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TITLE CLEAN ROOM TRANSPORTING, STORAGE AND MAINTENANCE PROCEDURE  PRODUCT LIGO BEAM TUBE MODULES  CALIFORNIA INSTITUTE OF TECHNOLOGY	IDENTIFICATION			
	CRTSM LIGO-8950053 04-B			
	REFERENCE NO. 953570 (930212)		SHT <u>1</u> OF <u>6</u>	
	OFFICE CHG		REVISION 4D	
	MADE BY SDH	CHKD BY KHF	MADE BY RAJ	CHKD BY RER
DATE 11/6/93	DATE 11/6/93	DATE 9/22/97	DATE 9/23/97	

**1.0 SCOPE:**

This procedure covers the activities associated with clean room operations. The following activities are described in this procedure:

- 1) Transportation of the clean room modules
- 2) Storage of clean room modules at site.
- 3) Maintenance Procedures for clean room equipment.

**2.0 REFERENCES:**

The construction and operation of the clean room is based on the following references:

- 1) Summary of concepts and Reference Design for a Laser Gravitational-Wave Observatory, CAL TECH; Feb-92.
- 2) Project Safety Manual, LIGPSM.
- 3) LIGO procedure CL3N.
- 4) LIGO Clean Room Specification CRSPEC

**3.0 EQUIPMENT:**

LIGO Clean Rooms consists of the following equipment and systems. For specific items, see applicable references. Equipment specific to the clean room is listed as systems or assemblies below. See Clean Room Specification for detailed listing of components.

- 1) Clean Room Module & Transporting Trucks
- 2) Rolling frame and Track Assembly
- 3) HVAC System
- 4) Exhaust System
- 5) Storage and Shelving Equipment
- 6) Safety Systems
- 7) Electrical & Lighting System
- 8) Purge Gas Manifold and Rack System
- 9) Inflatable & Secondary Sealing System
- 10) Ante Room Attachment





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11) Filter Unit HEPA 100, rated for < 0.3 micron particles.



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#### 4.0 STORAGE OF CLEAN ROOM MODULE:

- 4.1 The clean room shall be received from the manufacturer in a "conference room" cleaned condition.
- 4.1.1 All interior surfaces shall be wiped down with an approved cleaning agent.
- 4.1.2 A Cover shall be placed over the tube penetration opening and sealed with a gasket material to prevent any leakage into the building.
- 4.1.3 All Motorized dampers shall be closed on HVAC and Exhaust ducts.
- 4.1.4 All Doors and windows shall be locked before transportation and/or storage.
- 4.2 Short term storage shall shall comply with all activities noted per 4.1.
- 4.3 Long term storage shall comply with all activities in 4.1 and include the following:
- 4.3.1 Remove all materials from inside the building.
- 4.3.2 Remove battery powered emergency lighting equipment from the building.
- 4.3.3 Seal HVAC and Exhaust vents with taped covers.
- 4.3.4 Remove outside lighting and electrical equipment, ie:, cords, receptacles, etc. and store inside entry way of change room door.
- 4.3.5 Remove Ante Room attachment from clean room.

#### 5.0 TRANSPORTATION OF CLEAN ROOM MODULE:

Clean Room transportation is broken down into three activities. The first is loading and unloading from the container truck. Second, is during construction activities when removed from a completed beam tube section and towed away using the tow vehicle. The third type of transportation is from the rolling frame to another area or site.



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- 5.1 During loading and unloading activities associated with installation and removal of the Clean Room, all safety precautions and National, State, and Local requirements shall be met.
  - 5.1.1 Remove from container truck and mount clean room module onto rolling frame. The frame is equipped with 8"Ø 45° Vee groove wheels and moves on an angle frame turned on support plates. See attached detail.
  - 5.1.2 Install bottle racks and step assemblies to rolling frame.
  - 5.1.3 The tow vehicle shall be connected to the clean room module with a bar sized for towing and breaking forces.
- 5.2 The Clean Room will be moved using a tow vehicle along a track system during construction activities at site.
  - 5.2.1 The inside "screen door" at the tube opening shall be secured in the closed position with a Plexiglas cover in place.
  - 5.2.2 A plug shall be installed over the end of the tube opening in the Clean Room.
  - 5.2.3 Inspect all bottles in the rack to assure they are properly chained in place.
  - 5.2.4 Inspect and secure all loose items in the Clean Room Container.
  - 5.2.5 Disconnect the power cord from the site installation power and coil it inside the clean room entry way.
  - 5.2.6 Remove any braking effect used to secure clean room into position.
  - 5.2.7 The clean room shall be vacated during the moving and positioning activities.
- 5.3 The clean room shall be transportable from one area or site to another. This is accomplished by a container trailer.



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- 5.3.1 Remove bottle racks from rolling frame.
- 5.3.2 Remove step assemblies from rolling frame.
- 5.3.3 Lift the clean room module from the rolling frame and install on container truck.
- 5.3.4 Secure all equipment inside the building before moving.
- 5.3.5 Clean all surfaces of the room and lock and seal doors for transportation.
- 5.3.6 For transporting over public roadways, obtain all required permits and licenses.

## 6.0 MAINTENANCE CLEAN ROOM MODULE:

6.1 The maintenance of the clean room is broken down into the following categories:

- 1) Cleaning and janitorial functions
- 2) HVAC and exhaust system preventative maintenance, troubleshooting and Repair
- 3) Bag type filter maintenance and replacements
- 4) Roller frame and wheel maintenance.
- 5) Purge gas system maintenance
- 6) Compressed air system maintenance
- 7) Electrical and control maintenance
- 8) Safety equipment inspection and maintenance

6.2 Cleaning and janitorial functions shall be periodically as needed to maintain clean conditions. These include the following tasks:

- 1) Wipe down all surfaces including walls, storage bins, hoses, tools, etc., in the controlled area with an approved cleaning agent and lint free cloths.
- 2) Return all solvents to their containers for proper storage and dispose of all wiping cloths.
- 3) Wipe down all tables and inspection surfaces in the cleaning and inspection area.
- 4) Perform general cleaning, sweep and mop change room and storage room floors.



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- 5) Re-stock all inventories and remove all soiled clothing from clean room module.
- 6) Remove all soiled wiping cloths and paper towels from the clean room module.

6.3 Perform periodic maintenance on clean room module HVAC systems. Frequency of maintenance operations will be determined by experience with the equipment. These include but are not limited to the following. See equipment manufacturer's O&M Manual for greater detail.

- 1) Verify air balance periodically by performing air balance tests. Adjust air balance when necessary.
- 2) Lubricate all equipment bearings, bushings and linkages as necessary for good performance. Do not over lubricate.
- 3) Perform electrical inspections for loose connections, electrical load, etc. as necessary for safe operation.

6.4 The following is a listing of filter requirements for the clean room module HEPA 100 and Pre-filter maintenance.

- 1) Pre-filters will be inspected periodically and replaced when an estimated 50% blockage is noted. This will be determined by a method of holding the filter to a light and comparing it to a clean filter.
- 2) HEPA 100 filters will be replaced when the differential pressure drop across the filter reaches 1.0" or greater from the operating pressure of a clean filter.

6.5 Roller frame inspection and maintenance is to be periodically. These activities include but are not limited to the following:

- 1) Inspect the frame for any damage due to handling, corrosion, etc. Repair and paint areas as required.
- 2) Inspect alignment of all wheels on the track assembly. Check wheel grooves for foreign material and clean as required.
- 3) Lubricate wheel axles as required. Do not over lubricate. Wipe any excess noted.

6.6 Inspect purge and test gas systems, bottle racks, handling equipment, etc.



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- 1) Leak test by means of solution film testing of each joint when first set up or reassembled.
- 2) Inspect all hoses for leaks and breaks in the stainless steel braid when connected or reconnected. Replace as required.
- 3) Inspect chains and guards on the bottle racks for damage periodically. Repair as required.

6.7 Electrical and control systems include the electrical distribution system, lighting and HVAC control system. These item will require minimum inspection and maintenance but not be limited to the following.

- 1) Perform an initial load test on each circuit and record on log sheet.
- 2) Inspect all connections for heat and corrosion periodically.
- 3) Test all indicating lights, alarms, and calibrate all gages when required by CBI Calibration Program Standard 1146.

6.8 Safety Systems shall be tested periodically as experience dictates. These systems consist of the following:

- 1) Fire alarms shall be tested. Replace batteries periodically.
- 2) Test emergency lighting/exit system. Replace batteries as suggested by the manufacturer.

**7.0 ATTACHMENTS:**

**None (See Clean Room Specification CRSPEC)**