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**Welding and cleaning specification for SUS ETM  
structures**

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This is an internal working note  
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## 1. INTRODUCTION

This specification establishes control over the process of welding and cleaning of AdLIGO SUS ETM structures. The requirements specified here are intended to support the vacuum compatibility requirements of AdLIGO in-vacuum mechanical components, those applicable to structures, intended for use by the manufacturer.

## 2. CLEANING AND PREPARATION OF MATERIAL PROCEDURE

2.1 All materials used should be as specified on the Engineering drawings and certification provided.

2.2 Pre weld machining must be carefully controlled. All machines & fixtures to be cleaned to avoid cross contamination before any machining takes place.

Weld preps must be machined and not under any circumstances be ground (due to risk of cross contamination) if machining is impractical use new carbide burrs.

2.3 No Lubrication may be used, which might result in material contamination that cannot be removed by the cleaning methods described in 2.4 of this document. The use of cutting fluids or lubricants, which contain Sulphur or silicone compounds is prohibited.

2.4 Gross cleaning of piece parts before welding. (Reference LIGO-E960022-Appendix A, LIGO-E048225-B-D)

- Pressure wash / Steam clean to remove all loose particles, coolant etc. Prioritise on blind and through holes, while finishing with the main surfaces (changing nozzles as necessary to facilitate).
- Ultrasonic clean using Decon Neutracon<sup>1</sup> for 10 minutes, following manufacturer's instructions.
- Rinsing in demineralised /distilled water, at least three times, changing the rinse water every time.
- Ultrasonically clean in methanol for 10 minutes
- Bake in vacuum at 120 C° for 48 hours.

2.5 Inspect for cleanliness by taking a lint free clean room cloth dampened with Isopropyl Alcohol. Select various areas and rub vigorously. The cloth should not show signs of dirt to be acceptable.

Note: Solvents must be reagent grade, Methanol is the preferred solvent. Isopropanol and/or acetone may be substituted

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<sup>1</sup> Reference Appendix item 1.

### 3. HANDLING AND STORAGE PROCEDURES

- 3.1 Latex gloves are to be worn for handling, assembly and installation of cleaned or partially cleaned parts.
- 3.2 Tools and fixtures, which may contain cleaned parts in assembly or transport, are to be cleaned ultrasonically in methanol and air dried.
- 3.3 Parts to be wrapped in UHV quality aluminium foil.
- 3.4 Parts are to be stored in a clean dry area until welding commences. Parts should not be stored for a long periods after cleaning, welding should commence as soon as possible and definitely within 24 hours after parts are chemically cleaned.

### 4. WELDING

- 4.1 Welding wire from the bonded store shall be issued after checking their specification on the packet and cross-referencing to a unique QA number.
- 4.2 Store filler material in a manner such that it is protected from oil and other contaminants. The package seal must not be broken until just prior to welding. Rod from an opened package must be kept in a cabinet, or other, within the clean welding area. Before welding takes place the rods are to be cleaned using Isopropyl alcohol.
- 4.3 Welding shall take place in a clean area. The welding bench including any weld fixtures must be cleaned before the parts are taken out of their wrapping for welding.
- 4.4 Lint free clean area gloves must be used when handling parts.
- 4.5 Only welders with the appropriate certification to be employed on these tasks.
- 4.6 Use the Hitachi TIG welding plant. If preheating the parts is necessary under no circumstances will Propane, Oxy Acetylene be used as this will cause contamination in the weld.
- 4.7 All welds must be full penetration welds, with suitable preparation in order to achieve this. No trapped volumes are permitted, and all parts of the structure must be accessible for cleaning, assemblies with internal crevices are considered non-recleanable since these crevices act as traps for cleaning solutions. Inspect the root weld before further passes, if remedial action is required only use clean Carbide burrs, grinding is not allowed under any circumstances.
- 4.8 Wire brushing with clean new soft stainless steel brushes is allowed between passes.

### 5. INSPECTION OF WELDS AND TESTING

- 5.1 Qualify the weld preparation, cleaning process and welds by sectioning practice welds and visually inspecting for weld discontinuities and porosity. Photographic evidence should be taken at the appropriate magnification (photomicroscopy). Other techniques such as Radiography can be agreed upon. Dye Penetrant may only be used on a practice weld configuration and never on a final assembly.

- 5.2 Vacuum Testing. Before the item goes for final machining it should be tested to the limit of the Helium Leak Checker. The use of Q Compound to aid the sealing of blanking plates is allowed at this stage.
- 5.3 Final Vacuum Testing. Using clean dry 'O' rings {silicone grease is not allowed under any circumstances} All blanking plates must be cleaned to UHV standard, assemble in a clean room using lint free clean room gloves. Test using Varian 979 dry leak checker backed up with a turbo pump.

## **6. STORAGE**

- 6.1 Pack in UHV aluminium foil. TBD

## APPENDIX

### 1. DETERGENTS

#### DECON Neutracon

A special active surface agent for cleaning and decontaminating materials which may be corroded, etched, discoloured or weakened by acidic or alkaline cleaning agents. It is biodegradable, phosphate-free, non-corrosive, totally rinsable, non-toxic and non-flammable. Supplied as a viscous liquid concentrate, for dilution with water. Neutracon is a precise blend of highest quality anionic and non-ionic surface active agents in an aqueous polyhydric alcohol base, producing a near neutral (pH 7 ±) concentrate. Suitable for use with all non-ferrous metals such as aluminium, zinc, copper, silver, brass, etc, 'soft' or coated glass, polymers and other sensitive materials which should not be cleaned with acidic or alkaline cleaning agents

#### LIQUINOX

A detergent that does not leave a netting. Liquinox – Critical cleaning liquid detergent, Concentrated, anionic liquid detergent for manual and ultrasonic cleaning. Free rinsing to yield reliable results with no interfering residues. Extremely mild and completely soluble in hard and soft water USDA authorized. Dilute 1:100 pH 8.5. A reference to Liquinox can be found in LIGO E960022-A

#### ALCOHOL

isopropanol, isopropyl alcohol, or 2-propanol,  $(\text{CH}_3)_2\text{CHOH}$ , a colorless liquid that is miscible with water. It melts at  $-89^\circ\text{C}$ ; and boils at  $82.3^\circ\text{C}$ ; It is poisonous if taken internally. It is a major component of rubbing alcohols. Isopropanol is a secondary alcohol, any of a class of organic compounds with the general formula R-OH, where R represents an alkyl group made up of carbon and hydrogen in various proportions and – OH represents one or more hydroxyl groups. In common usage the term alcohol usually refers to ethanol. The class of alcohols also includes methanol; the amyl, butyl, and propyl alcohols; the glycols; and glycerol. It is one of the cheapest alcohols and has replaced ethanol for many uses because of its similar solvent properties. Isopropanol is made commercially by dissolving propylene gas in sulfuric acid and then hydrolyzing the sulfate ester that is formed; the propylene is a byproduct of petroleum refining. Isopropanol was formerly obtained largely by catalytic reduction of acetone.