भारत सरकार
अंतरिक्ष विभाग
सतीश धवन अंतरिक्ष केंद्र शार
श्रीहरिकोटा रेंज डा.घ. 524 124
श्री पोट्टि श्रीरामुलु नेल्लूर जिला, आं.प्र., भारत
दूरभाष : +91-8623 245060 (6 जं)
फैक्स : +91-8623 222099

सत्यमेव जयते

Goverment of India
Department of Space
Satish Dhawan Space Centre SHAR
Shriharikota Range P.O. 524 124
SPSR Nellore Dist., AP., India
Telephone : +91-8623 245060 (6 Lines)
Fax : +91-8623 222099

निविदा सूचना सं. TENDER NOTICE NO. SDSC SHAR/Sr.HPS/PT/RO-VALF/36/2026-27

भारत के राष्ट्रपति की ओर से वरि. प्रधान क्रय एवं भंडार, सतीश धवन अंतरिक्ष केंद्र श्रीहरिकोटा निम्नलिखित वस्तुओं के लिए ऑनलाइन निविदाएं आमंत्रित करते हैं/On behalf of President of India, Sr. Head Purchase and Stores, SDSC SHAR, SRIHARIKOTA invites on line quotations for the following: -

क्र.सं. Sl No	संदर्भ सं. Ref. No.	विवरण Description	मात्रा Qty.
01.	**SDSC SHAR /VALF PURCHASE /2026000582 Supply of Pneumatic Test Console (PTC) for TCX-2 [Public Tender - Two Part]**	**Design, fabrication, assembly, testing, supply of Pneumatic Test Console**	**01 Lot**
		Erection , Commissioning and testing of Pneumatic Test Console along with service racks	**01 Lot**
		Supply of spares for Pneumatic Test Console	**01 Lot**

निविदा दस्तावेजों को डाउनलोड करने की अंतिम तिथि Last Date for downloading of tender documents : 04.06.2026 at 16:00 hrs.
ऑनलाइन निविदा जमा करने की अंतिम तिथि Due Date for submission of bids online : 04.06.2026 at 16:30 hrs.
निविदाएं खोलने की नियत तिथि Due Date for opening of tenders : 05.06.2026 at 10:30 hrs.

निविदाकार के लिए निर्देश Instructions to Tenderers:

निविदाएं ईजीपीएस के माध्यम से ही भेजी जाएं तथा कोई निविदा शुल्क लागू नहीं होगा।
Bids shall be submitted on line through EGPS only and No tender fee shall be applicable.

01. कार्य के सम्पूर्ण विवरण/जानकारी तथा नियम व शर्तों इत्यादि के लिए संलग्न अनुलग्नक को देखें। / For full details/scope of work and terms and conditions etc., please see the enclosed annexures.

02. इच्छुक निविदाकार इसरो की ई-खरीद वेबसाइट इसरो न्यू ई-प्रोकुरमेंट www.eproc.vssc.gov.in से ई-निविदा डाउनलोड और अपनी निविदा ई-खरीद पोर्टल पर ऑनलाइन जमा कर सकते हैं। डाक / वाहक / स्वयं द्वारा प्राप्त निविदाओं पर विचार नहीं किया जाएगा। / Interested tenderers can download the e-tender from ISRO e-procurement website ISRO NEW E-PROCUREMENT www.eproc.vssc.gov.in and submit the offer on line in the e-procurement portal. Offers sent physically by post/courier/in person will not be considered.

03. निविदा दस्तावेज इसरो की वेबसाइट www.isro.gov.in इसरो न्यू ई-प्रोकुरमेंट वेबसाइट www.eproc.vssc.gov.in तथा सतीश धवन अंतरिक्ष केंद्र शार की वेबसाइट www.shar.gov.in पर भी उपलब्ध हैं। इन्हें केवल ई-खरीद पोर्टल से डाउनलोड और निविदा ऑनलाइन जमा कर सकते हैं। / Tender documents are also available on ISRO website www.isro.gov.in ISRO New e-procurement website www.eproc.vssc.gov.in and SDSC SHAR, Sriharikota website www.shar.gov.in. The same can be down loaded and offer submitted on line in the new e-procurement portal only.

04. निर्धारित तिथि/समय के पश्चात प्राप्त बोलियों पर विचार नहीं किया जाएगा। / Quotations received after the due date/time will not be considered.

05. निविदा दस्तावेज दिनांक 04.06.2026 को 16:00 बजे तक डाउनलोड करने के लिए उपलब्ध रहेंगे तथा निविदा ऑनलाइन जमा करने की अंतिम तिथि 04.06.2026 को 16:30 बजे तक है। निविदाएं दिनांक 05.06.2026 को 10:30 बजे खोली जाएंगी। / The tender documents are available for download upto 04.06.2026 at 16:00 hrs. and last date for submission of tenders on line 04.06.2026 at 16 30 hrs. and Tender Opening on 05.06.2026 at 10:30 hrs.

06.इच्छुक विक्रेता विवरण जानने के लिए निविदा खोले जाने वाले सत्र में शामिल हो सकते हैं। निविदा के मूल्यांकन पर विचार करने के लिए उनकी उपस्थिति अनिवार्य नहीं है। / Interested vendors can attend the Bid opening sessions to know the details. Presence not mandatory to consider the quote for evaluation.

07. वरि. प्रधान क्रय एवं भंडार, सतीश धवन अंतरिक्ष केंद्र श्रीहरिकोटा के पास किसी भी या सभी निविदाओं को स्वीकार / अस्वीकार करने का अधिकार है। / Sr. Head, Purchase and Stores, SDSC-SHAR, Sriharikota reserves the right to accept or reject any/or all the quotations.

08. GeM ARPTS Report ID: GEM/GARPTS /07052026/2ABKDNMP8GO

दिनांक DT:13.05.2026

वरि. प्रधान क्रय एवं भंडार
Sr. HEAD PURCHASE AND STORES

GOVERNMENT OF INDIA
DEPARTMENT OF SPACE
SATISH DHAWAN SPACE CENTRE SHAR SRIHARIKOTA (SDSC SHAR)
NELLORE

Tender for Supply of Pneumatic Test Console (PTC) for TCX-2

Bids to be submitted online

Tender No.: SDSC SHAR/VALF PURCHASE/SH202600058201 dated 14-05-2026

A. Tender Details

Tender No :	**SDSC SHAR/VALF PURCHASE/SH202600058201**
Tender Date :	**14-05-2026**
Tender Classification:	**GOODS**
Purchase Entity :	**VALF PURCHASE**
Centre :	**SATISH DHAWAN SPACE CENTRE SHAR SRIHARIKOTA (SDSC SHAR)**

Supply of Pneumatic Test Console (PTC) for TCX-2

GEM/GARPTS /07052026/2ABKDNMP8GO

As per tender documents

A.1 Tender Schedule

Bid Submission Start Date :	**14-05-2026 11:00**
Bid Clarification Due Date :	**29-05-2026 10:00**
Bid Submission Due Date :	**04-06-2026 16:30**
Bid Opening Date :	**05-06-2026 10:00**
Price Bid Opening Date :	**31-07-2026 14:30**

B. Tender Attachments

NA

Instructions To Vendors

1. INSTRUCTIONS TO TWO PART TENDER

1. We are proposing to invite Tenders in Two Parts viz., Part-I Techno and Commercial & Part-II Price. All Tenderers are requested to follow carefully the following instructions before preparing their offer.
PART- I- TECHNO COMMERCIAL BID:
(1)This part should contain detailed Specifications of the items quoted by you along with Technical Literature and Leaflets if any.
(2)All the Commercial terms and Conditions applicable also should be indicated separately under separate heads.
(3)The Commercial terms such as delivery terms, delivery period, payment terms, warranty, validity of the offer, Installation & Commissioning, Duties and Taxes etc shall come into this.
(4)Either Technical Specifications or Terms & Conditions as above should be very clearly reflected items wise with reference to the items called for in the tender.
(5)Please note that Prices should not be indicated in this part.
(6)Any deviations from the Technical Specifications and Commercial Terms shall be indicated separately.
PART II-PRICE BID:
(1)The prices applicable for the items, item wise in response to the tender shall come into this part.
(2)Tender shall indicate very clearly item wise prices with reference to their Technical Offer.

Note: 1. PLEASE NOTE THAT THE OFFERS SUBMITTED CONTRADICTORY TO ABOVE INSTRUCTIONS WILL BE LIABLE FOR REJECTION. PLEASE ENSURE OFFERS ARE SUBMITTED WITHIN THE DUE DATE.
2. BEING TWO PART TENDER, WE REQUEST YOU NOT TO DISCLOSE / INDICATE ANY OF THE PRICE VALUE WHILE SEEKING / PROVIDING CLARIFICATION. YOU SHOULD INDICATE ONLY IN PERCENTAGE. IN CASE IF YOU DISCLOSE ANY OF THE PRICE AMOUNT YOUR OFFER WILL BE REJECTED.

2. STANDARD TERMS & CONDITIONS

1. 1. OUR GST NUMBER: 37HYDF00385A1DZ- SDSC SHAR SRIHARIKOTA
2.Email for communication: psovalf(at)shar.gov.in
3.Instruction to Indigenous Suppliers:
A) Payment Terms shall be as specified in RFP. If not specifically mentioned Our Normal payment term is 100 percent within 30 days after receipt and acceptance of the item at our site. Please confirm

acceptance in your quotation.
B) Purchase - Price preference to MSEs
Purchase - Price preference will be applicable to the product reservation admissible to the Micro and Small Enterprises. Purchase - Price Preference shall be extended to the MSEs under the Public Procurement Policy for MSEs formulated under the Micro, Small and Medium Enterprises Development Act, 2006. The participating MSEs in a tender, quoting price within the band of L-1 plus 15 percent may also be allowed to supply a portion of the requirement by bringing down their price to the L-1 price, in a situation where L-1 price is from someone other than an MSE. Such MSEs may be allowed to supply up to 25 percent of the total tendered value. In case of more than one such eligible MSE, the supply will be shared equally.
Micro and Small Enterprises which have technical capability to deliver the goods and Services as per prescribed technical and quality specifications and may not be able to meet the qualification criterion relating to prior experience minus prior turnover may be relaxed as per guidelines issued by Ministry of MSMEs and as amended from time to time.
Interested vendors shall specifically claim the benefit with supporting documents.
C) Purchase - Price preference to Make-in-India Products:
Preference shall be given to Class 1 local supplier as defined in public procurement (Preference to Make in India), Order 2017 as amended from time to time and its subsequent Orders - Notifications issued by concerned Nodal Ministry for specific Goods - Products. The minimum local content to qualify as a Class 1 local supplier is denoted in the bid document 50 percent. If the bidder wants to avail the Purchase preference, the bidder must upload a certificate from the OEM regarding the percentage of the local content and the details of locations at which the local value addition is made along with their bid, failing which no purchase preference shall be granted. In case the bid value is more than Rupees 10 Crore, the declaration relating to percentage of local content shall be certified by the statutory auditor or cost auditor, if the OEM is a company and by a practicing cost accountant or chartered accountant for OEMs other than companies as per the Public Procurement (preference to Make-in-India) order 2017 dated 04.06.2020 and amendments thereof. In case Buyer has selected Purchase preference to Micro and Small Enterprises clause in the bid, the same will get precedence over this clause.
D) Instruction to Foreign Suppliers-(if allowed as per RFP)
a) Payment Terms shall be as specified in RFP. If not specifically mentioned Our normal payment term is SIGHT DRAFT, Please confirm acceptance in your offer, if you insist for L - C, and all bank charges shall be to your account. Confirm acceptance.
b) Please specify whether any export clearance is required in case of an order on you.
c) Warranty - Guarantee applicable for the item shall be mentioned in your offer
d) Special Certification for packing Material : as per Plant Quarantine (Regulation of Control into India) Order 2003, Articles packed with packing material of plant origin namely, hay, straw, wood shavings, wood chips, saw dust, wood waste, wooden pallets, Dunn age Mats, wooden packages, coir pith, pear or sphagnum moss etcetera, will be allowed entry by Customs only with a Phytosanitary Certificate. In case of a Purchase Order, if you propose to us any of the above material for packing such a certificate issued by your local Plant Quarantine Authority shall be furnished.
e) Confirm whether any Export License is required and for which End User Certificate is to be provided

by us, in case of an Order on you. (Enclose format for EUC, if applicable)
f) Either Indian Agent on behalf of the foreign principals or the foreign principal directly can quote against this order, but not both. In either case an Indian agent cannot represent more than one principal against the same tender.
g) In case the quote is in INR we prefer to execute the same on HSS Basis and for which Concessional Customs duty as per Notification number 50 - 2017 Customs dated 30.06.2017, Serial Number 539(A) as amended by Notification number 05 - 2018 dated 25.01.2018 and vide Notification No.05-2025 dt.01.02.2025 and 45-2025 dtd 24.10.2025. In case the quote is on Indian Rupee (Outside High Sea Sale), the price shall include taxes and duties if any. We shall not be able to provide any duty or IGST tax exemption - concession certificates. If the item quote is of USA make, please quote for all-inclusive price since we prefer to get the item on FOR destination basis.
h) Any bidder from a country which shares a land border with India will be eligible to bid in any procurement whether of goods, services (including consultancy services and non-consultancy services) or works (including turnkey projects) only if the bidder is registered with Competent Authority as specified in Office Memorandum number F.No.6 - 18 - 2019-PPD, Ministry of Finance, Department of Expenditure, Public Procurement Division dated 23rd July 2020. All the conditions mentioned in the above OM is applicable for this tender.
E) Common terms to Indigenous and foreign suppliers:
a.Warranty
You shall provide applicable warranty for the items offered by you without fail. For the applicable period you shall provide necessary warranty certificate.
b.Performance Bank Guarantee
Towards the performance of the systems during the warranty period you shall submit a performance bank guarantee equivalent to 3 percent of the order value to cover the warranty period. This PBG shall be interest free and the same shall be returned to you on successful completion of all contractual obligations. The said PBG shall have a further claim period of 2 months.
c.Security Deposit
On acceptance of the order, you shall submit an interest free amount equivalent to 3 percent of the total contract - order value towards security deposit. This security deposit is collected towards the performance of the Contract. The said Security Deposit shall be submitted either in the form of Bank Guarantee - Demand Draft - FDR receipts duly endorsed in the name of the centre. The Security Deposit will be returned to you on successful completion of the Contractual obligations; failing which it shall be forfeited - adjusted.
4.Offer Validity
Your offer shall be valid for 180 days in case of 2 part - 90 days in case of single part from the date of tender opening. In case your offer validity is less than the mentioned above, the said offer is liable for rejection which may please be noted.
5. Liquidated Damages:
If you fail to deliver the ordered items satisfactorily within the time specified or any extension thereof, Liquidated Damage at 0.5 percent (zero point five percent) of the order value or part thereof the un-delivered items for each calendar week of delay shall be recovered from your bill. However total Liquidated Damage shall not exceed 10 percent (ten percent) of the order value.

6.FORCE MAJEURE:
Should a part or whole work covered under this contract be delayed in delivery - completion of work due to reasons of Force majeure which shall include legal lockouts, strikes, riots, civil commotion, fire, accidents, quarantines, epidemic, acts of God and War, stoppage of deliveries by the Government, freight embargoes etcetera; the delivery period - completion of work referred to in this Contract shall be extended by a period not in excess of duration of such Force Majeure. The occurrence shall be notified by either party within reasonable time.
Note:
I.Offers received through post, courier, fax or email will not be considered.
II.Technical and commercial bid (Part-I) shall not contain any price details. Optional accessories or other price details, if any shall be uploaded in Supporting documents related to Price Bid, to be opened along with Price Bid.
III.In respect of FIM being issued, the fabricator shall submit Bank Guarantee for equivalent sum compulsorily. In case, submission of Bank Guarantee is not possible, the reasons there for shall be clearly mentioned. However, for such cases the fabricators at their cost shall secure such FIM through Insurance Policy with Director, SDSC SHAR as beneficiary. In case of PSU and Government Organization, Indemnity Bond in lieu of Bank Guarantee is acceptable. Balance FIM - Scrap, if any shall be returned along with the supply of the items. Please confirm acceptance in your quotation.
IV.SDSC SHAR shall have the right to place part order among the parties for the items for which they are the lowest.
V.TERMS AND CONDITIONS IN THE RFP SHALL PREVAIL OVER OTHER TERMS AND CONDITIONS(in case of any contradiction or ambiguity)

3. General Instructions to Vendor

1. Instructions to tenderers

TeleNo.08623-225174/225127
Fax No.08623-225170/22-5028

e-Mail ID : hps@shar.gov.in, sselvan@shar.gov.in, psovalf@shar.gov.in
1. Interested tenderers may, at their option, login to https://eproc.isro.gov.in and submit your offers.

2. TENDER FEE IS NOT APPLICABLE.

3. EARNEST MONEY DEPOSIT IS NOT APPLICABLE IF NOT MENTIONED IN THE RFP SPECIFICATION.
4. Indian agents while quoting on behalf of their principals are requested to attach Principals original quote, necessary authorization letter from their Principals, copy of agency agreement etc. in their bid.

5. TWO PART BIDS: In case of Two part tender, price details shall not be uploaded in the Technical &

Commercial Bids (Part I), failing to which the bid will be treated as INVALID.
6. The offer should be valid for a minimum period of 180 days for 2 part / 90 days for single part from the date of opening.
7. Due date & time: Sufficient time has been allotted for Bid submission. Vendors are requested to complete Bid submission well in advance. Last minute requests for due date extension citing server problems etc. will not be entertained. Bids will not be entertained after the due date and time.

7 (A). Request for the extension of the due date will not be considered.

8.
(a) Bid Opening for Public Tender: In case of Public Tender-Two Part Tenders: Technical and Commercial Bids will be opened on the first day specified for Tender opening. Interested vendors can attend the tender opening session to know the bidding details (Bidders presence is not mandatory to consider the quote for evaluation). Price Bid opening of the selected vendors will be scheduled later and it will be intimated to the selected Bidder (s).

(b) For Limited Tender: Bidders participation is not allowed.

9. Prices are required to be quoted according to the units indicated.

10. Preference will be given to those tenderers offering supplies from ready stocks and on the basis of FOR destination delivery at site.

11. (a) All available technical literature, catalogues and other data in support of the specifications and detail of the items should be furnished as attachments.

(b) Samples, if called for, should be submitted free of all charges by the tenderer and the Purchaser shall not be responsible for any loss or damage thereof due to any reason whatsoever. In the event of non-acceptance of tender, the tenderer will have to remove the samples at his own expense.

(c) Approximate net and gross weight of the items offered shall be indicated in your offer. If dimensions details are available the same should be indicated in your offer.

(d) Specifications: Stores offered should strictly conform to our specifications. Deviations, if any, should be clearly indicated by the tenderer in their quotation. The tenderer should also indicate the Make/Type number of the stores offered and provide catalogues, technical literature and samples wherever necessary. Test certificates wherever necessary should be attached. Whenever options are called for in our specifications, the tenderer should address all such options. Wherever specifically mentioned by us the tenderer could suggest changes to specifications with appropriate response for the same.

12. The purchaser shall be under no obligation to accept the lowest or any tender and reserves the right of acceptance of the whole or any part of the tender or portion of quantity offered and the tenderers shall supply the same at the rates quoted.

13. All amounts shall be indicated both in words as well as in figures. Where there is difference between amounts quoted in words and figures, amount quoted in words shall prevail.

14. The tenderer will be required to furnish a document containing the name of his bankers as well as the latest income-tax clearance certificate duly counter signed by the Income-tax Officer of the Circle concerned under the Seal of his office, if required by the Purchaser.

15. The Purchaser reserves the right to place order on the successful tenderers for additional quantity up to 25% of the quantity offered by them at the rates quoted.

16. Sr. Head, Purchase and Stores, SDSC SHAR SRIHARIKOTA reserves the right to accept or reject any bid in part or full without assigning any reason thereof.

17. Any bidder from a country which shares a land border with India will be eligible to bid in any procurement whether of goods, services (including consultancy services and non-consultancy services) or works (including turnkey projects) only if the bidder is registered with Competent Authority as specified in Office Memorandum no.F.No.6/18/2019-PPD, Ministry of Finance, Department of Expenditure, Public Procurement Division dated 23rd July 2020. All the conditions mentioned in the above OM is applicable for this tender.

C. Bid Templates

C.1 Technical Bid - Supply of Pneumatic Test Console (PTC) for TCX-2

1. Pneumatic test console: Design, fabrication, assembly, testing, supply of Pneumatic Test Console, as per Annexure-3,4 & 5 of the RFP document.

Item specifications for Pneumatic test console: Design, fabrication, assembly, testing, supply of Pneumatic Test Console, as per Annexure-3,4 & 5 of the RFP document.

Sl No	Specification	Value	Compliance	Offered Specification	Remark
1	Spec., as per Annexure-1 of RFP document	Yes/No	Yes / No / Explain		

Document : RFP

2. ERECTION AND COMMISSIONING: Erection , Commissioning and testing of Pneumatic Test Console along with service racks at SDSC SHAR, as per Annexure-1 of the RFP document.

Item specifications for ERECTION AND COMMISSIONING: Erection , Commissioning and testing of Pneumatic Test Console along with service racks at SDSC SHAR, as per Annexure-1 of the RFP document.

Sl No	Specification	Value	Compliance	Offered Specification	Remark
1	Specification as per Annexure-I of RFP document.	Yes/No	Yes / No / Explain		

3. SPARES: Supply of spares for Pneumatic Test Console, as per Annexure-6 of the RFP document.

Item specifications for SPARES: Supply of spares for Pneumatic Test Console, as per Annexure-6 of the RFP document.

Sl No	Specification	Value	Compliance	Offered Specification	Remark
1	Spares: Specification as per Annexure-6 of RFP document.	Yes/No	Yes / No / Explain		

Common Specifications (Applicable for all items)

Sl No	Specification	Value	Compliance	Offered Specification	Remark
1	Specification, as per RFP document	Specification for Pneumatic Test Console	Yes / No / Explain		

Supporting Documents required from Vendor

1. Ptice breakup for SPARES as per Annexure 6 of RFP document. (Price Bid Related)

2. Price break up document as mentioned in Sl. No. 20 of Annexure 9 of RFP document (Price Bid Related)

3. Technical Compliance as per Annexure-9 of RFP documemnt(Sl. No. 14 TO 19)

4. Technical Compliance as per Annexure-9 of RFP documemnt(Sl. No. 7 TO 13)

5. Technical Compliance as per Annexure-9 of RFP documemnt(Sl. No. 1 TO 6) to be uploaded

6. UDYAM Certificate if claiming MSE purchase preference

7. Annual turnover

8. Current Solvency Certificate for an amount of Rs. 50 Lakhs

9. Copy audited balance sheet

10. Firm establishment certificate and nature of work

11. MII certificate indicating precentage of local content along with location of value addtion.

12. Any other docuements as mentioned in the RFP

5 additional documents can be uploaded by the vendor

C.2 Commercial Terms / Bid

Sl. No.	Description	Compliance	Vendor Terms
1	Supply conditions, as per the RFP document.	Yes / No / Explain	
2	The procurement intended for the bonafide use in Systems/Sub-systems of Launch Vehicle Project of Indian Space Research Organization, Government of India, Department of Space and eligible for IGST@5% as per guiding principles conveyed by the Ministry of Finance Dept. of Revenue Notification No. 25/2018-Integrated Tax (Rate) Schedule-I; Sl. No. 243B dated 31.12.2018 (Amendment to Notification No. 07/2018-Integrated Tax (Rate) dated 25.01.2018 and Notification No. 01/2017- Integrated Tax (Rate) dated: 28.06.2017) End user certificate in this effect shall be issued in the event of PO.	Yes / No / Explain	
3	Please confirm here whether your quoted "UNIT PRICE" in our Price Bid is EXCLUDING GST or INCLUDING GST. ---------- NOTE: If you are not clearly stating "GST is Inclusive OR Extra in basic cost" it will be treated as "GST is included in the quoted Basic/Unit cost in the price bid". Your offer will be evaluated as INCLUSIVE OF GST.	Yes / No / Explain	
4	Delivery Term FOR : SDSC SRIHARIKOTA (MANDATORY)	Yes / No / Explain	
5	Packing and Forwarding(P & F) charges, extra if any, please mention percentage in price-bid. Please note that in case of Two part tenders, only percentage should be mentioned otherwise those offers shall be summarily rejected.	Yes / No / Explain	
6	Freight charges, extra if any, please mention percentage in price-bid Please note that in case of Two part tenders, only percentage should be mentioned otherwise those offers shall be summarily rejected.	Yes / No / Explain	
7	Delivery Period required for delivery of the items/completion of total scope of work: Within 36 weeks as detailed in the RFP (Table No. 4)	Yes / No / Explain	

8	Payment Term: Please refer no. 2 of Annexure 2 of RFP of this tender. Kindly clearly indicate payment of OPTION. Note: 1. Rate of interest at MCLR of RBI shall be calculated on portion of advance payment for arriving L1. 2. After release of advance payment, any delay attributable to the supplier in effecting the scope of PO after prescribed delivery period, interest will be levied beyond the specified delivery period on the amount of balance advance payments as per the Prime Lending Rate of RBI. 3.In case of non-performance/poor performance, advance payment shall be recovered from supplier with interest as per the Prime Lending Rate of RBI along with 2% penal interest from the date of release of advance payment and the BG against advance payment shall be forfeited.	Yes / No / Explain	
9	Warranty/Guarantee: Warranty/Guarantee for the offered item shall be from the date of acceptance of the item at our site for a minimum period of one year or specified in the tender document.	Yes / No / Explain	
10	Liquidated Damages (LD) :- Since delivery is the essence of this order, LD @ 0.5% per week or part thereof subject to a maximum of 10% of the order value for the delayed period of supply.	Yes / No / Explain	
11	Security Deposit (SD) 3% value of the order shall be deposited with SDSC within 10 days from the date of the Purchase Order towards security deposit in the form of Bank Guarantee(BG)/ FDR/DD towards performance of the Contract valid till completion of the contract period plus sixty days towards claim period. (This will be returned by SDSC immediately on execution of the order satisfactorily as per order terms. If not, the amount will be forfeited). NOT REQUIRED FOR LANDED COST BELOW RS.5 LAKHS.	Yes / No / Explain	

12	Performance Bank Guarantee (PBG) You have to submit a BG/DD/FDR in lieu of PBG from a Nationalized / Scheduled Bank for 3% of the order value at the time of supply valid till the completion of warranty period plus 60 days towards claim period.	Yes / No / Explain	
13	Combined BG for PBG cum SD In case, if parties are unable to provide two separate BGs, i.e., one for SD & one for PBG, they can submit a combined BG for SD & PBG for 3% of the Order value valid till the completion of total contractual obligation (i.e., Supply period plus warranty period plus 60 days). Please confirm.	Yes / No / Explain	
14	Insurance Being a Govt. Of India Dept., Insurance is not required at our cost. Please ensure the safe delivery of the ordered item with proper transport worthy packing.	Yes / No / Explain	
15	Validity of Offer In case of single part tender - the validity of offers/tenders should be 90 days. In case of two part tender - 120 days from the date of opening of Part-I bid and 60 days from the date of opening of Part-II bid. Tenders shorter than offer validity mentioned above will not be considered for evaluation.	Yes / No / Explain	
16	The bidder shall provide compliance to Order No. F.No.7/10/2021 PPD dated 23.02.2023 and amendments thereof by Ministry of Finance, Department of Expenditure, Public Procurement Division regarding restrictions on procurement from a bidder of a country which shares a land border with India and comply to all the provisions of the Order. In this regard, you shall certify that the bidder entity is not from such a country or, is from such a country, has been registered with the Competent Authority.	Yes / No / Explain	
17	As per the above Order, are you (the Bidder/Company/Entity) OR offering product/service is from such a Country sharing Land border with INDIA.	Yes / No / Explain	

18	Make-In-India (MII) Clause: Provisions contained in Public Procurement Policy (Preference to Make in India), Order 2017 issued by DPIIT vide OM No. P-45021/2/2017-PP(BE-II) dated 16.09.2020 & directives related including latest amendments (if any) is applicable for this tender. You are requested to provide Self Declaration Certificate that the offered Item meets Local Content Requirement of Class 1 or Class 2 as per Make in India(MII) Policy, clearly indicating the Percentage of local content & the details of Location(s) at which value addition is made in the offered product. It may be noted that Local Content shall not include services such as Transportation, Insurance, Installation, Commissioning, Training and after sales service support like AMC/CMC etc.	Yes / No / Explain	
19	Please mention in PERCENTAGE the Value addition of offered products happened in INDIA in line with Make In India Policy. (Mandatory). You have to upload MII Deceleration mentioning place and percentage of value addition along with Offer.	Yes / No / Explain	

20	Purchase preference to Micro and Small Enterprises (MSEs): Purchase preference will be given to MSEs as defined in Public Procurement Policy for Micro and Small Enterprises (MSEs) Order, 2012 dated 23.03.2012 issued by Ministry of Micro, Small and Medium Enterprises and its subsequent Orders/Notifications issued by concerned Ministry. If the bidder wants to avail the Purchase preference, the BIDDER MUST BE MANUFACTURER OF THE OFFERED PRODUCT in case of bid for supply of goods. TRADERS ARE EXCLUDED from the purview of Public Procurement Policy for Micro and Small Enterprises. In respect of bid for Services, the bidder must be the Service provider of the offered Service. Relevant documentary evidence along with UDYAM REGISTRATION in this regard shall be uploaded along with the bid in respect of the offered product or service. If L-1 is not an MSE and MSE Seller (s) has/have quoted price within L-1 plus 15% (Selected by Buyer) of margin of purchase preference/price band defined in relevant policy, such Seller shall be given opportunity to match L-1 price and contract will be awarded for 25% (selected by Buyer) percentage of total QUANTITY.	Yes / No / Explain	
21	Are you claiming MSME Preference for this tendered item/service? Note: You should have been the MANUFACTURER of the offered product or SERVICE Provider of the said service (in service tender) as per your MSME Registration. (If YES, valid Udyam Registration documents shall be uploaded. Otherwise your claim will not be considered. False declarations will be in breach of the Code of Integrity under Rule 175(1)(i)(h))	Yes / No / Explain	
22	Please Select for the offered Product whether you are: (1) Manufacturer (2) Authorized Agent (3) Distributor (4) Dealer (5) Reseller (6) Others	Yes / No / Explain	

23	ARBITRATION:- The Contract/PO shall be interpreted, construed and governed by the Laws in India. In the event of any dispute/s, difference/s or claim/s arising out of or relating to the interpretation and application of the Contract/PO, such dispute/s or difference/s or claim/s shall be settled amicably by mutual consultations of the good Office of the respective Parties and recognizing their mutual interests attempt to reach a solution satisfactory to both the parties. If such a resolution is not possible, within 30 days from the date of receipt of written notice of the existence of such dispute/s, then the unresolved dispute/s or difference/s or claim/s shall be referred to the Sole Arbitrator appointed by the Parties by mutual consent in accordance with the rules and procedures of Arbitration and Conciliation Act 1996 as amended from time to time. The arbitration shall be conducted in Bengaluru in the Arbitration and Conciliation Centre - Bengaluru (Domestic and International) as per its rules and regulations. The expenses for the Arbitration shall be shared equally or as may be determined by the Arbitrator. The considered and written decision of the Arbitrator shall be final and binding between the Parties. The applicable language for Arbitration shall be English only.	Yes / No / Explain	
24	Do you have Unique GeM Seller ID? If YES, provide details If NO, As per Office Memorandum No 6/9/2020-PPD dated 24/08/2020 of Department of Expenditure, it shall be mandatory for sellers providing Goods and Services to Central Government Organizations to be registered on GeM and obtain a Unique GeM Seller ID, at the time of Placement of Order/acceptance of contract. Tenderers shall ensure the same.	Yes / No / Explain	
25	Address on which PO is to be placed and GSTIN	-	
26	Please provide valid/currently using E-mail Id & Contact no. for seeking further clarifications if any	-	
27	Remarks if any.	-	

C.3 Price Bid

Sl. No.	Item	Quantity	Unit Price	Currency	Total Price	Remark
1	Pneumatic test console: Design, fabrication, assembly, testing, supply of Pneumatic Test Console, as per Annexure-3,4 & 5 of the RFP document.	1.00 Lot		-		
2	ERECTION AND COMMISSIONING: Erection , Commissioning and testing of Pneumatic Test Console along with service racks at SDSC SHAR, as per Annexure-1 of the RFP document.	1.00 Lot		-		
3	SPARES: Supply of spares for Pneumatic Test Console, as per Annexure-6 of the RFP document.	1.00 Lot		-		

REQUEST FOR PROPOSAL - PNEUMATIC TEST CONSOLE (PTC) FOR C32 STAGE PREPARATIONS AT TCX-2

Specifications for Design, fabrication, assembly, testing, supply, erection & commissioning of Pneumatic Test Console

May-2026

Vehicle Assembly & Launch Facilities
SATISH DHAWAN SPACE CENTRE SHAR
SRIHARIKOTA – 524124

INDEX

1. Scope of the work

Design, fabrication, assembly, testing, supply, erection and commissioning of Pneumatic Test Console at SDSC SHAR as per the following specifications:

The major part of the supply consists of:

1) High pressure panel fitted with flow components – 1 No.
2) Low pressure panel fitted with flow components – 1 No.
3) Distribution racks fitted with flow components – 2 No's
4) Interconnecting pipelines with racks and consoles
5) Interconnecting pipelines with racks and servicing article.

The supply of the above includes the procurement of all individual bought-out components mentioned in the list of component schedule.

The scope of supply is given below:

Sl. No	Description	Qty.
1.	Design, fabrication, assembly, testing and supply of Pneumatic Test Console, as per Annexure -3, 4 & 5	1 LOT
2.	Erection, commissioning and testing of Pneumatic Test Console along with service racks at SDSC SHAR	1 LOT
3.	Supply of Spares for Pneumatic Test Console, as per Annexure-6	1 LOT

2. Introduction

To carryout pneumatic leak check of C32 stage Pneumatic test console is planned. It is also used for the gas medium replacement in tanks, gas bottles and inner cavities of engine. The layout of Pneumatic test console in C32 stage preparation building is given in **Sketch-1**.

The total pneumatic system consists of gas cylinder (GHe & GN2 at 400 bar), gas supply lines, PTC and vent lines with vent header.

The pneumatic test console is planned to meet the following operations:

Supply of compressed gases (Helium and Nitrogen) at required pressures, flow rate and quality, to C32 stage pneumatic systems & its units, simultaneously by several lines:

1) Consists of safety features for preventing excess pressure to stage systems;
2) Measuring the gas pressure supplied to C32 stage systems by individual lines;

3) Filling of engine cavities of C32 stage and its units with gases of required composition and parameter at the required rate;
4) Taking the gas sampling from the stage for checking the quality of the gas to meet the specification (standards);
5) Venting of the compressed gases from the C32 stage and the pneumatic panel and to the vent lines of the building;
6) Replacement of gas medium in the cavities of C32 stage systems and units;
7) Individual gas supply pressure monitoring and venting of the compressed gas.

Note: The supply of high pressure gas(GN_2), Storage Cylinders is not under the scope of the tender

3. List of annexures of the Tender Document

a) General Terms and conditions of the tender is given **Annexure-1**
b) Bid submission and offer validity, payments terms and delivery schedule is given in **Annexure-2**.
c) Technical specifications of Pneumatic Test Console (PTC) are given in **Annexure-3.**
d) Technical specifications of flow components and piping elements, Conditions for Procurement of Flow Components and testing is given in **Annexure-4.**
e) The details of flow components are given in **Annexure-5**.
f) The details of Supply of spares are given in **Annexure-6**.
g) Tentative Quality Assurance Plan for flow components, piping/tubing elements, and fabrication, testing and assembly is given in **Annexure-7.**
h) Bid Evaluation Criteria to be submitted by the bidder along with technical bid as given in **Annexure-8.**
i) Party shall give technical compliance point-wise confirmation as given in **Annexure-9.** Change in specification/deviations (if any) shall be brought out in the offer with detailed justification.
j) Party shall submit the details of the flow components, preferred make, bore size, PN rating, end connections. Party has to submit the technical specifications of the flow component as per format given in **Annexure-10** along with Techno-commercial bid.
k) Overall layout of Technical complex-2, including drawings (Sketch 1 to 10) are given in **Annexure-11.**

Annexure- 1

General Terms & Conditions

1.1 Supply part

a) All the supplied items/flow components should be as per the approved drawing & specifications by the department.

b) The Preferred make of items/flow component should be as per Purchase order only.

c) All the structural members required for pipe/flow component support structures are under the scope of the supplier.

1.2 Design Considerations

a. Piping shall be designed as per ANSI 31.3 (Process Piping)/Equipment.

b. Max. Velocity considered for GHe – 80 m/s.

c. Pressure gauges shall be metric threaded end connection (M20 x 1.5).

d. Threaded end connections are envisaged up to 25NB/ 25 NPS and 400 Bar.

e. **NPT threads with PTFE sealing is not permitted for piping and flow components other than Pressure Transmitter and solenoid valve interfaces.**

f. All fluid circuits are to be designed for 1.25 times of maximum working pressure for maximum operating pressure up to 100.0 Bar. Above 100.0 Bar, all fluid circuits are to be designed for 1.1 times of maximum working pressure. However maximum working pressure for piping shall be considered as 10 Bar if working pressure is less than 10 Bar.

g. Hydro testing of piping with DM Water shall be 1.5 times the Maximum Operating Pressure (MOP) for pipe lines.

h. Within the equipment, piping circuits bore shall be maintained equivalent to that of flow components nominal bore as a good engineering practice to minimize pressure drops in the lines.

i. Thinning allowance due to bending shall be considered (Approx. 10% of wall thickness). Ovality shall be less than 8% of the inner diameter for pipe bending. Bend surface shall be smooth and free from wrinkles and waviness.

j. Ball run test shall be carried out for all weld joints and bend to ensure minimum flow passage (Ball Size= Pipe inner diameter-3.5mm).

k. The routing of piping/ tubing and mounting of flow components are such a way that all the threaded/ weld joints are approachable for leak checks and maintenance.

l. Party has to design the Intermediate spool between flow component and tube /pipe (one side of the intermediate spool shall have flow component interface and other side male metric threaded interface to suit pipe/tube butt welded nipple and nut)

m. All metric threaded connectors (Captive Nut, Butt welded nipple, Union, Butt welded union) required during fabrication of piping spools and assembly to the equipment shall be made as per the finalized drawings.

n. MOC of the components/parts which are not mentioned here shall be considered as SS316 and SS316L (in case of welding).

1.3 Fabrication, testing and conditioning

1.3.1. During Fabrication of the equipment

a. TIG welding shall be employed for welding of pipes and tubes. Orbital TIG Welding is preferred.

b. Argon (Purity 99.95%) shall be used as shield and purge gas.

c. 6G Qualified welders shall be employed for welding as per ASME Section IX (PQR, WPS & WQR shall be submitted as per ASME section IX prior to fabrication)

d. Prior to welding, all edges of weld type flow components and Pipes, & weld fittings shall undergo edge preparation and cleaning as required for butt welding (like root gap, root face & bevel angle)

e. No socket welding is permitted.

f. All pipes & fittings shall be cleaned with IPA and purged with GN2 prior to welding

g. All weld joints fit-ups & alignment shall be done by the qualified fitter

h. All weld joints shall undergo DP root and final (Dye penetrant) test.

i. All weld joints are of butt weld type with 100% radiography as per ASME Sec. V for sensitivity of 2-2T.

j. X-Ray or Gama Ray shall be employed.

k. If any weld joint is found with any defect, Repair work shall be taken up and Re -radiography shall be taken up by the party.

l. Radiography films (Slow motion film) shall be evaluated and report shall be submitted by Level II ISNT/ ASNT (or) equivalent qualified person. Finally, the same shall be certified by Purchaser representative as per relevant codes such ANSI B 31.3 and ASME-Sec. V.

m. The penetrometer used shall confirm to ASTM E 1025/ASTM E747 (or) relevant DIN standards.

n. SS Filler Wires shall be SS Filler wires (ER SS 308 L / 316 L), and Size shall be 1.6 mm / 2.0 mm / 2.5 mm

o. Electrodes for MS Structural (E7018/E6013): Size 2.5 mm / 3.15 mm shall be used.

p. Dye-Penetrant test (Kit Containing cleaner / Penetrant / Developer) shall be carried out accordingly.

q. Bend radius of the pipes shall be greater than 3D-4D.

r. All the conversion adapter drawings shall be submitted to department, for approval. After clearance, party has to fabricate the adapters.

s. The Metric threaded connector drawings will be provided by the department after PO placement.

t. No compression tube fittings shall be used in the process piping. Compression tube fittings are permitted only for the instrumentation purpose and EP valve command supply solenoid valves.

u. All pipe & flow components shall be supported properly.

v. Any leak during fabrication or testing remains in the responsibility of the supplier including replacement of flow components.

w. All the service racks are to be assembled to PTC and tested as per site configuration given in **Sketch -1**

I) Testing & conditioning of the equipment after fabrication

a. During hydro test of pipe lines, in place of flow components, dummy flow components/adaptors/spools shall be used to avoid damage of flow components during hydro testing.

b. DM Water with chloride content of less than 25 PPM shall be used as hydro testing medium for pipe lines.

c. After the clearance of radiography, all the weld joint shall be subjected to hydro test at 1.5 times MOP.

d. Two pressure gauges shall be used during hydro test with a pressure gauge range of 1.5 to 2 times of test pressure (one at the inlet of the pipe/equipment and other at the extreme or end of the pipe /equipment).

e. Hold the hydro test pressure for 30min, and there shall be no pressure drop for 30min

f. During hydro test, all weld joints and threaded joints shall be inspected for any leakage.

g. After the hydro test, all the pipe lines shall be purged with GN2 for conditioning

II) Cleaning of pipe lines after fabrication for oxygen gas usage

a. All SS pipes lines after welding & hydro test, pickling and passivation shall be taken up for external surfaces. IPA cleaning has to be carried out for internal surfaces.

b. Procedure for pickling and passivation will be provided by the department after placement of PO

c. After picking and passivation, all pipes lines shall be flushed with DM water to get the PH of 6.5 to 7.5.

d. All pipe lines shall be purged with dry nitrogen gas and measure the moisture concentration after purging shall be less than 10PPM.

e. After pickling passivation, clean all pipes spools for oxygen cleaning (particle and oil removal) as per ASTM G93/CGA 4.1.

f. Type of Cleaning agent and methods shall be finalized as per SS pipelines requirement for oxygen cleaning.

1.4 Assembly and Integrated Testing of Equipment:

a) All flow components shall be assembled firmly with proper sequence, torque and alignment to the respective end connections as per the drawings of cabinets identified for that equipment.

b) All the SS pipe supports shall be separated by shim plates and the same arrangement shall be clamped to supports with SS clamps.

c) Pneumatic Leak checking of the equipment to be carried out at maximum operating pressure using pressure drop/ snoop method and functional

testing of the integrated equipment shall be carried out using R Grade Gaseous Nitrogen (GN_2).

d) All flow components are to be firmly fixed on an open structure with proper clamping/ bolting arrangement. Access shall be provided for servicing of the components.

e) Pneumatic valves and their associated solenoid valves and instruments wiring shall be carried out and terminated properly at specified locations with MIL grade connectors along with the mating connector.

f) Scope of integrated Testing:
   - Pneumatic leak checks at maximum operating pressure with GN_2/GHe using snoop solution.
   - Seat leak checks of flow components.
   - Valves functional checks (Manual & EP valves)
   - Connector level interface checks of instruments.
   - Functional testing of instrumentation elements like solenoid, EP valves, Electronic regulator, pressure transmitters etc.

1.4.1 Cabinets for Pneumatic Servicing Rig:

a. The cabinet doors shall be made of Stainless Steel (SS Sheet Thickness = 2 mm). The Cabinets shall have hinged doors on front, back and Sides. However, for front and back side door locking provision shall be envisaged with a key and for side doors locking provision with tower bolts.

b. At all four corners of the top of the cabinet/ Panels eye bolts shall be provided for handling purpose at suitable locations.

c. All inlet, outlet, vent connectors, electrical connectors and earth elements shall be terminated at the back side of the cabinet.

d. Equipment shall be supplied with mating connectors on all side (inlet, vent and outlet for interfacing with the ground system (nut & nipples). Dummy nipples shall be provided till supply.

e. Pneumatic servicing rigs shall have wheels with locking provision.

f. Fabrication of cabinets shall be taken up after final clearance of 3D drawings of pneumatic equipment.

g. The cost of fabrication of cabinets and structural works of all equipment is in the scope of supply (**inclusive of equipment cost**).

h. All MS structural elements like supports, cabin structures and other members shall be sand blasted and painted with ALLUMINUM EPOXY MASTIC primer for 100micron DFT as final coat

i. **Tentative Cabinet Size:** HPP: 2500mm (L) x 1000mm (W) X 2050mm (H) – approx., LPP: 1505mm (L) x 1000mm (W) X 2050mm (H) - approx. Cabinet Drawing is enclosed in **Sketch 3 & 4. Exact cabinet size shall be finalized during realization of the equipment.**

1.5 Inspection and Quality Assurance:

a) The PTC and its accessories will be inspected by the representatives of the purchaser at the works of the contractor during the course of fabrication and testing.

b) The contractor shall submit the Quality Assurance Plan (QAP) and to establish a document, to maintain the quality system. Contractor has to ensure that the raw materials, fabricated items, process of fabrication, bought out items etc., confirms to the specification. Tentative QAP is given in **Annexure-7**

c) The contractor has to maintain clear, complete, documented instruction for the manufacturing, testing and installation of all sub systems of the PTC.

d) Any person appointed by the purchaser shall have access and right to inspect the work or any part thereof, at all times during the progress of the work. The purpose of inspection and supervision by the purchaser is to ensure that the job is properly executed as per the specifications. Any work which is proved faulty during the process of fabrication shall be corrected by the contractor without delay. Contractor is always having the responsibility of ensuring, the process of work in line with the specifications.

e) The purchaser, at all reasonable times, shall have free access to all the work areas where materials are being prepared or fabricated and the contractor shall extend all facilities to the representatives of the purchaser for the inspection.

f) The purchaser is not under any obligation to discover defects in the work performed and its shall be the sole responsibility of the contractor to ensure

such completed work is defect-free and meets the technical specifications. Inspection and clearance for dispatch by the purchaser's inspectors shall not relieve the contractor of any of his obligations and duties.

g) All the necessary testing of flow components will be witnessed by flow components manufacturer QC and reports will be reviewed by rig /equipment manufacturer QC and department engineer for final dispatch clearance.

h) The supplier has to inform the purchaser, the readiness of the materials for inspection well in advance for participation (minimum two weeks). The items shall be dispatched only after completion of inspection by the purchaser's inspection engineers.

i) All the materials shall be tested at government approved (NABL)laboratories for Indian vendors.

1.6 Bid Pre-Qualification criteria (Refer Sl. No. 1.2 of Annexure-2):

Bidders who are qualifying/ meeting following technical and financial criteria are eligible to participate in the bid for supply of Pneumatic Test Console. The Bid Pre-qualification criteria contains:

A) Technical qualification requirements

B) Financial qualification requirements

C) Documents for the Techno-Commercial bid

Bidders shall furnish all the information mentioned in the criteria with documentary proof and submit along with the quotation. The details are given in **Sl. no. 1.2 of Annexure-2**.

1.7 General Conditions:

a. Party shall mention the Preferred make of each item/flow component, model numbers, DN & PN rating in the Techno commercial bid. Selected flow components shall be reputed preferred make and highly reliable for high pressure applications. The offered Preferred make of the flow components will be evaluated before the price bid opening.

b. After placement of order, change in the Preferred make of the items is not acceptable.
c. Current rating and voltage requirements of status indicator for the Electro-pneumatic valves shall be submitted.
d. The cable of Pressure transmitters/ EP valves/ Solenoid valves/ Pressure relays/ Electronic Regulator shall be with SS316 Double compression weather proof cable gland of IP 67 or better.
e. The flow components shall be inscribed/tagged with Model No, size, working pressure and material of construction of body, manufacturers number etc.
f. All equipment name plates tagging and P & I drawings, shall be in the scope of supplier.
g. Party has to generate fabrication drawings of equipment and obtain approval from the department prior to the procurement / fabrication.
h. Equipment general arrangement drawings shall be provided with overall dimensions (size), weight, handling provisions etc.
i. Purchaser reserves the right to cancel the PO at any time with the application of penalty (as per procurement rules) & forfeiture of Security deposit, in case of failure of bidder, to fulfil P.O technical specifications.
j. Quality Assurance Plan (QAP) shall be prepared by supplier and submitted to department for approval after order placement.
k. **The delivery period for the supply of the pneumatic test console shall be within 36 weeks from the date of release of the purchase order**.
l. **P & I drawing of Pneumatic Test Console is given in Sketch-2**. Any configuration change in the pneumatic system shall be mutually agreed and finalized.
m. Both mechanical and electrical mating connectors shall be sent along with items.
n. Documentation: At the time of dispatch, 3 sets of documents comprising the following shall be submitted.
    - ✓ P & I and electrical wiring diagrams.
    - ✓ Generations of Isometric drawings.
    - ✓ Approved specifications of the flow components, piping elements & interments

- ✓ Flow components and piping elements test reports
- ✓ As built drawings.
- ✓ Material history (consists of all flow components, pipes, pipe fittings, machined fittings, Pressure gauge, pressure transmitters etc.)
- ✓ Weld joint history reports (format shall include dates of fit-up, welding and radiography)
- ✓ Radiography reports
- ✓ Hydro test report.
- ✓ Pneumatic leak check report.
- ✓ Functional testing of integrated equipment (sample formats will be provided by the department)
- ✓ All flow components drawing.
- ✓ Factory test certificates for all flow components.

o. Any damage of flow components, equipment and connectors during the course of fabrication, testing, assembly and till supply, the damaged item/equipment is to be replaced with new one and its replacement shall be in the supplier's scope. (No additional cost will be paid for replacement of the item/equipment).

p. Equipment shall be properly packed to avoid any transportation damage including rain protection and to be delivered to SDSC SHAR, Sriharikota.

q. All pressure gauges and pressure transmitters shall be removed during transportation. SS dummy plug shall be used in place of pressure gauges.

r. Unloading of the items at SDSC SHAR is in the scope of department at free of cost.

s. Total price of equipment or spares shall be inclusive of all costs (Eg. Custom duty, GST, fabrication, Testing, TPI (if any), Packing & Forwarding and any other charges as applicable)

t. All the material tests shall be carried out at government approved laboratories for Indian vendors.

u. The Supplier should comply all labour laws, Minimum wages act, payment of Employees provident fund and ESI/ Insurance under workman compensation act and other laws applicable from time to time.

v. The Supplier shall take all safety precautions and ensure the safety of his Workmen. SDSC SHAR is not responsible for any injury/ loss of life due to accident/ explosion during the execution of the contract.

Wherever codes / standards are not mentioned, the following codes may be considered while designing PTC.

Table 1: Standards while designing PTC

Sl. No.	Item	Standard
1.	Ball valve-design	BS 5351/ Equivalent
2.	Ball valve-test	BS 6755/ Equivalent
3.	Globe valve	BS 6364/ ANSI B 16.34/ Equivalent
4.	Seamless pipe	ASTM A 312TP
5.	Seamless pipe dimensional	ANSI B-36.19/ ANSI B36.10
6.	Seamless tube	ASTM A 269
7.	Butt weld fittings	ANSI B16.9
8.	Edge preparation	ANSI B 16.25
9.	SRV Design	API-520
10.	SRV Testing	API-527
11.	Bolts	ASTM A 193Gr B8
12.	Nuts	ASTM A 194Gr B8
13.	IGC	ASTM A 262 PRACTICE-E
14.	UT	ASTM-E213
15.	Eddy current	ASTM E-426
16.	Hydro test	ASTM A-530
17.	Pickling and passivation	ASTM A 380
18.	Process piping	ANSI B 31.3

1.8 Inspection:

Inspection of Equipment shall be carried out by the Supplier QC, along with department engineer prior to dispatch from supplier's site as per approved QAP. The supplier shall ensure that QAP is strictly followed in all stages of manufacturing, Testing & Inspection. The supplier has to inform the purchaser,

the readiness of the materials for inspection well in advance for participation. The items shall be dispatched only after completion of inspection by the department engineer.

1.9 Warranty:

The Equipment with accessories supplied shall be warranted for trouble free service of 12-month period from the date of receipt and acceptance. In case any defects are noticed during the above period due to faulty design, poor workmanship, use of substandard materials, defects in flow components etc., the same shall be rectified / replaced by party with free of cost within a reasonable period.

He shall make his own arrangements to provide materials labour, equipment's and any other appliances required in this regard. Equipment's, items or components repaired or replaced by the contractor shall be guaranteed for a period of 12 months from the date of repairs or replacements.

1.10 Preferred make in India (MII) Clause

For this procurement, bids from Class-I & Class-II Local Suppliers are admissible. Hence provisions contained in Public Procurement (Preference to Preferred make in India), Order 2017 issued by Department for Promotion of Industry and Internal Trade (DIPP), Ministry of Commerce & Industries vide letter No. P-45021/2/2017-PP(BE-II) dated 04.06.2020 and subsequent amendment & directives shall be followed. Accordingly, offer will be evaluated & processed in conformation with above referred GOI order (Specially mentioned below). The bidder shall provide compliance and undertaking as per order and hereafter amendments:

a) Order no: F.No.6/18/2019 PPD dated 23.07.2020 of Department of Expenditure), Ministry of Finance Under Public procurement division for the General Financial rule (GFRs).

b) Class-I local supplier means a supplier or service provider, whose goods, service or works offered for procurement, has local content equal to or more than 50%, as defined under order.

c) Class-II local supplier means a supplier or service provider, whose goods, services or works offered for procurement, has local content more than 20% but less than 50%, as defined under this Order.

d) Verification of local content:

i. The Class I local supplier/ Class- II local supplier at the time to tender, bidding or solicitation shall be required to indicate percentage of local content and provide self-certification that the item offered meets the local content requirement for Class-I local supplier / Class II local supplier as the case may be. They shall also give details of the location(s) at which the local value addition is made.

ii. False declarations will be in breach of the code of Integrity under Rule 175(1)(i)(h) of the General Financial Rules (GFR) for which a bidder or its successors can be debarred for up to two years as per Rule 151(iii) of the general Financial Rules along with such other actions as may be permissible under Law.

iii. A supplier who has been debarred by any procuring entry for violation of this order shall not be eligible for preference under this order for procurement by any other procuring entity for the duration of the debarment.

e) The percentage of local content should be specifically mentioned in the offer; without which it will be summarily rejected.

f) Preference will be given to Class-I Local supplier as per standard policy.

1.11 Liquidated Damages:

In all cases, delivery schedule indicated in the Purchase Order/Contract is the essence of the contract and if the party fails to deliver the material within the delivery schedule, Liquidated Damages will be levied for the undelivered portion of the purchase order @ 0.5% per week or part thereof subject to a maximum of 10% of total order value.

1.12 Performance Bank Guarantee:

The contractor has to submit a PBG from a Nationalized / Scheduled Bank for 3% of the order value at the time of supply valid till the completion of warranty period plus 60 days towards claim period.

1.13 Security Deposit:

3% value of the order shall be deposited with SDSC within 10 days from the date of the Purchase Order towards security deposit in the form of Bank Guarantee towards performance of the Contract valid till completion of the contract period plus sixty days towards claim period.

1.14 GST

As per the Notification No. 6/2018 & 7/2018-Central Tax (Rate) dt:25.01.2018 A(ix) S.No.243A as amended by Notification No.24/2018-Central Tax (Rate) Dt: 31.12.2018 b(viii) S.No.243B issued by Ministry of Finance (Dept. of Revenue) & Government of Andhra Pradesh, Revenue (Commercial Taxes-II) Department, G.O.MS.No. 93 Dated: 19-02-2018 A(ix) S.No.243A and as per the Notification No. 7/2018-Integrated Tax (Rate) dt:25.01.2018 A(ix) S.No.243A as amended by Notification No.25/2018-Integrated Tax (Rate) Dt: 31.12.2018 b(viii) S.No.243B issued by Ministry of Finance (Dept. of Revenue), SDSC SHAR is eligible to avail GST/IGST @5% for the procurements related to Scientific and technical instruments, apparatus, equipment, accessories, parts, components, spares, tools, mock ups and modules, raw material and consumables required for launch vehicles and satellites and payload. we will issue only End User Certificate for availing GST/IGST @5%.

1.15 Risk & Cost Purchase

Timely delivery of goods/services is of prime importance and where the vendor fails to fulfil their contractual obligations, the Procuring Entity shall be entitled, and it shall be lawful on his part, to procure Stores and/or services similar to those ordered/cancelled, with such terms and conditions and in such manner as it deems fit at the Risk and Cost of the Contractor and the Contractor shall be liable to the Procuring Entity for the extra expenditure, if any, incurred or

accrued by the Procuring Entity for arranging such procurement. However, the Contractor shall not be entitled to benefits if any, from such procurements.

Prior to resorting to risk purchase the Purchaser shall consider impact of the default by the contractor & proper notice to the contractor to invoke risk purchase clause and method of recovering the additional amount spent by the Purchaser. The cost as per risk purchase exercise may be recovered from the Earnest Money Deposit/ Security Deposit/ Performance Security of the supplier and/or bills submitted by the supplier against the same contract or any other contract. GST will be charged / levied on Risk Purchase as per the provision of GST Act Rule thereon.

Risk purchase action may be initiated under any of the following conditions.

a. When the supplier fails to deliver the materials even after extending the delivery period.
b. When the supplier fails to respond to purchases request for supply of the materials and fails to provide any genuine and bonafide reason for the delay in supply.
c. When the supplier breaches any of the terms and conditions of the supply order/ contract and as a result fails to execute the order satisfactorily.

Annexure- 2

Bid submission and offer validity, Payments terms, Bidder qualification & evaluation criteria and delivery schedule

1. Bid/Offer Submission details:

Supplier shall present the bids on two-part basis as highlighted below:

- ✓ **Part-I: Techno-Commercial bid**
- ✓ **Part-II: Price bid indicating the price**

1.1 PART-I: TECHNO-COMMERCIAL BID:

The tenderer shall necessarily present the following in the techno-commercial bid:

a) The tenderer shall furnish point-wise confirmation **(Technical Compliance attached in Annexures – 9 & 10)** for the technical specifications given in the enquiry. However, change of specifications/ deviations (if any) shall be brought out in the offer with detailed justification. Suppliers are expected to furnish quotations with best match to design standards, materials of construction and other technical conditions.

b) Tenderer need to furnish the details related to commercial terms indicating payment terms, details of bank guarantee in case of advance payments etc.

c) Mode of dispatch of the pneumatic equipment shall be by Road.

d) Bidder need to submit Un-priced price bid copy (as highlighted below) along with the Techno-commercial bid indicating the description of all the cost elements considered, without indicating the price. *Tenderer shall note that indication of price in the techno-commercial bid will lead to dis-qualification of bid.*

e) The price bids will be opened only after evaluation and acceptance of the techno commercial bid of the respective tenderer.

f) Compliance and Preferred make of Spares list along with the flow components model numbers shall be submitted by the supplier along with techno commercial bid.

1.2 Bid Pre-Qualification criteria:

Bidders who are qualifying/ meeting following technical and financial criteria are eligible to participate in the bid for supply of Pneumatic Test Console.

Bidders shall furnish all the information mentioned in the criteria with documentary proof and submit along with the quotation.

A. Technical Qualification requirements:

The bidder shall meet the following technical qualifying requirements and shall submit relevant certificates to establish its credentials.

a) The bidder shall be an organization with minimum 3 years of experience ending with 31.03.2026 and executed the contracts on the supply of Pneumatic systems.

b) The bidder is in the field of realization of high pressure Pneumatic systems of more than or equal to 250 bar and executed atleast one work order of 250 bar range.

B. Financial Qualification requirements:

a. The bidder should have an average annual turnover of not less than the value of 2.5 crores per year in the last three financial years ending with 31.03.2025

b. In the last five years, the firm should have undertaken and successfully executed single work on Pneumatic systems of not less than 120 lakhs in single order or 90 lakhs each of two orders or 70 lakhs each of three orders.

c. Balance sheet shall be submitted for the last three financial years (2022-23, 2023-24, 2024-25), including Profit & Loss statement.

d. Current **Solvency Certificate** (Rs. 50,00,000/- of order value of Current FY).

C. The following documents shall be submitted along with the Techno commercial bid for pre-qualification of bidder

a. Firm establishment certificate and nature of work.

b. Details of work of similar type completed, minimum three years ending with 31.03.2026.

c. Documentary evidence (Technical details and drawings) for fulfilling special technical conditions as per RFP document.

d. Structure and Organization chart.

Format of Un-Priced Price Bid: (To be enclosed with Techno-commercial bid)

Table 2: Confirmation for item wise cost break up by the supplier.

Sl No	Description	Qty	Unit Price	Total Price	Taxes if any	Total Cost including Tax	Separate Cost mentioned in price bid (YES/NO)
1	Design, fabrication, assembly, testing, supply of Pneumatic Test Console, as per Annexure -3, 4 & 5	1 LOT	Unpriced	Unpriced	Unpriced	Unpriced	
2	Erection, commissioning and testing of Pneumatic Test Console along with service racks at SDSC SHAR	1 LOT	Unpriced	Unpriced	Unpriced	Unpriced	
3	Supply of Spares for Pneumatic Test Console, as per Annexure-6	1 LOT	Unpriced	Unpriced	Unpriced	Unpriced	

1.3 PART-II: PRICE BID INDICATING THE PRICE:

Price bid should be submitted by the tendered in the following format with price break up.

Table 3: Price bid indicating the price

S. No	Description	Qty	Unit Price	Total Price	Taxes if any	Total Cost incl. Tax
1.	Design, fabrication, assembly, testing, supply of Pneumatic Test Console as per annexure - 3, 4 & 5 *	1 LOT				
2.	Erection, commissioning and testing of Pneumatic Test Console along with service racks at site	1 LOT				
3.	Supply of Spares as per Annexure-6*	1 LOT				

*** Table 3A: Price bid format for Flow components (including spares it has to be quoted in the format separately).**

S. No	Description of the flow component/ spare flow component	Make	Qty	Unit Price	Total Price	Taxes if any	Total Cost including Tax

Note:

a) Total price of equipment or spares shall be inclusive of all costs (Eg. Custom duty, GST, fabrication, Testing, Forwarding and any other charges as applicable)

b) **The scope of the work can't be separated. Hence, overall L1 (Sl. No. 1, 2 & 3) will be considered for bid evaluation.**

c) **Party, who is taking the full scope of work only, is allowed to participate.**

1. Offer Validity:

The validity of the offers / tenders should be 120 days from the date of

opening of the tenders. **Tenders with offer validity less than the period mentioned above, will not be considered for evaluation**.

2. Payment Terms:

A) Our general payment terms are 100% payment within 30 days after receipt and acceptance of items at purchaser's (SDSC-SHAR, Sriharikota) site.

B) However, if the Suppliers are requesting for advance payment, department may consider as given below:

1. *After placement of confirmed purchase order:*
   30% of supply cost as advance against submission of bank guarantee for an equal amount from a Nationalized/ Scheduled bank and the same shall be valid till contract completion plus 60 days. Format for bank guarantee shall be obtained from Department after the award of contract.

   In case of advance payments, if the vendor/supplier is not supplying the material within the delivery schedule, the advance amount will be recovered and interest will be levied as per the Marginal Cost of Lending Rate (MCLR) of SBI plus 2% penal interest.

   Further wherever advance payments are requested, Interest will be loaded for advance payments/stage payments as per the MCLR of SBI and will be added to the landed cost for comparison purpose, while arriving at L1.
2. *After the receipt of items and acceptance at SDSC SHAR, Sriharikota*
   60% of supply cost of the purchase order against the receipt of materials at Purchasers/ Department site along with GST (including fro advance portion)
3. *After commissioning at SDSC SHAR, Sriharikota*
   Balance 10% of supply cost and 100% of commissioning charges after installation and acceptance by Department and submission of performance bank guarantee of equal amount valid till warranty period plus 60 days.

4. *For spares 100% payment within 30 days after receipt and acceptance of items at purchaser's site (SDSC SHAR).*

4. Delivery schedule/Sequence of steps to be followed after awarding the contract along with time line.

The following steps to be followed after awarding the contract.

Table 4: Delivery schedule after awarding the contract with time line

Sl. No.	Approval Time	Description
1.	T0	Date of Release of purchase order
2.	T1 = T0+2 Weeks	Finalization of flow components
3.	T2 = T1+1Week	i. Submission of details of flow components with model numbers for all items. ii. Generation of finalized specification of flow components and QAPs
4.	T3 = T2+ 1Week	i. Verification of model numbers and department approval for procurement of flow components. ii. QAP approval by department
5.	T4= T3+2 Weeks	Generation of fabrication drawings
6.	T5= T4+ 1 Week	Review and Approval of fabrication drawings/procedures by department. The comments if any, offered by Department have to be incorporated.
7.	T6= T5+24 Weeks	✓Procurement& integration of all flow components, instruments, piping elements, and structural items etc. ✓Fabrication & Testing of the equipment at supplier site. ✓Supply of items to SDSC SHAR, as per PO
8.	T7= T6+1 week	✓Clearance for site fabrication by department (Department clearance will be provided, after the receipt of items)
9.	T8= T7+4 weeks	✓Erection, commissioning & testing at SDSC SHAR
Note: All the Events (T0 – T8) of Purchase Order shall be completed within 36 weeks from the date of release of purchase order.		

5. Bid Evaluation Criteria:

a. In respect of Two-Bid system, the technical Bids submitted by the Bidders will be evaluated by the Department with reference to the technical specifications as mentioned in the tender document. The Price Bids of technically qualified bids only considered for evaluation.

b. During evaluation, SDSC SHAR may request Bidder for any additional clarification/document on the bid, if required.

c. **The scope of the work can't be separated. Hence, overall L1 (Sl. 1, 2 & 3) will be considered for bid evaluation.**

d. The time schedule for completion is given in the tender document. Bidder is required to confirm the completion period unconditionally.

e. Department deserves the right to inspect the supplier site and verify the credentials, quoted by the party, during technical evaluation.

f. SDSC SHAR reserves the right to reject any bid if not meeting the technical/commercial requirements and terms & conditions. Such decisions by the SDSC SHAR shall bear no liability whatsoever consequent upon such decision.

Annexure- 3

Technical Specifications of Pneumatic Test Console

1. Overall specification of PTC:

The general specification of Pneumatic panel are as follows:

a) Working medium : GHe & GN2
b) Gas pressure at input, (bar), max : 400
c) Gas pressure at output, (bar) : 0.3 – 335
d) Maximum flow : 25 – 100 gms/sec.
e) Pressure check : Visual
f) Control mode : manual & Semi-automatic
g) Evacuation of supply lines with vacuum pump
h) Operating conditions : -10 to +50°C

2. Configuration of Pneumatic Test Console:

Pneumatic test console comprises of the following equipment:

a. High Pressure Panel : 1 No.
b. Low Pressure Panel : 1 No.
c. Servicing rack 1 for UCU's : 1 No.
d. Servicing rack 2 for Engine : 1 No.
e. Servicing rack 3 for Stage : 1 No.
f. Servicing rack 4 for Fuel tank pr. Monitoring : 1 No.
g. Cabinets for Pneumatic Servicing rig (HPP & LPP Panel): 2 No's
h. Set of connecting pipelines between panels and racks

HP panel and LP panel are positioned inside the PTC room and servicing racks (4 No's) are positioned inside the high bay for servicing the C32 stage. The service racks are connected with HP and LP panels by means of ½ inch tubes and fittings. Based on the above requirements a P&I for PTC is finalized and shown in **Sketch-2**. All the components shall be assembled as per the P& I diagram.

3a. High Pressure Panel (HPP):

High Pressure panel is used for receiving, adjusting and checking of the pressure, for supplying of compressed gas to C32 stage systems and units as well as for venting of gas from the article. The configuration of HP panel is shown in **Sketch-3**.

Compressed gases are supplied manually with the help of shutoff valves from gas cylinders through rigid high pressure lines (400 bar) to HP panel and the pressure is checked visually with the help of pressure gauges. The output operating pressure ranges from 5 – 335 bar and at a gas flow rate of 25 to 100 gm/s.

HP panel consists of high-pressure plumbing, needle valves, EP valve, check valves, Regulators (including Electronic regulator), Safety valves, Pressure switches, Pressure Transmitters and Pressure gauges.

3b. Low Pressure Panel (LPP):

Low Pressure panel is used for receiving, adjusting and checking of the pressure, for supplying of compressed gas to C32 stage systems and units as well as for venting of gas from the article. The configuration of LP panel is shown in **Sketch-4**.

Compressed gases are supplied manually with the help of shutoff valves from High pressure panel at 50 bar and the pressure is checked visually with the help of pressure gauges. The output operating pressure, ranges from 0-6 bar and at a gas flow rate in the range of 2 to 30 gm/s. LP panel also provides the line for evacuating the stage inner cavities and medium replacement.

Under excess pressure in the particular line (group of lines) HPP and LPP provide an automatic disposal of surplus compressed gases to a venting line through safety valves.

3c. Servicing rack-1 for UCU's

The servicing rack-1 (**Sketch-5, 1&2**) is intended for interfacing the UCU's with PTC for servicing the stage at required pressures and flow rates and also for taking gas samples from the stage. The pipelines from HPP and LPP are connected through dismountable joints. The pipe lines, valves filters are rigidly secured to the rack with help of clamps. Working platform is provided at two levels (i.e. at 263 and 2163 mm above the floor) and to approach the above platform a ladder is provided. The servicing rack is constructed out of rectangle box section, the working platforms covered with a rubber mat. Rack is provided with wheels and jacks for mobility and stability respectively. Working area of rack is 900 x 800 mm. The total working load capacity of the rack is 200 kg, max. Rack frame with plate

is used for securing of 27 pipelines (out of which 7 pipelines are connected to sampling ports) with a diameter of ½ inch connected to which on outside are the pipelines running from HPP and LPP.

All pipe unions at the rack input and output after being checked for cleanness, degreased and after lubrication of threaded connections should be capped and locked. Seven valves for taking gas samples are fastened to the frame plate with the help of clips and connected to pipelines. Filters are installed in each pipelines. All the pipeline outlet area is of size M18x1.5 (Male) mm and plugged with metallic caps.

3d. Servicing rack-2 for Propulsion unit:

The servicing rack (**Sketch-6, 1&2**) is intended for interfacing the PU with PTC for servicing the engine at required pressures and flow rates and also for taking gas samples from engine. The pipelines from HPP and LPP are connected through servicing rack-1 with the help of dismountable joints. The pipelines, valves are rigidly secured to rack with the help of clamps. Working platform is provided one level (i.e. at 1660 mm above the floor) and to approach the above platform a ladder is provided. The servicing rack is constructed out of rectangle box section and the working platforms covered with a rubber mat.

The rack has wheels for easy moving relative to article. The rack is a welded structure made of rectangular section. The rack accommodates pipelines (7 No's), Valves (3 No's) for sampling and filters. All the pipeline outlets are of size M18 x 1.5 mm (Male) and plugged with metallic caps.

3e. Servicing rack-3

The servicing rack (**Sketch-7, 1&2**) is intended for interfacing the HPFS with PTC for servicing LOX tank at required pressures and flow rates and also for taking gas samples from LOX tank. The pipelines from HPP and LPP are connected through servicing rack-1 with the help of dismountable joints. The pipelines, valves, filters are rigidly secured to rack with the help of clamps. Working platform is provided one level (ie at 850 mm above the floor). The servicing rack is constructed out of rectangle box section and the working platforms covered with a rubber mat.

The rack has wheels for easy moving relative to article and also provided with rests (screw jack). The rack accommodates pipelines (4 No's), Valves (1 No.) for sampling and filters. All the pipeline outlets are size of M18 x 1.5 mm (male) and plugged with metallic caps.

3f. Service rack-4:

This service rack is a single column support for servicing the LH2 tank either for monitoring the pressure or for taking gas sample. It supports two pipelines, valve and filter.

3g. Cabinets for Pneumatic Servicing Rig (High Pressure Panel & Low Pressure Panel)

- The cabinet doors shall be made of Stainless Steel (SS Sheet Thickness = 2 mm). The Cabinets shall have hinged doors on front, back and sides. However, for front and back side door locking provision shall be envisaged with a key and for side doors locking provision with tower bolts.
- At all four corners of the top of the cabinet/ Panels eye bolts shall be provided for handling purpose at suitable locations.
- All inlet, outlet, vent connectors, electrical connectors and earth elements shall be terminated at the back side of the cabinet.
- Equipment shall be supplied with mating connectors on all side (inlet, vent and outlet for interfacing with the ground system (nut & nipples). Dummy nipples shall be provided till supply.
- Pneumatic servicing rigs shall have wheels with locking provision.
- Fabrication of cabinets shall be taken up after final clearance of 3D drawings of pneumatic equipment.
- The cost of fabrication of cabinets and structural works of all equipment is in the scope of supply (**inclusive of equipment cost**).
- All MS structural elements like supports, cabin structures and other members shall be sand blasted and painted with ALLUMINUM EPOXY MASTIC primer for 100 micron DFT as final coat
- **Tentative Cabinet Size:** HPP: 2500mm (L) x 1000mm (W) X 2050mm (H) - approx., LPP: 1505mm (L) x 1000mm (W) X 2050mm (H) - approx. Cabinet

Drawing is enclosed in **Sketch 3 & 4. Exact cabinet size shall be finalized during realization of the equipment.**

4. PTC Configuration:

Party has to design the PTC for C32 stage and to submit the total design report to the Department for further review and approval. Only after obtaining the clearance from the Department, the procurement action of the components shall be taken up. The design report shall contain the details of each component selected and its technical brochure should be enclosed. While designing the PTC, the following shall be taken into consideration:

a. Input gas pressure of PTC is 400 bar(g).
b. Operating output pressures of PTC are 0 – 335 bar(g).
c. GHe and GN2 are the working medium.
d. Maximum flow conditions to meet the different requirements.
e. Inbuilt safety features like Pressure Switches, SRV's, relays, etc.
f. Interlocking with stage pressures (Pressure relays)
g. All manual control and semi-automatic in operation.

The maximum flow condition come in two cases:

a. During pressurization of tanks at 6 bar(g): 25 gm/sec of GHe.
b. During UCU purge sensor checks at 6 bar(g): 40 gm/sec of GN2.

a) Regulators:

Based on the maximum flow rate conditions, suitable regulators are to be selected. SS tubes of 1" & ¾" sizes shall be selected on delivery side to reduce the pressure losses, according to the requirement, according to the requirement. All the selected pressure regulators shall be of Panel mounted and non-venting type. The pressure rating of the regulators shall be either minimum or exceeding ASTM/ ANSI B31.3 Standard. The details of the regulators are as per Annexure-5 table.

b) Piping/ Tubing:

The pressure rating of pipes/ tubes shall be selected such that the allowable working pressure of the pipe is greater than the operating pressures. The material selected for the above pipe is SS316L. The input & output lines size selected as ½" size except tank pressurization lines which are of 1" size. All the 1/4" size lines are rated to a minimum pressure of 400 bar irrespective of individual working

pressures as given in the flow component schedule. ¼" size tube shall be for pressure gauge/ pressure switch fittings. The wall thickness calculation for each size of the tube shall be as per ASME/ ANSI B31.1 and they are to be furnished in the report.

The design of high pressure tubing shall be as per ASTM-A269-079. Tubing shall confirm to ASTM A269. The tube length given in the component schedule is only an approximate estimation. Actual requirement can be estimated and shall be considered in the offer. Tube thickness has to be selected appropriately and thickness sheets are to be submitted.

c) Valves:

For controlling the flow, the needle valves of Butech/ Swagelok/ Parker/ Equivalent make shall be selected with appropriate pressure rating and size as per the operating pressure line requirement. The operating torque of each valve under pressure shall be minimal. One number of the check valve is introduced on GHe line to avoid contamination between GN2 and GHe gases. Also, one number of shut-off valve has to be introduced for controlling the excess pressure in tanks through pressure switch relays. All the selected valves shall be of panel mounted. The pressure rating of the valves shall be either minimum or exceeding ASTM/ ANSI B31.3 standard or API 598/ ASME/ ANSI B16.34.

d) Safety relief valves:

Spring loaded safety relief valves of different set pressures with single pressure rating need to be selected. Safety relief set pressure shall be set as110-115% of line operating pressure. The relief rate of each valve should have the capability of pressure regulator failure so that excess pressure will not go to the system to be serviced and over pressure should not exceed 10% of the set pressure. The design of Safety relief valves shall be either minimum or exceeding of ASTM/ ANSI B31.3 standards.

e) Filters:

T-type filters, 5-micron SS wire mesh type are to be provided at the inlet of PTC (Refer Annexure 4 & 5) and 35 numbers of SS mesh type filters are provided at the outlet of PTC (Refer Annexure 4 & 5) to control the gas contamination. Filtration area shall be 5 – 10 times cross sectional area of the tube. Norman filters are provided at the inlet of PTC. All the line mounted filters shall be fixed at the

outlet racks. The end connections of each filter should be as per service requirement. The ends of the filters shall be closed with metallic closures. The maximum operating pressure of the filters shall be 400 bar.

f) Pressure gauges:

Pressure gauges of different rating of 25 – 50% of line operating pressures are selected with the accuracy of 0.25%. All the selected gauges shall be of panel mounted.

g) Line Fittings:

For inter connection of pipes weldable 3-piece construction of metric/ BSP fittings are to be used. The fittings may be of Parker/ Butech/ Equivalent Custom Preferred make with higher rating than the operating pressures. The Custom Preferred make fitting shall be as per GOST/ JIS/ AFNOR standards. NPT is not allowed.

h) End Connection:

All the outlets of PTC with or without PTC shall be M18 x 1.5 mm size. Input lines of PTC shall be provided with M16 x 1.5 mm size. All the outlets/ inlets are plugged with pipe nipple and nut to avoid contamination, and for checking every individual lines for leakage. At the input ends one set of mating adapters shall be supplied. End connection of each outlet shall be done through an intermediate adapter (for fixing it to racks). One side of the adapter shall be fixed with tube and the other side with metallic closure.

i) Vent lines:

Two different vent lines with common headers are to be provided. One line for safety vale outlet and the other one for venting of the individual lines/ stage lines. These vent lines are to be connected with facility gas vent line using vent hoses.

j) PTC vent hoses:

For venting/ releasing of gases from PTC during the course of preparation/ operation, three numbers of 1” size, 3 m SS wire braided flexible hoses with an end fitting of M30 x 1.5 mm shall be provided. The pressure rating of the vent hoses shall be of minimum of 16 bar. One set of mating adaptors for ground vent line shall be supplied.

k) System vent hoses:

For venting or releasing of the gases from the system during the course of operations, 3 numbers of ½" size, 3 m long SS wire braided flexible hoses with an end fitting of M18 x 1.5 mm shall be supplied. The pressure rating of vent hoses shall be of minimum of 16 bar. One set of mating adaptors for ground cent line shall be supplied.

l) Vent Header:

For venting/ releasing of gases from the system during the course of operation, a 2.5 m long 80 NB size SS 316L pipe along with suitable adaptors/ flanges shall be supplied. This venting header further in turn will be connected to the facility vent line which is not in the scope of supply (Refer **Sketch-8** for the details).

m) Marking sealing, tagging of PTC:

Each component of the system shall be tagged with identified label. Each connection of the assembled components shall be wire locked and sealed. Marking of the legends of operating components shall be either stamped/etched/engraved on the operating console. P& I of each panel shall be engraved on a separate plate and it can be fixed on the consoles.

n) Bought out components:

For designing/ procurement of PTC components, only the Preferred makes listed in the component schedule shall be considered. In case of not able to select a particular component from the given list of Preferred makes and it shall be brought out in the tendering stage itself. The contractor shall Preferred make specific prior approval of the Purchaser for any other Preferred make of bought-out components other than indicated in the component schedule. The Purchaser reserves the right either to accept or reject such items.

Supplier shall submit for all the bought out components, test certificates like materials, leak test report, hydro test & cleanliness before installing them into the Pneumatic Test Console.

o) Electrical system:

The electrical system is meant for operating the EP shut-off valve in conjunction with pressure switches (set pressure) for supply/ stop of gas to the system in service (Safety interlock diagram of PTC is shown in **Sketch -2 & 9**). It shall also power. It should consist of the following:

i. It should work on OR'ed DC 20-40V supplied by SMPS programmable DC power supply (2 No's), as per **Annexure-4**.
ii. Necessary fuse rating shall be used.
iii. 4 Pressure Switches (1,2,3,4) and its feedback should be sensed.
iv. Two manual control switches
SW1 – for Powering ON the PTC
SW2 – For turning SV1 ON & energize/ de-energize the safety alarm
v. Two types of relays (Preferred make: OEN/ Equivalent)
Single Control relay (4 Pole with 7A rating/suitable for the safety alarm)
2 way controlled relay (4 pole SPDT type with 7A rating/suitable for the safety alarm/SV1)
vi. Electro Pneumatic Valves with status (5 No's)
vii. Solenoid Valves (6 No's)
viii. Pressure Transmitter (7 No's)
ix. Electronic Pressure Regulator (ER) (1 No's)
x. DC operated safety alarm (1 No's)
xi. All the interface and power lines to the above electrical components in the PTC shall be terminated in MIL standard D38999 circular connectors (Preferred make: Amphenol/ Souriau/ Equivalent) of Electroless Nickel Plated Aluminum finished as per the following details

Power supply: D38999/20FJ29SN-1 No's
EPV Command, ER supply & its output: D38999/20FJ61SN-1 No's
EPV Status: D38999/20FJ61SN-1 No's
Solenoid Valves Command Supply: D38999/20FJ29SN-1 No's
These connectors shall be rigidly fixed to the PTC panel. The counterpart connectors for interfacing to the above connectors shall also be provided by the supplier.

Control element is EPV operated by both manual switch SW2 through 2-way relay and bared pressure switch contact closing it should de-energize the power supply to EPV and apply voltage to alarm. If pressure relay is opened and it should automatically bring back the initial condition. Supplier shall provide necessary

interface circuit diagram along with technical quotation for verification and acceptance.

p) Portable pressure monitoring unit:

- This pressure monitoring unit is meant for checking the preservation pressures of the system as a mobile portable unit. This unit consists of two pressure gauges, two needle valves and end fittings. The schematic of the above unit is shown in **Sketch-10**. All MS structural elements like supports, cabin structures and other members shall be sand blasted and painted with ALLUMINUM EPOXY MASTIC primer for 100micron DFT as final coat.

Note: Please refer Annexure-5 for details on flow components

Annexure- 4

Technical Specifications of Flow Components and PTC elements

1. Specification for Pressure Regulator

Preferred make: IMI/TESCOM/HALE HAMILTON/ Equivalent

Table 5: Specification for Pressure Regulator

S.No.	Description	Specification
Technical Specifications		
1.	**Quantity & Details**	**As per annexure-5&6**
2.	**Types / Constructional Details**	
3.	Loading	Spring loaded
4.	Seating	Soft seated /Metal to metal
5.	Sensing	Piston
6.	Poppet shape	Conical
7.	Balancing	Balanced design is preferred.
8.	Poppet Shut off	By Spring
9.	End connections	Metric /BSPP threaded with face seals
10.	Medium	Gaseous Nitrogen and Gaseous Helium
11.	**Material of Construction of Regulator Elements and Seals**	
12.	Body	ASTM A 182/479/276 /SS316 /Equivalent
13.	Wetted parts	SS316
14.	Seals	VITON/PTFE/PEEK/Equivalent
15.	Cleaning	For Oxygen gas service
16.	Flow rate	**As per annexure-5**
17.	C_V of the Regulator	Calculation to be provided by supplier for sizing of the regulator and operating Cv shall be 60% of maximum Cv (drop shall be <5% at rated flow rate of set pressure)
18.	Failure flow rate	Calculation to be provided by supplier when the regulator is full open and at maximum inlet pressure
19.	Inlet & Outlet pressure range	**As per annexure-5**

2. Specification for Safety Relief Valves

PREFERRED MAKE: TYCO SANMAR/ SWAGELOK/ Equivalent

Table 6: Specification for Safety Relief Valves

S.No.	Description	Specifications
Technical Specifications		
1.	**Quantity & details**	**As per annexure-5**
2.	**Types / Constructional Details**	
3.	Service	Gas application
4.	End Connections	**As per annexure-5**
5.	Constructional features	Conventional SRV
		Spring loaded
		Metal to metal seating/Soft seat
		With test gag
		Blow down adjustment ring
		Full nozzle/Semi nozzle based on design
6.	Dimensions	Manufacturer's standard
7.	**Operating conditions**	
8.	Working temperature	-10 to +50°C
9.	Working fluid	GN_2 & GHe
10.	Set pressure (P_S)	1.1 times of MOP bar(g)
11.	Back pressure during relieving(SBP+BBP)	<10% of Set Pressure
12.	Over pressure during relieving	10% of Set Pressure
13.	SRV Sizing criteria	Regulator Failure condition & Non-fire condition
14.	Flow condition during relieving	Based on inlet and outlet pressure ratio
15.	Relieving flow rate	Pressure regulator failure flow rate with 10% over pressure over set pressure
16.	**Design and testing standards to be followed**	
17.	Sizing of orifice	As per API RP 520 Part-1/equivalent. Calculations shall be submitted prior to selection
18.	Selection of orifice	As per API RP 526 5th Edition/equivalent
19.	Testing	As per API RP 527 Part-1/equivalent
20.	**Material of Construction of valve elements:**	
21.	Body& end connection Material	ASTM A 182 /479/276 SS316/ASTM A 351/Equivalent Sand casting of body is not acceptable

S.No.	Description	Specifications
22.	Wetted parts	SS316/Equivalent
23.	Soft Seals/seats	Viton/PTFE/PEEK/PVDF/KEL-F/Equivalent

3. Specification for Electro-Pneumatic Ball Valves

PREFERRED MAKE: ORSEAL/SANKEY/ Equivalent

Table 7: Specification for Electro-Pneumatic Ball Valves

1.	Supply of EP Ball valve as per Annexure-5	
S. No	**Description**	**Specification**
1.	**Type**	Two way Reduced Bore EP Ball valves with Pneumatic Actuator and Switchbox
2.	**Actuator**	Elomatic/ Equivalent
3.	**Switch Box**	Topworx/ Equivalent
I. Valve Construction		
1.	Type	Ball type
2.	Port	2way valves – Inlet & outlet ports
3.	Maximum Working Pressure	400 Bar
4.	Mode of operation	By direct mounted pneumatic actuator
5.	Fluid medium	GN2/GHe
6.	End Connections	SS316L, BSPP/ Metric threaded end connection
7.	Operating temperature	-10 to +50°C
II. Valve Design & Testing		
1.	Design code	BS 5351/ API 6D /ANSI B16.34/ Equivalent
2.	Testing code	BS 6755 Part –I/ BS-EN-ISO-12266 Part 1/API-598/ Equivalent
3.	Leakage Class	As per ANSI B 16.104 Class VI – 100% Bubble Tight shut off
III. Valve Special Features		
1.	Blowout proof stem	To be provided
2.	Antistatic Device	To be provided
IV. Material of Construction of valve		
1.	Body and Ball Material	A479/SS 316L. Body shall be made of Forged/Rolled Bar Stock. Ball shall be of solid ball.
2.	Seat Material	PVDF/PEEK/PTFE/ DEVLON Equivalent

S. No	Description	Specification
3.	Face seals of end adaptor	PTFE/ DEVLON/ Equivalent
4.	Stem	A479/SS316L
5.	Stem seal	PTFE/ VITON/ Equivalent
6.	Body seal	VITON/ PTFE/ Equivalent
7.	Bolting / Nuts /Fasteners	A 193 Gr. B 8M/8 & A 194 Gr. 8M/8
V. Actuator specifications		
1.	Type	Spring return, single acting piston & Direct Mounted.
2.	Size	0040
3.	Rotation Angle/Direction	90º /CW (Spring to close/Clock Wise)
4.	Inlet pressure	5 to 7 bar (g) of GN_2 or GHe
5.	Pinion Material	High Grade Aluminium, Hard anodized
6.	Valve interface	Standard ISO 5211 Interface
7.	Temperature Range	-10ºC to +50ºC
8.	Visual Indication Code	Standard (Knob)
9.	Seals	Nitrile/Viton/Equivalent.
10.	Air Supply Connections	1/4" NPT (F).
11.	Interface with Solenoid	Namur type provision.
12.	Vent port	Shall be provided with muffler.
13.	Response time	Opening: 0.5 to 1.0 sec Closing: 1.0 to 2.0 sec
VI. Switchbox specifications		
A. Enclosure Specifications		
1.	Material of Construction	Tropicalized aluminium.
2.	Area Classification	Flame proof
3.	Cable Entry	¾" NPT (female) 2 nos. (1 No to be plugged)
4.	Visual Display	Standard 90⁰ Green OPEN, Red CLOSED
5.	Shaft	NAMUR 316 stainless steel
6.	O-Rings	Buna-N/Equivalent

S. No	Description	Specification
7.	Mounting Accessories	All fittings, connectors, screws, etc. Shall be of SS316 & the scope includes the supply of coupling and mounting bracket links.
8.	All the four no. of Micro-Switches with terminal blocks, spring loaded rotary cams for position setting along with connecting shaft etc., shall be housed inside the enclosure.	
B. Sensor/Limit switch Specifications		
9.	Type	Mechanical SPDT Switches
10.	Preferred make	Honeywell or equivalent
11.	No. of switches for each valve	4 nos. (2 Nos. for ON and 2 nos. for OFF Status)
12.	Contacting Rating	5 Amps at 24 VDC
13.	Operating Temperature	-10 Deg. C to +50 Deg. C
14.	Cams for switches	Individual cam with adjustment Provision for each Micro-Switch to be provided.
15.	The three wires/leads from each of the Micro-Switches shall be sealed at switch side and other end terminated on terminal blocks. It means all the 12 leads from all the micro switches shall be terminated on terminal blocks.	
16.	The specified Micro-Switch assemblies housed in Flame proof enclosure will be mounted on Actuator for monitoring the ON/OFF status of Electro Pneumatic Valves.	
1.	The cross-sectional drawings with material of construction of all part shall be sent to purchaser for approval before commencing production. The supplier shall guarantee that the valves supplied shall be exactly as per the approved drawings in all respects.	
2.	Material test certificates of all wetted parts of the valves and all other test certificates like body hydro test, leak test, functional test etc. shall be furnished to the purchaser before dispatch of valves.	

4. Technical specifications of Electronic Regulator

PREFERRED MAKE: TESCOM/ Equivalent

Technical details for sizing and selection, Quantity & Details: As per annexure-5

Table 8: Specifications of Electronic Regulator

S.No	Specification	Direct electronic pressure regulator
1.	Regulator Unit shall consist of	▪ Electronic regulator with area ratio loader regulator
2.	Inlet pressure *	100 to 400 bar

3.	Required Outlet pressure range *	1t o 350 bar
4.	Flow rate*	Minimum 150 Nm^3/hr of Helium/ Nitrogen at 50bar Outlet and 100bar inlet pressure
5.	Droop	<0.2% at rated flow
6.	Medium	Helium /Nitrogen
7.	Type	Direct electronic regulator with area ratio loader
8.	Self-venting provision in the EPR	Self-venting regulator with BSPP end connection interface
9.	EPR control pressure	7.0 to 8.0bar
10	Feed back to the controller	Facility pressure transmitter(4-20mA)
11	Type of sensing in the dome	Piston /Diaphragm
12	Ratio loader area ratio	Area ratio is based on the design
13	End connections	Metric or BSPP with face seal. **NPT is not allowed**
14	Selection and sizing	Cv of the direct electronic regulator shall be to meet the flow 150 Nm^3/hr of Helium/ Nitrogen at 50bar and 100bar inlet pressure **(No dome and pilot combination are allowed)**
Functional capabilities of Electronic Pressure Regulator		
15	Method of pressure control	Area ratio or dome pressure shall be managed by Pulse width modifier (PWM) solenoid valves. One for charging the dome and another for venting the dome /area ratio loader.
16	Control Type	Microprocessor-based closed-loop PID control
17	Dome Pressure Control	Pneumatic output to dome inlet of mechanical regulator
18	Accuracy	±0.1% of full-scale or better
19	Repeatability	±0.05% of full-scale or better
20	Loop Update Rate	≤50ms or better
21	Control Stability	Tunable via PID parameters
22	Control Profiles	Programmable multi-step pressure/time profiles
23	Leakage Class	100% Bubble Tight shut off.
24	End connection	BSPP or metric threaded along with required adaptors (male to male adaptors with seals in case of female threads)

Material of construction for regulator		
25	Body & Internals (Regulator)	SS316L/ Equivalent or higher grade as per manufacturer's standard.
26	Seat	Metal to Metal seat/soft seated
27	End fittings	SS316L/ Equivalent higher grade as per manufacturer's standard
28	Body manufacturing method	Machined from forged/rolled bar stock or Investment casting with radiography quality. Sand casting is not acceptable.
29	Seals	Viton
EPR Inputs and Outputs		
30	Set point Input	Analog (4–20 mA / 1–5 V), Digital (RS-485 Modbus RTU) and USB
31	Feedback Input	External pressure sensor (4–20 mA / 1–5 V)
32	Communication Ports	USB and RS-485
33	Analog Output	4–20 mA for monitored pressure optional
34	Response time	Rise time- 300 ms (max) Fall time-600 ms (Max)
35	Accuracy	Accuracy of 0.1% at room temperature
36	Control Type	Microprocessor-based closed-loop PID control
Electrical and Pneumatic Requirements of EPR		
37	Power Supply	22–28.5 VDC; ≤340 mA peak
38	Ingress Protection	IP 65 or better
39	Environment conditions	Humidity: 100% RH Temperature: 20 to 50 degree Celsius
40	Pneumatic Supply	Clean, dry air or nitrogen at 6.5–8.5 bar
41	External Analog Input impedance	250 ohms or better
42	Electrical Interface	Terminal block / plug-in connectors; with cable glands
43	Pneumatic Port Connections	NPT (or equivalent) for input, exhaust, and dome output

5. Specification for Manual Needle & Globe Valves:

PREFERRED MAKE: Butech/ Swagelok/ Parker/ Equivalent

Table 9: Specification for Manual Needle Valves

Sr.No	Description	Specification
1.0 Technical Specifications		
1.	**Quantity & details**	**As per Annexure - 5**
2.	**Configuration and constructional features**	
3.	Type	**Needle & Globe**
4.	Stem type	V stem point/Blunt
5.	Type of seating	Metal to metal /soft seated
6.	Flow pattern	Straight /angled
7.	Size of orifice (bore)	**As per Annexure - 5**
8.	End connection	BSPP male /Metric threads
9.	Type of mounting	Panel mount
10.	Valve operation by	Handle
11.	Operating temperature	-10 to 50Deg.C
12.	Steam sealing	By Gland packing or O-ring
13.	Body type	Single piece body
14.	Gland packing & loading	Based on the manufacturer design
15.	Cleaning	For Oxygen gas usage
16.	**Material of construction Valve & seals**	
17.	Body Material	**ASTM A 182 /479/276 SS316**
18.	Stem and wetted parts	
19.	Seat Material	Metal to metal /PCTFE/as per the design
20.	Gland packing	PTFE/based on the design/VITON
21.	Handle	SS316
22.	Cleaning	Total assembly shall be cleaned for oxygen gas usage

6. Specification for Straight In-Line Filters:

PREFERRED MAKE: NORMAN/ Puronics/ Equivalent

Table 10: Specification for Straight In-Line Filters

S.No.	Description	Specification
1.0 Technical Specification		
1.	**Quantity & details**	**As annexure-5**
2.	Type	Straight In-line
3.	Fluid Medium	GN_2 and GHe
4.	Temperature	-10 to 50°C
5.	Operating Pressure (max.)	400 bar
6.	End Fitting	With suitable conversion adapters (short size), it should be brought to M18 x 1.5 (male)
7.	Housing material	SS316 (No welding is allowed on the filter body)
8.	Element material	SS304L
9.	Micron rating	10 micron (absolute)
10.	O-ring material	Viton
11.	Filter element type	Re-cleanable Pleated microweave 304L stainless steel mesh
12.	Cleaning	For Oxygen gas usage

6A. Specification for T-Type Filters:

PREFERRED MAKE: NORMAN/ Equivalent

Table 11: Specification for T-Type Filters

S.No.	Description	Specification
1.0 Technical Specification		
1.	**Quantity & details**	**As annexure-5**
2.	**Type, operating conditions and constructional features**	
3.	Type	T-type filter – Inline filters
4.	Fluid Medium	GN_2 and GHe
5.	Temperature	-10 to 50°C
6.	Operating Pressure (max.)	400 bar
7.	End Fitting	With suitable conversion adapters (short size), it should be brought to M18 x 1.5 (male)
8.	Body material	SS316, ASTM A 182/479/276/SS304/SS316 (No welding is allowed on the filter body)
9.	Element material	SS304L

S.No.	Description	Specification
10.	Micron rating	5 micron (absolute)
11.	O-ring material	Viton
12.	Filter element type	SS pleated mesh
13.	Cleaning	For Oxygen gas usage

7. Specification for Solenoid Valves:

Preferred make: ASCO/ IMI/ Equivalent

Table 12: Specification for Solenoid Valves

Sl. No	Description		Specification
1.	Item	:	**3/2 way, universal, Dual redundant (solenoid coil and valve) low power direct operated Ex-proof solenoid**
2.	Operation	:	Low power direct operated poppet type, Normally closed
3.	Service	:	Nitrogen/Air
4.	Orifice size	:	5.7 mm
5.	Operating pressure	:	0 – 10 bar & 400 bar, as per Annexure-5
6.	Process end connections	:	¼” NPT (F) for all three ports.
7.	Exhaust port/ports	:	Suitable silencer/mufflers shall be supplied
8.	Mounting	:	Suitable for Panel mounting, all accessories should be SS material. Party has to supply all accessories.
9.	Body Material	:	SS 316
10.	Temperature	:	-25 To 60°C
11.	Elastomer/seals	:	Viton
12.	Type of construction	:	Safe venting high availability design.
Solenoid			
13.	Number of coils & valves	:	Two
14.	Power rating	:	3.6 watts or better

15.	Rated operating voltage	:	24 V DC nominal (Tolerance: +10% & -15%)
16.	Ambient temperature	:	0 - 60°C
17.	Insulation Class	:	H on wire
18.	Termination	:	Through terminal block.
19.	Protection	:	Voltage suppressor across coil.
20.	Cable entry	:	½" NPT (F)
21.	Quantity	:	As per Annexure-5

8. Specification for Pressure Transmitter:

Preferred make: Rosemount / Honeywell / Equivalent

Table 13: Specification for Pressure Transmitter

S. No	Specification	Description
1	Transmitter Type	SMART,HART Protocol latest revision, Absolute transmitter, In-line
2	Sensor type	Piezo resistive sensor technology or equivalent
3	Operating Range	As per Annexure-5, Provision to re-range up to minimum span of 5 bar (A) without effecting accuracy
4	Accuracy	$\pm$ 0.075% of calibrated Span or better
5	Stability	$\pm$ 0.125% of URL for 5 years without calibration or $\pm$ 0.25% of URL for 10 years without calibration
6	Response time	$\leq$ 200ms
7	Transient protections	Built in surge protection required
8	Output Failure modes	Configurable through HART
9	Damping time	Configurable through HART
10	Voltage	24 VDC Nominal, Excitation through Intrinsically safe barrier

S. No	Specification	Description
11	Electrical interfaces	Two Wire, 4 – 20 mA with super imposed digital communication HART
13	Transmitter turn ON time	Less than 10 Sec
15	Electromagnetic compatibility	Should meet EN 61326 or equivalent
16	Process connection	½”-14 NPT Female
17	Process fluid	Gas: Nitrogen, Helium, Air
18	Enclosure Protection	IP65 or better
19	Over pressure	150% of the rated pressure
21	Operating temperature	Ambient: 0 To 60^0 C
22	Local indicator	Built in LCD Indicator to display the parameters
23	Calibration Range	As per Annexure -5
24	Material of Construction	• Isolate diaphragm: SS 316L • Electronic Housing: Al Alloy or better • Fill Fluid: Silicon Oil
25	RFI effects	To be complied
26	Terminals	Cage clamps or better
27	Cable gland entry	½ inch NPT
28	Mounting and accessories	Suitable mounting accessories for 2 inch pipe mountable or panel mountable shall be supplied

9. Specification for Electronic Pressure Switches:

Preferred make: Wika / Switzer / Equivalent

Table 14: Specification for Electronic Pressure Switches

S. No	Specification	Description
1	Preferred make	Wika (PSD-30) / Switzer / Equivalent
2	Range	0 – 10 bar
3	Power Supply	15 ..30 V DC

4	Output	4-20 mA (Analog output), DC 0-10V or suitable analog output
5	Accuracy & Switch point accuracy	± 1% of span
6	Set point Adjustment	via key pad
7	Display	4 Digit, LED, Rotatable by 180 deg.
8	Electrical Connector	Circular M12 x 1 (4 pin) straight version along with interface cable.
9	Interface cable	Straight version 4-pin, 2m PUR Cable has to be provided, along with electrical connector.
10	End Connection	½" BSP (Male) (Conversion adapter ½"BSP Male to M12 x 1 (Male) has to be provided)
11	Wetted parts	SS316L

10. Specification for Pressure Gauges:

PREFERRED MAKE: WIKA/ Equivalent

Table 15: Specification for Pressure Gauges

Sl. No.	Description	Specification
1.	Preferred make	WIKA
2.	Type	Bourdon tube type - without liquid filling
3.	Measuring system & Material	a) Bourdon tube: Stainless steel for high pressures & Copper for low pressures (<100 bar) b) Casing: Bayonet bezel of Stainless steel with window of instrument glass
4.	Accuracy & Resolution	Ref. Table 26 of **Annexure -5**
5.	End Connection	M20 x 1.5 mm (Male)
6.	Location of connection	Bottom – Radial bottom entry (Lower Mount- LM)
7.	Dial Size (nom.)	160 mm
8.	Pointer	Knife-edge pointer, Black Aluminium (For all, except Sl. No. 23 & 24 as per annexure-5) & Adjustable pointer for Sl. No.23 & 24 (Range -1 to 9 bar) Ref. Table 26 of **Annexure-5**.
9.	Protection	IP54 or better
10.	**General Conditions:** a) NABL traceable calibration shall be provided. b) Dial shall be white (aluminium) in color with black lettering (bar). **All the pressure gauges shall have a overprotection range of 130% of FSD (As per WIKA data sheet).**	

11. Specification for Tubing:

Table 16: Specification for Tubing

S. No	Description	Specification
1.0 Technical Specification		
1.	Length & size of tube	Tubing-1, 2, 3, 4, 5 & system tubes as per annexure-5
2.	Type of tubes	Seamless as per std. ASTM A269-07a
3.	Edge preparation for pipe	As per ANSI B 16.25
4.	Dimensional tolerance	As per ANSI B36.19
5.	Straightness	Shall be ± 3 mm per 3.0m
6.	Operating Pressure (max.)	400 bar
7.	Material of construction	SS316L
	Tests to be carried out on pipes (Raw material to Dispatch)	
8.	Visual inspection of pipes	All tubes shall be visually examined for absence of scratches, dents, surface irregularities
9.	Hydro testing of tubes	As per **ASTM A530**
10.	Eddy current test	As per practice **ASTM A 450** for all tubes
11.	Ball run test	To be carried out, before assembly to PTC
12.	Pickling and passivation	As per **AMS 2700** both inside & outside
General conditions		
13.	**Inspection:** As per approved QAP.	
14.	Production of master file: Three copies of production master file shall be supplied and shall contain the following. ▪ Dimensional and visual check reports ▪ Raw material test certificates ▪ Mechanical, Chemical, Heat treatment certificate and IGC test reports of final product. ▪ Hydro test reports. ▪ Pickling and passivation All the above reports / test results shall be bound neatly	

12. Specification for Hoses:

Table 17: Specification for Hoses

S. No	Description	Specification
1.0 Technical Specification		
1	Length, size & Quantity of Hoses	PTC Vent hoses, System vent hoses, System Pressurization hoses & Vent Header as per annexure-5
2	Type of Hose	SS Corrugated
		100 bar: Double braided
		25 bar: Single braided
		16 bar: Single braided
3	End Connection	As per Annexure-5
4	Operating Pressure (max.)	100 bar/ 25 bar/ 16 bar
5	Material of construction	SS316L
6	Braiding material	SS316L
7	**Tests to be carried out on Hoses**	
9	Visual inspection of pipes	All hoses shall be visually examined for absence of scratches, dents, surface irregularities
10	Hydro testing of tubes	As per **ASTM A530**
11	Pneumatic strength test	To be carried out for the 1.1 times of maximum operational pressure
12	Ball run test	To be carried out, before assembly to PTC
13	Mechanical Particle test	All the pipe lines are to be cleaned with TCE & IPA and to ensure no dust particles, before assembly to PTC
General conditions		
14	**Inspection:** As per approved QAP.	
15	Production of master file: Three copies of production master file shall be supplied and shall contain the following. ▪ Dimensional and visual check reports ▪ Raw material test certificates ▪ Physical, Chemical and IGC test reports of final product. ▪ Hydro test reports. ▪ Pickling and passivation ▪ Ultrasonic test reports &Eddy current test reports.	

S. No	Description	Specification
	All the above reports / test results shall be bound neatly	

13. Check Valve:

Preferred make: Swagelok/ Parker/ Equivalent

Table 18: Specifications for Check valves

S.No.	Description		Specification
1.0 Technical Specification			
1.	**Quantity & details**		**As annexure-5**
2.	**Type, operating conditions and constructional features**		
3.	Pressure rating		400 bar
4.	Fluid Medium		GN_2 and GHe
5.	Temperature		-10 to +50°C
6.	Cracking Pressure (Nominal)		0.69 bar
7.	Cracking Pressure range		0.49 to 1.1 bar
8.	Re-seal Pressure		0.21 bar or more inlet pressure
9.	Materials of construction	Body	ASTM A182/ ASTM A479/276/ F316
		Poppet	Fluoro carbon FKM- Bonded SS 316/ A479/ VITON/ PTFE/ Equivalent
		Spring	SS302/ Equivalent
		O-ring	Fluoro carbon FKM/ VITON
		Back-up ring	PTFE/ Equivalent
10.	End Fitting		Metric/ BSPP

14. Specification for Machined Components

14.1 Type, Material of Construction, Machining & testing

a) Machining of the items shall be done with strict tolerance, surface finish and work man ship shall be followed.

b) Required adapters drawings like nipples, captive nuts, unions etc. shall be done as per requirement **(Drawing shall be sent to department for approval, prior to fabrication)**

c) Machining shall be made from brand new forged bar stock.

d) Material for machined items shall be SS316L (if welding is involved) shall be as per ASTM A 182/479/276 for all adaptors/unions

e) Mechanical, Chemical, IGC, ASTM 262 practice E reports have to be provided, for each dia/bar of the rod (Should be from NABL accredited lab)

14.2 Finished product testing

a) Chemical analysis one per each heat or lot
b) IGC test as applicable practice A or B.
c) Supplier shall provide required inspection tools during inspection like GO & NO GO gauges, thread gauges, micro meters, dial gauges etc., for carry out inspection.
d) Surface finish requirement as specified in the drawings shall be strictly adhered.
e) All the threads and machined surfaces shall be properly protected with PVC plugs/caps to avoid transit damage.
f) Items shall be thoroughly de-burred and degreased prior to the packing.
g) No burs, dents, scratches are permitted on the machined surfaces.

14.3 Quantity & other details: As per the approved fabrication drawings

15. Specification for Standard Fittings

Preferred Make: SAWAN/ Equivalent

Table 19: Specification for Standard Fittings

S.No.	Description	Technical specification
Technical Specification: Elbows, Tees, Reducers		
1.	Type of fittings	Butt weld
2.	Manufactured	As per ASTM A403 WP316L
3.	Dimensions	As Per ASME B16.9 & 16.28
4.	Edge preparation	AMSE B 16.25
5.	Material of constructions	SS 316L
6.	**Tests to be carried out on pipes butt weld Fittings & Flanges**	
7.	Visual & dimensional inspection	All fittings shall be checked for dimensions and end preparation
8.	Solution annealing	All fittings shall be subjected to Solution annealing as per standard
9.	IGC test	As per **ASTM A262 Practice-E** shall be carried out one per each heat /lot of each size
10.	Mechanical & Chemical analysis	Chemical & mechanical analysis Shall be carried out one per each heat /lot of each size/type of fitting as per standards

S.No.	Description	Technical specification
11.	PMI	**PMI** of finished product (**one sample per heat or lot number of each size**) shall be carried out as per standard procedure and the samples for testing will be selected by Purchaser during inspection.
12.	Pickling and passivation	All fittings shall be pickled and passivated (Both inside & Outside surfaces)
13.	**General conditions**	
14.	All the tests shall be carried out by NABL approved laboratory	
15.	All fittings shall be chemically etched or Laser printed with details like size, class rating, type, material, heat/Lot number and trade symbol.	
16.	All fittings are to be of seamless quality. Butt-Weld Tees shall be of swaged (or) forming only.	
17.	**Nowhere welded construction is acceptable.**	
18.	**Certification:** Test certificate for solution annealing, chemical analysis, mechanical & IGC tests shall be supplied along with dispatch documents.	
19.	**Three copies** of production master file shall be supplied and shall contain the following. a. Dimensional & Visual check reports. b. Solution annealing c. All Material Analysis reports & heat treatment charts d. IGC & Micro analysis Reports. e. Final inspection Report / Release note.	
20.	**Final specification of pipe fittings for approval**	
21.	**Inspection shall be as per approved QAP**	

16. SMPS Power Supply specifications:

Table 19A: Power supply specifications

Proffered make: Lambda/ Equivalent

SL.NO	PARAMETER	SPECIFICATION
1	Type	SMPS
2	Input	180 to 265 VAC, 47 to 53 Hz.
3	Output	0-60,0-14A,840W Min. Output voltage: better than 0.5% of FSO

		Min. Output Current : better than 0.5% of FSO
4	Efficiency	Better than 80%
5	Power Factor	0.98 (typical at Full load)
6	Line Regulation (CV mode) Line Regulation (CC mode)	0.1 % or better
7	Load Regulation (CV mode) Load Regulation (CC mode)	0.1 % or better
8	Ripple r.m.s 5Hz to 1 MHz) (CV mode) Ripple r.m.s 5Hz to 1 MHz) (CC mode)	10 mV or better 10 mA or better
9	Remote sense Compensation	2V drop on each load wire or better
10	Volt meter (display front end)	Display : 4 Digit
11	Ammeter (display front end)	Display : 4 Digit
12	Control Functions	Output ON/OFF, Remote sensing, AC ON/OFF, Fold back, OVP/UVL, OCP. Vout and Iout (Coarse and Fine adjustment)
13	LED Indication	CV, CC, Fold back, Local/Remote, Output ON/OFF, OVP, UVP.
14	Protections	Fold back, Over Voltage Protection (OVP), Over Temperature Protection (OTP), Under Voltage Protection (UVP)
15	Cooling	Forced air cooling by internal fan
16	Parallel Operation	Master-Slave method
17	Series operation	Shall support up to 2 units.
18	Programming	RS232/485 /USB interface.
19	V out programming accuracy	0.1 % of rated Output or better
20	I out programming accuracy	0.2 %. of rated Output or better
21	Operating Temperature	0 to 50°C
22	Operating RH	20 % to 90 %
23	Monitoring provision	Front panel measuring via banana sockets (Ø4mm) for Voltage and Current
24	Withstand voltage / Isolation Voltage	Input-Output & Input to all communication devices / ports, Input-

		Ground: >1500Vdc for a minimum Of 1 min. Output to Ground & all communication devices / ports : >500 Vdc for a minimum of 1 min.
25	EMC standards	IEC/EN61326-1
26	Insulation resistance	Input-Output, Input-Ground, Output-Ground: > 100MΩ

17. Additional information on Codes/ Standard:

Where ever codes / standards are not mentioned, the following codes may be considered while designing PTC.

Table 20: Additional information on Codes/ Standard

Sl. No.	Item	Standard
1.	Ball valve-design	BS 5351/ Equivalent
2.	Ball valve-test	BS 6755/ Equivalent
3.	Globe valve	BS 6364/ ANSI B 16.34/ Equivalent
4.	Seamless pipe	ASTM A 312TP
5.	Seamless pipe dimensional	ANSI B-36.19/ ANSI B36.10
6.	Seamless tube	ASTM A 269
7.	Butt weld fittings	ANSI B16.9
8.	Edge preparation	ANSI B 16.25
9.	SRV Design	API-520
10.	SRV Testing	API-527
11.	Bolts	ASTM A 193Gr B8
12.	Nuts	ASTM A 194Gr B8
13.	IGC	ASTM A 262 PRACTICE-E
14.	UT	ASTM-E213
15.	Eddy current	ASTM E-426
16.	Hydro test	ASTM A-530
17.	Pickling and passivation	AMS 2700/ ASTM A 380
18.	Process piping	ANSI B 31.3

18. Terms &Conditions for Procurement of Flow Components

a) All flow components shall be strictly procured only from original manufacturers/authorized agents only

b) PN Rating, bore mentioned in the document are indicative. However, Nearest size may be selected based on the availability and based on the final design/sizing

c) **PN rating of the flow components shall be greater than the MOP**

d) During offer, preferred make of all flow components shall be submitted. Without which offer will be rejected.

e) All flow components procurement shall be taken up only after obtaining the approval of constructional/design clearance from the department.

f) No NPT threads are allowed as part of body or end connections

g) No welding is allowed on the flow component body

h) Socket weld type flow components are not acceptable

i) Valve bodies shall be machined from rolled or forged bar stock. **Casted bodies are not acceptable (except for safety relief valves)**

j) **All flow components end connections shall be metric or BSPP threaded and shall be welded to pipes or tubes by means of butt welded nut & nipple only. Material construction of adaptors shall be 316L only.**

k) **All the conversion/ union drawings shall be submitted for purchaser's review, before procurement.**

Annexure- 5

Details of Flow components in Pneumatic Test Console

1. Pressure Regulator Details

Table 21: List of Pressure Regulators

Sr. No	Tag No	Purpose	Inlet pressure bar(g)		Outlet pressure range bar(g)	Flow rate With 1.25 flow factor (Nm^3/hr)	Quantity (Nos)	CV/diameter of orifice & Failure flow rate	Make
			Max.	Min.					
GHe Pneumatic servicing rig									
1	PR1H	Command system leak checks	400	100	0-50	150	1	**To be calculated by the regulator manufacturer**	IMI/Tesco/ hale Hamilton/ Equivalent
2	PR2H	Command system leak checks	400	100	0-50	150	1		IMI/Tesco/ hale Hamilton/ Equivalent
3	PR3H	Gas bottle charging (CGB), primary regulator for LOX & LH2 tanks charging	400	100	50-150	550	1		IMI/Tesco/ hale Hamilton/ Equivalent
4	PR4H	LOX & LH2 tank leak checks	210	50	0-9	550	1		IMI/Tesco/ hale Hamilton/ Equivalent

Sr. No	Tag No	Purpose	Inlet pressure bar(g)		Outlet pressure range bar(g)	Flow rate With 1.25 flow factor (Nm^3/hr)	Quantity (Nos)	CV/diameter of orifice & Failure flow rate	Make
			Max.	Min.					
5	PRL	Engine, command blocks and purge line checks	100	10	0.3-10	50	1		IMI/Tesco/ hale Hamilton/ Equivalent

2. Safety Relief Valves details

Table 22: List of Safety Relief Valves

Sr. No	Tag No	Service	Pressure in bar(g)		End connection Inlet & Outlet	Discharge flow rate (Kg/Hr)	Quantity (Nos)	Calculated Diameter of nozzle & selected size in mm	Make
			MOP	Set					
GHe Pneumatic servicing rig									
1.	VR1H	Cryo gas bottle charging	70	77^{+5}	BSSP/Metric	As per PR3H failure flow rate	**1**	**To be calculated based failure flow rate of regulator & 10% over pressure criterial**	TYCOSANMAR/Equivalent
2.	VR2H	Start-up gas bottle charging	260	286^{+5}	BSSP/Metric		**1**		TYCOSANMAR/Equivalent
3.	VR3H	Ambient gas bottle charging	335	363^{+5}	BSSP/Metric		**1**		TYCOSANMAR/Equivalent

Sr. No	Tag No	Service	Pressure in bar(g)		End connection Inlet & Outlet	Discharge flow rate (Kg/Hr)	Quantity (Nos)	Calculated Diameter of nozzle & selected size in mm	Make
			MOP	Set					
4.	VR4H	For supplying Command pressure	50	$55^{+2.5}$	BSSP/Metric	As per PR1H failure flow rate	**1**		TYCOSANMAR/Equivalent
5.	VR5H	For supplying Command pressure	50	$55^{+2.5}$	BSSP/Metric	As per PR2H failure flow rate	**1**		TYCOSANMAR/Equivalent
6.	VR6H	For ground pressurization line (LOX & LH2) leak check	9	$9.9^{+1.0}$	BSSP/Metric	As per PR4H failure flow rate	**1**		TYCOSANMAR/Equivalent
7.	VR7H	For supplying Command pressure to SV's & ER	7.5	$7.7^{+0.2}$	BSSP/Metric	As per PR4H failure flow rate	**1**		TYCOSANMAR/Equivalent
8.	VR8H	Located in the downstream of PR3H	190	210^{+5}	BSSP/Metric	As per PR3H failure flow rate	**1**		TYCOSANMAR/Equivalent
9.	VR1L	Located in the downstream of PR1L	6.0	$6.6^{+0.30}$	BSSP/Metric	As per PR1L failure flow rate	**1**		TYCOSANMAR/Equivalent

Sr. No	Tag No	Service	Pressure in bar(g)		End connection Inlet & Outlet	Discharge flow rate (Kg/Hr)	Quantity (Nos)	Calculated Diameter of nozzle & selected size in mm	Make
			MOP	Set					
10.	VR2L	RCS leak check & Pressure hold check of AFVV	2.8	$3.1^{+0.15}$	BSSP/Metric	As per PR1L failure flow rate	**1**		TYCOSANMAR/Equivalent
11.	VR3L	Nozzle closure leak checks	1.75	$1.95^{+0.1}$	BSSP/Metric	As per PR1L failure flow rate	**1**		TYCOSANMAR/Equivalent
12.	VR4L	Pressure hold of EPCV modules	0.54	$0.60^{+0.1}$	BSSP/Metric	As per PR1L failure flow rate	**1**		TYCOSANMAR/Equivalent

3. Manual Valves Details

Table 23: List of Manual valves

Sr. No	Tag No	Purpose	Type of Manual valve	End connection		Flow rate Nm^3/hr	Min.Operating pressure Bar(g) for sizing	PN BAR	Quantity (Nos)	MAKE
				Inlet	Outlet					
GHe Pneumatic servicing rig										
1.	VM1HV	LOX tank pressure monitoring	Needle	BSPP /Metric		50	2	100	1	Butech/ Swagelok/

Sr. No	Tag No	Purpose	Type of Manual valve	End connection		Flow rate Nm^3/hr	Min.Operating pressure Bar(g) for sizing	PN BAR	Quantity (Nos)	MAKE
				Inlet	Outlet					
										Parker/ Equivalent
2.	VM2HV	LH2 tank pressure monitoring	Needle	BSPP /Metric		50	2.4	100	1	Butech/ Swagelok/ Parker/ Equivalent
3.	VM3H	For supplying command pressures to stage valves	Needle	BSPP /Metric		50	50	100	1	
4.	VM4H		Needle	BSPP /Metric		50	50	100	1	
5.	VM5H		Needle	BSPP /Metric		50	50	100	1	
6.	VM6H		Needle	BSPP /Metric		50	50	100	1	
7.	VM7H		Needle	BSPP /Metric		50	50	100	1	
8.	VM8H		Needle	BSPP /Metric		50	50	100	1	
9.	VM9H	For supplying command pressures to PTC- EP valves & ER	Needle	BSPP /Metric		50	9	100	1	Butech/ Swagelok/ Parker/ Equivalent
10.	VM10H	For LOX tank charging	**Globe**	BSPP /Metric		500	9	25	1	Butech/ Swagelok/ Parker/ Equivalent
11.	VM11H	For LH2 tank charging	**Globe**	BSPP /Metric		500	9	25	1	Butech/ Swagelok/

Sr. No	Tag No	Purpose	Type of Manual valve	End connection		Flow rate Nm^3/hr	Min.Operating pressure Bar(g) for sizing	PN BAR	Quantity (Nos)	MAKE
				Inlet	Outlet					
										Parker/ Equivalent
12.	VM12H	For CGB charging	Needle	BSPP or Metric		50	70	400	1	Butech/ Swagelok/ Parker/ Equivalent
13.	VM13H	For SGB charging	Needle	BSPP or Metric		150	260	400	1	Butech/ Swagelok/ Parker/ Equivalent
14.	VM14H	For AGB charging	Needle	BSPP or Metric		150	335	400	1	Butech/ Swagelok/ Parker/ Equivalent
15.	VM15HV	PR1H outlet vent	Needle	BSPP or Metric		50	50	100	1	Butech/ Swagelok/ Parker/ Equivalent
16.	VM16HV	PR2H outlet vent	Needle	BSPP or Metric		50	50	100	1	Butech/ Swagelok/ Parker/ Equivalent
17.	VM17HV	PR4H outlet vent	Needle	BSPP or Metric		50	9	100	1	Butech/ Swagelok/

Sr. No	Tag No	Purpose	Type of Manual valve	End connection		Flow rate Nm^3/hr	Min.Operating pressure Bar(g) for sizing	PN BAR	Quantity (Nos)	MAKE
				Inlet	Outlet					
										Parker/ Equivalent
18.	VM18HV	PR3H outlet vent	Needle	BSPP or Metric		50	150	400	1	Butech/ Swagelok/ Parker/ Equivalent
19.	VM19H	Isolation for PR4H	Needle	BSPP or Metric		550	150	400	1	Butech/ Swagelok/ Parker/ Equivalent
20.	VM20H	Isolation from HPP to LPP	Needle	BSPP or Metric		50	50	400	1	Butech/ Swagelok/ Parker/ Equivalent
21.	VM21H	Isolation for PR1H	Needle	BSPP or Metric		150	400	400	1	Butech/ Swagelok/ Parker/ Equivalent
22.	VM22H	Isolation for PR2H	Needle	BSPP or Metric		150	400	400	1	Butech/ Swagelok/ Parker/ Equivalent
23.	VM23H	GHe inlet	Needle	BSPP or Metric		550	400	400	1	Butech/ Swagelok/

Sr. No	Tag No	Purpose	Type of Manual valve	End connection		Flow rate Nm^3/hr	Min.Operating pressure Bar(g) for sizing	PN BAR	Quantity (Nos)	MAKE
				Inlet	Outlet					
										Parker/ Equivalent
24.	VM24H	GN_2 inlet	Needle	BSPP or Metric		550	400	400	1	Butech/ Swagelok/ Parker/ Equivalent
25.	VM25H	Outlet Isolation for PR3H	Needle	BSPP or Metric		50	150	400	1	Butech/ Swagelok/ Parker/ Equivalent
26.	VM26H	Bypass for SV1 & PR3H	Needle	BSPP or Metric		50	400	400	1	Butech/ Swagelok/ Parker/ Equivalent
27.	VM27HV	PTC inlet vent for GHe & GN_2	Needle	BSPP or Metric		150	400	400	1	Butech/ Swagelok/ Parker/ Equivalent
28.	VM28HV	PR3H outlet vent	Needle	BSPP or Metric		50	150	400	1	Butech/ Swagelok/ Parker/ Equivalent
29.	VM29H	Isolation for VR7H	Needle	BSPP or Metric		50	9	100	1	Butech/ Swagelok/

Sr. No	Tag No	Purpose	Type of Manual valve	End connection		Flow rate Nm^3/hr	Min.Operating pressure Bar(g) for sizing	PN BAR	Quantity (Nos)	MAKE
				Inlet	Outlet					
										Parker/ Equivalent
30.	VM3HV	For venting command pressures from stage valves	Needle	BSPP or Metric		50	50	100	1	Butech/ Swagelok/ Parker/ Equivalent
31.	VM4HV		Needle	BSPP or Metric		50	50	100	1	Butech/ Swagelok/ Parker/ Equivalent
32.	VM5HV		Needle	BSPP or Metric		50	50	100	1	Butech/ Swagelok/ Parker/ Equivalent
33.	VM6HV		Needle	BSPP or Metric		50	50	100	1	Butech/ Swagelok/ Parker/ Equivalent
34.	VM7HV		Needle	BSPP or Metric		50	50	100	1	Butech/ Swagelok/ Parker/ Equivalent
35.	VM8HV		Needle	BSPP or Metric		50	50	100	1	Butech/ Swagelok/

Sr. No	Tag No	Purpose	Type of Manual valve	End connection		Flow rate Nm^3/hr	Min.Operating pressure Bar(g) for sizing	PN BAR	Quantity (Nos)	MAKE
				Inlet	Outlet					
										Parker/ Equivalent
36.	VM9HV	Vent for VM9H	Needle	BSPP or Metric		50	9	100	1	Butech/ Swagelok/ Parker/ Equivalent
37.	VM10HV	For LOX tank venting	Needle	BSPP or Metric		50	9	25	1	Butech/ Swagelok/ Parker/ Equivalent
38.	VM11HV	For LH2 tank venting	Needle	BSPP or Metric		50	9	25	1	Butech/ Swagelok/ Parker/ Equivalent
39.	VM12HV	CGB venting	Needle	BSPP or Metric		50	70	400	1	Butech/ Swagelok/ Parker/ Equivalent
40.	VM13HV	SGB Venting	Needle	BSPP or Metric		50	260	400	1	Butech/ Swagelok/ Parker/ Equivalent
41.	VM14HV	AGB Venting	Needle	BSPP or Metric		50	335	400	1	Butech/ Swagelok/

Sr. No	Tag No	Purpose	Type of Manual valve	End connection		Flow rate Nm^3/hr	Min.Operating pressure Bar(g) for sizing	PN BAR	Quantity (Nos)	MAKE
				Inlet	Outlet					
										Parker/ Equivalent
42.	VM1LV	Aux. Venting for LOX & LH2 tanks	Needle	BSPP or Metric		50	2.5	10	1	Butech/ Swagelok/ Parker/ Equivalent
43.	VM2LV		Needle	BSPP or Metric		50	2.5	10	1	Butech/ Swagelok/ Parker/ Equivalent
44.	VM3L	For supplying low pressures of 0.3 to 5.5 bar (g) to various stage fluid circuits	Needle	BSPP or Metric		50	6	10	1	Butech/ Swagelok/ Parker/ Equivalent
45.	VM4L		Needle	BSPP or Metric		50	6	10	1	
46.	VM5L		Needle	BSPP or Metric		50	6	10	1	
47.	VM6L		Needle	BSPP or Metric		50	6	10	1	
48.	VM7L		Needle	BSPP or Metric		50	6	10	1	
49.	VM8L		Needle	BSPP or Metric		50	6	10	1	
50.	VM9L		Needle	BSPP or Metric		50	6	10	1	
51.	VM10L		Needle	BSPP or Metric		50	6	10	1	
52.	VM11L		Needle	BSPP or Metric		50	6	10	1	
53.	VM12L		Needle	BSPP or Metric		50	6	10	1	
54.	VM13L		Needle	BSPP or Metric		50	6	10	1	

Sr. No	Tag No	Purpose	Type of Manual valve	End connection		Flow rate Nm^3/hr	Min.Operating pressure Bar(g) for sizing	PN BAR	Quantity (Nos)	MAKE
				Inlet	Outlet					
55.	VM14L		Needle	BSPP or Metric		50	6	10	1	
56.	VM15L	Inlet for LPP	Needle	BSPP or Metric		50	50	100	1	Butech/ Swagelok/ Parker/ Equivalent
57.	VM16L	Outlet isolation for PRL	Needle	BSPP or Metric		50	6	10	1	Butech/ Swagelok/ Parker/ Equivalent
58.	VM17L	Isolation for PG's	Needle	BSPP or Metric		50	6	10	1	Butech/ Swagelok/ Parker/ Equivalent
59.	VM18LV	Common vent for LPP valves	Needle	BSPP or Metric		50	6	10	1	Butech/ Swagelok/ Parker/ Equivalent
60.	VM19L	Isolation for Vacuum pump	Needle	BSPP or Metric		50	6	10	1	Butech/ Swagelok/ Parker/ Equivalent
61.	VM20LV	Outlet vent for PRL	Needle	BSPP or Metric		50	6	10	1	Butech/ Swagelok/

Sr. No	Tag No	Purpose	Type of Manual valve	End connection		Flow rate Nm^3/hr	Min.Operating pressure Bar(g) for sizing	PN BAR	Quantity (Nos)	MAKE
				Inlet	Outlet					
										Parker/ Equivalent
62.	VM1HS	Gas sampling port for LOX tank	Needle	BSPP or Metric		50	2.5	10	1	Butech/ Swagelok/ Parker/ Equivalent
63.	VM2HS	Gas sampling port for LH2 tank	Needle	BSPP or Metric		50	2.5	10	1	Butech/ Swagelok/ Parker/ Equivalent
64.	VM12HS1	Gas sampling port for CGB	Needle	BSPP or Metric		50	70	400	1	Butech/ Swagelok/ Parker/ Equivalent
65.	VM12HS2	Aux. Gas sampling port	Needle	BSPP or Metric		50	70	400	1	Butech/ Swagelok/ Parker/ Equivalent
66.	VM13HS	Gas sampling port for SGB	Needle	BSPP or Metric		50	260	400	1	Butech/ Swagelok/ Parker/ Equivalent
67.	VM14HS	Gas sampling	Needle	BSPP or Metric		50	335	400	1	Butech/ Swagelok/

Sr. No	Tag No	Purpose	Type of Manual valve	End connection		Flow rate Nm^3/hr	Min.Operating pressure Bar(g) for sizing	PN BAR	Quantity (Nos)	MAKE
				Inlet	Outlet					
		port for AGB								Parker/ Equivalent
68.	VM1LS	For gas sampling of LOX & LH2 tanks	Needle	BSPP or Metric		50	2.5	10	1	Butech/ Swagelok/ Parker/ Equivalent
69.	VM2LS		Needle	BSPP or Metric		50	2.5	10	1	Butech/ Swagelok/ Parker/ Equivalent
70.	VM3LS	For gas sampling of Engine, command blocks, etc.,	Needle	BSPP or Metric		50	6	10	1	Butech/ Swagelok/ Parker/ Equivalent
71.	VM4LS		Needle	BSPP or Metric		50	6	10	1	Butech/ Swagelok/ Parker/ Equivalent
72.	VM5LS		Needle	BSPP or Metric		50	6	10	1	Butech/ Swagelok/ Parker/ Equivalent
73.	VM14LS		Needle	BSPP or Metric		50	6	10	1	Butech/ Swagelok/

Sr. No	Tag No	Purpose	Type of Manual valve	End connection		Flow rate Nm^3/hr	Min.Operating pressure Bar(g) for sizing	PN BAR	Quantity (Nos)	MAKE
				Inlet	Outlet					
										Parker/ Equivalent
74.	VM1	Bypass for EP1	Needle	BSPP or Metric		500	9	25	1	Butech/ Swagelok/ Parker/ Equivalent
75.	VM2	Bypass for EP2	Needle	BSPP or Metric		500	9	25	1	Butech/ Swagelok/ Parker/ Equivalent
76.	VM3	For supplying command pressure to ER	Needle	BSPP or Metric		50	9	25	1	Butech/ Swagelok/ Parker/ Equivalent
77.	VM4	Bypass for ER1	Needle	BSPP or Metric		50	400	400	1	Butech/ Swagelok/ Parker/ Equivalent
78.	VM5	Outlet of ER1 self-vent port	Needle	BSPP or Metric		50	400	400	1	Butech/ Swagelok/ Parker/ Equivalent
79.	VM6	Isolation for EP5	Needle	BSPP or Metric		50	50	100	1	Butech/ Swagelok/

Sr. No	Tag No	Purpose	Type of Manual valve	End connection		Flow rate Nm^3/hr	Min.Operating pressure Bar(g) for sizing	PN BAR	Quantity (Nos)	MAKE
				Inlet	Outlet					
										Parker/ Equivalent
"*" FFR: shall be sized for Failure Flow rate of Regulator at MOP mentioned										

4. Check Valve (non-return valve) Details

Table 24: List of Check valves

S. No	Tag No	Purpose	Size	Type	End connection	Min Operating pressure, bar	PN bar	Preferred make	Actual Qty. (No's)
1	VC1	To avoid the GN_2 admission towards GHe side	15NB x 160 SCH	Spring loaded poppet (In-line)	BSPP or Metric	400	400	Swagelok/ Parker/ Equivalent	1
2	VC2	To avoid the atm. Entry into the service line containing 3-way EP valve	15NB x 160 SCH	Spring loaded poppet (In-line)	BSPP or Metric	50	100	Swagelok/ Parker/ Equivalent	1

5. Filter Details

Table 25: List of Filters

Sr. No	Tag No	Purpose	Element Type	PN rating(bar)	Micron Rating (abs)	Mesh MOC SS	Inlet & out let pipes Size (dia x thick)	End connection	Qty (Nos)	Filter Mesh area (mm2)	Make
GHe Pneumatic servicing rig											
1.	F1H	PTC inlet (GHe)	Cylindrical Pleated mesh	400	5	304L/ 316L	15NB x 160SCH (pipe)	(M18x1.5)	1	Selected filter shall meet the flow rate specification of service line (or) 5 to 10 times of inlet tube ID/ whichever is greater	Norman/ Puronics/ Equivalent
2.	F2H	PTC Inlet (GN_2)	Cylindrical Pleated mesh	400	5	304L/ 316L	15NB x 160SCH (pipe)	(M18x1.5)	1		Norman/ Puronics/ Equivalent
3.	F3H	For supplying command pressures to stage valves VR 02 Inlet	Cylindrical Pleated mesh	100	10	304L/ 316L	Φ12.7 x 2.11	(M18x1.5)	1		Norman/ Puronics/ Equivalent
4.	F4H		Cylindrical Pleated mesh	100	10	304L/ 316L	Φ12.7 x 2.11	(M18x1.5)	1		Norman/ Puronics/ Equivalent
5.	F5H		Cylindrical	100	10	304L/ 316L	Φ12.7 x 2.11	(M18x1.5)	1		Norman/ Puronics/

Sr. No	Tag No	Purpose	Element Type	PN rating(bar)	Micron Rating (abs)	Mesh MOC SS	Inlet & out let pipes Size (dia x thick)	End connection	Qty (Nos)	Filter Mesh area (mm2)	Make
			Pleated mesh								Equivalent
6.	F6H		Cylindrical Pleated mesh	100	10	304L/ 316L	Φ12.7 x 2.11	(M18x1.5)	1	Selected filter shall meet the flow rate specification of service line (or) 5 to 10 times of inlet tube ID/ whichever is greater	Norman/ Puronics/ Equivalent
7.	F7H		Cylindrical Pleated mesh	100	10	304L/ 316L	Φ12.7 x 2.11	(M18x1.5)	1		Norman/ Puronics/ Equivalent
8.	F8H1		Cylindrical Pleated mesh	100	10	304L/ 316L	Φ12.7 x 2.11	(M18x1.5)	1		Norman/ Puronics/ Equivalent
9.	F8H2		Cylindrical Pleated mesh	100	10	304L/ 316L	Φ12.7 x 2.11	(M18x1.5)	1		Norman/ Puronics/ Equivalent
10.	F9H	For ground	Cylindrical	25	10	304L/ 316L	Φ12.7 x 2.11	(M18x1.5)	1		Norman/ Puronics/

Sr. No	Tag No	Purpose	Element Type	PN rating(bar)	Micron Rating (abs)	Mesh MOC SS	Inlet & out let pipes Size (dia x thick)	End connection	Qty (Nos)	Filter Mesh area (mm2)	Make
		pressurization line leak check	Pleated mesh								Equivalent
11.	F10H	For LOX & LH2 tank charging	Cylindrical Pleated mesh	25	10	304L/ 316L	Φ12.7 x 2.11	(M18x1.5)	1	Selected filter shall meet the flow rate specification of service line (or) 5 to 10 times of inlet tube ID/ whichever is greater	Norman/ Puronics/ Equivalent
12.	F11H		Cylindrical Pleated mesh	25	10	304L/ 316L	Φ12.7 x 2.11	(M18x1.5)	1		Norman/ Puronics/ Equivalent
13.	F12H1	For CGB	Cylindrical Pleated mesh	400	10	304L/ 316L	Φ12.7 x 2.11	(M18x1.5)	1		Norman/ Puronics/ Equivalent
14.	F12H2	Aux. Service line	Cylindrical Pleated mesh	400	10	304L/ 316L	Φ12.7 x 2.11	(M18x1.5)	1		Norman/ Puronics/ Equivalent

Sr. No	Tag No	Purpose	Element Type	PN rating(bar)	Micron Rating (abs)	Mesh MOC SS	Inlet & out let pipes Size (dia x thick)	End connection	Qty (Nos)	Filter Mesh area (mm2)	Make
15.	F13H	For SGB	Cylindrical Pleated mesh	400	10	304L/ 316L	Φ12.7 x 2.11	(M18x1.5)	1	Selected filter shall meet the flow rate specification of service line (or) 5 to 10 times of inlet tube ID/ whichever is greater	Norman/ Puronics/ Equivalent
16.	F14H	For AGB	Cylindrical Pleated mesh	400	10	304L/ 316L	Φ12.7 x 2.11	(M18x1.5)	1		Norman/ Puronics/ Equivalent
17.	F1L	LPP inlet	Cylindrical Pleated mesh	100	10	304L/ 316L	Φ12.7 x 2.11	(M18x1.5)	1		Norman/ Puronics/ Equivalent
18.	F3L1	For supplying GHe or GN_2 to various stage fluid circuits	Cylindrical Pleated mesh	10	10	304L/ 316L	Φ12.7 x 2.11	(M18x1.5)	1		Norman/ Puronics/ Equivalent
19.	F3L4		Cylindrical Pleated mesh	10	10	304L/ 316L	Φ12.7 x 2.11	(M18x1.5)	1		Norman/ Puronics/ Equivalent

Sr. No	Tag No	Purpose	Element Type	PN rating(bar)	Micron Rating (abs)	Mesh MOC SS	Inlet & out let pipes Size (dia x thick)	End connection	Qty (Nos)	Filter Mesh area (mm2)	Make
20.	F4L		Cylindrical Pleated mesh	10	10	304L/ 316L	Φ12.7 x 2.11	(M18x1.5)	1	Selected filter shall meet the flow rate specification of service line (or) 5 to 10 times of inlet tube ID/ whichever is greater	Norman/ Puronics/ Equivalent
21.	F5L		Cylindrical Pleated mesh	10	10	304L/ 316L	Φ12.7 x 2.11	(M18x1.5)	1		Norman/ Puronics/ Equivalent
22.	F6L	For supplying GHe or GN_2 to various stage fluid circuits	Cylindrical Pleated mesh	10	10	304L/ 316L	Φ12.7 x 2.11	(M18x1.5)	1		Norman/ Puronics/ Equivalent
23.	F7L		Cylindrical Pleated mesh	10	10	304L/ 316L	Φ12.7 x 2.11	(M18x1.5)	1		Norman/ Puronics/ Equivalent
24.	F8L		Cylindrical Pleated mesh	10	10	304L/ 316L	Φ12.7 x 2.11	(M18x1.5)	1		Norman/ Puronics/ Equivalent

Sr. No	Tag No	Purpose	Element Type	PN rating(bar)	Micron Rating (abs)	Mesh MOC SS	Inlet & out let pipes Size (dia x thick)	End connection	Qty (Nos)	Filter Mesh area (mm2)	Make
25.	F9L1		Cylindrical Pleated mesh	10	10	304L/ 316L	Φ12.7 x 2.11	(M18x1.5)	1	Selected filter shall meet the flow rate specification of service line (or) 5 to 10 times of inlet tube ID/ whichever is greater	Norman/ Puronics/ Equivalent
26.	F9L3		Cylindrical Pleated mesh	10	10	304L/ 316L	Φ12.7 x 2.11	(M18x1.5)	1		Norman/ Puronics/ Equivalent
27.	F10L1		Cylindrical Pleated mesh	10	10	304L/ 316L	Φ12.7 x 2.11	(M18x1.5)	1		Norman/ Puronics/ Equivalent
28.	F10L3		Cylindrical Pleated mesh	10	10	304L/ 316L	Φ12.7 x 2.11	(M18x1.5)	1		Norman/ Puronics/ Equivalent
29.	F11L1	For supplying GHe or GN_2	Cylindrical Pleated mesh	10	10	304L/ 316L	Φ12.7 x 2.11	(M18x1.5)	1		Norman/ Puronics/ Equivalent

Sr. No	Tag No	Purpose	Element Type	PN rating(bar)	Micron Rating (abs)	Mesh MOC SS	Inlet & out let pipes Size (dia x thick)	End connection	Qty (Nos)	Filter Mesh area (mm2)	Make
30.	F11L3	to various stage fluid circuits	Cylindrical Pleated mesh	10	10	304L/ 316L	Φ12.7 x 2.11	(M18x1.5)	1	Selected filter shall meet the flow rate specification of service line (or) 5 to 10 times of inlet tube ID/ whichever is greater	Norman/ Puronics/ Equivalent
31.	F12L		Cylindrical Pleated mesh	10	10	304L/ 316L	Φ12.7 x 2.11	(M18x1.5)	1		Norman/ Puronics/ Equivalent
32.	F13L		Cylindrical Pleated mesh	10	10	304L/ 316L	Φ12.7 x 2.11	(M18x1.5)	1		Norman/ Puronics/ Equivalent
33.	F14L		Cylindrical Pleated mesh	10	10	304L/ 316L	Φ12.7 x 2.11	(M18x1.5)	1		Norman/ Puronics/ Equivalent

6. Pressure Gauge Details

Table 26: List of Pressure Gauges

S. No	Tag No	MOP Bar (g)	Range bar(g)	Resolution, bar (g)	Accuracy Class	Purpose	Dial Size (mm)	End Connection	Mounting	Quantity (Nos)	MAKE
GHe Pneumatic servicing rig											
1.	PG1H	2.5	0-4	0.02	0.25%	LOX tank pressure monitoring	160	M20X1.5	Panel mount	1	Wika
2.	PG2H	2.8	0-4	0.02	0.25%	LH2 tank pressure monitoring	160	M20X1.5	Panel mount	1	Wika
3.	PG3H	50	0-100	0.5	0.25%	For supplying Stage command pressures	160	M20X1.5	Panel mount	1	Wika
4.	PG4H	50	0-100	0.5	0.25%		160	M20X1.5	Panel mount	1	Wika
5.	PG5H	50	0-100	0.5	0.25%		160	M20X1.5	Panel mount	1	Wika
6.	PG6H	50	0-100	0.5	0.25%		160	M20X1.5	Panel mount	1	Wika
7.	PG7H	50	0-100	0.5	0.25%		160	M20X1.5	Panel mount	1	Wika
8.	PG8H	50	0-100	0.5	0.25%		160	M20X1.5	Panel mount	1	Wika
9.	PG9H	9	0-20	0.2	0.25%	For supplying command pressures to the PTC Ep's & ER	160	M20X1.5	Panel mount	1	Wika

S. No	Tag No	MOP Bar (g)	Range bar(g)	Resolution, bar (g)	Accuracy Class	Purpose	Dial Size (mm)	End Connection	Mounting	Quantity (Nos)	MAKE
10	PG10H	9	0-20	0.2	0.25%	For LOX tank charging	160	M20X1.5	Panel mount	1	Wika
11	PG11H	9	0-20	0.2	0.25%	For LH2 tank charging	160	M20X1.5	Panel mount	1	Wika
12	PG12H	70	0-160	1.0	0.25%	For CGB charging	160	M20X1.5	Panel mount	1	Wika
13	PG13H	260	0-400	2.0	0.25%	For SGB charging	160	M20X1.5	Panel mount	1	Wika
14	PG14H	335	0-400	2.0	0.25%	For AGB charging	160	M20X1.5	Panel mount	1	Wika
15	PG15H	50	0-100	0.5	0.25%	PR1H outlet	160	M20X1.5	Panel mount	1	Wika
16	PG16H	50	0-100	0.5	0.25%	PR2H outlet	160	M20X1.5	Panel mount	1	Wika
17	PG17H	9	0-20	0.2	0.25%	PR4H outlet	160	M20X1.5	Panel mount	1	Wika
18	PG18H	210	0-400	2.0	0.25%	PR3H outlet	160	M20X1.5	Panel mount	1	Wika
19	PG19H	400	0-600	5.0	0.25%	GN_2 PTC inlet	160	M20X1.5	Panel mount	1	Wika
20	PG20H	400	0-600	5.0	0.25%	GHe PTC inlet	160	M20X1.5	Panel mount	1	Wika
21	PG21H	335	0-400	2.0	0.25%	ER outlet or VM25H outlet	160	M20X1.5	Panel mount	1	Wika

S. No	Tag No	MOP Bar (g)	Range bar(g)	Resolution, bar (g)	Accuracy Class	Purpose	Dial Size (mm)	End Connection	Mounting	Quantity (Nos)	MAKE
22	PG1L	50	100	0.5	0.25%	LPP inlet	160	M20X1.5	Panel mount	1	Wika
23	PGV1L	5	-1-9	0.2	1.0 %	PRL outlet	160	M20X1.5	Panel mount	1	Wika
24	PGV2L	5	-1-9	0.2	1.0 %	VM16L outlet	160	M20X1.5	Panel mount	1	Wika
25	PG2L	0.54	0-1	0.005	0.25%	Pressure hold of EPCV modules	160	M20X1.5	Panel mount	1	Wika
26	PG3L	1.80	0-2.5	0.02	0.25%	Nozzle closure leak checks	160	M20X1.5	Panel mount	1	Wika
27	PG4L	2.8	0-4	0.02	0.25%	RCS leak checks & Pressure hold test of AFVVV	160	M20X1.5	Panel mount	1	Wika
28	PG5L	5	0-10	0.05	0.25%	Purge circuit leak checks	160	M20X1.5	Panel mount	1	Wika
29	PG6L	1	0-1.6	0.01	0.25%	LOX or LH2 tank pressure monitoring	160	M20X1.5	Panel mount	1	Wika
30	PG7L	1.80	0-2.5	0.02	0.25%		160	M20X1.5	Panel mount	1	Wika
31	PG8L	5	0-10	0.05	0.25%	Purge circuit leak checks	160	M20X1.5	Panel mount	1	Wika
32	PG9L	1	0-1.6	0.01	0.25%		160	M20X1.5	Panel mount	1	Wika

S. No	Tag No	MOP Bar (g)	Range bar(g)	Resolution, bar (g)	Accuracy Class	Purpose	Dial Size (mm)	End Connection	Mounting	Quantity (Nos)	MAKE
33	PG10L	2.5	0-4	0.02	0.25%	LOX or LH2 tank pressure monitoring	160	M20X1.5	Panel mount	1	Wika
34	PG11L	5	0-10	0.05	0.25%	Purge circuit leak checks	160	M20X1.5	Panel mount	1	Wika

7. Pressure Switch Details

Table 27: List of Pressure switches

Sr. No	Tag No	Service	Operating Pressure in bar(g)	Pressure range, bar	End connection Inlet & Outlet	Make	Quantity (No's)
1.	PS1H	For LOX tank	$0\text{-}4^{\pm 0.1}$	0-10	BSSP/Metric	Switzer/ Wika/ Equivalent	1
2.	PS2H	For LH2 tank	$1.0\text{-}5.0^{\pm 0.1}$	0-10	BSSP/Metric		1
3.	PS3H	For Lox tank charge line	$6.6^{\pm 0.3}$	0-10	BSSP/Metric		1
4.	PS4H	For LH2 tank charge line	$6.6^{\pm 0.3}$	0-10	BSSP/Metric		1

8. EP Ball Valve Details

Table 28: List of EP Ball Valves

Sr. No	Tag No	Purpose	Type of valves	End connections		Inlet & Outlet pipe size, mm	MOP (bar)	PN (bar)	Quantity (Nos)	Make
				Inlet size	Outlet size					
GHe Pneumatic servicing rig										
1.	EP1	LOX tank charging	Two-way reduced bore	½" BSPP/ Metric		Φ12.7 x 2.11	9	25	1	ORSEAL/ SANKEY/ Equivalent
2.	EP2	LH2 tank charging	Two-way reduced bore	½"BSPP / Metric		Φ12.7 x 2.11	9	25	1	ORSEAL/ SANKEY/ Equivalent
3.	EP3	SGB charging	Two-way reduced bore	½"BSPP /Metric		Φ12.7 x 2.11	260	400	1	ORSEAL/ SANKEY/ Equivalent
4.	EP4	AGB charging	Two-way reduced bore	½"BSPP/Metric		Φ12.7 x 2.11	335	400	1	ORSEAL/ SANKEY/ Equivalent
5.	EP5	For supplying command pressures to the stage valves	Three-way L-port EP ball valve	½"BSPP / Metric		Φ12.7 x 2.11	50	100	1	ORSEAL/ SANKEY/ Equivalent

9. Electronic Regulator Details

Table 29: List of Electronic Regulators

Sr. No	Tag No	Purpose	Type of valves	End connections	Inlet & Outlet pipe size (DN)	Min. Flow rate Nm^3/hr	Accuracy	MOP (Bar)	PN (BAR)	Quantity (Nos)	Make
GHe Pneumatic servicing rig											
1.	ER1	For AGB & SGB charging	Direct ER with area ratio loader piston/ Diaphragm sensing Control: Microprocessor-based closed loop PID control Control stability: Tunable via PID parameters	BSPP/ Metric	15NB X 160SCH	150	±0.1% of full scale or better	335	400	1	TESCOM/ Equivalent

10. Solenoid valve Details

Table 30: List of Solenoid valves

S. No	Tag No	Purpose	Type of valve	End connections Inlet, Outlet, & Vent	MOC	Nominal Operating voltage	Min Bore (DN) mm	MOP (Bar)	PN BAR	Quantity (Nos)	Make
GHe Pneumatic servicing rig											
1.	VS1	For operating EP1	3-Way Dual coil & Low Power	BSPP/Metric / NPT	SS316	24VDC	6	10	10	1	Asco/ IMI/ Equivalent
2.	VS2	For operating EP2	3-Way Dual coil & Low Power	BSPP/Metric	SS316	24VDC	6	10	10	1	Asco/ IMI/ Equivalent
3.	VS3	For operating EP3	3-Way Dual coil & Low Power	BSPP/Metric	SS316	24VDC	6	10	10	1	Asco/ IMI/ Equivalent
4.	VS4	For operating EP4	3-Way Dual coil & Low Power	BSPP/Metric	SS316	24VDC	6	10	10	1	Asco/ IMI/ Equivalent
5.	VS5	For operating EP5	3-Way Dual coil & Low Power	BSPP/Metric	SS316	24VDC	6	10	10	1	Asco/ IMI/ Equivalent

S. No	Tag No	Purpose	Type of valve	End connections Inlet, Outlet, & Vent	MOC	Nominal Operating voltage	Min Bore (DN) mm	MOP (Bar)	PN BAR	Quantity (Nos)	Make
6.	SV1	Located at PTC inlet	2-Way Single/ Dual coil & Low Power	BSPP/Metric	SS316	24VDC	6	400	400	1	Asco/ IMI/ Equivalent

11. Pressure Transmitter Details

Table 31: List of Pressure Transmitter

Sr. No	Tag No	Service	Entry	MOP bar(g)	End Connection Size/Type	Range bar(g)	Qty. (Nos)	Make
GHe Pneumatic servicing rig								
1.	PT1	LOX tank pressurization	BOTTOM	9	BSPP/Metric	0-50	1	Rosemount / Honeywell/Equivalent
2.	PT2	LH2 tank pressurization	BOTTOM	9	BSPP/Metric	0-50	1	Rosemount /Honeywell/Equivalent
3.	PT3	SGB charging	BOTTOM	260	BSPP/Metric	0-500	1	Rosemount /Honeywell/Equivalent
4.	PT4	AGB charging	BOTTOM	335	BSPP/Metric	0-500	1	Rosemount /Honeywell/Equivalent
5.	PT5	To monitor the command	BOTTOM	9	BSPP/Metric	0-50	1	Rosemount /Honeywell/Equivalent

Sr. No	Tag No	Service	Entry	MOP bar(g)	End Connection Size/Type	Range bar(g)	Qty. (Nos)	Make
		supply pressure to Ep's						
6.	PT6	Located at the downstream of ER	BOTTOM	335	BSPP/Metric	0-500	1	Rosemount /Honeywell/Equivalent
7.	PT7	To monitor the command supply pressure to stage valves	BOTTOM	50	BSPP/Metric	0-500	1	Rosemount /Honeywell/Equivalent

12. Tube Fitting Details

Table 32: Tube Fitting Details

S. No	Tag No	Purpose	End connection	MOC	MOP Bar (g)	PN Bar (g)	Preferred make	Quantity (No's)
GHe Pneumatic servicing rig								
1	Tube fittings	To interconnect the lines of PTC as per P&I	BSPP/ Metric	SS 316L	335	400	SAWAL/ Equivalent	As per P&I diagram **(Ref. Sketch 2)**

13. PTC Tubing Details

Table 33: PTC Tubing Details

S. No	Tag No	Purpose	Material	Size	End connection	MOP Bar (g)	PN bar	Preferred make	Actual Qty. (No's)
1	Tubing 1	PTC to Rack-1 **(Ref. Sketch 5, 1&2)**	SS316L as per ASTM A269	OD: ½" x 2.11 mm wall thickness	Metric (M18 x 1.5)	335	400	Sandvic/ Ratnamani/ Equivalent	360+36 m
2	Tubing 3	PTC to Rack-4 for LH2 Tank Pr. monitoring	SS316L as per ASTM A269	OD: ½" x 2.11 mm wall thickness	Metric (M18 x 1.5)	6	10	Sandvic/ Ratnamani/ Equivalent	30+3m
3	Tubing 4	PTC to Rack-2 **(Ref. Sketch 6, 1&2)**	SS316L as per ASTM A269	OD: ½" x 2.11 mm wall thickness	Metric (M18 x 1.5)	335	400	Sandvic/ Ratnamani/ Equivalent	90+9m
4	Tubing 5	PTC to Rack-3 **(Ref. Sketch 7, 1&2)**	SS316L as per ASTM A269	OD: ½" x 2.11 mm wall thickness	Metric (M18 x 1.5)	6	10	Sandvic/ Ratnamani/ Equivalent	80+8m
5	System Tubes 1	For interfacing PTC rack to test ports of Stage, for servicing	SS316L as per ASTM A269	OD: 1/2" x 2.11 mm wall thickness, 5m length	With end fittings of M18x1.5(F) to M18x1.5(F)	335	400	Sandvic/ Ratnamani/ Equivalent	20 no's
					With end fittings of M18x1.5(F) to M20x1.5(F)	335	400		5

S. No	Tag No	Purpose	Material	Size	End connection	MOP Bar (g)	PN bar	Preferred make	Actual Qty. (No's)
6	System Tubes 2	For interfacing PTC rack to test ports of Stage, for servicing	SS316L as per ASTM A269	OD: 1/2" x 2.11 mm wall thickness, 3m length	With end fittings of M18x1.5(F) to M18x1.5(F)	335	400	Sandvic/ Ratnamani/ Equivalent	80 no's
7	PTC tubing	PTC internal tubes	SS316L as per ASTM A269	15NBx160SCH (pipe)	Metric	335	400	Sandvic/ Ratnamani/ Equivalent	20+2m
				OD: 19.05mm x 2.87 mm wall thickness					25+5m
				OD: 6.35mm x 1.20 mm wall thickness					35+5m
8	SS Pipe	PTC to Rack-1 for LOX tank prn. (C10HR1) **(Ref. Sketch 5, 1&2)**	SS316L as per ASTM A269	25NPS x 40SCH	Metric (M18 x 1.5)	9	25	Sandvic/ Ratnamani/ Equivalent	20+2m
		PTC to Rack-1 for LH2 tank prn. (C11HR1) **(Ref. Sketch 5, 1&2)**	SS316L as per ASTM A269	25NPS x 40SCH	Metric (M18 x 1.5)	9	25	Sandvic/ Ratnamani/ Equivalent	20+2m

Note: *Quantity of SS Pipes is indicative only. Quantity may vary +/- 10% according to actual site conditions. Adaptors sizes and quantity mentioned in the drawings are indicative only. However, it is in Scope of party to arrange suitable adaptors for assembly of all flow components as per actual site conditions with prior approval of department.*

14. Hose Details (Corrugated Metallic hoses)

Table 34: Hose details

S. No	Tag No	Size	End connection	Type	MOP Bar (g)	PN bar	Preferred make	Actual Qty. (No's)
1	PTC vent hoses	1" size, 3 m long	M18 x 1.5	SS wire braided (single)	10	16	INSAP/ Madras Hydraulics/ Equivalent	3
2	System vent hoses	½" size, 3 m long	M18 x 1.5	SS wire braided (single)	10	16	INSAP/ Madras hydraulics/ Equivalent	3
		½" size, 3 m long		SS wire braided (Double)	50	100		
3	System pressurization hoses (LH2)	OD: 35.5, DN25 (1") 3 m long	Suitable conversion adapter to M18 x 1.5	SS wire braided (single)	9	25	INSAP/ Madras hydraulics/ Equivalent	1
4	System pressurization hoses (LOX)	1-1/4" size, 3 m long	Suitable conversion adapter to M18 x 1.5	SS wire braided (single)	9	25	INSAP/ Madras hydraulics/ Equivalent	1

S. No	Tag No	Size	End connection	Type	MOP Bar (g)	PN bar	Preferred make	Actual Qty. (No's)
5	Vent header	Size: 80 NB **(Ref. Sketch 8)**	With end fittings as per the sketch	SS 316L	10	25	-	1

15. Portable Pressure Monitoring Panel (PPMP):

Table 35: Portable Pressure Monitoring Panel (PPMP)

S. No	Tag No	Specification	End connection	Preferred make	Actual Qty. (No's)
1	Portable pressure monitoring panel	Operating pressure range: 1-10 bar	With end fittings	Material: SS316L	1
2	Fabrication of panels, racks, assembly of components and testing at factory	As per **Sketch 10**		MS structure/ Powder coated AL sheets/ SS sheets	As per requirement

Note: Customs duty exemption certificate for imported items may be provided.

16. Electrical Components details

Table 36: Electrical Components

S. No	Tag No	Specification	Preferred make	Actual Qty. (No's)
1	Power Supply	0-60V, 0-14 amp	Lambda/ Equivalent	2
2	Single way, 4 pole Relay	24V DC, 7 amp	OEN/ Equivalent	1
3	Two way, 4 pole Relay	24V DC, 7 amp	OEN/ Equivalent	1

Annexure- 6

Supply of Spares for Pneumatic Test Console (Table no. 37 to 50)

Table 37: List of Pressure Regulators Spares:

Sr. No	Tag No	Spare Regulators Qty (Nos)	Spare kits (Nos)	Remarks
1	PR1H	1	2	**Model numbers shall be same as selected in the rigs.**
2	PR3H	1	2	
3	PR4H	1	2	
4	PRL	1	2	
Note: Spare kits of pressure regulator consists of Poppet, springs, O-rings and other seals as applicable.				

Table 38: List of Safety Relief Valve Spares:

Sr. No	Tag No	Spare safety relief valves (Nos)	Spare kits (Nos)	Remarks
1.	VR1H	**1**	**2**	**Model numbers shall be same as selected in the rigs.**
2.	VR2H	**1**	**2**	
3.	VR3H	**1**	**2**	
4.	VR4H	**1**	**2**	
5.	VR6H	**1**	**2**	
6.	VR7H	**1**	**2**	
7.	VR8H	**1**	**2**	

Sr. No	Tag No	Spare safety relief valves (Nos)	Spare kits (Nos)	Remarks
8.	VR1L	**1**	**2**	
9.	VR2L	**1**	**2**	
10.	VR3L	**1**	**2**	
11.	VR4L	**1**	**2**	
Note: Spare kits of safety relief valve consists of Poppet/disc, springs, nozzles/seat, O-rings as applicable.				

Table 39: List of Manual Valve Spares:

Sr. No	Tag No	Purpose	Type of Manual valve	End connection		Flow rate NM3/Hr	Min.Operating pressure for sizing Bar(g)	PN BAR	Spares Quantity (Nos)
				Inlet	Outlet				
1.	VM3H	For supplying command pressures to stage valves	Needle	BSPP /Metric		50	50	100	1
2.	VM10H/ VM11H	For LOX tank charging	**Globe**	BSPP /Metric		500	9	25	1
3.	VM14H	For AGB charging	Needle	BSPP or Metric		150	335	400	1
4.	VM21H	Isolation for PR1H	Needle	BSPP or Metric		150	400	400	1
5.	VM23H	GHe inlet	Needle	BSPP or Metric		550	400	400	1
6.	VM3HV	For venting command pressures from stage valves	Needle	BSPP or Metric		50	50	100	1

Sr. No	Tag No	Purpose	Type of Manual valve	End connection		Flow rate NM3/Hr	Min.Operating pressure for sizing Bar(g)	PN BAR	Spares Quantity (Nos)
				Inlet	Outlet				
7.	VM11HV	For LH2 tank venting	Needle	BSPP or Metric		50	9	25	1
8.	VM3L	For supplying low pressures of 0.3 to 5.5 bar (g) to various stage fluid circuits	Needle	BSPP or Metric		50	6	10	1
9.	VM1HS	Gas sampling port for LOX tank	Needle	BSPP or Metric		50	2.5	10	1
10.	VM14HS	Gas sampling port for AGB	Needle	BSPP or Metric		50	335	400	1
Note: Spare Kits consists of Stem seal, body seal and other soft seals as applicable									

Table 40: List of Check valves

S. No	Tag No	Purpose	Size	Type	End connection	Min Operating pressure, bar	PN bar	Preferred make	Spare Qty. (No's)
1	VC1	To avoid the GN_2 admission towards GHe side	15NB x 160 SCH	Spring loaded poppet (In-line)	BSPP or Metric	400	400	Swagelok/ Parker/ Equivalent	1
2	VC2	To avoid the atm. Entry into the service line containing 3-way EP valve	15NB x 160 SCH	Spring loaded poppet (In-line)	BSPP or Metric	50	100	Swagelok/ Parker/ Equivalent	1

Table 41: List of Filter Spares:

Sr. No	Type	PN	Micron Rating (abs)	Mesh MOC SS	Inlet & out let pipes Size (dia x thick)	End connection	Spare Quantity* (Nos)	Filter elements & seals kits (Nos)	Remarks
GHe Pneumatic servicing rig									
1.	Mesh	400	5	304L/316L	15NB x 160 SCH	(M18x1.5)	1	1	**Model number shall be same as selected in the rigs**
2.	Mesh	400	10	304L/316L	Φ12.7 x 2.11	(M18x1.5)	1	2	
3.	Mesh	100	20	304L/316L	Φ12.7 x 2.11	(M18x1.5)	1	2	
4.	Mesh	25	10	304L/316L	Φ12.7 x 2.11	(M18x1.5)	1	2	
5.	Mesh	10	10	304L/316L	Φ12.7 x 2.11	(M18x1.5)	1	2	

Note: Spare Kits consists of filter elements and seals as applicable.

***Spare quantity means the full set of filter (Filter body including Filter element as integral part with suitable conversion adapters)**

Table 42: List of Pressure Gauge Spares:

Sr. No	Tag No	MOP bar(g)	Range bar(g)	Resolution bar (g)	Accuracy Class	Dial Size (mm)	End Connection	Mounting	Spare Quantity (Nos)
1.	PG1H	2.5	0-4	0.02	0.25%	160	M20X1.5	Panel mount	1
2.	PG3H	50	0-100	0.5	0.25%	160	M20X1.5	Panel mount	1

Sr. No	Tag No	MOP bar(g)	Range bar(g)	Resolution bar (g)	Accuracy Class	Dial Size (mm)	End Connection	Mounting	Spare Quantity (Nos)
3.	PG10H	9	0-20	0.2	0.25%	160	M20X1.5	Panel mount	1
4.	PG12H	70	0-160	1.0	0.25%	160	M20X1.5	Panel mount	1
5.	PG13H	260	0-400	2.0	0.25%	160	M20X1.5	Panel mount	1
6.	PG19H	400	0-600	5.0	0.25%	160	M20X1.5	Panel mount	1
7.	PGV1L	5	-1-9	0.2	1.0%	160	M20X1.5	Panel mount	1
8.	PG7L	1.80	0-2.5	0.02	0.25%	160	M20X1.5	Panel mount	1
9.	PG9L	1	0-1.6	0.01	0.25%	160	M20X1.5	Panel mount	1
10.	PG11L	5	0-10	0.05	0.25%	160	M20X1.5	Panel mount	1

Table 43: List of Pressure Switches Spares

Sr. No	Tag No	Service	Operating Pressure in bar(g)	Pressure range, bar	End connection Inlet & Outlet	Make	Spare quantity (No's)
1.	PS2H	For LH2 tank	$1.0\text{-}5.0^{\pm 0.1}$	0-10	BSSP/Metric	Switzer/ Wika/ Equivalent	1
2.	PS4H	For LH2 tank charge line	$6.6^{\pm 0.3}$	0-10	BSSP/Metric		1

Table 44: List of EP Valve Spares:

Sr. No	Type	End connections		Inlet & Outlet pipe size, mm	MOP (bar)	PN (bar)	Spares Valves Quantity (Nos)	Spare kits (Nos)	Remarks
		Inlet size	Outlet size						
1.	Two-way electro pneumatic reduced bore ball valves	½" BSPP/Metric		Φ12.7 x 2.11	335	400	1	2	**Model number shall be same as selected in the rigs**
2.	Two-way electro pneumatic reduced bore ball valves	½" BSPP/Metric		Φ12.7 x 2.11	9	25	1	2	
3.	Three-way electro pneumatic reduced bore ball valves	½" BSPP/Metric		Φ12.7 x 2.11	50	100	-	1	
Note: Spare Kits consists of Stem seal, body seal, seat, ball and other soft seals as applicable.									

Table 45: List of Electronic Regulator Spares:

Sr. No	Tag No	End connections		Inlet & Outlet pipe size (DN)	MOP (Bar)	PN (BAR)	Spares Valves Quantity (Nos)	Spare kits (Nos)	Remarks
		Inlet	Outlet						
1.	Two-way electro pneumatic reduced bore ball valves	BSPP/Metric		15NB X 160SCH	335	400	1	2	**Model number shall be same as selected in the rigs**
Note: Spare Kits consists of Stem seal, body seal, seat, ball and other soft seals as applicable.									

Table 46: List of Solenoid Valve Spares:

Sr. No	Type of valve	End connections Inlet, Outlet, & Vent ,	MOC	Operating voltage	Min.Bore (DN) mm	MOP (Bar)	PN (BAR)	Spare Quantity (Nos)
1.	3-Way Dual coil & Low Power	BSPP/Metric	SS316	24VDC	6	10	10	1
2.	2-Way Dual coil & Low Power	BSPP/Metric	SS316	24VDC	6	400	400	1
Note : Spare make and model numbers shall be same as main flow components selected for pneumatic servicing rig .There shall be no change in the make and model numbers.								

Table 47: List of Pressure Transmitter Spares:

Sr.No	Type	Entry	MOP bar(g)	End Connection Size/Type	Range bar(g)	Spares Quantity (Nos)	Remarks
1.	High Pressure Transmitters	BOTTOM	335	BSPP/Metric	0-500	1	**Model number shall be same as selected in the rigs.**
2.	Low Pressure Transmitters	BOTTOM	9	BSPP/Metric	0-50	1	

Table 48: PTC Tubing Spares Details

S. No	Tag No	Purpose	Material	Size	End connection	MOP Bar (g)	PN bar	Preferred make	Spare Qty. (No's)
1	System Tubes 1	For interfacing PTC rack to test		OD: 1/2" x 2.11 mm wall	With end fittings of	335	400		5 no's

S. No	Tag No	Purpose	Material	Size	End connection	MOP Bar (g)	PN bar	Preferred make	Spare Qty. (No's)
		ports of Stage, for servicing	SS316L as per ASTM A269	thickness, 5m length	M18x1.5(F) to M18x1.5(F)			Sandvic/ Ratnamani/ Equivalent	
					With end fittings of M18x1.5(F) to M20x1.5(F)	335	400		2
2	System Tubes 2	For interfacing PTC rack to test ports of Stage, for servicing	SS316L as per ASTM A269	OD: 1/2" x 2.11 mm wall thickness, 3m length	With end fittings of M18x1.5(F) to M18x1.5(F)	335	400	Sandvic/ Ratnamani/ Equivalent	10 no's

Table 49: Hose Spares details

S. No	Tag No	Size	End connection	Type	MOP Bar (g)	PN bar	Preferred make	Spare Qty. (No's)
1	PTC vent hoses	1" size, 3 m long	M18 x 1.5	SS wire braided (single)	10	16	INSAP/ Madras Hydraulics/ Equivalent	1
2	System vent hoses	½" size, 3 m long	M18 x 1.5	SS wire braided (single)	10	16	INSAP/ Madras hydraulics/ Equivalent	1

S. No	Tag No	Size	End connection	Type	MOP Bar (g)	PN bar	Preferred make	Spare Qty. (No's)
		½" size, 3 m long		SS wire braided (Double)	50	100		
3	System pressurization hoses (LH2)	OD: 35.5, DN25 (1") 3 m long	Suitable conversion adapter to M18 x 1.5	SS wire braided (single)	9	25	INSAP/ Madras hydraulics/ Equivalent	1
4	System pressurization hoses (LOX)	1-1/4" size, 3 m long	Suitable conversion adapter to M18 x 1.5	SS wire braided (single)	9	25	INSAP/ Madras hydraulics/ Equivalent	1
5	Vent header	Size: 80 NB **(Ref. Sketch 8)**	With end fittings as per the sketch	SS 316L	10	25	-	-

Table 50: Electrical Components

S. No	Tag No	Specification	Preferred make	Spare Qty. (No's)
1	Single way, 4 pole Relay	24V DC, 7 amp	OEN/ Equivalent	1
2	Two way, 4 pole Relay	24V DC, 7 amp	OEN/ Equivalent	1

Annexure- 7

Tentative Quality Assurance Plan for flow components

(For flow components, piping/ tubing elements, fabrication, testing and assembly)

Note: Tentative QAP is given below. However final QAP shall be mutually agreed and finalized before the order placement. Party shall submit the QAP along with the Techno-commercial bid.

Table 51: Tentative QAP for Pressure Regulators

Sr. No	Characteristics	Ref. Document Acceptance Criteria	Method of check	Quantum of check/type Manufacturer's QC	 SHAR
1	Quantity and model number	**Quantity:** As per Table **21 & 37** **Make:** As submitted as part of offer **Model number:** As per the finalized list of model numbers	Verification of quantity & model numbers	V 100%	R 100%
2	Bill of material	Approved drawing	▪ Verification of material of constructional valve elements ▪ Review material confirmatory certificates from manufacturer for soft seals	V 100%	R 100%
3	Material test certificates of regulator elements	As per ASTM standards /equivalent one per each heat or lot number	Review of MTCs/Reports	R 100%	R 100%
4	Dimensional & visual inspection	Approved drawing	Measurement using tools	W 100%	R 100%
5	Body Hydro test of body	All bodies shall undergo 1.5 Times design pressure	Testing on RIG	W 100 %	R 100%

Sr. No	Characteristics	Ref. Document Acceptance Criteria	Method of check	Quantum of check/type Manufacturer's QC	 SHAR
		Spec.: No pressure drop for 10min			
6	Seat Pneumatic test at Maximum inlet pressure	maximum inlet pressure and no load and maximum outlet pressure **Spec.: Bubble tight**	Testing on RIG	W 100%	R 100%
7	Body Pneumatic test at MOP with all elements assembled condition	At Maximum inlet pressure and maximum outlet pressure **as per table 5** **Spec.: No leak indication with snoop**	Testing on RIG	W 100%	R 100%
8	Oxygen cleaning	**As per CGA 4.1/ASTM G G93 /Equivalent**	Cleaning using approved procedures and agents	W 100%	R 100%
9	Review of Cv and failure flow rate calculations	As per the tender document specification and table 5&21	Review	R 100%	R 100%
10	Final Documentation	**As per PO (3 Copies)**	Verification of Documents/ Certificates	V 100%	R 100%

Table 52: Tentative QAP for Safety Relief Valves

Sr. No	Characteristics	Ref. Document/Acceptance criteria	Method of check	Quantum of check/type Manufacturer's QC	 SHAR
1	Quantity and make model number	**Quantity:** As per table **22 & 38** **Make:** As submitted as part of offer **Model number:** As per the finalized list of model numbers	Verification make model& quantity	V 100%	R 100%

Sr. No	Characteristics	Ref. Document/Acceptance criteria	Method of check	Quantum of check/type	
				Manufacturer's QC	SHAR
2	Bill of material	Approved drawing	Verification of material of constructional valve elements as per approved drawings& material confirmatory certificates from manufacturer	V 100%	
3	Material test certificates of safety relief valve elements	As per ASTM standards /equivalent one per each lot or heat number	Review of MTCs/Reports	R 100%	R 100%
4	Dimensional & visual inspection	Approved drawing	Measurement using tools	W 100%	R 100%
5	Body Hydro test	1.5 times MOP **Spec.: No pressure drop for 10min**	Testing on RIG	W 100 %	R 100%
6	Body Pneumatic test at MOP with all elements assembled condition	At Maximum operating pressure as per table 22 & 22A **Spec: No leak indication with snoop**	Testing on RIG	W 100%	R 100%
7	Set pressure & Seat pneumatic test	1.1 times MOP(g)as per table 7 **Spec.: Variation is ±3% above 5bar** At MOP(g)**as per table 6** **Spec.: As per the API 527 part 1/Equivalent**	Testing on RIG	W 100%	R 100%
8	Oxygen cleaning	**As per CGA 4.1/ASTM G G93 /Equivalent**	Cleaning using approved procedures and agents	W 100%	R 100%
9	Final Documentation	**As per P O (3Copies)**	Review of Documents/ Certificates	R 100%	R 100%

Table 53: Tentative QAP for Manual (Needle & Globe) Valves

Sr. No	Characteristics / type of check	Ref. Document	Method of check	Quantum of check/type	
				Manufacturer's QC	SHAR
1	Quantity, make and model number	**Manual Valves (Needle & Globe) Quantity:** As per table **23 & 39** **Make:** As submitted as part of offer **Model number:** As per the finalized list of model numbers	Verification of quantity, make and model	V 100%	R 100%
2	Material test certificates	As per ASTM standards: one per each lot or heat	Review of MTCs/Reports	R 100%	R 100%
3	Bill of material	As per Approved drawing.	Verification of material of constructional valve elements as per approved drawings and manufacturer's confirmatory certificates	V 100%	V 100%
4	Dimensional & visual inspection	Approved drawing	Measurement using tools	W 100%	R 100%
5	Body /shell Hydro test	BSEN-ISO-12266 Part 1/ API 598 **Spec.: No drop for 10min.**	Testing on RIG	W 100 %	R 100%
6	Seat Pneumatic test at PN rating in both directions	BSEN-ISO-12266 Part 1/ API 598 **Spec.: Bubble tight**	Testing on RIG	W 100%	R 100%
		BSEN-ISO-12266 Part 1/	Testing on RIG	W	R

Sr. No	Characteristics / type of check	Ref. Document	Method of check	Quantum of check/type	
				Manufacturer's QC	SHAR
7	Body Pneumatic test at PN rating	API 598 **Spec.: No leak indication with snoop**		100%	100%
8	Oxygen cleaning	**As per CGA 4.1/ASTM G G93 /Equivalent**	Cleaning using approved procedures and agents	W 100%	R 100%
9	Final Documentation	As per approved P O	Review of Documents/ Certificates	V 100 %	R 100%

Table 54: Tentative QAP for Check Valves

Sr. No	Characteristics / type of check	Ref. Document	Method of check	Quantum of check/type	
				Manufacturer's QC	SHAR
1	Quantity, make and model number	**Check Valves Quantity:** As per Table **24 & 40** **Make:** As submitted as part of offer **Model number:** As per the finalized list of model numbers	Verification of quantity, make and model	V 100%	R 100%
2	Material test certificates	As per ASTM standards: one per each lot or heat	Review of MTCs/Reports	R 100%	R 100%
3	Bill of material	As per Approved drawing.	Verification of material of constructional valve elements as per approved drawings and manufacturer's confirmatory certificates	V 100%	V 100%

Sr. No	Characteristics / type of check	Ref. Document	Method of check	Quantum of check/type	
				Manufacturer's QC	SHAR
4	Dimensional & visual inspection	Approved drawing	Measurement using tools	W 100%	R 100%
5	Back Pressure test	As per ASTM standards/ IS14846	Conduct back pressure test to check the integrity	W 100%	R 100%
6	Performance checks	As per ASTM standards/ IS14846	Operational checks (3 times full open & full close)	W 100%	R 100%
7	Body /shell Hydro test	BSEN-ISO-12266 Part 1/ API 598/ IS14846 **Spec.: No drop for 10min.**	Testing on RIG	W 100 %	R 100%
8	Seat Pneumatic test at PN rating in both directions	BSEN-ISO-12266 Part 1/ API 598 **Spec.: Bubble tight**	Testing on RIG	W 100%	R 100%
9	Body Pneumatic test at PN rating	BSEN-ISO-12266 Part 1/ API 598 **Spec.: No leak indication with snoop**	Testing on RIG	W 100%	R 100%
10	Oxygen cleaning	**As per CGA 4.1/ASTM G G93 /Equivalent**	Cleaning using approved procedures and agents	W 100%	R 100%
11	Final Documentation	As per approved P O	Review of Documents/ Certificates	V 100 %	R 100%

Table 55: Tentative QAP for Filters

Sr.No	Characteristics / type of check	Ref. Document Acceptance Criteria	Method of check	Quantum of check/type Manufacturer's QC	 SHAR
1	Quantity, make and model number	**Quantity:** As per table **25 & 41** **Make:** As submitted as part of offer **Model number:** As per the finalized list of model numbers	Verification of quantity, make and model	V 100%	R 100%
2	Bill of material	Approved drawing.	Verification of material of constructional filter elements as per approved drawings& material confirmatory certificates from manufacturer	V 100%	R 100%
3	Material test reports of the filter elements	As per ASTM standards /equivalent one per each lot or heat number	Verification of MTCs/Reports	R 100%	R 100%
5	Dimensional & visual inspection	Approved drawing	Measurement using tools	W 100%	R 100%
6	Body Hydro test	1.5 Times MOP **Spec.: No pressure drop for 10min**	Testing on RIG	W 100 %	R 100%
7	Body Pneumatic test at MOP with all elements assembled condition	At Maximum operating pressure **Spec.: No leak indication with snoop**	Testing on RIG	W 100%	R 100%
8	Bubble point & Multi pass test of filter elements	As per the ISO 2942/equivalent Shall meet the 5 & 10 micron rating	Testing on RIG	W 100%	R 100%

Sr.No	Characteristics / type of check	Ref. Document Acceptance Criteria	Method of check	Quantum of check/type Manufacturer's QC	 SHAR
9	Collapsibility test of filter elements **(if the test already done and meeting the specification, certificate shall be submitted for review)**	As per the ISO 2941/equivalent **one per each model of filter element)** **Spec.: Shall with stand maximum of 5bar in both directions**	Testing on RIG	W/R 1 per each model	R 100%
10	Oxygen cleaning	**As per CGA 4.1/ASTM G G93 /Equivalent**	Cleaning using approved procedures and agents	W 100%	R 100%
11	Final Documentation	**As Per PO (3Copies)**	Verification of Documents/ Certificates	V 100%	R 100%
Note: All bubble point, collapsibility test, multi pass test shall be carried out at CMTI, Bangalore for one model.					

Table 56: Tentative QAP for Pressure Gauges

Sr. No	Characteristics / type of check	Ref. Document Acceptance Criteria	Method of check	Quantum of check/type Manufacturer's QC	 SHAR
1	Quantity, make and model number	**Quantity:** As per table **26 & 42** **Make:** As submitted as part of offer **Model number:** As per the finalized list of model numbers	Verification of quantity, make and model	V 100%	R 100%
2	Bill of material	Approved drawing.	Verification of material of constructional Pressure gauges as per approved drawings& material confirmatory certificates from manufacturer	V 100%	R 100%

Sr. No	Characteristics / type of check		Ref. Document Acceptance Criteria	Method of check	Quantum of check/type Manufacturer's QC	 SHAR
3	Material test reports		As per ASTM standards /equivalent one per each lot or heat number	Verification of MTCs/Reports	R 100%	R 100%
4	Specification of gauge & visual inspection		As per PO	Visual verification or with tools	W 100%	R 100%
5	Weather proofness for case		IS: 13947 IP: 65	Type test	W 100 %	R 100%
6	Sensing element material & socket material		Guidelines for sampling tests	Chemical analysis	W 100%	R 100%
7	**Gauge Performance**	Calibration at 5 points along with span	Set point accuracy within ±0.25% of fsd NABL traceable calibration shall be provided	Comparison method	W 100%	R 100%
		Over range check	Test report	Testing		
		workmanship	Co Stds.	Observation		
8	Oxygen cleaning		**As per CGA 4.1/ASTM G G93 /Equivalent**	Cleaning using approved procedures and agents	W 100%	R 100%
9	Final Documentation		**As Per PO (3Copies)**	Verification of Documents/ Certificates	V 100%	R 100%

Table 57: Tentative QAP for Pressure Switches

Sr. No	Characteristics / type of check	Ref. Document Acceptance Criteria	Method of check	Quantum of check/type	
				Manufacturer's QC	SHAR
1	Quantity, make and model number	**Quantity:** As per table **27 & 43** **Make:** As submitted as part of offer **Model number:** As per the finalized list of model numbers	Verification of quantity, make and model	V 100%	R 100%
2	Bill of material	Approved drawing.	Verification of material of constructional Pressure switches as per approved drawings& material confirmatory certificates from manufacturer	V 100%	R 100%
3	Material test reports	As per ASTM standards /equivalent one per each lot or heat number	Verification of MTCs/Reports	R 100%	R 100%
5	Specification of Pressure switches & visual inspection	As per PO	Visual verification or with tools	W 100%	R 100%
6	Cleanliness check	ISO 15001/ ASTM G93 Oil- free & dry No particulate for GHe service	Testing on RIG	W 100 %	R 100%
7	Calibration at 5 points along with span	Set point accuracy within ±0.1% of span ISO/IEC 17025	Comparison method	W 100 %	R 100%
8	Body Pneumatic test at MOP with all elements assembled condition	At Maximum operating pressure as per ASME B31.3/ ISO 23555 **Spec.: No leak indication with snoop**	Testing on RIG	W 100%	R 100%

Sr. No	Characteristics / type of check	Ref. Document Acceptance Criteria	Method of check	Quantum of check/type Manufacturer's QC	 SHAR
9	Insulation Resistance	IEC 60947-5-1	>100MΩ at 500V DC between contacts/ ground	W 100%	R 100%
10	Oxygen cleaning	**As per CGA 4.1/ASTM G G93 /Equivalent**	Cleaning using approved procedures and agents	W 100%	R 100%
11	Final Documentation	**As Per PO (3Copies)**	Verification of Documents/ Certificates	V 100%	R 100%

Table 58: Tentative QAP for EP Ball Valves

Sr. No	Characteristics	Ref. Document Acceptance Criteria	Method of check	Quantum of check/type Manufacturer's QC	 SHAR
1.0Valve					
1.1.	Quantity, make and model number	**Quantity:** As per table 28 & 44 **Make:** As submitted as part of offer **Model number:** As per the finalized list of model numbers	Verification of quantity, make and model	V 100%	V 100%
1.2	Bill of material	Approved drawing.	Verification of material of constructional valve elements as per approved drawings and manufacturer's confirmatory certificates	V 100%	V 100%
1.3	Material test certificates of Valve elements	As per ASTM standards one per each lot /heat	Review of MTCs/Reports	R 100%	R 100%

Sr. No	Characteristics	Ref. Document Acceptance Criteria	Method of check	Quantum of check/type Manufacturer's QC	 SHAR
1.4	Dimensional & visual inspection	As per Approved drawing	Measurement using tools	W 100%	R 100%
1.5	Body Hydro test	BSEN-ISO-12266 Part 1/ API 598 **Spec.: No drop for 10min.**	Testing on RIG	W 100 %	R 100%
1.6	Seat Pneumatic test at PN rating	BSEN-ISO-12266 Part 1/ API 598 **Spec.: Bubble tight**	Testing on RIG	W 100%	R 100%
1.7	Body Pneumatic test at PN rating	BSEN-ISO-12266 Part 1/ API 598 **Spec.: No leak indication with snoop**	Testing on RIG	W 100%	R 100%
1.8	Oxygen cleaning	**As per CGA 4.1/ASTM G G93 /Equivalent**	Cleaning using approved procedures and agents	W 100%	R 100%
1.9	Final Documentation	As per approved P O	Review of Documents/ Certificates	R 100%	R 100%
2.0 Actuator					
1.2.2	Make & model number of actuator	As per the finalized model numbers	Verification of make and model	R 100%	R 100%
3.0 Micro switch & switch box					
3.1	Make of microswitch & switch box	As submitted in the offer	Verification of make and model	V 100 %	V 100 %
3.2	microswitch and switch box details and certificates verification	As submitted in the offer	Verification of microswitch internal and details as per technical specification	V 100 %	V 100 %

Table 59: Tentative QAP for Electronic Regulator

Sr. No	Characteristics	Ref. Document Acceptance Criteria	Method of check	Quantum of check/type Manufacturer's QC	 SHAR
1	Quantity and model number	**Quantity:** As per Table **29 & 45** **Make: As** submitted as part of offer **Model number:** As per the finalized list of model numbers	Verification of quantity & model numbers	V 100%	R 100%
2	Bill of material	Approved drawing	▪ Verification of material of constructional valve elements ▪ Review material confirmatory certificates from manufacturer for soft seals	V 100%	R 100%
3	Material test certificates of regulator elements	As per ASTM standards /equivalent one per each heat or lot number	Review of MTCs/Reports	R 100%	R 100%
4	Dimensional & visual inspection	Approved drawing	Measurement using tools	W 100%	R 100%
5	Body Hydro test of body	All bodies shall undergo 1.5 Times design pressure **Spec.: No pressure drop for 10min**	Testing on RIG	W 100 %	R 100%
6	Seat Pneumatic test at Maximum inlet pressure	maximum inlet pressure and no load and maximum outlet pressure **Spec.: Bubble tight**	Testing on RIG	W 100%	W/R 100%
7	Body Pneumatic test at MOP with all elements assembled condition	At Maximum inlet pressure and maximum outlet pressure **as per table 8**	Testing on RIG	W 100%	W/R 100%

Sr. No	Characteristics	Ref. Document Acceptance Criteria	Method of check	Quantum of check/type Manufacturer's QC	 SHAR
		Spec.: No leak indication with snoop			
8	Oxygen cleaning	**As per CGA 4.1/ASTM G G93 /Equivalent**	Cleaning using approved procedures and agents	W 100%	R 100%
9	Review of Cv and failure flow rate calculations	As per the tender document specification and table 4&14	Review	R 100%	R 100%
10	Final Documentation	**As per PO (3 Copies)**	Verification of Documents/ Certificates	V 100%	R 100%

Table 60: Tentative QAP for Solenoid Valves

Sl.No.	Component / Operation List	Characteristics checked &Type of Test	Reference Documents	Method of check	Quantum of Check /Scope of Inspection Manufacturer QC	 SHAR
1		Quantity, make and model number	**Quantity:** As per table **30 & 46** **Make:** As submitted as part of offer **Model number:** As per the finalized list of model numbers	Verification of quantity, make and model	V 100%	R 100%
1a.	Identification of raw material for valve block, Interlinking block (if any), with Mill test certificates along with Ultrasonic testing and Microstructure	Material Characteristics Chemical Mechanical Micro structure (Solution annealing)	As per PO, drawing & Relevant Standards	Review	R 100%	R 100%

Sl.No.	Component / Operation List	Characteristics checked &Type of Test	Reference Documents	Method of check	Quantum of Check /Scope of Inspection	
					Manufacturer QC	SHAR
	from NABL/Govt Approved labs					
1b.	Identification of raw material for solenoid housing & critical internal parts like core, core tube etc with Lab test & Mill test certificates respectively.	Material Characteristics 1. Chemical	As per PO, drawing & Relevant Standards	Review	R 100%	R 100%
1c.	Identify all the hex bolts and screws required with PMI report for material of construction.	Material of Construction 1. PMI	As per PO & Relevant Standards	Review	R 100%	R 100%
1d.	Identify all the soft seals required with Manufacturer or vendor compliance certificate for material of construction.	Material of Construction	As per PO & Relevant Standards	Review	R 100%	R 100%
2a.	Review of weather proof type test report of solenoid enclosure from Approved Govt agency.	1. Degree of Protection	As per PO & Relevant Standards	Review	R 100%	R 100%

Sl.No.	Component / Operation List	Characteristics checked &Type of Test	Reference Documents	Method of check	Quantum of Check /Scope of Inspection	
					Manufacturer QC	SHAR
3.	Painting of complete surface of valve body, Intermediate block, SOV housing & Mounting bracket.	1. Thickness of epoxy painting. 2. Surface Finish verification.	As per PO & Relevant Vendor Standards	Review	W 100%	R 100%
4.	Manufacturer can Sample One Number from each block (Valve, Interlinking & Namur) and test it in NABL/Govt Approved labs.	Material Characteristics 1. Chemical	As per PO, drawing & Relevant Standards	Visual	R 100%	R 100%
5.	Internal Testing & final inspection of Assembled solenoid valves	a. HV test of coil	As per Approved Test procedures.	Visual	W 100%	W/R 1Sample
		b. CR & IR test for coil	As per Approved Test procedures.	Visual	W 100%	W/R 1Sample
		c. Freewheeling diode testing and installation	As per Approved Test procedures.	Visual	W 100%	W/R 1Sample
		d. Polarity protection diode and surge suppressor testing and installation	As per Approved Test procedures.	Visual	W 100%	W/R 1Sample

Sl.No.	Component / Operation List	Characteristics checked &Type of Test	Reference Documents	Method of check	Quantum of Check /Scope of Inspection	
					Manufacturer QC	SHAR
		e. Functional testing of solenoid valve at maximum and minimum operating pressure and rated voltage.	As per Approved Test procedures.	Visual	W 100%	W/R 1Sample
		f. External leak at safe working pressure.	As per Approved Test procedures.	Visual	W 100%	W/R 1Sample
		g. Seat leak test at 1.1 times of MOP.	As per Approved Test procedures.	Visual	W 100%	W/R 1Sample
		h. Continuous energization	Continuous energization for 4 to 5 hours without pressure and perform operation test.	Visual	W 100%	W/R 1Sample
		i. Dimensional inspection for solenoid valve and its ports with Go & No-go gauge.	As per General Arrangement Drawing	Visual	W 100%	W/R 1Sample

Table 61: Tentative QAP for Pressure Transmitter

Sr. No	Characteristics / type of check	Ref. Document Acceptance Criteria	Method of check	Quantum of check/type	
				Manufacturer's QC	SHAR
1	Quantity, make and model number	**Quantity:** As per table **31 & 47** **Make:** As submitted as part of offer **Model number:** As per the finalized list of model numbers	Verification of quantity, make and model	V 100%	R 100%
2	Bill of material	Approved drawing.	Verification of material of constructional Pressure switches as per approved drawings& material confirmatory certificates from manufacturer	V 100%	R 100%
3	Material test reports	As per ASTM standards /equivalent	Verification of MTCs/Reports	R 100%	R 100%
5	Specification of Pressure Transmitter & visual inspection	As per PO	Visual verification or with tools	W 100%	R 100%
6	Cleanliness check	ISO 15001/ ASTM G93 Oil- free & dry No particulate for GHe service	Testing on RIG	W 100 %	R 100%
7	Calibration at 5 points along with span	Set point accuracy within ±0.075% of span ISO/IEC 60770/ Equivalent	Comparison method	W 100 %	R 100%
8	Structural integrity of pressure contained parts	1.5 Times MOP as per ASME B31.3/ B16.5 **Spec.: No pressure drop for 10min**	Testing on RIG	W 100 %	R 100%

Sr. No	Characteristics / type of check	Ref. Document Acceptance Criteria	Method of check	Quantum of check/type Manufacturer's QC	 SHAR
9	Body Pneumatic test at MOP with all elements assembled condition	At Maximum operating pressure as per ASME B31.3/ ISO 23555 **Spec.: No leak indication with snoop**	Testing on RIG	W 100%	R 100%
10	Insulation Resistance	IEC 60947-5-1	>100MΩ at 500V DC between contacts/ ground	W 100%	R 100%
11	Oxygen cleaning	**As per CGA 4.1/ASTM G G93 /Equivalent**	Cleaning using approved procedures and agents	W 100%	R 100%
12	Final Documentation	**As Per PO (3Copies)**	Verification of Documents/ Certificates	V 100%	R 100%

Table 62: Tentative QAP for Pipe fittings

Sr.NO	Characteristics/ type of check	Ref. Document	Method of check	Quantum of check Manufacturer's QC	 SHAR
1.0 Raw material					
1.1	Chemical testing of raw material one per each size or heat /lot numbers	ANSI 316L	Review of test certificates	R 100%	R 100%
1.2	Mechanical testing of raw material one per each size or heat /lot numbers	ASTM A 370	Review of test certificates	R 100%	R 100%

Sr.NO	Characteristics/ type of check	Ref. Document	Method of check	Quantum of check	
				Manufacturer's QC	SHAR
1.3	IGC testing one per each size and heat /lot number	ASTM A262 E	Review of test certificates	R 100%	R 100%
2.0 Finished product					
2.1	**Fittings manufactured shall be manufactured as per ASTM A403 WP 316L**				
2.2	Dimensions	As per ASME B 16.9&16.28	Verification	V 100%	W/R 100%
2.3	**Flanges shall be manufactured as per ASTM A182 F 316L**				
2.4	Dimensional	As per ASME B 16.5 and end shall be RF and spiral serration	Measurement using tools	W 100%	W/R 100%
2.5	Chemical testing of raw material one per heat /lot numbers of each size	ANSI 316L	Review of test certificates	R 100%	R 100%
2.6	Mechanical testing of raw material one per heat /lot numbers of each size	ASTM A 370	Review of test certificates	R 100%	R 100%
2.7	IGC testing one per heat /lot numbers of each size	ASTM A262 B	Review of test certificates	R 100%	R 100%
2.8	Solution annealing of the finished products	Shall be as per the standards	Review of heat charts	R 100%	R 100%
2.9	PMI of the identified fittings: one per each type, size and heat/lot number	As per 316L	Witness	W 100%	W 100%

Sr.NO	Characteristics/ type of check	Ref. Document	Method of check	Quantum of check	
				Manufacturer's QC	SHAR
2.10	Final documentation	Test reports of the above test	Review	R 100%	R 100%

Table 63: Tentative QAP for Machined Fittings

Sr.NO	Characteristics/ type of check	Ref. Document	Method of check	Quantum of check	
				Manufacturer's QC	SHAR
1.0 Raw material					
1.1	Mechanical testing one per each lot /heat of each size of raw material	▪ ASTM A182/276/479 F316 for fittings ▪ F316 **L only for weld type fittings**	Review of test certificates	R 100%	
1.2	Chemical analysis one per each lot /heat of each size of raw material		Review of test certificates	R 100%	R 100%
1.3	IGC testing one per each lot /heat of each size of raw material	▪ IGC Practice E test as per ASTM 262.	Review of test certificates	R 100%	R 100%
2.0 Finished products					
2.1	Dimensional and Visual inspection of threads and critical surfaces	▪ As per the approved drawings	Measurement and visual inspection	W 100%	W 100%
2.2	Chemical analysis one per each lot /heat of each size	▪ ASTM A182 /479/276F316 for fittings	Review of test certificates	R 100%	R 100%

Sr.NO	Characteristics/ type of check	Ref. Document	Method of check	Quantum of check	
				Manufacturer's QC	SHAR
2.3	IGC testing one per each lot /heat of each size	▪ IGC Practice A/C test as per ASTM 262	Review of test certificates	R 100%	R 100%

Table 64: Tentative QAP for Pipes and Tubes

Sr.No	Characteristics	Reference documents	Method of check	Quantum of check	
				Manufacturer's QC	SHAR
1.0Raw material					
1.1	Raw material test certificates per heat/lot with chemical, physical, and IGC test reports prior to production for each size	▪ For Pipes as per ASTM A312 TP 316L ▪ For tubes as per ASTM A269-07a TP316L ▪ As per ASTM A262 practice E for both pipes and tubes.	Review of Raw material certificates	R 100%	R 100%
2.0 After final production					
2.1	Heat treatment of pipes	▪ As per standard	Review of reports	R 100%	R 100%
2.2	Chemical & Mechanical analysis: one per heat/lot for each size for pipe and tube on selected samples	▪ For Pipes as per ASTM A312 TP 316L ▪ For tubes as per ASTM A269-07a TP316L	Review of Raw material certificates	R 100%	R 100%
2.3	IGC test: One per each heat/ lot for each pipe & tube size	▪ As per ASTM A262 practice E for both pipes and tubes.	Review of IGC reports	R 100%	R 100%

Sr.No	Characteristics	Reference documents	Method of check	Quantum of check	
				Manufacturer's QC	SHAR
2.4	Ultrasonic test on finished pipes. (For both Longitudinal & Transverse discontinues)	▪ For pipes as per ASTM E213/ASME sec V/ASTM A999.	Witnessing	W 100%	W/R 100%
2.5	Eddy current test on finished tubes.	▪ For tubes as per ASTM E426	Witnessing	W 100%	W/R 100%
2.6	Hydrostatic test	▪ For pipes as per ASTM A 530/ASTM A999. ▪ For tubes as per ASTM A 1016.	Witnessing	W 100%	W/R 100%
2.7	Pickling and Passivation	▪ As per ASTM A380 for both pipes and tubes.	Witnessing/Review of Pickling and passivation reports	W 100%	W/R 100%
2.8	Visual & Dimensional check	▪ As per ANSI B 36.19	Witnessing	W 100%	W/R 100%
1.2.9	Final Documentation	3 Copies of all test reports and manufacturing (cold pilgering) process certification by the manufacturer	Verification of Documents/ Certificates	V 100%	R 100%

Table 65: TENTATIVE QAP for Metallic Corrugated (SS) Hoses

Sr.No	Characteristics	Reference documents	Method of check	Quantum of check	
				Manufacturer's QC	SHAR
1.0Raw material					
1.1	Raw material test certificates per heat/lot with chemical, physical, and IGC test	▪ For Pipes as per ASTM A312 TP 316L	Review of Raw material certificates	R 100%	R 100%

Sr.No	Characteristics	Reference documents	Method of check	Quantum of check	
				Manufacturer's QC	SHAR
	reports prior to production for each size	▪ For tubes as per ASTM A269-07a TP316L ▪ As per ASTM A262 practice E for both pipes and tubes.			
2.0 After final production					
2.2	Chemical & Mechanical analysis: one per heat/lot for each size for pipe and tube on selected samples	▪ For Pipes as per ASTM A312 TP 316L ▪ For tubes as per ASTM A269-07a TP316L	Review of Raw material certificates	R 100%	R 100%
2.3	IGC test: One per each heat/ lot for each pipe & tube size	▪ As per ASTM A262 practice E for both pipes and tubes.	Review of IGC reports	R 100%	R 100%
2.6	Hydrostatic test	▪ For pipes as per ASTM A 530/ASTM A999. ▪ For tubes as per ASTM A 1016.	Witnessing	W 100%	W/R 100%
2.8	Visual & Dimensional check	▪ As per ANSI B 36.19	Witnessing	W 100%	W/R 100%
1.2.9	Final Documentation	3 Copies of all test reports and manufacturing (cold pilgering) process certification by the manufacturer	Verification of Documents/ Certificates	V 100%	R 100%

Table 66: Tentative QAP for Fabrication and Qualification

Sr.NO	Characteristics / type of check	Ref. Document & Acceptance	Method of check	Quantum of check	
				Manufacturer's QC	SHAR
1.0 Prior to fabrication					
1.1	TIG Welding: Welding Procedure Scheme (WPS) & Procedure Qualification Record (PQR)	▪ Ref. Standard ASME Section IX	Witness/Review Review only when welder is already qualified	W 100%	W/R 100%
1.2	Welder Qualification Record (WQR)	▪ Acceptance of 6G qualified welder as per ASME Section IX ▪ PQR as per Ref. standard ASME Section IX		W/R 100%	W/R 100%
1.3	Mechanical clearance: MTCs of Pipes, pipe fittings and machined fittings	▪ As per the QAP of fittings, pipe and machined fittings	Review	R 100%	R 100%
2.0 During fabrication:					
2.1	Joint preparation and Fit up of the weld joints	▪ Fit-up as per drawing and but weld joint geometry as per ASME B16.25	Witness	W 100%	W/R 100%
2.2	Bending of the pipe lines for pipes <25NB	▪ Pipe bending shall be of Bend radius **3D to 4D**	Witness	W 100%	W/R 100%
2.3	TIG welding process	▪ As per Welding Procedure Scheme (WPS)	Witness	W 100%	R 100%
2.4	Dye Penetrant (DP) testing for root weld	▪ DP test as per ASME section V article 6	Witness by Level II (ISNT /ASNT)	W 100%	R 100%
2.5	Dye Penetrant (DP) testing for final weld joint			W 100%	W 100%

Sr.NO	Characteristics / type of check	Ref. Document & Acceptance	Method of check	Quantum of check	
				Manufacturer's QC	SHAR
2.6	Radiography testing of the weld joint and Interpretation	▪ X-RAY / Gamma Ray with 2-2T Sensitivity. Radiography procedure as per the standards ▪ Ref. Standard ASME BP&V Section V Section V article 2 ▪ **Acceptance as per Ref. Standard ASME B 31.3**	Interpretation by Level II (ISNT /ASNT)	R 100%	R 100%
2.7	Hydro static testing with DM water / Pneumatic strength testing of the pipes	▪ Hydro test at 1.5 X MOP. Hydro test as **per procedure** ▪ **Spec.: No pressure drop for 30 min**	Witness	W 100%	W 100%
2.8	Pickling and Passivation of external weld surfaces of weld joints and flushing with DM water	▪ Pickling & Passivation procedure number 2 ▪ Standard ASTM A380	Witness	W 100%	W 100%
2.9	Moisture check of pipelines after Pickling and Passivation	▪ Moisture check **as per procedure** ▪ **Spec.: Dryness shall be better than -60°C dew point (below 10ppm)**	Witness	W 100%	W 100%
2.10	Cleaning of Internal surfaces of pipes spools with IPA	▪ Oxygen cleaning prior to assembly to of flow components **as per approved procedure and medium**	Witness	W 100%	W 100%

Sr.NO	Characteristics / type of check	Ref. Document & Acceptance	Method of check	Quantum of check	
				Manufacturer's QC	SHAR
2.12	Contamination check of each pipelines	▪ Cleanliness check after hydrotest and prior to assembly as per **procedure** **Spec.: No visible particle or discoloration**	Witness	W 100%	W 100%

Table 67: Tentative QAP for Assembly and Testing

Sr.No	Characteristics/ Type of check	Ref. Document	Method of check	Quantum of check	
				Manufacturer's QC	SHAR
1.0 Assembly and leak checks					
1.1	Assembly of flow components (valves and regulators)	▪ As per P&ID of each equipment, pressure rating, end connection and finalized model numbers	Witness/Verification		
1.2	Assembly of filters	▪ As per the P&ID of each equipment, micron rating and finalized model numbers mentioned in tender document			
1.3	Ball run test of spools prior to assembly	▪ Pipe ID -3.5 mm ball shall pass through all spools (up to 15NB) ▪ For 6mm tube :1.5mm ball shall be used			
1.4	Assembly of qualified spool pieces	▪ As per the as built drawings		W 100%	W/R 100%

Sr.No	Characteristics/ Type of check	Ref. Document	Method of check	Quantum of check	
				Manufacturer's QC	SHAR
1.5	Pneumatic leak checks of all threaded or flanged joints	▪ At respective MOP of the line as mentioned equipment drawings with GN_2 medium **Spec.:** ▪ **No foam or frothing with snoop.**			
2.0	**Functional checks of valves and regulators**				
2.1	Operational checks of manual and EP valves	▪ Opening and closing of manual valves shall be with pressure ▪ Local status for EP valves functional checks	Witness	W 100%	W/R 100%
2.2	Seat leak check of all manual valves, EP valves	▪ At respective MOP of the line with GN_2 medium at the inlet of the valves **Spec.:** ▪ **No bubble formation when snoop foam is applied at the outlet**			
2.3	Seat leak check of pressure regulators	▪ At No load and respective MOP of the line with Maximum inlet pressure and GN_2 medium at the inlet of the regulator. **Spec.:** ▪ **No pressure rise in the downstream/outlet of for 15min**. Note: Other regulation path shall be kept unloaded while performing regulator seat leak checks of one path.			
3.0	**Condition, interface verification, Installation of orifices**				

Sr.No	Characteristics/ Type of check	Ref. Document	Method of check	Quantum of check	
				Manufacturer's QC	SHAR
3.1	Cleanliness check of all out lets	▪ Cleanliness check with banian cloth with sufficient flow through the cloth (lint free banian cloth shall be used) **Spec.: No visible particle or discoloration in the Babian cloth**	Witness	W 100%	W/R 100%
3.2	Interface verification of all out let interfaces of EVUs	▪ Size and pitch of the interfaces are as per the P&IDs ▪ **(Shall be checked with GO/NO GO gauges)**	Witness		
3.3	Installation of orifices after measurement using microscope	▪ As per the sizes given by SHAR	Witness	W 100%	W/R 100%
3.4	Tagging of elements and equipment	▪ As per the P&ID of equipment	Witness/ Verification	W 100%	V 100%
3.5	Wiring of Electrical connections of all equipment (Status/PS/PT/SOVs)	▪ As per the approved electrical drawings			
Note: Medium of leak check and purging shall be with GN_2 only					

V-Verification; R-Review; W-Witness

Annexure- 8

Bid Evaluation Criteria

(To be submitted by the bidder along with Technical Bid)

Sl. No	Description	Vendor Compliance with supporting documents
1.	The technical Bid submitted by the Bidders will be evaluated by the Department with reference to the technical specifications given in tender document. The Price Bids of only technically qualified bids would be considered.	
2.	During evaluation, SDSC SHAR may request Bidder for any additional clarification/document on the bid, if required	
3.	The scope of the work can't be separated. Hence, overall L1 (Sl. No. 1, 2 & 3) will be considered for bid evaluation.	
4.	The time schedule for completion is given in the Proposal document. Bidder is required to confirm the completion period unconditionally.	
5.	Department deserves the right to inspect the supplier site and verify the credentials, quoted by the party, during technical evaluation.	
6.	SDSC SHAR reserves the right to reject any bid if not meeting the technical/commercial requirements and terms & conditions. Such decisions by the SDSC SHAR shall bear no liability whatsoever consequent upon such decision	

	SIGNATURE	:	
	NAME	:	
	DESIGNATION	:	
SEAL OF THE COMPANY	DATE	:	

Annexure- 9

Technical Compliance

(To be submitted by the bidder as Part of Techno-commercial bid)

Bidder shall submit point wise acceptance to the following and shall submit the proofs for all points without which offer will not be considered.

S. No.	Description	Acceptance of Bidder
1.	The full scope of work is understood and agreeable. There are no deviations in our offer to the terms and conditions of the tender.	
2.	The bidder has to sign and submit a copy of all the pages of the tender document confirming his acceptance to all the specifications.	
3.	Procurement of items: Confirm to procure all PTC elements (Flow components, Pressure gauges, Pressure switches, Electronic regulators, EP Valves, Solenoid valves, etc.,) from the manufacturers or their authorized Dealer/agents only	
4.	Acceptance to Scope of Work includes Supply, Design, fabrication, assembly and integrated testing of equipment, inspection & Quality assurance and general guidelines are given in **Annexure-1**.	
	Acceptance of security deposit as per **Annexure-1**	
	Acceptance of warranty as per **Annexure-1**	
	Acceptance of LD clause as per **Annexure-1**	
	Acceptance of PBG as per **Annexure-1**	
5.	Acceptance to Bid submission, offer validity, Payment terms, delivery schedule, Bid evaluation criteria and other purchase terms and conditions are given in **Annexure-2.** Indication of clear payment option to be chosen by the party as stated in para no. 5 of **Annexure-2.**	
6.	Acceptance to technical specifications of Pneumatic Test Console as given in **Annexure-3.**	

S. No.	Description	Acceptance of Bidder
7.	Acceptance of technical specifications of flow components, and Pneumatic Test Console elements as given in **Annexure-4.**	
8.	Acceptance of the details of flow components in Pneumatic Test Console as given in **Annexure-5.**	
9.	Acceptance to flow components as per the P&I diagram	
10.	Acceptance of supply of spares for Pneumatic Test Console as given in **Annexure-6.**	
11.	Acceptance of tentative Quality Assurance Plan as per **Annexure-7.** However, final QAP shall be mutually agreed and finalized before order placement. Party shall submit the QAP along with the Techno commercial bid.	
12.	Acceptance of Bid evaluation criteria as per **Annexure-8.**	
13.	Party shall submit the details of the flow component Preferred make, constructional drawings, bore size, end connections and submit the technical specifications of the flow components as given in **Annexure-10**	
14.	Acceptance to the delivery schedule of **36 weeks** from the date of purchase order	
15.	For this procurement, bids from Class-I & class-II Local Suppliers are admissible under Preferred make in India clause as given in **Section-1.10 of Annexure-1**. Acceptance of this clause shall be confirmed by the bidder	
16.	Submit the documentary proof along with the bid: a. Registration certificate b. Profit & Loss statement and Balance sheet for the last three financial years. c. Financial Qualification requirements, to meet the pre-qualification criteria, as given in **section 1.2 of Annexure-2.**	
17.	A supplier who has been debarred for violation of MII clause order shall not be eligible, for preference under this order for procurement till the duration of the debarment.	

S. No.	Description	Acceptance of Bidder
18.	The percentage of local content should be specifically mentioned in the offer, without which it will be summarily rejected.	
19.	Preference will be given to Class-I Local supplier as per standard policy.	
20.	Total cost of the system shall be inclusive of all charges (eg. P&F, transportation, Testing, Customs duty and any other charges as applicable) **including GST** (Applicable HSN code shall be mentioned along with offer). **Reference format as per Table 3 & 3A of Annexure-2.** **All cost heads need to be mentioned explicitly and No extra cost/Additional shall be mentioned in the offer.** **Do not disclose any price related to offered product/spare, etc., in the technical bid. If such a price found in techno-commercial evaluation, offer shall be rejected.**	

Annexure- 10

Compliance to the flow components specifications
(To be submitted by the bidder)

Party shall submit the details of the flow component Preferred make, model number, bore size, working pressure and PN rating, end connections and submit the technical specifications of the flow component.

1. Pressure Regulator Details

Sr. No	Tag No	Purpose	Inlet pressure bar(g)		Outlet pressure range bar(g)	Flow rate With 1.25 flow factor (Nm^3/hr)	Quantity (Nos)	CV/diameter of orifice & Failure flow rate	Make
			Max.	Min.					
GHe Pneumatic servicing rig									
1	PR1H	Command system leak checks							
2	PR2H	Command system leak checks							
3	PR3H	Gas bottle charging (CGB), primary regulator for LOX							

Sr. No	Tag No	Purpose	Inlet pressure bar(g)		Outlet pressure range bar(g)	Flow rate With 1.25 flow factor (Nm^3/hr)	Quantity (Nos)	CV/diameter of orifice & Failure flow rate	Make
			Max.	Min.					
		& LH2 tanks charging							
4	PR4H	LOX & LH2 tank leak checks							
5	PRL	Engine, command blocks and purge line checks							

2. Safety Relief Valves details

Sr. No	Tag No	Service	Pressure in bar(g)		End connection Inlet & Outlet	Discharge flow rate (Kg/Hr)	Quantity (Nos)	Calculated Diameter of nozzle & selected size in mm	Make
			MOP	Set					
GHe Pneumatic servicing rig									
1.	VR1H	Cryo gas bottle charging	70						

Sr. No	Tag No	Service	Pressure in bar(g)		End connection Inlet & Outlet	Discharge flow rate (Kg/Hr)	Quantity (Nos)	Calculated Diameter of nozzle & selected size in mm	Make
			MOP	Set					
2.	VR2H	Start-up gas bottle charging	260						
3.	VR3H	Ambient gas bottle charging	335						
4.	VR4H	For supplying Command pressure	50						
5.	VR5H	For supplying Command pressure	50						
6.	VR6H	For ground pressurization line (LOX & LH2) leak check	9						
7.	VR7H	For supplying Command pressure to SV's & ER	7						

Sr. No	Tag No	Service	Pressure in bar(g)		End connection Inlet & Outlet	Discharge flow rate (Kg/Hr)	Quantity (Nos)	Calculated Diameter of nozzle & selected size in mm	Make
			MOP	Set					
8.	VR8H	Located in the downstream of PR3H	190						
9.	VR1L	Located in the downstream of PR1L	6.0						
10.	VR2L	RCS leak check & Pressure hold check of AFVV	2.8						
11.	VR3L	Nozzle closure leak checks	1.75						

Sr. No	Tag No	Service	Pressure in bar(g)		End connection Inlet & Outlet	Discharge flow rate (Kg/Hr)	Quantity (Nos)	Calculated Diameter of nozzle & selected size in mm	Make
			MOP	Set					
12.	VR4L	Pressure hold of EPCV modules	0.54						

3. Manual Valves Details

List of Manual valves

Sr. No	Tag No	Purpose	Type of Manual valve	End connection		Flow rate Nm^3/hr	Min.Operating pressure Bar(g) for sizing	PN BAR	Quantity (Nos)	MAKE
				Inlet	Outlet					
GHe Pneumatic servicing rig										
1.	VM1HV	LOX tank pressure monitoring	Needle				2			
2.	VM2HV	LH2 tank pressure monitoring	Needle				2.4			
3.	VM3H	For supplying	Needle				50			
4.	VM4H		Needle				50			

Sr. No	Tag No	Purpose	Type of Manual valve	End connection		Flow rate Nm^3/hr	Min.Operating pressure Bar(g) for sizing	PN BAR	Quantity (Nos)	MAKE
				Inlet	Outlet					
5.	VM5H	command pressures to stage valves	Needle				50			
6.	VM6H		Needle				50			
7.	VM7H		Needle				50			
8.	VM8H		Needle				50			
9.	VM9H	For supplying command pressures to PTC- EP valves & ER	Needle				9			
10.	VM10H	For LOX tank charging	**Globe**				9			
11.	VM11H	For LH2 tank charging	**Globe**				9			
12.	VM12H	For CGB charging	Needle				70			
13.	VM13H	For SGB charging	Needle				260			

Sr. No	Tag No	Purpose	Type of Manual valve	End connection		Flow rate Nm^3/hr	Min.Operating pressure Bar(g) for sizing	PN BAR	Quantity (Nos)	MAKE
				Inlet	Outlet					
14.	VM14H	For AGB charging	Needle				335			
15.	VM15HV	PR1H outlet vent	Needle				50			
16.	VM16HV	PR2H outlet vent	Needle				50			
17.	VM17HV	PR4H outlet vent	Needle				9			
18.	VM18HV	PR3H outlet vent	Needle				150			
19.	VM19H	Isolation for PR4H	Needle				150			
20.	VM20H	Isolation from HPP to LPP	Needle				50			
21.	VM21H	Isolation for PR1H	Needle				400			
22.	VM22H	Isolation for PR2H	Needle				400			
23.	VM23H	GHe inlet	Needle				400			
24.	VM24H	GN_2 inlet	Needle				400			

Sr. No	Tag No	Purpose	Type of Manual valve	End connection		Flow rate Nm^3/hr	Min.Operating pressure Bar(g) for sizing	PN BAR	Quantity (Nos)	MAKE
				Inlet	Outlet					
25.	VM25H	Outlet Isolation for PR3H	Needle				150			
26.	VM26H	Bypass for SV1 & PR3H	Needle				400			
27.	VM27HV	PTC inlet vent for GHe & GN_2	Needle				400			
28.	VM28HV	PR3H outlet vent	Needle				150			
29.	VM29H	Isolation for VR7H	Needle				9			
30.	VM3HV	For venting command pressures from stage valves	Needle				50			
31.	VM4HV		Needle				50			
32.	VM5HV		Needle				50			
33.	VM6HV		Needle				50			
34.	VM7HV		Needle				50			
35.	VM8HV		Needle				50			
36.	VM9HV	Vent for VM9H	Needle				9			

Sr. No	Tag No	Purpose	Type of Manual valve	End connection		Flow rate Nm^3/hr	Min.Operating pressure Bar(g) for sizing	PN BAR	Quantity (Nos)	MAKE
				Inlet	Outlet					
37.	VM10HV	For LOX tank venting	Needle				9			
38.	VM11HV	For LH2 tank venting	Needle				9			
39.	VM12HV	CGB venting	Needle				70			
40.	VM13HV	SGB Venting	Needle				260			
41.	VM14HV	AGB Venting	Needle				335			
42.	VM1LV	Aux. Venting for LOX & LH2 tanks	Needle				2.5			
43.	VM2LV		Needle				2.5			
44.	VM3L	For supplying low pressures of 0.3 to 5.5 bar (g)	Needle				6			
45.	VM4L		Needle				6			
46.	VM5L		Needle				6			
47.	VM6L		Needle				6			
48.	VM7L		Needle				6			

Sr. No	Tag No	Purpose	Type of Manual valve	End connection		Flow rate Nm^3/hr	Min.Operating pressure Bar(g) for sizing	PN BAR	Quantity (Nos)	MAKE
				Inlet	Outlet					
49.	VM8L	to various stage fluid circuits	Needle				6			
50.	VM9L		Needle				6			
51.	VM10L		Needle				6			
52.	VM11L		Needle				6			
53.	VM12L		Needle				6			
54.	VM13L		Needle				6			
55.	VM14L		Needle				6			
56.	VM15L	Inlet for LPP	Needle				50			
57.	VM16L	Outlet isolation for PRL	Needle				6			
58.	VM17L	Isolation for PG's	Needle				6			
59.	VM18LV	Common vent for LPP valves	Needle				6			
60.	VM19L	Isolation for Vacuum pump	Needle				6			

Sr. No	Tag No	Purpose	Type of Manual valve	End connection		Flow rate Nm^3/hr	Min.Operating pressure Bar(g) for sizing	PN BAR	Quantity (Nos)	MAKE
				Inlet	Outlet					
61.	VM20LV	Outlet vent for PRL	Needle				6			
62.	VM1HS	Gas sampling port for LOX tank	Needle				2.5			
63.	VM2HS	Gas sampling port for LH2 tank	Needle				2.5			
64.	VM12HS1	Gas sampling port for CGB	Needle				70			
65.	VM12HS2	Aux. Gas sampling port	Needle				70			
66.	VM13HS	Gas sampling port for SGB	Needle				260			
67.	VM14HS	Gas sampling	Needle				335			

Sr. No	Tag No	Purpose	Type of Manual valve	End connection		Flow rate Nm^3/hr	Min.Operating pressure Bar(g) for sizing	PN BAR	Quantity (Nos)	MAKE
				Inlet	Outlet					
		port for AGB								
68.	VM1LS	For gas sampling of LOX & LH2 tanks	Needle				2.5			
69.	VM2LS		Needle				2.5			
70.	VM3LS	For gas sampling of Engine, command blocks, etc.,	Needle				6			
71.	VM4LS		Needle				6			
72.	VM5LS		Needle				6			
73.	VM14LS		Needle				6			
74.	VM1	Bypass for EP1	Needle				9			
75.	VM2	Bypass for EP2	Needle				9			
76.	VM3	For supplying command pressure to ER	Needle				9			
77.	VM4	Bypass for ER1	Needle				400			

Sr. No	Tag No	Purpose	Type of Manual valve	End connection		Flow rate Nm^3/hr	Min.Operating pressure Bar(g) for sizing	PN BAR	Quantity (Nos)	MAKE
				Inlet	Outlet					
78.	VM5	Outlet of ER1 self-vent port	Needle				400			
79.	VM6	Isolation for EP5	Needle				50			
"*" FFR: shall be sized for Failure Flow rate of Regulator at MOP mentioned										

4. Check Valve (non-return valve) Details

Table 24: List of Check valves

S. No	Tag No	Purpose	Size	Type	End connection	Min Operating pressure, bar	PN bar	Preferred make	Actual Qty. (No's)
1	VC1	To avoid the GN_2 admission towards GHe side	15NB x 160 SCH	Spring loaded poppet (In-line)		400	400		
2	VC2	To avoid the atm. Entry into the service line containing 3-way EP valve	15NB x 160 SCH	Spring loaded poppet (In-line)		50	100		

5. Filter Details

List of Filters

Sr. No	Tag No	Purpose	Element Type	PN rating(bar)	Micron Rating (abs)	Mesh MOC SS	Inlet & out let pipes Size (dia x thick)	End connection	Qty (Nos)	Filter Mesh area (mm2)	Make
GHe Pneumatic servicing rig											
1.	F1H	PTC inlet (GHe)	Mesh		5						
2.	F2H	PTC Inlet (GN_2)	Mesh		5						
3.	F3H	For supplying command pressures to stage valves	Mesh		10						
4.	F4H		Mesh		10						
5.	F5H		Mesh		10						
6.	F6H		Mesh		10						
7.	F7H		Mesh		10						
8.	F8H1		Mesh		10						

Sr. No	Tag No	Purpose	Element Type	PN rating(bar)	Micron Rating (abs)	Mesh MOC SS	Inlet & out let pipes Size (dia x thick)	End connection	Qty (Nos)	Filter Mesh area (mm2)	Make
9.	F8H2	VR 02 Inlet	Mesh		10						
10.	F9H	For ground pressurization line leak check	Mesh		10						
11.	F10H	For LOX & LH2 tank charging	Mesh		10						
12.	F11H		Mesh		10						
13.	F12H1	For CGB	Mesh		10						

Sr. No	Tag No	Purpose	Element Type	PN rating(bar)	Micron Rating (abs)	Mesh MOC SS	Inlet & out let pipes Size (dia x thick)	End connection	Qty (Nos)	Filter Mesh area (mm2)	Make
14.	F12H2	Aux. Service line	Mesh		10						
15.	F13H	For SGB	Mesh		10						
16.	F14H	For AGB	Mesh		10						
17.	F1L	LPP inlet	Mesh		10						
18.	F3L1	For supplying GHe or GN_2 to various stage fluid circuits	Mesh		10						
19.	F3L4		Mesh		10						
20.	F4L		Mesh		10						
21.	F5L		Mesh		10						

Sr. No	Tag No	Purpose	Element Type	PN rating(bar)	Micron Rating (abs)	Mesh MOC SS	Inlet & out let pipes Size (dia x thick)	End connection	Qty (Nos)	Filter Mesh area (mm2)	Make
22.	F6L	For supplying GHe or GN_2 to various stage fluid circuits	Mesh		10						
23.	F7L		Mesh		10						
24.	F8L		Mesh		10						
25.	F9L1		Mesh		10						
26.	F9L3		Mesh		10						
27.	F10L1		Mesh		10						
28.	F10L3		Mesh		10						
29.	F11L1	For supplying GHe or GN_2 to various stage fluid circuits	Mesh		10						
30.	F11L3		Mesh		10						
31.	F12L		Mesh		10						
32.	F13L		Mesh		10						
33.	F14L		Mesh		10						

6. Pressure Gauge Details

S. No	Tag No	MOP Bar (g)	Range bar(g)	Resolution, bar (g)	Accuracy Class	Purpose	Dial Size (mm)	End Connection	Mounting	Quantity (Nos)	MAKE
	GHe Pneumatic servicing rig										
1.	PG1H	2.4	0-4			LOX tank pressure monitoring					
2.	PG2H	2.8	0-4			LH2 tank pressure monitoring					
3.	PG3H	50	0-100			For supplying Stage command pressures					
4.	PG4H	50	0-100								
5.	PG5H	50	0-100								
6.	PG6H	50	0-100								
7.	PG7H	50	0-100								
8.	PG8H	50	0-100								
9.	PG9H	9	0-20			For supplying command pressures to the PTC Ep's & ER					

S. No	Tag No	MOP Bar (g)	Range bar(g)	Resolution, bar (g)	Accuracy Class	Purpose	Dial Size (mm)	End Connection	Mounting	Quantity (Nos)	MAKE
10.	PG10H	9	0-20			For LOX tank charging					
11.	PG11H	9	0-20			For LH2 tank charging					
12.	PG12H	70	0-160			For CGB charging					
13.	PG13H	260	0-400			For SGB charging					
14.	PG14H	335	0-400			For AGB charging					
15.	PG15H	50	0-100			PR1H outlet					
16.	PG16H	50	0-100			PR2H outlet					
17.	PG17H	9	0-20			PR4H outlet					
18.	PG18H	210	0-400			PR3H outlet					
19.	PG19H	400	0-600			GN_2 PTC inlet					
20.	PG20H	400	0-600			GHe PTC inlet					
21.	PG21H	335	0-400			ER outlet or VM25H outlet					

S. No	Tag No	MOP Bar (g)	Range bar(g)	Resolution, bar (g)	Accuracy Class	Purpose	Dial Size (mm)	End Connection	Mounting	Quantity (Nos)	MAKE
22.	PG1L	50	100			LPP inlet					
23.	PGV1L	5	-1-9			PRL outlet					
24.	PGV2L	5	-1-9			VM16L outlet					
25.	PG2L	0.54	0-1			Pressure hold of EPCV modules					
26.	PG3L	1.80	0-2.5			Nozzle closure leak checks					
27.	PG4L	2.8	0-4			RCS leak checks & Pressure hold test of AFVVV					
28.	PG5L	5	0-10			Purge circuit leak checks					
29.	PG6L	1	0-1.6			LOX or LH2 tank pressure monitoring					
30.	PG7L	1.80	0-2.5								
31.	PG8L	5	0-10			Purge circuit leak checks					
32.	PG9L	1	0-1.6								

S. No	Tag No	MOP Bar (g)	Range bar(g)	Resolution, bar (g)	Accuracy Class	Purpose	Dial Size (mm)	End Connection	Mounting	Quantity (Nos)	MAKE
33.	PG10L	2.5	0-4			LOX or LH2 tank pressure monitoring					
34.	PG11L	5	0-10			Purge circuit leak checks					

7. Pressure Switch Details

Sr. No	Tag No	Service	Operating Pressure in bar(g)	Pressure range	End connection Inlet & Outlet	Make	Quantity (No's)	Spare quantity (No's)
GHe Pneumatic servicing rig								
1.	PS1H	For LOX tank	$0\text{-}4^{\pm 0.1}$	0-10				
2.	PS2H	For LH2 tank	$1.0\text{-}5.0^{\pm 0.1}$	0-10				
3.	PS3H	For Lox tank charge line	$6.6^{\pm 0.3}$	0-10				
4.	PS4H	For LH2 tank charge line	$6.6^{\pm 0.3}$	0-10				

8. EP Valve Details

Sr. No	Tag No	Purpose	Type of valves	End connections		Inlet & Outlet pipe size (DN)	MOP (Bar)	PN (BAR)	Quantity (Nos)	Make
				Inlet	Outlet					
GHe Pneumatic servicing rig										
1.	EP1	LOX tank charging	Two-way reduced bore				9			
2.	EP2	LH2 tank charging	Two-way reduced bore				9			
3.	EP3	SGB charging	Two-way reduced bore				260			
4.	EP4	AGB charging	Two-way reduced bore				335			
5.	EP5	For supplying command pressures to the stage valves	Three-way reduced bore				50			

9. Electronic Regulator Details

List of Electronic Regulators

Sr. No	Tag No	Purpose	Type of valves	End connections	Inlet & Outlet pipe size (DN)	Min. Flow rate Nm^3/hr	Accuracy	MOP (Bar)	PN (BAR)	Quantity (Nos)	Make
GHe Pneumatic servicing rig											
1.	ER1	For AGB & SGB charging						335			

10. Solenoid valve Details

Sr. No	Tag No	Purpose	Type of valve	End connections Inlet, Outlet, & Vent	MOC	Nominal Operating voltage	Min Bore (DN) mm	MOP (Bar)	PN BAR	Quantity (Nos)	Make
GHe Pneumatic servicing rig											
1.	VS1	For operating EP1	3-Way Dual coil & Low Power					10			
2.	VS2	For operating EP2	3-Way Dual coil & Low Power					10			

Sr. No	Tag No	Purpose	Type of valve	End connections Inlet, Outlet, & Vent	MOC	Nominal Operating voltage	Min Bore (DN) mm	MOP (Bar)	PN BAR	Quantity (Nos)	Make
3.	VS3	For operating EP3	3-Way Dual coil & Low Power					10			
4.	VS4	For operating EP4	3-Way Dual coil & Low Power					10			
5.	VS5	For operating EP5	3-Way Dual coil & Low Power					10			
6.	SV1	Located at PTC inlet	2-Way Dual coil & Low Power					400			

11. Pressure Transmitter Details

Sr.No	Tag No	Service	Entry	MOP bar(g)	End Connection Size/Type	Range bar(g)	Qty. (Nos)	Make
GHe Pneumatic servicing rig								
1.	PT1	LOX tank pressurization		9		0-50		
2.	PT2	LH2 tank pressurization		9		0-50		
3.	PT3	SGB charging		260		0-500		
4.	PT4	AGB charging		335		0-500		

Sr.No	Tag No	Service	Entry	MOP bar(g)	End Connection Size/Type	Range bar(g)	Qty. (Nos)	Make
5.	PT5	To monitor the command supply pressure to Ep's		9		0-50		
6.	PT6	Located at the downstream of ER		335		0-500		
7.	PT7	To monitor the command supply pressure to stage valves		50		0-500		

12. Tube Fitting Details

S. No	Tag No	Purpose	End connection	MOC	MOP Bar (g)	PN Bar (g)	Preferred make	Quantity (No's)
GHe Pneumatic servicing rig								
1	Tube fittings	To interconnect the lines of PTC as per P&I			335			

13. PTC Tubing Details

S. No	Tag No	Purpose	Material	Size	End connection	MOP Bar (g)	PN bar	Preferred make	Actual Qty. (No's)
1	Tubing 1	PTC to Rack-1 **(Ref. Sketch 5&2)**				335			
2	Tubing 2	PTC to Rack-1 for LOX tank prn. **(Ref. Sketch 5&2)**				9			
		PTC to Rack-1 for LH2 tank prn. **(Ref. Sketch 5&2)**				9			
3	Tubing 3	PTC to Rack-4 for LH2 Tank Pr. monitoring				6			
4	Tubing 4	PTC to Rack-2 **(Ref. Sketch 6&2)**				335			
5	Tubing 5	PTC to Rack-3 **(Ref. Sketch 7&2)**				6			

S. No	Tag No	Purpose	Material	Size	End connection	MOP Bar (g)	PN bar	Preferred make	Actual Qty. (No's)
6	System Tubes 1	For interfacing PTC rack to test ports of Stage, for servicing				335			
						335			
7	System Tubes 2	For interfacing PTC rack to test ports of Stage, for servicing				335			

Note: *Quantity of SS Pipes is indicative only. Quantity may vary +/- 10% according to actual site conditions. Adaptors sizes and quantity mentioned in the drawings are indicative only. However, it is in Scope of party to arrange suitable adaptors for assembly of all flow components as per actual site conditions with prior approval of department.*

14. Hose Details (Corrugated Metallic hoses)

S. No	Tag No	Size	End connection	Type	MOP Bar (g)	PN bar	Preferred make	Actual Qty. (No's)
1	PTC vent hoses				10			
2	System vent hoses				10			
					50			

S. No	Tag No	Size	End connection	Type	MOP Bar (g)	PN bar	Preferred make	Actual Qty. (No's)
3	System pressurization hoses (LH2)				9			
4	System pressurization hoses (LOX)				9			
5	Vent header				10			

15. Portable Pressure Monitoring Panel (PPMP):

Portable Pressure Monitoring Panel (PPMP)

S. No	Tag No	Specification	End connection	Preferred make	Actual Qty. (No's)
1	Portable pressure monitoring panel				
2	Fabrication of panels, racks, assembly of components and testing at factory				

Supply of Spares for Pneumatic Test Console

16. List of Pressure Regulators Spares:

Sr. No	Tag No	Spare Regulators Qty (Nos)	Spare kits (Nos)	Remarks
1	PR1H			
2	PR3H			
3	PR4H			
4	PRL			
Note: Spare kits of pressure regulator consists of Poppet, springs, O-rings and other seals as applicable.				

17. List of Safety Relief Valve Spares:

Sr. No	Tag No	Spare safety relief valves (Nos)	Spare kits (Nos)	Remarks
1.	VR1H			
2.	VR2H			
3.	VR3H			
4.	VR4H			
5.	VR6H			
6.	VR7H			

Sr. No	Tag No	Spare safety relief valves (Nos)	Spare kits (Nos)	Remarks
7.	VR8H			
8.	VR1L			
9.	VR2L			
10.	VR3L			
11.	VR4L			
Note: Spare kits of safety relief valve consists of Poppet/disc, springs, nozzles/seat, O-rings as applicable.				

18. List of Manual Valve Spares:

Sr. No	Tag No	Purpose	Type of Manual valve	End connection		Flow rate NM3/Hr	Min.Operating pressure for sizing Bar(g)	PN BAR	Spares Quantity (Nos)
				Inlet	Outlet				
11.	VM3H	For supplying command pressures to stage valves	Needle				50		
12.	VM10H/ VM11H	For LOX tank charging	**Globe**				9		
13.	VM14H	For AGB charging	Needle				335		
14.	VM21H	Isolation for PR1H	Needle				400		
15.	VM23H	GHe inlet	Needle				400		

Sr. No	Tag No	Purpose	Type of Manual valve	End connection		Flow rate NM3/Hr	Min.Operating pressure for sizing Bar(g)	PN BAR	Spares Quantity (Nos)
				Inlet	Outlet				
16.	VM3HV	For venting command pressures from stage valves	Needle				50		
17.	VM11HV	For LH2 tank venting	Needle				9		
18.	VM3L	For supplying low pressures of 0.3 to 5.5 bar (g) to various stage fluid circuits	Needle				6		
19.	VM1HS	Gas sampling port for LOX tank	Needle				2.5		
20.	VM14HS	Gas sampling port for AGB	Needle				335		
Note: Spare Kits consists of Stem seal, body seal and other soft seals as applicable									

19. List of Check valves

S. No	Tag No	Purpose	Size	Type	End connection	Min Operating pressure, bar	PN bar	Preferred make	Spare Qty. (No's)
1	VC1	To avoid the GN_2 admission towards GHe side				400			

S. No	Tag No	Purpose	Size	Type	End connection	Min Operating pressure, bar	PN bar	Preferred make	Spare Qty. (No's)
2	VC2	To avoid the atm. Entry into the service line containing 3-way EP valve				50			

20.List of Filter Spares:

Sr. No	Type	PN	Micron Rating (abs)	Mesh MOC SS	Inlet & out let pipes Size (dia x thick)	End connection	Spare Quantity* (Nos)	Filter elements & seals kits (Nos)	Remarks
GHe Pneumatic servicing rig									
1	Mesh		5						
2	Mesh		10						
3	Mesh		20						
4	Mesh		10						
5	Mesh		10						

Note: Spare Kits consists of filter elements and seals as applicable.

***Spare quantity means the full set of filter (Filter body including Filter element as integral part with suitable conversion adapters)**

21. List of Pressure Gauge Spares:

Sr. No	Tag No	MOP bar(g)	Range bar(g)	Resolution bar (g)	Accuracy Class	Dial Size (mm)	End Connection	Mounting	Spare Quantity (Nos)
1.	PG1H	2.5							
2.	PG3H	50							
3.	PG10H	9							
4.	PG12H	70							
5.	PG13H	260							
6.	PG19H	400							
7.	PGV1L	5							
8.	PG7L	1.80							
9.	PG9L	1							
10.	PG11L	5							

22. List of Pressure Switches Spares

Sr. No	Tag No	Service	Operating Pressure in bar(g)	Pressure range, bar	End connection Inlet & Outlet	Make	Spare quantity (No's)
1	PS2H	For LH2 tank	$1.0\text{-}5.0^{\pm 0.1}$				
2	PS4H	For LH2 tank charge line	$6.6^{\pm 0.3}$				

23. List of EP Valve Spares:

Sr. No	Type	End connections		Inlet & Outlet pipe size, mm	MOP (bar)	PN (bar)	Spares Valves Quantity (Nos)	Spare kits (Nos)	Remarks
		Inlet size	Outlet size						
1	Two-way electro pneumatic reduced bore ball valves				335				
2	Two-way electro pneumatic reduced bore ball valves				9				
3	Three-way electro pneumatic reduced bore ball valves				50				
Note: Spare Kits consists of Stem seal, body seal, seat, ball and other soft seals as applicable.									

24. List of Electronic Regulator Spares:

Sr. No	Tag No	End connections		Inlet & Outlet pipe size (DN)	MOP (Bar)	PN (BAR)	Spares Valves Quantity (Nos)	Spare kits (Nos)	Remarks
		Inlet	Outlet						
1	Two-way electro pneumatic reduced bore ball valves				335				
Note: Spare Kits consists of Stem seal, body seal, seat, ball and other soft seals as applicable.									

25. List of Solenoid Valve Spares:

Sr. No	Type of valve	End connections Inlet, Outlet, & Vent ,	MOC	Operating voltage	Min.Bore (DN) mm	MOP (Bar)	PN (BAR)	Spare Quantity (Nos)
1	3-Way Dual coil & Low Power					10		
2	2-Way Dual coil & Low Power					400		
Note : Spare make and model numbers shall be same as main flow components selected for pneumatic servicing rig .There shall be no change in the make and model numbers.								

26. List of Pressure Transmitter Spares:

Sr.No	Type	Entry	MOP bar(g)	End Connection Size/Type	Range bar(g)	Spares Quantity (Nos)	Remarks
1	High Pressure Transmitters		335				
2	Low Pressure Transmitters		9				

27. PTC Tubing Spares Details

S. No	Tag No	Purpose	Material	Size	End connection	MOP Bar (g)	PN bar	Preferred make	Spare Qty. (No's)
1	System Tubes 1	For interfacing PTC rack to test ports of Stage, for servicing				335			
						335			
2	System Tubes 2	For interfacing PTC rack to test ports of Stage, for servicing				335			

28. Hose Spares details

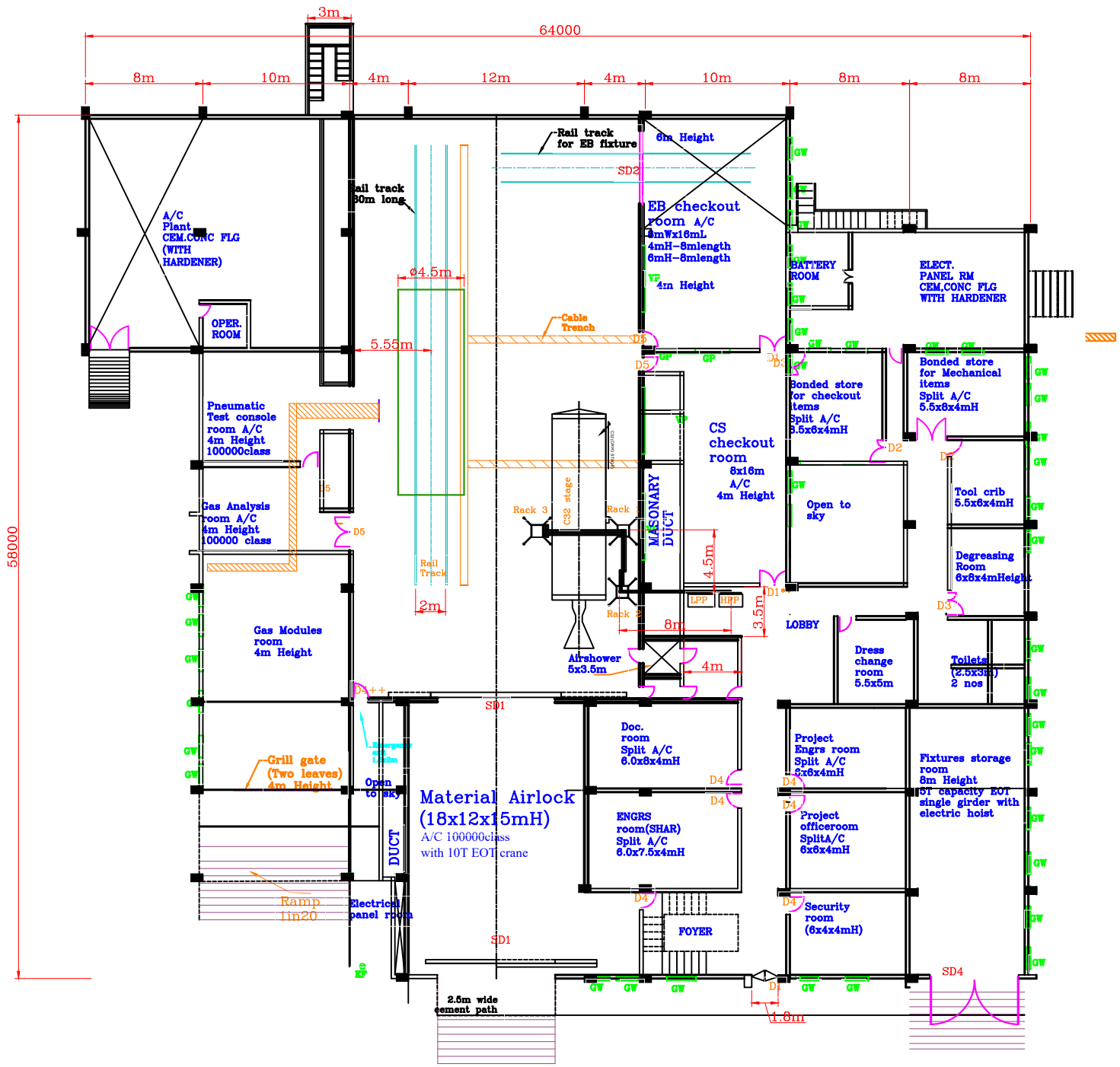
S. No	Tag No	Size	End connection	Type	MOP Bar (g)	PN bar	Preferred make	Spare Qty. (No's)
1	PTC vent hoses				10			
2	System vent hoses				10			
					50			
3	System pressurization hoses (LH2)				9			
4	System pressurization hoses (LOX)				9			
5	Vent header				10			

Electrical Components

S. No	Tag No	Specification	Preferred make	Spare Qty. (No's)
1	Single way, 4 pole Relay			
2	Two way, 4 pole Relay			

Annexure- 11

(Sketch 1 to 10)



Note:

SD1– Steel Sliding door (8x10m)
SD2– Steel Sliding door (5x5m)
SD3– Sliding door (3x2m) (with Bulletproof/Shockproof glass)
SD4– Swing door (6x5m)
D1 – Glass door (2x2.1m
D2 – Wooden door (2x2.1m)
D3 – Wooden door (1.5x2.1m)
D4 – Wooden door (1.0x2.1m)
D5 – Glass door (1.5x2.1m)
GW – Glass windows (1.5x1.5m) (Fibre glass)
GP – Glass panels
EF – Exhaust Fans
D6 – Sliding glass door(1.0x2.1m)
D7 – Glass door (1.5x2.1m)

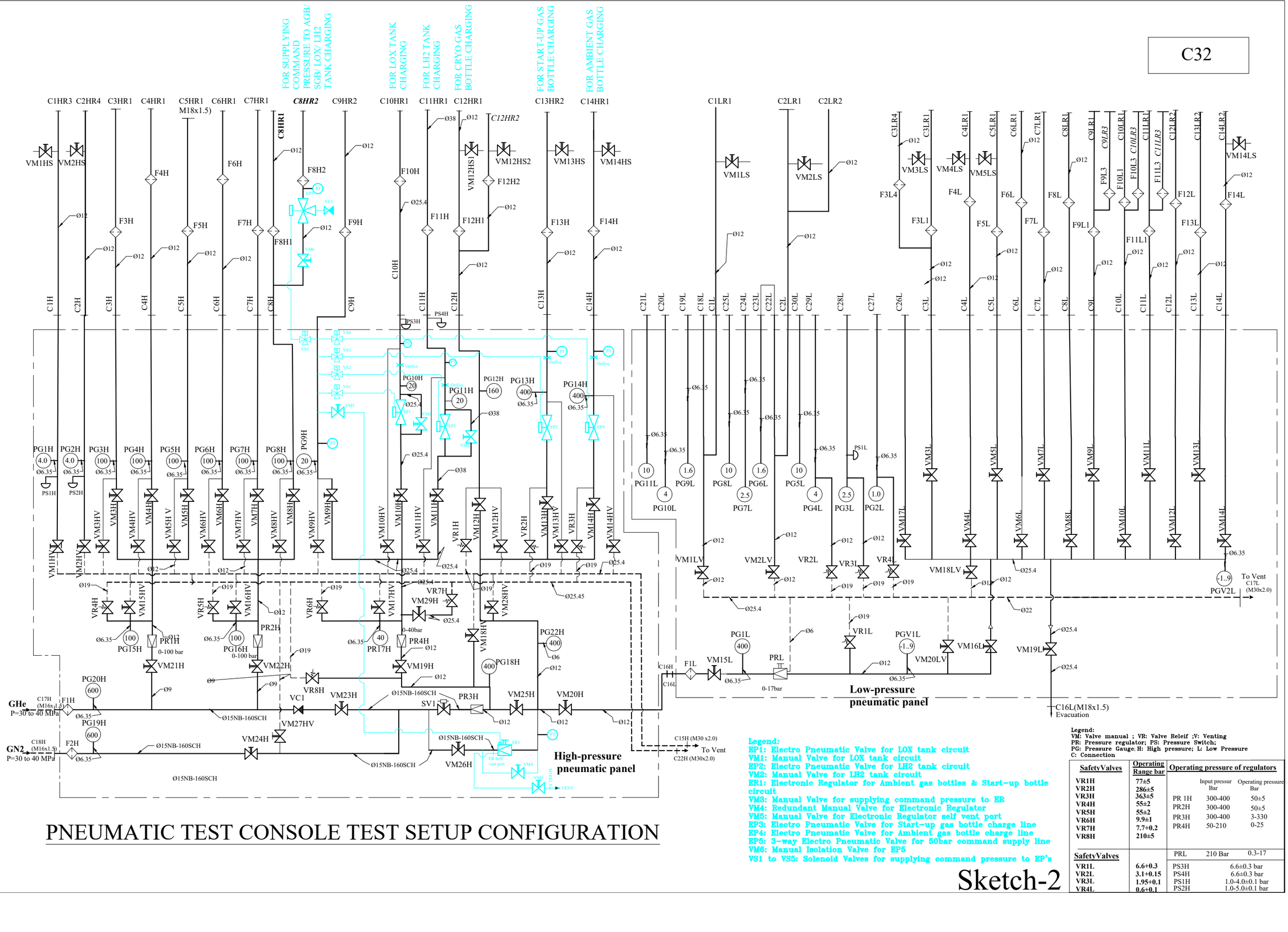
** – Will not be opened during normal operations
D4++ – Locking from inside
VP – Glass Viewing panel (3x1.5mH)
Cable trench (0.5x0.5m)

LAYOUT OF C32 PREPARATION FACILITY(Ground Floor)

Sketch–1

TechnicalComplex–2
SDSC SHAR

C32



PNEUMATIC TEST CONSOLE TEST SETUP CONFIGURATION

Legend:
EP1: Electro Pneumatic Valve for LOX tank circuit
VM1: Manual Valve for LOX tank circuit
EP2: Electro Pneumatic Valve for LH2 tank circuit
VM2: Manual Valve for LH2 tank circuit
ER1: Electronic Regulator for Ambient gas bottles & Start-up bottle circuit
VM3: Manual Valve for supplying command pressure to ER
VM4: Redundant Manual Valve for Electronic Regulator
VM5: Manual Valve for Electronic Regulator self vent port
EP3: Electro Pneumatic Valve for Start-up gas bottle charge line
EP4: Electro Pneumatic Valve for Ambient gas bottle charge line
EP5: 3-way Electro Pneumatic Valve for 50bar command supply line
VM6: Manual Isolation Valve for EP5
VS1 to VS5: Solenoid Valves for supplying command pressure to EP's

Legend:
VM: Valve manual ; VR: Valve Releif ;V: Venting
PR: Pressure regulator; PS: Pressure Switch;
PG: Pressure Gauge; H: High pressure; L: Low Pressure
C: Connection

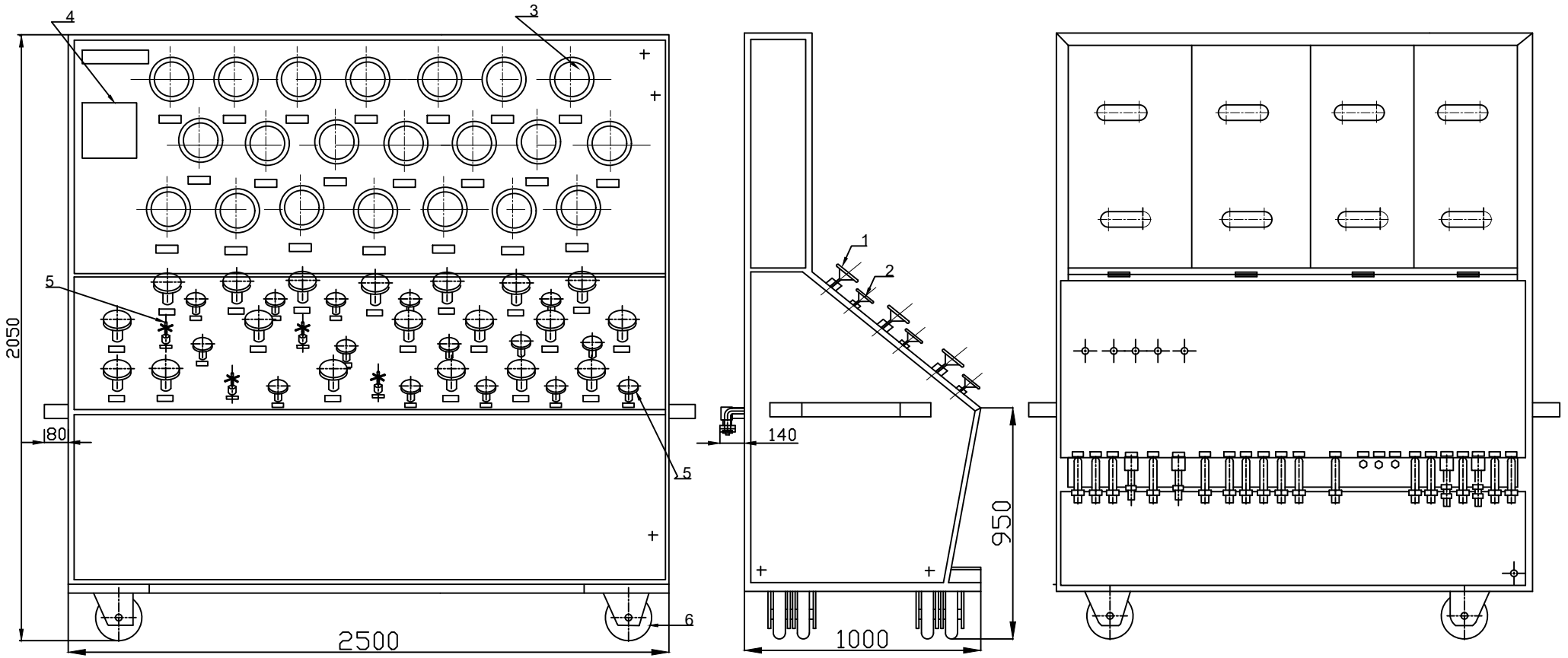
SafetyValves	Operating Range bar
VR1H	77±5
VR2H	286±5
VR3H	363±5
VR4H	55±2
VR5H	55±2
VR6H	9.9±1
VR7H	7.7+0.2
VR8H	210±5

SafetyValves	Operating Range bar
VR1L	6.6+0.3
VR2L	3.1+0.15
VR3L	1.95+0.1
VR4L	0.6+0.1

Operating pressure of regulators	Input pressur Bar	Operating pressure Bar
PR 1H	300-400	50±5
PR2H	300-400	50±5
PR3H	300-400	3-330
PR4H	50-210	0-25
PRL	210 Bar	0.3-17

PS3H	6.6±0.3 bar
PS4H	6.6±0.3 bar
PS1H	1.0-4.0±0.1 bar
PS2H	1.0-5.0±0.1 bar

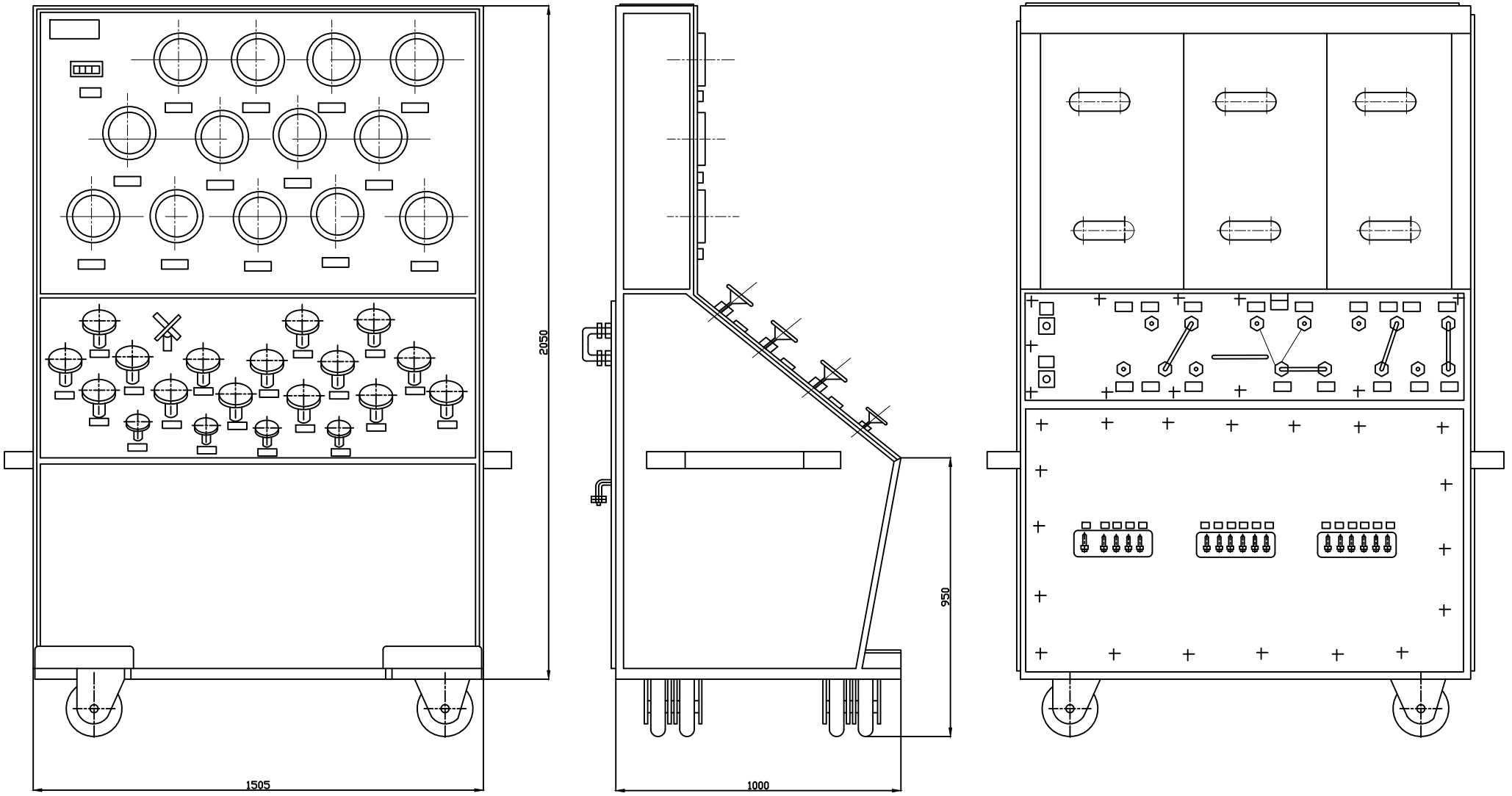
Sketch-2



6.	Castor wheels
5.	Press. regulating valve
4.	Light and Audio signal indicator
3.	Press. gage
2.	Drain valve
1.	Shut-off check valve

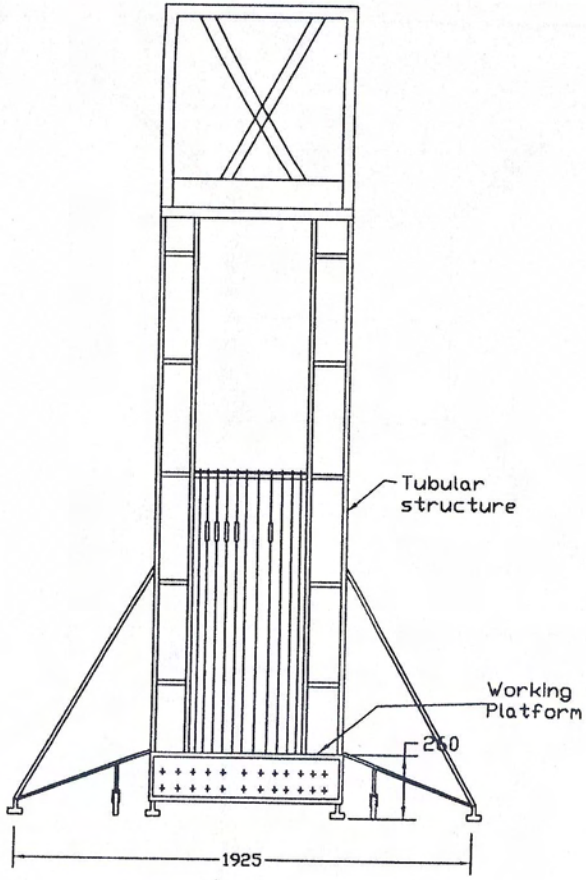
Sketch-3

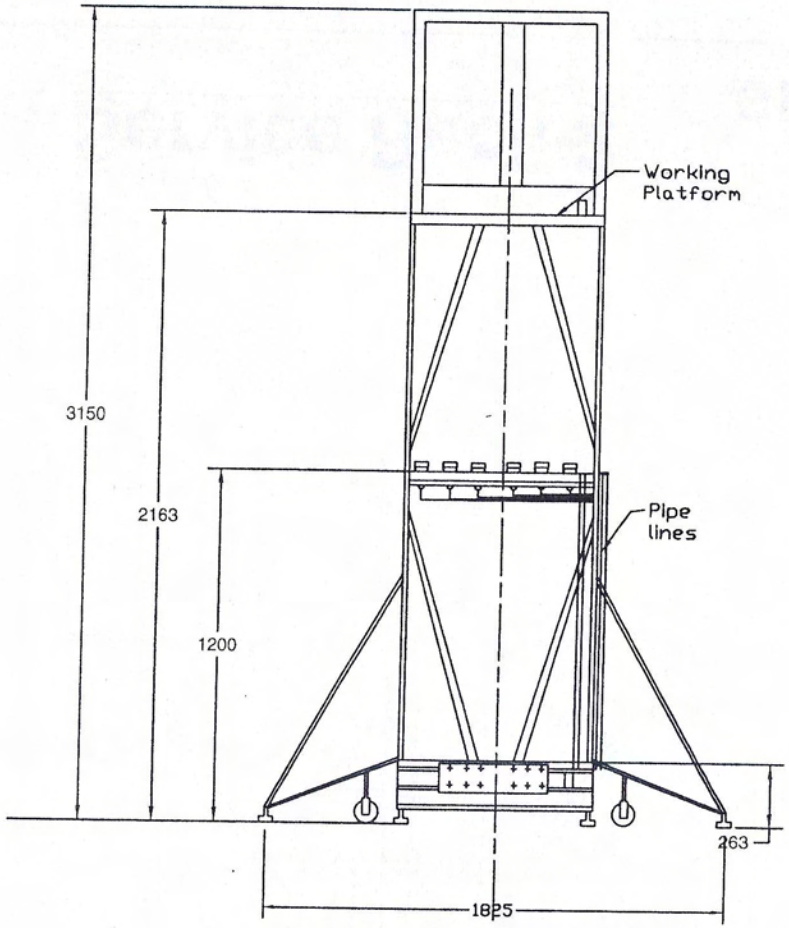
HIGH PRESSURE PANEL

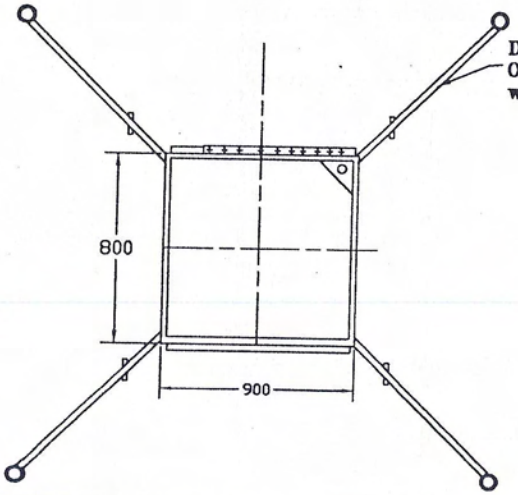


Sketch-4

LOW PRESSURE PANEL

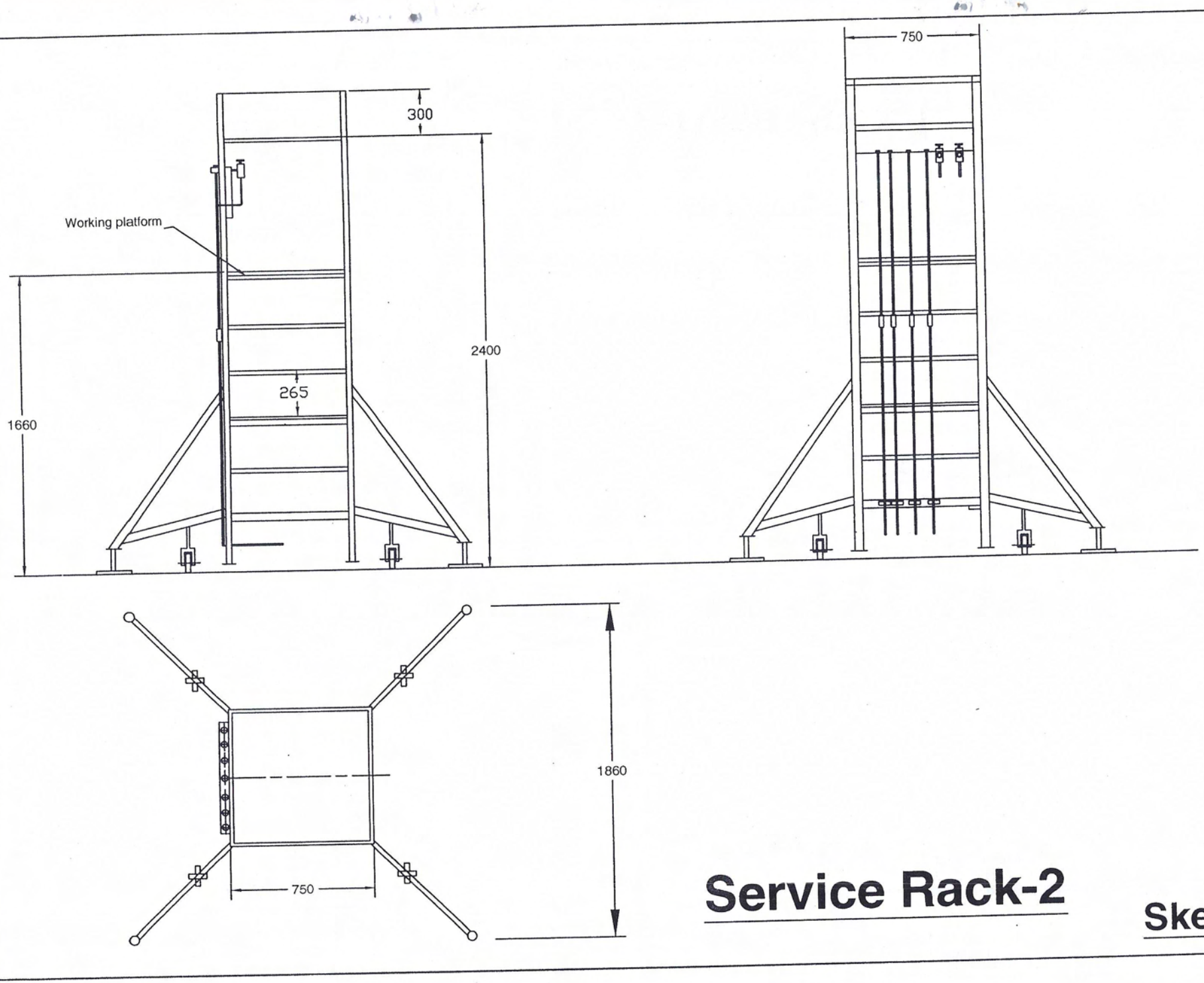






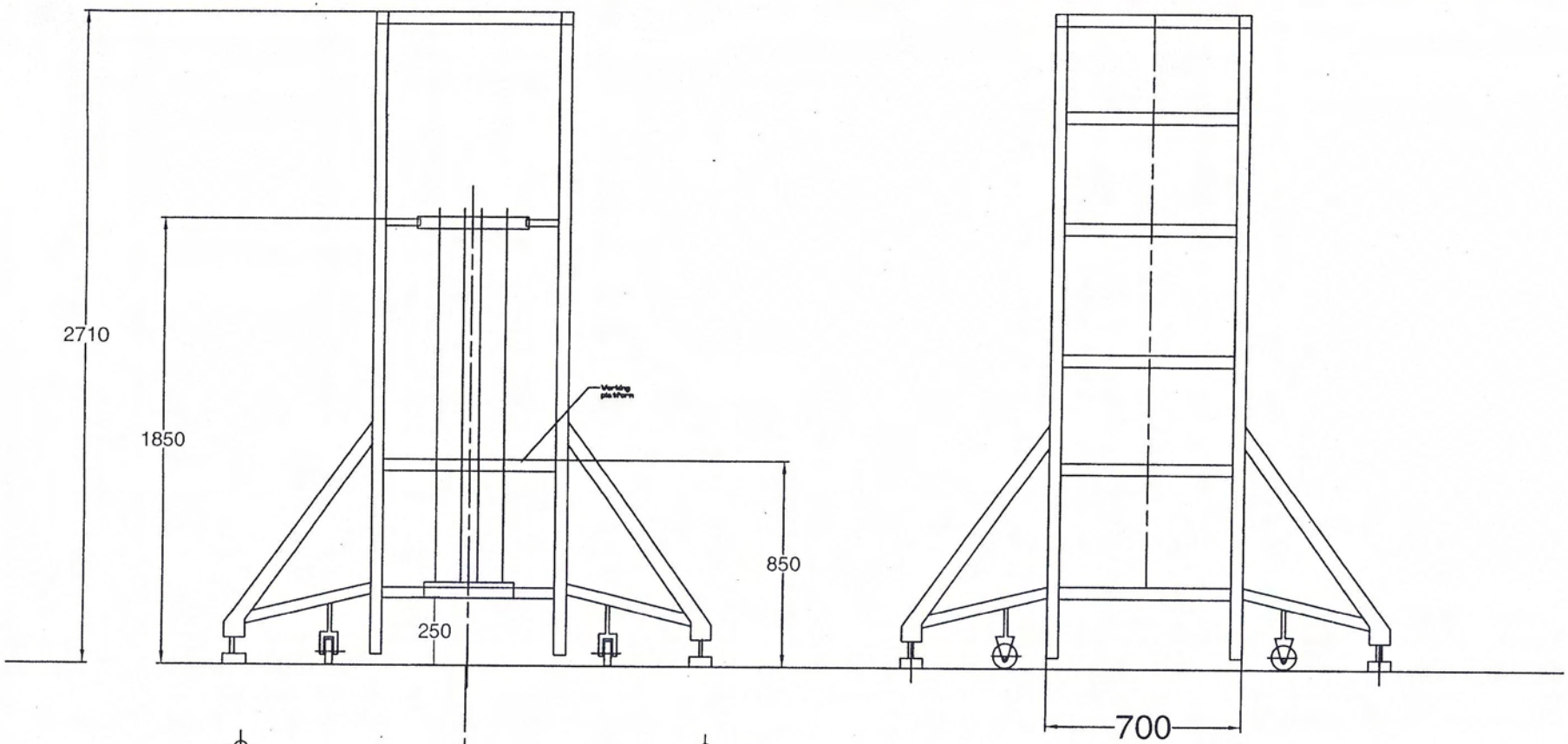
Service Rack-1

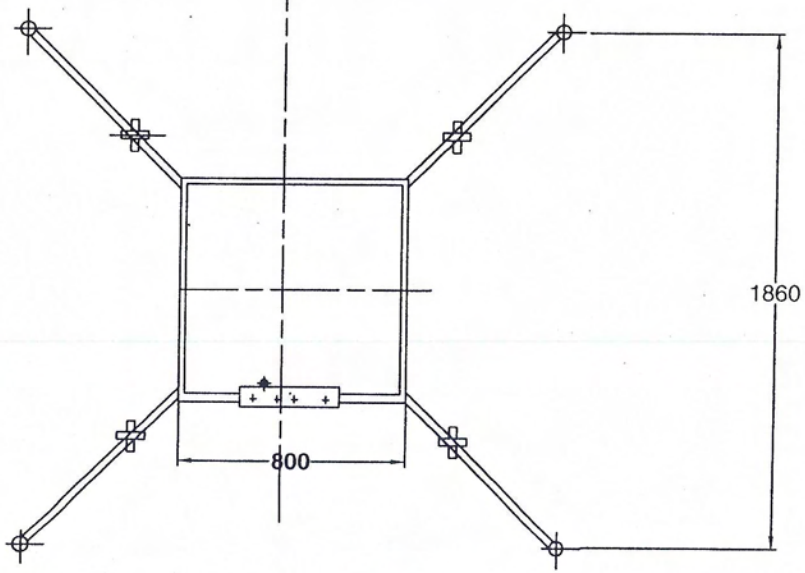
Sketch-5



Service Rack-2

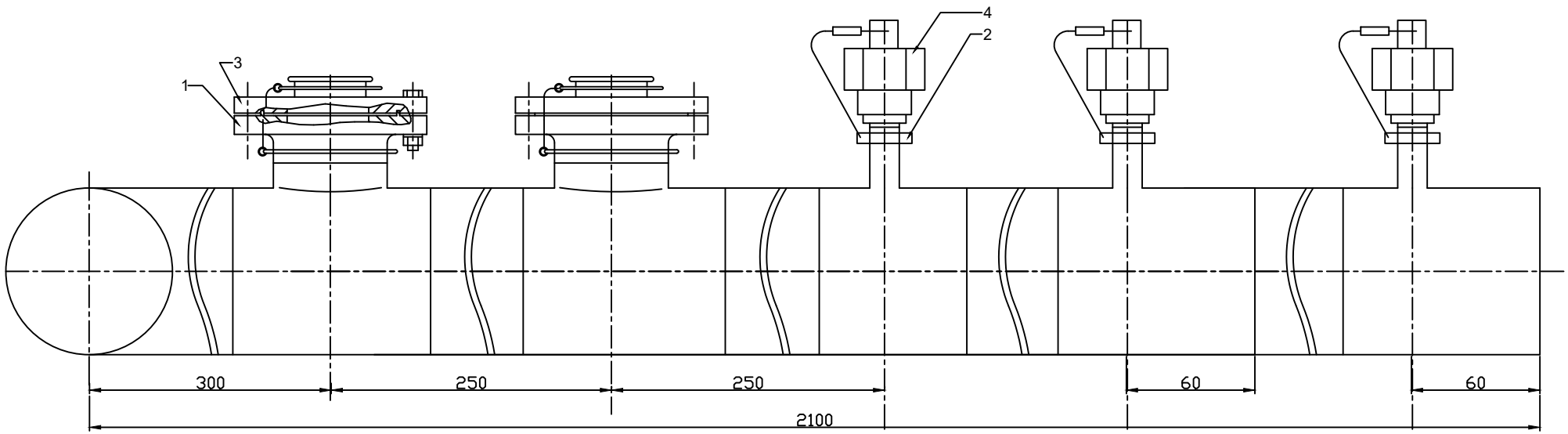
Sketch-6





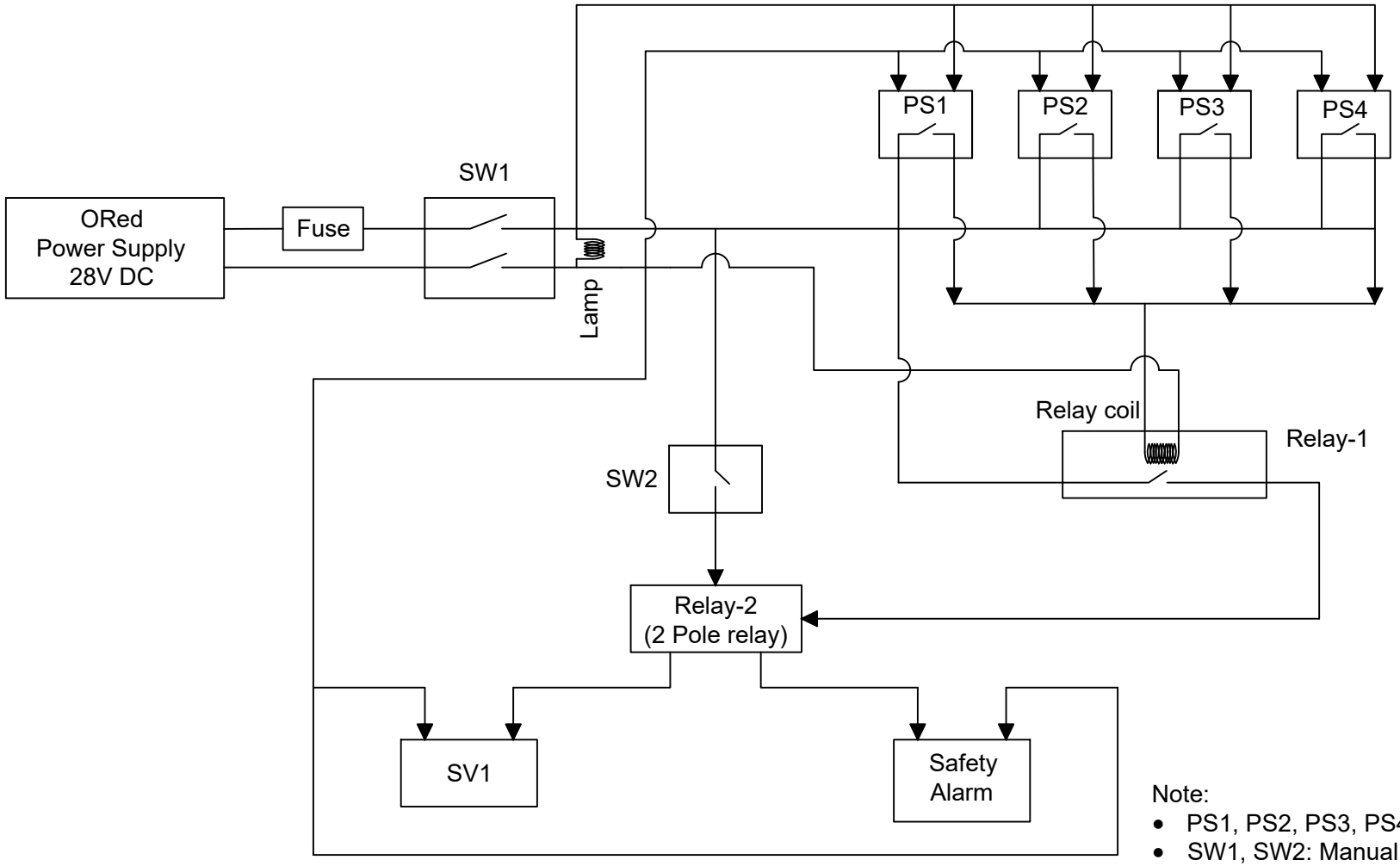
Service Rack-3

Sketch-7



Sketch-8
VENT HEADER

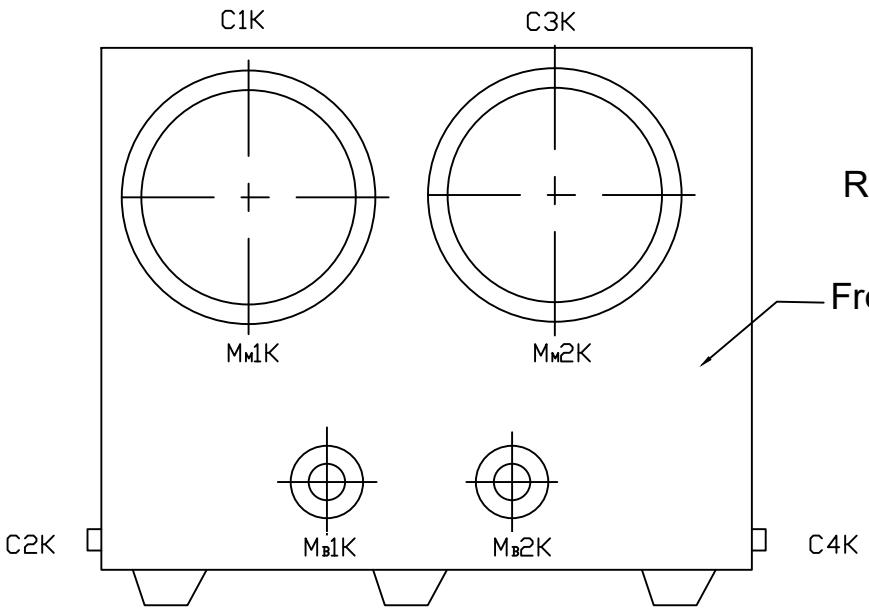
PTC SAFETY INTERLOCK BLOCK DAIGRAM

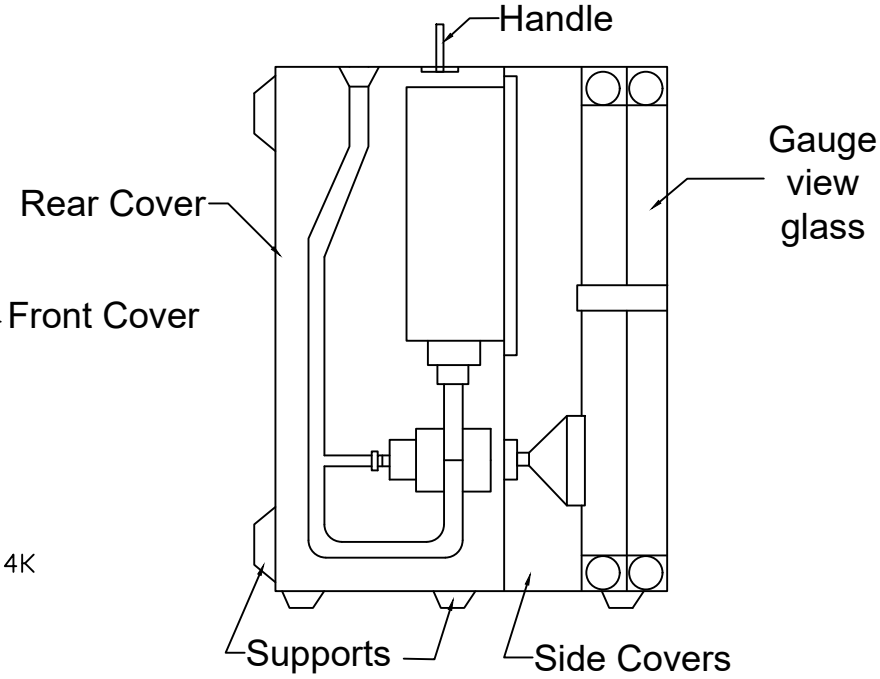


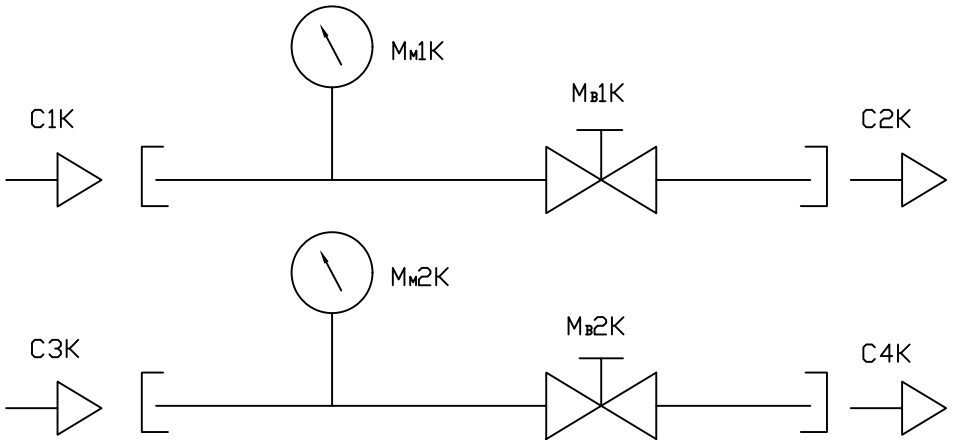
Sketch - 9

Note:

- PS1, PS2, PS3, PS4: Pressure Switches
- SW1, SW2: Manual Control Switch with Indicator
- Relay-1: Single Control Relay
- Relay-2: 2-Way Control Relay
- All Relay with Status Monitoring







Sketch-10

Portable pressure monitoring panel