

Government of India
Bhabha Atomic Research Centre
Electromagnetic Application and Instrumentation Division

Ref: EmA&ID/EMAS/19/166767

Date: 30.8.2019

Detailed Engineering, fabrication, assembly, testing, supply and safe delivery of 200 mm radius bending magnet dipole yoke conforming to the Technical Specification Number: EmA&ID/TIMSY/19 dated 30.8.19

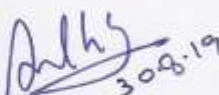
Dear Sir/Madam,

Quotations are invited for "Detailed Engineering, fabrication, assembly, testing, supply and safe delivery of 200 mm radius bending magnet dipole yoke conforming to the Technical Specification Number: EmA&ID/TIMSY/19 dated 30.8.19"

Bidder shall quote for deliverables as per technical specifications.

1. No Free Issue material is involved.
2. Taxes and Excise Duties shall be quoted separately. Form AF/H whichever is applicable shall be provided, if required.
3. **The quotation must reach The Head, EmA&ID by 15.9.2019 (12:00 Noon) and must be sent in a sealed envelope super scribed with the reference number & the due date given above. Courier are not allowed in BARC premises; the quotation shall be sent by speed post/registered post.**
4. The address on the envelope should read: **The Head,**
Electromagnetic Application Section,
Electromagnetic Application and Instrumentation Division,
RCnD Bldg., North Site
BARC, Trombay,
Mumbai - 400 085.
(Kind Attn: Elina Mishra, SO/D)
5. The bidder shall complete the job within 4 weeks from the date of firm work order issued to the bidder. The finished components shall be delivered by the bidder at **RCZ stores, BARC, Trombay, Mumbai-400 085.**
6. Head, EMAS, Electromagnetic Application and Instrumentation Division reserves the rights to accept/reject any or all quotations without assigning any reason.
7. In case of any technical query, please contact Ms. Elina Mishra or Mr. Vikas Teotia (Extn: 23943).
8. Delivery charges if any must be clearly mentioned in the offer. Quotation must also indicate the validity of offer. Quotation must also indicate the VAT no and PAN no of the party.
9. Drawings / Sketches must be returned along with the offer.
10. The quotation has to be signed by authorized person with company seal.
11. Payment will be made by cheque only after satisfactory completion of work on production of bill, delivery challan and advance stamped receipt. It may be noted that IT @ 2% and surcharge on tax at 15% shall be deducted from your bills.

Encl.: Technical Specification Sheet no: - EmA&ID/TIMSY/19


30.8.19
Sanjay Malhotra
Head, EmA&ID

Specification no.	Revision no.	Total pages	Date
EmA&ID/TIMSY/19	0	7	30.8.2019

Detailed Engineering, fabrication, assembly, testing, supply and safe delivery of 200 mm radius bending magnet dipole yoke and support frame confirming to the Technical Specification Number: EmA&ID/TIMSY/19 dated 30.8.19

1.0 Scope

This specification specifies “*Detailed Engineering, fabrication, assembly, testing, supply and safe delivery of 200 mm radius bending magnet dipole yoke confirming to the Technical Specification Number: EmA&ID/TIMSY/19 dated 30.8.19*”.

The job includes fabrication of the soft iron magnetic yoke as per the given drawing. This requires precise fabrication of magnetic yoke and its sub-components and fabrication of magnet assembly frames. Supplier shall also be responsible for testing of the fabricated products including geometrical qualification of the magnet yoke, its sub-components and their assembly. Assembly and safe packaging of the magnets and other components is also in the supplier’s scope.

This document is organized as follows:

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2.0 Statement of purpose

Dipole magnets are used to bend the beam bunch according to the magnetic strength and mass of the charged particle in the beam. To give a certain direction of bending to the beam bunch, the magnet has to have varying magnetic field vector spatially. This is done by a bending dipole magnet. The entry and exit profile of the magnet is crucial as it determines proper entry and exit of the beam. Precise fabrication with strict tolerances is inevitable to achieve the required magnetic rigidity along with the desired homogeneity.

3.0 Details of deliverables and scope of supply

The list of the items to be fabricated, assembled, inspected, packed and safely delivered to the purchaser includes (reference documents and drawings attached):

Item no.	Description	Quantity	Reference No.
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1.	200 mm radius bending magnet dipole yoke	1 set	A3-E00EMCA01
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The scope of the supplier includes:

- Preparation of manufacturing drawings on the basis of engineering drawings provided by the purchaser. Approval shall be taken from the purchaser on the prepared manufacturing drawings before the start of fabrication.
- Manufacturing of yoke as per Para 6.1 of this technical specification.
- Packing of the magnet and shipment as per Para 6.2 of this technical document.
- Inspection of the fabricated components as per Annexures A.

4.0 Vendor Qualification

Suppliers will be qualified based on technical evaluation. As this is a multi-disciplinary work hence supplier must have technically qualified and trained staff for both mechanical and electromagnetics jobs. Supplier must have required infrastructure and past experience of similar jobs. Supplier will be evaluated based on the information provided by the supplier as requested below. Purchaser's specialists may visit the supplier facilities for evaluation and for detailed technical discussions.

SN	Type of job	Outsourcing permissible (Yes/No)
1.	Preparation of manufacturing drawings on the basis of engineering drawings provided by the purchaser.	No
2.	Fabrication of Magnet Yokes. Supplier shall have fabrication facilities to meet the geometric tolerances of the job	No
3.	Geometric inspection using gantry based CMM having better than 5 microns accuracy	No
4.	Nickel plating of yoke	Yes

Purchaser's specialists may visit the supplier facilities for evaluation and for detailed technical discussions. Details to be furnished by the vendor related to facilities and expertise:

Particulars	To be filled by the vendor
Human resource (The supplier must give the complete detail of human resources including Engineers, Consultants (if any), Draftsmen, Technicians, Welder, Assembly Mechanic, quality control inspector, machinist etc.)	
Infrastructure: The supplier must give the detail of infrastructure suitable for this jobs such as 3D Drafting software, Manufacturing machines, welding machines, Assembly room, other tools and tackles, Inspection and Metrology facilities, building head room, overhead crane facility.	

5.0 Details of Free Issue Material to be provided by the purchaser

Free issue material in the form of soft iron plates and nest balls will be provided to the supplier under this work order. The dimensions of the plates are given as follows:

SN	Description of the material	Quantity	Price
1.	Soft iron plate (2 m x 1 m x 100 mm)	1 No.	7,87,000
2.	Nest Balls	5 No	6,500

Insurance for the issue material has to be drawn by the supplier in compliance with DPS norms and regulations. The FIM is accountable, however no scrap is returned.

6.0 Technical description of the job

This technical specification document includes fabrication, assembly, qualification and testing and supply of the bending magnetic yokes. The end use of these components demands fabrication within the tolerances and assembly of components which are covered in this document.

The electromagnetic bending dipole magnets deflect the charged particle beam along the radius of the magnet. They are used in particle accelerators and spectrometers for bending the magnet along the required orbit. The dimensions of the yoke, flatness and perpendicularity, maintaining the air gap aperture is critical for the functionality of these magnets and are optimized to perform within the specified limits and at the same time achieving the desired field and uniformity. The magnet yoke precision fabrication shall be achieved using EDM wire cut only.

The complete dipole magnet is made of soft iron plates which are provided as FIM. The required profile of the magnet yoke has to be cut out of the soft iron plates as per the drawings provided. The different plates of the magnet yoke are assembled and fitted using required bolts and dowel pins. Fit bolts and dowel pins shall ensure zero yoke to yoke distance where the plates meet. Strict flatness, parallelity and perpendicularity of different surfaces of the yoke are required to ensure repeatability of assembly of the magnet.

6.1 Magnet Yoke:

- The yoke consists of multiple soft iron plates that are fitted together to form a complete magnetic yoke.
- The soft iron profile pieces as per the drawings are to be cut out from the soft iron plates provided by BARC as free issue material.
- The soft iron yoke plates are to be stacked one over the other as shown in the drawing and have to be fitted by bolts and dowel pins for ensuring that there is no air gap within the plates. The position of the dowel pins has to be engineered and decided by the supplier, however approval of the purchaser for the same must be taken.
- Most important concern in the magnet is the air gap. The air gap between the magnet poles has to be maintained as 14 mm within a tolerance of ± 50 microns. This is also one of the major acceptance criteria.
- All the plates surface should have geometrical tolerance of flatness within 50 microns.
- Offset between the plates while assembly in radial direction should be within 100 microns.
- Offset between the plates while assembly in azimuthal direction should be within 0.1° .

- For alignment and fiducialisation purposes, groves for welding nest balls are to be provided at appropriate places as shown in the drawing.
- For lifting the complete structure after assembly, eye bolt tapings must be provided at appropriate places as shown in the drawing.
- All the other dimensions, fitments, tolerances and other relevant details are provided in the drawing.
- Adjustable legs must be provided in at the bottom of the yoke assembly to adjust the height of the magnet.

6.2 Assembly of the magnet yokes, packing and shipment:

- The magnet yoke plates shall be properly assembled, fitted by dowel pins and bolts to stack it together and form a single rigid structure.
- Reference surfaces for fiducial mounting will be used for installation and magnetic measurements.
- The complete magnet has to be properly packed and shipped to the purchaser with all the geometric qualification test certificates and reports.

7.0 Acceptance criteria

Following are the acceptance criteria of the components and coils and other relevant parameters:

S.N.	Particulars	Acceptance criteria
1.	Visual	Any signs of damage, deterioration and oxidation shall not be present on any component.
2.	Geometric and dimensional accuracy of sub components and the final assembly	<p>Following are applicable to each and every component.</p> <ol style="list-style-type: none"> 1. Geometric tolerances of each and every component shall be strictly as per drawings. Geometric inspections shall be done after each step and inspection reports (Annexure A) for all shall be prepared and submitted. The inspection report shall be based on scanned object on CMM and the deviation shall be compared and reported. The deviation must not be greater than 50 microns (and specified tolerances at different critical dimensions as per the drawings). <p>Following acceptability criteria are applicable to the assembled magnet</p> <ol style="list-style-type: none"> 1. The air gap aperture shall be determined by measuring the inner distance between the poles of the magnet. This shall not vary more than ± 50 microns of the true value. 2. Height and width of the magnet shall be within ± 50 microns of the true value. 3. Flatness, parallelity and perpendicularity of different surfaces should be strictly within the specified tolerances. 4. Repeatability of the assembly with values with in ± 50 microns. These measurements shall be done five times on each magnet.

8.0 Price and delivery schedule

The supplier shall give overall price and its break-up for all the deliverables mentioned. The overall price will be compared. The supplier shall offer prices in following format.

Item no.	Description	Quantity	Price per unit	Total price
1.	Bending dipole magnet yoke	1 set		

The cost incurred in preparation of jigs if any shall be included in the price as mentioned above. The work activity plan shall be as per our requirement. However, supplier shall give their activity schedule as per their resources.

Following program is required for the timescales of fabrication and delivery:

- | | | |
|--|---|--------|
| a. Awarding the purchase order | : | Week 0 |
| b. Preparation of approach paper by the supplier and sketch design | : | Week 1 |
| c. Preparation of detailed engineering design including 2D and 3D drawings | : | Week 2 |
| d. Production of insurance and supply of FIM to the supplier | : | Week 3 |
| e. Manufacturing of Magnet yoke | : | Week 6 |
| f. Qualification of Magnets and Functional acceptance test | : | Week 7 |
| g. Delivery | : | Week 8 |

The supplier can give their own schedule keeping in mind their timescales. Final schedule shall be given to the supplier along with the purchase order.

9 List of concept drawings attached

SN	Drawing title	Drawing Number
1.	Bending magnet yoke	A3-E00EMCA01

10 List of Appendix

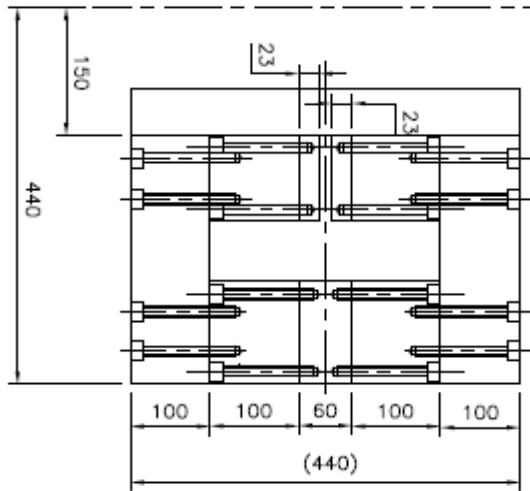
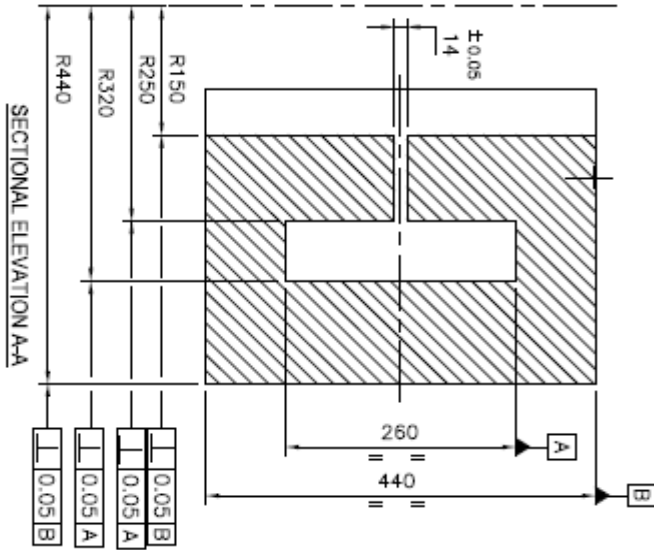
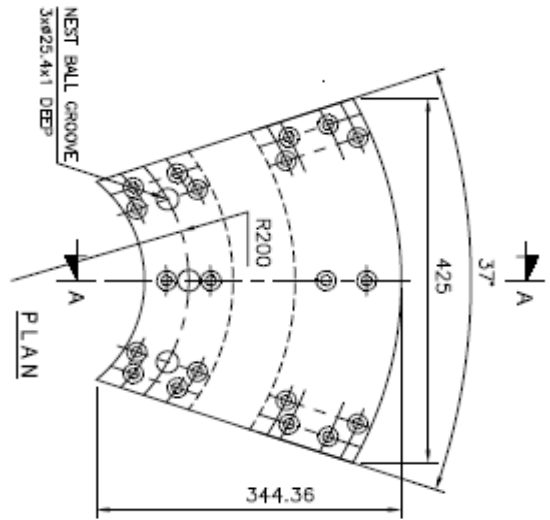
SN	Appendix Name	Particular	Page No
1.	Appendix A	Geometrical Qualifications	7

11 General conditions

- All intellectual property rights belong to purchaser for work done under this technical specification/PO.
- Supplier shall maintain the authenticity of drawings or any related drawings/document provided by the purchaser.
- All activities would normally be carried with due professional care. However, purchaser shall not be responsible for any loss or personnel accident during execution of the work pertaining to the technical specifications under this PO.
- Supplier agree to hold in confidence all information provided by the purchaser.
- Supplier shall collaborate and coordinate all the work sub-contracted to any vendor.
- Publication if any pertaining to work of related to work under this purchase order can be done only after prior mutual consent of purchaser.
- All the raw materials required for deliverables except the Free Issue Material mentioned is in scope of supplier and the supplier should quote accordingly.
- Overall cost of all the items in the deliverables will be compared which will also include packaging, forwarding and safe delivery costs to BARC RCZ stores.
- Suppliers shall give complete details of their product & list of users for technical evaluation.
- Supplier shall submit along with the quotation, compliance certificate adhering to the specifications.

ANNEXURE A
(GEOMETRICAL QUALIFICATIONS)

- The geometric dimensions of the components shall be strictly as per the fabrication drawings generated.
- Geometric tolerances of each and every component should be strictly adhered to.
- Geometric inspections shall be done after each step by scanning the object on CMM. The inspection report shall be based on scanned object on CMM and the deviation shall be compared and reported. The deviation must not be greater than 20 microns.
- This shall be repeated for all the fabricated components.



- ALL PLATES SURFACE SHOULD HAVE GEOMETRICAL TOL. OF FLATNESS 0.05 UNO.
- OFFSET BETWEEN THE PLATES WHILE ASSEMBLY IN RADIAL DIRECTION SHOULD BE WITHIN 0.1
- OFFSET BETWEEN THE PLATES WHILE ASSEMBLY IN AZIMUTHAL DIRECTION SHOULD BE WITHIN 0.1*

NOTES:-

- 1) ALL LINEAR DIMENSIONAL TOLERANCES AS PER IS:2102 (MED)
- 2) UNLESS OTHERWISE STATED:-
 - a) MACHINE ALL OVER.
 - b) SURFACE FINISH TO BE $\sqrt{1.6}$ OR BETTER.
 - c) DO NOT SCALE THE DRAWING.

BENDING MAGNET YOKE		Appr'D.	SCALE
			1:1
ALL DIMENSIONS ARE IN mm		DRG. No.	DATE
DRN	RAC	PROJECT	
DRG. CHKT'D.	30/08/19		
DES'N. CHKT'D.			
GOVERNMENT OF INDIA BHABHA ATOMIC RESEARCH CENTRE ELECTROMAGNETIC APPLICATIONS & INSTRUMENTATION DIVISION		DRG. No.	DATE
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