



LASER INTERFEROMETER GRAVITATIONAL WAVE OBSERVATORY

*LIGO Laboratory / LIGO Scientific Collaboration*

LIGO-E1300854-v3

*LIGO*

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*ISC Custom Optics: Acceptance Documentation*

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of the LIGO Laboratory.

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## 1 Requirements documentation

An overview of the general requirements set to guide the purchasing of the ISC custom optics can be found here: [LIGO-E1300857](#). The basic summary is that all in-vacuum optics have been made using super-polished (or nearly so) substrates and ion-beam sputtered coatings, in order to minimize scattered light and ghost beams. The other design principle was to provide adequate optical apertures (based on experience).

This approach led to the in-vacuum optics generally being custom made. The specifications given to the vendors are referenced below.

## 2 Design overview and detailed design documentation

a) *Final Design Document (FDD)*: The design specifications for all ISC custom optics are collected in the DCC file card:

<https://dcc.ligo.org/LIGO-E1100064>

b) *Review reports*:

- FDR report: LIGO-T1000334-v1
- The FDR report made one recommendation with regards to procurement of optics (sec. 1.2), which was to develop a procurement plan for the custom optics so that orders could be placed by fall 2010. This was done.

c) *Supporting design documents*: The DCC tree node for ISC custom optics is:

aLIGO Document Tree > aLIGO, ISC > aLIGO, ISC, Optical and Opto-Mechanical Components & Assemblies > aLIGO, ISC, Custom Optics: [LIGO-E1300856](#)

d) *Drawings*: not relevant

e) *Bill(s) of Materials (BOM)*: not relevant

f) *Interface control*: none

g) *Software*: not relevant

h) *Design source data*: not applicable

## 3 Materials and fabrication specification

No special materials or fabrication specifications

## 4 Parts and **in-process** spares inventoried

The inventory of ISC custom optics is found in (& linked in the DCC tree): [LIGO-E1300858](#)

All ISC custom optics are entered into ICS, using the optic's E-number specification as the drawing#/key; e.g., *E1100048-v1-00-0904* is a 2-inch HR, 1064 nm.

The task of indicating in ICS those optics that are installed in assemblies is in progress (at each observatory), but not complete as of this writing. Also, updating ICS entries to indicate optics that have visible damage/defects is a work in progress.

Spares of all optics were procured, both to supply in-process spares and to have optics available for inevitable changes to the ISC detection table layouts. The spare count is given in the inventory spreadsheet, [LIGO-E1300858](#).

We also procured 21 wedged 2" substrates (uncoated), to have on hand for turning into coated optics as needed (to avoid the substrate delivery time of ~6 months). These are listed in the BOM referenced above (but are not put into ICS, until coated).

Note that we are also re-using some initial LIGO optics (2", 1064nm): HRs; 50/50's; 90/10's. These are included in the inventory spreadsheet and the optic specifications file card.

## 5 Assembly procedures

Optics used in-vacuum are cleaned according to the procedures given in [LIGO-E1100439](#), and the procedures referenced therein. In particular, some of the ISC custom optics have ground glass edges, which are cleaned according to [LIGO-E1200266](#). Optics that have been cleaned, but not necessarily installed, are indicated as being 'cleaned' in ICS.

Storage: Optics that have not been cleaned are kept in their original vendor containers. Optics that have been cleaned, but not installed, are stored in Empire West Safe-Guard PET-G containers.

## 6 Installation procedures

Procedures for installing optics in optics mount depend on the mount itself. As several optics mounts are used in Advanced LIGO, a detailed procedure will be provided together with documentation of the optical table layouts.

## 7 Test documents

Vendor provided test data are included in the DCC specification file card. Any LIGO-generated measurements are included in the same card. E.g.: [LIGO-E1000671](#), contains both vendor (ATF) and LIGO (Keita/Corey) data.

## 8 User interface software

Not applicable.

## 9 Operation Manual

Not applicable.

## 10 Safety

Not applicable.