



# SPECIFICATION

## Specification for Oxidation of Polished Mirror (Super #8) Stainless Steel for aLIGO Baffles and Beam Dumps

AUTHOR(S)	DATE	Document Change Notice, Release or Approval
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### 1 Scope

This process specification is for the process of oxidizing mirror finished (Super #8) 304 stainless steel baffles to provide baffling for aLIGO stray light beams in an Ultra-High Vacuum (UHV) system. The oxidation process reduces the reflectivity of the stainless steel baffle @1064nm to approx 12%, without significantly increasing the optical scattering properties of the surface. It includes material requirements and the process and preparation for oxidation.

### 2 Manufacturing Process

#### 2.1 Material

The sheet metal will be Super #8 mirror finished [one side] 304 stainless sheet 14-18 gauge thick with protective PVC covering. Super #8 finish can also be called a non-directional finish.

#### 2.2 Shaping

The requirements of LIGO document E0900364 for machining, allowable machining fluids, and standard cleaning practices (post machining/stamping and forming) should be followed.

Upon approval from LIGO, this sheet metal shall be water jet cut. Water jet cutter abrasive agents must be approved by LIGO. No other fluid or contaminant may be added to water without prior approval from LIGO. The cut surface quality is Q4.

Do not remove PVC covering prior to cutting and shaping. Ship parts with PVC covering intact.

Markings shall be made by scribing, engraving, vibratory tool, or laser marking on the non-mirrored side. DO NOT STAMP.

#### 2.3 Baffle Parts Preparation

The PVC covering is to be carefully removed without disturbing flatness or form of the part.

Parts shall be precision cleaned to particulate level 100 (or lower) and Non-Volatile Residue (NVR) level A/10 (or lower) per IEST-STD-CC1246D.



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The baffle parts material will be cleaned with **Acetone**, then in **Liquinox**, then **De-ionized water** immediately to keep the solvents and detergents from staining the surface. LIGO will accept suggestions from the supplier on alternate detergents or parameters used to meet the LIGO specification. Cleanliness is to be qualified by Gravimetric testing.

Parts are to be dried and individually wrapped in **CP Stat 100** bags.

### 3 Baking Process & Preparation

#### 3.1 Preparation

Prepare the working area for the parts to be baked and wrapped:

- No porcelain spraying in the area
- No sand blasting in the area
- Clean gloves (heavy duty cotton and latex for everyone handling the parts)
- Line up two or more tables for staging the parts
- UHV foil covered preparation tables.
- C3 cloths, lint-free wipes and UHV foil ready for wrapping.
- CP Stat 100 material ready (bags and rolls)

At the baking site, a portable clean room may be erected adjacent to the furnace with several large tables inside on which to wrap the oxidized parts.

Wipe down parts with alcohol and clean room wipes for touch up cleaning prior to baking if necessary.

#### 3.2 Processing

##### 3.2.1 Continuous Furnace

Bake parts in a continuous furnace at a temperature of 1560°F.

Prior to passing the parts through the furnace, check the furnace speed and temp:

- Speed - 5 linear feet per min (18 Hz setting).
- Stabilize the oven at 1560°F [849°C] for 15 minutes prior to running the parts.
- Turn off inlet fan [air door] near the furnace to reduce the potential dust on the part.

Attach the parts to the furnace conveyer rail with clean 304 stainless wire hooks. The stainless hooks need to be attached with the long part of the hook on the backside away from the mirror side so it does not touch the mirror side.

The parts will be passed through the furnace a total of 4 time each.



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### 3.2.2 Box Furnace

- Prior to inserting parts into the box furnace, pre-heat box furnace to temp 1500°F [816°C].
- Prepare an oxidation load on the conveyor rails that weighs approximately 197 lbs—this includes the angle supports for the base plate, base plate, oxidation payload, holding fixtures, and extra stainless steel ballast if necessary.

Bake parts in box furnace at 1500°F temperature:

- Open the furnace door and insert the parts using the conveyor rails
- Retract conveyor rails
- Close furnace door and wait until the oven temperature returns to 1500°F
- Immediately open furnace door and use conveyor rails to remove parts from furnace

## 4 Packaging for Shipment

### 4.1 FTIR Sampling

When parts are cool enough to be moved, they are to be removed from conveyer rail, placed on a clean table, allowed to cool to room temperature, and FTIR samples are immediately taken.

The parts are to be completely double wrapped in Ameristat bags and sealed with Clean-room tape. If part is too large for the bags, wrap the part using a roll of CP Stat 100 or put into custom made bags of the same material. It is unacceptable to wrap parts in UHV grade aluminum foil because it scratches the oxidized surface. Place labels with part numbers on outer layer of CP Stat 100.

### 4.2 FTIR Sampling of crated parts

Decide where the sample is to be taken and wipe down the corresponding outer area of CP Stat with isopropanol. The baffle can stay in its crate for the sampling procedure. Cut through the outer wrapping using a Class B razor, taking care not to scratch the metal surfaces of the part. Make two 15-20" horizontal cuts about 15" apart with a vertical bisecting cut seem to work well. To prevent cross contamination, cut away any outer CP Stat layers that can't be folded away from the baffle. Regular cleanroom garb (minus shoe covers) should be worn. Wipe down the area to be sampled with isopropanol. A single 10" X 10" area should suffice. After sampling, pull the wrapping back together and seal with cleanroom tape. It may be necessary to tape extra CP Stat over the cut (an extra bag or a couple of sheets off the roll) if there isn't enough wrapping to effectively reseal, or if there is a chance that the tape may contact the metal.

### 4.3 Shipping Protection

Package parts in suitable containers to avoid physical or environmental damage during shipment to the sites.