

LIGO Laboratory / LIGO Scientific Collaboration

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**ELI VENT & SEPTUM INSTALLATION
PROCEDURE**

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Distribution of this document:
Detector Technical Review Board

This is an internal working note
of the LIGO Laboratory.

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Introduction & scope

This is the procedure for venting the L1 vertex section and installing the HAM6 isolation septum for the ELI retrofit. The procedure leaves off with the septum installed and sealed along with its window and blankoffs, the vertex section under vacuum, and HAM6 open and ready for SEI installation.

Starting conditions

- Optical lever fiducials for optic undergoing work checked and logged
- OSEM voltages and coil currents for optic undergoing work checked and logged
- HEPI shut down to safe mode
- Verified clean BURT of all relevant EPICS channels (LOS, ASC, HEPI, etc.)
- LVEA and chamber exterior cleaned
- PSL shutter locked/tagged out

Equipment & materials

1. (35) — $\frac{3}{4}$ " x 6" long bolts for HAM 6 flange
2. (20) — $\frac{1}{2}$ " x 5" bolts for mode cleaner tube supports
3. (70) — $\frac{5}{16}$ "-24 x XX" long silver plated vented stainless 12 point bolts for internal conflat flanges.
4. Viton o-rings for septum plate
5. Copper gaskets for conflat flanges
 - a. 10" for viewports,
 - b. new 8" valve for HAM 6 turbo,
 - c. 10" valve for ion pump,
 - d. new 10" gate for large turbo,
 - e. 14" valves and
 - f. 14" large ion pumps
6. Verified all tooling is available and clean, in particular class B tools for viewport installation.
7. Verified certs for torque wrenches.
8. Verified clean room garb is available.
9. Verified covers for 84" & 60" nozzles are clean.
10. Verified UHV foil is available.

Task steps

11. Start clean air compressor and blow down 4" line through all ports. Check all ports for hydrocarbon, moisture and particle count.

12. Spin up turbo at vertex to verify operation.
13. Clean and move the A frame from clean air compressor to mode cleaner tube.
14. Move portable clean room to cover HAM 6.
15. Take baseline RGA scans of the main volume.
16. Log ITM, BS, RM, MMT3 optical lever fiducials.
17. Log OSEM voltages and coil currents for same
18. All LOS to local damping
19. HEPI shut down to safe mode
20. Turn down LOS high voltage DC supplies in electronics high bay
21. Soft close GV3 & GV5
22. Hard close GV1 & GV2
23. Vent vertex section of the main volume
24. Disconnect large turbo pump from 10" valve and move turbo pump away from work area.
25. Disconnect roots blower from 6" valve and move blower away from work area.
26. Cover 6" and 10" ports with UHV foil.
27. Remove IP3 & IP4; cover the ion pump nozzles with UHV foil.
28. Remove 14" CETEC valves and wrap in UHV foil and m-stat. Cover 14" ports on mode cleaner tube with UHV foil
29. Pretension A-frame sling to take weight of MC tube end in case there is a preload
30. Remove all bolts from flange that attaches HAM6 to mode cleaner tube.
31. Install tie rods to HAM6 bellows and retract bellows.
32. Take up A-frame hoist slack to support mode cleaner tube.
33. Remove 18 bolts from mode cleaner tube support posts.

34. Install tie rods on mode cleaner tube and retract bellows.
35. Remove 84" door from HAM6 (doesn't matter which but prefer west side)
36. Remove 60" end cap (to insure septum plate is clocked correctly)
37. **Install inner and outer O-rings in septum plate grooves**
38. Install new septum plate; slide plate down and verify that nozzles are horizontal
39. Slowly relax bellows tie rods until a proper seal is made; install new 3/4" x 6" bolts and torque to spec.
40. Install shims and new 1/2" x 5" bolts to attach mode cleaner tube to supports (6 plcs)
41. Remove all tie rods
42. Relax A frame support
43. Replace 10" CETEC valve with new VAT 10" valve.
44. Install new 14" VAT valves (gates up)
45. Install large ion pumps
46. Install 6" blind on 6" roughing valve.
47. Reinstall large turbo pump; begin roughing out ion pumps
48. Working inside HAM6 install view port and (2) – blanks to septum plate **using procedure LIGO-E070xxxx**
49. **Request QA/exit inspection from ID**
50. Rough vertex section and spin up turbo
51. **Leak check annuli and main volume per standard procedure.**
52. If there are no leaks and pressure is low enough take RGA scan.
53. If vacuum is tight, proceed to installation of new vacuum equipment on HAM6 and vent vertex in preparation for work in HAM1, HAM2, HAM4 &