

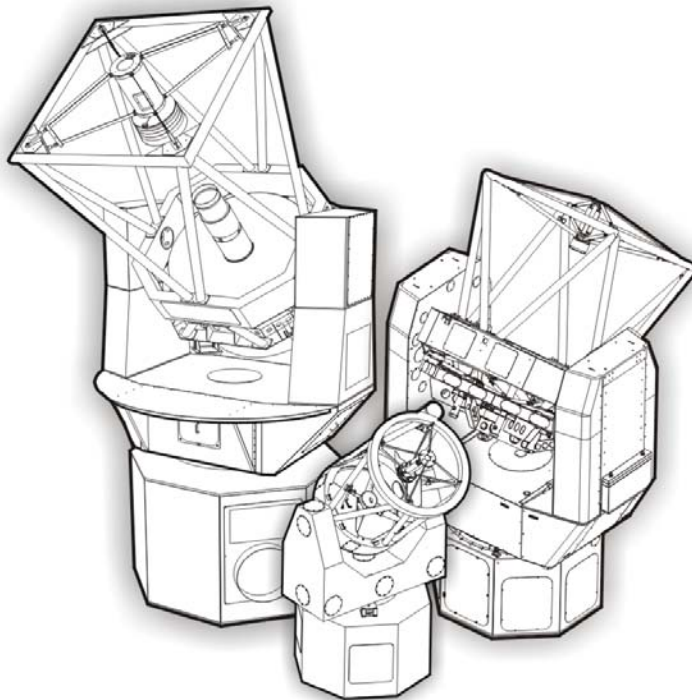
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**EOS Technologies, Inc.**

**2.4 m Telescope  
Primary Mirror Polishing Specification**

**TS-4892-2**



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**DOCUMENT CONTROL**

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1	16 Sep 03	Initial Release	CHS	CHS
2	18 Nov 03	Changed 2.1 to reflect change to mirror blank contract. Changed 5.1 to select Option 1 for polishing.	RLM	RLM

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## 1. GENERAL REQUIREMENTS

This document defines the requirements for grinding, polishing and testing a 2.4 meter diameter concave parabolic mirror for an f/15 Cassegrain telescope.

## 2. MATERIAL SPECIFICATIONS

### 2.1 Mirror Blank

A generated mirror blank shall be provided to vendor for polishing. The blank shall be made from Astrosital with the nominal dimensions of 2400mm diameter and 150mm thick. Note, the attached drawing indicates 2410 mm but has been revised to reflect a change to the mirror blank contract to eliminate a cosmetic defect to the blank.

### 2.2 Blank Dimensions

The blank shall be provided to the polishing vendor as per the attached mirror blank drawing (Appendix A).

### 2.3 Fiducial Marking

The mirror is to have an edge fiducial mark permanently inscribed on the outer edge that will be referenced in all tests. This shall consist of a 1 mm wide radial groove on the surface of the outer edge chamfer.

## 3. SUBSTRATE QUALITY

### 3.1 Subsurface Damage

Prior to polishing the optical surface, the optician will grind in the radius (and any required aspherizing grinding) through a series of successively smaller grits as necessary to remove the subsurface damage from each previous grind.

### 3.2 Bevels

The mirror blank shall have bevels not less than 5mm on the hypotenuse on the inside and outside edges for the front face. The inside and outside bevels on the rear face shall be not less than 2mm on the hypotenuse.

### 3.3 Finish on Non-Optical Surfaces

The finish on all non-optical surfaces (back sides) shall be 120 grit or smoother.

## 4. OPTICAL SURFACE

The polished optical surface (front face) shall be a concave paraboloid with an annular region of optical surface meeting the wave front quality specification (Section 5).

### 4.1 Clear Aperture:

Outer Diameter:	$\geq 2350$ mm
Inner Diameter	$\leq 340$ mm

### 4.2 Location

The optical vertex of the mirror shall be within 2 mm of the mechanical center.

### 4.3 Vertex Radius of Curvature

Vertex Radius of Curvature	$7200 \pm 7$ mm
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### 4.4 Conic Constant

Conic Constant	$-1.000 \pm 0.001$
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## 5. WAVEFRONT ERROR (WFE)

### 5.1 Final Wavefront Quality

The wavefront from the final polished surface, not including scratches/digs, shall have maximum rms WFE over the entire clear aperture as specified in the table below. The maximum peak-to-valley (PV) WFE, based on a sampling described below, are provided for reference purposes only.

Maximum RMS WFE:	50 nm
Maximum PV WFE (reference):	200 nm

Final polishing shall be completed supporting the substrate on the mirror support (to be supplied and fitted by EOSt on vendors premises). The mirror support will be passive, with 27 support points in a whiffle tree configuration. Some pictures of the typical mirror support arrangement are included in Appendix B. The mirror in these pictures is 1800mm diameter.

### 5.2 Surface Smoothness

The surface figure shall be as smooth as possible, free of ripple, zones and local bumps.

### 5.3 Surface Roughness

The mirror surface shall be polished to 20 A rms or better surface roughness to minimize scattered light. The scratch/dig of the surface shall be 60-40 S/D or better. The contractor shall define and perform a testing method for verifying that the surface roughness specification has been met.

## 6. TESTING

### 6.1 Surface Figure Test

The surface figure shall be tested using the following techniques:

6.1.1. Full Aperture Interferometry - The clear aperture of the mirror shall be interferometrically tested at a wavelength of 633 nm using a null corrector to verify that the 98% of the area of the clear optical aperture surface figure meet the peak-to-valley and rms requirements.

6.1.2. Second Test Method - An additional test or certification method is required to verify the radius of curvature and conic constant error that can be caused by the null corrector.

6.1.3. A test to demonstrate that the vertex of the mirror is within 2 mm of the mechanical center.

## 7. TEST SAMPLING AND ACCURACY

### 7.1 Spatial Sampling

The test shall have a minimum spatial sampling resolution of 35 mm on the optic measured perpendicular to the optical axis.

### 7.2 Data Points

At least 98% of the data points contained within the clear aperture must be within the peak-to-valley specification. The points to be excluded plus data dropouts will not exceed 2%.

The remaining 2% of the data shall be randomly distributed over the aperture, and not concentrated in any particular region. The intent is to allow for sampling noise or other random effects, not to allow any particular region to depart from the specification.

### **7.3 Test Accuracy**

The test accuracy for full aperture interferometry, including the effects of null corrector lens, vibration and optical shop seeing must be included in the maximum rms WFE requirement.

### **7.4 Post Spatial Smoothing**

No post spatial smoothing of the surface map is to be allowed other than that provided by averaging of multiple measurements.

## **8. INSPECTION AND REPORTS**

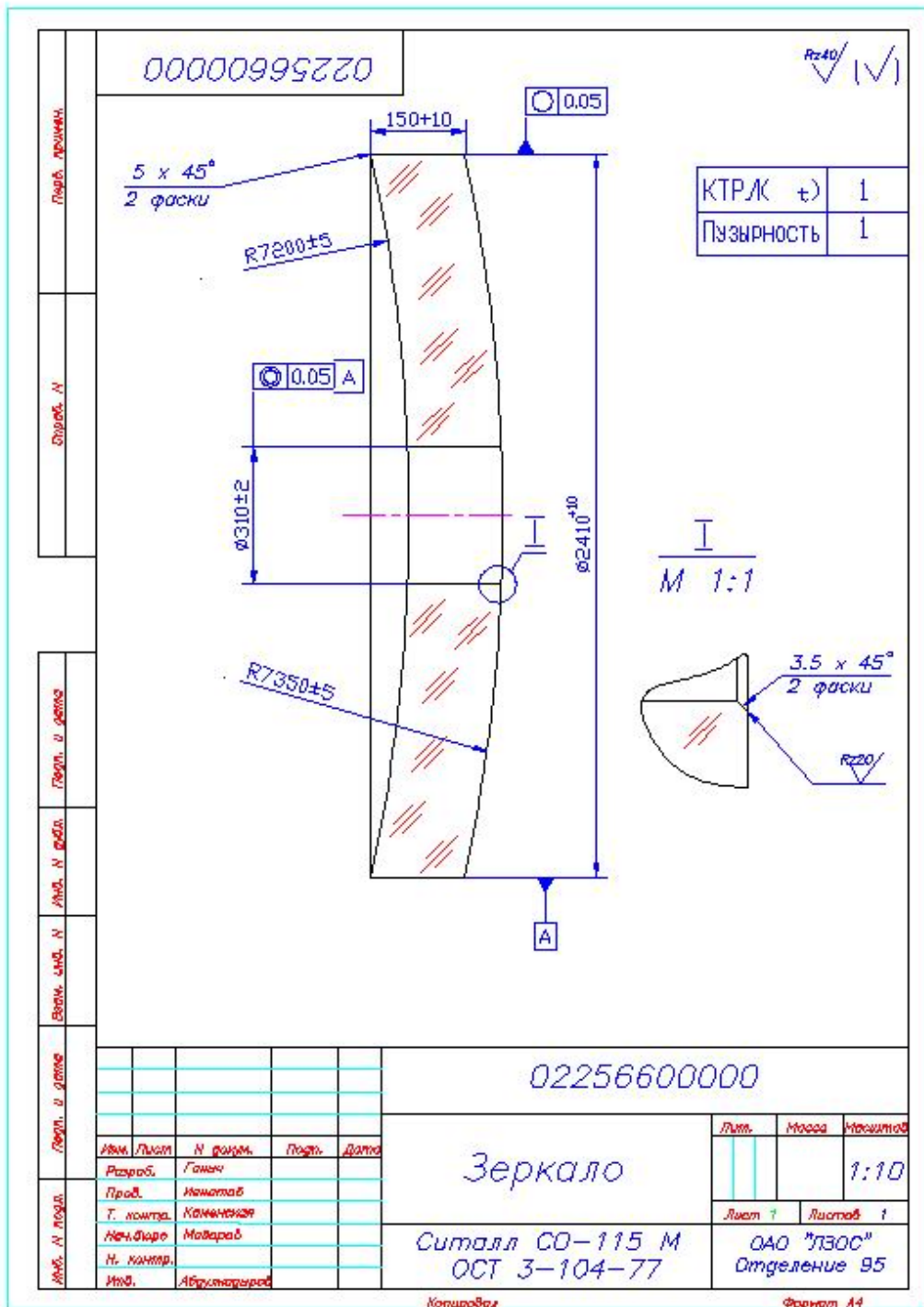
### **8.1 Inspection Map**

The front surface of the mirror shall be examined for surface defects. An inspection map shall be made if live fractures are found. The fractured area will be grayed out with a small hand held grinder to eliminate any chance of the fracture growing. EOST is to be notified of the live fractures before any repair is made.

### **8.2 Testing and Inspection Reports**

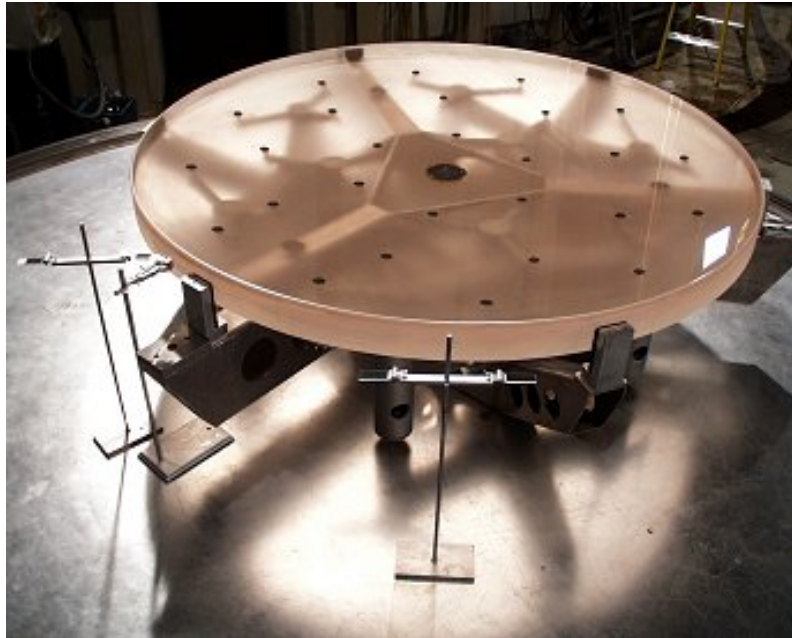
Reports of testing and inspections accomplished per sections 6.0, 7.0 and 8.0 of this specification shall be delivered at the time of delivery of the mirror to EOST.

**Appendix A: Primary Mirror Blank Drawing**

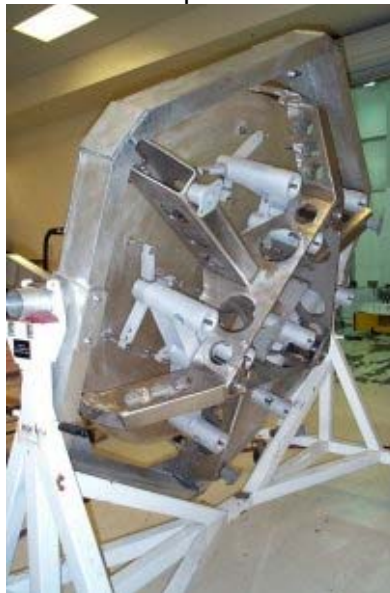




## Appendix B: Mirror Support Arrangement



1800mm mirror on 27 point whiffle tree support.



1800mm mirror on 27 point whiffle tree support in turning cart.