

LIGO - T940025 - 00 - B



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Plainfield, Illinois 60544-8929

FACSIMILE MESSAGE

Fax No. is: 815 439 6010
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October 11, 1994

To: Rai Weiss
LIGO Project - MIT

Fax No. (617)253-7014

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

Plainfield Engineering - PAE

RE: Section Leak Test - October 6 To October 10
LIGO Design & Qualification Test - Caltech Contract C146

Rai,

Attached are the lab notes from October 6 through this morning on the pump down and leak testing of the two section assembly. The assembly is composed of sections 21-A and 21-D. Evacuation of the assembly started on the afternoon of the 6th. A leak was discovered around 7:00 am on the 7th. The repair was made on the 7th and the assembly was rough pumped to 160 torr on the evening of the 7th and left in that condition over the weekend. Pumping resumed in the morning of the 10th and the assembly was tested in the late afternoon of the 10th. The behavior to the assembly was similar to the behavior to the previous section leak test. After approximately 10 minutes, the helium pressure started to rise.

Based on tests conducted this morning, it appears that the source of the helium pressure rise is the mass spectrometer. Another leak test will be conducted on the assembly today with the mass spectrometer isolated as much as possible. As always, your comments would be appreciated.

Regards,


M. L. Tellalian
Plainfield Engineering

cc: Larry Jones - LIGO Project
FAX # (818)304-9834

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REGAN J	LEAK TEST OF 21-D WITH 21-A ATTACHED	
7:30 AM - 1:00 PM	MOVED 21-C ASSEMBLY & SET UP 21-D WITH 21-A FOR LEAK TESTING.	
	* SMOOTHED WELD CONTOUR @ INFLAMMABLE SEAL CONTACT AREA.	
	* CLEANED DIFF PUMP	
	* BLACKLIGHT INSPECTED 21-D + 21-A.	
	RECEIVING SIX (6) WELD MACHINES & ELECTRICAL PANEL FROM INDECO. OTHER THREE (3) WELD MACHINES TO COME FROM K ³ .	
	FITTING 21C TO 21-B	
	FITTING & WELDING 21A & D ASSEMBLIES	
13:15	STARTED	ROUGHING PUMP 760 t
13:25	680 t	
13:30	670 t	(Shut valve to system for 10 minutes; pumping on foreline.)
13:50	570 t	
14:02	400 t	
14:16	310 t	Can cover seal space at opposite end from pump & MS is 10 t
14:31	245 t	Seal space 7.8 t
14:36		Closed system to repump foreline
14:40	220 t	Open roughing valve to system.
15:00	150 t	Seal space 6.9 t
15:07	140 t	Seal space 5.7 t
15:15	120 t	" " "
15:30	105 t	Seal Space 4.9 t; foreline 21 mt
15:45	92 t	Seal space 4.8 t; foreline 19 mt
16:00	73 t	" " 4.7 t; foreline 17 mt
16:15	60 t	" " 4.5 t; foreline 10 mt
16:32	45 t	Seal space 3.8 t; foreline 7 mt
16:47	35 t	" " 3.5 t; foreline 6 mt
17:00	30 t	" " 3.5 t; foreline

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1715	25t	Seal space	3.4t	;	foreline	6mt	
1730	20t	"	"	3.3t	;	"	4mt
1745	15t	"	"	3.3t	;	"	4mt
1800	12t	"	"	3.2t	;	"	4mt
1815	10t	"	"	"	;	"	3mt
1830	8.4t	"	"	3.0t	;	"	3mt
1835	Isolated MS from foreline; calibrated MS to direct read						
1845	6.8t	Seal space	3.0t	;	foreline isolated	-	7mt
1915	4.1t	"	"	2.9t			
1930	3.3t	"	"	2.9t			
1945	2.6t	"	"	2.8t			
2000	2.0t	"	"	2.8t			
2015	1.6t	"	"	2.8t			
2030	1.3t	"	"	2.8t			
2045	1.1t	"	"	2.7t			
2100	.93t	"	"	2.7t			
2115	.76t	"	"	2.6t			
2130	.62t	"	"	2.6t			
2145	.53t	"	"	2.6t			
2200	.45t	"	"	2.6t			
2215	.37t	"	"	2.6t			
2230	.31t	"	"	2.6t	FORELINE ISOLATED	-	88mt
2245	.27t	"	"	2.6t	"	"	- 93mt
2300	.24t	"	"	2.5t	"	"	- 99mt
2315	.20t	"	"	2.5t	"	"	- 104mt
2330	.18t	"	"	2.5t	"	"	- 107mt
2345	.16t	"	"	2.5t	"	"	- 110mt
2355	Opened 10" Slide valve; closed 3" through-g line valve						
2400	Pressure in foreline 140 mt						
2400	.14t	"	"	2.5t	FORELINE	134mt	
2415	.13t	"	"	2.5t	"	122mt	
2430	.12t	"	"	2.3t	"	115mt	
2445	.11t	"	"	2.3t	"	104mt	
0100	100mt	"	"	2.4t	"	94mt	
0106	STARTED COOLING COLD TRAP ABOVE 100 SLIDE VALVE						

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Time	Pressure	Flow	Notes
0115	97 mt	SEAL SPACE 2.5t ; FDBLINE 88mt	
0120		CLOSED 10" SLIDE VALVE & TUNED ON DIFFUSION PUMP HEATER	
0123	94 mt	SEAL SPACE 2.5t ; FDBLINE 15 mt	
0130	94 mt	" " 2.5t ; " 8 mt	
0145	96 mt	" " 2.5t ; " 7 mt	
		TOTAL GAS LOAD 3.28×10^{-2} t/s 4.32×10^2 scc/sec	
0200	97 mt	SEAL SPACE 2.5t ; FDBLINE 15 mt	
0215		OPENED 10" SLIDE VALVE	
0215	96 96 mt	SEAL SPACE 2.5t ; FDBLINE 200 mt	
0230	69 mt	" " 2.5t ; FDBLINE 230 mt	
0245	37 mt	" " 2.5t ; " 225 mt	
0300	8.2 mt	" " 2.5t ; " 215 mt	
0315	4.7×10^{-5} t	" " 2.4t ; " 20 mt	
0330	3.9×10^{-5} t	" " 2.4t ; " - 20 mt	
0345	3.6×10^{-5} t	" " 2.4t ; " - 19 mt	
0355		STARTED N ₂ SWEEP	
0400	2.0×10^{-4} t	" " 2.4t ; " 70 mt	
0415	2.0×10^{-4} t	SEAL SPACE 2.4t ; " 71 mt	
0430	2.0×10^{-4} t	" " 2.4t ; " 71 mt	END OF N ₂ SWEEP
0435	3.6×10^{-5} t	" " 2.4t ; " 21 mt	
0445	3.3×10^{-5} t	" " 2.4t ; " 17 mt	
0500	3.3×10^{-5} t	" " 2.4t ; " 17 mt	
0505		STARTED N ₂ SWEEP	
0510	2.5×10^{-4} t	2.4t ; " 72 mt	
0515		END N ₂ SWEEP	
0520	3.2×10^{-5} t	2.4t ; " 17 mt	
0530	3.2×10^{-5} t	2.4t ; " 17 mt	
0545	3.2×10^{-5} t	2.4t ; " 18 mt	
0600	3.2×10^{-5} t	2.4t ; " 18 mt	
0615		NO DATA TAKEN	
0630	3.2×10^{-5} t	2.4t ; " 17 mt	
		PUMPDOWN NOT PROCEEDING ON SCHEDULE WILL SPRAY REPAIRS	
0700		MAJOR LEAK FOUND 2nd & STIFFENER FROM PUMP END LEAK APPROX SIZE PEBBLED MATCHING ON 10 ⁻⁶ SCALE P = 3.0×10^{-5} t HMS BLG 450 ⁻⁸ w/ THROTTLE VALVE PARTIALLY OPEN	
0725		SPRAYED REST OF REPAIRS & START/STOPS - NO OTHER DETECTABLE LEAKS	

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0730

$P = 2.9 \times 10^{-5}$

pressure = 14 mt SEAL 2.3 tons
 REPRESSURIZED TO FIX LEAK
 LEAK LOCATED @ ABOUT 2nd° OF
 2nd SMALL STIFFENER FROM PUMP
 END ~ 1' FROM ROUND SEAM

ACTIVITIES DURING THE MORNING OF 10/7/94

- MOVED SIX (6) WELD MACHINES & POWER CONTROLLER INTO LOCATION FOR IZK BALE
- PRESSURIZED 21-D UNDER LEAK TEST AND LOCATED THE THRU CRACK INSIDE + OUTSIDE
- OUTLINED ^{REPAIR} PREPARE PROCEDURE FOR CRACK + PREPARED NOW CONFIRMANCE # CHECK LIST
- BEGAN REMOVING SECTION OF STIFFENER

1930

WELD REPAIRED + RE TESTED W/ HMS ON
 INSIDE OF TUBE BACKGROUND 1.3×10^{-1}
 NO INDICATION W/ THRU CRACK FULLY OPEN
 R.P. STARTED

1980

$P = 210$ TONS SYSTEM SHUTDOWN FOR
 WEEKEND

NOTE → HOOKED UP STOKES ROUGHING PUMP TO
 THE CHAMBER. KEPT SMALL PUMP BACKING DIFF PUMP
 DETERMINED DURING THE DAY THAT CLEARANCE UNDER
 TUBE @ SUPPORTS IS NOT SUFFICIENT TO DRILL HOLES FOR
 ANCHORS WITH TUBE IN PLACE.

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MONDAY, OCTOBER 10

0655	160 t	CHAMBER PRESSURE (VALVED CLOSED FOR WEEKEND)
0656		STARTED ROUGHING PUMP
0657		OPENED CHAMBER VALVE 1
0700	120 t	
0715	52 t	
0730	18 t	
		STARTED SMALL ROUGHING PUMP + OPENED GATE VALVE TO CONNECT PUMP TO CHAMBER
0745	6 t	
0800		NO READING TAKEN
0814		TURN ON LV2 + WATER TO DIFF PUMP
0815	1.3 t	TURNED OFF DP HEATER
0830		NO READING TAKEN
0845	0.560 t	TURNED ON SEAL R.P.'S
0900	.42 t	SEAL PRESSURE 6.7 t
0915	.32 t	
0930	.26 t	STOKES PUMP SLAMMED DOWN BELIEVE IT NEEDS BALLASTING SEAL = 9.4 t
0940	.23 t	SHUT CHAMBER VALVE VALVE & OPENED R.P. BALLAST VALVE - WITH BALLAST FOR 1/2 HR SEAL 9.0 t
1010	.23 t	RESTARTED ROUGHING SEAL 8.3 t
1020	.20 t	SEAL 8.2 t
1030	.17 t	
1045	.14 t	SEAL = 8.0 t
1100	.11 t	7.9 t
1115	.096 t	7.8 t
1120	9.0×10^{-2} t	STARTED OPENING DIFF PUMP ISOL VALVE
1120	8.0×10^{-2} t	7.7 t CLOSED ROUGHING PUMP VALVE
1130	6.7×10^{-2} t	7.7 t & AGAIN STARTED BALLAST
1140	4.7×10^{-2} t	7.7 t
150	2.9×10^{-2} t	SEAL = 7.7 t
200	1.1×10^{-2} t	7.7 t

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Time	Pressure	Notes
1205	Chamber pressure = 1.4t	SEAL PRESSURE = 7.6t
1210	1.0×10^{-4} Torr	X-OVER COMPLETE 7.6t
1215	2.3×10^{-5} t	7.6t
1310	5.8×10^{-6} t	7.9t
1330	4.8×10^{-6} t	HMS BKG 1.5×10^{-9} HMS CALIBRATION 7.3t 2×10^{-8} LEAK = 2×10^{-8} UNHMS
1350		START LEAK CHECKING w/ the SPRAY
1410	3.8×10^{-6} t	SPRAY LEAK TESTED ALL LIKELY WELDING SPOTS (REPAIRS, ETC.) NO INDICATION OF LEAKAGE HMS BKG 1.3×10^{-9} HMS FULLY BACKING D.P. w/ THROTTLING VALVE W/ OPEN.
1415	3.8×10^{-6} t	SHUT OFF SEAL PUMP ON NON PUMP END & REPRESSURIZED BETWEEN SEALS
1420	3.7×10^{-6} t	NON PUMP END SEAL SEEMS TO BE TIGHT UNREPRESSURIZED PUMP END SEAL
1425	3.7×10^{-6} t	SEAL ON PUMP END SEEMS TO BE TIGHT ALSO
1445	3.4×10^{-6} t	TIGHT ALSO
1720	2.7×10^{-6} t	TUBE BAKED, N ₂ ON SEALS He READY FOR SPRAY
1735	2.5×10^{-6} t	DEGASSED GAGE
1700	Calibrated HMS. Adjusted HMS sensitivity to read 20% above direct readout from helium standard leak of 2.0×10^{-8} std cc/s; is to have a signal of 2.4×10^{-8} for that leak.	
1742	Background based on zeroing during HMS calibration is 1.45×10^{-9} ; nulled background to 4.0×10^{-10} .	
1744	Background at 3.8×10^{-10} ; can pressure is 2.4×10^{-6} t.	
1745	Evacuating polyethylene bag.	
1754	Background is 3.8×10^{-10} ; can pressure is 2.4×10^{-6} t. Helium started into polyethylene bag. Oxygen measured at	
1759	in middle near bottom along length top near end Oxygen level 14.0%. HMS signal unchanged	
1800	Oxygen level 10.0%. HMS signal unchanged	
1801	Oxygen level 8.6%. HMS signal unchanged.	
1802	Oxygen level 4.9%. HMS signal unchanged	
1803	Oxygen level 4.4%. HMS signal unchanged	

0
90
HELIUM
41
5
58
6
64
7
71
8
81

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- 12 1804 Oxygen level 4.3% Changing Helium bottles.
~~1804~~ HMS signal started to increase since previous 3.8×10^{-10} reading. HMS signal at 4.4×10^{-10} at 1804 1/2
- 11 1805 HMS signal at 5.1×10^{-10} .
- 12 1806 HMS signal at 5.8×10^{-10} .
- 15 1807 Oxygen level at 3.5% HMS signal at 6.7×10^{-10} .
- 7 1809 Oxygen level at 3.1% HMS signal at 8.2×10^{-10} .
- 8 1810 Oxygen level at 2.9%. HMS signal at 1.05×10^{-9} .
- 7 1811 Oxygen level at 3.1%. HMS signal at 1.15×10^{-9} .
Stopped injecting helium.
- 19.5 1813 1/2 HMS signal at 1.45×10^{-9} .
- 20 1814 HMS signal at 1.55×10^{-9} .
- 24 1818 HMS signal at 1.75×10^{-9} . Oxygen level at 18.9%.
- 25 1819 HMS signal at 2.3×10^{-9} . Oxygen level at 18.9%.
- 27 1821 HMS signal peaked at 2.6×10^{-9} .
- 21 1823 Opened system standard leak to get evacuated of helium; the helium burst cleaned up from system as soon as leak was closed.
Nulled zero from 2.6×10^{-9} to 3.0×10^{-10} to calibrate system.
- 1827 to 1828 Conducted one calibration of system; signal went from 3.0×10^{-10} to 1.15×10^{-9} for an 8.5×10^{-10} signal increase for a 5.0×10^{-10} std cc/s leak of helium.
- 1829 to 1830 Conducted second calibration of system; signal went from 3.1×10^{-10} to 1.05×10^{-9} for an 7.4×10^{-10} signal increase for a 5.0×10^{-10} std cc/s helium leak.

System clean-up time was timed at 55 seconds. Likewise response time was approximated at about 50 seconds. Waiting time was instantaneous; i.e. when helium rise was first indicated.

For helium standard leak, the helium signal increase would clean up as soon the leak was closed. For the helium signal received after nine (9) minutes, the signal does not clean up readily indicating hang up in the system elastometer seals.

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1838

Closed 10" ϕ slide valve to isolate can section.
Background is 2.5×10^{-9} ; can pressure is 2.5×10^{-6} t.

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0720

Can pressure 8.0×10^{-4} t; HMS calibration - reads

0740

Cooled 10" ϕ cold trap. 23.3×10^{-9} for 2×10^{-8} std tok

0750

Opened 10" ϕ slide valve; HMS background 1.25×10^{-9} .

0805

Can pressure 6.3×10^{-6} t; foreline 2 mt;
HMS background 1.4×10^{-9} .

0821

4.0×10^{-6} can pressure; HMS background is
 1.65×10^{-9} Injected He into bag around HMS.

0822

HMS signal rising.

0824

1.2×10^{-7} HMS signal peaked

0831

5.6×10^{-9} HMS signal

0832

Isolated HMS; vented HMS manifold and
metal hose, re-umped HMS; HMS signal is
 5.3×10^{-9} , gauged a little on background.

to 0836

0838

HMS signal back to 5.6×10^{-9} ; didn't gain any the
HMS definitely most, if not all, of our problem

0845

Started purging bag around HMS with N_2 ; HMS
signal (background) still rising. 7.8×10^{-9} HMS signal

0853

HMS signal at 9.8×10^{-9} ; still purging bag around
HMS with N_2

0856

Can pressure 2.8×10^{-6} t; foreline at 1 mt.

0904

HMS background signal 1.2×10^{-8} ; still N_2 purging HMS.
Can pressure is 2.7×10^{-6} t.

0908 1/2

Isolated HMS from system; background 1.25×10^{-8}
before isolating.

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