



TITLE SPECIAL CLEANING OF BEAM TUBE CAN SECTIONS		IDENTIFICATION CL - S5 LIGO-8970185-00-B			
		REFERENCE NO. 953571		SHT 1 OF 4	
PRODUCT LIGO BEAM TUBE MODULES QUALIFICATION TEST CALIFORNIA INSTITUTE OF TECHNOLOGY		OFFICE LIGO		REVISION 0	
		MADE BY KSD	CHKD BY SWP	MADE BY	CHKD BY
		DATE 2/7/97	DATE 3/20/97	DATE	DATE

1.0 SCOPE:

This procedure is to be used to clean Beam Tubes that have been rejected due to an unacceptable FTIR cleanliness sample.


2.0 Equipment And Material To Be Used With This Procedure:

- (2) Plastic End Caps Modified With Vent and Drain Nozzles
- 1/2" Stainless Steel Banding Material
- Stretch Wrap Material
- (3) 6" X 6" X 16' Timbers
- (30) Gallons 2-Propanol (Isopropyl Alcohol, A.C.S. Reagent Grade). If reagent grade alcohol is not available a lower grade can be used with approval from Caltech. Four liter containers will be used to pour the alcohol into the tube.
- (2) Spill Containment Boxes (Made From Black Plastic and 6" X 6" Timbers)
- Containers To Collect Spent Alcohol (alcohol shipping containers)
- Respirators (Organic Vapor)
- Face Shields
- Rubber Gloves
- Plastic Aprons
- (2) Fire Extinguishers (Dry Chemical Power or Carbon Dioxide)
- No Smoking Signs
- Barricade Warning Tape
- Air Monitoring Equipment
- FTIR Sampling Equipment and Material
- (4) One Gallon Plastic Containers for transfer of alcohol
- Nitrogen Gas for venting tube after the wash

3.0 Equipment Setup:

3.1 Place (3) 6" X 6" X 16' timbers on floor underneath load-out hoists. Timbers must level within 1/4". Timbers to be equally spaced so that there is an equal load on the tube.

3.2 Construct spill containment boxes utilizing black plastic and 6" X 6" timbers at tube end locations. The purpose of the spill containment boxes is to contain any alcohol leakage that may occur during the cleaning of the tube. (15) gallons of alcohol equals approximately (2) cubic feet.

APPROVED	
 KSD LIGO	3/27/97 DATE 4/9/97 DATE



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3.3 Modify (2) shipping covers as follows:

- Cut a 3" hole in the center of one cover. The alcohol will be poured into the tube through this hole. The 3" hole will also provides ventilation to the inside of the tube. Steam clean cover prior to using for tube cleaning.
- Cut a 3" vent hole in the center and a drain hole to accept a PVC fitting with valve at the outer edge of the second cover. The drain hole and fitting to be positioned so that the cover can be placed on the tube and the alcohol can be drained from the tube. Attach the PVC fitting and valve. Steam clean cover and attached hardware. Clean inside of drain to prevent FTIR contamination.

3.4 Clean one gallon transfer containers with a single rinse of virgin alcohol.

4.0 Safety Provisions:

4.1 The alcohol wash will be performed only on non scheduled work days and will be the only activity authorized within the shop.

4.1 Rope off area with barricade tape 50' from tube and place no smoking signs at this boundary. Place fire extinguishers at boundary near each end of the tube.

4.2 Open all doors in Bay #1 for ventilation.

4.3 Turnoff electrical power at the (3) electrical services that feed Bay #1 and #2. **Note: Do not turnoff power to FIRE SYSTEM.**

4.4 The air must be monitored from the time the alcohol is poured into the tube until the alcohol has been drained and completely vented from the tube. **Note: Propanol has a vapor saturation level at room temperature above the lower explosive limit.** The air is to be monitored at each end of the tube at all times during the cleaning process. If during any time the Lower Explosive Limit (LEL) reading becomes greater than 10% of the LEL the area is to be cleared of personnel and additional ventilation provided. The LEL inside the tube must be less than 10% before the end caps are removed. Vent the tube with nitrogen gas if needed to lower LEL to 10%.

4.5 During the alcohol cleaning activities the access to the barricade area is limited to authorized personnel only.



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4.6 Respirators, rubber gloves, rubber aprons and face shields must be worn by personnel handling alcohol.

5.0 Tube Preparation:

5.1 Move tube inside cleaning room and remove the plastic shipping bags and covers. Clean the outside surface of the beam tube approximately 4" from the end of the tube with alcohol. Install modified covers on each end of the tube. Band the covers tight on to the tube using the stainless steel banding. Apply (2) layers of stretch plastic sealing covers to tube.

5.2 Move the tube to the ship-out area. Place the tube on the previously setup timber. tube must be level within 1/4".

6.0 Alcohol Wash:

6.1 Pour (15) gallons of 2-Propanol directly into the tube through a vent hole on a cover. Pour as quickly as possible to minimize the amount of vapor that escapes.

6.2 As soon as the alcohol has been poured start rotating the tube. Rotate the tube for 30 minutes at a rate of 1/2 turn per minute. Mark tube at bottom and rotate approximately 1' foot pass this mark in both directions. Continually monitor the LEL reading at the ends of the tube during this operation.

6.3 Raise one end of the tube so that the tube is at approximately a 1:20 slope. Drain the alcohol from the tube through the drain fitting into the 4 liter bottles. Allow the tube to drain until the flow rate out of the tube is less than a drop every second. Collect a sample of 500 ml of 2-propanol alcohol after each special cleaning with the 15 gallons of alcohol. **Each sample should be taken after approximately 1/2 of the alcohol in the tube has been drained through the drain valve.**

6.4 Lower the high end of the tube back on to the timbers.

6.5 Repeat steps 6.1 through 6.3.



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6.6 Allow the tube to vent. Monitor the air inside the tube during venting to determine when it is safe to remove the covers. The LEL inside the tube must be less than 10% before the tube can be moved back inside the cleaning room and remove the covers. If necessary, purge the tube with nitrogen gas to lower the LEL to below 10%

6.7 Move the tube inside the cleaning room and remove the covers. Steam clean tube in accordance with procedure "Cleaning Of beam Tube Can Section" #CL4.

6.8 Perform FTIR sampling as follows:

(a). Collect a sample of 500 ml of the virgin 2-propanol alcohol.

(b). Collect a sample of 500 ml of propanol alcohol after the steam cleaning in accordance with procedure "CLSAMP".

6.9 Cover and bag ends of tube.

7.0 Acceptance:

The tube will ship upon Caltech acceptance of the FTIR results.