Advanced LIGO Coating Research

Overview of Optics Handling and Cleaning Procedures

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Mirror Cleaning Requirements

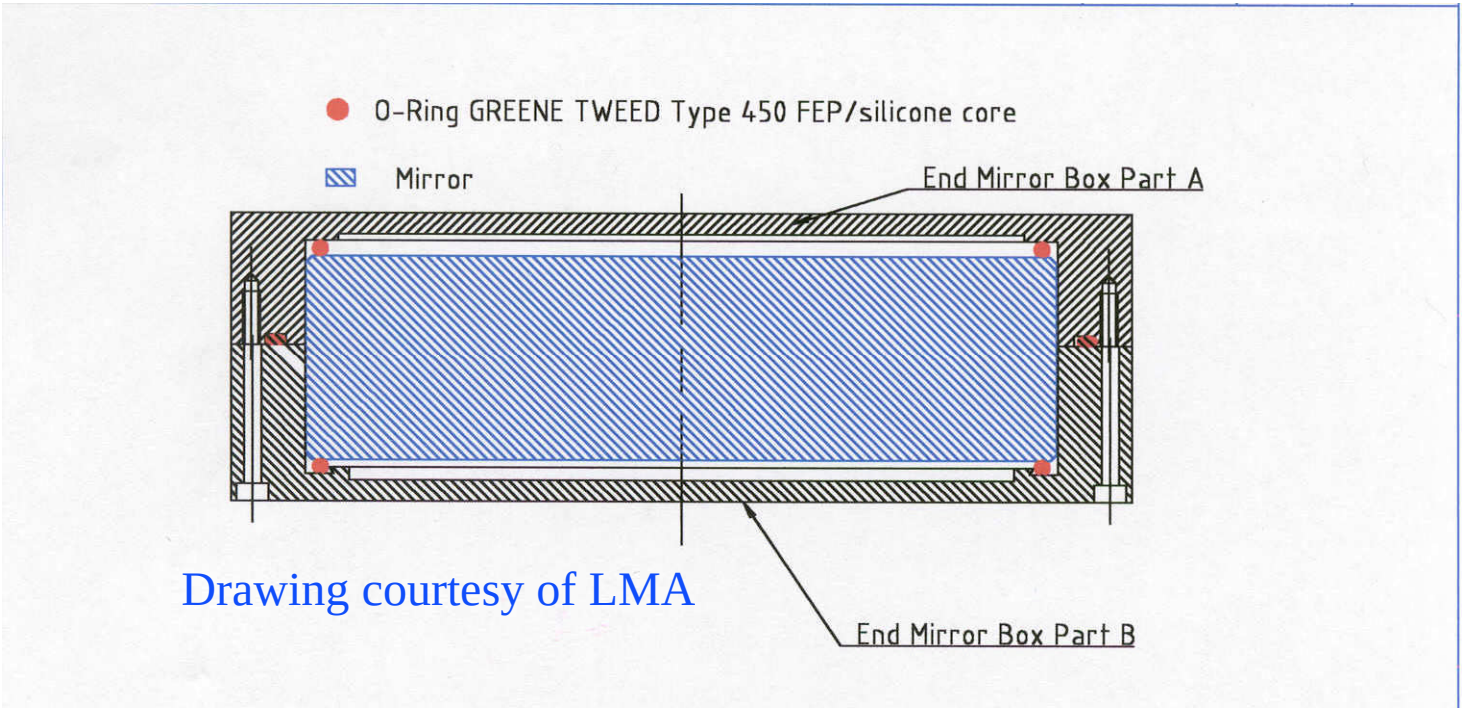
Adv. LIGO optic's surface cleanliness requirements will be more stringent than LIGO I

Mirror Handling Procedures

Proposed Adv. LIGO Mirror Storage Case

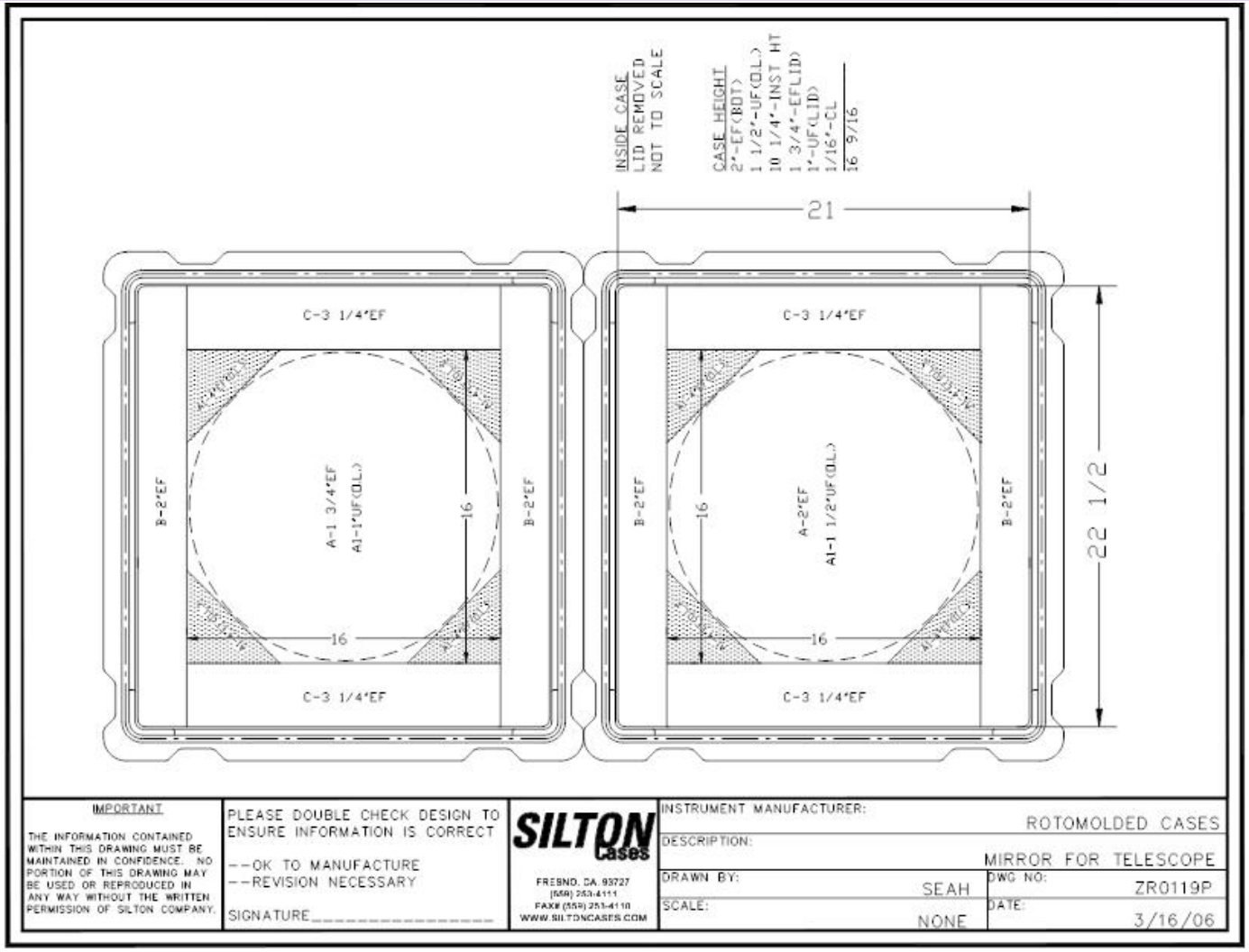
Storage cases will be a modified version of the one shown

Mirrors must remain covered as much as possible.

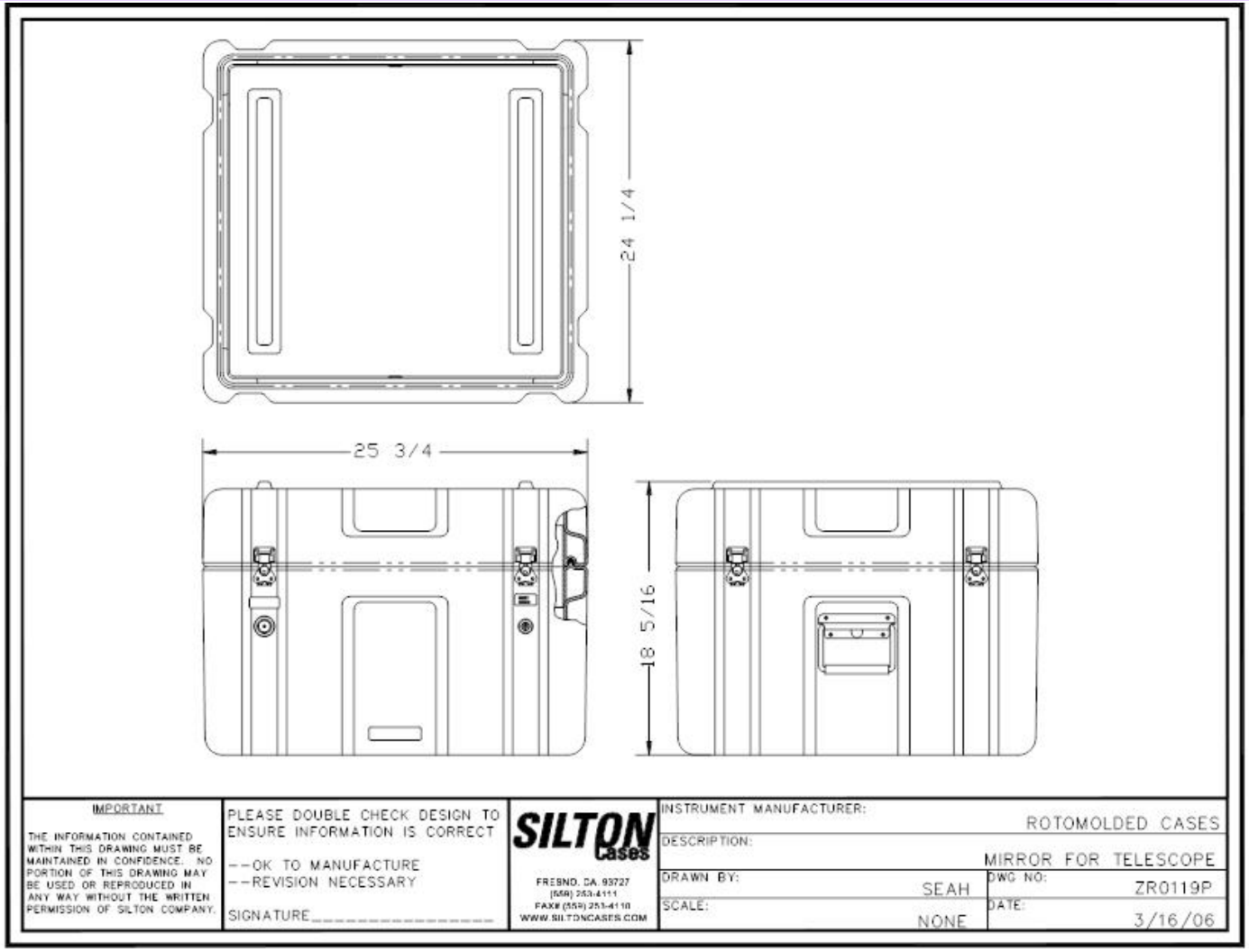


Drawing courtesy of LMA

Proposed Adv. LIGO Mirror Transit Case



Proposed Adv. LIGO Mirror Transit Case



Use of Vacuum Caps

While cleaning mirror flats, before “ear” attachment, the surfaces will be protected with vacuum caps

Vacuum caps used in GEO

Protection During SUS Assembly

Mirror covers are part of the SUS catcher. They are used during ribbon / fiber welding

Adv. LIGO Mirror Cleaning

Cleaning Objective:

To remove any contaminants present on the mirror surface.

Must identify the nature of the contaminant.

After coating, the main contaminants, when the mirrors are kept in the proper environment, are dust particles and hydrocarbons from the air.

Mirror Cleaning

After a careful evaluation of different cleaning methods (custom 5 station cleaning system, megasonics, UV laser cleaning, etc…) we concluded that cleaning needs to take place after all assembly processes are finished, including welding of the fibers, and immediately before the suspensions are installed.

A manual wipe with high purity methanol is suggested. Preliminary tests on scatter measurements done at Caltech and absorption measurements done at Stanford suggest that the process is promising.

More testing remains to be done.

Another Alternative

A new alternative being researched is the use of an strippable coating: “First Contact”

The solution goes on a in a liquid form and dries in a short time to an elastic film. A peel tab is then used to pull off the film. Particles and organic residues are removed.

A paper from Jean Bennett and Daniel Rönnow in

Applied Optics, June 2000 states that: no residue that produced scattering was found on a slicon wafer after treatment with Opticlean (now First Contact)

JPL – FTIR Testing
Ref.: T060051-00

"First Contact" was applied to a glass surface pre-cleaned and tested to a level of less than 0.01 micrograms per square centimeter of molecular residue.

After the film was removed, the surface showed less than 0.02 micrograms per square centimeter of molecular residue.

A 1.0 microgram per square centimeter level is a 10-nanometer average film thickness (density of 1.0).