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FACSIMILE MESSAGE

CBI
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Fax No. is: 815 439 6010
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January 4, 1995

To: Larry Jones
LIGO Project Caltech Pasadena, California

Fax No. (818)304-9834

From: M. L. Tellalian Phone (815)439-6517

Plainfield Engineering - PAE

RE: Emergency Procedure Instructions, Outgas Procedure Comments, Baffle Cleaning, Schedule
LIGO Design & Qualification Test - Caltech Contract C146

Larry,

Emergency Procedure Instructions
Attached for your information are emergency procedure instructions for the QT prepared by Warren Carpenter. These instructions will be a part of Warrens training class for people involved with the QT.

Outgas Test Procedure Comments
Your fax of Rai's comments was received yesterday and is being reviewed. Warren will present our response to you and Rai later today if possible. Attached is an E-mail message sent to Rai by Warren yesterday which contains Warren's initial comments.

Baffle Cleaning
A baffle cleaning procedure is being prepared which utilizes the aluminum heads used for the tube cleaning. The head will be inclined and supported of the center 6" port. The inclined head will be filled with the cleaning agent to overflowing which requires approximately 4 gallons. The baffle is placed in the head and covered with plastic. The inclined head is then rotated about the center port to wash the cleaning agent around the head and baffle. The duration and rotation will be consistent with the beam tube cleaning. A trial was made yesterday and this appears to work well. There is sufficient unused Merichem at CBI to clean the two baffles. Nearly all of the propanol was used for the tube cleaning. As such, CBI proposes that the baffles be cleaning with propanol used for the beam tube rinse. The baffles could be wiped dry after cleaning with or without unused propanol if desired. A baffle cleaning procedure is being prepared so let me have your comments.

Schedule
CBI will not conduct a preliminary leak test with a temporary head. The QT should be assembled and ready for leak testing by January 13. Naturally, the duration required for leak testing is difficult to predict. Heat up of the tube will start as soon as the leak test is completed and the insulation is attached. The schedule will be updated at the end of this week.

Give me a call if you have any questions.

Regards,

Marty Tellalian

M. L. Tellalian - Plainfield Engineering

CBI PROPRIETARY		IDENTIFICATION EMER-PRO			
TITLE	QUALIFICATION TEST EMERGENCY OPERATING PROCEDURES	REFERENCE NO. 930212		SHT 1 OF 6	
		OFFICE RCE		REVISION 0	
PRODUCT	LIGO BEAM TUBE MODULES QUALIFICATION TEST CALIFORNIA INSTITUTE OF TECHNOLOGY	MADE BY WAC	CHKD BY MLT	MADE BY	CHKD BY
		DATE 1/3/95	DATE 1/3/95	DATE	DATE

EMERGENCY PROCEDURES INSTRUCTIONS

INTRODUCTION

There are five main emergencies that can be predicted during the operation of the qualification test pumping system. These are:

- Loss of power
- Loss of LN2 or failure of the LN2 trap level controls
- Failure of a pump
- Failure of the bake out system
- Failure of the control system

Computer log notebook entries must be made for any operator action including any emergency action. The test director must be notified if any of these emergencies occur.

LOSS OF POWER

The loss of power will stop the control PLC (programmable logic controller), shut vacuum valves V3 and V10, stop all pumps, will stop the tube bake out and will stop the flow of liquid nitrogen (LN2) to the cold traps. The most important step in recovering from a power outage is to close the vacuum valve V1. This will isolate the beam tube from the pumping system. This should be accomplished as soon as possible after the power failure occurs.

The automatic valves (V3 and V10) will shut on power failure. However, it is important to isolate the roughing pumps from the rest of the system by closing V8, V9 and V11. This is done because the roughing pumps are at a higher pressure than the rest of the system and when the turbomolecular pumps slow down, gas will flow from the high pressure roughing pumps to the rest of the pumping system. Since the roughing pumps are lubricated and sealed by oil, the reverse flow of gas back into the pumping system will carry oil vapor into the pumping system. This contaminates the pumping system and may require that the pumping system be baked or even disassembled for cleaning. It is therefore imperative that the gas flow from the roughing pumps to the rest of the system must be prevented. This should be accomplished within the first five minutes of the power loss

CBI PROPRIETARY	IDENTIFICATION EMER-PRO			
TITLE QUALIFICATION TEST EMERGENCY OPERATING PROCEDURES	REFERENCE NO. 930212		SHT 2 OF 6	
	OFFICE RCE		REVISION 0	
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The next step is to reinstate the cooling of the LN2 traps. Cooling may be reinstated by opening the manual valves which bypass the solenoid valves. The valves will have to be throttled in order to maintain liquid in the trap without overflowing LN2 out of the trap vent. This can be accomplished by opening the valve until liquid starts to flow out of the vent and then reducing the flow until the vent line stays well frosted but does not vent liquid. The cold traps will maintain the cryogenic temperature for at least 12 hours. However, in order to minimize the possibilities of loosing any vapors which are condensed on the cold trap, the trap manual valves should be activated within the first four hours of the power loss if possible.

If cooling of the traps is not feasible for some reason, they must be isolated from the rest of the pumping system by shutting the vacuum valves which surround the traps. The valves which must be shut are as follows:

Trap	**Valves**
LNT1	V3 - should already be closed - confirm closure
LNT2	V2 and V5
LNT3	V4 and V15

Contact the test conductor after a power failure has been detected and safety measures have been instituted.

After the vacuum system is isolated from the tube, the roughing pumps are isolated from the pumping system, and the flow of LN2 has been reestablished to the cold traps; the reason for the loss of power must be investigated and power must be reestablished as soon as possible minimize the costs associated with the lost time.

LOSS OF LN2 OR LN2 CONTROL FAILURE

The daytime operator shall always check the weight of the LN2 dewar at the end of the day. If there is not sufficient liquid to last the night, the daytime operator shall replace the LN2 dewar prior to leaving for the night. The dewar shall have a minimum of 20 lb. of nitrogen at the end of each day shift.

CBI PROPRIETARY		IDENTIFICATION EMER-PRO			
TITLE	QUALIFICATION TEST EMERGENCY OPERATING PROCEDURES	REFERENCE NO. 930212		SHT 3 OF 6	
		OFFICE RCE		REVISION 0	
PRODUCT	LIGO BEAM TUBE MODULES QUALIFICATION TEST CALIFORNIA INSTITUTE OF TECHNOLOGY	MADE BY WAC	CHKD BY MLT	MADE BY	CHKD BY
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The procedure for loss of LN2 or the failure of a cold trap level control is to first close V1 and the valves surrounding the traps.

Trap	**Valves**
LNT1	V3
LNT2	V2 and V5
LNT3	V4 and V15

The next step is the determine the reason for the loss of LN2. The most probable reason for the loss is that the dewar has run out of liquid. This must be avoided at all cost to prevent warm-up of the cold traps. The second probable cause is that the trap level control or solenoid has failed or is turned off. Check the logs and procedures to make sure that the trap is supposed to be cold. If the trap is supposed to be cold and the controller is in the on position but not working, first open the manual bypass valve around the solenoid valve and adjust the flow, then switch to the manual fill mode on the level controller to see if this will energize the solenoid. If nothing happens, determine if a 110V power signal is sent to the solenoid during manual operation. If there is no signal, the level controller has failed. The controller can be repaired or the spare level controller can be utilized. If the solenoid has failed, it can be replaced with a spare.

Contact the test conductor after an LN2 trap failure has been detected.

PUMP FAILURE

The failure of a roughing or turbomolecular pump may , if left uncorrected for a period of time, contaminate the entire tube with pump oil. This is unacceptable and the system is designed to automatically isolate the pumps in the case of a pump failure. The pneumatic valves, V3 and V10 will shut upon failure of a pump or upon loss of power. The manual valve V1 which isolates the tube from the pumping system should be manually closed whenever a pump has failed or when a pump problem is suspected. In addition, if the pumping system has shutdown or a roughing pump has stopped, the valves separating the roughing pumps from the rest of the system should be manually closed. These valves are V8, V9 and V11.

Contact the test conductor after the malfunction has been detected.

FAILURE OF THE BAKE OUT SYSTEM

A failure of the bake out system requires no emergency action but must be corrected as soon as possible in order to proceed with the test and prevent unnecessary loss of time. The point of

contact for problems with the bake out systems is either Matt Stobart (6348) or the test director. The bake out system failure should be evaluated to determine if all weld machines are not operational or if only one machine is malfunctioning. If all machines are malfunctioning, check the power supply and the power supply contactor. If only one machine has failed, determine if it is the machine itself, the remote control or the power supply which has failed. If the machine or remote control has failed, replace it with a spare.

If the automatic control has failed on the one machine with automatic control, run the machine in manual or replace the automatic control with a remote control box. Care must be exercised when changing the control features of the welding machines. The tube temperature, tube pressure and welding machine current must be closely monitored to prevent deviating from the desired control parameters.

Contract the test conductor after a bake-out malfunction is detected.

FAILURE OF THE CONTROL SYSTEM

The control system is designed around the use of a PLC. This is the heart of the control system and typically will not be a problem during the test. However, if the system should fail, an electrical engineer must be contacted for repair of the PLC. The primary contact for the control system shall be Matt Stobart (6348) or the test conductor. If the pumping system is affected by the control system malfunction, then V1, V3, V5 and V10 should be closed to prevent contamination of the tube. The automatic valves (V3 and V10) can be manually closed by turning the manual operating screw on the pneumatic solenoid valve (located on the valve actuator) . Roughing pump isolation valves (V8, V9 and V11) should also be closed if the roughing system is affected by the control system failure.

Contract the test conductor after a control malfunction is detected.

CBI PROPRIETARY

IDENTIFICATION: EMER-PRO

TITLE	QUALIFICATION TEST EMERGENCY OPERATING PROCEDURES	REFERENCE NO. 930212		SHT 5 OF 6	
		OFFICE RCE		REVISION 0	
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STEP BY STEP PROCEDURE

LOSS OF POWER

1. Close V1 and confirm automatic closure of V3 and V10
2. Close the valves surrounding the LN2 traps

Trap	Valves
LNT1	V3 - should already be closed - confirm closure
LNT2	V2 and V5
LNT3	V4 and V15

3. Close the valves which isolate the roughing pumps (V8, V9 and V11)
4. Try to quickly determine the reason for the power loss, if it is a local problem.
5. **Contact the test conductor**.
6. Inform the utility company if the problem is not just within the building
7. Slightly open the bypass valves around the solenoid valves for the LN2 traps to ensure that the LN2 traps are continuously cooled. This should be done within the first four hours of the failure.

LOSS OF LN2 OR LN2 CONTROL FAILURE

1. Close V1.
2. Determine if the LN2 dewar is empty. If it is, quickly replace the dewar. Note this in the logbook file and **call the test conductor**. Continue as discussed below if the dewar is not empty.
3. Close the valves surrounding the trap or traps which have failed.

Trap	Valves
LNT1	V3
LNT2	V2 and V5
LNT3	V4 and V15

3. Slightly open the bypass valves around the LN2 solenoid valves of the malfunctioning trap or controller. Throttle these bypass valves until the trap discharge line is frosty but not discharging liquid.
4. Try to determine the cause of the failure and repair if possible.
5. **Call the test conductor prior to opening any vacuum valves.**

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PUMP FAILURE

1. Shut V1
2. Confirm the closure of V3 and V10
3. Shut the roughing pump isolation valves V8, V9 and V11.
4. **Contact the test conductor after the malfunction has been detected.**

FAILURE OF THE BAKE OUT SYSTEM

1. Determine the failure point of the bake-out system. This may be the power system, a welding machine, the PLC control system or the controller which is operated by the PLC.
2. Attempt to fix the problem or replace the faulty component if the operator is confident that he has correctly isolated the problem area and if the operator is confident that he can correctly repair or replace the faulty component.
3. **Contact the test director if the problem solution is not readily apparent or if the corrective action is unsafe.**

FAILURE OF THE CONTROL SYSTEM

1. Immediately close valves V1, V3, V5 and V10.
2. Close valves V8, V9 and V11 if the roughing pumps have stopped.
3. Try to determine the component which has failed.
4. **Contract the test conductor after a control malfunction is detected.**

Carpenter, Warren A.

From: Carpenter, Warren A.
To: Weiss, Rainer (LIGO)
Cc: Tellalian, Martin L.; Morgan, Paula; Peters, Steve W.
Subject: Initial comments on the outgassing procedure
Date: Tuesday, January 03, 1995 4:13PM

We received the fax of your comments which was sent to us by Larry on 1/3/95.

I have not had time to review your entire write-up but I thought I would respond to your opening comments.

We have not changed the file type descriptors simply because it creates an extra step in transferring data files to you. Changing the existing file type descriptors will create another step in the process which can cause errors and loss of data. We would like to keep everything as simple as possible to reduce error generation as much as possible. If you want these descriptors changed, we can do this for you.

Pump down of calibrated leaks. Agreed these will have to be evacuated during pumpdown.

N2 bleeder operation. The bleeders have already been adjusted. I have adjusted the bleeders with the roughing pumps isolated from the rest of the system and have adjusted them so that they supply the full flow of the roughing pump at the bottom of the viscous flow range. I believe that these values are 1.45 E-1 torr for the large roughing pump piping and 5E-1 torr for the small roughing pump piping. The pressure can then never go below the viscous flow range when pumping on the system. These bleeder valves are never touched and will always be open throughout the qualification test. The bleeders are not shut on pump failure or after activation of the turbo pumps. Shutting of the bleeders after the TMPs are started will result in contamination of the entire roughing system up to the TMPs.

I did not set a time for the activation of the RGA vacuum system. It takes less than one hour to be evacuated far below the pressure that the main pumping system will reach after 24 hours of operation. I can turn on this system early in order to clean it up as much as possible if you want a scan of the RGA system by itself.

Pirani gage recording. Only the P1 pirani gage will be recorded. It was felt that the other gages were not of importance.

Operation of TMP2. Agreed TMP2 can be turned on earlier. I waited to turn on the pump only because it was not needed before then. I have not made the calculation, but it could probably be turned on when the high vacuum side of TMP1 reaches 1 E-4 torr. We would not turn on TMP2 at .1 torr to prevent overloading TMP2 due to the compression of TMP1. TMP2 should not be contaminated because the N2 bleed valve is never shut down.

We can discuss your write-up tomorrow.