



COMPONENT SPECIFICATION

TEL_PAR PRIMARY MIRROR

| APPROVALS: | DATE | REV | DCN NO | BY | CHK | DCC | DATE |
|-------------------------------------|---------|-----|--------|----|-----|-----|------|
| DRAWN: MICHAEL SMITH, JONATHAN KERN | 10/6/98 | | | | | | |
| CHECKED: | | | | | | | |
| 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 +/- 0.12 mm |
| Diameter | 203.2 +0.0, -0.1 mm |
| minimum edge thickness | 43 mm +/- 0.5 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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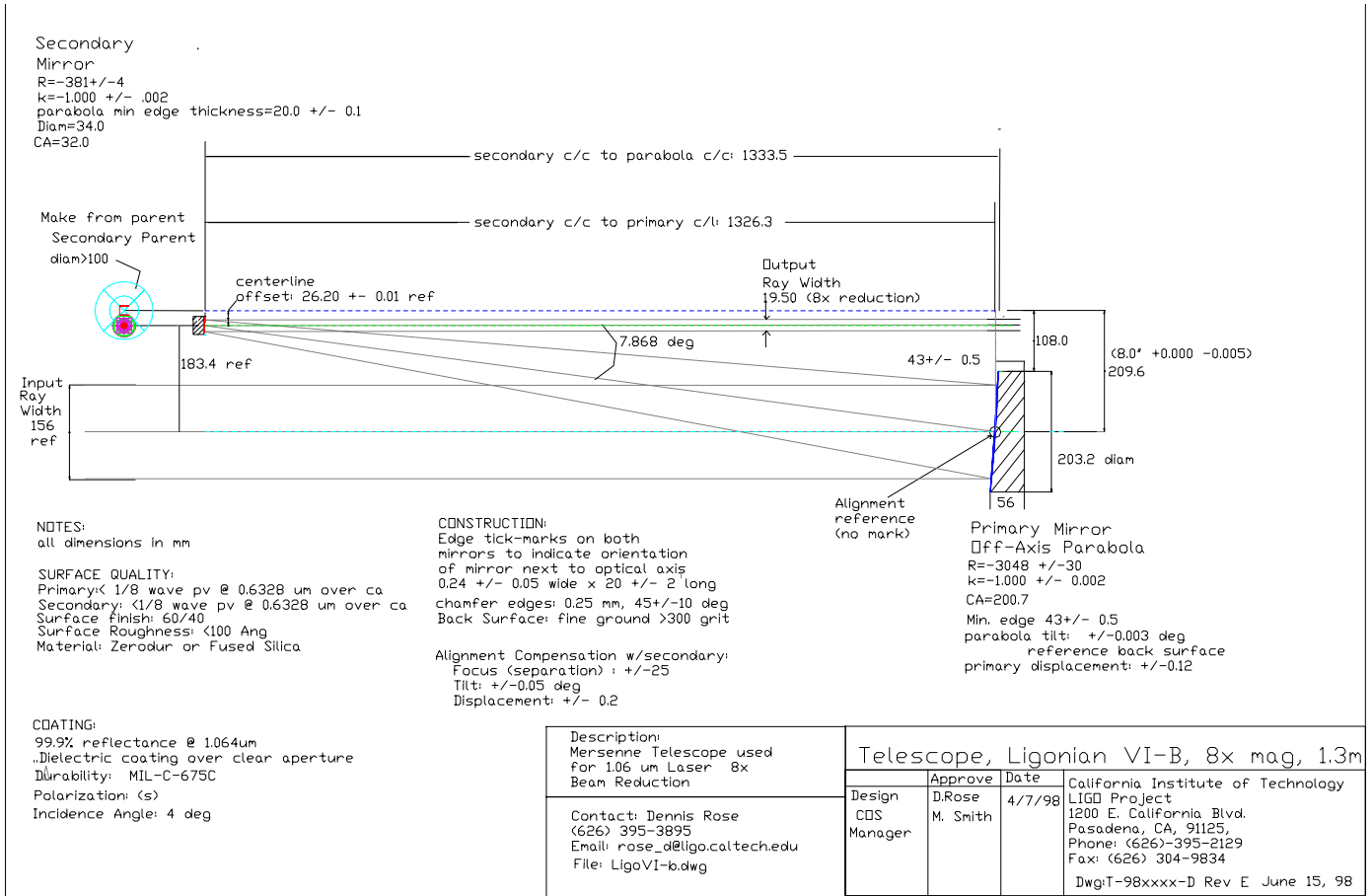


Figure 1: Optical Schematic, PO telescope

3.2. DESIGN AND CONSTRUCTION

3.2.1. Materials

3.2.1.1 Mirrors

Substrate material

Zerodur or fused silica

Edge chamfer

0.25 mm @ 45 deg +/- 10deg



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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.

7.1.2. Mechanical Parts

Mechanical parts shall be degreased in a clean solvent and shall be subsequently cleaned in an ultrasonic bath in the following manner.

- Ultrasonic clean in Alconox (1 tbs to 1 gal water) or Liquinox for 10 minutes
- Rinse in distilled water
- Ultrasonic clean in ethanol for 10 minutes



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- Rinse in distilled water

7.2. Packaging for Shipment

7.2.1. Optical Parts

The cleaned and disassembled optical components shall be protected with 6 layers of lint-free lens tissue. In addition, all components shall be wrapped in UHV quality aluminum foil and placed in a sealed, clean polyethylene bag before shipping, as described in 7.2.2.

7.2.2. Mechanical Parts

Cleaned mechanical parts will be wrapped for shipping as follows:

- wrap the part(s) with UHV quality aluminum foil
- Place each part(s) in a clean polyethylene bag. Optionally use an anti-static bag fabricated from "CP Stat 100(TM) ESD poly sheet cleaned to Class 100".
- Place "PRE-CLEAN PART..." and identification labels outside bag.
- Place the bagged part(s) in an appropriate shipping container, using care to not puncture or cut the bag. Seal the shipping container closed. Attach a label with the LIGO part number (drawing number(s), including revision letter) and serial number(s) to the outside of the container.

The shipping containers must be such that they insure that the bag does not get punctured and that the parts are properly supported during transit.

The CP Stat material is ordered as follows:

CP Stat 100 ESD sheeting cleaned to Class 100 with CFC certification that it passes JPL specifications. At the time of this writing, it is available in various sheet and bag sizes from:

Caltex Plastics, Inc.
P.O. Box 58546
2380 E. 51st Street
Vernon, CA 90058
(213) 583-4140

At the time of this writing, one source for UHV Quality Aluminum Foil is:

ASTM B-479 Dry Annealed A Allfoil
4597 Vanepps Rd.
Brooklyn, OH 44131
(216) 661-0211