

Advanced LIGO Large Optics Handling and Shipping Procedures

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1 Scope

The Advanced LIGO Optics need to be handled and shipped with extreme care to ensure that the delicate optical surfaces are not degraded.

A special aluminum box (mirror carrier) and shipping case have been manufactured and procured for storage and transportation.

This document is a guide on the steps to follow to unpack the substrate, remove it from the aluminum mirror carrier and re-pack the optic for shipment or storage.

2 Receiving

The substrate is shipped in a high impact, shock absorbing shipping container.

The container is fitted with casters and a pull handle.



It is recommended to move the case on its wheels for only short distances. Remove the lid by twisting the latches.

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3 Unpacking the mirror carrier

To remove the mirror carrier from the shipping container pass a strap through the aluminum case's handles and while one person holds the shipping container the other should lift the aluminum box out of the orange shipping case with the aid of a mechanical lift.

Inside the orange container are the necessary special tools to remove the mirror from the box.



Carefully wipe clean the aluminum carrier with a dry clean room, lint free cloth. Take the aluminum mirror carrier to the processing area.

4 Removal of the optic from the aluminum carrier

Minimize travel of the optic when unprotected.

The aluminum box should only be opened in a clean room environment by knowledgeable clean room personnel.

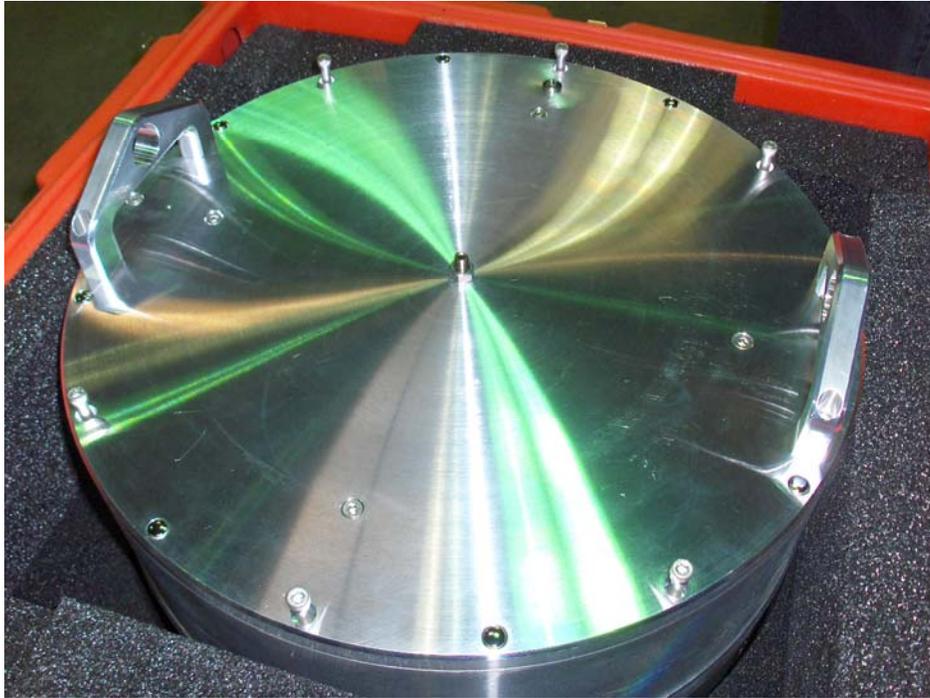
NOTE: if mirror case is empty skip steps 2 and 3

1. Slowly, using a 5/32 hex key, unscrew the vent screw on the carrier cover.
2. Loosen nut that is in the middle of top (counter clock wise)
3. Turn set screw counter clock wise until you feel the retaining disk inside make firm contact with the top. This is the retaining disk and o-ring that secures the mirror in place.
4. Remove all the screws securing the top (6 screws), except the screws under the handles. (2 screws).

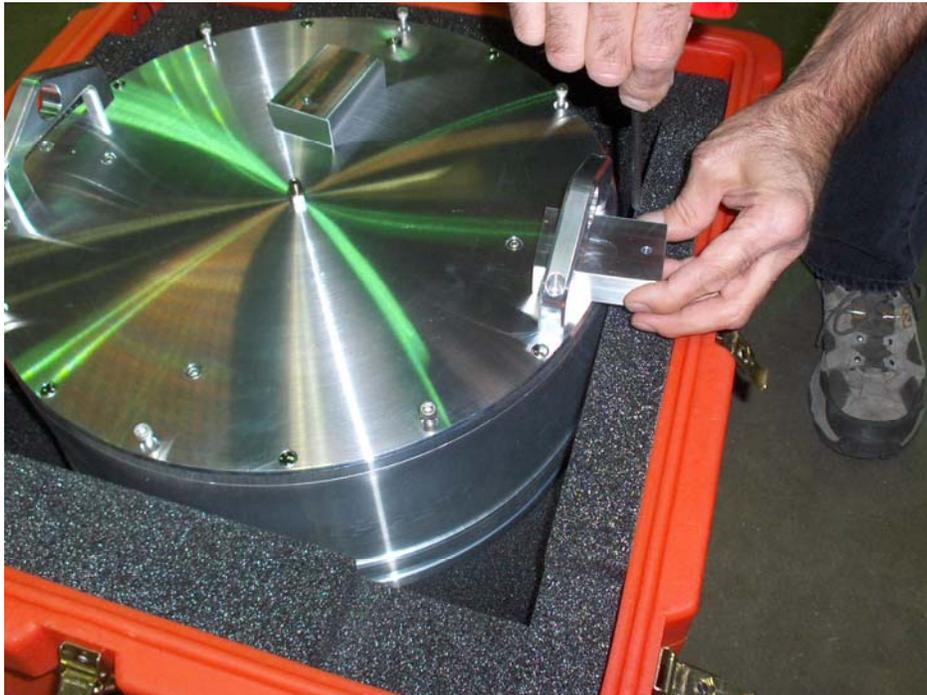


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5. Slide the blocks under the handles with the bearing side down, and the hole toward the outside of the cover.

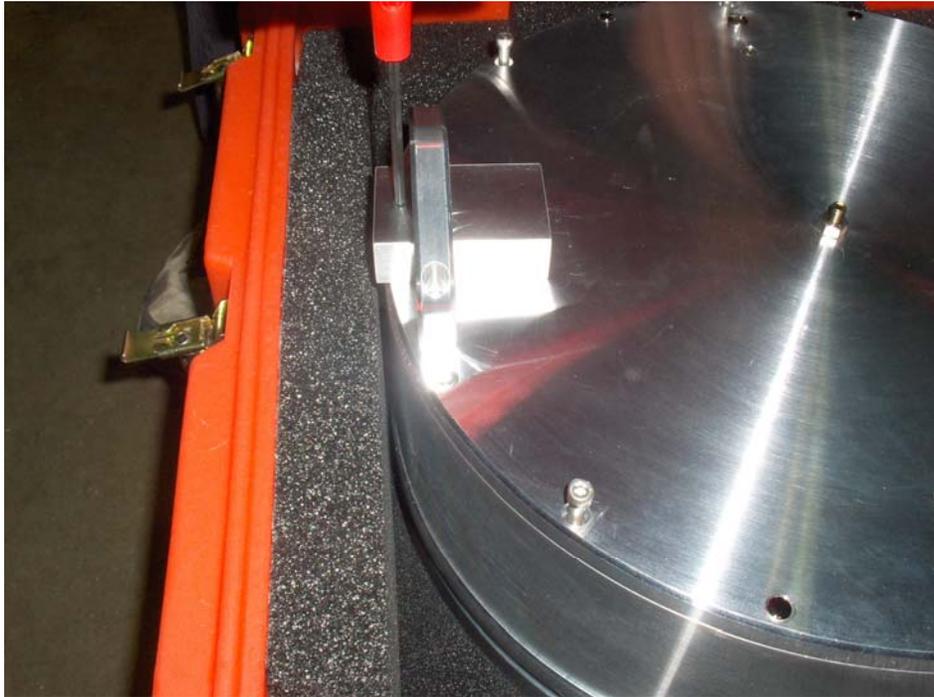




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- 6. Position the hole over the head of the screw, and place the wrench through the hole, and engage the screw; do this with both blocks.



- 7. Turn both wrenches **COUNTER** clock wise at the same time, until the cover just pops open.
- 8. Now turn both wrenches **CLOCK** wise until the screws just touch the case again. This is done so the block can be removed.
- 9. Remove the wrenches, and blocks.
- 10. Remove last two screws, and pull top off.





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5 Placement of the substrate into the carrier

Before placing the optic into the carrier, wipe all surfaces of the aluminum box with a clean room wipe.

When placing the top back on

1. Make sure that the retaining disk/o-ring has been backed off and is lightly resting against the inside of the top, so there is no movement.
2. Put screws in top, and use the screws to align the top before dropping it all the way down. (it will not turn easily when it is resting on the o-ring).
3. Tighten the eight screws that retain the top.
4. Loosen locking nut in middle of aluminum box, and turn set screw clock wise until retaining disk/o-ring makes full contact with optic.
5. Turn screw an additional 1/4 turn clock wise.
6. Turn locking nut clock wise to lock the screw into place.
7. Place the aluminum mirror carrier inside the shipping case.
8. Replace and latch the lid on the shipping container.