



# COMPONENT SPECIFICATION

## Conflat/Viewports - COS

APPROVALS:	DATE	REV	DCN NO	BY	CHK	DCC	DATE
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## 1 SCOPE

This is a specification for a vacuum flange mounted, fused silica optical window assembly (Conflat/Viewports) which consists of 1) a stainless steel 10' vacuum flange, 2) a vacuum brazed bellows, 3) a fused silica optical window and 4) a removable aluminum cover to protect the exterior surface of the window. These Conflat/Viewports will be used in a ground-based high vacuum environment, as optical input and output windows.

## 2 APPLICABLE DOCUMENTS

### 2.1. LIGO Documents

LIGO-960641-05, Electronic Submissions to the Document Control Center

- [http://ligo.caltech.edu/LIGO\\_web/dcc/docs/L960641-05.pdf](http://ligo.caltech.edu/LIGO_web/dcc/docs/L960641-05.pdf)

LIGO-E960022-03, Vacuum Compatibility, Cleaning Methods and Compatibility Procedures

- [http://ligo.caltech.edu/LIGO\\_web/dcc/docs/E960022-03.pdf](http://ligo.caltech.edu/LIGO_web/dcc/docs/E960022-03.pdf)

LIGO-E960050-A, Vacuum Compatible materials list

- [http://ligo.caltech.edu/LIGO\\_web/dcc/docs/E960050-A.pdf](http://ligo.caltech.edu/LIGO_web/dcc/docs/E960050-A.pdf)

### 2.2. Non-LIGO Documents

MIL-C-675C

## 3 REQUIREMENTS

### 3.1. Performance characteristics

#### 3.1.1. Optical Characteristics

##### 3.1.1.1 General Characteristics

Wedge	30 min. +/- 5 min
Surface Roughness	<0.8 Å (Superpolish)
Unobstructed diameter	3.00 inches
Clear Aperture -	2.75 inches min
Thickness -	.500 inches
Transmissivity across optical aperture	>99.9% at 1060nm and normal incidence



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Wavefront distortion <math>\lambda/10?</math> @ 633 nm wavelength

#### 3.1.1.2 Antireflection Coating

##### 3.1.1.2.1 Type 1 (Provided by REO (Research Electro Optics))

Applied to both surfaces of window optic

Protective overcoating	$SiO_2$ overcoat on outside surface
Polarization	S
Wavelength	1064 nm
Incidence angle	5.3 deg
Transmissivity per surface	>99.9%
Durability	MIL-C-675C

##### 3.1.1.2.2 Type 2

Applied to both surfaces of window optic

Protective overcoating	$SiO_2$ overcoat on outside surface
Polarization	S
Wavelength	1064 nm
Incidence angle	5.3 deg
Transmissivity per surface	>99.6%
Durability	MIL-C-675C

#### 3.1.2. Mechanical Characteristics

##### 3.1.2.1 Flange Configuration

Standard 10" conflat (see 1)

##### 3.1.2.2 Protective cover

An aluminum cover, of at least 0.250" thick and 5.5" diameter shall be provided to protect the exterior surface of the window. A pattern of six #8-32 x 0.500" deep blind holes shall be provided surrounding, and concentric with the off axis window (see 1), for attaching the cover. This cover shall be machined flat on one surface, to mount to the stainless steel flange without a gasket, and relieved if necessary, to clear the face of the optical window by >0.040 inch.

### 3.2. Design and Construction

#### 3.2.1. Vacuum compatibility

Assembled device shall be compatible with ultra high vacuum practice. All metal to metal welds shall be TIG, or MIG machine welded. No obvious asymmetries or weld metal buildup shall be obvious in a visual inspection



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conducted from 16 inches. Proper welding current and component cooling shall be selected so that no discoloration, or other evidence of overheating is visually evident from the same distance

#### 3.2.2. Materials

##### 3.2.2.1 Windows

Material - Optical grade "A" fused silica (Hereaus Infrasil 301-A, Herasil 1-A, Suprasil 311-A, Suprasil 312-A)

- A substitution of any other window material must be approved by cognizant LIGO personnel.

##### 3.2.2.2 Window assembly

Assembly	braze alloy to be 97.5% lead, 2.5% silver alloy
Edging	edge chips shall not exceed 10% of the total perimeter, or be larger than 0.03" max width.
Location	center of optical window placed 0.95 inches from the center of the conflat flange (see 1).

##### 3.2.2.3 Flange

Material - Typ 304 low hydrogen Stainless Steel

##### 3.2.2.4 Allowed material:

- LIGO Vacuum Compatible materials specified in LIGO document E960050-A-E  
[http://ligo.caltech.edu/LIGO\\_web/dcc/docs/E960050-A.pdf](http://ligo.caltech.edu/LIGO_web/dcc/docs/E960050-A.pdf)

##### 3.2.2.5 Disallowed Materials:

Do not use: organic materials, elastomers, vacuum grease, adhesives including epoxy. No anodizing, lubricants or elastomers are permitted during manufacture, and all machined parts must be machined dry (no coolants, except water).

##### 3.2.2.6 Cleaning and packaging procedure

###### 3.2.2.6.1 Optical window

After receiving antireflection coating, no object will be permitted to contact either surface of the window, except for lint-free lens tissue. Both surfaces of the optical window shall be protected with at least 6 layers of lens tissue before packing for shipment to Caltech. Optic and flange shall be cleaned and packaged in accordance with good commercial practice.



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#### 3.2.3. Marking

#### 3.2.4. Part Number/Serial Number

A serial number shall be etched, ground or sandblasted on the side of each conflat/viewport. The serial number shall be of the format WND-PO-XX-Z, where

- XX is incremental for each conflat/viewport, starting at 01
- Z is the current revision letter of this specification

## 4 TEST PROCEDURES

### 4.1. Optical window

#### 4.1.1. Visual Surface Inspection Test

Both surfaces of the optical window shall be free of visible stains and surface defects, when the window is illuminated with a high-intensity lightsource and viewed in a darkened environment with the unaided eye.

#### 4.1.2. Transmissivity Test

Transmissivity through the clear aperture shall be measured with a collimated laser beam, 1064 nm wavelength. The beam diameter shall fill the clear aperture when making transmissivity measurements.

#### 4.1.3. Wavefront Distortion Test

Wavefront distortion over the clear aperture shall be measured at 633 nm wavelength with an appropriate interferometer.

### 4.2. Flange and seals

#### 4.2.1. Visual inspection

No obvious asymmetries or weld metal buildup shall be evident and no discoloration shall be visible in a visual inspection conducted from 16 inches.

#### 4.2.2. Ultrasonic cleaning Test

The conflats/viewports shall yield no visible debris in an ultrasonic bath after a single cleaning, done in the following manner.

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



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#### 4.2.3. Q-Tip test

The conflats shall yield no debris or visible contamination to a manually applied Q-Tip wipe, following the Ultrasonic cleaning procedure (4.2.2.).

#### 4.3. Vacuum tightness test

No leak shall be detectable on Helium Mass Spectrometer leak detector with sensitivity of  $2 \times 10^{-10}$  std. cc/sec

## 5 DOCUMENTATION

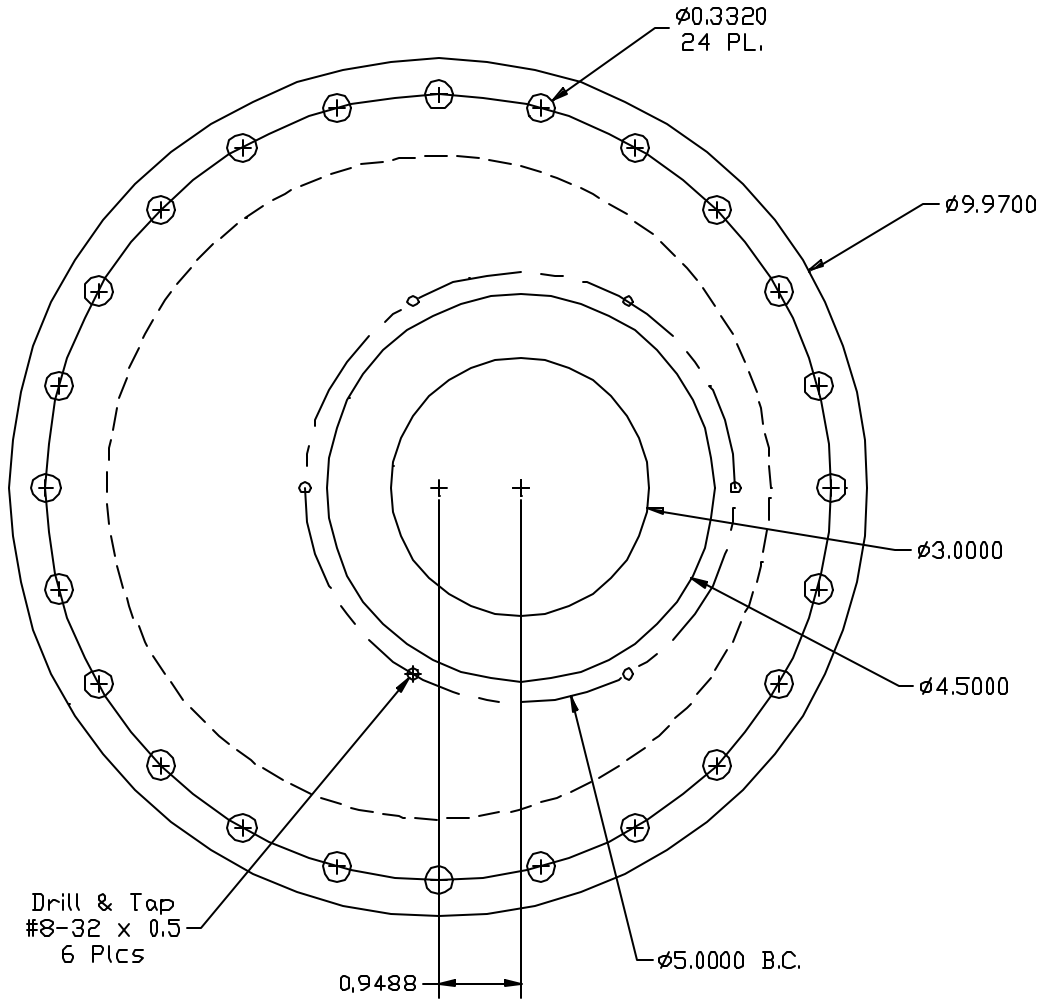
- 1) Interferogram of transmitted wavefront across clear aperture
- 2) Transmissivity through clear aperture
- 3) Results of Helium leak test
- 4) Compliance Certification for this specification



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### 6 CONFLAT PLAN



**Figure 1: Conflat Plan**