATOR

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							suppliar	TPI	Client/PM C	
4.1	Final Inspection (At Actuator Manufacturer's Works)	1. Visual, Dimensional Checks 2. Bill of Material 2.Verification of Tag no. and Plate no. 4.Hydrostatics test at 1.5 times the actuator Design pressure for min. 2 hrs. 5.Check for Actuator torque or Thrust 6. Seal test of Hydraulic Circuits 7. Verification of opening and closing time and contriol of operating time 8. Actutaor functional test including open close operations (at Least 5 times) Remote operation of actuator and checking of all remote feedbacks and signals, Local operation of actuator, operation of linit switches and position indicators (mechanical & Electrical) 9. Check for Emergency manual override.	100% by Supplier and on random basis by TPIA	Refer note -6	Refer note -5	Supplier's test record	-	P	P	
4.2	Integral Testing	Valve/Actuator assembly test at valve manufacturer's work. The following as a minmum shall be Carried out - Open/Close Operations. (at min. & Max. Pressure. -Stroke time (if applicable) -No Load test or Load operations with the min. Required feeding pressure. - Electrical and Mechanical Operation test.	100% of each type and rating	Refer note -6	Refer note -5	Supplier's test record	-	P	P	
5	Painting									



QUALITY ASSURANCE PLAN GAS OVER OIL ACTUATOR

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006



Sr. No.	Stage /Activity	Characterstics	Quantum of Check	Reference Document	Acceptance Norms	Format Of Records	Inspection By			Remarks
							suppliar	TPI	Client/PM C	
5.1	Painting & Packing	1. Visual 2. Suitable protection to prevent entry of foreign material 3. Protection against damage during transportation 4. Suitable packing for outdoor storage areas with heavy rains/high ambient temprature ubnless otherwise agreed	100%	Refer note -6	Refer note -5	Supplier's test record	-	W	W	
6	Documentation and IC									
6.1	Documentation and IC	1. Certificate for testing agency like ATEX, CIMFR, BASEEFA, FM/UL, PTB etc. for suitability in specified hazardeous area. 2. Statutory approval certificates from CCE/PESO for use in specifiessd hazardeous area. 3. Degree of protection certificate for actutaor enclosure, JB, Solenoid Enclosure, Limit switches etc. 4. Flameproof Certification for cable glands, Relays, Valves etc from independent testing agency. 4. A valid BIS license for inmdegenious supply. 5. Operation and maintenace manual	100%	Refer note -6	Refer note -5	Supplier's test record	-	R	R	
- Supplier to submit internal test reports, type test reports before offereing items for inspection to TPIA.										
*Radiography Films shall be reviewed										
Legend :										
M : Manufacturer		C : Client				A : Approval		H : Hold		R : Review
NA : Not Applicable		W / R : Witness of Test & Review of Certificates & Documents as per QAP			W : Witness		RW : Random Witness			
Notes: -										
1	wherever W/R or H/W is indicated, inspection Engineer shall decide the option to be exercised for the particular stage and supplier.									
2	In case of conflict between purchase specification, conotract documents and ITP, more stringent conditions shall be applicable.									
3	This documnets describes genreally the requirements pertaining to all types of the items. Requirements specific to PO and the item are only applicable									
4	Acceptance norms/ acceptance criteria for all the activities shall be as per relevent/job specification/standard specification/data sheets/applicable codes & standard etc. refered there in /job specification/approved documents.									
5	Reference documents are relevent Job specifications /standard specifications/data sheets/applicable codes & standards									