

Clean Soldering Techniques  
14 January, 2013  
Richard Abbott, LIGO, Caltech  
T1300040-v1

## 1. Summary

The following is a short note to capture concepts and methods for achieving reliable and relatively clean solder joints for ultra-high vacuum applications. This process is likely to evolve over time, but is targeted at soldering items that are not practical to be re-cleaned via the standard LIGO clean and bake process. An example might be a spot repair of a wire or solder joint for an item that is part of a complex system (possibly installed in a vacuum chamber) rendering it impractical to disassemble. This procedure is an option of last resort, not a matter of convenience to circumvent a proper clean and bake cycle. Permission should be obtained from the site vacuum lead prior to engaging this process.

For issues relating to vacuum compatible materials, see LIGO-E960050. The procedure in this note assumes the use of alloy 63/37 (SnPb) solder due to its eutectic nature and excellent solderability. Other alloys are used in LIGO depending on their application. It is less likely that an emergency repair will be done using the less common alloys (gold, silver, etc.), but the same principles apply.

## 2. Tools

- a. Soldering iron with clean, preferably new, tip, sized commensurate with the desired solder joint. Set the soldering iron temperature to 725 degrees F.
- b. HEPA filtered vacuum cleaner with vacuum nozzle cleaned and wrapped in clean aluminum foil
- c. Solder that has been wiped clean with isopropyl alcohol until the exterior is shiny and free from visible contamination. Experiments conducted in January, 2013 at Caltech suggest that standard rosin core solder residue is highly soluble in isopropyl alcohol and the standard UHV clean and bake procedure will adequately clean this residue. While rosin core, 63/37 alloy (SnPb) solder yields excellent quality solder joints, its use should be constrained to the smallest possible usage due to the inability to conduct a full clean and bake in the context of this procedure.
- d. Class B cleaned hand tools as needed (tweezers etc.)

## 3. Method

- a. Areas adjacent to the intended point of soldering should be protected by draping with UHV foil, or clean wipes

- b. Get the HEPA vacuum running, and have the nozzle close to the point you intend to solder.
- c. Solder the item in question using normal soldering techniques using the minimum amount of solder consistent with a good joint. Once finished, the HEPA vacuum cleaner can be removed.
- d. Wet a clean wipe with isopropyl alcohol and begin to clean the affected area. The initial cleaning phase is an effort to remove the bulk contaminants without spreading the dissolved matter. Use multiple wipes to isolate the contaminant and prevent reapplication of contamination. Clean only toward the contaminated area to avoid spreading contamination. Don't skimp on the use of clean wipes to avoid recontamination.
- e. After achieving the best results possible with wipes, dam the affected area with clean wipes to avoid spreading contamination and judiciously spray down the contaminated area with isopropyl alcohol. Repeat several times
- f. For wires that penetrate a plated hole, such as those found on flexible circuit boards, don't forget to clean both the top and bottom surface of the circuit board as flux will accumulate on both sides.