

Government of India  
Bhabha Atomic Research Centre  
**Electromagnetic Applications & Instrumentation Division**

Ref : BARC/EmA&ID/KS/2021/24512

Date : 17-01-2022

**Sub : Minor fabrication job of "Fabrication, assembly, and qualification of high precision magnet assembly with Vacuum sealing"**

Dear Sirs,

1. Quotations are invited for the minor fabrication job of "**Fabrication, assembly, and qualification of high precision magnet assembly with Vacuum sealing**".
2. Bidder shall quote for the machining and fabrication along with raw materials involved in the technical specification. Taxes shall be quoted separately.
3. The quotation must reach Head, EmA&ID by due date **24.01.2022** and must be sent in a sealed envelope **super scribed with the reference number & the due date given above**.
4. The address on the envelop should read:  
**Head,  
Electromagnetic Applications &  
Instrumentation Division,  
RCnD Building  
BARC, Trombay, Mumbai - 400 085.  
(Kind Attn: Shr V M Phalke)**
5. Any modification required during the fabrication process shall be made after approval from our engineer.
6. The bidder shall complete the same within 10 weeks from the date of firm work order issued to the bidder.
7. Head, EmA&ID reserves the rights to accept / reject any or all quotations without assigning any reason.
8. Delivery charges if any must be clearly mentioned in the offer.
9. Quotation must also indicate the validity of offer.
10. Quotation should be submitted on printed format along with PAN, GSTIN. Computer generated format and without PAN & GSTIN, the quotation will be rejected.

Encl.:

**01) Technical specification :**

V.M.Phalke  
SA(F),EmA&ID

Through:

Kumud Singh,  
SO(F),EmA&ID

**Technical Specifications for minor fabrication job of “Fabrication, assembly, and qualification of high precision magnet assembly with Vacuum sealing”**

| Specification no. | Revision no. | Date of Issue | Total Number of pages |
|-------------------|--------------|---------------|-----------------------|
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**1.0 INTRODUCTION**

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The heavy duty extruded cross section to be used and LM Guide and other accessories should be nonmagnetic by nature. Supplier shall arrange for non-magnetic assembly tools while assembly the system at purchaser’s premises. Non-magnetic tools and CMM inspection are the mandatory requirements

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**2.0 SCOPE OF SUPPLY**

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The successful bidder shall deliver the Fabrication, assembly, and qualification of high precision magnet assembly with Vacuum sealing ” and all relevant documentation as defined in this technical specification.

**2.1 Supplier’s Responsibility:**

1. Supplier needs to make manufacturing as per our design to get the smooth aligning of the system. It is sole responsibility of the supplier to install, align and synchronize the motions as per our specifications.

The supplier is responsible for:

- (a) A complete Manufacturing File, containing detailed information about the production and quality control;
- (b) The procurement of raw materials and subcomponents as per para 4.0
- (c) The design and construction of all necessary tooling for the manufacture, assembly, and qualification.
- (d) Jigs and fixture for welding of parts.
- (e) The Quality Control Records (QCR), Inspection and test plans records (ITP) as per para 5.1;

**2.1 Deliverables included in the supply:**

| Sr. No | Job description  | Quantity |
|--------|--|----------|
| 1.     | <b>a) Support structure with heavy duty extruded aluminum cross section and 20mm thick ss base plate with all mountings to accommodate marx generator.</b> | 1 No.    |
| 2.     | Qualification test reports   | 1 Set    |

**2.2 Free Issue material**

No free issue material is involved. Raw material shall be arranged by the supplier.

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### 3.0 TECHNICAL REQUIRMENTS

#### 3.1 Technical specification

Heavy duty extruded cross section to carry heavy loads (3ton) and base plate 20mm ss  
With all necessary mountings for holding vacuum vessel with sealing in position firmly.

#### *(a) Support structure with heavy duty extruded aluminum alloy 80mmx80mm*

|    |                          |                          |
|----|--------------------------|--------------------------|
| 1) | Material of construction | Aluminum alloy 6000Grade |
| 2) | Base Plate               | SS304                    |
| 3) | Mountings                | SS,Al.                   |

Fabrication and Supply

*(a) Fabrication, testing, supply of stand as per attached Drg. and safe delivery to Purchaser's site.*

*(b) Geometrical inspection and qualification.*

*(c) Material test certificates shall be provided along with the supply.*

*(d) Transportation and safe delivery to purchaser's site including protection for all machined and sealing surfaces to mitigate any damage during transportation.*

### 4.0 RAW MATERIALS

#### 4.0 List of material to be used for support stand

| Sr.No. | Description.                | Material |
|--------|-----------------------------|----------|
| 1      | BASE PLATE FOR A-DLW SYSTEM | SS304    |
| 2      | AL EXTRUSION-100x100mm      | Al-6061  |
| 3      | AL EXTRUSION-100x100-2000L  | Al-6061  |
| 4      | AL EXTRUSION-100x100-650L   | Al-6061  |
| 6      | AL EXTRUSION-100x100-400L   | Al-6061  |
| 6      | L BRACKET                   | Al-6061  |
| 7      | CORNER LIFTING HOOK         | Al-6061  |

#### 4.1 SS304 (S30400)

##### A. Chemical Composition:

| Sr. No. | Element   | Composition % |
|---------|-----------|---------------|
| 1       | Carbon    | 0.08%max      |
| 2       | Chromium  | 19%           |
| 3       | Nickel    | 9%            |
| 4       | Manganese | 2%            |

##### B. Physical Properties:

| Sr. No | Parameter                | Value                  |
|--------|--------------------------|------------------------|
| 1      | Density (nominal)        | 7.87 g/cm <sup>3</sup> |
| 2      | Specific heat [J/(kg.K)] | 500                    |
| 3      | Melting temperature      | 1460                   |

##### C. Mechanical properties

| S.No. | Particulars                     | Value  |
|-------|---------------------------------|--------|
| 1     | Tensile strength                | 515MPa |
| 2     | Yield strength                  | 205MPa |
| 3     | Ductility(% Elongation in 50mm) | 40     |

## 4.2 Aluminium 6061(UNS NO.99061)

### A.Chemical Composition:

| Sr. No | Element  | Composition % |
|--------|----------|---------------|
| 1      | Mgnesium | 1%            |
| 2      | Silicon  | 0.6%          |
| 3      | Copper   | 0.3%          |
| 4      | Chromium | 0.2%          |

### B.Physical Properties

| Sr.No. | Parameter                | Value       |
|--------|--------------------------|-------------|
|        | Density (nominal)        | 2.7gm/cu cm |
|        | Specific heat [J/(kg.K)] | 896         |
|        | Melting temperature      | 650         |

### C.Mechanical properties

| Sr.No | Parameter                      | Value  |
|-------|--------------------------------|--------|
| 1     | Tensile strength               | 240MPa |
| 2     | Yield strength                 | 145MPa |
| 3     | Ductility(% Elongation in 50mm | 22-25  |

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## 5.0 PERFORMANCE OF THE CONTRACT

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### 5.1 Fabrication and Delivery Schedule

Delivery of support stand is expected in **about ten (10) weeks after the contract is awarded.**

Container and packaging design is subject to review and approval by Purchaser, but approval shall not relieve Manufacturer of any responsibility for damage to the assemblies during transit due to improper packaging or handling.

### 5.2 Manufacturing Plan

The Subcontractor shall submit a manufacturing plan to the purchaser for approval. The plan shall identify and describe all aspects of work to be executed from the point of design work through delivery of synchronizing mechanism. The Manufacturing Plan shall include and document the following stages:

- Manufacturing drawings
- Parts Procurement
- Machining,welding and Fabrication
- Inspection and testing

In cases where the Subcontractor modifies the design and/or develops its own tooling, an approval of the purchaser would be necessary to proceed to the next step of the manufacturing phase.

The Purchaser must accept the Manufacturing Plan prior to use. Sections of the Manufacturing Plan may be submitted earlier for acceptance. This will allow the Subcontractor to commence some fabrication tasks earlier.

### 5.3 Progress Report

The Subcontractor shall submit a monthly progress report to the purchase representative. The progress report shall be submitted within the 15th day of the month following the one for which progress is reported.

### 5.4 Quality Assurance Plan

The Subcontractor shall submit a Quality Assurance (QA) Plan to the Purchaser for approval before the fabrication process starts. The plan shall ensure that each item offered for acceptance conforms to the requirements herein. As a minimum requirement the QA plan shall include:

- Description of manufacturing traceability.
- Proposed layout of Travelers. Details of each step of the fabrication process must be well described in a traveler-type document, which must be made available to the Purchaser be approved before the fabrication starts.
- QA plan must include methods for inspection and dimensional control of mechanical parts and subassemblies including description of the measuring equipment, sequence and frequency of inspection, methods for defect/ flaw determination, criteria for rejection of parts including corrective action and plan for record keeping.
- QA plan must include a description of the welding equipment and welding procedure for each weld joint.
- QA document must include Non-Conformance reporting. Discrepancies shall be reported in the Subcontractor's Non-Conformance Reports and submitted to the Purchaser for acceptance. Work shall be placed on hold until the corrective action has been accepted by the Purchaser.

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## **6.0 INSPECTION BY THE PURCHASER**

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### **6.1 Hold points**

In addition to any hold points identified by the Subcontractor in the normal course of QC, Test, or Fabrication operations, the Purchaser may specify in the subcontract hold points in the processing and fabrication of the finished product covered by this Specification. The purpose of all hold points shall be to determine conformance of products to the requirements of this Specification before continuation of further processing and/or fabrication. The Purchaser may elect to witness and sign off any mandatory hold points.

In the event of a Non-Conforming condition further processing of the Non-Conforming item shall be put on hold until the corrective action has been accepted by the Purchaser.

### **6.2 Purchaser right to inspection**

- The Purchaser reserves the right to have its designated representative witness, at the place of manufacture, processing/fabrication operations agreed upon by the Purchaser and Subcontractor and specified in the Subcontract.
- The Purchaser reserves the right to have its designated representative witness, at the place of manufacture, the inspections, analyses, and tests established under the Subcontractor's QA Program to demonstrate compliance with the Specification.

### **6.3 Corrective action**

In the event that any live assembly or a portion thereof is rejected by the Purchaser as a result of poor workmanship or nonconformance to this Scope of Work, the Subcontractor shall take corrective action on the material or process, or both as necessary, on all items or portions thereof which were similarly manufactured which are subject to the same cause for rejection.

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## **7.0 CONFORMANCE TESTS**

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### **7.1 Responsibility for testing and inspection**

The Subcontractor shall be responsible for performing all required inspections, analyses, and tests designated as factory acceptance tests herein. The Subcontractor shall provide space, personnel, and test equipment to meet all inspection requirements. All testing and inspection shall be performed at the Subcontractor's facilities, or at the facilities of a

mutually acceptable Designated Test Agency (including Purchaser's site). The Subcontractor shall notify the Purchaser 15 calendar days in advance of scheduled commencement of any tests and inspections required by this Scope of Work to allow the Purchaser to arrange for witnessing the inspection, if elected. Results of inspections, analyses, and tests performed by the Subcontractor shall be reported in the Traveler. Inspections specified herein are not intended to supplant any controls, examinations, inspections, or tests that the Subcontractor shall perform to assure the quality of the final product.

Purchaser is responsible for performing site acceptance tests and communicate to the supplier of any modification required in series vessel assembly. The conformance tests required to be performed are as stated below:

| <b>Factory acceptance tests</b> |                        |  |  |
|---------------------------------|------------------------|--|--|
| <b>Sr. no</b>                   | <b>Qualification</b>   | <b>Acceptance criteria</b>   | <b>Scope</b>   |
| 1.                              | Visual inspection      | Visual signs of damage, deterioration and oxidation shall not be present on any component of the assembly,   | Purchaser Representative shall inspect the vessel assembly at suppliers premises   |
| 2.                              | Load Qualification     | Supplier/ fabricator shall demonstrate load bearing capacity of the stand by using dummy loads   | Purchaser Representative shall inspect the vessel assembly at suppliers premises   |
| 3.                              | Geometrical inspection | Parts and final assemblies shall be measured by coordinate measuring machine (CMM) to check the geometrical properties of the objects and their adherence to released drawings | Supplier shall carry out these inspection tests and a report shall be given for approval. Purchaser reserves the right to be present during these tests. |

### **7.2 Test Certificates**

*Supplier shall carry out and arrange for the following test certificates for the raw materials:*

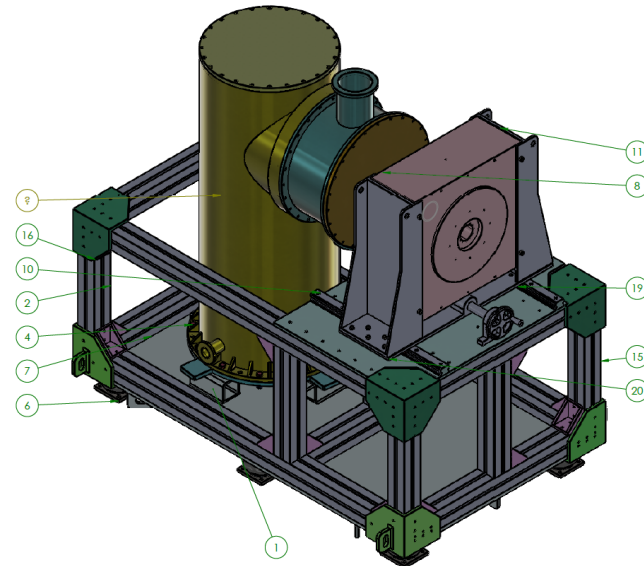
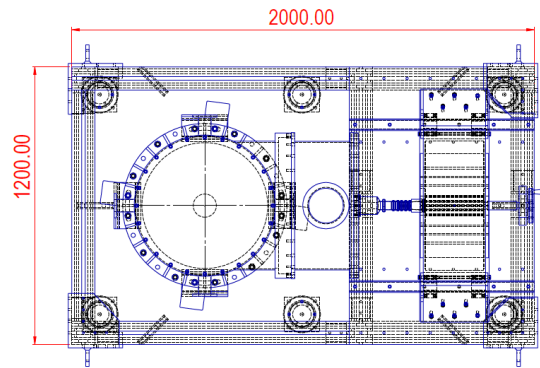
| <b>Sr. No</b> | <b>Test Certificate</b>   |
|---------------|---|
| 1.            | Mill test certificate - Mill test certificate containing heat no., batch no., chemical composition, size etc.   |
| 2.            | Mechanical test certificate - Mechanical and other physical properties of the plates & sheets shall conform to the requirements of ASTM standards   |
| 3.            | Chemical test certificate   |
| 4.            | Dimensional inspection report - Dimensional inspection report containing drawing dimension, measured dimension, deviation if any, within tolerance limit or not, rectification needed etc |

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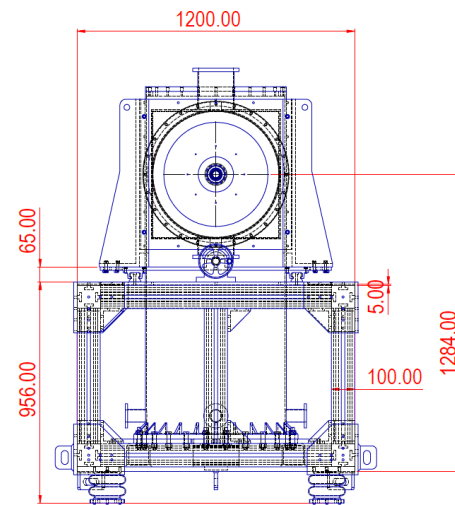
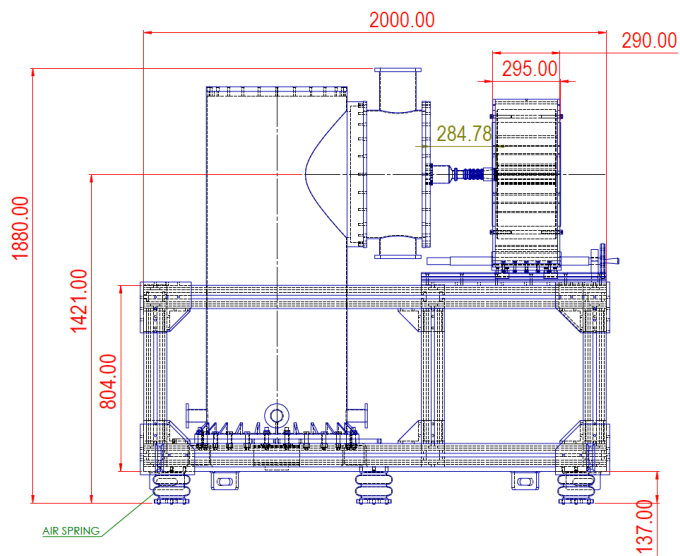
## **8.0 GENERAL DESCRIPTION**

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- Supplier shall quote with material; no free issue material is involved in this tender.
- Overall cost will be compared and include packaging, forwarding and safe delivery to BARC at RCZ stores.
- Suppliers shall give complete details of their product, facilities, winding machine details, list of users and compliance certificates form users for technical evaluation. Quotations submitted with incomplete details are viable for rejection. A technical committee will visit the facilities
- Vendors with test facilities for qualification of welding (radiography tests on test specimen), leak test, Pressure testing and basic metrology equipment's for dimensional checks will be given preference. In case vendor plans of sub-contracting the job, same shall be clearly brought out in quotations. The sub-contracting can only be carried out only after prior permission of the purchaser. In all circumstances the responsibility of completion of job up to the satisfaction of the purchaser lies with the supplier. Vendors shall list down the details of qualification checks performed on the fabricated parts by self or in collaboration with other laboratories.
- Supplier Qualification: (Requirements of Supplier Qualifications)
  - **Human resources**
  - The supplier must give the details of qualified human resources including draughtsmen, welding technicians, Quality control personnel.
  - **Infrastructure:**
  - The supplier must give the details of infrastructure suitable for this job such as Floor Space availability, welding equipment's, leak check and pressure testing equipment's etc.
  - **Past experience:**
  - The supplier must give their past three year turnover and similar jobs executed by them with reference, volume of work and completion schedule, present commitments and anticipated commitments inside and outside India. Vendors who have in past executed similar projects for similar applications will be given preference. Vendors should have in past executed, should have knowledge about superconducting magnets and cryogenic materials.
  - **Sub-contractors:**
  - Supplier should list the jobs, which they want to sub-contract. They should also produce the list of sub-contractors and their infrastructures and facilities.



|    |   |    |
|----|---|----|
| 1  | BASE PLATE FOR A-DLW SYSTEM                                   | 1  |
| 2  | AL EXTRUSION-100x100  | 2  |
| 3  | AL EXTRUSION-100x100-2000L                                    | 4  |
| 4  | MARX GEN. SUB ASSY  | 1  |
| 5  | AIR SPRING  | 6  |
| 6  | AIR SPRING BASE FLANGE  | 6  |
| 7  | AL EXTRUSION-100x100-650L                                     | 6  |
| 8  | X-BAND BWO CAVITY   | 1  |
| 9  | MARX GEN. MAGNET  | 1  |
| 10 | AL PLATE 900x1200x15  | 1  |
| 11 | Part1   | 2  |
| 12 | B18.3.1M - 12 x 1.75 x 80 Hex SHCS - 362NIX                   | 7  |
| 13 | B18.3.1M - 8 x 1.25 x 20 Hex SHCS -- 33NIX                    | 20 |
| 14 | B18.3.1M - 10 x 1.5 x 35 Hex SHCS -- 33NIX                    | 10 |
| 15 | AL EXTRUSION-100x100-400L                                     | 6  |
| 16 | L BRACKET   | 26 |
| 17 | B18.2.4.2M - Hex nut, Style 2, M16 x 2-D-N                    | 4  |
| 18 | B18.2.3.5M - Hex bolt M16 x 2.0 x 70 --38N                    | 4  |
| 19 | LM BLOCK  | 4  |
| 20 | PM MAG-BKT BASE PLATE   | 1  |
| 21 | B18.2.4.2M - Hex nut, Style 2, M10 x 1.5, with 16mm WAF --D-N | 10 |
| 22 | CORNER BRACKET TOP  | 1  |
| 23 | CORNER LIFTING HOOK   | 3  |
| 24 | MirrorCORNER BRACKET TOP                                      | 1  |
| 25 | MirrorMirrorCORNER BRACKET TOP                                | 1  |
| 26 | MirrorMirrorMirrorCORNER BRACKET TOP                          | 1  |



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