

**Government of India
Bhabha Atomic Research Centre
Accelerator Control Division**

Ref: ACnD/EMAS/18/755

Date: 19.11.2018

Detailed Engineering, fabrication, assembly, testing, supply and safe delivery of C type magnet yoke with coil assemblies and support frames for steering magnets confirming to the Technical Specification Number: ACnD/CDC/18 dated 11.10.2018


Dear Sir/Madam,

Quotations are invited for "Detailed Engineering, fabrication, assembly, testing, supply and safe delivery of C type magnet yoke with coil assemblies and support frames for steering magnets confirming to the Technical Specification Number: ACnD/CDC/18 dated 11.10.2018"

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, EMAS, ACnD by 6.12.2018 (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,
Accelerator Control 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, Accelerator Control Division reserves the rights to accept/reject any or all quotations without assigning any reason.
7. 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.
8. Drawings / Sketches must be returned along with the offer.
9. The quotation has to be signed by authorized person with company seal.
10. 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: - ACnD/CDC/18


19.11.18
Sanjay Malhotra,
Head, EMAS, ACnD

Specification no.	Revision no.	Total pages	Date
ACnD/HBDC/18	0	11	11.10.2018

Detailed Engineering, fabrication, assembly, testing, supply and safe delivery of C type magnet yoke with coil assemblies and support frame for steering magnets confirming to the Technical Specification Number: ACnD/CDC/18 dated 11.10.2018

1.0 Scope

This specification specifies “*Detailed Engineering, fabrication, assembly, testing, supply and safe delivery of C type magnet yoke with coil assemblies and support frame for steering magnets confirming to the Technical Specification Number: ACnD/CDC/18 dated 11.10.2018*” for proton beam orbit correction and optics measurement.

The electromagnetic dipole correctors (DCs) are integral part of the high energy beam line of high intensity proton accelerators. The primary function of the various kinds of magnets in these lines is to keep the emittance growth of the output beam as low as possible by focusing the proton beam and ensuring proper orbit correction and transverse beam position control. DCs are placed in conjunction with focusing elements and take the feedback signal from beam position monitors for beam orbit correction.

The job includes fabrication of the soft iron magnetic frames, shunt plates, electromagnetic coil windings along with their bobbins, aluminium support frames. This requires precise fabrication of magnetic yoke and its sub-components and fabrication of magnet assembly frames. Precise winding of the coil assemblies is also required so as to ensure the specified MMF requirements. Supplier shall also be responsible for testing of the fabricated products including geometrical qualification of the magnet yoke, coil winding and 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:

S.No.	Particulars	Page
1.	Para 2.0 gives statement of purpose	1
2.	Para 3.0 gives details of delivery and scope of the supplier	2
3.	Para 4.0 gives vendor qualification	2
4.	Para 5.0 gives details of free issue material to be provided by the purchaser	3
5.	Para 6.0 gives technical specifications of the job	3
6.	Para 7.0 gives acceptance criteria	7
7.	Para 8.0 gives price and delivery schedule	8
8.	Para 9.0 gives list of concept drawings attached	9
9.	Para 10.0 gives list of appendix	9
10.	Para 11.0 gives detail of general conditions	8

2.0 Statement of purpose

The Beam Transport line of high intensity proton accelerators is required to match the optical functions between the SRF cavities/DTL cavities. The primary function of the lines is to keep the emittance growth of the output beam as low as possible. The transverse focusing of the beam is achieved by strong focusing quadrupoles. The Dipole correctors or steering magnets serve the function of a control element to achieve the desired transverse beam position and beam orbit

correction. To minimize the emittance growth high magnetic field rigidity is required in a highly constrained longitudinal space for these corrector magnets. Magnet construction and installation errors lead to differences between the actual beam orbit and intended beam orbit of the machine known as design orbit and reference orbit. Orbit correction is a fundamental requirement in the alignment and tuning process of an accelerator. This document specifies all the technological specifications and requirements for manufacturing such items along with their frames, assembly procedures, electromagnetic coil winding specifications, their qualifications and testing.

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.
1.	Electromagnetic Dipole Corrector magnet yoke with shunt plates packed in wooden boxes	4 sets.	
2.	Electromagnetic coil winding with bobbin packed in wooden boxes	4 sets.	
3.	Assembly and support platforms	4 no.	
4.	Test/ Inspection certificates	4 sets.	

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.
- Purchase of raw material as per technical specification and produce test certificates for approval from purchaser before procuring.
- Manufacturing of yokes, shunt plates, electromagnetic coil with bobbin, frames as per Para 6.1 of this technical specification.
- Assembly of magnet and frames as per Para 6.2 of this technical document.
- Inspection of the fabricated components as per Annexures.
- Packing of the mag net assemblies as per Para 6.3 in wooden suitcases and shipment of the same.

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 and support frames. 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
5.	Coil fabrication including bobbin fabrication, winding, varnish and epoxy hand lapping	Yes
6.	Coil Electrical and thermal tests	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, electrical and magnetic testing equipment, 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

No free issue material will be provided to the supplier under this work order. The supplier has to procure all the raw materials involved according to the technical specifications. The test reports of the raw material have to be provided to the purchaser for their final approval before procuring.

6.0 Technical description of the job

This technical specification document includes fabrication, assembly, qualification and testing and supply of C type magnetic yokes, shunt plates, electromagnetic coil winding assembly along with bobbin for Dipole Correctors and their support platforms. The end use of these components demands fabrication within the tolerances and assembly of components which are covered in this document.

The electromagnetic Dipole Correctors are C type steering magnets that can deflect the charged particle beam in horizontal and vertical directions. They are used in particle accelerators for correcting the beam orbit where misalignment may arise due to magnet construction and installation errors. They are also used to maintain the transverse beam position in the beam line and for optics measurements also. The dimensions of the yoke, flatness and perpendicularity, air gap aperture and EM coil winding precision, no of turns, etc. are critical for the functionality of these magnets and

are optimized to perform within the specified limits and at the same time achieving the desired integral field strength. The magnet yoke and bobbins shall be fabricated using EDM wire cut only.

Each C magnet is made in 2 unsymmetrical parts. The two parts are assembled together using fit bolts and hex nuts connectors during assembly. Fit bolts shall ensure zero yoke to yoke distance. Strict flatness, parallelity and perpendicularity of different surfaces of the yoke are required to ensure repeatability of assembly of the magnet.

The electromagnetic coil shall be placed on the common leg of 1 half of the yoke. Then the other half of the yoke will be placed on the assembly and bolted. The EM coils are wound using double annealed copper wires having H-modified enameling wound on molded bobbins. The bobbins along with the coil assemblies (details in para 5.0) will be provided as a free issue material for complete assembly of the dipole corrector to be carried out by the supplier.

Two shunt iron plates per magnet assembly is to be fabricated. These plates are of the same cross section and thickness as the magnetic yoke but with 5 mm thickness. The shunt iron plates are to be bolted to the magnetic yoke using support studs.

The magnet support platforms are made out of Aluminum A96069 T6. The tolerances of fabrication of these assembly frames are given in the drawing. The assembly of these magnets in beam lattice needs accurate knowledge of its magnetic center and deviation of magnetic center from geometric center. This reference is taken with help for laser targets fixed on nest ball targets. These nest ball targets are off the shelf components which shall be tag welded on the magnet yoke. A 0.5 mm deep groove shall locate these targets. The nest ball targets are magnetic and consist of a strong magnet for holding the laser target. During welding these magnets shall be removed. The material of construction of the nest ball targets is SS-304. The nest ball targets will be tag welded to the magnet yoke.

6.1 Magnet Yoke and shunt plates:

The yoke is basically an assembly of two low carbon magnetic soft steel structures which combine to form a C shape. The magnetic yoke sits on an aluminium frame on which reference surfaces will be provided for fiducialization and alignment. Two shunt iron plates are placed on either sides of the magnetic yoke whose drawing is provided. The raw material for the magnet yoke is low carbon soft magnetic steel. The specification of the low carbon soft magnetic steel is as given below:

- **Raw material for magnetic yoke:**

- i) Chemical composition**

The percentage of iron in the plates shall be more than 99.5 %.

The maximum permissible values for other elements are as given below:

% weight Composition	C	Mn	P	S	N	Cu
Max Permissible	0.01	0.12	0.01	0.008	0.006	0.03

- ii) Physical Properties**

S.No.	Parameter	Value
a.	Grain Size (ASTM E 112-12)	Grain size number (G) < 6.0
b.	Microstructure	Ferritic
c.	Specific Gravity (nominal)	7.85 g/cm ³
d.	Ultimate Tensile Strength (nominal)	≥240 MPa
e.	Yield Strength (nominal)	≥120 MPa

iii) Magnetic Properties

Sl. No.	Parameter	Value
1	Saturation Induction B_{sat}	> 2.15 Tesla
2	Magnetic field Intensity required for 1 T	< 500 A/m
3	Magnetic field Intensity required for 1.5 T	< 1200 A/m
4	Magnetic field Intensity required for 2.0 T	< 20000 A/m
5	μ_r (max)	> 3200
6	Coercive Force	< 100 A/m

The geometrical dimensions and the fabrication of the two halves of C type cores should be strictly as per the given drawings within the specified tolerances.

- Recommended machining and processing methodologies for soft magnetic steel shall be followed. The processes involve wire cutting, turning/milling, drilling.
- Any burrs, chips and dust shall then be properly cleaned and both the yoke parts will be nickel coated for rust protection.
- Proper fitting and assembling of both the yokes should be done using bolts. Flatness of the two fitting surfaces should be properly maintained to ensure minimum air gap between both the surfaces for continuity of magnetic field lines.
- Slots for nest ball targets are to be machined in the horizontal and vertical yokes as per the drawings.

6.2 Electromagnetic coils and bobbins:

- The leg of the C type magnetic yoke is equipped with an electromagnetic coil with bobbin assembly. The size of the copper coils to be used and no of turns per coil winding is given in the table below.

Winding No.	Total Dimension	Wire Gauge	No of turns
1	150 mm X 120 mm X 150 mm	3.5 mm X 3 mm	400

- The current passing through these coils generate a MMF which in turn generates magnetic field needed for beam steering. The MMF depends on the no. of turns of the coil and thus the total no. of turns should be exactly what is specified for the required MMF to be achieved.
- Each coil winding set must be identical and the properties should be such that they can be used interchangeably.
- The coils are made of rectangular cross section (3.5 mm x 3 mm) annealed copper conductor and vacuum impregnated with vacuum compatible varnish. The finished coils shall behave in all respects as rigid units so that relative movements between turns due to the action of magnetic forces and thermal strains inside the windings are excluded.
- The insulation to be used in the coil windings is H-modified class of insulation which has a temperature range of 180°C. The insulation is to be transparent.
- The coil shall be wound on G11 bobbin of 3 mm thickness good thermal, mechanical and electrical properties. It should be tough and withstand repeated impact in addition to possessing highly resistance to abrasion and to most chemicals. These shall retain their shape at elevated temperatures, should be strong in thin sections and have low coefficients of friction. The technical specifications of the bobbin are listed in the table below:

i) Mechanical Properties

Sl. No.	Parameter	Value
1.	Material of molding	G11
2.	Thickness of bobbin	3 mm
3.	Specific gravity	1.8
4.	Marten's Heat Distortion Temperature	> 240 deg C
5.	Tensile Strength	> 200 N/m ²
6.	Shear Strength	> 100 N/mm ²
7.	Impact Strength	> 75 kJ/m ²

ii) Electrical Properties:

Sl. No.	Parameter	Value
1.	Insulation resistance	> 104 MΩ
2.	Dissipation factor at 50 Hz	< 0.02
3.	Comparative Tracking Index	> 300

- The coil ends of each leg shall be connected to electrically insulated flexible copper connecting wires through terminal blocks. These blocks should be direct mounting type on the yoke of the DC. These wires from the terminal blocks should be brought out for connecting with the power supply.
- The technical specifications of the coil windings of the frame is listed below:

Sr. No	Parameter	Value	Unit
1.	Nominal current	10	A
2.	Maximum current	12	A
3.	Maximum stabilized voltage	3	V
4.	Resistance	0.264 ± 0.0132	Ω
5.	Conductor size	3.5 mm x 3 mm	
6.	Number of turns	400	Turns
7.	Number of layers per winding	10	Layers
8.	Number of turns per layer	40	Turns
9.	Nominal current density	1.33	A/mm ²
10.	Maximum current density	1.5	A/mm ²
11.	Maximum power dissipation	30	watts
12.	Temperature rise	24.1	°C
13.	Weight of each coil	16	kgs (approx.)
14.	Weight of yoke	25	kgs

- Bobbin thickness of 3 mm maybe kept for insulating the coils from the magnetic yoke.
- The environment in which insulation and winding operations are to be done should be completely free of dust, metallic particles and other contaminants.
- The coil winding should be done using a single continuous length of cable without any joints or overlaps.
- Appropriate mandrel must be used on which winding should be done and the conductor should be kept under proper mechanical conditions.
- To fill in all the pores in the coil winding, it shall be vacuum impregnated with H class varnish.
- A layer of thermally conductive epoxy shall be applied for protection.
- No epoxy shall be applied on leads.

6.2 Support platforms:

The support frames on which the dipole corrector with the coil windings will be rested shall be made of Aluminum A96069 T6. The magnet frame assembly, dimensions and tolerances are given in the drawing attached. The flatness, parallelity and perpendicularity should be ensured to prevent the tilt of magnetic field with respect to the ground datum. Slots and steps have been provided at appropriate places to guide DC in its fixed position for ensuring repeatability. Clamps made of aluminium will be used to fix the DC to the frame tightly and prevent any slippage.

6.3 Assembly of the magnet yokes, coil windings, packing and shipment:

- The magnets shall be properly rested and fixed on the support frames. Reference surfaces for fiducial mounting will be used for installation and magnetic measurements.
- The coil assemblies shall be properly packed inside wooden boxes with proper lining and covering.
- Then they will be shipped to the purchaser with all the geometric, thermal and electrical qualification test certificates.
- The magnets will be assembled individually and properly packed in wooden boxes with proper foam lining and covering.
- Then they will be shipped to the purchaser with all the geometric, thermal, magnetic and electrical qualification test certificates.

7 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. Loose terminal connection or wiring shall not be present.
2.	Geometric and dimensional accuracy of sub components and the final assembly	Following are applicable to each and every component. <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). Following are applicable to assembled magnet<ol style="list-style-type: none">1. The air gap aperture shall be determined by measuring the inner distance between the opposite legs of the assembled magnet. This shall not vary more than ± 20 microns of the true value.2. Height and width of the magnet shall be within ± 20 microns of the true value.3. Flatness, parallelity and perpendicularity of different surfaces should be within the specified tolerances.

		4. Repeatability of the assembly with values with in ± 20 microns. These measurements shall be done five times on each magnet.
3.	Qualification of electromagnetic coils	1. Hi-pot Test between coil terminals and magnet yoke: Leakage current less than 5 micro Ampere at 1000 V DC. 2. Ring test: Compared with reference coil. (G_o , No G_o test) 3. Resistance: $0.264 \pm 0.0132 \Omega$ 4. Turns: 400 (No deviation permitted)
4.	Magnetic qualifications	Supplier shall assemble the coil assembly with the magnetic yoke to give the complete shape to the dipole corrector. The coil windings end with connecting leads. These leads are to be brought to the terminal blocks that are to be fixed in the magnet yoke at appropriate places. Magnetic qualifications are then to be carried out on the dipole correctors. The supplier is not responsible for the integral field strength, uniformity, etc of the magnet. These responsibilities lie with the purchaser. However, the manpower (electrical/electronics engineer and other required supporting staff) and logistics to be provided by the supplier.
5.	Thermal qualification	1. After 12 hours of continuous operation, voltage across coils for fixed DC current shall be noted. (For each coil) 2. Combined thermal heat run test with voltage tapping on individual magnet. (Applicable to magnet assembled in frames).

8 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.	Electromagnetic Dipole Corrector Magnet Yoke Assembly	4 sets		
2.	Electromagnetic coil assembly with bobbin	4 sets		
3.	Magnet assembly support platform	4 sets		

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 3 |
| d. Procurement of raw material by supplier | : | Week 6 |
| e. Manufacturing of Magnet, coils and frame | : | Week14 |
| f. Qualification of Magnets | : | Week21 |
| g. Functional acceptance test | : | Week23 |
| h. Delivery | : | Week24 |

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.	General Assembly of Dipole Corrector	A3-A02EMCA84
2.	Magnetic yoke	A3-A02EMCA85
3.	Magnetic shunt plate	A3-A02EMCA86
4.	Electromagnetic coil winding and bobbin	A3-A02EMCA87
5.	Support Frame	A3-A02EMCA88

10 List of Appendix

SN	Appendix Name	Particular	Page No
1.	Appendix A	Geometrical Qualifications	10
2.	Appendix B	Thermal and Electrical Qualifications	11

11 General conditions

- a. All intellectual property rights belong to purchaser for work done under this technical specification/PO.
- b. Supplier shall maintain the authenticity of drawings or any related drawings/document provided by the purchaser.
- c. 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.
- d. Supplier agree to hold in confidence all information provided by the purchaser.
- e. Supplier shall collaborate and coordinate all the work sub-contracted to any vendor.
- f. Publication if any pertaining to work of related to work under this purchase order can be done only after prior mutual consent of purchaser.
- g. All the raw materials required for deliverables except the Free Issue Material mentioned is in scope of supplier and the supplier should quote accordingly.
- h. 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.
- i. Suppliers shall give complete details of their product & list of users for technical evaluation.
- j. 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.

ANNEXURE B

(QUALIFICATIONS TESTS ON COIL ASSEMBLIES)

- The following electrical qualification tests need to be carried out with the coil assembly before assembly.

1. Winding Material Specifications

Sr. No	Parameter	Value
a)	Wire Gauge	
b)	Grade of conductor	
c)	ISO standard for winding material	
d)	Class of insulation	
e)	Thermal class	
f)	Chemical Base of insulation: (Modified polyester/Polyamide)	

2. Coil Specifications

Sr. No	Parameter	Value
a)	Total no of turns	
b)	Total no of windings	
c)	No of turns per layer	

3. Electrical Parameters

Coil No.	Dimensional Check					Remarks
	Resistance	Inductance @ 100 Hz	Q @ 100 Hz	Inductance @ 1 kHz	Q @ 1 kHz	Pass/fail

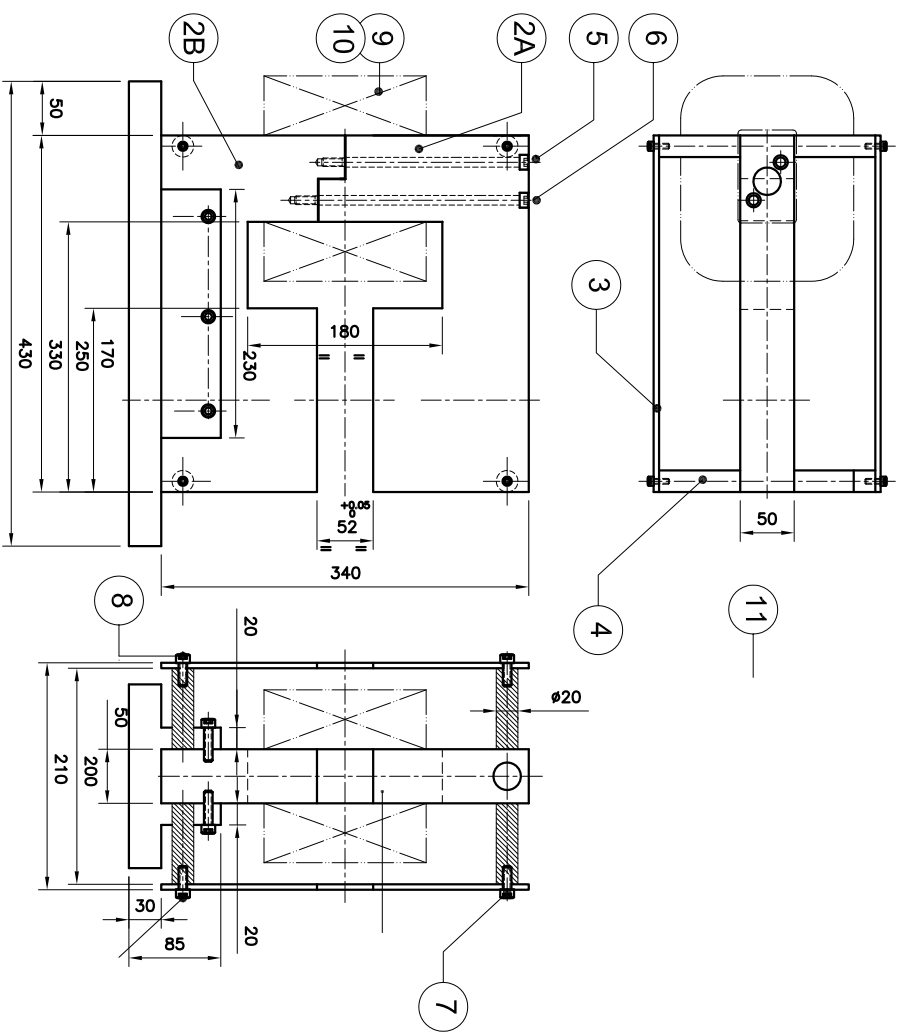
4. Ring Test

Coil No.	Pass/Fail

5. Hipot Test

Coil No.	Leakage Current Between Coil and Dummy Core

A maximum leakage current of 5 μ A is allowed at a coil to core voltage of 1000 V DC.



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) REMOVE ALL EXTERNAL SHARP CORNERS AND EDGES BY CHAMF. TO $0.5 \times 45^\circ$
- 3) GEOMETRICAL TOL. OF SURFACE FLATNESS 0.05 UNO.
- 4) DO NOT SCALE THE DRAWING.

REV. / ZONE	CHANGE MADE	DATE	INITIAL

CLASS OF DEVIATION	RANGE OF NOMINAL DIMENSIONS	3	6	30	120	315	120
ABOVE INCLUDING	0.5	3	6	30	120	315	120
BELOW INCLUDING	0.02	0.05	0.1	0.15	0.2		

BILL OF MATERIAL

SR.NO.	DESCRIPTION	QTY.	MATERIAL	REF. DRG. NO.
01	BASE FRAME	01	T-6061	A3-A02EMCA88
2A	YOKE TOP	01	AISI 1010	A3-A02EMCA85
2B	YOKE BOTTOM	01	AISI 1010	A3-A02EMCA85
3	MAGNETIC SHIELD PLATE 5THKx340x330	02	AISI 1010	A3-A02EMCA86
04	SUPPORT SPACER	02	ALUMINIUM	A3-A02EMCA84
05	HEX. HD. SCREW M10X190 LG	01	IS:1364 Gr. 304	
06	HEX. HD. SCREW M10X215 LG	01	IS:1364 Gr. 304	
07	HEX.SKT.HD.CAP SCREW M8X15 LG	08	IS:2269 CL-10.9	
08	HEX.SKT.HD.CAP SCREW M8X35 LG	06	IS:2269 CL-10.9	
09	BOBBIN	01	G11	A3-A02EMCA87
10	COIL	01	OHFC COPPER	A3-A02EMCA87

G.A. OF C - DIPOLE CORRECTOR

DR/N	RBC	PROJECT	APP'D.
	02.07.2018		
DRG. CHK'D			
DEST'D			
DES'N			

REV.	DATE	

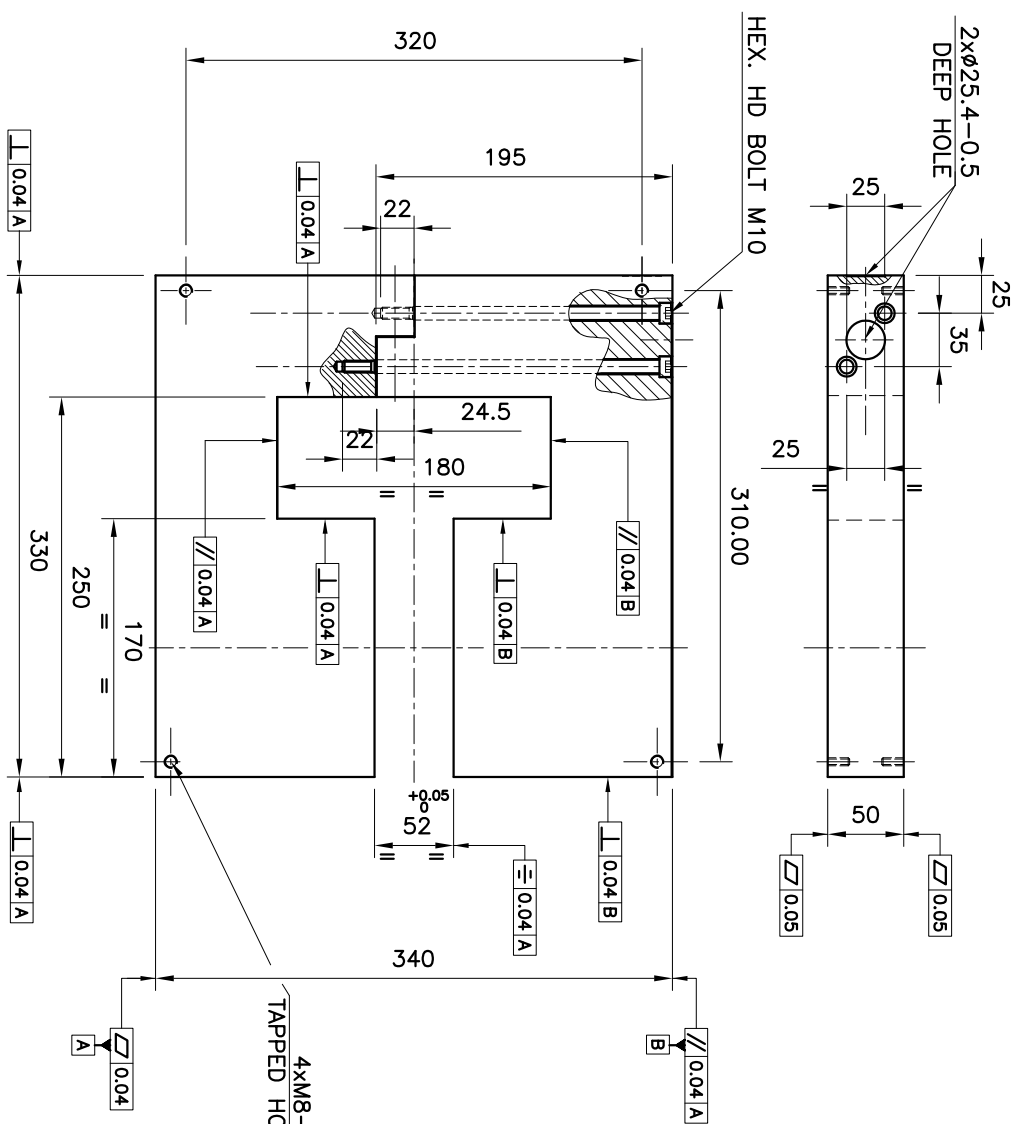
DRG. No.	DATE	
A3-A02EMCA84	11.10.2018	

SH	1 OF 1	DATE

FOR TENDER PURPOSE ONLY

SCALE
1:1

ALL DIMENSIONS ARE IN mm



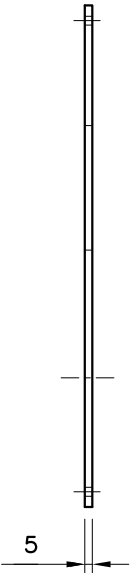
NOTES:-

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- 2) UNLESS OTHERWISE STATED:-
 - a) MACHINE ALL OVER.
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 - 3) GEOMETRICAL TOL. OF SURFACE FLATNESS 0.05 UNO.
 - 4) DO NOT SCALE THE DRAWING.

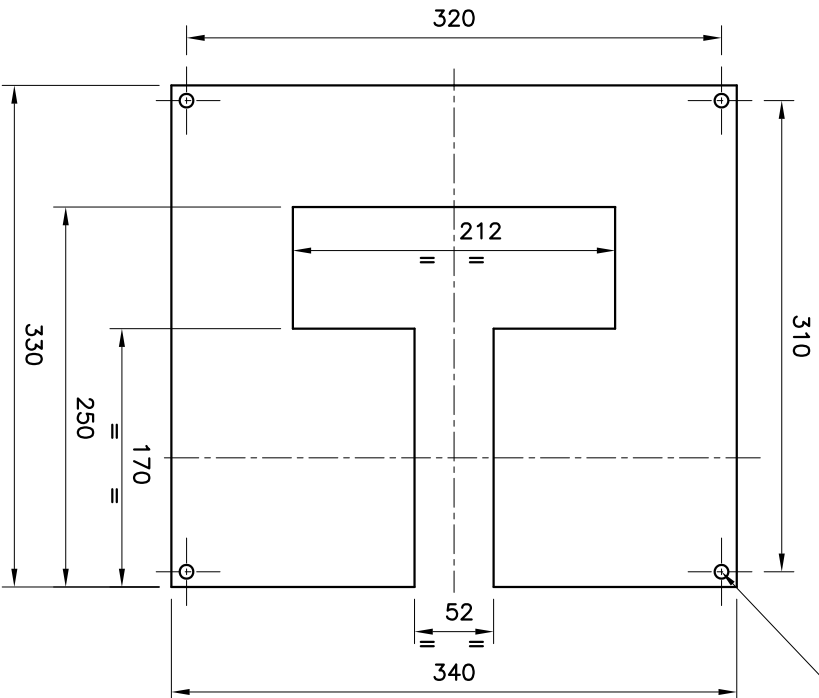
REV / ZONE	CHANGE MADE	DATE	INITIAL

CLASS OF DEVIATION INCLUDING	RANGE OF NOMINAL DIMENSIONS					
	0.5	3	6	30	120	315
FINE	±0.02	±0.05	±0.1	±0.15	±0.2	

TITLE:-		DETAILS OF C - MAGNETIC YOKE	
DRN	RBC	PROJECT	FOR TENDER PURPOSE ONLY
	11.10.2018		
DRG. CHK'D			
DEST'D			
DES'N			
AP'P'D.		MATERIAL: AISI 1010 QTY: 1+1 NOS/ASSY	
ALL DIMENSIONS ARE IN mm		SCALE 1:1	
REV.	DATE		
	11.10.2018		
DRG. No.			
A3-ADZEMCAR85			
SH 1 OF 1	DATE		



4xØ9 THRU
HOLE AS SHOWN



DETAILS OF MAGNETIC SHIELD

MATL : AISI 1010
QTY. : 2 NOS/ASSY

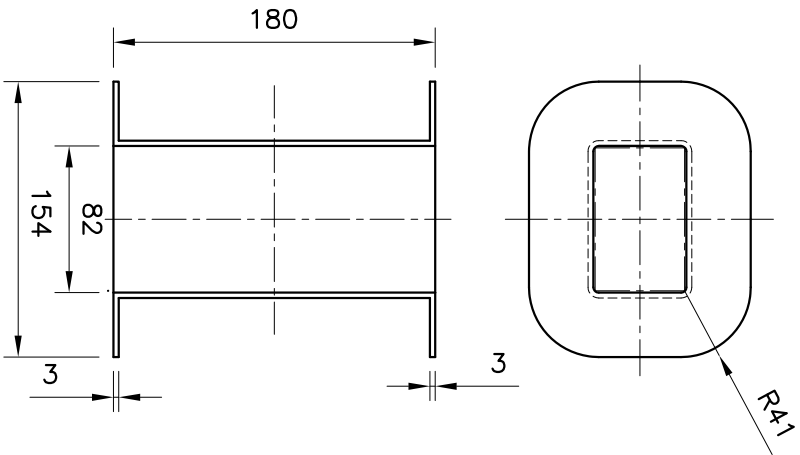
NOTES:-

- 1) ALL LINEAR DIMENSIONAL TOLERANCES AS PER IS:2102 (MED)
- 2) UNLESS OTHERWISE STATED:-
 - a) MACHINE ALL OVER.
 - b) SURFACE FINISH TO BE $1.6 \sqrt{\text{OR BETTER}}$.
 - c) REMOVE ALL EXTERNAL SHARP CORNERS AND EDGES BY CHAMF. TO $0.5 \times 45^\circ$
- 3) GEOMETRICAL TOL. OF SURFACE FLATNESS 0.05 UNO.
- 4) DO NOT SCALE THE DRAWING.

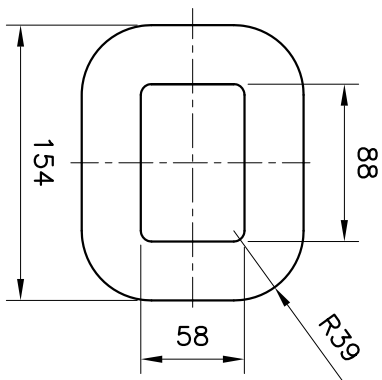
REV	ZONE	CHANGE MADE	DATE	INITIAL

CLASS OF DEVIATION	RANGE OF NOMINAL DIMENSIONS	±0.02	±0.05	±0.1	±0.15	±0.2
ABOVE	0.5	3	6	30	120	315
INCLUDING	3	6	30	120	315	

TITLE:-		DRN		RQC		PROJECT		APP'D.	
DETAILS OF MAGNETIC SHIELD		11.10.2018		11.10.2018		FOR TENDER PURPOSE ONLY		SCALE	
		DRG. CHK'D						ALL DIMENSIONS ARE IN mm	
		DES'N						REV.	
								DATE 11.10.2018	
								DRG. No.	
								A3-A02EMCA86	
								SH 1 OF 1	
								DATE	

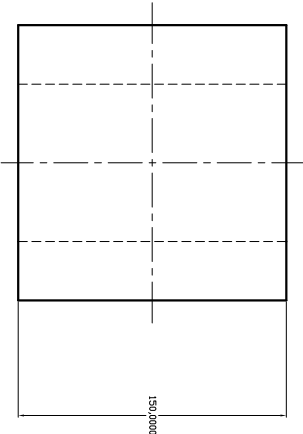


DETAILS OF BOBBIN
 MATL : G11
 QTY : 1 NOS/ASSY



DETAILS OF COIL

MATERIAL : ETP COPPER
 NO. OF LAYER/WINDING : 10
 NO. OF TURNS/LAYER : 40
 CONDUCTOR SIZE : 35x3 MM



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) REMOVE ALL EXTERNAL SHARP CORNERS AND EDGES BY CHAMF. TO $0.5 \times 45^\circ$
- 3) GEOMETRICAL TOL. OF SURFACE FLATNESS 0.05 UNO.
- 4) DO NOT SCALE THE DRAWING.

TITLE:-

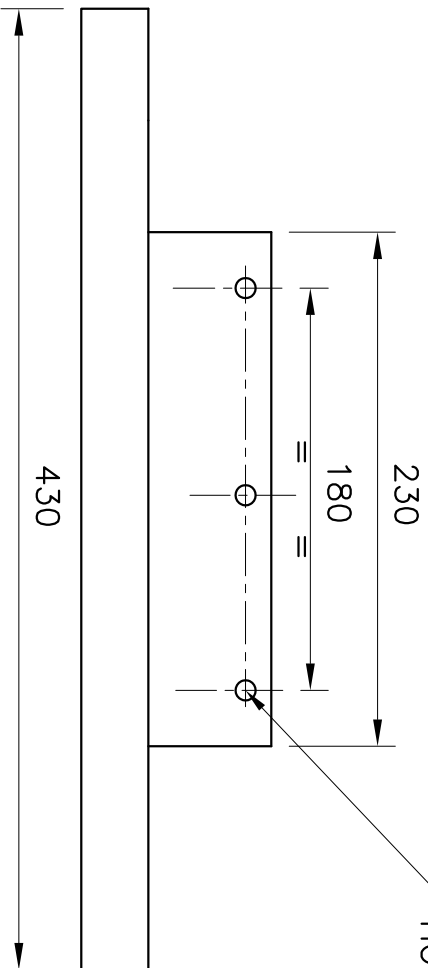
DETAILS OF BOBBIN & COIL

FOR TENDER PURPOSE ONLY

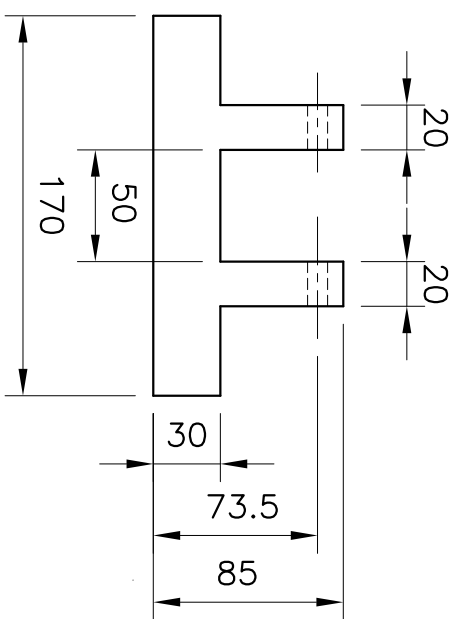
REV/ZONE	CHANGE MADE	DATE	INITIAL

CLASS OF DEVIATION	RANGE OF NOMINAL DIMENSIONS	±0.02	±0.05	±0.1	±0.15	±0.2

DR/N	RBC	PROJECT	APP'D.
11.10.2018	11.10.2018	FOR TENDER PURPOSE ONLY	SCALE 1:1
DRG. CHK'D	DRG. No.	ALL DIMENSIONS ARE IN mm	DATE 11.10.2018
DES'N	A3-A02EMCA87	SH 1 OF 1	DATE



6xØ9 THR'U
HOLE AS SHOWN



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) REMOVE ALL EXTERNAL SHARP CORNERS AND EDGES BY CHAMF. TO $0.5 \times 45^\circ$
- 3) GEOMETRICAL TOL. OF SURFACE FLATNESS 0.05 UNO.
- 4) DO NOT SCALE THE DRAWING.

REV / ZONE	CHANGE MADE	DATE	INITIAL

CLASS OF DEVIATION	RANGE OF NOMINAL DIMENSIONS	±0.02	±0.05	±0.1	±0.15	±0.2
ABOVE INCLUDING	3	6	30	120	315	120
BELOW INCLUDING	0.5	3	6	30	120	315

TITLE:-		PROJECT	
DETAILS OF FRAME		FOR TENDER PURPOSE ONLY	
DR'N	REC	DR'N	REC
DRG. CHK'D		DRG. CHK'D	
DES'N		DES'N	
AP'P'D.		AP'P'D.	
ALL DIMENSIONS ARE IN mm		SCALE	
		1:1	
REV. No.		DATE	
DRG. No.		DATE	
A3-A02EMCA88		11.10.2018	
SH 1 OF 1		DATE	

MATL : AL T-6061
QTY. : 1NOS/ASSY