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**BSC ISI/Quad Installation at LASTI:  
Installation Procedure**

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Distribution of this document:  
Advanced LIGO Project

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## 1. Overview of the BSC ISI/QUAD Installation into Chamber

This document covers the procedure for the installation of the BSC ISI and Quad Suspension Upper Structure into the BSC chamber at LASTI. It must be read before beginning work on the installation.

The hazard analysis, LIGO BSC ISI/Quad Installation into BSC Chamber, LIGO document number E0080115-00-D, must be read before beginning work on the installation and used in conjunction with the installation procedure.

### **A note about clean room standards:**

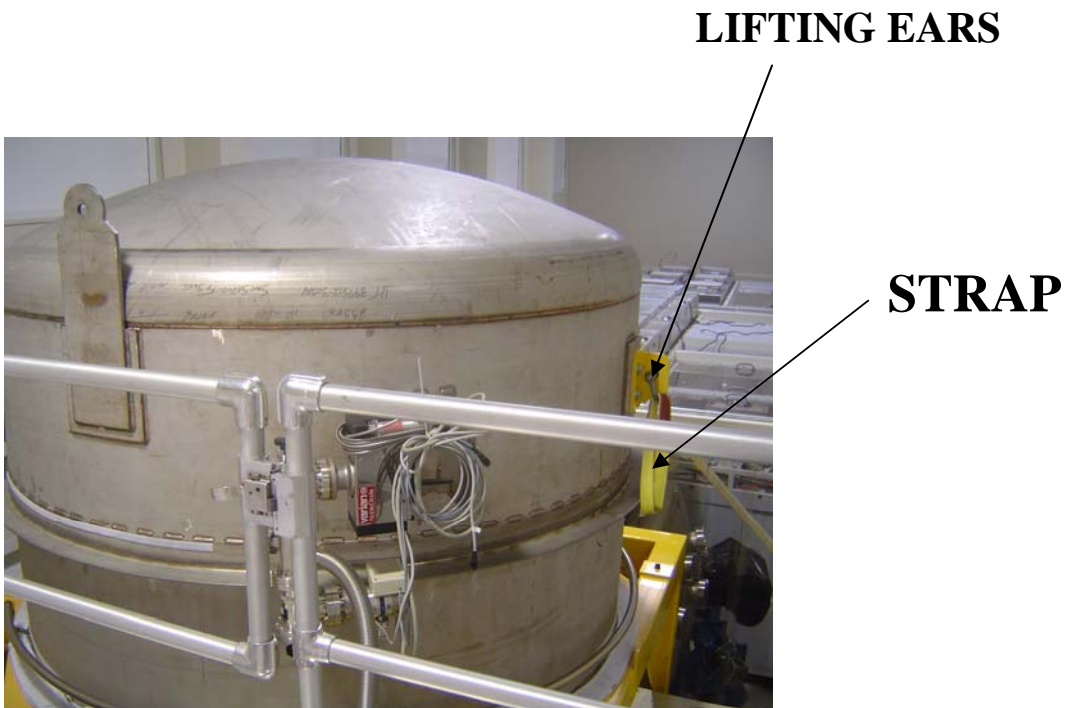
For a clean procedure all LIGO standards should be followed. Clean room garb including gloves should be worn when working with parts. Parts should be cleaned and handled according to the standard in LIGO document number E960022. Class A and Class B cleaning procedures and requirements on garbing and handling parts are specified in the LIGO documents M990034-C, LIGO Contamination Control Plan.

All tools that come in contact with the Class an assembly should be cleaned to LIGO class B standards. The ISI should be handled under a portable clean room. Any time a part of the ISI assembly is not covered by the portable clean room or not being actively worked on it should be covered with appropriate clean covers. (C3 polyester or equivalent).

## 2.0 Preparation

### 2.1 BSC Chamber

1. Remove the (48) bolts holding the dome to BSC chamber.
2. Attach both 2.5 ton hoists to lifting ears using lifting straps rated for 4000 lbs or greater (fig. 1).
3. Raise dome 4-5 inches and attach dome covers to both the top of the BSC chamber and to the top of the dome. Use spring clamps to hold O-ring in place if necessary.
4. Remove clean room safety railing to allow dome to pass over.
5. Lift dome and place onto yellow dome stand (fig 2).
6. Replace clean room safety railing.
7. Attach skirting and assemble BSC upper floor staging (fig. 3).
8. Remove side access door V049-4-0148. Store door clamped to dome stand.
9. Install BSC internal platform V049-4-036 sections 1, 2, and 3 only. The two pieces which make up section 4 is not used to allow room for the installation tooling tripods.
10. Install three septum flanges to the septum plate inside the BSC chamber..
11. Cover door opening with appropriate C3 polyester door cover whenever work isn't being done in the BSC chamber.



**FIG. 1**

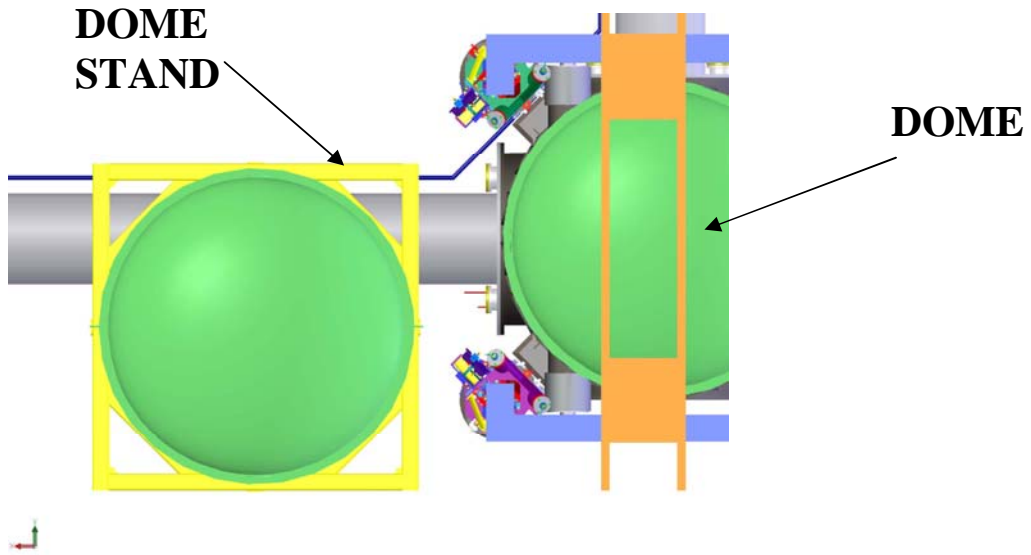


FIG. 2

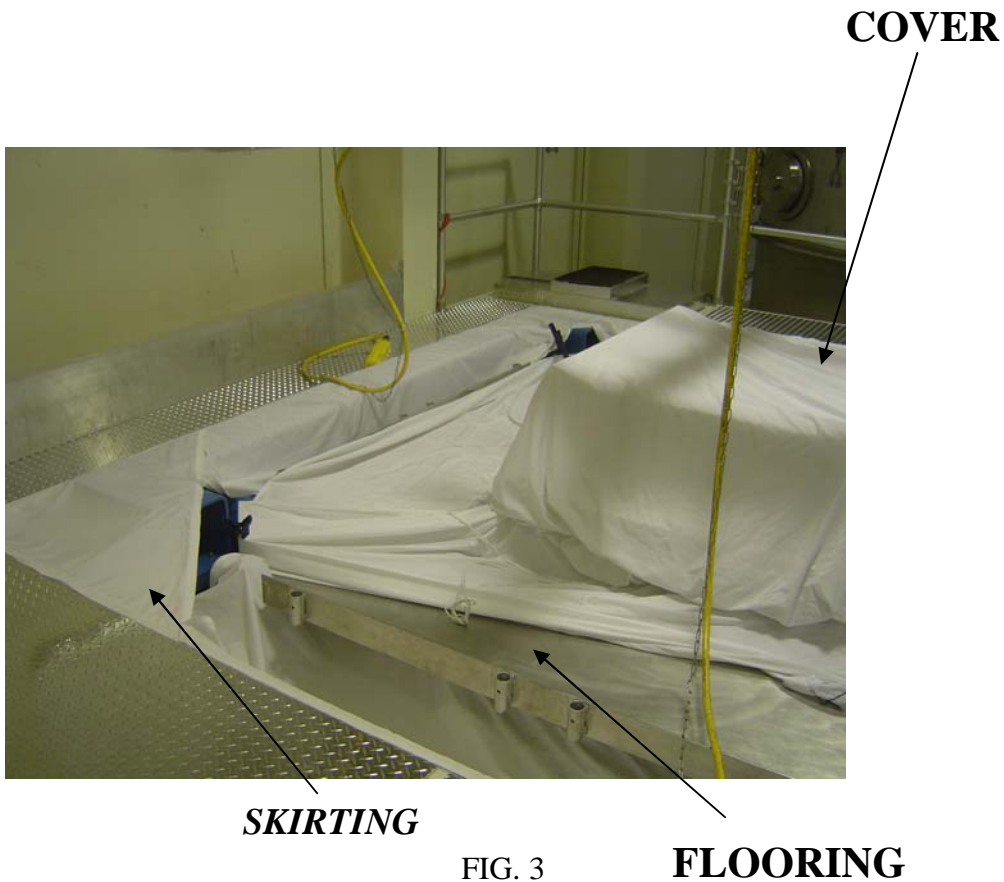
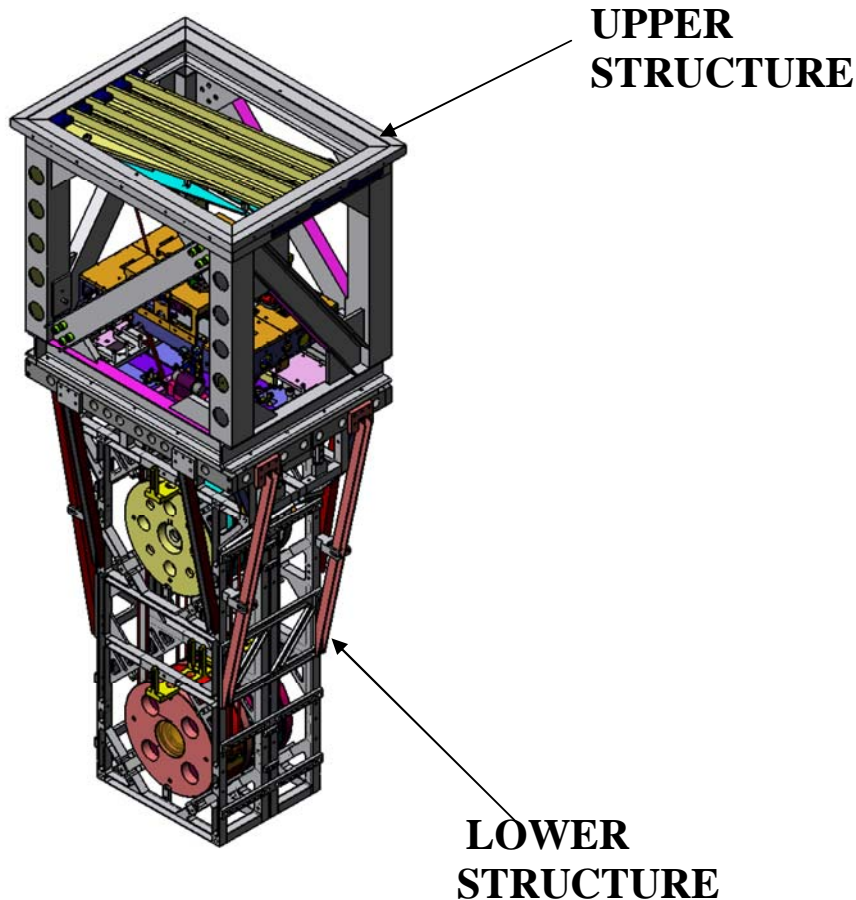


FIG. 3

### 2.2 Quad Suspension

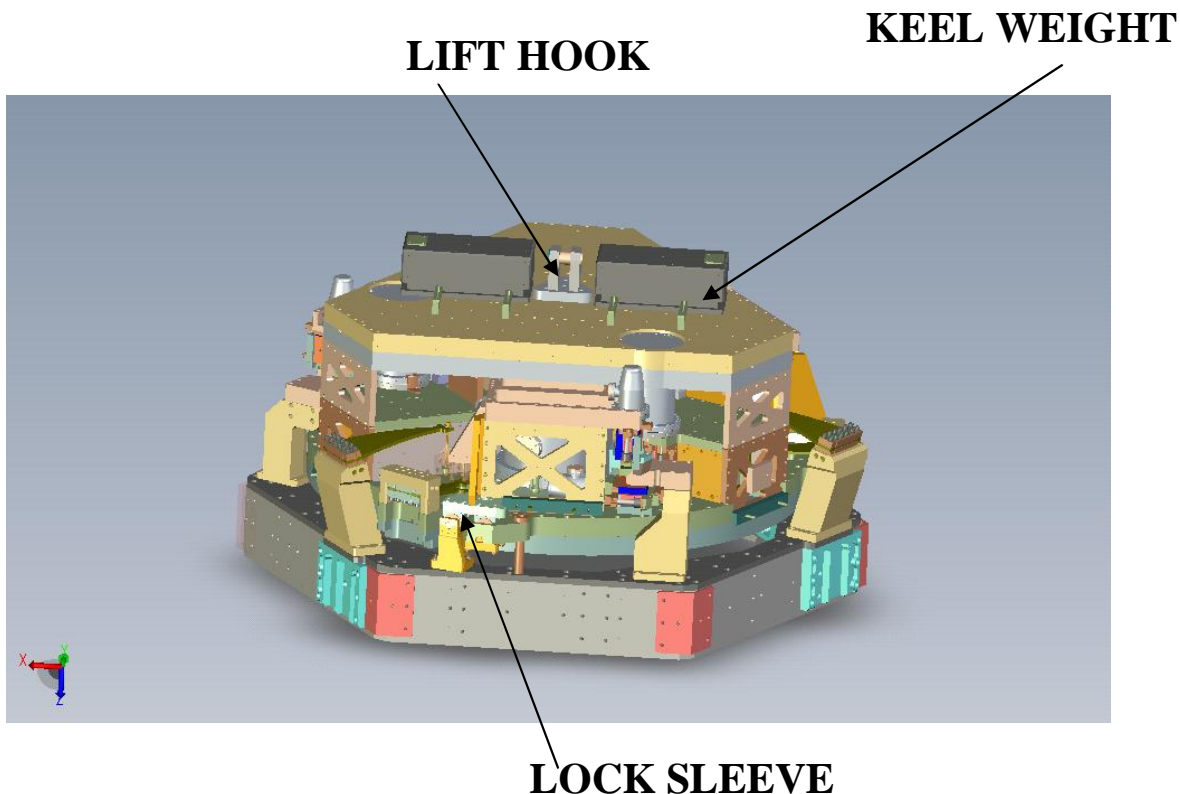
1. The quad is initially mounted to the optics table of the BSC-ISI and the BSC-ISI is fastened to the test stand as shown in fig. 5.
2. Lock down all 8 masses (4 per chain).
2. Remove cross braces from BSC scaffolding to allow the fixturing to slide under the test stand (do not allow access to scaffolding until cross braces are back in place.)
3. Remove lower structure assembly TD-1084-090 (fig. 4) per ETM Quad Assembly Procedure T060040-00 and place onto Quad translation/lift table per the Installation Tooling Demonstration video G070359-00.
4. Replace cross braces on BSC scaffolding.



*Fig 4*

**2.3 BSC Internal Seismic Isolation**

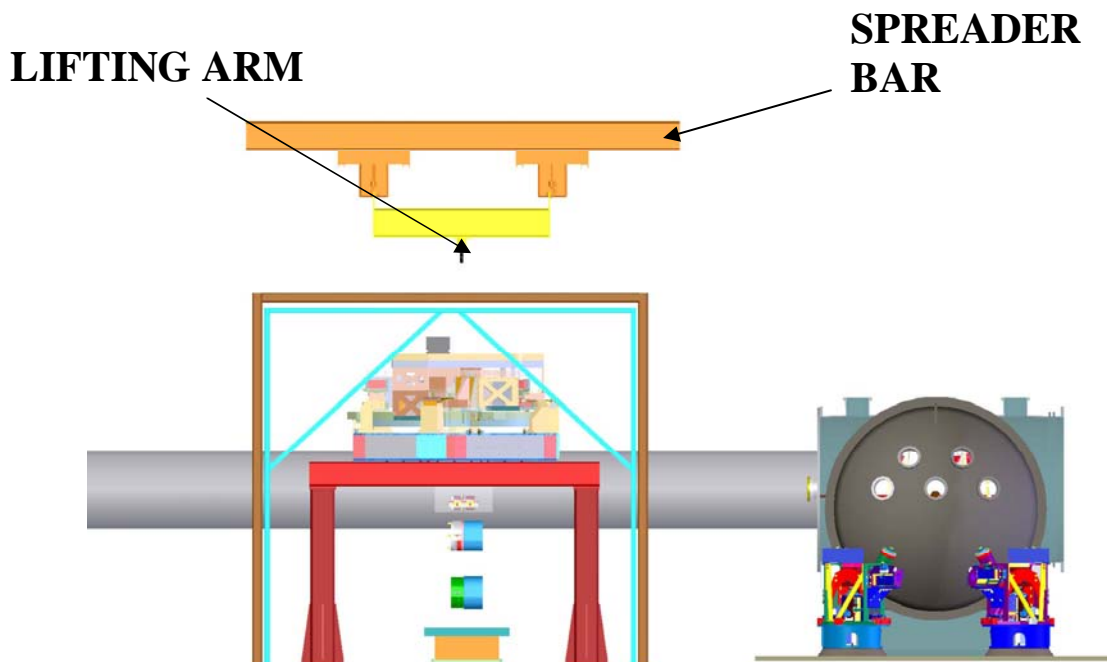
1. Lock down stage 1 and stage 2 by turning lock sleeves D047934-A CCW until the sleeve makes contact with the post cap.
2. Remove keel weights D047867-A from top of stage 2.
3. Remove external cabling and secure sensor cables.
4. Walk around ISI structure to make sure all trim masses and instruments are securely fastened.
5. Take a quick spectra from STS-2 (using mass signals UVW) and GS-13. Lock all STS-2's and GS-13's.
6. Repeat step 5 to check that the instruments are properly locked.
7. Check for loose tools and hardware which may have been left on the structure.
8. Attach lift hook D04048-A using three A286 5/8-11 bolts. Torque to 210 ft-lbs.
9. Wipe down exposed surfaces of ISI structure with alcohol and lint free cloths.
10. Cover the ISI/Quad assembly with a C3 polyester cover and pull elastic tie at bottom to reduce contamination. Cover upper structure and optics table with C3 polyester cover.
11. Lock down and unload the pair of springs at all four HEPI units on BSC chamber per the reverse of the loading procedure in step 11 of E040011-B.



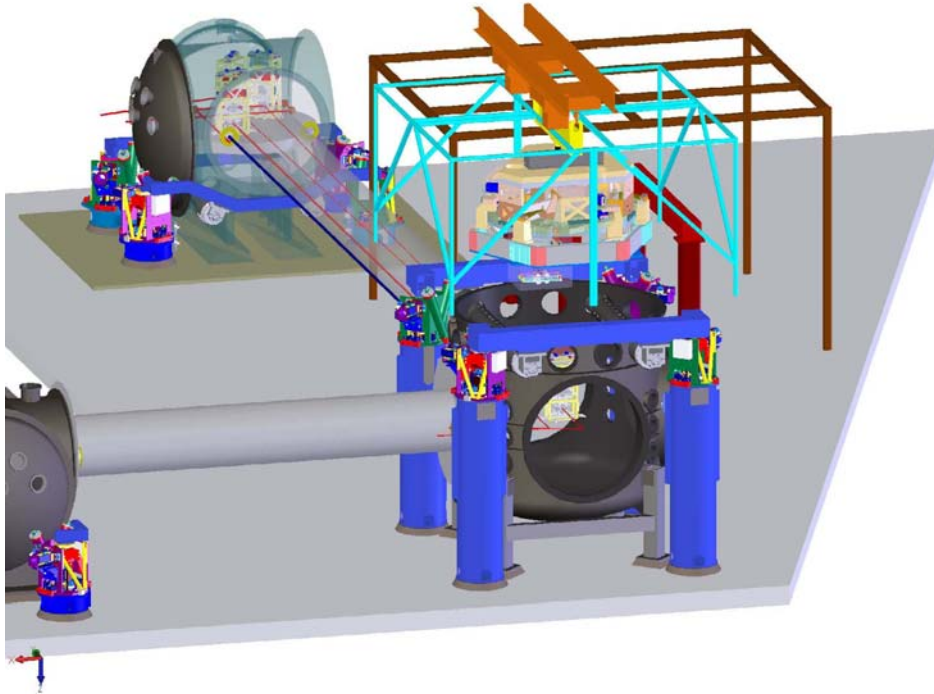
**FIG. 4**

### 3.0 Installation

1. Install SEI lifting arm D080132-00 onto 6 ton spreader bar in place of the lifting hook. Be sure to replace cotter pin with a new pin.
2. Move the clean room to the side to allow access for both the hoist and spreader bar.
3. Attach lifting arm to lift hook on BSC-ISI.
4. Attach 2 safety straps running from stage 2 of the seismic isolation system to the spreader bar. The safety straps are rated at 15000 lbs each and not under load during the lift.
5. Remove the (12) 3/8-24 bolts holding the stage 0 to the test stand.
6. Load test the setup by lifting the ISI/upper-quad assembly 3-4" above the test stand and leave for a minimum of 1 hour.
7. Carefully lift the ISI/Quad assembly with C3 polyester cover up over the BSC chamber and down onto the support tubes (fig. 6).
8. Uncover the BSC top opening by peeling the two covers to the side. Expose as little of the BSC chamber as possible
9. Insert the (12) 3/8-24 bolts and tighten hand tight. Lower the ISI/Quad completely and remove the lift hook.
10. Torque all 3/8 -24 bolts to 260 in-lbs.
10. Replace C3 polyester cover over BSC chamber.



*FIG. 5*



*FIG. 6*

11. Assemble installation conveyor and translation table per G070359-00.
12. Attach lower quad per ETM Quad Assembly Procedure T060040-00.
13. Run in-vacuum cabling to feed throughs.
14. Release all masses and tune quad per T060040-00.
15. Remove installation tooling and replace side access door.
16. Replace keel masses on BSC ISI.
17. Run in-vacuum cabling for ISI, unlock lockers on both stages, and recheck balance.
18. Install cartridge clean room over BSC chamber.
19. Unlock seismometers and take quick power spectra.
20. Using two cranes lift BSC dome off of dome platform and onto BSC chamber.