Government of India
Bhabha Atomic Research Centre
Electromagnetic Applications & Instrumentation Division

Ref No: EmA&ID/2021/PKR/ 11788 Date: 28/10/2021.

----------To whom so ever it may concern----------

Sub: Fabrication and testing of cryogenic sub kelvin temperature measurement system conforming to technical specification no : EmA&ID/EMAS/PKR/21/05 dated 23.10.2021.

Dear Sir/Madam,

1. Tender is invited for "Fabrication and testing of cryogenic sub kelvin temperature measurement system conforming to technical specification no : EmA&ID/EMAS/PKR/21/05 dated 23.10.2021".
2. Bidder shall quote for manpower, purchase of raw materials, flow rate qualifications conforming to tender technical specification.
3. Taxes and Excise Duties shall be quoted separately. Form AF / H whichever is applicable shall be provided, if required.

   The quotation must reach The Head, Electromagnetic Application & Instrumentation Division by 05.11.2021 and must be sent in a sealed envelope super scribed with the reference number & the due date given above only through India Ordinary Post/Speed Post.

4. The address on the envelop should read: The Head,
   Electromagnetic Application & Instrumentation Division,
   RCnD Bldg., North Site
   BARC, Trombay,
   Mumbai - 400 085.
   (Kind Attn: RAI P K, TO/C)
5. The bidder shall complete the job within 4 months from the date of firm work order issued to the bidder.
6. Head, Electromagnetic Application & Instrumentation Division reserves the rights to accept / reject any or all quotations without assigning any reason.
7. Quotation must also indicate the validity of offer. Quotation must also indicate the GST No and PAN number of the supplier.
8. The quotation has to be signed by authorized person with company seal.
9. Payment will be made by EFT(Electronic fund transfer) only after satisfactory completion of work on production of bill, delivery challan and advance stamped receipt. Income tax as applicable will be collected at the time of payment.
10. In case of any technical clarifications, the supplier may kindly contact the indenting officer through Email only. (Email ID: pkrai@barc.gov.in)

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(RAI P K)
TO/C, EmA&ID

Work Order Enquiry No: EmA&ID/2021/PKR/11788 dated: 28/10/2021

Technical specification

Document no.	Revision no.	Date of Issue	No of pages
EmA&ID/EMAS/PKR/21/05	0	23.10.2021	6

Fabrication and testing of cryogenic sub kelvin temperature measurement system

1.0 SCOPE

Fabrication and testing of cryogenic sub kelvin temperature measurement system. The complete job shall be carried out strictly as per requirements, specifications and its compliance standards as detailed in this document. In this specification, the supplier shall be referred to as the "supplier" and Bhabha Atomic research Centre shall be referred to as the "buyer".

Supplier shall provide complete raw material to carry out the above jobs. The supplier shall be qualified as per Para 5.0 of this document. The brief description of contents of the tender specification document is as described below.

Para 2.0 gives the detailed job description.

Para 3.0 gives the deliverables.

Para 4.0 gives the general requirements.

Para 5.0 gives the requirements for raw material procurement.

Para 6.0 gives the requirements of supplier qualifications.

Para 7.0 gives the requirements of packaging and safe delivery.

Para 8.0 gives the confidentiality clause.

2.0 DETAILED JOB DESCRIPTION

A system is designed to reach the temperature below 1 Kelvin. The main purpose of the system is to do the experiments below 1 kelvin. The main obstacle of this system is to measure temperature below 1 Kelvin. Hence the devolvement of the system to measure the temperature in these range is necessary.

Detail specification of the temperature measurement system is in Table 1.

3.0 DELIVERABLES

Fabrication and testing of cryogenic sub kelvin temperature measurement system - 1 set

4.0 GENERAL REQUIREMENTS

4.1 The supplier shall submit detail design report and its troubleshooting, working manual.

4.2 The part number and the source of all the hardware's shall be cleared mentioned before purchase of the same from the market. They shall be purchased and installed only after prior approval from BARC. Any component of inferior quantity purchased without prior approval will be rejected strictly.

4.3 The Supplier shall indicate in detail the standards adopted for the materials and processes and the quality control procedures followed by them.

4.4 Supplier can suggest the color, aesthetics, and other details as suitable. Supplier must offer best quality/IS certified material only.

4.5 Supplier should have similar work experience and along with the offer, shall submit the details of past experience with documentary proof.

4.6 Materials, tools, manpower etc required for the above work will not be supplied by the user. Supplier has to arrange the above on his own (No free issue material).

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4.7 The supplier shall incorporate minor changes in the design as required at the time of execution of work at no extra cost.

4.8 The above job shall be done strictly under the supervision of our engineers in test facility at BARC premises.

4.9 Working personnel shall observe all the safety precaution during working.

4.10 The working personnel shall behave well with other officers and workers inside BARC campus.

4.11 The contractor shall be solely responsible, in case of any casualty involving working personnel. However, first aid will be provided by BARC.

4.12 General BARC security rules shall apply to all the working personnel.

4.13 Entry permit will be issued on weekly basis and contractor shall have valid photo pass with valid Police Verification certificate (PVC) as per the norms of BARC security.

4.14 Prior permission will be taken from security if the persons are required to do the job on Saturday, Sunday, Holidays and beyond normal working hours (08:00 to 18:00 hrs).

5.0 RAW MATERIAL PROCUREMENT

5.1 The raw material, electrical components used by supplier for the manufacturing of these components shall be of brand new and shall not be used previously.

5.2 All the material shall strictly confirm to their corresponding IS standards and shall be purchased only after prior approval from the purchaser.

6.0 REQUIREMENTS OF SUPPLIER QUALIFICATIONS

6.1 The supplier shall be evaluated on the basis of the following criteria

6.1.1 The supplier shall have previous experience in carrying out similar such jobs inside BARC and copy /proof of the same shall be attached.

6.1.2 The supplier shall submit the details of the welder, fitter and other man power, facility available with the supplier to carry out the job successfully.

6.1.3 The supplier shall provide the list of their employees along with their valid PVC certificate, who are intended to work in this job.

6.1.4 The supplier shall have minimum experience of 5 years in the development of chiller and proof of document of the same shall be provided.

7.0 REQUIREMENTS OF PRICE AND DELIVERY SCHEDULE

7.1 The supplier shall give lump sum price for the raw materials and man power to complete this job.

7.2 The complete job is expected to the completed in a duration of 4 Months.

8.0 CONFIDENTIALITY CLAUSE

8.1 No party shall disclose any information to any third party concerning the matters under this Contract generally. In particular, any information identified as "Proprietary" in nature by disclosing party shall be kept strictly confidential by the receiving party and shall not be disclosed to any third party without the prior written consent of the original disclosing party. This clause shall apply to sub-contractors, consultants, advisors or the employees engaged by a party with equal force.

8.2 "Restricted information" categories under section 18 of the Atomic Energy Act, 1962 and "Official secrets" under section 5 of the Official Secrets Act, 1923: Any contravention of the above mentioned provisions by any contractor / sub-contractor, consultant, advisor or the employees of the contractor will invite penal consequences under the aforesaid legislation.

8.3 Prohibition against the use of BARC's name without permission for publicity purpose. The contractor or sub-contractors, consultants, advisors or the employees engaged by a party

shall not use BARC's name for publicity purpose through any public media like: press, radio, TV or Internet without any prior approval of BARC (wide circular ref.: 2/Misc-9/Lgl/2001/92 date 30/04/2001).

Table 1. Sub Kelvin temperature measurement system

Parameters	Values
Input type	AC, 4-lead differential, resistance
Number of inputs	1
Maximum channels	16 (with optional scanner)
Resistance ranges	22 ranges from 2 mΩ to 63.2 MΩ (excitation dependent)
Maximum update rate	10 rdg/s (single range and input)
Range change settling	3 s + filter settling
Channel change (scan) settling	3 s + filter settling
Resolution	Sensor and range dependent, refer to Measurement Input Specifications table
Accuracy	Sensor and range dependent, refer to Measurement Input Specifications table
Temperature coefficient	±0.0015%/°C of rdg
Maximum lead resistance	100 Ω + 10% of resistance range per lead for current ≤3.16 mA; 10 Ω + 10% of resistance range per lead for current ≥10 mA
Isolation	Isolated from chassis and heater grounds
Lead connections	V+, V-, I+, I-, V shield, I shield, individual guards
Scanner lead connections	V+, V-, I+, I-, for each sensor, shield common to all
Common mode rejection	Matched impedance voltage input and current output, active CMR
Excitation	Sinusoidal AC current source
Excitation frequency	9.8 Hz, 11.6 Hz, 13.7 Hz (default), 16.2 Hz, or 18.2 Hz
Excitation currents	22 ranges from 1 pA to 31.6 mA RMS
Excitation accuracy	±2% of nominal
Minimum excitation power	10-18 W into 100 kΩ (see Measurement Input Specifications table for other ranges)
Typical DC bias current	2 pA +1% of excitation current (4.0 × 10-19 W into 100 kΩ)
Maximum DC bias current	4 pA +1% of excitation current (1.6 × 10-18 W into 100 kΩ)
Power up current protection	Current output shunted on power up
Voltage input ranges	12 ranges from 2 µV to 632 mV RMS
Voltage input over-range	20%

Voltage input impedance	>5 × 1013 Ω
Maximum input voltage noise	10 nV/√Hz at 10 Hz
Range selection modes	Manual, voltage excitation, current excitation, autorange
Scanner modes	Manual or autoscan
Filter	1 s to 200 s settling time, 1% to 80% filter window
Additional software features	Min/Max reading capture, pause (3 s to 60 s) on range and/or channel change, scanner dwell time (1 s to 200 s)
Supported sensors	NTC resistive sensors including germanium, Cernox®, Rox™, PTC resistive sensors including rhodium-iron
Quadrature display	Real and imaginary
Connectors	6-pin DIN (current out), 6-pin DIN (voltage in), and D6-pin DIN (current out), 6-pin DIN (voltage in), and DA-15 (scanner control)
Supported scanners	Lake Shore 3726 and 3708

Control Inputs

Input type	AC, four-lead differential, resistance
Number of inputs	1
Measurement units	Ω, K (with temperature curve)
Resistance ranges	6 ranges from 2 kΩ to 200 kΩ
Maximum update rate	10 rdg/s (single range)
Range change settling	3 s + filter settling
Resolution	Sensor and range dependent, refer to Control Input Specifications table
Accuracy	Sensor and range dependent, refer to Control Input Specifications table
Temperature coefficient	±0.0015%/°C of reading
Maximum lead resistance	100 Ω + 10% of resistance range per lead
Isolation	Isolated from chassis, common to measurement input
Lead connections	V+, V-, I+, I-, shield
Common mode rejection	Matched impedance voltage input and current output
Excitation	Sinusoidal AC current source
Excitation frequency	9.8 Hz, 11.6 Hz, 13.7 Hz, 16.2 Hz (default), or 18.2 Hz
Excitation currents	6 ranges from 316 pA to 100 nA RMS

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Excitation accuracy	±8% of nominal for 316 pA and 1 nA ranges;
±2% of nominal for the other ranges	
Power up current protection	Current output shunted on power up
Voltage input range	200 µV
Voltage input over-range	20%
Maximum input voltage noise	20 nV/√Hz at 10 Hz
Range selection modes	Manual, standard autorange, and Rox™ RX-102B-RS optimized autorange
Filter	1 s to 200 s settling time, 1% to 80% filter window
Additional software features	Minimum/maximum reading capture
Supported sensors	NTC resistive sensors (optimized for Rox™ RX-102B-RS sensor)
Minimum temperature	Down to 10 mK using a Rox™ RX-102B-RS sensor in a well-designed system
Connector	6-pin DIN
nput type	AC, four-lead differential, resistance
Number of inputs	1
Measurement units	Ω, K (with temperature curve)
Resistance ranges	6 ranges from 2 kΩ to 200 kΩ
Maximum update rate	10 rdg/s (single range)
Range change settling	3 s + filter settling
Resolution	Sensor and range dependent, refer to Control Input Specifications table
Accuracy	Sensor and range dependent, refer to Control Input Specifications table