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Cleaning Procedures for Viton and PFA O-rings

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LIGO Scientific Collaboration

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## 1 Introduction

The purpose of this document is to outline the accepted cleaning procedure for two kinds of o-rings used in LIGO hardware, viton o-rings and PFA encapsulated viton o-rings. The PFA encapsulated o-rings are used in the aLIGO core optics shipping containers and in the ergo-arm vacuum plates. This is not a cleaning procedure for o-rings that will be kept in vacuum. For a complete explanation of the cleaning of vacuum compatible materials see Dennis Coyne's LIGO doc# E960022.

Use at least reagent grade chemicals for all cleaning, spectroscopic grade is encouraged whenever possible. For cleaning the optic itself, use only spectroscopic grade solvents.

## 2 Past Research done on o-rings and optics

Viton and PFA encapsulated o-rings were both tested on optics at Caltech around 2009 to see if either of them left any residue or marks on fused silica. The Viton o-rings left marks on the optic's surface and the PFA encapsulated ones did not, so it was decided to use PFA encapsulated Viton o-rings in optics tooling and storage containers. Bob Taylor performed a bake test around the same time, in which the PFA encapsulated o-rings were baked at 50C for 48 Hrs. The PFA sleeves deformed from the bake, even at this low temperature, and as such baking them is not advised.

## 3 Cleaning

### **PFA encapsulated viton o-rings:**

1. Submerge in DI water ultrasonic bath for 10 minutes.
2. Wipe dry with lint free cloth.
3. Wipe with isopropanol & lint free cloth just prior to inserting into clean o-ring groove.

### **Viton o-rings:**

1. DI water ultrasonic bath, 10 minutes.
2. Wipe dry with lint free cloth
3. Optional: Wipe with isopropanol

## 4 Notes on cleaning o-rings with Acetone and Methanol

**Methanol** has been approved to clean PFA encapsulated o-rings (see the Chemical Resistance Guide below and additional links) The manufacturer of these o-rings, Row Inc., recommends a quick wipe with methanol only if the o-ring is very dirty. In most cases isopropanol is sufficient.

Some people have seen a residue left on the optic after cleaning the o-rings with methanol. It has not been determined whether or not the methanol is to blame, but this is something to watch for. No

residue has been seen following the cleaning procedure above (see [T1000108](#) for a list of o-ring residue tests done at Caltech)

**Acetone** should not be used to clean the o-rings. Although acetone should be ok to use with PFA, it will attack the latex in gloves, which may then carry over to the o-ring.

**Isopropanol**, but not methanol or acetone, can be used to wipe Viton o-rings clean.

#### Safety risks of Methanol and Acetone:

Acetone is **less harsh** than methanol on the respiratory system. OSHA Permissible Exposure Limits (PEL's) for Acetone are 1000ppm or 2400 mg/m<sup>3</sup> and for Methanol (Methyl Alcohol) they are 200ppm or 260 mg/m<sup>3</sup>. Also note that methanol has a ST of 250ppm or 325 mg/m<sup>3</sup>. The ST is an exposure limit which should not be exceeded in a 15 minute period.

### 4.1 Supplier Information

Row Inc., <http://www.row-inc.com/> supplies viton and PFA encapsulated viton o-rings. To order, send your request to Mike Broderick, [mbroderick@row-inc.com](mailto:mbroderick@row-inc.com). The tape they sometimes use on the o-rings is difficult to remove so be sure to ask that they ship the o-rings flat in a "pizza box". You can also ask that they clean them in isopropanol before shipping them.

### 3.2 Additional Links and Chemical Resistance guide

#### Dupont Chemical Resistance Guide on Viton & PFA

| Chemical Fluid                  | Viton-A | Viton-B | Perfluoroelastomer |
|---------------------------------|---------|---------|--------------------|
| isopropanol (isopropyl alcohol) | 1       | 1       | 1                  |
| methanol (methyl alcohol)       | 4       | 1       | 1                  |
| acetone                         | 4       | 4       | 1                  |

1 = little to minor effect, 0 to 5% volume swell

2 = minor to moderate effect, 5 to 10 % volume swell

3 = moderate to severe effect, 10 to 20% volume swell]

4 = not recommended

Links:

LIGO document E960022

<https://dcc.ligo.org/cgi-bin/DocDB/ShowDocument?docid=3652>

PFA chemical resistances link.

<http://www.zeusinc.com/technicalservices/technicalbulletins/chemicalresistanceofpolymers/chemicalresistancechartpfa.aspx>

PFA, PEEK, and other polymers information link

<http://entegrisfluidhandling.com/Default.asp?G=1024>

OSHA Links for methanol and acetone:

<http://www.cdc.gov/niosh/npg/npgd0004.html>

<http://www.cdc.gov/niosh/npg/npgd0397.html>