

**हर एक काम
देश के नाम**



GAIL (India) Limited



ARC TENDER FOR PROCUREMENT OF BALL VALVES

VOLUME II OF II (TECHNICAL)

(BID DOCUMENT NO - 44/LEPL/GAIL/2-R0)

GEM TENDER REF : GEM/2023/B/3292506



OPEN DOMESTIC COMPETITIVE BIDDING



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**Project Management Consultant
Lyons Engineering Pvt. Ltd.**

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GAIL (INDIA) LTD.

ANNUAL RATE CONTRACT

MATERIAL REQUISITION (MR) VALVES (8" TO 20")

GAIL-034-PI-DOC-MR-001



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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.)

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	Size	Rating	DMNN STD	Material Description	Unit	Qty
1	BALL VALVE (ACTUATED)	12"	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 length of 1.5D on both side of valve. Pup-piece (API 5L X70, 8.7 mm WT), including tubing, fitting & associated materials, (Connection size for tubing is 3/4 " NPT, male)	NOS	2

2	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 length of 1.5D on both side of valve. Pup-piece (API 5L X65, 7.1 mm WT), including tubing, fitting & associated materials, (Connection size for tubing is 3/4 " NPT, male)	NOS	10
3	BALL VALVE (ACTUATED)	4"	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, Gas actuated, Butt Weld ASME B16.25, pup piece length of 1.5D on both side of valve. Pup-piece (API 5L X42, 7.1 mm WT), including tubing, fitting & associated materials, (Connection size for tubing is 3/4 " NPT, male)	NOS	30

GROUP- B (MANUAL BALL VALVES)-AS PER API 6D

S. No.	Item	Size	Rating	DMNN STD	Material Description	Unit	Qty
4	BALL VALVE	20"	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, Reduced Bore, Above Ground manual, Butt Weld, ASME B16.25, STD:API 6D, pup piece length of 1.5D on both side of valve. (Pup-piece API 5L X70, 12.7 mm WT)	NOS	2
5	BALL VALVE	18"	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, Reduced Bore, Above Ground manual, Butt Weld, ASME B16.25, STD:API 6D, pup piece length of 1.5D on both side of valve. (Pup-piece API 5L X70, 11.3 mm WT)	NOS	2
6	BALL VALVE	16"	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, Reduced Bore, Above Ground manual, Butt Weld, ASME B16.25, STD:API 6D, pup piece length of 1.5D on both side of valve. (Pup-piece API 5L X70, 10.3 mm WT)	NOS	1

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7	BALL VALVE	12"	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, Butt Weld, ASME B16.25, pup piece length of 1.5D on both side of valve. (Pup-piece API 5L X70, 8.7 mm WT)	NOS	15
8	BALL VALVE	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, Full Bore, Butt Weld, ASME B16.25, pup piece length of 1.5D on both side of valve. (Pup-piece API 5L X65, WT 7.1 mm)	NOS	25

B. REMARKS/COMMENTS

1. 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. 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

Scope of work & supply includes design, engineering, manufacturing, fabrication, procurement of bought out items / components, Testing and inspection, assembly at shop, integration, internal testing, packaging, shipping, documentation, the equipment with all internals and accessories shown on the data sheets, specifications and all unmentioned parts necessary for a satisfactory operation, Supervision for Installation & commissioning of actuated valve and testing except those which are indicated to be out of the Vendor's supply.

Installation shall be carried out as per GAIL standards or as recommended in the tender. For special instruments, the installation may be carried out as per vendor/ manufacturer's recommendations however all such installation standards shall be subject to GAIL's review.

Bidder shall quote for man day rates as per Scope defined in bid document for installation supervision and commissioning of the actuated valve. The quoted man-day rates for installation supervision and commissioning shall be valid for **36 months** from date of supply of actuated valve. Bidder shall depute only qualified and competent person for Supervision of Installation, start-up and

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commissioning of the complete package of actuated valve at site.

Manpower required for supervision for Installation and commissioning of actuated valve shall be deputed unconditionally on request of GAIL/ GAIL's Representative/ site In-charge.

Manday of this ARC may be used for site supervision in other actuated valve installation supplied by bidder irrespective of warranty period.

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.

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.


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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 control operations (LOFC)	LOF	-	6	2 weeks	6	2 weeks + with final tech. file	
10	Test reports	TRS	-	6	1 week after test	6	2 weeks + with final tech. file	
11	NDE reports	NOR	-	6	1 week after test	6	2 weeks + with final tech. file	


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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 4",8" &
12",600# /300 #)**



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DATA SHEET FOR BALL VALVES					
Sr. No.	Description		Specification		
GENERAL					
1	Valve Size		4",8" & 12"		
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 Length minimum 1.5 D for both side of the Valve		
13	Bi- Directional		Required		
14	Double Block and Bleed		Required		
15	Blow out proof stem		Required		
16	Anti-static device		Required		
17	Operation		Manual		
18	Open and close Ball position indicator		Required		
VALVE MATERIAL SPECIFICATION					
		Part	Specified Material / Equivalent Material		
19	Body		ASTM A 216 Gr.WCB		
20	Ball (SOLID)		ASTM A 105 + 0.003"ENP		
21	Body seat ring		AISI 4140 + 0.003"ENP / AISI 410		
22	Seat Seal (Secondary)		Viton / RPTFE/PEEK		
23	Seat Seal (Primary)		Devlon V API		
24	Stem		AISI 4140 + 0.003"ENP / AISI 410 (No casting)		
25	Stem seals		Viton / RPTFE		
26	Stud bolts / Nuts		ASTM A 193 Gr. B7/ASTM A 194 Gr. 2H (Galvanized)		
27	Anti-static device		SS302		
VALVE TESTING REQUIREMENT					
28	Fire Resistant Design Requirement		As per API 6FA/API 607		
29	Hydrostatic Test	Body	As per API 6D Latest Edition		
		Seat	As per API 6D Latest Edition		
0	28.11.22	Issued For Bid	AP	JR	TR
Rev.	Date	Purpose	Prepared By:	Checked By:	Approved By:



**DATA SHEET FOR BUTT
WELD END GAS ACTUATED
BALL VALVE (SIZE 4",8" &
12",600# /300 #)**



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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.

0	28.11.22	Issued For Bid	AP	JR	TR
Rev.	Date	Purpose	Prepared By:	Checked By:	Approved By:



**DATA SHEET FOR BUTT
WELD END BALL VALVE
(SIZE 2"AND ABOVE 600#)**



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DATA SHEET FOR BALL VALVES					
Sr. No.	Description		Specification		
GENERAL					
1	Valve Size		2" and above		
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/Reduced Bore		
12	End Connections		Butt Weld End (as per ASME B 16.25), pup-piece on either side and length equal to diameter of valve.		
13	Bi- Directional		Required		
14	Double Block and Bleed		Required		
15	Blow out proof stem		Required		
16	Anti-static device		Required		
17	Operation		Manual		
18	Open and close Ball position indicator		Required		
VALVE MATERIAL SPECIFICATION					
	Part		Specified Material / Equivalent Material		
19	Body		ASTM A 216 Gr.WCB		
20	Ball (SOLID)		ASTM A 105 + 0.003" ENP		
21	Body seat ring		AISI 4140 + 0.003"ENP / AISI 410		
22	Seat Seal (Secondary)		Viton / RPTFE/PEEK		
23	Seat Seal (Primary)		Devlon V API		
24	Stem		AISI 4140 + 0.003"ENP / AISI 410 (No casting)		
25	Stem seals		Viton / RPTFE		
26	Stud bolts / Nuts		ASTM A 193 Gr. B7/ASTM A 194 Gr. 2H (Galvanized)		
27	Anti-static device		SS302		
VALVE TESTING REQUIREMENT					
28	Fire Resistant Design Requirement		As per API 6FA/API 607		
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 BALL VALVE
(SIZE 2"AND ABOVE 600#)**



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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.

0	20.09.19	Issued For Approval	AP	JR	SB
Rev.	Date	Purpose	Prepared By:	Checked By:	Approved By:



**DATA SHEET FOR BUTT
WELD/FLANGED END BALL
VALVE (SIZE 4",600#)**



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DATA SHEET FOR BALL VALVES		
Sr. No.	Description	Specification
GENERAL		
1	Valve Size	4"
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	4"(Trunnion mounted)
11	Bore	Full Bore
12	End Connections	One end Butt Weld (as per ASME B 16.25), Pup Piece 100 mm long required and other end flanged
13	Bi- Directional	Required
14	Double Block and Bleed	Required
15	Blow out proof stem	Required
16	Anti-static device	Required
17	Operation	Manual
18	Open and close Ball position indicator	Required
VALVE MATERIAL SPECIFICATION		
	Part	Specified Material / Equivalent Material
19	Body	ASTM A 216 Gr.WCB
20	Ball (SOLID)	ASTM A 105 + 0.003"ENP
21	Body seat ring	AISI 4140 + 0.003"ENP / AISI 410
22	Seat Seal (Secondary)	Viton / RPTFE/PEEK
23	Seat Seal (Primary)	Devlon V API
24	Stem	AISI 4140 + 0.003"ENP / AISI 410 (No casting)
25	Stem seals	Viton / RPTFE
26	Stud bolts / Nuts	ASTM A 193 Gr. B7/ASTM A 194 Gr. 2H (Galvanized)
27	Anti-static device	SS302
VALVE TESTING REQUIREMENT		
28	Fire Resistant Design Requirement	As per API 6FA/API 607
29	Hydrostatic Test	
	Body	As per API 6D Latest Edition
	Seat	As per API 6D Latest Edition

0	20.09.19	Issued For Approval	AP	JR	SB
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**DATA SHEET FOR BUTT
WELD/FLANGED END BALL
VALVE (SIZE 4",600#)**



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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.

0	20.09.19	Issued For Approval	AP	JR	SB
Rev.	Date	Purpose	Prepared By:	Checked By:	Approved By:





**DATA SHEET FOR FLANGE
END BALL VALVE (SIZE
2",600#)**



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DATA SHEET FOR BALL VALVES					
Sr. No.	Description		Specification		
GENERAL					
1	Valve Size		2"		
2	ANSI Rating		600#		
3	Design Standard		BS EN ISO 17292 / API 6D		
4	Corrosion allowance		1.5MM		
5	Design Factor		0.5		
SERVICE CONDITIONS					
6	Service		Natural Gas		
7	Design Pressure		98 KG /CM2		
8	Design Temperature		-29°C to 65°C		
VALVE CONSTRUCTION DESIGN					
9	Location		Above Ground		
10	Valve Type		Floating (2" & below)		
11	Bore		Full Bore		
12	End Connections		Flange (as per ASME B 16.5)		
13	Bi- Directional		Required		
14	Double Block and Bleed		Required		
15	Blow out proof stem		Required		
16	Anti-static device		Required		
17	Operation		Manual		
18	Open and close Ball position indicator		Required		
VALVE MATERIAL SPECIFICATION					
		Part	Specified Material / Equivalent Material		
19	Body		ASTM A 216 Gr.WCB		
20	Ball (SOLID)		ASTM A 105 + 0.003" ENP		
21	Body seat ring		AISI 4140 + 0.003"ENP / AISI 410		
22	Seat Seal (Secondary)		Viton / RPTFE/PEEK		
23	Seat Seal (Primary)		Devlon V API		
24	Stem		AISI 4140 + 0.003"ENP / AISI 410 (No casting)		
25	Stem seals		Viton / RPTFE		
26	Stud bolts / Nuts		ASTM A 193 Gr. B7/ASTM A 194 Gr. 2H (Galvanized)		
27	Anti-static device		SS302		
VALVE TESTING REQUIREMENT					
28	Fire Resistant Design Requirement		As per API 6FA/API 607		
29	Hydrostatic Test	Body	As per API 6D Latest Edition		
0	20.09.19	Issued For Approval	AP	JR	SB
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	DATA SHEET FOR FLANGE END BALL VALVE (SIZE 2",600#)	
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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.

0	20.09.19	Issued For Approval	AP	JR	SB
Rev.	Date	Purpose	Prepared By:	Checked By:	Approved By:



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



Doc No.
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) with pup piece length 100 mm min.		
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		
0	20.12.19	Issued For Tender	AP	JR	SB
Rev.	Date	Purpose	Prepared By:	Checked By:	Approved By:



**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.

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



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Page 1 of 2

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)

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



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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 BUTT
WELD/FLANGED END BALL
VALVE (SIZE 4",600#)**



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DATA SHEET FOR BALL VALVES			
Sr. No.	Description	Specification	
GENERAL			
1	Valve Size	4"	
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 /CM2	
8	Design Temperature	-29°C to 65°C	
VALVE CONSTRUCTION DESIGN			
9	Location	Above Ground	
10	Valve Type	4"(Trunnion mounted)	
11	Bore	Full Bore	
12	End Connections	One end Butt Weld (as per ASME B 16.25), Pup Piece 100 mm long required and other end flanged	
13	Bi- Directional	Required	
14	Double Block and Bleed	Required	
15	Blow out proof stem	Required	
16	Anti-static device	Required	
17	Operation	Manual	
18	Open and close Ball position indicator	Required	
VALVE MATERIAL SPECIFICATION			
	Part	Specified Material / Equivalent Material	
19	Body	ASTM A 216 Gr.WCB	
20	Ball (SOLID)	ASTM A 105 + 0.003"ENP	
21	Body seat ring	AISI 4140 + 0.003"ENP / AISI 410	
22	Seat Seal (Secondary)	Viton / RPTFE/PEEK	
23	Seat Seal (Primary)	Devlon V API	
24	Stem	AISI 4140 + 0.003"ENP / AISI 410 (No casting)	
25	Stem seals	Viton / RPTFE	
26	Stud bolts / Nuts	ASTM A 193 Gr. B7/ASTM A 194 Gr. 2H (Galvanized)	
27	Anti-static device	SS302	
VALVE TESTING REQUIREMENT			
28	Fire Resistant Design Requirement	As per API 6FA/API 607	
29	Hydrostatic Test	Body	As per API 6D Latest Edition
		Seat	As per API 6D Latest Edition

0	20.09.19	Issued For Approval	AP	JR	SB
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**DATA SHEET FOR BUTT
WELD/FLANGED END BALL
VALVE (SIZE 4",600#)**



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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 GAS OVER OIL
ACTUATOR



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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**

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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.

0	20.12.19	Issued For Tender	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	
0	19.09.2019	Issued for Approval	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

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Technical Specification for Ball Valve (Size Below 2")	Doc No.	Rev	
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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:
- Order Number
 - Manufacturer's Name
 - Valve size and rating
 - Tag Number
 - 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:
- 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
 - 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.
 - 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:
- Detailed sectional drawings showing all parts with reference numbers and material specifications.
 - 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

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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-001

Rev	Date	Purpose	Prepared By	Checked By	Approved By	
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 dyepenetrator or wet - 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.

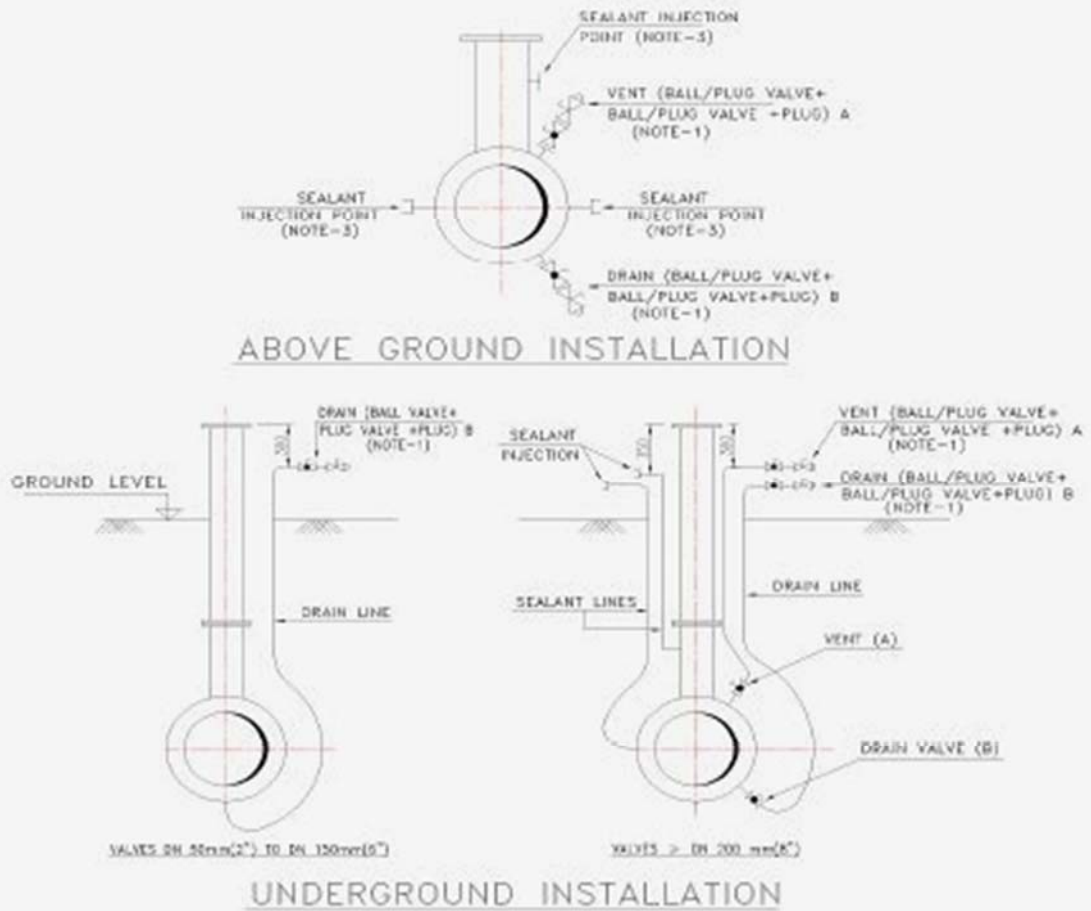
10.0 GUARANTEE

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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UNDERGROUND INSTALLATION

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



GAIL INDIA LIMITED

**TECHNICAL SPECIFICATION
FOR
ACTUATOR**


GAIL-034-PI-DOC-TS-008

Rev	Date	Purpose	Prepared By	Checked By	Approved By
0	20.12.2019	Issued for Tender	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

Rev	Date	Purpose	Prepared By	Checked By	Approved By
0	19.09.2019	Issued for Bid	AP	JR	SB



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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 clients requirement or otherwise shall be referred to J P Kenny for deviation permit.

2.0 CODES & STANDARDS

Without prejudice to the specifications of the contract, the following codes and standards shall be followed for the work covered by this contract.

- IS: 5 Colors for ready mixed paints and enamels.
- IS: 101 Methods of test for ready mixed paints and enamels,
- IS: 161 Heat resistant paints.
- IS: 2074 Specifications for ready mixed paint, red oxide zinc chrome priming.
- IS: 2339 Aluminum paint for general purposes in dual container.
- IS: 2379 Color code for identification of pipelines.
- IS: 2932 Specification for enamel, synthetic, exterior (a) undercoating. (b) Finishing.

3.0 CONDITIONS OF DELIVERY


Packaging

Every recipient will be fitted with a hermetically-sealed lid with an opening that is sufficiently large to allow the contents to be stirred: the outside and inside are protected against oxidation, and, the lid, are marked with a strip of color identical to the contents.

4.0 COMPOSITION OF THE PAINT PRODUCTS USED

a) Quality

The composition and quality of the products may not differ from batch to batch. A batch is all of the products of a specified manufacture. If the analyses of products bring to light that the composition does not conform to the specifications of the paint manufacturer, the

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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 nonconformity of the composition of the products. Their purpose is therefore not to assess the quality of the different components. The analyses concerned are not acceptance tests of the products supplied and in no way affect the obligations of the contractor specified in the contract towards the OWNER.

5.0 IDENTIFICATION

Every recipient will bear the following information:

- Name of the manufacturer
- Date and number of manufacture
- Name of the product type
- Batch no
- Net weight of the produced or the contents of the recipient
- Date of the expiry.


At the time of delivery, this packaging must bear labels in conformity with the legal stipulations in force.

Leaving the site after work

After completion of a job a general clean-up shall be carried out by the Contractor to remove all debris, materials or irregularities that his work has brought to the site so that it is left tidy:

The restoration work includes among other things:

- the removal of abrasives.
- the removal of the different protective coverings.
- the Contractor will make the required repairs to any damage after refitting the supports.
- the removal of paint and cleaning of the stains on the floor.

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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 oldie surface is the best guarantee for good anti-corrosion protection.

Paintwork may never begin until the surface to be treated is dry and is independent of the base coat and cleared of dirt, dust, rust, scale, grease, salt attack, cement powder, cement mud-scale, sand, oil, etc.

Based on the environmental conditions of coastal and saline nature, the Painting specification for station pipes defines the complete requirements like:

- Surface preparation standards like NACE etc.
- Sand blasting process
- Color Codes for piping

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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 low i.e. it may contain no carbon and less than 1% free silicon dioxide. The Sa 3 will always be requested and must at least reach Sa 2½ during the initial stage of the paintwork. For blasting followed by metallisation, the surface preparation degree to be achieved is always Sa 3. The degree of cleanliness to be obtained will be inspected in accordance with the Swedish standard SVENSK STANDARD ISO 8501-1-1988 SS 05.5900.

- Sa 3: surface blasted down to the bare metal; when the surface is inspected with a magnifying glass, scale, rust and foreign bodies must be completely removed and it should be possible to raise a metallic -shine on the treated surface.
- Sa 2 1/2: blasted very carefully. Scale, rust and foreign bodies must be removed in such a way that anything left behind will only be visible as nuances (shading) or strips.

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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 nick out any possibility of poisoning (ventilation). The Contractor will provide drip collectors to keep the environment free of pollution.

7.9 Condition of the metal after stripping

The Contractor must call in a representative of the OWNER/OWNER's representative or of the Approved supervisory Body responsible for checking the condition of the metal during stripping and informing the OWNER/OWNER's representative immediately of any damage that he might have noticed.

- Deep corrosion of the plates - rivets - bolts
- Faulty welding

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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 % aluminum with a minimum guaranteed degree of purity of 99.5 % is used (subject to other specifications). The application thereof is always carried out in accordance with the conditions of the manufacturer and may at all times be submitted to the OWNER's representative.
- The sealant should be applied maximum 3 hours 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 forecast that the temperature will fall to below 0°C before the paint is dry. The temperature of the surface to be painted must be at least 3°C higher than the dew point of the ambient air. Application of the paint is also not permitted if there is a danger that the coat of paint will not be dry before dew or condensation sets in.

The work must be stopped:

- If the temperature of the surface to be painted is higher than that described by the supplier.
- In rain, snow, mist or fog or when the relative humidity is higher than 80 %.

Coats that have not yet dried and have been exposed to frost, mist, snow or rain and might thereby be damaged must be removed after drying and the surfaces must be repainted at the expense of the Contractor.

Working in direct sunlight or in hot weather must be avoided,

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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	10-12 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	20-25 microns/coat
	Covering capacity	16-18 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	30-40 microns / coat
	Covering Capacity	10-12 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 theoretical. Allowing the losses during application, min specified DFT should be maintained.
2. All paints shall be applied in accordance with manufacturer's instructions for surface preparation, intervals, curing and application. The surface preparation quality and workmanship should be ensured.
3. Selected chlorinated rubber paint should have resistance to corrosive atmosphere and suitable for marine environment,
4. All primers and finish coats should be cold cured and air-drying unless otherwise specified.
5. Technical data sheets for all paints shall be supplied at the time of submission of quotations.
6. In case of use of epoxy tie coat, manufacturer should demonstrate satisfactory test for inter coat adhesion. In case of limited availability of epoxy tie coat (P-9) alternate system may be used taking into the service requirement of the system.
7. In case of F-6, F-9, F-1 1 & F-1 2 Finish Coats, No Primer are required.

MANUFACTURERS


The paints shall conform to the specifications given above and Class-I quality in their products range of any of the-following manufacturers:

- i) Asian Paints (India) Ltd,
- ii) Bombay Paints
- iii) Berger Paints India Ltd.
- iv) Gaodlass Nerolac Paints Ltd.
- v) Jenson & Nicholson
- vi) Shalimar Paints

STORAGE

All paints and painting material shall be stored only in rooms to be provided by contractor and approved by OWNER/ OWNER 's Representative for the purpose. All necessary precautions shall be taken to prevent fire. The storage building shall preferably be separate from adjacent, building.

A signboard bearing the words given below shall be clearly displayed outside:
PAINT STORAGE No NAKED LIGHT highly -inflammable

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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 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 will, 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.

ENGINEERING STANDARD



PIPING MATERIAL SPECIFICATION


(CS)

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 3¼" : 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			
		0.1.0" - 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"-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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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"	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	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			
	GAIL-034-PI-DOC-TS-010				0			
								

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		
		01.0" - 1.5"	PE, SEAMLESS	XS	ASME B36-10	ASTM A 106 Gr.B		
		2"-10"	BE, SEAMLESS	XS	ASME B36-10	ASTM A 106 Gr.B (Charpy)		
		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"	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"-8"	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.								
PIPING MATERIAL SPECIFICATION	DOCUMENT NO.				Rev			
	GAIL-034-PI-DOC-TS-010				0			
								

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





QUALITY ASSURANCE PLAN- BALL VALVE

GAIL-034-PI-DOC-QAP-001

QUALITY ASSURANCE PLAN- BALL VALVE

REV	DATE	DESCRIPTION	PREP	CHK	APPR
0	20.09.2019	ISSUED FOR APPROVAL	AP	JR	SB

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	TPIA	CLAIM/TPIA
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	W
		Non Destructive Examination (NDT): Radiography (100% Critical Area & BW Ends)	100%	ASME B16.34	RT Report	P	W	W
		Non Destructive Examination (NDT): Magnetic Particle Examination (100% exterior & accessible interior)	100%	ASME B16.34	MPI Report	P	W	W

SL. NO.	COMPONENT & OPERATION	CHARACTERISTICS/ METHOD OFCHECK	QUANTUM OF CHECK	REFERENCE DOCUMENT & ACCEPTENCE CRITERIA	FORMAT OF RECORD	SCOPE OF INSPECTION		
						SUPPLIER	TPIA	CLAINT/TPI
1.2	Forging: Ball,SeatRing&S pindle/Stem	Chemical: Chemical Analysis	AllHeats	Material & Technical Specification	Vendor Test Certificate	P	R	R
		Mechanical: MechanicalTest	AllHeats	Material&Tec hnical Specification	VendorTest Certificate	P	W	W
		Impact(@- 29 ⁰ C):ImpactTest	AllHeats	ASTM A370	Test Report	P	W	W
		Non Destructive Examination (NDT):Radiography (100% Critical Area & BW Ends)	100%	ASMEB16.34	RT Report	P	W	W
		NonDestructive Examination (NDT):Magnetic Particle Examination(100% exterior & accessible interior)	100%	ASMEB16.34	MPIReport	P	R	R
		ENP(ForBall): Visual, Thickness&Hardness	100%	25microns(min) &50HRC(min)	VendorTest 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: MechanicalTest	All Heats	Material & Technical Specification	Vendor Test Certificate	P	W	W

SL. NO.	COMPONENT & OPERATION	CHARACTERISTICS/ METHOD OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENT & ACCEPTANCE CRITERIA	FORMAT OF RECORD	SCOPE OF INSPECTION		
						SUPPLIER	TPIA	CLAINT/TPIA
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	W
3.0		MACHINED COMPONENTS						
3.1	Body, Connector, Ball & Seat Ring	Surface examination & Dimension Inspection: Visual & Measurement	100%	Manufacturer's Drawing	GRN	P	R	R
4.0		IN-PROCESS						
4.1	Body & Connector joint welding	Non Destructive Examination (NDT):Magnetic Particle Examination (MPI)	100%	ASME Sec VIII- Appendix V & VI	MPI Report	P	R	R
4.2	Valve & Pup Piece Bevel Ends joint welding	Non Destructive Examination (NDT):Radiography (100% On weld joint)	100%	ASMEB16.34	RT Report	P	R	R

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

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 stockist, items shall be accepted based on manufacturer's TC with EN310204 type 3.2 certification from approved suppliers.



**QUALITY ASSURANCE PLAN
GAS OVER OIL ACTUATOR**

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



Sr. No.	Components	Material	Work Phase	Type of Test	Standard Ref.	Inspection By			Remarks
						Vendor	TPI	Client/PMC	
1	Housing & Cover	Carbon Steel	Raw material	Mech/Chem characteristics	Vendor to Provide	P	R	R	CERT EN 10204 3.2
			Welded	Visual & Dimensional Inspection	Vendor Drawing				
			Machined	Visual & Dimensional Inspection	Vendor Drawing				
2	Scotch Yoke	Carbon Steel	Raw material	Mech/Chem characteristics	Vendor to Provide	P	R	R	CERT EN 10204 3.2
			Welded	Visual & Dimensional Inspection	Vendor Drawing				
			Machined	Visual & Dimensional Inspection	Vendor Drawing				
3	Guide/Thrust bar	Alloy Steel	Raw material	Mech/Chem characteristics	Vendor to Provide	P	R	R	CERT EN 10204 3.2
			Machined	Visual & Dimensional Inspection	Vendor Drawing				
			Cr-Plated	Cr Thickness Test	Vendor Drawing				
4	Cylinder Tube	Carbon Steel	Raw material	Mech/Chem characteristics	Vendor to Provide	P	R	R	CERT EN 10204 3.2
			Machined	Visual & Dimensional Inspection	Vendor Drawing				
4.1	Cylinder Liner	Carbon Steel	Raw material	Mech/Chem characteristics	Vendor to Provide	P	R	R	CERT EN 10204 3.2
			Machined	Visual & Dimensional Inspection	Vendor Drawing				
4.2	Head Flange	Carbon Steel	Raw material	Mech/Chem characteristics	Vendor to Provide	P	R	R	CERT EN 10204 3.2
			Machined	Visual & Dimensional Inspection	Vendor Drawing				
4.3	End Flange	Carbon Steel	Raw material	Mech/Chem characteristics	Vendor to Provide	P	R	R	CERT EN 10204 3.2
			Machined	Visual & Dimensional Inspection	Vendor Drawing				



QUALITY ASSURANCE PLAN GAS OVER OIL ACTUATOR

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



Sr. No.	Components	Material	Work Phase	Type of Test	Standard Ref.	Inspection By			Remarks
						Vendor	TPI	Client/PMC	
4.4	Piston	Alloy Steel	Raw material	Mech/Chem characteristics	Vendor to Provide	P	R	R	CERT EN 10204 3.2
			Machined	Visual & Dimensional Inspection	Vendor Drawing				
4.5	Piston Rod	Alloy Steel	Raw material	Mech/Chem characteristics	Vendor to Provide	P	R	R	CERT EN 10204 3.2
			Machined	Visual & Dimensional Inspection	Vendor Drawing				
			Cr-Plated	Cr Thickness Test	Vendor Drawing				
4.6	Tie Rods	Alloy Steel	Raw material	Mech/Chem characteristics	Vendor to Provide	P	R	R	CERT EN 10204 3.2
			Machined	Visual & Dimensional Inspection	Vendor Drawing				
4.7	Nuts	Carbon steel/ Stainless Steel	Raw material	Mech/Chem characteristics	Vendor to Provide	P	R	R	CERT EN 10204 3.2
			Machined	Visual & Dimensional Inspection	Vendor Drawing				
5	Gas Hydraulic & Storage Tanks	Carbon Steel	Raw material	Mech/Chem characteristics	ASME VIII Div 1	P	R	R	CERT EN 10204 3.1
			Tanks	Hydrotest					
6	Only Actuator		Assembled	Tightness Test	Test Procedure for GOV	P	R	R	CERT EN 10204 3.1
7	Actuator		Painted Actuator	Paint Inspection	Vendor to Provide	P	R	R	CERT EN 10204 3.1
8	Actuator & Control Unit		Assembled	Tightness Test	Test Procedure for GOV	P	W	R	CERT EN 10204 3.1
				Performance Test	Test Procedure for GOV	P	W	R	CERT EN 10204 3.1
				Functional Test	Test Procedure for GOV	P	W	R	CERT EN 10204 3.1
				Elect Func Test	Test Procedure for GOV	P	W	R	CERT EN 10204 3.1
				Insulation Test	Test Procedure for GOV	P	W	R	CERT EN 10204 3.1
9	IR & IRN		Ended Actuator	Documentation Review			P	P	
				Final Inspection			P	P	

- Supplier to submit internal test reports, type test reports before offering items for inspection to TPIA.

*Radiography Films shall be reviewed



QUALITY ASSURANCE PLAN GAS OVER OIL ACTUATOR

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



Sr. No.	Components	Material	Work Phase	Type of Test	Standard Ref.	Inspection By			Remarks
						Vendor	TPI	Client/PMC	
Legend :									
	M : Manufacturer	C : Client	B : Major	P : Performer	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, contract documents and ITP, more stringent conditions shall be applicable.								
3	This document describes generally 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 relevant/job specification/standard specification/data sheets/applicable codes & standard etc. referred there in /job specification/approved documents.								
5	Reference documents are relevant Job specifications /standard specifications/data sheets/applicable codes & standards								
6	Certification requirements to comply with EN 10204 - 3.2 (Latest Edition). All bought out items shall be provided with 3.2 certificates.								
7	The above Testing and acceptance criteria are minimum requirements, however, equipment supplier shall ensure that the product also comply to the additional requirements as per Technical specifications & data sheets.								