

Government of India
Bhabha Atomic Research Centre
Accelerator Control Division

Ref : BARC/ACnD/17-18/561

Date : 8/8/17

Sub : Fabrication, machining, and assembly, of electromagnet

Dear Sirs,

Quotations are invited for the minor fabrication job "Fabrication, machining, and assembly of electromagnet as per specification TSP/PulseSolenoid/1.0

1. Bidder shall quote for the machining and fabrication, with raw materials excluding the materials mentioned as purchaser free issue material referred in technical specification. Taxes, VAT and Excise Duties shall be quoted separately.
2. The quotation must reach Head, ACnD by due date 18.8.17 and must be sent in a **sealed envelope super scribed with the reference number & the due date given above. (by Indian/speed post only)**
3. The address on the envelop should read:

**Head, Electromagnetic Applications Section
Accelerator Control Division,
BARC, Trombay,
Mumbai - 400 085.
(Kind Attn: P Trivedi)**

4. Any modification required during the fabrication process shall be made after approval from our engineer.
5. The bidder shall complete the same within 4 month from the date of firm work order issued to the bidder.
6. Head, ACnD 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.
8. Quotation must also indicate the validity of offer.
9. Quotation should be submitted on printed format along with PAN, GST. The quotations received in computer-generated format and without PAN, GST, the quotation will be summarily rejected.
10. For any clarification regarding specification please contact Praveen Trivedi SO/E ACnD phone-022-25593477

Encl.: Technical specification : TSP/PulseSolenoid/1.0 (Annexure-B)


8.8.17
Head EMAS

(Annexure-B)
TSP/PulseSolenoid/1.0

Technical specification for fabrication, machining, and assembly, of electromagnet

1.0 SCOPE: - This tender document specifies the requirements for fabrication, machining, and assembly of solenoid, The work shall be done strictly carried out as per the specifications and standards details in this document. In this document, BARC shall be referred as purchaser and fabricator/company who will be executing job is mentioned as the supplier.

The raw un-machined soft iron plates to be used in fabrication of core of solenoid shall be provided as Free Issue Material (FIM) as per Annexure-C by purchaser. Supplier shall arrange other required raw material/ facilities as per the requirement for technical specification. The supplier shall be qualified as per the Para 10.0. The brief description of contents of this tender specification document is as described below.

- Para 2.0 gives the statement of purpose
- Para 3.0 gives the deliverables
- Para 4.0 gives the general description & requirements
- Para 5.0 gives the engineering requirements
- Para 6.0 gives the requirements of manufacturing and workmanship
- Para 7.0 gives the requirements of inspection and testing
- Para 8.0 gives the requirements of documentation requirements
- Para9.0 gives the requirements of quality assurance
- Para 10.0 gives the requirements of supplier qualifications
- Para 11.0 gives the requirements of packaging and safe delivery
- Para 12.0 gives the price and delivery schedule
- Para 13.0 gives the confidentiality requirement

2.0 Statement of purpose: - The solenoid Electromagnet is required to generate a magnetic field of 3.7T Tesla in the air gap

3.0 Deliverables:-

S No.	Description	Qty
<u>Fabrication, machining, and assembly of solenoid</u>		
1.	Solenoid magnet Core assembly	As per drawing.
	Documents: - fabrication drawings, test reports and inspection reports.	01 set.

The scope of the supplier includes:

1. 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. The supplier can however make feasible changes but he should get it approved any changes made by purchaser.
2. Purchase of raw material other than Free issued material as per technical specification and produce test certificates for approval from purchaser before procuring.
3. Magnet core to be machined, assembled as per technical specification below.
4. Testing and Inspection of assembly in presence of purchaser representative.
5. Packing of the magnet assemblies' wooden suitcases and shipment of the same.

4.0 GENERAL DESCRIPTION AND REQUIREMENTS

4.1 The electromagnet core is of soft Iron, low carbon high quality magnetic steel. The electromagnet consists of yoke, and poles. The yoke are machined from plates. All the sub-assemblies of the electromagnets are integrated through bolted assembly mechanism.

4.2 The supplier shall workout a detailed design to meet fabrication requirements and work description, quantity and main fabrication material. He shall submit along with the offer dimensional drawing giving all the salient features, material details of individual items and assembly view of the fixtures.

4.3 The Supplier shall indicate in detail the standards adopted for the materials and processes and the quality control procedures followed by them.

4.4 Supplier can suggest the color, aesthetics, and other details as suitable. Supplier must offer best quality/IS certified material only.

4.5 Supplier should have similar work experience and along with the offer, shall submit the details of past experience with documentary proof.

4.6 Materials tools, manpower etc required for the above work will not be supplied by the user. Supplier has to arrange the above on his own.

5.0 ENGINEERING REQUIREMENTS

5.1 Electromagnet Core assembly :

5.1.1 The solenoid core assembly consist of yoke, and pole shall be machined to the required dimension and tolerance as per the drawings provided in Annexure-F.

5.1.2 The cutting of plates shall be carried out strictly using water jet cutting and flame/plasma cutting is strictly prohibited

5.1.3 The soft iron material consist of low carbon (0.01% by wt) , low sulphur and low phosphorous (0.003 % by wt and 0.01% by wt respectively). Therefore following precautions (5.1.5 to 5.5.8) shall be taken during machining.

5.1.4 Turning - Sharply ground tools and carefully selected cutting data are particularly important, since in the case of incorrect selection, pure Iron tends to smearing. The most rational production for coarse turning is achieved with a slow feed and a deep cut. Where the Best surface quality and dimensional accuracy are required in fine turning, the feed should not exceed 0.1 mm. With correctly selected cutting data, the turned surface has a gloss appearance, and otherwise matt. An extremely fine cutting surface is

also important. Adequate cooling and lubrication are also essential in order to preserve the tool and the work piece. It is recommended to use a mineral oil containing 1-1.5 % sulphur and 5 % grease.

- 5.1.5 Milling – In order to obtain a fine surface, cylindrical milling cutters with a pitch angle of 45 - 52° are recommended. The radial cutting angle should be 30°. At cutting speeds of 25 – 45 m/min, a feed of 19 - 32 mm/m should be selected. The use of side milling cutters requires a radial cutting angle of 10°. A clean swarf gap shape of the tools must be ensured. For cooling and lubrication, the same recommendations apply as for turning.
- 5.1.6 Thread cutting – Normal cutting tools can be used for the production of individual threads. As soon as the required number of threads increases however, non-cutting thread production provides more economical results. This can be used for the production of both internal and external threads. This increases the strength values, reducing the danger of the thread being stripped.
- 5.1.7 Drilling – A slightly lower free angle should be selected than for drilling normal steels. The cutting speed is approx. 24 m/min, the feed approx. 0.05- 0.10 mm/rev.
- 5.1.8 Any other mechanical process including non-cutting forming or welding is permitted. In case of necessary during fabrication, the required machining parameters shall be clearly indicated and prior approval shall be obtained from the purchaser.
- 5.1.9 The complete magnet assembly shall be integrated and assembled. After the assembly of yoke and final dimensional control checks, the yoke shall be protected against rust by painting or any anti rust coating. Nickel plating should be done on every surface of core. Note: the painting or coating should not in any case change the design dimension tolerances especially the air gap length (pole gap length).
- 5.1.10 Lifting lugs to be made as per drawings in Annexure-E.
- 5.1.11 . The machining and core fabrication in complete is in scope of supplier.

5.2 Solenoid assembly:

- 5.2.1 The air gap between the magnet poles shall be free of any materials and have full access. All the service ports/connections shall be provided in the top plate of the magnet with free access to the air gap completely.

6.0 REQUIREMENTS OF MANUFACTURING AND WORKMANSHIP

6.0 The manufacturing process and workmanship shall be consistent with high grade industrial practice and shall be adequate to achieve the accuracies for intended requirements. Manufacturing process shall ensure the interchangeability of parts.

6.1 If supplier wants to use any jigs and fixtures for the manufacture, same shall be approved by the purchaser. Before commencement of production, supplier shall prepare quality control sheets for various stage of manufacturing and same shall be approved by the purchaser and will be used by third party/ BARC QS.

6.2 The supplier should adopt and incorporate high safety industrial standards in fabrication work.

7.0 INSPECTION AND TESTING

7.1 At suppliers premises

7.1.1 Electromagnet core mechanical testing:

7.1.1.1 After the mechanical assembly of the Pulsed solenoid magnet, the main geometrical dimensions like length along the yoke, flatness of the whole assembly, squareness of the sides and of end faces, pole shoe profile shall be measured according to the tolerance mentioned in the approved manufacturing drawings and recorded.

7.1.1.2 The distance between the poles and individual poles horizontality shall be measured and recorded.

7.1.1.3 The air gap volume should be precisely measured and recorded.

8.0 REQUIREMENT OF QUALITY ASSURANCES

Quality surveillance and expediting, relating to all the aspects of the contract will be carried out by the purchaser or his authorized representative for which purpose the supplier and his subcontractor shall

8.1 Allow access at all reasonable times during manufacture, assembly and testing to the premises in which the work is being carried out.

8.2 Furnish the latest drawings and/or tooling, gauges, instruments, testing equipment etc. required for inspecting the jobs. Prints of all the latest required drawings and approved procedures shall be made available for inspection and retention, if so desired.

8.3 Produce an inspection plan to the purchaser's satisfaction and notify when checkpoints on the plan are imminent so that the purchaser's representative may be present, if it is so desired.

8.4 Obtain acceptance of the components in the form of a shipping release from the purchaser's representative before the shipment.

8.5 The supplier shall be responsible for the inspection of the components that is subcontracted by him.

8.6 Waiving of quality surveillance by the purchaser's or acceptance of the items by the purchaser or his authorized agent, shall not relieve the supplier from the responsibility for supplying the items in accordance with specification requirements of this document and purchase order.

9.0 REQUIREMENT OF PACKAGING AND SAFE DELIVERY

9.1 Protective covers: Supplier shall make necessary arrangements for all components using a suitable PVC cover or moulded thermocol. Proper care should be taken while handling the component during fabrication, inspection, testing and packing.

9.2 Packaging: After completion of all testing and identifying the components, the components shall be packed suitably for shipment, so that no damage occurs in transit. The purchaser shall subject the packing procedure to prior approval. At least one copy of packing list shall be kept in the package for quick and easy verification.

10 REQUIREMENTS OF SUPPLIER QUALIFICATIONS

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 magnetics 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.

S.No	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

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:

S.No	Particulars	To be filled by the vendor
1	<u>Human resource</u> (The supplier must give the complete detail of <u>human resources including Engineers, Consultants (if any), Draftsmen, Technicians, Welder, Assembly Mechanic, quality control inspector, machinist etc.)</u>	
2	<u>infrastructure:</u> <u>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</u>	
3	<u>Past experience</u> The supplier shall give their past three year turn over and job executed by them with reference , volume of work and completion schedule , present commitments and anticipated commitments inside and outside India.The expierence should be related to magnetic assembly .	
4	<u>Sub Contract:</u> Supplier shall list the jobs, which they want to sub-contract. They should also produce the list of sub-contractors and their infrastructures and facilities	

The bidder shall provide with the tender documents sufficient information for technical evaluation of the supplier. These shall include

11.1 A draft time schedule showing the manufacturing, testing of the yoke, and magnets.

11.2 Bidder shall quote for a complete fabrication of electromagnet. Incomplete offers will not be considered.

11.3 The bidder should have experience of fabrication of electromagnet assembly He should submit users list for whom he executed the orders for above.

11.4 A list of previous projects, similar or comparable in size and scope to assess the supplier's viability and ability to accomplish the job.

12 REQUIREMENTS OF PRICE AND DELIVERY SCHEDULE

12.1 The magnet shall be delivered RCZ Stores BARC. The supplier shall give a lump-sum price with delivery schedule. The complete job is expected to be completed in a duration of 04 Months.

13 CONFIDENTIALITY CLAUSE

13.1 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.

13.2 "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.

13.3 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)

14. Acceptance criteria

S.No	Particulars	Acceptance criterion
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 component. And final assembly	Following are applicable to each and every component. 1. Geometric tolerances of each and every component shall sub components and the be strictly as per drawings. Geometric inspections shall be done after each step and inspection reports)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

		<p>tolerances at different critical dimensions). Following are applicable to assembled magnet</p> <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.
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- As listed all the testing requirement should be successfully passed as per above specifications for acceptance.

15. List of Drawing:-

As per annexure-D; drawings Annexure-E

16 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.
- 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-C
FREE ISSUE MATERIAL

The following material shall be provided as free issue material (FIM).

S.No	Item Description	Nos	Total cost (Rs)
01	Un-Machined soft iron plates 2000mmx1000mmx100mm	One Nos	300000

The balance material shall be returned to RCZ Stores, BARC, Trombay.

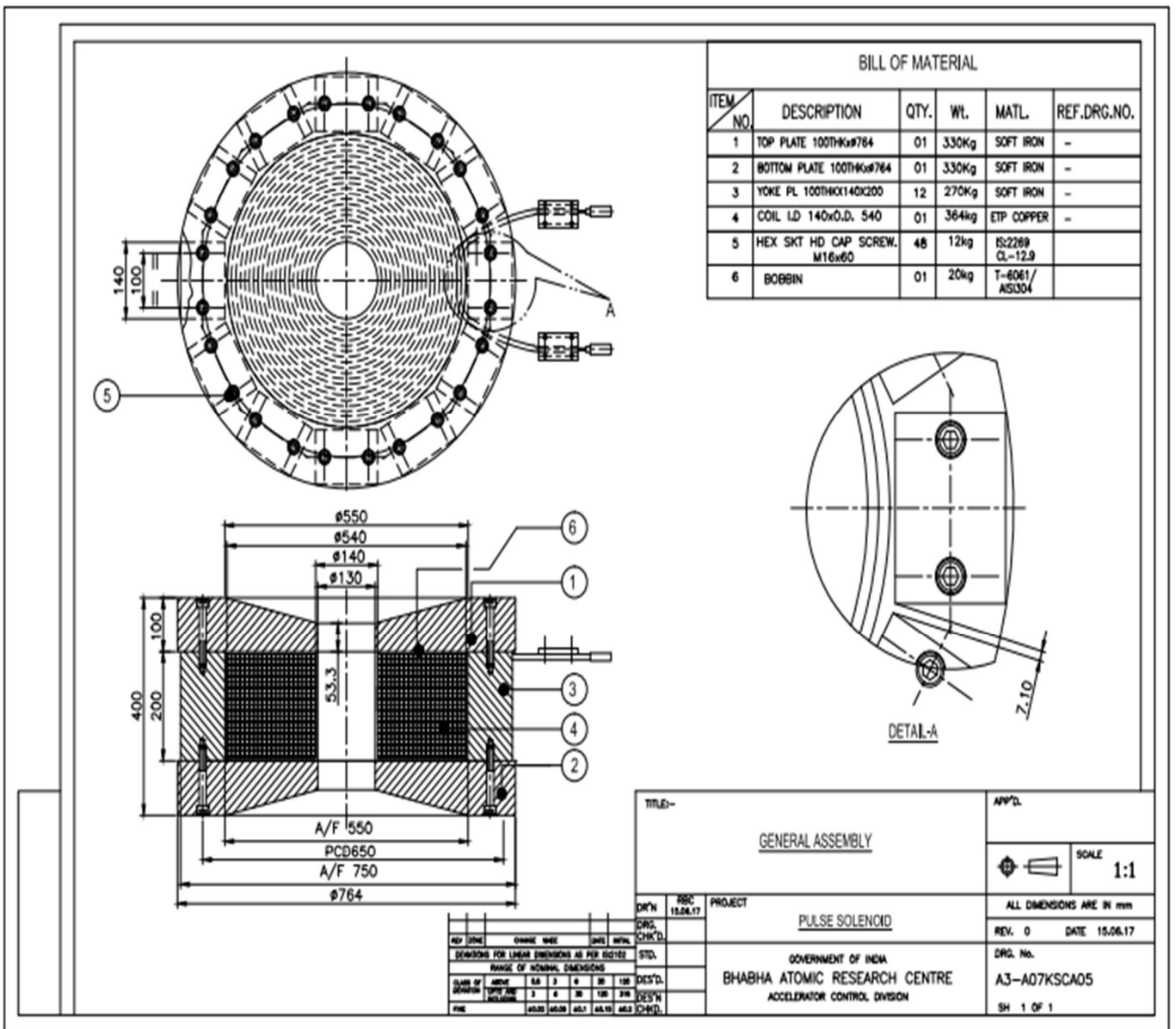
The FIM will be issued against submission of insurance policy with risks to be covered for any loss or damage to the purchaser materials due to fire, theft, riot, burglary, strike, civil commotion etc and any damage arising out of other causes such as other material falling on purchaser's material. The beneficiary shall be the "The President of India acting through Head, ACnD, MRG , BARC".

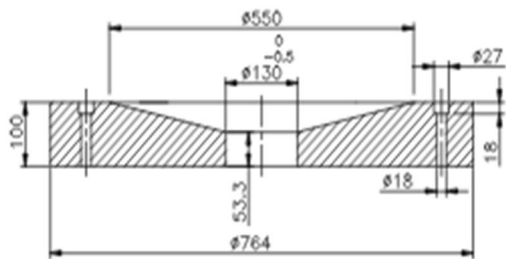
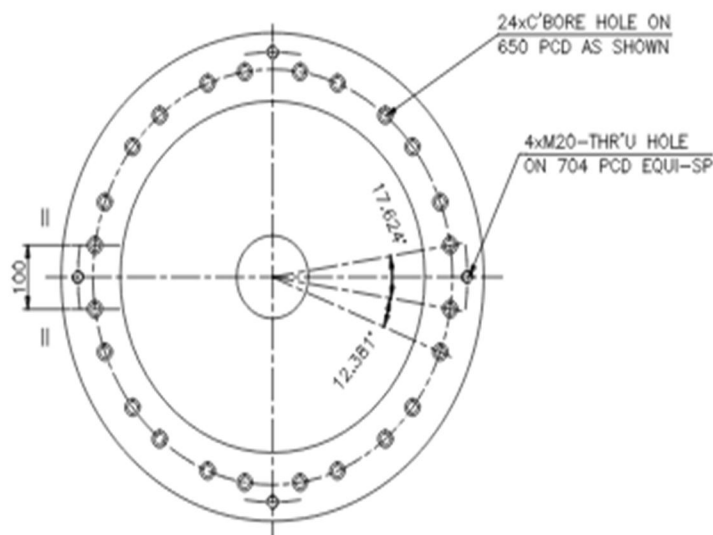
The supplier shall draw the insurance for the above free issue material in compliance with the DPS norms and regulations. The FIM is accountable however no scrap will be returned.

Annexure-D
List of Drawings

S.No	Description	Drawing No
1	General Assembly	A3-A07KSCA05
2	Details of Top and bottom plate	A3-A07KSCA06
3	Yoke plate	A4-A07KSCA07

Annexure-E



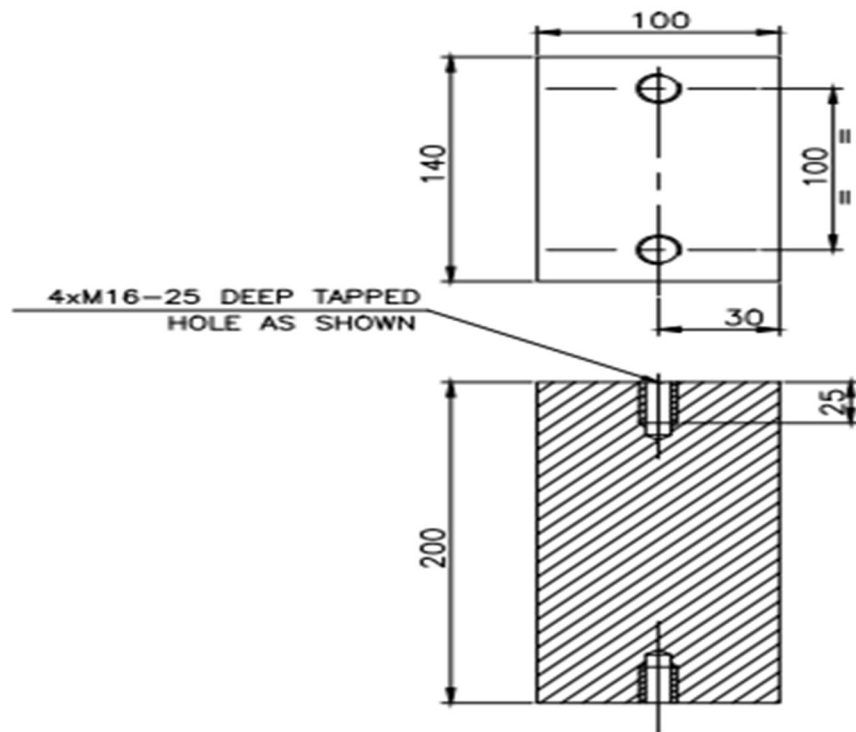


TOP & BOTTOM PLATE

MATL: AISI 1010
QTY: 1+1 NOS.

NO.	DATE	BY	CHKD.	DRN	RSC
1				10.06.17	
4 NOS OF NEW HOLE ADDED DEVIATIONS FOR LINEAR DIMENSIONS AS PER IS2102 STD.					
RANGE OF NOMINAL DIMENSIONS 0.2 0.3 0.4 0.5 0.6 0.7 0.8 0.9 1.0 1.5 2.0					
GRADE OF SURFACE	GRADE	GRADE	GRADE	GRADE	GRADE
TOP & BOT SURF	2	4	3B	1.5B	3.15
PERF.	0.15	0.10	0.1	0.15	0.1

TITLE--		APP'D.
DETAILS OF TOP & BOTTOM PLATE		
SCALE 1:1		
PROJECT		ALL DIMENSIONS ARE IN mm
PULSE SOLENOID		REV. 1 DATE 13.06.17
GOVERNMENT OF INDIA BHABHA ATOMIC RESEARCH CENTRE ACCELERATOR CONTROL DIVISION		DRG. No. A3-A07KSCA06
		SH 1 OF 1



NOTES :

- 1) MACHINING TOL. AS PER IS:2102 (MED.)
 - a) MACHINE ALL OVER
 - b) SURFACE FINISH TO BE $3.2 \sqrt{\text{OR BETTER}}$
 - c) REMOVE ALL BURRS.
 - d) REMOVE ALL EXTERNAL SHARP CORNERS AND EDGES BY CHAMF. TO $0.15 \times 45^\circ$
 - e) ROUND ALL INTERNAL SHARP CORNERS AND EDGES TO $R=0.40$
- 2) DO NOT SCALE THE DRAWING.

MATL : AISI 1010
 QTY : 12Nos./ASSY.

PROJECT
PULSE SOLENOID

TITLE
 (03) YOKE PLATE

APP'D

SCALE

ALL DIMENSIONS ARE IN mm

DRG. NO.

A4-A07KSCA07

DR'N R.B.C.
 15.06.17

DRG.

GOVERNMENT OF INDIA