



# MULTIPLE MIRROR TELESCOPE OBSERVATORY

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MMT Secondary and Tertiary Puck Repair

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Whenever the secondary or tertiary finger assemblies come loose from the mirror puck (except by decementing) some glass is pulled off the side and top edge of the puck and remains cemented to the fingers. If enough glass is missing, the finger assembly will not seat on the puck properly. This memo describes a method for filling these holes with a material strong enough to support the cemented fingers. To date, three pucks have been repaired by this method and no problems have developed. These repairs were fairly recent, however, so that the method hasn't yet passed the test of time.

The filling material is trademarked Torr Seal, a high vacuum epoxy made by Varian, Inc. Tests have shown that it sets to the required hardness and will hold the metal fingers with the same cement currently used with the finger assemblies (Summers Laboratories Lens Bond RD3-74). Torr Seal has three properties that distinguish it (for this application) from regular (household) epoxy: 1) hardness when set, 2) it can be easily sanded smooth, and 3) it can be formed or smoothed before it sets using ethyl alcohol (with no apparent degradation). Its only drawback (that limits its applicability) is a higher coefficient of expansion with temperature than that of glass (by a factor of 10). This effect is probably not important in filling the shallow holes on the surface of the puck but would preclude its use in deep holes.

Some physical properties of Torr Seal (as obtained from Varian, Inc.) are:

Linear Expansion (30 - 90°C) =  $30.3 \times 10^{-6}$  inches/inch/°C  
(inches of expansion per inch of Torr Seal)

Flexural Strength = 11,000 psi  $\pm$  20%

Linear Shrinkage (25°C) = .00125 inches/inch

Compressive Strength = 10,000 psi  $\pm$  20% (25°C)

Thermal Conductivity =  $10.4 \times 10^{-4}$  cal/sec/cm<sup>2</sup>/°C/cm

The items required are:

1. Two clean steel strips of length equal to the circumference of the puck and width of about 1 inch. One should be bent to shape around the puck and other bent around the first forming two rings. (These already exist for both size pucks and are in the IR Lab).
2. One or two large hose clamps that will fit over the puck and both steel rings.
3. Beeswax or paraffin, heatgun, Torr Seal, applicators, razor blade, acetone, ethyl alcohol, and TCE (Trichloroethylene).

The procedure is:

1. Clean the puck surface (including the holes) and the steel rings with acetone.
2. Rub the inside of the steel ring that goes against the puck with wax. Heat it and the wax with the heat gun to ensure a smooth, uniform coat. The wax keeps the Torr Seal from sticking to the steel.

3. Mix the Torr Seal and fill the holes leaving some excess but as little as possible. Don't try to fill holes on the edge of the puck after the steel rings are mounted (except as touch-up). It is often difficult to fill them completely when this is the case. Excess Torr Seal that gets on the surface where it is not needed can be removed with paper towels and ethyl alcohol.
4. When the holes are filled, wrap the wax coated steel ring carefully around the puck so the edge rises a bit above the edge of the puck. The seam that is created by the two ends of the strip should be located where there are no holes or Torr Seal.
5. Wrap the second steel ring around the first leaving its seam in a different location.
6. Put the hose clamp in a central location around both rings and tighten.
7. Touch up the top surface of the puck (if there were holes on the edges) using Torr Seal, ethyl alcohol, and a razor blade as needed. The idea is to make the repairs flush with the surface.
8. Let set overnight.
9. Dismantle.
10. Clean the puck with TCE and paper towels several times to remove any wax. Also, clean the wax from the steel ring.
11. Sand until the repairs are flush with the surface, final sanding should be done with 400 grit sandpaper.
12. Wipe off the surface with acetone.

The finger assembly can now be mounted in the usual manner.

NOTE: If repairing a puck that already has Torr Seal in it, remove as much as possible by filing, scraping, gouging, and sanding. Low heat from the heat gun may also be helpful. The existing Torr Seal may not have to be removed unless it has been subjected to heat or decementing agent while removing the finger assembly.