

FAX COVER PAGE

CALIFORNIA INSTITUTE OF TECHNOLOGY

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DATE:	7/18/96

FROM:	Larry Jones
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FAX NUMBER:	(818) 304-9834
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REFER TO:	LIGO-T960133-00-B
SUBJECT:	Spiral weld outgassing

NUMBER OF PAGES FAXED INCLUDING THIS COVER SHEET:	25
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NOTE:

These readings are about 1/2 of what the final QT weld outgassing readings were, even before the base material effects (approx. 3x the QT) are subtracted off. Remember that this is leftover QT material. I believe that part of the base material increase is due to the fact that this material is from a central part of the coil (not sure how deep). Remember that a core reading during the QT was 2x the normal (outer wrap) reading. I see no reason for concern, and believe that the spiral weld has passed, with flying colors. Do you agree? I'm preparing a writup for distribution, similar to the QT writup that's attached.

H₂ Outgassing from Weld Test Coupons

Jordan Camp, July 17, 1996

Data taken by Steve Vass

Sample:	W1	W2	W3	accum (hrs)	Date
Description:	6 Weld coupons WS - 40	6 Weld coupons WS - 20	6 Weld coupons		
Chamber:	LH4-2N	LH4-3N	LH4-4N		
Background, as last measured (torr·l/s·cm ²)					
Area [cm ²]	1,563	1,563	12,619		
Outgassing rate [torr·l/s·cm ²]	2 days after pumpdown, before 250 C bake				
	After 250 C bake				
	2.5e-13	1.6e-13	6.4e-14	14	7/15/96
	1.6e-13	1.3e-13	9.8e-14	20	7/16/96
	1.6e-13	1.0e-13	9.7e-14	20	7/17/96

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CALIFORNIA INSTITUTE OF TECHNOLOGY

TO W. Althouse, G. Stapfer

DATE 6/14/94

FROM L. Jones *[Signature]*

EXT MAIL EMAIL

SUBJECT Cleaned weld wire H₂ outgassing effects

Ref.: My memo to you of 5/2/94, "Standard weld wire H₂ outgassing effects (Revised)"

Prior testing of welded coupons qualified the use of beam tube welds made with standard (as received) filler wire (see ref. memo). The FDR board questioned the wisdom of depending upon a consistent condition of cleanliness in standard filler wire, and recommended that a cleaning process be instituted to control consistency. CBI reviewed industrial practices for cleaning wire and proposed a proprietary method from a firm, Techalloy, which appears effective and inexpensive. This was approved and CBI provided additional coupons made with the cleaned filler wire for evaluation. These were tested in the vacuum test facility for hydrogen outgassing; data sheets are attached.

The table below shows the H₂ outgassing flux calculated for each of the standard weld wire H₂ outgassing measurements; units are *torr · liter/s*. The number of coupons in the welded batches (6 each) contain the equivalent amount of weld that the nonwelded batch (48 coupons) surface area would have in the beam tube. However, they also contain additional background of the outgassing from the six coupon sheets. This was calculated as 1/8 of the average flux reading of the nonwelded batch, and subtracted from the average flux for each welded batch to arrive at the "Weld Contribution" numbers. Weld contribution from standard filler wire (referenced memo) and from cleaned and baked filler wire (memo of 2/2/94) is shown for comparison.

Date/description	No. 1 Welded (6)	No. 2 Welded (6)	Nonwelded (48)
6/9/94	4.3×10^{-10}	4.4×10^{-10}	9.5×10^{-10}
6/10/94	3.6×10^{-10}	3.6×10^{-10}	9.8×10^{-10}
6/13/94	3.3×10^{-10}	3.3×10^{-10}	8.5×10^{-10}
6/14/94	4.7×10^{-10}	4.9×10^{-10}	9.1×10^{-10}
Average	4.0×10^{-10}	4.1×10^{-10}	9.2×10^{-10}
Sheet Contribution	1.2×10^{-10}	1.2×10^{-10}	9.2×10^{-10}
Weld Contribution (Cleaned Wire)	2.8×10^{-10} <small>HAZ 3.3×10^{-13} $\text{torr} \cdot \text{liter}/\text{cm}^2$</small>	2.9×10^{-10} <small>3.5×10^{-13}</small>	0
Weld Contribution (Standard Wire)	5.6×10^{-10}	5.6×10^{-10}	0
Weld Contribution (Cleaned & Baked Wire)	1.9×10^{-10}	3.1×10^{-10}	0

HAZ ~ 0.6" wide (1.52 cm)

6 COUPONS: $6 \times 18 \times 2 \times 2.54 \times 1.52 = 836 \text{ cm}^2$ HAZ

TUBE w/ 16" SKEW:

65' SURF: $49\pi(65)(12) = 1.2 \times 10^5 \text{ m}^2$

WELD: $(49\pi + 3\pi(65)(12))0.6 = 4.5 \times 10^3 \text{ m}^2$ (3.75%)

The weld contribution with cleaned filler wire is essentially the same as the contribution from cleaned and baked filler wire, and half of the contribution from standard wire.

CONCLUSION: The use of weld filler wire cleaned with the Techalloy process is acceptable for all beam tube welds (note: this does not include flux core filler wire, which is notorious for high hydrogen levels, and was not tested).

Distribution:

- A. Abramovici
- B. Barish
- J. Camp
- D. Shoemaker
- R. Weiss
- S. Whitcomb
- J. Worden

H₂ Outgassing from Welds with Cleaned Filler Wire

Jordan Camp, 14 June 1994

Sample:	W1	W2	P	Date
Description:	Six welded coupons	Six welded coupons	48 plain coupons	
Chamber:	LH4-2N	LH4-3N	LH4-4N	
Background, as last measured (torr·l/s·cm ²)	1.5e-14	1.9e-14	1.1e-14	
Area (weld length) [cm ² (cm)]	1,577 (549)	1,577 (549)	12,619	
Outgassing rate [torr·l/s·cm ² (torr·l/s·cm)]	pre-bake measurement			
	8.1e-14 (2.3e-13)	1.1e-13 (3.2e-13)	1.1e-13	6/3/94
	After 36 hr 250 C bake			
	2.7e-13 (7.7e-13)	2.8e-13 (8.0e-13)	7.5e-14	6/9/94
	2.3e-13 (6.6e-13)	2.3e-13 (6.6e-13)	7.8e-14	6/10/94
	2.1e-13 (6.0e-13)	2.1e-13 (6.0e-13)	6.7e-14	6/13/94
	3.0e-13 (8.6e-13)	3.1e-13 (9.0e-13)	7.2e-14	6/14/94