SPECIFICATION FOR SEAL GAS BOOSTER

IOCL-PARADIP PX PLANT PROJECT(RECYCLE GAS)

Ref. Doc

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1.0 **SCOPE**

This specification defines the scope of supply for a seal gas booster (s) that shall be used to ensure seal gas flow to centrifugal compressor dry seals during compressor start-up or when compressor is in pressurized shutdown.

The seal gas booster (s) is realized as pneumatic driven, reciprocating (single or double acting) compressor. The booster (s) shall be suitable for horizontal or vertical mounting.

2.0 **TECHNICAL DATA: Refer clause 22.**

3.0 **TECHNICAL REQUIREMENTS**

3.1 The booster shall be suitable for operation of minimum 2000 hrs without any maintenance required.

3.2 The seal gas booster(s) shall be suitable for instant start-up without any lead time.

3.3 The booster material shall be SS316 as a minimum.

3.4 The booster shall be supplied in completely assembled condition. BHEL shall connect the gas inlet & outlet lines, instrument connection. Vendor to inform accessories required (like air filter & regulator, SOV) etc. to be supplied by purchaser.

3.5 All the sizing, material selection, design etc. shall be in line with ASME standard for pressure equipment.

4.0 **SPARES REQUIREMENT**

4.1 Commissioning spares required for commissioning the offered equipment as per vendor recommendation for all pneumatic equipment shall be included in Vendor's scope of supply along with the main equipment. Vendor to submit a list of such spares required along with the offer.

4.2 Mandatory spares shall be as follows to be included in vendor's scope of supply. The word "TYPE" means the make, model no, range, size/length, rating, material as applicable.

4.2.1 Pneumatic actuated booster:

- Pneumatic circuit spares (as applicable): all wear & tear parts and seals including:
- Pneumatic cylinder-01 no
- Air filter reducer-01 no
- Snubber-01 no
- Pneumatic distributor-01 no

4.2.2 Process side Booster spares: 01 set of all wear & tear parts and seals including:

- -gaskets
- -seals
- -o-rings
- -check valve

4.2.3 Special tools kits & tackles: as per vendor recommendation.

5.0 **H_2 SERVICE REQUIREMENTS**

The wetted parts of booster shall be compliant to attached **IOCL H2 service requirements (Doc no: IPPX-6394-8440-SP-000-0028).**

6.0 **DESIGN STANDARDS (AS APPLICABLE)**

6.1 European directive no 94/9/EC (ATEX)

6.2 European directive no 97/23/EC (PED)

6.3 ASME VIII Div. 1

6.4 ANSI B16.34

6.5 NACE MR0103 / MR0175

6.6 Gas Hazardous area classification: IEC Zone-1, Gas group II C, T3.

7.0 **PIPING REQUIREMENTS**

7.1 Piping Interface connections

Description	Type
Process gas inlet	1" NPTF or higher
Process gas outlet	1" NPTF or higher
Vent / drain	½" NPTF or higher
Instrument air inlet	½" NPTF or higher

7.2 All the materials in contact with gas inlet / outlet and vent shall be of SS 316 or equivalent forging /casting materials.

7.3 All the materials in instrument airline shall be SS316 piping / tubing.

7.4 All Butt-welded joints shall be TIG welded and the welds shall be 100% radio graphed.

7.5 All the vent/ drain holes, if any shall be plugged with threaded plugs/caps.

8.0 **DOCUMENTATION REQUIREMENTS**

8.1 Along with technical offer, arranged in this sequence only:

- 8.1.1 Booster technical details.
- 8.1.2 Booster Performance / operation graphs / curves.
- 8.1.3 Booster Data sheets.
- 8.1.4 Instrument air consumption.
- 8.1.5 Recommended spares list along with special tools (if any).
- 8.1.6 Signed & stamped copy of this specification.
- 8.1.7 Filled in Check List.
- 8.1.8 Filled in PTR.
- 8.1.9 Filled in Deviation Format.
- 8.1.10 Filled in Price Schedule marked 'QUOTED' for each item.
- 8.1.11 Filled in Logistic Certificate.

8.2 Within 2 weeks of Placement of Order / LOI: Vendor shall submit following for approval for the documents as mentioned below within 2 weeks of Placement of PO /LOI:

- 8.2.1 General Arrangement drawing of seal gas booster giving overall dimensions. It shall show location / disposition of various equipment / Instruments on the booster and location of customer termination connection.
- 8.2.2 Bill of Material of all the equipment, instruments, components etc. The Bill of Material should clearly show the make and model of each component, which are subjected to BHEL / CUSTOMER approval.
- 8.2.3 Booster Data sheets.
- 8.2.4 Instrument datasheets.
- 8.2.5 Booster Performance / operation graphs / curves.
- 8.2.6 Quality assurance plan.
- 8.2.7 Spares list.

8.3 Final Documentation: Vendor shall furnish the following:

- 8.3.1 Documents mentioned 8.2.1 above.
- 8.3.2 Instruction, Service and Maintenance manual
- 8.3.3 Test and Inspection reports : 3 copies.
- 8.3.4 Guarantee Certificates : 3 copies.
- 8.3.5 Photographs for all views : 2 sets (In DVD, the digital photos shall be provided).

9.0 **EQUIPMENT QUALIFICATION CRITERIA (EQC)**

Seal Gas Booster shall be identical in frame size and identical or validly similar in terms of **application (seal gas supply to compressor seals),** Type of drive, inlet and discharge pressures, inlet temperatures, flow, number and materials etc. as compared to **at least two units designed, manufactured, tested and supplied from the proposed manufacturing plant in last fifteen years**

at least one of these units shall have been operating satisfactorily in the field for at least 8000 hours without any major problems as on the date of issue of enquiry.
Vendor shall furnish complete reference list / details (Proven track record) along with the offer. These details shall include Plant name, year of commissioning, number of operating hours completed and name of contact person(s) etc. for the seal gas booster similar to one being offered.

10.0 PROVEN TRACK RECORD

Vendor shall submit filled in PTR as per EQC listed in above clause.

11.0 INSPECTION AND TESTING REQUIREMENTS

All the equipment shall be subject to inspection and witness tests by Third Party Inspection agency. The schedule of quality checks shall be furnished by the vendor in the quality plan which is subject to the approval of BHEL. The minimum shall be as indicated in below table.

Quality Plan

Sl. No.	Description	Type of check Quantum of check 100%	Ref. Documents	Type of Inspection	Agency
1	Assembly of Booster	- Location of equipment - Correctness of flow Schematics - Overall dimensions	- Approved GA drawing	Physical check	Lloyd's / DNV / BV / TUV etc.
2	Welding (if applicable)	Type	Manufacturing drawings.	-Review of Radiograph certificate -Welding efficiency of 1	
3	Booster	- Material Certification	-BHEL/ CUSTOMER Specification - Approved drgs / docs.	Verification of test report / certificate	
4	Gas leak test	- Leakage with **HELIUM**	--Do--	Witness	
5	Name Plates	- Correctness	--Do--	Physical check	
6	Performance test	-performance	Booster shall be tested to verify pressure & flow parameters	Witness	

12.0 MARKING AND SHIPPING

12.1 Name plates: The Individual components shall be provided with Nameplates giving important details like make, model etc. Each component shall be provided with stainless steel Tag plates duly punching Tag Nos. as applicable on it.

12.2 Preparation for Shipment:

12.2.1 Equipment shall be suitably prepared for shipment. The preparation shall make the equipment suitable for 6 months of outdoor storage from the date of shipment.

12.2.2 Seal gas booster assembly shall be marked with details like, drawing no, job number, PO No. etc. at a convenient location.

12.2.3 Lifting Points and lifting lugs shall be clearly identified.

12.2.4 All Loose supplied items like flanges, nut-bolt, gaskets etc. if any, shall be listed out separately in the packing list.

12.2.5 Adequate amount of silica gel or equivalent shall be provided in the box before dispatch for the removal of moisture till installation.

12.2.6 All safety instructions for storage and handling shall be indicated on external surface of the box.

13.0 **DEVIATIONS**

Bidder shall submit duly filled deviation format along with technical offer, otherwise, it will be presumed that there are no deviations from this specification. Offer without this deviation list will not be evaluated & shall be considered for rejection. If, there are no deviations, bidder shall submit signed copy of deviation format, mentioning "No Deviations".

14.0 **GUARANTEE**

Refer ITB documents.

15.0 **TENDER EVALUATION CRITERIA**

15.1 The total price for the complete package i.e. Main System, Mandatory spares, Supervision of erection & commissioning charges shall be considered for L1 evaluation.

15.2 Duly signed & stamped un-priced price schedule and unit prices shall be submitted along with technical offer by bidder as a token of concurrence that all items are quoted without which the offer will not be evaluated. For unpriced bid bidder to fill 'Quoted' for each item and submit (refer PRICE SCHEDULE format).

16.0 **TENDER REJECTION**

Non-compliance to inclusion of any the following documents with technical offer shall lead to rejection of the bids.

16.1 Filled in Check List not included.

16.2 Filled in PTR not included.

16.3 Filled in Deviation Format not included.

16.4 Filled in Price Schedule marked 'QUOTED' for each item not included.

16.5 Filled in Logistic Certificate not included.

17.0 **SPECIAL NOTES**

17.1 Vendor shall confirm that the bill of material furnished along with offer is only indicative and the final BOM, which shall be furnished during detailed Engineering (after order placement) for the approval of BHEL. The additional items, if any required at later stage for complying BHEL specification or for the satisfactory working of the seal gas booster shall be supplied by vendor without any price/delivery implications

17.2 Vendor should bring out in his offer clause wise deviations if any, with respect to proposed supply along with price adder for withdrawing the deviation to comply with specification. Failure to highlight the same will be construed as acceptance on the part of the vendor to meet the requirement of this specification totally.

17.3 Vendor shall provide the relevant technical information and supporting documents whenever asked for by the customer/ consultant.

17.4 Vendor to clearly bring out any additional requirements, which are essential for proper functioning of the Seal Gas Booster. This shall be included in the offer.

18.0 **Check List**

(To be filled by the vendor and submitted along with the offer without which offer will not be considered)

Sl. No	Description	Vendor Confirmation (Yes/No)
1	Booster technical details, catalog included.	
2	Booster Performance / operation graphs / curves included.	
3	Booster Data sheets included.	
4	Instrument air consumption included.	
5	Commissioning spares list included. (As per vendor recommendation)	
6	Mandatory spares list included.	
7	Special tools (if any) included.	
8	Signed & stamped copy of this specification included.	
9	Filled in Check List included.	
10	Filled in PTR included.	
11	Filled in Deviation Format included.	
12	Filled in Price Schedule marked 'QUOTED' for each item included.	
13	Filled in Logistic Certificate included.	

VENDOR SIGNATURE WITH SEAL

19.0 **PTR Format**

19.1 Name of the Bidder
19.2 Whether manufacturer & supplier:
19.3 Whether System Integrator & Supplier:
19.4 Name of Packager:

Sl.No	PTR Requirement	Ref-1	Ref-2	Ref-3	Ref-4
1	Description of item as manufactured & Supplied/ engineered (identify bidder's scope of work)				
2	Plant / Purchaser's name, address, Tel no, Fax no, email and contact person				
3	Application (seal gas supply to compressor seals)				
4	Type of drive,				
5	Inlet and discharge pressures, flow				
6	Material				
7	Make & model no of the booster supplied.				
8	Date of order placed				
9	Contractual completion date				
10	Actual completion date/ month & year of commissioning				
11	Number of operating hours completed				
12	Reasons of delay if any				
13	Details of major break down till date.				

VENDOR SIGNATURE WITH SEAL

Vendor to furnish the complete exhaustive reference list separately for our review.

20.0 **Deviation Format**

Sl.No	Clause No. of Specification	Deviation	Reason for deviation	Deviation category	
				Product/design limitation	Optimization

VENDOR SIGNATURE WITH SEAL

21.0 **Logistic support certificate:**

CERTIFICATE FOR LOGISTIC SUPPORT

(TO BE SIGNED BY **VENDOR'S PRINCIPAL** (Original equipment manufacturer) CORPORATE LEVEL SIGNATORY ON COMPANY LETTERHEAD)

I, ON BEHALF OF M/s, ---------- CONFIRM THAT THE SEAL GAS BOOSTER QUOTED BY M/s ----------FOR <PROJECT NAME OF BHEL / BHEL CUSTOMER> (INDIA) SHALL CONTINUED TO BE SUPPORTED BY US AND QUOTED SYSTEM SHALL NOT BE WITHDRAWN FROM "INDIAN" MARKET AS A MATTER OF CORPORATE POLICY.

I, FURTHER CONFIRM THAT IN CASE OF PLACEMENT OF ORDER ON US, <BHEL / BHEL CUSTOMER> (INDIA) SHALL BE SUPPORTED IN PROVIDING BACK-UP ENGINEERING, MAINTENANCE SUPPORT AND SPARE PART SUPPORT FOR A PERIOD OF NOT LESS THAN TEN (10) YEARS FROM THE DATE OF PLACEMENT OF ORDER.

(SIGNATURE WITH SEAL)

CERTIFICATE FOR LOGISTIC SUPPORT

(TO BE SIGNED BY **VENDOR'S CORPORATE** (Bidder for the enquiry) LEVEL SIGNATORY ON COMPANY LETTERHEAD)

I, ON BEHALF OF M/s ----------CONFIRM THAT THE SEAL GAS BOOSTER QUOTED BY US FOR <PROJECT NAME OF BHEL / BHEL CUSTOMER> (INDIA), SHALL CONTINUE TO BE SUPPORTED BY US AND OUR PRINCIPAL M/S ----------

I, FURTHER CONFIRM THAT IN CASE OF PLACEMENT OF ORDER ON US WE SHALL CONTINUE TO SUPPORT M/S <BHEL / BHEL CUSTOMER> (INDIA) IN PROVIDING BACK-UP ENGINEERING, MAINTENANCE SUPPORT AND SPARE PART SUPPORT FOR A PERIOD OF NOT LESS THAN TEN (10) YEARS FROM THE DATE OF PLACEMENT OF ORDER.

(SIGNATURE WITH SEAL)

Ref. Doc

CERTIFICATE FOR LOGISTIC SUPPORT

(TO BE SIGNED BY "Bidders **VENDOR" CORPORATE** LEVEL SIGNATORY ON COMPANY LETTERHEAD)

Applicable for all major sub-systems bought-out by the bidder

I, ON BEHALF OF M/s, ---------- CONFIRM THAT THE ---------- QUOTED BY THROUGH M/S---------- FOR <PROJECT NAME OF BHEL / BHEL CUSTOMER> (INDIA), SHALLCONTINUE TO BE SUPPORTED BY US AND OUR PRINCIPAL M/S ----------

I, FURTHER CONFIRM THAT IN CASE OF PLACEMENT OF ORDER ON US, WE SHALL CONTINUE TO SUPPORT M/S <BHEL / BHEL CUSTOMER> (INDIA) IN PROVIDING BACK-UP ENGINEERING, MAINTENANCE SUPPORT AND SPARE PART SUPPORT FOR A PERIOD OF NOT LESS THAN TEN (10) YEARS FROM THE DATE OF PLACEMENT OF ORDER.

(SIGNATURE WITH SEAL)

Ref. Doc

22.0 PROJECT SPECIFIC BOOSTER TECHNICAL DATA & PRICE SCHEDULE:

22.1 PROJECT SPECIFIC TECHNICAL DATA FOR SEAL GAS BOOSTER-MCA1070:

22.1.1 **Utility**: Instrument Air (for pneumatic drive)

SL NO	PARAMETER	MIN	NOR	MAX	MECH. DESIGN
a	Pressure (kg/cm^{2}g)	4.5	6.5	8	10.5
b	Temperature (°C)	40	40	50	65

22.1.2 **Design conditions-Process (MCA1070)**

SL NO	PARAMETER	VALUE
a	Design Pressure	37.85 kg/cm2g
b	Maximum Working Temperature	100 °C
c	Gas leak test Pressure (HELIUM)	56.77 kg/cm2g

22.1.3 **Operating conditions (MCA1070):**

SL NO	**PARAMETER**	**VALUE**		
a	**Operating case**	**Case-1**	**Case-2**	**Case-3**
b	Inlet Pressure (Kg/Cm2(g))	31	26	8
c	Inlet Temperature (deg C)	66	65	40
d	Gas Mol Wt. (Refer Gas Composition)	10.8 (hydrogen)#	9.6 (hydrogen)#	28.016 (nitrogen)#
e	Flow (ACM^3/Hr)-required	*	*	*
f	Pressure increase (ΔP required, Kg/Cm2)	2	2	2
g	QTY of Booster (vendor to indicate)			
h	Maximum Flow (ACM^3/Hr) possibe with selected single booster			
i	Maximum Flow (Kg/Hr) possibe with selected single booster			

*** For all operating cases, vendor to inform the maximum gas flow possible from selected booster.**

 # Refer Gas composition

22.2 **PRICE SCHEDULE: : SEAL GAS BOOSTER**

22.2.1 **Offer ref no.:**

22.2.2 **Offer date:**

22.2.3 **Enquiry ref. no:**

22.2.4 **Enquiry date:**

Sl.No.	DESCRIPTION	RFQ Qty	Booster Qty per set	Unit Price	Total Price
1	SEAL GAS BOOSTER-MCA1070(TC9765442114) along with commissioning spares / special tools (as per vendor recommendation clause 4.1 & 4.2.3)				
2	Seal Gas Booster spares-MCA1070 (TC9765442122) as listed in clause 4.2.1 & 4.2.2		--		
3	Additional price to withdraw the deviations if any taken by vendor for respective clause of BHEL specification.	Clause wise			
4	Total Price for L1 Evaluation • 1+2				

Notes:

i. Any additional requirements, which are essential for proper functioning of the seal gas booster but not indicated in specification, are included in the offer.

ii. Vendor shall submit UNIT PRICE for all spare items for the booster.

VENDOR SIGNATURE WITH SEAL

<Security Level 2>

IPPX

ENGINEERING SPECIFICATION FOR MATERIALS REQUIREMENT FOR HYDROGEN SERVICE

DOC. NO. : IPPX-6394-8440-SP-000-0028

PROJECT NAME: 1.2 MMTPA PX-PTA PROJECT, IOCL PARADIP REFINERY

TOYO JOB NO. : 6394

OWNER: INDIAN OIL CORPORATION LIMITED.

PMC : TOYO ENGINEERING INDIA PRIVATE LIMITED.

T2	21 MAY 2020	ISSUED FOR IPPX TENDER	AMD	SMS / SRK / SGS	TP
T1	24 DEC. 2019	ISSUED FOR IPPX TENDER	AMD	SMS / SRK / SGS	TP
O1	08 JULY 2019	FOR APPROVAL	AMD	SMS / SRK / SGS	SA
REV	**DATE**	**DESCRIPTION**	**MADE BY**	**REVIEWED BY**	**APPROVED BY**

TOYO ENGINEERING INDIA PRIVATE LIMITED MUMBAI, INDIA

(THIS DOCUMENT IS PREPARED WITH CHANGES AS HIGHLIGHTED IN PDRP SPECIFICATION DOC. NO PDRP-8440- SP-0028_REV_F1)

IndianOil	PARADIP REFINERY PROJECT SPECIFICATION MATERIALS REQUIREMENT FOR HYDROGEN SERVICE	PDRP-8440-SP-0028 PAGE 1 OF 8 REV F1

Client's Name:	Indian Oil Corporation Limited (IOCL)
Project Title:	Paradip Refinery Project (PDRP)
Project Location:	Paradip, Orissa State, India
FW Doc Class:	Class 1

REVISION	F1	Signature
DATE	14/09/2009	
ORIG. BY	S. Parvizi	
CHK. BY	A Lugan	
APP. BY	A Lugan	

MPIC Review M.A. Allerton 15/10/09

REVISION HISTORY			
Revision	**Date**	**Reason for Issue**	**Originator**
O1	09/09/09	Issued For Comments	S.P
F1	14/09/09	For Project Implementation Phase	S. Parvizi

1. SCOPE

This specification is a supplementary document to the Piping material specification.

When conflicting standards or specifications occur, the more stringent requirement shall be used or it shall be brought to the attention of the Owner's Engineer for resolution.

2. ABBREVIATIONS

AS	Alloy Steel with alloying elements of >5%
CS	Carbon Steel
FN	Ferrite Number
LAS	Low alloy steel with <than 5% alloying elements in total
PWHT	Post Weld Heat Treatment
Pp	Partial Pressure
SS	Austenitic Stainless Steel

3. REFERENCE

The following Reference document shall be used in conjunction with this specification.

3.1 API–American Petroleum Institute

API 941	API Recommended Practice 941, Sixth Edition, March 2004, "Steels for Hydrogen Service at Elevated Temperatures and Pressures in Petroleum Refineries and Petrochemical Plants".

3.2 ASME–American Society of Mechanical Engineers

ASME B1.20.1	Pipe Threads, General Purpose (Inch)
ASME B16.5	Pipe Flanges and Flanged Fittings NPS 1/2 Through NPS 24 Metric/Inch Standard
ASME B16.9	Factory-Made Wrought Butt welding Fittings
ASME B16.20	Metallic Gaskets for Pipe Flanges Ring-Joint, Spiral-Wound, and Jacketed
ASME B31.1	Power Piping
ASME B31.3	Process Piping
ASME B31.4	Pipeline Transportation Systems for Liquid Hydrocarbons and Other Liquids
ASME B31.8	Gas Transmission and Distribution Piping Systems
ASME SEC VIII D1	BPVC Section VIII - Rules for Construction of Pressure Vessels - Division 1

3.3 ASTM–American Society for Testing and Materials

ASTM A 53/A 53M	Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless
ASTM A 105/A 105M	Standard Specification for Carbon Steel Forgings for Piping Applications
ASTM A 106/A 106M	Standard Specification for Seamless Carbon Steel Pipe for High-Temperature Service
ASTM A 193/A 193M	Standard Specification for Alloy-Steel and Stainless Steel Bolting Materials for High Temperature or High Pressure Service and Other Special Purpose Applications
ASTM A 194/A 194M	Standard Specification for Carbon and Alloy Steel Nuts for Bolts

	for High Pressure or High Temperature Service, or Both
ASTM A 269	Standard Specification for Seamless and Welded Austenitic Stainless Steel Tubing for General Service
ASTM A234	Piping Fitting of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service

4. DEFINITION OF HYDROGEN SERVICE

Any process environment with any of the following operating condition shall be considered as Hydrogen service and all requirements of this specification shall apply.

- Hydrogen partial pressure is above 100 psi and the temperature is above 230°C
- Hydrogen concentration of above 90% independent of pressure and temperature
- Hydrogen partial pressure above 1000 psi independent of temperature.

5. MATERIALS SELECTION

Material selection guidance for Hydrogen service can be obtained by referring to 941(Nelson Curve) depicted in this standard i.e. when Hydrogen partial pressure and temperature are known then their location on this graph will indicate the most suitable material recommended. However, the use of this graph shall also be complemented by service experience and lessons learnt. For precautionary purpose it is recommended to add 25 psi and 10 °C to the operating pp and temperature figures to locate the point on the curve and select the material accordingly.

5.1 Pipe

Pipe materials shall be killed Carbon steel seamless.

5.2 Fittings

Fittings shall be carbon steel as per ASME B16.9.

5.3 Flanges

Flanges shall be based as per ASME B16.5.

5.4 Manufacturing Requirement for Pipe, Fitting and Flanges

- All carbon steel pipes, fittings and flanges having thickness of more than or equal to 9.53mm shall be in normalised condition.
- LAS materials shall be post weld heat treated irrespective of their thicknesses.
- All stainless steel material weldments shall be checked for ferrite number (FN) and this number shall be within the range of 3-8.%. The ferrite number shall be determined by a well calibrated ferriscope technique.
- For all carbon steel and low alloy steel pipe, fitting and flanges of over 20 mm thick, Impact test shall be carried out as per ASME Section VIII D1. The impact test specimen shall be in full heat treated condition and conducted at 0° C in accordance with ASTM A370.(unless more stringent requirements are specified elsewhere) The average impact energy shall be 27 J minimum per set of 3 specimens, with a minimum reading of 19J . For welded materials the impact specimens shall be conducted on the weld metal and heat affected zones
- For carbon steel material , unless more stringent requirements are specified elsewhere, the hardness shall not exceed 200 BHN . For the LAS and AS these limits shall be 225 and 241 BHN maximum respectively . Hardness measurement on finished welds can determine the PWHT requirement for hydrogen rich service.If this hardness is higher than these figures then PWHT will be required.
- All longitudinal and girth welds shall be 100% radiographed in accordance with ASME section VIII D1 para UW-51 and ASME section V. Radiography shall be carried out after PWHT.
- Min flange rating used will be 300 pounds

5.5 Valves

Carbon steel valves shall be in normalised condition, while alloy steel shall be in normalised and tempered condition.

All cast valves shall be radiographic quality and all cast valve flanges and bodies with flange rating of class 900 or greater shall be examined in accordance to ASMR Section –VIII DIV 1 appendix 7 Para 7.2-7.5.. Recommended practice and quality control of radiography shall comply with ASTM E94 and ASTM E142.

Body / bonnet / cover joints & stuffing box of valves shall have low emission. One valve per metallurgy, per rating, per size shall be helium leak tested as per ASME Sec.V, Subsection A, Article 10 (Detector Probe Technique).

All CS and LAS valves shall have magnetic particle and bend testing on their surfaces in accordance to ASTM A216 and A217, supplementary requirements of S3 and S4 shall apply and no linear discontinuities are allowed. Casting shall be preheated to minimum 200 °C prior to welding and all alloy steel shall be PWHT'ed after welding for stress relieving

Dye penetrant test of welds shall comply with ASTM B 165 procedure B-2 with acceptance criteria of ASME VIII Div. Appendix 8

The hardness limit shall be 200 and 225 BHN max for Carbon steel and alloy steel respectively.

Tensile strength limit for the CS and LAS is 70000 and 100,000 psi max respectively. T2

Charpy impact test is required for all valve material with an average impact energy of 20 Jouls out of three sets with a single minimum value of 15.J conducted at 0°C.

Stainless Steel valves shall be in solution annealed , pickled and passivated condition. The entire surface of all castings shall be dye penetrant inspected after pickling. Dye penetrant test shall be as ASTM E165 procedure B-2, Interpretation as per Appendix 8 of ASME –VIII Div. 1.

Critical areas SS bodies and bonnet casting defined by ASME B16.34 shall be fully radiographed and meet the following requirements:

Size	category	level	Standard
<2"	A,B,CA	2	ASTM E446
<2"	CB,OC,CD	3	"
<2"	D,B,F	0	"

For the casting size of 2-4.5" Standard ASTM E186 shall apply.

Repair welds shall be limited and if repairing is technically justified it shall be 100% radiographed and evaluated as per para 344.5 of ASME B31.3 with minimum casting quality of 0.95.

5.6 Bolts

Stud bolts will be ASTM A 193/A 193M, B7, plated and/or coated if specified.

Hex nuts will be ASTM A 194/A 194M, 2H, plated and/or coated if specified. For electroplated CS material, it shall be baked appropriately to remove any trapped hydrogen.

5.7 Tubing

Tubing shall comply with ASTM A 269, TP 316 S.S.

5.8 Gaskets

Gaskets shall be per ASME B16.20, and purchased from the approved vendors..

5.9 Miscellaneous Materials

All materials including sealants, lubricants, elastomers, and seals shall be suitable for the service design as specified by the Owner's Engineer or in the Purchase Order.

6. FABRICATION

- ASME Category A and B butt joints shall be 100% radiographically examined .
- PMI (positive materials identification) shall be conducted on 100% of Cr-Mo alloys.
- Non-metallic material is not recommended for this service, however, if required for some reasons, the manufacturer or vendor shall recommend and confirm the appropriate elastomer for this service, which also requires approval by the Owner's Engineer.
- When welding any fitting, regardless of material, care must always be taken so as not to damage the Swagelok end or port. If this end is left unprotected, weld spatter during welding can cause damage to threads, machined surfaces, and/or sealing surfaces. This can be eliminated by using a nut or standard fitting plug to cover the thread and seat areas.
- Use of flanges shall be minimised where practical. However, where flanges are required , gasket reliability shall be taken into consideration and utilise spiral wound gasket for a low pressure class
- All valves for this service shall bear a tag "*For Hydrogen Service*" and be packaged in 3-mil polyethylene bag or equal to prevent any contamination during transportation.