

**Specification for Remotely controlled air operated pneumatic
booster with integrated control system
(10 bar to 700 bar)**

1 Scope of work

Design, realization, supply, installation and commissioning of remotely controlled (from 150 meter distance) air operated pneumatic booster with integrated control system (10 bar to 700 bar) at HRAG/ASOE/VSSC as per the trailing specification.

2 Detailed description

Pneumatic pressure booster system shall be realized as per P&ID diagram shown in fig. 1. This remotely operated system shall provide a booster outlet pressure (DUT pressure) controlled through an electronic regulator coupled with a dome loaded regulator / equivalent system. In auto mode of operation, booster shall be controlled based on test pressure (DUT pressure). The operation sequence of all the valves, regulator etc. shall be fully automated based on the desired test pressure for DUT. Pneumatic booster shall be controlled through a SCADA / PLC based control system. Features for plotting real time pressure vs time plots during operation shall be provided. The overall system shall be integrated in a caster wheel type console for easy movement.

2.1 General specification

Sl.	Parameter	Specification
1	Mode of Operation	The equipment offered shall work in fully automatic mode through PLC / SCADA system. Offered system shall be capable for remote operation from a distance of minimum 150 meters.
2	Test pressure	Following two pressure regulation loop shall be provided at the outlet of gas booster which can be selected from the SCADA console – (A) low pressure regulation system in which the test pressure is settable between 10 - 100 bar (g)

		(b) high pressure regulation system in which the test pressure is settable between 100 - 700 bar (g)
3	Volume of specimen	250 cc (Approx.)
4	Pneumatic medium	Helium / Nitrogen
5	Minimum settable incremental pressure	2 bar
6	Accuracy of settable pressure at a distance of minimum 150 m	+/- 1 bar for low pressure regulation system & +/- 2 bar for high pressure regulation system

2.2 **System features**

- a. Pneumatic booster with inbuilt control system housed in stainless steel with powder coating cabinet
- b. Provision for lockable caster wheel for easy movement
- c. Cabinet with provision for GN2 / GHe cylinder holding mechanism
- d. Booster with external pilot modification to enable use of external components to start / stop the booster or equivalent system to automatically cut-off the booster for low inlet pressure (settable) & high outlet pressure (settable) which can be set remotely
- e. Pressure gauge to indicate inlet pressure supply
- f. Gas filter - inline filter for maintaining air drive quality
- g. Adjustable air regulator to set the Air Drive Pressure
- h. ON/Off valve and speed control valve to adjust cycling speed that the booster cycles or equivalent system for controlling the rate of pressurisation
- i. Relief Valve to protect the booster & other components from over pressurization.
- j. Inter stage cooler (a tube & shell cooler) to reduce the booster gas temperature (part of the booster)
- k. Suitably sized filter to stop any ingested contamination from entering the booster

- l. Adequate mechanism in the control system for precise DUT pressure control (± 1 bar in the range of 10 bar to 100 bar and ± 2 bar in the range of 100 bar to 700 bar) through PC from a minimum distance of 150 meter

3 Instrumentation and control system

- 3.1 The equipment offered shall work in fully automated mode of operation.
- 3.2 Standard controller having provisions for pressure control and programming shall be used.
- 3.3 Feature for dynamically changing the pressure set point (whenever the booster is in operation in auto mode) shall be provided.
- 3.4 The following shall be interfaced with the controller:
 - i. Electronic pressure regulator or equivalent system
 - ii. Electro pneumatic valves
 - iii. Pressure transducers
 - iv. Digital pressure gauges (real time plotting of pressure vs time graph)
- 3.5 Party shall mention the make and model number of all the subsystems used in the system along with supporting documents like data sheet / manual.
- 3.6 Software for PC based operation and remote control shall be provided. This software shall be license free to enable / adding multiple pressure transducers. Support for the software including future updates etc. shall be provided free of cost. An extra copy of all necessary software (installable) shall be provided, so that it can be reinstalled in case of any exigency arising due to corruption of loaded software.

4. Data logging

- 4.1 Provision for real time monitoring / trend display generation and printing of pressure vs time plot (for all pressure transducers) using external PC interface via LAN shall be provided. The basic configuration of this external PC shall be as follows –

Processor type	:	Intel® Core™ i7-10700 or better
RAM	:	8 GB (minimum)
Hard disk	:	SATA 1 TB (minimum)
Monitor	:	LED 32 inch

- 4.2 Ethernet connectivity to PC shall be available with provision for remote operation (minimum 150 meters from pneumatic booster).
- 4.3 USB port shall be provided for downloading test data. Feature for saving data in the PC during the test with settable data sample rate and provision for data retrieval at a later stage shall be provided. Internal memory storage shall be sufficient for storing test data for minimum 1000 hours.

5 Trouble shooting / servicing

Real time mimic diagram of full system shall be displayed on the screen so that the fault conditions are visible to the operator. Audible and visual alarm system shall be provided for warning the operator about any malfunction / variation in service conditions.

6 Calibration

Party shall provide valid calibration certificates for all transducers and digital pressure gauges used in the system.

7 Inspection and Acceptance Test Plan at factory and VSSC

Demonstration of all specifications & performance shall be done during factory acceptance test for various test profiles (Sample test profiles will be provided by VSSC during PDI).

8 Safety

- 8.1 Air pilot switch (inlet) shall be provided to stop the booster when supply pressure falls to set point or equivalent system.
- 8.2 Adjustable air pilot switch (outlet) with variable set point shall be provided to stop the booster when outlet pressure reaches to set point or equivalent system.
- 8.3 Relief Valve shall be provided to protect the booster & other components from over pressurization.
- 8.4 Functioning of all interlocks shall be demonstrated.
- 8.5 Safe shut down & revival in the event of electrical power failure shall be demonstrated.
- 8.6 All Safety alarms & it's acknowledgment shall be demonstrated
- 8.7 Emergency push stop button shall be provided.
- 8.8 Emergency venting provision (independent unit) shall be provided at control room.

- 8.9 Operating procedure: A detailed operating procedure with necessary diagrams highlighting Do's and Dont's shall be provided along with the unit.

9 Detailed specifications of various sub systems

This system shall consist of following elements:

- a. High pressure gas booster
- b. Gas receiver
- c. Pressure regulator for drive air and gas inlet
- d. Electro-Pneumatic valves
- e. Pressure gauges (bourdon tube type)
- f. Pressure Transducers
- g. Safety Relief Valve
- h. Electronic Pressure Regulator (EPR) coupled with dome loaded regulator (Self venting type)/ Equivalent system meeting the functional requirement is also acceptable
- i. Digital Pressure Gauge
- j. Needle valves
- k. Check valves
- l. Air filters

9.1 High pressure booster

Type	: Air driven two stage boosters with inter stage cooler
Medium	: GHe / GN ₂
Outlet pressure	: 700 bar (minimum)
Drive air supply	: 1 to 7 bar
Inlet air pressure range	: 35 bar to 200 bar (minimum)
Quantity	: 1 No.

9.2 Gas receiver

Working Pressure	: 700 bar (minimum)
Volume	: 2-3 Litres or as per system requirement
Approval	: ASME U STAMPED / PED Directive
Quantity	: 1 No.

9.3 Pressure regulator for drive air and gas inlet (PR)

Pressure Regulation : As per system requirement

Quantity : 1 No

9.4 Electro-Pneumatic valves (EPV 1 to EPV12)

Working Pressure : As per the system requirement

Quantity : 12 Nos

9.5 Pressure Gauges (PG-1 to PG-3)

Range : As per the system requirement

Type : Bourdon tube gauge

Accuracy : 0.5% FS

Quantity : 3 Nos.

9.6 Pressure Transducer (PT-1 to PT-5)

Pressure Range : As per system requirement

Accuracy : As per system requirement

Qty : 5 Nos.

Party shall select appropriate transducer for meeting the pressure control specification of +/-1 bar in the range of 10 to 100 bar and +/-2 bar in the range of 100 to 700 bar.

9.7 Safety Relief Valve (SRV)

Adequate number of safety relief valves shall be provided in the system.

9.8 EPR coupled with dome loaded regulator (self-venting type) EPR1 –EPR2/ equivalent system

Control Range : 10 to 100 bar and 100 to 700 bar

Accuracy : +/- 1 bar for low pressure regulation system &
+/- 2 bar for high pressure regulation system

Ramp rate : 1 – 5 bar per minute (settable)

Qty : 2 Nos.

9.9 Digital Pressure Gauges (DPG1-DPG2)

Working Range : 350 bar & 1000 bar

Accuracy : 0.1% FS

Qty : 2 Nos.

9.10 Needle valves (NV-1 to NV-8)

Operating pressure range : As per system requirement

Qty : 8 Nos.

9.11 Check valves

Operating pressure range : As per system requirement

Qty : 2 Nos.

9.12 Air filters

Operating range : As per system requirement

Qty : 5 Nos.

Filtering size : 10μ

Allowable pressure drop : 2 bar

Note –

- a) Additional gauges / transducers / electro pneumatic valves, regulator, needle valve etc. required for meeting the specification of booster shall be added by the party.
- b) If required, party shall provide suitable signal conditioning unit, so that signals can be faithfully acquired with minimum noise and common mode signals.

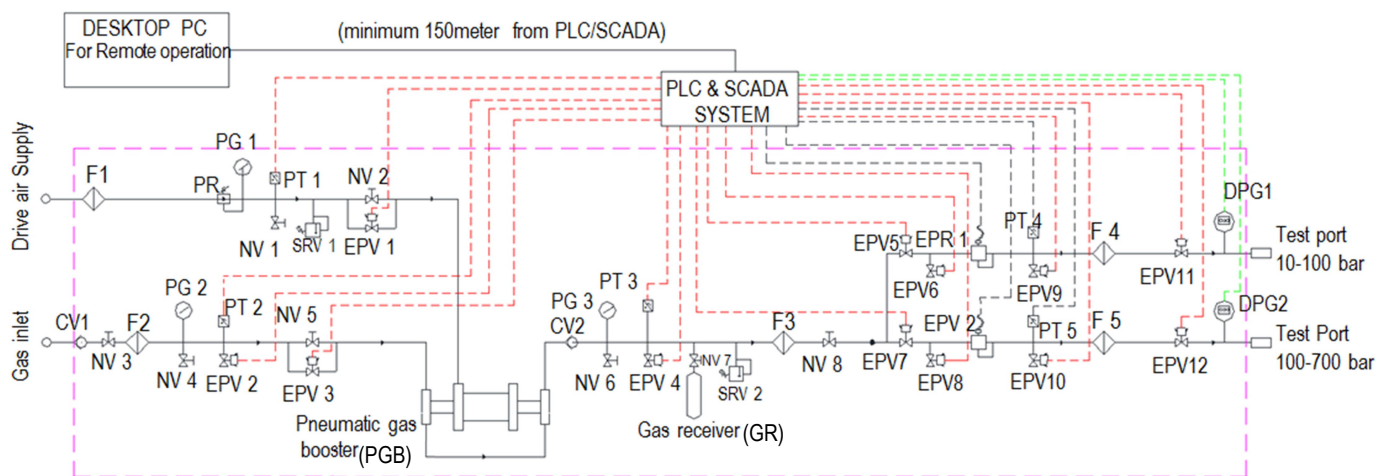
10 General Terms and Conditions

- 10.1 **Safety:** All statutory safety requirements for the equipment shall be complied. Details of safety features incorporated in the equipment like relief valve, shutoff valve, etc. and safety procedures to be followed during the operation shall be explained. Safety interlocks shall be provided wherever feasible.
- 10.2 **Ergonomic design:** Machine and the control panel are to be ergonomically designed.
- 10.3 **Delivery schedule:** Party shall submit the system configuration drawings to VSSC for review within 1 month of placement of PO. Party shall deliver the equipment within 12 months of clearance of system configuration drawings by VSSC.

- 10.4 **Pre delivery inspection:** VSSC engineers will inspect the machine at party's site for its performance before dispatching. During PDI supplier shall demonstrate the functioning of integrated system and safety aspects. Clearance will be based on the successful demonstration of the system at factory. Party shall give training to VSSC Engineers for the operation and maintenance of the equipment.
- 10.5 **Packing and forwarding:** After the initial acceptance, party shall properly pack and forward the equipment to our site at VSSC, Trivandrum for final installation and commissioning.
- 10.6 **Installation and commissioning:** Party shall be responsible for the installation, commissioning and training of the equipment at VSSC. Installation and commissioning shall be completed within one month of clearance of equipment after pre delivery inspection by VSSC. Operating and maintenance manual (hard copy) of the system shall be provided by the supplier.
- 10.7 **Warranty:** Total equipment shall have comprehensive warranty for a period of 12 months from the date of final acceptance at VSSC.
- 10.8 **AMC:** Party shall indicate Annual Maintenance Contract (AMC) charges for a period of 5 years after completion of warranty period in the price bid. This amount will also be taken into consideration for determining the lowest quote.
- 10.9 Party shall provide a list of essential spares required with the price of spares (price shall be provided in price bid) for trouble free operation of the equipment for at least 5 years. This amount will not be taken into consideration for determining the lowest quote.
- 10.10 Any other items that are essential for realisation of the equipment conforming to all specification requirements, installation and also for the regular operation but are not referred herein, may also be included in the offer.
- 10.11 Supplier shall provide the details of similar systems supplied to Government / PSU / Private industries highlighting / indicating the date of supply and contact details including telephone number and email address.

Note:

P&ID is provided in Fig.-I for reference. Party is free to suggest modification where ever it is essential to achieve the test pressure setting between low pressure range (10 to 100 bar) & high pressure range (100 to 700 bar) with an accuracy of +/-1 bar and +/- 2 bar respectively. However, the party has to submit the detailed drawing for verification and approval by VSSC prior to fabrication.



(Fig No.1: P&ID)

SI No	Key Words & Qty(Nos)	Description
1	F (5)	Air filter
2	CV (2)	Check valve
3	NV (8)	Needle valve
4	PG (3)	Pressure Gauge(Bourdon tube)
5	PR (1)	Pressure regulator
6	PT (5)	Pressure Transducer
7	SRV (2)	Safety relief valve
8	EPV (12)	Electro pneumatic valve
9	EPR (2)	EPR coupled with dome loaded regulator (Self venting type)
10	DPG (2)	Digital pressure gauge
11	PGB (1)	Pneumatic gas Booster
12	GR (1)	Gas receiver

(Table No.1: Major component list)

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