Ref. No.: BARC/APPD/EBC/SRG/2019/ 222

Date: 18/10/2019

Subject: Inviting quotations for fabrication of Cathode assembly as per annexure-1 and drawings.

Dear Sir,

On behalf of the President of India, you are invited to quote for fabrication of Cathode assembly as per annexure-1 and drawings. Terms & conditions are given below.

<table>
<thead>
<tr>
<th>SN</th>
<th>Description of the Job</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Fabrication of Cathode assembly as per annexure-1 and drawings.</td>
<td>01 Set</td>
</tr>
</tbody>
</table>

**Terms and Conditions:**

1. The supplier should quote for fabrication of the items, including the cost of the materials. No free issue materials will be provided by BARC.

2. The material will be inspected before start of the fabrication.

3. The quotations should have minimum validity period of two months.

4. Material/supply/fabrication requirement can be scrapped/Cancelled before placement of work order without any notice.

5. Since the goods are to be supplied against the work order meant for research and development purpose of a research organization under DAE, the necessary GST will be exempted to the party.

6. Supplier should submit their offers in their letterhead, placed in sealed envelope supercribed with the above-mentioned Reference No., due date and Title “Quotation for fabrication of Cathode assembly as per annexure-1 and drawings. Kind attention: "Mechanical Section, EBC". Quotation should be addressed to Head, APPD, Electron Beam Centre, Rain Tree Marg, Sector-7, CBD, Belapur, Navi Mumbai-400614, on or before dated: 01/11/2019 (before 14:00 hours). The quotation should contain the following details like (i) Period of validity, (ii) terms and conditions of offer, (iii) Approximate period of completion of job, (iv) Copies of registration and income tax clearance certificates, (v) PAN, GST, registration no and Company’s seal with proprietor, signature. The quotation containing above information should reached to us before due date by speed post only. No courier and other mode of delivery will be accepted.
7. The fabrication of the item shall be subjected to inspection by our Scientists/Engineer at the supplier’s works. Necessary inspection facilities should be provided to them during fabrication at the supplier’s premises. The purchaser has the right to make the minor modification in the design and drawings. Additional charges will not be admissible for such minor modifications, if any. The item should be delivered to us at Electron Beam Centre, Kharghar, Navi Mumbai, after approval by Scientists/Engineers.

8. Please note that shorter delivery period will be preferred. For any clarifications you may contact Electron Beam Centre, Kharghar, on Telephone Number: 022-27524551, Fax: 91-22-27524554.

9. Payment will be made only after delivery and installation of the item to the above mentioned address and approval by our Scientists/Engineers as per BARC rules.

10. Work should be as per drawing and annexure-1.

---

R. K. Rajawat  
AD, BTDG and Head, APPD, BARC  
आर. के. राजावत /R.K. Rajawat  
सह निदेशक /Associate Director  
बीएमडीटी एनन्य्य ग्रुप/ Government of India  
भारत भारत/Beam Technology Development Group/Government of India  
P.O. Box, Bombay-65, India /65, P.O.B.O.C., Bombay, Mumbai-65.

Copy to: Accounts Officer, Works Section Central Complex, BARC.
Annexure-1
Technical specification for fabrication of Cathode assembly

1.0 Scope:
This specification establishes technical requirement of procurement of materials, fabrication, machining, inspection, assembly, alignment, Helium leak testing, evacuation, packaging, safe delivery at site of “Cathode assembly as per annexure-1 and drawings.” The Cathode assembly will be delivered at Electron Beam centre, Sector-7, CBD, Belapur, Near Kharghar Railway Station, Navi Mumbai-400614, Maharashtra.

The integration of the Cathode assembly components and precise positioning of its elements are to be done on micron scale, which requires good alignment and strict quality controls per approved quality assurance plan.

2.0 Work Includes:
The work includes but is not limited to

2.1 Approval of fabrication drawings including tolerances, finish and fabrication process by BARC Engineer.

2.2 Approval of inspection procedure: vendor should submit fabrication, inspection and testing procedures, keeping these documents as guide lines. Approval of quality assurance plan is to be taken from BARC Engineer.

2.3 Documentation and as built drawing should be provided by the vendor after fabrication.

2.4 Following material tests are to be done:

2.4.1 Physical test: mill test report for physical properties like ultimate tensile strength, yield strength and percentage elongation for stainless steel ASTM SA 182 grade 316L.

2.4.2 Test for stainless property of stainless steel 316 L by IGC test.

2.4.3 Chemical Test: Chemical composition testing of SS 316 L should be carried out as per ASTM standard.

2.4.4 All flanges should be made by forged material as per ASTM SA 182 grade 316L.

2.5 Qualification of all process & procedures for manufacturing of the component & demonstration of the same by mock-ups.

2.6 Machining, cleaning, CMM measurement, Surface finish measurement, assembly, and packing in clean room.

3.0 Code and Standards:
The following codes and standards have to follow by the vendor during fabrication and inspection.

a) ASTM Sec II: Part A, B & C (Material)

b) IS-919: Dimensional Tolerances (which is not shown in drawing)

4.0 Materials: Materials and standard parts shall be of genuine quality and in accordance with good practice pertinent to the manufacture of SS components and shall also be subject to approval by the Purchaser. The quantity of material to be procured shall be calculated by the
fabricator as per the approved drawings and taking into account the cutting / machining losses, scrap etc. Material should be strictly as per following standards.

a) Stainless steel (as per ASTM A 182 Grade 316L)

b) Macor (Machinable glass Ceramic):

It should be compatible with ultra high vacuum application and no porosity and less out gassing.

- Density: 2.52 gm/cm³
- CTE: 13 μm/m°C (@20-100°C
- Thermal conductivity: 1.5 W/mK

5.0 Machining and fitting:

As far as possible, all fitting and machining shall be shop work and as per tolerances mentioned in the drawing or general tolerances also approved in the drawing. Contractor shall provide enough material as finish machining allowance at these places to take care of possible fabrication stress relieving distortions, especially in alignment jigs. All surfaces, which becomes gasket surfaces and vacuum surfaces shall be scratch free and have a 0.2 - 0.4 micrometer surface finish or as per specified in the drawings (whichever is less). All conflat flanges should be made in accordance with ISO standards. Inspection should be carried out for all knife edge angle, surface finish and dimensions. The knife edge should be protected against any scratches, dent mark etc.

5.1 Surface Finish:

Internal and outer surface finish of the Cathode assembly components should be maintained at 0.2-0.4 micrometre Ra value. All components should be electro polished after final machining.

6.0 Inspection, tests and reports:

6.1 The tolerances mentioned in the approved drawings are the upper limit. The measurements should be within the tolerances level.

6.2 Material acceptance: As per this technical specification and inspected by BARC engineers at BARC approved labs.

6.3 Dimensional acceptance: All components required to be inspected in co-ordinate measuring machine or high accuracy height gauge.

6.4 Assembly and alignment acceptance: Vender has to make necessary fixtures and gauges for alignment.

6.5 Macor and Invar are to be machined with proper RPM and surface finish.

6.6 All parts should be made in CNC machine of accuracy 1 micrometer. A tolerance in parts varies from 5 to 20 micrometer. Surface finish varies from 0.1 micrometer to 0.4 micrometers.

6.7 All vacuum parts should be Helium leak tested separately at leak rate of $10^{-10}$ std.cc/s at vendor’s workshop. Complete assembly and sub assemblies should also be Helium leak tested. Completed assembly should be vacuum tested at $10^{-5}$ mbar using turbo-molecular pump for 24 hours at vendors site.
6.8 All welding should be done with Advani Orilcon (Adhore) make electrode as per ASME code for material 304L and 316L.

6.9 All parts should be electro polished to give mirror finish.

7.0 Packing & Transport:
The Cathode assembly components should have proper packing to protect them while transporting. For critical components make separate case. Proper care must be taken while transporting by the Vendor. Any damage during transport will be the responsibility of the Vendor. All the equipment shall be dispatched to Stores Officer, Electron Beam Centre, Rain Tree Marg, Sector-7, CBD, Belapur, Near Kharghar Railway Station, Navi Mumbai, Pin- 400614, Maharashtra.
<table>
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<tr>
<th>SL No</th>
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<th>DESCRIPTION OF ITEMS</th>
<th>MATERIAL</th>
<th>QUANTITY</th>
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<tr>
<td>01</td>
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<td>14 kV HIGH VOLTAGE FEEDTHROUGH</td>
<td>STANDARD</td>
<td>04 Nos.</td>
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<td>FEEDTHROUGH FLANGE DN 35 CF</td>
<td>SS316 L</td>
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<td>TOP FLANGE</td>
<td>SS316 L</td>
<td>02 Nos.</td>
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<td>60 kV ISOLATOR HAVING DN 100 CF FLANGES</td>
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<td>INTERMEDIATE ADAPTOR FLANGE</td>
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<td>MACOR</td>
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<td>ALUMINA</td>
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<td>SPECIAL M3 SCREW</td>
<td>SS304</td>
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<td>12-3 Sets.</td>
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<td>6-2 Sets.</td>
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<td>32-8 Sets.</td>
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<td>40±10 Sets.</td>
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</tbody>
</table>
Part No-1
14 kV High Voltage Feedthrough
Material: Standard
Quantity: 4 Nos.
16 - Ø8.4 mm CLEAR HOLES EQUISpaced ON 130.3 mm P.C.D

TOP VIEW

Ø120.6
Ø115.0
Ø97.5

FRONT VIEW
Part No-4
60 kV Isolator having DN 100 CF Flanges
Material: Standard
Quantity: 1 No
**Material:** S316L  
**Gun Vacuum Chamber**  
Water-Cooled Double-Walled  
**Part No-6**

<table>
<thead>
<tr>
<th>No.</th>
<th>Part Description</th>
<th>Material</th>
<th>Description</th>
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<tbody>
<tr>
<td>1</td>
<td>Top View</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Bottom View</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Left View</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Right View</td>
<td></td>
<td></td>
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</tbody>
</table>

**Quantity:** 2 Sets.
Quantity: 2 NOS.
Material: SS 316L
Grid Cathode Holder Tube

Part No. 7

Section at D-P

Impressed holes on support
4 x 4.5 x 3 mm through

Section at A-A

Spaced on 5.5 mm pitch
6.0 x 0.5 mm clear holes equi-

Section at B-B

0.06 x 0.02

Section at C-C

0.06 x 0.02
4-Ø4 x 3.5 mm deep slots

Part No-8
Feedthrough wire locator MACOR disc
Material: MACOR
Quantity: 2 Nos.

Section at A-A’
Section at B-B’
Section at A-A'

Part No-9

Lock nut

Material: SS 316L

Quantity: 4 Nos.
Part No-10
Cathode holder tube
Material: SS 316L
Quantity: 2 Nos.
/-NOS.
Material: SS 316L
Grip Holder Tube

Part No: 11

Section at B-B:
- M4 x 1.5p
- Diameter: 0.60 ±0.02
- Width: 16.25
- Height: 33.50
- Length: 53.5 ±0.02
- Hole: 2.50

Section at A-A:
- M4 x 1.5p
- Diameter: 0.60 ±0.02
- Width: 20.00
- Height: 33.50
- Length: 53.5 ±0.02
- Hole: 2.50

Top View:
- Diameter: 53.5 ±0.02
- Height: 9.75
- Hole: 2.50
Part No-13
Cathode assembly
Material: Standard
Quantity: 2 Nos.
FIGURE-15

Top view

Section at A-A'

Part No-14
Cathode assembly holder MACOR base
Material: MACOR
Quantity: 2 Nos.
FIGURE-18

8-03 mm clear holes equispaced on 93.0 mm P.c.d

TOP VIEW

4-M3 tapped holes equispaced on 73.0 mm p.c.d

SECTION C-C'

Section A-A'

Part No-17
Anode Holder Tube
Material: SS 316L
Quantity: 2 Nos.

PART NO-17
FIGURE-19

4-Ø3.2 mm clear holes equispaced on 73.0 mm pcd

6-Ø6.0 mm clear hole equispaced on 56.0 mm pcd

TOP VIEW

SECTIONAL FRONT VIEW AT A-A

Part No-18
Anode
MATERIAL: SS 316L
QUANTITY: 2 Nos.
Assembly of Part Nos. 22, 23, 1 & 2

Top View

Dimensions:
- 0.35 mm
- 0.46 mm clear holes
- 120°

Section A-A

Dimensions:
- 0.35 mm
- 0.46 mm clear holes
- 120°
Quantity: 2 NOS.
Material: SS304
Cover-5 (SS Meshed for HV Insulator)
Part NO-26
Part No-27
SS Spacer type-1 (0.2 mm)
Material: SS316L
Quantity: 10 Nos.

Part No-28
SS Spacer type-2 (0.5 mm)
Material: SS316L
Quantity: 10 Nos.

Part No-29
SS Spacer type-3 (1 mm)
Material: SS316L
Quantity: 10 Nos.
FIGURE-29

6-Ø6.6 CLEAR HOLES EQUI SPACED ON 58.7 P.C.D

TOP VIEW

DETAIL AT D'

Ø58.7

FRONT VIEW

Part No-34
DN 35 CF Blank Flange
Material: SS304L
Quantity: 4 Nos.
FIGURE-30

20-08.4 CLEAR HOLES EQUI
SPACED ON 181.0 P.C.D

TOP VIEW

DETAIL AT G'

FRONT VIEW

Part No-35
DN 150 CF Blank Flange
Material: SS304L
Quantity: 2 Nos.
FIGURE-31

Front View

SS Handle-1 (for DN 100 CF flange)
Material: SS304L
Quantity: 8 Nos.

Part No-36
Part No-37
SS Handle-2 (for DN 150 CF flange)
Material: SS304L
Quantity: 4 Nos.
**PART No-38**

*FIGURE-38*

**Jig-1 (for anode-grid concentricity)**

- Material: SS304
- Quantity: 2 Nos.

**PART No-39**

*FIGURE-34*

**Jig-2 (for anode-grid conc. & spacing)**

- Material: SS304
- Quantity: 2 Nos.
Part No-40
Jig-3 (for cathode-grid conc. & spacing)
Material: SS304
Quantity: 2 Nos.
**FIGURE-36**

**PART No-41**

**Jig-4 (for tightening lock nut)**

Material: SS304

Quantity: 2 Nos.

**PART No-42**

**Jig-5 (for tightening Cathode assembly holder Nut)**

Material: SS304

Quantity: 2 Nos.

**PART No-43**

Special M3 screw

Material: SS304

Quantity: 8 Nos.