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## **INDIAN INSTITUTE OF ASTROPHYSICS**

(Ministry of science and Technology, **Govt. of India**)

Koramangala, Bangalore – 560034

### **Public Tender Notice No.PR/PT/SS/TMT/EOI/HEX/CON/570 dated 12th January 2018**

#### **India TMT Co-Ordination Centre**

#### **EXPRESSION OF INTEREST**

IIA/ITCC is inviting submission of Expression of Interest (EOI) from suitable vendors for Process Development of Hex Cutting and Pocketing on polished glass blank for India-TMT.

The details of the specification and other details can be found attached as Annexure - A & B. The EOI is proposed for acquisitions development of new technology as per the specification mentioned. Meeting at IIA/ITCC, Bangalore with respect to the EOI will be convened with the interested parties within two weeks from the last date of submission of the inputs, if needed, to know the capability of the vendor for development for the required technology. Those participating in EoI alone will be considered for the further phases of procurement.

The interested bidders shall submit their EOI proposals for Process Development of Hex Cutting and Pocketing on polished glass blank for India-TMT, on or before 31/01/2018 at 5.30 PM in the prescribed format and other requirements as per Annexure-C, D, E and F to IIA/ITCC at the following address: -

**The Director  
Indian Institute of Astrophysics  
Koramangala, II Block, Bengaluru-560 034  
India  
Phone No.080-2254 1254**

Any amendment to the EoI will be published only in the IIA website: <https://www.iiap.res.in>

It is the responsibility of participating organization to visit the IIA website frequently to know about the latest updated/ amendments/ corrigendum/addendum/clarification, if any.

## **INTRODUCTION**

The Thirty Meter Telescope (TMT) International Observatory (TIO) is a joint venture of scientific institutions in Canada, China, India, Japan and the US to build a 30 m diameter optical-infra-red telescope. TMT has 30m diameter primary mirror (M1) composed of 492 hexagonal shaped segments made of low expansion glass material. Each hexagonal segment has an approximate size of 1.44m across the corners and an approximate thickness of 45mm. All these segments are non-axial asymmetric hyperbolic in shape with asphericity ranging from 6 $\mu$ m to 230 $\mu$ m. The segments are produced from a CLEARCERAM-Z blank of 1520mm diameter with meniscus shape. The bottom surface, S2 (Convex), is ground and polished into spherical shape. After polishing the S2 surface, S1 (Concave) surface is ground and polished into required aspherical shape. S1 aspherical surface polishing is achieved by Stress Mirror Polishing (SMP) technology with full tool polishing. Once the S1 surface polishing is completed, the polished roundel glass blank will be cropped into hexagonal shape. Once the hexagonal shape is obtained, the S2 surface will undergo milling/grinding to have central pocket required to hold the segment to the structure and then edge pockets to mount edge sensors for the segment alignments in the telescope structure. The hexing, central pocketing and edge pocketing are the activities that need to be carried out on polished roundel prior to its mounting over the telescope Segment Support Assembly (SSA). The scope of the work is to develop required process for hexing and pocketing on the polished glass blank to meet all the required specifications.

## **2.0 GLASS BLANK DEFINITION**

### **2.1 Sub Sized Roundel**

The sub size roundel refers to the polished roundel of diameter not less than 300mm, and thickness between 45 to 50mm. Surface type is plano-plano and the glass material is either Clearceram or Zerodur. Surface finish is 1/4 RMS or better and cosmetic quality is 60/40.

### **2.2 Full Sized Roundel**

The full size roundel refers to the polished roundel of diameter not less than 1500mm and thickness of 45 to 50mm. Surface type is plano-plano and the glass material is either Clearceram or Zerodur. Surface finish is 1/4 RMS or better and cosmetic quality is 60/40.

### **2.3 Qualification Roundel for Phase II**

The qualification roundel is the ITCC/IIA supplied polished roundel of size 1520mm diameter and 46mm thickness of meniscus type with ROC ~60000mm. The material of the glass is Clearceram-Z.

## **3.0 SCOPE OF WORK**

Design, development and qualification of manufacturing operations required to turn a polished full size roundel into a machined hexagonal segment meeting all necessary requirements as given in Table 1 and the corresponding drawing is shown in Figure 1

The scope of work is taken into two Phases as Phase I and Phase II. Phase I is the process development and Phase II is the process qualification. For Phase I, more than one vendor will be selected based on the selection criteria mentioned in Section 5.1. For Phase II only one vendor will be selected based on successful completion of Phase I and techno commercial evaluation.

### 3.1 PHASE I: HEXING & POCKETING PROCESS DEVELOPMENT

The process development can be of two types depending on the vendor's choice as mentioned below.

#### ***(A) Choice1***

The vendor performs the process development on a sub size roundel and then moves the process development to a full size roundel. The requirements and the performance criteria are given in Table 1. The total tenure for the process development should not be more than 8 months from the date of release of PO. The deliverables from the Choice 1 is given in Section 4.1

#### ***(B) Choice 2***

In this case, the vendor directly starts the process development on full size roundel. The requirements and the performance criteria are given in Table 1. The total tenure for the process development should not be more than 8 months from the date of release of PO. The deliverables of Choice 2 process development are given in the Section 4.1

In both the cases, the glass blank procurement, polishing, design and development of the required fixtures and accessories are entirely the vendor's responsibility.

The number of glass blanks and the iterations required for the process development under choice 1 and 2 are not limited and it can be decided by the vendor. However, vendor needs to provide IIA/ITCC the complete details of the parameters tuned in all the iterative process.

The parameters to be derived from the process development is given in Table 2 but not limited to the list in Table 2. **The vendor(s) should provide IIA/ITCC a detailed report with parameters for the machine, tools and accessories that will be required for hexing and pocketing 1520mm meniscus roundels, at six months from the start of Phase I.**

Glass blank specification and polishing requirements on full size and sub size roundel are given in Table 3. If the vendor prefers to develop the process under choice 1, the sub size roundel specifications and the related drawings will be provided on request.

### **3.2 PHASE II: PROCESS QUALIFICATION**

Phase II is the process qualification. The qualified vendor from Phase I will be required to transfer the developed process on the qualification roundel in the CNC machine which would be procured based on the Phase I process development and the same will be used for the India-TMT segment production at the later stage. Development of the fixtures and accessories required for Phase II operation will be the vendor's responsibility. The requirements and the performance criteria for Phase II is given in Table 1 and the deliverables of process qualification is given in the Section 4.2

## **4.0 DELIVERABLES**

### **4.1 Deliverables of Phase I**

- Iterative process recipe as well the final Process recipe
  - o If Choice 1 is opted, the process recipe has to be provided for both the sub sized and full sized level.
- Machine Parameters derived from Phase I that should be used for selecting the suitable machine for Phase II (and the production of segments at the later stage) with proper justification.
- Details about the fixtures and accessories used at both sub size and full size process development.
- Document containing the entire iterative process that is followed during the process development with the schedule
- Vendor must provide ITCC/IIA with the complete Phase II plan and requirements.
- Vendor must provide all the metrology data and compliance matrix meeting all the process requirements

### **4.2 Deliverables of Phase II**

- Hexed and machined qualification roundel

- Design and fabrication details of the fixtures and accessories used for the qualification process
- The process / technology whichever is being used, should be delivered to ITCC / IIA.
- Vendor must provide all the metrology data and compliance matrix meeting all the process requirements;

The below listed criteria will be seen for the selection of the vendors for the Phase I process development in their technical offer and hence the vendors must provide their technical offer to ITCC/IIA with the following details but not limited to the list below.

- a) Vendors must have experience in precision optics fabrication
- b) Vendors must provide a complete project plan with milestones and timeline.
- c) Vendors should confirm the availability of machines (or access to the machines) and the manpower required for the Phase I process development.
- d) Vendors must provide the details about the Metrology equipment and the Metrology plans.
- e) The vendors should provide the details about the glass material to be used for the iterative and final process development.
- f) Vendors must indicate the feasibility of polishing, pre-machining and optical measurement of the glass blank on their own.
- g) Vendors should indicate the plan for making the fixtures and the accessories required for the process development.
- h) The vendors must be able to suggest/propose specific machines to ITCC/IIA for Phase II operation and the segment production based on the Phase I process development.
- i) The vendors must provide a clear plan for the execution of Phase II.
- j) Vendors should indicate the requirement of fixture/accessories required for Phase II operation.
- k) The vendors must be able to perform the required opto-mechanical analysis for the process development.

- l) Vendors must provide the handling and safety guidelines to be followed during the process development and process qualification
- m) Vendors must indicate any secondary process required for the both Phase I and Phase II

**ANNEXURE-B**

**6.0 PERFORMANCE REQUIREMENTS**

Vendor must meet the all the performance requirements listed in Table 1 in addition to the features given in the drawing attached in Appendix for the process development and process qualification.

*Table 1. Performance requirements for Phase I and Phase II*

<b>Description</b>	<b>Requirement on Sub Size Roundel</b>	<b>Requirement on Sub Size Roundel</b>	<b>Requirement on Qualification Roundel</b>	<b>Remarks</b>
Surface deformation due to slicing/machining	< 1/3 $\mu$ m PTV	<1 $\mu$ m PTV	<1 $\mu$ m PTV	Minimum 100mm aperture interferometric measurement close to the slicing edge and machining area
Hexed Surface Finish	Better than 0.4 $\mu$ m Ra	Better than 0.4 $\mu$ m Ra	Better than 0.4 $\mu$ m Ra	
Chip Size	<200 $\mu$ m on Front surface <400 $\mu$ m on Back surface	<200 $\mu$ m on Front surface <400 $\mu$ m on Back surface	<200 $\mu$ m on Front surface <400 $\mu$ m on Back surface	
Profile waviness over the length of slicing	<200 $\mu$ m	<200 $\mu$ m	<200 $\mu$ m	
Tapering	<200 $\mu$ m	<200 $\mu$ m	<200 $\mu$ m	
Length of Cut	At least One maximum length	720mm	720mm	
Bevelling	0.5mm at 45 degree	0.5mm at 45 degree	0.5mm at 45 degree	To be done only after process verification

Hexing vertex roundness	Refer Drawing	Refer Drawing	Refer Drawing	To be done only after process verification
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## 7.0 PROCESS PARAMETERS

Vendor must provide the details of process parameters as given in Table 2 but not limited, at end of the process development as well the process qualification. The parameters required to choose the suitable machine for Phase II should be clearly indicated to IIA/ITCC

*Table 2. Process parameters based on process development and process qualification*

Description	Parameters/s ub size roundel	Parameter/ full size roundel	Parameters / Qualification roundel	Remarks
Wheel Shape				
Diamond type/size				
Bond Type				
Depth of diamond section				
Concentration				
Substrate material				
Spindle speed or surface footage				
Depth of cut				
Traverse feed rate				
Machine parameters				
Coolant				
Each Process Duration				
Machine vibration level				
Fixture details				

## 8.0 GLASS and POLISHING SPECIFICATION

The final glass and polishing to be used for process development and process qualification are given in table below. The glass/polishing to be used for iterative process can be decided by vendor

*Table 3. Glass and polishing specification to be used for Phase I and Phase 11*

<b>GLASS / POLISHING SPECIFICATION</b>	<b>Sub Size Roundel</b>	<b>Full Size Roundel</b>	<b>Qualification Roundel</b>	<b>Remarks</b>
Material	Clearceram/ Zerodur	Clearceram/ Zerodur	Clearceram	Qualification
Scope of Glass procurement	Vendor	Vendor	IIA/ITCC	The final glass for qualification will be provided by IIA/ITCC. If vendors wants to multiple iteration, glass to be arranged by vendor
Polishing Scope	Vendor	Vendor	IIA/ITCC	
Type	Plano-Plano	Plano- Plano	Meniscus	
Diameter (mm)	Not less than 300	Not less than 1500	1520	
Thickness (mm)	45 to 50	45 to 50	46	Uniform thickness (<0.1mm)
Surface finish ( $\lambda$ 633nm)	$\lambda/4$ RMS or better	$\lambda/2$ RMS or better	$\lambda/2$ RMS or better	For final glass to be used for process development
Cosmetic	60/40	60/40	60/40	

## **9.0 PROCESS MONITORING**

- ITCC representative's and/or authorized person(s) shall be entitled to monitor, inspect and/or audit the performance of the development work during the project.
- The supplier shall enable ITCC representative's and/or authorized person(s) to monitor the work and shall provide them with any assistance they require.
- The supplier shall report to ITCC, once in two weeks / whenever requested, on the progress of the work and/or any problems that arise during the work flow and on the steps taken by the supplier to overcome these problems.

- In terms of inadequate progress/performance, IIA/ITCC has rights to terminate the work at any point of the time.

## 10.0 QUALITY CONTROL AND ACCEPTANCE TESTS

- Supplier's quality management system shall conform/be certified to the minimum of appropriate ISO 9001:2000 standard.
- Quality Management System should perform all the work with the highest quality control standards in use, with respect to goods of the same or similar nature and construction.
- The delivery should meet all the requirements as specified in the order and all applicable documents shall pass all Acceptance Test(s), as specified in Table 4.

## 11.0 ACCEPTANCE TESTS

Acceptance test matrix is given below. In addition to the list below all the parameters given in the drawing (Appendix) will be considered for acceptance.

*Table 4. Acceptance tests for Phase I and Phase II*

Description	Requirement on Sub Size Roundel	Requirement on Sub Size Roundel	Requirement on Qualification Roundel	Remarks
Surface deformation due to slicing/machining	< 1/3 $\mu$ m PTV	<1 $\mu$ m PTV	<1 $\mu$ m PTV	
Hexed Surface Finish	Better than 0.4 $\mu$ m Ra	Better than 0.4 $\mu$ m Ra	Better than 0.4 $\mu$ m Ra	
Chip Size	<200 $\mu$ m on Front surface <400 $\mu$ m on Back surface	<200 $\mu$ m on Front surface <400 $\mu$ m on Back surface	<200 $\mu$ m on Front surface <400 $\mu$ m on Back surface	
Profile waviness over the length of slicing	<200 $\mu$ m	<200 $\mu$ m	<200 $\mu$ m	
Tapering	<200 $\mu$ m	<200 $\mu$ m	<200 $\mu$ m	
Length of Cut	At least One	720mm	720mm	

	maximum length			
Bevelling	0.5mm at 45 degree	0.5mm at 45 degree	0.5mm at 45 degree	
Hexing vertex roundness	Refer Drawing	Refer Drawing	Refer Drawing	
Material	Clearceram/ Zerodur	Clearceram/ Zerodur	Clearceram	
Scope of Glass procurement	Vendor	Vendor	IIA/ITCC	
Polishing Scope	Vendor	Vendor	IIA/ITCC	
Type	Plano-Plano	Plano-Plano	Meniscus	
Diameter (mm)	Not less than 300	Not less than 1500	1520	
Thickness (mm)	45 to 50	45 to 50	46	Uniform thickness (<0.1mm)
Surface finish (1 633nm)	1/4 RMS or better	1/2 RMS or better	1/2 RMS or better	
Cosmetic	60/40	60/40	60/40	

**NOTE 1:**

The full size roundel hexing and pocketing drawings (Document number: M1S -001-01000\_H) are attached as a separate PDF file with this document.

**NOTE 2:**

The sub sized roundel hexing and pocketing drawings will be furnished according to the requirements from the vendors.

ANNEXURE-C

Invitation to submit Expression of Interest (EOI) for Process Development of Hex Cutting and Pocketing on polished glass blank for India-TMT.

a)	Name of Company proposed for participation for process development	
b)	Whether it is Govt/public/private sector/Partnership/proprietary firm	
c)	Address with phone/fax numbers	
d)	Name of the contact person: Name: Designation Telephone No. Mobile No. Email Id	
e)	Annual Turnover for the previous three years	1. 2016-17 2. 2015-16 3. 2014-15
f)	Brief Profile of the Company/Vendor	
g)	No. of years of experience in fabrication and handling of precision optics.	
h)	Details of infrastructure available presently and proposed for such a requirement.	

l)	Date of visit to IIA/IIAP for technical discussion :	
j)	Additional information, if any,	

**Authorized signatory with Designation**

**ANNEXURE-D**

**PROOF FOR HAVING PARTICIPATED IN TECHNICAL  
DISCUSSION/CLARIFICATION**

<b>Name of the person</b>	
<b>Designation</b>	
<b>Phone No. &amp; Mobile No.</b>	
<b>E-Mail ID:</b>	
<b>Company name</b>	
<b>Address</b>	
<b>Date of participation for technical discussion/clarification</b>	
	<b>Signature</b>
<b>Countersigned by IIA/ITCC Official</b>	

**This should be submitted along with the EOI document**

## ANNEXURE-E

### EOI SUBMISSION FORMAT

<b>Sl.No.</b>	<b>List of documents to be enclosed</b>	
<b>1.</b>	<b>Cover letter illustrating the Authorized official's signature</b>	
<b>2.</b>	<b>Annexure-C &amp; D duly filled in and signed</b>	
<b>3.</b>	<b>Copies of the Registration/Incorporation certificate PAN No/Income Tax returns for proceeding three years. GSTIN</b>	
<b>4.</b>	<b>Copies of certified audited statement of accounts or separate audited certificates confirming the turnover for the last three years</b>	
<b>5.</b>	<b>Details of Organization structure</b>	
<b>6.</b>	<b>List of relevant experience and capacity (Purchase order/sanction letter &amp; certificate of completion of works</b>	
<b>7.</b>	<b>CVs of Experts and professionals within organization</b>	

<b>8.</b>	<b>Brief report with complete technical details for this EOI</b>	
<b>9.</b>	<b>Any other documents relevant for Assessment and Evaluation</b>	

**ANNEXURE-F**

**EOI Eligibility Criteria**

<b>Criteria</b>	<b>Sub-Criteria</b>	<b>Weightage*</b>	<b>Break-up of Weightage</b>
<b>Past experience of the firm in fabrication and handling of precision optics.</b>		<b>20</b>	
<b>Manufacturing capabilities/tie-ups</b>		<b>20</b>	
<b>Quality accreditations, licensing requirements</b>		<b>20</b>	
<b>Experts &amp; Professionals</b>		<b>10</b>	
<b>Innovation ideas for execution of Phase-II with equipment details</b>		<b>20</b>	
<b>Financial stability of the company</b>		<b>10</b>	

**The bidder who secure minimum of 70 out of 100 shall be eligible next stage of procurement process.**

