

Technical specification

Specification no.	Revision no.	Date of Issue	No of pages
EmA&ID/EMAS/PKR/22/31	0	02/03/2022	05

Development, fabrication & cold testing of high thermal & electrical conductance joints for cold mass surfaces at cryogenic temperatures

1.0 SCOPE

Tender is invited for support for development, fabrication & testing of low thermal resistance joints for 4.2 K applications inside BARC premises. 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 raw materials required for machining, along with facility shall be provided by the purchaser. In case the material has to be taken outside for modification, the buyer will make the arrangement. Supplier shall be qualified as per Para (7.0). The brief description of contents of this tender specification document is as described below.

Para 2.0 gives deliverables.

Para 3.0 gives detailed job description.

Para 4.0 gives the general requirement details.

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 price and delivery schedule.

Para 8.0 Confidentiality clause

2.0 DELIVERABLES

S. No:	Description	Quantity
	Development, fabrication & testing of low thermal resistance joints for 4.2 K applications	01 Set
1	High Thermal Conductance Joints for cold mass surfaces using soft metal cold welded sheets (Drawing: 01)	
2	High Electrical Conductance Joints for LTS superconducting magnets using soft metal cold welded sheets (Drawing: 02)	

3.0 DETAILED JOB DESCRIPTION

Development fabrication & testing of onsite low thermal resistance joints for 4.2 K applications is required as per given instructions.

- I. 3.65-Tesla Nb-Ti wound superconducting magnet is cooled by two stage pulse tube cryocooler. The heat removal capacity of these cryocoolers is limited to 1.6 watt at 4.2 K for second stage and 40 W at 50 K for first stage.
- II. Radiation losses of the horizontal magnet are reduced by installation of intermediate temperature thermal shield. PT Cryocoolers are used to extract heat loads from these thermal shields.

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- III. Aluminized Mylar (MLI) is wrapped on outer surface of these shields to reduce radiative thermal heat load of the magnet.
- IV. Cryocooler extenders are used to connect low temperature ports of the magnet to 4.2 K. Construction material of cryocooler extenders have to be strictly OFHC copper in such a way that minimum 4 numbers of straps can be connected with it.
- V. The vessel is 1 meters long with an outside diameter of 0.8 meters. Cryostat comprises of a vacuum vessel, radiation shields at 50 K, cold mass at 4.2K, magnet suspending system (tie rods and compression posts), current leads, thermal interconnects, cold plates, cold fins, quench protection system etc. All the above mentioned components/systems operate at cryogenic temperatures.
- VI. Heat transfer rate is maximized by developing low thermal resistance joints. These joints are formed by using ultra-pure (99.999%) Indium foils. These foils are of single use and is cold welded to the mating surfaces. The mating surfaces shall be cleaned thoroughly so that it is free from dirt, grease & oil. Acetone LR may be used to clean the surfaces. Vacuum compatible cryogenic grade greases must be used on both the sides of the Indium foil.
- VII. Ultrapure Indium (grade 5N) foils shall be used for making ultra-low thermal resistance joints. Indium foils shall have following properties:

Color	Silver
Purity	99.9999% (6N Pure)
Trace Material	< 100 ppm
Resistivity	8.37 $\mu\Omega$ -cm
Melting Point	156 °C
Density	7.3 gmL at 25°C

- VIII. If the Indium foil gets twisted or scratched during joint formation, it has to be reworked.
- IX. During formation of thermal joints Indium sheets shall be cut from a sharp edge rollers.
- X. After blanket installation shortening of blankets with 50 K & 300 K surfaces will be checked. Once it is confirmed by the purchaser that there is no shortening in the blankets, sealing of vessel will be carried out.

4.0 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.** Supplier should have similar work experience and along with the offer shall submit the details of past experience with documentary proof.
- iii.** Supplier shall supply skilled manpower (fitters & electronic technicians) for the above-mentioned job.
- iv.** The above job shall be carried out strictly under the supervision of our engineers in test facility at BARC premises.
- v.** Working personnel shall observe all the safety precaution during working.
- vi.** The contractor shall be solely responsible, in case of any causality involving working personnel. However first aid will be provided by BARC.

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

5.0 ENGINEERING MANUFACTURING & WORKMANSHIP REQUIREMENTS:

- 5.1 Indium foils shall not be oxidized and it shall be kept in a moisture free box.
- 5.2 Indium foils shall not be touched with bare hands. Always lint free blue color hand gloves shall be used.
- 5.3 Suitable precautions shall be taken while cutting of the foils.

6.0 INSPECTION & TESTING

- 6.1 Visual inspection of the blankets shall be carried out. During cutting and integration operations there should be no wear and tear of the blankets.
- 6.2 Dimensional checks may be performed on MLI blankets.
- 6.3 Joint electrical resistances have to be measured.
- 6.4 Thermal conductivity test shall be carried out

7.0 REQUIREMENTS OF PRICE AND WORK COMPLETION

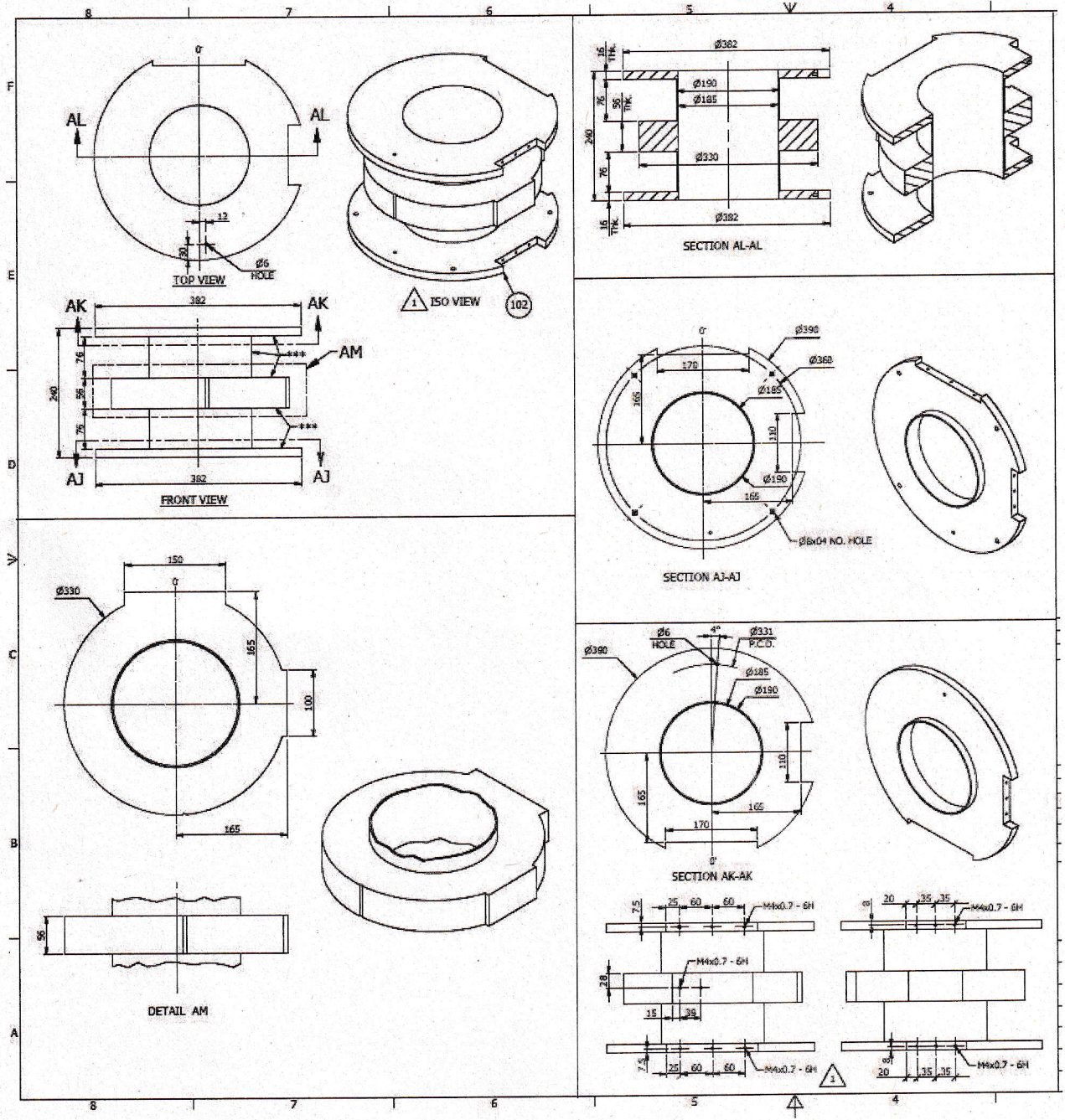
- I. The work shall be completed within 4 months from the date of placement of firm work order. The complete job is expected to complete in 04 months
- II. The supplier shall provide overall cost with delivery schedule.

8.0 CONFIDENTIALITY CLAUSE

- I. 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.
- II. "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.
- III. 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).

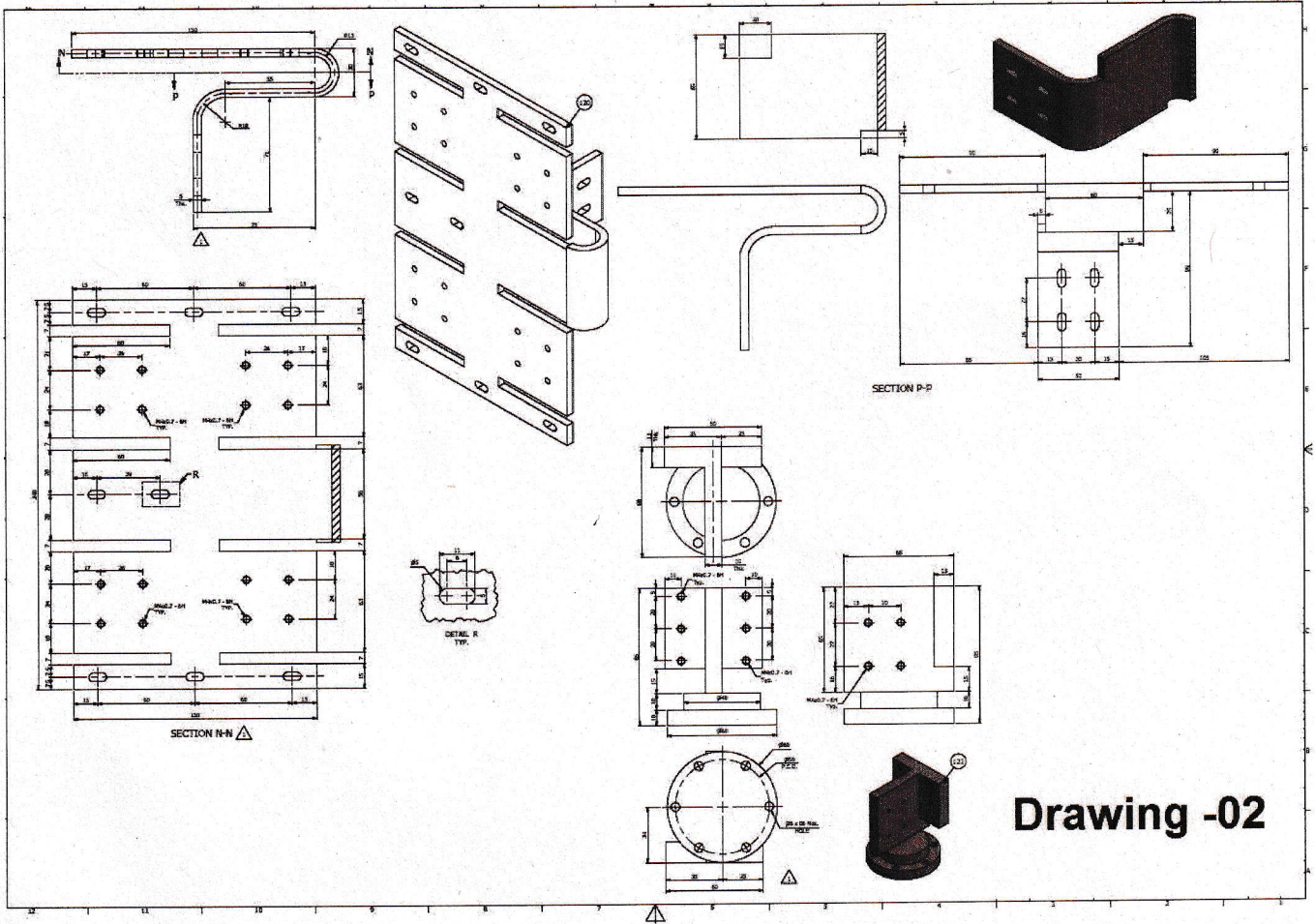
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Drawing 01



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Drawing:02



Drawing -02

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