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निविदा सूचना सं. TENDER NOTICE NO. SDSC SHAR/Sr.HPS/PT/RO-LSSF/14/2025-2026

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

क्र.सं. Sl No	संदर्भ सं. Ref. No.	विवरण Description	मात्रा Qty.
01.	SDSC SHAR /TLP PURCHASE /TLP/ 2026000192 [Public Tender - Two Part]	Realization of High Pressure and High Flow Rate Gaseous Oxygen (GOx) supply system at SDSC SHAR, Sriharikota along with spares.	03 Line items

निविदा दस्तावेजों को डाउनलोड करने की अंतिम तिथि Last Date for downloading of tender documents : 13.04.2026 at 14:00 hrs.
ऑनलाइन निविदा जमा करने की अंतिम तिथि Due Date for submission of bids online : 13.04.2026 at 14:00 hrs.
निविदाएं खोलने की नियत तिथि Due Date for opening of tenders : 13.04.2026 at 14:05 hrs.

निविदाकार के लिए निर्देश Instructions to Tenderers:

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

- कार्य के सम्पूर्ण विवरण/जानकारी तथा नियम व शर्तों इत्यादि के लिए संलग्न अनुलम्बक को देखें। / For full details/scope of work and terms and conditions etc., please see the enclosed annexures.
- इच्छुक निविदाकार इसरो की ई-खरीद वेबसाइट इसरो न्यू ई-प्रोक्यूरमेंट www.eproc.isro.gov.in से ई-निविदा डाउनलोड और अपनी निविदा ई-खरीद पोर्टल पर ऑनलाइन जमा कर सकते हैं। डाक / वाहक / स्वयं द्वारा प्राप्त निविदाओं पर विचार नहीं किया जाएगा। / Interested tenderers can download the e-tender from ISRO NEW E-PROCUREMENT website www.eproc.isro.gov.in and submit the offer online in the e-procurement portal. Offers sent physically by post/courier/in person will not be considered.
- निविदा दस्तावेज इसरो की वेबसाइट www.isro.gov.in इसरो न्यू ई-प्रोक्यूरमेंट वेबसाइट www.eproc.isro.gov.in तथा सतीश धवन अंतरिक्ष केंद्र शार की वेबसाइट www.shar.gov.in पर भी उपलब्ध हैं। इन्हें केवल ई-खरीद पोर्टल से डाउनलोड और निविदा ऑनलाइन जमा कर सकते हैं। / Tender documents are also available on ISRO website www.isro.gov.in, ISRO New e-procurement website www.eproc.isro.gov.in and SDSC SHAR, Sriharikota website www.shar.gov.in. The same can be downloaded and offer can be submitted online in the new e-procurement portal only.
- निर्धारित तिथि/समय के पश्चात प्राप्त बोलियों पर विचार नहीं किया जाएगा। / Quotations received after the due date/time will not be considered.
- वरि. प्रधान क्रय एवं भंडार, सतीश धवन अंतरिक्ष केंद्र श्रीहरिकोटा के पास किसी भी या सभी निविदाओं को स्वीकार / अस्वीकार करने का अधिकार है। / Sr. Head, Purchase and Stores, SDSC-SHAR, Sriharikota reserves the right to accept or reject any/or all the quotations.
- GeM GARPTS Report ID: GEM/GARPTS /05032026/LRGJ4HS62G50

दिनांक DT: 12.03.2026

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



GOVERNMENT OF INDIA
DEPARTMENT OF SPACE

**Request for Proposal
For Realisation of
High Pressure & High Flow Rate
Gaseous Oxygen (GOX) Supply
System**



**Third Launch Pad (TLP)
Project,
SDSC SHAR, Sriharikota,
524124**

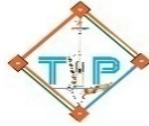
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1. Introduction:

Towards Lift-off environment simulation studies of the sub scaled rocket motors, a high-pressure gaseous oxygen supply system with high flow rate is required to be realized at SDSC-SHAR, ISRO, Sriharikota, Andhra Pradesh, which is located about 100km from North of Chennai.

For this sub scaled model testing, the gaseous oxygen is required to be supplied at 3.3Kg/s flow rate with 70bar pressure in three independent regulation paths simultaneously drawing ~10Kg/s from the common source of cylinder module as shown in the P&ID(**Annexure-29**). The details of the system are explained in the following sections of this document.

2. System Specifications:

S.No	System Description	Specification
1	Medium	Gaseous Oxygen (GOX)
2	Purity	>99.5%
3	Regulator outlet Pressure range	40 -70Bar
4	Delivery Temperature of gas	>298K
5	Total flow rate from source (Minimum)	10Kg/s
6	Maximum test duration	20seconds
7	Number of delivery paths	3Nos
8	Flow rate of each delivery path (Minimum)	3.3Kg/s
9	Maximum quantity to be supplied from source cylinders	200Kgs
10	Response time of the delivery electro pneumatic valve	<400ms
11	Existing source cylinders capacity (water capacity)	2 x 2000Litre (Department scope)
12	Source operating pressure range	250-150bar
13	Source common header pipe size (minimum)	65NB X 160SCH
14	Delivery pipe line size of each path (minimum)	50NB X 80SCH
15	Type of Flow measuring instrument of each path	Coriolis Mass flow meters for gas application
16	Maximum Valve size in the system	50NB
17	Maximum Pressure rating of flow components	2500#
18	Material of construction of pipes (MOC)	Monel
19	Material of construction of flow components	Monel /Brass/ equivalent material compatible with GOX as per technical specifications
20	Type of Pressure measurement	Pressure transmitter /transducer
22	Type of temperature measurement	Temperature transmitter
23	Material of construction of hoses	Monel / Inconel /Hastelloy C 22
24	Pneumatic supply for EP valve operation	8-10bar GN2

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25	Pressure regulation	By means of electronic regulators
26	Design pressure (Refer Annexure-29 for MOP)	a) 1.25x MOP if MOP≤100Bar b) 1.1x MOP if MOP>100Bar

3. Functional Requirements:

- a) Boosting of gas cylinder module of 2x2Cu.M water volume to 250bar pressure using booster Unit.
- b) Bleeding of the GOX through vent circuit just before the terminal point of the circuit and setting of the functional parameters up to stabilization to simulate forward flow resistance prior to supply to the test article.
- c) Supply of high-pressure gaseous oxygen (GOX) to sub scaled model test article drawing from cylinder module to a common header and through three independent regulation modules at the specified flow rate and pressure.
- d) Measurement of GOX pressure, temperature & flow during operation of the system for testing in all three paths as per the requirement.
- e) System electro pneumatic valves and electronic pressure regulators are to be operated remotely as per operational sequence and data related to the measurements of pressure, temperature, flow rate and valve status etc. shall have suitable interfaces to be acquired by a PLC system for control & monitoring through SCADA system. PLC & SCADA systems are in the scope of department.
- f) **Note: Instrumentation wiring from modules to till FJB is in the scope of supplier. However, the control system along with instrumentation wiring from FJB is in the scope of department.**
- g) The realized system shall meet the different test cases given in the **Table-1**.

Table 1: Different Test cases requirements

Test Cases	Path-1		Path-2		Path-3	
	Pr. bar(a)	Operating flow Rate kg/s	Pr. bar(a)	Operating flow Rate kg/s	Pr. bar(a)	Operating flow Rate kg/s
1.	70	3.0	70	3.0	70	3.0
2.	70	3.0	50	1.5	50	1.5
3.	70	3.0	-	-	-	-
4.	-	-	50	1.5	50	1.5

Note:

System is sized to service the maximum flow rate and minimum pressure of 50bar and hence other test cases are subset for sizing. However, system shall be tested for all the above four test cases during system performance tests as part of commissioning.

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4. System Configuration:

System is configured with existing high-pressure cylinder module connected by monel piping to three independent regulation paths through common header with required /necessary piping ,flow components and measurements to meet all the requirements of the system, modular approach is adopted to configure, fabrication, assembly and testing for the ease of the system supply and realization.

The following three modules are envisaged under modular approach towards supply and realization of high pressure GOX system at SDSC.

Module-1: GOX Cylinder Source, Piping and Booster Unit

Module-2: Pressure Regulation and Delivery Valve Unit

Module-3: Piping work to be carried out at SDSC SHAR

The major flow components / equipment of the system is booster unit, Pressure regulators, safety relief valves, electro pneumatic ball valves, globe valves, manual ball valves, filters, gauge shut-off valves, Monel piping, high pressure hoses and required measuring instruments like pressure & temperature transmitters, pressure gauges, and mass flow meters, etc...

Note: The supply of high-pressure cylinders is not under the scope of the vendor. However, the supply & installation of the cylinder valves & neck adapters to meet the functional requirement of the system is in the scope of the contractor.

Details of modules:

4.1. Module-1: GOX cylinder source, piping and Booster Unit

a) Cylinder Module:

In this module, the capacity of the GOX cylinders module is selected and configured to meet the requirement of two consecutive sub scale model tests without re-charging. Considering each sub-scale model test duration of 20 seconds and at the total consumption rate of 10kg/s, the mass of GOX for two tests is estimated as **400kg**. It is envisaged to supply the requirement on pressure depletion mode from **250bar to 150bar** in the cylinder module for two tests taking in to the account of pressure drop during sub scale model test. The required number of cylinders is estimated as 2 cylinders with 2Cu.M water capacity of each including the additional venting requirements. It is planned to use the existing cylinders at SDSC SHAR for this purpose and the same will be made available at site towards interfacing with the piping and commissioning of the system.

b) Gas Booster Unit:

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The cylinder module is planned to be charged from 150bar to 250bar using gas booster unit. The approximate quantity required to be boosted is 200kg with in the 40hours duration. Accordingly, booster capacity shall be selected and included in the scope of supply.

c) Cylinder Neck adaptors, Valves, and piping

Each cylinder is required to be equipped with a neck adaptor and outlet valve with minimum bore of 20mm to facilitate high flow rate requirements on both sides of the cylinders. The cylinder neck adaptors & outlet valves piping shall be connected to common headers of size 65NB on each side through a suitable adapter/ fittings and piping at SDSC SHAR as given below.

S.No	Description of location	Size & SCH	Length (m) (Approx.)
Cylinder neck to main header piping			
1	Cylinder piping to main header: (Outlet-1 to header, Outlet-2 to header, Outlet-3 to header, Outlet-4 to respective header) (Refer Annexure-29: P&ID)	25NBX160SCH	6m
2	Cylinder outlet header to interface I-1 (Refer Annexure-29: P&ID)	65NBX160SCH	25m

4.2. Module-2: Pressure regulation and Delivery Valve Unit

a. Pressure Regulation Unit

The pressure regulation unit consists of three paths for delivery of GOX at 3.0 kg/s at 70bar to sub scale model test simultaneously in three paths as per the P & ID. Also, it is envisaged that the delivery pressure for each path required to be varying from 50-70bar as per different test case requirements as mentioned in **Table-1** for test requirements of each path. However, each path is sized to deliver 3.3Kg/s and at outlet pressure range of 40 to 90bar. Each of these paths consists of on-off valve, 20micron filter, dome loaded pressure regulator with electronic regulator as pilot to dome regulator, a vent circuit with ON/OFF valve, pressure transmitter /transducer, safety valves and a Coriolis mass flow meter etc. Diameter of each path inlet and outlet pipe size is considered as minimum 50NB, however the common header size is 65NB. Oxygen compatibility material as mentioned in specification is selected as material of construction for pipes, tubes and wetted parts of all other flow components.

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b. Delivery Valve Unit:

The delivery valve unit consists of three paths, each of these paths required to deliver the maximum flow rate of 3 kg/s at minimum 70bar to the test article during the test. However, the system is designed for 3.3kg/s flow rate in each path considering 10% margin on actual flow rate of 3kg/s at 40bar. Each path consists of temperature sensor, pressure sensor/transducer, a vent/bleed valve (15NBX600#) circuit with on/off valve and an on/off delivery ball valve and size of each path shall be considered as 50NB to match with the respective path of pressure regulation unit and shall be terminated with required interface in the rig outlet. Oxygen compatibility material as mentioned in specification is selected as material of construction for pipes, tubes and wetted parts of all other flow components. However, Hastelloy C 22/Inconel shall be considered for instruments i.e. temperature sensor, pressure sensor etc.

Response time of ON & OFF for 50NBX600# valve shall be **<0.4 seconds**. Vent circuit in the downstream of ON/OFF valve outlet piping shall be extended up to **3 m above** the floor level towards venting of gaseous oxygen and circuit is to be terminated horizontally to avoid rain water entry into the circuit.

Both pressure Regulation and delivery valve units shall be combined and is made as a single unit with the **tentative dimensions of Height:1.8m x Width:1.5m x Length :2.5m(Approx.)** and shall be covered/ enclosed with **2.0 mm thick SS** sheet with doors provision as per requirement with suitable size considering accessibility for maintenance and replacement of the components.

However, the dimensions of the equipment may be varied after 3D modelling with the finalized component dimensions after review and approval.

4.3. Module-3: Piping work (Yard piping & outlet piping) to be carried out at SDSC SHAR

In this module, the piping shall be taken up at test facility (SDSC SHAR) and the scope is as mentioned below. **All pipes and pipe fittings required for fabrications are in the scope of the contractor**, Welding, testing (radiography, hydro), oxygen cleaning, conditioning and pneumatic testing and commissioning are included the scope of the contractor). All pipe and fittings shall be made of **Monel 400**.

S.No	Description of location (Refer Annexure-29: P&ID)	Size & schedule	Total Length (m) (Approx.)
Module 1 out let to Module 2 inlet			
1	Main common header to Module 2 Inlet (Between interfaces I-1 & I-2)	65NBX160SCH	55m



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Module 2 out let to outlet (hose inlet)

2	Module-2path1,2,&3 to respective hoses inlet Path 1 outlet interfaces :I-3 to I-4:17m Path 2 outlet interfaces :I-7 to I-8:17m Path 3 outlet interfaces I-11 to I-12:17m	50NBX80SCH	51m
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Hose outlet to test article

3	Outlets of hoses to Test article Path 1 Hose outlet interfaces: I-5 to I-6:9m Path 2 Hose outlet interfaces: I-9 to I-10: 9m Path 2 Hose outlet interfaces :I-13 to I-14:9m	50NBX80SCH	27m
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Note :

- a. The above mentioned quantities are only for supply to SDSC SHAR to make module 3 piping. However, Module 2 Piping and fittings shall be procured and fabricated at vendor premises as part of equipment realization
- b. Total length of the pipe to be supplied per each Sch /size is as specified above. However, total length for realization may be less than the supplied and the remaining pipes shall be handed over to SDSC SHAR after verification.
- c. Usage of equivalent/compatible material for fittings shall be subjected to department approval.

Note: Refer layout sketch for details on pipe length and location as per annexure 28

5. Scope of Contractor:

The major scope of work of supplier/contractor for establishing/realization of gaseous oxygen supply system is as follows:

- a) Supply of Pressure regulation and delivery valve unit (module-2) along with booster unit, monel pipes & required fittings to SDSC as per RFP specifications including Detailed engineering, procurement, fabrication & testing.
- b) Supply of spare flow components and spare kits as per Annexure-25.
- c) Erection & commissioning of high-pressure gaseous oxygen supply system at SDSC SHAR as per RFP specifications including laying, testing, Oxygen cleaning & fabrication of monel piping.

Towards realisation of high-pressure gaseous oxygen (GOX) supply system, the following flow components and equipment shall be procured and integrated for meeting the system specifications/requirements/objectives, but not be limited to:

- Gas cylinder's valves and neck adaptors (**Gaseous oxygen cylinder are not part of the supply**)
- Pressure regulators

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- Electronic pressure regulator
- Safety valves
- Ball valves
- Filters
- Coriolis mass Flow meters for gas flow measurement
- Pressure transducer/ pressure transmitter
- Temperature Transmitter
- Pressure gauges
- Manual Globe valves
- Monel Hoses
- Monel pipes and pipe fittings,etc...

The Supplier/Contractor shall review and confirm compliance with the RFP specifications and any deviations from the specified requirements must be clearly brought out with comprehensive reasoning during the tendering process for review & approval of the Department. Upon approval, the supplier/contractor is responsible for configuring, detailing, procuring, testing, qualifying, supplying, erecting, and commissioning the system to meet all functional requirements as outlined in the document.

5.1. Major activities of the contractor, but not be limited to:

- a. Verification of the Piping and Instrumentation Diagram (P&ID) and the schedule of components, including regulators, valves, pressure transducers (PTT), pressure transmitter (PT), temperature transducers (TT) and other relevant equipment ..etc
- b. Reviewing facility layout and conducting a site visit, if required.
- c. Preparation of isometric & fabrication drawings for the entire system in compliance with approved P&IDs and respective drawings provided in the tender document.
- d. Detailed Engineering of the system with associated interfaces& components (i.e. regulators, safety valves, temperature sensor, pressure sensor etc.)
- e. Procurement of pipes, pipe fittings, and machined fittings.
- f. Procurement of manual valves, EP ball valves, flow meters, and other instruments etc...
- g. Procurement of booster unit.
- h. Fabrication of modules at works/factory prior to dispatch to SDSC SHAR.
- i. Cleaning of pipe lines & other components for oxygen servicing.
- j. Qualification and Testing of modules 1 and 2 at factory as per the scope.
- k. Procurement & supply of spares flow components and spare kits as per [annexure 25](#)

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- l. Packing and Supply of prequalified modules 1 and 2 to site along with commissioning spares.
- m. Erection, testing of modules and piping for interconnections of all the system elements/modules at site including laying of command gas tubing/piping from existing department command gas header at site to module 2 inlet.
- n. Wiring and Cable laying within the pressure regulation & delivery unit (module 2) and extension up to field junction box (FJB) as per the site conditions
- o. The data cable shall be used for all the analog command and measurement channels. The individual shield of data cable shall be extended individually from each field element cable till analog command and measurement chain connectors in field junction box.
- p. The control cable shall be used for all the digital command and status monitoring channels. The overall shield of all control cable shall be extended individually from each field element cable till digital command and status chain connectors in field junction box
- q. Wiring of the module 2 has to be interfaced to the Field Junction Box (FJB) by means of cable glands and necessary terminal blocks
- r. Commissioning and qualification of High Pressure GOX supply system at SDSC.
- s. Deployment of TPIA to carry out inspection works as listed elsewhere in the RFP.
- t. The above listed works are not exhaustive and however, other items /sub-systems required for completeness of the system realization towards meeting the system functional requirements are also included in the contractor scope.
- u. All the structural members required for realization of the high-pressure gaseous oxygen supply system are under the scope of the contractor.
- v. All equipment and pipe supports shall be fabricated & erected as per the system requirement including anchoring requirements.
- w. All the pipe clamps required for routing is under the scope of the contractor.
- x. All equipment name plates and tagging shall be in the scope of supplier.
- y. Equipment general arrangement drawings shall be provided with overall dimensions (size, weight, handling provision etc.).
- z. All pipelines shall be painted as per color coding given by department.
- aa. All mechanical mating connectors shall be sent along with items.
- bb. Any item/works not listed here but are required to make the system complete in all respects for its safe operation and system functional requirements are also included in the supplier scope

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5.2. Detailed engineering

Detailed engineering work shall commence immediately after the award of contract. The Contractor shall present comprehensive detailed engineering and development details of equipment and flow components including all external and internal interfaces of the system. The detailed engineering document shall be submitted to the department for review and approval. Implementation shall be only after incorporating all the recommendations provided by the department.

The Contractor shall prepare and submit the following documents during the detailed engineering phase for review and approval by the Department:

- a) Specifications of piping, equipment & flow components, data sheets, make & model of each element & quality assurance plans (QAP) for all the fabricated, bought out items to be supplied for the system.
- b) Piping drawings for entire system as per the facility layout.
- c) 3D modeling of all equipment by using piping modeling software such as plant 3D or any other equivalent packages. 3D modeling shall include the structural support for piping and equipment.
- d) Fabrication drawings for each module with bill of materials.
- e) Wiring diagram showing cable connection from instruments to Field Junction Box.
- f) Typical test procedures are provided in [Annexure-27](#) as guidelines. Considering these guidelines, the contractor shall develop and submit all the procedures (Covering all the stages of fabrication, testing and qualification sequence) for approval of the department.
 - **Welding Procedure Specification (WPS) & Procedure Qualification Record (PQR):** Details for weld joints, welding processes, fillers, electrodes, purge/shield gases, joint qualification procedures, techniques, evaluation methods and final testing and acceptance criteria/standards.
 - **Cleaning:** Procedure for degreasing, oxygen cleaning of units/piping circuits/equipment as per CGA G 4.1/ASTM G 93.
 - **Testing:** Preparation of test procedures for hydro/pneumatic, integrated qualification checks and functional tests.
 - **Painting:** procedure for painting of all modules/skids, piping, flow components & structural material.
- g) Finalization of procurement specifications, identifying vendors/sources for procurement, modalities, and scope of supply for all items.

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h) Details for system and subsystem interfaces (process, civil pedestals, mechanical, electrical, and instrumentation).

Note: Civil pedestals are in the scope of department and contractor shall submit the number of pedestals required and sizes of each pedestal along with embedment plates requirement.

i) Identification of applicable standards and codes for all relevant areas.

j) Preparation of a project execution plan highlighting milestone activities.

k) Creation of a project schedule, including a work breakdown structure and work packages as required.

l) Development of detailed schedule charts.

m) Quality Assurance Plan (QAP) for fabrication, testing, qualification, erection and commissioning of the system as per **S.No.6.3** is indicative. However, the party shall prepare detailed QAP and submit for department approval.

5.6.1. Guidelines to be followed during detailed engineering:

- Lifting lugs or eye bolts to be provided on all the skid of the modules towards installation and erection.
- Pressure gauges shall have metric threaded end connection (M20 x 1.5).
- Threaded end connections shall be used up to 15NB size and for pressure rating 400 Bar.
- NPT threads with PTFE sealing is not permitted for piping and flow components other than Pressure Transmitter and solenoid valves interfaces.
- Within the equipment, piping circuits bore shall be maintained equivalent to the nominal bore of flow components nominal bore as per good engineering practice.
- The routing of piping/ tubing and mounting of flow components shall be carried out in such a way that all the temporary joints/ weld joints are approachable for leak checks and maintenance.
- All metric threaded connectors (Captive Nut, Butt welded nipple, Union, Butt welded union) required during fabrication of piping spools and equipment assembly shall be made as per the finalized drawings.
- Selection of material of construction (MOC)for components/parts which are not mentioned in the document shall be Monel 400.
- In case any flow component for the given flow rate is not available as a standard catalogue product with reputed manufacturers, two of similar size flow components (maximum number of similar flow components is two) in

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parallel can be considered in order to meet the flow rate with the approval of department .However, relevant proofs for non availability of single flow component shall be submitted to department for review and approval.

5.3. Procurement and Supply of Materials:

The procurement process shall commence in parallel with the detailed engineering for critical components/equipment and immediately after award of contract (as applicable based on type of item/items to be procured) for the long lead items such as globe valves, ball valves, pressure regulators& instruments etc.

Procurement of items like “Pipes, pipe fittings, standard bought out items such as bolts, nuts, gaskets, pipe clamps, etc.” shall be taken up after completion of detailed engineering and approval of submitted documents.

The general specifications of the materials/ items/equipment are provided in the annexures. The Contractor is responsible for ensuring that all materials, items, and equipment comply with the Department's requirements. Any deviation with respect to department procurement specifications shall be submitted for review and approval by the Department.

5.6.1. Guide Lines for Procurement of Items

- a) Obtain Department approval for drawings, procurement specifications &QAP prior to procurement of items.
- b) Submit detailed specifications, catalogues, technical literature, un-priced purchase orders, and Quality Assurance Plans (QAP) to the Department after the placement of POs for the respective item.
- c) No deviation is allowed with respect to purchase order specifications.
- d) Expediting services shall be provided for submission of drawings, manufacturing schedules, supply of materials and dispatch.
- e) Furnish the following documents after placement of orders for each bought-out item procured/supplied:
 - Quality assurance plan for the approval by Department
 - Cross sectional drawings of all elements along with bill of material

The contractor shall also supply the following material along-with the respective modules towards complete system erection and commissioning, but not be limited to:

- ✓ Commissioning spares for flow components in all the modules
- ✓ Pipe clamps to support yard piping and other modules.

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✓ Structural members/ Channel to support yard piping.

5.4. Purchase and Supply of Spare flow Components & Spares kits:

To ensure trouble-free operation of the high-pressure GOX supply system after commissioning, the **Contractor shall supply spare flow components and spare kits as specified in Annexure-25**. Accordingly, the bidder shall mention the unit rates for these spare flow components and spares kits in the submitted offer (**price bid**).

5.5. Guidelines for Fabrication, instrumentation, testing, inspection & painting:

Equipment for the high-pressure GOX supply system shall be fabricated, tested, and inspected at the Contractor's facilities. The detailed specifications for fabrication or procurement of each equipment or component are provided in Annexure-1 to 24. Upon completion of shop fabrication, the Contractor shall organize a pre-delivery inspection involving the department's representatives and a third-party inspection agency, as per the approved Quality Assurance Plan (QAP). The Contractor shall notify the **Department approximately 2 weeks** in advance to schedule the inspection. Only qualified & calibrated test rigs, gauges, instruments and equipment shall be used for testing at the contractor's/supplier's premises. All the GOX system equipment and components shall be painted as per annexure-27 after inspection.

5.6.1. Guide Lines for Fabrication of Module 2:

- 1) Pressure regulation & delivery valve unit is housed in GOX servicing panel and the same shall be divided into two compartments as given below:
 - a. First compartment houses only oxygen servicing lines & flow components
 - b. Second compartment houses only solenoid valves and other measurements.
- 2) Routing of pipeline and location of the flow components suitably placed by considering the accessibility, assembly and disassembly during factory assembly & maintenance of the system. All temporary joints shall be accessible for carrying out the leak check & torque/loosening of joints for attending leaks.
- 3) Piping, routing and tapings and other details shall be as per the ASTM G 88
- 4) Overall equipment dimensions shall be finalized based on the detailed engineering and 3D modeling.
- 5) For GOX Servicing Panel, spring regulators, manual valves, and globe valve handles shall be located on the top desk of the cabinet (panel mount type) and all measuring devices (PIs & PTs) shall be kept in front panel at 1.5 meter elevation of the panel.
- 6) All inlet, out let and vent (both SRV & Line vent) interfaces location and sizes shall be as per the approved drawings.

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- 7) Cabinet shall be made of Stainless-steel materials for structure and covering sheet (covering sheet shall be 2.0mm thick)
- 8) All electrical connectors and earthing elements shall be terminated at the back side of the cabinet.
- 9) Locking arrangement shall be provided for the cabinet doors.
- 10) P & ID and wiring diagrams shall be engraved and fixed on the GOX servicing rig.
- 11) GOX servicing rig shall have eye bolts for easy lifting the panel using material handling equipment and castor wheels of required capacity shall be provided on all sides
- 12) GOX servicing rig mounting details shall be provided as part of detailed engineering.

5.6.2. Guidelines for Fabrication of modules and erection of system:

- a. Welding Procedure Specification (WPS) and Procedure Qualification Record (PQR) shall be submitted for review and approval.
- b. 6G Qualified welders shall be employed for welding as per ASME Section IX.
- c. Fabrication/production drawings as per the finalized model numbers shall be submitted for approval.
- d. Sequence /arrangement of flow components shall be as per the P & ID.
- e. Fit-Ups & alignments of all the weld joints shall be performed by the qualified fitter and Bend radius of the pipes shall be greater than 4D and bending is allowed only up to 25NB pipe size.
- f. Edge preparation and cleaning (e.g., root gap, root face, bevel angle) shall be carried out for welded type flow components, pipes, and weld fittings prior to welding.
- g. TIG welding shall be employed for welding of pipes and tubes.
- h. Final as-built drawings shall be submitted for review prior to hydro testing indicating the joint numbers, fittings details and other details for each line .
- i. Argon (Purity 99.95%) shall be used as shield and purge gas for TIG welding.
- j. Dye penetration (DP) test shall be carried out on all weld joints for root and final weld inspection
- k. Filler Wires for Monel TIG welding shall be Monel Filler wires (ER NiCu7), and Size shall be 1.6 mm / 2.0 mm / 2.4 mm or as per WPS & PQR.
- l. Dye-Penetrant Test Kit shall contain cleaner, Penetrant and Developer
- m. No socket welding is permitted unless mentioned.**
- n. All pipes & fittings shall be chemically cleaned with oxygen cleaning agent andpurged with GN2 after welding to remove the scales and weld tinted layers

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- o. All butt weld joints shall be 100% radio graphed as per ASME Sec. V for sensitivity of 2-2T using X-Ray or Gama Ray methods.
- p. Radiography source shall be arranged by contractor himself. Transportation of source from storage room to work spot and back shall be the responsibility of contractor. The contractor shall be responsible for the safe storage of radiography sources. Radiography source shall be stored in a room (Department)which is located about 5 Km from the work spot.
- q. In case of any defective weld joint, repair and re-radiography of weld joint shall be taken up by the contractor at his own cost.
- r. Radiography films (Slow motion film) shall be evaluated by Level II ISNT/ ASNT (or) equivalent qualified person. Finally, the same shall be certified by Purchaser representative as per relevant codes such ANSI B 31.3 and ASME-Sec.V.
- s. The used penetrometer shall confirm to ASTM E 1025/ASTM E747 (or) relevant DIN standards.
- t. Electrodes for MS Structural (E7018/E6013): Size 2.5 mm / 3.15 mm.
- u. No compression tube fittings shall be used in the process piping. Compression tube fittings are permitted only for tubing works related to the instrumentation and command supply related connections in solenoid valves and EP valve actuators.
- v. Ball run test shall be carried out for all weld joints and bend to ensure minimum flow passage as per standards. (Ball Size= Pipe inner diameter-3.5mm).
- w. All command tubes within the panel shall be connected to a command header of 25NB size and length as per the requirement. Tubes/pipes of required sizes shall be connected from the main command header to the solenoid valves to meet the response time specification.
- x. All pipe & flow components shall be supported properly as per good engineering practice.
- y. **Tested and cleaned pipe lines/ spools shall be preserved in the clean room or preserved in self sealing polythene covers to protect from the ambient contamination prior to assembly.**
- z. Painting shall be carried out for as per the procedure and scheme mentioned in the annexure 27.

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5.6.3. Guidelines for Instrumentation:

- a. All the instruments/Process elements shall be mounted on their respective location on the prefabricated mounting structure within the equipment after proper cleaning and pneumatic testing of the equipment/ pipe line.
- b. Wiring and interfacing of instrumentation of all equipment/Process elements along with necessary cables, cable glands & connectors (with Plug, socket and back shells (based on need) shall be carried out. All the cables shall be interfaced to a field junction box.
- c. All the cables shall enter the Process elements through necessary cable glands (Specification as mentioned in RFP) as per requirement and applicability.
- d. All the cables from each instrument/Process element shall be laid on Perforated GI trays and terminated in the centralized metallic field junction box
- e. Connectors & glands on the Field junction box (FJB) shall be provided to further extend the multi pair/triad cables to control system. The multi pair / triad cables from the junction box to the PLC control system are in the scope of SDSC SHAR.
- f. Solenoid valves shall be Namur mounted type for the operation of the electro pneumatic valves towards quick response time. The suitable provision shall be provided on the valve actuators to mount these solenoid valves
- g. The FJBs, instrumentation elements and cable trays shall be mounted on the fabricated rigid structure erected on the skids/ modules.

5.6.4. Guidelines for Assembly and Integrated Testing of Equipment:

- a) Tested and cleaned pipe lines/ spools shall be connected to the flow components
- b) All Monel pipes shall be separated from MS supports by a shim plate and clamped to supports with SS clamps
- c) Proper size & diameter clamps with shim plates shall be used for pipe line supporting inside the equipment (clamps & shim plates sizes shall be as per the drawing for each size).
- d) All flow components are to be firmly fixed on the support structure with proper clamping/ bolting arrangement.
- e) **All threaded assemblies shall be applied with oxygen compatible grease prior to assembly.**
- f) All flow components shall be assembled firmly with proper sequence, torques and alignment to the respective end connections as per the drawings.

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- g) All flow components to be assembled with utmost care to avoid damage of sealing surfaces and threaded joints during assembly
- h) Pneumatic leak checking of the equipment shall be carried out at maximum operating pressure using snoop/ pressure drop method.

5.6. Testing of modules at factory and SHAR

- a. Pneumatic leak checks of each module at maximum operating pressure with GN2 using snoop solution.
- b. Seat leak checks of flow components.
- c. Valves functional checks (Manual & EP valves)
- d. Connector level interface checks of instruments.
- e. Functional testing of instrumentation elements like solenoid, EP pneumatic valves, pressure transmitters etc.
- f. Cleanliness checks by Banian cloth at vendor place and particle measurement at SDSC SHAR prior to admitting the oxygen.
- g. Cleanliness check for oil content measurement by dragger tube method.
- h. Carrying out flow trials using nitrogen and gaseous oxygen at SHAR

5.6.1. Functional Testing of Integrated System:

After the module level testing of individual equipment/ modules is completed independently at vendor premises, all modules shall be interconnected through piping as planned for integration at the SHAR site. Functional testing of the integrated system shall be conducted by contractor/supplier to ensure compliance with the test specifications/requirements using Gaseous Nitrogen and Gaseous Oxygen to establish the equivalent flow rate and **process parameters at SDSC SHAR as part of commissioning.**

The following functional checks of **system** shall be carried out at SDSC SHAR after completion of the fabrication, qualification and oxygen cleaning of pipe lines

1. Assembly of flow components as per the P&ID
2. Functional check of all elements using GN2
3. Leak checks of all valves and pipe lines using GN2
4. Electronic pressure regulation using control system
5. Mass flow meter checks using GN2
6. Response time checks of EP valves
7. Interface verification of all threaded interfaces
8. Cleanliness, moisture and oil measurement etc...

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The following sequence of operation shall be carried out at SDSC SHAR for the functional testing of the integrated system:

- I. **Integration of Modules:** Interconnect all modules using pipelines as per the integration plan.
- II. **Integrity Inspection during cylinder charging:** During cylinder charging, inspect the integrity of temporary joints on booster unit, and cylinder bank using the snoop solution.
- III. **Post-Charging Integrity Inspection:** After charging all cylinders to 250 bar, inspect the integrity of cylinder neck valve joints, temporary joints, and permanent joints using the snoop and pressure drop method.
- IV. **Testing of Regulation and delivery unit:** Blind all vents and delivery lines of Module-2 After successful testing of Module-1, operate the valves in the regulation and delivery module. Ensure electronic pressure regulators are set to a discharge pressure of 70 bar by supplying high-pressure GN2 to regulator dome and command gas. Verify a downstream pressure of 70 bar and an upstream pressure of ~250 bar. Conduct pneumatic leak checks on Module-2 using the snoop and pressure drop method. Ensure venting of line pressure from down-stream of pressure regulator.
- V. **Verification of flow and pressure parameters:** Upon successful completion of above checks for all modules,
 - a) Load the dome load regulator to 70bar(a)
 - b) Open all blinds of delivery unit for flow checks of forward and vent path.
 - c) Ensure the required orifices are installed in the delivery path to simulate test article resistance and in the vent path to meet the required bleed flow rate
 - d) Ensure opening of regulator inlet valves (VM01, VM03, VM04, VM06, VM07&VM09) and down-stream pressure of the regulator to 70bar (a).
 - e) Open VP02, VP04, & VP06 simultaneously allow the bleeding of the regulators till process parameters are stabilized
 - f) After Establishing The required parameters, Open VP01,VP03&VP05 and read the response times of valves
 - g) Record, pressure, flow rate and temperature parameters of Module-2& with the help of temporary data recorder at the interval of 100ms and for duration of 10 sec.

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- h) Verify the test data with the test specifications.
- i) In case of deviations, fine tuning of the regulator pressure accordingly by adjusting the dome pressure.
- j) Repeat the test through main path to establish the test parameters as per specifications. Two consecutive tests are to be performed to verify the consistency in achieving of critical parameters.
- k) Open VP02, VP04, VP06&allow the bleeding of the regulators and obtain the stable delivery pressure and temperatures
- l) Carryout the test through the main path by opening VP01, VP03, VP05 and establish the required parameters through main path as per test specifications for two consecutive tests.
- m) Carry out integrated functional test for all the test cases as mentioned in Table-1.

6. Scope of Inspection:

The Contractor shall be responsible for inspection as per the scope highlighted below:

6.1. Inspection by third party inspection (TPI) agency

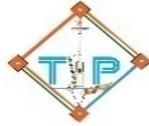
The Contractor shall be responsible for coordinating inspection activities as outlined below. In addition to the inspection of contractor /supplier, a Third-Party Inspection (TPIA) agency shall be the primary entity responsible for inspecting as per the QAP mentioned in **S.No:6.3**.Third-Party Inspection (TPIA)agency shall be selected from the following list:

- **Lloyds Register Industrial Services Pvt Ltd (LRIS)**
- **Det-Norske Veritas (DNV)**
- **TechnischerUberwachungsVerein (TUV)**
- **Bureau Veritas**

If none of the listed TPI agencies are available at a particular location, the Department may, at its discretion and on a case-by-case basis, may permit the engagement of an alternative TPI agency based on the Contractor's proposal.

6.2. The TPI agency shall be responsible for

1. Review of test certificates of booster unit, equipment, flow components and piping elements etc.in annexure 1-24as per their Quality Assurance Plans (QAP)
2. Approval of QAP and test Procedures.

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3. Review/ Witness of fabrication, testing and qualification activities at the premises of Contractor/ Sub-contractor/ test labs/ Vendor/Sub-vendor (as applicable) as per approved QAP.
4. Issue of inspection release note for the activities carried out.

6.3. QAP for fabrication, testing, qualification, erection & commissioning of the system

S.No	Characteristics	Ref. Document	Method of check	Quantum of check/type		
		Acceptance Criteria		Mfr's QC	TPI	SHAR
At Vendor premises						
1.	Bill of material as per approved documents for <ul style="list-style-type: none"> • Flow components • Pipe fittings • Machined fittings • Spare flow components • Spare kits 	Technical specification document as given in Annexure-1 to Annexure-24 and as per the finalized list of model numbers.	Verification of quantities & make, model numbers	R 100%	R 100%	R 100%
2.	Material construction of (MOC)/MTC's	As per specifications	Review of MTCs	100% H	100% R	100% R
3.	Solution annealing/HT (As applicable for pipes, fittings etc.) if applicable.	As per ASTM A351 S11.1	Review of MTCs	100% H	100% R	100% R
4.	Dimensions & Visual inspection	Dimensions & visual	Measurement	100% W	100% R	100% R
5.	Identification Tagging and labelling	As per standards	Visual Inspection	100% H	100% R	100% R



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6.	TIG Welding: Welding Procedure Scheme (WPS) & Procedure Qualification Record (PQR) Welder Qualification Record (WQR)	Ref. Standard ASME Section IX	Witness/ Review (Review if the welder is already qualified)	W 100%	W 100%	R 100%
At SHAR & Vendor premises						
1.	Joint preparation and fit up of the weld joints	Fit-up as per drawing and butt weld joint geometry as per ASME B16.25	Witness	W 100%	W 10(R N)%	-
2.	Bending of the pipe lines for pipes <25NB	Pipe bending: Bend radius shall be 3D to 4D	Witness	W 100%	W 10(R N)%	-
3.	TIG welding process	As per Welding Procedure Scheme (WPS)	Witness	W 100%	W 10(R N)%	-
4.	Dye Penetrant (DP) testing for root & final weld of each joint	DP test as per ASME section V article 6	Witness by Level II (ISNT /ASNT)	W 100%	W 10(R N)%	-
5.	Radiography testing of the weld joint and Interpretation	<ul style="list-style-type: none"> ▪ X-RAY / Gamma Ray with 2-2T Sensitivity. ▪ Acceptance as per Ref. Standard ASME B 31.3 	Interpretation by Level II (ISNT /ASNT)	R 100%	R 100%	R 100%
6.	As built drawings of all lines	<ul style="list-style-type: none"> ▪ As per the approved drawings 	Verification of joint and line numbers	R 100%	R 100%	R 100%
7.	Hydro testing of pipe lines	<ul style="list-style-type: none"> ▪ 1.5 time the Design pressure 	Testing on rig	W 100%	W 100%	W 100%
8.	Oxygen cleaning of pipe lines	<ul style="list-style-type: none"> ▪ As per CGA G 4.1 or ASTM G 93 	Cleaning using as per standard fluids	W 100%	W 100%	W 100%
9.	Moisture check of pipelines	Spec.: Dryness shall be better than -60°C dew point (below 10ppm)	Witness	W 100%	W 100%	W 100%



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10.	Ball run test of spools prior to assembly	Ball size as given in specification document	Witness	W 100%	W 100%	W 100%
11.	Interface verification of all out let thread interfaces	Size and pitch of the interfaces (check with GO/NO GO gauges)	Witness	W 100%	W 100%	W 100%
12.	Contamination check of each pipelines using banian cloth at vendor premises	Cleanliness check Spec.: No visible particle or discoloration	Witness	W 100%	W 100%	W 100%
13.	Pneumatic testing of module 2 at vendor premises	<ul style="list-style-type: none"> ▪ Pneumatic test at 1.1 X design pressure. ▪ Spec.: No pressure drop for 30 min 	Witness	W 100%	W 100%	W 100%
14.	Wiring of Electrical connections of all equipment (Status/PS/PT/SOVs)	As per the approved electrical drawings	Witness	W 100%	W 100%	W 100%
Pre dispatch activities at vendor premises						
15.	Tagging of elements and equipment	As per the P&ID of equipment	Witness/ Verification	W 100%	W 100%	W 100%
16.	Painting of pipe lines and structures	As per specification	Visual Inspection	100% H	100% R	100% R
17.	Packing and dispatching to SDSC SHAR	Standard packing for long distance transportation.	As per manufacturer	100% H	100% R	100% R
18.	Dispatch clearance and inspection release note	As per procedures	As per manufacturer	100% H	100% R	100% R
19.	Final Documentation	As per PO (3 Copies)	Verification of Documents/ Certificates	V 100%	R 100%	R 100%
Activities at SDSC SHAR after fabrication of the module 3 piping						
20.	Receipt of items at SHAR	As per procedure	Witness	100% H	NA	100% R



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21.	Cleanliness check of all out lets at SDSC SHAR	Cleanliness check with banian cloth with sufficient flow through the milli pore paper and acceptance as per the annexure 27 and procedure 1	Witness	W 100%	W 100%	W 100%
22.	Erection of equipment & modules at SHAR	As per approved 3D layout drawing of system.	Witness	100% H	W 100%	100% R
23.	Integration of all modules as per P&ID	As per P&ID	Witness	W 100%	W 100%	W 100%
24.	Installation of orifices before flow checks	As per the sizes given by SHAR	Witness	W 100%	R 100%	W 100%
25.	Gas charging of cylinders at SHAR	As per approved test procedure	Witness	W 100%	W 100%	W 100%
26.	Functional checks of system elements	As per the leak tightness and leak rates mentioned in the doc after open and close	Witness	W 100%	W 100%	W 100%
27.	Commissioning of high pressure & high flow rate gaseous oxygen supply system at SHAR to establish the flow rates and parameters as per the specified parameters in the RFP.	As per procedures	Witness	W 100%	W 100%	W 100%
28.	Final Documentation (3 sets)	As per standards	Verification	100% R	R 100%	100% R

W: Witness, R: Review, V: Verification

6.4. Inspection by department

In addition to the inspection by TPI agency, the Department reserves the right to carry out inspection by deputing their representative(s) to perform raw material inspection, stage wise inspection during fabrication and testing at the Contractor premise, test labs, Sub-contractor facilities including on-site as applicable as per QAP.

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The Contractor shall facilitate inspections by Department representatives at these locations.

The participation or approval by the Department representatives during the inspection or review does not relieve the contractor from their responsibility to comply with RFP specification and requirements.

7. Packing & transportation of materials:

The Contractor shall be responsible for packing, transportation, storage and handling of all materials. All the equipment, flow components, pipes, pipe fittings, instruments, etc. shall be protected at ends by dust-tight plugs/ closures. The materials shall be packed for delivery by road in a suitable manner for safe transportation to Sriharikota, in accordance with the accepted practices and to protect them from damage and deterioration during the transportation. The Contractor shall be responsible for all damages due to improper or inadequate packing.

8. Erection and Commissioning at SDSC SHAR

8.1. Erection Activities:

Fabricated and tested modules and flow components will be delivered to SDSC SHAR along with contractor representative. After receipt of the items, erection of the modules will be carried out by the contractor by deploying the men and machinery to the site. Necessary material handling support for unloading & movement of the equipment will be provided by the department at free of cost based on availability. However, request for material handling support shall be submitted in advance. However, correct positioning, alignment and interconnection including manpower for loading & unloading of the equipment, will be in the scope of the contractor. Any damage during erection activities shall be rectified by the Contractor at their own cost. Civil foundation prior to installation will be provided by SDSC SHAR.

The following steps may be followed for erection of the equipment, piping, modules, and instrumentation by the party at SDSC SHAR.

1. Cylinder Module Interconnection with Monel piping and laying of yard piping
2. Radiography testing, hydrotesting and oxygen cleaning of pipe lines fabricated at site and pneumatic testing
3. Erection of pressure regulation and delivery valve unit
4. Interconnection of piping between cylinder module, regulation and delivery module and test article.
5. Generation and submission of test reports for obtaining the necessary clearance for commissioning.

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Any additional piping and pipe fittings etc., required to suit site conditions shall be provided by the party at free of cost during erection towards completion of the entire system as per the specification.

8.2. Commissioning Activities

The following activities shall be carried out for commissioning of high-pressure GOX supply system:

1. Functional checks of all elements
2. Pneumatic leak checks of the entire system at MOP along with through leak checks of components using GN2 and followed by GOX.
3. Purging & Qualification of the system for moisture, particulate and oil measurement. The Contractor shall carry out purging activities, while the Department shall collect samples for analysis at the SDSC SHAR laboratory. If samples fail to meet specifications, the Contractor shall repeat purging activities until compliance is achieved.
4. Charging of gas cylinder to 250bar using gas booster.
5. **Demonstration/establishment of the system with specified flow rates and pressure at the end of delivery valve unit at SDSC SHAR using GN2 /GOX and achieving consistency in the results as given below.**

S.No	Test case	Test Requirement (at the end of delivery valve unit)
1	GN2 flow test	Equivalent/Maximum permissible flow rate at 70bar pressure using GN2 source to be carried out independently in each path for test case 1.
2	GOX low flow test	80-100g/s flow rate at 70bar pressure with Gaseous Oxygen to be carried out independently in each path.
3	System performance flow test with GOX	Flow and pressure shall be established during performance test for all test cases as mentioned in table 1 (Minimum 2 number of flow tests shall be demonstrated for 20 seconds of steady state condition for consistency results. If the flow parameters are not comparable, additional tests are required to be carried out with necessary rectification in the system)
4	System performance to demonstrate margin over flow rate with GOX	3.3 kg/s Flow rate at 70bar pressure shall be established to check design conditions in each path simultaneously.

Note: Contractor shall supply and install suitable terminal orifices to establish required test flow rates at specified pressure.

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9. Documentation

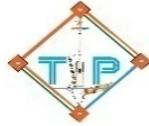
At the time of dispatch, the Contractor shall submit three sets of the following documents:

- a) Approved specifications and QAPs of equipment, flow components, piping elements, instrumentation elements, cables used for PTs, TTs& solenoid valves & connectors...etc
- b) Approved drawings of all bought items including flow components,piping and equipment
- c) List of finalized make and model numbers for all flow component
- d) Spare flow components and Spare kits list as per Annexure-25.**
- e) Approved QAP for fabrication ,tests, qualification and commissioning of the system
- f) GA Drawing of equipment and as built equipment drawings
- g) As built drawings of entire system after realization
- h) 3D drawings of all equipment and module
- i) P&I diagram, Electrical wiring diagrams with bill of materials
- j) Assembly and cross-sectional drawings of flow components & equipment.
- k) Catalogue of flow components.
- l) Test certificates for all the flow components.
- m) Weld joint history reports, including dates of fit-up, welding, and radiography details.
- n) Test reports of material tests, Hydro ,oxygen cleaning and pneumatic test of equipment
- o) Operational and maintenance documents of all equipment and system
- p) System commissioning report along with test results

10. Department Scope:

The Department shall provide the following:

- Review and approval of detailed engineering document, QAP, technical specification and test procedures etc....
- Inspection activities at vendor, sub-vendor, testing laboratories and at SDSC SHAR.
- Construction of civil pedestals for piping routing at site as specified by the contractor and approved by department.
- Arranging the material handling equipment for the receipt and erection of equipment at SDSC SHAR, at free of cost.

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- Supply of GN2 for purging, pneumatic tests and GN2 flow test requirement to be carried out at SDSC SHAR.
- **Connection of all the instruments with cables from Field Junction Box(FJB) to control system.**
- Gaseous nitrogen supply for EP valves command supply, electronic regulator control pressure ,dome loading to the regulation and delivery unit(**Module 2**)and for other purging operations.
- Electrical power supply on chargeable basis for pipe or structural welding and other erection and fabrication works at SDSC SHAR.
- Supply of Low Pressure oxygen gas to the booster unit to boost the cylinders as per the quantity requirement for all the tests.
- 2 Nos of 2Cu.M. water volume gas cylinders
- Analysis of system cleanliness and gas samples.
- De Mineralized Water for Hydro test of piping at SDSC SHAR

11. System Realization Schedule

The overall timeline for establishment of high pressure & high flow gaseous oxygen supply system at SDSC SHAR, as per defined scope shall be within **09months** from the date of release of purchase order.

a.	Supply of Pressure regulation and delivery valve unit (module-2) along with booster unit and monel pipes& required fittings to SDSC as per RFP specifications including Detailed engineering, procurement, fabrication & testing.	07 Months
b.	Supply of spare flow components and spare kits as per Annexure-25.	
c.	Erection & commissioning of high-pressure gaseous oxygen supply system at SDSC SHAR as per RFP specifications including laying, testing, Oxygen cleaning & fabrication of monel piping.	02 Months

11.1. The break-up of the overall schedule for realization of the system

S.No	Description of the activity	Responsibility	Schedule	
a)	Release of Purchase order	Department	T0	T0
b)	Detailed Engineering and submission of document for approval	Vendor	T1=T0+25Days	T0+1Month



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S.No	Description of the activity	Responsibility	Schedule	
c)	Review and approval of detailed engineering document	Department	T2=T1+5Days	
d)	Generation and submission of finalized procurement specifications, drawings and QAPs of flow components and piping elements	Vendor	T3=T2+25Days	T0+ 2 Months
	Review and Approval of the finalized procurement specifications, drawings and QAPs of all flow components and piping elements	Department	T4=T3+5Days	
e)	Generation and submission of 3d modelling and fabrication drawings for review and approval	Vendor	T5=T4+25Days	T0+ 3 Months
f)	Review and approval of 3D modelling and fabrication drawings	Department	T6=T5+5Days	
g)	Placement of Purchase order for all brought out items after obtaining the clearance for detailed engineering ,specifications and QAPs Un-priced PO copes shall be submitted	Vendor	T7=T6+15Days	T0+ 3.5 Months
h)	Receipt of all bought out items	Vendor	T8=T7+1.5Months	T0+ 5 Months
i)	Fabrication, qualification, testing, cleaning and &Integration of components &equipment and supply of GOX supply system along with spare flow components and spare kits	Vendor + Department (Inspection)	T9=T8+2Months	T0+ 7 Months
j)	Laying and fabrication of required piping and testing of piping, cleaning ,erection and commissioning of the high-pressure gaseous oxygen system	Vendor + Department (Inspection)	T10=T9+2 Months	T0+ 9 Months

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12. Criteria for acceptance of items at SDSC SHAR

12.1. For Supply of Equipment

- Receipt of items in damage free condition at SDSC SHAR after satisfactory completion of the all activities at vendor premises as per scope.
- Receipt of test documentation of each item as per QAP.
- Visual inspection of items received in damage free condition.
- Review of production master files.

12.2. For Supply of Spare flow components and Spares kits:

- Upon quantity verification as per **Annexure-25**.
- Visual inspection of items received in damage free condition.
- Verification of material compliance certificates

12.3. For Erection & commissioning:

- Successful completion of laying of pipeline, fabrication, testing/qualification of piping, cleaning conditioning, interfacing to the system.
- **Upon successfully demonstrating the end parameter as per Table-1 and as per approved QAP for realization**

13. Bid Submission details

Offers shall be submitted on E-procurement portal as two-part Bid as per the details given below:

13.1. Part-I – Techno-commercial Bid:

Details to be furnished in Techno-commercial Bid are as follows:

- ✓ The bidder shall furnish confirmation for the RFP general specification in the format provided in **S.No.19** and technical specifications in the format provided in **S.No.20**. However, change of specifications/ deviations (if any) shall be brought out in the offer as deviation summary with detailed justification shall be submitted in the format provided in **Annexure-A**. Exclusions, if any from scope of supply shall be clearly indicated in the offer. Acceptance of terms and conditions shall be submitted in the format provided in **Annexure-B**.
- ✓ **Table 2,3,Annexure-A & B** shall be submitted as part of techno commercial bid.
- ✓ Commercial conditions i.e. payment terms, warranty, taxes, make in India clause are explained in **S.No.17**. Point wise confirmation to the same shall be submitted by the supplier.
- ✓ Party shall mention the make of each flow component considered in the Techno commercial bid. Selected flow components shall be of reputed make and highly reliable for high pressure GOX application. The offered make of the flow component will be

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evaluated by the Department if required before price bid opening(w.r.t submitted catalogue, model number and general arrangement drawing). Parties offer will not be considered for further evaluation of the bidding process in case the offered make& model number is not meeting the technical specifications. After placement of P.O, change in make is not acceptable.

- ✓ Un-priced bid shall be submitted in the formats provided in **Table—2,3**.
- ✓ **Bidder shall note that indication of price in the techno-commercial bid, will lead to dis-qualification of bid. Price bid formats shall be carefully linked to price bid on e-procurement portal.**

13.2. Part-II – Price Bid:

- ✓ **Price bid shall be submitted in the formats provided in Table—4,5**

In view of Two Part bid, the Offers submitted contrary to above instructions will be summarily rejected.

The overall landed cost to SDSC SHAR (including the cost of spares) will be taken as the basis towards finalization of the purchase order, for the complete scope of work. Item wise L1 will not be considered due to the technical interface requirements at purchaser's site. Overall L1 will be arrived based on the quote for sum of the items in **Table 4** for basic system, Spares and erection commissioning. Splitting of order based on item wise lowest quote is not envisaged due to nature of work as they are interrelated.

₹ in Rs

Table 2: Confirmation on unpriced bid

S. No.	Description	Quantity (n)	Cost (in Rs) (A)	GST, as applicable (in Rs) (B)	Total cost (in Rs) (n x A + B)	Separate Cost mentioned in price bid (YES/NO)
1	Supply of Pressure regulation and delivery valve unit (module-2) along with booster unit and monel pipes & required fittings to SDSC as per RFP specifications	1Lot	Unpriced (Quoted /not quoted)	Unpriced (Quoted /not quoted)	Unpriced (Quoted /not quoted)	YES/NO



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S. No.	Description	Quantity (n)	Cost (in Rs) (A)	GST, as applicable (in Rs) (B)	Total cost (in Rs) (n x A + B)	Separate Cost mentioned in price bid (YES/NO)
	including Detailed engineering, procurement, fabrication & testing.					
2	Supply of spare flow components and spare kits as per Annexure-25.	1Lot	Unpriced (Quoted /not quoted)	Unpriced (Quoted /not quoted)	Unpriced (Quoted /not quoted)	YES/NO
3	Erection & commissioning of high-pressure gaseous oxygen supply system at SDSC SHAR as per RFP specifications including laying, testing, Oxygen cleaning & fabrication of monel piping.	1Lot	Unpriced (Quoted /not quoted)	Unpriced (Quoted /not quoted)	Unpriced (Quoted /not quoted)	YES/NO



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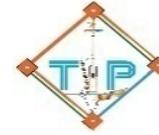
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Table 3: Confirmation on item wise cost breakup of spare flow components and spare kits(Un priced):

S.No	Tag No (Refer ANNEXURE- 1 to 24)	Quantity of spare, Nos (n)	Unit Cost (in Rs) (A)	GST (as applicable) (in Rs) (B)	Total Cost (incl. (in Rs) C = (n*A)+B	Separate Cost mentioned in price bid (YES/NO)
A) Spare flow components						
1.	VMN01-S1	01	Quoted /not quoted	Quoted /not quoted	Quoted /not quoted	YES/NO
2.	NNV01-S1	01	Quoted /not quoted	Quoted /not quoted	Quoted /not quoted	YES/NO
3.	FL01(element)-S1	01	Quoted /not quoted	Quoted /not quoted	Quoted /not quoted	YES/NO
4.	FL02(element)-S1	01	Quoted /not quoted	Quoted /not quoted	Quoted /not quoted	YES/NO
5.	VM01-S1	01	Quoted /not quoted	Quoted /not quoted	Quoted /not quoted	YES/NO
6.	VM02-S1	01	Quoted /not quoted	Quoted /not quoted	Quoted /not quoted	YES/NO
7.	VM03-S1	01	Quoted /not quoted	Quoted /not quoted	Quoted /not quoted	YES/NO
8.	VR01-S1	01	Quoted /not quoted	Quoted /not quoted	Quoted /not quoted	YES/NO
9.	EVR01-S1	01	Quoted /not quoted	Quoted /not quoted	Quoted /not quoted	YES/NO
10.	VR spring 01 for EVR01-S1	01	Quoted /not quoted	Quoted /not quoted	Quoted /not quoted	YES/NO
11.	SRV01-S1	01	Quoted /not quoted	Quoted /not quoted	Quoted /not quoted	YES/NO
12.	VP01-S1	01	Quoted /not quoted	Quoted /not quoted	Quoted /not quoted	YES/NO
13.	VP02-S1	01	Quoted /not quoted	Quoted /not quoted	Quoted /not quoted	YES/NO
14.	VGS01-S1	01	Quoted /not quoted	Quoted /not quoted	Quoted /not quoted	YES/NO
15.	PT01-S1	01	Quoted /not quoted	Quoted /not quoted	Quoted /not quoted	YES/NO
16.	MFM01-S1	01	Quoted /not quoted	Quoted /not quoted	Quoted /not quoted	YES/NO
17.	PTT01-S1	01	Quoted /not quoted	Quoted /not quoted	Quoted /not quoted	YES/NO



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18.	PI01-S1	01	Quoted /not quoted	Quoted /not quoted	Quoted /not quoted	YES/NO
19.	PI03-S1	01	Quoted /not quoted	Quoted /not quoted	Quoted /not quoted	YES/NO
20.	SOV of VP01-S1	01	Quoted /not quoted	Quoted /not quoted	Quoted /not quoted	YES/NO
21.	SOV of VP02-S1	01	Quoted /not quoted	Quoted /not quoted	Quoted /not quoted	YES/NO
22.	TT01-S1	01	Quoted /not quoted	Quoted /not quoted	Quoted /not quoted	YES/NO
B) Spare kits of flow components						
1.	VMN01	02	Quoted /not quoted	Quoted /not quoted	Quoted /not quoted	YES/NO
2.	NNV01	02	Quoted /not quoted	Quoted /not quoted	Quoted /not quoted	YES/NO
3.	FL01	01	Quoted /not quoted	Quoted /not quoted	Quoted /not quoted	YES/NO
4.	FL02	02	Quoted /not quoted	Quoted /not quoted	Quoted /not quoted	YES/NO
5.	VM01	02	Quoted /not quoted	Quoted /not quoted	Quoted /not quoted	YES/NO
6.	VM02	02	Quoted /not quoted	Quoted /not quoted	Quoted /not quoted	YES/NO
7.	VM03	02	Quoted /not quoted	Quoted /not quoted	Quoted /not quoted	YES/NO
8.	VR01-S1	02	Quoted /not quoted	Quoted /not quoted	Quoted /not quoted	YES/NO
9.	EVR-S1	02	Quoted /not quoted	Quoted /not quoted	Quoted /not quoted	YES/NO
10.	SRV01-S1	02	Quoted /not quoted	Quoted /not quoted	Quoted /not quoted	YES/NO
11.	VP01-S1	02	Quoted /not quoted	Quoted /not quoted	Quoted /not quoted	YES/NO
12.	VP02-S1	02	Quoted /not quoted	Quoted /not quoted	Quoted /not quoted	YES/NO
13.	VGS01	02	Quoted /not quoted	Quoted /not quoted	Quoted /not quoted	YES/NO

Note :To be submitted along with technical Bid



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14. Minimum Qualification Criteria

The following are the minimum essential criteria to be met by the bidder for further evaluation of the bid. Bidder is requested to provide all the necessary support documents. In case of any deviation/non-compliances/ lack of supporting document, bid shall be summarily rejected. **Bidder compliance with supporting document to be submitted along with technical Bid**

S.No	Description	Bidder Compliance with supporting documents
1.	<p>Previous technical experience:</p> <p>i. The Bidder should be a company or firm established with at least 3years as on 01/01/2026.</p> <p>ii. Bidder should be in the field of supply ,erection fabrication, assembly, inspection, testing and commissioning of any gas system.</p> <p>Copies of the purchase orders in above areas along with work completion proofs shall be submitted along with the techno commercial bid.</p>	
2.	<p>Specific experience:</p> <p>The following minimum specific experience is required to be fulfilled as part of the scope of the work in the previously executed POs.</p> <p>a) Oxygen cleaning of the equipment /components as per the standards</p> <p>b) Monel or Cu:Ni alloy pipes /tubes welding for the oxygen gas systems</p> <p>Party shall submit the purchase order /work order copies with the scope as mentioned above and along with end user certificate for the same as part of offer, without which offer will not be accepted.</p>	
3.	<p>A. The bidder should have executed the contracts for following values in the above-mentioned field in S.No.1 during the last seven years prior to tender due date:</p> <p>a) Single order value not less than Rs.500Lakhs (or)</p> <p>b) Two orders of value not less than Rs.300Lakhs each (or)</p> <p>c) Three orders of value not less than Rs.100Lakhs each.</p> <p>B. For Specific experience requirements as mentioned in the S.No.2, purchase order with the defined scope</p>	



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S.No	Description	Bidder Compliance with supporting documents
	shall be submitted with specific experience as criteria. Note : Party shall meet all the criteria mentioned in S.No1, 2 and 3A for technical qualification.	
4.	Bidder should have average annual turnover for the last three years (FY: 2022-23, 2023-24& 2024-25) of Rs.450 Lakhs	
5.	The Bidders shall submit Profit & Loss Accounts, Balance Sheets duly certified by the auditor and IT returns for the last three financial years with acknowledgement from IT Department up to last 3 years (ending with 31-03-2025). Necessary documents shall be submitted	
6.	Latest Solvency certificate from any nationalized/Scheduled bank shall be submitted for a value of minimum Rs.200 Lakhs . The solvency certificate shall be issued on or after January 2026.	

SIGNATURE :

NAME :

DESIGNATION :

SEAL OF THE COMPANY DATE :

15. Bid Evaluation Criteria: **To be submitted along with technical Bid**

SI.No	Description	Bidder Compliance with supporting documents
1.	In respect of Two-part Bid system, the technical Bids forwarded by the Bidders will be evaluated by the Department with reference to the technical specifications as mentioned in the RFP. The compliance of Technical Bids would be determined on the basis of the parameters specified in the RFP. The Price Bids of only those Bidders will be opened whose Technical Bids would clear the technical evaluation.	
2.	During evaluation, SDSC SHAR may request Bidder for any additional clarification/document on the bid, if required	
3.	Performance of Bidder on similar nature of works executed/ under execution will be taken into consideration before	



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	selecting the Bidder for opening his price bid (as per qualification criteria)	
4.	The time schedule for completion is given in the Proposal document. Bidder is required to confirm the completion period unconditionally.	
5.	SDSC SHAR reserves the right to reject any bid if not meeting the technical/commercial requirements and terms & conditions. Such decisions by the SDSC SHAR shall bear no liability whatsoever consequent upon such decision	
6.	Purchaser reserves the right for evaluation of any bidder by visiting his manufacturing premises towards acceptance of the techno-commercial bid. The decision of the purchaser is final in this regard.	
7.	Preference will be given to MSE as per public procurement policy.	
8.	Technically qualified over all Lowest (L1) bidder will be awarded the contract by considering the nature of work (Integrated testing is involved as part of the scope of the work.Split order is not envisaged).	
9.	Party who is capable of executing full scope of the work only will be taken into consideration for evaluation.	

SIGNATURE :

NAME :

DESIGNATION :

SEAL OF THE COMPANY DATE :



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16. Submission of Make& Model number for flow components:

S.No	Name of the component / Equipment	System Quantity (Nos)	Ref. Tag No	Ref. annexure for technical specification	Make	Model No	GA Drawing	Specification confirmation by manufacturer (YES/NO)
1.	Dome loaded Pressure regulator	3	VR01, 02 & 03	Annexure-1				
2.	Electronic pressure regulator	3	EVR-01, 02, 03	Annexure-2				
3.	Safety relief valve	3	SRV-01,02,03	Annexure-3				
4.	Filter	1	FL01	Annexure-7				
		3	FL02, 03, 04					
5.	Electro pneumatic ball valve	3	VP01, 03, 05,	Annexure-4				
		3	VP 02,04,06					
6.	Manual Ball valve	4	VMN01,02,03,04	Annexure-5				
		3	VM01, 04, 07					
		3	VM02, 05, 08					
		3	VM03, 06, 09					
7.	Manual Globe Valve	8	CCNV01, NNV01 to NNV04 NV01,02,03	Annexure-6				
8.	Pressure transmitter	5	PT-01, 02, 03, 04,05,	Annexure-13				
9.	Pressure gauge	2	PI-01, 02, 03,	Annexure-8				



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			04,05					
10.		03	PI, 03, 04,05					
11.	Coriolis mass flow meter along with transmitter	3	MFM 01, 02, 03	Annexure-15				
12.	Temperature sensor and transmitter with thermo well	3	TT- 01, 02, 03	Annexure -14				
13.	Gauge shut of valves	8	VGS01 to 08	Annexure -23				
14.	Pressure Transducer	6	PTT,01,02,03,04 , 05,06	Annexure -24				
15.	Booster Unit	1	BU1	Annexure -21				
16.	Solenoid valves (5mm bore)	03	VP02,04,06	Annexure -12				
17.	Solenoid valves (12mm bore)	03	VP01,03,05					

Note :Make of the spare flow components shall be same as main flow components mentioned in the annexure 1-24and To be submitted with along with the technical bid



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Formats for Price Bids

inRs

Table 4: Price bid Format

S.No.		Quantity (n)	Cost (In Rs) (A)	GST, as applicable (in Rs) (B)	Total cost (in Rs) (n x A + B)	Separate Cost mentione d in price bid (YES/NO)
1	Supply of Pressure regulation and delivery valve unit (module-2) along with booster unit and monel pipes & required fittings to SDSC as per RFP specifications including Detailed engineering, procurement, fabrication & testing.	1No	---	---	---	---
2	Supply of spare flow components and spare kits as per Annexure-25.	1Lot	---	---	---	---
3	Erection & commissioning of high-pressure gaseous oxygen	1Lot	----	---	---	---



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<p>supply system at SDSC SHAR as per RFP specifications including laying, testing, Oxygen cleaning & fabrication of Monel piping.</p>					
<p style="color: blue;">Not to submit along with the technical bid. It shall be attached as part of the price bid</p>					

Table 5:Item wise cost breakup of spare flow components and spares kits in the price bid

S.No	Ref. Tag No	Quantity of spare, Nos (n)	Unit Cost (in Rs) (A)	GST (as applicable) (in Rs) (B)	Total Cost (in Rs) C = (n*A)+B	Separate Cost mentioned in price bid (YES/NO)
A)Spare flow components						
1.	VMN01-S1	01				
2.	NNV01-S1	01				
3.	FL01(element)-S1	01				
4.	FL02(element)-S1	01				
5.	VM01-S1	01				
6.	VM02-S1	01				
7.	VM03-S1	01				
8.	VR01-S1	01				
9.	EVR01-S1	01				
10.	VR spring 01 for EVR01-S1	01				
11.	SRV01-S1	01				
12.	VP01-S1	01				
13.	VP02-S1	01				
14.	VGS01-S1	01				
15.	PT01-S1	01				



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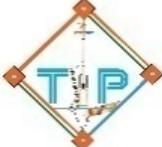
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16.	MFM01-S1	01				
17.	PTT01-S1	01				
18.	PI01-S1	01				
19.	PI03-S1	01				
20.	SOV of VP01-S1	01				
21.	SOV of VP02-S1	01				
22.	TT01-S1	01				

B) Spare kits of flow components

1.	VMN01	02				
2.	NNV01	02				
3.	FL01	01				
4.	FL02	02				
5.	VM01	02				
6.	VM02	02				
7.	VM03	02				
8.	VR01-S1	02				
9.	EVR-S1	02				
10.	SRV01-S1	02				
11.	VP01-S1	02				
12.	VP02-S1	02				
13.	VGS01	02				

Not to submit along with the technical bid. It shall be attached as part of the price bid

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17. General Terms and Conditions:

1. Bidder must undertake detailed engineering, fabrication, factory testing, qualification, supply of Booster Unit, Monel pipes and fittings supply and piping at SDSC SHAR as per S.No 4.1&4.3, Oxygen cleaning, spare flow components and spare kits, erection and commissioning of high-pressure and high flow gaseous oxygen supply system as per the specifications and requirements indicated in the RFP
2. Party shall mention the make of each item / flow component, model number, DN & PN rating in the techno commercial bid. Selected flow components shall be standard / reputed make and highly reliable for high pressure application. The offered make of the flow component will be evaluated before price bid opening. If the offered make is not acceptable based on the technical specifications, party shall change the make. **After placement of the order, change of make is not acceptable.**
3. **Offer Validity:**
The validity of the offers / tenders should be 120 days from the date of opening of the tenders. **Tenders with offer validity less than the period mentioned above, will not be considered for evaluation.**
4. **Taxes:**
Party shall quote with 5% GST rates for supply of HP GOX system.
SDSC SHAR is eligible for GST@5% as per the notification no. 6/2018-Central Tax (Rate) dt:25.01.2018A (ix) S.No.243A as amended by Notification No 25/2018-Integrated Tax (Rate) Dt: 31.12.2018(viii) S.No.243B issued by Ministry of Finance (Dept. of Revenue).
5. **Payment Terms:**
 - 5.1 **Our general payment term is 100% payment within 30 days after supply and commissioning of system at our site.**
 - Or
 - 5.2 **However, in case of any request from supplier/party, the following payment terms may be considered for payments:**
 - 5.2.1 **Advance Against Bank Guarantee:** 20% of Supply value under Line item 1 as advance against submission of Advance Bank Guarantee for an equal amount. In case contractor / supplier is not realizing the system within the delivery schedule, penal interest as applicable shall be levied
 - 5.2.2 **Detailed Engineering:** 10% of the Supply value under Line item 1 upon completion and approval of Detailed Engineering by Department.
 - 5.2.3 **Supply of Items:**
 - a) 30% of Pro-rata basis of supply of equipment under Line item-1 against receipt & acceptance of items at SDSC SHAR within 30 days.
 - b) 90% of Pro-rata basis of Supply under Line item 2 and acceptance of spare flow components & spare kits as per annexure 25
 - 5.2.4 **Erection & Commissioning :**
 - a) 90% of Line item 3 after successful erection and commissioning.
 - b) 30% of Supply of equipment value under Line item 1

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5.2.5 **Final Payment (against PBG):** 10% of the total order value after satisfactory erection and commissioning of the system at SHAR as per the scope of the contract/PO and against submission of Performance Bank Guarantee.

Note:

(a) Wherever advance payment is requested, Bank Guarantee from any commercial bank on Rs.200 non-judicial stamp paper should be furnished for the equivalent amount valid till completion of total scope of work plus 60 days.

(b) After drawl of advance payments, if the vendor/supplier is not supplying the material within the delivery schedule, the advance amount will be recovered and interest will be levied as per the RBI Prime Lending Rate or similar rate published by RBI plus 2% penal interest.

(c) In case of any delay attributable to the contractor/supplier in effecting the supply after the prescribed delivery date. Interest at RBI Prime Lending Rate or similar rate published by RBI will be charged for the period beyond the specified delivery date, on the amount of balance advance payment in addition to LD.

(d) Interest will be loaded for advance payments/stage payments as per the RBI Prime Lending Rate or similar published by RBI and will be added to the landed cost for comparison purpose.

6. **Make in India Clause**

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

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

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

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

(d) Verification of local content:

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

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addition is made.

(ii) **In case bid value is in excess of Rs. 10 Cr., Class-I local supplier / Class-II local supplier shall be required to provide a certificate from the statutory auditor or cost auditor of the company (in the case of companies) or from a practicing cost accountant or practicing chartered accountant (in respect of suppliers other than companies) giving the percentage of local content.**

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

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

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

(f) **Purchase preference to MSE/MII-Class-I local suppliers will be as per notification No.F.1/4/2021-PPD dated 18-05-2023 and its directives/amendments thereof issued by Ministry of Finance, Department of Expenditure, Public Procurement Division".**

7. **Liquidated Damages:**

Since delivery is the essence of this order, in case of delay in completion of total scope of work beyond the stipulated delivery period, Liquidated Damage will be levied @ 0.5% per week or part thereof on undelivered portion as pre-estimated damages subject to a maximum of 10% of total order value.

8. **Security deposit cum performance bank guarantee:**

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

9. **Arbitration:**

The Purchase Order shall be interpreted, construed and governed by the Laws in India. In the event of any dispute/s, difference/s or claim/s arising out of or relating to the interpretation and application of the Contract, such dispute/s or difference/s or claim/s shall be settled amicably by mutual consultations of the good Offices of the respective Parties and recognizing their mutual interests attempt to reach a solution satisfactory to both the parties. If such a resolution is not possible, within 30 days from the date of receipt of written notice of the existence of such dispute/s, then the unresolved dispute/s or difference/s or claim/s shall be referred to the Sole Arbitrator appointed by the Parties by mutual consent in accordance with the rules and procedures of Arbitration and Conciliation Act 1996 as amended from time to time. The arbitration shall be conducted in Bengaluru in the Arbitration and Conciliation

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Centre –Bengaluru (Domestic and International) as per its rules and regulations. The expenses for the Arbitration shall be shared equally or as may be determined by the Arbitrator. The considered and written decision of the Arbitrator shall be final and binding between the Parties. The applicable language for Arbitration shall be “English” only.

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

10. **Applicable law and jurisdiction**

The laws of India shall govern this contract for the time being in force. The Courts of Andhra Pradesh, India only shall have jurisdiction to be with and decide any legal matters or disputes what so ever arising out of the contract.

11.

Special conditions

The delivery period mentioned in the tender enquiry, **IF ANY**, is with the stipulation that no credit will be given for earlier deliveries and offers with delivery beyond the period will be treated as unresponsive.

The bidders should note that conditional discounts would not have advantage in the evaluation process of tenders.

Non-acceptance of any conditions wherever called for related to Guarantee/ Warranty, Advance Bank Guarantee, Security deposit cum Performance Bank Guarantee, Liquidated damages are liable for disqualification.

Wherever installation/ commissioning involved, the guarantee/warranty period shall reckon only from the date of installation.

The specifications given by the department along with the tender enquiry are confidential and shall not be disclosed to any third party.

12. **Exclusion of tenders:**

The following tenders shall be summarily rejected from the procurement process:

- (a) Unsolicited tenders from bidders.
- (b) The tenders which materially depart from the requirements specified in the tender document or which contain false information.
- (c) The tenders of bidders who have not agreed to furnish Advance Bank Guarantee or Security cum Performance Bank Guarantee.
- (d) The validity of the tenders is shorter than the period specified in the tender enquiry.
- (e) The tenders received from bidders or their agents or anyone acting on their behalf, who have promised or given to any official of the Centre/Unit/Department, a gratification in any form, or anything of value, so as to unduly influence the procurement process.
- (f) The tenders received from bidders, who, in the opinion of the

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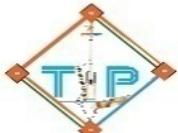
Centre/Unit, have a conflict of interest materially affecting fair competition.

(g) If a firm quotes 'NIL' charges / consideration, the bid shall be treated as un-responsive and will not be considered.

13. **Delivery conditions: Total system shall be realized within 9months from the date of purchase order and the detailed schedule as mentioned in S.No 11 of enclosed specification.**
14. Technically qualified and Over all lowest(L1) will be awarded the contract due to the nature of the scope. Split order is not envisaged.
15. Material handling support for unloading the equipment at site will be provide at free of cost based on the availability. However, party shall provide the dimensions and weight of the equipment along with the request letter
16. **All flow components and spare shall be supplied along with the equipment supply. However, party shall procure separate spares for the commissioning of the system and the cost shall be inclusive of the system supply.**
17. **Party shall deliver the equipment and flow components with proper packing and required care.**
18. **Quote shall be on "TWO-PART BID" basis, viz., techno commercial bid & Price bid separately.**
19. Before purchase of flow components, Party shall submit all the technical specifications of the flow components, constructional drawings & seal kit. The same shall be sent for department approval after TPI verification.
20. Party has to generate fabrication drawings and obtain approval from the department prior to the procurement / fabrication.
21. Any damage of flow components, cylinders ,equipment & connectors during fabrication, testing, assembly and till supply, the damaged item /equipment is to be replaced with new item and its replacement or repair shall be in the supplier's scope.**(No additional cost will be paid for replacement or repair of the item/equipment)**
22. Equipment shall be properly packed to avoid any transportation damages and to be delivered to SDSC SHAR, Sriharikota, INDIA.
23. Equipment general arrangement drawings shall be provided by providing overall dimensions (size), weight, handling provisions etc.
24. The flow components shall be inscribed with Model No, size, working pressure and material of construction of body, manufacturers number etc.
25. All equipment name plates, tagging, P&IDs & Wirings diagrams shall be in the scope of supplier
26. The purchaser reserves the right to cancel the PO at any time with the application of penalty & Security deposit in case of failure of bidder to fulfill various technical requirements
27. Bidders should submit point wise compliance by filling the compliance given in **S.No. 19 and S.No.20 along with techno commercial bid**

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28. **Quoted cost shall be inclusive of detailed engineering, drafting, 3D modeling ,flow components, Instruments, piping elements and their testing charges, structural, cabinet sheets, welding, radiography, cleaning, assembly, consumables used during fabrication, testing, men & machinery used, commissioning, (test media at factory and testing machinery), spare flow components,spare kits and cost of spares replaced during commissioning, TPI, P&F, transportation, Customs, delivery and any other charges not mentioned above (except GST). Applicable GST is 5%.**
29. All flow components shall be selected to meet the functional/ performance requirements as specified. It may be noted that specifications& QAP mentioned in Annexure-1 to 24 are indicative. However, the detailed specifications & QAP will be finalized after approval of flow components make& model numbers.
30. Inspection: Inspection of Equipment shall be carried out by the Supplier QC & TPIA along with department engineer prior to dispatch from supplier's site as per approved QAP. The supplier shall ensure that QAP is strictly followed in all stages of manufacturing, Testing & Inspection. The supplier has to inform the purchaser, the readiness of the materials for inspection well in advance for participation (**minimum 2 weeks in advance**). The items shall be dispatched only after completion of inspection and clearance for dispatch by the department engineer.
31. **WARRANTY:**The Equipment with accessories supplied shall be warranted for trouble free service of 12 months period from the date of erection and commissioning. In case any defects are noticed during the above period due to faulty design, poor workmanship, use of substandard materials etc., the same shall be rectified / replaced by party with free of cost within a reasonable period.
32. The contractor shall take prior approval from the department for awarding sub contract for part of the work in PO if any, however overall responsibility lies with thebidder/ contractor.
33. Supplier should submit relevant work completion documents (like delivery challan, payment receipts, IRN by TPIA, dispatch clearance by customer or user certification etc.) from the customer for confirming the delivery and successful execution of purchase orders submitted for compliance to **point number 2 & 3** of minimum qualification criteria mentioned **in S.No.14.Non-submission of relevant work completion proofs shall lead to technical disqualification of the offer.**
34. Technical compliance to the specifications shall be signed by the bidder.
35. **The firm must provide a self-declaration that there is no complaint/vigilance inquiry against them in any Govt./Department/PSU and they have not been black listed by any Govt. Department/PSU**
36. Technical proposal of the bidder, which is not able to substantiate/satisfy the claims made by it with respect to the technical requirements laid down in this RFP, will be summarily rejected
37. **Offers of those bidders taking full scope of the work as per the requirements indicated in the RFP only will be considered for evaluation.**
38. **Department reserves the right to inspect the contractor shop floor/premises for**

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evaluation, if required. After evaluating the contractor, decision of the Department is final.

39. MSME:Purchase preference will be given to MSEs having valid Udyam Registration and whose credentials are validated online through Udyam Registration portal as defined in Public Procurement Policy for Micro and Small Enterprises (MSEs) Order, 2012 dated 23.03.2012 issued by Ministry of Micro, Small and Medium Enterprises and its subsequent orders/ Notifications issued by concerned Ministry. If the bidder wants to avail themselves of the Purchase preference, the bidder must be the manufacturer / OEM of the offered product on GeM. Traders are excluded from the purview of Public Procurement Policy for Micro and Small Enterprises and hence resellers offering products manufactured by some other OEM are not eligible for any purchase preference. In respect of bid for Services, the bidder must be the Service provider of the offered Service. Relevant documentary evidence in this regard shall be uploaded along with the bid in respect of the offered product or service and Buyer will decide eligibility for purchase preference based on documentary evidence submitted, while evaluating the bid. If L-1 is not an MSE and MSE Seller (s) has / have quoted price within L-1+ 15% (Selected by Buyer) of margin of purchase preference /price band defined in relevant policy, such MSE Seller shall be given opportunity to match L-1 price and contract will be awarded for 100% (selected by Buyer) percentage of total quantity. The buyers are advised to refer the OM No. F.1/4/2021-PPD dated 18.05.2023. OM_No.1_4_2021_PPD_dated_18.05.2023 for compliance of Concurrent application of Public Procurement Policy for Micro and Small Enterprises Order, 2012 and Public Procurement (Preference to Make in India) Order, 2017. Benefits of MSE will be allowed only if seller is validated on-line in GeM profile as well as validated and approved by Buyer after evaluation of documents submitted.
- MSEs which have technical capability to deliver the goods & services as per prescribed technical & quality requirements, relaxations areas per the prevailing MSE guidelines subjected to acceptance of the vendor by department vendor evaluation.**
40. **Procurement From a bidder sharing land border with India** Bidder has to comply with the provisions regarding Procurement from a Country sharing Land Border with India. Suppliers / OEM shall not be allowed to sub-contract works or Purchase from any of the Firm / Manufacturer from a country which shares a land border with India unless such Firm / Manufacturer is registered with the competent authority.DoE order on public procurement dated 23.02.2023 shall be referred from Gov. Portal. Latest Guidelines/ Circulars/ Notifications issued by competent authorities shall be applicable.
41. **It is responsibility of the contractor to ensure all safety norms are being followed by his personal during execution of this work. Department will not hold any responsibility to any mishap to the contractor personnel at the site.**
42. **The supplied material shall be entered to the SDSC premises only through department stores and security endorsements. Payment towards the supply shall be cleared only after receipt and acceptance by the department**
43. **If any discrepancy is found during procuring, fabrication and realization.**



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Supplier shall immediately inform the department and shall obtain necessary clarification/approval before proceeding with the job any further.

44.

Risk and Cost Purchase:

Timely delivery of goods/services is of prime importance and where the vendor fails to fulfill their contractual obligations, the Procuring Entity shall be entitled, and it shall be lawful on his part, to procure Stores and/ or services similar to those ordered/cancelled, with such terms and conditions and in such manner as it deems fit at the "Risk and Cost" of the Contractor and the Contractor shall be liable to the Procuring Entity for the extra expenditure, if any, incurred or accrued by the Procuring Entity for arranging such procurement. However, the Contractor shall not be entitled to benefits if any, from such procurements.

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

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

a. When the supplier fails to deliver the materials even after extending the delivery period.

b. When the supplier fails to respond to purchases request for supply of the materials and fails to provide any genuine and bonafide reason for the delay in supply.

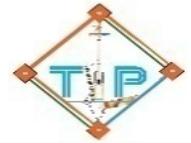
c. When the supplier breaches any of the terms and conditions of the supply order/ contract and as a result fails to execute the order satisfactorily.

18. List of the Annexure

S.No.	Items to be Supplied	Reference Annexure
1.	Pressure Regulators	Annexure-1
2.	Electronic Pressure regulators	Annexure-2
3.	Safety Relief Valves	Annexure-3
4.	Electro-Pneumatic Ball Valves	Annexure-4
5.	Manual ball valve	Annexure-5
6.	Manual globe Valves	Annexure-6
7.	Filters	Annexure-7



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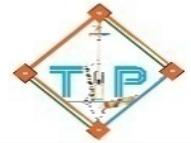
8.	Pressure Gauges	Annexure-8
9.	Pipes and Tubes	Annexure-9
10.	Machined Components	Annexure-10
11.	Standard Fittings	Annexure-11
12.	Solenoid Valves	Annexure-12
13.	Pressure Transmitter	Annexure-13
14.	Temperature sensors and transmitter with thermo well	Annexure-14
15.	Coriolis mass flow meter with transmitter	Annexure-15
16.	Multi-Pin Circular Connector	Annexure-16
17.	Control & Data cable	Annexure-17
18.	Cable Glands.	Annexure-18
19.	Field junction box (FJB)	Annexure-19
20.	GI perforated cable trays	Annexure -20
21.	Pneumatic Boosters unit	Annexure -21
22.	High pressure flexible hoses	Annexure -22
23.	Gauge shut off valves	Annexure -23
24.	Pressure Transducer	Annexure -24
25.	List of spare flow components and spare kits	Annexure -25
26.	Vendor evaluation format	Annexure -26
27.	Procedure for fabrication and testing	Annexure -27
28.	JATF HP GOX Overall Layout	Annexure -28
29.	Process P&ID	Annexure -29

19. Compliance to be submitted by the bidder for the tender specification

S.No	General RFP Specifications	Bidder's Compliance (Yes/No)
1.	Acceptance to Gaseous oxygen supply system for test facility requirements and location of the facility to be established as per the specification S.No 1 (Introduction) of enclosed specification	
2.	Acceptance to the system specifications as per S.No .2 of enclosed specification	
3.	Acceptance to functional Requirements as per S.no 3 of enclosed specification	
4.	Acceptance to system Configuration as per S.No 4 of enclosed specification	
5.	Acceptance to scope of contractor as per S.No 5 of enclosed specification	



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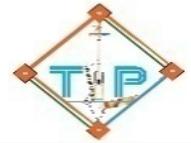
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6.	Acceptance to scope of Inspection as per S.No 6 of enclosed specification	
7.	Acceptance to packing and transportation of materials as per S.No 7 of enclosed specification	
8.	Acceptance to Erection & Commissioning at SDSC as per S.No 8 of enclosed specification	
9.	Acceptance to documentation as per S.No 9 of enclosed specification	
10.	Acceptance to department scope as per S.No 10 of enclosed specification	
11.	Acceptance to system realization schedule as per S.No 11 of enclosed specification	
12.	Bidder Compliance to acceptance criteria of items at SDSC SHAR as per S.No 12 of enclosed specification	
13.	Acceptance to bid submission details as per S.No 13 of enclosed specification	
14.	Submission of bidder compliance and proofs related to minimum qualification criteria as part of technical bid as per S.No 14 of enclosed specification	
15.	Acceptance to bid evaluation criteria and to submit the bidder compliance as per S.No 15 of enclosed specification	
16.	Acceptance to submission of Make and Model number of flow components as per the specification S.No 16 of enclosed specification as part of technical bid	
17.	Acceptance to General terms and Conditions as per S.No 17 of enclosed specification	
18.	Acceptance to submit the bidder compliance to the technical specification, quantity and QAP as per S.No 20 of enclosed specification	
19.	Acceptance to payment terms and conditions as per S.No 17 of enclosed specification and party shall specify the option for payment in technical bid.	Either 5.1 or 5.2 specified as part of offer
20.	Party shall mention the make in India content as per S.No17 of enclosed specification and proofs shall be submitted as part of the offer	Percentage of make in India content shall be mentioned
21.	Bidder shall quote with 5%GST rates for realization of HP GOX system as per S.No17 of enclosed specification	
22.	Bidder shall submit vendor evaluation format in annexure 26 and the required proofs as part of the offer .without which offer will not	



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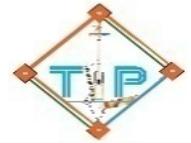
	be accepted.	
23.	Acceptance to bid evaluation criteria i.e. technically qualified and Over all lowest(L1) for awarding the contract.	
24.	Party shall submit the self-declaration that there is no complaint/vigilance inquiry against them in any Govt./Department/PSU and they have not been black listed by any Govt. Department/PSU as per point number 35 of S.No17 of enclosed specification	
25.	Bidder who is capable of executing full scope of the work only will be taken into consideration for evaluation (part or partial full work scope is not acceptable). Party shall mention whether offer is submitted for full scope of work or part of the scope	Full scope /part of the scope
26.	Acceptance to the P&ID as per the annexure 29 of the enclosed specifications	
27.	Change of specifications/ deviations (if any) shall be brought out in the offer as deviation summary with detailed justification shall be submitted in the format provided in Annexure-A of enclosed specifications as part of technical bid	
28.	Confirmation to supply the list of spare flow components and spare kits as per the annexure 25	
29.	Acceptance to submit the compliance to preferred makes as per the S.No 21 .However alternate make meeting technical and performance requirements may offered subject to dept. approval	

20. Confirmation for Technical Specifications, Quantity and QAP

S.No.	Description	Reference Annexure	Bidder compliance (Yes/No)
1.	Confirmation for Technical Specifications of Pressure Regulators	Annexure-1	
2.	Confirmation for list of pressure regulators	Annexure-1A	
3.	Confirmation for QAP of Pressure regulator	Annexure-1B	
4.	Confirmation on Technical Specifications of Electronic Pressure regulators	Annexure-2	
5.	Confirmation for list of Electronic Pressure Regulators	Annexure-2A	
6.	Confirmation for Quality Assurance Plan for Electronic Pressure Regulators	Annexure-2B	
7.	Confirmation for Technical Specifications of Safety Relief Valves	Annexure-3	



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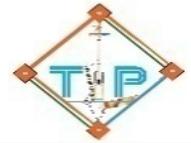
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8.	Confirmation for list of Safety Relief Valves	Annexure-3A	
9.	Confirmation for Quality Assurance Plan for Safety relief valve	Annexure-3B	
10.	Confirmation for Technical Specifications of Electro-Pneumatic Ball Valves	Annexure-4	
11.	Confirmation for list of Electro Pneumatic ball valve	Annexure-4A	
12.	Confirmation for Quality Assurance Plan for Electro Pneumatic ball valve	Annexure-4B	
13.	Confirmation for Technical Specifications of Manual ball valve	Annexure-5	
14.	Confirmation for list of Manual Ball Valves	Annexure-5A	
15.	Confirmation for Quality Assurance Plan for Manual ball valve	Annexure-5B	
16.	Confirmation for Technical Specifications of Manual globe Valves	Annexure-6	
17.	Confirmation for list of Manual globe Valves	Annexure-6A	
18.	Confirmation for Quality assurance plan for Manual Globe valves	Annexure-6B	
19.	Confirmation for Technical Specifications of Filters	Annexure-7	
20.	Confirmation for list of filters	Annexure-7A	
21.	Confirmation for Quality Assurance Plan for filters	Annexure-7B	
22.	Confirmation for Technical Specifications of Pressure Gauges	Annexure-8	
23.	Confirmation for list of Pressure gauges	Annexure-8A	
24.	Confirmation for Technical Specifications of seamless Monel pipes & tubes	Annexure-9	
25.	Confirmation for Quality Assurance Plan for seamless Monel pipes & tubes	Annexure-9A	
26.	Confirmation for Technical Specifications of Machined Components	Annexure-10	
27.	Confirmation for Technical Specifications of Standard Fittings	Annexure-11	
28.	Confirmation for Technical Specifications of Solenoid Valves	Annexure-12	
29.	Confirmation for Quality Assurance Plan for solenoid valves	Annexure-12A	
30.	Confirmation for Technical Specifications of Pressure Transmitter	Annexure-13	



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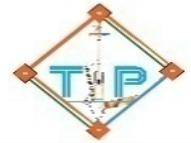
31.	Confirmation for list of Pressure Transmitter	Annexure-13A	
32.	Confirmation for Technical Specifications of Temperature sensors and transmitter with thermo well	Annexure-14	
33.	Confirmation for list of Temperature sensors and transmitter	Annexure-14A	
34.	Confirmation for Technical Specifications of Coriolis mass flow meter	Annexure-15	
35.	Confirmation for list of Coriolis mass flow meter	Annexure-15A	
36.	Confirmation for Technical Specifications of Multi-Pin Circular Connector	Annexure-16	
37.	Confirmation for Technical Specifications of Control & Data cable	Annexure-17	
38.	Confirmation on Technical Specifications of Cable Glands.	Annexure-18	
39.	Confirmation on Technical Specifications of Field Junction Box (FJB)	Annexure-19	
40.	Confirmation on Technical Specifications of GI Perforated cable trays	Annexure-20	
41.	Confirmation on Technical Specifications of Specification of Pneumatic Boosters unit	Annexure-21	
42.	Confirmation on Quality Assurance Plan for Pneumatic Boosters unit	Annexure-21A	
43.	Confirmation on Technical Specifications of High pressure flexible hoses	Annexure -22	
44.	Confirmation for list of High pressure flexible hoses	Annexure -22A	
45.	Confirmation for Quality Assurance Plan for High pressure flexible hoses	Annexure-22B	
46.	Confirmation on Technical Specifications of Gauge shut off valves	Annexure -23	
47.	Confirmation on Technical Specifications of Pressure Transducer	Annexure -24	
48.	Confirmation for list of Pressure Transducer	Annexure -24A	

21. List of preferred makes:

The preferable makes for various components/ items are given in the below table. Bidder shall specify the reputed make/ model number for each component while submitting the bid.



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S.No	Flow components	Preferred makes
1	Pressure Regulators	M/s Hale Hamilton, M/s Swagelok, M/s Tescom
2	Electronic Pressure Regulators	M/s Tescom
3	Safety Relief Valves	M/s Leser/ M/s Anderson Greenwood Crosby Sanmar Limited
4	Electro Pneumatic Ball Valves	M/s Orseal ,M/s Sankey Control Pvt.,Ltd,M/s Velan
5	Manual Ball Valves	M/s Orseal ,M/s Sankey Control Pvt.,Ltd,M/s Velan
6	Manual globe Valves	M/s Orseal ,M/s Sankey Control Pvt.,Ltd,M/s Velan/M/s Halehamilton
7	Filters	M/s Norman/M/s Puronics/M/s John crane,M/s IMI Norgren Herion
8	Pressure Gauges	M/s Wika /M/s Mass /M/S Fiebig
9	Solenoid Valves	M/s IMI Norgren Herion,M/s ASCO
10	Pressure Transmitter	M/s Rose Mount /M/s SEIMENS
11	Temperature Sensors and transmitter with thermo well	M/s Wika/ M/s Emerson /M/s Endress and Hauser /M/s Yokogawa
12	Mass flow meter	M/s Emerson /M/s Endress and Hauser /M/s Yokogawa
13	Pneumatic Boosters unit	M/s Maximator /M/s Haskel
14	Pressure Transducer	M/s Wika/ M/s Rose Mount /M/s SEIMENS
15	Gauge shut off valves	M/s Parker /M/s Swagelok/M/s Thompson

The above list indicates the department preferred makes. However, alternate makes meeting all technical and performance requirements may be offered subject to submission of complete details and prior approval of the department prior to price bid opening.

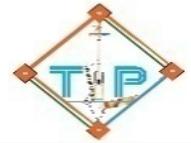
22. Annexures

Annexure-1: Specification for Pressure Regulators

S.No	Description	Specification
Technical Specifications		
1.	Quantity & Details	As per Annexure 1A
2.	Types / Constructional Details	
3.	Loading	Dome
4.	Seating	Soft seated
5.	Sensing	Diaphragm
6.	Poppet shape	As per the design
7.	Balancing	Balanced design is preferred. No bleed type.
8.	Poppet Shut off	By Spring
9.	End connections	Flanged /Metric /BSPP threaded with face seals
10.	Medium	Gaseous Oxygen(>99.5%)



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S.No	Description	Specification
11.	Material of Construction of Regulator Elements and Seals	
12.	Body	Brass, Monel
13.	Wetted parts	Monel
14.	Seat	PTFE/PCTFE
15.	Seals	PTFE/PCTFE/KALREZ(FFKM)
16.	Cleaning	For Oxygen gas service as per G93 or CGA4.1
17.	Minimum flow rate	3.3 kg/s
18.	C _v of the Regulator	Min 12, To be confirmed by the Contractor
19.	Failure flow rate	Calculation to be provided by manufacturer when the regulator is full open and at maximum inlet pressure
20.	Droop or selection	<2% minimum of minimum out let pressure(40bar) when the inlet pressure is minimum(140bar) and maximum flow rate(3.3Kg/s)(shall indicate in the regulator flow curves) Or The ratio working Cv to maximum Cv shall be 0.6 (Calculation shall be provided).

Annexure 1A: List of Pressure Regulators

S.No	Tag No	Purpose	Inlet pressure bar(a)		Outlet *pressure range bar(a)	Nominal Flow rate of gaseous oxygen Kg/s	Flow coefficient CV	Failure flow rate Kg/s
			Max.	Min.				
C) Within the GOX Servicing system								
1	VR01	Pressure regulator for path 1	250	140	40-90	3.3	Min.12	To be provided by the manufacturer
2	VR02	Pressure regulator for path 2	250	140	40-90	3.3	Min.12	
3	VR03	Pressure regulator for path 3	250	140	40-90	3.3	Min.12	



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B) Spare Quantity as per annexure 25

4	VR01-S1	Spare regulator to be supplied	250	140	40-90	3.3	Min.12
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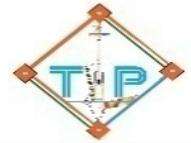
Note-*Given pressure range may be subset of actual pressure range of the regulator.

Annexure 1B: QAP of Pressure Regulator

S.No	Description	Ref Document	Acceptance Norms	Method of Check	Quantum of Check		
					MFR-QA	TPI	ISRO
1.	Bill of material and material test certificates	As per the PO/ approved drawing	Shall be as per the PO specification	Verification	100%R	100%R	100% R
2.	Hydro shell/body test	1.5 times design pressure	No pressure drop for 10min	Testing on Rig	100%W	100%R	100% R
3.	Pneumatic test of the body	1.1 times MOP	No leak indication with liquid leak detector	Testing on Rig	100%W	100%R	100% W/R
4.	Zero leak testing at No flow conditional minimum and maximum outlet pressure when inlet pressure is maximum	As per the specification	No pressure rise in the downstream for 15min	Testing on Rig	100%H	100%R	100% W/R
5.	Body interface s Leakage	As per the specification	No leak indication with liquid leak detector	Testing on Rig	100%H	100%R	100% W/R
6.	Review of Cv /flow	As per the tender document	As per the droop and	R 100%	R 100%	R 100%	R 100%



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S.No	Description	Ref Document	Acceptance Norms	Method of Check	Quantum of Check		
					MFR-QA	TPI	ISRO
	curves	specificatio n					
7.	Oxygen Cleaning	Approved procedure and standards	As per the standards	Cleaning	100%W	100%r	100% R

Annexure-2: Specifications of Electronic Pressure Regulators

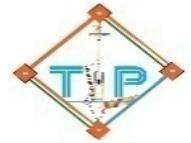
S.No	EPR description	Specification
1	Quantity and spares	As per annexure 2A
2	Inlet pressure to EPR	250 to 140bar
3	Required Outlet pressure range	40 to 100bar Note :Selected regulation range shall be more than the required regulation range of 40-100bar
4	Flow rate	Suitable for pressurization of dome of the regulator including bleeding requirement
5	droop	<0.2% at rated flow
6	Medium	Air /Nitrogen
7	Type	Area ratio electronic pilot regulator
8	Self-venting provision	Self-venting electronic pilot regulator suitable only for dome volume loading
9	Electronic control pressure	7.5bar to 8.0bar (a)
10	Feed back to the controller	Outlet pressure transducer (4-20mA)
11	Type of sensing in the dome	Piston /Diaphragm
12	Ratio loader area ratio	Area ratio is based on the design
13	End connections	Metric or BSPP with face seal. NPT is not permitted

Functional capabilities

1	Method of pressure control	Area ratio or dome pressure shall be managed by Pulse width modifier (PWM) solenoid valves. One for charging the dome and another for venting the dome /area ratio loader
2	Control Type	Microprocessor-based closed-loop PID control
3	Dome Pressure Control	Pneumatic output to dome inlet of mechanical regulator
4	Accuracy	±0.1% of full-scale or better
5	Repeatability	±0.05% of full-scale or better
6	Loop Update Rate	≤50 ms or better



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7	Feedback	Provision of feedback from internal pressure sensor of the electronic regulator (stand alone application) as well as external pressure transmitter / transducer based on requirements
8	Control Stability	Tuneable via PID parameters
9	Control Profiles	Programmable multi-step pressure/time profiles
10	Leakage Class	100% Bubble Tight shut off.
11	End connection	BSPB or metric threaded along with required adaptors (male to male adaptors with seals in case of female threads)
12	Failure mode selection	Provision for selection of default settings for command failure or feedback failure similar to power failure

Material of construction

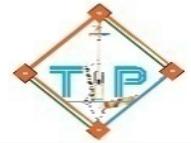
1	Body & Internals (Regulator)	SS316L/SS304L/ Equivalent higher grade as per manufacturer's standard.
2	Seat	Metal to Metal seat/ soft seated
3	End fittings	SS316L/SS304L/ Equivalent higher grade as per manufacturer's standard
4	Body manufacturing method	Machined from forged/rolled bar stock or Investment casting with radiography quality. Sand casting is not acceptable.
5	Seals	Viton

Inputs and Outputs

1	Set point Input	Analog (4–20 mA),Digital (RS-485 Modbus RTU) and USB port for configuration and commanding.
2	Feedback Input	External pressure sensor (4–20 mA)
3	Communication Ports	USB and RS-485
4	Analog Output	4–20 mA for monitored pressure
5	Response time	Rise time- 300 ms (max) Fall time-600 ms (Max)
6	Accuracy	Accuracy of 0.1% at room temperature



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7	Control Type	Microprocessor-based closed-loop PID control
8	Software and hard ware	All the required accessories and software shall be provided
Electrical and Pneumatic Requirements		
1	Power Supply	22–28.5 V DC; ≤340 mA peak
2	Ingress Protection	IP 65 or better
3	Environment conditions	Humidity: 100% RH non condensing from 0 to 60 Deg.C
4	Pneumatic Supply	Clean, dry air or nitrogen at 6.5–8.5 bar
5	External Analog Input impedance	250 ohms
6	Electrical Interface	Terminal block / plug-in connectors; with cable glands
7	Pneumatic Port Connections	NPT (or equivalent) for input, exhaust, and dome output

Annexure 2A: List of Electronic Pressure Regulators:

S.No	Tag No	Purpose	Inlet pressure* bar(a)		Outlet pressure range * bar(a)	Flow rate Kg/s of GN2	Flow coefficie nt CV
			Max.	Min.			
A) Within the GOX Servicing system							
1	EVR0 1	Pressure regulator for path 1	250	140	40-100	As per per dome loading requireme nt	As per per dome loading requireme nt
2	EVR0 2	Pressure regulator for path 2	250	140	40-100		
3	EVR0 3	Pressure regulator for path 3	250	140	40-100		
B) Spare quantity as per annexure 25							
4	EVR0 1-S1	Spare regulator for the above EVR	250	140	40-100	As per per dome loading requireme nt	As per per dome loading requireme nt
5\$	VR Spring 01 for EVR0 1	Spring regulator for offline testing	250	140	40-100		

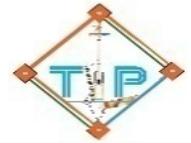
Note :

1.\$One spring with the same range shall be selected to load all three regulators dome to load the regulators when control system is not available.

2.*Selected regulation range shall be more than the required regulation range of 40-



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100bar(a)

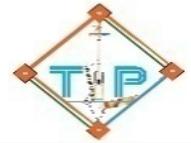
3. process medium supply of 250-140 bar for electronic pressure regulator is Gaseous nitrogen

Annexure 2B: Quality Assurance Plan

S. No	Characteristics	Ref. Document	Method of check	Quantum of check/type		
		Acceptance Criteria		Manufacturer QC	TPIA	SHAR
1	Quantity, Make & Model number:	As per PO specifications and drawings	Verification of quantity & model numbers	R 100%	R 100%	R 100%
2	Bill of material	As per Approved drawing	<ul style="list-style-type: none"> Verification of material of constructional valve elements Review material confirmatory certificates from manufacturer for soft seals 	R 100%	R 100%	R 100%
3	Verification of ER internals and interfacing details	As per the PO specifications and drawings	<ul style="list-style-type: none"> Verification 	R 100%	R 100%	R 100%
4	Material test certificates of regulator elements	As per ASTM standards /equivalent one per each heat or lot number	Review of MTCs/Reports	R 100%	R 100%	R 100%
5	Dimensional & visual inspection	Approved drawing	Measurement using tools	W 100%	R 100%	R 100%
6	Body Hydro test of body	All bodies shall undergo 1.5 Times design pressure Spec.: No	Testing on RIG	W 100 %	R 100 %	R 100%



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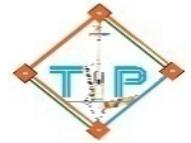
		pressure drop for 10min				
7	Seat Pneumatic test at Maximum inlet pressure	maximum inlet pressure and no load and maximum outlet pressure Spec.: Bubble tight	Testing on RIG	W 100%	R 100%	W/R 100%
8	Body Pneumatic test at MOP with all elements assembled condition	At Maximum inlet pressure and maximum outlet pressure Spec.: No leak indication with snoop	Testing on RIG	W 100%	R 100%	W/R 100%
9	Review of Cv /flow curves	As per the tender document specification	Review	R 100%	R 100%	R 100%
11	Final Documentation	As per PO (3 Copies)	Verification of Documents/ Certificates	R 100%	R 100%	R 100%

Annexure-3: Specification for Safety Relief Valves

S.No	Description	Specifications
Technical Specifications		
1.	Quantity & Spares	As per annexure 3A
2.	Type / Constructional Details	
3.	Service	Gas application
4.	End Connections	Flanged/Threaded valves: Metric /BSPP
5.	Constructional features	Conventional SRV
		Spring loaded
		Metal to metal seating/Soft seated with PTFE/PCTFE
		With test gag
		Blow down adjustment ring
		Full nozzle/Semi nozzle based on design
6.	Dimensions	Manufacturer's standard
7.	Operating conditions	
8.	Working temperature	45 °C (MAX)



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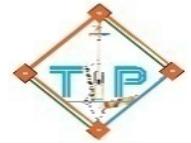
S.No	Description	Specifications
9.	Working fluid	GOX
10.	Set pressure (P_s)	As per annexure 3A
11.	Back pressure relieving (SBP+BBP) during	<10% of Set Pressure
12.	Over pressure during relieving	10% of Set Pressure
13.	SRV Sizing criteria	Regulator Failure condition & Non-fire condition
14.	Flow condition during relieving	Based on inlet and outlet pressure ratio
15.	Relieving flow rate	Pressure regulator failure flow rate with 10% over and above the set pressure
16.	Design and testing standards to be followed	
17.	Sizing of orifice	As per API RP 520 Part-1/equivalent. Calculations shall be submitted prior to selection
18.	Selection of orifice	As per API RP 526 5 th Edition/equivalent
19.	Testing	As per API RP 527 Part-1/equivalent
20.	Material of Construction of valve elements:	
21.	Body & end connection Material	Brass, Bronze & Monel400/Equivalent material for oxygen compatibility
22.	Wetted parts	Bronze / Brass/ Monel400/Equivalent material for oxygen compatibility
23.	Soft Seals/seats	PTFE/Kalrez(FFKM)/KEL-F

Annexure 3A: List of Safety Relief Valves

S. No	Tag No	Service	Pressure in bar(g)		End connection Inlet & Outlet	Discharge flow rate (Kg/Hr)	Calculated nozzle area mm ²	Selected nozzle area mm ²
			MOP	Set				
A) With in the GOX Servicing system								
1	SRV 01	Safety relief valve for VR1 outlet	90	99	Flanged	Based on the regulator failure flow rate	Based on API 521 calculations with 10% over pressure over and above set	Next higher size based on API 521 calculation
2	SRV 02	Safety relief valve for VR2 outlet	90	99	Flanged			



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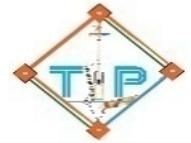
3	SRV 03	Safety relief valve for VR3 outlet	90	99	Flanged	pressure
B) Spare quantity as per annexure 25						
4	SRV 01-S1	Spare relief valve for the above SRVs	90	99	Flanged	

Annexure 3B: Quality Assurance Plan for Safety relief valve

Description	Ref Document	Acceptance Norms	Method of Check	Quantum of Check		
				MFR-QA	TPI	SDSC SHAR
Bill of material	As per Approved drawing	<ul style="list-style-type: none"> Verification of material of constructional valve elements Review material confirmatory certificates from manufacturer for soft seals 	Review	R 100%	R 100%	R 100%
Sizing and selection of orifice	As per API 521	<ul style="list-style-type: none"> As per API 521 	Review	R 100%	R 100%	R 100%
Hydro shell/body test	As per standards	Testing on Rig	Testing on Rig	100% W	100% R	100% R
Pneumatic set pressure test			Testing on Rig	100% W	100% R	100% W/R
Functional testing at set pressure	As per standards	Testing on rig	Testing on Rig	100% W	100% R	100% W/R
Seat leak checking at	As per API 527	Testing on rig	Testing on	100%	100	100%



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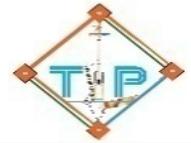
Description	Ref Document	Acceptance Norms	Method of Check	Quantum of Check		
				MFR-QA	TPI	SDSC SHAR
operating Pr.	or equivalent		Rig	W	%R	W/R
Oxygen Cleaning	Approved procedure and cleaning agents	As per standard	Cleaning	100% W	100 %R	100% R

Annexure-4: Specification for Electro Pneumatic Ball Valves

S.No	Description	Specifications
Technical Specifications		
1.	Quantity & spares	As per the annexure 4A
2.	Specification for Valves	
3.	Type	Pneumatically actuated Ball valve
4.	End connection Style	Flanged as per class rating/welded end connection
5.	Port configuration	Two Way & normally closed
6.	Body construction	Single Piece(except end connection)/ Two piece
7.	Constructional features	Floating ball
		Bore –Full bore
		With Blowout proof stem
		Dual stem seals (gland packing & O-ring)
		Solid ball
		Anti-Static
8.	Manufacturing standard	Manufacturer's standard
9.	Face to face dimensions	Manufacturer's standard
10.	Design code	ASME B 16.34/equivalent
11.	Testing code	BSEN-ISO-12266 Part 1/API 598 /Equivalent
12.	Working temperature	-10 to 50 °C
13.	Maximum working Pressure (MOP)	(PN rating of the ball valve shall be greater than MOP)
14.	Fluid Handled/medium	GOX



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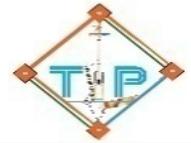
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S.No	Description	Specifications
15.	Leakage through seat	Zero bubble for 5min when inlet pressure is 5bar to PN rating
16.	Cleaning	For Oxygen gas usage
17.	Material of construction Valve & seals	
18.	Body Material	MONEL400/ Inconel/Hastelloy C 22/ Brass/ Bronze
19.	Stem	MONELK500/equivalent
20.	Ball Material	MONELK500/ equivalent
21.	Seat Material	PTFE /PCTFE
22.	Primary & Secondary stem seal	PTFE /PCTFE/Kalrez /Equivalent
23.	Body seal /End connection	PTFE/ Kalrez/PCTFE/Equivalent
24.	preferred Valve response time	Open :<0.4 seconds Close :<0.6 seconds
25.	Actuator specification: Type, MOC, construction & other details (applicable for Electro Pneumatic Ball Valves)	
26.	Type	a) Pneumatically actuated& Single acting
		b) Spring return
		c)Direct mounted on valves with ISO mounting pad
		d) fail to close position
		e) Quarter turn (90 degree)
27.	Pneumatic supply connections to actuator	¼ "NPT, Female or 1/4" BSPP
28.	Pneumatic pressure	Air/GN2 at 6-10bar
29.	Type of solenoid mounting	Provision for Namur mounting of solenoid valve
30.	Body material	Die cast Aluminum Alloy Internally Hard anodized, externally coated with Polyurethane/ Epoxy powder
31.	Piston and rack	Anodized die cast Aluminum
32.	Response time	a) Opening :< 0.4sec b) Closing :<0.6 sec
33.	Actuator torque	The actuator shall be selected with 30 to 50% extra torque than normal torque required to open or close valve against operating pressure as per class rating of the valve.
34.	Springs	Cartridge type multi springs with spring steel as MOC



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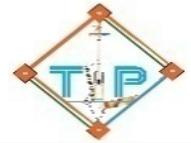
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S.No	Description	Specifications
35.	Dimensions of actuator	Envelope dimensions of the actuator shall be sent as a part of offer
36.	Weight	Weight of the actuator shall be mentioned in the offer
37.	Testing	100% Valves shall undergo Valve timings (opening & closing) test by using Namur mount solenoid valve.
38.	Specification for limit switches	
39.	Limit switch	The specified Micro-Switch assemblies housed in Flame proof enclosure will be mounted on Actuator for monitoring the ON/OFF status of Electro Pneumatic Valves.
40.	Type	Heavy Duty, SPDT Switches with form C contacts (Single pole double throw contacts)
41.	No. of switches per valve	4Nos. (2 Nos. for OPEN & 2 Nos. for CLOSE Status)
42.	Contacting Rating	5Amps at 24V DC/Equivalent
43.	Operating Temperature	Max 50 °C
44.	Specification for limit switch enclosure	
45.	Enclosure	All the four no. of Micro-Switches, 15 nos of terminal blocks, spring loaded rotary cams for position setting along with connecting shaft etc., shall be housed inside the enclosure as specified below. Note: (\$)- Micro-Switches shall be mechanical contact type. Three wires/leads from each of the Micro-Switches shall be sealed at switch side and other end terminated on terminal blocks (shall be of cage clamp, not screw type)/PCB. It means all the 12 leads from all the micro switches shall be terminated on terminal blocks/PCB. However, total 15 nos. of terminal blocks including spares shall be provided inside each enclosure
46.	Material of Construction	Tropicalized/Die cast Aluminum Alloy with corrosion resistant paint/Equivalent higher grades
47.	Degree of protection	IP 65 or Better
48.	Electrical Classification	Flame proof suitable for Zone 1 or better, Group II C environment certified by BASEEFA/ IS 2148 Gr.II C or equivalent International Agency.
49.	Cable Entry	$\frac{3}{4}$ " NPT (female) 2 nos. (1 no. to be plugged) One no. of $\frac{3}{4}$ " NPT suitable compression gland (GR-IIC) shall be supplied with each enclosure.
50.	Local ON/OFF indication	Impact Resistant Thermoplastic (Preferable). To be mounted on Micro-Switch assembly.



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

Annexure 4A: List of Electro Pneumatic ball valve

S. No	Tag No	Purpose	Type of valve	Inlet & Outlet pipe size	Bore	MOP	MOC of body & trim
A) Within the gaseous oxygen system							
1.	VP01	Path 1 charge	Pneumatically actuated Ball valve	50NBX80SCH	2 way Full Bore	90	Monel
2.	VP02	Path 1 Vent	Pneumatically actuated Ball valve	15NBX80SCH	2 way Full Bore	90	Monel
3.	VP03	Path 2 charge	Pneumatically actuated Ball valve	50NBX80SCH	2 way Full Bore	90	Monel
4.	VP04	Path 2 Vent	Pneumatically actuated Ball valve	15NBX80SCH	2 way Full Bore	90	Monel
5.	VP05	Path 3 charge	Pneumatically actuated Ball valve	50NBX80SCH	2 way Full Bore	90	Monel
6.	VP06	Path 3 Vent	Pneumatically actuated Ball valve	15NBX80SCH	2 way Full Bore	90	Monel
B) Spare Quantity as per annexure 25							
7.	VP01-S1	Spare for 50NBX80SCH	Pneumatically actuated Ball valve	50NBX80SCH	2 way Full Bore	90	Monel
8.	VP02-S1	Spare for 15NBX80SCH	Pneumatically actuated Ball valve	15NBX80SCH	2 way Full Bore	90	Monel



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Annexure 4B: Quality assurance plan for Electro Pneumatic ball valve

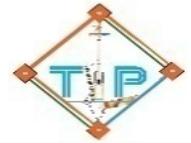
Description	Ref Document	Acceptance Norms	Method of Check	Quantum of Check		
				MFR-QA	TPI	ISRO
Bill of material	As per the approved drawing	As per the specification	Verification	100 % R	100 % R	100 % R
Material testing (Mechanical & chemical)	As per standard	As per standard	As per standards	100 % W	100 % R	100 % R
Hydro shell/body test	BS 6755 Part-1/ BS-EN-ISO 12266 Part-1, API598/ Equivalent	Testing on rig	Testing on Rig	100%W	100%R	100% R
Hydrostatic seat test			Testing on Rig	100%W	100%R	100% R
Pneumatic test of body and seat			Testing on Rig	100%W	100%R	100% W/R
Reverse seat leak check	As per approved drawings	As per standard	Testing on Rig	100%W	100%R	100% W/R
Functional testing using actuators	As per the specification	As per the response time mentioned in the specification	Testing on Rig	100%W	100%R	100% W/R
Oxygen Cleaning	Approved procedure and cleaning agents	As per standard	Cleaning	100%W	100% R	100% R

Annexure-5: Specification for Manual Ball Valves

S.No	Description	Specifications
1.	Quantity & Spares	As per the annexure 5A
2.	Specification for Valves	
3.	Type	Handle operated Manual Ball valve
4.	End connection Style	Flanged as per class rating/welded end connection



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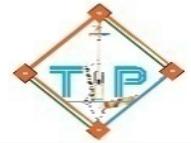
S.No	Description	Specifications
5.	Port configuration	Two Way & normally closed
6.	Body construction	Single Piece(except end connection)/ Two piece
7.	Constructional features	Floating ball
		Bore –Full bore
		With Blowout proof stem
		Dual stem seals (gland packing & O-ring)
		Solid ball
		Anti-Static
8.	Manufacturing standard	Manufacturer's standard
9.	Face to face dimensions	Manufacturer's standard
10.	Design code	ASME B 16.34/equivalent
11.	Testing code	BSEN-ISO-12266 Part 1/API 598 /Equivalent
12.	Working temperature	-10 to 50 °C
13.	Maximum working Pressure (MOP)	(PN rating of the ball valve shall be greater than MOP)
14.	Fluid Handled/medium	GOX
15.	Leakage through seat	Zero bubbles for 5min when inlet pressure is 5bar to PN rating
16.	Cleaning	For Oxygen gas usage
17.	Material of construction Valve & seals	
18.	Body Material	MONEL400/ Inconel/Hastelloy C 22/ Brass/ Bronze
19.	Stem	MONEL400/MONEL K500/equivalent
20.	Ball Material	MONEL400/MONELK500/equivalent
21.	Seat Material	PTFE /PCTFE
22.	Primary & Secondary stem seal	PTFE /PCTFE/ KALREZ /EQUIVALENT
23.	Body seal /End connection	PTFE/ KALREZ/PCTFE/EQUIVALENT

Annexure 5A: List of Manual Ball Valves

S. No	Tag No	Purpose	Type of valve	Inlet & Outlet pipe size	Bore	MOP	MOC of body & trim
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A) Within GOX supply system

1.	VMN01	Cylinder outlet 1	2way Manual Ball valve	25NBX 160SCH	Full Bore	250	MONEL
2.	VMN02	Cylinder outlet 2	2way Manual Ball valve	25NBX 160SCH	Full Bore	250	MONEL
3.	VMN03	Cylinder outlet 3	2way Manual Ball valve	25NBX 160SCH	Full Bore	250	MONEL
4.	VMN04	Cylinder outlet 4	2way Manual Ball valve	25NBX 160SCH	Full Bore	250	MONEL
5.	VM01	Regulation path1 inlet	2way Manual Ball valve	50NBX 160SCH	Full Bore	250	MONEL
6.	VM02	Regulation outlet vent path1	2way Manual Ball valve	15NBX 80SCH	Reduced bore	90	MONEL
7.	VM03	Regulation outlet path1	2way Manual Ball valve	50NBX 80SCH	Full Bore	90	MONEL
8.	VM04	Regulation path2 inlet	2way Manual Ball valve	50NBX 160SCH	Full Bore	250	MONEL
9.	VM05	Regulation outlet vent path2	2way Manual Ball valve	15NBX 80SCH	Reduced bore	90	MONEL
10.	VM06	Regulation outlet path2	2way Manual Ball valve	50NBX 80SCH	Full Bore	90	MONEL
11.	VM07	Regulation path3 inlet	2way Manual Ball valve	50NBX 160SCH	Full Bore	250	MONEL
12.	VM08	Regulation outlet vent path3	2way Manual Ball valve	15NBX 80SCH	Reduced bore	90	MONEL
13.	VM09	Regulation outlet path 3	2way Manual Ball valve	50NBX 80SCH	Full Bore	90	MONEL

B) Spare quantity as per annexure 25

14.	VMN01-S1	Spare valve for VMN01	2way Manual Ball valve	25NBX 160SCH	Full Bore	250	MONEL
15.	VM01-S1	Spare valve for VM01	2way Manual Ball valve	50NBX 160SCH	Full Bore	250	MONEL
16.	VM02-S1	Spare valve for VM02	2way Manual Ball valve	15NBX 80SCH	Reduced bore	90	MONEL

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17.	VM03-S1	Spare valve for VM09	2way Manual Ball valve	50NBX 80SCH	Full Bore	90	MONEL
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Annexure 5B:Quality assurance plan for Manual ball valve

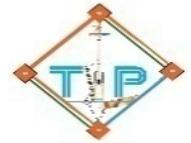
Description	Ref Document	Acceptance Norms	Method of Check	Quantum of Check		
				MFR-QA	TPI	ISRO
Bill of material	As per the approved drawing	As per the specification	Verification	100 % R	100 % R	100 % R
Material testing (Mechanical & chemical)	As per standard	As per standard	As per standards	100 % W	100 % R	100 % R
Hydro shell/body test	BS 6755 Part-1/ BS-EN-ISO 12266 Part-1, API598/ Equivalent	Testing on rig	Testing on Rig	100%W	100%R	100%R
Hydrostatic seat test			Testing on Rig	100%W	100%R	100%R
Pneumatic test of body and seat			Testing on Rig	100%W	100%R	100%w
Reverse seat leak check	As per standards	As per standard	Testing on Rig	100%W	100%R	100%R
Oxygen Cleaning	Approved procedure and cleaning agents	As per standard	Cleaning	100%W	100%R	100%R

Annexure-6: Specification for Manual Globe Valves

S.No	Description	Specification
1.0 Technical Specifications		
1.	Quantity & details	As per the annexure 6A
2.	Configuration and constructional features	
3.	Type	Non rotating stem globe valve
4.	Seating configuration	Flat or conical or spherical
5.	Type of seating	Metal to metal /soft seated
6.	Flow pattern	Straight /angled



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S.No	Description	Specification
7.	Size of orifice (bore)	10mm(Minimum)
8.	End connection	BSPP male /Metric threads
9.	Type of mounting	Panel mount
10.	Valve operation by	Handle
11.	Operating temperature	-10 to 50Deg.C
12.	Steam sealing	By Gland packing or O-ring
13.	Body type	Single Piece/ Two piece (except end connection)
14.	Gland packing & loading	Based on the manufacturer design
15.	Cleaning	For Oxygen gas usage
16.	Material of construction Valve & seals	
17.	Body Material	Monel /Brass /Equivalent material for oxygen compatibility
18.	Stem and wetted parts	
19.	Seat Material	Metal to metal /PCTFE/as per the design
20.	Gland packing	PTFE/based on the design/VITON
21.	Handle	SS304/316
22.	Cleaning	Total assembly shall be cleaned for oxygen usage

Annexure 6A:List of Manual globe Valves

S. No	Tag No	Purpose	Medium	Type of valve	Inlet & Outlet pipe size	Min Bore	MOP bar	MOC of body & trim
A)With in the GOX supply system								
1.	CCNV01	Cylinder charging	GOX	Globe valve	1/2 Inch BSPP/metric	10mm	250	Monel-400/Bra ss
2.	NNV01	Cylinder out let 1	GOX	Globe valve	1/2 Inch BSPP/metric	10mm	250	Monel-400/Bra ss
3.	NNV02	Cylinder out let 2	GOX	Globe valve	1/2 Inch BSPP/metric	10mm	250	Monel-400/Bra ss
4.	NNV03	Cylinder out let 3	GOX	Globe valve	1/2 Inch BSPP/metric	10mm	250	Monel-400/Bra ss
5.	NNV04	Cylinder	GOX	Globe	1/2 Inch	10mm	250	Monel-400/Bra



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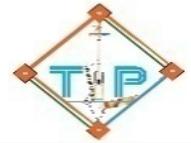
		out let 4		valve	BSP/metric			ss
6.	NV01	Inlet Bypass valve(Low flow)	GOX	Globe valve	1/2 Inch BSP/metric	10mm	250	Monel-400/Bra ss
7.	NV02	Inlet Bypass valve(Low flow)	GOX	Globe valve	1/2 Inch BSP/metric	10mm	250	Monel-400/Bra ss
8.	NV03	Inlet Bypass valve(Low flow)	GOX	Globe valve	1/2 Inch BSP/metric	10mm	250	Monel-400/Bra ss
B)Spare Quantity as per annexure 25								
9.	NNV01-S1	Spare Manual Needle valve	GOX	Globe valve	1/2 Inch BSP/metric	10mm	250	Monel-400/Bra ss

Annexure 6B:Quality assurance plan for Manual Globe valves

Description	Ref Document	Acceptance Norms	Method of Check	Quantum of Check		
				MFR-QA	TPI	ISRO
Bill of material	As per the approved drawing	As per the specification	Verification	100 % R	100 % R	100 % R
Material testing (Mechanical & chemical)	As per standard	As per standard	As per standards	100 % W	100 % R	100 % R
Hydro shell/body test	BS 6755 Part-1/ BS-EN-ISO 12266 Part-1, API598/ Equivalent	Testing on rig	Testing on Rig	100%W	100%R	100%R
Hydrostatic seat test			Testing on Rig	100%W	100%R	100%R
Pneumatic test of body and seat			Testing on Rig	100%W	100%R	100%w
Reverse seat leak check	As per standards	As per standard	Testing on Rig	100%W	100%R	100%R



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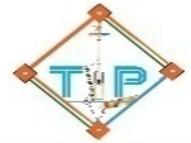
Description	Ref Document	Acceptance Norms	Method of Check	Quantum of Check		
				MFR-QA	TPI	ISRO
Oxygen Cleaning	Approved procedure and cleaning agents	As per standard	Cleaning	100%W	100%R	100%R

Annexure-7: Specification for Filters:

S.No	Description	Specification
A) Technical Specification		
1.	Quantity & details	As per Table 7A
2.	Type, operating conditions and constructional features	
3.	Type	T-Type / In line
4.	Fluid Medium	GOX
5.	Temperature	-10 °C to +50 °C
6.	Filter element type	Nickel 200 Woven Mesh Type Pleated/cylindrical <ul style="list-style-type: none"> ✓ Filtration mesh shall be provided with internal and external supporting mesh of higher micron rating ✓ Fixing of filter element with end caps and to the adapters shall be only by welding. Adhesive is not permitted.
7.	Filtration rating	20 micron (absolute)
8.	Filtration area	Greater than 7times the inlet pipes ID
9.	Flow type	Bi-directional
10.	Collapsibility	Element should withstand for a maximum differential pressure of 5 Bar without any damage.
11.	Design standard	Manufacturers standard
12.	Threads to be	Metric /BSPP/flanged
13.	Cleaning	For Oxygen gas usage
B) Material of construction of filter and it's elements		
14.	Body	Monel 400/Brass
15.	Mesh	Nickel 200
16.	Perforation cylinder	Monel 400
17.	Seals & O-rings	PTFE /PCTFE/ Kalrez //Metallic /Equivalent
18.	End connections	Metric /BSPP/Flanged



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Annexure 7A: List of Filters

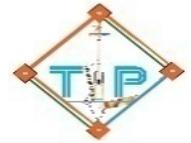
S. No	Tag No	Purpose	Element	MOP Bar	Micro n Rating (abs)	MOC of body (bar)	Mesh MOC	Pipes Size & Schedule	Min Filter flow area	
A)With in the GOX supply system										
1.	FL01	Cylinder Charging	Mesh	250	20	Monel/brass	Nicke l 200	15NB, 160sch	Flow area shall be greater than 7 times Inlet pipe area	
2.	FL02	VR1 inlet	Mesh	250	20	Monel/brass	Nicke l 200	50NB, 160sch		
3.	FL03	VR2 inlet	Mesh	250	20	Monel/brass	Nicke l 200	50NB, 160sch		
4.	FL04	VR3 inlet	Mesh	250	20	Monel/brass	Nicke l 200	50NB, 160sch		
B)Spare Quantity (element alone) as per annexure 25										
5.	FL01-S1	Spare element alone for FL01	Mesh	250	20	Monel/brass	Nicke l 200	15NB, 160sch		
6.	FL02-S1	Spare element alone for FL02	Mesh	250	20	Monel/brass	Nicke l 200	50NB, 160sch		

Annexure 7B:Quality Assurance plan for filters:

Description	Ref Document	Acceptance Norms	Method of Check	Quantum of Check		
				MFR-QA	TPI	ISRO
Bill material of	As per the approved drawing	As per the approved drawing	Verification	100%R	100%R	100%R
Material testing (Mechanical & chemical)	As per ASTM standards for the material selected	As per standard	As per standards	100 % W	100 % R	100 % R
Hydro shell/body test	1.5 times design pressure	No pressure drop for	Testing on Rig	100%W	100%R	100%R



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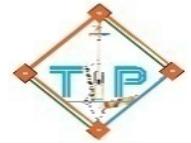
		10min				
Pneumatic test of the body with filter element	1.1 time design pressure	No indication of external leak with snoop		100%W	100%R	100%R
Multi pass / (Type test)	As per ISO4572 /equivalent	As per standard	Testing on rig	100%H	100%R	100%R
Collapsible test (Type test)	As per ISO2942/Equivalent	>5bar (g) as per the specification	Testing on rig	100%H	100%R	100%R
Bubble point testing of filter elements	As per ISO2942/Equivalent	As per 20micron abs	Testing on rig	100%W	100%R	100%W
Oxygen Cleaning	Approved procedure and cleaning standards CGA G 4.1 /ASTM G 93 /equivalent	As per standard	Cleaning	100%W	100%R	100%R

Annexure-8: Specification for Pressure Gauges:

S.No	Description	Specifications
1.0 Technical specifications		
1.	Quantity & Details	As per table 8A
2.	Type, MOC, operating conditions, Configuration& other details	
3.	Type	Bourdon tube with blow out disc at top, laminated safety glass window
4.	Material of construction	a) Bezel & Casing SS 304/316 or Equivalent b) Bourdon tube – Monel400/oxygen compatible material – TIG welded to the socket c) Socket & other wetted parts – Monel400/ compatible material d) Pointer – Aluminum or equivalent with zero adjustment provision
5.	Working media	GOX
6.	Type of entry	Bottom /Panel mounted



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S.No	Description	Specifications
7.	End connection	M20 x 1.5/1/2 Inch BSPP
8.	Accuracy	± 0.5% of FSD
9.	Resolution/LC	1% of full-scale value
10.	Design /manufacturing Std.	EN837 – 1 or equivalent DIN/IS Standards
11.	Design Temperature & Rh	60Deg C & RH-100%
12.	Classification	Weather proof (IP65 or better)
13.	Dial Size	160mm

General conditions

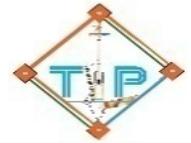
14.	Pressure gauges shall be provided with Shatter proof glass. Bezel material shall be same as that of case material.
15.	The gauge indicator movement shall be micro point adjustment for calibration purpose.
16.	Pressure gauges shall have over range protection of minimum 130% FSD and primary elements shall withstand the specified overpressure without losing their elastic properties and performance.
17.	The instrument serial no, Model no, accuracy, range, resolution, etc. shall be printed on the dial.
18.	Original calibration certificates for each pressure gauge from the manufacturers shall be supplied.
19.	Supplier may exercise multiple options (combinations) vis-à-vis %FSD and Resolution and where ever it is not matching in the schedule of pressure gauges, supplier may suggest accordingly.

Annexure 8A: List of Pressure Gauges

S. No	Tag No	MOP bar(g)	Range bar(g)	Accuracy Class	Purpose	Dial Size	End Connection	Mounting	Wetted parts
A)With in the GOX supply System									
1.	PI01	250	0-400	0.5%	GOX Source pressure inlet	160	M20X1.5	Bottom/panel	Monel *
2.	PI02	250	0-400	0.5%	GOX Source pressure inlet	160	M20X1.5	Bottom/panel	Monel *



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S. No	Tag No	MOP bar(g)	Range bar(g)	Accuracy Class	Purpose	Dial Size	End Connection	Mounting	Wetted parts
3.	PI03	100	0-160	0.5%	VR1 outlet	160	M20X1.5	Bottom/panel	Monel *
4.	PI04	100	0-160	0.5%	VR2 outlet	160	M20X1.5	Bottom/panel	Monel *
5.	PI05	100	0-160	0.5%	VR3 outlet	160	M20X1.5	Bottom/panel	Monel *

B) Spare Quantity as per annexure 25

6.	PI01-S1	250	0-600	0.5%	Spare PI for PI01	160	M20X1.5	Bottom/panel	MONEL *
7.	PI03-S1	100	0-160	0.5%	Spare PI for PI03	160	M20X1.5	Bottom/panel	MONEL *

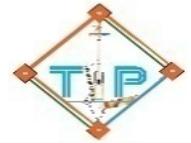
***All wetted parts shall be made with MONEL or equivalent oxygen compatible material and cleaned for oxygen service**

Annexure 9: Specification of seamless Monel pipes & Tubes

S.No	Description	Specification
Seamless Monel400 pipes and tubes as per the requirement after finalizing the detailed engineering		
1.	Standard	ASTM B165 (for Monel pipe and tubes)
2.	Material of construction	Monel400
3.	Edge preparation	Square cut, smooth & de-burred ends
4.	Length	6 to 7 m (straight)
5.	Dimensional tolerance	As per ASTM B829
6.	Straightness	Shall be ± 3 mm over a length of 3 m. (1 mm/Metre)
7.	Allowable Variation in quantity:	± 1 Length in each size
8.	Manufacturing process	<ul style="list-style-type: none"> All pipes up to 50NB shall be manufactured by Cold Pilgering/Cold drawn Process & seamless only. All pipes above 50NB shall be manufactured by cold drawn seamless only. Cold Pilgered/cold drawn pipes shall be solution annealed as per ASTM B165 if applicable Heat treatment charts shall be submitted for review



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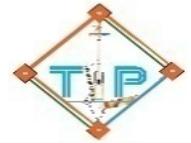
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S.No	Description	Specification
9.	Testing	Pipes: <ul style="list-style-type: none">✓ All pipes shall be tested hydrostatically as per ASTM A829/equivalent✓ All pipes shall be visually examined for absence of scratches, dents, surface irregularities, etc.✓ one sample for each size of pipe and material shall be tested to confirm chemical composition. Test certificates shall be produced during inspection.✓ Minimum one test specimen from each heat (ladle)/lot for each size of pipe and material shall undergo mechanical testing like UTS, yield & percentage of elongation as per standards✓ All the pipes shall be tested by ultrasonic Test as per Practice ASTM E-213/ ASTM A999 for all sizes.✓ Heat treatment charts shall be submitted for department & TPI for review if applicable.
10	Testing	Tubes: <ul style="list-style-type: none">▪ Finished material testing: Chemical analysis, Tensile testing, Hardness test▪ Hydrostatic test as per ASTM A 530/1016 a
11	Inspection by the manufacturer QC	<ul style="list-style-type: none">➤ Pipes/tubes shall be cleaned and dried before dispatch. Ends shall be protected with suitable plastic caps to avoid entry of dust, water and foreign materials during storage and transportation.➤ Material shall be wrapped in polythene sheet and packed in a wooden box as seaworthy package.➤ All pipes/tubes shall be clearly marked indicating manufacturer's reference, material grade, dimensions, heat treatment and Lot number.➤ Cold pilgered/cold drawn pipes shall be solution annealed if applicable.➤ All tubes should have smooth & bright surface finish as per standard.
12	Service Medium	Gaseous Oxygen, Gaseous Nitrogen
13	Production master file	Production master file (3copies) shall comprise the following: <ul style="list-style-type: none">✓ Dimensional and visual check reports✓ Mechanical, chemical Test reports.✓ Heat treatment charts.



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S.No	Description	Specification
		<ul style="list-style-type: none"> ✓ Hydro test reports ✓ Ultrasonic test reports (for pipes) / Eddy current test reports (for tubes) if done by the pipe manufacturer ✓ Final inspection report
14	Inspection and testing	Testing of pipes/tubes shall follow the Quality Assurance Plan (QAP)

Annexure 9A:Quality Assurance Plan (QAP)

S.No	Characteristics/ Type of check	Ref. documents	Method of check	Equipment manufacturer QC	TPI Scope	SHAR
a)	Visual & Dimensional check	ASTM B165	Witnessing	W 100%	R 100%	R 100%
b)	Chemical analysis & Mechanical (One sample per each heat/lot for each size) on selected sample	ASTM B165	Verification of material test certificates	W 100%	R 100%	R 100%
c)	Ultrasonic test on finished pipes (for both Longitudinal& transverse discontinues)	As per ASTM E213/ ASME sec V/ASTM A 999	Review of test certificate if the test is done by the pipes manufacturer .Otherwise not applicable	R 100%	R 100%	R 100%
d)	Eddy Current Testing on tubes	As per A1016/ ASTM A 426		R 100%	R 100%	W100 %
e)	Hardness test	ASTM A312/A999/ A370	Witnessing	W 100%	R 100%	R100 %
f)	Hydrostatic test	As per ASTM B 829	Review of test certificate	R 100%	R 100%	R 100%
g)	Heat treatment	As per standard	Review of test certificate	R 100%	R 100%	R 100%

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			if applicable			
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Annexure-10: Specification for Machined Components:

S.No	Description	Specifications
1.	Quantity & other details:	As per the approved fabrication drawings after detailed engineering, if applicable
Type, MOC, Machining & testing		
2.	Machining of the items shall be done with CNC machines only and strict tolerance, surface finish and work man ship shall be followed.	
3.	Required adapters drawings like nipples, captive nuts, unions, orifices etc. shall be approved by department prior to machining.	
4.	Machining shall be made from brand new forged bar stock.	
5.	Material for machined items shall be Monel 400/Monel K 500 (if welding is involved) shall be as per ASTM A 182 /479/276/ B 165 for all adaptors/unions	
6.	Raw material testing	
7.	Chemical and mechanical test one per each heat or lot used	
8.	Finished product	
9.	Chemical analysis one per each heat or lot	
10.	Supplier shall provide required inspection tools during inspection like GO & NO GO gauges, thread gauges, micro meters, dial gauges etc., for carry out inspection.	
11.	Surface finish requirement as specified in the drawings shall be strictly adhered.	
12.	All the threads and machined surfaces shall be properly protected with PVC plugs/caps to avoid transit damage.	
13.	Items shall be thoroughly de-burred and degreased prior to the packing.	
14.	No burs, dents, scratches are permitted on the machined surfaces.	

Annexure-11: Specification for Standard Fittings

S.No	Description	Technical specification
Technical Specification: Elbows, Tees, Reducers & Caps as per the BOQ of fabrications drawings after detailed engineering		
1.	Type of fittings	Butt weld
2.	Manufactured	As per ASTM B165 /equivalent for but weld fittings
3.	Dimensions	As Per ASME B 16.9 & 16.28, ASTM B829 /equivalent
4.	Edge preparation	AMSE B 16.25 or equivalent



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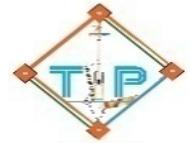
S.No	Description	Technical specification
5.	Material of constructions	Monel400
6.	Tests to be carried out on pipes butt weld Fittings & Flanges	
7.	Visual & dimensional inspection	All fittings shall be checked for dimensions and end preparation
8.	Solution annealing	All fittings shall be subjected to Solution annealing as per standard if applicable
9.	Mechanical & Chemical analysis	Chemical & mechanical analysis Shall be carried out one per each heat /lot of each size/type of fitting as per standards
10.	PMI	PMI Of finished product (one sample per heat or lot number of each size) shall be carried out as per standard procedure and the samples for testing will be selected by Purchaser during inspection.
11.	General conditions	
12.	All the tests shall be carried out by NABL approved laboratory	
13.	All fittings shall be chemically etched or Laser printed with details like, size, class rating, type, material, heat/Lot number and trade symbol.	
14.	All fittings are to be of seamless quality. Butt-Weld Tees shall be of swaged (or) forming only.	
15.	Nowhere welded/forged construction is acceptable.	
16.	Certification: Test certificate for solution annealing, chemical analysis, mechanical tests shall be supplied along with dispatch documents.	
17.	Three copies of production master file shall be supplied and shall contain the following. a. Dimensional & Visual check reports. b. Solution annealing c. All Material Analysis reports & heat treatment charts d. Final inspection Report / Release note.	
18.	Final specification of pipe fittings for approval	
19.	Inspection shall be as per approved QAP	

Annexure-12: Specification for Solenoid Valves

S.No	Description	Specification
Technical Specifications		
1.	Quantity and details	: 5MM Bore:4 Nos (3 With the system+1spare)



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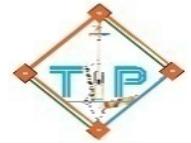
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S.No	Description	Specification
		12MM Bore :4Nos(3 With the system+1spare)
2.	Type, end connection, MOC & construction	
3.	Item	: 3/2 way, universal, Single coil low power for 5mm /basedon the design for 12mm solenoid valve direct operated Ex-proof solenoid
4.	Operation	: Low power direct operated poppet type, normally closed for <5mm (Namur mounting) Direct operated solenoid valve for >12mm(Namur is preferred) No pilot operated solenoid valves are allowed
5.	Service	: Nitrogen/Air
6.	Orifice size	: 1. 5mm for VP02,VP04&VP06 2. 12mm for VP01,VP03&VP05
7.	Operating pressure	: 0 – 10 bar (G)
8.	Process end connections	: <ul style="list-style-type: none">▪ 1/4" NPT /BSPP for all three ports. For VP02,VP04&VP06▪ 1/2" NPT /BSPP for all three ports for VP01,VP03&VP05
9.	Exhaust port/ports	: Suitable silencer/mufflers shall be supplied
10.	Mounting	: Suitable for Panel mounting, all accessories should be SS material (SS304 or better). Party has to supply all accessories (Mounting brackets, Bolts & nuts., etc.).
11.	Body Material	: SS 316/304
12.	Temperature	: -25 To 60°C
13.	Elastomer/seals	: Viton
14.	Type of construction	: Safe venting high availability design.
15.	Valve Body Painting	: Epoxy Painting (40-60 Microns thick). Color: As per OEM
16.	Solenoid	
17.	Number of coils & valves	: Single
18.	Power rating	: <ul style="list-style-type: none">▪ Typically, 3.6 to 4 watts for VP02,VP04&VP06▪ Based on the design power raring for VP01,VP03&VP05
19.	Protection class & enclosure	: Die cast aluminium to Gas group IIC, Zone-1 Exd, IP67.
20.	Rated operating voltage	: 24 V DC nominal (Tolerance: +10% & -15%)



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1	Compliance certificate for material of construction of all elements	Material of Construction	As per PO & Relevant Standards	Review	R 100%	R 100%	R 100%
2.	Review of weather proof type test report of solenoid enclosure from Approved Govt agency.	Degree of Protection	As per PO & Relevant Standards	Review	R 100%	R 100%	R 100%
3	Internal Testing & final inspection of Assembled solenoid valves	a. HV test of coil Type repott	As per Approved Test procedures.	Visual	W 100%	R 100%	R 100%
		b. CR & IR test for coil	As per Approved Test procedures.	Visual	W 100%	R 100%	R 100%
		c. Freewheeling diode testing and installation	As per Approved Test procedures.	Visual	W 100%	R 100%	R 100%
		d. Polarity protection diode and surge suppressor testing and installation	As per Approved Test procedures.	Visual	W 100%	R 100%	R 100%
		e. Functional testing of solenoid valve at	As per Approved Test procedures.	Visual	W 100%	W/R 1Sample	R 1Sa

		maximum and minimum operating pressure and rated voltage.					
	f.	External leak at safe working pressure.	As per Approved Test procedures.	Visual	W 100%	W 100%	R 100%
	g.	Seat leak test at 1.1 times of MOP.	As per Approved Test procedures.	Visual	W 100%	W 100%	R

Annexure-13: Specification for Pressure Transmitter

S.No	Description	Specification
1.	Quantity & details	As per annexure 13A
2.	Type	SMART (HART Protocol, Latest revision) ,AbsoluteAll Electronics shall be in concealed housing, Electrical interfaces for display and excitation through terminal blocks with screws at Transmitter housing.
3.	Range	0-400bar(a)
4.	Range ability	0-400 bar(a) – 10:1
5.	Accuracy	± 0.075% of calibrated Span @ lab conditions.
6.	Total probable error	± 0.15% of span or better (Linearity, hysteresis and repeatability effects should not be included at actual process conditions)
7.	Stability	5 years without calibration
8.	Power Supply	12 to 36 V DC (24 VDC Nominal)/ Excitation through intrinsic safe barriers.
9.	Output signal	Two-wire, 4-20mA with super imposed digital communication.
10.	Zero and Span adjustment	Non-interactive, Local & Via digital communication
11.	Process Fluid	Gaseous Oxygen (GOX)
12.	Local Indicator	Built in LCD Indicator to display the pressure value in Engineering units (5-digit)
13.	Transient Protection	Built in surge protection



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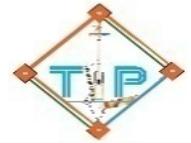
14.	Electrical Classification	FM Explosion proof and Intrinsic safety approval.
15.	Environment Protection	IP65 or better
16.	Operating temperature	Ambient : 0 to 60 Deg.C Medium : -10 to 60 Deg.C
17.	Process Connection	½” NPT (F)/M20X1.2
18.	Electrical connection	½” NPT (F)
19.	Material of Construction: Wetted Parts	a) Wetted material: Monel /Cu: ni alloys/Hastelloy C 22 C22 b) wetted O rings: KALREZ
	Cleaning	Cleaning for oxygen service
	Non-wetted Parts	SS304L/304/316 based on the manufacturer
20.	Mounting	2” Pipe (std) or panel mounting
21.	Over Pressure	150% of the rated Pressure
22.	Party shall furnish the relevant catalogue/technical literature along with the items	
23.	The transmitter shall be supplied along with the digital local indicators calibrated in engineering units (bar).	
24.	Each transmitter shall have name plate covering model no, tag no, range, calibrated span, supply voltage, max working pressure, output etc.	
25.	All mounting accessories shall be supplied with the item.	
26.	Installation, operational & maintenance manuals, calibration certificate shall be supplied along with the items.	
27.	Material test certificate for the wetted parts/certificate of conformity to be supplied along with the item.	
28.	Ex. Proof /intrinsicly safe certificate and weather proof certificate shall be furnished with the item.	
29.	All transmitters are to be calibrated for absolute measurements of its maximum range.	

Annexure-13A: List of Pressure Transmitters

S.No	Tag No	Service	Settling time/ response time	MOP bar(a)	End Connection Size/Type	Range bar(a)	Wetted parts
A) With in the GOX supply system							
1.	PT01	GOX Source pressure inlet	≤ 100ms	250	M20 X 1.5/ 1/2”NPT	0-400	Monel400/ Hastelloy C 22 / Inconel *



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S.No	Tag No	Service	Settling time/ response time	MOP bar(a)	End Connection Size/Type	Range bar(a)	Wetted parts
2.	PT02	Regulation Unit inlet	≤ 100ms	250	M20 X 1.5/ 1/2"NPT	0-400	
3.	PT03	VR01 inlet	≤ 100ms	250	M20 X 1.5/ 1/2"NPT	0-400	
4.	PT04	VR02 inlet	≤ 100ms	250	M20 X 1.5/ 1/2"NPT	0-400	
5.	PT05	VR03 inlet	≤ 100ms	250	M20 X 1.5/ 1/2"NPT	0-400	
B) Spare Quantity as per annexure 25							
6.	PT01-S1	Spare for PT01	≤ 100ms	250	M20 X 1.5/ 1/2"NPT	0-400	

***All wetted parts shall be made with MONEL or equivalent oxygen compatible material and cleaned for oxygen service**

Annexure-14: Specifications of Temperature Sensors and transmitter with thermo well

S.No.	Description	Specification
1.	Quantity & details	As per table 14 A
2.	Sensor Type	Resistance Temperature detector (RTD), PT100 (100 Ω with α=0.00385)– 4- wires configuration
3.	Ingress Protection	IP 65 or better
4.	Extension length	50 mm
5.	Temperature measurement range	250K – 473K
6.	Accuracy	Class A
7.	Service	Suitable for GOX application for installation in bare lines
8.	Maximum Operating pressure	250 bar
9.	Connection type	Sensor Lead Wire Terminal
10.	Maximum operating Pressure rating	250 bar
11.	Insulation resistance	>25 MΩ between casing and current leads at 25°C and RH < 80 %
12.	Mounting arrangement	As per process
13.	Thermo well /Structural material of sensor mounting tube and	Monel 400/ Inconel/Hastelloy C 22



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mounting flange		
14.	Protection of sensor and pipe union pins	Appropriate plastic caps shall be provided. The pipe union pins shall be protected with a plastic cap. A mating pipe union for the above mentioned one should be included into the scope of delivery.
15.	Calibration certificate	All sensors shall be supplied with a calibration certificate indicating a Resistance depending on the temperature measured.
16.	Hazardous certification	For flame proof approval – ATEX or similar
17.	Medium	Gaseous Oxygen

General Conditions:

- a. The sensors shall be supplied complete with mounting flange and sensor thermo well. Sensor can be bought from the sensor manufacturer and the same can be fitted with the thermo well by the supplier.
- b. Material certification for thermo well
 - a. A sectional drawing of the recommended pipeline mounting arrangement of the sensor in shall be submitted for review and approval before commencement of fabrication
 - b. Wiring scheme, overall dimensions, mounting arrangement and sensor assembly with instructions shall be submitted for department's review and approval before procurement and supply.

Specification For Temperature Transmitter Without Matched Sensor

1.	Housing Style	Filed mount housing, dual compartment housing. Aluminium material with 1/2"- 14NPT conduit entry.
2.	Transmitter Output	4-20 mA with digital signal based on HART latest protocol
3.	Range of operation	-40°C to 85°C
4.	Accuracy	±0.10°C or better
5.	Stability	±0.25% of reading for 5 years or better
6.	Transmitter input	PT 100 in 2 wire, 3 wire or 4 wire configuration
7.	Measuring Configuration	Single-Sensor Input
8.	Product Certification	FM IS, Non-incendive& Explosion proof combo.
9.	Mounting Bracket	"U" mounting bracket for 2" pipe mounting- All SST
10.	Display	LCD Display
11.	Transient Protector	Integral Transient Protector required
12.	5 Point Calibration	5 Point Calibration required
13.	Calibration Certification	Calibration Certificate (3-point calibration) required
14.	HART Revision configuration	Configured for HART latest Revision

General Conditions:



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1. The relevant catalogue / technical literature in support of quoted specification shall be furnished along with supply of items.
2. Hard copy of Relevant catalogue / technical literature, Installation, operation and maintenance manuals, calibration and warranty certificates along with the supply of items
3. Each transmitter shall have the name plate covering the Model No, Range, calibrated Span, supply voltage & Output.
4. Ex-Proof / Intrinsically safe certificate and weather proof certificate shall be furnished along with the item.
5. All mounting accessories shall be supplied with the items.

Annexure 14A: List of Temperature sensors and Transmitters

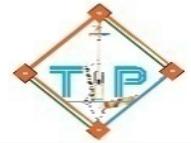
S. No	Tag No	Service	Sensor Type	Pressure rating	Range Temperature(K)	Sensor body MOC	Required accuracy	Transmitter
A)With in GOX supply system								
1.	TT01	Article 1 inlet	PT100	400 bar	250-473K	Monel 400 / Hastelloy C 22 / Inconel	Class A	Rosemount
2.	TT02	Article 2 inlet	PT100	400 bar	250-473K		Class A	Rosemount
3.	TT03	Article 3 inlet	PT100	400 bar	250-473K		Class A	Rosemount
B) Spare Quantity as per annexure 25								
4	TT01-S1	Spare	PT100	400 bar	250-473K	Monel 400 / Hastelloy C 22 / Inconel	Class A	Rosemount

Annexure-15: Specification for Coriolis massflow meter with transmitter

S.No.	Description	Specification
1.	Quantity & details	As per annexure 15A
2.	Type of flow meter	Coriolis mass flow meter
3.	Power supply	Core processor of sensor to be powered by the compatible transmitter
4.	Medium	Gaseous Oxygen(Purity >99.5%)
5.	Working pressure	40-90bar
6.	Working temperature	Ambient
7.	Flow rate	0-5kg/s
8.	Minimum flow to be measured	300 g/s



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9.	Allowable pressure drop	Less than 0.4 bar at 40 bar and 3.3kg/s
10.	Pipe Line size	50NB
11.	Pipe line schedule	Schedule 80
12.	Material of construction	Monel400/Hastelloy C 22 /Equivalent oxygen compatible material
13.	End Connection	Flanged
14.	Flow meter accuracy	≤0.5%
15.	Sensor case	Standard pressure containment
16.	Sensor electronics	Shall be integral on sensor with wires to interface
17.	Calibration	Shall supply sensor calibration certification traceability to primary standards
18.	Conduit connection	½" NPT
19.	Approvals	ATEX- Equipment Category 2 (Zone 1- Flame Proof terminal compartment)
20.	Sensor tube health diagnostics	Provision of meter verification for health verification of the sensor

For remote mount transmitter

21.	Sensor to transmitter compatibility	Transmitter shall be compatible to interface with sensor.
22.	Mounting	Remote mount transmitter
23.	Power Supply	12 to 36 V DC (24 VDC Nominal) or better
24.	Output signal	4-20mA DC output for mass flow rate with HART capability
25.	Zero and Span adjustment	Non interactive, Local /Via digital communication
26.	Local Indicator	Built in LCD Indicator to display the flow rate in value in Engineering units (5-digit) and configuration of the flow meter
27.	Transient Protection	Built in surge protection
28.	Hazardous area classification	Suitable for zone 1 group II C environment and certified for Ex-proof and intrinsic safety
29.	Electrical Classification	FM Explosion proof and Intrinsic safety approval.
30.	Environment Protection	IP65 or better



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31.	Configuration tool	HART hand held communicator should be supported by the device.
32.	Accessories	One number Latest HART communicators with accessories shall be provided

Annexure 15A: List of mass flow meter

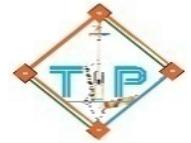
S.No	Tag No	Line Size	Temp range (K)	Working Pressure , bar (a)	Flow rate	Delta P	Accuracy	MOC
A) With in the GOX supply system								
01	MFM01	50NB 80SCH	293-323	40-90	0-5 kg/s	TBD	±0.5%	Monel 400*
02	MFM02	50NB 80SCH	293-323	40-90	0-5 kg/s	TBD	±0.5%	Monel 400*
03	MFM03	50NB 80SCH	293-323	40-90	0-5 kg/s	TBD	±0.5%	Monel 400*
B) Spare Quantity as per the annexure 25								
04	MFM1-S1	50NB 80SCH	293-323	40-90	0-5 kg/s	TBD	±0.5%	Monel 400*
*All wetted parts shall be made with MONEL or equivalent oxygen compatible material and cleaned for oxygen service								

Annexure-16: Specifications of Multi-Pin Circular Connector

S.No	Description	Specifications
a)	Technical specifications	
1.	Type	The connectors shall conform to MIL-C-26482G- Series-II or equivalent.
2.	Shell (Body)	Material: Aluminum alloy. Finish: Olive green Cadmium plated.
3.	Insulator	Neoprene (-55 °C to +200°C)
4.	Position	Normal/ Alternate as required (max 5 position)
5.	Insulation Resistance	Minimum 500MΩ at 250V AC
6.	Contacts	Material: Copper base alloy. Finish: Gold plated.
7.	Coupling	Bayonet
8.	Mating cycle	Minimum 500
9.	Polarization	Five key and Five insert orientation
10.	Contact Termination	Crimping with metal retention clip



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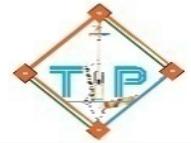
S.No	Description	Specifications
11.	Contacts	Continuous current rating: 7.5A DC for size # 20
		Voltage rating: 250V AC
		Resistance: ≤ 7.33 milli ohms resistance for size #20 contact
12.	Shell Size (No of contacts)	Shall be finalized during detailed engineering
13.	Mounting	Rear Panel mounting suitable for 2 to 3 mm thick plate
14.	Tentative MIL Part No	Receptacle: MS3470 Plug: MS3476 Environmental Boot Back shell (Type: Straight): M85049 Strain relief Back shelf (Type: Straight): M85049
b)	General conditions	
1.	All the wall mounting receptacle shall be rear mount type suitable for a panel/ plate thickness of 3mm to 4mm.	
2.	Wall mounting receptacle with narrow flange along with pins, strain relief back shell (Type: Straight clamp) with internal cable bush for receptacle.	
3.	Socket straight plug with pins, Environmental Back shell (Type: Straight) with internal cable bush for plug.	
4.	The following connectors shall be ensured. a. Command – 26 Pin Connectors – 2 Nos b. Status – 32 Pin Connectors – 2 Nos c. Pressure Transmitter – 19 Pin Connector -1 No Note: After detail engineering if number of pins for connector increases then suitably it is to be incorporated. However no of pins for Solenoid command, EP-Valve status and Pressure transmitters shall be different based on the no of elements.	

Annexure-17: Specifications of Control & Data cable

S.No	Description	Specifications
1	Type	Single pair/triad, Multi pair/ triad, flexible.
2	Type of cable	Overall Screened
3	Conductor	High conductivity Annealed Tinned copper (ATC) electrolytic grade, As per IS:8130/84
4	Core	Multi strand 7 Nos of 0.3mm for 0.5Sq.mm copper conductor.
5	Primary core insulation	Extruded solid High-Density polyethylene (HDPE) as per BS: 5308 part-1/EN-50290-2-23. Nominal thickness of 0.5mm, voltage grade 300V minimum.



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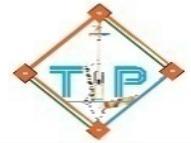
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6	Colour of core insulation	The cores are to be identified as below. Single Pair: Red, Black Three triad: White, Blue, Brown with Numbering For other cables, the color shall be finalized as part of cable "Technical Data sheet" Approval during detailed engineering.
7	Twists/Mtrs	15 to 20 (nominal), Polyester Taping (~0.03mm thick) shall be provided on each pair/triad immediately after twisting of cores.
8	Drain wire size	7/ 0.3mm stranded ATC
9	Screening	100% coverage with ~0.025 mm thick Aluminium Mylar tape with 25% over lap along with drain wire. Polyester tape (~0.025mm thick) shall be provided above the Aluminium Mylar tape.
10	Overall tape	Overall polyester tape (~0.025mm thick) shall be provided after grouping of Pairs/triads.
11	Braid	ATC wire of ~0.15mm diameter,85% Coverage/Overlap,
12	Final tape	Polyester Taping (~0.025mm thick) shall be provided above the braid.
13	Sheath	PVC Type ST-1, 1.8 mm thick (nominal). As per IS: 5831/84. With Rodent and termite protection.
14	Conductor resistance	40.1Ω / Km (Max) at 20°C as per IS: 8130
15	Insulation resistance	More than 5000M Ω/Km at Room Temperature.
16	Mutual capacitance between cores	< 75 pF / Meter
17	Max. Capacitance between core & screen	< 400 pF / Meter
18	<u>High Voltage Test</u> Core to Core Core to Shield	~2000V AC for 2 Minutes ~2000V AC for 1 Minute.
19	Attenuation at 1KHz	1.2 dB Max/Km
20	L/R ratio	< 25 μH/Ω
21	Operating Temperature	0 °C to 70 °C
22	Cable Identification	The cable identification shall be provided by embossing the details on the outer sheath the parameters like Year, Manufacturers name, Voltage grade, Cable size, Type of cable. Etc. as per clause 17.0 of IS-7098 part-1 (1988)



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23	Standard Packing	<p>1) The cables shall be supplied in standard drum of 500/1000 m length +/- 5 % depending upon size of cable.</p> <p>2) The cables shall be provided with secured and protected packing so as to avoid damages in transit to site under normal conditions and prevention from deterioration during storage.</p> <p>3) The cables shall be supplied wound on suitable wooden drums and adequately packed to meet the requirements of shipping involved.</p> <p>4) Both the ends of the cable shall be accessible for testing purpose. Cable ends shall be suitable sealed to prevent any ingress of moisture and shall be fully protected against mechanical damage</p> <p>5) Each drum shall be marked in indelible paint with details as per IS Specifications.</p> <p>6) The tolerance in cable length on each drum shall be +/- 5% of the standard drum length.</p>
24	General Conditions	<p>Party has to submit the Cables data sheet and QAP for Approval.</p> <p>The Cables manufactured as per approved QAP, shall be inspected and cleared by Department Personal.</p>

Annexure-18: Specifications of Cable Glands.

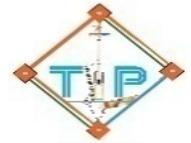
S.No	Description	Specifications
1.	Type	Double compression, Weather proof
2.	IP rating	IP 66 or better as per IS 12063-1987
3.	MOC	SS304/SS316
4.	Tentative Size	½" NPT (PT)
5.	Standard	BS 6121 or equivalent
6.	Sealing Rubber Ring	Nitrile/ Neoprene or Equivalent
7.	Inner and Outer Bushes size of Dia.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

Annexure-19: Specifications of Field Junction Box (FJB).

S.No	Description	Specification
1	Approximate Dimensions	~ 600 (H)x400(W)x200(D) / as per design requirement
2	No of Gland plates	3 Nos on left, right and bottom.
3	Gaskets	Silicone/Neoprene



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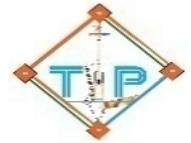
4	Material of Construction	SS or equivalent
5	Panel sheet and Enclosure thickness	Min 2mm
6	Gland Plate thickness	3mm
7	Finish	Electro Polished.
8	Enclosure	Fixed with concealed hinges and locked with SS screws.
9	Top and side entry gland punching hole details	as per design requirement
10	Size of Cable Duct inside enclosure.	100mmx100mmx450mm L, PVC type.
11	Terminal Blocks	Wago make 1.5 Sq.mm Cage clamp type 2-conductor through Double Deck terminal blocks of latest series with proper numbering, endplate and Screwless end stops.
12	Weather protection	IP 65
13	Ambient temperature	Ta: -20 to +75 deg
14	Earth Connection	2 Nos External (M6) and 1 No Internal (M6) with screws and washer.
15	Hard ware	SS or equivalent
16	Painting	Initial primer and Epoxy Coating (40-60 Microns thick)
17	Mounting	Wall/Panel mounting.
18	Fixing Hardware	Suitable Anchoring fasteners 4Nos per FJB.
19	FJB hole closure	All the FJB holes must be closed with suitable SS blanking plugs with Silicone sealing washer and check nut of ET thread.

Annexure-20: Specification for supply of GI perforated cable trays

S.NO	Description	Specification
1	Item description	Hot Dipped Galvanised Perforated Cable Trays.
	Items dimensions	1. 50 mm (W)/ 100 mm (W) /150 mm (W) x 25 mm (H) x 2.50mm (Thickness) 2. 150 mm (W) x 50 mm (H)/ 25 mm (H) x 2.50mm (Thickness)
2	Quantity required	As per design requirement
3	Type of the tray fold	Straight Type fold



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4	Type of perforation	Serial perforation
5	Galvanised coating thickness	Minimum of 90 micron.

Annexure 21: Specification of Pneumatic Boosters unit

S.No	Description	Specification
1.1	Type	Pneumatically driven oxygen gas pressure booster
1.2	Medium to be boosted & purity	Gaseous Oxygen &> 99.5% pure
1.3	Number of stages	Single stage or multi stage based on design
1.4	Booster action	Single acting or double acting based on design
1.5	Medium Working Temperature	Max.50 deg. C
1.6	Drive Gas	Dry Air/Nitrogen
1.7	Minimum delivery parameters to be ensured against the following minimum parameters such as oxygen pressure of 5bar(g) and drive gas pressure of 7-10 bar(g)	Delivery pressure of 250 to 275bar(g) and delivery flow rate shall be based on the catalogue model and based on the number of boosters
1.8	Maximum Delivery Pressure	250-275bar(g)
1.9	Minimum Inlet pressure	5bar
1.10	Maximum Inlet Pressure of Oxygen	150bar(g)
1.11	Inlet/Outlet Connections for Oxygen gas side	NPT/BSPP /Metric
1.12	Drive gas connections	NPT/BSPP /Metric
1.13	Inlet/Outlet Isolation Valves/flow components and measurements etc.	All necessary isolation valves/flow components ,measurements shall be incorporated in the booster unit
1.14	Cleanliness requirement on oxygen end	For oxygen service as per ASTM G93/CGA 4.1/Equivalent
1.15	Oxygen gas quality	Oil free
1.16	Material of wetted components/parts, metallic on oxygen side	Brass /Monel/equivalent material for 275bar oxygen handling as per standards
1.17	Material of wetted parts, metallic on drive gas side	SS304(L)/316(L)
1.18	Non-material on oxygen gas side	PTFE/PCTFE/KELRETZ

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1.19	Non-material on drive gas side	PTFE/PCTFE/VITON /Equivalent
1.20	Certifications/approvals	Supplier shall submit all the necessary certifications i.e. adiabatic shock tests/oxygen cleaning

Annexure 21A: Quality Assurance Plan(QAP)

S.No	Characteristics	Ref. Document	Method of check	Quantum of check	
				QC&TPI	SHAR
1.	Material test certificates of all elements	As per the standards	Review of test certificates	R 100%	R 100%
2	Bill of material of booster unit	As per the approved drawings	Review of bill material	R 100%	R 100%
3	Oxygen cleaning certificate	As per the ASTM G93/CGA G 4.1/Equivalent	Review of oxygen cleaning certificate	R 100%	R 100%
4	Functional checking of all elements	As per the approved procedure	Witness	W* 100%	W/R* 100%
5	Leak checking with GN2 at MOP	As per the approved procedure	Witness	W* 100%	W/R* 100%
6	Performance checking of the booster with GO2	As per the approved procedure	Witness	W* 100%	W/R* 100%
7	Oil measurement in the outlet of oxygen side	No traces of oil	Witness	W* 100%	W/R* 100%
8	Final documentation	As per the PO terms and conditions	Review of test certificates	R 100%	R 100%

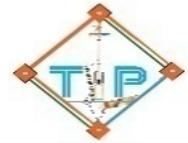
***Marked tests will be witnessed by Manufacturer QC ,TPI and purchaser if the tests are planned in India.**

Annexure-22: Specification of high pressure flexible hoses

S. No	Description	Specification
1.	Standard	BS 6501 Part1 / ISO 10380 or equivalent Hose Manufacturing Standard.
2.	Material of construction	a) The material of construction of corrugated hoses shall be Monel400/Inconel/Hastelloy C 22



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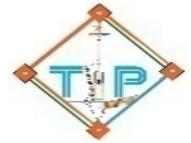
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		<ul style="list-style-type: none"> b) The material of the wire braiding provided shall be SS. c) The material of end fittings for the hoses and stub ends shall be Monel400/Inconel/ Hastelloy C 22 . All the end fittings shall be supplied with end closures. d) The material of Loose flanges shall be Monel400/Inconel/ Hastelloy C 22
3.	Length	As per table
4.	Dimensional tolerance	✓ As per ASTM B829
5.	Manufacturing process	<ul style="list-style-type: none"> • General assembly / Fabrication drawing of the hoses along with end adaptors indicating Part No. with material of construction, hose dimensions as specified in the table, design pressure, working pressure, test pressure etc., shall be furnished for purchaser's approval prior to commencement of fabrication. • All the hoses shall be made of annular corrugated inner core (metal hoses) provided with single/double SSI wire braiding. • The design and manufacturing of the hoses shall be as per manufacturer's standard/ BS 6501 Part1 / ISO 10380 or equivalent Hose Manufacturing Standard. • Details related to max. working pressure, quantity required, medium applicability, size, length and end connections are furnished in annexure 22A
6.	Testing	<ul style="list-style-type: none"> • Chemical analysis and physical testing reports for each heat or lot of material used in the hose assembly. • Mechanical properties shall include UTS, yield strength and % elongation etc., for each heat. • Burst Test details: Burst test shall be carried with one hose for each size. Burst test pressure shall be a minimum of 3 times of MOP. Burst test details are to be provided. Failure of the hose prior to pressure below burst test pressure is not acceptable. • Radiography wherever applicable. • Pneumatic test for 100% hose assemblies: All hoses shall be subjected to pressure test at 1.25 times of Maximum operating pressure with dry nitrogen/Dry Air. Leaks shall be checked with snoop solution and there shall be no visible leaks. • Helium leak test report for 100% hose assemblies: All the hoses listed in annexure 22A shall be subjected to helium leak test (MSLD-sniffer method) at Max. operating pressure, acceptable leak rate shall be better



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		<p>than 5×10^{-7} mbar lit/sec.</p> <ul style="list-style-type: none"> • Visual inspection, dimensional inspection reports. • Internal and external cleanliness checks.
7.	Service Medium	Gaseous Oxygen
8.	Production master file	<p>Production master file (3 copies) shall comprise the following:</p> <ul style="list-style-type: none"> ✓ Dimensional and visual check reports ✓ Raw material test certificates. ✓ Mechanical, chemical, IGC and Microstructure Examination Test reports. ✓ Hydro test reports ✓ Burst test report ✓ Helium leak check reports ✓ Final inspection report ✓ Inspection release note duly approved by TPI (as applicable) <p>Note: All the above reports / test results shall be bound neatly.</p>
9.	Documents/ Drawings	<p>a) The following documents/ drawings have to be submitted to the purchaser for approval.</p> <ul style="list-style-type: none"> ✓ Fabrication drawings showing overall dimensions, sectional views, Bill of materials. ✓ Specifications of hose dimensions, end fittings/ connections etc. ✓ Quality Assurance Plan. <p>Based on purchaser approval, fabrication of hoses/end fittings need to be taken-up.</p> <p>b) The following documents shall be submitted to the purchaser for approval, to obtain dispatch clearance.</p> <ul style="list-style-type: none"> ✓ Material test certificates indicating chemical composition, mechanical properties. ✓ Radiography reports, wherever applicable ✓ Pneumatic test reports ✓ Burst test reports ✓ Helium leak test reports ✓ Visual and dimensional test reports ✓ Oxygen Cleanliness check reports



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Annexure 22A: List of High Pressure Flexible Hoses

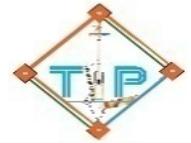
S.No	Tag.No	Size	Maximum Operating Pressure bar (g)	Wire Braiding	Length mm*	End Connection		Qty (Nos)
						First End	Second End	
1.	HP GOX M1	15NB	400	Single /Double	3000±300	Stub end with M14X1.5 nut and nipple	Stub end with M14X1.5 nut and nipple	02
2.	HP GOX M4	50NB	100	Single /Double	3000±300	Stub end with DN50 Swivel type Flange ANSI B16.5 Class-600#	Stub end with DN50 Swivel type Flange ANSI B16.5 Class-600 #	04

Annexure 22B:Quality Assurance plan (QAP)

S. No.	Characteristics/Type of check	Specification/ Reference documents	Method of check	Quantum of check		
				Manufacturer QC	TPIA	SHAR
1.	Review of raw material with MIL test certificates from Government approved lab per heat/lot with chemical, Mechanical	<ul style="list-style-type: none"> As per ASTM standards . 	Review of raw material test certificates	100% R	100% R	100% R
2.	Visual Inspection of hoses (internal, External)	No damage	Visual	100% W	100% R	100% W/R
3.	Dimensional Check	As per	Using	100%	100% R	100%



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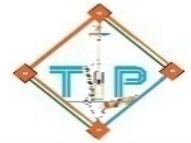
		approved drawing	Suitable calibrated measuring instruments	W		W/R
4.	Pneumatic test	As per Purchase Order	Pressure hold method / Dip test method	100% W	100% R	100% W/R
5.	Helium leak test	As per Purchase Order	Sniffing along with hose by helium leak detector	100% W	100% R	100% W/R
6.	Cleanliness	As per Purchase Order	Visual inspection	100% W	100% R	100% W/R
7.	Verification of Hose Identification tag	As per Purchase Order	Visual	100% R	100% R	100% W/R
8.	Packing & Dispatch	As per Purchase Order	Visual	100% R	100% R	100% R
9.	Final documentation	As per Purchase Order	Review	100% R	100% R	100% R

Annexure 23: Specification for Gauge Shutoff Valves

S.No	Description	Specification
1.	Quantity:	08+1(spare)=9Nos
2.	Type	Needle Valve Non-Rotating Plug
3.	Body construction	Single Piece
4.	Body manufacturing	Machined from forged/rolled bar stock
5.	No. of ports	3-ports (Female ports with face seal config.)
6.	Port Description	Port 1 – Inlet ; Port 2 – Outlet ; Port 3 – Vent



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S.No	Description	Specification
7.	No. of handles	Two handles- 1)Gauge isolation 2)Vent isolation (T-type with SS handle configuration for easy rotation)
8.	End connections	Metric Threaded (M20x1.5)/BSPP (1/2")
9.	Operating Temp.	-50°C to +50°C
10.	Fluid Medium	GOX
11.	Maximum Operating Pressure	400bar
12.	Design Standard	Manufacturer's Standard
13.	Minimum bore	>1.5 mm
Material of Construction of Valve & seals		
14.	Body	Monel 400
15.	Wetted parts	Monel 400
16.	Stem seal&Gland packing	KALREZ/PTFE/PCTFE/
17.	Seat	Metal to Metal / Soft
18.	Handle	SS 316/304

Annexure-24: Specification for Pressure Transducer

S.No.	Description	Specification
1.	Measurement Type	Gauge
2.	Transmitter Output	4 – 20 mA, 2 wire
3.	Range	0 – 160bar
4.	Accuracy	0.5% span or better
5.	Wetted Parts	Monel 400/Hastelloy C 22 / Inconel
6.	Internal pressure transmission medium	Halocarbon oil or similar inert fluid (For gaseous oxygen application)
7.	Response time	≤25 ms
8.	Process connection	M20 X 1.5(M) or ½ " NPT
9.	Cable gland entry	½" NPT



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10.	Power	24V DC operated with Overvoltage protection till 40 V
11.	Reverse Polarity Protection	Required
12.	Insulation voltage	DC 500V or better
13.	Enclosure	Field casing with minimum IP 6K9K rating
14.	Hazardous area certification	EExia IIC T4/T6 shall be conforming to ATEX/PTB certified for use in zone I and gas group II C
15.	Preferable make	Wika or equivalent

General Conditions:

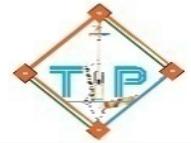
- The relevant catalogue / technical literature in support of quoted specification shall be furnished along with supply of items.**
- Each transmitter shall have nameplate covering Model no., range, supply voltage, Max.working pressure, output etc.
- All mounting accessories shall be supplied with the item.
- Hardcopy of installation, operational and maintenance manuals, calibration certificate, warranty certificate shall be supplied along with the items.
- Material test certificates for the wetted parts / certificate of conformity to be supplied along with the item.
- Ex-Proof / Intrinsically safe certificate and weather proof certificate shall be furnished along with the item.

Annexure-24A: List of Pressure Transducer

S.No	Tag No	Service	Settling time/ response time	MOP bar(a)	End Connection Size/Type	Range bar(a)	Wetted parts	Required accuracy
a. With in the GOX supply system								
1.	PTT01	VR01 outlet	≤ 25ms	100	M20X1.5	0-160	Monel/ Hastelloy C 22equivalent oxygen compatible material	±0.5%
2.	PTT02	VR01 outlet	≤ 25ms	100	M20X1.5	0-160		±0.5%
3.	PTT03	VR02 outlet	≤ 25ms	100	M20X1.5	0-160		±0.5%
4.	PTT04	VR02 outlet	≤ 25ms	100	M20X1.5	0-160		±0.5%
5.	PTT05	VR03	≤ 25ms	100	M20X1.5	0-160		±0.5%



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		outlet					
6.	PTT06	VR03 outlet	≤ 25ms	100	M20X1.5	0-160	±0.5%
b. Spare Quantity as per annexure 25							
7.	PTT-S1	Spare for PT08	≤ 25ms	100	M20X1.5	0-160	±0.5%
*All wetted parts shall be made with MONEL/Hastelloy C 22or equivalent oxygen compatible material and cleaned for oxygen service							

Annexure 25: List of spare flow components and spare kits

S.No	Ref. Tag No as spare	Quantity of spare, Nos (n)	Remarks
A)Spare flow components			
1.	VMN01-S1	01	Spare valve for VMN01
2.	NNV01-S1	01	Spare valve for NNV01
3.	FL01(element)-S1	01	Filter element for FL01
4.	FL02(element)-S1	01	Filter element for FL01
5.	VM01-S1	01	Spare valve for VM01
6.	VM02-S1	01	Spare valve for VM02
7.	VM03-S1	01	Spare valve for VM03
8.	VR01-S1	01	Spare dome regulator VR01
9.	EVR01-S1	01	Spare electronic regulator VR01
10.	VR spring 01 for EVR01-S1	01	Spare spring regulator VR spring 01
11.	SRV01-S1	01	Spare safety relief valve SRV01
12.	VP01-S1	01	Spare electro pneumatic valve for VP01
13.	VP02-S1	01	Spare electro pneumatic valve for VP02
14.	VGS01-S1	01	Spare Gauge shut off valve for VGS01
15.	PT01-S1	01	Spare pressure transmitter for PT01
16.	MFM01-S1	01	Spare mass flow meter for MFM01
17.	PTT01-S1	01	Spare pressure transducer for PTT01
18.	PI01-S1	01	Spare pressure indicator for PI01
19.	PI03-S1	01	Spare pressure indicator for PI03
20.	SOV of VP01-S1	01	Spare solenoid valve for VP01



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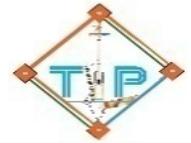
21.	SOV of VP02-S1	01	Spare solenoid valve for VP02
22.	TT01-S1	01	Spare temperature sensor with transmitter for TT01
B) Spare kits of flow components			
1.	VMN01	02	Stem and body O-rings /seats
2.	NNV01	02	Body O-rings and stem pickings
3.	FL01	01	Soft seals /gaskets
4.	FL02	02	Soft seals /gaskets
5.	VM01	02	Stem and body O-rings /seats
6.	VM02	02	Stem and body O-rings /seats
7.	VM03	02	Stem and body O-rings /seats
8.	VR01-S1	02	Soft seals and Poppet
9.	EVR-S1	02	Soft seals and Poppet
10.	SRV01-S1	02	O-rings, gaskets, disc
11.	VP01-S1	02	Stem and body O-rings /seats
12.	VP02-S1	02	Stem and body O-rings /seats
13.	VGS01	02	Body O-rings and stem pickings

Annexure 26: Vendor Evaluation Format

S.No.	Description	To be filled / confirmed by the bidder
The Bidder must submit the following table with documentary proof to confirm his acceptance to meet the requirements detailed above, without which the offer will not be considered.		
1.	Name of Company/Transporter	
2.	Address of Company	
3.	Type of Company(Proprietary/Pvt.Ltd /Public Ltd/Joint Venture/Consortium)	
4.	Registration number	
5.	Year of inception of the company	
6.	Registered address	
7.	Name & address of the office of the Chief Executive of the company	
8.	Name & Designation of the officer of the Bidder to whom all correspondence shall be made for expeditious technical/ commercial co-ordination. Telephone number	



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S.No.	Description	To be filled / confirmed by the bidder
	Fax number E-mail address	
9.	<u>Bidder's previous track record:</u> The manufacturer should be a Company/Society/Firm registered since last 3 (Three) years or more.	
10.	Locations of the Branches of Company (if any)	
11.	Annual turn-over of the company for the last three years ending with 31.03.2025	
12.	IT returns for the last 3 years ending with 31 st march 2025	
13.	Enclose copies of the similar type Purchase orders for High pressure oxygen system executed in last three years	
14.	Customers feedback on the services which is in writing (Pl. enclose copies). If any	
15.	Quality certification of the company, if any	
16.	PAN Card Copy	
17.	The Profit & Loss Account details for the last 3 years which is duly audited and Submitted as part of the Annual Report	
18.	No. of employees (Supplier shall mention contract personnel separately) Design Engineers Draftsman fitters 6G qualified Welders for monel 400 Supervisors Technicians Helpers Administrative Staff.	
19.	Visit by Purchaser: During the Technical evaluation of the Tender, if required the purchaser has right to visit the bidder's facilities to Clarify / confirm the documents /claims submitted by him. It is the responsibility of the bidder to submit necessary supporting documents / to show his facilities.	

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S.No.	Description	To be filled / confirmed by the bidder
20.	Supplier shall agree to all the terms and conditions of the indent specifications	
21.	TWO PART BID: Bidders shall quote the tender in two part bid basis. Technical bid shall be evaluated first, only technically suitable bidders shall be allowed for price bid.	
22.	Note: If any clarification required on specification, the bidder can visit the SDSC-SHAR, Sriharikota, before submitting the bids.	

SIGNATURE :

NAME :

DESIGNATION :

SEAL OF THE COMPANY DATE :

Annexure-27: Procedure for Cleaning, testing and painting

The following procedures shall be followed during fabrication testing and qualification of valve units.

S. No	Procedure Number	Description
1.	Procedure-1	Cleaning of pipelines
2.	Procedure-2	Painting
3.	Procedure-3	Pneumatic / Hydro test procedure for pipe lines

Procedure-1: Cleaning of pipelines

System cleanliness is critical in oxygen components and systems because contaminants may cause functional anomalies of the flow components or ignition. Components used in oxygen systems should always be clean before initial assembly to ensure contaminants do not damage the hardware. After initial mock up assembly, oxygen systems must be disassembled and thoroughly cleaned, reassembled, leak tested, and purged with clean, oil free, filtered, dried with GN₂ or helium before they are wetted with oxygen.

A) Cleaning:

After the final hydraulic/pneumatic pressure test (as applicable), chemical cleaning is to be carried out for both inside and outside surfaces of the vessel.

B) Degreasing



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This is done to remove oil and grease. This is done by one of the following methods:

- By vapour phase degreasing with trichloro ethylene or per chloro ethylene.
- By liquid phase degreasing with trichloro ethylene or per chloro ethylene.
- By circulating aqueous solutions as per the standards.
- Or any other equivalent method after approval of department.**

Cleaning should ensure the removal of contaminants that could cause mechanical malfunctions, system failures, fires, or explosions. This specialized service must be performed by properly trained and qualified individuals at approved facilities.

Oxygen systems and components should be thoroughly cleaned in accordance with ASTM G 93 or CGA G 4.1 and shall achieve the following specification.

- The maximum allowable non-volatile residue on parts used for oxygen service is normally $<0.3 \text{ mg/NM}^3$.
- Particulate contamination as per levels 25 shall be followed and the specification is as given below.

S.No	ParticleSize Range μm	Maximum Number of Particles per $0.1\text{m}^2 *$
01	<5	Unlimited
02	5 to 15	19
03	>15 to 25	4
04	>25	0

C) Drying

The drying is done on pipe lines as well as piping to remove watervapor (moisture) and this is done as given below:

Oil free compressed air dew point less than -50 deg.Ci used to purge initials.

Passing dry nitrogen having dew point less than -40 deg.C and free from oil and greases (less than 10ppm at 60 deg.C till the moisture level at the exit comes to the inlet concentration value.

D) Sealing

After drying, the tanks and pipes should be sealed so that ambient moisture never enters inside.

The tanks are to be pressurised to 0.5 bar with dry N_2 gas at -40° C dew point.

Procedure-2: Painting

A) General:

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- Paints and other materials used for painting shall confirm to relevant Indian Standards. Where no Indian standard exists, material shall conform to other recognized standard specification.
- The shade of paints shall confirm to Indian standard IS-05
- Different painting scheme shall be followed for Carbon Steel (CS) and Stainless Steel (SS)

B) Surface Preparation:

Surface preparation shall comply with requirements of Indian standard IS 1477 part I & part II. This standard shall be considered as the minimum standard acceptable, wherever not specifically mentioned following shall be followed:

- The surfaces shall not be burnished by excessive wire brushing or be indented by hammers and chisels.
- Hand cleaning shall be by chipping and scraping followed by wire brushing mechanically or by hand. All surfaces of SS & CS shall be washed down to remove greases and dirt using a suitable solvent and shall be dried off before painting.
- All recesses and surface hollows where in rain water would be retained or where difficulty in painting be experienced shall be sealed with suitable non hardening sealant after obtaining approval from SHAR/ISRO
- Some equipment may be delivered to site without any priming or painting. All such equipment's must be cleaned thoroughly and made free from scale, rust, grease, dust and corrosive accumulation of any foreign materials whatsoever and down to bare metal level before painting commences.
- Equipment already primer or painted shall be cleaned down by washing with a suitable solvent and drying off with a succession of clean dry gas. Any areas of rust, scale loose or damaged paint shall be removed by wire brushing and these areas are patch primed before proceeding with appropriate painting scheme.

C) Mixing and application of paint

Coating materials shall be thoroughly mixed prior to application in order to avoid settling of pigments. Thinning shall be for workability and improved spray characteristic only. The manufacturers recommended thinner and amount shall be used.



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Spray equipment shall be adjusted to produce an even, wet coat with minimum over spray. Coatings shall be applied in even, parallel passes, overlapping 50 percent. Special attention shall be paid to welds, cutouts, sharp edges, rivets, crevices and bolts to ensure complete coverage and proper thickness.

D) Environmental Conditions

No coating shall be applied when rain is imminent or when the temperature or humidity is outside limits recommended by the coating manufacturer. To prevent moisture condensation during application, surface temperature must be at least -15 de. C above the dew point.

E) Methods of application

Coatings shall be applied with airless or conventional spray equipment or both based on the suitability for the nature/type of paint as recommended by the paint manufacturer. Application with brushes will be permitted for smaller size pipelines, minor touch up and when spray application is prohibited in the area of work.

F) Coating finish

Each coat of material applied shall be free of runs, sags, blisters, bubbles and mud cracking, Variations in colour, gloss, excessive film build up, foreign contaminations, etc. special care shall be taken to ensure complete coverage and proper thickness on welds, corners, sharp edges, surfaces touching supports, bolts, nuts and rivets.

G) Coating Drying and Curing

The coating manufacturers recommended drying and curing times for handling and top coating shall be followed.

H) Marking of Items of Equipment

- a) All items of facility, equipment and flow components are to be marked with the item numbers as per approved Technical drawings.
- b) The item number is to be painted on the equipment in a prominent position
- c) All the pipelines wherever applicable are to be painted with GROUND COLOUR and COLOUR BAND of different paint. In this case, if the paint as per specified colour is not available, alternate colour with same specification shall be applied.

I) Painting scheme

- a) For Stainless pipelines & equipment
 - ✓ High built epoxy: 120-130 microns



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- ✓ Aliphatic Polyurethane: 30-40 microns
- ✓ Total Dry Film thickness 150 ± 10 microns
- b) For Carbon steel equipment and pipe supports and rig structure
 - ✓ Epoxy mastic coating: 120-130 microns
 - ✓ Aliphatic Polyurethane: 30-40 microns
 - ✓ Total Dry Film thickness 150±10 microns
- Dry Film thickness shall be measured for each coat
- Dry Film thickness shall be measured using a reliable Coating Thickness meter and shall be calibrated before usage.
- Paints shall be applied within the expiry date
- Manufacturers recommendations shall be followed for mixing, application, weather condition and drying time of each coating

J) Colour scheme

For identification of piping and equipment based on fluid service colour coding with ground colours and colour bands are to be provided as per the following guidelines:

K) Ground colours

Recommended shades of colours or final coat (Aliphatic Polyurethane) that shall be used are given in table below. Colours used should be as near to the specified colour shade as possible.

I. Color code for Piping		
S. No	Medium	Colour shade No. as per IS-05
1	Gaseous Nitrogen	Brilliant Green - 221
2	Liquid Oxygen	White
3	Gaseous Oxygen	<ul style="list-style-type: none"> ✓ Base colour: White ✓ Colour band: Cannery yellow - 309

II. Color code for Equipment		
S. No	Equipment	Colour shade No. as per IS-05
1	Structural steel , Pipe supports, Working Platforms etc	Light Grey – 631

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Equipment not mentioned in the above shall be painted with base colour of the fluid as recommended in Table-I

L) Colour bands:

They shall be superimposed in the colour and shall be applied near the valves, junctions, walls and as well as 3 meters intervals

The minimum width of the narrowest colour band shall be 25mm or diameter of the pipe, whichever is more

M) Paint specification

Paints used as primers, intermediate and finish coats shall compatible to the surfaces being painted

a) Aliphatic Polyurethane coating

Aliphatic Polyurethane coatings shall conform to the following minimum requirements:

- a) Catalyst isocyanate cured
- b) High gloss finish
- c) Gloss and colour retentive upon prolonged exterior exposure
- d) Suitable as an exterior finish coat over an inorganic zinc primer and an inhibitive polyamide epoxy intermediate coat
- e) Hard, tough, flexible and abrasion resistance
- f) Minimum theoretical coverages rate of 17 sq.m/litre at 25 microns DFT

b) High Build Epoxy coating

High Build Epoxy Coatings shall conform to the following minimum requirements:

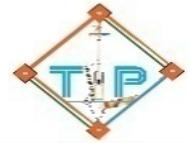
- a) High performance general maintenance coating for new or old steel
- b) Self priming top coat over most existing coatings
- c) Excellent adhesion to rusted steel and most aged paints
- d) Can be over coated with wide range of top coats
- e) 125 microns or more in a single coat
- f) Two component, catalyst cured
- g) Minimum theoretical coverages rate of 32sq.m/litre at 25 microns DFT
- h) Volume solid (minimum) 80%

c) Epoxy Mastic Coating

Epoxy Mastic Coatings shall conform to the following minimum requirements:



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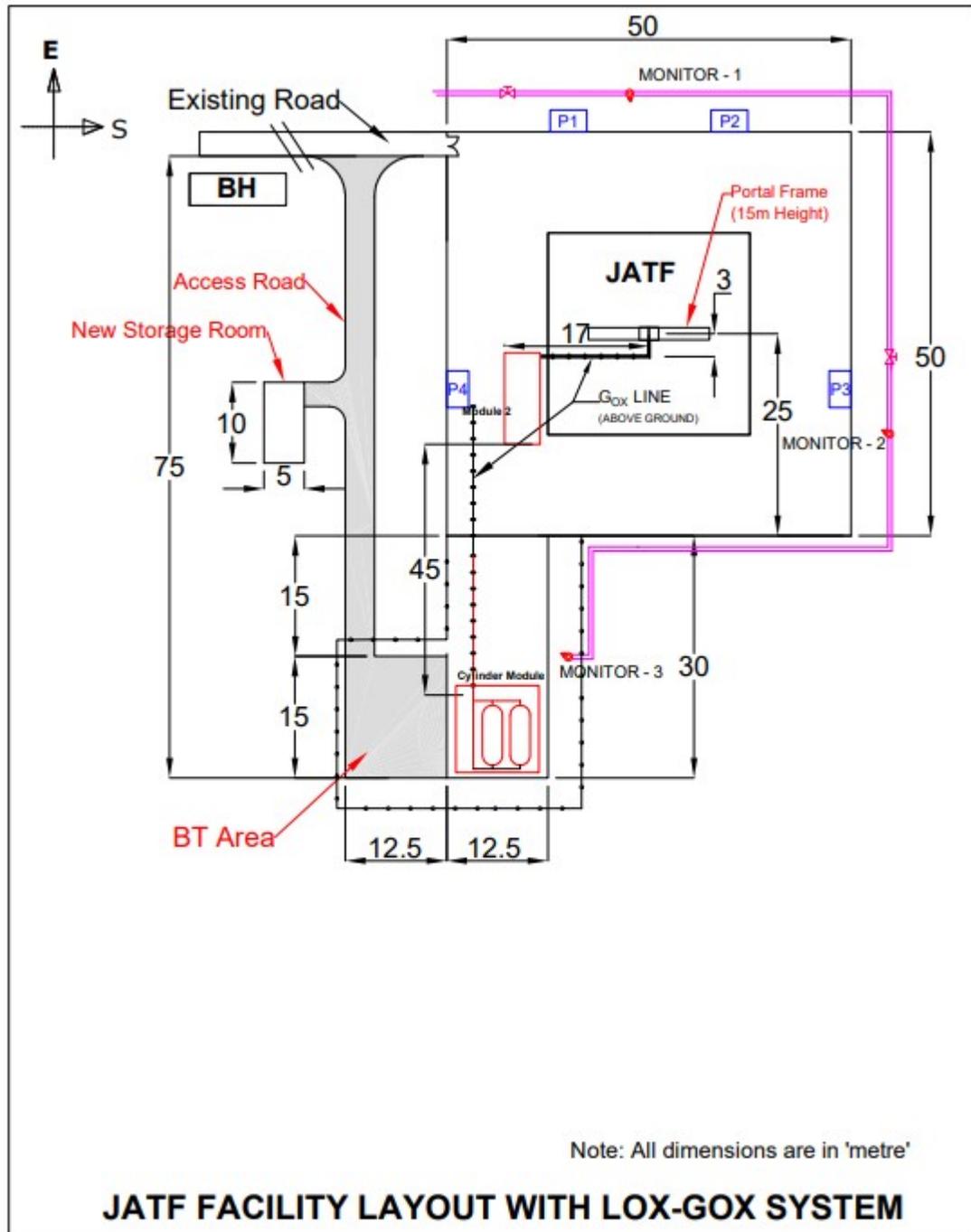
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- a) Aluminum pigmented
- b) Specifically intended for use over mechanically cleaned steel
- c) Two-component, catalyst cured
- d) Minimum theoretical coverages rate of 36sq.m/litre at 25 microns DFT
- e) Minimum shelf life of 24 months
- f) Excellent adhesion to rusted steel and most aged paints

Procedure-3: Procedure for Hydro/Pneumatic test of pipe lines:

- a. Each pipe line segment of each module shall undergo through hydro test after completion of fabrication activities and qualification of weld joints through DP and radiography.
- b. Hydrotest shall be carried out only with DM Water. Chloride content of DM Water shall be less than 25 PPM for hydro testing of pipe lines.
- c. All the weld joint shall be subjected to hydro test at 1.5 times MOP. The test shall be performed after qualification of Joints in radiography.
- d. Dummy flow components/adaptors/spools shall be used to avoid damage of flow components during hydro testing of pipe lines and modules.
- e. Two pressure gauges shall be used during hydro test with a pressure gauge range of 1.5 to 2 times of test pressure (one at the inlet of the pipe/equipment and other at the extreme or end of the pipe /equipment).
- f. Hydro test pressure shall be maintained for 30min and no pressure drop is allowed in this 30min duration.
- g. During hydro test, all weld joints and threaded joints shall be inspected for any leakage.
- h. Cleaning of pipe lines after fabrication for oxygen gas usage shall be carried out.
- i. After picking and passivation, all pipe lines shall be flushed with DW water to get the PH of 6.5 to 7.5
- j. After the hydro test, all the pipe lines shall be purged with GN2 for conditioning to below 10ppm (Dew point temperature - -60.5° C) of moisture content.
- k. After purging and cleanliness checks lines of yard piping or modules shall be closed with proper dummy and positive pressure of 1 bar shall be maintained.

Annexure – 28: JATF HP GOX Overall Layout



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Annexure – 29: Process and Instrumentation Diagram of gaseous oxygen supply system

A3 size drawing attached for reference for annexure 29

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TO BE SUBMITTED ALONGWITH TECHNICAL BID

Annexure -A

Name of the work : _____

Name of bidder : _____

EXCEPTIONS AND DEVIATIONS

In line with Proposal Document, Bidder may stipulate Exceptions and deviations to the Proposal conditions if considered unavoidable.

S. No.	Reference in Specification		Dept. Specification	Offered Specification	Deviation
	Page No.	Clause No.			

NOTE :

- ✓ Any deviations taken by the Bidder to the stipulations of the Proposal document shall be brought out strictly as per this format and enclosed along with the bid.
- ✓ Any deviations not brought out as per this Proforma and written elsewhere in the Proposal document shall not be recognized and the same is treated as null and void.
- ✓ Any wilful attempt by the Bidders to camouflage the deviations by giving them in the covering letter or in any other documents that are enclosed may render the Bid itself non-responsive.

(Signature Of Bidder)

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TO BE SUBMITTED ALONGWITH TECHNICAL BID

Annexure -B

ACCEPTANCE OF TERMS AND CONDITIONS BY THE BIDDER

We hereby agree to all the terms and conditions as given in Tender Notice No. _____ dated: _____ for Engineering, fabrication, testing, qualification, supply, erection, commissioning of high-pressure gaseous oxygen supply system (as per the specifications and requirements indicated in the RFP) to SDSC SHAR, Sriharikota.

Company Seal

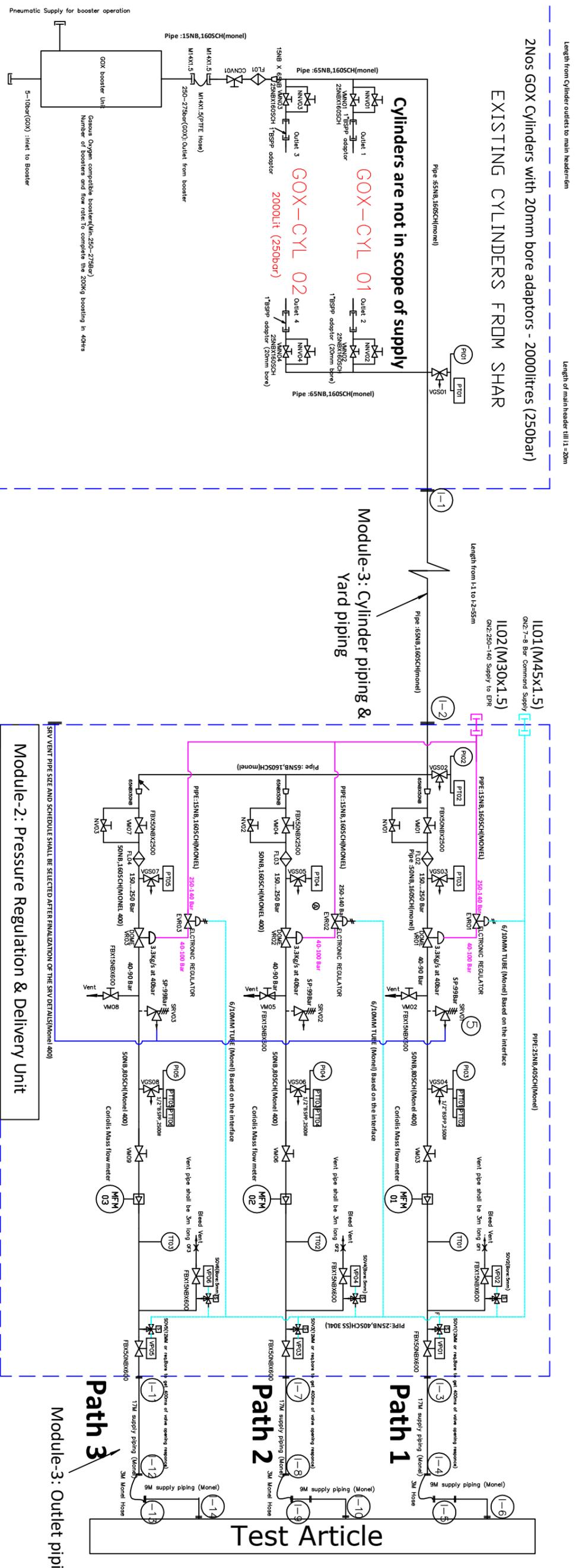
(Authorised Signatory of Company)

Place : _____

Date : _____

High Pressure Gaseous Oxygen Supply System

Annexure 29



Note: 2000Lit. Cylinders is not in the scope of supply. However, Neck valve adaptors /valves are to be supplied and cylinders header interconnection piping has to be fabricated in-situ

Module-1: GOX Cylinder Bank

- Note 1:
1. All Valves wetted parts shall be made of Monel (including regulator)
 2. All components shall be cleaned for oxygen service as per ASTM G93 or CGA. G 4.1
 3. Seat shall be compatible for oxygen service (PCTFE is preferred)
 4. All pipes shall be monel pipes
 5. All pressure Gauges range shall be 1.5 to 4 times the MOP
 6. VGS 1-10, 400BAR with inlet and outlet as 1/2" BSPP or M20X1.5 and vent 1/4" BSPP

 SATISH DHAWAN SPACE CENTRE SHAR		NAME	DT
TITLE : P&ID of High Pressure Gaseous Oxygen Supply System		DESIGNED	11.02.26
SCALE: DIM : mm MATERIAL: As per Spec QTY: As per RFP		DRAWN	RD 11.02.26
NTS TLP/SMP&ETF /HT		REVIEWED	SKS 11.02.26
DRG NUMBER		REV 00	SHEET 1 OF 1