



# First Contact Pour and Brush Application and Removal Procedure

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## Table of Contents

- 1 Objective.....1
- 2 Supporting Documents.....2
  - 2.1 Applicable to Installation and Cleaning of aLIGO Optics.....2
  - 2.2 Background information on the use of First Contact .....2
- 3 Materials .....2
  - List of required materials, manufacturer and part number:.....2
  - 1. Red First Contact, Photonic Cleaning Technologies Part# RFCL for 1 Liter.....2
- 4 Brush/Pour Applications of First Contact.....3
  - 4.1 Brushing on First Contact .....3
  - 4.2 Pouring on first contact (Horizontal optic) .....4
  - 4.3 Brush on Application for Small Optics (≤2” diameter).....5
- 5 Removal of dry first contact .....5

## 1 Objective

This document explains the pouring and brushing procedures for applying first contact (fc), as well as how to remove the dried film. This document serves as an alternative procedure For applying to suspended in chamber optics, please see [E1300017](#).

Important Reminders on First Contact:

1. First Contact comes in a couple different colors. Use the red polymer first contact only. It is easier to see and apply, and comes off of coated optics more readily. The **clear and red polymer solvents and thinners are not compatible, do not mix them.**
2. Isopropanol and Methanol **are not compatible** with first contact, wet or dry.
3. If the dry fc is difficult to remove, or comes off in more than one piece, pour/spray/brush more onto the optic and let the whole layer dry for easier removal.
4. Do not exceed 30psi going to the ion gun, the filter may burst.
5. Photonic Cleaning Technologies has informed us that red first contact will fade to orange or clear if stored for prolonged periods in bright light or high temperatures.
6. First Contact has an expiration date of one year from date of purchase.



## First Contact Pour and Brush Application and Removal Procedure

### 2 Supporting Documents

#### 2.1 Applicable to Installation and Cleaning of aLIGO Optics

LIGO-E1300017: [First Contact Spray Application Procedure](#)

LIGO-E1000079: [First Contact Wipe and Pour Application Procedure](#)

LIGO-E1200266: [Cleaning Ground Glass with Freon](#)

LIGO-T1100286: [Methanol Soak/Rinse Cleaning Procedure](#)

LIGO-T1200321: [Guidelines on Protecting the Optics in Chamber](#)

LIGO-E1201035: [Chamber Entry & Exit Guidelines](#)

LIGO-T1100559: [First Contact Kit Materials List](#)

#### 2.2 Background information on the use of First Contact

E1000128 First Contact FTIR, 2010

T0900438 LIGO vacuum qualification of First Contact

T1000137 Drag Wiping and First Contact Tests

T1000425 First Contact Hazard Analysis

T060161 FTIR and Residue tests, 2006

T070280 Photonic Cleaning Technologies Technical Information

### 3 Materials

List of required materials, manufacturer and part number:

1. Red First Contact, Photonic Cleaning Technologies Part# RFCL for 1 Liter
2. Red First Contact thinner, Photonic Cleaning Technologies Part#RTFCL for 1 Liter
3. Clean room gloves, VWR Part #79999-xxx
4. Fine PEEK mesh, McMaster Carr Part# 9289T11
5. Custom nylon brushes from Gordon Brush [www.gordonbrush.com](http://www.gordonbrush.com) (ordered by COC)
6. Flashlight like Coast G45 LED flashlight from Lights and Knives(in techmart) OR barlight from Fiber Optic Systems, Illuminator Part# FSI-1060-250 and light part # 50-3077
7. Kapton tape, McMaster Carr part#7639A75
8. Ion gun, Terra Universal Part#2005-55 or equivalent
9. TX1010 cloth cleanroom wipes
10. Lint-free Berkshire lenswipes, 9''x9''. VWR part number 52847-150



## First Contact Pour and Brush Application and Removal Procedure

### 4 Brush/Pour Applications of First Contact

This procedure should **not** be used on suspended optics unless COC has approved it, due to the danger of damaging the delicate coating by dragging dust along the faces in the brush. The preferred way to apply First Contact to suspended optics in chamber is by spraying it on, as in [E1300017](#).

If optics needing cleaning have visible dust on their faces, it should be blown off with an ion gun before brushing. If possible, safely lay the optics flat in an optical mount and then use the pour application explained in Section 5. This is especially useful if the optic is very dirty because there is no risk of dragging dust around and damaging the optic. It is easier, faster and only requires one person.

#### 4.1 Brushing on First Contact

1. Both people put on [gloves](#) (LIGO approved kind for cleanroom use, see Materials item #3)
2. NOTE: If any FC solution gets on your gloves at any point, **immediately change gloves.**
3. If the optic is  $\leq 2''$  in diameter, use the procedure in Section 4.3. If it is larger than this, proceed to the next step.
4. Pour some Red First Contact (Materials item #1) into a small beaker. (Fig.1)
5. Pour thinner (Materials item #2) into a second small beaker.



**Figure 1: 1'' aluminum handled nylon brush from Gordon Brush.**

6. Person 1 is in charge of holding the flashlight, passing the solvents in and out of the chamber, and watching for drips. Angle the flashlight (see Materials item #6 for the [flashlight](#)) so that Person 2 can see the FC they are applying. Resituate flashlight throughout procedure if Person 2 cannot see what they are doing. This is to avoid getting FC too close to the barrel of the optic, and to avoid drips.
7. Immerse brush into Red First Contact. Wipe off excess against side of beaker. Use pure undyed nylon paintbrushes that do not contain adhesive, or the custom nylon brushes from GordonBrush that were ordered by COC.
8. NOTE: If the optic is vertical it is important that the brush does not drip FC onto the barrel, or let it run down to the bottom edge. If there is not too much on the brush, this should not be a problem. Person 1 should watch for drips.
9. Begin brushing the FC. Start at the top of the optic, so that any excess solvent can be caught before it reaches the bottom. Brush slowly and lightly, avoiding as much bristle to optic contact as possible. Brush FC on in a circle that starts at least 14mm away from the optic's



## First Contact Pour and Brush Application and Removal Procedure

edge, taking special care that the FC does not drip or run off the optic face near the bottom. Doing a circle first helps keep dripping to a minimum.

10. After you complete the initial circle, go back in and fill in the rest using slow, uniform horizontal sweeps across the face.
11. Now that one layer is done set your brush in thinner and pass it back out of the chamber. Wait 20 minutes. First Contact includes acetone, so it is ok to use acetone as a thinner to keep your brush from stiffening. However the thinner sold by Photonic Cleaning works better. Do NOT use methanol as thinner.
12. Repeat twice for a total of 3 layers.
13. Leave to dry for as long as possible before removing, for a minimum of 4 hours.

### 4.2 Pouring on first contact (Horizontal optic)

It is easiest to apply first contact when an optic is horizontal. In this orientation drips aren't such a problem, and it also takes much less time, requiring one thick layer instead of three thin ones. This application also reduces possible scratching from particulates being dragged along the surface, as there is no painting involved. It usually takes around 45mL of solvent for a 340mm diameter optic (test mass size).

1. Put on gloves. NOTE: If any FC solution gets on gloves at any point, immediately change gloves.
2. Pour the FC onto the optic's surface straight from its plastic bottle. Wrapping a clean wipe around the bottle cuts down on drips from the bottle. If you want to measure out exact quantities pour the FC into a 50mL clean glass beaker and use this to pour onto the optic. Be sure to keep a tight hold on the glass beaker.
4. Make a pool of solvent right in the middle of the optic, ~20mL to start and then let it spread out a bit. If it is flowing all to one side or another pour the remaining quantity off center to compensate.

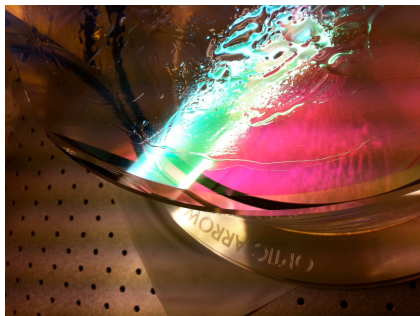


Figure 2: FC layer 14mm from edge of ETM02

5. Fold a lens tissue so that you have a rounded edge.
6. Gently push the solvent around with the rounded edge of a Berkshire lens tissue until you get a fairly uniform coating. Use your lens tissue to spread the solvent around in a radial motion for a more uniform coating. Push down with as little force as necessary to spread the solvent, let the solvent touch the optic and not the tissue.



## First Contact Pour and Brush Application and Removal Procedure

7. Spread FC out to no more than 14mm from the edge of core optics, to allow for lifting the optic with the ErgoArm without touching the film.
8. Remove the same way as vertically applied FC.

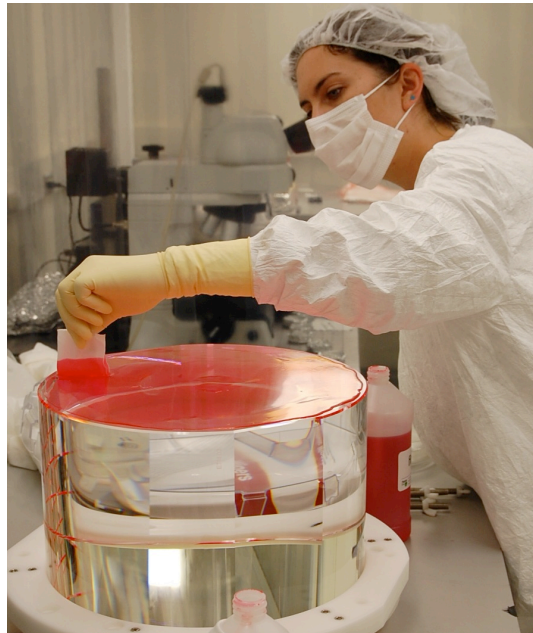


Figure 3: Spreading FC onto a tests mass with a Berkshire lens tissue

### 4.3 Brush on Application for Small Optics ( $\leq 2''$ diameter)

1. Put on gloves.
2. Liberally apply FC using the small applicator bottle (Fig. 5) and brush. Can apply all the way out to the edge.
3. Remove the same way as for large optics, using a very small piece of PEEK mesh.



Figure 4: Small FC applicator bottle and two refill bottles.

## 5 Removal of dry first contact

1. Cut a strip of PEEK mesh. Small pieces will work, 0.5''x 2'' is a good size for a test mass size optic.

## First Contact Pour and Brush Application and Removal Procedure

2. Hold mesh against the top of the optic. Leave about half the strip sticking up off the top of the optic.
3. With one hand hold the PEEK mesh strip, and with your other hand dab FC onto the part of the mesh that is on the optic using the small applicator brush. The PEEK mesh can be applied to an already dry film, the dry FC will dissolve in the solvent and recombine into one new layer.
4. Let the mesh dry for at least an hour. If the FC film is really stretchy and breaks when you try to remove it, wait longer until it does not break when pulled.
5. Do not exceed 30psi on the N2 canister for the terra universal ion gun.
6. Holding the ion gun in one hand, begin to peel the PEEK mesh off from the surface. If the dried FC does not come off in a single piece STOP, and reapply a thicker layer. As soon as the dry FC film starts detaching from the optical surface, start blowing nitrogen from the [ion gun](#) (Materials item #8) onto the optic. Hold the gun parallel to the optic face, focusing most on the area where the film is detaching itself from the optic. Use the flashlight and pay close attention to the edges when peeling it off to make sure nothing is left behind on the optic.



**Figure 6: Removing film from test mass.**

7. Shine the flashlight around the outer surface of the optic face to check for any stray dried First Contact. Remove any last bits by dragwiping an acetone soaked lens tissue around the edge in a circular fashion. The middle of the optic will be the cleanest part so wiping from edge to middle to edge will drag any contaminants you have into the center, and is not recommended. If latex gloves touch the wet acetone, the tissue may leave some latex residue on the optic. To avoid doing this, either grip the tissue by the dry part only, OR use roundtip forceps to hold the tissue. Acetone has also been seen to dissolve cleanroom wipes enough so that wiping them on optics leaves wipe fibers and polymer. For this reason, use lint-free Berkshire lens tissue instead, in materials list #9.
8. Done!



**First Contact Pour and Brush Application and Removal Procedure**

