Government of India
Bhabha Atomic Research Centre
Cryo-Technology Division

Ref: - BARC/CrTD/NK/20/OPA/ 109876 Date: 02/11/2020

Tender No.: BARC/CrTD/NK/20/OPA/ 109876
Tender Due Date: 10:00 hrs, 13 November, 2020

Sub: Invitation of quotation for

"Manufacturing of heat exchangers as per attached technical specification."

Dear Sir,

1. Quotations are invited for minor fabrication/repairs jobs as per the enclosed Technical specifications and General Terms and conditions as per the annexure.
2. Bidder shall quote for: - Manufacturing of heat exchangers as per attached technical specification.
3. Taxes should be quoted separately.
4. The Quotation must reach Head, Cryo-Technology Division by 10:00 hrs, 13 November 2020 and must be sent in the sealed envelope super scribed with the above reference number and the due date given above. Also the name of the work should be displayed on the envelope.
5. The address on the envelope should read: -
   Attn: Naveen Kumar (SO/E)

   To Head Cryo-Technology Division
   278-H, CrTD Office, 2nd Floor, CFB,
   Bhabha Atomic Research Centre,
   Mumbai - 400 085

6. The bidder shall have to take an insurance policy against any material issued to him by the purchaser.
7. The Fabrication / Repair work shall be subjected to inspection by our Engineer at CFB, BARC and/or party's place.
8. The bidder shall deliver finished components after approval of our Engineer within 2 months from the date the firm purchase order is placed with the bidder. The finished components/equipments and the scrap from free issue material shall be delivered by the bidder at CFB, Cryo Technology Division, Bhabha Atomic Research Centre, Trombay, Mumbai 400 085.
9. Head, Cryo-Technology Division, BARC reserves the right to accept or reject any or all the quotations without assigning any reason.

Naveen Kumar (SO-E)
BARC, Trombay
ANNEXURE – 1
TECHNICAL SPECIFICATIONS

This document covers the requirements and scope of vendor regarding the fabrication, testing along with acceptance criteria, inspection, packing and forwarding of 02 Nos. of heat exchangers.

The party shall submit the drawings (GA and Part) as well as QAP, clearly indicating the hold/witness/approval/review points, for the prior approval before starting the manufacturing work.

1. Technical requirements:-

The required heat exchangers are of shell and helical coil type. These items are the part of process where purity of process fluid is of utmost requirement. In view of this any leakage from shell or coil is not acceptable. Also the cleanliness of the coils and shell shall be needed.

1.1 Coil Assembly Specification:-

<table>
<thead>
<tr>
<th>Material (tube and fin)</th>
<th>Deoxidized copper (copper+silver more than 99.99%) (preferably C12200)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Finned Tube</td>
<td>Integral Fin</td>
</tr>
<tr>
<td>Fin height</td>
<td>1.3mm</td>
</tr>
<tr>
<td>Fin density</td>
<td>19 fin/inch or more</td>
</tr>
<tr>
<td>Plane tube OD</td>
<td>19.05mm</td>
</tr>
<tr>
<td>Plane tube thickness</td>
<td>2.01mm</td>
</tr>
<tr>
<td>Length of tube in the coil</td>
<td>20m</td>
</tr>
<tr>
<td>No of physically separated Coils</td>
<td>02</td>
</tr>
<tr>
<td>Pitch</td>
<td>Triangular close packed</td>
</tr>
<tr>
<td>Design Pressure</td>
<td>26 bar (a)</td>
</tr>
<tr>
<td>Working Temperature</td>
<td>80°C</td>
</tr>
<tr>
<td>Working Fluid</td>
<td>Normal tap water</td>
</tr>
</tbody>
</table>

- Two coils shall be connected in parallel.
- No joint between copper tubes is allowed inside the shell.
- All the coils should be contained inside the shell having the maximum outside diameter of 275mm.
- All the coils shall be mounted on welded mandrel.
- Gap between coil assembly and shell as well as mandrel should be filled with nylon braided rope or the other suitable material with the prior approval.
- Finned tube shall be completely free of metallic bur and in bright condition.

1.2 Shell and mandrel specification:-

<table>
<thead>
<tr>
<th>Material</th>
<th>SS 304 or 316</th>
</tr>
</thead>
<tbody>
<tr>
<td>Working pressure</td>
<td>26 bar (a)</td>
</tr>
<tr>
<td>Working Temperature</td>
<td>80°C</td>
</tr>
</tbody>
</table>
ANNEXURE – I
TECHNICAL SPECIFICATIONS

<table>
<thead>
<tr>
<th>Mechanical Design Code</th>
<th>ASME SEC VIII, DIV 1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Thickness of cylindrical shell</td>
<td>More than 4.1mm</td>
</tr>
<tr>
<td>Maximum outside diameter of shell</td>
<td>300 mm</td>
</tr>
<tr>
<td>Maximum height of heat exchanger</td>
<td>600mm</td>
</tr>
<tr>
<td>Working fluid in the shell</td>
<td>Helium</td>
</tr>
</tbody>
</table>

Shell and mandrel shall be constructed so as to allow complete removal of coils from shell assembly. Shell should have flat top head to accommodate the required fittings. Coil and top head should have removable connections with each other to allow separation of coil from top head without cutting and reassembly without brazing or welding. Top head will have one and cylindrical shell will have 2 threaded connections (3/4 inch, sch. 40 imperial size and thread on outside diameter) for temperature and pressure instrumentation. Top head shall also have a threaded connection (M30X2, LENGTH 60MM, drawing will be provided) for valve mounting.

An intermediate mandrel should be inserted between two coils. This mandrel should allow fluid from inlet to flow over the two coils.

1.3 **Inlet and outlet connection :-**

For coil side fluid- Water coming to heat exchanger should be divided into two parts and reach two coils connected in parallel. This can be done by a suitable manifold and header. Similarly water coming out from the two coils shall merge into one using a manifold. All the fittings shall be leak tight. Final water inlet and outlet connection shall have the inlet diameter larger than 23mm.

For shell side fluid- Bottom head of the shell side fluid will serve as the inlet as well as outlet of the heat exchanger. The actual arrangement is shown in Fig. 1. Draft drawing of the component shall be provided. Minor changes can be made with prior approval.

![Fig. 1: Bottom head with combined inlet and outlet arrangement for the shell side fluid](image-url)
ANNEXURE – 1

TECHNICAL SPECIFICATIONS

2. Manufacturing:
   1.1 Fabrication:-
   The Welding and Brazing of Heat exchanger shall be in accordance with ASME boiler and pressure vessel code (BPVC) section VIII, Div. -I and concurrence of Section IX when required.

   1.2 Cleanliness:-
   All welds shall be finished smoothly and merge with the parent metal without ridges or undercutting. All scale oxides, weld spatter and other foreign materials shall be completely removed and buffed on both the inside and the outside of the equipment. All surfaces that will not permit cleaning after complete fabrications shall be cleaned of all foreign material prior to assembly. Only certified and approved chemicals and cleaning agents shall be employed. There should not be any burr or foreign particles attached to the copper fin.

3. Testing Requirements and Acceptance Criterion for heat exchanger:-
   1. Pneumatic test with dry nitrogen (Scope of manufacturer at fabrication site).
      Acceptance criteria: - No perceptible drop in pressure during pneumatic test when left for 2 hours at 26 bar. Testing method shall be as per ASME BPVC section-VIII, Div. -I, UG 100.

   2. Helium mass spectrometry leak detection (MSLD) test (Scope of purchaser at installation site).
      Acceptance criteria: - Helium leak rates should not be more than
      • \(1 \times 10^{-6}\) mbar.l/s when shell and coil both are pressurised at 26 bar separately, for helium MSLD test in sniffer mode.
      • \(1 \times 10^{-9}\) mbar.l/s when coils are pressurised at 26 bar and kept in the evacuated shell, for helium MSLD test in vacuum mode with shell connected to the evacuation port of the MSLD machine.

4. Inspection:-
   In person inspection is required for as built coils before assembly and during the tests listed below. Vendor shall inform the BARC in advance for tests. BARC shall have the right to inspect fabrication steps during manufacturing at the vendor’s site. BARC will inform the vendor about the helium leak test; so that the vendor can inspect the testing if they want.
   1. Material sampling, stamping, and sealing for testing.
   2. Pneumatic testing.
   3. Helium leak testing.

5. Scope of Vendor: -
ANNEXURE - 1
TECHNICAL SPECIFICATIONS

1. Testing: Pneumatic test at 29 bar (abs.)
2. Material testing (chemical composition and mechanical properties) from NABL certified Labs.
3. Welder qualification report as per ASME boiler and pressure vessel code, section IX.
4. Brazing qualification report (For the exactly same material combination which is being used in fabrication).
5. Drawings i) Before fabrication for the approval and ii) As fabricated
6. Connected end fittings of the water lines. Types and size of the fitting should be in agreement with BARC.
7. All the openings, for which the supply of instrumentation is not the scope of manufacturer, should be supplied with blind fittings of the leak tightness better than 10⁻⁸ mbar l/s.
8. One no. of bottom blind flange of the heat exchanger shall be supplied to BARC.
9. For the ease of installation a suitable arrangement for holding the heat exchanger with the consent of BARC.
10. Heat Exchangers shall be guaranteed against faults in the material and workmanship for at least a period of 12 months after commissioning or 18 months after dispatch ex works, whichever expires the earlier. Helium leak test will be done on purchaser's site but vender has to give guarantee for the specified leak rate.

6. Delivery
1.1 Packing and Forwarding: All the heat exchanger surfaces shall be thoroughly cleaned and mechanical surfaces, flanges etc. shall be protected by using wooden plank along with rubber sheets to avoid any damage in transit.

1.2 Documentation: The vendor shall submit one copy of bound data folder containing the following information:
   i. Certified material test reports showing chemical analysis, physical/mechanical properties of all the materials used in the fabrication of the heat exchangers.
   ii. Pneumatic test report.
   iii. Detail component design drawings and fabrication drawings.
   iv. Brazing and welding procedure specification and qualification certificate.

1.3 Place of delivery: - CrTD, BARC, Trombay, Mumbai

7. Other terms and conditions:
1. Draft drawing of the bottom head of the shell can be provided on request. Minor modification can be done with prior written approval.
2. Headers and fittings for water inlet and outlet shall be selected with the consent of BARC.

8. General terms and conditions:
1. Completion period: - The party should complete the entire job within 2 months after the receipt of the work order. Any delay which is attributed to the contractor is liable for penalty @ 1/2% per week (max.5%) to be imposed on the contractor. However, in
case any extension in delivery is to be granted to contractor, party's request for extension may be called for before expiry of work Order. The same may be justified by the Division, whether extension granted is with or without levy of liquidated damages.

2. **Terms of payments** :- No advance payment shall be made. Full payments shall be made only after completion of the job. 3) Payment shall be made through ECS, by Accounts Officer, BARC. The fabricator shall have to submit in advance duly signed and stamped receipt along with the bills, for the immediate payment.

3. **a. Confidentiality** :- Party shall not disclose any information to any third party concerning the matters under this contract generally. In particular, any information identified as “Property” in nature by the disclosing party shall be kept strictly confidential by the receiving party and shall not be disclosed to any third party without the prior consent of the original disclosing party.

4. This clause shall apply to the sub-contractors, consultants, advisers or the employees engaged by the party with equal force.

5. **b. “Restricted information” categories under Section 18 of the Atomic Energy Act, 1962 and “Official Secrets” under Section 5 of the Official Secrets Act, 1923 :-**

6. Any contravention of the above mentioned provisions by any vendor, sub-contractor, consultant, adviser or the employees of a vendor will invite penal consequences under the aforesaid legislation.

7. **Important**: Party shall have to get the security clearance / Police verification for the manpower / Persons which will be deployed for the execution of the job. Details of GST no. /PAN No. / Registration etc. are to be provided by the party.

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