

UHV Cleanliness Requirements: Cleaning/Baking and Contamination Control

Dennis Coyne HAM-SAS Bidder's Conference @ LIGO Laboratory, Caltech 25 October 2005



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LIGOBasic UHV Compatibility Requirements

- Cleanliness Requirements:
 - » Achieve a Non-Volatile Residue (NVR) level of A/50 or better (per MIL-STD-1246C or IEST-STD-CC1246D) on piece parts before clean assembly
 - » Achieve a Particulate Cleanliness Level of 50 or better (per MIL-STD 1246C or IEST-STD-CC1246D) on piece parts before clean assembly
 - » Perform clean assembly and all steps through UHV Packaging in a Class 100 Clean Room (per FED-STD-209)
 - Comply with Contamination Control Protocols defined in E048228 (M990034 is also a good guide)
 - » Package the Clean Parts per E048227
- No Virtual Leaks
 - » Full Penetration Welds
- No Cold Welding
 - » Stainless fasteners into Aluminum
 - » Silver coated Stainless Fasteners into Stainless
 - » Oversized pilot and tap for tapped holes



Ultra-High Vacuum (UHV) Cleanliness Requirements Related to Manufacturing Processes





Practical UHV Requirements

- Must pre-clean parts before welding and winding
- Must clean parts multiple times during fabrication
- Must thoroughly clean parts!
 - » "gross" clean with solvents and acids
 - » Mechanical clean (scrub) parts especially tapped holes multiple times, with powered rotary tool – during "gross" and "precision" clean steps
 - "precision" clean with hot, water soluble detergents (steam or hot water spray) – multiple times
 - » Never let parts dry with detergent
 - » Multiple rinses with Deionized water
- Must bake parts (air or vacuum) after "precision" cleaning
- Must maintain parts in a class 100 clean room
 - or keep wrapped in "UHV Foil" and keep in at least a class 10,000 clean area)
 - » limit exposure, keep wrapped /covered when possible
- Must Control Contamination with Good Clean Room Practice
 - » All tools must be cleaned, air baked, wrapped & kept in Class 100 areas
 - » All personnel must wear full clean room garb, including hair net, face mask and gloves



UHV Requirement References

- Particulate Level 50 and NVR Level A/50 per <u>MIL-STD-1246C</u> or <u>IEST-STD-CC1246D</u>
 - Cleaning for UHV Service:
 - » Contractor is to certify the cleaning and baking process with representative parts to demonstrate 1246 Level 50-A/50
 - NVR Level to be confirmed via FTIR (Fourier Transform Infrared analysis)
 - Particulate level to be confirmed by particle sizing and counting or equivalent particle area coverage
 - » LIGO Lab will independently assess the contractor's cleaning/baking process with representative parts by RGA (mass spectrometer outgassing analysis) per E960022
 - » Guidance: <u>E048227</u>, Process Specification for Ad-LIGO Seismic Isolation System In-Vacuum Mechanical Elements: Fabrication (includes cleaning)
 - Contamination Control:
 - » Per <u>E048228</u>, Process Specification for Ad-LIGO Seismic Isolation System In-Vacuum Mechanical Elements: Contamination Control
 - » Additional Guidance:
 - <u>M990034</u>, LIGO Contamination Control Plan
 - <u>FED-STD-209</u>, Airborne Particulate Cleanliness Classes in Cleanrooms and Clean Zones
 - <u>ISO-14644</u>, Cleanrooms and controlled environments [ISO-14644 superceeds FED-STD-209]
 - Packaging:
 - » Per <u>E048227</u>, Process Specification for Ad-LIGO Seismic Isolation System In-Vacuum Mechanical Elements: UHV Packaging

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HAM Chamber Clean Rooms

"Full" Clean Room Dress





Concrete Floor – Cleaned Routinely, not ideal, ^o but serviceable

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UHV Foil

