



SUBSTRATE, ALIGO STEERING MIRROR

| AUTHOR:                    | CHECKED:     | DATE     | APPROVALS |      |      |
|----------------------------|--------------|----------|-----------|------|------|
|                            |              |          | DCN NO.   | REV  | DATE |
| Rodica Martin, Dave Reitze | David Tanner | 04-01-08 |           | -01- |      |
|                            |              | 04-25-08 |           | -02- |      |
|                            |              |          |           |      |      |
|                            |              |          |           |      |      |
|                            |              |          |           |      |      |

Applicable Documents

- D070097-01-D ALIGO Steering Mirror Substrate
- D070089-01-D ALIGO Steering Mirror Blank

Requirements

Physical Configuration

Fabricate from D070097-01-D ALIGO Steering Mirror Substrate

Serial Number

The Serial number shall be of the format:

SMx-YY-Z Where

x is 1 for half the number of mirrors (6) and 2 for the other half (6)

YY is incremental for each optic starting at 01.

Z is the current revision letter of this specification.

Registration Marks

Registration mark shall be etched, ground or sandblasted coincident with the registration mark drawn on the Blank within 5 mm. The arrow orientation used on the Blank will be preserved if possible or changes reported in detail. Reference D070089-01-D ALIGO Steering Mirror Blank

Side and Bevel Polish

Sides and Bevels shall be polished from a 5 micrometer grit finish. These surfaces shall appear transparent with no grey, scuffs or scratches visible to the naked eye when viewed in normal room light against a black background.

**SUBSTRATE, ALIGO STEERING MIRROR****Scratches and Point Defects:****Scratches**

The total area of scratches within the central 40 mm diameter shall not exceed  $5 \times 10^2$  square micrometers, width times length).

The total area of scratches outside the central 40 mm diameter shall not exceed  $30 \times 10^2$  square micrometers.

**Point Defects**

There shall be no point defects of radius  $> 2.5$  micrometers within the central 40 mm diameter.

There shall be no more than 80 point defects of radius  $> 2.5$  micrometers on the entire surface.

Point defects of radius greater than 25 micrometers are treated like scratches for the purpose of this specification. Average density of defects less than 2.5 micrometer radius must be less than or equal with 1 per  $4 \text{ mm}^2$

**Inspection Method**

1. The surface is examined visually by two observers independently. The examination is done against a dark background using a three-bundle fiberoptic illumination system of 200 W total power. A 100% inspection of the surface is carried out. Pits and scratches down to 2 micrometers in width can be detected using this method of inspection. Any scratches that are detected will be measured using a calibrated eyepiece.
2. Further inspection will be done with a 6X eyeglass using the same illumination conditions, again, with two observers. Slicks down to 0.5 micrometers wide can be detected using this method. The surface will be scanned along one or two chords from center to edge, then at ten positions around the edge, and ten to fifteen positions near the center.
3. An inspection is then carried out with a dark field microscope with a similar sampling frequency as described in section 2.

**Surface Figure, measured over the central 60 mm diameter**

All specified quantities refer to the physical surface of the optic.

**Surface 1: Flat**

Radius of curvature:  $> 80$  kilometers

Astigmatism:  $< 10$  nanometers (surface peak to valley)

**Surface 2: Flat**

Radius of curvature:  $> 80$  kilometers

Astigmatism:  $< 40$  nanometers (surface peak to valley)

**SUBSTRATE, ALIGO STEERING MIRROR****Surface Errors, Surface 1**

All specified quantities refer to the physical surface of the optics.

The following root mean square ( $\sigma_{\text{rms}}$ ) and peak-to-valley ( $\sigma_{\text{pv}}$ ) standard deviation values are calculated from the phase maps which are to be provided with each optics.  $\sigma_{\text{rms}}$  is defined as the square root of the mean of the square of each pixel value.  $\sigma_{\text{pv}}$  is defined as the maximum peak-to-valley deviation. Known bad pixels are excluded from this calculation. The calculation assumes a wavelength of 632.8 nanometer wavelength source.

**Aberrations**

With piston, tip, tilt, power (best fit spherical surface) and astigmatism removed over the central 60 mm diameter aperture:

RMS deviation from flatness < 1/200 wave

P-V deviation from flatness < 1/40 wave

**Microroughness**

$\sigma_{\text{rms}} < 0.05$  nanometers

$\sigma_{\text{pv}} < 2.4$  nanometers

Measured at the following locations:

1. The center of the mirror substrate
2. Four positions equally spaced along the circumference of centered 40 mm diameter circle.

**Surface Errors, Surface 2****Aberrations**

With piston, tip, tilt, power (best fit spherical surface) and astigmatism removed over the central 60 mm diameter aperture:

RMS deviation from flatness < 1/20 wave

**Microroughness**

$\sigma_{\text{rms}} < 1$  nanometers

$\sigma_{\text{pv}} < 5$  nanometers



**SUBSTRATE, ALIGO STEERING MIRROR**

**Table 1**

| Specification                           | Test Method                 | Frequency of Inspection | Data Delivered   |
|---|-----------------------------|-------------------------|--|
| Physical Dimensions                     | Measurement                 | 100%                    | Diameter, Thickness, Bevel dimension, Wedge angle.                                 |
| Side and Bevel Polish                   | Visual Inspection           | 100%                    | Certification  |
| Scratches and Point Defects             | Visual Inspection           | 100%                    | Certification  |
| Registration Mark Location/Orientation  | Visual Inspection           | 100%                    | Certification  |
| Registration Mark Dimensions            | Visual Inspection           | 100%                    | Certification  |
| Identification Location                 | Visual Inspection           | 100%                    | Certification  |
| Identification Serial Number            | Visual Inspection           | 100%                    | Certification  |
| Surface Figure                          | Interferometry              | 100%                    | Surface Map  |
| Surface Errors – Low Spatial Frequency  | Interferometry              | 100%                    | Surface Map  |
| Surface Errors – High Spatial Frequency | High Resolution Surface Map | 100%                    | Surface maps for 3 central locations. Numerical values included with Certification |

Data: For the purpose of all data collection the Registration mark shall be at the top center of the optic.

Format: All Data shall be delivered according to Table 1. In addition to the hard copy the Surface Data shall be delivered on IBM PC compatible disk or via electronic file transfer in ASCII format. Phase difference data shall be in units of nanometers.