भारत सरकार/Government of India
अंतरिक्ष विभाग/Department of Space
द्रव नोदन प्रणाली केंद्र
LIQUID PROPULSION SYSTEMS CENTRE
एच ए एल II स्टेज, 80 फीट रोड
HAL II STAGE, 80 FEET ROAD,
बेंगलूरु/BANGALORE-560 008.
फोन सं./Phone No.080 25037171/140
ई-मेल/Email: purchase@lpscb.gov.in

दिनांक/Date: 02.07.2025

लोक निविदा सूचना सं. एल बी2025000090-01 दिनांक 02.07.2025
PUBLIC TENDER NOTICE NO. LB2025000090-01 DATED 02.07.2025

गैस वितरण बैंक की अभिकल्पना, संविरचन, आपूर्ति व परीक्षण के लिए निविदा
Tender for Design, Fabrication, Supply and Testing of Gas Distribution Bank

निविदा वर्गीकरण: लोक निविदा
Tender Classification: PUBLIC TENDER

निविदा की निर्धारित तिथियाँ/TENDER SCHEDULE

बोली-पूर्व बैठक की तिथि/Pre-bid Meeting Date	:	10.07.2025 10:00
बोली प्रस्तुति की आरंभिक तिथि/Bid Submission Start Date	:	10.07.2025 14:00
बोली स्पष्टीकरण की नियत तिथि/Bid Clarification Due Date	:	10.07.2025 10:00
बोली प्रस्तुतीकरण की नियत तिथि/Bid Submission Due Date	:	31.07.2025 14:00
बोली खुलने की तिथि/Bid Opening Date	:	31.07.2025 15:00
मूल्य बोली खुलने की तिथि / Price Bid Opening Date	:	14.08.2025 14:00

निविदा दस्तावेज़ https://www.isro.gov.in/ OR https://eproc.vssc.gov.in या इसरो ई-प्रापण पोर्टल से डाउनलोड किए जा सकते हैं।/Tender documents can be downloaded from https://www.isro.gov.in/ OR https://eproc.vssc.gov.in or ISRO E-Procurement Portal.

हस्ताक्षरित/Signed
क्रय व भंडार अधिकारी/Purchase & Stores Officer

GOVERNMENT OF INDIA
DEPARTMENT OF SPACE
LIQUID PROPULSION SYSTEMS CENTRE (LPSC-B)
BANGALORE

Tender for Gas distribution bank for SSL

Bids to be submitted online

Tender No.: LPSC-B/Liquid Propulsion Systems Centre, Bengaluru/LB202500009001 dated 02-07-2025

A. Tender Details

Tender No :	**LPSC-B/Liquid Propulsion Systems Centre, Bengaluru/LB202500009001**
Tender Date :	**02-07-2025**
Tender Classification:	**GOODS**
Purchase Entity :	**Liquid Propulsion Systems Centre, Bengaluru**
Centre :	**LIQUID PROPULSION SYSTEMS CENTRE (LPSC-B)**

Gas distribution bank for SSL

Gas distribution bank for SSL

A.1 Tender Schedule

Tender Publish Date :	**02-07-2025 16:00**
Bid Clarification Due Date :	**10-07-2025 10:00**
Bid Submission Start Date :	**10-07-2025 14:00**
Bid Submission Due Date :	**31-07-2025 14:00**
Bid Opening Date :	**31-07-2025 15:00**
Price Bid Opening Date :	**14-08-2025 14:00**

A.2 Pre-bid Meeting Details

Date :	**10-07-2025 10:00**
Place :	**LPSC/ISRO, BENGALURU**
Location :	**80 Feet Road, HAL 2nd Stage HPO, Bengaluru 560008**
Centre :	**LIQUID PROPULSION SYSTEMS CENTRE (LPSC-B), BANGALORE, KARNATAKA**

Details :	**1. Pre-bid meeting is scheduled on July 10th, 2025 at 10:00 hours in online/offline mode.** **2. Please note that Pre-bid meeting is NOT MANDATORY to participate in bidding process.** **3. Vendors interested in attending pre-bid meeting may intimate their willingness and furnish details of personnel ttending pre-bid meeting by sending mail to "purchase@lpscb.gov.in" at least 48 hours prior to meeting scheduled on 10th July, 2025 at 11:00 hours.**

B. Tender Attachments

Technical Write-up/Drawings

Document : Design, fabrication, supply of gas distribution system in LPSC B --Design, fabrication, supply of gas distribution system in LPSC B

Instructions To Vendors

2. Instructions to Vendors

1. LPSC(B) invites offers through eprocurement portal (https://eproc.isro.gov.in) for the supply / service of items as listed in the Tender document.

2. Prospective vendors interested in participating in the tendering process need to get registered in the e-procurement portal by using Digital Signature Certificate. Offers submitted through our online portal only shall be considered and offers received through fax or email or in person shall not be considered.

3. The Tenderers are requested to update their address and contact details, if necessary and submit the Bids online at least two days prior to closing date to avoid last minute system / network related problems. In case of any technical issues, tenderers may write to helpdesk team (eprocure@vssc.gov.in, egps@lpscb.gov.in) for resolution. Request for the extension of the due date for such instances shall not be considered.

4. GST @ 5% is applicable for following goods mentioned under Sl. No. 243B as per Department of Revenue Notification No. 25/2018 - Integrated Tax (Rate) dated 31/12/2018 (Amendment to Notification Nos. 07/2018 dated 25/01/2018 and 01/2017 dated 28/06/2017) and Department of Revenue Notification No. 24/2018 - Central Tax (Rate) dated 31/12/2018 (Amendment to Notification Nos. 06/2018 dated 25/01/2018 and 01/2017 dated 28/06/2017) and Government of Karnataka Notification No. 24/2018 dated 31/12/2018 (Amendment to Notification Nos. 06/2018 dated 25/01/2018 and 01/2017 dated 29/06/2017).
"Scientific and technical instruments, apparatus, equipment, accessories, parts, components, spares, tools, mock ups and modules, raw material and consumables required for Launch Vehicles and Satellites and Payloads"

5. LPSC(B), ISRO is eligible for Customs Duty Concession vide Notification No. 50/2017-Customs dated 30/06/2017 (Sl. No. 539), Notification No. 5/2018-Customs dated 25/01/2018 (Sl. No. 539A) and Notification No. 05/2025-Customs dated 01/02/2025 (Sl. No. 539A). Necessary Customs Duty Concession Certificate shall be provided if applicable.

6. Offer Validity: The offer shall be valid for a period of 90 days (for Single Part Tender) and 120 days (for Two Part Tender) from the date of opening of the tender or any other period as specified in the Tender document. Offers with lesser validity period than that specified are liable for exclusion from the procurement process.

7. In case of Two Part Tender, Tenderers shall not mention any kind of price element in Techno-Commercial Bid. If any Price element is mentioned in the Techno-Commercial bid, their offer shall be liable for rejection.

8. LPSC(B) reserves the right to accept or reject any quotation in part or in full or part without assigning any reason thereof. LPSC(B) shall be under no obligation to accept the lowest tender and reserves the right to accept whole or any part of the tender or part of the quantity offered and the Tenderers shall supply the same at the rates quoted.

9. Bank Details: Tenderer shall provide their bank details such as IFSC code, IBAN No. , SWIFT etc. along with their offer which shall be not be changed till completion of supply/service.

10. Applicable Law: The Contract shall be governed by Indian Law for the time being in force and jurisdiction shall lie in the Courts of India.

11. Only Class-I and Class-II Local suppliers as per Public Procurement Policy (Preference to Make in India) Order, 2017 are eligible to participate in the bid unless otherwise specified in the Tender document.

12. As far as implementation of Public Procurement Policy (Preference to Make in India) Order, 2017 is concerned, the Office Orders vide No. P-45021/2/2017-B.E-II dated 15/06/2017, which is partially modified by Order No. P-45021/2/2017-PP(BE-II) dated 28/05/2018, Order No. P-45021/2/2017-PP(BE-II) dated 29/05/2019, Order No. P-45021/2/2017-PP (BE-II) dated 04/06/2020 and Order No. P-45021/2/2017-PP (BE-II) dated 16/09/2020 and subsequent Amendments issued by the Department for Promotion of Industries and Internal Trade (DPIIT), Ministry of Commerce and Industry regarding Class-I / Class-II local suppliers, Purchase preference, verification of local contents etc. shall be applicable to this tender unless otherwise specified in the Tender document.
Therefore, bidders may ensure compliance of the same while submitting tenders.

13. Price Preference shall be extended to the MSEs under the Public Procurement Policy for MSEs formulated under the Micro, Small and Medium Enterprises Development Act, 2006 unless otherwise specified in the Tender document. Such MSEs shall produce documentary proof of registration as per provisions of the Policy i.e. registration with District Industries Centre (DIC) or Khadi and Village Industries Commission (KVIC) or Khadi and Industries Board (KVIB) or Coir Board or National Small Industries Commission (NSIC) or Directorate of Handicrafts and Handlooms or Udyog Aadhar Memorandum or any other body specified by Ministry of MSME.

14. As per the Rule 144 (xi) of General Financial Rules,2017, any bidder from a country which shares a land border with India will be eligible to bid in this tender, only if the bidder is registered with the Competent Authority. Competent Authority for the purpose of registration shall be the Registration Committee constituted by the Department for Promotion of Industry and Internal Trade (DPIIT).

15. Resolution of Disputes: Any dispute, disagreement or question arising out of or relating to or in consequence of the contract or to its fulfillment, or the validity of enforcement thereof which cannot be settled mutually, or the settlement of which is not herein specifically provided for, shall within 30 (thirty) days from the date either party informs the other in writing that such dispute or disagreement exists be referred to arbitration by the sole arbitrator. The Arbitrator shall be appointed as per the Indian Arbitration and Conciliation Act 1996 and proceedings will be conducted in Bangalore. The Arbitration proceedings shall be conducted in accordance with and subject to the Arbitration and Conciliation Act 1996 (Act 26 of 1996) as amended from time to time and the decision of the Arbitrator shall be final and binding on the parties thereto. Each party shall bear its own cost of preparing and presenting its case. The cost of Arbitration including the fees and expenses of the Arbitrator shall be shared equally by the parties unless the award provides otherwise. Subject to provisions of this clause, the courts at Bangalore shall have exclusive jurisdiction. Performance under this Contract shall, however continue during Arbitration proceeding and no payment due or payable by the parties hereto shall be withheld unless any such payment is/or forms a part of the subject matter of the Arbitration proceedings.

16. Force Majeure: Neither party shall bear responsibility for the complete or partial non-performance of any of his obligations if the non-performance results from such force majeure circumstances such as, but not restricted to, flood, fire, earthquake, civil commotion, sabotage, explosion, epidemic, quarantine restriction, strike, lock-out, freight embargo, acts of the Government, acts of public enemy and other acts of God as well as war or revolution, military operation, blockade, acts or actions of State authorities or any other circumstance beyond the control of the parties provided the other party is notified in writing within 21 days from the date of commencement of the unforeseeable event.

3. Local Content Declaration

1. DECLARATION OF LOCAL CONTENT
(To be given on company letter head with self certification - For tender value below Rs. 10 Crores
(To be given by Statutory Auditor or Cost Auditor or Cost Accountant or CA - For tender value above Rs. 10 Crores)
Date:
To,
Sub: Declaration of Local content
Tender Ref No:
Name of Tender:
1. Country of Origin of Goods being offered:
2. We hereby declare that items offered has -----% local content:

3. Details of Local Value additions:
4. Address At which Local value addition is being made:
"Local Content" means the amount of value added in India which shall, be the total value of the item being offered minus the value of the imported content in the item (including all customs duties) as a proportion of the total value, in percent.
It is certified that the above mentioned Local content is excluding the following (a) (b) & (c):
a. Imported items sourced locally from resellers/distributors are excluded from calculation of the above local content.
b. The license fees/royalties paid/ technical charges paid out of India shall be excluded from local content calculation.
c. Procurement/Supply of repackaged/refurbished/rebranded imported products as understood commonly shall be treated as reselling of imported products and shall be excluded from calculation of local content. The definition of repackaged /refurbished/rebranded imported products is as follows; Refurbishing means repair or reconditioning of an imported product does not amount to manufacture because no new goods come into existence. Repackaging means repacking of imported goods from bulk pack to smaller packs would not ordinarily amount to manufacture of a new item. Rebranding means relabeling or renaming or change in symbol or logo/makes or corporate image of a company/organization/ firm for an imported product would amount to rebranding.

It is certified that as per DPIITs OM Ref P-45021/102/2019-BE-II-Paart(1)(E-50310) Dtd. 04/03/2021 the local content mentioned above, by which we are Class-I local suppliers / Class-ll local suppliers, does not contain services such as transportation, insurance, installation, commissioning, training and after sales service support like AMC / value addition.
"False declaration will be in breach of Code of Integrity under Rule175(1)(i)(h)of the General Financial Rules 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."

Yours faithfully,
(Signature of the Bidder/OEM with Official seal)

C. Bid Templates

C.1 Technical Bid - Gas distribution bank for SSL

1. Gas bank system GN2 distribution panel

Item specifications for Gas bank system GN2 distribution panel

Sl No	Specification	Value	Compliance	Offered Specification	Remark
1	Design, fabrication, supply of GN2 gas distribution system in LPSCB	Refer attached tender document	Yes / No / Explain		

2. Gas bank system GHe distribution panel

Item specifications for Gas bank system GHe distribution panel

Sl No	Specification	Value	Compliance	Offered Specification	Remark
1	Design, fabrication, supply of GHe gas distribution system in LPSCB	Refer attached tender document	Yes / No / Explain		

3. Gas bank system Air distribution panel

Item specifications for Gas bank system Air distribution panel

Sl No	Specification	Value	Compliance	Offered Specification	Remark
1	Design, fabrication, supply of Air distribution system in LPSCB	Refer attached tender document	Yes / No / Explain		

4. Gas bank system Point-of-Use panel

Item specifications for Gas bank system Point-of-Use panel

Sl No	Specification	Value	Compliance	Offered Specification	Remark

1	Design, fabrication, supply of POU panel in gas distribution system in LPSC-B	Refer attached tender document	Yes / No / Explain		

5. Gas bank system Supply of empty cylinders High Pressure (300bar) 50L

Item specifications for Gas bank system Supply of empty cylinders High Pressure (300bar) 50L

Sl No	Specification	Value	Compliance	Offered Specification	Remark
1	Supply of empty cylinders High Pressure (300bar) 50L	Refer attached tender document.	Yes / No / Explain		

6. Gas bank system Gas Boosting Control panel

Item specifications for Gas bank system Gas Boosting Control panel

Sl No	Specification	Value	Compliance	Offered Specification	Remark
1	Design, fabrication, supply of Gas boosting control Panel	Refer attached tender document.	Yes / No / Explain		

7. Gas bank system Gas Boosting System

Item specifications for Gas bank system Gas Boosting System

Sl No	Specification	Value	Compliance	Offered Specification	Remark
1	Design, fabrication, supply of gas boosting system	Refer attached tender document.	Yes / No / Explain		

Common Specifications (Applicable for all items)

Sl No	Specification	Value	Compliance	Offered Specification	Remark

1	Design, fabrication, supply and testing of gas distribution system and gas boosting system in LPSC B	As per document attached	Yes / No / Explain		

Supporting Documents required from Vendor

1. Filled compliance sheet

2. Bill of materials for all the systems and panels along with make and model no. of offered components.

3. Details of similar project execution in ISRO or any Aerospace industries in India and reference of at least 2 installations during last 10 years. Enclose the completion/appreciation certificates

4. All other relevant documents

5. Certificate of FP test carried out on welds.

6. Three sets of detailed operation and maintenance manuals along with necessary drawings in hard and soft copy

7. Calibration certificates of all measurement instruments such as pressure gauges etc. for a period of one year

8. Datasheets and details of all components such as valves, pressure gauges, pressure regulators, filters, tubes and fittings, etc

9. Complete Gas distribution system and boosting system (including high pressure cylinder network) layout drawings.

10. Drawings of all the panels.

5 additional documents can be uploaded by the vendor

C.2 Commercial Terms / Bid

Sl. No.	Description	Compliance	Vendor Terms
1	material(items) in batches. Service within delivery period including testing. Warranty & Delivery period included in the document uploaded under commercial terms.	Yes / No / Explain	
2	This is a Two Part Tender. Do not mention price element in Techno Commercial Bid. If any Price element mentioned in technical bid, your offer will not be considered.	Yes / No / Explain	
3	Goods and Services Tax (GST): Kindly mention percentage of GST considered in your offer along with HSN Code.	Yes / No / Explain	
4	Delivery Terms: FOR LPSC, Bangalore	Yes / No / Explain	
5	Delivery Period: The supply shall be completed within 9 months from the date of receipt of PO or date of issue of FIM (if applicable), whichever is later.	Yes / No / Explain	
6	Payment Terms: 100% payment shall be made within 30 days of receipt and acceptance of the items at our site.	Yes / No / Explain	
7	Liquidated Damages (LD): If the ordered items are not supplied within the delivery schedule, LD shall be levied from your bill @ 0.5% of the order value per week or 0.5% of the value of the stores for which the delivery is delayed for each week of delay subject to a maximum of 5% of the order value. However, in case of inordinate delay in completion period, LD @ 10% shall be recovered.	Yes / No / Explain	
8	Warranty: The items shall be warranted for a minimum period of 12 months from the date of supply or acceptance of items at our site which ever is later. Necessary warranty certificate shall be furnished along with the supply. Party may also offer extended Warranty for a period of one year, after completion of Warranty Period.	Yes / No / Explain	

9	Performance Bank Guarantee (PBG): You have to submit PBG towards fulfilment of warranty obligations and performance of the system for 3% of the Order Value from a Nationalized / Scheduled Bank on non-judicial stamp paper of appropriate value valid till the completion of warranty period plus 60 days as per the format provided by Department.	Yes / No / Explain	
10	Security Deposit (SD): You have to furnish a Bank Guarantee from a Nationalized / Scheduled Bank on non-judicial stamp paper of appropriate value for 3% of the order value within 10 days of receipt of order towards the faithful execution of the order valid till the completion of the scope of work as per order plus sixty days (as claim period). SD shall only be applicable for order value above INR 50.00 Lakhs. SD shall be returned to you immediately on execution of the order satisfactorily as per order terms. In case of non-performance / poor performance, the amount shall be withheld.	Yes / No / Explain	
11	SD cum PBG: In case, if parties are unable to provide two separate BGs, i.e. one for SD and one for PBG, they can submit a combined BG for SD & PBG within 10 days of receipt of order for 3% of order value valid till the completion of total contractual obligation (i.e. supply period plus warranty period plus 60 days) as per the format provided by the Department.	Yes / No / Explain	
12	Insurance: Being a Government of India Department, Insurance is not required at our cost. Please ensure the safe delivery of the ordered item with proper AIR / SEA / ROAD worthy packing.	Yes / No / Explain	
13	Free Issue Material (FIM), if applicable: You have to submit Bank Guarantee for a value equivalent to FIM (if applicable) from a Nationalized / Scheduled Bank on non-judicial stamp paper of appropriate value towards issue of FIM. The BG shall be valid till receipt and acceptance of supply and satisfactory accounting of FIM.	Yes / No / Explain	
14	Address, contact details like Telephone Number, e-mail, etc. on which order to be placed.	Yes / No / Explain	

15	Details of Principal: Address, contact details like Telephone Number, e-mail, etc. (if applicable)	Yes / No / Explain	
16	Bank Details: Bank name, Branch address, Account No., IFSC Code, IBAN Number, SWIFT, etc.	Yes / No / Explain	
17	Local Content (%): Please mention the percentage of Local Content and the location where local value addition takes place (Kindly enclose self-certification document in the prescribed format)	Yes / No / Explain	
18	MSE Status: Kindly mention the classification under MSE and submit supporting documentation (if applicable)	Yes / No / Explain	
19	Validity of offer: 06 months from the date of opening of tender or as specified in the Tender Document.	Yes / No / Explain	
20	Any other terms	Yes / No / Explain	

C.3 Price Bid

Sl. No.	Item	Quantity	Unit Price	Currency	Total Price	Remark
1	Gas bank system GN2 distribution panel	1.00 Nos.		-		
2	Gas bank system GHe distribution panel	1.00 Nos.		-		
3	Gas bank system Air distribution panel	1.00 Nos.		-		
4	Gas bank system Point-of-Use panel	2.00 Nos.		-		
5	Gas bank system Supply of empty cylinders High Pressure (300bar) 50L	8.00 Nos.		-		
6	Gas bank system Gas Boosting Control panel	1.00 Nos.		-		

7	Gas bank system Gas Boosting System	1.00 Nos.		-		

Common charges (Applicable for all items)

P & F Charges	
Freight if any (Value)	
Installation & Configuration	
Other Costs, if any (Value)	
Taxes, if any (Percentage)	

Table of Contents

List of Figures and Tables

ABBREVIATIONS

SSL	System Simulation Laboratory
GN2	Gaseous Nitrogen
GHe	Gaseous Helium
POU	Point Of Use (Panel)
ASME	American Society for Mechanical Engineers
ASTM	American Society for Testing and Materials
SOV	Shut-Off Valve
CV	Check Valve
NV	Needle Valve
BV	Ball Valve
PR	Manually operated Pressure Regulator
FPI	Fluorescent Penetrant Inspection
LP	Leak Test/Purging Line
MEOP	Maximum Expected Operating Pressure

PART–A: TECHNICAL SPECIFICATION

Introduction

This document provides scope of work and specifications for design, fabrication, supply, installation, testing, commissioning and demonstration of gas distribution system and associated utilities for SSL in LPSC-B. Detailed scope of work in provided in Chapter 1.

System Simulation Lab (SSL) is a cold flow test facility for simulation of pressure drop characteristic of flight components. Towards this gas distribution system along with utilities needs to be installed in the facility to supply gases from sources to the user points.

The gas distribution system shall supply pressurised gaseous Nitrogen, Helium and compressed air from gas cylinder bank in gas distribution room to boosting equipment and then regulated to the user points in SSL to cater for the requirements during simulation tests. Figure-1 shows schematic of layout of all panels in gas distribution system. The gas distribution system consists of Gas distribution panels along with compressed Air panel (1 No.), Point-of-Use (POU) panels (2 no.), boosting control panel (1 no.) and SS tubes & valves connecting all these panels. The panels shall be installed at locations indicated in overall layout of the system is shown in Figure-2. Detailed technical description of the system is in Chapter 2.

Chapter 3 contains details of utilities to be supplied, integrated and tested along with above-described gas distribution.

(Note: LPSC will supply High-Pure Nitrogen gas & Helium gas cylinders, air compressors required for testing. Hence the supply of these items is not part of this scope of work. Where ever details provided related to these items are only for information).

Chapter 1: Scope of Work

1.1 Scope of Work

The scope of work includes design, fabrication, supply, installation, testing, commissioning and demonstration of **Gas distribution System along with Gas booster supplies of GN2, GHe and compressed Air at regulated pressure to cold flow test setup** at System Simulation laboratory (SSL) at LPSC-B.

1.1.1 Gas Distribution System:

The overall scope of work includes **design, fabrication, supply, installation, testing, commissioning and demonstration of gas distribution & boosting system** for supply of gases (GN2, GHe and compressed air) including gas distribution panels, Point-of-Use (POU) panel, boosting Control panel, high pressure GHe & GN2 cylinders, stainless-steel tubes for interconnecting all the panels at SSL at LPSC-B as per detailed specifications and bill of materials provided in chapter 2. Schematic of the gas distribution system in shown in Figure-1.

a) The gas distribution system shall supply pure gaseous Nitrogen, Helium and compressed air from gas distribution room to the user points.

b) High pressure gas cylinders of 50L capacity, 4 nos. each for GHe and GN2. Cylinders shall be identified separately. Max Pressure capacity shall be atleast 300bar. PESO Certificates and relevant certificates to be provided.

c) 1 No. of gas distribution panel (with supply of GN2 & GHe) ,1 No. of compressed air distribution panel, 1 no gas boosting control panel shall be provided in gas distribution room. The regulation and piping arrangement can be combined in single panel as feasible.

d) At user points, POU panels (1 No.) shall be provided as per layout shown in figure-2.

e) The gas supply piping for Nitrogen, Helium and compressed air from the gas distribution panels to the user points shall be made of SS304L tube with 1/2“OD as per layout shown in figure 2. Approximate length of tubing required **is 20 meters**.

f) Structure of all panels (gas distribution, POU and control) shall be made up of stainless-steel (SS 304) sheets and frames. The structures shall be buffed to mirror finish for elegant look.

g) Panels mounted on pedestal shall be fastened to ground and provided with a height accessible to operator to reach all components.

h) The panels shall be grouted/ fixed rigidly on the ground using appropriate anchor.

a) The fluid circuit shall be constructed with high quality orbital TIG welding with 100% fusion except for component interfaces. The component interfaces shall be connected with standard double compression ferrule fittings. All the welded joints must be Fluorescent Penetrant (FP) tested.

i) Vendor shall submit the design and layout of the panels to LPSC and approval shall be obtained for the detailed design and layout prior to commencement of fabrication/assembly of individual panels and of the entire system.

j) The system shall be realized as per approved layout by LPSC. Any deviation from the approved layout shall be intimated to LPSC before implementation.

k) All the SS 304L tubes used in the realization of system shall be pre-cleaned and passivated as per standard.

l) Entire tubing for gas supply shall be routed through trenches/walls appropriately and shall be covered with a suitable PVC casing. Tubes are required to be routed across the wall through the hole as per schematic. The entire tubing shall be securely anchored with suitable anchors/supports.

m)All the gas supply lines shall be provided with appropriate colour coding as per relevant standard for clear identification.

n) All the panels shall be provided with schematic drawing of the fluid circuits on the front side of the panel and with clear identification of components at their respective location. Also, the valve operating positions like open/close shall be marked by means of good quality stickers.

o) The certificate of conformance for materials, functionality and calibration certificate for pressure gauges and pressure transmitters shall be submitted. Details of required documents are mentioned in section 5.2.

p) Quantity of spare components is mentioned in bill of materials of each panel. Spare components shall be supplied together with the panels.

q) Installation, integration, testing, commissioning and demonstration of the entire system shall be carried out “On Site” basis in LPSCB.

r) The gas supply lines and compressed air supply lines shall be provided with appropriate identification labels.

1.2 Scope of LPSC

a) To provide buildings and civil construction as per the layout.

b) Review and approve the design drawings, specifications, layout of the entire gas distribution panel, compressed air panel, Point of Use panel and booster Panel after placement of PO.

c) Participation in factory acceptance tests to provide pre-dispatch clearance as per the criteria.

d) Evaluation of the system after installation and provide final acceptance of the systems based on site acceptance test data analysis and review committee clearance.

e) To provide facility like electricity, gases (GHe, GN2, Compressed Air), IPA, particle counters etc. for site acceptance tests.

f) Air compressor and gas booster shall be provided to which inlet and outlet connections are part of gas distribution system.

Chapter 2: Gas Distribution System

The gas distribution system shall supply gaseous nitrogen, helium and compressed air from gas distribution room to user point locations. The overall schematic and layout of the system is shown in Figure 1 & Figure 2. The gas distribution room shall have GN2, GHe and compressed air distribution panels. The GN2 and GHe distribution panels are separate units but have identical fluid circuits. The gases shall be supplied to Point-Of-Use (POU) panels (2 No. with 3 circuits for each gas) and Boosting Control panel (1 no.) through SS 304 tubes with Isolation Valves at necessary locations.

The major components of gas distribution system are as follows.

Table 1: Major components of Gas Distribution System

Sl. No	**Description of Items**	**QTY**	**Remarks**
1	Gas distribution panel –GN2	1	Refer Figure-3
2	Gas distribution panel -GHe	1	Refer Figure-4
3	Compressed air panel	1	Refer Figure-5
4	Point-of-Use panel	2	Each has 3 Circuits for High Pr gas, GN2 regulation, compressed air
5	High Pressure (300bar) 50L Volume gas cylinders	4	Supply of empty Ghe cylinders
6	High Pressure (300bar) 50L Volume gas cylinders	4	Supply of empty GN2 cylinders
7	Boosting Control panel	1	High pressure-300bar for GHe & GN2
8	Gas Boosting System	1	300bar pressure
9	SS tubes	1	As per scope of work
10	Fittings	1	As per scope of work

2.1 Gas Distribution Panel – GN2 & GHe

The gas distribution panels are located inside the Gas Distribution Room. Two separate panels for GN2 and GHe distribution are required. The circuits for both the gases are identical and have same specifications. Fluid circuit is shown in Figure-3 & 4.

2.1.1 Technical Description

a) The inlet pressure for both the distribution panels is 150 bar.
b) Both GN2 & GHe gas circuits shall have inlet from a group of four cylinders arranged in a row.
c) Gas distribution panel is located next to the cylinder cluster and reachable to operating personnel within 1.5m from ground.
d) The Gas cylinders (in LPSC scope) shall be positioned in a row with ground support frame and belts. Cylinder outlet is connected with SS316 bull nose connecter, SS braided flexible hose, check valve and isolation valves.
e) The cylinders shall be supported by fabricated stainless-steel structure/frame with proper anchoring and belts to ensure safety shall be supplied by Party.
f) The panel structure shall be made of SS304 sheets and frame.
g) The panels shall be leg mounted. Stability of panels shall be ensured and it shall be properly anchored to the ground. The panels shall house the flow components as per fluid circuit shown in Figure 3 & Figure 4.
h) Table 2 gives list of components, brief specifications, recommended make and quantity for gas distribution panels.
i) The fluid circuit shall be with 1/2" OD annealed seamless SS304L tubes, hoses from cylinders to tubes, suitable fittings and flow components as per details provided in Table 2.
j) All the pressure gauges, regulators, valves shall be assembled on the front panel aesthetically.
k) Vendor shall optimally design the panel sizes while considering future maintenance activities. Vendor shall submit the design to LPSC and approval shall be obtained prior to commencement of fabrication/assembly.
l) All tube joints shall be welded by orbital TIG welding with 100% fusion construction except component interfaces, which shall be provided with double compression ferrule type tube fittings. All the welded joints must be Fluorescent Penetrant (FP) tested as per relevant standard.
m) The panel fluid circuit shall be proof pressure tested at 225 bar (1.5 times of 150 bar) and leak tested (Bubble leak method with Helium) at operating pressure 150 bar.
n) Schematic drawing of the fluid circuit shall be provided on front side with clear identification of components at their respective location. Also, the valve operating positions like open/close shall be marked by means of good quality stickers.

Table 2: Bill of materials for gas distribution panel

Operating Pressure: 150 Bar **Qty**: 1 no GN2 & 1no GHe Fluid Circuit: Refer Figure- 3 & 4		**Gas Distribution Panel- GN2**		**Gas Distribution Panel- GHe**		
S No	**Details &Specifications of components**	**ID**	**Qty**	**ID**	**Qty**	**Make**
1	**Shut-Off Valve** Type: Ball valve Pressure Rating: 250 bar minimum Material: SS316 Interface: 1/2"	SOV-5 to SOV-14	10	SOV-15 to SOV-23	9	Swagelok/ Hamlet/ Dk-lok/ Fitok
2	**Check Valve** Type: Spring-poppet Pressure Rating: 250 bar min. Material: SS316 Interface: 1/2"	CV-1 to CV-4	4	CV-5 to CV-8	4	Swagelok/ Hamlet/ Dk-lok/ Fitok
3	**SS braided flexible hoses** Pressure Rating: 250 bar min. Core: PTFE Interface: 1/2" Length: 2 meters	-	4	-	4	Titeflex / Swagelok / Hamlet
4	**Gas Filter** Type: Pleated Wire Mesh Filter Range: 20µ absolute Pressure Rating: 250 bar Body material: SS316 Mesh material: SS316 Interface: 1/2"	F-1	1	F-2	1	Swagelok/Norman/Classic
5	**Bourdon tube pressure gauge** Bourdon tube material: SS316 Range: 0-250 bar Resolution: 1 bar Accuracy: ±1% FSO Dial size: 6” Interface: ½” M BSP	PG-1	1	PG-3	1	WIKA/ Ashcroft
6	**Pressure Reducing Regulator** Type: Spring loaded regulator Venting: Self Venting Inlet pressure: 150 bar Outlet Pressure: 0 to 60 bar Cv: 0.2 Body material: SS 316 Interface: 1/2"	PR-1	1	PR-2	1	Tescom/ GCE
7	**Bourdon tube pressure gauge** Bourdon tube material: SS316 Range: 0-250 bar Resolution: 1 bar Accuracy: ±1% FSO Dial size: 6”	PG-2	1	PG-4	1	WIKA/ Ashcroft

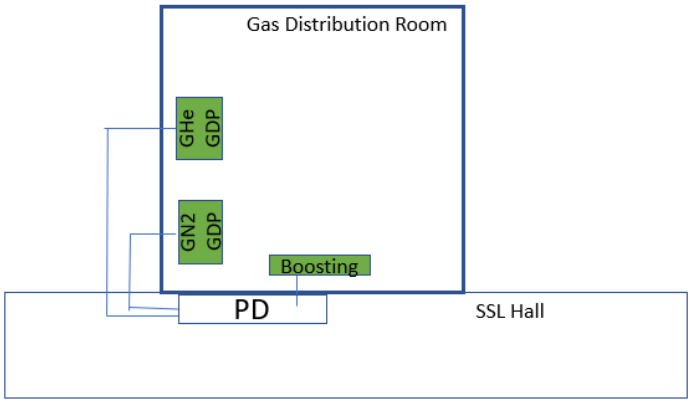
	Interface: ½" M BSP					
8	**Gas Filter** Type: Pleated Wire Mesh Filter Range: 10µ absolute Pressure Rating: 250 bar Body material: SS316 Mesh material: SS316 Interface: 1/2"	F-3, F-4 & F-5	3	F-6 & F-7	2	Swagelok/Norman/Classic
9	**Relief valve** Pressure Rating: 250 bar Body material: SS 316 Interface size: 1/2 "interface Fully open orifice size: 6.4 mm Set Pressure Range: 52 to 100 bar	RV-1	1	RV-2	1	Swagelok/ Hamlet/ Dk-lok/ Fitok
10	**Seamless Tubes:** Tube OD: 1/2" Pressure rating: 300 bar Material: AISI 304L As per std.		As per fluid circuit		As per fluid circuit	Sandvik/ Ratnamani / Tubacex
11	**Fittings:** Union, elbow, tee, reducers, cross, plugs, caps, bulk heads etc. Pressure rating: 300 bar Material: SS316 Size: as deemed necessary in order to suit the components interface.		As per fluid circuit		As per fluid circuit	Swagelok/Hamlet/ Dk-lok/ Fitok
12	**Gas cylinder connector (Bull nose & Adapter)** Material: SS316 as per IS 3224		4		4	Standard make
13	**Belt for gas cylinders (safety purpose)** Cylinder size: Ø 230 x 1400 mm height nominal		4		4	Standard make
14	**Structure to support 4 cylinders along the wall** Cylinder size: Ø 230 x 1400mm height nominal		1		1 sets	Standard make

Testing of Panel components till regulator inlet shall be 225bar. Hence the rating for these components shall encompass the test pressure of 225bar. Industrial standard providing above 225bar shall be chosen for these components.

Testing of Panel components after regulator outlet shall be at 90 bar.

A. Digital display of pressures from Panels:

1. Digital pressure gauges along with analogue gauges (specified in the table 2 & table 4) is desired.
2. Qty for Gas distribution & Boosting panels: 6nos.
3. Spec:
    1. Type: Gauge Pressure
    2. Accuracy: 0.1% FS
    3. Mounting: Vertical position
    4. Adjustment: Offset and span factor adjustable
    5. Memory: Integrated data logger
    6. Mean value interval: adjustable
    7. Measuring rate better than 50/s
    8. Battery status display
    9. Backlighting
4. Digital display of the pressure readings from each panel shall be transmitted to the other side of room (Hall of SSL) as follows.



PD: Pressure Reading Display

B. Pressure display from various panels:

	Gas distribution Systems Fig-3 & 4			
	Inlet		Regulated	
GN2		PG1		PG2
GHe		PG3		PG4
	Gas boosting Output Fig-6			
GN2			PG-3	
GHe			PG-2	

Readings from Digital Pressure gauges of various panels to be displayed in the SSL hall.
Pressure indicator to have: Units in bar.
Corresponding Unit Resolution: up to first decimal point
Accuracy: ≤0.2% FS

2.2 Compressed Air Distribution Panel

The compressed air distribution panel is located inside Gas Distribution Room. It is connected to air compressor as shown in fluid circuit Figure 5. The panel shall supply compressed air to POU panel through 1/2" SS tubes. Bill of materials is mentioned in Table -3. The panel shall be realized as per the following points.

2.2.1 Technical Description

a) The operating pressure for the compressed air distribution panel fluid circuit is 15 bar.

b) The panel shall be connected to air compressor through isolation valves and SS braided flexible hoses.

c) The panel structure shall be made of SS304 sheets and frame.

d) The panel shall be of pedestal mounted. Stability of panel shall be ensured and it shall be properly anchored to the ground.

e) The panel shall house the flow components as per fluid circuit shown in Figure 5.

f) Table-3 gives list of components, brief specifications, recommended make and quantity for compressed air distribution panel.

g) The fluid circuit shall be realized with 1/2" OD (as per std) annealed seamless SS304L tubes, suitable fittings and flow components as per details provided in Table 3.

h) All the valves, pressure gauge, pressure display shall be assembled on the front side aesthetically.

i) Vendor shall optimally design the panel sizes while considering future maintenance activities. Vendor shall submit the design to LPSC and approval shall be obtained prior to commencement of fabrication/assembly.

j) All tube joints shall be welded by orbital TIG welding with 100% fusion construction except component interfaces, which shall be provided with double compression ferrule type tube fittings. All the welded joints to be Fluorescent Penetrant (FP) tested.

k) The fluid circuit shall be proof pressure tested at 23 bar (1.5 times of 15 bar) and leak tested (Bubble leak method with helium) at operating pressure 15 bar.

l) Schematic drawing of the fluid circuit shall be provided on front side with clear identification of components at their respective location. Also, the valve operating positions like open/close shall be marked by means of good quality stickers.

Table 3: Bill of materials for compressed air distribution panel

Compressed Air Distribution Panel **Location**: Gas Distribution Room **Operating Pressure**: 15 Bar **Qty**: 1 No. **Panel structure material:** SS304 **Fluid Circuit:**			
S. No	**Details &Specifications of components**	**Qty (Nos.)**	**Make**
1	**SOV-1 to SOV-4** **Shut-Off Valve** Type: Ball valve Pressure Rating: 30 bar Material: SS316 Interface: 1/2"	4	Swagelok/Hamlet/ Dk-lok/ Fitok
2	**SS braided flexible hoses** Pressure Rating: 60 bar Core: PTFE Interface: 1/2" Length: 3 meters	1	Titeflex/ Swagelok/ Hamlet
3	**PG** **Bourdon tube pressure gauge** Bourdon tube material: SS316 Range: 0-30 bar Resolution: 0.5 bar Accuracy: ±1% FSO Dial size: 6”	1	WIKA/ Ashcroft
4	**RV** **Relief valve** Pressure Rating: 60 bar Body material: SS 316 Interface size: 1/2 “interface Set Pressure Range: 5 to 15bar	1	Swagelok/Hamlet/ Dk-lok/ Fitok
5	**Seamless Tubes** Tube OD: 1/2" x 0.065” wall thickness, ASTM A269 equivalent Material: SS304L	As per fluid circuit	Sandvik/ Ratnamani / Tubacex
6	**Fittings:** Union, elbow, tee, reducers, cross, plugs, caps, bulk heads etc. Pressure rating: 30 bar Material: SS316 Size: as deemed necessary in order to suit the components interface.	As per fluid circuit	Swagelok/Hamlet/ Dk-lok/ Fitok

Since the proof pressure testing for this circuit is 1.5x 15bar, pressure rating of all components at 30bar is desired.

2.3 High Pressure gas cylinders

8 nos of cylinders are to be located in Gas cylinder room along the wall- 4 nos each for GHe and GN2 shall be supplied by the party and arranged as per safety protocols. A common valve (Three-way) connects boosted gas from gas booster outlet to high pressure cylinders -either GHe or GN2 placed on either side of panel. The connection of cylinders is shown in Booster connection Panel in Figure 6.

S. No	Details &Specifications of components	Qty (Nos.)	Make
1	**High Pressure Empty gas cylinders for GHE** Operating pr: 300bar Capacity: 50L Material: Chrome Moly Steel	4	EKC/Linde/Luxor
2	**High Pressure Empty gas cylinders for GN2** Operating pr: 300bar Capacity: 50L Material: Chrome Moly Steel	4	EKC/Linde/Luxor
3	**Gas cylinder connector (Bull nose & Adapter)** Material: SS316 as per IS 3224 Interface: ½" OD	8	Standard make
4	**Belt for gas cylinders (safety purpose)** Cylinder size: Ø 230 x 1400 mm height nominal	8	Standard make
5	**Structure to support 4 cylinders along the wall** Cylinder size: Ø 230 x 1400mm height nominal	1 set	Standard make

Specification of Empty cylinder	
Seamless steel cylinders	
Technical data	
Water capacity	Min 50.0 liter
Cylinder Valve	Brass Valve with Butterfly knob for opening
Proof pressure	450 bar
Working pressure	300 bar
Colour of body	Brown for Ghe & Gray with black band at top for GN2
Length	1200mm (Nominal) Without cap & valve
Outside diameter	270mm (Nominal)
Neck ring & Cap	Fitted

Specification of cylinders shall adhere to IS 7285 (Part 2): 2004

Neck Threading: IS 3224:2002, 25.4mm, 14 TPI, Type 4, Size 2, Taper-1:8

Fabrication method of cylinders to include

- Hot spinning Process
- Heat Treatment: Hardened, Quenched and Tempered

Test to be carried out on Cylinders:

Visual Inspection

Hydrostatic Stretch Test (Test pressure 450 bar)

Air leakage Test (Test pressure 300 bar)

Hardness Test

Ultrasonic Test

Measured Water capacity of cylinder

Wall thickness measurement of Wall & Base

Minimum value of parameters:

1. Yield Stress: 840 MPa min
2. Tensile Test: 990-1100 MPa
3. Elongation (%) : 14 min
4. Hardness: 265-330 BHN
5. Impact Test Charpy (V) -20C Transverse direction:
6. Individual: 32 J/cm2
7. Average: 40 J/cm2

Other Instructions

i. Identification nos shall be embossed on each cylinder.

ii. Party shall provide necessary test results & inspection/acceptance certificate for each cylinder.

iii. PESO certification for each cylinder shall be provided.

iv. Party shall provide necessary Helium gas filling permission certificate from dept of explosives-Govt. of India for each cylinder.

2.4 Boosting Control Panel

Boosting Control panel is located in Gas Distribution room as shown in the layout (Figure-2). Fluid circuit of boosting control panel is shown in Figure 6. List of components and specifications are provided in Table-4 for Control Panel. The Control Panels shall be designed, fabricated, assembled, tested and supplied as per the following points.

2.4.1 Technical Description

(a) The panel has two inlets from set of GN2 and GHe each.

(b) Gas Inlet to the panel shall be connected to respective gas supply line coming from Gas distribution panels-GN2 & GHe. Both the gas inlets are connected to a Junction valve (3-way valve) after which the selected gas is passed to booster.

(c) Booster Panel connects Air compressor, Gas booster and high-pressure cylinders. Panel should be leg-mounted on ground in Gas distribution room and valves to be accessible from the main hall via a back-to-back panel. Gas booster to be located below the panel on ground for convenience of connection.

(d) Either of GHe or GN2 gas shall be boosted. From the Gas distribution panel, gas is sent to gas booster and outlet of gas booster is connected to high pressure cylinders of either GHe & GN2. Junction Valves (3-way valve) shall be provided at inlet and outlet of gas booster to select the gas source.

(e) Boosting Control panel consists of valves for gas selection, allow compressed air to booster, connection of gas and compressed air to gas booster, connection to high pressure cylinders.

(f) The panel has two paths for GN2 and GHe gases and boosting outlet distributed to high pressure cylinders of GHe & GN2 separately. The respective modules shall be connected with GN2 and GHe lines emerging from gas distribution panels.

(g) The panel structure shall be made of SS304 sheets and frame.

(h) The panel shall be of leg-mounted pedestal type while ensuring stability and it shall be properly anchored to the ground.

(i) The panel shall house the flow components as per fluid circuit shown in Figure 6.Table 4 provide list of components, brief specifications, recommended make and quantity for Control Panel respectively.

(j) The fluid circuit shall be realized with ½” OD tubes at inlet and after boosting 1/2" OD seamless SS304L tubes.

(k) All the pressure gauges, pressure transmitter display, regulators, valves shall be assembled on the front side aesthetically.

(l) Vendor shall optimally design the panel sizes while considering future maintenance activities.

(m) Vendor shall submit the design to LPSC and approval shall be obtained prior to commencement of fabrication/assembly.

(n) Schematic drawing of the fluid circuit shall be provided on front side with clear identification of components at their respective location. Also, the valve operating positions like open/close shall be marked by means of good quality stickers.

(o) All tube joints shall be welded by orbital TIG welding with 100% fusion construction except component interfaces, which shall be provided with double compression ferrule type tube fittings. All the welded joints should be Fluorescent Penetrant (FP) tested.

PRESSURE TESTING:

(p) The fluid circuit till the booster shall be proof pressure tested at 225 bar (1.5 times of 150 bar) and leak tested (Bubble leak method with helium) at operating pressure 150 bar.

(q) The fluid circuit from booster outlet till HP cylinder inlet shall be proof pressure tested at **450 bar (1.5 times of 300 bar)** and leak tested (Bubble leak method with helium) at operating pressure 300 bar.

(r) Control panels are the interface between gas distribution system and high-pressure cylinders. Figure-6 details the circuit between booster and high-pressure cylinders.

Table 4: Bill of materials for Boosting Control Panel

Boosting Control Panel **Location**: Gas distribution room **Operating Pressure**: 50 bar max at inlet & 300bar at outlet. **Qty**: 1 Panel **Panel structure material:** SS 304 **Fluid Circuit:** Figure 6			
S. No	**Details &Specifications of components**	**Qty (Nos.)**	**Make**
	Till Inlet to Gas Booster		
1	**F-1** **Gas Filter** Type: Pleated Wire Mesh Filter Range: 10µ absolute Pressure Rating: 250 bar Body material: SS316 Mesh material: SS316 Interface: 1/2"	1	Swagelok/Norman/Classic
2	**PG-1** **Bourdon tube pressure gauge** Bourdon tube material: SS316 Range: 0-300 bar Resolution: 1 bar Accuracy: ±1% FSO Dial size: 6”	1	WIKA/ Ashcroft

	Interface: 1/2"		
3	**SOV-11 & SOV-12** **Shut-Off Valve** Type: Ball valve Pressure Rating: 250 bar Material: SS316 Interface: 1/2"	2	Swagelok/Hamlet/ Dk-lok/ Fitok
4	**JV-1** **3-Way Valve** Type: Ball valve Pressure Rating: 250 bar Material: SS316 Interface: 1/2"	1	Swagelok/Hamlet/ Dk-lok/ Fitok
5	**JV-2** **3-Way Valve** Type: Ball valve Pressure Rating: 250 bar Material: SS316 Interface: 1/2"	1	Swagelok/Hamlet/ Dk-lok/ Fitok
4	**Seamless Tubes** Tube OD: 1/2" x 0.065” wall thickness, ASTM A269 equivalent Material: SS304L Pressure rating: 400 bar	As per fluid circuit	Sandvik/ Ratnamani / Tubacex
5	**Fittings** Union, elbow, tee, reducers, cross, plugs, caps, bulk heads etc. Pressure rating: 200 bar Material: SS316 Size: ½” as deemed necessary in order to suit the components interface.	As per fluid circuit	Swagelok/Hamlet/ Dk-lok/ Fitok

- Proof pressure test of this part of the circuit shall be at 225 bar. Components of rating higher than this as per standard are to be chosen for installation.

From Gas Booster till high Pressure cylinder inlets

S. No	Details &Specifications of components	Qty for GHe (Nos.)		Qty for GN2 (Nos.)		Make
6	**Shut-Off Valve** Type: Ball valve Pressure Rating: 500 bar Material: SS316 Interface: 1/2"	**SOV-1 to SOV-5**	5	**SOV-6 to SOV-10**	5	Swagelok/Hamlet / Dk-lok/ Fitok
7	**Bourdon tube pressure gauge** Bourdon tube material: SS316 Range: 0-500 bar Resolution: 1 bar Accuracy: ±1% FSO Dial size: 6”	PG-2	1	PG-3	1	Wika/ / Ashcroft
8	**Check Valve** Type: Spring poppet Pressure Rating: 500 bar Material: SS316 Interface: 1/2" Cracking Pr: 1/3 bar	CV-1	1	CV-2	1	Swagelok/Hamlet / Dk-lok/ Fitok
9	**Relief valve** Pressure Rating: 500 bar Body material: SS 316 Interface size: 1/2“ interface Set Pressure Range: 250 to 300bar	RV-1	1	RV-2	1	Swagelok/Hamlet / Dk-lok/ Fitok
10	T-Joint plugged with 1/2” interface	TJ	1	TJ	1	Swagelok/Hamlet / Dk-lok/ Fitok
11	**Seamless Tubes** Tube OD: ½” as deemed necessary in order to suit the components interface. ASTM A269 equivalent Material: SS304L	As per fluid circuit				Sandvik/ Ratnamani / Tubacex

S. No	Details &Specifications of components	Qty for GHe (Nos.)	Qty for GN2 (Nos.)	Make
	Pressure rating: 500 bar			
12	**Fittings** Union, elbow, tee, reducers, cross, plugs, caps, bulk heads etc. Pressure rating: 400 bar Material: SS316 Size: as deemed necessary in order to suit the components interface.	As per fluid circuit		Swagelok/Hamlet / Dk-lok/ Fitok

- Proof pressure test of this part of the circuit shall be at 425 bar. Components of rating higher than this as per standard are to be chosen for installation.

2.5 Point of Use (POU) Panel

Two nos. of POU panels shall be located in the main hall of SSL; the locations are shown in layout (Figure-2). The panels have 4 circuits as per the fluid circuit shown in Figure 7 consisting of:

1. Regulated GN2 gas circuit
2. High Pressure gas (GN2) circuits
3. High Pressure gas (GHe) circuits
4. Compressed Air

Bill of materials is as per Table 5. The panel shall be realized as per following points.

2.3.1 Technical Description

a) The operating pressure for the POU panel fluid circuit is 50 bar for GN2, 300 bar for High Pressure module and 15 bar for compressed air module.

b) Inlet of each module shall be connected to respective gas supply lines.

c) The panel structure shall be made of SS304 sheets and frame.

d) The panel shall be of pedestal-mounted while ensuring stability and it shall be properly anchored to the ground.

e) The panel shall house the flow components as per fluid circuit shown in Figure 7.

f) Table 5 gives list of components, brief specifications, recommended make and quantity for POU panel.

g) The fluid circuit for GN2 regulated supply & High-Pressure module shall be realized with 1/2" OD seamless SS304L tubes, while compressed air module shall be realized with 1/2" OD seamless SS304L tubes. Suitable fittings and flow components shall be provided as per details mentioned in Table 5.

h) All the pressure gauges, regulator, valves shall be assembled on the front side aesthetically.

i) Vendor shall optimally design the panel sizes while considering future maintenance activities. Vendor shall submit the design to LPSC and approval shall be obtained prior to commencement of fabrication/assembly.

j) All tube joints shall be welded by **orbital TIG welding with 100% fusion** construction except component interfaces, which shall be provided with double compression ferrule type tube fittings. All the welded joints to be Fluorescent Penetrant (FP) tested.

Proof tests for 4 circuits:

k) The fluid circuit (GN2) shall be proof pressure tested at 75 bar (1.5 times of 50 bar) and leak tested (Bubble leak method with helium) at operating pressure 50 bar.

l) For High Pressure circuits (GN2 & GHe), max operating pressure is 300bar and Proof pressure to be tested is **425bar.**

m) For compressed air module, proof pressure shall be done at 8 bar followed by leak test at 5 bar operating pressure.

n) Schematic drawing of the fluid circuit shall be provided on front side with clear identification of components at their respective location. Also, the valve operating positions like open/close shall be marked by means of good quality stickers.

Table 5: Bill of materials for Point-of-Use (POU) Panel

POU Panel **Location**: Main Hall **Operating Pressure**: 50 Bar for GN2 regulated circuit, 300 bar for GN2 & GHe HP circuits, 15 bar for compressed air module. **Qty**:2 Panels **Panel structure material:** SS304 **Fluid Circuit:** Figure 7			
S. No	**Details &Specifications of components**	**Qty per panel (Nos.)**	**Make**
For GN2 Regulated circuit (1/2" interface & Fittings)			
1	**Shut-Off Valve** Type: Ball valve Material: SS316 Interface: 1/2" ID : Pressure Rating SOV-1: 200 bar SOV-2: 150 bar	2	Swagelok/Hamlet/ Dk-lok/Fitok
2	**NV-1 & NV-2** **Needle Valve** Material: SS316 Interface: 1/2" Pressure Rating: 150bar	2	Swagelok/Hamlet/ Dk-lok/ Fitok
3	**PG-1 & PG-2** **Bourdon tube pressure gauge** Bourdon tube material: SS316 Resolution: 1 bar Accuracy: ±1% FSO Dial size: 6" ID: Range PG-1: 0-200 bar PG-2: 0-50 bar	2	WIKA/ Ashcroft
4	**F-1, F-2, F-3** **Gas Filter** Range: 5µ absolute Pressure Rating: 100 bar	3	Swagelok/ Norman/ Classic

	Body material: SS316 Mesh material: SS316 Interface: 1/2"		
5	**RV-1** **Relief valve** Pressure Rating: 100 bar Body material: SS 316 Interface size: 1/2“interface Set Pressure Range: 24 to 50 bar	1	Swagelok/Hamlet / Dk-lok/ Fitok
6	**PR-1** **Pressure Reducing Regulator** Type: Spring loaded Venting: Self Venting Inlet pressure: 200 bar Outlet Pressure: 0 to 50 bar Cv: 0.20 Body material: SS 316	1	Tescom/GCE
7	T-joint with Plugged end interface: ½” thread with end flare	1	Swagelok/Hamlet / Dk-lok/ Fitok
8	**Seamless Tubes** Tube OD: 1/2" x 0.065” wall thickness, ASTM A269 equivalent Material: SS304L Pressure rating: 200 bar	As per fluid circuit	Sandvik/ Ratnamani / Tubacex
9	**Fittings:** Union, elbow, tee, reducers, cross, plugs, caps, bulk heads etc. Pressure rating: 200 bar Material: SS316 Size: as deemed necessary in order to suit the components interface.	As per fluid circuit	Swagelok/Hamlet / Dk-lok/ Fitok
	Proof pressure of this circuit is 75bar.		

For High Pressure Module (1/2" interface & Fittings)			
S. No	**Details &Specifications of components**	**Qty per panel (Nos.)**	**Make**
1	**SOV-3 to SOV-6** **Shut-Off Valve** Type: Ball valve Material: SS316 Interface: 1/2" Pressure Rating :500 bar	4	Swagelok/Hamlet / Dk-lok/ Fitok
2	**PG-3 & PG-4** **Bourdon tube pressure gauge** Bourdon tube material: SS316 Resolution: 1 bar Accuracy: ±1% FSO Dial size: 6" Range: 0-500 bar	2	WIKA/ Ashcroft
3	**F-4 & F-5** **Gas Filter** Range:10µ absolute Pressure Rating: 500 bar Body material: SS316 Mesh material: SS316 Interface: 1/2"	2	Swagelok/ Norman/ Classic
4	**RV-2 & RV-3** **Relief valve** Pressure Rating: 500 bar Body material: SS 316 Interface size: 1/4"interface Set Pressure Range: 260 to 330 bar	2	Swagelok/Hamlet/ Dk-lok/ Fitok
5	T-joint with Plugged end interface: ½" thread with end flare	1	
6	**Seamless Tubes** Tube OD: **1/2" x 0.083"** wall thickness, ASTM A269 equivalent Material: SS304L Pressure rating: 500 bar	As per fluid circuit	Sandvik/ Ratnamani / Tubacex
7	**Fittings:** Union, elbow, tee, reducers, cross, plugs, caps, bulk heads etc. Pressure rating: 500 bar Material: SS316 Size: as deemed necessary in order to suit the components interface.	As per fluid circuit	Swagelok/Hamlet/ Dk-lok/ Fitok
	Proof pressure of this circuit is 425bar.		

For Compressed Air Module (1/2” interface & Fittings)			
S. No	**Details &Specifications of components**	**Qty per panel (Nos.)**	**Make**
1	**SOV-7 to SOV-9** **Shut-Off Valve** Type: Ball valve Pressure Rating: 100bar Material: SS316 Interface: 1/2"	3	Swagelok/Hamlet/ Dk-Lok/ Fitok
2	**PG-5** **Bourdon tube pressure gauge** Bourdon tube material: SS316 Range: 0-20 bar Resolution: 0.5 bar Accuracy: ±1% FSO Dial size: 6”	1	WIKA/Ashcroft
3	**F-6** **Gas Filter** Range: 10µ absolute Pressure Rating: 100bar Body material: SS316 Mesh material: SS316 Interface: 1/2"	1	Swagelok/ Norman/ Classic
4	**Seamless Tube:** Tube OD: 1/2" x 0.065” wall thickness As per std Pressure rating: 100 bar	As per fluid circuit	Sandvik/ Ratnamani / Tubacex
5	**Fittings:** Union, elbow, tee, reducers, cross, plugs, caps, bulk heads etc. Pressure rating: 100 bar Material: SS316 Size: as deemed necessary in order to suit the components interface.	As per fluid circuit	Swagelok/ Hamlet/ Dk-lok/ Fitok
	Proof pressure of this circuit is 30 bar.		

Table 6: Bill of materials for SS tubes and fittings for inter-connecting the panels

S. No.	Details &Specifications of components	Qty	Make
1	**SS Seamless Tubes** Tube OD: 1/2" x 0.065" wall thickness, ASTM A269 equivalent Material: SS304L Pressure rating: 400 bar	As per circuit and lab layout (Approximate length: 20m)	Sandvik/ Ratnamani / Tubacex
2	**SS Seamless Tubes** Tube OD: 1/2" x 0.083" wall thickness, ASTM A269 equivalent Material: SS304L Pressure rating: 400 bar	As per circuit and lab layout (Approximate length: 20m)	Sandvik/ Ratnamani/ Tubacex
3	**Isolation Valves** Type: Ball valve Pressure Rating: 200 bar Material: SS316 Interface: 1/2"	6 Nos.	Swagelok/Hamlet/ Dk-lok/ Fitok
4	**Fittings** Union, elbow, tee, reducers, cross, plugs, caps etc. Pressure rating: 200 bar Material: SS316 Size: as deemed necessary in order to suit the components interface.	As per fluid circuit	Swagelok/Hamlet/ Dk-lok/ Fitok

Note: The length of SS tubes given is approximate. It may vary while installation at our site. The payment will be made on actual length after installation. Hence Vendor is requested to provide the offer per meter basis.

2.6 Supply of Gas Booster System

Gas Booster System Type		Compressed air operated. No electrical connections. Double acting gas booster.
Utility required		Compressed air at 6.0barg/100psig or higher
Suitable for gases		Nitrogen, Helium
Details of major components		
Sl No	**Components**	**Specification**
1	Gas Booster Unit	• Air driven, two stage, double air head, balanced opposed piston type with non-lubricated gas sections. • Internal cooling with exhaust air to both gas ends. • Fitted with external Pilot modification. • Boosting outlet pressure shall be capable of 20,000 psi. **MAKE: HASKEL/HII**
2	Gas inlet filter	5micron nominal particulate filter (4500 psi max working pressure) **MAKE: BUTECH/NORMAN/CLASSIC/ DK-LOK**
3	Gas outlet filter	5micron nominal particulate filter (20000 psi max working pressure) **MAKE: BUTECH/NORMAN/CLASSIC/ DK·LOK**
4	Air pilot switch, Low inlet automatic cut-off	Spring set at 50 psig to 180 psig, decreasing (internally adjustable) **MAKE: HASKEL/HII**
5	Air pilot switch, High Outlet automatic cut-off	Spring set at 6000 psig to 20000 psig, increasing (externally adjustable) **MAKE: HASKEL/HII**
6	Safety relief valve	Spring set at 2000 psig to 20000 psig. **MAKE: HASKEL/HII**
7	Gas pulsation dampener	One to 1.3 Litre capacity, 20000 psi max working pressure. Proof pressure test at 40000psi **MAKE: HYSTAT/HII**
8	Outlet non return valve	20000 psi max working pressure. **MAKE: BUTECH /SWAGELOK/PARKER/ DK·LOK**
9	Outlet high pressure gas regulator	Manual operated piston sensing In : 20,000 psi, out :20,000 psi **MAKE: TESCOM/ SWAGELOK/GCE**

10	Booster supply gas pressure gauge	4 inch dia, 0-3000 psi, solid front, full safety blowout back **MAKE: DE-WIT/WIKA/ HEISE**
11	Booster discharge gas pressure gauge	4 inch dia, 0-20,000 psi, solid front, full safety blowout back, NI SPANC tube end and SS Socket **MAKE: DE-WIT/WIKA/ HEISE**
12	Regulated outlet gas pressure gauge	4inch dia, 0-20,000 psi, solid front, full safety blowout back **MAKE: DE-WIT/WIKA/ HEISE**
13	Drive air control system comprising of Make: LEGRIS/ Festo/ WIKA/	Drive air filters,
		Drive air pressure regulator
		Air pressure gauge
		On/ OFF cycling speed control valves
14	Frame arrangement (1170mm x 370mm x 620mm)	All duly piped and fitted in a steel frame with sloping gauge panel as per standard arrangement. Note: Frame outer dimensions as per figure-l with mounting at bottom.

Each part entered in to the system should have certificate from origin source and country.

Warranty period:

One year from the date of supply of equipment and an extended warranty for one year.

Installation and Commissioning:

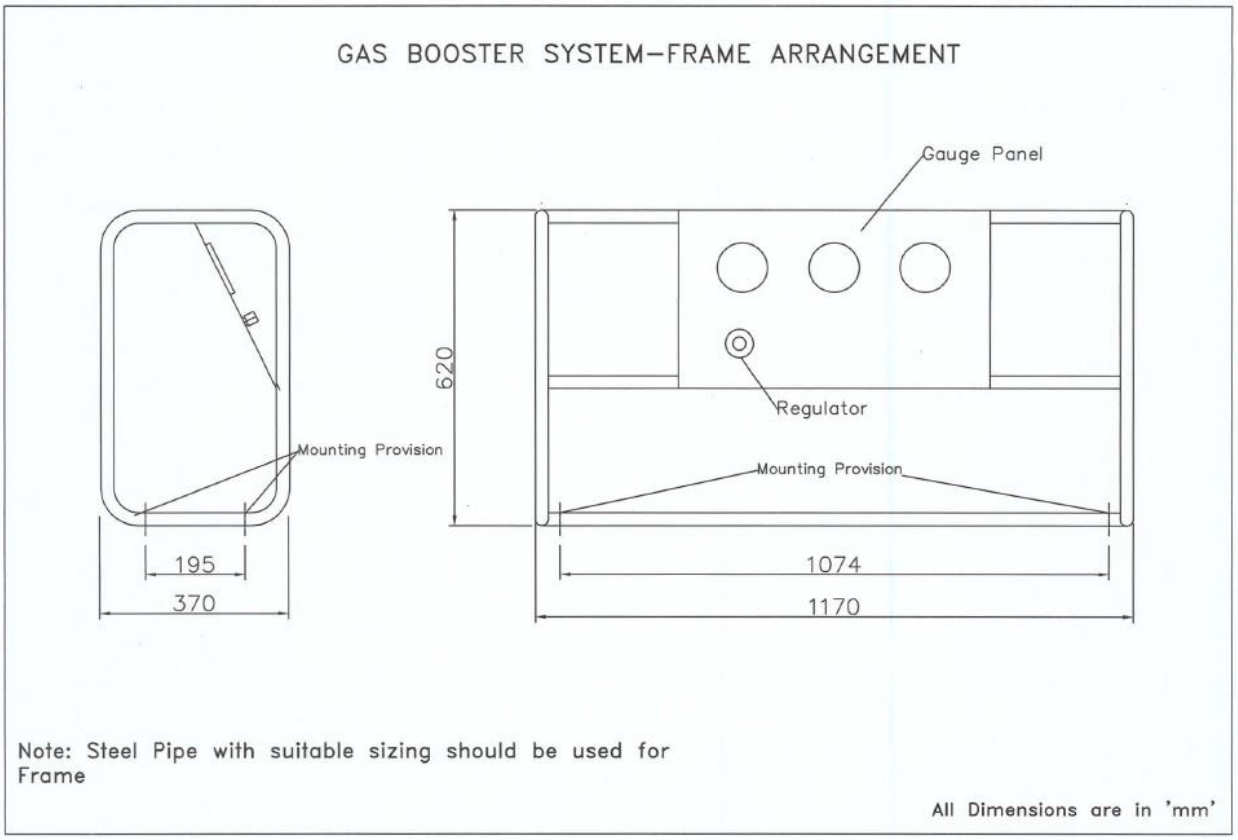
- All the equipment supplied by the supplier shall be installed, commissioned and demonstrated for satisfactory performance at LPSC (Bangalore) site.

Training:

- The day-to-day operation training to be provided by the supplier or their authorized representatives at LPSC (Bangalore) site

Documentation:

- The operating and maintenance manual, calibration certificate and warranty certificate shall be provided by the supplier.



GAS BOOSTER SYSTEM

Chapter-3 Drawings for the Gas distribution System

Dotted line: Supplied by LPSC-B

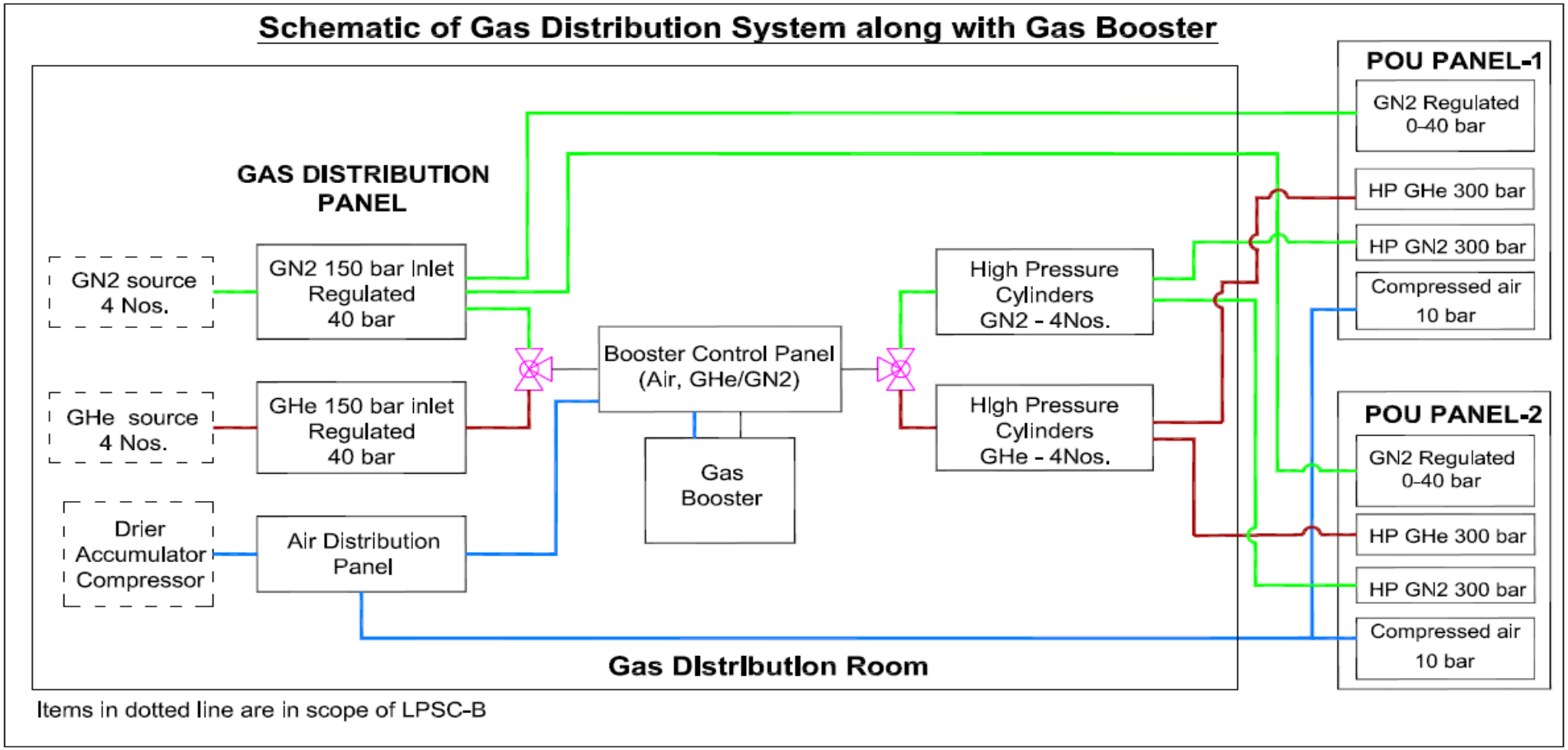
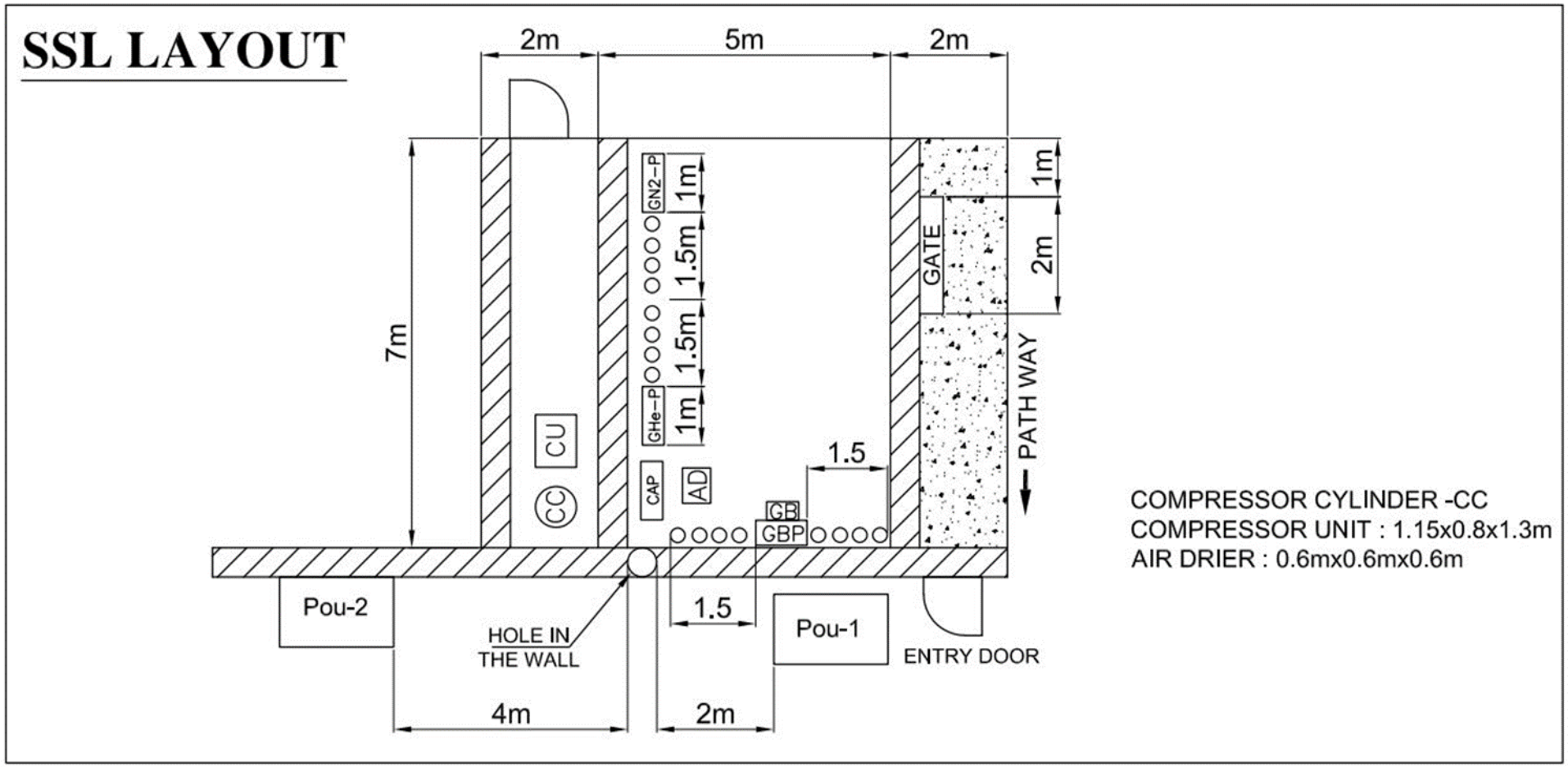


Figure 1: Schematic of Gas Distribution System



BCU: Boosting Control Panel; GDP: Gas Distribution Panel; ACP: Air compressor Equipment

Figure 2: Overall layout of gas distribution system

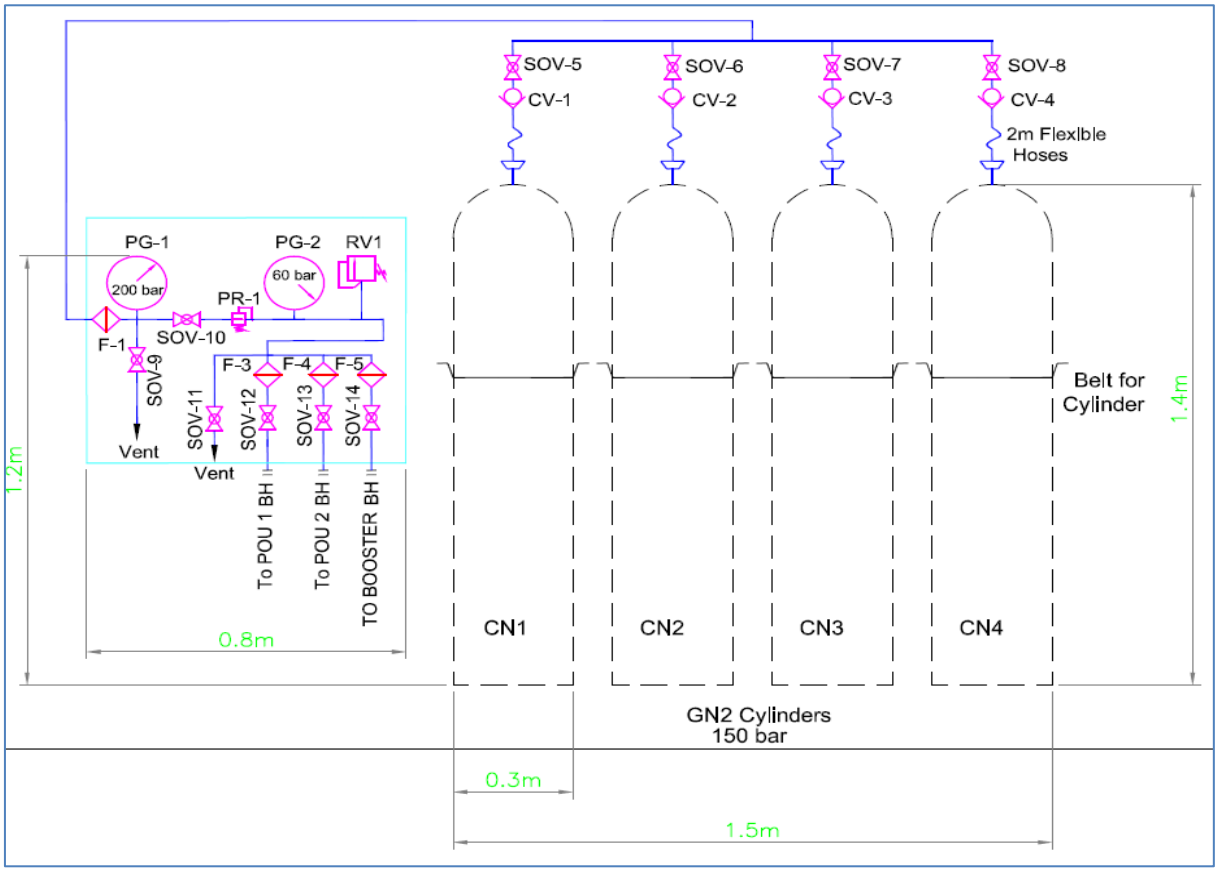


Figure 3: Fluid circuit of Gas Distribution Panel for GN2

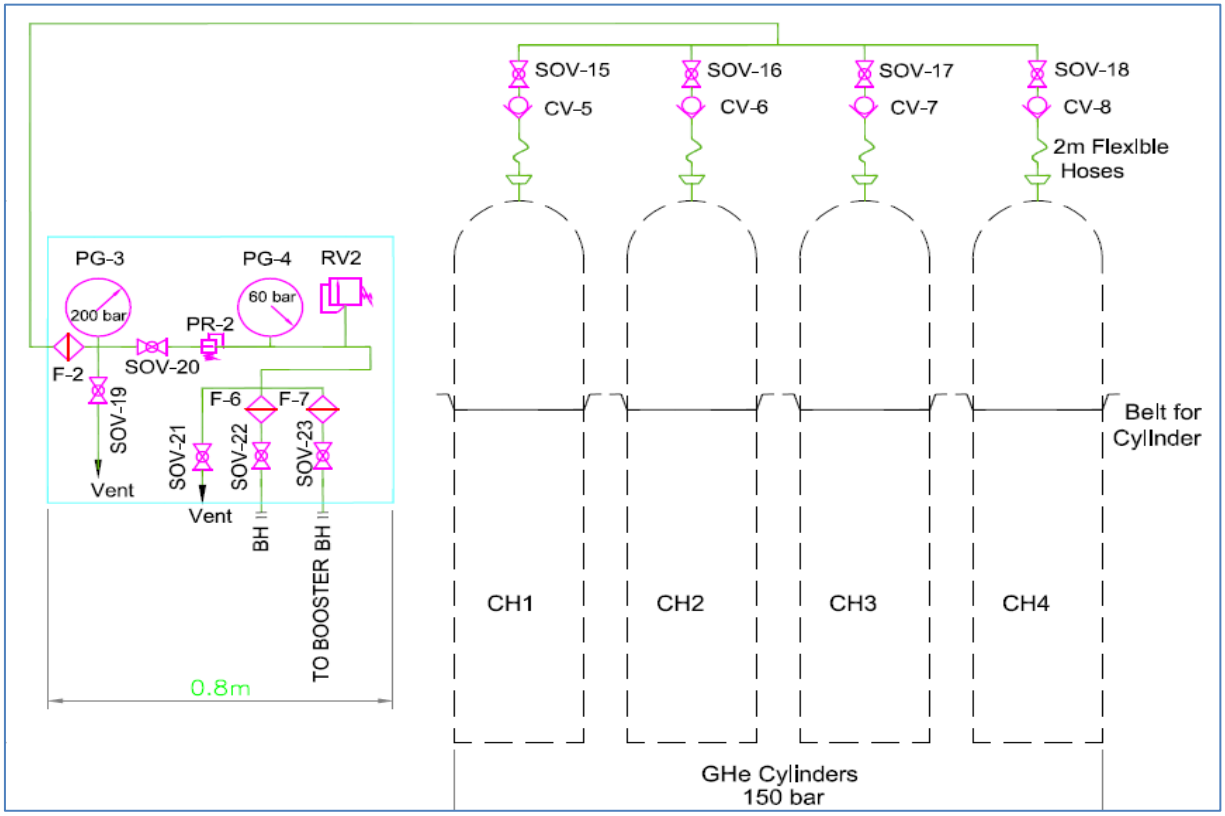


Figure 4: Fluid circuit of Gas Distribution Panel for GHe

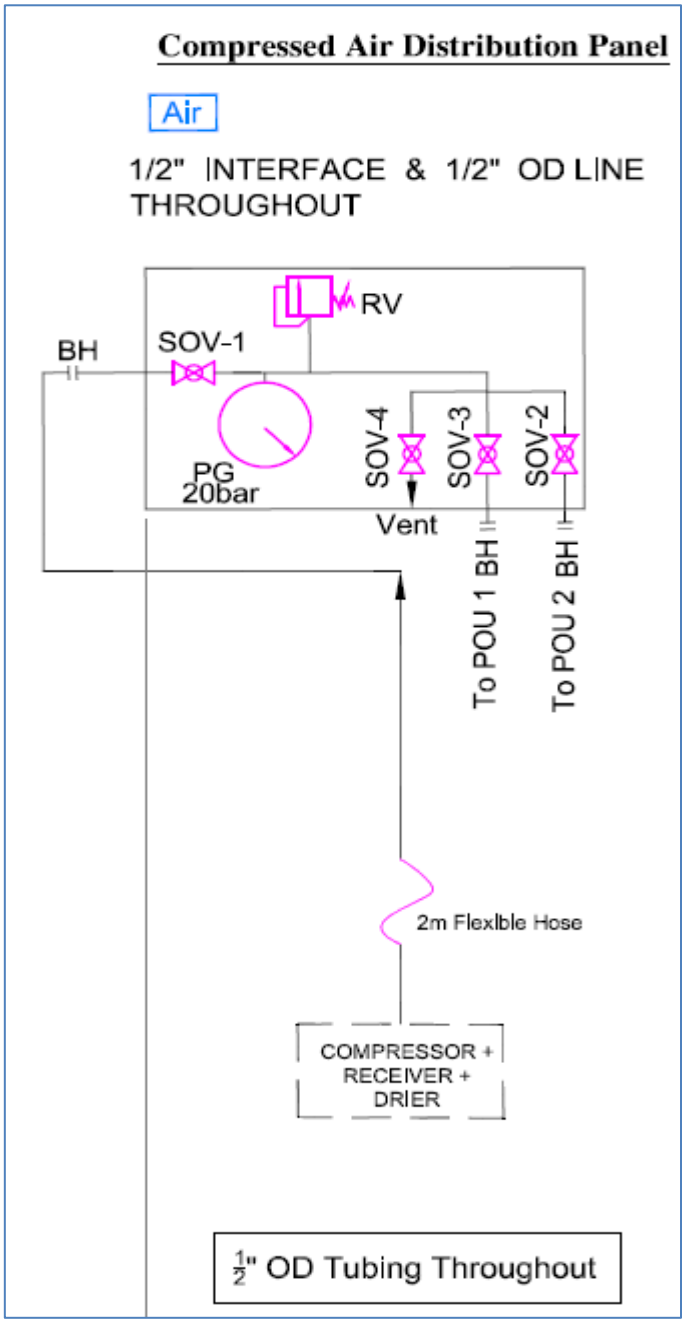


Figure 5: Fluid circuit of Compressed Air Distribution Panel (1 No.)

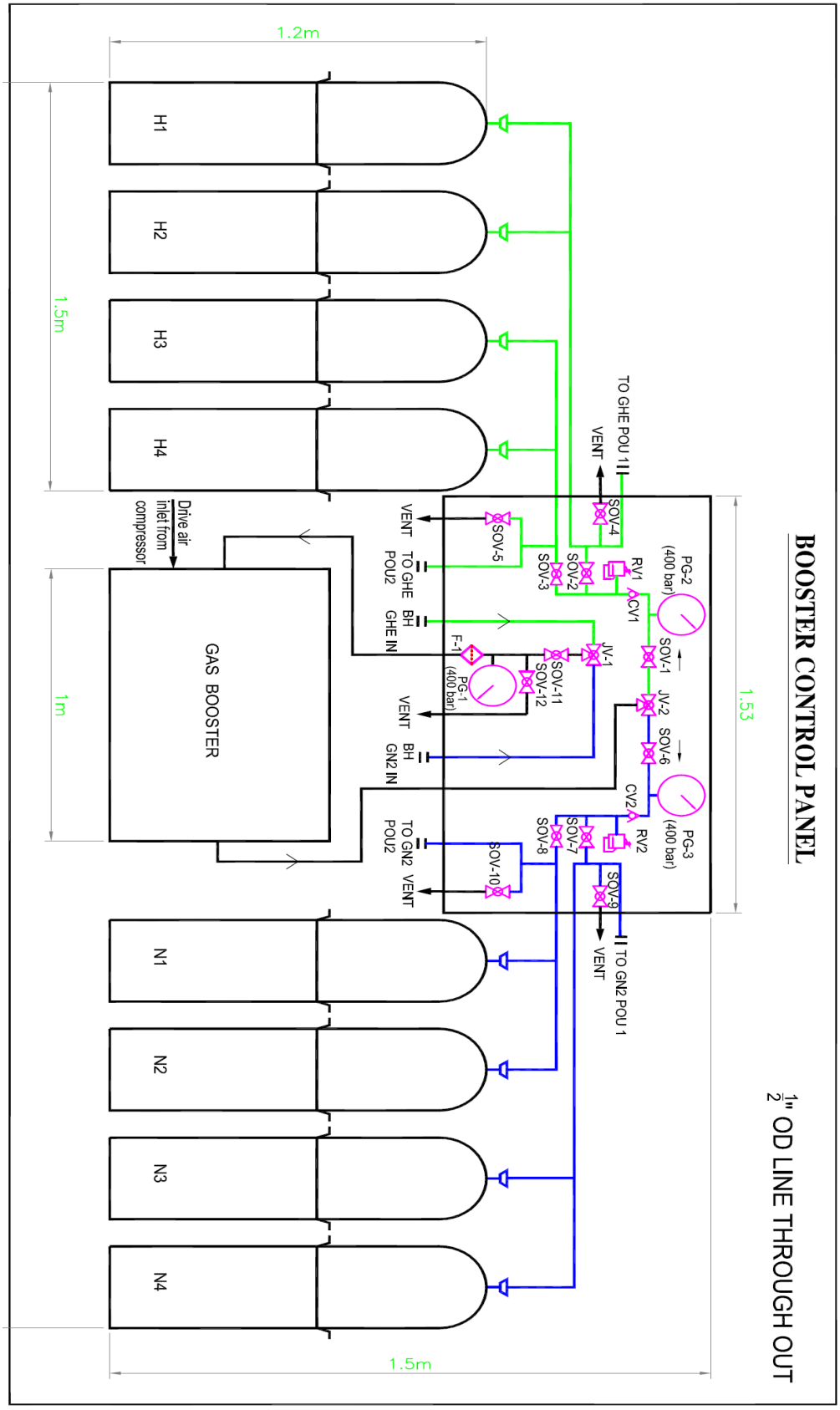


Figure 6: Fluid circuit of Boosting Control Panel

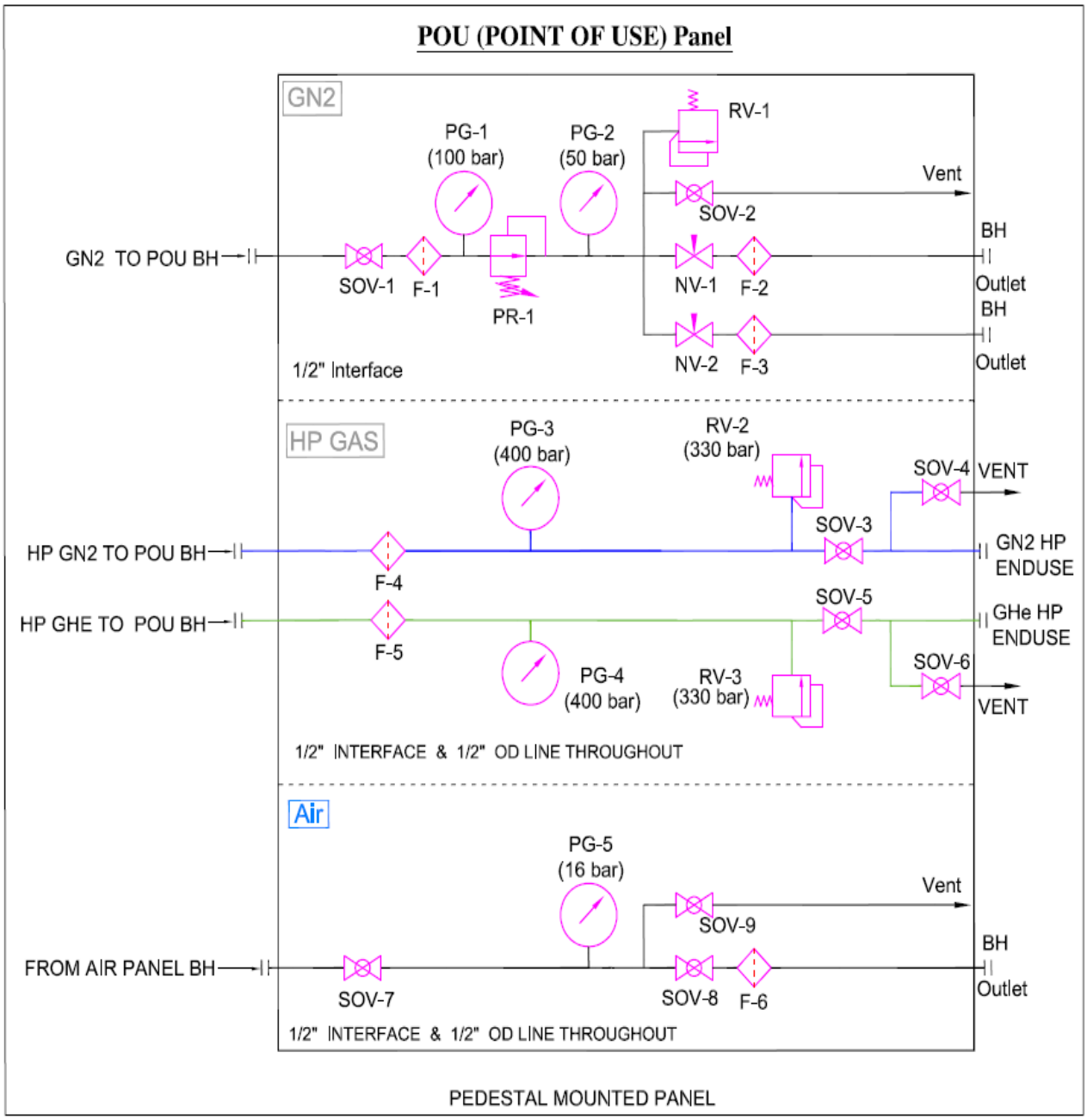


Figure 7: Fluid circuit of Point-of-Use (POU) Panel

Chapter-4 List of Spares

Technical specification of the spares shall be submitted in part-A of the bid. The price of the spares shall be quoted separately from the rest of the items in part-B of the bid.

1. List of Spares: Valves, Gauges, Regulator and Filters for Gas distribution Panel

Operating Pressure: 150 Bar Fluid Circuit: Refer Figure-3 & 4		**Spares for Gas distribution Panels**	
SNo	**Details &Specifications of components**	**Qty**	**Make**
1	**Shut-Off Valve** Type: Ball valve Pressure Rating: 250 bar Material: SS316 Interface: 1/2"	5	Swagelok/ Hamlet/ Dk-lok/ Fitok
2	**Check Valve** Type: Spring-poppet Pressure Rating: 250 bar min. Material: SS316 Interface: 1/2"	2	Swagelok/Hamlet /Dk-lok/ Fitok
3	**SS braided flexible hoses** Pressure Rating: 250 bar min. Core: PTFE Interface: 1/2" Length: 2 meters	2	Titeflex / Swagelok / Hamlet
4	**Bourdon tube pressure gauge** Bourdon tube material: SS316 Range: 0-250 bar Resolution: 1 bar Accuracy: ±1% FSO Dial size: 6” Interface: ½” M BSP	1	WIKA/ Ashcroft
5	**Bourdon tube pressure gauge** Bourdon tube material: SS316 Range: 0-100 bar Resolution: 1 bar Accuracy: ±1% FSO Dial size: 6” Interface: ½” M BSP	1	WIKA/ Ashcroft
6	**Gas Filter** Type: Pleated Wire Mesh Filter Range: 20µ absolute Pressure Rating: 250 bar Body material: SS316	1	Swagelok/ Norman/ Classic

	Mesh material: SS316 Interface: 1/2"		
7	**Gas Filter** Type: Pleated Wire Mesh Filter Range: 10µ absolute Pressure Rating: 250 bar Body material: SS316 Mesh material: SS316 Interface: 1/2"	2	Swagelok/ Norman/ Classic
8	**Relief valve** Pressure Rating: 250 bar Body material: SS 316 Interface size: 1/2 “interface Fully open orifice size: 6.4 mm Set Pressure Range: 52 to 100 bar	1	Swagelok/Hamlet / Dk-lok/ Fitok
9	**Pressure Reducing Regulator** Type: Spring loaded regulator Venting: Self Venting Inlet pressure: 300 bar Outlet Pressure: 0 to 60 bar Cv: 2 Body material: SS 316 Interface: 1/2"	1	Tescom/GCE

2. List of Spares: Valves and Gauges for Compressed Air distribution Panel

Compressed Air Distribution Panel **Operating Pressure**: 15 Bar **Fluid Circuit: Figure-5**			
S. No	**Details &Specifications of components**	**Spares (Nos.)**	**Make**
1	**Shut-Off Valve** Type: Ball valve Pressure Rating: 30 bar Material: SS316 Interface: 1/2"	1	Swagelok/Hamlet/ Dk-lok/ Fitok
2	**SS braided flexible hoses** Pressure Rating: 60 bar Core: PTFE Interface: 1/2" Length: 3 meters	1	Titeflex/Swagelok/ Hamlet
3	**Relief valve** Pressure Rating: 60 bar Body material: SS 316 Interface size: 1/2 “interface Set Pressure Range: 5 to 15bar	1	Swagelok/Hamlet/ Dk-lok/ Fitok

3. List of Spares for High Pressure gas cylinder bank

S. No	Details & Specifications of components	Spares (Nos.)	Make
1	**High Pressure Empty gas cylinders for GHE** Operating pr: 300bar Capacity: 50L Material: Chrome Moly Steel	2	EKC/Linde/Luxor
2	**High Pressure Empty gas cylinders for GN2** Operating pr: 300bar Capacity: 50L Material: Chrome Moly Steel	2	EKC/Linde/Luxor
3	**Gas cylinder connector (Bull nose & Adapter)** Material: SS316 as per IS 3224 Interface: ½" OD	2	Standard make
4	**Belt for gas cylinders (safety purpose)** Cylinder size: Ø 230 x 1400 mm height nominal	2	Standard make

4. List of Spares: Valves and Gauges for Boosting Control Panel

Boosting Control Panel **Operating Pressure**: 150 bar max at inlet & 300bar at outlet. **Fluid Circuit:** Figure 6			
S. No	**Details &Specifications of components**	**Spares (Nos.)**	**Make**
	Inlet to Gas Booster		
1	**3-Way Valve** Type: Ball valve Pressure Rating: 250 bar Material: SS316 Interface: 1/2"	1	Swagelok/Hamlet/ Dk-lok/ Fitok

2	**Shut-Off Valve** Type: Ball valve Pressure Rating: 250 bar Material: SS316 Interface: 1/2"	1	Swagelok/Hamlet/ Dk-lok/ Fitok
	From Gas Booster till high Pressure cylinder inlets		
6	**JV-2** **3-Way Valve** Type: Ball valve Pressure Rating: 500 bar Material: SS316 Interface: 1/2"	1	Swagelok/Hamlet/ Dk-lok/ Fitok
7	**Shut-Off Valve** Type: Ball valve Pressure Rating: 500 bar Material: SS316 Interface: 1/2"	2	Swagelok/Hamlet/ Dk-lok/ Fitok
8	**Bourdon tube pressure gauge** Bourdon tube material: SS316 Range: 0-500 bar Resolution: 1 bar Accuracy: ±1% FSO Dial size: 6”	1	WIKA/ Ashcroft
9	**Check Valve** Type: Spring poppet Pressure Rating: 500 bar Material: SS316 Interface: 1/2" Cracking Pr: 1/3 bar	1	Swagelok/Hamlet/ Dk-lok/ Fitok
10	**Relief valve** Pressure Rating: 500 bar Body material: SS 316 Interface size: 1/2“interface Set Pressure Range: 250 to 300bar	1	Swagelok/Hamlet/ Dk-lok/ Fitok

5. List of Spares: Valves and Gauges for Point-of-Use Panel

POU Panel **Operating Pressure**: 50 Bar for GN2, 300bar for GHe module, 15 bar for compressed air module. **Fluid Circuit:** Figure 7			
S. No	**Details &Specifications of components**	**Spares (Nos.)**	**Make**
For GN2 Module (1/2" interface & Fittings)			
1	**Shut-Off Valve** Type: Ball valve Material: SS316 Interface: 1/2" Pressure Rating: 200 bar	1	Swagelok/Hamlet / Dk-lok/Fitok
2	**Needle Valve** Material: SS316 Interface: 1/2" Pressure Rating: 150bar	1	Swagelok/Hamlet /Dk-lok/ Fitok
3	**Bourdon tube pressure gauge** Bourdon tube material: SS316 Resolution: 1 bar Accuracy: ±1% FSO Dial size: 6"	1 no. each of PG-1: 0-200 bar PG-2: 0-50 bar	WIKA/Ashcroft
4	**Gas Filter** Range: 5µ absolute Pressure Rating: 100 bar Body material: SS316 Mesh material: SS316 Interface: 1/2"	1	Swagelok/Norman/ Classic
5	**Relief valve** Pressure Rating: 100 bar Body material: SS 316 Interface size: 1/2"interface Set Pressure Range: 24 to 50 bar	1	Swagelok/Hamlet /Dk-lok/ Fitok
6	**Pressure Reducing Regulator** Type: Spring loaded Venting: Self Venting Inlet pressure: 200 bar Outlet Pressure: 0 to 50 bar Cv: 0.20 Body material: SS 316	1	Tescom/ GCE

For High Pressure Module (1/2” interface & Fittings)			
1	**Shut-Off Valve** Type: Ball valve Material: SS316 Interface: 1/4" Pressure Rating: 500 bar	2	Swagelok/Hamlet / Dk-lok/ Fitok
2	**Bourdon tube pressure gauge** Bourdon tube material: SS316 Resolution: 1 bar Accuracy: ±1% FSO Dial size: 6” Range: 0-500 bar	1	WIKA/ Ashcroft
3	**Gas Filter** Range:10µ absolute Pressure Rating: 500 bar Body material: SS316 Mesh material: SS316 Interface: 1/2"	1	Swagelok/Norman/ Classic
4	**Relief valve** Pressure Rating: 500 bar Body material: SS 316 Interface size: 1/4“interface Set Pressure Range: 260 to 330 bar	1	Swagelok/Hamlet /Dk-lok/ Fitok
For Compressed Air Module (1/2” interface & Fittings)			
1	**Shut-Off Valve** Type: Ball valve Pressure Rating: 100bar Material: SS316 Interface: 1/2"	1	Swagelok/Hamlet /Dk-Lok/ Fitok
2	**Bourdon tube pressure gauge** Bourdon tube material: SS316 Range: 0-20 bar Resolution: 0.5 bar Accuracy: ±1% FSO Dial size: 6”	1	WIKA/ Ashcroft
3	**Gas Filter** Range: 10µ absolute Pressure Rating: 100bar Body material: SS316 Mesh material: SS316 Interface: 1/2"	1	Swagelok/Norman// Classic

Chapter-5: Acceptance Criteria & Other Relevant Information

Final acceptance will be based on installation at our site in LPSC and successful functional testing and performance demonstration of all the components and subsystems of gas distribution system to satisfactory level in the presence of LPSC engineers as per following.

5.1 Pre-Delivery Inspection (Factory Acceptance Test – FAT)

a) Physical verification for all components and subsystems for the facility as per bill of materials.
b) Verification of the material & equipment test reports.
c) Visual inspection & Dimensional inspection of panels.
d) Proof pressure test of panel of each type (at 1.5 times MEOP)
e) Leak test (by snoop solution) at MEOP of one panel of each type.
f) Completeness of all deliverables.
g) The PDI/ FAT shall be carried out at suppliers site/ factory by LPSCB representatives. Supplier shall inform one week in advance for PDI.

5.2 Documents Requirement

a) Drawings of all the panels.
b) Complete Gas distribution system and boosting system (including high pressure cylinder network) layout drawings.
c) Datasheets and details of all components such as valves, pressure gauges, pressure regulators, filters, tubes and fittings, etc.
d) Calibration certificates of all measurement instruments such as pressure gauges etc. for a period of one year.
e) Three sets of detailed operation and maintenance manuals along with necessary drawings in hard and soft copy.
f) Certificate of FP test carried out on welds.
g) All other relevant documents.

5.3 Post installation Acceptance testing at LPSC

- Proof pressure testing of all panels and interconnections to be demonstrated.
- Boosting cycles to GHe & GN2 to be demonstrated
- POU panels demonstration for steady operation shall be demonstrated integrated to SSL lab test.
- Combined testing from two HP cylinders -one from each network shall be demonstrated wrt operation sequence and steady supply. Test will be connected to LPSC setup to draw the output.

5.4 Warranty

a) The entire gas distribution system, boosting system and other utilities shall be warranted for total performance and failure-free operation for a minimum period of 12 months from date of final acceptance of system by LPSC.

5.5 General Conditions

a) LPSC will supply Nitrogen, Helium, air compressors (with Receiver Tank) for testing. Hence the supplies of these items are not part of the scope of work.
b) All supplied assemblies/systems and components shall be state-of-the-art technology.
c) Third Party inspection certificate for the raw material procurement shall be provided.
d) Fabrication, assembly of all the panels shall be done based on approval from LPSC.
e) The drawings and layouts of gas distribution system and boosting & high-pressure cylinder network shall be approved and cleared by LPSC before the start of realization.
f) Spare items mentioned in bill of materials shall be supplied along with delivery of other items.
g) All the tubes and fittings used for realization of gas distribution, boosting & high-pressure cylinder network shall be pre-cleaned and passivated. Certificate for the same shall be provided.
h) All the tubes and fittings to be procured as per ASTM standards and material test certificates shall be provided to LPSC.
i) Use of standard/recommended fabrication and assembly procedures and construction practices shall be adopted.
j) High quality workmanship using well trained, well qualified certified personnel and well supervisory manpower shall be employed.
k) **Detailed technical specification including make, model no., part number** shall be provided by party for all the equipment/components.
l) Calibration certificates of all measuring instruments, such as pressure gauges, pressure transmitters, mass flow meters etc. shall be provided.
m) During execution of work, changes (which lead to improvements) suggested by the party or LPSC shall be implemented with mutual agreement.
n) The party shall arrange necessary support equipment, tools, machines, accessories etc. LPSC would not provide any such items.
o) All necessary safety precautions shall be taken by party during execution of work and also party is responsible for personal safety of the work force engaged by party for this project.
p) Parties can visit the site in existing SSL in LPSC-Bengaluru before submitting the offer.
q) Vendor shall provide the cost breakup for equipment / components and execution / installation and testing cost separately along with offer (Quotation).

r) Subcontracting if any, shall be intimated in advance to LPSC and prior permission shall be obtained.

5.6 Delivery Schedule

a) The delivery schedule for supply, installation and commissioning of gas distribution and boosting & high-pressure cylinder network along with utilities shall be **9 months from the placement of purchase order.**

T_0 is date of purchase order placement.

S. No	Description	Time period (Months)
1	Approval of Panel and layout Drawings	T_0+2
2	Procurement of all major items, fabrication of panels	T_0+6
3	Pre-despatch inspection by LPSC & FAT, Delivery and transportation to LPSC	T_0+7
4	Installation, commissioning & Acceptance at LPSC	T_0+9

- Total time for completion = **9 months**

b) The gas distribution system, boosting & high-pressure cylinder network along with utilities shall be supplied, installed and commissioned at System Simulation Laboratory, LPSC-B.

PART-B: COMMERCIAL TERMS & CONDITIONS

1. Price

The prices are FIRM and FIXED. On receipt of order, Vendor has to prepare detailed work break-up and schedule chart (in consultation with LPSC) and submit to LPSC for our acceptance.

2. Security Deposit

The party shall submit the security deposit for the performance of the contract, equivalent to 3% of the total order value in the form of bank guarantee or either form of negotiable instrument, issued by a nationalized or scheduled bank in a Rs. 500 non-judicial stamp paper. This security deposit will be returned (interest free) after the successful completion of the ordered contract. The security deposit shall have a further claim period of 6 months.

3. Warranty

The total system shall be warranted for total performance and failure-free operation for a period of 12 months from date of final acceptance of system by LPSC/ISRO.

4. Performance Bank Guarantee (PBG)

To cover the warranty period of 12 months, the party shall submit the performance bank guarantee for the performance of the vacuum system operation, equivalent to 3% of the total order value in the form of bank guarantee or either form of negotiable instrument issued by a nationalized or scheduled bank in a Rs. 500 non-judicial stamp paper. This PBG (interest free) will be returned after the successful completion of the warranty period. The PBG shall have a further claim period of 6 months.

5. Liquidated Damages

As per the Delivery Schedule mentioned is the essence of the contract\order, in case if you fail to deliver the item within the time specified or any extension thereof. Liquidated damages at 0.5% (Zero Point Five Percent) of the order value or part thereof of the undelivered item for each calendar week of delay shall be recovered from your bill. However, total LD shall not exceed 10% (Ten Percent of the Order Value).

6. Arbitration

Dispute if any shall be settled mutually, failing which it will be referred to a One Man arbitrator appointed by Director, LPSC in accordance with the Indian Arbitration and Conciliation Act 1996, whose decision shall be final and binding on both the parties. In case of import supply, the Arbitration shall be applicable as per International Chamber of Commerce.

7. Jurisdiction

The Courts in the City of Bangalore alone shall have jurisdiction to deal with and decide any matter or dispute whatsoever arising out of this agreement including those arising under the Arbitration Act.

8. Force Majeure

If at any time during the continuance of the order the performance in whole or in part by either Contractor of any obligation under this order shall be prevented or delayed by reasons of any war, hostility, acts of public enemy, civil commotion, sabotage, fire, floods, epidemic, quarantine restrictions, strikes, go-slow, lockout or acts of God, notice of which is given either Contractor to the other within 21 days from the date of occurrence thereof, neither Contractor shall be reasons of such eventuality be entitled to terminate this order nor shall either Contractor have any claim for damages against the other in respect of such non-performance or delay in performance.

9. Secrecy

The drawings and documents sent along with this tender form part of vital documents and same should be kept on top secret. Under any situations, contractor should not part with or transfer the technology/contents of drawings and documents whatsoever to any 3rd party/agency without our prior consent. If at any time, it is brought to our notice that the secrecy has been transferred by you intentionally or otherwise to any third party /agency, contractor shall be liable to indemnify the loss/ damage to Government of India.

10. Indemnity

Contractor shall warrant and be deemed to have warranted that all the items supplied against this tender are free and clean of any infringement of any patent, copy right or trademark and shall at all times indemnify LPSC against all claims which may be made in respect of the items for infringement of any right protected by patent registration of design or trade mark and shall take all risk of accidents or damage which may cause a failure of the supply from whatsoever cause arising and the entire responsibility for the sufficiency of all the means used for executing the Purchase Order.

11. Delivery

Items shall be supplied and installed and site acceptance tested within **9 months** from the date of receipt of order. This delivery schedule is the essence of the order and shall be strictly complied with. Detailed Grant chart shall be provided to prove the same.

12. Payment Terms

100% payment shall be made after receipt of all items and installation, commissioning & acceptance at the site.

13. Validity

The quoted price should be valid for a period of 6 months from the date opening of the technical and commercial quotation.

14. Heritage Clause

Party should have executed similar works at aerospace industries. Details of similar project execution in ISRO or any Aerospace industries in India and reference of at least 2 installations during last 10 years to be provided. Enclose the completion/appreciation certificates from clients.

Party should have realised similar gas bank project at minimum of 80% value of quoted price of one work or 50% value of quoted price of two works or 30% value of quoted price of three works.

15. General Conditions to The Vendors

15.1 Vendor Details

The execution of the complete project is on turnkey basis as per the specifications and requirements deliberated in previous sections. The response to the tender is in the form of two separate offers, one as 'Technical offer' and other as 'Commercial offer'. Both the offers are to be submitted simultaneously.

In order to understand the vendors profile for execution of the project, following information shall be provided to LPSC along with the technical offer.

a) Profile of the company clearly bringing out the areas of strengths and weaknesses to supply the system of such nature.
b) Self-assessment of technical and organizational competence to supply the system of this nature and magnitude.
c) List of sub-contractors and major equipment suppliers for this project execution.
d) Local office in India or authorized Indian agents details to be provided for ease of project executions.
e) All necessary electrical and mechanical tools and hardware, material handling equipment etc. which are useful and necessary for assembly and efficient working of system, are under the scope of vendor's supply and the cost of the same shall be deemed to be included in the quote, whether specifically mentioned in the tender document or not.
f) Any material and labour which may be necessary to complete the work in accordance with the intent of the specification shall be furnished by the vendor without any extra cost.

g) Any modifications in the system till installation shall meet the technical specification of the tender document and prior approval to be obtained from LPSC. Further the modifications made shall be technically equal or superior w.r.t. to the original offer and should not have any additional cost implication.

15.2 Pre-bid visit to existing facility

Vendors shall attend pre-bid meeting to obtain necessary clarifications on specified date before submission of quotation. Vendors are permitted to visit the existing facility in LPSC-Bengaluru and obtain necessary clarifications on specified date before submission of quotation.

15.3 Mode of Quoting

The offers shall be submitted on two-part basis as follows: Technical & commercial (other than price) bid & Price bid. Also the validity of quotation shall be 6 months minimum from the date of quoting. The contractor chosen on the basis of suitability of techno-commercial merits will have to sign a contract with ISRO. The scope of contract will cover the turnkey execution of the total system as per terms enlisted in the contract document.

a) The quotation shall be based on fixed and firm price and no price escalation is permitted.
b) During the evaluation of technical bids alternatives/options/suggestions shall be confirmed in technical offer to meet the system specifications. As the contract is for fixed price, no provision for addition/reduction in charges will be entertained after opening the price bid.
c) FIRM DELIVERY PERIOD After receipt of order shall be quoted taking into account of all contingencies.
d) Offer shall be valid for minimum six months from the due date.
e) LPSC/ISRO may incorporate specific provisions and conditions before ordering with mutual consent. These provisions will deal with delivery schedule, specifications, demonstration criteria, financial provision, quality control procedures, specific provisions relating to imported items, penalty clauses, etc.
f) Any information kept vague or not furnished shall be treated as non-compliance with the requirements of the vendor and hence tender are liable for rejection

15.4 Following Documents Shall Be Submitted By The Vendor Along With Technical Offer (Part-A)

a) Compliance matrix of each specification as given in this document.
b) List and details of non-compliance of specifications by the vendor if any.
c) Confirmation of scope of supply as given in this document by vendor.

d) Overall plan of project execution with details of facilities/capabilities available for timely completion of the project in all respects.

e) Preliminary system layout plan of the proposed gas distribution

f) List of imported items and source of supply shall be provided.

g) Specification of components, model number, data sheet and source of supply.

h) Information asked in Section 15.1 Vendor Details.

i) List of Indian associates or partners, consultants, subcontractors, major equipment suppliers, proposal to be involved in this project, the past experience, competence and extent of the involvement.

j) Details of utilities to be provided by LPSC/ISRO and time stages at which these are required by the contractor

k) Commercial Terms such as delivery date, taxes, duties payable, place of delivery, payment term, validity, guarantee etc. and scope of supply shall not be covered in this part. Please enclose a copy of the details indicated in price quotation *(WITHOUT PRICES OR BY MASKING THE PRICE)* mainly to know the items/ specifications for which you have indicated prices in price bid. **This part should not contain prices.**

l) The Technical and commercial part of the offer should be kept in a sealed envelope super scribing the following details:

QUOTATION AGAINST TENDER NO - _____

DUE ON _____

GAS DISTRIBUTION SYSTEM AT LPSC, BENGALURU

PART A – TECHNICAL & COMMERCIAL

15.5 Following Documents Shall Be Submitted Along with Price Bid (Part-B)

a) The vendor responding to this tender, shall submit comprehensive price bid in a separate document meeting all the requirements specified therein.

b) This contract is proposed to be firm and fixed price contract and no price escalation will be permitted during the period of contract.

c) Vendor shall not be allowed to change any item from imported to indigenous or vice-versa without prior approval of LPSC (B) after Purchase Order is placed.

d) The Vendor is chosen on the basis of suitability of techno-commercial merits. The scope of contract will cover the turnkey execution of the total system.

e) Vendor shall furnish all details as called for in this chapter giving due justification. Any information kept vague or not furnished shall be treated as non-compliance with the requirements of the Vendor and hence tender is liable for rejection

The offer should include the following documents:

f) The total cost of the systems including fabrication, supply, installation, commissioning and testing.
g) Break up of various elements like design, direct material, direct labour, overheads, etc.
h) Price bid for spares listed in Chapter-4 Shall be given separately.
i) For all items, vendor shall furnish separate details like equipment cost in foreign currency, foreign exchange conversion rate, equipment cost in Indian rupees without, customs duty/Excise duty etc.
j) Transportation charges, taxes, government levies shall be specified separately.
k) Installation & commissioning charges shall be specified separately.
l) Acceptance to furnish warranty certificate for the period of 1 year, from the date of installation, commissioning and acceptance of the total system.
m) Performance bank guarantee for a minimum period of 12 months from the date of acceptance of the total system by LPSC/ISRO from a nationalized Bank.
n) Acceptance to the commercial clauses and conditions.
o) Any other information relevant to this tender.
p) This part should also be kept in a sealed cover super scribing as follows:

QUOTATION AGAINST TENDER NO - _____

DUE ON _____

TEST FACILITY AT, LPSC, BENGALURU

PART B – PRICE BID

16. Special Instructions to Tenderers for Submitting Two Part Tenders

File No:

ITEM: **Gas Distribution & Gas Boosting System at LPSC, Bengaluru Campus**

Please note the following instructions and submit your offer accordingly.

(a) PART-I: TECHNO–COMMERCIAL

This part shall contain only the technical details and specifications together with technical catalogues. All commercial conditions shall also be indicated in this part. Deviations, if any, to our specifications shall be brought out very clearly. Tenderers shall mention point-wise confirmation with regard to Technical Specification and Commercial Terms & conditions (Techno-Commercial). Price details should not be shown in this part.

This part shall contain the detailed technical specification and commercial terms such as delivery dates, taxes, duties payable, place of delivery, payment term, validity,

S. No	Details/Specifications	Compliance
	PART–A: TECHNICAL SPECIFICATION	**Yes/No**
1.	**Introduction** This document provides scope of work and specifications for design, fabrication, supply, installation, testing, commissioning and demonstration of gas distribution system and associated utilities for SSL in LPSC-B. Detailed scope of work in provided in Chapter 1. System Simulation Lab (SSL) is a cold flow test facility for simulation of pressure drop characteristic of flight components. Towards this gas distribution system along with utilities needs to be installed in the facility to supply gases from sources to the user points. The gas distribution system shall supply pressurised gaseous Nitrogen, Helium and compressed air from gas cylinder bank in gas distribution room to boosting equipment and then regulated to the user points in SSL to cater for the requirements during simulation tests. Figure-1 shows schematic of layout of all panels in gas distribution system. The gas distribution system consists of Gas distribution panels along with compressed Air panel (1 No.), Point-of-Use (POU) panels (2 no.), boosting control panel (1 no.) and SS tubes & valves connecting all these panels. The panels shall be installed at locations indicated in overall layout of the system is shown in Figure-2. Detailed technical description of the system is in Chapter 2. Chapter 3 contains details of utilities to be supplied, integrated and tested along with above-described gas distribution. **(Note: LPSC will supply High-Pure Nitrogen gas & Helium gas cylinders, air compressors required for testing. Hence the supply of these items is not part of this scope of work. Where ever details provided related to these items are only for information).**	

2.	**Chapter 1: Scope of Work**	
3.	**1.1 Scope of Work** The scope of work includes design, fabrication, supply, installation, testing, commissioning and demonstration of **Gas distribution System along with Gas booster supplies of GN2, GHe and compressed Air at regulated pressure to cold flow test setup** at System Simulation laboratory (SSL) at LPSC-B.	
4.	**1.1.1 Gas Distribution System:** The overall scope of work includes **design, fabrication, supply, installation, testing, commissioning and demonstration of gas distribution & boosting system** for supply of gases (GN2, GHe and compressed air) including gas distribution panels, Point-of-Use (POU) panel, boosting Control panel, high pressure GHe & GN2 cylinders, stainless-steel tubes for interconnecting all the panels at SSL at LPSC-B as per detailed specifications and bill of materials provided in chapter 2. Schematic of the gas distribution system in shown in Figure-1.	
5.	a) The gas distribution system shall supply pure gaseous Nitrogen, Helium and compressed air from gas distribution room to the user points.	
6.	b) High pressure gas cylinders of 50L capacity, 4 nos. each for GHe and GN2. Cylinders shall be identified separately. Max Pressure capacity shall be atleast 300bar. PESO Certificates and relevant certificates to be provided.	
7.	c) 1 No. of gas distribution panel (with supply of GN2 & GHe) ,1 No. of compressed air distribution panel, 1 no gas boosting control panel shall be provided in gas distribution room. The regulation and piping arrangement can be combined in single panel as feasible.	
8.	d) At user points, POU panels (1 No.) shall be provided as per layout shown in figure- 2.	
9.	e) The gas supply piping for Nitrogen, Helium and compressed air from the gas distribution panels to the user points shall be made of SS304L tube with 1/2“OD as per layout shown in figure 2. Approximate length of tubing required **is 20 meters**.	
10.	f) Structure of all panels (gas distribution, POU and control) shall be made up of stainless-steel (SS 304) sheets and frames. The structures shall be buffed to mirror finish for elegant look.	

11.	g) Panels mounted on pedestal shall be fastened to ground and provided with a height accessible to operator to reach all components.	
12.	h) The panels shall be grouted/ fixed rigidly on the ground using appropriate anchor.	
13.	a) The fluid circuit shall be constructed with high quality orbital TIG welding with 100% fusion except for component interfaces. The component interfaces shall be connected with standard double compression ferrule fittings. All the welded joints must be Fluorescent Penetrant (FP) tested.	
14.	i) Vendor shall submit the design and layout of the panels to LPSC and approval shall be obtained for the detailed design and layout prior to commencement of fabrication/assembly of individual panels and of the entire system.	
15.	j) The system shall be realized as per approved layout by LPSC. Any deviation from the approved layout shall be intimated to LPSC before implementation.	
16.	k) All the SS 304L tubes used in the realization of system shall be pre-cleaned and passivated as per standard.	
17.	l) Entire tubing for gas supply shall be routed through trenches/walls appropriately and shall be covered with a suitable PVC casing. Tubes are required to be routed across the wall through the hole as per schematic. The entire tubing shall be securely anchored with suitable anchors/supports.	
18.	m)All the gas supply lines shall be provided with appropriate colour coding as per relevant standard for clear identification.	
19.	n) All the panels shall be provided with schematic drawing of the fluid circuits on the front side of the panel and with clear identification of components at their respective location. Also, the valve operating positions like open/close shall be marked by means of good quality stickers.	
20.	o) The certificate of conformance for materials, functionality and calibration certificate for pressure gauges and pressure transmitters shall be submitted. Details of required documents are mentioned in section 5.2.	
21.	p) Quantity of spare components is mentioned in bill of materials of each panel. Spare components shall be supplied together with the panels.	

22.	q) Installation, integration, testing, commissioning and demonstration of the entire system shall be carried out “On Site” basis in LPSCB.	
23.	r) The gas supply lines and compressed air supply lines shall be provided with appropriate identification labels.	
24.	**1.2 Scope of LPSC**	
25.	a) To provide buildings and civil construction as per the layout.	
26.	b) Review and approve the design drawings, specifications, layout of the entire gas distribution panel, compressed air panel, Point of Use panel and booster Panel after placement of PO.	
27.	c) Participation in factory acceptance tests to provide pre-dispatch clearance as per the criteria.	
28.	d) Evaluation of the system after installation and provide final acceptance of the systems based on site acceptance test data analysis and review committee clearance.	
29.	e) To provide facility like electricity, gases (GHe, GN2, Compressed Air), IPA, particle counters etc. for site acceptance tests.	
30.	f) Air compressor and gas booster shall be provided to which inlet and outlet connections are part of gas distribution system.	
31.	**Chapter 2: Gas Distribution System**	
32.	The gas distribution system shall supply gaseous nitrogen, helium and compressed air from gas distribution room to user point locations. The overall schematic and layout of the system is shown in Figure 1 & Figure 2. The gas distribution room shall have GN2, GHe and compressed air distribution panels. The GN2 and GHe distribution panels are separate units but have identical fluid circuits. The gases shall be supplied to Point-Of-Use (POU) panels (2 No. with 3 circuits for each gas) and Boosting Control panel (1 no.) through SS 304 tubes with Isolation Valves at necessary locations. The major components of gas distribution system are as follows.	
33.	**Table 1:** Major components of Gas Distribution System	

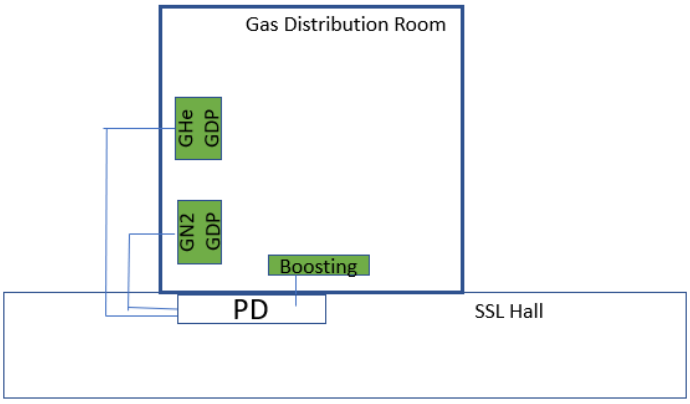
34.	**Sl. No**	**Description of Items**	**QTY**	**Remarks**	
35.	1	Gas distribution panel –GN2	1	Refer Figure-3	
36.	2	Gas distribution panel -GHe	1	Refer Figure-4	
37.	3	Compressed air panel	1	Refer Figure-5	
38.	4	Point-of-Use panel	2	Each has 3 Circuits for High Pr gas, GN2 regulation, compressed air	

39.	5	High Pressure (300bar) 50L Volume gas cylinders	4	Supply of empty Ghe cylinders	
40.	6	High Pressure (300bar) 50L Volume gas cylinders	4	Supply of empty GN2 cylinders	
41.	7	Boosting Control panel	1	High pressure-300bar for GHe & GN2	
42.	8	Gas Boosting System	1	300bar pressure	
43.	9	SS tubes	1	As per scope of work	
44.	10	Fittings	1	As per scope of work	
45.	**2.1 Gas Distribution Panel – GN2 & GHe**				
46.	The gas distribution panels are located inside the Gas Distribution Room. Two separate panels for GN2 and GHe distribution are required. The circuits for both the gases are identical and have same specifications. Fluid circuit is shown in Figure-3 & 4.				
47.	**2.1.1 Technical Description**				
48.	a) The inlet pressure for both the distribution panels is 150 bar.				
49.	b) Both GN2 & GHe gas circuits shall have inlet from a group of four cylinders arranged in a row.				
50.	c) Gas distribution panel is located next to the cylinder cluster and reachable to operating personnel within 1.5m from ground.				
51.	d) The Gas cylinders (in LPSC scope) shall be positioned in a row with ground support frame and belts. Cylinder outlet is connected with SS316 bull nose connecter, SS braided flexible hose, check valve and isolation valves.				
52.	e) The cylinders shall be supported by fabricated stainless-steel structure/frame with proper anchoring and belts to ensure safety shall be supplied by Party.				
53.	f) The panel structure shall be made of SS304 sheets and frame.				
54.	g) The panels shall be leg mounted. Stability of panels shall be ensured and it shall be properly anchored to the ground. The panels shall house the flow components as per fluid circuit shown in Figure 3 & Figure 4.				
55.	h) Table 2 gives list of components, brief specifications, recommended make and quantity for gas distribution panels.				
56.	i) The fluid circuit shall be with 1/2" OD annealed seamless SS304L tubes, hoses from cylinders to tubes, suitable fittings and flow components as per details provided in Table 2.				
57.	j) All the pressure gauges, regulators, valves shall be assembled on the front panel aesthetically.				
58.	k) Vendor shall optimally design the panel sizes while considering future maintenance activities. Vendor shall submit the design to LPSC and approval shall be obtained prior to commencement of fabrication/assembly.				

59.	l) All tube joints shall be welded by orbital TIG welding with 100% fusion construction except component interfaces, which shall be provided with double compression ferrule type tube fittings. All the welded joints must be Fluorescent Penetrant (FP) tested as per relevant standard.							
60.	m) The panel fluid circuit shall be proof pressure tested at 225 bar (1.5 times of 150 bar) and leak tested (Bubble leak method with Helium) at operating pressure 150 bar.							
61.	n) Schematic drawing of the fluid circuit shall be provided on front side with clear identification of components at their respective location. Also, the valve operating positions like open/close shall be marked by means of good quality stickers.							
62.	**Table 2:** Bill of materials for gas distribution panel							
63.	**Operating Pressure**: 150 Bar **Qty**: 1 no GN2 & 1no GHe Fluid Circuit: Refer Figure- 3 & 4		**Gas Distribution Panel- GN2**		**Gas Distribution Panel- GHe**			
64.	**S No**	**Details &Specifications of components**	**ID**	**Qty**	**ID**	**Qty**	**Make**	
65.	1	**Shut-Off Valve** Type: Ball valve Pressure Rating: 250 bar minimum Material: SS316 Interface: 1/2"	SOV-5 to SOV-14	10	SOV-15 to SOV-23	9	Swagelok/ Hamlet/ Dk-lok/ Fitok	
66.	2	**Check Valve** Type: Spring-poppet Pressure Rating: 250 bar min. Material: SS316 Interface: 1/2"	CV-1 to CV-4	4	CV-5 to CV-8	4	Swagelok/ Hamlet/ Dk-lok/ Fitok	
67.	3	**SS braided flexible hoses** Pressure Rating: 250 bar min. Core: PTFE Interface: 1/2" Length: 2 meters	-	4	-	4	Titeflex / Swagelok /Hamlet	
68.	4	**Gas Filter** Type: Pleated Wire Mesh Filter Range: 20µ absolute Pressure Rating: 250 bar Body material: SS316	F-1	1	F-2	1	Swagelok/Norman/ Classic	

		Mesh material: SS316 Interface: 1/2"						
69.	5	**Bourdon tube pressure gauge** Bourdon tube material: SS316 Range: 0-250 bar Resolution: 1 bar Accuracy: ±1% FSO Dial size: 6” Interface: ½” M BSP	PG-1	1	PG-3	1	WIKA/ Ashcroft	
70.	6	**Pressure Reducing Regulator** Type: Spring loaded regulator Venting: Self Venting Inlet pressure: 150 bar Outlet Pressure: 0 to 60 bar Cv: 2 Body material: SS 316 Interface: 1/2"	PR-1	1	PR-2	1	Tescom/ GCE	
71.	7	**Bourdon tube pressure gauge** Bourdon tube material: SS316 Range: 0-250 bar Resolution: 1 bar Accuracy: ±1% FSO Dial size: 6” Interface: ½” M BSP	PG-2	1	PG-4	1	WIKA/ Ashcroft	
72.	8	**Gas Filter** Type: Pleated Wire Mesh Filter Range: 10µ absolute Pressure Rating: 250 bar Body material: SS316 Mesh material: SS316 Interface: 1/2"	F-3, F-4 & F-5	3	F-6 & F-7	2	Swagelok/Norman/Classic	
73.	9	**Relief valve**	RV-1	1	RV-2	1	Swagelok/ Hamlet/	

		Pressure Rating: 250 bar Body material: SS 316 Interface size: 1/2 “interface Fully open orifice size: 6.4 mm Set Pressure Range: 52 to 100 bar					Dk-lok/ Fitok	
74.	10	**Seamless Tubes:** Tube OD: 1/2" Pressure rating: 300 bar Material: AISI 304L As per std.		As per fluid circuit		As per fluid circuit	Sandvik/ Ratnamani / Tubacex	
75.	11	**Fittings:** Union, elbow, tee, reducers, cross, plugs, caps, bulk heads etc. Pressure rating: 300 bar Material: SS316 Size: as deemed necessary in order to suit the components interface.		As per fluid circuit		As per fluid circuit	Swagelok/Hamlet/ Dk-lok/ Fitok	
76.	12	**Gas cylinder connector (Bull nose & Adapter)** Material: SS316 as per IS 3224		4		4	Standard make	
77.	13	**Belt for gas cylinders (safety purpose)** Cylinder size: Ø 230 x 1400 mm height nominal		4		4	Standard make	
78.	14	**Structure to support 4 cylinders along the wall** Cylinder size: Ø 230 x 1400mm height nominal		1		1 sets	Standard make	

79.	Testing of Panel components till regulator inlet shall be 225bar. Hence the rating for these components shall encompass the test pressure of 225bar. Industrial standard providing above 225bar shall be chosen for these components. Testing of Panel components after regulator outlet shall be at 90 bar.	
80.	**A. Digital display of pressures from Panels:**	
81.	1. Digital pressure gauges along with analogue gauges (specified in the table 2 & table 4) is desired.	
82.	2. Qty for Gas distribution & Boosting panels: 6nos.	
83.	3. Specification:	
84.	1. Type: Gauge Pressure	
85.	2. Accuracy: 0.1% FS	
86.	3. Mounting: Vertical position	
87.	4. Adjustment: Offset and span factor adjustable	
88.	5. Memory: Integrated data logger	
89.	6. Mean value interval: adjustable	
90.	7. Measuring rate better than 50/s	
91.	8. Battery status display	
92.	9. Backlighting	
93.	4. Digital display of the pressure readings from each panel shall be transmitted to the other side of room (Hall of SSL) as follows.	
94.	 PD: Pressure Reading Display	
95.	**B. Pressure display from various panels:**	
96.	Pressure sensor display details from Gas distribution panels Fig-3 & Fig-4.	

	Inlet	Regulated
GN2	PG1	PG2
GHe	PG3	PG4

	Gas boosting Output Fig-6	
GN2		PG-3
GHe		PG-2

97.	Readings from Digital Pressure gauges of various panels to be displayed in the SSL hall.	
98.	Pressure indicator to have: Units in bar.	
99.	Corresponding Unit Resolution: up to first decimal point	
100.	Accuracy: ≤0.2% FS	
101.	**2.2 Compressed Air Distribution Panel**	
102.	The compressed air distribution panel is located inside Gas Distribution Room. It is connected to air compressor as shown in fluid circuit Figure 5. The panel shall supply compressed air to POU panel through 1/2" SS tubes. Bill of materials is mentioned in Table -3. The panel shall be realized as per the following points.	
103.	**2.2.1 Technical Description**	
104.	a) The operating pressure for the compressed air distribution panel fluid circuit is 15 bar.	
105.	b) The panel shall be connected to air compressor through isolation valves and SS braided flexible hoses.	
106.	c) The panel structure shall be made of SS304 sheets and frame.	
107.	d) The panel shall be of pedestal mounted. Stability of panel shall be ensured and it shall be properly anchored to the ground.	
108.	e) The panel shall house the flow components as per fluid circuit shown in Figure 5.	
109.	f) Table-3 gives list of components, brief specifications, recommended make and quantity for compressed air distribution panel.	
110.	g) The fluid circuit shall be realized with 1/2" OD (as per std) annealed seamless SS304L tubes, suitable fittings and flow components as per details provided in Table 3.	
111.	h) All the valves, pressure gauge, pressure display shall be assembled on the front side aesthetically.	
112.	i) Vendor shall optimally design the panel sizes while considering future maintenance activities. Vendor shall submit the design to LPSC and approval shall be obtained prior to commencement of fabrication/assembly.	
113.	j) All tube joints shall be welded by orbital TIG welding with 100% fusion construction except component interfaces, which shall be provided with double compression ferrule type tube fittings. All the welded joints to be Fluorescent Penetrant (FP) tested.	

114.	k) The fluid circuit shall be proof pressure tested at 23 bar (1.5 times of 15 bar) and leak tested (Bubble leak method with helium) at operating pressure 15 bar.				
115.	l) Schematic drawing of the fluid circuit shall be provided on front side with clear identification of components at their respective location. Also, the valve operating positions like open/close shall be marked by means of good quality stickers.				
116.	**Table 3:** Bill of materials for compressed air distribution panel				
117.	**<u>Compressed Air Distribution Panel</u>** **Location**: Gas Distribution Room **Operating Pressure**: 15 Bar **Qty**: 1 No. **Panel structure material:** SS304 **Fluid Circuit:**				
118.	**S. No**	**Details &Specifications of components**	**Qty (Nos.)**	**Make**	
119.	1	**SOV-1 to SOV-4** **Shut-Off Valve** Type: Ball valve Pressure Rating: 30 bar Material: SS316 Interface: 1/2"	4	Swagelok/Hamlet/ Dk-lok/ Fitok	
120.	2	**SS braided flexible hoses** Pressure Rating: 60 bar Core: PTFE Interface: 1/2" Length: 3 meters	1	Titeflex/ Swagelok/ Hamlet	
121.	3	**PG** **Bourdon tube pressure gauge** Bourdon tube material: SS316 Range: 0-30 bar Resolution: 0.5 bar Accuracy: ±1% FSO Dial size: 6”	1	WIKA/ Ashcroft	
122.	4	**RV** **Relief valve** Pressure Rating: 60 bar Body material: SS 316 Interface size: 1/2 “interface Set Pressure Range: 5 to 15bar	1	Swagelok/Hamlet/ Dk-lok/ Fitok	
123.	5	**Seamless Tubes** Tube OD: 1/2" x 0.065” wall thickness, ASTM A269 equivalent	As per fluid circuit	Sandvik/ Ratnamani / Tubacex	

		Material: SS304L			
124.	6	**Fittings:** Union, elbow, tee, reducers, cross, plugs, caps, bulk heads etc. Pressure rating: 30 bar Material: SS316 Size: as deemed necessary in order to suit the components interface.	As per fluid circuit	Swagelok/Hamlet/ Dk-lok/ Fitok	
125.	Since the proof pressure testing for this circuit is 1.5x 15bar, pressure rating of all components at 30bar is desired.				
126.	**2.3 High Pressure gas cylinders**				
127.	8 nos of cylinders are to be located in Gas cylinder room along the wall- 4 nos each for GHe and GN2 shall be supplied by the party and arranged as per safety protocols. A common valve (Three-way) connects boosted gas from gas booster outlet to high pressure cylinders -either GHe or GN2 placed on either side of panel. The connection of cylinders is shown in Booster connection Panel in Figure 6.				
128.	**S. No**	**Details &Specifications of components**	**Qty (Nos.)**	**Make**	
129.	1	**High Pressure Empty gas cylinders for GHE** Operating pr: 300bar Capacity: 50L Material: Chrome Moly Steel	4	EKC/Linde/ Luxor	
130.	2	**High Pressure Empty gas cylinders for GN2** Operating pr: 300bar Capacity: 50L Material: Chrome Moly Steel	4	EKC/Linde/ Luxor	
131.	3	**Gas cylinder connector (Bull nose & Adapter)** Material: SS316 as per IS 3224 Interface: ½" OD	8	Standard make	
132.	4	**Belt for gas cylinders (safety purpose)** Cylinder size: Ø 230 x 1400 mm height nominal	8	Standard make	
133.	5	**Structure to support 4 cylinders along the wall**	1 set	Standard make	

		Cylinder size: Ø 230 x 1400mm height nominal			
134.	**Specification of Empty Seamless steel cylinder**				
135.	**Technical data**				
136.	Water capacity	Min 50.0 liter			
137.	Cylinder Valve	Brass Valve with Butterfly knob for opening			
138.	Proof pressure	450 bar			
139.	Working pressure	300 bar			
140.	Colour of body	Brown for Ghe & Gray with black band at top for GN2			
141.	Length	1200mm (Nominal) Without cap & valve			
142.	Outside diameter	270mm (Nominal)			
143.	Neck ring & Cap	Fitted			
144.	Specification of cylinders shall adhere to IS 7285 (Part 2): 2004				
145.	Neck Threading: IS 3224:2002, 25.4mm, 14 TPI, Type 4, Size 2, Taper-1:8				
146.	Fabrication method of cylinders to include				
147.	• Hot spinning Process				
148.	• Heat Treatment: Hardened, Quenched and Tempered				
149.	Test to be carried out on Cylinders:				
150.	Visual Inspection				
151.	Hydrostatic Stretch Test (Test pressure 450 bar)				
152.	Air leakage Test (Test pressure 300 bar)				
153.	Hardness Test				
154.	Ultrasonic Test				
155.	Measured Water capacity of cylinder				
156.	Wall thickness measurement of Wall & Base				
157.	Minimum value of parameters:				
158.	a. Yield Stress: 840 MPa min				
159.	b. Tensile Test: 990-1100 MPa				
160.	c. Elongation (%) : 14 min				

161.	d. Hardness: 265-330 BHN	
162.	e. Impact Test Charpy (V) -20C Transverse direction:	
163.	f. Individual: 32 J/cm2	
164.	g. Average: 40 J/cm2	
165.	**Other Instructions**	
166.	i. Identification nos shall be embossed on each cylinder.	
167.	ii. Party shall provide necessary test results & inspection/acceptance certificate for each cylinder.	
168.	iii. PESO certification for each cylinder shall be provided.	
169.	iv. Party shall provide necessary Helium gas filling permission certificate from dept of explosives-Govt. of India for each cylinder.	
170.	**2.4 Boosting Control Panel**	
171.	Boosting Control panel is located in Gas Distribution room as shown in the layout (Figure-2). Fluid circuit of boosting control panel is shown in Figure 6. List of components and specifications are provided in Table-4 for Control Panel. The Control Panels shall be designed, fabricated, assembled, tested and supplied as per the following points.	
172.	**2.4.1 Technical Description**	
173.	(a) The panel has two inlets from set of GN2 and GHe each.	
174.	(b) Gas Inlet to the panel shall be connected to respective gas supply line coming from Gas distribution panels-GN2 & GHe. Both the gas inlets are connected to a Junction valve (3-way valve) after which the selected gas is passed to booster.	
175.	(c) Booster Panel connects Air compressor, Gas booster and high-pressure cylinders. Panel should be leg-mounted on ground in Gas distribution room and valves to be accessible from the main hall via a back-to-back panel. Gas booster to be located below the panel on ground for convenience of connection.	
176.	(d) Either of GHe or GN2 gas shall be boosted. From the Gas distribution panel, gas is sent to gas booster and outlet of gas booster is connected to high pressure cylinders of either GHe & GN2. Junction Valves (3-way valve) shall be provided at inlet and outlet of gas booster to select the gas source.	
177.	(e) Boosting Control panel consists of valves for gas selection, allow compressed air to booster, connection of gas and compressed air to gas booster, connection to high pressure cylinders.	
178.	(f) The panel has two paths for GN2 and GHe gases and boosting outlet distributed to high pressure cylinders of GHe & GN2 separately. The respective modules shall be connected with GN2 and GHe lines emerging from gas distribution panels.	

179.	(g) The panel structure shall be made of SS304 sheets and frame.			
180.	(h) The panel shall be of leg-mounted pedestal type while ensuring stability and it shall be properly anchored to the ground.			
181.	(i) The panel shall house the flow components as per fluid circuit shown in Figure 6.Table 4 provide list of components, brief specifications, recommended make and quantity for Control Panel respectively.			
182.	(j) The fluid circuit shall be realized with ½" OD tubes at inlet and after boosting 1/2" OD seamless SS304L tubes.			
183.	(k) All the pressure gauges, pressure transmitter display, regulators, valves shall be assembled on the front side aesthetically.			
184.	(l) Vendor shall optimally design the panel sizes while considering future maintenance activities.			
185.	(m) Vendor shall submit the design to LPSC and approval shall be obtained prior to commencement of fabrication/assembly.			
186.	(n) Schematic drawing of the fluid circuit shall be provided on front side with clear identification of components at their respective location. Also, the valve operating positions like open/close shall be marked by means of good quality stickers.			
187.	(o) All tube joints shall be welded by orbital TIG welding with 100% fusion construction except component interfaces, which shall be provided with double compression ferrule type tube fittings. All the welded joints should be Fluorescent Penetrant (FP) tested.			
188.	**PRESSURE TESTING:**			
189.	(p) The fluid circuit till the booster shall be proof pressure tested at 225 bar (1.5 times of 150 bar) and leak tested (Bubble leak method with helium) at operating pressure 150 bar.			
190.	(q) The fluid circuit from booster outlet till HP cylinder inlet shall be proof pressure tested at **450 bar (1.5 times of 300 bar)** and leak tested (Bubble leak method with helium) at operating pressure 300 bar.			
191.	(r) Control panels are the interface between gas distribution system and high-pressure cylinders. Figure-6 details the circuit between booster and high-pressure cylinders.			
192.	Table 4: Bill of materials for Boosting Control Panel			
193.	**Boosting Control Panel** **Location**: Gas distribution room **Operating Pressure**: 50 bar max at inlet & 300bar at outlet.			

	Qty: 1 Panel **Panel structure material:** SS 304 **Fluid Circuit:** Figure 6				
194.	**S.No**	**Details & Specifications of components**	**Qty (Nos.)**	**Make**	
195.	1.	**Till Inlet to Gas Booster**			
196.	2.	**F-1** **Gas Filter** Type: Pleated Wire Mesh Filter Range: 10µ absolute Pressure Rating: 250 bar Body material: SS316 Mesh material: SS316 Interface: 1/2"	1	Swagelok/Norman/Classic	
197.	3.	**PG-1** **Bourdon tube pressure gauge** Bourdon tube material: SS316 Range: 0-300 bar Resolution: 1 bar Accuracy: ±1% FSO Dial size: 6” Interface: 1/2"	1	WIKA/ Ashcroft	
198.	4.	**SOV-11 & SOV-12** **Shut-Off Valve** Type: Ball valve Pressure Rating: 250 bar Material: SS316 Interface: 1/2"	2	Swagelok/Hamlet/ Dk-lok/ Fitok	
199.	5.	**JV-1** **3-Way Valve** Type: Ball valve Pressure Rating: 250 bar Material: SS316 Interface: 1/2"	1	Swagelok/Hamlet/ Dk-lok/ Fitok	

200.	6.	**JV-2** **3-Way Valve** Type: Ball valve Pressure Rating: 250 bar Material: SS316 Interface: 1/2"	1	Swagelok/Hamlet/ Dk-lok/ Fitok	
201.	7.	**Seamless Tubes** Tube OD: 1/2" x 0.065" wall thickness, ASTM A269 equivalent Material: SS304L Pressure rating: 400 bar	As per fluid circuit	Sandvik/ Ratnamani / Tubacex	
202.	8.	**Fittings** Union, elbow, tee, reducers, cross, plugs, caps, bulk heads etc. Pressure rating: 200 bar Material: SS316 Size: ½" as deemed necessary in order to suit the components interface.	As per fluid circuit	Swagelok/Hamlet/ Dk-lok/ Fitok	
203.	Proof pressure test of this part of the circuit shall be at 225 bar. Components of rating higher than this as per standard are to be chosen for installation.				
204.	**From Gas Booster till high Pressure cylinder inlets**				

205.	**S. No**	**Details &Specifications of components**	**Qty for GHe (Nos.)**		**Qty for GN2 (Nos.)**		**Make**	
206.	6	**Shut-Off Valve** Type: Ball valve Pressure Rating: 500 bar Material: SS316 Interface: 1/2"	**SOV-1 to SOV-5**	5	**SOV-6 to SOV-10**	5	Swagelok/ Hamlet/ Dk-lok/ Fitok	
207.	7	**Bourdon tube pressure gauge** Bourdon tube material: SS316	PG-2	1	PG-3	1	Wika/ Ashcroft	

		Range: 0-500 bar Resolution: 1 bar Accuracy: ±1% FSO Dial size: 6”						
208.	8	**Check Valve** Type: Spring poppet Pressure Rating: 500 bar Material: SS316 Interface: 1/2" Cracking Pr: 1/3 bar	CV-1	1	CV-2	1	Swagelok/Hamlet/ Dk-lok/ Fitok	
209.	9	**Relief valve** Pressure Rating: 500 bar Body material: SS 316 Interface size: 1/2“ interface Set Pressure Range: 250 to 300bar	RV-1	1	RV-2	1	Swagelok/Hamlet/ Dk-lok/ Fitok	
210.	10	T-Joint plugged with 1/2” interface	TJ	1	TJ	1	Swagelok/Hamlet/ Dk-lok/ Fitok	
211.	11	**Seamless Tubes** Tube OD: ½” as deemed necessary in order to suit the components interface. ASTM A269 equivalent Material: SS304L Pressure rating: 500 bar	As per fluid circuit				Sandvik/ Ratnamani / Tubacex	
212.	12	**Fittings** Union, elbow, tee, reducers, cross, plugs, caps, bulk heads etc.	As per fluid circuit				Swagelok/Hamlet/ Dk-lok/ Fitok	

		Pressure rating: 400 bar Material: SS316 Size: as deemed necessary in order to suit the components interface.			
213.	Proof pressure test of this part of the circuit shall be at 425 bar. Components of rating higher than this as per standard are to be chosen for installation.				
214.	**2.5 Point of Use (POU) Panel**				
215.	Two nos. of POU panels shall be located in the main hall of SSL; the locations are shown in layout (Figure-2). The panels have 4 circuits as per the fluid circuit shown in Figure 7 consisting of: 1. Regulated GN2 gas circuit 2. High Pressure gas (GN2) circuits 3. High Pressure gas (GHe) circuits 4. Compressed Air				
216.	Bill of materials is as per Table 5. The panel shall be realized as per following points.				
217.	**2.3.1 Technical Description**				
218.	a) The operating pressure for the POU panel fluid circuit is 50 bar for GN2, 300 bar for High Pressure module and 15 bar for compressed air module.				
219.	b) Inlet of each module shall be connected to respective gas supply lines.				
220.	c) The panel structure shall be made of SS304 sheets and frame.				
221.	d) The panel shall be of pedestal-mounted while ensuring stability and it shall be properly anchored to the ground.				
222.	e) The panel shall house the flow components as per fluid circuit shown in Figure 7.				
223.	f) Table 5 gives list of components, brief specifications, recommended make and quantity for POU panel.				
224.	g) The fluid circuit for GN2 regulated supply & High-Pressure module shall be realized with 1/2" OD seamless SS304L tubes, while compressed air module shall be realized with 1/2" OD seamless SS304L tubes. Suitable fittings and flow components shall be provided as per details mentioned in Table 5.				
225.	h) All the pressure gauges, regulator, valves shall be assembled on the front side aesthetically.				

226.	i) Vendor shall optimally design the panel sizes while considering future maintenance activities. Vendor shall submit the design to LPSC and approval shall be obtained prior to commencement of fabrication/assembly.				
227.	j) All tube joints shall be welded by **orbital TIG welding with 100% fusion** construction except component interfaces, which shall be provided with double compression ferrule type tube fittings. All the welded joints to be Fluorescent Penetrant (FP) tested.				
228.	**Proof tests for 4 circuits:**				
229.	k) The fluid circuit (GN2) shall be proof pressure tested at 75 bar (1.5 times of 50 bar) and leak tested (Bubble leak method with helium) at operating pressure 50 bar.				
230.	l) For High Pressure circuits (GN2 & GHe), max operating pressure is 300bar and Proof pressure to be tested is **425bar.**				
231.	m) For compressed air module, proof pressure shall be done at 8 bar followed by leak test at 5 bar operating pressure.				
232.	n) Schematic drawing of the fluid circuit shall be provided on front side with clear identification of components at their respective location. Also, the valve operating positions like open/close shall be marked by means of good quality stickers.				
233.	**Table 5:** Bill of materials for Point-of-Use (POU) Panel				
234.	**POU Panel** **Location**: Main Hall **Operating Pressure**: 50 Bar for GN2 regulated circuit, 300 bar for GN2 & GHe HP circuits, 15 bar for compressed air module. **Qty**:2 Panels **Panel structure material:** SS304 **Fluid Circuit: Figure 7**				
235.	**S. No**	**Details & Specifications of components**	**Qty per panel (Nos.)**	**Make**	
236.		**For GN2 Regulated circuit (1/2" interface & Fittings)**			
237.	1	**Shut-Off Valve** Type: Ball valve Material: SS316 Interface: 1/2" ID : Pressure Rating SOV-1: 200 bar SOV-2: 150 bar	2	Swagelok/Hamlet/ Dk-lok/Fitok	

238.	2	**NV-1 & NV-2** **Needle Valve** Material: SS316 Interface: 1/2" Pressure Rating: 150bar	2	Swagelok/Hamlet/ Dk-lok/ Fitok	
239.	3	**PG-1 & PG-2** **Bourdon tube pressure gauge** Bourdon tube material: SS316 Resolution: 1 bar Accuracy: ±1% FSO Dial size: 6” ID: Range PG-1: 0-200 bar PG-2: 0-50 bar	2	WIKA/ Ashcroft	
240.	4	**F-1, F-2, F-3** **Gas Filter** Range: 5µ absolute Pressure Rating: 100 bar Body material: SS316 Mesh material: SS316 Interface: 1/2"	3	Swagelok/ Norman/ Classic	
241.	5	**RV-1** **Relief valve** Pressure Rating: 100 bar Body material: SS 316 Interface size: 1/2“interface Set Pressure Range: 24 to 50 bar	1	Swagelok/Hamlet/ Dk-lok/ Fitok	
242.	6	**PR-1** **Pressure Reducing Regulator** Type: Spring loaded Venting: Self Venting Inlet pressure: 200 bar Outlet Pressure: 0 to 50 bar Cv: 0.20 Body material: SS 316	1	Tescom/GCE	
243.	7	T-joint with Plugged end interface: ½” thread with end flare	1	Swagelok/Hamlet/ Dk-lok/ Fitok	

244.	8	**Seamless Tubes** Tube OD: 1/2" x 0.065” wall thickness, ASTM A269 equivalent Material: SS304L Pressure rating: 200 bar	As per fluid circuit	Sandvik/ Ratnamani / Tubacex	
245.	9	**Fittings:** Union, elbow, tee, reducers, cross, plugs, caps, bulk heads etc. Pressure rating: 200 bar Material: SS316 Size: as deemed necessary in order to suit the components interface.	As per fluid circuit	Swagelok/Hamlet/ Dk-lok/ Fitok	
246.	**Proof pressure of this circuit is 75bar.**				

247.	**For High Pressure Module (1/2” interface & Fittings)**				
248.	**S. No**	**Details &Specifications of components**	**Qty per panel (Nos.)**	**Make**	
249.	1	**SOV-3 to SOV-6** **Shut-Off Valve** Type: Ball valve Material: SS316 Interface: 1/2" Pressure Rating :500 bar	4	Swagelok/Hamlet/ Dk-lok/ Fitok	
250.	2	**PG-3 & PG-4** **Bourdon tube pressure gauge** Bourdon tube material: SS316 Resolution: 1 bar Accuracy: ±1% FSO Dial size: 6” Range: 0-500 bar	2	WIKA/ Ashcroft	
251.	3	**F-4 & F-5** **Gas Filter** Range:10µ absolute Pressure Rating: 500 bar Body material: SS316 Mesh material: SS316	2	Swagelok/ Norman/ Classic	

		Interface: 1/2"			
252.	4	**RV-2 & RV-3** **Relief valve** Pressure Rating: 500 bar Body material: SS 316 Interface size: 1/4“interface Set Pressure Range: 260 to 330 bar	2	Swagelok/Hamlet/ Dk-lok/ Fitok	
253.	5	T-joint with Plugged end interface: ½” thread with end flare	1		
254.	6	**Seamless Tubes** Tube OD: **1/2" x 0.083”** wall thickness, ASTM A269 equivalent Material: SS304L Pressure rating: 500 bar	As per fluid circuit	Sandvik/ Ratnamani / Tubacex	
255.	7	**Fittings:** Union, elbow, tee, reducers, cross, plugs, caps, bulk heads etc. Pressure rating: 500 bar Material: SS316 Size: as deemed necessary in order to suit the components interface.	As per fluid circuit	Swagelok/Hamlet/ Dk-lok/ Fitok	
256.		**Proof pressure of this circuit is 425bar.**			
257.	**For Compressed Air Module (1/2” interface & Fittings)**				
258.	**S. No**	**Details &Specifications of components**	**Qty per panel (Nos.)**	**Make**	
259.	1	**SOV-7 to SOV-9** **Shut-Off Valve** Type: Ball valve Pressure Rating: 100bar Material: SS316 Interface: 1/2"	3	Swagelok/Hamlet/ Dk-Lok/ Fitok	
260.	2	**PG-5** **Bourdon tube pressure gauge** Bourdon tube material: SS316 Range: 0-20 bar Resolution: 0.5 bar Accuracy: ±1% FSO Dial size: 6”	1	WIKA/Ashcroft	
261.	3	**F-6**	1	Swagelok/	

		Gas Filter Range: 10µ absolute Pressure Rating: 100bar Body material: SS316 Mesh material: SS316 Interface: 1/2"		Norman/ Classic	
262.	4	**Seamless Tube:** Tube OD: 1/2" x 0.065" wall thickness As per std Pressure rating: 100 bar	As per fluid circuit	Sandvik/ Ratnamani / Tubacex	
263.	5	**Fittings:** Union, elbow, tee, reducers, cross, plugs, caps, bulk heads etc. Pressure rating: 100 bar Material: SS316 Size: as deemed necessary in order to suit the components interface.	As per fluid circuit	Swagelok/ Hamlet/ Dk-lok/ Fitok	
264.	**Proof pressure of this circuit is 30 bar.**				
265.	Table 6: Bill of materials for SS tubes and fittings for inter-connecting the panels				

266.	**S. No.**	**Details &Specifications of components**	**Qty**	**Make**	
267.	1	**SS Seamless Tubes** Tube OD: 1/2" x 0.065" wall thickness, ASTM A269 equivalent Material: SS304L Pressure rating: 400 bar	As per circuit and lab layout (Approximate length: 20m)	Sandvik/ Ratnamani / Tubacex	
268.	2	**SS Seamless Tubes** Tube OD: 1/2" x 0.083" wall thickness, ASTM A269 equivalent Material: SS304L Pressure rating: 400 bar	As per circuit and lab layout (Approximate length: 20m)	Sandvik/ Ratnamani/ Tubacex	
269.	3	**Isolation Valves** Type: Ball valve Pressure Rating: 200 bar Material: SS316 Interface: 1/2"	6 Nos.	Swagelok/Hamlet/ Dk-lok/ Fitok	

270.	4	**Fittings** Union, elbow, tee, reducers, cross, plugs, caps etc. Pressure rating: 200 bar Material: SS316 Size: as deemed necessary in order to suit the components interface.	As per fluid circuit	Swagelok/ Hamlet/ Dk-lok/ Fitok	
271.	Note: The length of SS tubes given is approximate. It may vary while installation at our site. The payment will be made on actual length after installation. Hence Vendor is requested to provide the offer per meter basis.				

272.	**2.6 Supply of Gas Booster System**			
273.	Gas Booster System Type		Compressed air operated. No electrical connections. Double acting gas booster.	
274.	Utility required		Compressed air at 6.0barg/100psig or higher	
275.	Suitable for gases		Nitrogen, Helium	
276.	Details of major components			
277.	**Sl No**	**Components**	**Specification**	
278.	1	Gas Booster Unit	• Air driven, two stage, double air head, balanced opposed piston type with non-lubricated gas sections. • Internal cooling with exhaust air to both gas ends. • Fitted with external Pilot modification. • Boosting outlet pressure shall be capable of 20,000 psi. **MAKE: HASKEL/HII**	
279.	2	Gas inlet filter	5micron nominal particulate filter (4500 psi max working pressure) **MAKE: BUTECH/NORMAN/CLASSIC/ DK-LOK**	
280.	3	Gas outlet filter	5micron nominal particulate filter (20000 psi max working pressure) **MAKE: BUTECH/NORMAN/CLASSIC/ DK·LOK**	
281.	4	Air pilot switch, Low inlet automatic cut-off	Spring set at 50 psig to 180 psig, decreasing (internally adjustable) **MAKE: HASKEL/HII**	

282.	5	Air pilot switch, High Outlet automatic cut-off	Spring set at 6000 psig to 20000 psig, increasing (externally adjustable) **MAKE: HASKEL/HII**	
283.	6	Safety relief valve	Spring set at 2000 psig to 20000 psig. **MAKE: HASKEL/HII**	
284.	7	Gas pulsation dampener	One to 1.3 Litre capacity, 20000 psi max working pressure. Proof pressure test at 40000psi **MAKE: HYSTAT/HII**	
285.	8	Outlet non return valve	20000 psi max working pressure. **MAKE: BUTECH /SWAGELOK/PARKER/ DK·LOK**	
286.	9	Outlet high pressure gas regulator	Manual operated piston sensing In : 20,000 psi, out :20,000 psi **MAKE: TESCOM/ SWAGELOK/GCE**	
287.	10	Booster supply gas pressure gauge	4 inch dia, 0-3000 psi, solid front, full safety blowout back **MAKE: DE-WIT/WIKA/ HEISE**	
288.	11	Booster discharge gas pressure gauge	4 inch dia, 0-20,000 psi, solid front, full safety blowout back, NI SPANC tube end and SS Socket **MAKE: DE-WIT/WIKA/ HEISE**	
289.	12	Regulated outlet gas pressure gauge	4inch dia, 0-20,000 psi, solid front, full safety blowout back **MAKE: DE-WIT/WIKA/ HEISE**	
290.	13	Drive air control system comprising of Make: LEGRIS/ Festo/ WIKA/	Drive air filters,	
291.			Drive air pressure regulator	
292.			Air pressure gauge	
293.			On/ OFF cycling speed control valves	
294.	14	Frame arrangement (1170mm x 370mm x 620mm)	All duly piped and fitted in a steel frame with sloping gauge panel as per standard arrangement. Note: Frame outer dimensions as per figure-I with mounting at bottom.	
295.	Each part entered in to the system should have certificate from origin source and country.			
296.	**Warranty period: One year from the date of supply of equipment and an extended warranty for one year.**			
297.	**Installation and Commissioning:** All the equipment supplied by the supplier shall be installed, commissioned and demonstrated for satisfactory performance at LPSC (Bangalore) site.			
298.	**Training:** The day-to-day operation training to be provided by the supplier or their authorized representatives at LPSC (Bangalore) site			

299.	**Documentation:** The operating and maintenance manual, calibration certificate and warranty certificate shall be provided by the supplier.	

300.	**Chapter-4 List of Spares**	
301.	Technical specification of the spares shall be submitted in part-A of the bid. The price of the spares shall be quoted separately from the rest of the items in part-B of the bid.	
302.	**1. List of Spares: Valves, Gauges, Regulator and Filters for Gas distribution Panel**	

303.	**Operating Pressure**: 150 Bar Fluid Circuit: Refer Figure-3 & 4		**Spares for Gas distribution Panels**		
304.	**S No**	**Details &Specifications of components**	**Qty**	**Make**	
305.	1	**Shut-Off Valve** Type: Ball valve Pressure Rating: 250 bar Material: SS316 Interface: 1/2"	5	Swagelok/ Hamlet/ Dk-lok/ Fitok	
306.	2	**Check Valve** Type: Spring-poppet Pressure Rating: 250 bar min. Material: SS316 Interface: 1/2"	2	Swagelok/Hamlet /Dk-lok/ Fitok	
307.	3	**SS braided flexible hoses** Pressure Rating: 250 bar min. Core: PTFE Interface: 1/2" Length: 2 meters	2	Titeflex / Swagelok / Hamlet	
308.	4	**Bourdon tube pressure gauge** Bourdon tube material: SS316 Range: 0-250 bar Resolution: 1 bar Accuracy: ±1% FSO Dial size: 6” Interface: ½” M BSP	1	WIKA/ Ashcroft	
309.	5	**Bourdon tube pressure gauge** Bourdon tube material: SS316 Range: 0-100 bar Resolution: 1 bar Accuracy: ±1% FSO Dial size: 6” Interface: ½” M BSP	1	WIKA/ Ashcroft	
310.	6	**Gas Filter** Type: Pleated Wire Mesh Filter Range: 20µ absolute Pressure Rating: 250 bar Body material: SS316	1	Swagelok/ Norman/ Classic	

		Mesh material: SS316 Interface: 1/2"			
311.	7	**Gas Filter** Type: Pleated Wire Mesh Filter Range: 10µ absolute Pressure Rating: 250 bar Body material: SS316 Mesh material: SS316 Interface: 1/2"	2	Swagelok/ Norman/ Classic	
312.	8	**Relief valve** Pressure Rating: 250 bar Body material: SS 316 Interface size: 1/2 “interface Fully open orifice size: 6.4 mm Set Pressure Range: 52 to 100 bar	1	Swagelok/Hamlet / Dk-lok/ Fitok	
313.	9	**Pressure Reducing Regulator** Type: Spring loaded regulator Venting: Self Venting Inlet pressure: 300 bar Outlet Pressure: 0 to 60 bar Cv: 2 Body material: SS 316 Interface: 1/2"	1	Tescom/ GCE	

314.	**2.List of Spares: Valves and Gauges for Compressed Air distribution Panel**				
315.	**Compressed Air Distribution Panel** **Operating Pressure**: 15 Bar **Fluid Circuit: Figure-5**				
316.	**S. No**	**Details & Specifications of components**	**Spares (Nos.)**	**Make**	
317.	1	**Shut-Off Valve** Type: Ball valve Pressure Rating: 30 bar Material: SS316 Interface: 1/2"	1	Swagelok/ Hamlet/ Dk-lok/ Fitok	
318.	2	**SS braided flexible hoses** Pressure Rating: 60 bar Core: PTFE Interface: 1/2" Length: 3 meters	1	Titeflex/ Swagelok/ Hamlet	
319.	3	**Relief valve** Pressure Rating: 60 bar Body material: SS 316 Interface size: 1/2 “interface Set Pressure Range: 5 to 15bar	1	Swagelok/ Hamlet/ Dk-lok/ Fitok	

324.	**3.List of Spares for High Pressure gas cylinder bank**				
325.	**S. No**	**Details & Specifications of components**	**Spares (Nos.)**	**Make**	
326.	1	**High Pressure Empty gas cylinders for GHE** Operating pr: 300bar Capacity: 50L Material: Chrome Moly Steel	2	EKC/Linde/ Luxor	
327.	2	**High Pressure Empty gas cylinders for GN2** Operating pr: 300bar Capacity: 50L Material: Chrome Moly Steel	2	EKC/Linde/ Luxor	
328.	3	**Gas cylinder connector (Bull nose & Adapter)** Material: SS316 as per IS 3224 Interface: ½" OD	2	Standard make	
329.	4	**Belt for gas cylinders (safety purpose)** Cylinder size: Ø 230 x 1400 mm height nominal	2	Standard make	
330.	**4.List of Spares: Valves and Gauges for Boosting Control Panel**				
331.	**Boosting Control Panel** **Operating Pressure**: 150 bar max at inlet & 300bar at outlet. **Fluid Circuit:** Figure 6				
332.	**S. No**	**Details &Specifications of components**	**Spares (Nos.)**	**Make**	
333.		**Inlet to Gas Booster**			
334.	1	**3-Way Valve** Type: Ball valve Pressure Rating: 250 bar Material: SS316 Interface: 1/2"	1	Swagelok/ Hamlet/ Dk-lok/ Fitok	
335.	2	**Shut-Off Valve** Type: Ball valve Pressure Rating: 250 bar Material: SS316 Interface: 1/2"	1	Swagelok/Hamlet/ Dk-lok/ Fitok	
336.		**From Gas Booster till high Pressure cylinder inlets**			

337.	6	**JV-2** **3-Way Valve** Type: Ball valve Pressure Rating: 500 bar Material: SS316 Interface: 1/2"	1	Swagelok/Hamlet/ Dk-lok/ Fitok	
338.	7	**Shut-Off Valve** Type: Ball valve Pressure Rating: 500 bar Material: SS316 Interface: 1/2"	2	Swagelok/ Hamlet/ Dk-lok/ Fitok	
339.	8	**Bourdon tube pressure gauge** Bourdon tube material: SS316 Range: 0-500 bar Resolution: 1 bar Accuracy: ±1% FSO Dial size: 6”	1	WIKA/ Ashcroft	
340.	9	**Check Valve** Type: Spring poppet Pressure Rating: 500 bar Material: SS316 Interface: 1/2" Cracking Pr: 1/3 bar	1	Swagelok/Hamlet/ Dk-lok/ Fitok	
341.	10	**Relief valve** Pressure Rating: 500 bar Body material: SS 316 Interface size: 1/2“interface Set Pressure Range: 250 to 300bar	1	Swagelok/ Hamlet/ Dk-lok/ Fitok	
342.	**5.List of Spares: Valves and Gauges for Point-of-Use Panel**				
343.	**POU Panel** **Operating Pressure**: 50 Bar for GN2, 300bar for GHe module, 15 bar for compressed air module. **Fluid Circuit:** Figure 7				
344.	**S. No**	**Details & Specifications of components**	**Spares (Nos.)**	**Make**	
345.	**For GN2 Module (1/2” interface & Fittings)**				
346.	1	**Shut-Off Valve** Type: Ball valve Material: SS316 Interface: 1/2" Pressure Rating: 200 bar	1	Swagelok/ Hamlet/ Dk-lok/Fitok	

347.	2	**Needle Valve** Material: SS316 Interface: 1/2" Pressure Rating: 150bar	1	Swagelok/ Hamlet/ Dk-lok/ Fitok	
348.	3	**Bourdon tube pressure gauge** Bourdon tube material: SS316 Resolution: 1 bar Accuracy: ±1% FSO Dial size: 6”	1 no. each of PG-1: 0-200 bar PG-2: 0-50 bar	WIKA/ Ashcroft	
349.	4	**Gas Filter** Range: 5µ absolute Pressure Rating: 100 bar Body material: SS316 Mesh material: SS316 Interface: 1/2"	1	Swagelok/ Norman/ Classic	
350.	5	**Relief valve** Pressure Rating: 100 bar Body material: SS 316 Interface size: 1/2“interface Set Pressure Range: 24 to 50 bar	1	Swagelok/ Hamlet/Dk-lok/ Fitok	
351.	6	**Pressure Reducing Regulator** Type: Spring loaded Venting: Self Venting Inlet pressure: 200 bar Outlet Pressure: 0 to 50 bar Cv: 0.20 Body material: SS 316	1	Tescom/ GCE	
352.	**For High Pressure Module (1/2” interface & Fittings)**				
353.	1	**Shut-Off Valve** Type: Ball valve Material: SS316 Interface: 1/4" Pressure Rating: 500 bar	2	Swagelok/Hamlet/ Dk-lok/ Fitok	
354.	2	**Bourdon tube pressure gauge** Bourdon tube material: SS316 Resolution: 1 bar Accuracy: ±1% FSO Dial size: 6” Range: 0-500 bar	1	WIKA/ Ashcroft	

355.	3	**Gas Filter** Range:10µ absolute Pressure Rating: 500 bar Body material: SS316 Mesh material: SS316 Interface: 1/2"	1	Swagelok/ Norman/ Classic	
356.	4	**Relief valve** Pressure Rating: 500 bar Body material: SS 316 Interface size: 1/4“interface Set Pressure Range: 260 to 330 bar	1	Swagelok/ Hamlet/ Dk-lok/ Fitok	
357.	**For Compressed Air Module (1/2” interface & Fittings)**				
358.	1	**Shut-Off Valve** Type: Ball valve Pressure Rating: 100bar Material: SS316 Interface: 1/2"	1	Swagelok/Hamlet/Dk-Lok/ Fitok	
359.	2	**Bourdon tube pressure gauge** Bourdon tube material: SS316 Range: 0-20 bar Resolution: 0.5 bar Accuracy: ±1% FSO Dial size: 6”	1	WIKA/ Ashcroft	
360.	3	**Gas Filter** Range: 10µ absolute Pressure Rating: 100bar Body material: SS316 Mesh material: SS316 Interface: 1/2"	1	Swagelok/Norman//Classic	

361.	**Chapter-5: Acceptance Criteria & Other Relevant Information**	
362.	Final acceptance will be based on installation at our site in LPSC and successful functional testing and performance demonstration of all the components and subsystems of gas distribution system to satisfactory level in the presence of LPSC engineers as per following.	
363.	**5.1 Pre-Delivery Inspection (Factory Acceptance Test – FAT)**	
364.	a) Physical verification for all components and subsystems for the facility as per bill of materials.	
365.	b) Verification of the material & equipment test reports.	
366.	c) Visual inspection & Dimensional inspection of panels.	
367.	d) Proof pressure test of panel of each type (at 1.5 times MEOP)	
368.	e) Leak test (by snoop solution) at MEOP of one panel of each type.	
369.	f) Completeness of all deliverables.	
370.	g) The PDI/ FAT shall be carried out at suppliers site/ factory by LPSCB representatives. Supplier shall inform one week in advance for PDI.	
371.	**5.2 Documents Requirement**	
372.	a) Drawings of all the panels.	
373.	b) Complete Gas distribution system and boosting system (including high pressure cylinder network) layout drawings.	
374.	c) Datasheets and details of all components such as valves, pressure gauges, pressure regulators, filters, tubes and fittings, etc.	
375.	d) Calibration certificates of all measurement instruments such as pressure gauges etc. for a period of one year.	
376.	e) Three sets of detailed operation and maintenance manuals along with necessary drawings in hard and soft copy.	
377.	f) Certificate of FP test carried out on welds.	
378.	g) All other relevant documents.	
379.	**5.3 Post installation Acceptance testing at LPSC**	
380.	➢ Proof pressure testing of all panels and interconnections to be demonstrated.	
381.	➢ Boosting cycles to GHe & GN2 to be demonstrated	
382.	➢ POU panels demonstration for steady operation shall be demonstrated integrated to SSL lab test.	
383.	➢ Combined testing from two HP cylinders -one from each network shall be demonstrated wrt operation sequence and steady supply. Test will be connected to LPSC setup to draw the output.	
384.	**5.4 Warranty**	
385.	a) The entire gas distribution system, boosting system and other utilities shall be warranted for total performance and failure-	

	free operation for a minimum period of 12 months from date of final acceptance of system by LPSC.	
386.	**5.5 General Conditions**	
387.	a) LPSC will supply Nitrogen, Helium, air compressors (with Receiver Tank) for testing. Hence the supplies of these items are not part of the scope of work.	
388.	b) All supplied assemblies/systems and components shall be state-of-the-art technology.	
389.	c) Third Party inspection certificate for the raw material procurement shall be provided.	
390.	d) Fabrication, assembly of all the panels shall be done based on approval from LPSC.	
391.	e) The drawings and layouts of gas distribution system and boosting & high-pressure cylinder network shall be approved and cleared by LPSC before the start of realization.	
392.	f) Spare items mentioned in bill of materials shall be supplied along with delivery of other items.	
393.	g) All the tubes and fittings used for realization of gas distribution, boosting & high-pressure cylinder network shall be pre-cleaned and passivated. Certificate for the same shall be provided.	
394.	h) All the tubes and fittings to be procured as per ASTM standards and material test certificates shall be provided to LPSC.	
395.	i) Use of standard/recommended fabrication and assembly procedures and construction practices shall be adopted.	
396.	j) High quality workmanship using well trained, well qualified certified personnel and well supervisory manpower shall be employed.	
397.	k) **Detailed technical specification including make, model no., part number** shall be provided by party for all the equipment/components.	
398.	l) Calibration certificates of all measuring instruments, such as pressure gauges, pressure transmitters, mass flow meters etc. shall be provided.	
399.	m) During execution of work, changes (which lead to improvements) suggested by the party or LPSC shall be implemented with mutual agreement.	
400.	n) The party shall arrange necessary support equipment, tools, machines, accessories etc. LPSC would not provide any such items.	
401.	o) All necessary safety precautions shall be taken by party during execution of work and also party is responsible for personal safety of the work force engaged by party for this project.	
402.	p) Parties can visit the site in existing SSL in LPSC-Bengaluru before submitting the offer.	
403.	q) Vendor shall provide the cost breakup for equipment / components and execution / installation and testing cost separately along with offer (Quotation).	

404.	r) Subcontracting if any, shall be intimated in advance to LPSC and prior permission shall be obtained.			
405.	**5.6 Delivery Schedule**			
406.	a) The delivery schedule for supply, installation and commissioning of gas distribution and boosting & high-pressure cylinder network along with utilities shall be **9 months from the placement of purchase order.**			
407.	T_0 is date of purchase order placement.			
408.	**S. No**	**Description**	**Time period (Months)**	
409.	1	Approval of Panel and layout Drawings	T_0+2	
410.	2	Procurement of all major items, fabrication of panels	T_0+6	
411.	3	Pre-despatch inspection by LPSC & FAT, Delivery and transportation to LPSC	T_0+7	
412.	4	Installation, commissioning & Acceptance at LPSC	T_0+9	
413.	Total time for completion = **9 months**			
414.	b) The gas distribution system, boosting & high-pressure cylinder network along with utilities shall be supplied, installed and commissioned at System Simulation Laboratory, LPSC-B.			

415.	**PART-B: COMMERCIAL TERMS & CONDITIONS**	
416.	**1. Price**	
417.	The prices are FIRM and FIXED. On receipt of order, Vendor has to prepare detailed work break-up and schedule chart (in consultation with LPSC) and submit to LPSC for our acceptance.	
418.	**2. Security Deposit**	
419.	The party shall submit the security deposit for the performance of the contract, equivalent to 3% of the total order value in the form of bank guarantee or either form of negotiable instrument, issued by a nationalized or scheduled bank in a Rs. 500 non-judicial stamp paper. This security deposit will be returned (interest free) after the successful completion of the ordered contract. The security deposit shall have a further claim period of 6 months.	
420.	**3. Warranty**	
421.	The total system shall be warranted for total performance and failure-free operation for a period of 12 months from date of final acceptance of system by LPSC/ISRO.	
422.	**4. Performance Bank Guarantee (PBG)**	
423.	To cover the warranty period of 12 months, the party shall submit the performance bank guarantee for the performance of the vacuum system operation, equivalent to 3% of the total order value in the form of bank guarantee or either form of negotiable instrument issued by a nationalized or scheduled bank in a Rs. 500 non-judicial stamp paper. This PBG (interest free) will be returned after the successful completion of the warranty period. The PBG shall have a further claim period of 6 months.	
424.	**5. Liquidated Damages**	
425.	As per the Delivery Schedule mentioned is the essence of the contract\order, in case if you fail to deliver the item within the time specified or any extension thereof. Liquidated damages at 0.5% (Zero Point Five Percent) of the order value or part thereof of the undelivered item for each calendar week of delay shall be recovered from your bill. However, total LD shall not exceed 10% (Ten Percent of the Order Value).	
426.	**6. Arbitration**	
427.	Dispute if any shall be settled mutually, failing which it will be referred to a One Man arbitrator appointed by Director, LPSC in accordance with the Indian Arbitration and Conciliation Act 1996, whose decision shall be final and binding on both the parties. In case of import supply, the Arbitration shall be applicable as per International Chamber of Commerce.	
428.	**7. Jurisdiction**	
429.	The Courts in the City of Bangalore alone shall have jurisdiction to deal with and decide any matter or dispute whatsoever arising out of this agreement including those arising under the Arbitration Act.	
430.	**8. Force Majeure**	
431.	If at any time during the continuance of the order the performance in whole or in part by either Contractor of any obligation under this order shall be prevented or delayed by reasons of any war, hostility, acts of public enemy, civil commotion, sabotage, fire, floods, epidemic, quarantine restrictions,	

	strikes, go-slow, lockout or acts of God, notice of which is given either Contractor to the other within 21 days from the date of occurrence thereof, neither Contractor shall be reasons of such eventuality be entitled to terminate this order nor shall either Contractor have any claim for damages against the other in respect of such non-performance or delay in performance.	
432.	**9. Secrecy**	
433.	The drawings and documents sent along with this tender form part of vital documents and same should be kept on top secret. Under any situations, contractor should not part with or transfer the technology/contents of drawings and documents whatsoever to any 3rd party/agency without our prior consent. If at any time, it is brought to our notice that the secrecy has been transferred by you intentionally or otherwise to any third party /agency, contractor shall be liable to indemnify the loss/ damage to Government of India.	
434.	**10. Indemnity**	
435.	Contractor shall warrant and be deemed to have warranted that all the items supplied against this tender are free and clean of any infringement of any patent, copy right or trademark and shall at all times indemnify LPSC against all claims which may be made in respect of the items for infringement of any right protected by patent registration of design or trade mark and shall take all risk of accidents or damage which may cause a failure of the supply from whatsoever cause arising and the entire responsibility for the sufficiency of all the means used for executing the Purchase Order.	
436.	**11. Delivery**	
437.	Items shall be supplied and installed and site acceptance tested within **9 months** from the date of receipt of order. This delivery schedule is the essence of the order and shall be strictly complied with. Detailed Grant chart shall be provided to prove the same.	
438.	**12. Payment Terms**	
439.	100% payment shall be made after receipt of all items and installation, commissioning & acceptance at the site.	
440.	**13. Validity**	
441.	The quoted price should be valid for a period of 6 months from the date opening of the technical and commercial quotation.	
442.	**14. Heritage Clause**	
443.	Party should have executed similar works at aerospace industries. Details of similar project execution in ISRO or any Aerospace industries in India and reference of at least 2 installations during last 10 years to be provided. Enclose the completion/appreciation certificates from clients.	
444.	Party should have realised similar gas bank project at minimum of 80% value of quoted price of one work or 50% value of quoted price of two works or 30% value of quoted price of three works.	
445.	**15. General Conditions to The Vendors**	
446.	**15.1 Vendor Details**	

447.	The execution of the complete project is on turnkey basis as per the specifications and requirements deliberated in previous sections. The response to the tender is in the form of two separate offers, one as 'Technical offer' and other as 'Commercial offer'. Both the offers are to be submitted simultaneously.	
448.	In order to understand the vendors profile for execution of the project, following information shall be provided to LPSC along with the technical offer.	
449.	a) Profile of the company clearly bringing out the areas of strengths and weaknesses to supply the system of such nature.	
450.	b) Self-assessment of technical and organizational competence to supply the system of this nature and magnitude.	
451.	c) List of sub-contractors and major equipment suppliers for this project execution.	
452.	d) Local office in India or authorized Indian agents details to be provided for ease of project executions.	
453.	e) All necessary electrical and mechanical tools and hardware, material handling equipment etc. which are useful and necessary for assembly and efficient working of system, are under the scope of vendor's supply and the cost of the same shall be deemed to be included in the quote, whether specifically mentioned in the tender document or not.	
454.	f) Any material and labour which may be necessary to complete the work in accordance with the intent of the specification shall be furnished by the vendor without any extra cost.	
455.	g) Any modifications in the system till installation shall meet the technical specification of the tender document and prior approval to be obtained from LPSC. Further the modifications made shall be technically equal or superior w.r.t. to the original offer and should not have any additional cost implication.	
456.	**15.2 Pre-bid visit to existing facility**	
457.	Vendors shall attend pre-bid meeting to obtain necessary clarifications on specified date before submission of quotation. Vendors are permitted to visit the existing facility in LPSC-Bengaluru and obtain necessary clarifications on specified date before submission of quotation.	
458.	**15.3 Mode of Quoting**	
459.	The offers shall be submitted on two-part basis as follows: Technical & commercial (other than price) bid & Price bid. Also the validity of quotation shall be 6 months minimum from the date of quoting. The contractor chosen on the basis of suitability of techno-commercial merits will have to sign a contract with ISRO. The scope of contract will cover the turnkey execution of the total system as per terms enlisted in the contract document.	
460.		
461.	a) The quotation shall be based on fixed and firm price and no price escalation is permitted.	
462.	b) During the evaluation of technical bids alternatives/options/suggestions shall be confirmed in technical offer to meet the system specifications. As the contract is for fixed price, no	

	provision for addition/reduction in charges will be entertained after opening the price bid.	
463.	c) FIRM DELIVERY PERIOD After receipt of order shall be quoted taking into account of all contingencies.	
464.	d) Offer shall be valid for minimum six months from the due date.	
465.	e) LPSC/ISRO may incorporate specific provisions and conditions before ordering with mutual consent. These provisions will deal with delivery schedule, specifications, demonstration criteria, financial provision, quality control procedures, specific provisions relating to imported items, penalty clauses, etc.	
466.	f) Any information kept vague or not furnished shall be treated as non-compliance with the requirements of the vendor and hence tender are liable for rejection	
467.		
468.	**15.4 Following Documents Shall Be Submitted By The Vendor Along With Technical Offer (Part-A)**	
469.	**a)** Compliance matrix of each specification as given in this document.	
470.	**b)** List and details of non-compliance of specifications by the vendor if any.	
471.	**c)** Confirmation of scope of supply as given in this document by vendor.	
472.	**d)** Overall plan of project execution with details of facilities/capabilities available for timely completion of the project in all respects.	
473.	**e)** Preliminary system layout plan of the proposed gas distribution	
474.	**f)** List of imported items and source of supply shall be provided.	
475.	**g)** Specification of components, model number, data sheet and source of supply.	
476.	**h)** Information asked in Section 15.1 Vendor Details.	
477.	**i)** List of Indian associates or partners, consultants, subcontractors, major equipment suppliers, proposal to be involved in this project, the past experience, competence and extent of the involvement.	
478.	**j)** Details of utilities to be provided by LPSC/ISRO and time stages at which these are required by the contractor	
479.	**k)** Commercial Terms such as delivery date, taxes, duties payable, place of delivery, payment term, validity, guarantee etc. and scope of supply shall not be covered in this part. Please enclose a copy of the details indicated in price quotation *(WITHOUT PRICES OR BY MASKING THE PRICE)* mainly to know the items/ specifications for which you have indicated prices in price bid. **This part should not contain prices.**	
480.	**l)** The Technical and commercial part of the offer should be kept in a sealed envelope super scribing the following details:	
481.	**QUOTATION AGAINST TENDER NO** - _____ **DUE ON** _____ **GAS DISTRIBUTION SYSTEM AT LPSC, BENGALURU** **PART A – TECHNICAL & COMMERCIAL**	
482.	**15.5 Following Documents Shall Be Submitted Along with Price Bid (Part-B)**	

483.	a) The vendor responding to this tender, shall submit comprehensive price bid in a separate document meeting all the requirements specified therein.	
484.	b) This contract is proposed to be firm and fixed price contract and no price escalation will be permitted during the period of contract.	
485.	c) Vendor shall not be allowed to change any item from imported to indigenous or vice-versa without prior approval of LPSC (B) after Purchase Order is placed.	
486.	d) The Vendor is chosen on the basis of suitability of techno-commercial merits. The scope of contract will cover the turnkey execution of the total system.	
487.	e) Vendor shall furnish all details as called for in this chapter giving due justification. Any information kept vague or not furnished shall be treated as non-compliance with the requirements of the Vendor and hence tender is liable for rejection	
488.	**The offer should include the following documents:**	
489.	f) The total cost of the systems including fabrication, supply, installation, commissioning and testing.	
490.	g) Break up of various elements like design, direct material, direct labour, overheads, etc.	
491.	h) Price bid for spares listed in Chapter-4 Shall be given separately.	
492.	i) For all items, vendor shall furnish separate details like equipment cost in foreign currency, foreign exchange conversion rate, equipment cost in Indian rupees without, customs duty/Excise duty etc.	
493.	j) Transportation charges, taxes, government levies shall be specified separately.	
494.	k) Installation & commissioning charges shall be specified separately.	
495.	l) Acceptance to furnish warranty certificate for the period of 1 year, from the date of installation, commissioning and acceptance of the total system.	
496.	m) Performance bank guarantee for a minimum period of 12 months from the date of acceptance of the total system by LPSC/ISRO from a nationalized Bank.	
497.	n) Acceptance to the commercial clauses and conditions.	
498.	o) Any other information relevant to this tender.	
499.	p) This part should also be kept in a sealed cover super scribing as follows:	
500.	**QUOTATION AGAINST TENDER NO - _____** **DUE ON _____** **TEST FACILITY AT, LPSC, BENGALURU** **PART B – PRICE BID**	
501.	**16. Special Instructions to Tenderers for Submitting Two Part Tenders**	

502.	File No: ITEM: **Gas Distribution & Gas Boosting System at LPSC, Bengaluru Campus**	
503.	Please note the following instructions and submit your offer accordingly.	
504.	**(a) PART-I: TECHNO–COMMERCIAL** This part shall contain only the technical details and specifications together with technical catalogues. All commercial conditions shall also be indicated in this part. Deviations, if any, to our specifications shall be brought out very clearly. Tenderers shall mention point-wise confirmation with regard to Technical Specification and Commercial Terms & conditions (Techno-Commercial). Price details should not be shown in this part. This part shall contain the detailed technical specification and commercial terms such as delivery dates, taxes, duties payable, place of delivery, payment term, validity, warranty \guarantee etc. and scope of supply shall be covered in this part. Please enclose a copy of the details indicated in price quotation (without prices or by masking the price). Mainly to know the items/specifications for which you have indicated prices in price bid.	
505.	**(b) PART-II: PRICE PART** The part shall contain the PRICE details only. The prices for the item shall be indicated item wise in this part. All the items as per specifications mentioned in the technical part shall be included and prices shall be indicated against each item. The break up for each item of supply and services also shall be indicated Whenever options are quoted, same shall also be indicated with quantity and unit rate separately. The prices are to be mentioned both in figures and in words.	

warranty \guarantee etc. and scope of supply shall be covered in this part. Please enclose a copy of the details indicated in price quotation (without prices or by masking the price). Mainly to know the items/specifications for which you have indicated prices in price bid.

(b) PART-II: PRICE PART

The part shall contain the PRICES details only.

The prices for the item shall be indicated item wise in this part. All the items as per specifications mentioned in the technical part shall be included and prices shall be indicated against each item. The break up for each item of supply and services also shall be indicated

Whenever options are quoted, same shall also be indicated with quantity and unit rate separately. The prices are to be mentioned both in figures and in words.