भारत सरकार
अंतरिक्ष विभाग
सतीश धवन अंतरिक्ष केंद्र शार
श्रीहरिकोटा रेंज डा.घ. 524 124
श्री पोट्टि श्रीरामुलु नेल्लूर जिला, आं.प्र., भारत
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सत्यमेव जयते

Goverment of India
Department of Space
Satish Dhawan Space Centre SHAR
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GOVERNMENT OF INDIA:: DEPARTMENT OF SPACE
SATISH DHAWAN SPACE CENTER SHAR:: SRIHARIKOTA – 524 124
SRI POTTI SREERAMULU.NELLORE DISTRICT (A.P)

TENDER NOTICE NO. SDSC SHAR/Sr.HPS/PT/LSSF/29/2022-2023

On behalf of President of India, Sr. Head Purchase and Stores, SDSC SHAR, SRIHARIKOTA invites on line quotations for the following.

Sl No	Ref. No.	Description	Qty.
01.	SHAR /LSSF/ 2022001428 New E-Procurement [Public Tender – Two Part]	Supply of ground servicing Pneumatic rings for CPCS and associated spare flow components and spare kits for flow components	04 items

Last Date for downloading of tender documents : 15.12.2022 at 16:00 hrs.
Due Date for submission of bids online : 15.12.2022 at 16:00 hrs.
Due Date for opening of tenders : 16.12.2022 at 14:30 hrs.

Instructions to Tenderers:

Bids shall be submitted on line through EGPS only and No tender fee shall be applicable.

01. For full details/scope of work and terms and conditions etc., please see the enclosed annexures.

02. Interested tenderers can download the e-tender from ISRO e-procurement website ISRO NEW E-PROCUREMENT (www.eproc.isro.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. Tender documents are also available on ISRO website www.isro.gov.in ISRO New e-procurement website (www.eproc.isro.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. Quotations received after the due date/time will not be considered.

05. The tender documents are available for download upto 15.12.2022 at 16:00 hrs. and last date for submission of tenders on line 15.12.2022 at 16:00 hrs. and Tender Opening on 16.12.2022 at 14:30 hrs.

06. Interested vendors can attend the Bid opening sessions to know the details. Presence not mandatory to consider the quote for evaluation.

07. Sr. Head, Purchase and Stores, SDSC-SHAR, Sriharikota reserves the right to accept or reject any/or all the quotations.

Status of item availability in GeM: Report ID: GEM/GARPTS/14112022/178QTXD4ANAL

DT: 15.11.2022

Sr. HEAD PURCHASE AND STORES

ENVIRONMENTAL CONTROL AND LIFE SUPPORT SYSTEM (ECLSS) - CPCS

Specifications for Supply of Pneumatic Servicing Rigs, associated flow component spares and Spare kits for the flow components

OCTOBER -2022
SATISH DHAWAN SPACE CENTRE SHAR
SRIHARIKOTA – 524124

Annexure-1

1. Scope of supply

The scope of supply includes design, engineering, procurement of flow components, instrumentation and piping elements, fabrication, qualification, assembly, wiring of equipment, testing and qualification as given in Table-1.

Table-1

Sl. No	Description	Medium	Qty (Nos)	Remarks
Pneumatic Servicing Rig				
1.	Design, engineering, procurement of flow components, fabrication, testing, & supply of pneumatic servicing rig [Gaseous Helium (GHe)] as per the Dwg No: LSSF/CGS/PSR-GHe-01/R0	GHe	3	
2.	Design, engineering, procurement of flow components fabrication, testing, & supply of pneumatic servicing rig [Gaseous Nitrogen (GN2)] Dwg. No: LSSF/CGS/PSR-GN2-01/R0	GN2	3	
Spare flow components & Spare Kits				
3.	Spare flow components and spare kits for the flow components for GHe pneumatic servicing rigs as per **annexure-6**	-	1 Lot	
4.	Spare flow components and spare kits for the flow components for GN2 pneumatic servicing rigs as per **annexure-6**		1 Lot	

2. Introduction

The pneumatic servicing rig is meant for supply of gases like, Nitrogen & Helium gases at the required pressures and flow rates by controlling or by regulating the given source pressure for qualification and testing of the Cabin Pressure Control System (CPCS) gas bottles and related circuits as part of sub system level preparation.

The major flow components inside the equipment are electro pneumatic ball valves, pressure regulators, safety relief valves, manual needle valves, metering valves,

filters, gauge shutoff valves, solenoid valves and required measuring instruments like pressure transmitters and pressure gauges.

The pneumatic servicing operations are critical in nature and are to be carried out remotely. The operations are as follows:

- ✓ Gas bottles charging with Gaseous Nitrogen (GN2)/Gaseous Helium (GHe).
- ✓ Maximum Operating Pressure (MOP) & Proof Pressure Tests (PPT) checks.
- ✓ System purging for achieving the purity and contamination of the circuits.

3. List of annexures of the Tender Document

3.1. Bid submission and offer validity, Taxes and payments terms and other purchase terms and conditions and delivery schedule is given in **Annexure-2**.

3.2. Technical specification of pneumatic servicing rigs is given in Annxure-3.

3.3. Technical specifications of flow components, instrumentation and piping elements, Conditions for Procurement of Flow Components and testing of flow components is given in Annexure-4.

3.4. The schedule of flow components details is given in Annexure-5.

3.5. The List of spare flow components and spare kits details are given in **Annexure-6**

3.6. Tentative Quality Assurance Plan for flow components, piping elements, and fabrication, testing and assembly Annexure-7.

3.7. Party shall submit the details of the flow component make, bore size, PN rating, end connections and submit the technical specifications of the flow component as given in Annexure-8.

3.8. Party shall give compliance to the Minimum Qualification Criteria as given in Annexure-9.

3.9. Party shall give compliance to the Bid Evaluation Criteria as given in Annexure-10.

3.10. Equipment wise P & I diagram are given in **Annexure-11.**

3.11. Party shall give point-wise confirmation as given in Annexure-12. Change in specification/deviations (if any) shall be brought out in the offer with detailed justification

4. Scope of Work

4.1. Design & Selection:

a. Sizing and selection of flow components viz., EP valves, Manual valves, pressure regulators and safety relief valves and piping as per specified flow rates and pressures.

b. Generation and submission of technical specification for each flow components and piping elements to meet the requirements.

c. Selection of flow components model numbers shall be as per schedule of flow components or as per the design, specification of flow components.

d. Finalisation of instrumentation elements.

e. Preparation of wiring diagrams of rigs.

Note:

1. Party shall mention the make of each flow component in the Techno commercial bid. Selected flow components shall be standard/reputed make and highly reliable for high pressure application.
2. The offered make of the flow component will be evaluated before price bid opening. **If the offered make is not acceptable based on the technical specifications, party shall change the make.**
3. **After placement of P.O, change in make is not acceptable**

4.2. Approvals after placing the PO

a. Sizing and selection of flow components and piping.

b. Submission of constructional drawings & model numbers of all flow components, wiring diagrams, instrumentation (Cables, connectors, Pressure Transmitters, Solenoid valves, cable glands) & piping elements for department approval before procurement.

c. Submission of detailed QAP for department approval prior to procurement of flow components, instrumentation & piping elements

4.3. Procurement

a. Party shall procure the flow components as per approved makes and model numbers.

b. Party shall procure approved makes and model numbers of the instrumentation elements i.e. Pressure Transmitters, Solenoid valves, cables, connectors and cable glands.

4.4. Acceptance of procured items

a. Party shall submit the test reports of all elements as per the approved QAPs, specifications and as per the scope.
b. Submission of test reports of all elements for final acceptance.

4.5. Generation of fabrication drawings, fabrication & qualification

a. Submission of isometric drawings and fabrication drawings and bill of materials required for fabrication.
b. The above drawings will be reviewed and approved by the department before commencement of fabrication.
c. Party shall submit the fabrication, qualification/testing and cleaning procedure for department approval.
d. Party shall submit the detailed Oxygen cleaning procedure and cleaning agents for department approval.
e. Fabrication of equipment as per the finalized procedure and as per the approved fabrication drawings.
f. Qualification and cleaning and conditioning of all pipe spools as per the procedure.

4.6. Assembly of flow components and Integrated testing:

a. Assembly of flow components as per the finalized model numbers and as per the P & ID.
b. Wiring and interfacing of instrumentation of all equipment along with mating connectors prior to functional checks.
c. Testing of Pneumatic servicing rigs as per the approved test procedure.
d. Checking of interfaces (i.e. inlet and outlet), moisture and cleanliness.

4.7. Delivery

a. Packing and transportation of equipment to SDSC SHAR, Sriharikota as per the Purchase Order (P.O terms and Conditions).

5. Design Considerations

5.1. Piping shall be designed as per ANSI 31.3 (Process Piping)/Equipment.
5.2. Max. Velocity considered for GN2 – 30 m/s and GHe – 80 m/s.

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

5.4. Threaded end connections are envisaged up to 25NB and 400 Bar.

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

5.6. All fluid circuits are designed for 1.25 times of maximum working pressure plus 1.5 mm corrosion allowance 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 plus 0.5 mm corrosion allowance. However maximum working pressure for piping shall be considered as 10 Bar if working pressure is less than 10 Bar.

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

5.8. 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.

5.9. 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.

5.10. 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).

5.11. 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.

5.12. 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.

5.13. MOC of the components/parts which are not mentioned here shall be considered as SS304/SS316 and SS304L/SS316L (in case of welding)

6. Fabrication, testing and conditioning

I) During Fabrication of the Equipment

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

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

6.3 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)

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

6.5 No socket welding is permitted.

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

6.7 All weld joints fit-Ups & alignment shall be done by the qualified fitter

6.8 All weld joints shall undergo DP root and final (Die penetrate) test.

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

6.10 X-Ray or Gama Ray shall be employed.

6.11 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.

6.12 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.

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

6.14 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

6.15 Electrodes for MS Structural(E7018/E6013): Size 2.5 mm / 3.15 mm, make

6.16 c) Dye-Penetrate test Kit Containing cleaner / Penetrant / Developer

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

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

6.19 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.

6.20 All pipe & flow components shall be supported properly.

II) Testing & conditioning of the equipment after fabrication

6.21 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.

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

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

6.24 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).

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

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

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

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

6.28 All SS pipes lines after welding &hydrotest, pickling and passivation shall be taken up for both internal external surfaces.

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

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

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

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

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

7. Assembly and Integrated Testing of Equipment:

7.1. All threaded assemblies shall be applied with oxygen compatible grease prior to assembly.

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

7.3. All flow components to be assembled with at most care to avoid damage of sealing surfaces and threaded joints during assembly

7.4. All the SS pipes & MS pipe supports shall be separated by shim plates and the same arrangement shall be clamped to supports with SS clamps.

7.5. Pneumatic Leak checking of the equipment to be carried out at maximum operating pressure using snoop/ pressure drop method and functional testing of the integrated equipment shall be carried out using R Grade Gaseous Nitrogen (GN2).

7.6. All flow components are to be firmly fixed inside the cabinets with proper clamping/ bolting arrangement.

7.7. Tested and cleaned pipe lines/ spools shall be connected to the flow components

7.8. Proper size & diameter clamps with shim plates shall be used for pipe line supporting inside the equipment (clamps & shim plates sizes shall be as per the drawing for each size)

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

7.10. **Scope of integrated Testing:**

a) Pneumatic leak checks at maximum operating pressure with GN2 using snoop solution.
b) Seat leak checks of flow components.
c) Valves functional checks (Manual & EP valves)
d) Connector level interface checks of instruments.
e) Functional testing of instrumentation elements like solenoid, EP pneumatic valves, pressure transmitters etc.
f) Cleanliness checks for particle analysis.

8. Cabinets for Pneumatic Servicing Rig:

8.1. 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.

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

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

8.4. 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 provide till supply

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

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

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

8.8. 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

8.9. **Tentative Cabinet Size:** 2000mm (L) x 1000mm (W) X 1500mm (H). Cabinet Drawing is enclosed in **Anexxure-11(Attachment 3). Exact cabinet size shall be finalized during realization of equipment.**

9. Inspection:

9.1. All piping elements, equipment fabrication activities and testing of flow components (**if procured from Indian vendors**) will be witnessed by flow components manufacturer QC, rig /equipment manufacturer QC and along with the department engineer.

9.2. 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 (minimum two weeks). The items shall be dispatched only after completion of inspection by the purchaser's inspection engineers.

9.3. In case, if the flow components are planned to procure from foreign vendors, flow component manufacturer QC will witness all the tests and reports will be reviewed by rig /equipment manufacturer QC and department engineer for final dispatch clearance

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

Annexure-2

Bid submission and offer validity, Taxes and payments terms and other purchase terms and conditions and delivery schedule

1. Bid/Offer Submission details:

Bid/Offer Submission details:

a) Supplier shall present the bids on <u>two-part basis as highlighted below</u>:

- ✓ **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:

- The tenderer shall furnish **<u>point-wise confirmation (Technical Compliance attached in Annexure-12)</u>** 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.
- Tenderer need to furnish the details related to commercial terms indicating payment terms, details of bank guarantee in case of advance payments etc.
- Mode of dispatch of the pneumatic equipment shall be by Road.
- Place of manufacturing shall be clearly indicated in the offer.
- Bidder need to submit Un-priced price bid copy (as highlighted below) 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 shall lead to dis-qualification of bid.
- The price bids will be opened only after evaluation and acceptance of the techno commercial bid of the respective tenderer.
- Spares list along with the flow components model numbers shall be submitted by the supplier along with techno commercial bid.

- **Format of Un-Priced Price Bid:**

  ✓ **Confirmation of item wise cost break up by the supplier.**

Sl No	Description	Qty (Nos)	Unit Price	Total Price	Taxes if any	Total Cost including Tax	Separate Cost mentioned in price bid (YES/NO)
1.	Design, engineering, procurement of flow components fabrication, testing, & supply of pneumatic servicing rig [Gaseous Helium (GHe)] as per the Dwg No: LSSF/CGS/PSR-GHe-01/R0	3	Unpriced	Unpriced	Unpriced	Unpriced	
2.	Design, engineering, procurement of flow components fabrication, testing, & supply of pneumatic servicing rig [Gaseous Nitrogen (GN2)] Dwg. No: LSSF/CGS/PSR-GN2-01/R0	3	Unpriced	Unpriced	Unpriced	Unpriced	
3.	Spare flow components and spare kits for the flow components for GHe pneumatic servicing rigs as per annexure-6	1 Lot	-	Unpriced	Unpriced	Unpriced	
4.	Spare flow components and spare kits for the flow components for GN2 pneumatic servicing rigs as per annexure-6	1 Lot	-	Unpriced	Unpriced	Unpriced	

1.2. **Part-II: Price bid indicating the price:**

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

Sl No	Description	Qty (Nos)	Unit Price	Total Price	Taxes if any	Total Cost including Tax	Separate Cost mentioned in price bid (YES/NO)
1.	Design, engineering, procurement of flow components fabrication, testing, & supply of pneumatic servicing rig [Gaseous Helium (GHe)] as per the Dwg No: LSSF/CGS/PSR-GHe-01/R0	3					
2.	Design, engineering, procurement of flow components fabrication, testing, & supply of pneumatic servicing rig [Gaseous Nitrogen (GN2)] Dwg. No: LSSF/CGS/PSR-GN2-01/R0	3					
3.	Spare flow components and spare kits for the flow components for GHe pneumatic servicing rigs as per annexure-6	1 Lot	-				
4.	Spare flow components and spare kits for the flow components for GN2 pneumatic servicing rigs as per annexure-6	1 Lot	-				

Note: "*" Total price of equipment or spares shall be inclusive of all costs (Eg. Custom duty, P& F any other charges as applicable) except GST. Party shall mention the HSN code for the pneumatic servicing rigs and spares separately.

2. Offer Validity:

The validity of the offers / tenders should be 180 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**.

3. Taxes and Duties:

a. GST details are given below:

GSTIN : 37AAAGS1366J1Z1

LEGAL NAME : SATISH DHAWAN SPACE CENTRE SHAR

VALIDITY FROM : 29/08/2017

TYPE OF REGISTRATION : REGULAR

4. Payment Terms:

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

However, in case of any request from supplier/party, the following payment terms may be considered.

a. 20% of order value as advance against submission of Advance Bank Guarantee.
b. 70% of order value against receipt and acceptance of items at SDSC SHAR based on the cost of each individual item on PRO-RATA basis within 30 days.
c. Balance 10% of order value after supplying of all items at SHAR and against submission of Performance Bank Guarantee.
d. Wherever advance payment is requested, Bank Guarantee from any Nationalized Bank/Scheduled Bank should be furnished. In case of advance payments, if the vendor/supplier is not supplying the material within the delivery schedule, interest will be levied as per the Marginal Cost of Lending Rate (MCLR) of SBI plus 2% penal interest.
e. 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. In case of different milestone payments submitted by the parties, a standard and transparent methodology like NPV will be adopted for evaluating the offers.

5. Mode of Payment:

Bidders can submit the banker details and payments can be made through NEFT/RTGS/ECS through PFMS.

6. 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 @ 0.5% per week or part thereof subject to a maximum of 10% of total order value.

7. Performance Bank Guarantee:

Performance Bank Guarantee for 3% of the order value should be furnished in the form of Bank Guarantee from nationalized/scheduled bank till warranty period plus sixty days.

8. Security Deposit:

Security Deposit for 3% of the order value is mandatory. Party shall furnish the Security Deposit in the form of Bank Guarantee from nationalized/scheduled bank or by Demand Draft valid till completion of the contract period plus sixty days for faithful execution of the contract.

9. Combined Bank Guarantee:

Combined Bank Guarantee for performance bank guarantee & security deposit of 3% of the order value should be furnished in the form of Bank Guarantee from nationalized/scheduled bank till warranty period plus sixty days **with in 10days from the receipt of PO.**

10. Arbitration:

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, such dispute/s or difference/s or claim/s shall be settled amicably by mutual consultations of the good Offices 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.

Work under the Contract shall be continued by the CONTRACTOR during the pendency of arbitration proceedings, without prejudice to a final adjustment in accordance with the decision of the Arbitrator unless otherwise directed in writing by the DEPARTMENT or unless the matter is such that the works cannot be possibly continued until the decision (whether final or interim) of the Arbitrator is obtained.

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

The following steps to be followed after awarding the contract.

Sl.No	Approval Time line	Description
1.	T0	Date of Release of purchase order
2.	T1 = T0+1 Weeks	Pipe Sizing calculations and Finalization of flow components.
3.	T2 = T1+1Week	1. Submission of details of flow component model numbers for each rack. 2. Generation of finalized specification of flow components and QAPs for approval
4.	T3 = T2+1Week	1. Verification of model numbers and department approval for procurement of flow components. 2. Verification and approval of finalized specification of flow components and QAPs for approval
5.	T4= T3+3days	Generation of fabrication drawings
6.	T5= T4+4days	Review and Approval of fabrication drawings/procedures by department. The comments if any, offered by Department have to be incorporated.
7.	T6= T5+8weeks	✓ Procurement of all flow components, instruments, piping elements and spare flow components and spare kits
8.	T7= T6+2weeks	Fabrication, testing of spools, oxygen cleaning, assembly, functional checking of equipment **and supply as given below:** ✓ Gaseous Helium servicing rig - 1 No ✓ Gaseous Nitrogen servicing rig – 1 No

Sl.No	Approval Time line	Description
9.	T8= T7+2weeks	Fabrication, testing of spools, oxygen cleaning, assembly, functional checking of equipment **and supply as given below:** ✓ Gaseous Helium servicing rig - 2 Nos ✓ Gaseous Nitrogen servicing rig – 2 Nos
Note: All the above events including entire scope of Purchase Order shall be completed within 4 months (16 Weeks) from the date of release of purchase order.		

12. Minimum Qualification criteria:

a. The Vendor should be in the field of design, procurement of flow components, fabrication, assembly, inspection, testing and delivery of pneumatic equipment during the last Five years ending with 31-03-2022.

- ✓ Single order value not less than **Rs.400 Lakhs** (or)
- ✓ Two orders of value not less than **Rs.300 Lakhs** (or) each
- ✓ Three orders of value not less than **Rs.200 Lakhs** each.

b. Details of the last five years purchase orders shall be submitted along with the offer for proof of above.

c. Tenderers should have average annual turnover for the last three years (FY: 2019-20, 2020-21 & 2021-22) of **Rs.400 Lakhs.**

d. The Bidders shall submit Profit & Loss Accounts, Balance Sheets duly certified by the auditor and IT returns for the last three financial years with acknowledgement from IT Department up to last 3 years (ending with 31-03-2022). Necessary documents shall be submitted.

e. Latest Solvency certificate form any Nationalized/Scheduled bank shall be submitted for a value of minimum **Rs.200 Lakhs**. The Solvency certificate must have been issued during current financial year.

f. **Manufacturing through sub vendors is not acceptable.**

g. Supplier should submit the end user certificate from the customer for confirming the satisfactory execution of design, fabrication, assembly inspection, testing and delivery of pneumatic equipment with an operating pressure of 250 bar and above. **Non-submission of relevant end user certificate shall lead to technical disqualification of the offer.**

h. The firm must provide a self-declaration that there is no complaint/vigilance inquiry against them in any Govt./Department/PSU and they have not been black listed by any Govt. Department/PSU.

i. Technical proposal of the bidder, which is not able to substantiate/satisfy the claims made by it with respect to the technical requirements laid down in this RFP, will be summarily rejected.

j. Offers of those bidders taking full scope of the work as per the requirements indicated in the RFP only will be considered.

13. Bid Evaluation Criteria:

a. In respect of Two-Bid system, the technical Bids forwarded by the Bidders will be evaluated by the Department with reference to the technical specifications as mentioned in the RFP. The compliance of Technical Bids would be determined on the basis of the parameters specified in the RFP. The Price Bids of only those Bidders will be opened whose Technical Bids would clear the technical evaluation.

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

c. Performance of Bidder on similar nature of works executed/ under execution will be taken into consideration before selecting the Bidder for opening his price bid (as per qualification criteria).

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

e. 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.

f. Purchaser reserves the right for evaluation of any bidder by visiting his manufacturing premises towards acceptance of the techno-commercial bid. The decision of the purchaser is final in this regard.

g. Preference will be given to MSME as per public procurement policy.

h. Part order acceptance to the quoted price: Part order will be issued as follows (GN2 RIG and GN2 rig spare flow components and spare kits for flow components) and (GHE rig and GHe rig spare flow components and spare kits for flow components).Rig and its spares together will be considered for splitting the order

14. General Conditions:

14.1. Party shall submit the make of flow components, model numbers, DN & PN rating in the Techno commercial bid.

14.2. Electrical wiring diagrams shall be provided for all the equipment.

14.3. Current rating and voltage requirements for individual elements shall be given for interface study.

14.4. Before purchase of flow components, Party shall submit all the technical specifications of the flow components, constructional drawings & seal kit and the same shall be sent for approval.

14.5. Party has to generate fabrication drawings of equipment and obtain approval from the department prior to the procurement / fabrication

14.6. The flow components shall be inscribed with Model No, size, working pressure and material of construction of body, manufacturers number etc.

14.7. Any damage of flow components, equipment and connectors during 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). Spare flow components/spare kits shall not be used for replacing the damaged flow components during testing.

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

14.9. Equipment general arrangement drawings shall be provided by providing overall dimensions (size), weight, handling provisions etc.

14.10. All MS structural elements like supports, cabin structures and other members shall be sand blasted and apply Aluminum Epoxy Mastic primer for 100micron DFT.

14.11. All pipe lines shall be painted (Primer and Finish Coat) as per color coding. For Helium Medium Light Orange and for Nitrogen Medium Brilliant Green shall be used for painting of pipe lines inside the racks.

14.12. All equipment name plates, tagging, P & IDs, wiring diagrams shall be in the scope of supplier.

14.13. Purchaser reserves right to cancel the PO at any time with the application of penalty & Security deposit in case of failure of bidder to fulfill P.O technical specifications.

14.14. All pressure gauges and pressure transmitters shall be removed during transportation. SS dummy plug (M20x1.5) shall be used in place of pressure gauges.

14.15. Tentative QAP is enclosed as part of technical specifications in **Annexure-7**. However final QAP shall be mutually agreed and finalized. Party shall submit the QAP along with the Techno commercial bid.

14.16. **The delivery period for the supply of the pneumatic equipment shall be within 4 months (16 Weeks) from the date of release of the purchase order.**

14.17. Equipment wise P & I drawing enclosed in **Annexure-11**. Any configuration change in the pneumatic equipment shall be mutually agreed and finalized.

14.18. Both mechanical and electrical mating connectors shall be sent along with equipment

14.19. **Documentation:** At the time of dispatch 3 sets of documents comprising the following shall be submitted.

- ✓ P & ID 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.
- ✓ Ball run test reports for all spools.
- ✓ 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 drawings.
- ✓ Factory test certificates for all flow components.

14.20. **Unloading and commissioning of the equipment at SDSC SHAR is in the scope of purchaser(SHAR)**

14.21. The cable shall enter all the Pressure transmitters shall be with SS304/316 Double compression weather proof cable gland of IP 67 or better.

14.22. Conditions for cable dressing: Since multiple single pair/triad cables will be wired from field instrument to connectors, the following cable dressing shall be planned at both the instrument connector end and Rack receptacle connector end for exposed wires.

a. **Inner layer**: The exposed wires shall be protected with Teflon (0.075mm thick) tapes.
b. **Middle Layer**: Heat shrinkable tubes (polyolefin sleeves (2:1)) of required diameter and length up to cable outer sheath.
c. **Outer layer**: 6.6 Polyamide Nylon Braid (Mesh type) of required size and length up to cable outer sheath.

14.23. Equipment cost shall be inclusive of flow components, piping elements, instrumentation elements and their testing charges, structural, cabinet, welding, assembly, consumables, cleaning, testing and customs, P&F (test media and testing machinery), delivery and any other charges not mentioned above and applicable **except GST (GST HSN code shall be mentioned as part of offer)**

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

14.25. All flow components performance tests mentioned here are tentative. However, the tests and scope will be finalized after finalization of flow components make, model numbers & QAP.

14.26. One/two persons from the party shall be deployed during transportation and unloading of the equipment

14.27. **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.

14.28. **WARRANTY:** The Equipment with accessories supplied shall be warranted for trouble free service of 12 months 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 etc., the same shall be rectified / replaced by party with free of cost within a reasonable period.

14.29. **Make in India (MII) Clause**

14.30. For this procurement, bids from Class-I & class-II Local Suppliers are admissible. Hence provisions contained in Public Procurement (Preference to 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. In case bid value is in excess of Rs. 10 Cr., Class-I local supplier / Class-II local supplier shall be required to provide a certificate from the statutory auditor or cost auditor of the company (in the case of companies) or from a practicing cost accountant or practicing chartered accountant (in respect of suppliers other than companies) giving the percentage of local content.

   iii. 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.

   iv. 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 and in their absence, Class-II Local supplier will be considered.

Annexure-3

Technical Specifications of Pneumatic Servicing Rigs

1. End Connections for GN2 Servicing Panel

Table 1: End Connections for GN2 Servicing Panel

Sr.No	Line Number	Details			
		Purpose	Type	Designation	Size
1.	615-GN2-15-D1-SS	EP valve CMD	Vent	V1	M30X1.5
2.	600-GN2-15-F8-SS	GN2 Inlet	Inlet	IL01	M30X1.5
3.			Vent	V2	M30X1.5
4.	601-GN2-15-F8-SS	CM GB servicing	Outlet	OL01	M30X1.5
5.					
6.				OL02	M30X1.5
7.					
8.	602-GN2-25-D1-SS	CM GB Vent	Vent	V3	M45X1.5
9.	603-GN2-15-F8-SS	SM GB servicing	Outlet	OL03	M30X1.5
10.					
11.				OL04	M30X1.5
12.					
13.	604-GN2-25-D1-SS	SM GB Vent	Vent	V4	M45X1.5
14.	606-GN2-15-F6-SS	HPR O/L Lines leak check	Outlet	OL05	M30X1.5
15.					
16.	606A-GN2-15-F7-SS	SPSR Testing	Outlet	OL05A1	M30X1.5
17.	607-GN2-25-D1-SS	VS1 (SRV Vent)	Vent	V5	M45X1.5
18.	609- GN2-15-D1-M	SPSR O/L Lines leak check & Purge	Outlet	OL06	M30X1.5
19.					
20.	610-GN2-25-D1-SS	VS2 (SRV Vent)	Vent	V6	M45X1.5
21.	612-GN2-15-D1-SS	CM SRV leak check	Outlet	OL07	M30X1.5
22.					
23.	613-GN2-25-D1-SS	VS3 (SRV Vent)	Vent	V7	M45X1.5
24.	615-GN2-15-D1-SS		Outlet	OL08	M30X1.5

Sr.No	Line Number	Details			
		Purpose	Type	Designation	Size
25.		EP Valve Command supply			
26.	616-GN2-25-D1-SS	VS4 (SRV Vent)	Vent	V6	M45X1.5

2. End Connections for GHe Servicing Panel

Table 2: End Connections for GHe Servicing Panel

Sr. No	Line Number	Details			
		Purpose	Type	Designation	Size
1.	515-GHe-15-D1-SS	EP valve CMD	Inlet	IL1A	M30X1.5
2.		EP valve CMD	Vent	V1	M30X1.5
3.	500-GHe-15-F8-SS	GHe/GN2 Inlet	Inlet	IL01	M30X1.5
4.			Vent	V2	M30X1.5
5.	501-GHe-15-F8-SS	CM GB servicing	Outlet	OL01	M30X1.5
6.					
7.				OL02	M30X1.5
8.					
9.	502-GHe-25-D1-SS	CM GB Vent	Vent	V3	M45X1.5
10.	503-GHe-15-F8-SS	SM GB servicing	Outlet	OL03	M30X1.5
11.					
12.				OL04	M30X1.5
13.					
14.	504-GHe-25-D1-SS	SM GB Vent	Vent	V4	M45X1.5
15.	506-GHe-15-F5-SS	HPR O/L Lines leak check	Outlet	OL05	M30X1.5
16.					
17.	507-GHe-25-D1-SS	VS1 (SRV Vent)	Vent	V5	M45X1.5
18.	509-GHe-15-D1-M	SPSR O/L Lines leak check & Purge	Outlet	OL06	M30X1.5
19.					
20.	510-GHe-25-D1-SS	VS2 (SRV Vent)	Vent	V6	M45X1.5
21.	512-GHe-15-D1-SS	CM SRV leak check	Outlet	OL07	M30X1.5
22.					

Sr. No	Line Number	Details			
		Purpose	Type	Designation	Size
23.	513-GHe-25-D1-SS	VS3 (SRV Vent)	Vent	V7	M45X1.5

3. Operating Pressure GN2 & GHe Servicing Rigs

Table 3: Operating Pressures for Helium & Nitrogen Servicing Rigs

Sr.No	Line Number	Medium	Purpose	Operating Pressure bar	
				Min.	Max.
A) Helium Servicing Rigs					
1.	500-GHe-15-F8-M	GHe	Inlet	150	400
2.	501-GHe-15-F8-SS	GHe	CM GB servicing	150	400
3.	502-GHe-25-D1-SS	GHe	CM GB venting	NA	*
4.	503-GHe-15-F8-SS	GHe	GOX GB SM servicing	100	400
5.	504-GHe-25-D1-SS	GHe	CM GB venting	NA	*
6.	505-GHe-15-F8-SS	GHe	CPPR O/L Line leak check VR01 I/L	100	400
7.	506-GHe-15-F6-SS	GHe	CPPR O/L Line leak check	50	75
8.	507-GHe-25-D1-SS	GHe	SRV vent (VS01) Header	NA	*
9.	508-GHe-15-F5-SS	GHe	SPSR O/L Line leak check & Purge VR02 I/L	50	75
10.	509-GHe-15-F5-SS	GHe	SPPR O/L Line leak check& Purge	9	13.5
11.	510-GHe-25-D1-SS	GHe	SRV vent (VS02) Header	NA	*
12.	511-GHe-15-F5-SS	GHe	CM SRV Line leak check VR03 I/L	50	75
13.	512-GHe-15-D1-SS	GHe	CM SRV Line leak check	1.5	2.0
14.	513-GHe-25-D1-SS	GHe	SRV vent (VS03) Header	NA	*
B) Nitrogen Servicing Rigs					
1.	600-GHe-15-F8-M	GN2	Inlet	150	400
2.	601-GHe-15-F8-SS	GN2	CM GB servicing	150	400
3.	602-GHe-25-D1-SS	GN2	CM GB venting	NA	*
4.	603-GHe-15-F8-SS	GN2	GOX GB SM servicing	100	400
5.	604-GHe-25-D1-SS	GN2	CM GB venting	NA	*
6.	605-GHe-15-F8-SS	GN2	CPPR O/L Line leak check VR01 I/L	100	400

Sr.No	Line Number	Medium	Purpose	Operating Pressure bar	
				Min.	Max.
7.	605A-GHe-15-F8-SS	GN2	SPPR O/L Line leak check VR01 I/L	300	400
8.	606-GHe-15-F6-SS	GN2	CPPR O/L Line leak check	50	75
9.	606A-GHe-15-F7-SS	GN2	SPPR Testing	30	250
10.	607-GHe-25-D1-SS	GN2	SRV vent (VS01) Header	NA	*
11.	608-GHe-15-F5-SS	GN2	SPSR O/L Line leak check & Purge VR02 I/L	50	75
12.	609-GHe-15-F5-SS	GN2	SPPR O/L Line leak check& Purge	9	13.5
13.	610-GHe-25-D1-SS	GN2	SRV vent (VS02) Header	NA	*
14.	611-GHe-15-F5-SS	GN2	CM SRV Line leak check VR03 I/L	50	75
15.	612-GHe-15-D1-SS	GN2	CM SRV Line leak check	1.5	2.0
16.	613-GHe-25-D1-SS	GN2	SRV vent (VS03) Header	NA	*
17.	614-GHe-15-F6-SS	GN2	EP Valve command supply VR03 I/L	50	75
18.	615-GHe-15-D1-SS	GN2	EP valve command supply O/L	7	8.5
19.	616-GHe-25-D1-SS	GN2	SRV vent (VS03) Header	NA	*
20.	**Note 1: All pressures are in bar (g)**				
21.	**Note 2:" *" SRV header shall be sized for back pressure less than 10% of set pressure (minimum size of SRV vent header shall be 25NB)**				

Annexure-4

Technical Specifications of Flow Components, Instrumentation and piping elements

1. Specification for Pressure Regulators

Sr.No	Description	Specification
Technical Specifications		
1.	**Quantity & Details**	**As per table 4&14(spares)**
2.	**Types / Constructional Details**	
3.	Loading	Spring
4.	Seating	Soft seated /Metal to metal
5.	Sensing	Diaphragm/piston
6.	Poppet shape	Conical
7.	Balancing	Balanced design is preferred. No bleed type.
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 SS304/SS316**
13.	Wetted parts	SS304/SS316
14.	Seals	VITON/PTFE/PEEK
15.	Cleaning	For Oxygen gas service
16.	Flow rate	**As per table 4**
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 (droop 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 & Out let pressure range	**As per table 4**

2. Specification for Safety Relief Valves

Sr.No	Description	Specifications
Technical Specifications		
1.	**Quantity & details**	**As per table 5&15(spares)**
2.	**Types / Constructional Details**	
3.	Service	Gas application
4.	End Connections	Threaded valves: Metric /BSPP
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	45 ^{0}C (MAX)
9.	Working fluid	GN2/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 flowrate 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:**	

Sr.No	Description	Specifications
21.	Body& end connection Material	**ASTM A 182 /479/276 SS304/SS316/ASTM A 351**
22.	Wetted parts	SS316/SS304
23.	Soft Seals/seats	Viton/PTFE/PEEK/PVDF/KEL-F

3. Specification for Electro-Pneumatic Ball Valves

Sl. No	Description	Specifications
Technical Specifications		
1.	**Quantity & details**	**As per table7&17(spares)**
2.	**Specification for Valves**	
3.	Type	Ball valve
4.	End connection Style	Metric /BSPP threaded end connection
5.	Port configuration	Two Way & normally closed
6.	Body construction	Single Piece (except end connection)
7.	Constructional features	Floating ball
		Reduced bore
		With Blowout proof stem
		Dual stem seals (gland packing & O-ring)
		By pneumatically operated actuator
		Solid ball
		Anti-Static
8.	Manufacturing standard	Manufacturer's standard
9.	Face to face dimensions	Manufacturer's standard
10.	Design code	ASME B 16.34/equivalent
11.	Testing code	BSEN-ISO-12266 Part 1/API 598 /Equivalent
12.	Working temperature	-10 to 50 ^{0}C
13.	Maximum working Pressure (MOP)	400BAR
14.	Fluid Handled/medium	GN_2/GHe
15.	Cleaning	For Oxygen gas usage
16.	**Material of construction Valve & seals**	
17.	Body Material	**ASTM A 182 /479/276 SS304/SS316**
18.	Stem	**ASTM A 182 F304/17-4PH**
19.	Ball Material	SS316/304 of Solid construction

Sl. No	Description	Specifications
20.	Seat Material	PTFE /PCTFE/PEEK/DELRIN/DEVLON
21.	Primary & Secondary stem seal	VITON/PTFE/ Equivalent
22.	Body seal /End connection	PTFE/VITON/Equivalent
23.	**Actuator specification: Type, MOC, construction &other details**	
24.	Type	a) Pneumatically actuated& Single acting
		b) Spring return
		c)Direct mounted on valves with ISO mounting pad
		d) fail to close position
		e) Quarter turn (90 degree)
25.	Pneumatic supply connections to actuator	¼ "NPT, Female or 1/4" BSPP
26.	Pneumatic pressure	Air/GN2 at 5-8bar
27.	Type of solenoid mounting	Provision Namur mounting of solenoid valve
28.	Body material	Die cast Aluminum Alloy Internally Hard anodized, externally coated with Polyurethane/ Epoxy powder
29.	Piston and rack	Anodized die cast Aluminum
30.	Response time	a) Opening :0.5 to 1.0sec b) Closing :1.0 to 2.0sec
31.	Actuator torque	The actuator shall be 30 to 50% extra torque than normal torque required to open or close valve against operating pressure as per class rating of the valve.
32.	Springs	Cartridge type multi springs of material spring steel
33.	Dimensions of actuator	Envelope dimensions of the actuator shall be sent **as a part of offer**
34.	Weight	Weight of the actuator shall be mentioned in the offer
35.	Testing	100% Valves shall undergo Valve timings (opening & closing) test by using Namur mount solenoid valve.
36.	**Specification for limit switches**	

Sl. No	Description	Specifications
37.	Limit switch	The specified Micro-Switch assemblies housed in Flame proof and weatherproof enclosure will be mounted on Actuator for monitoring the ON/OFF status of Electro Pneumatic Valves.
38.	Type	Heavy Duty, SPDT Switches (Single pole double throw contacts)
39.	No. of switches per valve	4Nos. (2 Nos. for OPEN & 2 Nos. for CLOSE Status)
40.	Contacting Rating	5Amps at 24V DC/Equivalent
41.	Operating Temperature	Max 50 °C
42.	**Specification for limit switch enclosure**	
43.	Enclosure	All the four no. of Micro-Switches, 15 nos of terminal blocks, spring loaded rotary cams for position setting along with connecting shaft etc., shall be housed inside the enclosure as specified below. **Note: ($)-**Micro-Switches shall be mechanical contact type. The three wires/leads from each of the Micro-Switches shall be sealed at switch side and other end terminated on terminal blocks (shall be of cage clamp, not screw type)/PCB. It means all the 12 leads from all the micro switches shall be terminated on terminal blocks/PCB. However, total 15 nos. of terminal blocks including spares shall be provided inside each enclosure
44.	Material of Construction	Tropicalized/Die cast Aluminum Alloy with corrosion resistant paint/Equivalent higher grades
45.	Degree of protection	IP 65 or Better
46.	Electrical Classification	Flame proof suitable for Zone 1 or better, Group II C environment certified by BASEEFA/ IS 2148 Gr.II C or equivalent International Agency.
47.	Cable Entry	¾" NPT (female) 2 nos. (1 no. to be plugged) One no. of ¾" NPT suitable compression gland (GR-IIC) shall be supplied with each enclosure.
48.	Local ON/OFF indication	Impact Resistant Thermoplastic (Preferable). To be mounted on Micro-Switch assembly.

Sl. No	Description	Specifications
49.	Mounting Accessories	All fittings, connectors, screws, Cir clips etc. shall be of SS 304 /316 only & the scope includes the supply of coupling and mounting bracket links.
50.	Cams for switches	Individual cam with adjustment Provision for each Micro-Switch to be provided.
51.	Mounting	To be mounted directly on actuator
52.	**Solenoid valves**	**As per number of EP Valves**

4. Specification for Manual Needle Valves:

Sr.No	Description	Specification
1.0 Technical Specifications		
1.	**Quantity & details**	**As per Table 8&18(spares)**
2.	**Configuration and constructional features**	
3.	Type	**Needle**
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 Table 8&18(spares)**
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 SS304/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	SS304/316
22.	Cleaning	Total assembly shall be cleaned for oxygen gas usage

5. Specification for Metering Valves

Sr. No	Description	Specification
Technical specifications		
1.	**Quantity & details**	**As per table 11&21(spares)**
2.	**Configuration and constructional features**	
3.	Type of valve	Metering
4.	Flow pattern	Angle valve
5.	Type of mounting	Panel mounting
6.	End connection	Metric/ BSSP
7.	Type of Seating	Metal to metal or soft seated
8.	Bore (d)	**As per table 11&21(spares)**
9.	Type of stem moment	Non -rotating
10.	Design	As per manufacturer standard
11.	Dimensions	As per manufacturer standard
12.	Working temperature	-10 to 50 Deg.C
13.	MOP	400bar
14.	Medium	GN2/GHe
15.	Type of handle	Handle with turns counter /Vernier
16.	**Material of Construction**	
17.	Body	**ASTM A 182 /479/276 SS304/SS316**
18.	Seals	VITON/PTFE/PCTFE
19.	Material of construction of all other wetted parts	All other wetted parts shall be of SS304/316 only

6. Specification for Filters:

Sr.No	Description	Specification
1.0 Technical Specification		
1.	**Quantity &details**	**As per Table 12&22(Spares)**
2.	**Type, operating conditions and constructional features**	
3.	Type	T-Type / In line
4.	Fluid Medium	GN2 / GHE
5.	Temperature	-10 °C to +50 °C
6.	Filter element type	SS Woven Mesh Type Pleated/cylindrical

Sr.No	Description	Specification
		✓ Filtration mesh shall be provided with internal and external supporting mesh of higher micron rating ✓ Fixing of filter element with end caps and to the adapters shall be only by welding. **Adhesive is not permitted.**
7.	Filtration rating	20micron (absolute)
8.	**Filtration area**	**Greater than 10times the inlet pipes ID as per the table 12**
9.	Flow type	Bi-directional
10.	Collapsibility	**Element should withstand for a maximum differential pressure of 5 Bar without any damage.**
11.	Design standard	Manufacturers standard
12.	Threads to be	Metric or BSPP
13.	Cleaning	For Oxygen gas usage
14.	**Material of construction of filter and it's elements**	
15.	Body	**ASTM A 182 /479/276 SS304/SS316**
16.	Mesh	SS 304L/316L
17.	Perforation cylinder	SS 304L/316L
18.	Seals & O-rings	PTFE/Viton/PCTFE /PEEK/Metal to metal
19.	End connections	Metric /BSPP

7. Specification for Pressure Gauges:

Sr.No	Description	Specifications
1.0 Technical specifications		
1.	**Quantity & Details**	**As per table 6&16(spares)**
2.	**Type ,MOC ,operating conditions, Configuration& other details**	
3.	Type	Bourdon tube with blow out disc at top, laminated safety glass window
4.	Material of construction	a) Bezel & Casing SS 304/316 or Equivalent b) Bourdon tube – SS1.4751 (316Ti) – TIG welded to the socket c) Socket & other wetted parts – SS 316Ti d) Pointer – Aluminum or equivalent with zero adjustment provision
5.	Working media	GN2/GHe

Sr.No	Description	Specifications
6.	Type of entry	Bottom /Panel mounted
7.	End connection	M20 x 1.5
8.	Accuracy	± 0.5% of FSD
9.	Resolution/LC	1% of full scale value
10.	Design /manufacturing Std.	EN837 – 1 or equivalent DIN/IS Standards
11.	Design Temperature & Rh	60Deg C & RH-100%
12.	Classification	Weather proof (IP65 or better)
13.	Dial Size	160mm
General conditions		
14.	Pressure gauges shall be provided with Shatter proof glass. Bezel material shall be same as that of case material.	
15.	The gauge indicator movement shall be micro point adjustment for calibration purpose.	
16.	Pressure gauges shall have over range protection of minimum 130% FSD and primary elements shall withstand the specified overpressure without losing their elastic properties and performance.	
17.	The instrument serial no, Model no, accuracy, range, resolution, etc. shall be printed on the dial.	
18.	Original calibration certificates for each pressure gauge from the manufacturers shall be supplied.	
19.	Supplier may exercise multiple options (combinations) vis-à-vis %FSD and Resolution and where ever it is not matching in the schedule of pressure gauges, supplier may suggest accordingly.	

8. Specification for Gauge Shutoff Valves:

Sr.No	Description	Specification
1.0 Technical Specifications		
1.	**Quantity &details**	**As per table 9 & 19(Spares)**
2.	**Type, Construction, Manufacturing, Size & Pressure rating**	
3.	Type	Needle Valve
		Non-Rotating Plug
4.	Body construction	Single Piece
5.	Body manufacturing	Machined from forged/rolled bar stock
6.	No. of ports	3-ports (Female ports with face seal config.)

Sr.No	Description	Specification
7.	Port Description	Port 1 – **Inlet**; Port 2 –**Outlet**; Port 3 – **Vent**
8.	No. of handles	Two handles- 1)Gauge isolation 2)Vent isolation **(T-type with SS handle configuration for easy rotation)**
9.	End connections	Metric Threaded /BSPP
10.	Operating Temp.	-50^0C to $+50^0$C
11.	Fluid Medium	GN2, GHe
12.	Maximum Operating Pressure	400bar
13.	Design Standard	Manufacturer's Standard
14.	Minimum bore	>1.5 mm
Material of Construction of Valve & seals		
15.	Body	**ASTM A 182 /ASTM A 479 /276/ F316/304**
16.	Wetted parts	SS304/316
17.	Stem seal	VITON/PTFE/PEEK/
18.	Seat	Metal to Metal / Soft
19.	Handle	SS 316/304
20.	Gland packing	PEEK/PCTFE/PTFE/VITON

9. Specification for Pipes and Tubes:

Sr. No	Description	Specification
1.0 Technical Specification		
1.	**Type, Construction, Manufacturing, Material & other details**	
2.	Type for pipes	Seam less as per std. ASTM A312 TP 316L/304L
		Smooth bore
3.	Type for tubes	Seam less as per std. ASTM A 269-07a
4.	Standard length of pipe	5-7 meters
5.	Edge preparation for pipe	As per ANSI B 16.25
6.	End Finish for tubes	Square cut, smooth & De-burred ends
7.	Dimensional tolerance	As per ANSI B36.19
8.	Straightness	Shall be $\pm$ 3 mm per 3.0m

Sr. No	Description	Specification
9.	Manufacturing Process	**Cold pilgering/ Cold drawings**
10.	Material of construction	**Pipe: SS316L/SS304L; Tube: SS316L**
11.	**Tests to be carried out on pipes & tubes (Raw material to Dispatch)**	
At Raw material stage		
12.	IGC test **(Raw material)**	As per **ASTMA262 Practice-E** shall be carried out one per each heat (ladle)/lot during raw material.
13.	Chemical & mechanical analysis **(Raw material)**	Chemical & mechanical analysis Shall be carried out for raw materials as per ASTM standards
After manufacturing of pipes		
14.	Visual inspection of pipes	All pipes & tubes shall be visually examined for absence of scratches, dents, surface irregularities
15.	IGC test of pipes	As per **ASTMA262 Practice-E** shall be carried out one per each heat /lot of each size.
16.	Mechanical & Chemical analysis of pipes	Chemical & mechanical analysis Shall be carried out one per each heat /lot of each size as per ASTM standards
17.	Hydro testing of pipes	As per **ASTM A530**
18.	Hydro testing of tubes	As per **ASTM A450**.
19.	Ultrasonic Test	As per Practice **ASTM E-213** for all pipes
20.	Eddy current test	As per practice **ASTM A 450** for all tubes
21.	Pickling and passivation	As per **ASTM A380** both inside & outside
General conditions		
22.	All pipes & tubes shall be manufactured by Cold Pilgering/ cold drawn only. **Hot finished pipes are not acceptable.**	
23.	**Pipes and Tubes shall be procured only from the manufacturers. Procurement through dealers and vendors is not acceptable.**	
24.	**Final specification of pipes and tubes for approval**	
25.	**Inspection: A**s per approved QAP.	
26.	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	

Sr. No	Description	Specification
	▪ Physical, Chemical and IGC test reports of final product. ▪ Hydro test reports. ▪ Pickling and passivation ▪ Ultrasonic test reports. ▪ Eddy current test reports. All the above reports / test results shall be bound neatly	

10. Specification for Machined Components:

Sr.No	Description	Specifications
1.0 Technical Specification		
1.	**Quantity & other details:**	**As per the approved fabrication drawings**
Type, MOC, Machining & testing		
2.	Machining of the items shall be done with CNC machines only and strict tolerance, surface finish and work man ship shall be followed.	
3.	Required adapters drawings like nipples, captive nuts, unions, orifices etc. shall be approved by department prior to machining.	
4.	Machining shall be made from brand new forged bar stock.	
5.	Material for machined items shall be SS304/ SS304L(if welding is involved) shall be as per ASTM A 182 /479/276 for all adaptors/unions	
6.	**Raw material testing**	
7.	Chemical and mechanical test one per each heat or lot used	
8.	IGC test (as per ASTM A 262 practice E) shall be carried out for raw material one per each heat lot	
9.	**Finished product**	
10.	Chemical analysis one per each heat or lot	
11.	IGC test as applicable.	
12.	Supplier shall provide required inspection tools during inspection like GO & NO GO gauges, thread gauges, micro meters, dial gauges etc., for carry out inspection.	
13.	Surface finish requirement as specified in the drawings shall be strictly adhered.	
14.	All the threads and machined surfaces shall be properly protected with PVC plugs/caps to avoid transit damage.	
15.	Items shall be thoroughly de-burred and degreased prior to the packing.	
16.	No burs, dents, scratches are permitted on the machined surfaces.	

11. Specification for Standard Fittings

Sr. No	Description	Technical specification
Technical Specification: Elbows, Tees, Reducers & Caps		
1.	Type of fittings	Butt weld
2.	Manufactured	As per ASTM A 403 WP 316/304L
3.	Dimensions	As Per ASME B 16.9 & 16.28
4.	Edge preparation	AMSE B 16.25
5.	Material of constructions	SS304L/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 **ASTMA262 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
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/forged construction is acceptable.**	
18.	**Certification:** Test certificate for solution annealing, chemical analysis, mechanical & IGC tests shall be supplied along with dispatch documents.	

Sr. No	Description	Technical specification
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**	

12. Specification for Solenoid Valves

Sl. No	Description		Specification
Technical Specifications			
1.	**Quantity and details**	**:**	**As per table 13&23(spares)**
2.	Type, end connection, MOC & construction		
3.	Item	:	3/2 way, universal, Dual redundant (solenoid coil and valve) low power direct operated Ex-proof solenoid
4.	Operation	:	Low power direct operated poppet type, normally closed
5.	Service	:	Nitrogen/Air
6.	Orifice size	:	≥5mm
7.	Operating pressure	:	0 – 10 bar (G)
8.	Process end connections	:	¼" NPT /BSPP for all three ports.
9.	Exhaust port/ports	:	Suitable silencer/mufflers shall be supplied
10.	Mounting	:	Suitable for Panel mounting, all accessories should be SS material (SS304 or better). Party has to supply all accessories (Mounting brackets, Bolts & nuts., etc.).
11.	Body Material	:	SS 316/304
12.	Temperature	:	-25 To 60°C
13.	Elastomer/seals	:	Viton
14.	Type of construction	:	Safe venting high availability design.
15.	Valve Body Painting	:	Epoxy Painting (40-60 Microns thick). Color: As per OEM
16.	**Solenoid**		

Sl. No	Description		Specification
17.	Number of coils & valves	:	Two
18.	Power rating	:	Typically 3.6 to 4 watts
19.	Protection class & enclosure	:	Die cast aluminum to Gas group IIC, Zone-1 Exd, IP67.
20.	Rated operating voltage	:	24 V DC nominal (Tolerance: +10% & -15%)
21.	Ambient temperature	:	0 - 60°C
22.	Solenoid enclosure	:	Di cast Aluminum with epoxy coated paint (40-60 Microns thick). Colour: As per OEM.
23.	Insulation Class	:	H on wire
24.	Termination	:	Through terminal block/Embedded Screw Terminals.
25.	Protection	:	Voltage suppressor across coil i.e. Free-wheeling diode, Polarity Protection diode, & Surge protection.
26.	Cable entry	:	½" NPT (F)
27.	**General conditions**		
28.	Each solenoid valve shall have name plate indicating model number, **unique serial number**, supply voltage, power rating, etc.		
29.	Ultrasonic cleaning of the internal parts of SOV are to be done to remove dust/dirt and machinery burs.etc.		
30.	Proper torque shall be ensured for all fasteners.		
31.	**Documents to be submitted after placement of PO**		
	1. Party shall submit QAP for our approval. 2. General arrangement diagram along with solenoid Internal wiring shall be provided For Approval. 3. Raw Material test certificates for the batch of the solenoids valves (Chemical, Mechanical, Micro Examination (Solution Annealing), Intergranular Corrosion test & Ultrasonic test) as per relevant standards shall be submitted for verification and clearance. 4. Solution Annealing certificates for the batch of solenoid valves. 5. Compliance certificate for Elastomer shall be provided. 6. OEM factory reports for all the solenoid valves. 7. 100% Functional testing of all the SOV in the OEM/Supplier premises as per approved QAP. 8. Installation, Operational & Maintenance manuals and solenoid valve test reports, Guarantee / warranty Certificates.		

Sl. No	Description		Specification
	9. Ex-proof and weather proof certificates. 10. Dis-assembly and assembly procedure for the solenoid valve.		

13. Specification for Pressure Transmitter:

Sr.No	Description	Specification
1.0 Technical Specifications		
Quantity ,Type, Characteristics, End connection, protection & MOC.		
1.	**Quantity & details**	**As per table 10&20(Spares)**
2.	Type	SMART (HART Protocol, Rev-7) Absolute All Electronics are housed in the Hermitically sealed, Electrical interfaces for display and excitation through terminal blocks with screws at Transmitter housing.
3.	Range	0-50 bar(a) 0-500 bar(a)
4.	Range ability	0-50 bar(a) -- 10:1 0-500 bar(a) – 10:1
5.	Accuracy	± 0.075% of calibrated Span
6.	Total probable error	$\pm$ 0.15% of span or better (Linearity, hysteresis and repeatability effects should not be included at actual process conditions)
7.	Stability	5 years without calibration
8.	Power Supply	12 to 36 V DC (24 VDC Nominal)
9.	Power supply effect	Less than $\pm$ 0.005% calibrator span per volt
10.	Output signal	Two-wire, 4-20mA with super imposed digital communication.
11.	Zero and Span adjustment	Non interactive, Local /Via digital communication
12.	Process Fluid	Gas **(GN2&GHE)**
13.	Local Indicator	Built in LCD Indicator to display the pressure value in Engineering units (5-digit)
14.	Transient Protection	Built in surge protection
15.	Electrical Classification	FM Explosion proof and Intrinsic safety approval.
16.	Environment Protection	IP55 **or better**
17.	Operating temperature	Ambient : 0 to 60 Deg.C Medium : -10 to 60 Deg.C

Sr.No	Description	Specification
18.	Process Connection	½" NPT (F)
19.	Electrical connection	½" NPT (F)
20.	Material of Construction: a) Wetted Parts b) Non wetted Parts	a) Isolate diaphragm: SST 316L b)Drain/Vent valves and Plug**: SST 316** c)Electronic Housing: **Al Alloy** d) Fill Fluid: **Silicon Oil** e) Mounting Accessories: Nuts and bolts, SS 316L f) Non-wetted O rings: **Buna-N**
21.	Mounting	2" Pipe (std) or panel mounting
22.	Over Pressure	150% of the rated Pressure
23.	Party shall furnish the relevant catalogue/technical literature along with the items	
24.	The transmitter shall be supplied along with the digital local indicators calibrated in engineering units (bar).	
25.	Each transmitter shall have name plate covering model no, tag no, range, calibrated span, supply voltage, max working pressure, output etc.	
26.	All mounting accessories shall be supplied with the item.	
27.	Installation, operational & maintenance manuals, calibration certificate shall be supplied along with the items.	
28.	Material test certificate for the wetted parts/certificate of conformity to be supplied along with the item.	
29.	Ex. proof /intrinsically safe certificate and weather proof certificate shall be furnished with the item.	
30.	All absolute Transmitters to be calibrated absolute.	

14. Technical specifications of Multi-Pin Circular Connector

Sl.No.	Description	Specifications
a)	**Technical specifications**	
1.	Type	**The connectors shall conform to MIL-C-26482G-Series-II or equivalent.**
2.	Shell (Body)	Material: Aluminum alloy. Finish: Olive green Cadmium plated.
3.	Insulator	Neoprene (-55 ºC to +200ºC)
4.	Position	Normal/ Alternate as required (max 5 position)
5.	Insulation Resistance	Minimum 500MΩ at 250V AC

Sl.No.	Description	Specifications
6.	Contacts	Material: Copper base alloy. Finish: Gold plated.
7.	Coupling	Bayonet
8.	Mating cycle	Minimum 500
9.	Polarization	Five key and Five insert orientation
10.	Contact Termination	Crimping with metal retention clip
11.	Contacts	Continuous current rating: 7.5A DC for size # 20
		Voltage rating: 250V AC
		Resistance: ≤7.33 milli ohms resistance for size #20 contact
12.	Shell Size (No of contacts)	Shall be finalized during detailed engineering
13.	Mounting	Rear Panel mounting suitable for 2 to 3 mm thick plate
14.	Tentative MIL Part No	Receptacle: MS3470 Plug: MS3476 Environmental Boot Back shell (Type: Straight): M85049 Strain relief Back shelf (Type: Straight): M85049
b)	**General conditions**	
1.	All the wall mounting receptacle shall be rear mount type suitable for a panel/ plate thickness of 3mm to 4mm.	
2.	Wall mounting receptacle with narrow flange along with pins, strain relief back shell (Type: Straight clamp) with internal cable bush for receptacle.	
3.	Socket straight plug with pins, Environmental Back shell (Type: Straight) with internal cable bush for plug.	
4.	For each rack the following connectors shall be ensured. a. Command – 26 Pin Connectors – 2 Nos b. Status – 32 Pin Connectors – 2 Nos c. Pressure Transmitter - 19 Pin Connector -1 No **Note**: After detail engineering if number of pins for connector increases then suitably it is to be incorporated. However no of pins for Solenoid command, EP-Valve status, Pressure transmitters and Pressure switches shall be different for each rack based on the no of elements.	

15. Technical specifications of Control & Data cable

Sl.No	Description	Specifications
1	Type	Single pair/triad, Multi pair/ triad, flexible.
2	Type of cable	Overall Screened
3	Conductor	High conductivity Annealed Tinned copper (ATC) electrolytic grade, As per IS:8130/84
4	Core	Multi strand 7 Nos of 0.3mm for 0.5Sq.mm copper conductor.
5	Primary core insulation	Extruded solid High-Density polyethylene (PE) as per BS: 5308 part-1/EN-50290-2-23. Nominal thickness of 0.5mm, voltage grade 300V minimum.
6	Colour of core insulation	The cores are to be identified as below. Single Pair: Red, Black Three triad: White, Blue, Brown with Numbering For other cables, the color shall be finalized as part of cable "Technical Data sheet" Approval during detailed engineering.
7	Twists/Mtrs	15 to 20 (nominal), Polyester Taping (~0.03mm thick) shall be provided on each pair/triad immediately after twisting of cores.
8	Drain wire size	7/ 0.3mm stranded ATC
9	Screening	100% coverage with ~0.025 mm thick Aluminum Mylar tape with 25% over lap along with drain wire. Polyester tape (~0.025mm thick) shall be provided above the Aluminum Mylar tape.
10	Overall tape	Overall polyester tape (~0.025mm thick) shall be provided after grouping of Pairs/triads.
11	Braid	ATC wire of ~0.15mm diameter,85% Coverage/Overlap,
12	Final tape	Polyester Taping (~0.025mm thick) shall be provided above the braid.
13	Sheath	PVC Type ST-1, 1.8 mm thick (nominal). As per IS: 5831/84. With Rodent and termite protection.
14	Conductor resistance	40.1Ω / Km (Max) at 20°C as per IS: 8130
15	Insulation resistance	More than 5000M Ω/Km at Room Temperature.

16	Mutual capacitance between cores	< 75 pF / Meter
17	Max. Capacitance between core & screen	< 400 pF / Meter
18	<u>High Voltage Test</u> Core to Core Core to Shield	 ~2000V AC for 2 Minutes ~2000V AC for 1 Minute.
19	Attenuation at 1KHz	1.2 dB Max/Km
20	L/R ratio	< 25 µH/Ω
21	Operating Temperature	0 °C to 70 °C
22	Cable Identification	The cable identification shall be provided by embossing the details on the outer sheath the parameters like Year, Manufacturers name, Voltage grade, Cable size, Type of cable. etc. as per clause 17.0 of IS-7098 part-1 (1988)
23	Standard Packing	1) The cables shall be supplied in standard drum of 500/1000M length +/- 5 % depending upon size of cable. 2) The cables shall be provided with secured and protected packing so as to avoid damages in transit to site under normal conditions and prevention from deterioration during storage. 3) The cables shall be supplied wound on suitable wooden drums and adequately packed to meet the requirements of shipping involved. 4) Both the ends of the cable shall be accessible for testing purpose. Cable ends shall be suitable sealed to prevent any ingress of moisture and shall be fully protected against mechanical damage 5) Each drum shall be marked in indelible paint with details as per IS Specifications. 6) The tolerance in cable length on each drum shall be +/- 5% of the standard drum length.
24	General Conditions	Party has to submit the Cables data sheet and QAP for Approval. The Cables manufactured as per approved QAP, shall be inspected and cleared by Department Personal.

16. Technical Specifications of Cable Glands.

Sl. No	Description	Specifications
1.	Type	Double compression, Weather proof
2.	IP rating	IP 66 or better as per IS 12063-1987
3.	MOC	SS304/SS316
4.	Tentative Size	½" NPT (PT)
5.	Standard	BS 6121 or equivalent
6.	Sealing Rubber Ring	Nitrile/ Neoprene or Equivalent
7.	Inner and Outer Bushes size of Dia.	Shall be finalized during detailed engineering

17. Conditions for Procurement of Flow Components

Sr.No	Description/Specifications
1.	**All flow components shall be strictly procured only from original manufacturers/authorized agents only**
2.	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 .**PN rating of the flow components shall be greater than the MOP**
3.	**During offer, make and constructional drawings of all flow components shall be submitted. without which offer will be rejected. No change in make is allowed after placement of PO**
4.	**All flow components procurement shall be taken up only after obtaining the approval of constructional/design clearance from the department.**
5.	All flow components selected for this requirement shall have the proven track record for the GN2/GHe medium at and above MOP. if the selected make is not acceptable based on the technical specification, it shall be changed
6.	**No NPT threads are allowed as part of body or end connections**
7.	Configuration /internal arrangement of all flow components shall be as per the requirement
8.	Materials of valve elements construction shall be SS304/316 only
9.	**No welding is allowed on the valve body**
10.	**Socket weld type flow components are not acceptable**

Sr.No	Description/Specifications
11.	Valve bodies shall be machined from rolled or forged bar stock. **Casted bodies are not acceptable (except for safety relief valves)**
12.	Material of construction of each element shall be approved by the department
13.	**Valves with flanged end connections are not acceptable. However, if the design requirement is more than the threaded valves, it will be accepted subjected review of the same.**
14.	All flow components shall be cleaned for oxygen servicing by the manufacturer premises(OEM) and shall use suitable agents for cleaning. Oxygen cleaning Certificate shall be produced. **Note: IPA cleaning is not acceptable**
15.	**It can be assumed that pressure rating of all solenoid valves for operating the pneumatic valves is as per the actuation pressure of pneumatic valves**
16.	Cleaning of all flow components shall be for oxygen gas usage and shall meet the specifications of ASTM G93/CGA G 4.1/equivalent
17.	**All flow components end connections shall be metric or BSPP threaded and shall be welded to pipes or tubes by means of butt welded BSPP/metric threaded adaptors and material construction of adaptors shall be SS304L/316L only**
18.	**All flow components GA and finalized constructional drawings shall be submitted for approval prior to procurement**

18. Testing of Flow Components:

1) All flow components materials shall be tested for chemical and mechanical
2) All valve elements shall be subjected heat treatment based on the applicable standards.
3) All valves/regulators/filters bodies shall be subjected to hydro test at 1.5 times of MOP
4) All valves/regulators seats shall be subjected to pneumatic seat leak check at MOP and shall meet the bubble tight shut off requirement.
5) All valves/regulators/filters and end connection seals shall be subjected to **GN2 leak check at MOP with snoop and shall meet no leak condition.**

6) **All filters one per one model shall be subjected to collapsibility test and shall meet the criteria of max DP as 5bar.if already done, report shall be submitted**
7) Safety relief valves set pressure and seat leakage test as per the ASTM /equivalent standards
8) All filters elements shall be tested for bubble point and shall meet the specification of 20micron.
9) All Pneumatic valves shall be tested for functional checks
10) All elements of the valve shall undergo material tests as per the standards
11) All soft seals manufacturer compliance (COC)shall be submitted for review
12) All SS Valve bodies shall undergo IGC test as per ASTM A 262 and as per the applicable practice after manufacturing

Annexure-5

Schedule of Flow component details inside Pneumatic Servicing rigs of GN2 (3Nos) and GHe (3Nos)

1. Pressure Regulators Details

Table 4: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
			Max.	Min.				
GN2 Pneumatic servicing rig								
1	VR1	CPPR O/L line leak check	400	100	50-75	275	3	**To be calculated by the regulator manufacturer.**
2	VR2	SPPR O/L line leak check & Purge	75	50	9-13.5	62.5	3	
3	VR3	SRV line leak check	75	50	2	25	3	
4	VR4	EP Valves command supply	75	50	7-8.5	125	3	
5	VR1A	SPPR Testing	400	300	30-250	4g/sec at 298K	3	
GHe Pneumatic servicing rig								
6	VR1	CPPR O/L line leak check	400	100	50-75	150	3	**To be calculated by the regulator manufacturer**
7	VR2	SPPR O/L line leak check & Purge	75	50	9-13.5	62.5	3	
8	VR3	SRV line leak check	75	50	2	25	3	

2. Safety Relief Valves details

Table 5: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
			MOP	Set				
GN2 Pneumatic servicing rig								
1.	VS01	CPPR O/L line leak check	50	55	BSSP/Metric	As per VR1 failure flow rate	**3**	**To be calculated based failure flow rate of regulator & 10% over pressure criterial**
2.	VS02		75	82.5	BSSP/Metric		**3**	
3.	VS02A	SPPR testing	250	275	BSSP/Metric	As per VR2A failure flow rate	**3**	
4.	VS03	SPPR O/L line leak check & Purge	9	9.9	BSSP/Metric	As per VR2 failure flow rate	**3**	
5.	VS04		13	14.5	BSSP/Metric		**3**	
6.	VS05	SRV line leak check	2	2.2	BSSP/Metric	As per VR3 failure flow rate	**3**	
7.	VS06	Valves CMD supply	8.5	9.35	BSSP/Metric	As per VR4 failure flow rate	**3**	
GHe Pneumatic servicing rig								
8.	VS01	CPPR O/L line leak check	50	55	BSSP/Metric	As per VR1 failure flow rate	**3**	**To be calculated based failure flow rate of regulator & 10% over pressure criterial**
9.	VS02		75	82.5	BSSP/Metric		**3**	
10.	VS03	SPPR O/L line leak check & Purge	9	9.9	BSSP/Metric	As per VR2 failure flow rate	**3**	
11.	VS04		13	14.5	BSSP/Metric		**3**	
12.	VS05	SRV line leak check	2	2.2	BSSP/Metric	As per VR3 failure flow rate	**3**	

3. Pressure Gauge Details

Table 6:List of Pressure Gauges

Sr. No	Tag No	MOP bar(g)	Range bar(g)	Accuracy Class	Purpose	Dial Size (mm)	End Connection	Mounting	Quantity (Nos)
GN2 Pneumatic servicing rig									
1.	PI01	400	0-600	0.5%	GN2 Inlet	160	M20X1.5	Panel mount	3
2.	PI02	75	0-150	0.5%	CPPR O/L Line leak check	160	M20X1.5	Panel mount	3
3.	PI02A	250	0-400	0.5%	SPPR Testing	160	M20X1.5	Panel mount	3
4.	PI03	13.5	0-25	0.5%	SPPR Line leak check /purge	160	M20X1.5	Panel mount	3
5.	PI04	2	0-6	0.5%	CM SRV testing	160	M20X1.5	Panel mount	3
6.	PI05	8.5	0-16	0.5%	Valves command supply	160	M20X1.5	Panel mount	3
GHe Pneumatic servicing rig									
7.	PI01	400	0-600	0.5%	GHe Inlet	160	M20X1.5	Panel mount	3
8.	PI02	75	0-150	0.5%	CPPR O/L Line leak check	160	M20X1.5	Panel mount	3
9.	PI03	13.5	0-25	0.5%	SPPR Line leak check /purge	160	M20X1.5	Panel mount	3

Sr. No	Tag No	MOP bar(g)	Range bar(g)	Accuracy Class	Purpose	Dial Size (mm)	End Connection	Mounting	Quantity (Nos)
10.	PI04	2	0-6	0.5%	CM SRV testing	160	M20X1.5	Panel mount	3

4. EP Ball Valves Details

Table 7:List of VP Ball Valves

Sr. No	Tag No	Purpose	Type of valves	End connections		Inlet & Outlet pipe size (DN)	MOP (Bar)	PN (BAR)	Quantity (Nos)
				Inlet	Outlet				
GN2 Pneumatic servicing rig									
1.	VP01	CM GB charging path1	Two-way reduced bore	½"BSPP/Metric		15NBX160SCH	400	400	3
2.	VP02	CM GB charging path2	Two-way reduced bore	½"BSPP/Metric		15NBX160SCH	400	400	3
3.	VP03	CM GB emergency vent	Two-way reduced bore	½"BSPP/Metric		15NBX160SCH	400	400	3
4.	VP04	CM GB controlled vent	Two-way reduced bore	½"BSPP/Metric		15NBX160SCH	400	400	3
5.	VP05	SM GB charging path1	Two-way reduced bore	½"BSPP/Metric		15NBX160SCH	400	400	3
6.	VP06	SM GB charging path2	Two-way reduced bore	½"BSPP/Metric		15NBX160SCH	400	400	3
7.	VP07	SM GB emergency vent	Two-way reduced bore	½"BSPP/Metric		15NBX160SCH	400	400	3
8.	VP08	SM GB controlled vent	Two-way reduced bore	½"BSPP/Metric		15NBX160SCH	400	400	3
GHe Pneumatic servicing rig									
9.	VP01	CM GB charging path1	Two-way reduced bore	½" BSPP/ Metric		15NBX160SCH	400	400	3
10.	VP02	CM GB charging path2	Two-way reduced bore	½"BSPP / Metric		15NBX160SCH	400	400	3

Sr. No	Tag No	Purpose	Type of valves	End connections		Inlet & Outlet pipe size (DN)	MOP (Bar)	PN (BAR)	Quantity (Nos)
				Inlet	Outlet				
11.	VP03	CM GB emergency vent	Two-way reduced bore	½"BSPP /Metric		15NBX160SCH	400	400	3
12.	VP04	CM GB controlled vent	Two-way reduced bore	½"BSPP/Metric		15NBX160SCH	400	400	3
13.	VP05	SM GB charging path1	Two-way reduced bore	½"BSPP / Metric		15NBX160SCH	400	400	3
14.	VP06	SM GB charging path2	Two-way reduced bore	½"BSPP /Metric		15NBX160SCH	400	400	3
15.	VP07	SM GB emergency vent	Two-way reduced bore	½"BSPP / Metric		15NBX160SCH	400	400	3
16.	VP08	SM GB controlled vent	Two-way reduced bore	½"BSPP/ Metric		15NBX160SCH	400	400	3

5. Manual Valves details

Table 8:List of Manual Valves

Sr. No	Tag No	Purpose	Type of Manual valve	End connection		Flow rate NM3/Hr	Min.Operating pressure Bar(g) for sizing	PN BAR	Quantity (Nos)
				Inlet	Outlet				
GN2 Pneumatic servicing rig									
1.	VM01	VP Valves command supply inlet	Needle	BSPP /Metric		100	7	50	3
2.	VM02	VP Valves command supply vent#	Needle	BSPP /Metric		100	7	50	3
3.	VM03	GN2 System inlet vent#	Needle	BSPP /Metric		260	100	400	3
4.	VM04	GN2 System inlet	Needle	BSPP /Metric		260	100	400	3
5.	VM05	CM GB Charging isolation	Needle	BSPP /Metric		260	100	400	3

Sr. No	Tag No	Purpose	Type of Manual valve	End connection		Flow rate NM3/Hr	Min.Operating pressure Bar(g) for sizing	PN BAR	Quantity (Nos)
				Inlet	Outlet				
6.	VM06	CM&SM Line leak check	Needle	BSPP /Metric		260	100	400	3
7.	VM07	SM GB Charging isolation 1	Needle	BSPP /Metric		260	100	400	3
8.	VM08	SM GB Charging isolation 2	Needle	BSPP /Metric		260	100	400	3
9.	VM09	VR01 inlet	Needle	BSPP /Metric		260	100	400	3
10.	VM09A	VR01A inlet	Needle	BSPP /Metric		260	100	400	3
11.	VM10	VS1 Inlet isolation*	Needle	BSPP /Metric		**VR01 FFR***	50	400	3
12.	VM11	VR01 Outlet	Needle	BSPP /Metric		50	50	400	3
13.	VM11A	VR01A Outlet	Needle	BSPP /Metric		50	30	400	3
14.	VM12	VR01 Outlet Vent #	Needle	BSPP /Metric		50	50	400	3
15.	VM12A	VR01A Outlet Vent #	Needle	BSPP /Metric		50	30	400	3
16.	VM13	CPPR O/L line	Needle	BSPP /Metric		50	50	400	3
17.	VM13A	SPPR Testing O/L line	Needle	BSPP /Metric		50	30	400	3
18.	VM14	VR02 inlet	Needle	BSPP /Metric		50	50	400	3
19.	VM15	VS03 inlet Isolation *	Needle	BSPP /Metric		**VR02 FFR***	9	50	3
20.	VM16	VR02 Outlet	Needle	BSPP /Metric		50	9	50	3
21.	VM17	VR02 Outlet Vent #	Needle	BSPP /Metric		50	9	50	3
22.	VM18	SPPR Line leak and purge	Needle	BSPP /Metric		50	9	50	3
23.	VM19	VR03 inlet	Needle	BSPP /Metric		20	50	400	3

Sr. No	Tag No	Purpose	Type of Manual valve	End connection		Flow rate NM3/Hr	Min.Operating pressure Bar(g) for sizing	PN BAR	Quantity (Nos)
				Inlet	Outlet				
24.	VM20	VR03 Outlet	Needle	BSPP /Metric		20	1.5	50	3
25.	VM21	VR03 Outlet Vent#	Needle	BSPP /Metric		20	1.5	50	3
26.	VM22	CM SRV Testing	Needle	BSPP /Metric		20	1.5	50	3
27.	VM23	VR04 inlet	Needle	BSPP /Metric		100	50	400	3
28.	VM24	VR04 Outlet	Needle	BSPP /Metric		100	7	50	3
29.	VM25	VR04 Outlet Vent#	Needle	BSPP /Metric		100	7	50	3
GHe Pneumatic servicing rig									
30.	VM01	VP Valves command supply inlet	Needle	BSPP /Metric		100	7	50	3
31.	VM02	VP Valves command supply vent#	Needle	BSPP /Metric		100	7	50	3
32.	VM03	GHe System inlet vent#	Needle	BSPP /Metric		160	100	400	3
33.	VM04	GHe System inlet	Needle	BSPP /Metric		160	100	400	3
34.	VM05	CM GB Charging isolation	Needle	BSPP /Metric		160	100	400	3
35.	VM06	CM&SM Line leak check	Needle	BSPP /Metric		160	100	400	3
36.	VM07	SM GB Charging isolation 1	Needle	BSPP /Metric		160	100	400	3
37.	VM08	SM GB Charging isolation 2	Needle	BSPP /Metric		160	100	400	3
38.	VM09	VR01 inlet	Needle	BSPP /Metric		160	100	400	3
39.	VM10	VS01 Inlet isolation *	Needle	BSPP /Metric		**VR01 FFR***	50	400	3
40.	VM11	VR01 Outlet	Needle	BSPP /Metric		50	50	400	3

Sr. No	Tag No	Purpose	Type of Manual valve	End connection		Flow rate NM3/Hr	Min.Operating pressure Bar(g) for sizing	PN BAR	Quantity (Nos)
				Inlet	Outlet				
41.	VM12	VR01 Outlet vent #	Needle	BSPP or Metric		50	50	400	3
42.	VM13	CPPR O/L line	Needle	BSPP or Metric		50	50	400	3
43.	VM14	VR02 inlet	Needle	BSPP or Metric		50	50	400	3
44.	VM15	VS03 Isolation*	Needle	BSPP or Metric		**VR02 FFR***	9	50	3
45.	VM16	VR02 Outlet	Needle	BSPP or Metric		50	9	50	3
46.	VM17	VR02 Outlet vent#	Needle	BSPP or Metric		50	9	50	3
47.	VM18	SPPR Line leak and purge	Needle	BSPP or Metric		50	9	50	3
48.	VM19	VR03 inlet	Needle	BSPP or Metric		20	50	400	3
49.	VM20	VR03 Outlet	Needle	BSPP or Metric		20	1.5	50	3
50.	VM21	VR03 Outlet Vent#	Needle	BSPP or Metric		20	1.5	50	3
51.	VM22	CM SRV Testing	Needle	BSPP or Metric		20	1.5	50	3
52.	**Bore of the needle valves shall be sized for maximum flow rate at minimum inlet pressure indicated in the table and with 1.25 flow factor and allowed pressure drop for main valves is 1% of Minimum Operating Pressure** **# Vent valves shall be as per the regime of flow with less than 10% back pressure at maximum flowrate and minimum operating pressure** **"*" FFR: shall be sized for Failure Flow rate of Regulator at MOP mentioned**								

6. Gauge Shutoff Valves details

Table 9:List of Gauge Shutoff Valves

Sr. No	Tag No	Service	Type	MOP Bar	Size	(PN) Rating	Quantity (Nos)
					Inlet, outlet & Vent		
GN2 Servicing Pneumatic servicing rig							
1.	VGS01	GN2 inlet PT01&PI01	Needle	400	Metric/BSPP	400	3
2.	VGS02	CM GB Charging PT02,03,04	Needle	400	Metric/BSPP	400	3
3.	VGS03	SM GB Charging PT05,06,07	Needle	400	Metric/BSPP	400	3
4.	VGS04	VR01 Outlet(PI02)	Needle	75	Metric/BSPP	400	3
5.	VGS04A	VR01A Outlet(PI02)	Needle	250	Metric/BSPP	400	3
6.	VGS05	CPPR O/L line(PT08)	Needle	75	Metric/BSPP	400	3
7.	VGS05A	SPPR Testing line(PT08A)	Needle	250	Metric/BSPP	400	3
8.	VGS06	VR02 Outlet(PI03)	Needle	13.5	Metric/BSPP	400	3
9.	VGS07	SPPR Line leak & purge(PT09)	Needle	13.5	Metric/BSPP	400	3
10.	VGS08	VR03 Outlet(PI04)	Needle	2	Metric/BSPP	400	3
11.	VGS09	CM SRV testing (PT10)	Needle	2	Metric/BSPP	400	3
12.	VGS10	VR04 Outlet(PI05&PT11)	Needle	8.5	Metric/BSPP	400	3
GHe Servicing Pneumatic servicing rig							
13.	VGS01	GHe inlet PT01&PI01	Needle	400	Metric/BSPP	400	3
14.	VGS02	CM GB Charging PT02,03,04	Needle	400	Metric/BSPP	400	3
15.	VGS03	SM GB Charging PT05,06,07	Needle	400	Metric/BSPP	400	3
16.	VGS04	VR01 Outlet(PI02)	Needle	75	Metric/BSPP	400	3
17.	VGS05	CPPR O/L line(PT08)	Needle	75	Metric/BSPP	400	3

Sr. No	Tag No	Service	Type	MOP Bar	Size	(PN) Rating	Quantity (Nos)
					Inlet, outlet & Vent		
18.	VGS06	VR02 Outlet(PI03)	Needle	13.5	Metric/BSPP	400	3
19.	VGS07	SPPR Line leak & purge(PT09)	Needle	13.5	Metric/BSPP	400	3
20.	VGS08	VR03 Outlet(PI04)	Needle	2	Metric/BSPP	400	3
21.	VGS09	CM SRV testing	Needle	2	Metric/BSPP	400	3

7. Pressure Transmitters details

Table 10:List of Pressure Transmitters

Sr.No	Tag No	Service	Entry	MOP bar(a)	End Connection Size/Type	Range bar(a)	Quantity (Nos)
GN2 Pneumatic servicing rig							
1.	PT01	GN2 System inlet	BOTTOM	400	1/2"NPT (F)	0-500	3
2.	PT02	CM GB Charging	BOTTOM	400	1/2"NPT (F)	0-500	3
3.	PT03		BOTTOM	400	1/2"NPT (F)	0-500	3
4.	PT04		BOTTOM	400	1/2"NPT (F)	0-500	3
5.	PT05	SM GB Charging	BOTTOM	400	1/2"NPT (F)	0-500	3
6.	PT06		BOTTOM	400	1/2"NPT (F)	0-500	3
7.	PT07		BOTTOM	400	1/2"NPT (F)	0-500	3
8.	PT08	CPPR Outlet line leak check	BOTTOM	75	1/2"NPT (F)	0-500	3
9.	PT08A	SPPR Testing	BOTTOM	250	1/2"NPT (F)	0-500	3

Sr.No	Tag No	Service	Entry	MOP bar(a)	End Connection Size/Type	Range bar(a)	Quantity (Nos)
10.	PT09	SPPR Line leak check and Purge	BOTTOM	13.5	1/2"NPT (F)	0-50	3
11.	PT10	CM SRV Testing	BOTTOM	2	1/2"NPT (F)	0-50	3
12.	PT11	EP Valve command valve supply	BOTTOM	8.5	1/2"NPT (F)	0-50	3
GHe Pneumatic servicing rig							
13.	PT01	GHe System inlet	BOTTOM	400	1/2"NPT (F)	0-500	3
14.	PT02	CM GB Charging	BOTTOM	400	1/2"NPT (F)	0-500	3
15.	PT03		BOTTOM	400	1/2"NPT (F)	0-500	3
16.	PT04		BOTTOM	400	1/2"NPT (F)	0-500	3
17.	PT05	SM GB Charging	BOTTOM	400	1/2"NPT (F)	0-500	3
18.	PT06		BOTTOM	400	1/2"NPT (F)	0-500	3
19.	PT07		BOTTOM	400	1/2"NPT (F)	0-500	3
20.	PT08	CPPR Outlet line leak check	BOTTOM	75	1/2"NPT (F)	0-500	3
21.	PT09	SPPR Line leak check and Purge	BOTTOM	13.5	1/2"NPT (F)	0-50	3
22.	PT10	CM SRV Testing	BOTTOM	2	1/2"NPT (F)	0-50	3

8. Metering Valve Details

Table 11:List of Metering Valves

Sr.No	Tag No	Purpose	Type of valve	End connections		MOP (Bar)	PN (BAR)	Quantity (Nos)
				Inlet	Outlet			
GN2 Pneumatic servicing rig								
1.	MV01	CM GB charging path1	Metering	BSPP or Metric		400	400	3
2.	MV02	CM GB charging path2	Metering	BSPP or Metric		400	400	3
3.	MV03	CM GB controlled vent	Metering	BSPP or Metric		400	400	3
4.	MV04	SM GB charging path1	Metering	BSPP or Metric		400	400	3
5.	MV05	SM GB charging path2	Metering	BSPP or Metric		400	400	3
6.	MV06	SM GB controlled vent	Metering	BSPP or Metric		400	400	3
GHe Pneumatic servicing rig								
7.	MV01	CM GB charging path1	Metering	BSPP or Metric		400	400	3
8.	MV02	CM GB charging path2	Metering	BSPP or Metric		400	400	3
9.	MV03	CM GB controlled vent	Metering	BSPP or Metric		400	400	3
10.	MV04	SM GB charging path1	Metering	BSPP or Metric		400	400	3
11.	MV05	SM GB charging path2	Metering	BSPP or Metric		400	400	3
12.	MV06	SM GB controlled vent	Metering	BSPP or Metric		400	400	3
13.	**Bore of the metering valve shall be based on the sizing for maximum flow rate(10NM3/Hr) indicated in the drawing and with 1.25 flow factor as per the regime of flow**							

9. Filter details

Table 12:List of Filters

Sr. No	Tag No	Purpose	Element Type	PN rating (bar)	Micron Rating (abs)	Mesh MOC SS	Inlet & outlet pipes Size& Schedule	End connection	Qty (Nos)	Filter Mesh area (mm2)
GN2 Pneumatic servicing rig										
1.	FL01	VP valve Cmd. supply	Mesh	100	20	304L/316L	15NB,40sch	BSPP/Metric	3	Greater than 10 times Inlet pipe area
2.	FL02	GN2 Inlet	Mesh	400	20	304L/316L	15NB,160sch	BSPP/Metric	3	
3.	FL03	CM GB Charging	Mesh	400	20	304L/316L	15NB,160sch	BSPP/Metric	3	
4.	FL04	CM&SM Line leak check	Mesh	400	20	304L/316L	15NB,160sch	BSPP/Metric	3	
5.	FL05	SM GB1	Mesh	400	20	304L/316L	15NB,160sch	BSPP/Metric	3	
6.	FL06	SM GB2	Mesh	400	20	304L/316L	15NB,160sch	BSPP/Metric	3	
7.	FL07	VR 01 Inlet	Mesh	400	20	304L/316L	15NB,160sch	BSPP/Metric	3	
8.	FL07A	VR 01A Inlet	Mesh	400	20	304L/316L	15NB,160sch	BSPP/Metric	3	
9.	FL08	CPPR Outlet lines	Mesh	400	20	304L/316L	15NB,160sch	BSPP/Metric	3	
10.	FL08A	SPPR Testing	Mesh	400	20	304L/316L	15NB,160sch	BSPP/Metric	3	
11.	FL09	VR 02 Inlet	Mesh	400	20	304L/316L	15NB,160sch	BSPP/Metric	3	
12.	FL10	SPPR Outlet lines	Mesh	100	20	304L/316L	15NB,40sch	BSPP/Metric	3	
13.	FL11	VR 03 Inlet	Mesh	400	20	304L/316L	15NB,160sch	BSPP/Metric	3	
14.	FL12	CM SRV testing	Mesh	100	20	304L/316L	15NB,40sch	BSPP/Metric	3	

Sr. No	Tag No	Purpose	Element Type	PN rating (bar)	Micron Rating (abs)	Mesh MOC SS	Inlet & outlet pipes Size& Schedule	End connection	Qty (Nos)	Filter Mesh area (mm2)
15.	FL13	VR 04 Inlet	Mesh	400	20	304L/316L	15NB,160sch	BSPP/Metric	3	
GHe Pneumatic servicing rig										
16.	FL01	VP valve command supply	Mesh	100	20	304L/316L	15NB,40sch	BSPP/Metric	3	Greater than 10 times Inlet pipe area
17.	FL02	GHe Inlet	Mesh	400	20	304L/316L	15NB,160sch	BSPP/Metric	3	
18.	FL03	CM GB Charging	Mesh	400	20	304L/316L	15NB,160sch	BSPP/Metric	3	
19.	FL04	CM&SM Line leak check	Mesh	400	20	304L/316L	15NB,160sch	BSPP/Metric	3	
20.	FL05	SM GB 1	Mesh	400	20	304L/316L	15NB,160sch	BSPP/Metric	3	
21.	FL06	SM GB 2	Mesh	400	20	304L/316L	15NB,160sch	BSPP/Metric	3	
22.	FL07	VR 01 Inlet	Mesh	400	20	304L/316L	15NB,160sch	BSPP/Metric	3	
23.	FL08	CPPR Outlet lines	Mesh	400	20	304L/316L	15NB,160sch	BSPP/Metric	3	
24.	FL09	VR 02 Inlet	Mesh	400	20	304L/316L	15NB,160sch	BSPP/Metric	3	
25.	FL10	SPPR Outlet lines	Mesh	100	20	304L/316L	15NB,40sch	BSPP/Metric	3	
26.	FL11	VR 03 Inlet	Mesh	400	20	304L/316L	15NB,160sch	BSPP/Metric	3	
27.	FL12	CM SRV testing	Mesh	100	20	304L/316L	15NB,40sch	BSPP/Metric	3	

10. Solenoid Valve Details

Table 13: List of Solenoid Valves

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)
GN2 Pneumatic servicing rig										
1.	SOV1	VP01 SOV	Dual coil & Low Power	¼" BSPP/NPT	SS304/316	24VDC	5.0	10	16	3
2.	SOV2	VP02 SOV	Dual coil & Low Power	¼" BSPP/NPT	SS304/316	24VDC	5.0	10	16	3
3.	SOV3	VP03 SOV	Dual coil & Low Power	¼" BSPP/NPT	SS304/316	24VDC	5.0	10	16	3
4.	SOV4	VP04 SOV	Dual coil & Low Power	¼" BSPP/NPT	SS304/316	24VDC	5.0	10	10	3
5.	SOV5	VP05 SOV	Dual coil & Low Power	¼" BSPP/NPT	SS304/316	24VDC	5.0	10	10	3
6.	SOV6	VP06 SOV	Dual coil & Low Power	¼" BSPP/NPT	SS304/316	24VDC	5.0	10	10	3
7.	SOV7	VP07 SOV	Dual coil & Low Power	¼" BSPP/NPT	SS304/316	24VDC	5.0	10	10	3
8.	SOV8	VP08 SOV	Dual coil & Low Power	¼" BSPP/NPT	SS304/316	24VDC	5.0	10	10	3
GHe Pneumatic servicing rig										
9.	SOV1	VP01 SOV	Dual coil & Low Power	¼" BSPP/NPT	SS304/316	24VDC	5.0	10	10	3
10.	SOV2	VP02 SOV	Dual coil & Low Power	¼" BSPP/NPT	SS304/316	24VDC	5.0	10	10	3
11.	SOV3	VP03 SOV	Dual coil & Low Power	¼" BSPP/NPT	SS304/316	24VDC	5.0	10	10	3
12.	SOV4	VP04 SOV	Dual coil & Low Power	¼" BSPP/NPT	SS304/316	24VDC	5.0	10	10	3
13.	SOV5	VP05 SOV	Dual coil & Low Power	¼" BSPP/NPT	SS304/316	24VDC	5.0	10	10	3

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)
14.	SOV6	VP06 SOV	Dual coil & Low Power	¼" BSPP/NPT	SS304/316	24VDC	5.0	10	10	3
15.	SOV7	VP07 SOV	Dual coil & Low Power	¼" BSPP/NPT	SS304/316	24VDC	5.0	10	10	3
16.	SOV8	VP08 SOV	Dual coil & Low Power	¼" BSPP/NPT	SS304/316	24VDC	5.0	10	10	3

Annexure-6

1. List of Spare Flow Components and Spare Kits to be supplied

Table 14:List of Pressure Regulators Spares

Sr. No	Tag No	Spare Regulators Qty (Nos)	Spare kits (Nos)	Remarks
GN2 Pneumatic servicing rig				**Model number shall be same as selected in the rigs.**
1	VR1	1	2	
2	VR2	1	2	
3	VR3	1	2	
4	VR4	1	2	
5	VR01A	1	2	
GHe Pneumatic servicing rig				
5	VR1	1	2	
6	VR2	1	2	
7	VR3	1	2	
Note: Spare kits of pressure regulator consists of Poppet, springs, O-rings and other seals as applicable.				

Table 15:List of Safety Relief Valves spares

Sr. No	Tag No	Spare safety relief valves (Nos)	Spare kits (Nos)	Remarks
GN2 Pneumatic servicing rig				**Model numbers shall be same as selected in the rigs.**
1.	VS01	**1**	**2**	
2.	VS02	**1**	**2**	
3.	VS02A	**1**	**2**	
4.	VS03	**1**	**2**	
5.	VS04	**1**	**2**	
6.	VS05	**1**	**2**	
7.	VS06	**1**	**2**	
GHe Pneumatic servicing rig				
1.	VS01	**1**	**2**	
2.	VS02	**1**	**2**	
3.	VS03	**1**	**2**	
4.	VS04	**1**	**2**	
5.	VS05	**1**	**2**	
Note: Spare kits of safety relief valve consists of Poppet/disc, springs, nozzles/seat, O-rings as applicable.				

Table 16:List of pressure Gauges spares

Sr. No	Tag No	MOP bar(g)	Range bar(g)	Accuracy Class	Dial Size	End Connection	Mounting	Spare pressure gauges Quantity (Nos)
GN2 Pneumatic servicing rig								
1.	PI01	400	0-600	0.5%	160	M20X1.5	Panel mount	1
2.	PI02	75	0-150	0.5%	160	M20X1.5	Panel mount	1
3.	PI02A	250	0-400	0.5%	160	M20X1.5	Panel mount	1
4.	PI03	13.5	0-25	0.5%	160	M20X1.5	Panel mount	1
5.	PI04	2	0-6	0.5%	160	M20X1.5	Panel mount	1
6.	PI05	8.5	0-16	0.5%	160	M20X1.5	Panel mount	1
GHe Pneumatic servicing rig								
1.	PI01	400	0-600	0.5%	160	M20X1.5	Panel mount	1
2.	PI02	75	0-150	0.5%	160	M20X1.5	Panel mount	1
3.	PI03	13.5	0-25	0.5%	160	M20X1.5	Panel mount	1
4.	PI04	2	0-6	0.5%	160	M20X1.5	Panel mount	1

Table 17:List of Spare EP Ball Valves

Sr. No	Type	End connections		Inlet & Outlet pipe size (DN)	MOP (Bar)	PN (BAR)	Spares Valves Quantity (Nos)	Spare kits (Nos)	Remarks
		Inlet	Outlet						
GN2 Pneumatic servicing rig									
1.	Two-way electro pneumatic reduced bore ball valves	½"BSPP/Metric		15NBX160SCH	400	400	2	4	**Model number shall be same as selected in the rigs.**
GHe Pneumatic servicing rig									
1.	Two-way electro pneumatic reduced bore ball valves	½" BSPP/Metric		15NBX160SCH	400	400	2	4	**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 18: List of Manual valves

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				valves	Kits
GN2 Pneumatic servicing rig										
1.	VM01	VP Valves command supply inlet	Needle	BSPP /Metric		100	7	50	1	2
2.	VM02	VP Valves command supply vent#	Needle	BSPP /Metric		100	7	50	1	2
3.	VM03	GN2 System inlet vent#	Needle	BSPP /Metric		260	100	400	1	2

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				valves	Kits
4.	VM04	GN2 System inlet	Needle	BSPP /Metric		260	100	400	1	2
5.	VM10	VS1 Inlet isolation*	Needle	BSPP /Metric		**VR01FFR**	50	400	1	2
6.	VM11	VR01 Outlet	Needle	BSPP /Metric		50	50	400	1	2
7.	VM12	VR01 Outlet Vent #	Needle	BSPP /Metric		50	50	400	1	2
8.	VM15	VS03 inlet Isolation *	Needle	BSPP /Metric		**VR02FFR**	9	50	1	2
9.	VM16	VR02 Outlet	Needle	BSPP /Metric		50	9	50	1	2
10.	VM17	VR02 Outlet Vent #	Needle	BSPP /Metric		50	9	50	1	2
11.	VM19	VR03 inlet	Needle	BSPP /Metric		20	50	400	1	2
12.	VM20	VR03 Outlet	Needle	BSPP /Metric		20	1.5	50	1	2
13.	VM21	VR03 Outlet Vent#	Needle	BSPP /Metric		20	1.5	50	1	2
14.	VM23	VR04 inlet	Needle	BSPP /Metric		100	50	400	1	2
15.	VM24	VR04 Outlet	Needle	BSPP /Metric		100	7	50	1	2
16.	VM25	VR04 Outlet Vent#	Needle	BSPP /Metric		100	7	50	1	2
GHe Pneumatic servicing rig										
17.	VM01	VP Valves command supply inlet	Needle	BSPP /Metric		100	7	50	1	2
18.	VM02	VP Valves command supply vent#	Needle	BSPP /Metric		100	7	50	1	2
19.	VM03	GHe System inlet vent#	Needle	BSPP /Metric		160	100	400	1	2
20.	VM09	VR01 inlet	Needle	BSPP /Metric		160	100	400	1	2

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				valves	Kits
21.	VM10	VS01 Inlet isolation *	Needle	BSPP /Metric		VR01FFR	50	400	1	2
22.	VM11	VR01 Outlet	Needle	BSPP /Metric		50	50	400	1	2
23.	VM12	VR01 Outlet vent #	Needle	BSPP or Metric		50	50	400	1	2
24.	VM14	VR02 inlet	Needle	BSPP or Metric		50	50	400	1	2
25.	VM15	VS03 Isolation*	Needle	BSPP or Metric		VR02FFR	9	50	1	2
26.	VM16	VR02 Outlet	Needle	BSPP or Metric		50	9	50	1	2
27.	VM17	VR02 Outlet vent#	Needle	BSPP or Metric		50	9	50	1	2
28.	VM19	VR03 inlet	Needle	BSPP or Metric		20	50	400	1	2
29.	VM20	VR03 Outlet	Needle	BSPP or Metric		20	1.5	50	1	2
30.	VM21	VR03 Outlet Vent#	Needle	BSPP or Metric		20	1.5	50	1	2
31.	**Note: Spare Kits consists of Stem seal, body seal and other soft seals as applicable**									

Table 19:List of Gauge Shutoff Valves Spares

Sr.No	Valve Type	Type	MOP Bar	Size	(PN) Rating	Spares Quantity (Nos)	Remarks
				Inlet, outlet & vent			
GN2 Pneumatic servicing rig							
1.	Gauge shut of valves	Needle	400	BSPP/Metric	400	2	**Model number shall be same as selected in the rigs.**

Sr.No	Valve Type	Type	MOP Bar	Size	(PN) Rating	Spares Quantity (Nos)	Remarks
				Inlet, outlet & vent			
GHe Pneumatic servicing rig							
1.	Gauge shut of valves	Needle	400	BSPP/Metric	400	2	**Model number shall be same as selected in the rigs.**

Table 20:List of Pressure Transmitters Spares

Sr.No	Type	Entry	MOP bar(a)	End Connection Size/Type	Range bar(a)	Spares Quantity (Nos)	Remarks
GN2 Pneumatic servicing rig							
1.	High Pressure Transmitters	BOTTOM	75	1/2"NPT (F)	0-500	1	**Model number shall be same as selected in the rigs.**
2.	Low Pressure Transmitters	BOTTOM	13	1/2"NPT (F)	0-50	1	
GHe Pneumatic servicing rig							
1.	High Pressure Transmitters	BOTTOM	75	1/2"NPT (F)	0-500	1	**Model number shall be same as selected in the rigs.**
2.	Low Pressure Transmitters	BOTTOM	13	1/2"NPT (F)	0-50	1	

Table 21:List of Metering Valves Spares

Sr. No	Type of valve	End connections		MOP (Bar)	PN (BAR)	Spare valves Quantity (Nos)	Spare kits	Remarks
		Inlet	Outlet					
GN2 Pneumatic servicing rig								
1.	Metering	BSPP or Metric		400	400	2	4	**Model number shall be same as selected in the rigs.**
GHe Pneumatic servicing rig								
2.	Metering	BSPP or Metric		400	400	2	4	**Model number shall be same as selected in the rigs**
Note: Spare Kits consists of body and stem soft seals as applicable.								

Table 22: List of Filters spares

Sr. No	Type	PN	Micron Rating (abs)	Mesh MOC SS	Inlet & out let pipes Size& Schedule	End connection	Spares Quantity (Nos)	Filter elements & seals kits (Nos)	Remarks
GN2 Pneumatic servicing rig									
1.	Mesh	400	20	304L/316L	15NB,160sch	BSPP/Metric	2	4	**Model number shall be same as**
2.	Mesh	100	20	304L/316L	15NB,40sch	BSPP/Metric	2	4	

Sr. No	Type	PN	Micron Rating (abs)	Mesh MOC SS	Inlet & out let pipes Size& Schedule	End connection	Spares Quantity (Nos)	Filter elements & seals kits (Nos)	Remarks
									selected in the rigs.
GHe Pneumatic servicing rig									
1.	Mesh	400	20	304L/316L	15NB,160sch	BSPP/Metric	2	4	
2.	Mesh	100	20	304L/316L	15NB,40sch	BSPP/Metric	2	4	
Note: Spare Kits consists of filter elements and seals as applicable.									

Table 23: List of Solenoid Valves spares

Sr. No	Type of valve	End connections Inlet, Outlet, & Vent ,	MOC	Operating voltage	Min.Bore (DN) mm	MOP (Bar)	PN (BAR)	Quantity (Nos)
GN2 Pneumatic servicing rig								
1.	Dual coil & Low Power	¼" BSPP/NPT	SS304/316	24VDC	≥5	10	10	2
GHe Pneumatic servicing rig								
1.	Dual coil & Low Power	¼" BSPP/NPT	SS304/316	24VDC	≥5	10	10	2

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.

Annexure-7

Tentative Quality Assurance Plan for flow components, piping elements, and fabrication, testing and assembly

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

Table 24: Tentative QAP for Pressure Regulators

Sr. No	Characteristics	Ref. Document	Method of check	Quantum of check/type	
		Acceptance Criteria		Manufacturer's QC	SHAR
1	Quantity and model number	**Quantity:** As per table 4&14 **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%

Sr. No	Characteristics	Ref. Document / Acceptance Criteria	Method of check	Quantum of check/type	
				Manufacturer's QC	SHAR
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%	R 100%
7	Body Pneumatic test at MOP with all elements assembled condition	At Maximum inlet pressure and maximum outlet pressure **as per table 4** **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 4&14	Review	R 100%	R 100%
10	Final Documentation	**As per PO (3 Copies)**	Verification of Documents/ Certificates	V 100%	R 100%

Table 25: 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 **12&22** **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%

Sr.No	Characteristics / type of check	Ref. Document Acceptance Criteria	Method of check	Quantum of check/type Manufacturer's QC	 SHAR
8	Bubble point test of filter elements	As per the ISO 2942/equivalent Shall meet the 20micron rating	Testing on RIG	W 100%	R 100%
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%

Table 26: 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 **5&15** **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%
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 5&15	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 leak indication with snoop			
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 5** **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 27: 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 7&17 **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%

Sr. No	Characteristics	Ref. Document / Acceptance Criteria	Method of check	Quantum of check/type	
				Manufacturer's QC	SHAR
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%
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%

Sr. No	Characteristics	Ref. Document / Acceptance Criteria	Method of check	Quantum of check/type	
				Manufacturer's QC	SHAR
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 28: Tentative QAP for Manual Valves /Metering Valves/Gauge Shutoff 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	a) **Manual Valves Quantity:** As per table 8&18 b) **Metering valves Gauge Shutoff Valves Quantity:** As per table 11&21 c) **Gauge Shutoff Valves Quantity:** As per table 9&19 **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	W 100%	R 100%

Sr. No	Characteristics / type of check	Ref. Document	Method of check	Quantum of check/type	
				Manufacturer's QC	SHAR
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%
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%
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 29: 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 304L ▪ 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 304L ▪ 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%
2.4	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%

Sr.No	Characteristics	Reference documents	Method of check	Quantum of check	
				Manufacturer's QC	SHAR
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 30: 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 304L	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%
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 304L**				
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 304L**				
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 304L	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
2.6	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 304L	Witness	W 100%	W 100%
2.10	Final documentation	Test reports of the above test	Review	R 100%	R 100%

Table 31: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 F304/316 for fittings	Review of test certificates	R 100%	

Sr.NO	Characteristics/ type of check	Ref. Document	Method of check	Quantum of check	
				Manufacturer's QC	SHAR
1.2	Chemical analysis one per each lot /heat of each size of raw material	▪ F304L/316 **L only for weld type fittings**	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 /479/276F304/316 for fittings	Review of test certificates	R 100%	R 100%
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 32: 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 procedure as per **sr.no.7.2. (18) (**Bend radius shall be **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%

Sr.NO	Characteristics / type of check	Ref. Document & Acceptance	Method of check	Quantum of check	
				Manufacturer's QC	SHAR
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%
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 design pressure. Hydro test as **per procedure number 1** ▪ **Spec.: No pressure drop for 30 min**	Witness	W 100%	W 100%
2.8	Pickling and Passivation of internal & external weld surfaces of weld joints and flushing with DM water	▪ Pickling & Passivation procedure number 2 ▪ Standard ASTM A380	Witness	W 100%	W 100%

Sr.NO	Characteristics / type of check	Ref. Document & Acceptance	Method of check	Quantum of check	
				Manufacturer's QC	SHAR
2.9	Moisture check of pipelines after Pickling and Passivation	▪ Moisture check **as per procedure number 3** ▪ **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 for oxygen gas usage	▪ Oxygen cleaning prior to assembly to of flow components **as per approved procedure and medium**	Witness	W 100%	W 100%
2.11	Flushing of spools with DM water after cleaning	▪ As per CGA G 4.1/G93	Witness	W 100%	W 100%
2.12	Contamination check of each pipelines	▪ Cleanliness check after hydrotest and prior to assembly as per **procedure number 5** **Spec.: No visible particle or discoloration**	Witness	W 100%	W 100%

Table 33: 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	W 100%	W/R 100%
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			
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**				

Sr.No	Characteristics/ Type of check	Ref. Document	Method of check	Quantum of check	
				Manufacturer's QC	SHAR
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					

Table 34: 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 **13&23** **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 from NABL/Govt Approved labs	Material Characteristics Chemical Mechanical Micro structure (Solution annealing)	As per PO, drawing & Relevant Standards	Review	R 100%	R 100%
1b.	Identification of raw material for solenoid housing & critical internal parts like core,	Material Characteristics 1. Chemical	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
	core tube etc with Lab test & Mill test certificates respectively.					
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	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
		surge suppressor testing and installation				
		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	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
			and perform operation test.			
		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

V-Verification; R-Review; W-Witness

Annexure-8

Compliance to the flow components specifications

(To be submitted by the bidder)

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

1. Pressure Regulators Details

Table 35: List of Pressure Regulators

Sr. No	Tag No	Purpose	Inlet pressure bar(a)		Outlet pressure range bar(a)	Make Selected	End Connections	Quantity (Nos)
			Maximum	Minimum				
GN2 Pneumatic servicing rig								
1	VR1	CPPR O/L line leak check						
2	VR2	SPPR O/L line leak check & Purge						
3	VR3	SRV line leak check						
4	VR4	EP Valves command supply						
5	VR01A	SPPR Testing						
GHe Pneumatic servicing rig								
6	VR1	CPPR O/L line leak check	400	100	50-75	275		

Sr. No	Tag No	Purpose	Inlet pressure bar(a)		Outlet pressure range bar(a)	Make Selected	End Connections	Quantity (Nos)
			Maximum	Minimum				
7	VR2	SPPR O/L line leak check & Purge	75	50	9-13	62.5		
8	VR3	SRV line leak check	75	50	2	25		

2. Safety Relief Valves details

Table 36: List of Safety Relief Valves

Sr. No	Tag No	Service	Pressure in bar(g)		End connection Inlet & Outlet	Make Selected	End Connections	Quantity (Nos)
			MOP	Set				
GN2 Pneumatic servicing rig								
1.	VS01	CPPR O/L line leak check						
2.	VS02							
3.	VS02A							
4.	VS03	SPPR O/L line leak check & Purge						
5.	VS04							
6.	VS05	SRV line leak check						
7.	VS06	Valves CMD supply						
GHe Pneumatic servicing rig								

Sr. No	Tag No	Service	Pressure in bar(g)		End connection Inlet & Outlet	Make Selected	End Connections	Quantity (Nos)
			MOP	Set				
8.	VS01	CPPR O/L line leak check						
9.	VS02							
10.	VS03	SPPR O/L line leak check & Purge						
11.	VS04							
12.	VS05	SRV line leak check						

3. Pressure Gauge Details

Table 37:List of Pressure Gauges

Sr. No	Tag No	MOP bar(g)	Range bar(g)	Accuracy Class	Purpose	Dial Size (mm)	End Connection	Mounting	Make	Quantity (Nos)
GN2 Pneumatic servicing rig										
1.	PI01				GN2 Inlet					
2.	PI02				CPPR O/L Line leak check					
3.	PI02A				SPPR Testing					
4.	PI03				SPPR Line leak check /purge					
5.	PI04				CM SRV testing					
6.	PI05				Valves command supply					
GHe Pneumatic servicing rig										
7.	PI01				GHe Inlet					

Sr. No	Tag No	MOP bar(g)	Range bar(g)	Accuracy Class	Purpose	Dial Size (mm)	End Connection	Mounting	Make	Quantity (Nos)
8.	PI02				CPPR O/L Line leak check					
9.	PI03				SPPR Line leak check /purge					
10.	PI04				CM SRV testing					

4. EP Ball Valves Details

Table 38:List of VP Ball Valves

Sr. No	Tag No	Purpose	Bore of Valve	Make	End connections		Inlet & Outlet pipe size and Schedule (DN)	MOP (Bar)	PN (BAR)	Quantity (Nos)
					Inlet	Outlet				
GN2 Pneumatic servicing rig										
1.	VP01	CM GB charging path1								
2.	VP02	CM GB charging path2								
3.	VP03	CM GB emergency vent								
4.	VP04	CM GB controlled vent								
5.	VP05	SM GB charging path1								
6.	VP06	SM GB charging path2								

Sr. No	Tag No	Purpose	Bore of Valve	Make	End connections		Inlet & Outlet pipe size and Schedule (DN)	MOP (Bar)	PN (BAR)	Quantity (Nos)
					Inlet	Outlet				
7.	VP07	SM GB emergency vent								
8.	VP08	SM GB controlled vent								
GHe Pneumatic servicing rig										
9.	VP01	CM GB charging path1								
10.	VP02	CM GB charging path2								
11.	VP03	CM GB emergency vent								
12.	VP04	CM GB controlled vent								
13.	VP05	SM GB charging path1								
14.	VP06	SM GB charging path2								
15.	VP07	SM GB emergency vent								
16.	VP08	SM GB controlled vent								

5. Manual Valves details

Table 39:List of Manual Valves (Needle Valve)

Sr.No	Tag No	Purpose	Type of valve	Make of Valve	End connections		Bore (DN) mm	MOP (Bar)	PN (BAR)	Quantity (Nos)
					Inlet	Outlet				
GN2 Pneumatic servicing rig										
1.	VM01	VP Valves command supply inlet								
2.	VM02	VP Valves command supply vent								
3.	VM03	GN2 System inlet vent								
4.	VM04	GN2 System inlet								
5.	VM05	CM GB Charging isolation								
6.	VM06	CM&SM Line leak check								
7.	VM07	SM GB Charging isolation 1								
8.	VM08	SM GB Charging isolation 2								
9.	VM09	VR01 inlet								
10.	VM09A	VR01A inlet								

Sr.No	Tag No	Purpose	Type of valve	Make of Valve	End connections		Bore (DN) mm	MOP (Bar)	PN (BAR)	Quantity (Nos)
					Inlet	Outlet				
11.	VM10	VS1 Inlet isolation								
12.	VM11	VR01 Outlet								
13.	VM11A	VR01A Outlet								
14.	VM12	VR01 Outlet Vent								
15.	VM12A	VR01A Outlet Vent								
16.	VM13	CPPR O/L line								
17.	VM13A	SPPR Testing								
18.	VM14	VR02 inlet								
19.	VM15	VS03 inlet								
20.	VM16	VR02 Outlet								
21.	VM17	VR02 Outlet Vent								
22.	VM18	SPPR Line leak and purge								
23.	VM19	VR03 inlet								

Sr.No	Tag No	Purpose	Type of valve	Make of Valve	End connections		Bore (DN) mm	MOP (Bar)	PN (BAR)	Quantity (Nos)
					Inlet	Outlet				
24.	VM20	VR03 Outlet								
25.	VM21	VR03 Outlet Vent								
26.	VM22	CM SRV Testing								
27.	VM23	VR04 inlet								
28.	VM24	VR04 Outlet								
29.	VM25	VR04 Outlet Vent								
GHe Pneumatic servicing rig										
30.	VM01	VP Valves command supply inlet								
31.	VM01	VP Valves command supply vent								
32.	VM03	GHe System inlet vent								
33.	VM04	GHe System inlet								
34.	VM05	CM GB Charging isolation								

Sr.No	Tag No	Purpose	Type of valve	Make of Valve	End connections		Bore (DN) mm	MOP (Bar)	PN (BAR)	Quantity (Nos)
					Inlet	Outlet				
35.	VM06	CM&SM Line leak check								
36.	VM07	SM GB Charging isolation 1								
37.	VM08	SM GB Charging isolation 2								
38.	VM09	VR01 inlet								
39.	VM10	VS01 Inlet isolation								
40.	VM11	VR01 Outlet								
41.	VM12	VR01 Outlet vent								
42.	VM13	CPPR O/L line								
43.	VM14	VR02 inlet								
44.	VM15	VS03 Isolation								
45.	VM16	VR02 Outlet								
46.	VM17	VR02 Outlet vent								
47.	VM18	SPPR Line leak and purge								

Sr.No	Tag No	Purpose	Type of valve	Make of Valve	End connections		Bore (DN) mm	MOP (Bar)	PN (BAR)	Quantity (Nos)
					Inlet	Outlet				
48.	VM19	VR03 inlet								
49.	VM20	VR03 Outlet								
50.	VM21	VR03 Outlet Vent								
51.	VM22	CM SRV Testing								

Table 40:List of Gauge Shutoff Valves

Sr.No	Tag No	Service	Type	Make of Valve	MOP Bar	Size			(PN) Rating	Quantity (Nos)
						Inlet	Outlet	Vent		
GN2 Servicing Pneumatic servicing rig										
1.	VGS01	GHe/GN2 inlet PT01&PI01	Needle							
2.	VGS02	CM GB Charging PT01,02,03	Needle							
3.	VGS03	SM GB Charging PT05,06,07	Needle							
4.	VGS04	VR01 Outlet(PI02)	Needle							

Sr.No	Tag No	Service	Type	Make of Valve	MOP Bar	Size			(PN) Rating	Quantity (Nos)
						Inlet	Outlet	Vent		
5.	VGS04A	VR01A Outlet(PI02A)	Needle							
6.	VGS05	CPPR O/L line(PT08)	Needle							
7.	VGS05A	SPPR Testing	Needle							
8.	VGS06	VR02 Outlet(PI03)	Needle							
9.	VGS07	SPPR Line leak & purge(PT09)	Needle							
10.	VGS08	VR03 Outlet(PI04)	Needle							
11.	VGS09	CM SRV testing (PT10)	Needle							
12.	VGS10	VR04 Outlet(PI05&PT11)	Needle							
GHe Servicing Pneumatic servicing rig										
13.	VGS01	GHe/GN2 inlet PT01&PI01	Needle							
14.	VGS02	CM GB Charging PT01,02,03	Needle							
15.	VGS03	SM GB Charging PT05,06,07	Needle							

Sr.No	Tag No	Service	Type	Make of Valve	MOP Bar	Size			(PN) Rating	Quantity (Nos)
						Inlet	Outlet	Vent		
16.	VGS04	VR01 Outlet(PI02)	Needle							
17.	VGS05	CPPR O/L line(PT08)	Needle							
18.	VGS06	VR02 Outlet(PI03)	Needle							
19.	VGS07	SPPR Line leak & purge(PT09)	Needle							
20.	VGS08	VR03 Outlet(PI04)	Needle							
21.	VGS09	CM SRV testing	Needle		2					

6. Pressure Transmitters details

Table 41:List of Pressure Transmitters

Sr.No	Tag No	Service	Make	Entry	MOP bar(a)	End Connection	Range bar(a)	Quantity (Nos)
GN2 Pneumatic servicing rig								
1.	PT01	GN2 System inlet						
2.	PT02	CM GB Charging						

Sr.No	Tag No	Service	Make	Entry	MOP bar(a)	End Connection	Range bar(a)	Quantity (Nos)
3.	PT03							
4.	PT04							
5.	PT05	SM GB Charging						
6.	PT06							
7.	PT07							
8.	PT08	CPPR Outlet line leak check						
9.	PT08A	SPPR Testing						
10.	PT09	SPPR Line leak check and Purge						
11.	PT10	CM SRV Testing						
12.	PT11	EP Valve command valve supply						
GHe Pneumatic servicing rig								
13.	PT01	GHe System inlet						
14.	PT02	CM GB Charging						

Sr.No	Tag No	Service	Make	Entry	MOP bar(a)	End Connection	Range bar(a)	Quantity (Nos)
15.	PT03							
16.	PT04							
17.	PT05	SM GB Charging						
18.	PT06							
19.	PT07							
20.	PT08	CPPR Outlet line leak check						
21.	PT09	SPPR Line leak check and Purge						
22.	PT10	CM SRV Testing						

7. Metering Valve Details

Table 42:List of Metering Valves

Sr.No	Tag No	Purpose	Type of valve	Make of Valve	End connections		Min. Bore (DN) mm	MOP (Bar)	PN (BAR)	Quantity (Nos)
					Inlet	Outlet				
GN2 Pneumatic servicing rig										

Sr.No	Tag No	Purpose	Type of valve	Make of Valve	End connections		Min. Bore (DN) mm	MOP (Bar)	PN (BAR)	Quantity (Nos)
					Inlet	Outlet				
1.	MV01	CM GB charging path1								
2.	MV02	CM GB charging path2								
3.	MV03	CM GB controlled vent								
4.	MV04	SM GB charging path1								
5.	MV05	SM GB charging path2								
6.	MV06	SM GB controlled vent								
GHe Pneumatic servicing rig										
7.	MV01	CM GB charging path1								
8.	MV02	CM GB charging path2								
9.	MV03	CM GB controlled vent								
10.	MV04	SM GB charging path1								
11.	MV05	SM GB charging path2								

Sr.No	Tag No	Purpose	Type of valve	Make of Valve	End connections		Min. Bore (DN) mm	MOP (Bar)	PN (BAR)	Quantity (Nos)
					Inlet	Outlet				
12.	MV06	SM GB controlled vent								

8. Filter details

Table 43:List of Filters

Sr. No	Tag No	Purpose	Make of Filter	Element Type	PN Rating Bar	Micron Rating (abs)	Mesh MOC SS	Inlet & outlet pipes Size& Schedule	End connection	Qty Nos	Filter Mesh area (mm2)
GN2 Pneumatic servicing rig											
1.	FL01	VP valve command supply									
2.	FL02	GN2/GHe Inlet									
3.	FL03	CM GB Charging									
4.	FL04	CM&SM Line leak check									

Sr. No	Tag No	Purpose	Make of Filter	Element Type	PN Rating Bar	Micron Rating (abs)	Mesh MOC SS	Inlet & outlet pipes Size& Schedule	End connection	Qty Nos	Filter Mesh area (mm2)
5.	FL05	SM GB Charging FDV 2									
6.	FL06	SM GB Charging FDV 1									
7.	FL07	VR 01 Inlet									
8.	FL07A	VR 01A Inlet									
9.	FL08	CPPR Outlet lines									
10.	FL08A	SPPR Testing									
11.	FL09	VR 02 Inlet									
12.	FL10	SPPR Outlet lines									
13.	FL11	VR 03 Inlet									
14.	FL12	CM SRV testing									

Sr. No	Tag No	Purpose	Make of Filter	Element Type	PN Rating Bar	Micron Rating (abs)	Mesh MOC SS	Inlet & outlet pipes Size& Schedule	End connection	Qty Nos	Filter Mesh area (mm2)
15.	FL13	VR 04 Inlet									
GHe Pneumatic servicing rig											
16.	FL01	VP valve command supply									
17.	FL02	GN2/GHe Inlet									
18.	FL03	CM GB Charging									
19.	FL04	CM&SM Line leak check									
20.	FL05	SM GB Charging FDV 2									
21.	FL06	SM GB Charging FDV 1									
22.	FL07	VR 01 Inlet									
23.	FL08	CPPR Outlet lines									

Sr. No	Tag No	Purpose	Make of Filter	Element Type	PN Rating Bar	Micron Rating (abs)	Mesh MOC SS	Inlet & outlet pipes Size& Schedule	End connection	Qty Nos	Filter Mesh area (mm2)
24.	FL09	VR 02 Inlet									
25.	FL10	SPPR Outlet lines									
26.	FL11	VR 03 Inlet									
27.	FL12	CM SRV testing									

9. Solenoid Valve Details

Table 44: List of Solenoid Valves

Sr. No	Tag No	Purpose	Type of valve	Make of Valve	End connections			MOC	Nominal Operating voltage	Min Bore (DN) mm	MOP (Bar)	PN (BAR)	Quantity (Nos)
					Inlet	Outlet	Vent						
GN2 Pneumatic servicing rig													
1.	SOV1	VP01 SOV											
2.	SOV2	VP02 SOV											
3.	SOV3	VP03 SOV											
4.	SOV4	VP04 SOV											
5.	SOV5	VP05 SOV											
6.	SOV6	VP06 SOV											
7.	SOV7	VP07 SOV											
8.	SOV8	VP08 SOV											
GHe Pneumatic servicing rig													

Sr. No	Tag No	Purpose	Type of valve	Make of Valve	End connections			MOC	Nominal Operating voltage	Min Bore (DN) mm	MOP (Bar)	PN (BAR)	Quantity (Nos)
					Inlet	Outlet	Vent						
9.	SOV1	VP01 SOV											
10.	SOV2	VP02 SOV											
11.	SOV3	VP03 SOV											
12.	SOV4	VP04 SOV											
13.	SOV5	VP05 SOV											
14.	SOV6	VP06 SOV											
15.	SOV7	VP07 SOV											
16.	SOV8	VP08 SOV											

Annexure-9

Minimum Qualification Criteria

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

The following are the minimum essential criteria to further validate/accept the bid. Vendor is requested to provide all the necessary support documents. In case of any deviation/non-compliances/ lack of supporting document, bid shall be summarily rejected.

Sl.No	Description	Vendor Compliance with supporting documents
1.	The Vendor should be in the field of design, procurement of flow components, fabrication, assembly, inspection, testing and delivery of pneumatic equipment during the last Five years ending with **31-03-2022.** ii. Single order value not less than **Rs.400 Lakhs** (or) iii. Two orders of value not less than **Rs.300 Lakhs** (or) each iv. Three orders of value not less than **Rs.200 Lakhs** each. v. Details of the last five years purchase orders shall be submitted along with the offer for proof of above.	
2.	Tenderers should have average annual turnover for the last three years (FY: 2019-20, 2020-21 & 2021-22) of **Rs.400 Lakhs**	
3.	The Bidders shall submit Profit & Loss Accounts, Balance Sheets duly certified by the auditor and IT returns for the last three financial years with acknowledgement from IT Department up to last 3 years (ending with 31-03-2022). Necessary documents shall be submitted	
4.	Latest Solvency certificate form any Nationalized/Scheduled bank shall be submitted for a value of minimum **Rs.200 Lakhs**. The Solvency certificate must have been issued during current financial year	
5.	Manufacturing through sub vendors is not acceptable	
6.	Supplier should submit the end user certificate from the customer for confirming the satisfactory execution of design, fabrication, assembly inspection, testing and delivery of complete pneumatic equipment with an operating pressure	

Sl.No	Description	Vendor Compliance with supporting documents
	of 250 bar and above. **Non-submission of relevant end user certificate shall lead to technical disqualification of the offer**	
7.	Technical compliance to the specifications shall be wetted by the bidder.	
8.	The firm must provide a self-declaration that there is no complaint/vigilance inquiry against them in any Govt./Department/PSU and they have not been black listed by any Govt. Department/PSU	
9.	Technical proposal of the bidder, which is not able to substantiate/satisfy the claims made by it with respect to the technical requirements laid down in this RFP, will be summarily rejected	
10.	Offers of those bidders taking full scope of the work as per the requirements indicated in the RFP only will be considered.	

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

Annexure-10

Bid Evaluation Criteria

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

Sl.No	Description	Vendor Compliance with supporting documents
1.	In respect of Two-Bid system, the technical Bids forwarded by the Bidders will be evaluated by the Department with reference to the technical specifications as mentioned in the RFP. The compliance of Technical Bids would be determined on the basis of the parameters specified in the RFP. The Price Bids of only those Bidders will be opened whose Technical Bids would clear the technical evaluation	
2.	During evaluation, SDSC SHAR may request Bidder for any additional clarification/document on the bid, if required	
3.	Performance of Bidder on similar nature of works executed/ under execution will be taken into consideration before selecting the Bidder for opening his price bid (as per qualification criteria)	
4.	The time schedule for completion is given in the Proposal document. Bidder is required to confirm the completion period unconditionally	
5.	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	
6.	Purchaser reserves the right for evaluation of any bidder by visiting his manufacturing premises towards acceptance of the techno-commercial bid. The decision of the purchaser is final in this regard	
7.	Preference will be given to MSME as per public procurement policy	

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

Annexure-11

Pneumatic Servicing Rigs Drawings

1. Gaseous helium (GHe) pneumatic servicing rig (Ref Dwg No: LSSF/CGS/PSR-GHe-01/R0) **(As per Attachment – 1)**
2. Gaseous Nitrogen (GN2) pneumatic servicing rig (Ref Dwg No: LSSF/CGS/PSR-GN2-01/R0) **(As per Attachment – 2)**
3. Panel dimensional and configuration drawing **as per Attachment – 3**

Annexure-12

Compliance to be submitted by The Supplier as Part of Bid Submission

Sr.No	Description	Acceptance of Bidder
Bidder shall submit point wise acceptance to the following and shall submit the poofs for all points without which offer will not be considered.		
1.	Procurement of items: Confirm to procure flow components, pipes & piping elements from the manufacturers or their authorized Dealer/agents only	
2.	The bidder shall submit the details of the machinery/manpower available/required for realization of the equipment as in- house	
3.	the 6G Qualified TIG Welder (min. of 3 welders) & ITI Qualified fitters (min. of 3) for carrying out works	
4.	Skilled workers for carrying out the Qualification/assembly and testing	
5.	Equipment for carrying out operations like pipe bending, cutting & grinding	
6.	Hydro and pneumatic testing equipment	
7.	Oxygen cleaning of the pipe spools after fabrications	
8.	Identified engineers for generating the test reports /design reports	
9.	**Acceptance of the bidder w.r.t each annexure of tender document**	
10.	Acceptance to Overview of System, Scope of Work & Supply, and Design for Guide Lines, fabrication, testing and conditioning Assembly & Integrated Testing of Equipment, Panels & Inspection as given in **Annexure 1.**	
11.	Acceptance to Bid submission, offer validity, taxes, payments, payment terms and other purchase terms and conditions, delivery and general conditions are as given in **Annexure-2.**	
12.	Acceptance to technical specifications of pneumatic servicing rigs as given in **Annexure 3.**	

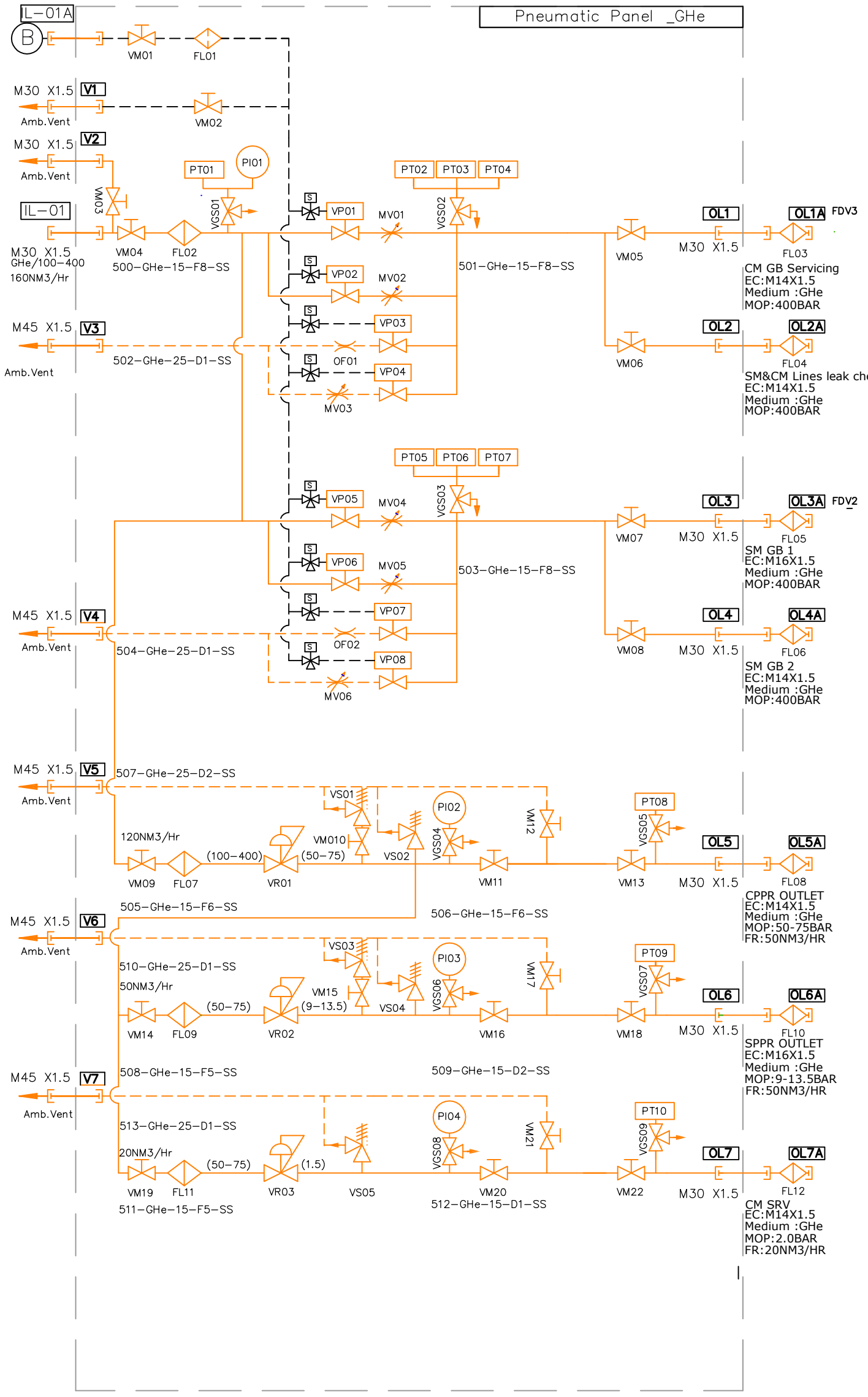
Sr.No	Description	Acceptance of Bidder
13.	Acceptance to technical specifications of flow components, instrumentation and piping elements, Conditions for Procurement of Flow Components and testing of flow components is **as given in Annexure-4.**	
14.	Acceptance to the schedule of flow components as given in **Annexure-5.**	
15.	Acceptance to supply the list of spare flow components and spare kits same as model numbers selected for rigs as given in **Annexure-6**	
16.	Tentative Quality Assurance Plan for flow components, piping elements, & fabrication, testing & assembly as given in **Annexure-7.**	
17.	Acceptance to generate final QAP and which shall be acceptable to both and shall be finalized before opening the price bid. Party shall submit the finalized QAP along with the Techno commercial bid.	
18.	Party shall submit the details of the flow component make, constructional drawings, bore size, PN rating, end connections and submit the technical specifications of the flow component as given in **Annexure-8**	
19.	Party shall give compliance to the Minimum Qualification Criteria as given in **Annexure-9**	
20.	Party shall give compliance to the Bid Evaluation Criteria as given in **Annexure-10**	
21.	Acceptance to Equipment Wise P & I (attachment 1& 2) diagrams are given in **Annexure-11**	
22.	Part order acceptance to the quoted price: Part order will be issued as follows (GN2 RIG and GN2 rig spare flow components and spare kits for flow components) and (GHE rig and GHe rig spare flow components and spare kits for flow components).Rig and its spares together will be considered for splitting the order	
23.	Total cost of equipment shall be inclusive of all charges (Eg. P&F, transportation Testing ,Customs duty and any	

Sr.No	Description	Acceptance of Bidder
	other charges as applicable) **except GST** (Applicable HSN code shall be mentioned along with offer. **No extra cost /Additional shall be mentioned in the offer**	
24.	Acceptance to the delivery schedule of **16weeks** from the date of purchase order	
25.	Any deviations shall be submitted separately with company stamp and signature of authorized	
26.	For this procurement, bids from Class-I & class-II Local Suppliers are admissible. Hence provisions contained in Public Procurement (Preference to 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	
27.	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).	
28.	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	
29.	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	
30.	Verification of local content: 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	

Sr.No	Description	Acceptance of Bidder
31.	In case bid value is in excess of Rs. 10 Cr., Class-I local supplier / Class-II local supplier shall be required to provide a certificate from the statutory auditor or cost auditor of the company (in the case of companies) or from a practicing cost accountant or practicing chartered accountant (in respect of suppliers other than companies) giving the percentage of local content	
32.	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	
33.	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	
34.	The percentage of local content should be specifically mentioned in the offer, without which it will be summarily rejected	
35.	Preference will be given to Class-I Local supplier and in their absence, Class-II Local supplier will be considered	

Attachment:01

CPCS PNEUMATIC SERVICING RIG -GHe



Nomenclature
VP: Pneumatic Valve
VM: Manual Valve
VR: Regulating Valve
VS: Safety Valve
MV: Metering Valve
VGS: Gauge Shut off Valve
PI: Pressure Indicator
PT: Pressure Transmitter
OF: Orifice

1: 0-07BAR	5: 39-60BAR	D: 40SCH
2: 8-12BAR	6: 61-120BAR	E: 80SCH
3: 13-24BAR	7: 121-280BAR	F: 160SCH
4: 25-38BAR	8: 281-400BAR	G: XXSCH

IL: Inlet
OL: Outlet
V: Vent

Attachment 01

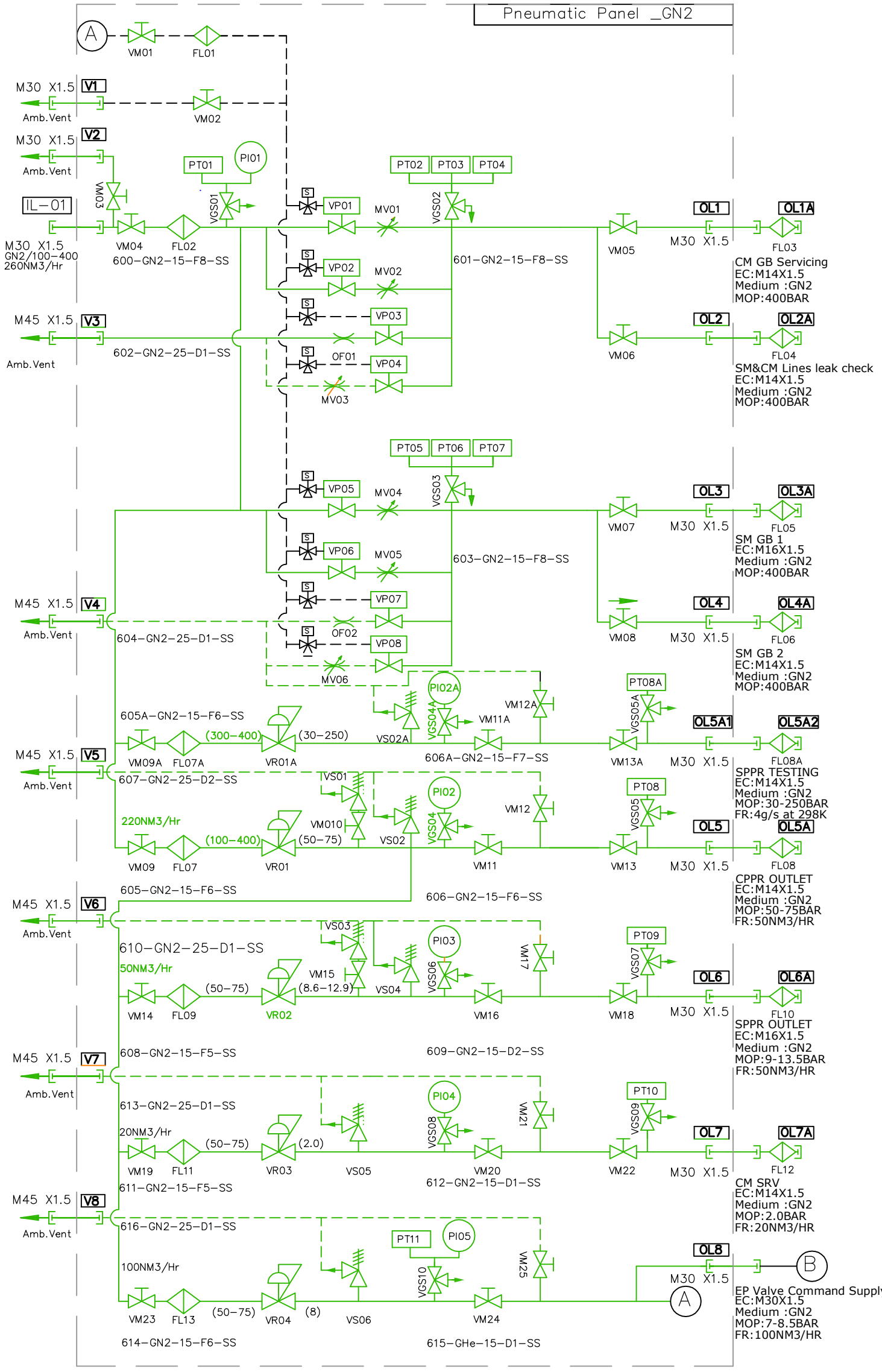
GLCRD PROJECT SATISH DHAWAN SPACE CENTRE SRIHARIKOTA SDSC : SHAR : ISRO		NAME	DT
	DRAWN	RD	04-08-22
	REVIEWED	GS	04-08-22
	APPROVED	JD	04-08-22

TITLE : Pneumatic Panel for GHe Servicing of Oribital Module

SCALE:NTS	DIM : NA	MATERIAL: SS	Qty. : 03	DRG NUMBER
	SDSC/LSSF/OM			LSSF/CGS/PSR-GHe-01/R0
				REV 00 SHEET 1 OF 1

Attachment:02

CPCS PNEUMATIC SERVICING RIG -GN2



Nomenclature
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4: 25-38BAR	8: 281-400BAR	G: XXSCH

IL: Inlet
OL: Outlet
V: Vent

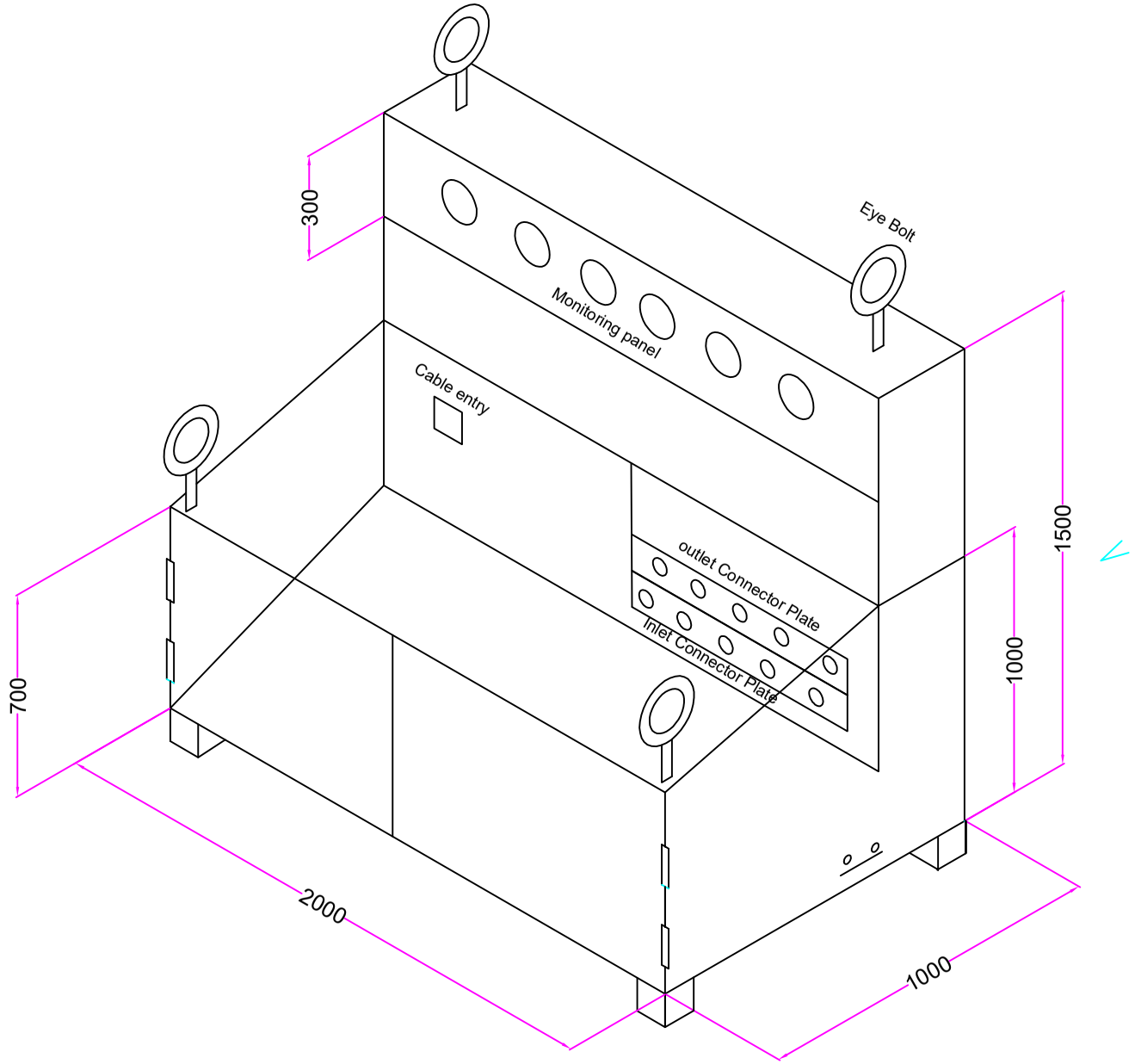
		NAME	DT
GLCRD PROJECT SATISH DHAWAN SPACE CENTRE SRIHARIKOTA SDSC : SHAR : ISRO	DRAWN	RD	04-08-22
	REVIEWED	GS	04-08-22
	APPROVED	JD	04-08-22

TITLE : Pneumatic Panel for GN2 Servicing of Oribital Module

SCALE:NTS	DIM : NA	MATERIAL: SS	Qty. : 03	DRG NUMBER
	SDSC/LSSF/OM			LSSF/CGS/PSR-GN2-01/R0
			REV 00	SHEET 1 OF 1

Attachment:02

Attachment 3



Cabinet for Pneumatic Serivicing Rig