



## COMPONENT SPECIFICATION

# TEL\_PAR PRIMARY MIRROR

APPROVALS:	DATE	REV	DCN NO	BY	CHK	DCC	DATE
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APPROVED:							
DCC RELEASE:							

## 1 SCOPE

This is a specification for the TEL\_PAR Primary Mirror. This concave parabolic primary mirror, together with the convex parabolic secondary mirror, forms an off-axis Mersenne reflecting 8X beam-reducing telescope.

## 2 APPLICABLE DOCUMENTS

- 1) Ligonian VI-B, 8x magnification, 1.3m, LIGO-E980129-00-D
- 2) Ligonian VI-B, Primary, LIGO-D980262-00-D
- 3) MIL-C-675C

## 3 REQUIREMENTS

### 3.1. PERFORMANCE CHARACTERISTICS

#### 3.1.1. Mirror Fabrication

##### 3.1.1.1 Front Surface

Radius of curvature	-3048 mm +/- 30
Conic constant	-1.000 +/- 0.002
Tilt tolerance, reference to back surface	+/- 0.03 deg
Clear aperture	200.7 mm
Edge displacement	108.00 +/- 0.5 mm
Diameter	203.2 +0.0, -0.1 mm
minimum edge thickness	43 mm +/- 1.0 mm
Surface irregularity	<0.25 wave peak to valley@ 633 nm over clear aperture
Surface finish	60/40
Surface roughness	<100 Ang
Surface quality	fine ground, >300 grit

##### 3.1.1.2 Back Surface

Surface quality	fine ground, >300 grit
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#### 3.1.1.3 Mirror Coating 1

Apply to primary and secondary mirror front surfaces

Front surface only

Wavelength 1064 nm

Polarization s

Incidence angle 4 deg

Multilayer dielectric coating, Reflectivity >99.9%

Durability per MIL-C-675C

#### 3.1.1.4 Mirror Coating 2

Apply to primary and secondary mirror front surfaces

Front surface only

Wavelength 1064 nm

Polarization s

Incidence angle 4 deg

Protected Silver, Reflectivity >98%

Durability per MIL-C-675C



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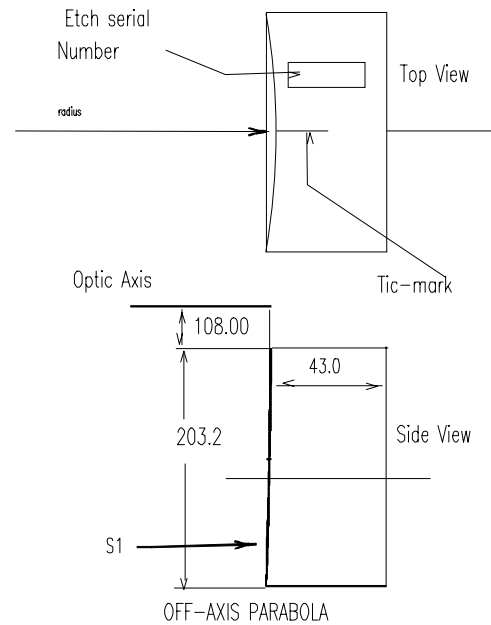
TEL\_PAR PRIMARY MIRROR

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					D980262-00-D					B
	RADIUS	RAD TOL	R	C.A. DIA	EDGE DIA	DIA TOL	EDGE THICKNESS	THI TOL	WEDGE	
S1	-3048	+/- 30	0.25	200.7	203.2	+0.0, -0.1	43.0 min	+/- 150		
S2	INF		/							

NOTES :

- All Dimensions in mm
- Material Zerodur or Fused Silica
- $K = -1.000 \pm 0.002$
- Min Edge:  $43.0 \pm 1.0$
- Parabola tilt:  $\pm 0.03$  deg ref back surface
- Edge displacement:  $108.00 \pm 0.05$
- Surface Finish: 60/40
- Surface Roughness: <100 Ang
- Chamfer edges: 0.25 mm, 45 +/- 10 deg
- Back Surface: fine ground: >300 grit
- Edge tic-mark on nearest optic axis to indicate orientation of mirror  
 $0.24 \pm 0.05$  wide x  $20 \pm 2$  long
- S1 Coating: > 99.9% reflectance @ 1.064 um  
 Durability: per MIL-C-675C  
 Polarization: <s>  
 Incidence Angle: 4 deg
- Etch serial number lettering  
 approximately 4 mm high



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	CHK	M. Smith	06/15/98
	APPD		
	SCALE		
			D980262-00-D
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Figure 1: Fabrication drawing, PO telescope secondary mirror

3.2. DESIGN AND CONSTRUCTION

3.2.1. Materials

3.2.1.1 Mirrors

Substrate material

Zerodur or fused silica



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Edge chamfer

0.25 mm @ 45 deg +/- 10deg

### 3.3. Quality Assurance/Control

#### 3.3.1. Identification

Separate (non-welded) parts and assemblies shall be marked with laser marking or acid etch techniques. A vibratory tool with a minimum tip radius of 0.0005" is acceptable for marking on surfaces which are not hidden from view. Engraving is also permitted.

Separate (non-welded) parts and assemblies to be serialized according to the document titled Part Numbers and Serialization of Detector Hardware, LIGO-L970196. This document allows for "bag-and-tag" type of identification for small parts.

##### 3.3.1.1 Optical Alignment Marks

Edge tick-mark shall be placed to indicate orientation of mirror next to the optical axis:

0.24 +/- 0.05 mm wide x 20 mm +/- 2 mm long.

##### 3.3.1.2 Serial Number

###### 3.3.1.2.1 Optical Serial Number

A serial number identifying a component set of primary and secondary mirrors shall be etched, ground or sand-blasted next to the alignment mark.

###### 3.3.1.2.1.1 Serial Number Format

The Serial number shall be of the format:

E980129-y S/N *nnn-c* Where

E980129-y is the LIGO piece part or assembly drawing number, E980129, including the revision letter, -y, to which the hardware item was built;

*nnn* is the sequential serial number, 001 through 999, in the order produced,

and c=1 describes the dielectric mirror coating, c=2 describes the protected silver mirror coating.

#### 3.3.2. Quality Assurance Provisions

A first article shall be produced and inspected for form, dimensions and workmanship.

#### 3.3.3. Purchaser Access

Non-escort privileges for the buyer, owner, government and owner representatives to all areas of the facilities where work is being performed shall be arranged. This will include access to all areas where material is being processed and stored. The purchaser shall have the right to witness all manufacturing processes.



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#### 3.3.4. QA Approval

LIGO QA reserves the right to inspect and approve vendor/fabricator QA plan and processes.

## 4 TEST PROCEDURES

The telescope mirror performance shall be verified by the following test procedures

### 4.1. WAVEFRONT DISTORTION

Interferogram of transmitted wavefront across clear aperture, @1064nm wavelength

## 5 DOCUMENTATION

- 1) Compliance Certification for items 3.1., 3.2., 3.3., 4.
- 2) Interferogram, See "WAVEFRONT DISTORTION" on page 5.

## 6 ENVIRONMENTAL CHARACTERISTICS

The PO Telescope will operate in a non-vibrational, ultra high vacuum environment, at room temperature (68F,+/-4F).

## 7 HANDLING AND SHIPPING PROCEDURES

### 7.1. Cleaning

Approved cleaning procedures for UHV components are detailed in LIGO-E960022, Vacuum Compatibility, Cleaning Methods and Compatibility Procedures.

#### 7.1.1. Optical Surfaces

All optical surfaces shall be cleaned in accordance with good commercial practice. Nothing shall contact the optical surfaces after cleaning, except for lint-free lens tissue.

### 7.2. Packaging for Shipment

#### 7.2.1. Optical Parts

The cleaned optical components shall be protected with lint-free lens tissue. In addition, all components shall be placed in a sealed, clean polyethylene bag before shipping.



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CONTINUATION SHEET

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The shipping containers must ensure that the bag does not get punctured and that the parts are properly protected during transit.