LIGO-E940005-01-B

FACSIMILE MESSAGE

Chicago Bridge & Iron Company
P.O. Box 41146
Houston, TX 77241-1146
713/466-7581
Fax No.: 713/466-4259

Date: 1/3/94

To:	LARRY JONES	**From:**	RICK PRIOR
	CALTECH		CHICAGO BRIDGE & IRON
	818/304-9834		HOUSTON CORPORATE WELDING

WE ARE TRANSMITTING 8 PAGE(S) (INCLUDING THIS COVER SHEET). IF THERE ARE ANY PROBLEMS, PLEASE CALL (713) 896 - 2916 .

REFERENCE: Final Outgassing Coupon Procedures

Attached you'll find a complete work order (H11377) for the preparation of the outgassing test coupons. Total hydrogen analysis was taken on the weld wire in 3 conditions and results are on sheet 3. Also, 100% RT was done on the completed welds to assure sound welds. The radiographs will be kept here in Houston and will be available for viewing at the meeting next week.

Also attached is the final WPS-WELDCOUP for the welding of the coupons. The only revisions were to the welding parameters on page 3. These are the actual parameters used for the welding of the coupons.

WMS-ER308L was unchanged and Chuck Sherlock faxed a final CLCOUP for the actual cleaning of the coupons.

If you have any questions or require anything else, please feel free to call.

Rick W. Prior
Houston Corporate Welding

cc: _____

CBI

Work Order and Report Form

Contract or Account	Project Code	Standard Code	CSI/Dept Code	Comp. Code	Unit Code	Remarks
930212	710	601	W			

PQR No. _____

Work Order No.	H11377
Rev. No.	2
Sheet	1 of 4
Standard	X
Nuclear	CPU 25

Purpose of test: Outgassing Test Coupons for LIGO

Written by: RWP Date: 12/8/93 Complete by date: 12/20/93

Mat'l Requirements

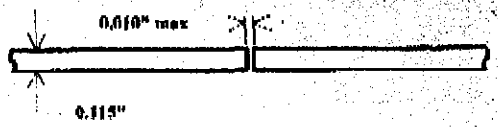
Mat'l (1) WL No. LIGO Rack _____ Slot _____ Mill _____ Country _____ in ___ mm ___

Mat'l (1) A240 Tp. 304 Gr. _____ H.T. _____ P No. 8 Gp. No. 1 Pipe dia. _____ Thk. 0.115 X

Mat'l (2) WL No. _____ Rack _____ Slot _____ Mill _____ Country _____ in ___ mm ___

Mat'l (2) _____ Gr. _____ H.T. _____ P No. _____ Gp. No. _____ Pipe dia. _____ Thk. _____

Joint Design:



Fit plates to zero gap
(0.010" maximum gap allowed)

Grain Dir.
Any

Plates Req: 1 (40" x 86" x 0.115")
[ ] Chem Pad
Edge Coating
Init./Date

Remarks: Plate provided by Caltech
1) Plate to be sheared in accordance to Sheet 2
2) Plates to be cleaned per procedure on Sheet 3
3) Plates to be welded per Sheet 3
4) X-ray plates for non-fusion.
5) Stamp coupons per Sheet 4
6) Final shearing per sheet 4
7) Clean/bake out of wire per Sheet 3

Position: 1G Land: _____ Gap: 0.010" max Witness Req'd: [ ]

Primary Elect. Process: GTA Manual [ ] Machine [X] Auto [ ] Semiauto [ ] A No 1 F No 6
Elect(1) AWS ER308L TN _____ Arcalloy _____ Mfr Alloy Rods Ctry USA ASME Spec. No. SFA 5.9
Ht. No. _____ Lot No. _____ Moisture AR _____ AB _____ AWS Spec. No. A 5.9
Flux TN: _____ Mfr _____ Ctry _____ Lot No. _____ Shielding ga 60/40 Purge gas 100% Ar
GMAW mode of transfer: Spray [ ] Glob [ ] Pulse [ ] Shortarc [ ] Current Polarity: DC/EN

Second Elect. Process: Manual [ ] Machine [ ] Auto [ ] Semiauto [ ] A No _____ F No _____
Elect(2) AWS _____ TN _____ Mfr _____ Ctry _____ ASME Spec. No. SFA-5. _____
Ht. No: _____ Lot No. _____ Moisture AR _____ AB _____ AWS Spec. No. A5. _____
Flux TN: _____ Mfr _____ Ctry _____ Lot No. _____ Shielding gas _____ Purge gas _____
GMAW mode of transfer: Spray [ ] Glob [ ] Pulse [ ] Shortarc [ ] Current Polarity: _____

Single or Multiple Pass
Side 1- S Side 2- S

Single or Multiple Arc
Side 1- S Side 2- S

GWPS: GTAW

Weld Tech std [X]
imp [ ] hd [ ] h&i [ ]
Type of Backing: None
Wash Dir:
Joint: SQ

Req'd NDE:

[X] RT
OK

[ ] PT

[ ] UT

[ ] Other

Tech files:
633-304L-1
822-5-44

Rem Address:

Comp. weld lab init. _____
Date _____
Evaluation of results: Satisfactory _____

by RWP Date 1/3/94

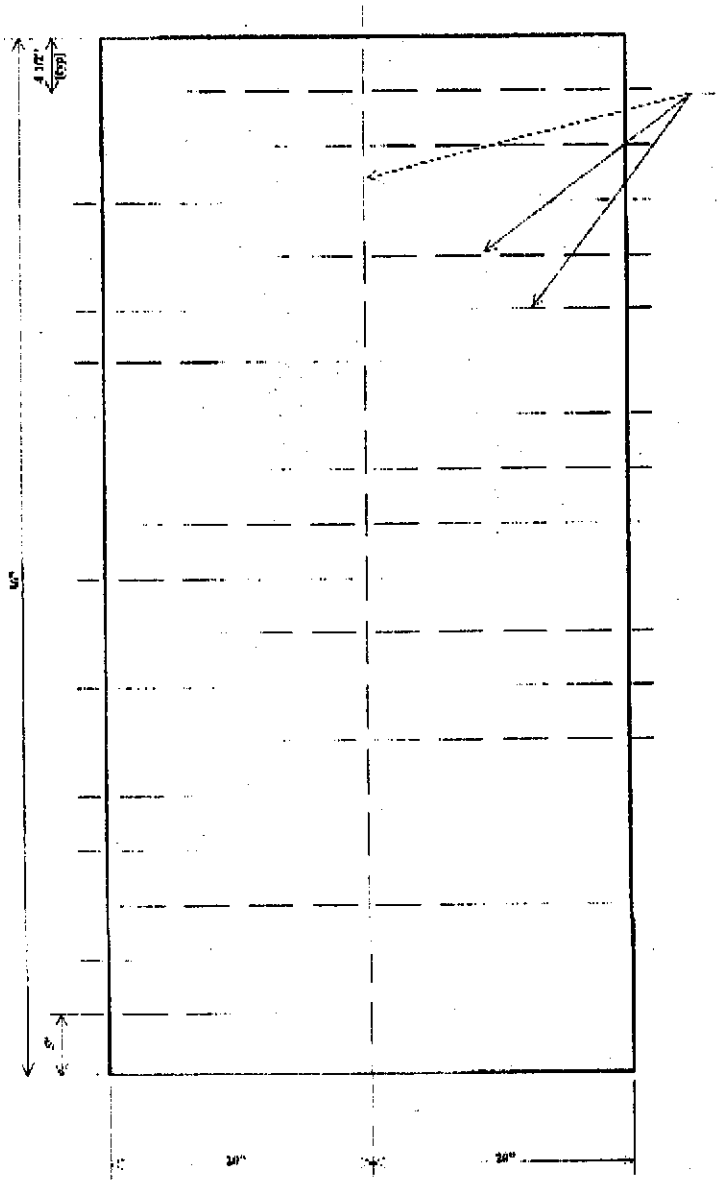
CBI

Work Order and Report Form

Work Order No	H11377
Rev. No.	2
Sht 2 of	4

Initial shearing procedure:

Shear the 40" x 86" LIGO sheet per the following sketch:



CBI

Work Order and Report Form

Work Order No			H11377
Rev. No.			2
Sht	3	of	4

Cleaning Procedure of 20" x 4 1/2" x 0.115" plates for welding:

1) Clean plates after initial shearing per attached CLCOUP steps 5.1 to 5.5.

Cleaning and Bake Out Procedure for ER308L:

1) Cleaning and bake out per attached WMS-ER308L.
2) Send 3 samples to Kawin for Total Hydrogen analysis.
   1) Before any cleaning or bake out — 7.1 ppm
   2) After cleaning/bake out — 0.87 ppm
   3) After final Scotch Brite cleaning. — 1.01 ppm

Welding Procedure:

1) Fit plates to ZERO gap using small autogenous "button" tacks.
2) All fitting/welding are to be done with an Argon purge.
3) Weld side 1 autogenous and allow the plate to cool to ambient.
4) Weld side 2 with ER308L and cool to ambient.
5) Use attached parameters for all welding. **(Record any changes from the W/O)**
6) Weld first plate and cut x-section to determine adequate bead overlap.

Shielding gas: 60% Argon - 40% Helium (40 cfh)
Purge gas: 100% Argon (< 0.6% oxygen level)

Welder's Name: Jimmy Benton Social Security Number: 064-38-3928 ID: JLB

Welding Parameters for the Diametics Gold Track II:

Record:	Parameter	Side 1	Side 2
X	Upslope time	3	3
X	Downslope time	2	2
X	Travel start delay	1	1
X	Wire Delay	N/A	1
	Oscillation amplitude	Zero	Zero
	Pulse mode	Off	Off
	Pulse width	N/A	N/A
	Pulse frequency	N/A	N/A
	Filler wire	Autogenous	ER308L
	Wire diameter	N/A	0.035"
X	AVC Response	20	20
	AVC mode	Samp	Samp
	Travel speed	18 ipm	18 ipm
	Primary weld current	230	230
	Arc voltage	10	10.5
	Wire feed speed	N/A	16
	Background weld current	N/A	N/A
	Arc voltage	N/A	N/A
	Wire feed speed	N/A	N/A
	Out dwell time	N/A	N/A
	Excursion time	N/A	N/A
	In dwell time	N/A	N/A

Notes: Plates #2 and #5 lost wire feed and were welded autogenous both sides. These plates were discarded and two more plates welded.

CBI

Work Order and Report Form

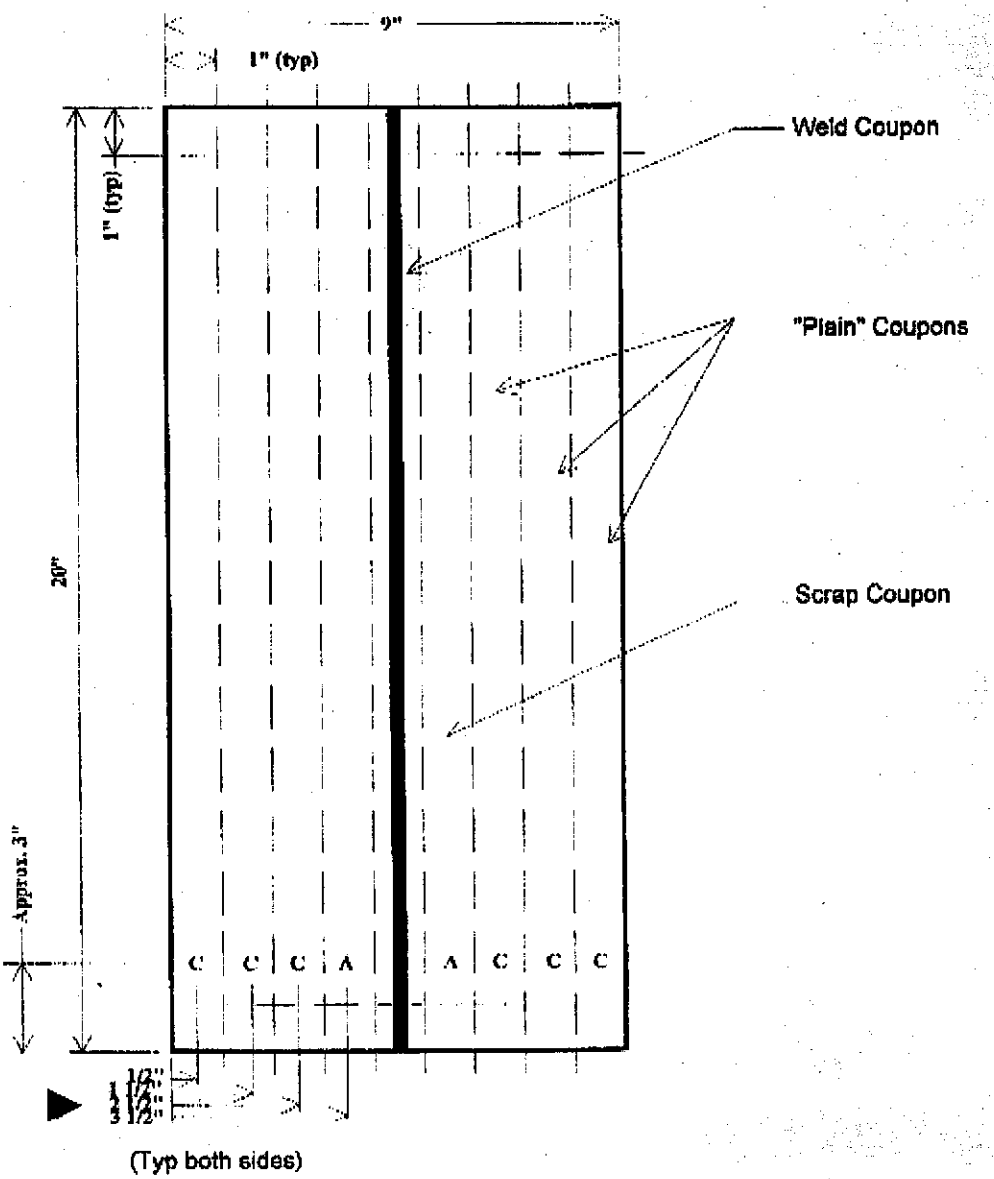
Work Order No	H11377
Rev. No.	2
Sht 4 of	4

Coupon stamping:

1) Stamp three outer coupons with "C"
2) Stamp the adjacent to weld coupon with "A"

Final shearing of the welded coupons:

Final size of coupons: 1" x 18" x 0.115"



CBI

WELDING PROCEDURE SPECIFICATION

IDENTIFICATION	CONTRACT
WPS	
WELDCOUP	*930212*

PAGE NO. *1* OF *3*
REV. NO. *1*
BY *RWP* DATE *12/17/93*

PRODUCT *OUTGASSING TEST COUPONS*
CUSTOMER *CALTECH - NSF*

WORK THIS DOCUMENT WITH GENERAL WELD PROCEDURE SPEC. GWPS- *GTAW*

REFERENCE PROCEDURE QUALIFICATION RECORD

NO.	POSITION QUALIFIED (QW-405)	THICKNESS QUALIFIED (QW-403)
PQR to be done for LIGO at a later date.		

SPECIFIC CONTRACT

POSITION (QW-406)	THICKNESS RANGE (QW-403)
1G	*1/8"*

SPECIFIC CONTRACT WPS REQUIREMENTS

CODE EDITION AND ADDENDA *ASME Section VIII & IX, 1992 Edition, 92 Add.*

JOINTS (QW-402) SEE GENERAL WELDING TECHNIQUE PAGE *3*

PREHEAT/INTERPASS TEMPERATURE (QW-406) SEE ATTACHED PAGE *2*

BACKING MATERIAL (QW-402)
None Required

POST WELD HEAT TREATMENT (QW-407)
PWHT REQUIRED *No*
IF PWHT IS REQUIRED, SEE APPROVED CONTRACT PWHT PROCEDURE FOR DETAILS AND EXTENT OF PWHT.

BASE MATERIAL (QW-403)

A240 Tp. 304L *(ASME P-8, Gp. 1)*

Any ASME P-8, Gp. 1 material may be welded together or to each other in any combination.

GAS (QW-408)

	SHIELDING	BACK UP
COMPOSITION:	*60%Ar/40%He*	*100%Ar*
FLOW RATE:	*20-45 cfh*	*10-20 cfh*

ELECTRICAL CHARACTERISTICS (QW-409)
CURRENT: *Direct Current*
POLARITY: *Electrode Negative*
OTHER: *Straight Polarity*
AMPERAGE AND VOLTAGE RANGE. SEE PAGE *3*

FILLER METAL (QW-404)

ASME SPECIFICATION NO:	*SFA 5.9*
ASME CLASSIFICATION:	*ER308L*
ASME ANALYSIS NO:	*A-8*
ASME GROUP NO:	*F-6*
CONSUMABLE INSERT:	*N/A*
SUPP. POWDER FILLER:	*N/A*

VOLUME OF WELD METAL REQUIRED *No*
SEE ATTACHED PAGE *N/A*
MODE OF TRANSFER *N/A*

FLUX (QW-404)
N/A

TECHNIQUE (QW-410)/ SPECIAL LIMITATIONS
SEE ATTACHED PAGE(S) *2, 3*
STRINGER OR WEAVE TECHNIQUE SEE PAGE *2, 3*
TYPE OF WELDING

MANUAL [ ] MACHINE [X]
SEMI-AUTOMATIC [ ] AUTOMATIC [ ]

CUSTOMER APPROVAL

REVIEW	OB ENGR	DIST ENGR	WELDING SERVICES HOUSTON	CORP QA	REG CONST QA	REG MFG QA

	BY	DATE
PREPARED	*RWP*	*12/6/93*
CHECKED	*BGG*	*12/6/93*
AUTHORIZED		

Printed in USA

WL100 REV JUL 87

CBI WELDING PROCEDURE SPECIFICATION

IDENTIFICATION WPS	CONTRACT
WELDCOUP	930212

PRODUCT	OUTGASSING TEST COUPONS	PAGE NO.	2 OF 3
CUSTOMER	CALTECH - NSF	REV. NO.	1
		BY RWP	DATE 12/17/93

LIMITATIONS:

1) *This WPS to be used with Dimetrics Gold Track II weld unit.*
2) *All welding is to be done in the downfiat (1G) position.*
3) *Pulsing current may be used.*
4) *Use a single pass per side technique.*
5) *Use a single EWTh-2 (2% thoriated Tungsten) electrode.*
6) *No single pass shall exceed 1/2" in thickness.*
7) *Only stainless steel brushes shall be used on stainless steel.*
8) *Parameters on Page 3 shall be followed.*
9) *Only filler material in accordance with WMS-ER308L shall be used.*

CLEANING:

Cleaning of coupons to be done in accordance with cleaning procedure CLCOUP.

INTERPASS TEMPERATURE:

The interpass temperature shall not exceed 350°F.

PREHEAT REQUIREMENTS (ASME P-8, Gp. 1):

No preheat is required except as an aid to remove moisture unless the ambient temperature falls below 0°F. When the ambient temperature falls below 0°F, a preheat of warm to the hand (approx. 100°F) is required within 3" of where the welding is started and maintained 3" ahead of the arc.

CBI

WELDING PROCEDURE SPECIFICATION

IDENTIFICATION
WPS
WELDCOUP

CONTRACT
930212

PAGE NO. 3 OF 3
REV. NO. *1*
BY RWP DATE *12/17/93*

PRODUCT *OUTGASSING TEST COUPONS*
CUSTOMER *CALTECH - NSF*

WELDING PARAMETERS FOR GOLD TRACK II:

Parameter	*First Pass*	*Second Pass*
Position	*1G*	*1G*
Shielding Gas	*60% Argon - 40% Helium*	*60% Argon - 40% Helium*
Flow rate	*20 - 45 cfh*	*20 - 45 cfh*
Purge Gas	*100% Argon*	*100% Argon*
Flow rate	*10 - 25 cfh **	*10 - 25 cfh **
Filler Wire	*Autogenous*	*ER308L ***
Diameter	*N/A*	*0.035"*
Pulse Mode	*Off*	*Off,*
Pulse Width	*N/A*	*N/A*
Pulse Frequency	*N/A*	*N/A*
AVC Response	*20*	*20*
AVC Mode	*N/A*	*N/A*
Upslope Time	*3*	*3*
Downslope Time	*2*	*2*
Travel Start Delay	*1*	*1*
Wire Start Delay	*N/A*	*1*
Oscillation Amplitude	*Zero*	*Zero*
Travel Speed (ipm)	*18*	*18*
Primary Weld Current (amps)	*230*	*230*
Primary Arc Voltage (volts)	*10.0*	*10.5*
Primary Wire Speed (ipm)	*N/A*	*18*
Background Weld Current (amps)	*N/A*	*N/A*
Background Arc Voltage (volts)	*N/A*	*N/A*
Background Wire Speed (ipm)	*N/A*	*N/A*
Out Dwell Time (sec x .1)	*N/A*	*N/A*
Excursion Time (sec x .1)	*N/A*	*N/A*
In Dwell Time (sec x .1)	*N/A*	*N/A*

Notes:

** Flow rate necessary to achieve < 0.5% oxygen level.*

*** ER308L to be cleaned and baked out per WMS-ER308L.*