

CSIR- NATIONAL PHYSICAL LABORATORY

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From: Director, CSIR-NPL

Ref No. 14-VIII/SKJ(9-OTE)2024PB/T-77

Dated : 20.11.2024

CORRIGENDUM

With reference to NPL's Global Tender ID: **2024_CSIR_207918_1**, Pre-Bid Conference (PBC) was concluded on 12.11.2024 for "PVTt Standard (Primary Gas Flow Standard)". Consequent upon the outcome of PBC, **some changes have been made in the technical specification of captioned tender. Revised specifications are as follows:**

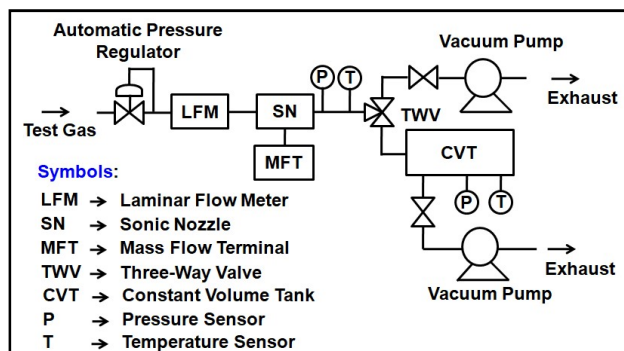
Final Specs after Pre-Bid Meeting

DETAIL TECHNICAL SPECIFICATIONS

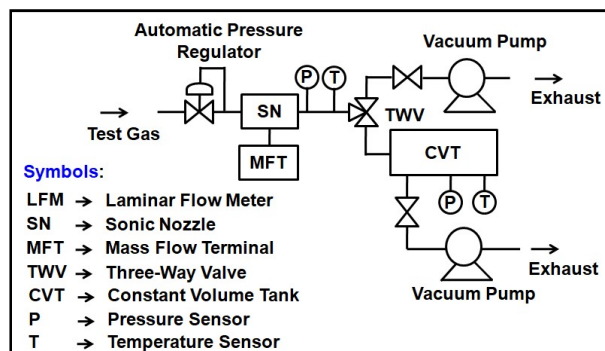
Annexure-1

Specifications of PVTt Standard (Primary Gas Flow Standard)

The turnkey PVTt (i.e. Pressure, Volume, Temperature and Time) standard consists of large number of items such as water temperature bath, collection tanks temperature and pressure sensors with indicators, vacuum pumps, vacuum sensors with indicators, sonic nozzles with flow display device, frequency counter/ timer, diverter valves, on/off valves, precision pressure regulators with feedback (also called automatic pressure regulators), pipes and fittings, automation hardware and software etc. Figure 1 shows the schematic diagram of calibration of the laminar flowmeter and sonic nozzle through PVTt Standard respectively.



(a) Laminar Flowmeter calibration



(b) Sonic nozzle calibration

Figure 1. Schematic diagram of calibration of the laminar flowmeter and sonic nozzle through PVTt Standard (Timer, air compressor system and other automation hardware not shown in the diagram)

The detailed specification of the system is given below:

- (1) Flow Range: 1 L/min to 1200 L/min referenced to standard temperature and pressure conditions of 25 °C and 101.325 kPaa respectively.
- (2) There will be two systems. First system will have tank volume of approx. 35 L which will cover the flow from 1 L/min to 100 L/min. Second system will have tank volume of approx. 450 L which will cover the flow range from 30 L/min to 1200 L/min. Expanded Uncertainty: $\pm 0.15\%$ or better in the above flow ranges.
- (3) Supported gas: Air and Nitrogen (The other gases can be also calibrated with increased uncertainty)
- (4) High stability Water Temperature Bath:
 - (a) Size: 2.5 m (L) \times 1 m (W) \times 1 m (H)
 - (b) Material of construction: SS 316L,
 - (c) Thickness of SS Sheet: minimum 2 mm
 - (d) Operating range: (20-30) °C
 - (e) The bath should have temperature uniformity of 100 mK or better and temperature stability of 100 mK or better. The heating and cooling arrangement should be provided for maintaining proper temperature uniformity and stability with 9 nos. of cylinders housed inside. So, all the clamping arrangement should be provided for these cylinders in the water bath.
 - (f) The bath should be covered with Acrylic sheet of minimum 5 mm thickness.
- (5) Collection Tanks:
 - (a) Material of construction: SS 316L with high finish inside
 - (b) Thickness of the each cylinder: minimum 6 mm
 - (c) Size of the cylinder for 35 L Tank: Length: approx. 1.82 m, inner diameter: 16 cm with end circular cap, Qty: 01 no., to be mounted horizontally in the water bath
 - (d) Size of the cylinder for 450 L Tank: Length: approx. 1.82 m, inner diameter: 20 cm with end circular cap, Qty: 08 nos. to be mounted horizontally in the water bath and interconnected
 - (g) End connection for 35 L Tank: KF16 or other leak proof fitting with DN15 pipe line
 - (h) End connection for 450 L Tank: KF25 or other leak proof fitting with DN25 pipe line

- (6) Sonic Nozzles alongwith Flow Display Device
- (a) 4 Nos. of sonic nozzles to cover flow range from 1 L/min to 50 L/min should be supplied.
 - (b) The flow should be displayed either in flow display instrument or in the computer automation software. For derivation of flow, high accuracy digital thermometers, pressure gauges and associated instrumentation of required accuracies should be used to get flow accuracy of $\pm 0.20\%$ or better. The accuracy is defined as $\leq \text{error} \pm \text{uncertainty}$.
 - (c) Operating pressure ranges of the sonic nozzles are 50 kPaa to 600 kPaa.
- (7) Temperature sensors with Display/ Readout:
 14 temperature sensors [4-wire 25.5 ohm PRT type with temperature co-efficient (α) of $0.0039250 \Omega/\Omega/^\circ\text{C}$, W(Ga) of ≥ 1.11807 with gold plated spade connectors and inconel sheath] alongwith readout and or temperature scanner should be provided. The length of the sensor cable must be approx. 1.5 m for connection to temperature readout/ scanner. The accuracy of the temperature measurement should be $\pm 0.02^\circ\text{C}$ or better.
- (8) Pressure gauges (Quantity: 02 nos):
- (a) Absolute type pressure gauges with maximum range of 130 kPaa or higher. Pressure measurement range: 40 kPaa to 130 kPaa or more.
 - (b) Resolution: 1 ppm, user selectable
 - (c) Long-term Stability (1 year): $\pm 0.005\%$ of reading or better
 - (d) Precision: $\pm 0.005\%$ of reading or better
 - (e) Accuracy of pressure gauges: $\pm 0.01\%$ or better at 100 kPaa.
- (9) Vacuum Gauges (Quantity: 2 nos.).
- (a) Thermocouple type or other type vacuum gauges for required application
 - (b) Range: 10 Paa to 100 kPaa
 - (c) Accuracy: $\pm 10.0\%$ or better at 10 Paa.
- (10) Vacuum pumps (alongwith roughing vacuum pump), Quantity: 02 nos. should be supplied. The vacuum pumps which are capable to achieve the vacuum level of 10 Paa without use of roughing vacuum pumps are also acceptable.
- (11) Frequency Counter/ timer (Quantity: 1 no.) for time interval measurement
- (a) Capability to measure Frequency, Period, Ratio, Time Interval, Phase, Voltage, Duty Cycle, Pulse Width, Rise/Fall Time
 - (b) Frequency measurement range: 0.001 Hz to 350 MHz, Time base frequency: 10 MHz
 - (c) No. of Channels: two
 - (d) Time measurement range: upto 1000 s or more, time measurement in positive &

negative trigger mode, trigger voltage: upto $\pm 5V$ DC (1x), $\pm 50V$ DC (10x),

common channel mode

- (e) GPIB/USB/ RS-232 interfaces.
 - (f) Resolution in time and frequency modes: 100 ps or better and 12 digits/s respectively
 - (g) Triggering source: Internal, external and other type if any
 - (h) Ageing rate: ± 0.5 ppm per year or better, high-stability Oven Time Base
 - (i) Calibration uncertainty (for one year): ± 0.5 ppm or better (at 95% confidence level) in frequency mode
 - (j) All the accessories (interface cables, signal input output cables, various adaptors (BNC to Banana, BNC to N-type, BNC male to female, etc., Tee), required for proper functioning of the frequency counters must be supplied.
- (12) Precision pressure regulators with feedback (i.e. Automatic Pressure Regulator), Quantity: 02 nos., for controlling upstream and downstream pressure to maintain the Pressure constant. The position of the pressure regulators may be altered depending upon the conditions.
- (a) Pressure range: 50 kPaa to 700 kPaa
 - (b) Stability: $\pm 0.05\%$ of the pressure set point or better
 - (c) Accuracy: $\pm 0.1\%$ of the reading or better
- (13) High speed 3-way switching valves, electro-pneumatic type (Quantity: 02 nos.)
- (a) One 3-way valve with size DN15 or other suitable size, flow rating of approx. 150 L/min@100 kPaa, Switching on time: 10 ms or less, Switching off time: 10 ms or less.
 - (b) One 3-way valve with size DN25 or other suitable size, flow rating approx. 1500 L/min @100 kPaa, Switching on time: 10 ms or less, Switching off time: 10 ms or less.
- In place of 3-way switching valve, two nos. of 2-way switching valves can be also used where one valve is kept on and other is kept off. The operation of these valves will be reversed when diverting the flow from bypass line to collection tank.
- (14) Complete automation of the system should be done with development of software. All the hardware & software for automation should be provided. The vendor should mention the application for software development (such as Lab View or other). A latest Desktop (i7 processor or better with minimum 16 GB RAM, 1 TB hard disk and 1 TB SSD) with genuine MS Windows 10 or higher version and other required software should be supplied for automation purpose. Also, one multifunction printer with fax, copy, scan (black & white and colour) and print (black & white) should be supplied. The acquired data should be presented in MS-Excel for further processing.

- (15) One 2 kVA online UPS with 1 hour battery backup should be supplied for the above system.
- (16) Warranty of the complete system for 1 year after satisfactory installation and commissioning.
- (17) The system should work on 220V $\pm 10\%$ and 50 Hz $\pm 5\%$ power supply condition.
- (18) All accessories, valves, adaptors, pipes, tubing etc. required for complete operation of the system should be supplied.
- (19) All the calibration certificates of the equipments (high stability water temperature bath, temperature sensors with readouts, pressure sensors with readout, pressure gauges, vacuum gauges, sonic nozzles, frequency counter/timer) should be supplied from ISO/IEC 17025 standard accredited laboratories.
- (20) On-site Training should be provided for 5 working days to the NPL staffs (3 nos.) for proper operation and maintenance of the system.
- (21) The items will be shipped to NPL. The pre-delivery test reports should contain all the calibration certificates of individual items.
- (22) After delivery of all the instruments and accessories, the turnkey solution will be integrated by the supplier at NPL. Supplier will be responsible to specify the followings in his/her quotation:
- (a) Timeline of the delivery
 - (b) Timeline of integration
 - (c) Timeline of testing in NPL
 - (d) Timeline of Acceptance Report preparation and commissioning of system

Note:

- (1) The high accuracy 12 kg weighing scale of required specification will be provided by NPL for determination of tank volume by volume expansion method.
- (2) The laminar flowmeters in the flow range 1 L/min to 50 L/min will be provided by NPL for use as a Device under Test (DUT).
- (3) The 3 nos. of sonic nozzles in the flow range 10 L/min to 1200 L/min along with flow display device will be provided by NPL for use as a DUT and also as a flow controlling device.

Criteria for Determining Lowest Quotation: The lowest quotation will be determined by sum of cost of individual items quoted by the party. The lowest quotation will not be determined by the lowest cost of the individual items.

Therefore, following extension in due date of submission & date of opening of the said tender may be read exactly as follows:

Due date & time of tender submission

For : 28.11.2024 up to 3.00PM (IST)

Read as : 16.12.2024 up to 3.00PM (IST)

Date & Time of Tender Opening

For : 29.11.2024 at 3:00PM (IST)

Read as : 17.12.2024 at 3.00PM (IST)

All other terms & conditions of said tender will remain the same.

Sr. Controller of Stores & Purchase

Minutes of TSC

Pre-bid Meeting (To be typed clearly by the I/O)

Name of Indentor **Dr. Shiv Kumar Jaiswal**

Indent No. : **PR1080012024 Dated 08.7.2024**

Item Description : **PVTt Standard (Primary Gas Flow Standard)**

Project No. : **GAP 240232**

Estimated Cost (in INR): **Rs. 300 Lakh**

No. of Budgetary Quotes : **02 (being Fabrication Work as Commercially not available)**

(1) A pre-bid meeting of TSC was held on 12/11/2024.

(2) Following queries were raised by participating Bidders: 04 (four)

Name of the Firm	Queries Raised	Remarks, if any
M/s. Fluke Technologies Pvt. Ltd., New Delhi	As per discussion during Pre-bid meeting, formal email received for queries (copy attached) (23) In technical specification sr. no. 2, removal of statement “Expanded Uncertainty: $\pm 0.15\%$ or better in the above flow ranges.” (24) In technical specification sr. no.4 (e), change of temperature uniformity of 50 mK or better and temperature stability of 20 mK or better to 100 mK or better and 100 mK or better respectively. (25) In technical specification sr. no.12, addition of accuracy: $\pm 0.1\%$ of reading or better (26) In commercial terms and conditions, (a) Inland Letter of Credit with 90% payment against delivery of equipments at Central Store and balance 10% payment after satisfactory installation & commissioning (b) 90% payment against delivery of all equipments and balance 10% payment after satisfactory installation & commissioning of the equipments.	
M/s. Yantrika Instruments Pvt. Ltd., Gurugram	Same comments as of Fluke during discussion in Pre-bid meeting. No email received	
M/s. Adcon Instruments Pvt. Ltd., Gurugram	No email received. Following comments received as per discussion in Pre-bid meeting. (1) In commercial terms and conditions, partial advance payment	

	<p>after PO and balance amount after satisfactory installation & commissioning</p> <p>(2) NPL should hire consultant for performance evaluation of the system</p>	
<p>M/s. Nagman Flow-level Systems and Solutions LLP, Chennai</p>	<p>As per discussion during Pre-bid meeting, formal email received for queries (copy attached)</p> <p>(1) In technical specification sr. no.2, we suggest keeping the total uncertainty calculation in NPL Scope. Thus, suggesting to remove this point as a compulsory criteria.</p> <p>(2) In technical specification sr. no. 6, mentioned as sonic nozzle with display. So, there is no specific make or model to be used and we are open to use any model or make to satisfy the requirement.</p> <p>(3) In technical specification sr. no. 8 (a), the maximum range of 150 kPaa or higher to be changed to maximum range of 130 kPaa or higher</p> <p>(4) In technical specification sr. no. 13 (a), Is it mandatory to stick to switch on and switch off time as 10 ms or less or can we go to higher on off time, being at the end diversion time is calculated as the difference between switch on and switch off time.</p> <p>(5) In commercial terms and conditions, suggested payment terms is following being a specialized project with lots of items to be bought from other vendors and being as a system integrator:</p> <ul style="list-style-type: none"> • 30% as advance along with Purchase Order • 30% against submission of the PO copy to vendors • 30% against delivery • 10% after successful commissioning <p>(6) Experience Criteria: The system to be developed is first of its kind in India and purely a customized one to get high accuracy. Hopefully, no body from India did such a system with water bath till now. Thus, we suggest taking out the prior experience required point from the document.</p>	
<p>M/s. Fluid Control Research Institute (FCRI), Kanjikode, Kerala</p>	<p>No comments as all comments already covered by other vendors.</p>	

Indentor's recommendation

1. The comments, as received from bidders during PBC, and our response is as follows:

Tender Specification and its number	Comment of bidder	Response of Indentor (Accepted/ Not accepted)	Revised specification (If any)	Justification for non-acceptance
M/s. Fluke Technologies Pvt. Ltd., New Delhi				
Technical specification sr. no. 2	Removal of statement "Expanded Uncertainty: $\pm 0.15\%$ or better in the above flow ranges."	Not accepted	Not revised, same as final specification as per attached sheet	It is required to fulfill the objective of the primary standard
Technical specification sr. no.4 (e)	Change of temperature uniformity of 50 mK or better and temperature stability of 20 mK or better to 100 mK or better and 100 mK or better respectively.	Accepted	In Revised Specification, it is included. The small change in temperature value will not affect overall uncertainty of the system	-
Technical specification sr. no. 12 (e) technical specification sr. no.12,	Addition of accuracy: $\pm 0.1\%$ of reading or better for automatic pressure controller	Accepted	In Revised Specification, it is included. The accuracy of pressure leads to accuracy of flow	-
Commercial terms and conditions	a) Inland Letter of Credit with 90% payment against delivery of equipments at Central Store and balance 10% payment after satisfactory installation & commissioning b) 90% payment against delivery of all equipments and balance 10% payment after satisfactory installation & commissioning of the equipments.	Not accepted	Not revised	There is no provision of advance payment in the project

M/s. Yantrika Instruments Pvt. Ltd., Gurugram				
Same comments as of Fluke. So same reply is applicable for Yantrika.				
M/s. Adcon Instruments Pvt. Ltd., Gurugram				
In commercial terms and conditions	partial advance payment after PO and balance amount after satisfactory installation & commissioning	Not accepted	Not revised	There is no provision of advance payment in the project
Technical specification sr. no. 2	NPL should hire consultant for performance evaluation of the system	Not accepted	Not revised, same as final specification as per attached sheet	It is the responsibility of the system integrator to do the performance evaluation to achieve the desired uncertainty.
M/s. Nagman Flow-level Systems and Solutions LLP, Chennai				
Technical specification sr. no. 2	We suggest keeping the total uncertainty calculation in NPL Scope. Thus, suggesting to remove this point as a compulsory criteria.	Not accepted	Not revised, same as final specification as per attached sheet	It is required to fulfill the objective of the primary standard
Technical specification sr. no. 6	It is mentioned as sonic nozzle with display. So, there is no specific make or model to be used and we are open to use any model or make to satisfy the requirement.	Accepted	Just as a clarification . No revision required as it is clearly mentioned	-
Technical specification sr. no. 8 (a),	The maximum range of 150 kPaa or higher to be changed to maximum range of 130 kPaa or higher	Accepted.	In Revised Specification, it is included. The cut off pressure is 95 kPaa. So still sufficient safety margin	-
Technical specification sr. no. 13 (a)	Is it mandatory to stick to switch on and switch off time as 10 ms or less or can we go to higher on off time, being at the end diversion time is calculated as the difference between switch on and switch off time.	Not accepted	Not revised, same as final specification as per attached sheet.	Collection time uncertainty is dependent on response time of the switching

				valves. System designed for optimal performance
Commercial terms and conditions	<p>Suggested payment terms :</p> <ul style="list-style-type: none"> • 30% as advance along with Purchase Order • 30% against submission of the PO copy to vendors • 30% against delivery • 10% after successful commissioning 	Not accepted	Not revised	There is no provision of advance payment in the project
Experience Criteria	The system to be developed is first of its kind in India and purely a customized one to get high accuracy. Hopefully, no body from India did such a system with water bath till now. Thus, we suggest taking out the prior experience required point from the document.	Accepted	This fact is well known, therefore, in technical specifications, we have not put any experience criteria.	-
M/s. Fluid Control Research Institute (FCRI), Kanjikode, Kerala				
No comments				