

|                |                                                             |
|----------------|-------------------------------------------------------------|
| <i>Title</i>   | <i>Procedure for Clean and Bake of Vacuum Feedthroughs.</i> |
| <i>Authors</i> | <i>L. Sanchez, R. Abbott Caltech</i>                        |
| <i>Date</i>    | <i>25 January 2021</i>                                      |

---

## Overview

The following note details the procedure for cleaning and baking vacuum feedthroughs. A basic check with the original manufacturer for any special handling processes is advised to be sure any limits imposed by the original manufacturer are observed. For reference, details relevant to the different species of the A-plus feedthroughs can be found at the collector point E2000302. Document E2000279 (Feedthrough tab) lists the total feedthroughs for both sites.

## Description

The LIGO document E960022 describes the guidelines for the Clean and Bake process for UHV parts. The previous process is listed on page 42 of this document. In addition, a pictorial guide for Advanced LIGO Feedthrough parts can be seen on E1200250.

Prior to the Clean and Bake process, all feedthroughs must be entered into the Inventory Control System (ICS). A Clean and Bake request form must be generated for each clean and bake job. When possible add photographs of all item. Verify the serial numbers and note the starting degree of cleanliness for the feedthroughs to be processed. A post-cleaning storage or assembly load must be recorded in ICS and approval must be obtained after completion.

The use of ultrasonic cleaning methods is deliberately not permitted in this procedure due to concerns raised by the original A+ feedthrough vendor (Solid Sealing Technologies, SST) in an email communication with Luis Sanchez. Also, Chandra Romel had the same concerns, but specifically was focused on assemblies with welded bellows. In an abundance of caution, it was decided to forego any ultrasonic cleaning.

The procedure below implies 100% helium leak check is required. On an as-need basis, the local Vacuum Representative can grant waivers for this step (or others) as required to meet specific program goals. The A+ vacuum feedthroughs are an example, for which it was decided that 100% helium leak checking was not required in part due to the ease with which these parts can be checked in situ on the related chamber.

Bolting a new conflat flange onto a chamber, or parent flange, exposes the conflat to additional stresses that may induce leaks. For this reason, when possible, flanges should be assembled clean prior to integration onto a HAM or BSC chamber and leak checked as an assembly. An example might be that a 12-inch flange has three 4.5-inch subflanges and is intended for installation onto a chamber. In this case, the subflanges can be integrated onto the main 12-inch flange prior to installation thus improving the reach of the leak check in terms of finding potential leaks. This principle won't apply when replacing or installing a 4.5-inch subflange onto an already installed 12-inch flange.

## Process Outline

1. Physically inspect each feedthrough to ensure all dimensions agree with the specification. This should include a test-fit of electrical connectors to ensure there are no interface issues. Electrical continuity and isolation (where required) must be verified before clean-and-bake.
2. Inspect the conflat knife edge for any damage to this critical sealing surface.
3. Prior to any further processing, a helium leak check should be performed to ensure the initial hermeticity of the parts - as received from the manufacturer - is known and the results recorded.
4. Prepare Liquinox cleaning solution in a stainless-steel container or tank.
5. Transfer prepared cleaning solution in a stainless tank or container (bucket).
6. Submerge the part or incremental sections until all surfaces have been exposed to cleaning solution.

7. Clean the entire part using soaked clean wipers/brushes, prioritizing on blind and through holes, while finishing with the main surfaces. Cleaning solution should not be allowed to dry on part during cleaning operations.
8. Perform a DI only water rinse to remove cleaning solution.
9. Rinse the part in IPA to bond with residual water and facilitate drying.
10. Dry the feedthroughs in a clean flow-bench for a minimum of 4 hours to evaporate the bulk of the cleaning solution prior to baking.
11. Carefully load the parts into a vacuum-bake oven taking care to avoid damage to the knife edges of the conflat sealing surface as well as the pins or protrusions of the electrical portions of the feedthrough.
12. Program the vacuum bake oven temperature controller to a ramp-hold-ramp profile per the description below. The ramp profile up and down avoids rapid temperature changes that may compromise the electrical feedthrough integrity via thermal stresses.
13. Program a linear 6-hour temperature ramp from ambient (assumed to be ~20C) to 150C over a 6-hour time period.
14. After the initial ramp to 150C, program a 48 hour hold at 150C.
15. At the end of the 150C, 48-hour period, program a 6-hour ramp from 150C to ambient.
16. After the parts return to ambient temperature, an RGA scan must be performed and approval must be obtained from a qualified vacuum reviewer (ask Systems if there is any doubt) as to the acceptability of the cleanliness associated with the RGA scan results.
17. Upon removal from the vacuum-bake oven, and prior to entering service, the vacuum feedthroughs must be helium leak checked once more, and the results recorded in the bake-load ICS report.
18. Post bake electrical testing may be required on a case-by-case basis depending on the physical complexity of the feedthrough. Consult the CDS group for further clarification.
19. Once the parts are certified based on the RGA scan results, the parts can be removed from the vacuum-bake oven and packaged per the normal process for Class-A cleaned parts. Special attention needs to be taken to ensure the knife-edge of the conflat flanges is protected. Packing conflat region with lint-free clean-room wipes is recommended prior to wrapping the unit in aluminum foil and bagging.
20. All process results and notes **MUST** be recorded in the bake-load ICS report associated with the parts.