

LIGO Clean and Bake Best Practices

Specific training for those involved in preparing parts for vacuum and other interested parties

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Clean and Bake: A Line of Defense in Contamination Control



- ▣ Standards and procedures in DCC
 - ▣ E0900047-LIGO Contamination Control Plan
 - ▣ E960022-LIGO Vacuum Compatibility, Cleaning Methods and Qualification Procedures
 - ▣ “Watch this document” due to changes
 - ▣ SYS has requested that any clean and bake other than the default be submitted for items already in the procurement/production pipeline
 - ▣ FDR should trigger any special cleaning/baking needs for items still in design
 - ▣ Changes in protocol since ILIGO
 - ▣ DI water is the solvent of choice
 - ▣ Alcohols etc. should only be used in special cases
 - ▣ Specific cleaning procedures added for maraging steel spring blades, SEI ISI diamond-turned target faces, etc.

Facility Modifications

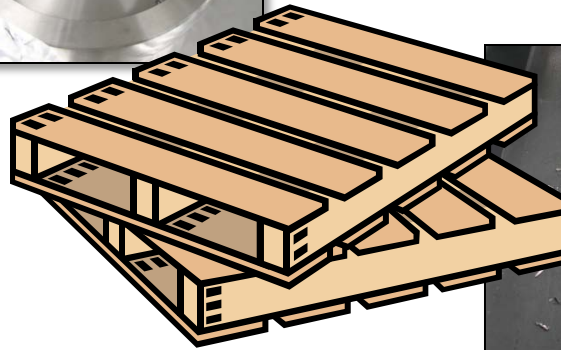
- Warehouse build-out
 - Exterior
 - Air Lock/Receiving
 - Interior
 - Vacuum prep facility
 - Clean storage
- DI water capacity
- Cleaning capacity
- Baking capacity

Parts Inspection

- During receiving

- Obvious problems like

- Weld slag
 - Hydrocarbons
 - Barrel nuts
 - Inks
 - Marker
 - Stamps
 - Adhesives
 - Tape
 - Tags



- Before taking into clean space

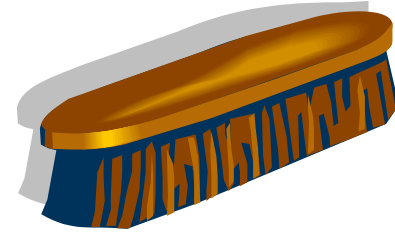
- Check for

- Shedders
 - Wood/Paper/Cardboard
 - Styrofoam
 - Production residue
 - Other “owies”

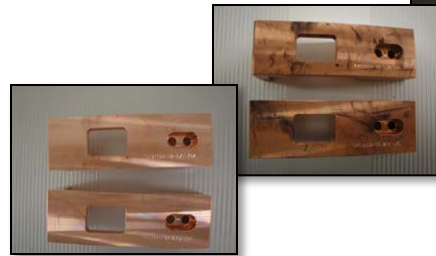
- Send to gross cleaning

- Removes “bad actors”
 - Vendor
 - In-House

Gross Cleaning

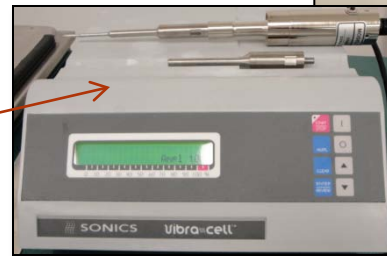


- Prepares parts for precision cleaning
 - For parts that are, well, gross
 - Expected
 - Fasteners
 - Copper
 - Unexpected
 - Barrel nuts
- Should not be located in clean space
- Should have dedicated equipment
- Can be fairly aggressive
 - Mechanical
 - Example: scrub brush
 - Chemical
 - Example: Citranox, Protex



Precision Cleaning

- Prepares parts for vacuum bake
- Tools
 - Cabinet washers
 - Ultrasonic cleaners
 - Wands (Vibracell)
 - For holes



- Counter-top models (Branson)
 - For small parts



- Huge models (Omegasonics)
 - For large parts
 - For large batches of small parts



Drying

Requires special attention due to DI water cleaning protocol



- Drying station

- Especially useful for light parts
 - HEPA filtered air
 - Heat lamps
 - Time



- Air bake oven

- Especially useful for heavy parts
 - Relatively low temperature
 - 60 to 80 degrees C
 - Relatively short time
 - 15 to 30 minutes

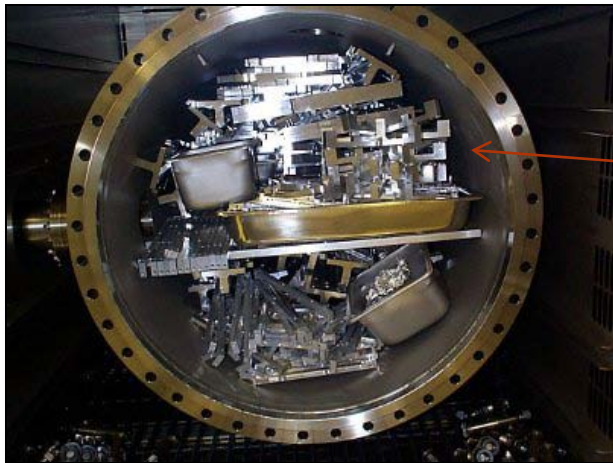


Baking

- Prepares parts for vacuum service
 - Drives off unwanted gasses
- Ovens
 - Air Bake
 - Class B prep (mostly)



- Small (3)
- Large (named the Galli-Morelli)
 - For SEI and SUS large parts (Class A)



- Vacuum Bake

- Class A prep
 - VBO-A in OSB, large
 - VBO-B in VPW, large
 - VBO-C in procurement

Wrap, Bag, and Tag

- Stainless steel tables



- Space for containers, bags, etc.
- WBT ASAP after unloading
- Kit if possible
 - Use Class B worksheet
- Labels
 - Class A →
 - Class B

LIGO CLASS A MATERIAL
WARNING: UHV BAKED MATERIALS
TOUCH WITH GLOVED HANDS ONLY!

- Foil: Friend or Foe?



- The blue box
 - Serrations vs shearing
 - See Dennis Coyne's quote in Notes
 - Glue/adhesive
- The art of the bag
- Crumpling is not a good thing

Zones in Wrap, Bag, and Tag

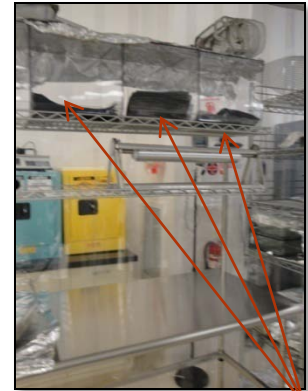
- “Clean” zones
 - Change outer gloves after working in any two consecutive clean zones
 - Zone 1 and Zone 2 **or** Zone 2 and Zone 3



• Zone 1 = Clean parts



• Zone 2 = Foil bag/container



• Zone 3 = Inner bag



- “Dirty” zone
 - Don’t work in clean zones without changing outer gloves
 - Zone 4 = Outer bag and label



Gotchas

- Special cleaning requirements

- Uncommon materials

- Parts

- Blind holes

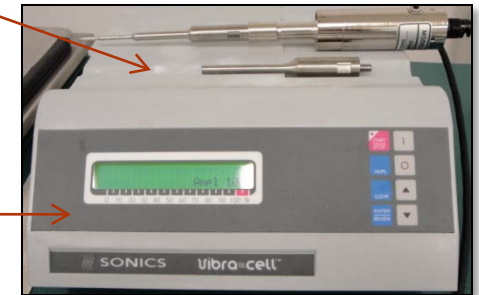
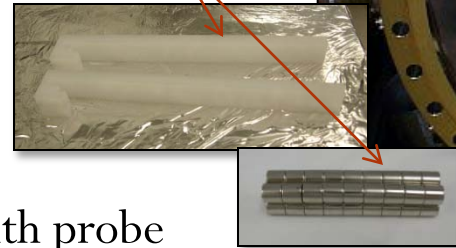
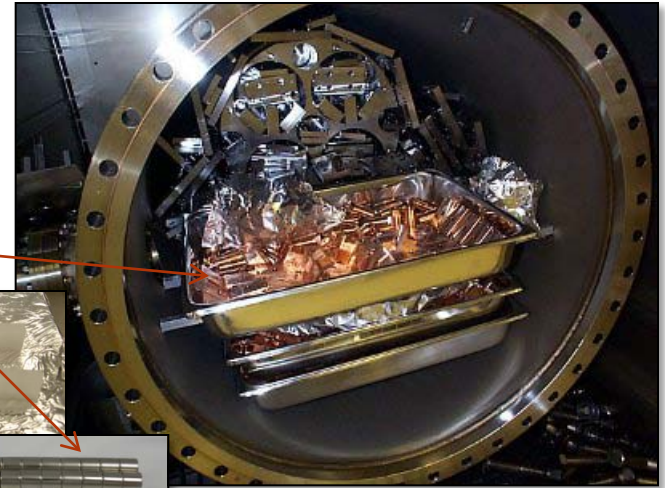
- Check with probe
- Always wand
- Inspect after cleaning

- Threaded holes

- Check with solvent soaked swab
- Wand if necessary
- Inspect after cleaning

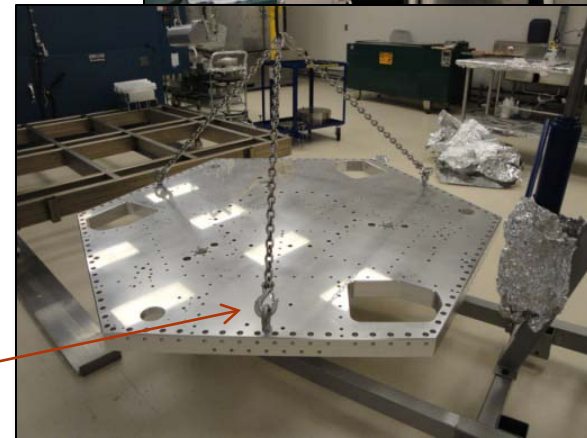
- Corners and odd geometries

- Inspect before and after cleaning



More Gotchas

- Ultrasonic cleaning cycle times
 - HULK is fierce
- Liquinox is persistent
 - Rinse 3 times
 - Use clean water each time
- Lingering water
 - Holes, corners, channels
- Installed lifting eyes/helicoils
 - Remove and clean holes before bake
- Incorrect materials in stock batches
- Overloading ultrasonic cleaners
- Blocking ports on VBO



Resources

- The Living Legends
 - CIT
 - Dennis Coyne (System level contamination control, material science)
 - Bob Taylor (Material qualification, prototype clean and bake)
 - LHO
 - Betsy Bland (Production clean and bake, site contamination control)
 - Kyle Ryan (Vacuum bake ovens, maximizing bake loads)
 - LLO
 - Tom Evans/Gary Traylor (Production clean and bake)
 - Mike Myers/Harry Overmier (Vacuum bake ovens)
- The Aqueous Cleaning Handbook
 - http://www.alconox.com/section_customer/book_info.asp
- John Worden's Vacuum System Basics Presentation

