

6 in Vacuum Viewport

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1 SCOPE

This is a specification for a 6-inch Vacuum Viewport Assembly, which consists of: 1) a modified 10 inch Conflat adaptor, 2) an O-ring sealed 6.0 in viewport, and 3) a viewport retaining ring.

2 APPLICABLE DOCUMENTS

LIGO Vacuum Compatibility, Cleaning Methods and Qualification Procedures:

[LIGO-E960022](#)

LIGO Vacuum Compatible Materials List:

[LIGO-E960050](#)

3 REQUIREMENTS

3.1 Design and Construction

The conceptual design of the viewport is shown in Figure 1. It consists of a (zero length) 10" Conflat adaptor, a 6" diameter laser-grade window, and a window retaining ring. The seal between the window and the Conflat adaptor interface is made with an O-ring. Additional O-rings or other compliant material are to be used capture the window against the Conflat adaptor.

3.1.1 Conflat adaptor and retaining plate

Material: 304 Stainless Steel

3.1.2 O-ring

Material: Viton or Fluorel. Allowed sources are: Dupont, 3M, Parker, Parco. Vendor to select the grade and size of O-rings; LIGO will clean and bake O-rings prior to assembly according to LIGO specifications.



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3.1.3 Window

Material	Fused silica (Corning 7980 or equivalent)
Diameter	6 inches (nominal)
Thickness	0.75-1 inch
Wedge	< 5 arc minutes
Clear aperture (CA)	5.2 inches diameter minimum
Surface quality	10-5 (over CA)
Transmitted wavefront quality	$\lambda/10$ at 633 nm (over CA)

3.1.4 Anti-Reflection (AR) coatings

All windows are to be AR coated on both sides. Two types of AR coatings are required:

Type I. Dual wavelength	1064 nm: $R < 0.2\%$ for 0-20 deg. AOI, <i>s</i> - & <i>p</i> -polarization 532 nm: $R < 0.3\%$ for 0-15 deg AOI, <i>s</i> - & <i>p</i> -polarization
Type II. Broadband near IR	$R < 0.5\%$ from 800-1080 nm, 0 deg AOI

These R specifications apply to each side of the window. Durability of AR coating should be per MIL-C-675C, Coating Adhesion and Durability, or current compatible standard, to be approved by LIGO.

3.1.5 Vacuum

Helium leak rate: $< 10^{-9}$ std cc/sec

3.2 Markings

The windows shall be marked on their barrel with a vendor part number, including an indicator for AR coating type. In addition, a customer-supplied drawing number and a vendor-chosen serial number shall be etched, or scribed on the assembly at the location indicated in Figure 1.

3.3 Physical Dimensions

The physical dimensions shall be according to D1001678, shown in Figure 1.

3.4 Allowed Materials

All materials shall conform to LIGO document E9960050, Vacuum Compatible Materials List. Liquids containing hydrocarbons or other contaminants, other than the machining fluids specified in E9960050, shall not be allowed to come into contact with the parts. All machining fluids shall be water soluble and free of sulfur, chlorine and silicone.

3.5 Disallowed Materials

The following materials shall not be used: organic materials, vacuum grease, adhesives including epoxy, anodizing, or lubricants.

3.6 Cleaning

The viewport parts must be cleaned per E960022, or the vendor's cleaning procedure after LIGO approval,



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prior to assembly and leak testing. The cleaned (vacuum prepared) assembly shall be kept clean and handled with appropriate care (e.g. gloved hands) during subsequent handling including leak testing and packaging.

4 TEST PROCEDURES

4.1 Visual Surface Inspection Test

Both faces of the viewport shall be free of surface defects when the window is illuminated with a high-intensity light source and viewed in a darkened environment with the unaided eye.

4.2 AR Coating Test

Performance of the AR coatings are to be verified by vendor measurement.

4.3 Wavefront Distortion Test

The transmitted wavefront distortion over the clear aperture is to be measured on the window only (i.e., not the assembled viewport).

4.4 Vacuum Leak Test

The vacuum leak rate shall be measured with a helium leak detector.

5 DOCUMENTATION

1. Interferogram of transmitted wavefront through the window, across the clear aperture
2. Measurement data of the AR coatings
3. Vacuum leak rate
4. Compliance Certification for this specification
5. Calibration certification for the test equipment, as appropriate
6. Material certification sheets for all materials
7. Inspection report
 - o Dimensional verification
 - o Test results
 - o Material list
 - o Inspection test procedures

6 SAFETY

The vendor must provide a structural safety analysis which shows that with worst case part tolerances and minimum fused silica strength the design has a factor of safety of 3.0 (on ultimate stress) under 1 atmosphere loading.

7 QUALITY ASSURANCE/CONTROL

LIGO QA reserves the right to inspect and approve the vendor's fabrication QA plan and processes.

8 HANDLING AND SHIPPING PROCEDURES

The viewport assembly shall be shipped in the assembled condition. The viewport surfaces shall be protected with lint-free lens tissue. The shipping containers must ensure that the parts are properly protected during transit.



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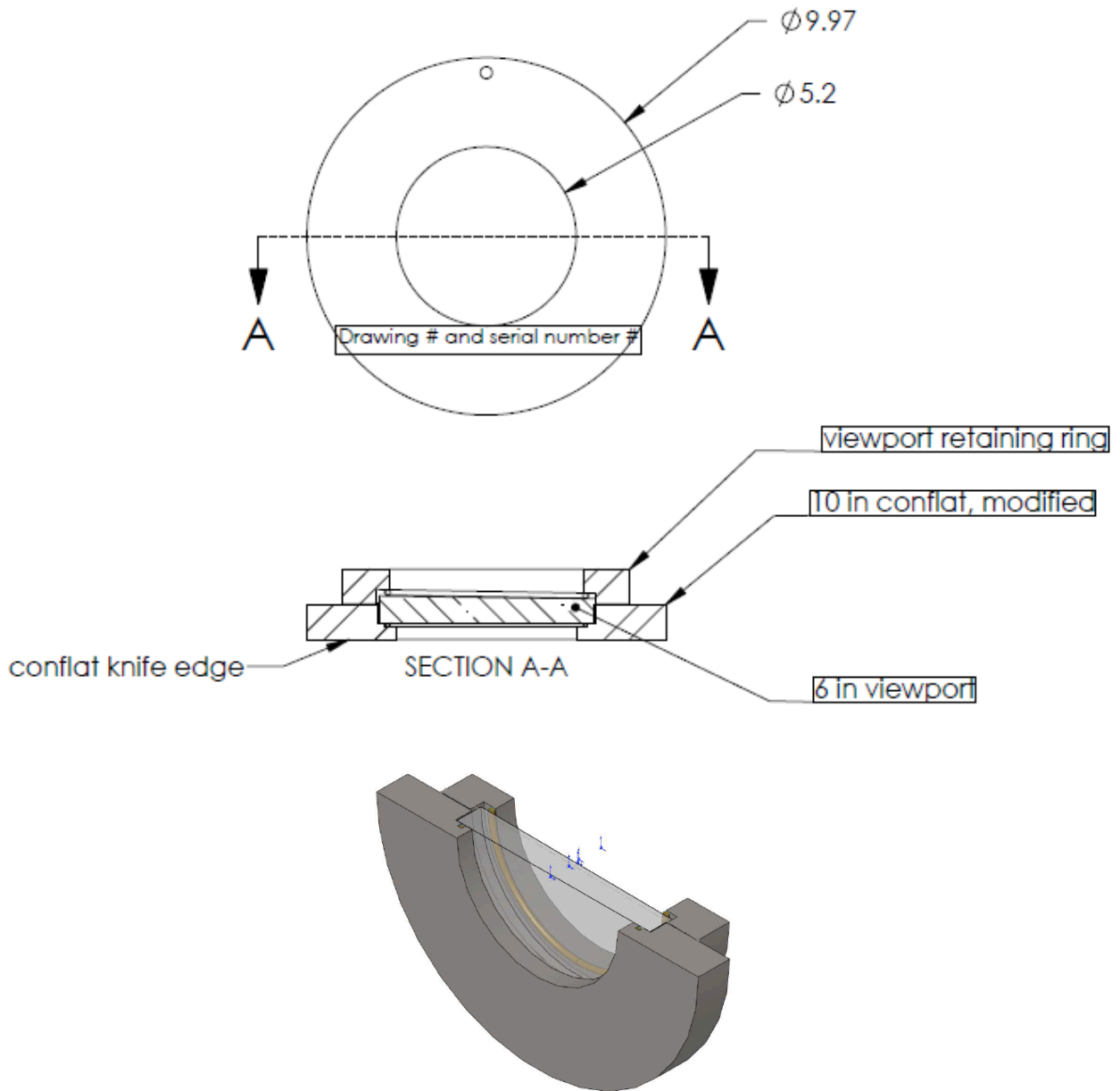


Figure 1: D1001678, 6 in Viewport Assembly