Sub Piping, insulation, electrical cabling and installation of water chillers for superconducting magnet cryocoolers conforming to technical document No: EmA&ID/EMAS/SC/20/01 dated 25/06/2020

Dear Sir/Madam,

1. Quotations are invited for piping, insulation, electrical cabling, beam columns building, civil work and installation of water chillers for superconducting magnet cryocoolers conforming to technical document No: EmA&ID/EMAS/SC/20/01 dated 25/06/2020

2. Bidder shall quote for piping, insulation, electrical cabling, beam columns building, civil work. The above mentioned job will be carried out at UED, RCnD Building, & CFB Building BARC.

3. Taxes and Excise Duties shall be quoted separately. Form AF / H whichever is applicable shall be provided, if required.

4. The quotation must reach The Head, Electromagnetic & Instrumentation Division by 07/09/2020 and must be sent in a sealed envelope super scribed with the reference number & the due date given above. The quotations must be send by speed post/ registered post only.

5. The address on the envelop should read:

The Head,
Electromagnetic Applications & Instrumentation Division,
RCnD Bldg., North Site
BARC, Trombay,
Mumbai - 400 085.
(Kind Attn: Uday Giri Pratap Singh Sachan, SO/D)

6. The fabrication job, assembly & integration of loop shall be done in the presence of our engineers. A minor modification in the loop drawings shall be done in presence of our engineers. All tools and components will be provided by purchaser. However this needs to be handled as per procedures. The purchaser is not responsible for any injury to personnel during carrying out the above jobs.

7. The bidder shall complete the above mentioned job within 8 weeks from the date of firm work order issued to the bidder.

8. Head, Electromagnetic Applications & Instrumentation Division reserves the rights to accept / reject any or all quotations without assigning any reason.

9. Quotation must also indicate the validity of offer.

10. Technical specification must be returned along with the offer.

11. Quotation must also indicate the VAT no and PAN no of the party.

12. The quotation has to be signed by authorized person with company seal

Encl.: Technical Specification Sheet no.- EmA&ID/GYT/01

Uday Giri Pratap Singh Sachan
(SO/D, EMAS, EmA&ID)
Specification for Minor fabrication Work order

<table>
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<th>Revision no.</th>
<th>Date of Issue</th>
<th>No of pages</th>
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Piping, insulation, electrical cabling and installation of water chillers for superconducting magnet cryocoolers

1.0 SCOPE

Tender is invited for Piping, insulation, electrical cabling and installation of water chillers for superconducting magnet cryocoolers. The complete job shall be carried out 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 as the "buyer".

Supplier shall provide complete manpower support to carry out the above mentioned job successfully. The supplier shall arrange for the required raw material/ components etc required for integration of room temperature flow control loop after obtaining approval from purchaser. Supplier shall be qualified as per Para (9.0). The brief description of contents of this tender specification document is as described below.

Para 2.0 gives detailed job description.
Para 3.0 gives the general requirement details.
Para 4.0 gives requirement of raw material procurement
Para 5.0 gives requirement of engineering manufacturing and workmanship.
Para 6.0 gives the inspection and testing
Para 7.0 gives the requirements of supplier qualifications.
Para 8.0 gives the requirements of price and delivery schedule.

2.0 DETAILED JOB DESCRIPTION

Piping, insulation, electrical cabling and installation of water chillers is required for 3.65 Tesla room temperature bore split coil cryogen free superconducting magnet.

I. The superconducting magnet is cooled by two stage Grifford McMahon cryocooler. The heat removal capacity of these cryocoolers is limited to 1.5 watt at 4.2 K for second stage and 50 W at 50 K for second stage.

II. Cryocooler extenders are used to connect the cryocooler with the magnet. 4.2 K cryocooler extender has to be made in OFHC copper in such a way that minimum 4 numbers of straps can be connected with it.

III. Cryocooler cold head is connected with F-50 H Helium compressor. The cold head heat is extracted through this helium compressor.

IV. There are two such magnets kept at different locations in which piping, insulation, electrical cabling and installation of water chillers has to be carried out.

V. F-50 H compressor is cooled by a continuous chilled water flow (1 litre/sec). The water chillers are used to circulate and cool the water required for cryocooler compressors.

VI. The facility has 17.5 kW chiller which operates at ambient temperature of 10 to 50° C. The chiller tank capacity is of 100 Litres and it uses R407C as refrigerant.

VII. The distance between chiller and Helium compressor is 40 meters and the location of chiller and helium compressor is respectively ground floor and first floor. The elevation difference is 6 meters.
VIII. It is required to construct an elevated shed (preferably mild steel) at a height of 3 meters. The supplier has to carry out civil work which includes building concrete columns in which mild steel angles will be grouted. A platform of size (3m×3m) shall be made of mild steel such that it should bear the weight (250 Kg) of chiller. Chekered plates to be used at the shed's floor. The shed roof shall be bigger than the floor size by 2 foot in all the directions. The shed walls shall be made of 5 mm mild steel plate up to 1-meter height. Grill shall be used to cover the remaining height of 2 meters. The shed shall be electrically grounded so that any possibility of electrical shock can be avoided.

IX. Shed shall be painted (single coat primer followed by three coats of acrylic paint) preferably white in color.

X. The supplier has to provide a heavy duty metallic ladder permanently fixed with the shed in order to carry out maintenance jobs.

XI. Piping for water flow has to be carried out from chiller placed at elevated shed to the helium compressor. Silicon tubes of diameter 12.7 mm with wall thickness 2mm shall only be used. Armaflex insulation shall be used to cover silicon tubes to avoid water dripping. The standard sealant shall be used for pasting armaflex insulation with silicon tubes.

XII. The Helium compressor is kept inside closed room on the first floor. For carrying out piping holes has to be cut in the walls if required. All the civil work required during installation shall be carried out by the supplier.

XIII. Two booster pumps of 2 HP are required in up line and downline of the chiller. All electrical & hydraulic connection of booster pump has to be carried out by the supplier.

XIV. During top up of water in the chiller we require to add ethylene glycol anti freezeant. Supplier has to purchase standard commercial grade ethylene and propylene glycol 100 Liters each.

XV. If required supplier has to top up refrigerant gas R-407C in chiller compressor. Refilling of R-407C shall be strictly carried out as per instructions given in the chiller manual.

XVI. Supplier has to also carry out installation of thermal switches on these lines.

3.0 GENERAL REQUIREMENTS

i. The supplier shall workout a detailed design to meet fabrication requirements and work description, quantity and main fabrication material. He shall submit along with offer dimensional drawing giving all the salient features, material details of individual items.

ii. Suppliers can suggest the color, aesthetics and other details as suitable.

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

iv. Supplier shall supply raw materials and skilled manpower (fitter & welder) for the above mentioned job.

v. The above job shall be carried out strictly under the supervision of our engineers in test facility at BARC premises.

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

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

viii. General BARC safety rules shall apply to all the working personnel.

ix. 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.

x. 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).
I. Job Location: CFB Building, RCnD Building, New RCnD Building, UED building

4.0 RAW MATERIAL

The following materials shall be used

I. Pipe fittings NPS2 Schedule 80 shall be used for housing of silicon tubes.
II. Armaflex insulation for chilled water tubes.
III. Polycab cables 4 core 3 sq mm length 100 meters
IV. Teflon tapes, electrical tapes and greases if required
V. R407C refrigerant for top up in chiller compressor.
VI. Braided Silicon tube of wall thickness 4 mm 180 meters shall be used.
VII. 2 HP single phase water booster pumps

5.0 ENGINEERING MANUFACTURING & WORKMANSHIP REQUIREMENTS:

I. There should be no joints in the braided silicon tube for the entire length. Complete tube shall be in a single length.
   a. Suitable precaution shall be taken during soldering and crimping of connectors and internal shorting of wires shall be avoided.

II. Cleanliness
   a. After assembly and testing the superconducting magnet facility has to be cleaned.

6.0 INSPECTION & TESTING

I. After chiller installation water leakages in the lines shall be checked and flow rate in silicon tubes shall be measured.

II. The refrigerant gas R407C pressure shall be limited to 15 bars.

III. After installation the chiller will be run for seven days continuously there should be no interlock tripping such as insufficient water flow/low pressure.

7.0 REQUIREMENTS OF SUPPLIER QUALIFICATIONS

I. Past experience: The supplier must give their past three-year turnover and job executed by them with reference, volume of work and completion schedule, present commitments and anticipated commitments inside and outside India.

8.0 REQUIREMENTS OF PRICE AND WORK COMPLETION

I. The supplier shall provide raw materials and support for the above job. The job shall be completed within 24 months from the date of placement of firm work order.

II. The supplier shall provide overall cost with delivery schedule.

9.0 Deliverables:

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<th>Component</th>
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<td>Piping, insulation, electrical cabling and installation of water chillers for superconducting magnet cryocoolers at UED, RCnD and CFB building Along with left over silicon flexible hoses, ethylene glycol, propylene glycol-100 Litres, Electrical cable 4 core, Armaflex insulation</td>
<td>02 Set</td>
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