भारत सरकार Government of India
अंतरिक्ष विभाग Department of Space
अंतरिक्ष उपयोग केंद्र Space Applications Centre
अहमदाबाद Ahmedabad

संदर्भ.सैक/एपीयूआर/मेसा/Ref. SAC/APUR/MESA/2021000310 मई May 18, 2021

शुद्धिपत्र-II CORRIGENDUM-II

विषयः कंपोनेन्ट्स की मशीनिंग हेतु निविदा सं. सैक/एपीयूआर/मेसा/2021000310
Sub: Tender No. SAC/APUR/MESA/2021000310 for Machining of Components.

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विषयांतर्गत निविदा के संबंध में, आरएफपी हमारी वेबसाइट (www.sac.gov.in & www.isro.gov.in) पर अपलोड की गई है।
With respect to subject tender, RFP is uploaded on our website (www.sac.gov.in & www.isro.gov.in).

बोलीकर्ता कृपया नोट करें कि उपर्युक्त ब्योरा उक्त निविदा का भाग होंगे। इसलिए, बोलीकर्ता उसे डाउनलोड कर लें और अपनी बोली तदनुसार प्रस्तुत करें।
Bidders may please note that the above details will be the part of the said tender. Therefore, bidders may download the same and submit their bid accordingly.

जिन विक्रेताओं ने अपनी बोली पहले से ही प्रस्तुत कर दी है वे, यदि चाहें, तो संशोधित प्रतिक्रिया मात्र ऑनलाइन मोड के माध्यम से अंतिम तिथि व समय के अंदर प्रस्तुत कर सकते हैं।
Vendors who have already submitted their bid may submit revised responses, if desired, within the due date and time through online mode only.

हस्ता./S/d
प्रधान, क्रय एवं भंडार Head, Purchase & Stores

संलग्नकः यथोपरि Encl. As above.

Annexure-A

Fabrication Requirements for Reflector Mold

This Annexure provides the details of mechanical-fabrication requirement for Cast Iron mold.

The mold fabrication and its surface profile measurement is a typical requirement, which we are proposing to outsource to Vendors.

1.0 Introduction

SAC/ISRO requires composite reflector antennas in various sizes and shapes (parabolic and shaped parabolic) for communication satellites. The profile of these reflectors is required to be very stringent to meet performance requirements. Since composite reflectors are fabricated using C.I. molds, the surface accuracy (RMS) of the mold profile is also required to be within specified limits.

This Annexure gives details of work definition and typical specifications of Mold.

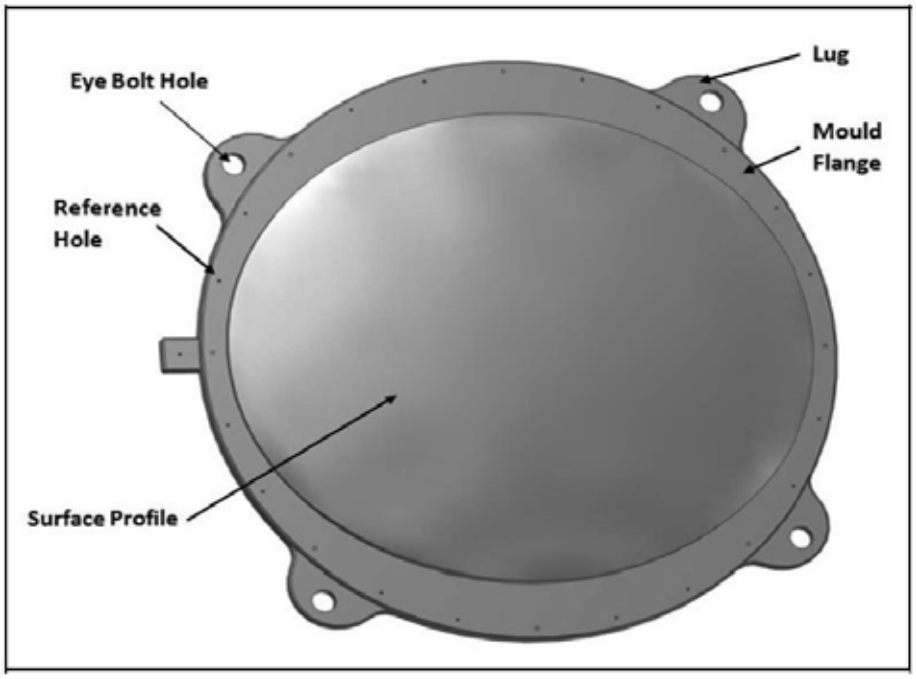

Figure – 1 Typical Mold Nomenclature

2.0 Scope of Work

The scope of work is briefly described below:

2.1 Solid model generation from given surface profile and set of drawings provided along with Purchase Order (typical drawings are provided)

2.2 Pattern making, C.I. casting and its stress relieving.

2.3 Submission of mechanical properties, chemical properties, visual inspection, result of NDT test and stress relieving cycle (as mentioned in Annexure-B) reports of C.I casting to SAC for approval.

2.4 CNC Machining of casting as per drawings supplied by SAC/ISRO.

2.5 Inspection of mold in unclamped condition. SAC/ISRO will provide Z Coordinates for the measurements of inspection points. Generally, inspection points will be in the grid of 25mm x 25 mm in X and Y coordinates.

2.6 Submission of inspection report to SAC/ISRO as per above point 2.5. SAC/ISRO Engineer will verify this report on CNC machine during his/her visit to vendor's place. Vendor shall inform in advance to SAC to send its engineer for this purpose. Vendor shall not dismount the mold from the machine until this activity is over.

2.7 Marking of references in presence of SAC/ISRO Engineers as per drawings provided by SAC.

2.8 Mold surface polishing and application of antirust coating.

2.9 Subject to clearance; packing and transportation of mold to

Stores Officer
Space Applications Centre (SAC/ISRO),
Jodhpur Tekra,
Ahmedabad-380015

2.10 Transportation charges will be paid extra as actual on submission of Lorry Receipt.

3.0 Typical Mold Specifications

Typical mold specifications are given below:

Sub clause	Parameter	Specification
3.1	Surface accuracy(RMS*)	**0.06 mm or better**
3.2	Surface Finish (Ra)	Max. 0.008mm
3.3	Surface Quality	Free from dent / Porosity /Cracks
3.4	Mold Material	Cast Iron (IS Grade-30)
3.5	Mold Surface	Surface Profile will be provided by SAC
3.6	Typical Mold Dimensions Diameter	2.5m
3.7	References/Alignment related block and boundary markings on the mold	Minimum four precision reamed holes are required on the flange. Additionally other marking points to be marked as shown in the drawing
3.8	Reference surface pads' accuracy	**0.020 mm,** Details as per the drawing provided by SAC
3.9	Surface inspection points-Grid size	25 mm x 25 mm interval

4.0 Mold Casting and Machining:

Vendor shall ensure following:

4.1 Vendor must have 3-Axis VMC machine having positioning accuracy of 20 micron or better in all axes; and with X and Y travel of minimum 2200 mm; installed at their Works; so as to fully accommodate the job on machine and to do the precision machining in single setup. The calibration report should not be older than 2 years from due date of inquiry. Calibration should have been completed by NABL Accreted calibration agency. The machining work cannot be outsourced by the bidder.

4.2 On completion of final machining of Mold, to carry out mold measurement/inspection.

4.3 To prepare inspection report and mail it to SAC/ISRO.

4.4 To verify Z-Coordinates in presence of SAC/ISRO Engineer on CNC Machine.

4.5 To drill and ream reference holes in flange and mark reference lines as per drawings provided and as per instructions provided by SAC/ISRO Engineer.

4.6 To carry out mold measurement/inspection in Stress free condition. (Mold in unclamped condition on machine bed itself)

4.7 To apply antirust coating to the mold before dispatch.

5.0 Mold Inspection/ measurement:

5.1 Vendor should have adequate inspection facility installed at their premises. This should facilitate inspection of machined mold on CNC machine itself in clamped condition and provide the report.

5.2 Vendor shall carry out measurements on mold surface profile in stress free condition also jointly with the SAC/ISRO engineers. Any discrepancy observed beyond the acceptable limits, in stress free measurement, shall be corrected.

5.3 Deviation Report to be provided for unclamped condition of mold for comparing it with CAD surface.

5.4 The mold will accepted based on various surface parameters like surface finish, surface RMS and Peak to Valley distance.

5.5 The surface RMS measurement in stress free condition is to be carried out using precision measurement technique.

5.6 The mold manufacturer can sub-contract for the precision measurement services for surface profile measurement/Inspection of Mold.

5.7 If deviation is observed on the mold surface beyond specifications, identify the area for re-machining/ rectification.

5.8 If rectification of mold is done then repeat the measurement and prepare the inspection report again after rectification.

6.0 SAC/ ISRO Responsibilities:

Necessary inputs will be supplied by SAC which are broadly described below.

6.1 Detailed drawings of Mold.

6.2 Data files in text or 3D CAD Model; defining 3-D surface profile of the reflector for pattern making and machining of mold.

6.3 Provide inspection points (approximate grid of 25mm x 25mm), boundary/rim co-ordinates, reference marking points etc. during course of fabrication.

6.4 Inspection verification jointly with vendor's team at Vendor's premises.

6.5 Acceptance and Approval of the mold by SAC/ISRO.

7.0 Vendor's Responsibilities:

7.1 As mentioned in para 2.0 titled "Scope of Work".

7.2 If the mold is received in damaged condition or rejected after inspection, vendor shall have to supply another one at no extra cost.

8.0 Product Assurance Plan:

Joint responsibilities of SAC/ISRO and VENDOR:

8.1 Assuring quality of casting.

8.2 Verification of equipment calibration certificates by SAC/ISRO.

8.3 Field Calibration also has to be carried out by party before start of each measurement.

8.4 Reviewing final product prior to delivery. Inspection Report should be provided to SAC/ISRO.

8.5 Vendor shall carry out measurements on mold surface profile in stress free condition also jointly with the SAC/ISRO Engineers after surface RMS measurement is completed.

9.0 Deliverables by Vendor:

Major Deliverables are shown below:

9.1 Quality certificates of material (C.I Grade 30) of the mold.

9.2 3-D model of the surface and accuracy report on the 3-D model on a CD media.

9.3 Inspection reports on a CD with RMS deviations (0.06 mm max.) computed on the finally approved surface and Ra_{max} value of 0.008mm.

9.4 Final machined Cast Iron mold as per the drawings.

Compliance Statement:

Vendor must comply mentioning **'YES'** or '**NO'** in the below Table:

Sr.	RFP Ref. No.	Parameter	Specification	Compliance? Mention YES or NO (If NO then specify)
1	2.2	Stress Relieving of Casting		
2	2.3	Material Test Report as per Annexure-B		
3	2.5	Inspection of Mold in unclamped condition in the grid of 25mm x 25mm (for Z-coordinates)		
4	2.6	To submit Inspection Report to SAC/ISRO		
5	3.1	Surface accuracy(RMS)	0.06 mm or better	
6	3.2	Surface Finish (Ra)	Max 0.008mm	
7	3.3	Surface Quality	Free from Dent/Porosity/ Cracks	
8	3.4	Mold Material	Cast Iron (IS Grade-30)	
9	3.7	References/Alignment related block and boundary markings on the mold	Minimum four precision reamed holes are required on the flange. Additionally other marking points to be marked as shown in the drawing	
10	3.8	Reference surface pads' accuracy	0.020 mm, Details as per the drawing provided by SAC	
11	4.1	3-axis VMC calibrated within last 2 years with a Positional accuracy of 20 micron and X and Y traverses of minimum 2200 mm installed and owned at Vendor's premises.		
12	4.4	To verify Z-Coordinates in presence of SAC/ISRO Engineer on CNC Machine.		
13	4.5	To drill and ream reference holes in flange and mark reference lines as per drawings provided and as per instructions provided by SAC/ISRO Engineer.		

14	4.7	To apply antirust coating to the mold before dispatch.	
15	5.2	To carry out measurements on mold surface profile in stress free condition jointly with the SAC/ISRO Engineers. Any discrepancy observed beyond the acceptable limits, in stress free measurement, shall be corrected.	
16	5.3	Deviation Report will be provided for unclamped condition of mold for comparing it with CAD surface	
17	5.7	If deviation is observed on the mold surface beyond specifications, identify the area for re-machining/ rectification.	
18	5.8	If rectification of mold is done then repeat the measurement and prepare the inspection report again after rectification.	
19	7.1	Vendor complies – As mentioned in para 2.0 titled “Scope of Work”.	
20	7.2	If the mold is received in damaged condition or rejected after inspection, Vendor agrees to supply another one at no extra cost.	
21	8.4	To review final product prior to delivery. Inspection Report should be provided to SAC/ISRO.	
22	9.3	To provide Inspection reports on a CD with RMS deviations (0.06 mm max.) computed on the finally approved surface and RaMax value of 0.008mm.	

Annexure-B

Date: _____

Acceptance Report

Supplier	
P.O. No.	
Item	
Drawing No	
Date of Inspection	
Ref Inspection Report	
Quantity	
Product ID	

SAC/ISRO Representatives _____

1. **Mechanical Properties of C.I. Grade FG300(International Std. Grade 30) as clarified by:**

UTS		**Refer attached material Test Certificate**
Hardness		
Type of Graphite		
Size of Graphite		
Matrix		

2. The following markings have been engraved as shown in marking drawing +x, -x, +y, -y Axes, Reference holes marked as R1 to R4

3. The product ID no. is machine engraved as:_____

4. Final surface of Z coordinates were measured on the mold at _____ points furnished by SAC using CNC machine and RMS is computed

5. Reflector boundary points have been indented as per co-ordinates provided by SAC. Aperture Centre 'A', reference points----- are marked

6. The 'Z' coordinate measurement was carried out using ……., technique/instrument

7. The final computed RMS value of the profile is -------- mm which is within specified limits. Detailed measurement report is provided in soft copy version

8. The cited mold is accepted and cleared for dispatch to the destination mentioned in SAC P.O.

(Sci./Engr.)	(Sci./Engr.)
SAC/ISRO	SAC/ISRO

Material Test Certificate

Test Certificate No. Date:

Name of the Company	
Reference Nos	
Purchaser's Name	
Drawing No	
Quantity	
Heat No	
Material grade	

Mechanical Properties:

Elements	Tensile Strength(MPa) Min	Yield Strength MPa Min	Elongation % Min	Hardness (BHN) Min-Max
Required				
Actual				

Microstructure specification	Observation
Flake Type	
Flake Size	
Pearlite	
Ferrite	
Carbide	

Chemical Properties:

Elements	C%	Si%	Mn%	P%	S%
Actual					

Heat Treatment: Stress relieving carried out (S.R cycle mentioned below)

1. Constant heating in furnace for 6 hrs. up to 600deg.C
2. Hold in furnace at 550 deg. C for 2 hrs.
3. Switch off furnace for cooling to atm. temperature (24-30 hrs.)

NDT: Radiography/Ultrasonic test for defect free casting as per IS2595/IS7666

Result:

Remark: We certify that the material described by this certificate confirms to material grade FG 300 as per IS 210

	Prepared by	**Approved by**
Signature		
Name		
Designation		