

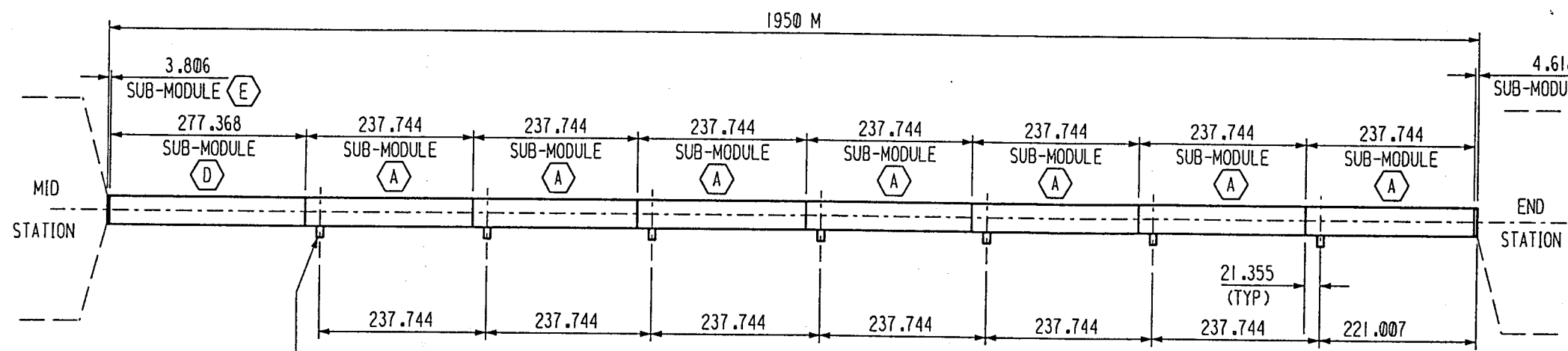


SUMMARY SHEET

LIST OF CONTRACT AND STANDARD DRAWINGS										LIST OF CONTRACT AND STANDARD DRAWINGS									
BILLS					DRAWINGS OR STANDARDS					BILLS					DRAWINGS OR STANDARDS				
SHT NO	REV	DWG OR STD	REV	DESCRIPTION	SHT NO	REV	DWG OR STD	REV	DESCRIPTION	SHT NO	REV	DWG OR STD	REV	DESCRIPTION	SHT NO	REV	DWG OR STD	REV	DESCRIPTION
		1	3	GENERAL MODULE CONFIGURATION															
		2	2	SUB-MODULES A & D															
		3	3	SUB-MODULES E,F,G & H															
		4	2	SUB ASSEMBLIES A,B & C															
	4	0	3	FIXED SUPPORT ELEVATION															
	4	0	4	FIXED SUPPORT PLAN VIEW AND DETAILS															
	4	0	5	SUPPORT LUG ASSEMBLY & SECTION DETAILS															
		9	2	SUB ASSEMBLIES H,J,K & L															
	1,2	1,0	2	PUMP PORTS															
	2	0	2	VACUUM STIFFENER															
	2	0	2	SUPPORT RING / BAFFLE STIFFENER															
	4	0	3	GUIDED SUPPORT ELEVATION															
	4	0	3	GUIDED SUPPORT SECTION DETAILS															
	4	0	3	GUIDED SUPPORT SECTION DETAILS															
		ER1	2	SUPPORT LEVELING, FIXED & GUIDED SUPPORTS															

BY	11	DET	12	DET	8	DET	9	DET	10	DET	12/15/94
CHKO											12/15/94
DATE	5/16/95	5/18/95	9/27/94	12/8/94	12/8/94	12/15/94					

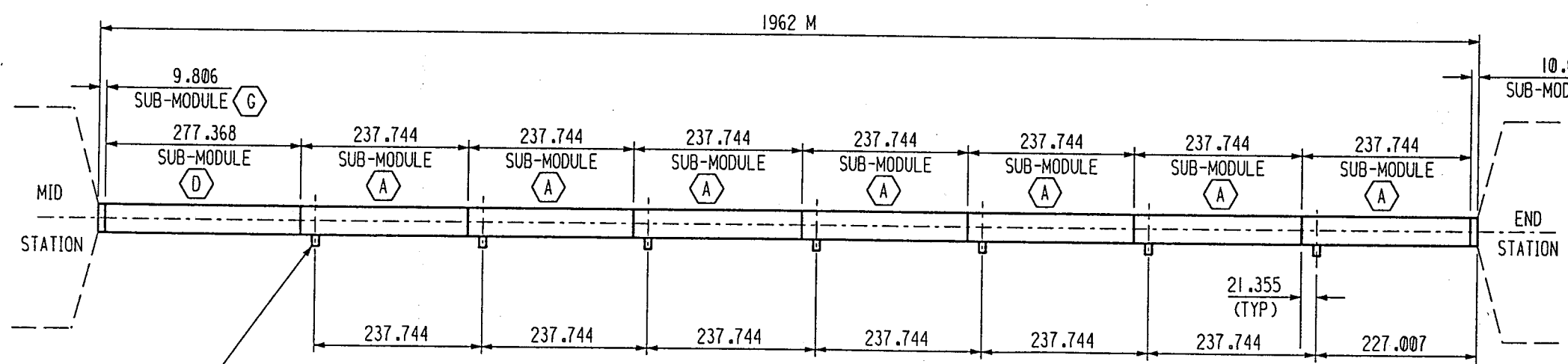
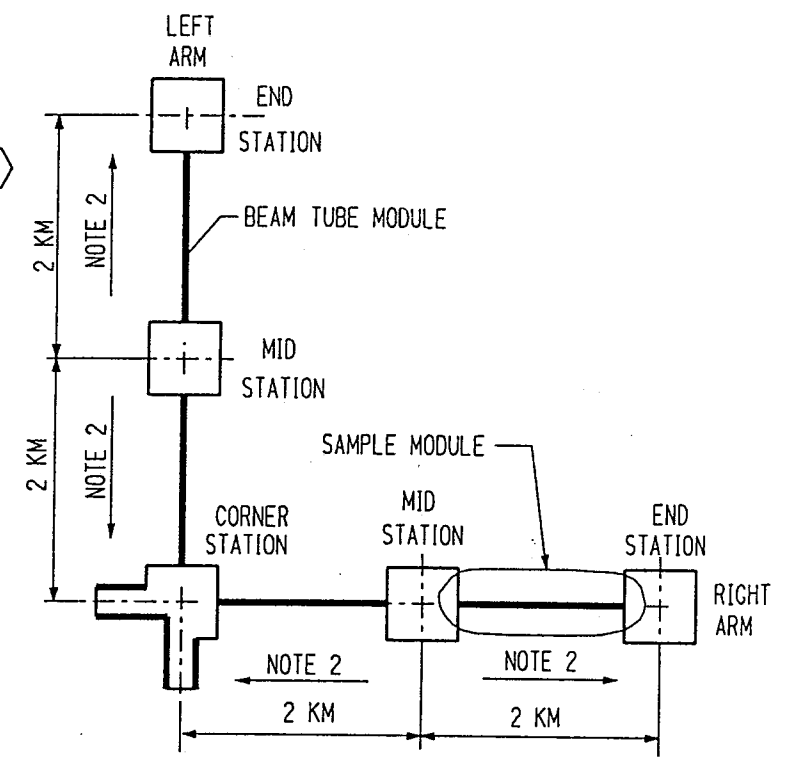
CONSTR ASSIGNED	MADE BY	CHKD BY	ENG COORDINATOR	CONTRACT NO.	SHEET
	KJR	DET		930212	01
	DATE	DATE			
	4/11/94	4/11/94			



BEAM TUBE MODULE CONFIGURATION - HANFORD, WA

(4) - REQD
(DIMENSIONS IN METERS)

- (49) - BEAM TUBE SECTIONS, LONG
- (49) - BEAM TUBE SECTIONS, SHORT
- (2) - END SECTIONS
- (50) - EXPANSION JOINTS
- (2460) - VACUUM STIFFENERS
- (149) - SUPPORT RINGS
- (7) - VACUUM PORTS
- (49) - SUPPORTS, FIXED
- (50) - SUPPORTS, GUIDED



BEAM TUBE MODULE CONFIGURATION - LIVINGSTON, LA

(4) - REQD
(DIMENSIONS IN METERS)

- (49) - BEAM TUBE SECTIONS, LONG
- (49) - BEAM TUBE SECTIONS, SHORT
- (2) - END SECTIONS
- (50) - EXPANSION JOINTS
- (2476) - VACUUM STIFFENERS
- (149) - SUPPORT RINGS
- (7) - VACUUM PORTS
- (49) - SUPPORTS, FIXED
- (50) - SUPPORTS, GUIDED

NOTES:

1. PUMP PORTS TO FACE OUT BOARD OF THE ANGLE BETWEEN THE ARMS.
2. CONSTRUCTION WILL START AT MIDSTATIONS AND PROCEED BOTH WAYS SIMULTANEOUSLY TOWARDS THE END STATION AND THE CORNER STATION.
3. THE BEAM TUBES ARE TO BE KEPT UNDER COVER TO PROTECT THEM FROM POTENTIALLY CORROSIVE ELEMENTS, EXCEPT AS NECESSARY DURING HANDLING, FABRICATION AND ASSEMBLING OPERATIONS.

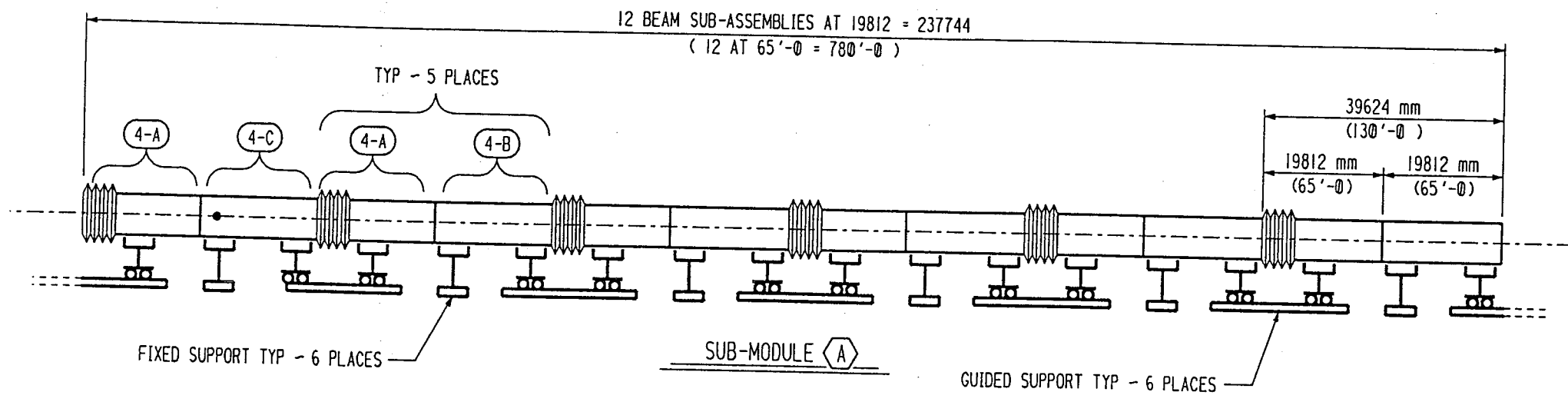
cbidesig

3212A001.DGN

INDICATES CHANGE FROM PREVIOUS ISSUE

BY: []		DATE: []		REMOVED BUFFLES & CHANGED VACUUM STIFFENER QUANTITY		DATE: []		UPDATED REV LEVEL		REVISIONS		REMARKS			
<p align="center">CBI</p> <p align="center">LIGO BEAM TUBE MODULES HANFORD, WA & LIVINGSTON, LA</p> <p align="center">GENERAL MODULE CONFIGURATION AND VACUUM PORT LOCATION</p>												CUSTOMER'S NO		CONTRACT NO	
BY: DAP		CHKD: []		DATE: []		D.E. THORN		ENGINEERING ASSIGNED		DWG: 1		REV: 3			
										SHT					

3212A001

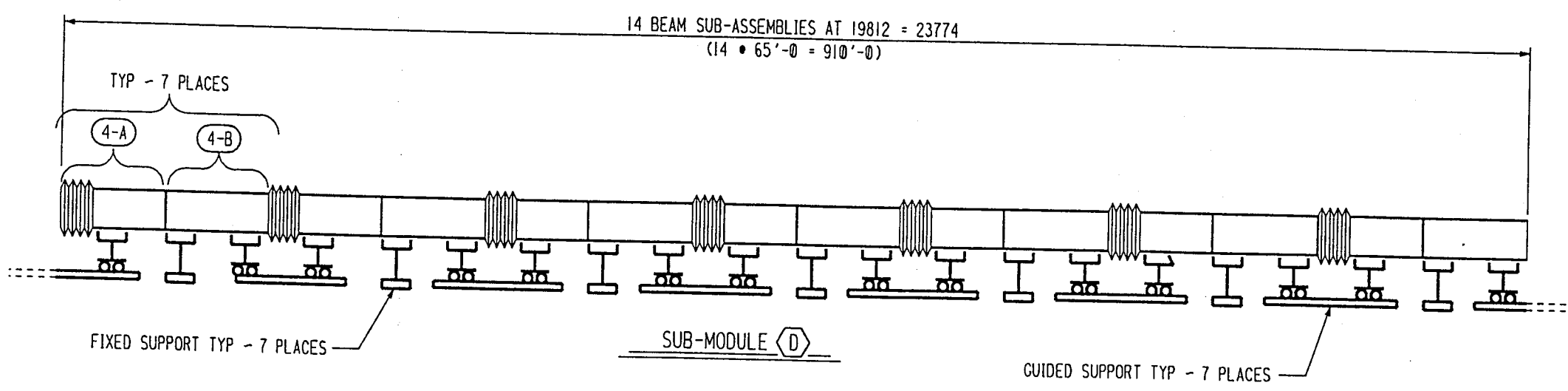
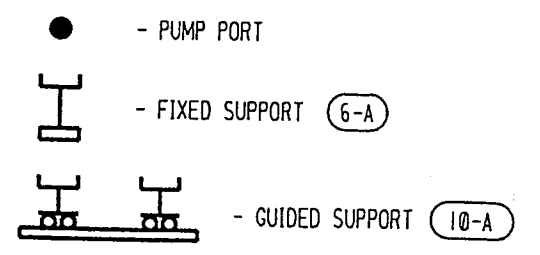


(A) SUB-MODULE CONSISTING OF THE FOLLOWING:

6	(4-A)	BEAM ASSEMBLY W/EXPANSION JOINT
5	(4-B)	BEAM ASSEMBLY
1	(4-C)	BEAM ASSEMBLY W/VACUUM PORT
6	-	FIXED SUPPORT (DWG # 6,7, & 8)
6	-	GUIDED SUPPORT (DWG # 17, 18, & 19)

(D) SUB-MODULE CONSISTING OF THE FOLLOWING:

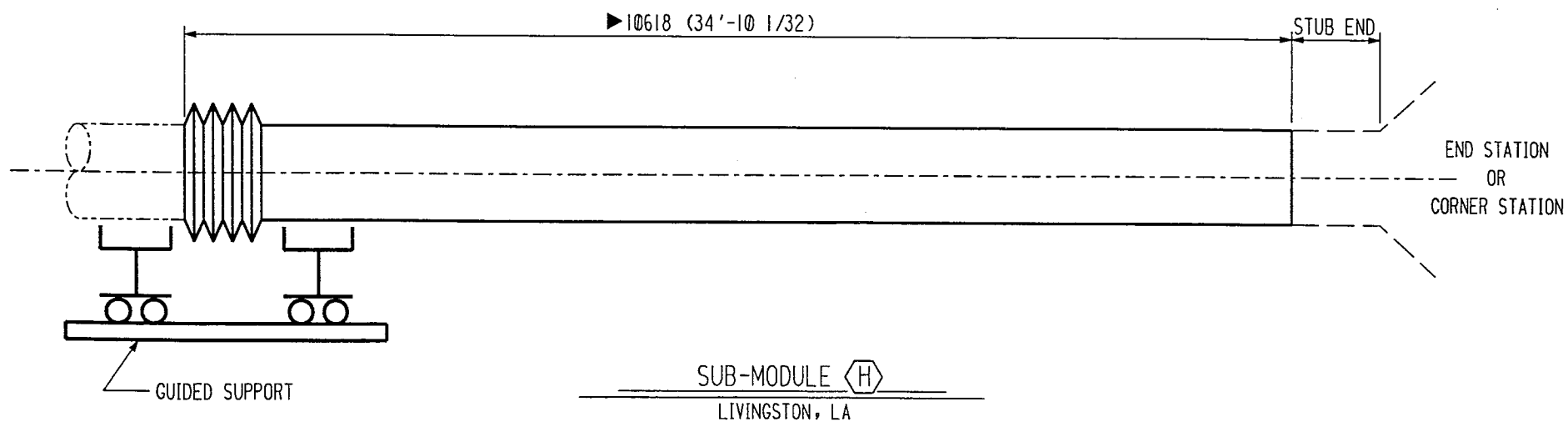
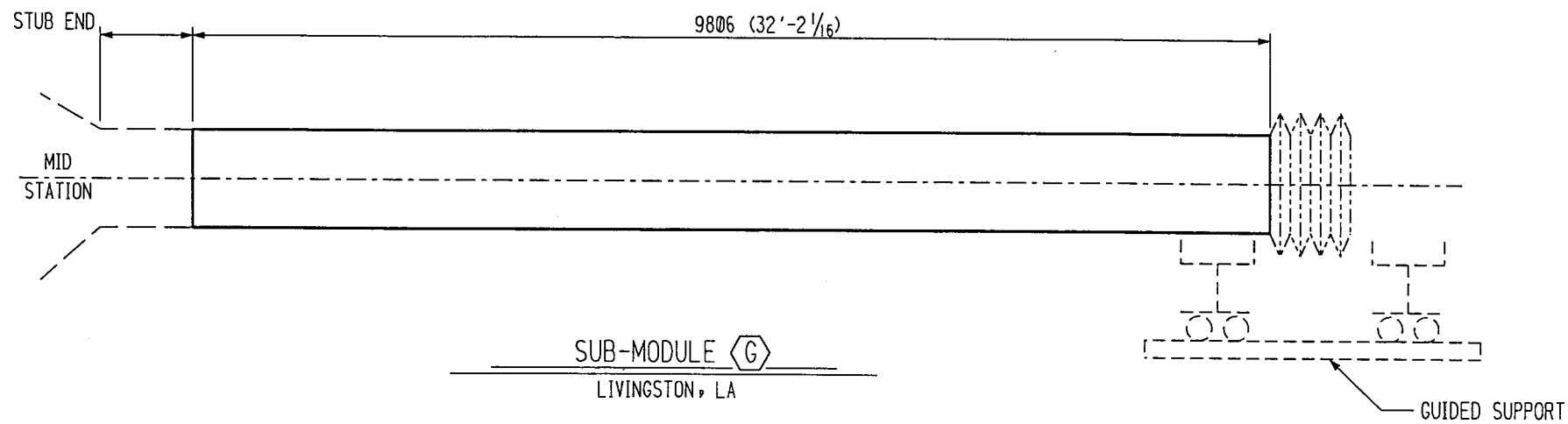
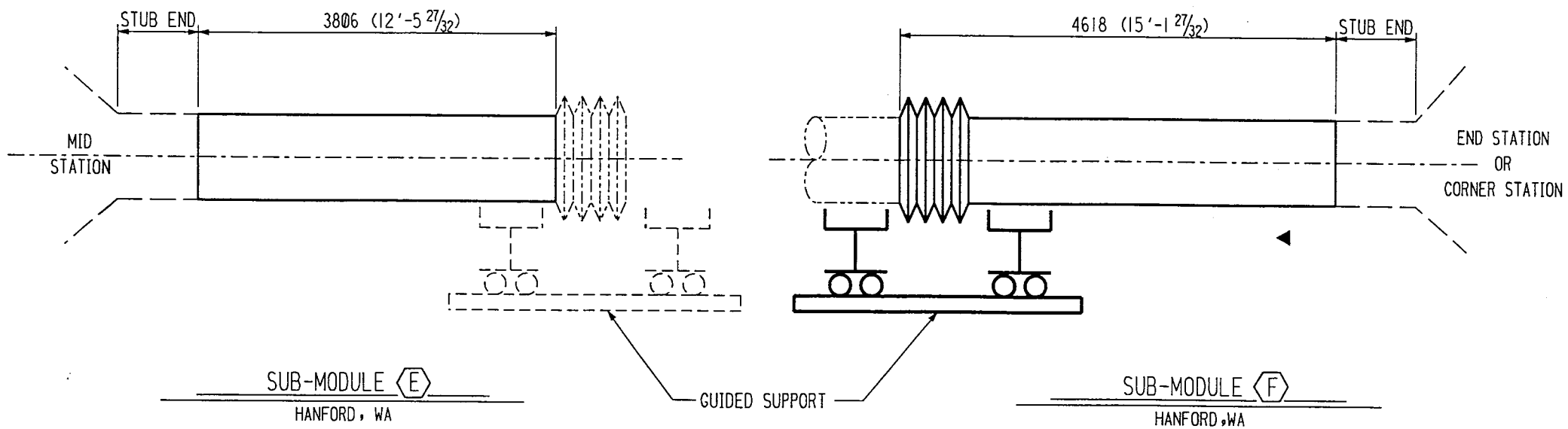
7	(4-A)	BEAM ASSEMBLY W/EXPANSION JOINT
7	(4-B)	BEAM ASSEMBLY
7	-	FIXED SUPPORT (DWG # 6,7, & 8)
7	-	GUIDED SUPPORT (DWG # 17, 18, & 19)



3212A002.DGN

INDICATES CHANGE FROM PREVIOUS ISSUE

BY		DATE		BY		DATE		REVISIONS		REMARKS	
										SUPPLIER'S / PURCHASER'S NO	
LIGO BEAM TUBE MODULES HANFORD, WA & LIVINGSTON, LA											
SUB-MODULES (A) & (D)											
CUSTOMER'S NO						CONTRACT NO					
BY KJR CHKD						DATE					
D.E. Thorn						930212					
ENGINEERING ASSIGNED						DWG 2		REV		2	
						SHT					



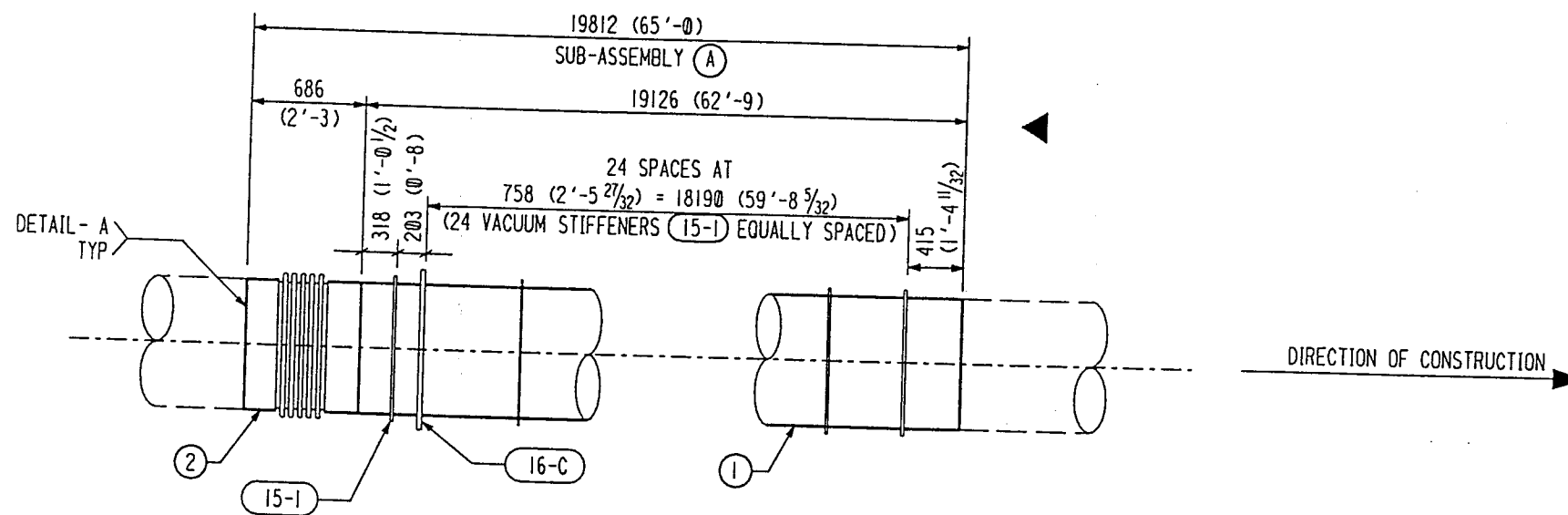
- Ⓔ SUB-MODULE CONSISTING OF THE FOLLOWING:
 - 1 Ⓓ BEAM ASSEMBLY
- Ⓕ SUB-MODULE CONSISTING OF THE FOLLOWING:
 - 1 Ⓓ BEAM ASSEMBLY W/EXPANSION JOINT
 - 1 - GUIDED SUPPORT (DWG # 17, 18, & 19)
- Ⓖ SUB-MODULE CONSISTING OF THE FOLLOWING:
 - 1 Ⓓ BEAM ASSEMBLY
- Ⓗ SUB-MODULE CONSISTING OF THE FOLLOWING:
 - 1 Ⓓ BEAM ASSEMBLY W/EXPANSION JOINT
 - 1 - GUIDED SUPPORT (DWG # 17, 18, & 19)

▶ INDICATES CHANGE FROM PREVIOUS ISSUE

3212A003.DGN

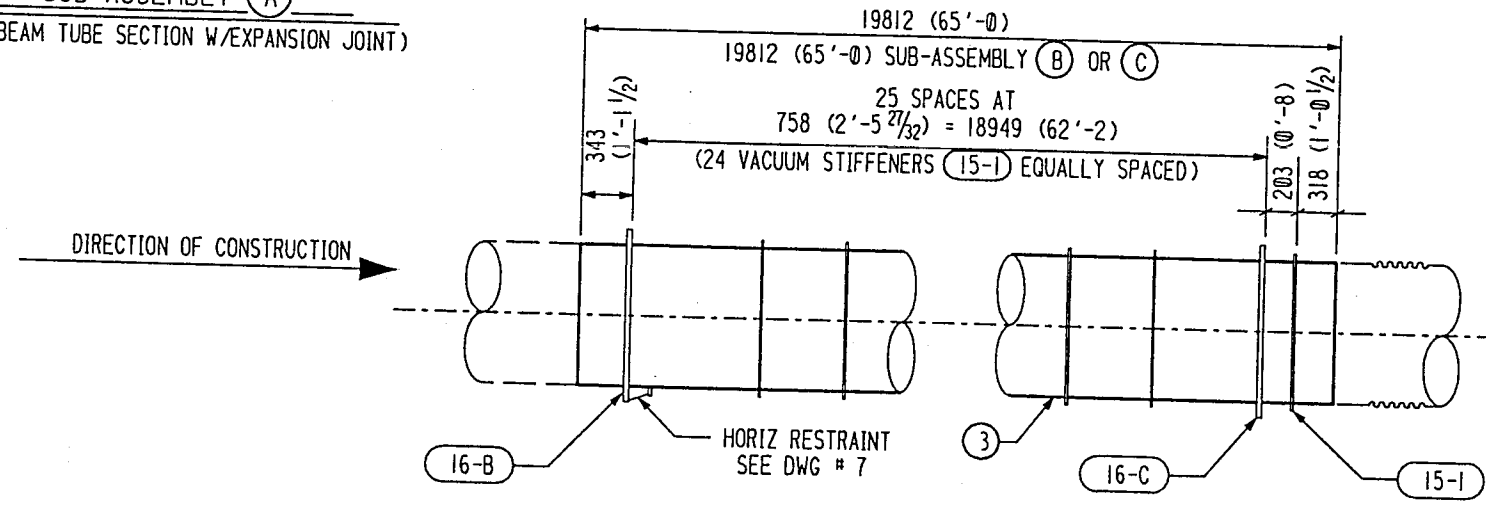
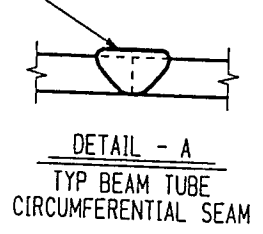
3212A003

IMK REY DIMENSION WAS CHKD 1430 (37'-6 11/16) DATE 5-19-95 BY KJR REMOVED DIMENSIONS CHKD 2 DATE 5-15-95 BY KJR FIXED DIM ON SUB-MODULE Ⓕ CHKD 1 DATE 7-8-94 BY KJR REMOVED BAFFLE CHKD 1 DATE 7-8-94 BY KJR UPDATED REV LEVEL.		CBI LIGO BEAM TUBE MODULES HANFORD, WA & LIVINGSTON, LA SUB-MODULES Ⓔ Ⓕ Ⓖ Ⓗ		SUPPLIER'S / PURCHASER'S NO
CUSTOMER'S NO BY KJR CHKD DATE D.E. Thorn ENGINEERING ASSIGNED		CONTRACT NO 930212 DWG 3 SHT 3		REV 3
REMARKS				

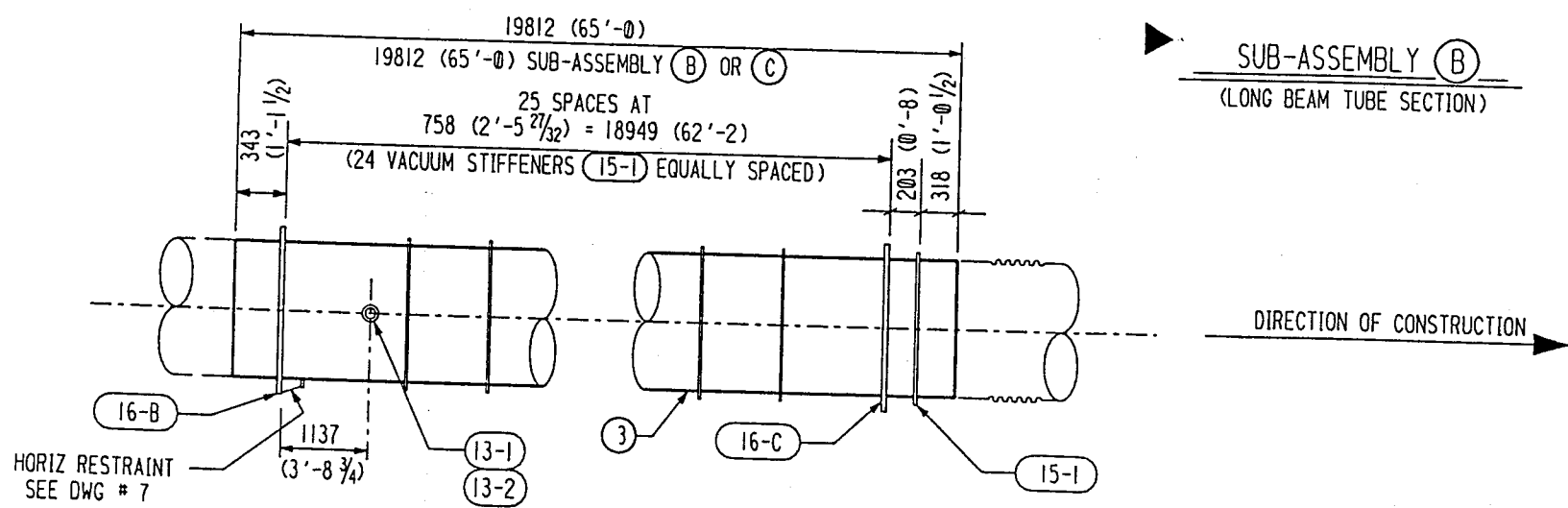


SUB-ASSEMBLY (A)
(SHORT BEAM TUBE SECTION W/EXPANSION JOINT)

PASS 1: AUTOGENOUS
PASS 2: ER308L
SEE NOTE 2



SUB-ASSEMBLY (B)
(LONG BEAM TUBE SECTION)



SUB-ASSEMBLY (C)
(LONG BEAM TUBE SECTION W/VACUUM PORT)

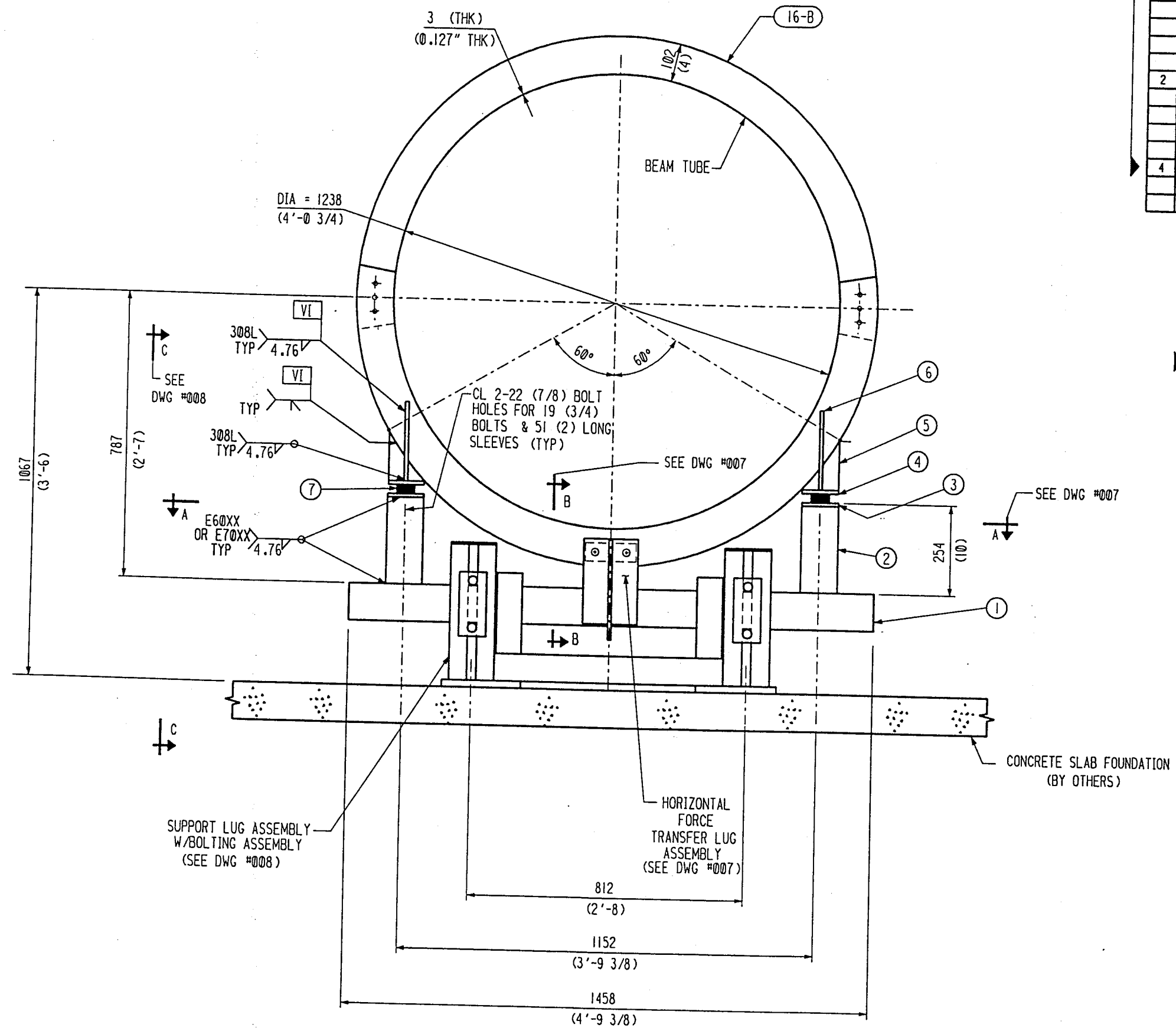
SHIP PC	MARK	ASSM PC	DESCRIPTION	LENGTH MM	SPEC
392	4-A		- BEAM TUBE ASSEMBLY -		
	4-1	392	BEAM TUBE 1245 DIA x 3.2 (49.00 OD x 0.127" THK x 62'-9 LG)	19126	M1
	4-2	392	EXPANSION JOINT	686	M2
	15-1	9800	VACUUM STIFFENERS		
	16-C	392	GUIDED SUPPORT RING ASS'Y		
336	4-B		- BEAM TUBE ASSEMBLY -		
	4-3	336	BEAM TUBE 1245 OD x 3.2 THK (49.00 OD x 0.127" THK x 65'-0 LG)	19812	M1
	15-1	8400	VACUUM STIFFENERS		
	16-B	336	FIXED SUPPORT RING ASS'Y		
	16-C	336	GUIDED SUPPORT RING ASS'Y		
56	4-C		- BEAM TUBE ASSEMBLY -		
	4-3	56	BEAM TUBE 1245 OD x 3.2 THK (49.00 OD x 0.127" THK x 65'-0 LG)	19812	M1
	13-1	56	VACUUM PORT		
	15-1	1400	VACUUM STIFFENERS		
	16-B	56	FIXED SUPPORT RING ASS'Y		
	16-C	56	GUIDED SUPPORT RING ASS'Y		
			M1 = MAT'L SPEC C-240-0186 (SA240 TP 304L HRAP)		
			M2 = MAT'L SPEC C-EJ-CO (SA240 TP 304L HRAP)		

- NOTES:**
1. DURING CONSTRUCTION, THE CLEAN ROOM WILL SLIDE OVER ENDS WITHOUT AN EXPANSION JOINT.
 2. CIRCUMFERENTIAL SEAM WILL BE WELDED BEFORE CLEANING AND LEAK TESTING.

		SUPPLIER'S / PURCHASER'S NO	
LIGO BEAM TUBE HANFORD, WA & LIVINGSTON, LA			
SUB-ASSEMBLIES (A) (B) & (C)			
CUSTOMER'S NO BY: KJR CHKD: _____ DATE: _____ D.E. Thom ENGINEERING ASSIGNED		CONTRACT NO 930212 DWG 4 SHT 2	

3212A004.DGN

INDICATES CHANGE FROM PREVIOUS ISSUE



SHP PC	MARK	ASSEM PC	DESCRIPTION	LENGTH MM	SPEC	D
1	6-A		FIXED SUPPORT FRAME ASSEMBLY			
	6-1	1	TUBULAR STEEL 102 X 102 X 10 (4 X 4 X 3/8)	1458	A500 GrB	
	6-2	2	TUBULAR STEEL 102 X 102 X 10 (4 X 4 X 3/16)	244	A500 GrB	
	6-3	2	PL 102 X 10 THK (4 X 3/8) W/HOLES	254	A36	
				(0'-10)		
2	6-B		FIXED SUPPORT BRACKET ASSEMBLY			
	6-4	2	PL 102 X 10 THK (4 X 3/8) W/HOLES	254	***	
				(0'-10)		
	6-5	2	PL SK X 10 THK (0'-3/8)		***	
	6-6	4	PL SK X 10 THK (0'-3/8)	203 (8)	***	
4	6-7		MICARTA BLOCK 50 X 50 X 25 (2 X 2 X 1) (GRADE G11) W/HOLES			

*** = SA240 TP304L

NOTES

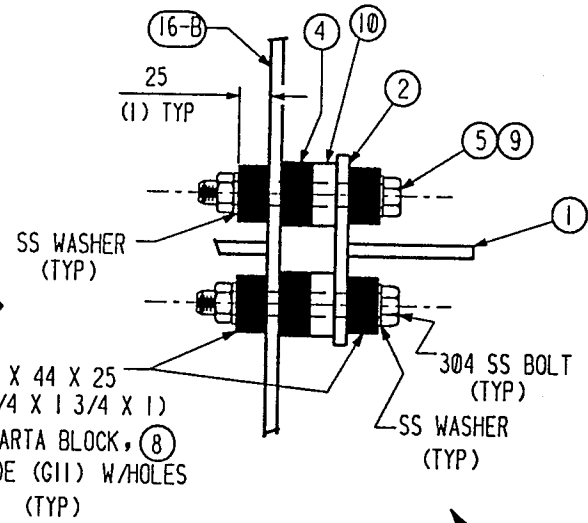
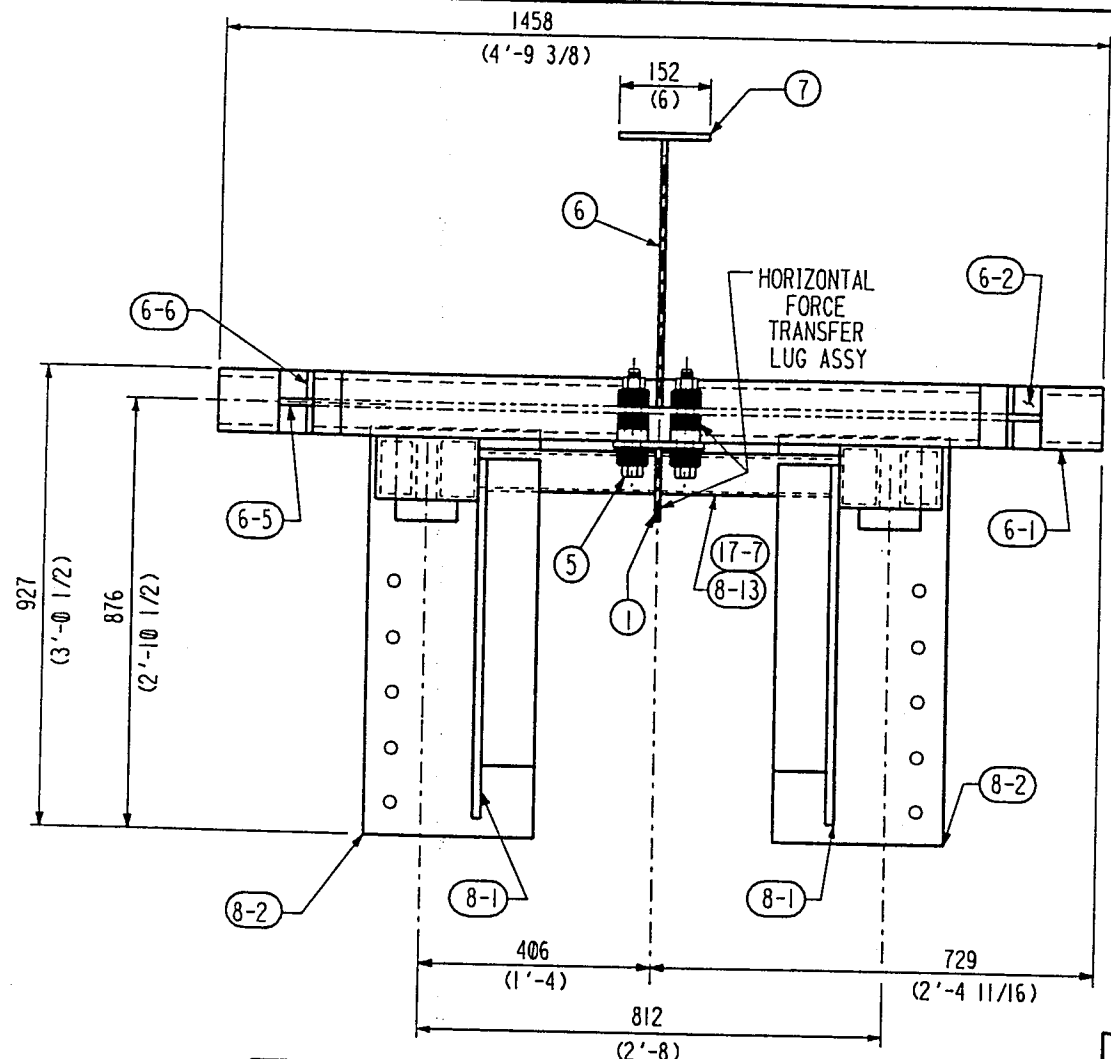
1. WORK THIS DWG WITH DWG #007 AND #008.
2. BILLED FOR ONE (1) FIXED SUPPORT. TOTAL OF 392 FIXED SUPPORTS REQD.

BEAM TUBE SUPPORT ELEVATION

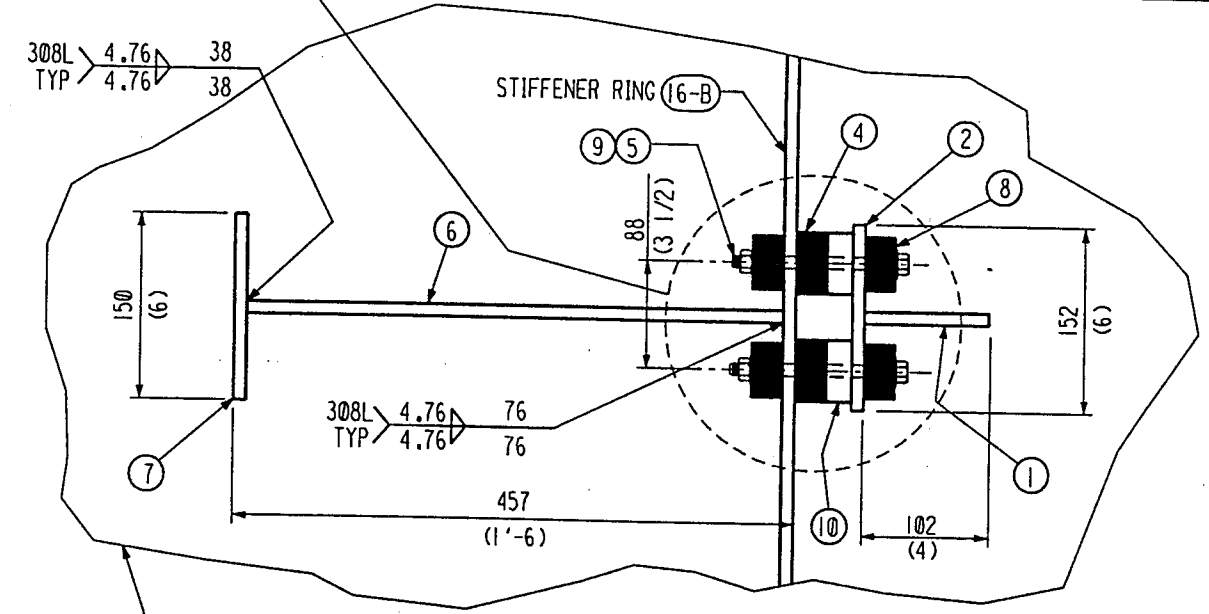
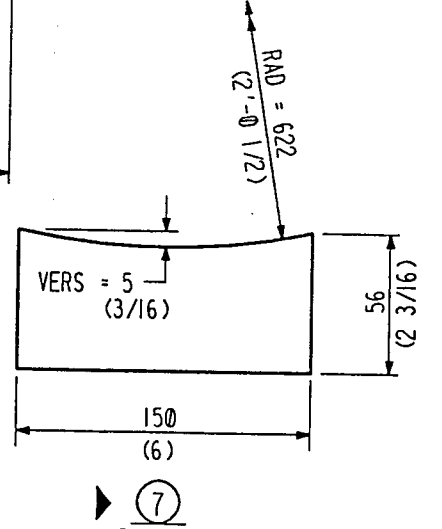
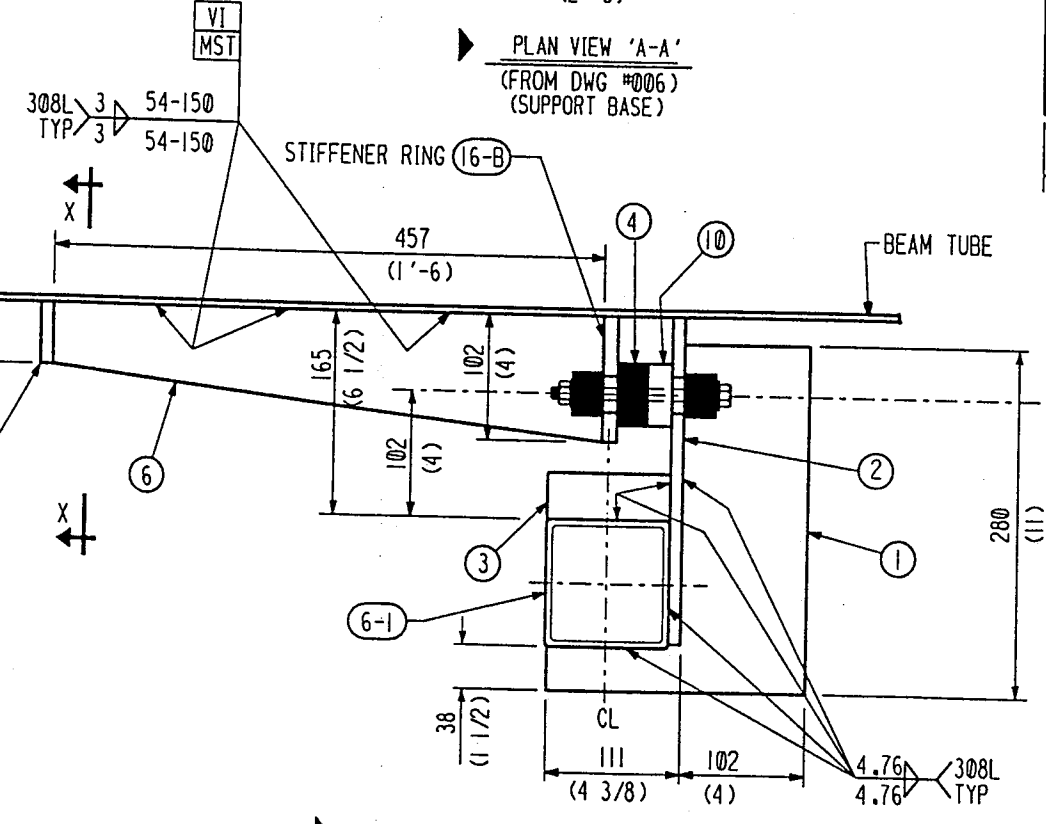
INDICATES CHANGE FROM PREVIOUS ISSUE

REMOVE NOTE 1 & 2 ADD ASSEMBLY ID AND CHANGE SIZE OF PC LK 7 REVISE SUPPORT LUG ASSEMBLY DELETED NOTE #3 REV MAT'L, PC WKS.	CBI SUPPLIER'S / PURCHASER'S NO	
	ELEVATION	
	BEAM TUBE FIXED SUPPORT LIGO HANFORD, WA. AND LIVINGSTON, LA.	
	CUSTOMER'S NO BY WAW CHKD DET DATE 2-9-94 D.E. THONN ENGINEERING ASSIGNED	CONTRACT NO 930212 DWG 006 SHT 3

3212A006



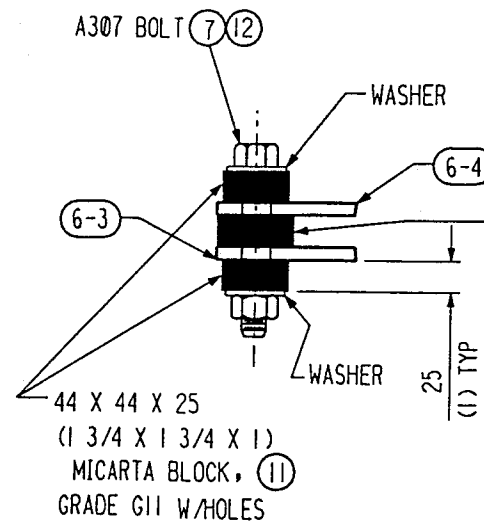
SHIP PC	MARK	ASSM PC	DESCRIPTION	LENGTH MM	SPEC	D
			FIXED SUPPORT			
1	7-1		PL SK X 10 (3/8) THK	280	***	
			(11)			
1	7-2		PL 150 X 10 (0'-6 X 3/8) THK	241	***	
			W/HOLES	0'-9 1/2		
1	7-3		PL 38 X 10 (0'-1 1/2 X 3/8) THK	83	***	
				0'-3 1/4		
2	7-4		MICARTA BLOCK 50 X 50 X 25 W/HOLES (2 X 2 X 1) (GRADE G11)			
2	7-5		BOLT 19 (3/4) DIA HXY HEX W/ HEX NUT	152	304 SS	
				(0'-6)		
1	7-6		PL SK X 10 (3/8) THK	457	***	
				(1'-6)		
1	7-7		PL 56 X 10 (0'-2 X 3/8) THK	152	***	
				(0'-6)		
4	7-8		MICARTA BLOCK 44 X 44 X 25 W/HOLES (1 3/4 X 1 3/4 X 1) GRADE G11			
2	7-9		MYLAR INSULATING SLEEVE 3/4" I.D. X 1/32" THK. (FROM F.H.MALONEY CO.)	102	MYLAR	
				(0'-4)		
2	7-10		PL 50 X 20 THK W/HOLES (2 X 3/4)	50	***	
				(0'-2)		
			*** = SA240 TP304L			



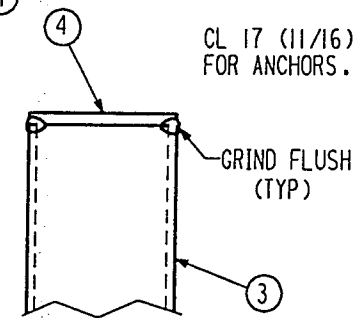
- NOTES
1. WORK THIS DWG WITH DWG #006 AND #008.
 2. BILLED FOR ONE (1) FIXED SUPPORT. TOTAL OF 392 FIXED SUPPORTS REQD.

REV'D BILLING DATE 12-15-94 BY WAW CHECKED DET DATE 12-13-94 BY WAW CHECKED DET DATE 5-18-95 BY WAW CHECKED DET		REV LENGTH OF PC MK 5 ADD PC MK 9 AND 10 REVISE DIMENSIONS IN PLAN VIEW DATE 12-13-94 REVISE SIZE AND # OF PC MK 4 DATE 12-13-94 REVISE PLAN VIEW A-A DATE 5-18-95 ADD DETAIL OF PC MK 7		REMARKS 1. WORK THIS DWG WITH DWG #006 AND #008. 2. BILLED FOR ONE (1) FIXED SUPPORT. TOTAL OF 392 FIXED SUPPORTS REQD.	
CBI PLAN VIEW AND DETAILS BEAM TUBE FIXED SUPPORT LIGO HANFORD, WA. AND LIVINGSTON, LA.				SUPPLIER'S / PURCHASER'S NO	
CUSTOMER'S NO BY WAW CHKD DET DATE 3-7-94 D.E. THONN ENGINEERING ASSIGNED		CONTRACT NO 930212 DWG 007 REV 4		SHEET	

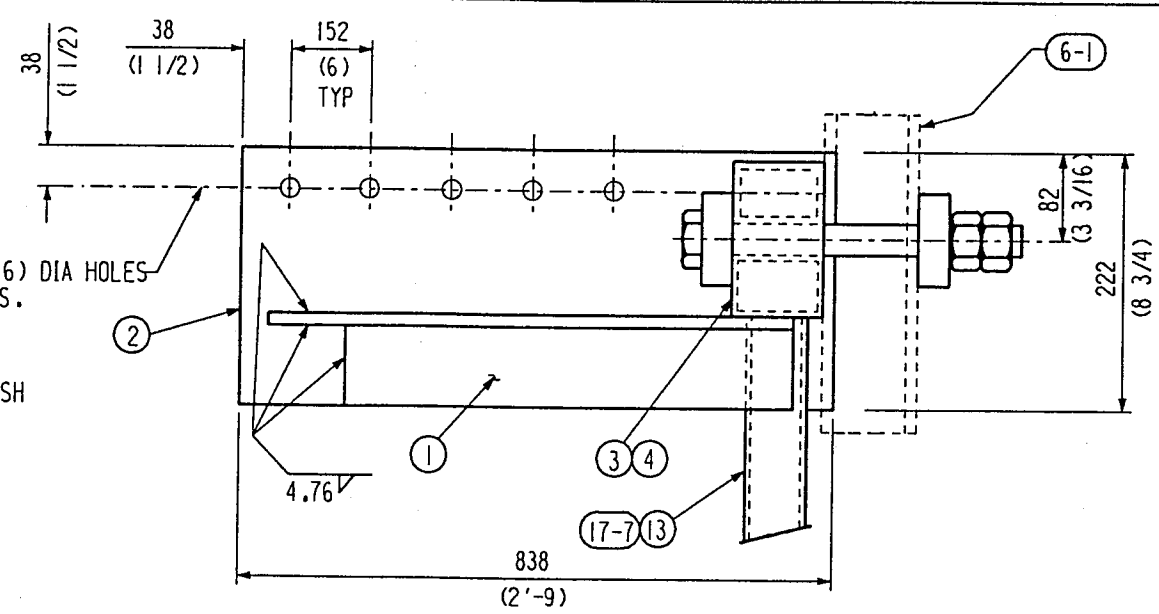
INDICATES CHANGE FROM PREVIOUS ISSUE



DETAIL A

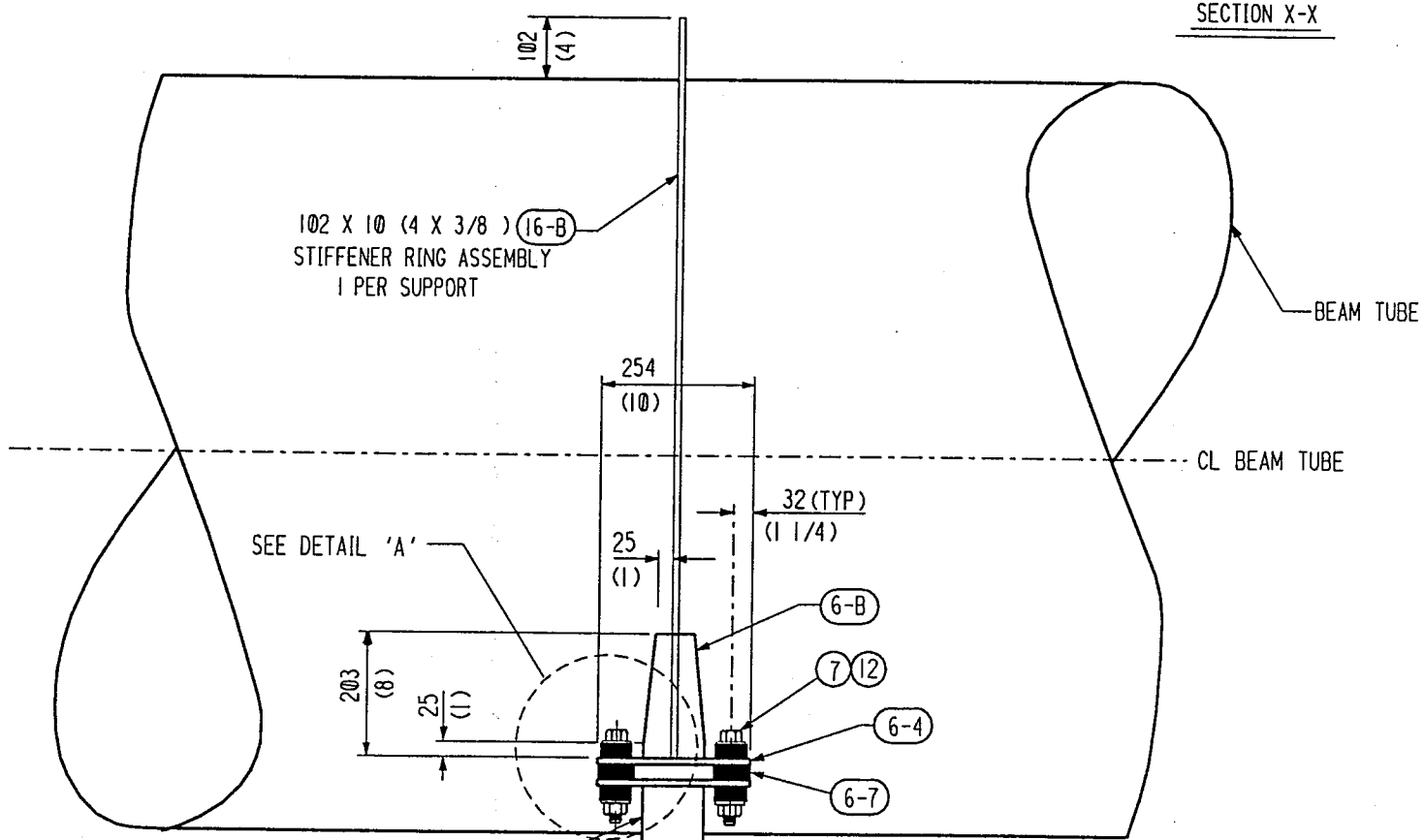


DETAIL 'B'

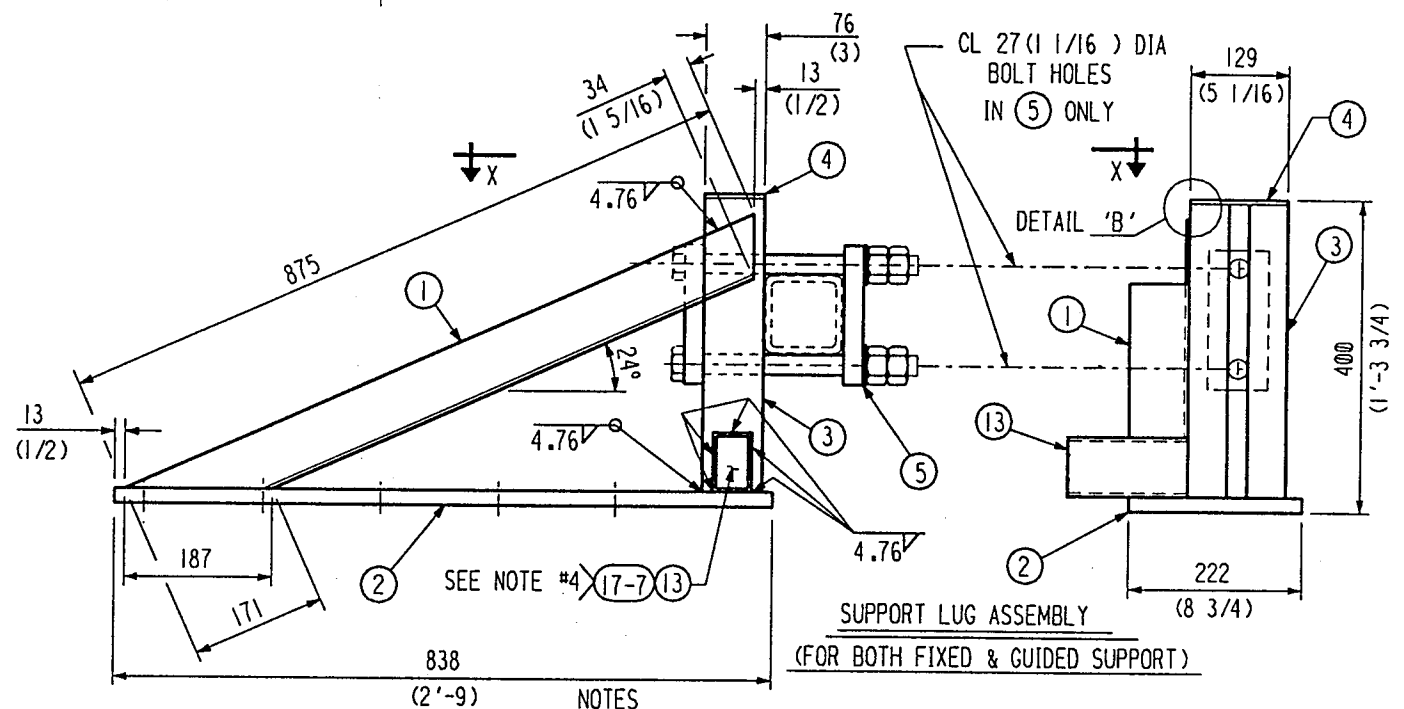


SECTION X-X

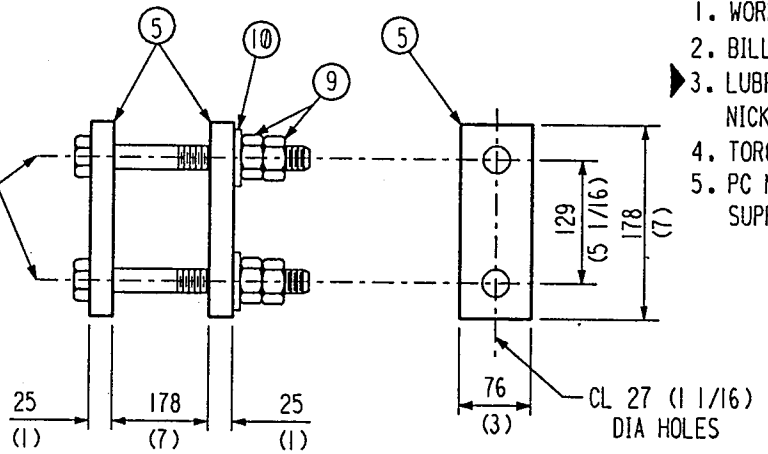
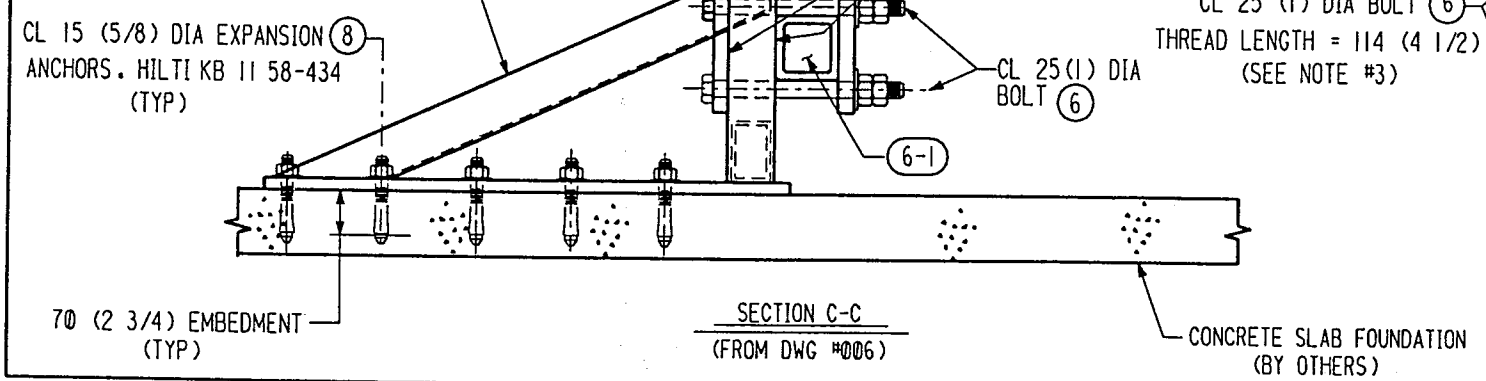
SHIP PC	MARK	ASSM PC	DESCRIPTION	LENGTH MM	SPEC	ID
2	8-A		FIXED SUPPORT LUGS			
	8-1	2	L 76 X 76 X 5 X SK (L 3 X 3 X 3/16)	875	A36	
	8-2	2	PL 222 X 19 THK (8 3/4 X 3/4)	838	A36	
			W/HOLES	(2'-9)		
	8-3	4	TUBULAR STEEL 76 X 50 X 5 (3 X 2 X 3/16)	375	A500 Gr B	
				1'-2 3/4		
	8-4	2	PL 76 X 6 (3 X 1/4)	127 (5)	A36	
	8-13	1	TUBULAR STEEL 76 X 50 X 5 (3 X 2 X 3/16)	683	A500 Gr B	
				2'-2 7/8		
4	8-5		PL 76 X 25 THK (3 X 1) W/HOLES	178 (7)	A36	
4	8-6		BOLT 25 (1) DIA HVY HEX	279	A325	
			THREAD LENGTH = 114 (4 1/2)	11		
4	8-7		BOLT 19 (3/4) DIA HVY HEX W/HEX NUTS	127 (5)	A307	
10	8-8		EXPANSION ANCHORS 15 (5/8) DIA	120	CS	
			HILTI KB11 58-434 W/70 (2 3/4)	(4 3/4)		
			EMBEDMENT DEPTH OR EQ.			
8	8-9		25 (1) HVY HEX NUT		A325	
4	8-10		25 (1) WASHER		CS	
8	8-11		MICARTA BLOCK 44 X 44 X 25 W/7/8 DIA HOLES (1 3/4 X 1 3/4 X 1) GRADE G11			
4	8-12		MYLAR INSULATING SLEEVE 3/4" I.D. X 1/32" THK. (FROM F.H.MALONEY CO.)	89	MYLAR	



SECTION C-C
(FROM DWG #006)



SUPPORT LUG ASSEMBLY
(FOR BOTH FIXED & GUIDED SUPPORT)

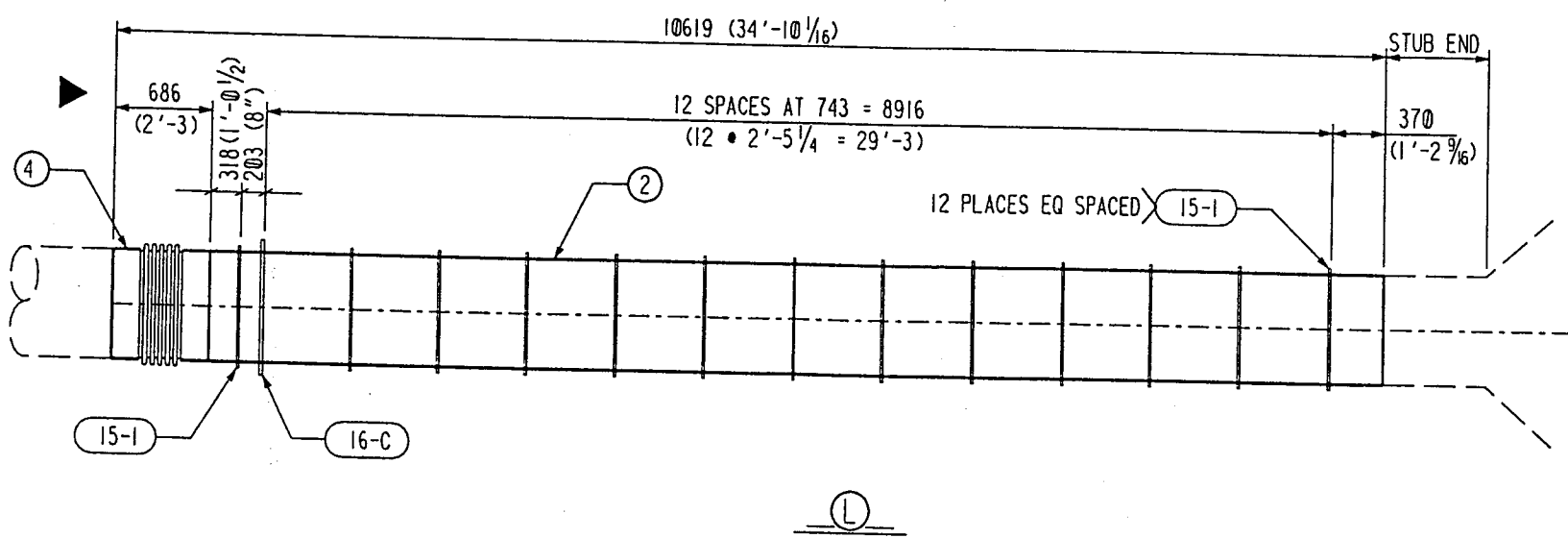
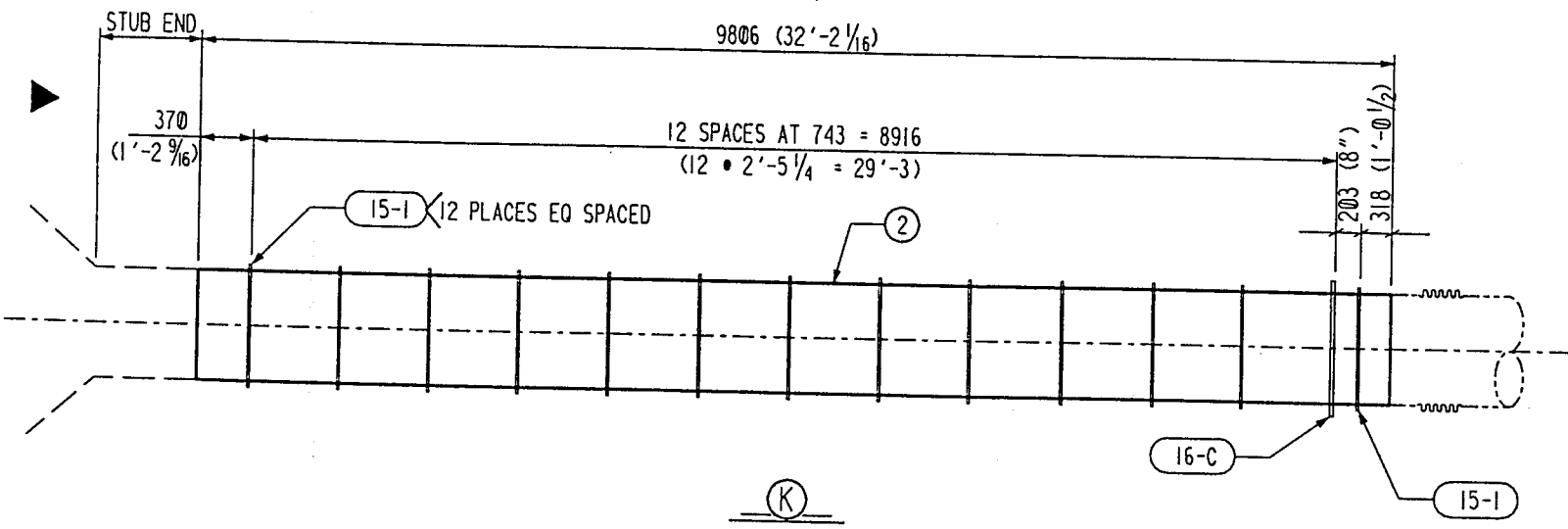
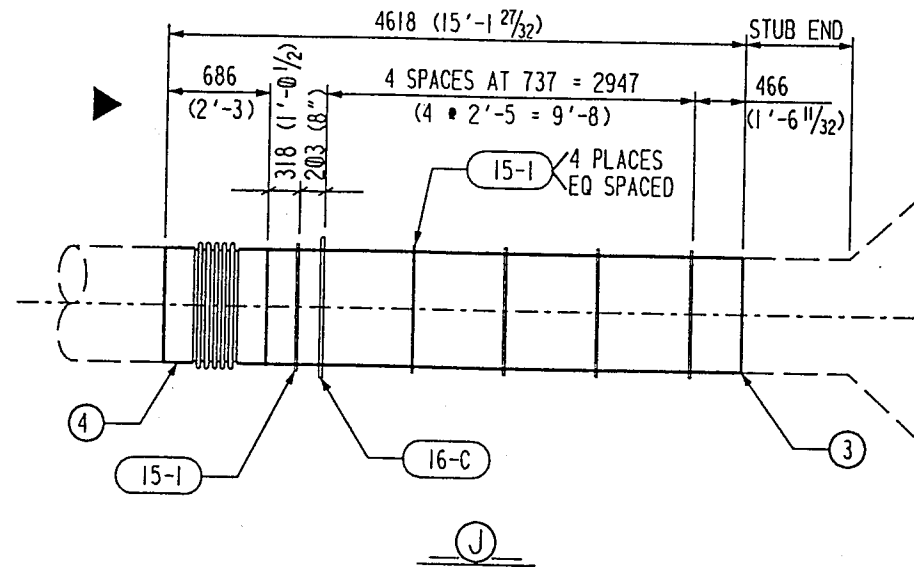
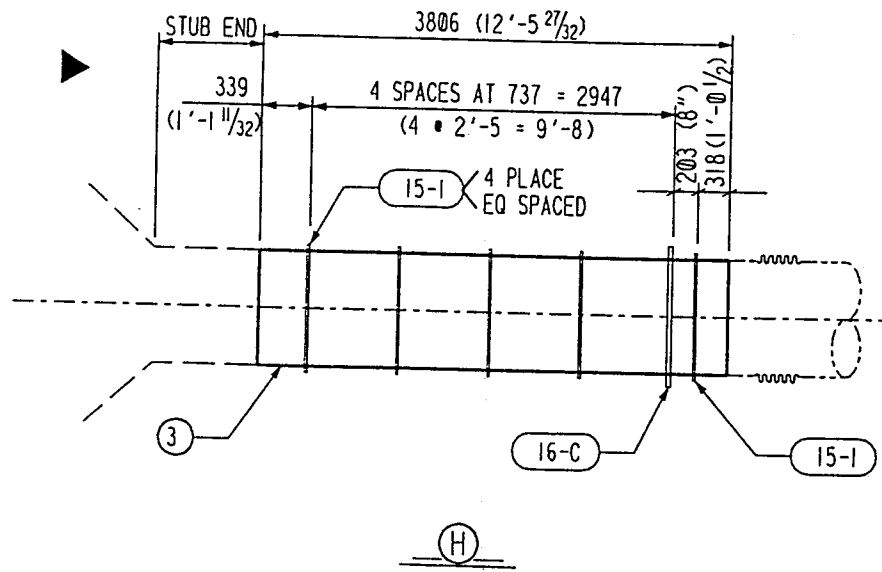


BOLTING ASSEMBLY

NOTES

1. WORK THIS DWG WITH DWG #006, #007 AND #009.
2. BILLED FOR ONE (1) FIXED SUPPORT. TOTAL OF 392 FIXED SUPP REQD.
3. LUBRICATE BOLT THREADS AND BEARING SURFACE OF NUTS WITH LOCTITE NICKEL ANTI-SEIZE 771.
4. TORQUE BOLTS (8-6) TO 200 FT #
5. PC MK (13) FOR FIXED SUPPORT ONLY, AND PC MK (17-7) FOR GUIDED SUPP ONLY.

BY: WAW		REV PC MK 6 AND 7		DATE: 12-7-94		ADDED PC MK 12	
CHKD: WAW		DATE: 5-17-95		ADDED NOTE 3 AND AS INDICATED			
BY: WAW		REV PC MK 8 AND 9		DATE: 5-17-95		ADDED SUB-ASSEMBLY ID AND PIECE MARKS	
CHKD: WAW		DATE: 5-18-95		REVISIONS		REMARKS	
<p align="center">CBI</p> <p align="center">SUPPORT LUG ASSY & SECTION DETAILS</p> <p align="center">BEAM TUBE FIXED/GUIDED SUPPORT</p> <p align="center">LIGO</p> <p align="center">HANFORD, WA. AND LIVINGSTON, LA.</p>				<p align="center">CUSTOMER'S NO</p> <p align="center">BY WAW CHKD DET DATE 3-8-94</p> <p align="center">D.E. THONN</p> <p align="center">ENGINEERING ASSIGNED</p>			
<p align="center">CONTRACT NO</p> <p align="center">930212</p> <p align="center">DWG 008</p> <p align="center">SHT 5</p>				<p align="center">SUPPLIER'S / PURCHASER'S NO</p>			

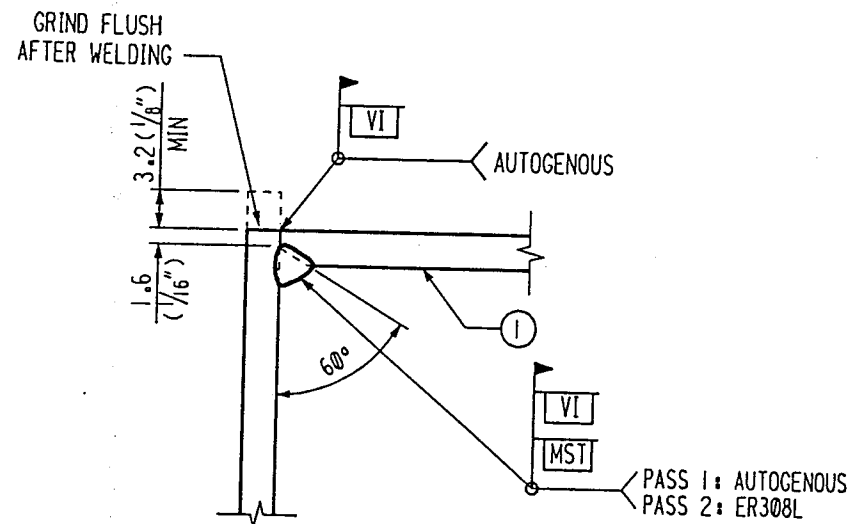


SHP PC	MARK	ASSM PC	DESCRIPTION	LENGTH MM	SPEC
4	9-H		- BEAM TUBE ASSEMBLY -		
	9-3	4	BEAM TUBE 1245 DIA x 3.2	3806	M1
	15-1	20	VACUUM STIFFENERS		
	16-C	4	GUIDED SUPPORT RING ASS'Y		
4	9-J		- BEAM TUBE ASSEMBLY -		
	9-3	4	BEAM TUBE 1245 DIA x 3.2	3932	M1
	9-4	4	EXPANSION JOINT	686	M2
	15-1	20	VACUUM STIFFENERS		
	16-C	4	GUIDED SUPPORT RING ASS'Y		
4	9-K		- BEAM TUBE ASSEMBLY -		
	9-2	4	BEAM TUBE 1245 DIA x 3.2	9806	M1
	15-1	52	VACUUM STIFFENERS		
	16-C	4	GUIDED SUPPORT RING ASS'Y		
4	9-L		- BEAM TUBE ASSEMBLY -		
	9-2	4	BEAM TUBE 1245 DIA x 3.2	9933	M1
	9-4	4	EXPANSION JOINT	686	M2
	15-1	52	VACUUM STIFFENERS		
	16-C	4	GUIDED SUPPORT RING ASS'Y		
			M1 = MAT'L SPEC C-240-0186 (SA240 TP 304L HRAP)		
			M2 = MAT'L SPEC C-EJ-CO (SA240 TP 304L HRAP)		

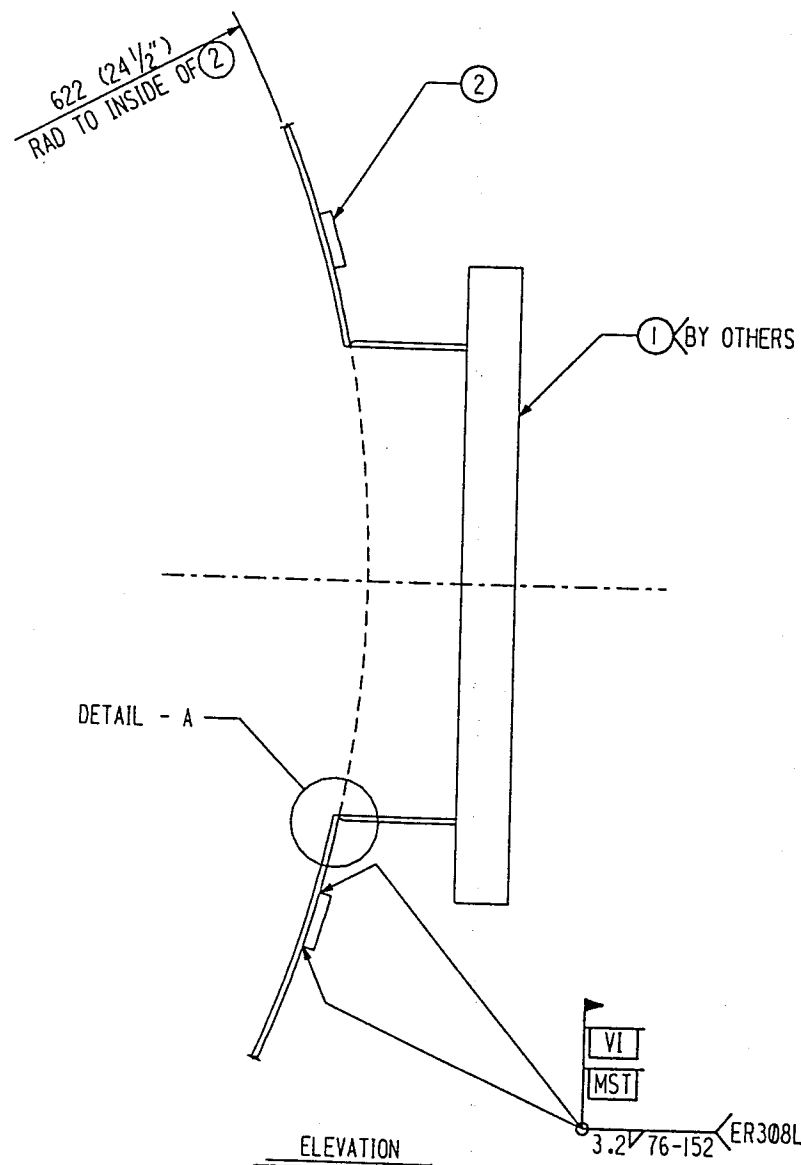
3212A009.DCN

INDICATES CHANGE FROM PREVIOUS ISSUE

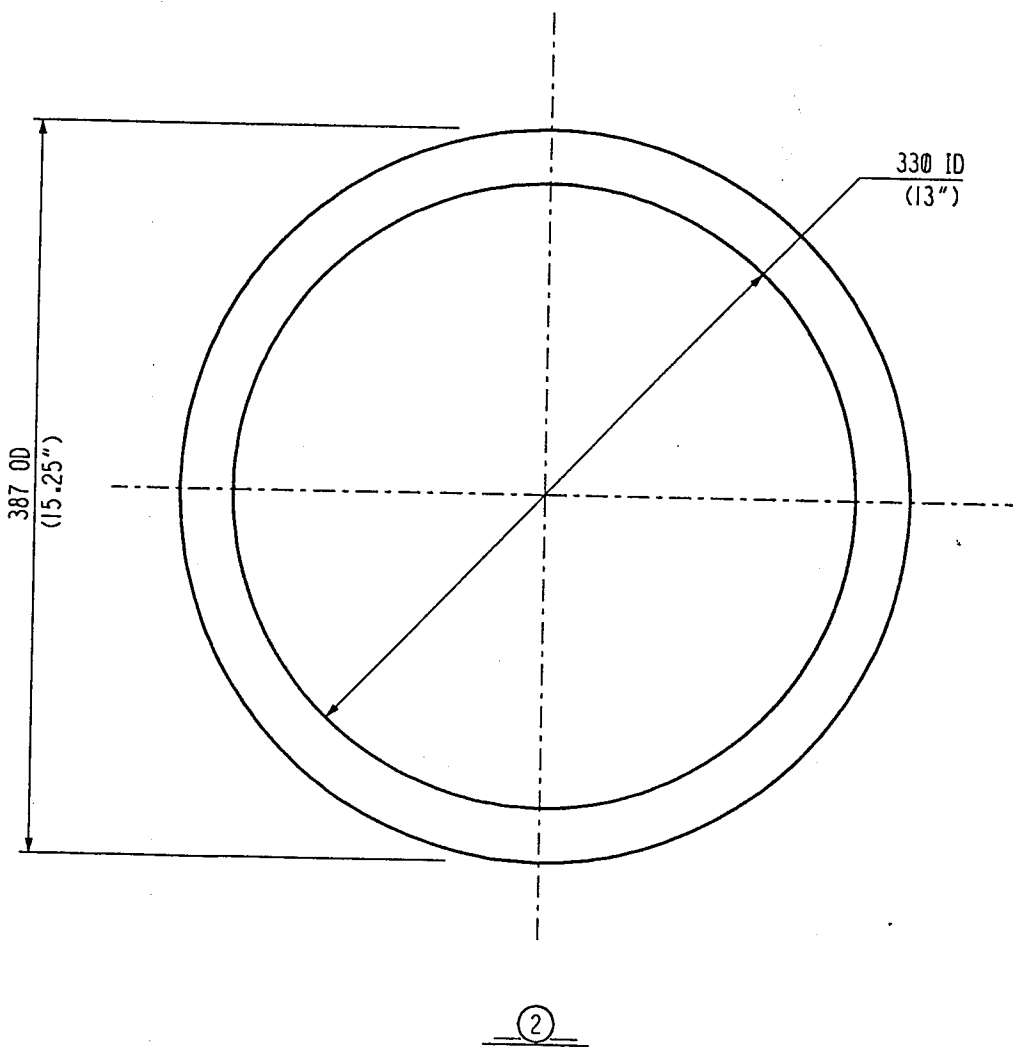
CHANGED LGTH OF EXPANSION JOINT & TUBE DIMENSIONS. ADDED MAT'L SPEC. REVISED PC MTS.	CBI SUPPLIER'S / PURCHASER'S NO	
	LIGO BEAM TUBE MODULES HANFORD, WA & LIVINGSTON, LA	
SUB-ASSEMBLIES (H) (J) (K) (L)		
CUSTOMER'S NO BY <u>KJR</u> CHKD <u>DATE</u>	CONTRACT NO 930212	DWG 9 SHEET 2
D.E. Thorn ENGINEERING ASSIGNED		



DETAIL - A



ELEVATION



SEE NOTE 3

SHIP PC	MARK	ASSM PC	DESCRIPTION	LENGTH MM	SPEC
			PUMP PORTS		
56	13-1		CONFLAT FLANGE OR EQUAL 13 1/4" OD W/PIPE 254 OD x 3.05 THK (10" OD x 0.12" THK)	63 (2.5")	M5
56	13-2		PL 387 OD x 6.35 x 330 ID (15.25" OD x .25" x 13" ID)		M6
			M5 = MAT'L SPEC C-PORT-OP (SA240 TP 304L)		
			M6 = MAT'L SPEC C-PORTPAD-I (SA240 TP 304L)		

SHOP:

REFER TO FABRICATION SPECIFICATION FOR INSTRUCTIONS.

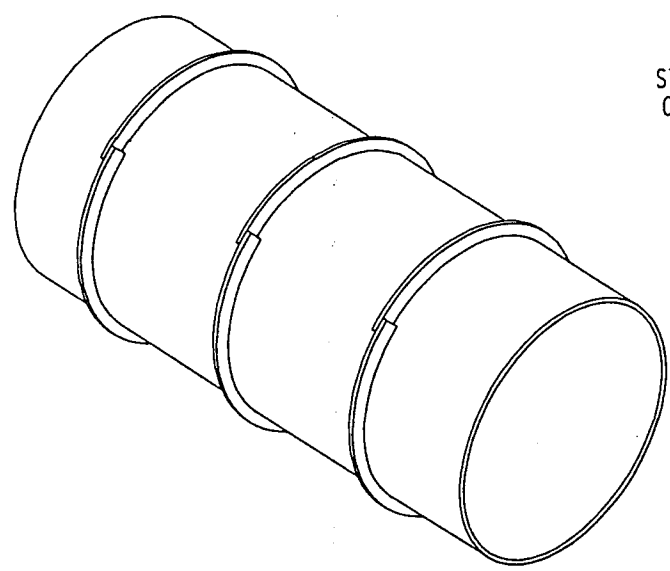
NOTES:

1. PUMP PORTS TO BE INSTALLED ON THE HORIZONTAL C OF THE BEAM TUBE.
2. REFER TO GENERAL MODULE CONFIGURATION FOR LOCATION & ORIENTATION.
3. CONFLAT IS A REGISTERED TRADE MARK OF VARIAN VACUUM PRODUCTS

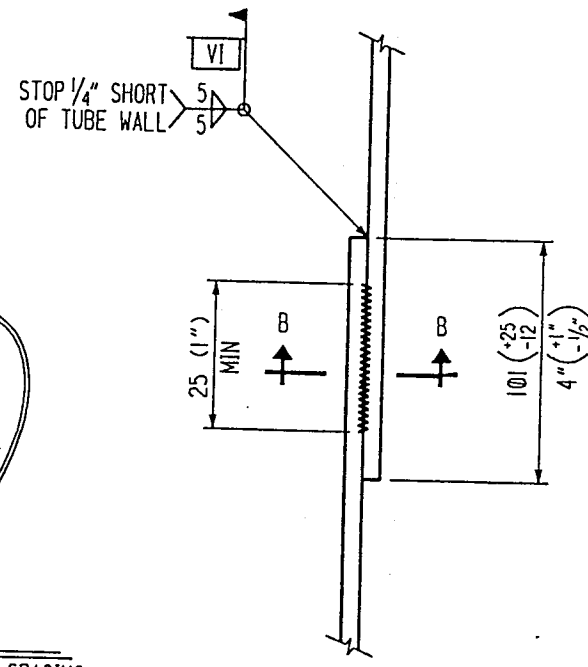
3212A013.DGN

INDICATES CHANGE FROM PREVIOUS ISSUE

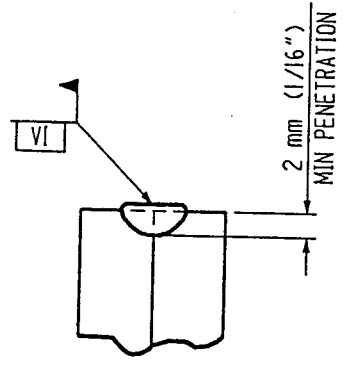
BY		DATE		REV		DATE		REV		DATE		REV		DATE		REV	
REVISIONS																	
REMARKS																	
CBI																	
PUMP PORTS																	
LIGO BEAM TUBE HANFORD, WA & LIVINGSTON, LA																	
CUSTOMER'S NO _____ CONTRACT NO _____																	
BY KJR CHKD _____ DATE _____																	
ENGINEERING ASSIGNED _____ DWG 13 REV _____																	
SHT _____ 2																	



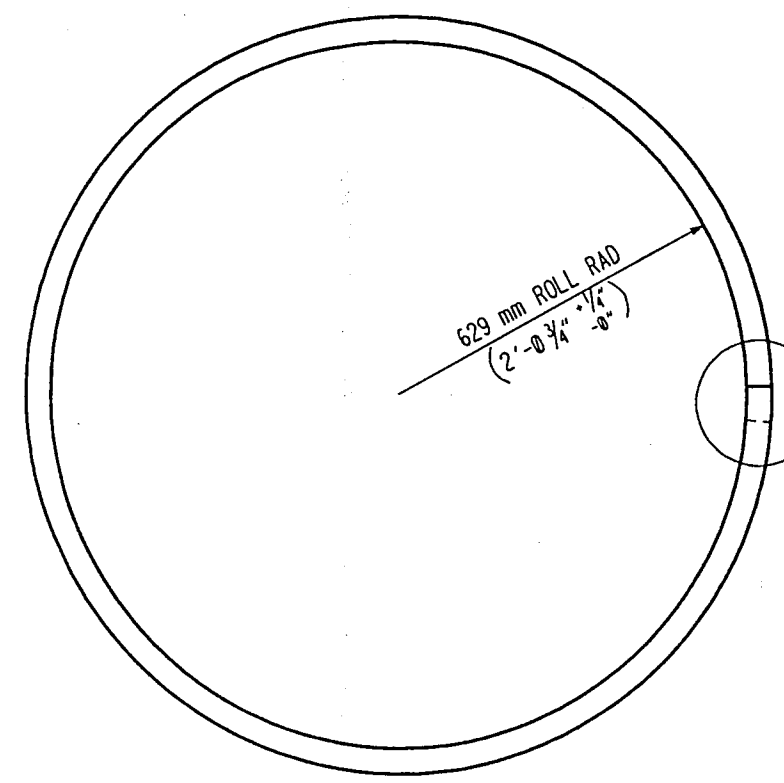
TYP STIFFENER LAYOUT
SEE SUB-MODULE DRAWINGS (# 2 & 3) FOR EXACT SPACING



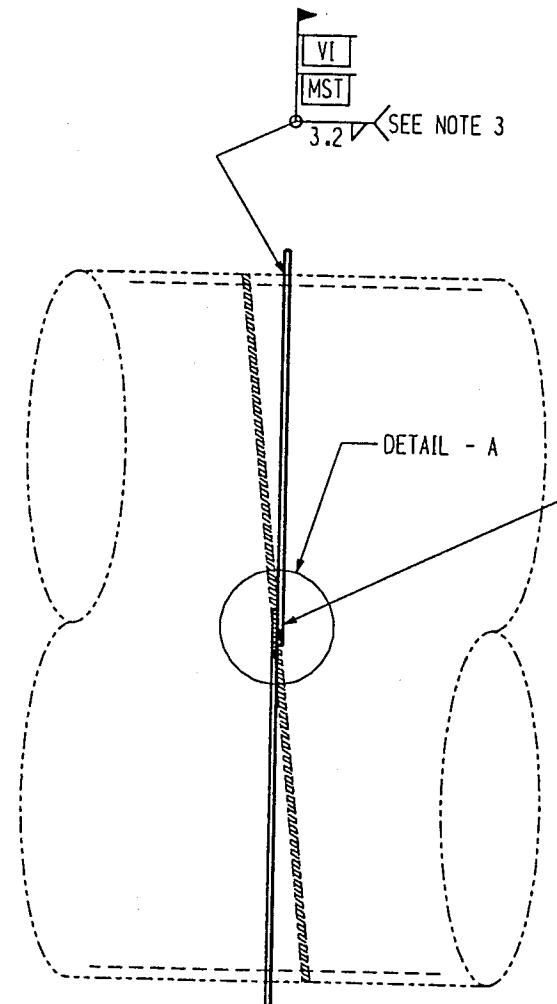
DETAIL - A
TYP LAP WELD



SECTION B-B

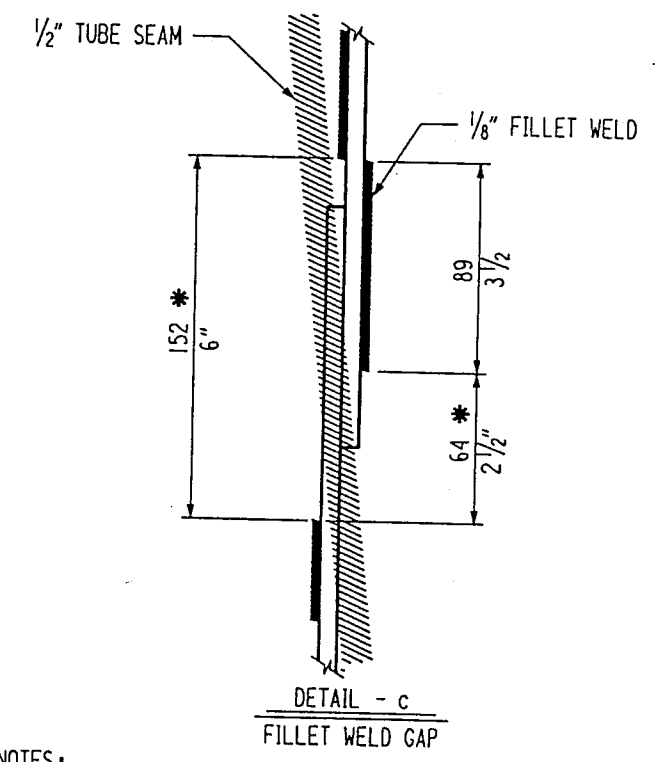


VACUUM STIFFENER ①



DETAIL - A
SEE NOTE 3
SEE DETAIL - C

SHIP PC	MARK	ASSM PC	DESCRIPTION	LENGTH MM	SPEC
			VACUUM STIFFENERS		
1974	15-1		BAR 44 x 5	4172	M3
			(1 3/4 x 3/16 x 13'-8 1/4)		
			M3 = MAT'L SPEC C-VAC-1		
			(SA240 TP 304L)		



DETAIL - C
FILLET WELD GAP

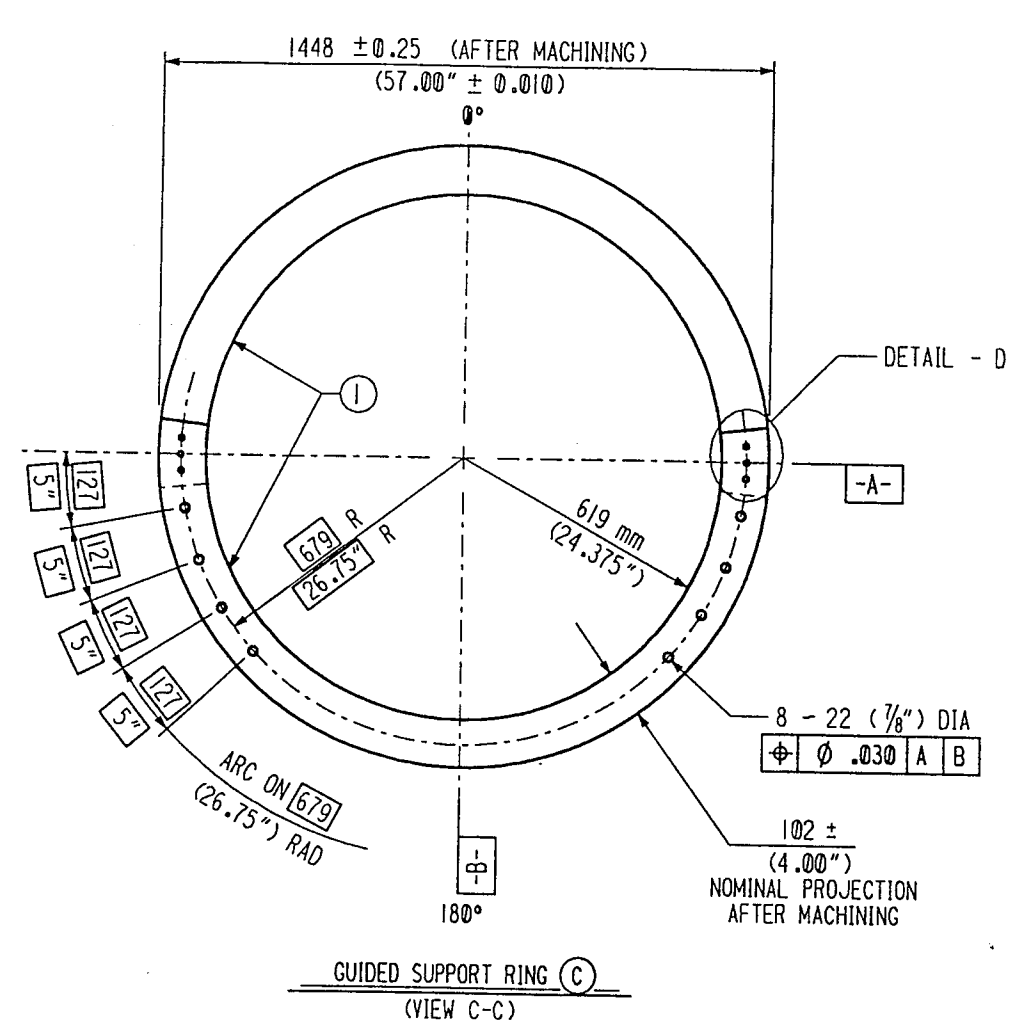
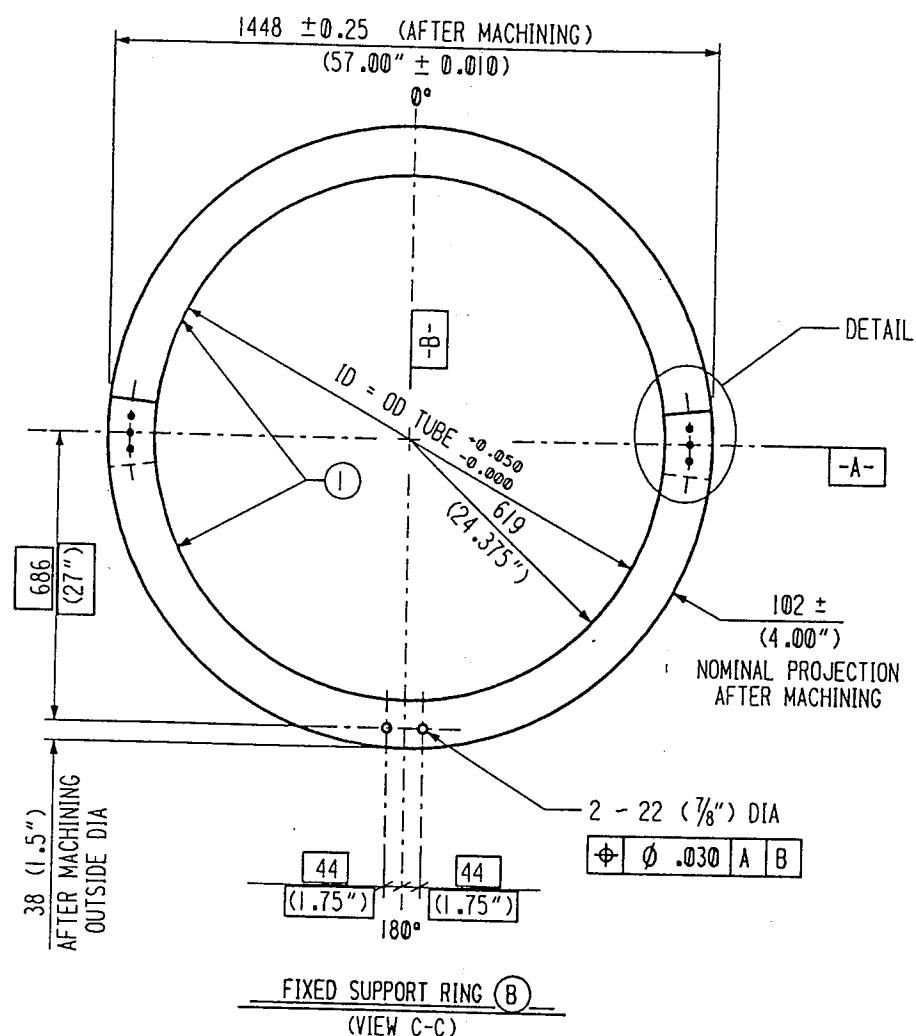
- NOTES:
1. STIFFENERS TO BE A SINGLE CONTINUOUS PIECE FORMED BY ROLLING 3/16" X 1 3/4" FLATS; ONLY THE ENDS OF THE STIFFENER TO BE CUT EDGES.
 2. STIFFENERS ARE TO BE INSTALLED BY EXPANDING OVER THE TUBE AND RELEASING INTO PLACE WITH A TIGHT FIT AROUND THE TUBE.
 3. DISCONTINUE FILLET WELD WHERE STIFFENER CROSSES TUBE SPIRAL WELD. SEE DETAIL - C.
 4. ALLOW EXTRA LENGTH FOR FORMING SO THAT THE ENDS OF THE STIFFENERS ARE ROLLED TO 622 (2'-0 1/2" +/- 1/4") RADIUS. STIFFENERS NOT FORMED AT ENDS MAY BE REJECTED.

* UNWELDED AREA MAY BE DECREASE BY LOCATING SPLICE CAREFULLY WITH LAP ON RIGHT SIDE.

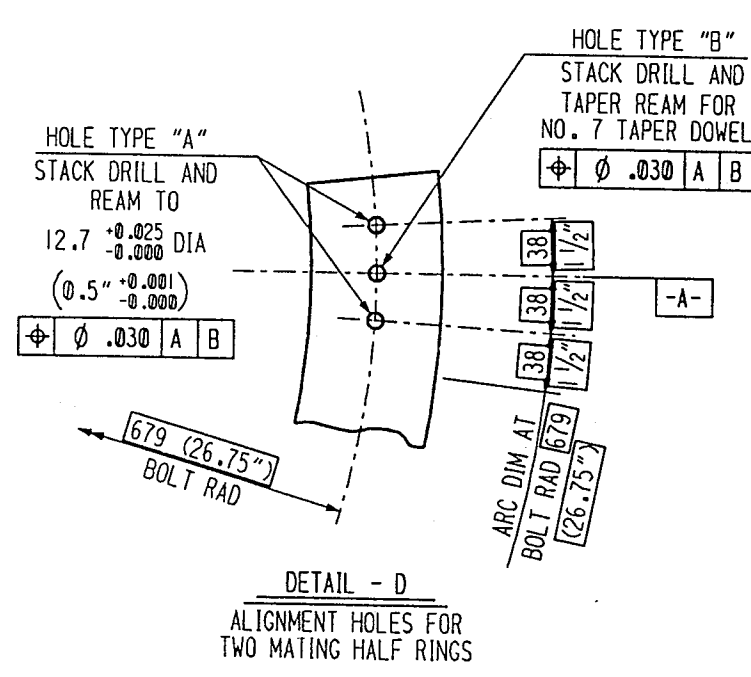
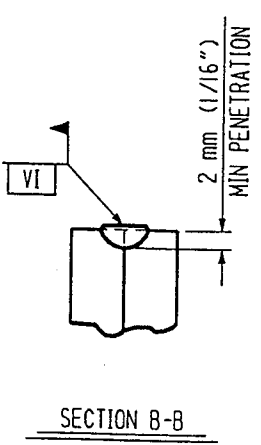
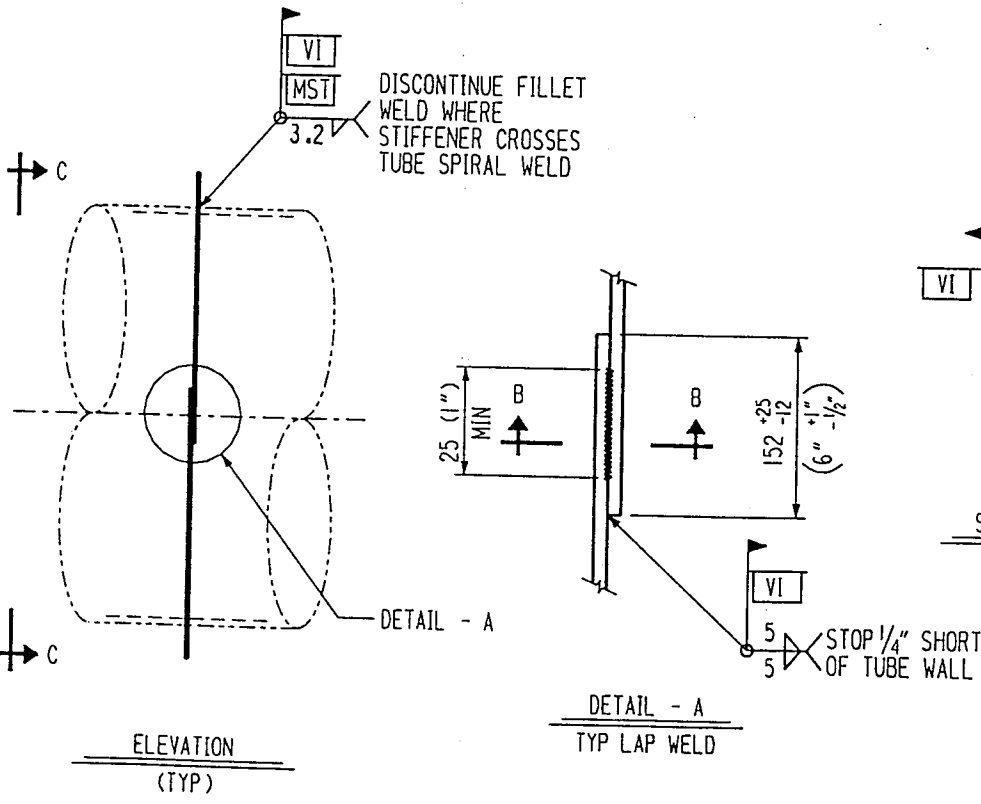
3212A015.DGN

INDICATES CHANGE FROM PREVIOUS ISSUE

CBI		SUPPLIER'S / PURCHASER'S NO	
VACUUM STIFFENER			
LIGO BEAM TUBE			
HANFORD, WA & LIVINGSTON, LA			
CUSTOMER'S NO		CONTRACT NO	
BY KJR CHKD		DATE	
D.F. Thorn		930212	
ENGINEERING ASSIGNED		DWG 15	
		REV 2	



SHP PC	MARK	ASSM PC	DESCRIPTION	LENGTH MM	SPEC
392	16-B		- FIXED SUPPORT RING ASS'Y -		
	16-1	784	BAR 114 x 9.5 ROLL FIN (4 1/2 x 3/8 x 7'-5 5/8)	2277	M4
800	16-C		- GUIDED SUPPORT RING ASS'Y -		
	16-1	1600	BAR 114 x 9.5 ROLL FIN (4 1/2 x 3/8 x 7'-5 5/8)	2277	M4
2384	16-4		BOLT 3/8" - 16 UNC-2A W/NUT	38 (1 1/2")	A307
2384	16-5		NO. 7 TAPER DOWEL PIN	152	A307
4768	16-6		SHOULDER BOLT 1/2" DIA SOCKET HD WITH NUT		A307
			5/8" SHOULDER LENGTH		
			3/8" - 16 UNC-3A THD		
			M4 = MAT'L SPEC C-SUPSTF-1 (SA240 TP 304L)		



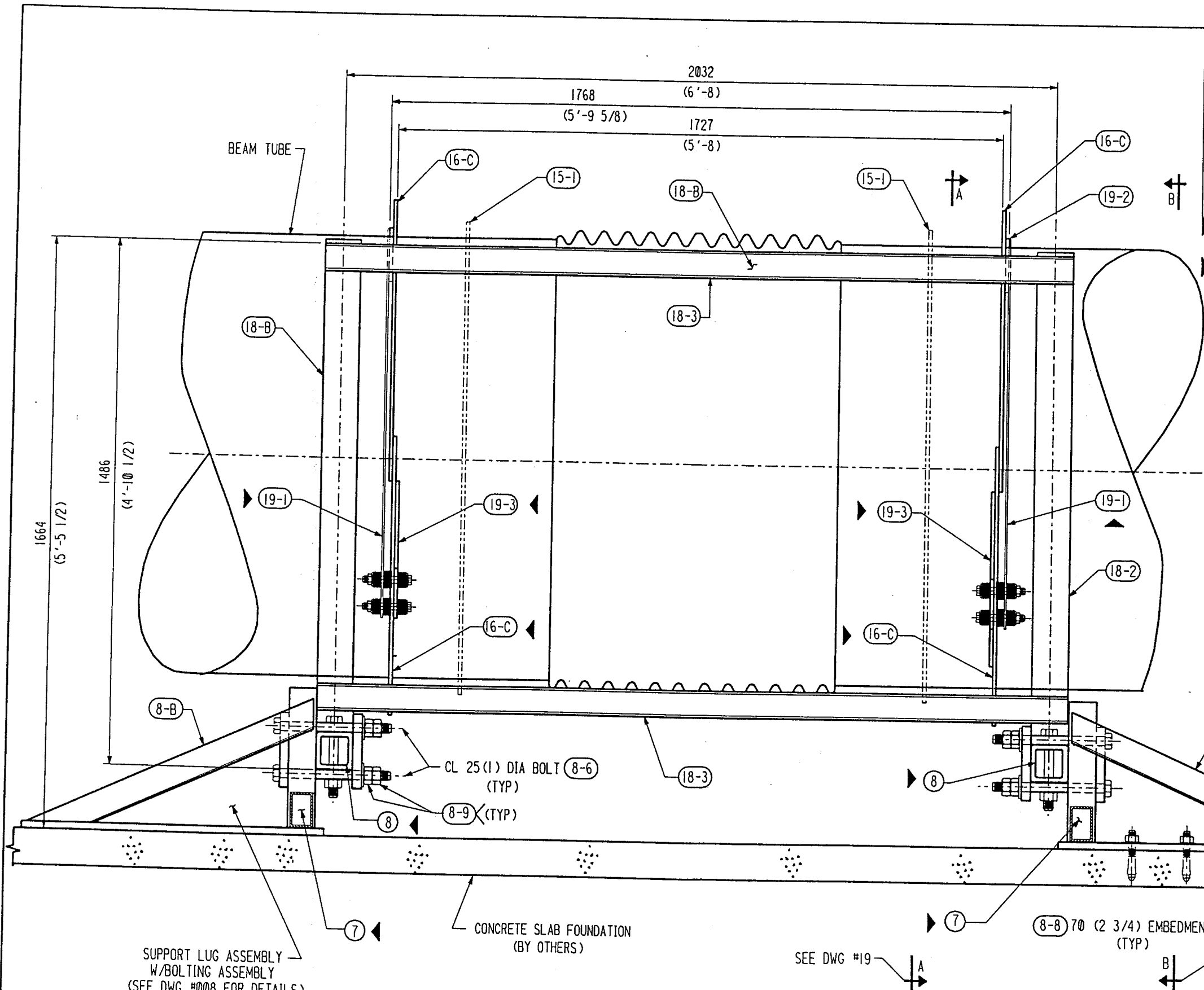
- SHOP:
- REFER TO FABRICATION SPECIFICATION C-SUPSTF-1 FOR INSTRUCTIONS.
- FIELD:
- MEASURE THE CIRCUMFERENCE OF THE TUBE WHERE THE STIFFENER SUPPORT WILL BE PLACED. CALCULATE THE OD OF THE TUBE.
 - MACHINE THE SUPPORT RING ID TO MATCH THE OD OF THE TUBE WHERE IT WILL BE ATTACHED WITH A TOLERANCE ON THE RING ID OF +0.050/-0.000
 - REMOVE BOLTS ONLY TO INSTALL. FIT SUPPORT AROUND BEAM TUBE, USING A NO. 7 DOWEL PIN TO LOCATE THE HOLE CENTERS
 - USE CARE TO MAKE SURE EACH SUPPORT IS FITTED TO THE PLACE IT WAS MACHINED FOR.
 - WELD THE SUPPORT TO THE TUBE. REMOVE ALL FASTENERS AFTER WELDING.

REVISIONS		REMARKS	
DATE	BY	DESCRIPTION	

		SUPPLIER'S / PURCHASER'S NO	
SUPPORT RING			
LIGO BEAM TUBE HANFORD, WA & LIVINGSTON, LA			
CUSTOMER'S NO		CONTRACT NO	
BY KJR CHKD WJC DATE 4-4-94		930212	
D.E. Thorn		DWG 16	REV
ENGINEERING ASSIGNED		SHT	2

INDICATES CHANGE FROM PREVIOUS ISSUE

3212A016.DGN



SHP PC	MARK	ASSM PC	DESCRIPTION	LENGTH MM	SPEC
2	8-B		GUIDED SUPPORT LUGS ASSY		
	8-1	4	L 76 X 76 X 5 X SK (L 3 X 3 X 3/16)	875	A36
	8-2	4	PL 222 X 19 THK (8 3/4 X 3/4) W/HOLE	838	A36
				(2'-9)	
	8-3	8	TUBULAR STEEL 76 X 50 X 5 (3 X 2 X 3/16)	375	A500 Gr B
				1'-2 3/4	
	8-4	4	PL 76 X 6 (3 X 1/4)	127 (5)	A36
	17-7	2	TUBULAR STEEL 76 X 50 X 5 (3 X 2 X 3/16)	835	A500 Gr B
				2'-8 7/8	
2	17-8		TUBULAR STEEL 102 X 102 X 10 (4 X 4 X 3/8) W/HOLES	1880	A500 Gr B
				(6'-2)	
8	8-5		PL 76 X 25 THK (3 X 1) W/HOLES	178 (7)	A36
8	8-6		BOLT 25 (1) DIA HVY HEX	279	A325
			THREAD LENGTH = 114 (4 1/2)	11	
20	8-8		EXPANSION ANCHORS 15 (5/8) DIA	120	CS
			HILTI KB11 58-434 W/70 (2 3/4)	(4 3/4)	
			EMBEDMENT DEPTH OR EQ.		
16	8-9		25 (1) HVY HEX NUT		A325
8	8-10		25 (1) WASHER		CS

NOTES ON INSULATION OF BEAM TUBE

1. THE BEAM TUBE MUST BE FULLY COVERED BY AT LEAST 4 INCHES OF INSULATION HAVING THERMAL CONDUCTIVITY, K, AT 284°F LESS THAN OR EQUAL TO 0.54 BTU IN/HR FT² °F, FOR AT LEAST 36 INCHES ON EITHER SIDE OF SUPPORT RING (16-1)

SUPPORT LUG ASSEMBLY W/BOLTING ASSEMBLY (SEE DWG #008 FOR DETAILS) (SEE THIS DWG #017 FOR BILLING) (TYP)

CONCRETE SLAB FOUNDATION (BY OTHERS)

SEE DWG #19

SEE DWG #18

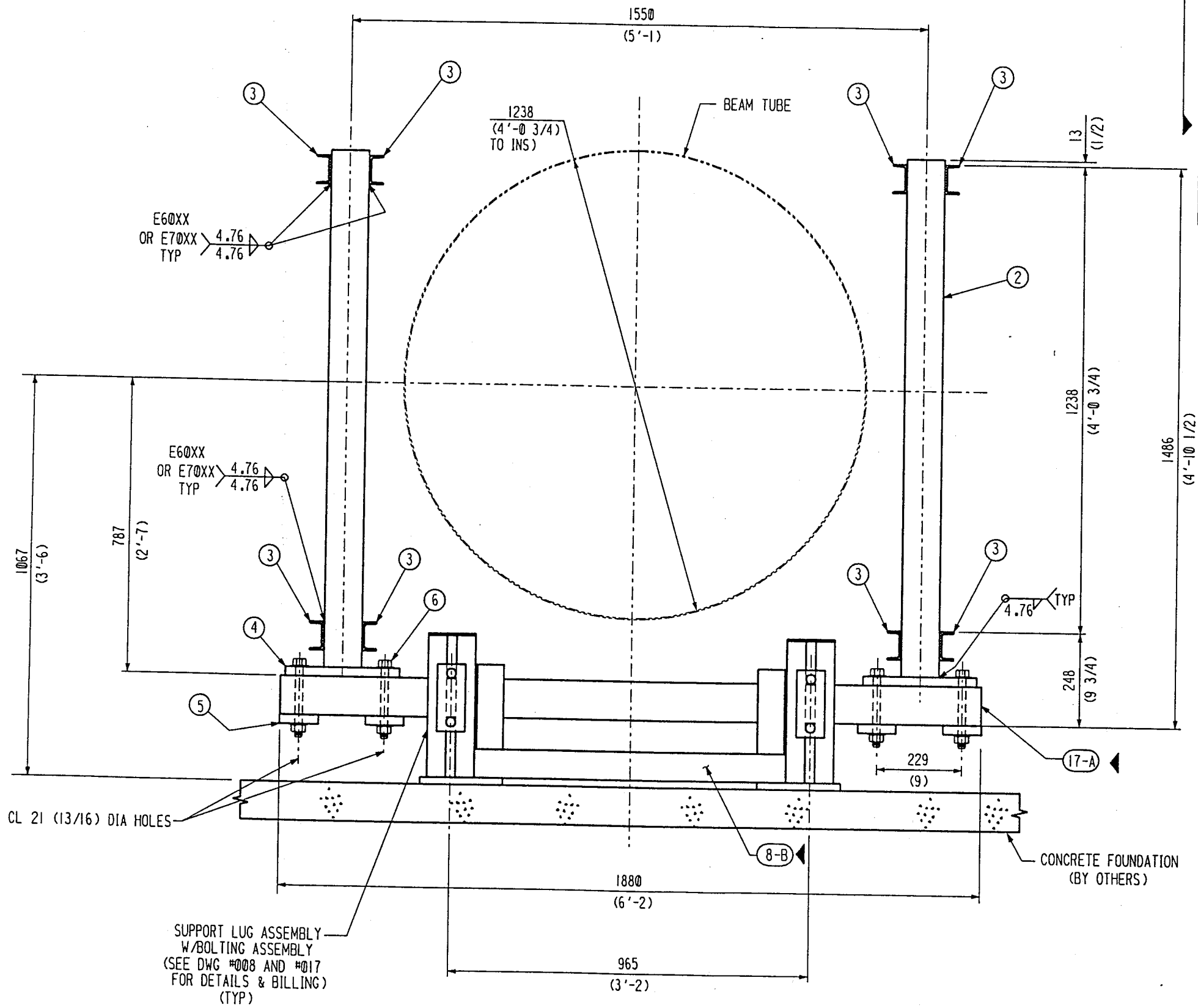
ELEVATION

NOTES

1. WORK THIS DWG WITH DWG #008, #018 AND #019.
2. BILLED FOR ONE (1) GUIDED SUPPORT. TOTAL OF 400 GUIDED SUPPORTS REQD.

INDICATES CHANGE FROM PREVIOUS ISSUE

REMOVE CBI PROPRIETARY NOTE. ADD DETAILS TO ELEVATION. REV PC MK 6 AND ADDED DIMENS. REVISE "ELEVATION" AS SHOWN. REVISE BILL OF MATERIALS. REVISED PC MKS.	CBI		SUPPLIER'S / PURCHASER'S NO
	ELEVATION BEAM TUBE GUIDED SUPPORT		
	CUSTOMER'S NO	CONTRACT NO	
BY WAW CHKD DET DATE 3-14-94	DWG #017	REV 3	
ENGINEERING ASSIGNED	SHT		



SHP PC	MARK	ASSN PC	DESCRIPTION	LENGTH MM	SPEC	D
2	18-B		GUIDED SUPPORT ASSEMBLY			
	18-2	4	TUBULAR STEEL 102 X 102 X 10 (4 X 4 X 3/16)	1372	A500 Gr-B	
	18-3	8	C 3 X 4.1 PBE	2134	A36	
	18-4	4	PL 102 X 25 (4 X 1) W/HOLES	305	A36	
	19-2	4	PL SK X 10 (3/8) THK W/HOLES	140	A36	
8	18-5		PL 102 X 25 (4 X 1) W/HOLES	102	A36	
8	18-6		BOLTS 19 (3/4) DIA HVY HEX W/HEX NUT AND WASHERS	203	A307	

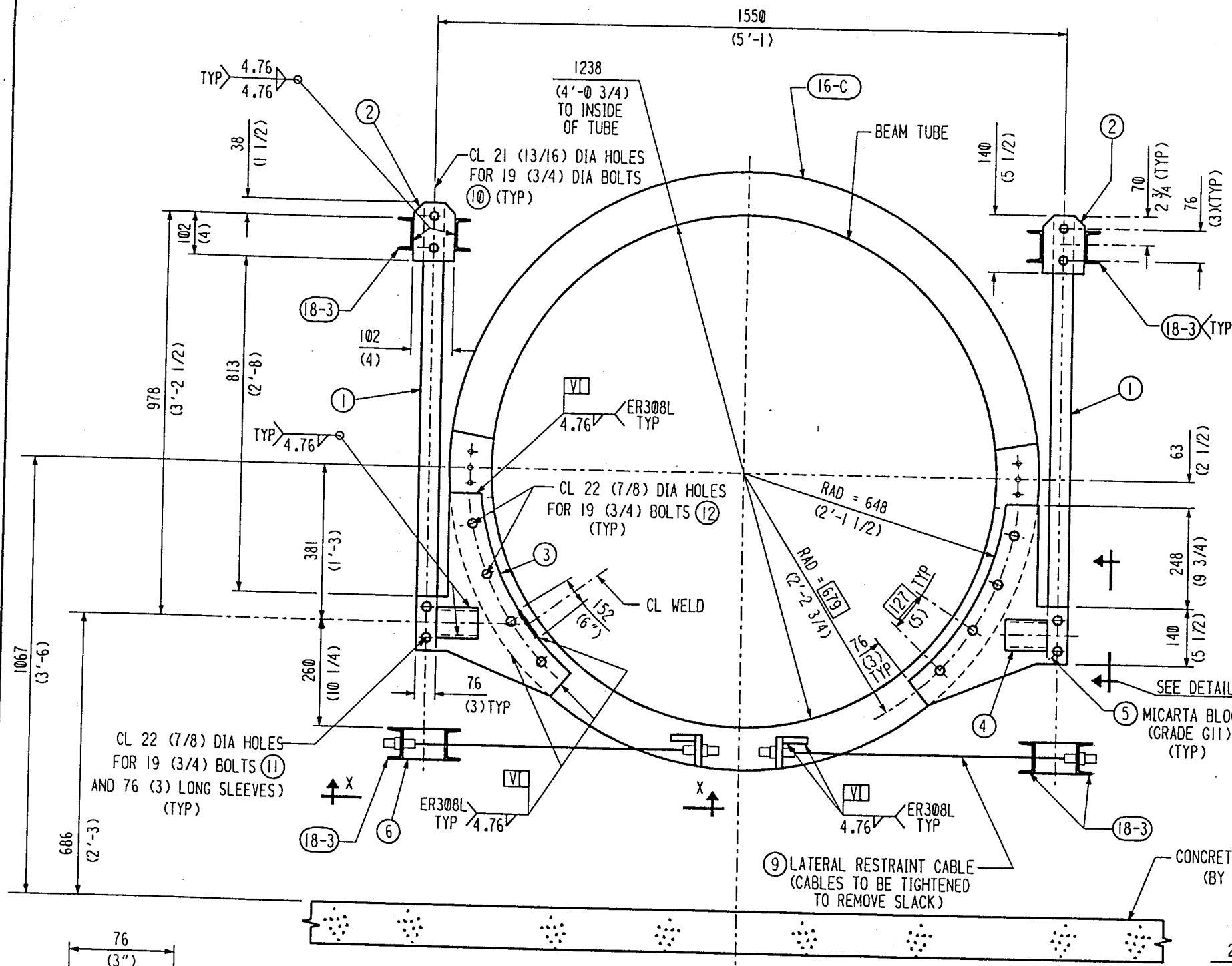
NOTES

1. WORK THIS DWG WITH DWG #008, #017 AND #019.
2. BILLED FOR ONE (1) GUIDED SUPPORT. TOTAL OF 400 GUIDED SUPPORTS REQD.

SECTION 8-B
(FROM DWG #017)
(SECTIONS NOT SHOWN FOR CLARITY)

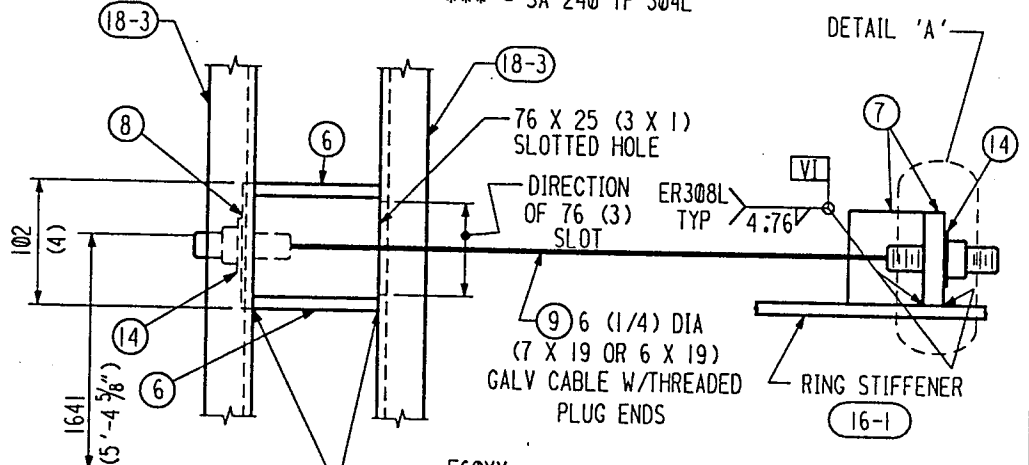
INDICATES CHANGE FROM PREVIOUS ISSUE

WAW CHECKED BY DATE 3-3-95 BY DATE 12-7-94 BY DATE 12-7-94		REVISE BILL OF MATERIALS REVISE PC MMS REVISE SECTION 8-B DELETE NOTE #3 & REV NOTE #2 ADDED PC MK 7 UPDATED REV LEVEL.		REMARKS	
				SUPPLIER'S / PURCHASER'S NO	
SECTION DETAILS BEAM TUBE GUIDED SUPPORT LIGO HANFORD, WA. AND LIVINGSTON, LA.					
CUSTOMER'S NO BY WAW CHKD DET DATE 3-15-94 D.E. THONN ENGINEERING ASSIGNED			CONTRACT NO 930212 DWG 018 REV 3		



SHIP PC	MARK	ASSM PC	DESCRIPTION	LENGTH MM	SPEC	D
4	19-1		BAR 50 X 4.76 (2 X 3/16) W/HOLES	1093 (3'-7")	A572 Gr50	
4	19-A		GUIDED SUPPORT PLATE ASSY			
	19-3	4	PL SK X 10 (3/8) THK W/HOLES		***	
	19-4	4	PL 102 X 4.76 BEND	165 (6 1/2")	304 SS	
4	19-5		MICARTA BLOCK 50 X 102 X 25 W/HOLES (2 X 4 X 1) (GRADE G11)			
8	19-6		PL 76 X 10 (3 X 3/8)	102 (4)	A36	
4	19-7		PL 76 X 16 (3 X 5/8)	76 (3)	***	
4	19-8		PL 38 X 6 (1 1/2 X 1/2) W/HOLES	102 (4)	A36	
1	19-9		RUN 6 (1/4) DIA (7 X 19 OR 6 X 19) GALV CABLE W/1/2" THREADED PLUG ENDS	3660 (12'-0")		
8	19-10		BOLT 19 (3/4) DIA HVY HEX W/HEX NUT AND WASHERS.	50 (2)	A307	
8	19-11		BOLT 19 (3/4) DIA HVY HEX W/HEX NUT	127 (5)	304 SS	
8	19-15		3/4" X 1/32 THK MYLAR INSULATING SLEEVE. (FROM F.H.MALONEY CO.)	76 (3)	MYLAR	
16	19-12		BOLT 19 (3/4) DIA HVY HEX W/HEX NUT AND STAINLESS STEEL WASHERS	51 (2)	304 SS	
16	19-13		MICARTA BLOCK 44 X 44 X 25 W/HOLES (1 3/4 X 1 3/4 X 1) GRADE G11			
8	19-14		14 (9/16) I.D. X 35 (1 3/8) O.D. GALV FLAT WASHER			
8	19-16		GROMMET 38 (1 1/2) DIA X SK W/14 (9/16) HOLE		G11	

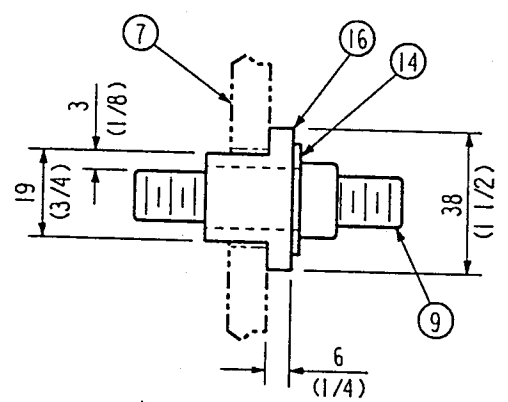
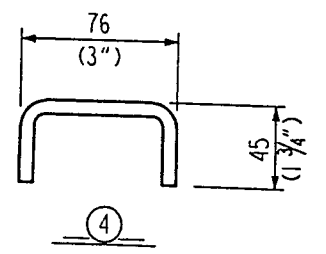
*** = SA 240 TP 304L



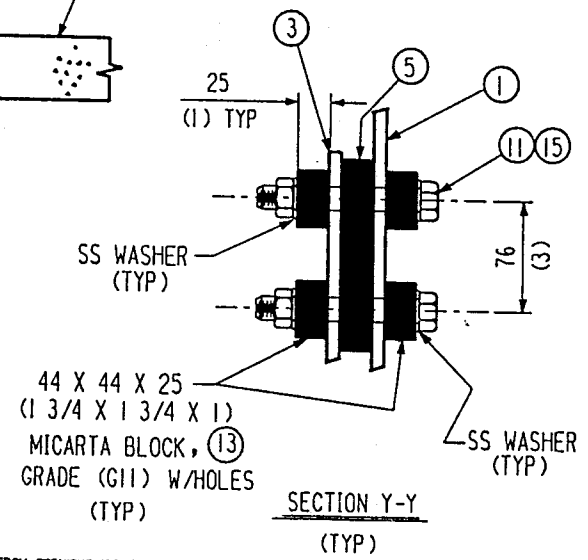
SECTION X-X (TYP)

NOTES

1. WORK THIS DWG WITH DWG #008, #017 AND #018
2. BILLED FOR ONE (1) GUIDED SUPPORT. TOTAL OF 400 GUIDED SUPPORTS REQ'D.
3. ALL CARBON STEEL MEMBERS TO BE GALVANIZED.



SECTION A-A (FROM DWG #017) (SECTIONS NOT SHOWN FOR CLARITY)

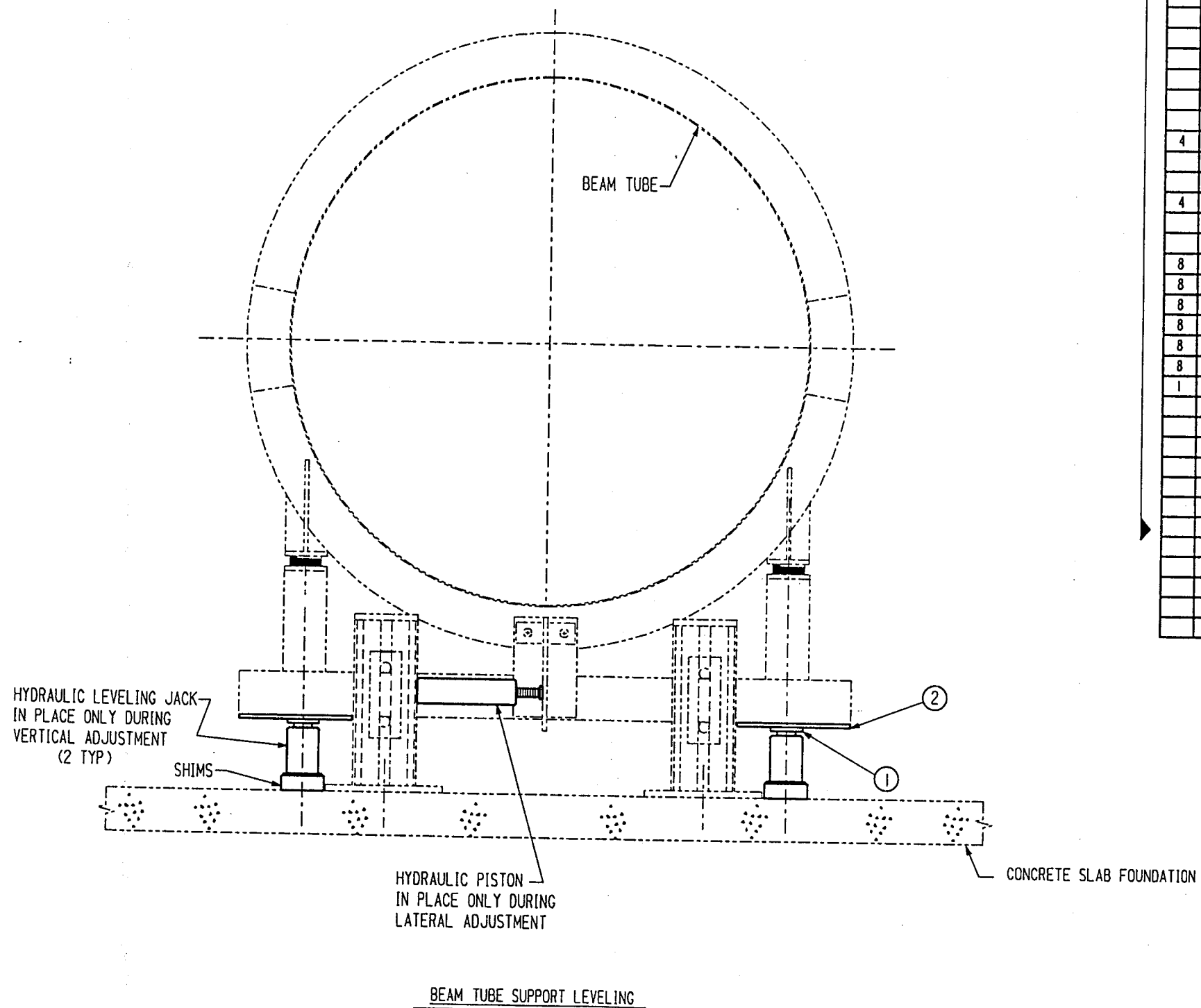


SECTION Y-Y (TYP)

INDICATES CHANGE FROM PREVIOUS ISSUE

REVISIONS		REMARKS	
BY	DATE	REVISIONS	REMARKS
WAW	5-5-95	1	REVISE BILL OF MATERIALS
WAW	12-7-94	2	ADDED DETAIL 'A'
WAW	7-8-94	3	REV MAT'L S & WELD. REV'D PC (16-C)

CBI		SUPPLIER'S / PURCHASER'S NO	
SECTION DETAILS			
BEAM TUBE GUIDED SUPPORT			
LIGO			
HANFORD, WA. AND LIVINGSTON, LA.			
CUSTOMER'S NO		CONTRACT NO	
BY WAW CHKD DET DATE 3-15-94		930212	
D.E. THONN		DWG 019	REV 3
ENGINEERING ASSIGNED		SHT	



SHP PC	MARK	ASSEM PC	DESCRIPTION	LENGTH MM	SPEC	ID
1	ERI-A		VERTICAL JACKING SYSTEM			
		1	ENERPAC P392 HYDRAULIC HAND PUMP	533 (21")		
		1	ENERPAC GP-105 HYDRAULIC GAUGE			
		1	ENERPAC GA-1 GAUGE ADAPTOR	71 (2.81)		
		1	ENERPAC HC-914 HIGH PRESSURE HOSE	1829 (72)		
		1	ENERPAC A-66 MANIFOLD			
		4	ENERPAC HC-913 HIGH PRESSURE HOSE	1829 (72)		
		4	ENERPAC RCS-101 LOW HEIGHT, SINGLE ACTING HYDRAULIC CYLINDERS	88/126		
				3.47/		
				4.97		
4	ERI-1		FLUOROGOLD SLIDE BEARING PLATES (1/16" THK FLUOROGOLD BONDED TO 3/16" THK X 3" X 3" CS PLATES.	76 (3)		
4	ERI-2		FLUOROGOLD SLIDE BEARING PLATES (1/16" THK FLUOROGOLD BONDED TO 3/16" THK X 3 1/2 X 10" CS PLATES	254 (10)		
8	ERI-3		SHEET 3 X 152 (1/8" X 6")	152 (6)	ALUMINUM	
8	ERI-4		BAR 6 X 152 (1/4" X 6")	152 (6)	ALUMINUM	
8	ERI-5		BAR 13 X 152 (1/2" X 6")	152 (6)	ALUMINUM	
8	ERI-6		BAR 25 X 152 (1" X 6")	152 (6)	ALUMINUM	
8	ERI-7		BAR 51 X 152 (2" X 6")	152 (6)	ALUMINUM	
8	ERI-8		BAR 76 X 152 (3" X 6")	152 (6)	ALUMINUM	
1	ERI-B		HORIZONTAL JACKING SYSTEM			
		1	ENERPAC P-142 HYDRAULIC HAND PUMP	337		
				(13.25")		
		1	ENERPAC HC-882 HIGH PRESSURE HOSE			
		1	ENERPAC RC-53 SINGLE-ACTING, SOLID PLUNGER HYDRAULIC CYLINDER	165/246		
		1	ENERPAC MZ-4002 EXTENSION TUBES	76 (3)		
		1	ENERPAC MZ-4002 EXTENSION TUBES	127 (5)		

NOTES

1. QUANTITIES SHOWN IN BILL OF MATERIALS ARE FOR ONE SET OF SUPPORT ADJUSTING HARDWARE. A TOTAL OF 2 SETS ARE REQUIRED.

BY		DATE		BY		DATE		BY		DATE		BY		DATE	
WAW		3-16-94		D.E. THORN		12-7-94		D.E. THORN		12-7-94		D.E. THORN		12-7-94	
CHKD		DATE		CHKD		DATE		CHKD		DATE		CHKD		DATE	
WAW		3-16-94		D.E. THORN		12-7-94		D.E. THORN		12-7-94		D.E. THORN		12-7-94	
REVISE BILL OF MATERIALS		UPDATED REV LEVEL		REMARKS											
CBI												SUPPLIER'S / PURCHASER'S NO			
SUPPORT LEVELING															
BEAM TUBE FIXED & GUIDED SUPPORT															
LIGO															
HANFORD, WA. AND LIVINGSTON, LA.															
CUSTOMER'S NO								CONTRACT NO							
BY WAW CHKD DET DATE 3-16-94								930212							
D.E. THORN								DVG ERI							
ENGINEERING ASSIGNED								SHT							
								REV 2							

INDICATES CHANGE FROM PREVIOUS ISSUE

DRAWING SUMMARY SHEET

<p>CBI</p> <p>STRUCTURE <u>LIGO PROJECT</u></p> <p>CUSTOMER <u>CALTECH</u></p> <p>LOCATION <u>HANFORD, WASHINGTON</u></p>	<p>SUPPLIER INSPECTION _____ BY _____</p> <p>SHOP INSP _____ BY _____</p> <p>FIELD INSP _____ BY _____</p> <p>SANDBLAST: SHOP _____ FIELD _____</p> <p>PICKLE _____ PAINT: SHOP _____ FIELD _____</p> <p style="text-align: right;">(SEE "P" SHEETS)</p>	<p>WEIGHT SUMMARY</p> <table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <th colspan="2">ESTIMATED WEIGHT</th> </tr> <tr> <td>FROM</td> <td></td> </tr> <tr> <td></td> <td></td> </tr> <tr> <td></td> <td></td> </tr> <tr> <td></td> <td></td> </tr> <tr> <td>DIRECTS</td> <td></td> </tr> <tr> <td>TOTAL</td> <td style="text-align: right;">↑</td> </tr> </table>	ESTIMATED WEIGHT		FROM								DIRECTS		TOTAL	↑
ESTIMATED WEIGHT																
FROM																
DIRECTS																
TOTAL	↑															
<p>LIST OF BILLS AND MISCELLANEOUS SUMMARY SHEETS ("0"-SHT)</p> <p>FINAL BILLS _____</p> <p>"W" SHTS _____</p> <p>STDS _____</p>																

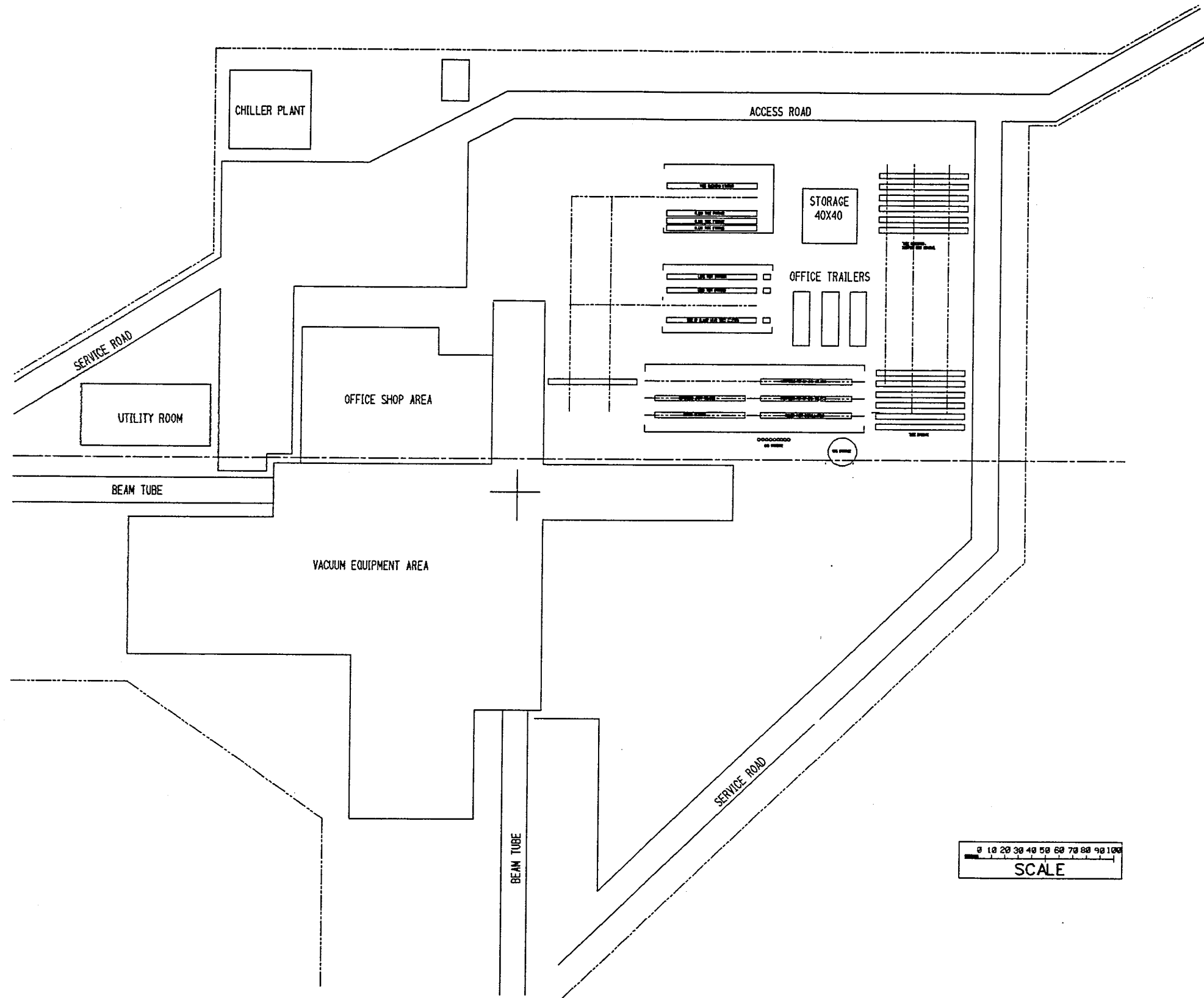
REMARKS:

DRAWINGS COMPLETE	YES <input type="checkbox"/>	NO <input checked="" type="checkbox"/>
FINAL BILLS COMPLETE	YES <input type="checkbox"/>	NO <input checked="" type="checkbox"/>

BILLS	DWG NUMBER	REV	DESCRIPTION	SHEET
	ER-3	5	HANFORD SITE LAYOUT; HOR. TUBE CONSTR.	
	ER-4	5	HANFORD BUILDING LAYOUT	
	ER-5	1	FAB SHOP CROSS SECTION	
	ER-6	1	FAB SHOP TOP VIEW AT STIFFENER FIT AND WELD SECTION	
	ER-7	2	HANFORD SITE; POWER DISTRIBUTION	
	ER-14	1	CROSS SECTION OF TRUCK LOADING	
	ER-15	1	ELEVATION OF TRUCK LOADING	
	ER-16	1	TRANSPORT AND HANDLING FRAME	
	ER-20	5	EXTERNAL STIFFENER FIT UP SEQUENCE	
	ER-21	1	VOID	
	ER-22	1	VOID	
	ER-23	0	VOID	
	ER-24	2	PLAN VIEW OF ACTUATOR LAYOUT	
	ER-25	0	VOID	
	ER-26	0	VOID	
	ER-27	0	VOID	
	ER-44	0	VOID	
	ER-45	3	FIT UP CLAMP	
	ER-46	3	FIT UP CLAMP DETAILS	
	ER-50	1	LEAK TEST STATION; ISOMETRIC VIEW	
	ER-51	4	HELIUM HOOD; LEAK TEST STATION	
	ER-52	1	VOID	
	ER-53	1	VOID	
	ER-54	2	ST. HOOD TEST ENCLOSURE; TOP SECTION	
	ER-55	2	ST. HOOD TEST ENCLOSURE; BOTTOM SECTION	
	ER-56	2	HOOD TEST ENCLOSURE; HELIUM HOOD DETAILS	
	ER-57	4	SADDLE AND HINGE; HELIUM HOOD	
	ER-58	4	SADDLE AND HINGE DETAILS	
	ER-59	2	HELIUM HOOD ENCLOSURE EQUIPMENT	
	ER-60	2	VACUUM PUMP END SEAL	
	ER-61	2	VACUUM PUMP END SEAL ASSY	
	ER-62	2	VACUUM PUMP END SEAL; CARRIAGE SUBASSY	
	ER-63	2	VAC. PUMP END SEAL; ROLLING BASE SUBASSY	
	ER-64	2	VACUUM PUMP END SEAL; END CAP SUBASSY	
	ER-65	2	VAC. PUMP END SEAL; LIFTING FRAME SUBASSY	
	ER-66	2	MECHANICAL VACUUM PUMP LINE SUBASSY	
	ER-67	2	DIFFUSION PUMP LINE SUBASSY	
	ER-68	2	CROSS-OVER LINE SUBASSY	

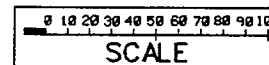
CONTINUE ON "0-1" SHEET

NO.	MADE BY	BSA	RDS	DATE	5-12-95
	CHKD BY	1	2		5-17-95
ENG ASSIGNED		CHG			
MFG ASSIGNED		CCC			
CONST ASSIGNED		NSS			
MADE BY		BSA		DATE 4-6-94	
CHECKED BY				DATE	
ENG COORDINATOR		JLR			
CONTRACT NO.		930212ER		"0"	



NOTES:

1. SEE ER-04 FOR LARGER VIEW OF TUBE FAB AREA.
- ▶ 2. THIS SITE LAYOUT IS FOR STIFFENING, LEAK TESTING, AND CLEANING OF TUBE SECTIONS AT THE INSTALLATION SITE.

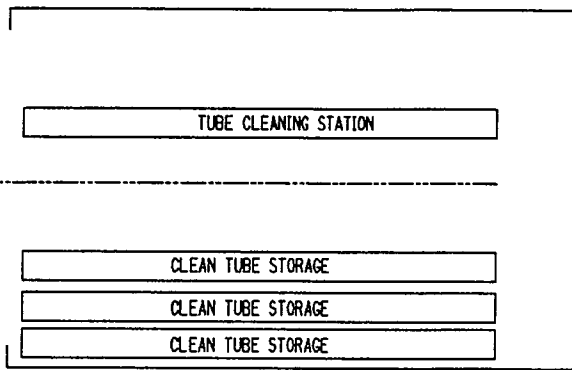


CAD FILE 30212003.DGN

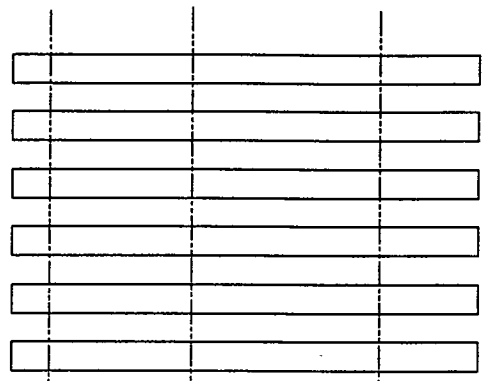
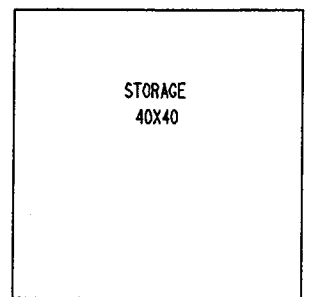
▶ INDICATES CHANGE FROM PREVIOUS ISSUE

Supplier's/Purchaser's No. _____	
LIGO PROJECT HANFORD SITE LAYOUT HORIZONTAL TUBE CONSTRUCTION	
Customer's No. _____	Contract No. 930212ER
By <u>DKL</u> Chkd _____ Date <u>9/23/93</u>	Dwg-ER-03 Rev. 5
J.L. RINGELSTETTER Engineering Supervisor	
Revisions: _____ Remarks: _____	

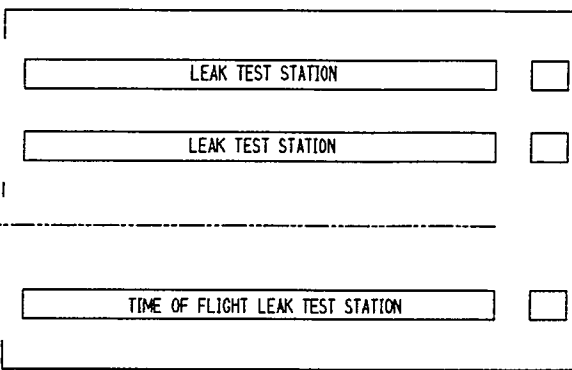
50' X 80' BUILDING



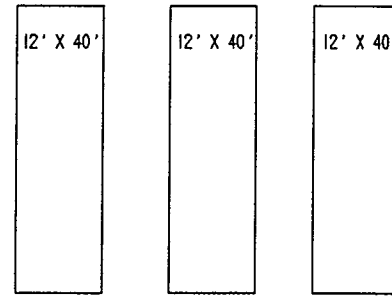
STORAGE
40X40



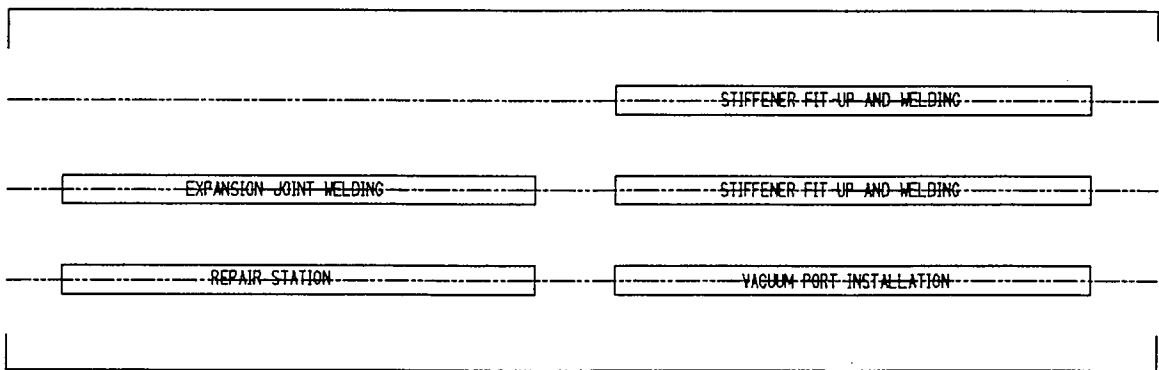
50' X 80' BUILDING - INSULATED



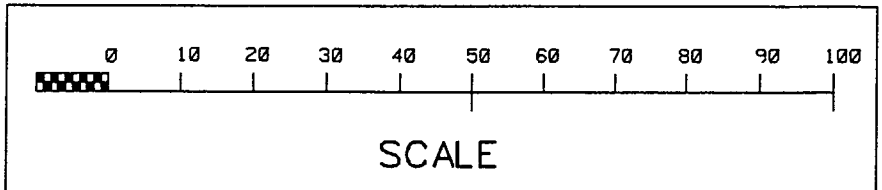
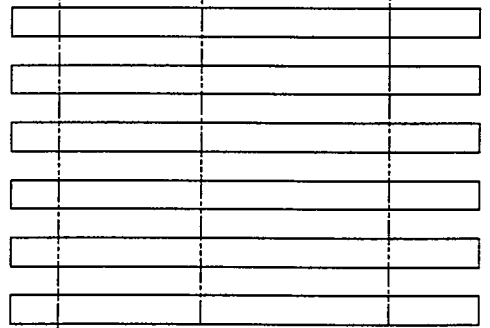
OFFICE TRAILERS



50' X 160' BUILDING



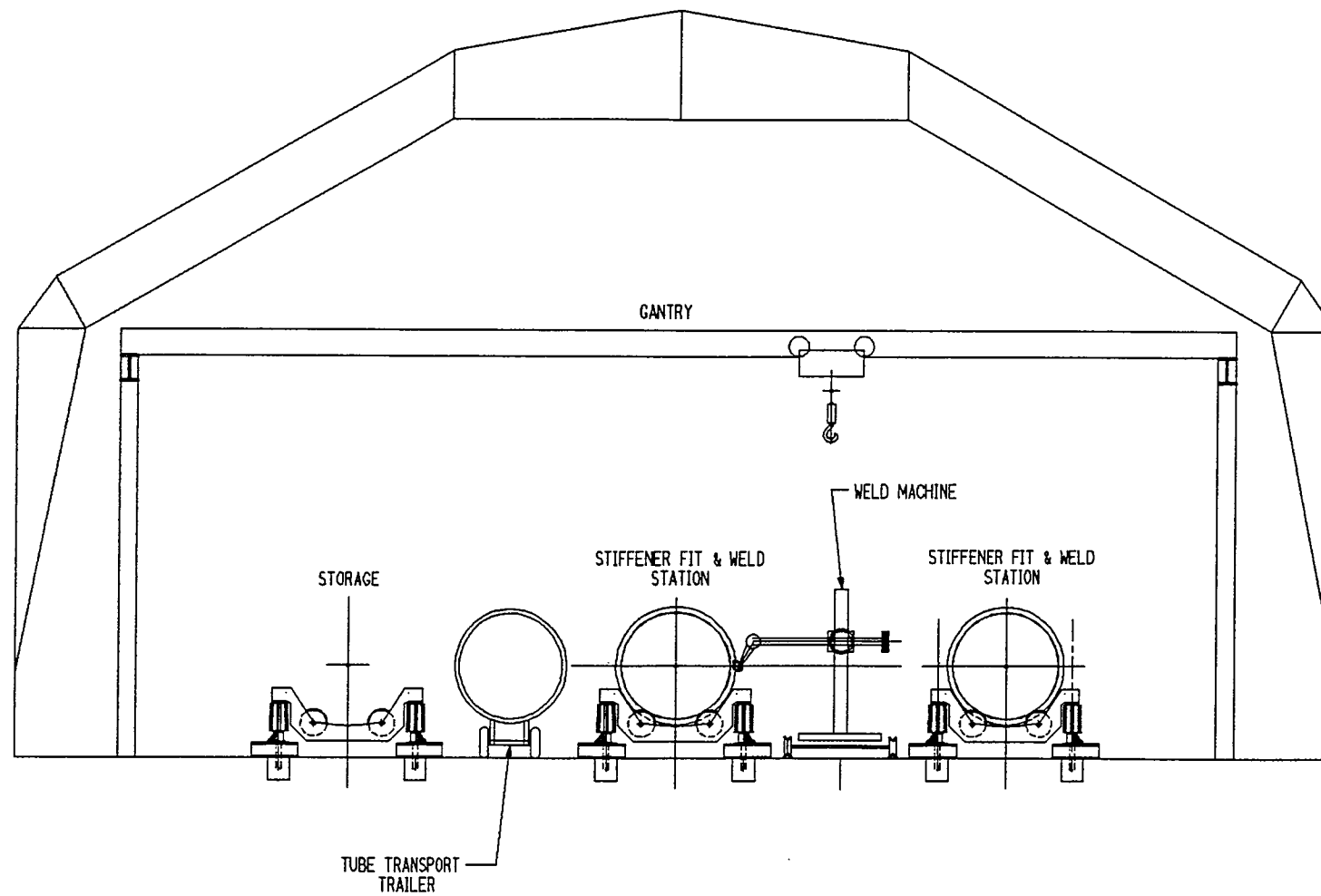
○○○○○○○○○○
GAS STORAGE



CAD FILE 130212004.DGN


INDICATES CHANGE FROM PREVIOUS ISSUE

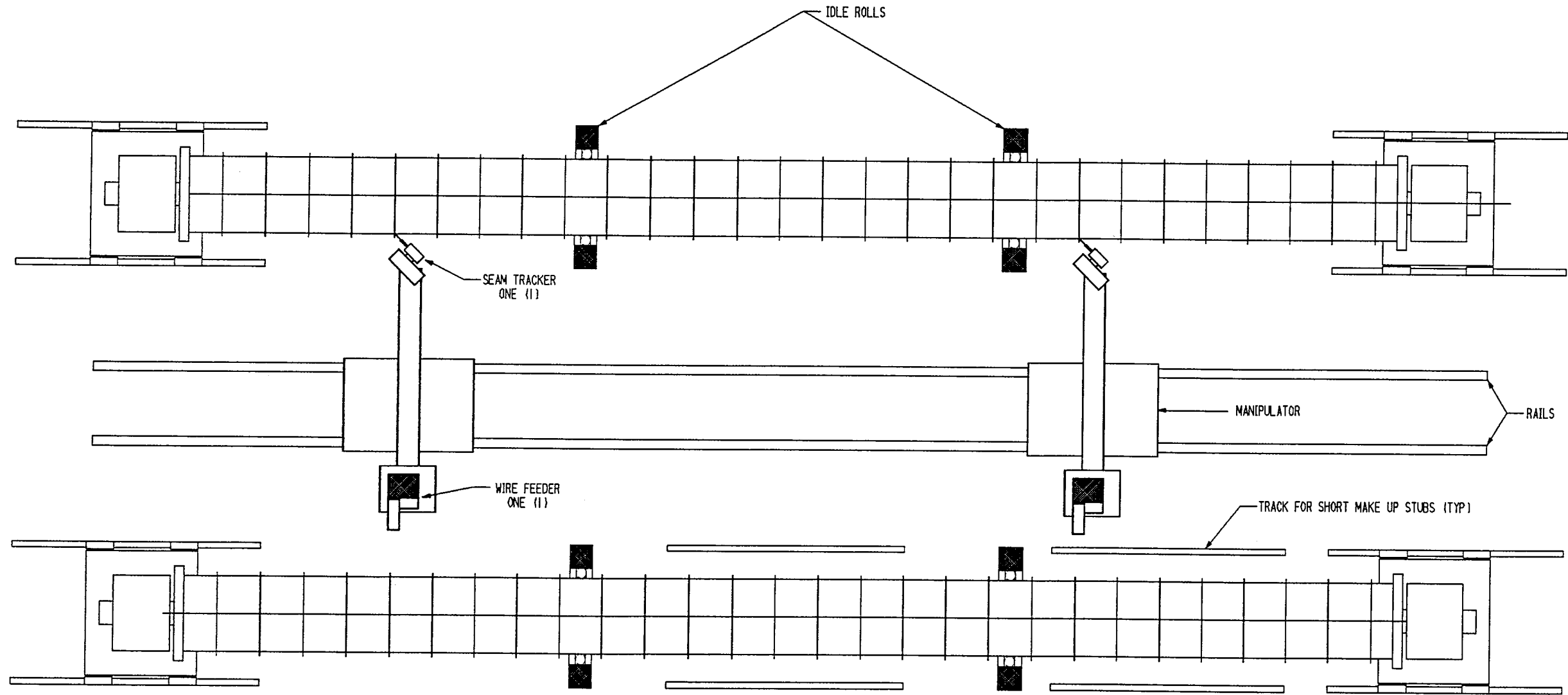
NEW LAYOUT		MODIFY TITLE BLOCK		FIT-UP & WELDING ARE SAME STATION	
By	Chkd	Date	By	Chkd	Date
DKL	DKL	1/21/94	DKL	DKL	1/21/94
Revisions					
Remarks					
LIGO PROJECT HANFORD SITE LAYOUT HORIZONTAL TUBE CONSTRUCTION					
Customer's No. _____			Contract No. 930212		
By DKL Chkd _____		Date 9/23/93		Dwg. ERO4 Rev. 5	
J.L. RINGELSTETTER		Engineering Supervisor		Sheet -	



CAD FILE 30212005.DGN

▶ INDICATES CHANGE FROM PREVIOUS ISSUE

Supplier's/Purchaser's No. _____	
 LIGO PROJECT FABRICATION SHOP CROSS SECTION	
Customer's No. _____	Contract No. 930212ER
By <u>DKL</u> Chkd _____ Date 3-22-94	Dwg. ER-5 Rev. 1
Engineering Supervisor	
Sheet -	

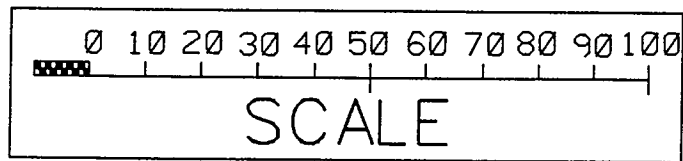


PLAN VIEW

CAD FILE 30212006.DGN

▶ INDICATES CHANGE FROM PREVIOUS ISSUE

By		Chkd	Date	REMAIN AND UPDATE		Supplier's/Purchaser's No. _____	
By		Chkd	Date	CHANGE TYPE OF SUPPORTS		CBI	
By		Chkd	Date	MODIFY TITLE BLOCK		LIGO PROJECT	
By		Chkd	Date	Remarks		FABRICATION SHOP TOP VIEW AT STIFFENER FIT AND WELD STATION	
By		Chkd	Date	Revisions		Customer's No. _____ Contract No. 930212ER	
By		Chkd	Date	Remarks		By RMP Chkd Date 4-8-94	
By		Chkd	Date	Remarks		J.J. RINGELSTETTER	
By		Chkd	Date	Remarks		Engineering Supervisor	
By		Chkd	Date	Remarks		Dwg. ER-6 Rev. 1	
By		Chkd	Date	Remarks		Sheet -	



CLEANING SHOP
80' X 50'

STORAGE
40X40

LEAK TEST SHOP
80' X 50'

OFFICE TRAILERS

RUN POWER 2KM.
TO MID STATION

OFFICE SHOP AREA

WELD FABRICATION SHOP
160' X 50'

PERMANENT POWER

○○○○○○○○○
GAS STORAGE

○
GAS STORAGE

VACUUM EQUIPMENT AREA

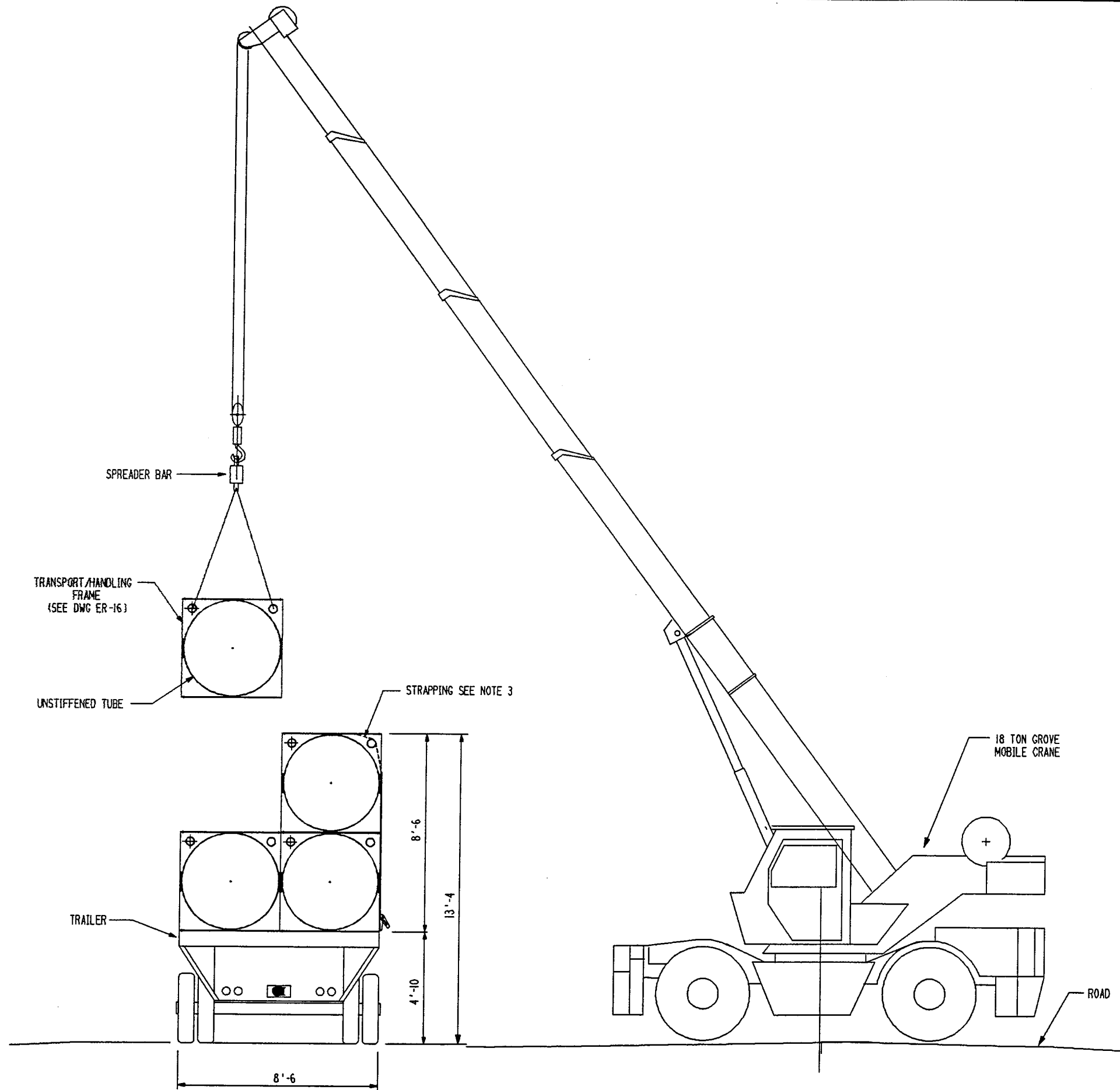
RUN POWER 2KM.
TO MID STATION

ACCESS ROAD

▶ INDICATES CHANGE FROM PREVIOUS ISSUE

CAD FILE | 30212007.DWG

Supplier's/Purchaser's No. _____	
CBI	
LIGO PROJECT HANFORD SITE LAYOUT POWER DISTRIBUTION	
Customer's No. _____	Contract No. 930212ER
By <u>DKL</u> Chkd _____ Date <u>3/10/94</u>	Dwg. <u>ER-07</u> Rev. _____
J.J. RINGELSTETTER Engineering Supervisor	
Sheet _____ of _____	



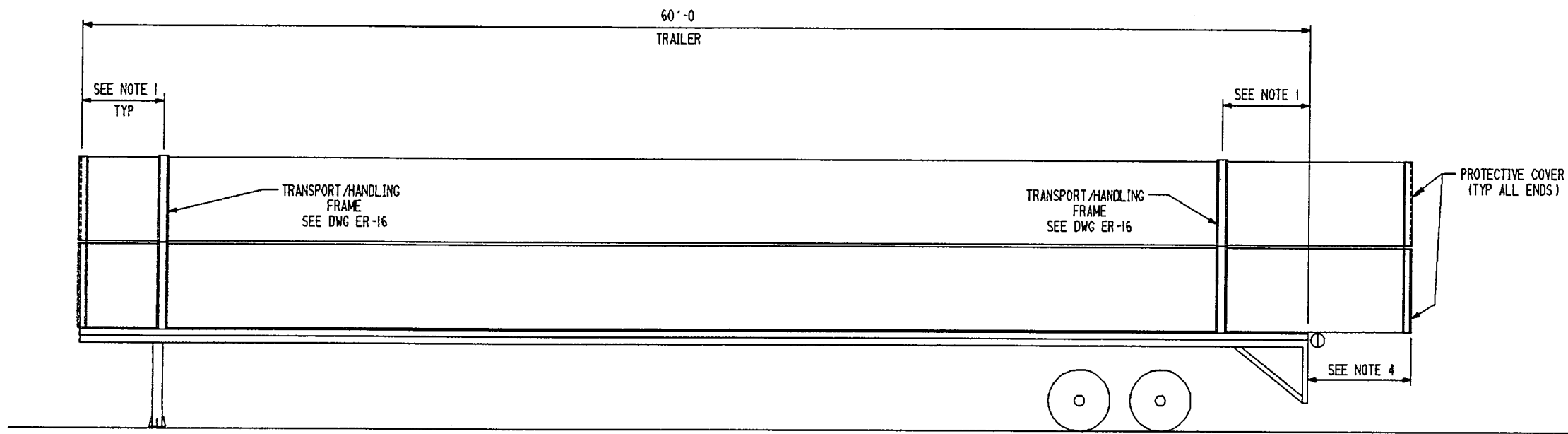
NOTES:

1. TUBE SECTIONS MUST BE SHIELDED FROM THE SUN WITH WHITETARPS DURING SHIPMENT. TARPS SHALL COMPLETELY COVER THE TUBE SIDES, TOP AND ENDS.
2. STIFFENED TUBE SECTIONS MUST NOT BE SUPPORTED ON THE TUBE STIFFENERS.
3. TUBES MUST BE STRAPPED AT SUPPORT FRAMES ONLY.

CAD FILE 30212014.DGN

▶ INDICATES CHANGE FROM PREVIOUS ISSUE

Supplier's/Purchaser's No. _____	
CBI	
LIGO PROJECT	
CROSS SECTION OF TRUCK LOADING FOR SHIPMENT OF UNSTIFFENED TUBE SECTIONS	
Customer's No. _____	Contract No. 930212
By <u>DKL</u> Chkd _____ Date <u>3-23-94</u>	Dwg. <u>ER-14</u> Rev. _____
J.L. RINGELSTETTER Engineering Supervisor	
Sheet - <u>1</u>	




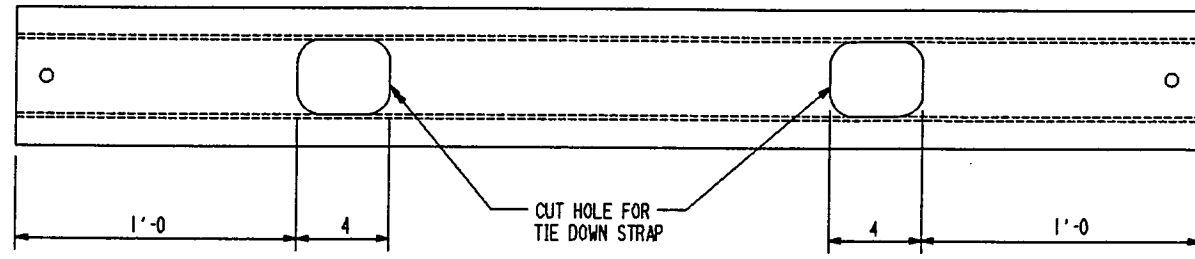
NOTES:

1. TUBE SECTIONS ARE TO BE SUPPORTED FROM TWO POINTS ONLY. SUPPORT POINTS SHALL BE NO LESS THAN 4'-0 FROM THE TUBE END AND NO MORE THAN 7'-0 FROM THE TUBE END.
2. TUBE SECTIONS MUST BE SHIELDED FROM THE SUN WITH WHITE TARPS DURING SHIPMENT. THE TARPS SHALL COMPLETELY COVER THE TUBE SIDES, TOPS, AND ENDS.
3. IN ADDITION TO THE COVERS, ENDS OF THE INDIVIDUALS TUBE SECTIONS SHALL BE PROTECTED AND COVERED.
4. MAXIMUM OVERHANG IS 5'-0.

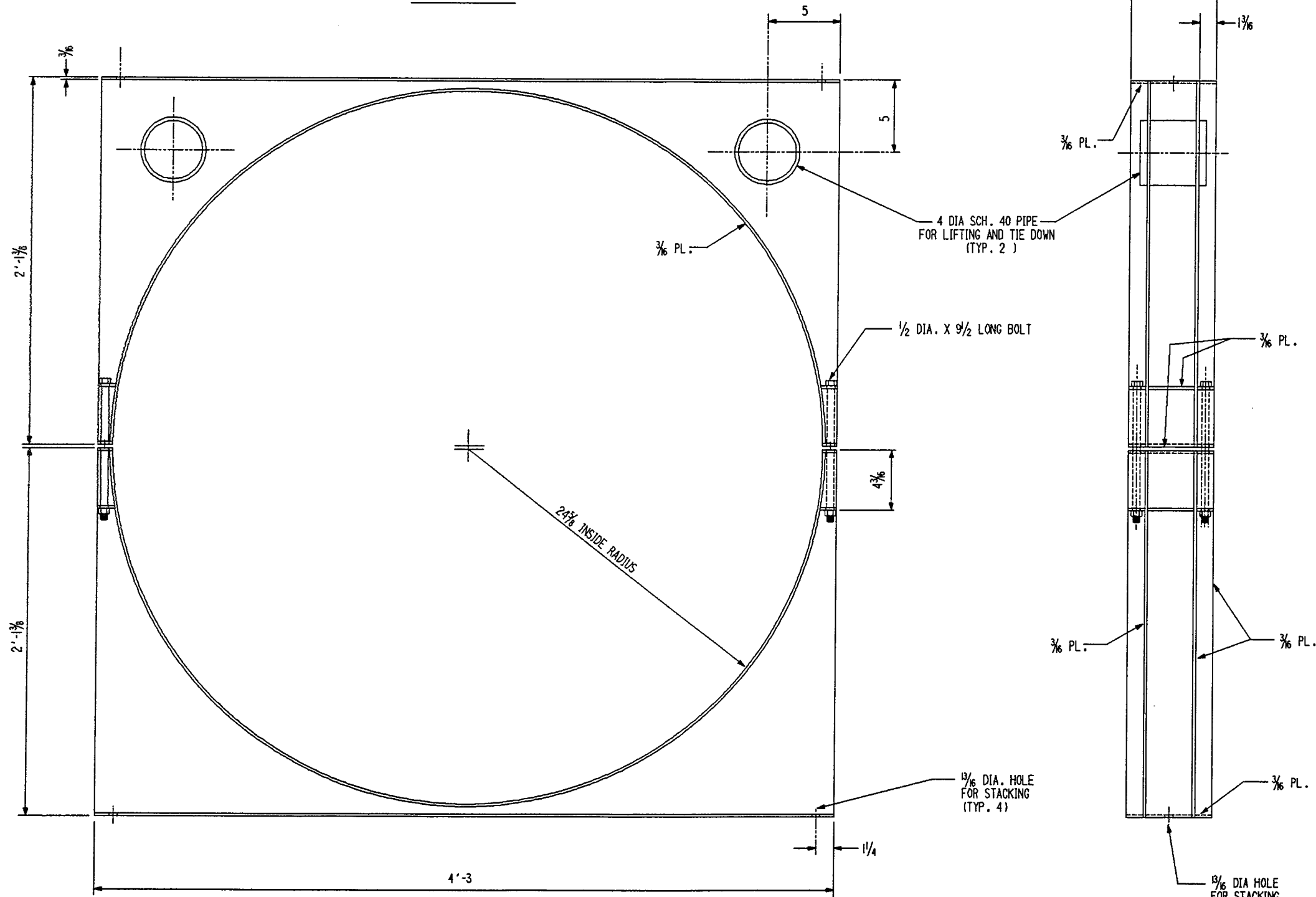
CAD FILE 30212015.DGN

▶ INDICATES CHANGE FROM PREVIOUS ISSUE

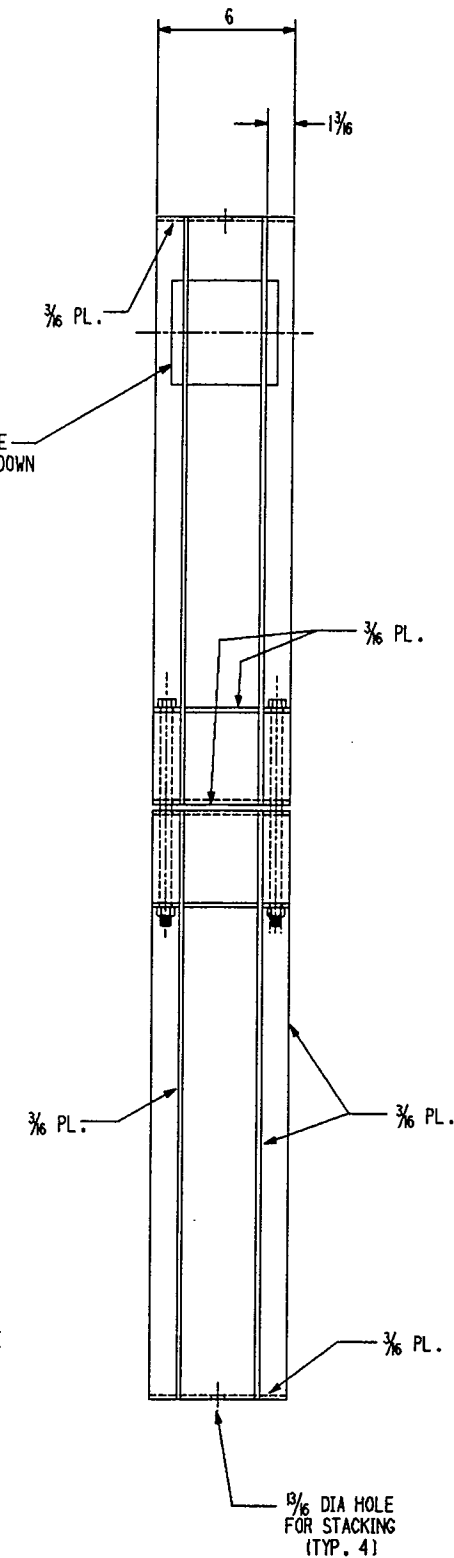
Supplier's/Purchaser's No. _____	
 LIGO PROJECT ELEVATION OF TRUCK LOADING FOR UNSTIFFENED TUBE SHIPMENT	
Customer's No. _____	Contract No. 930212
By DKL Chkd _____ Date 3-23-94	Dwg. ER-15 Rev. _____
J.L. RINGELSTETTER Engineering Supervisor	
Sheet _____	Rev. 1



TOP VIEW



ELEVATION VIEW



SIDE VIEW

▶ INDICATES CHANGE FROM PREVIOUS ISSUE

NOTES:

1. USE RUBBER SHEETING AS SOFTENER BETWEEN FRAME AND TUBE SHELL. INSTALL SUFFICIENT RUBBER SHEETING TO PROVIDE A SNUG FIT AROUND THE TUBE.
2. THE TUBE SECTIONS MUST BE HANDLED EACH SEPARATE.

CAD FILE 30212016.dgn

Supplier's/Purchaser's No. _____													
CBI													
LIGO PROJECT													
TRANSPORT & HANDLING FRAME FOR UNSTIFFENED TUBE SECTIONS													
Customer's No. _____	Contract No. 930212												
By <u>DKL</u> Chkd _____ Date <u>3-23-94</u>	Dwg. <u>ER-16</u> Rev. <u>1</u>												
J.L. RINGELSTETTER Engineering Supervisor													
<table border="1"> <tr><td>BY</td><td>CHKD</td><td>DATE</td><td>BY</td><td>CHKD</td><td>DATE</td></tr> <tr><td> </td><td> </td><td> </td><td> </td><td> </td><td> </td></tr> </table>	BY	CHKD	DATE	BY	CHKD	DATE							ADD NOTES MODIFY TITLE BLOCK GENERAL UPDATE 3-2-95
BY	CHKD	DATE	BY	CHKD	DATE								
Revisions Remarks													

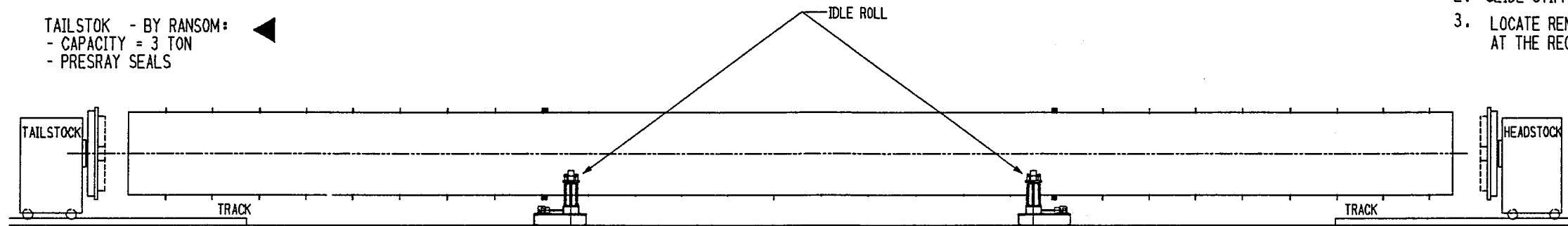
STEP 1

STEP 1

TAILSTOK - BY RANSOM:
 - CAPACITY = 3 TON
 - PRESRAY SEALS

1. SUPPORT PIPE SECTION ON TWO IDLE ROLLS IN HIGH POSITION.
2. SLIDE STIFFENERS UP AGAINST IDLE ROLLS.
3. LOCATE REMAINING STIFFENERS TO LEFT AND RIGHT OF IDLE ROLLS, AT THE REQUIRED CENTERS.

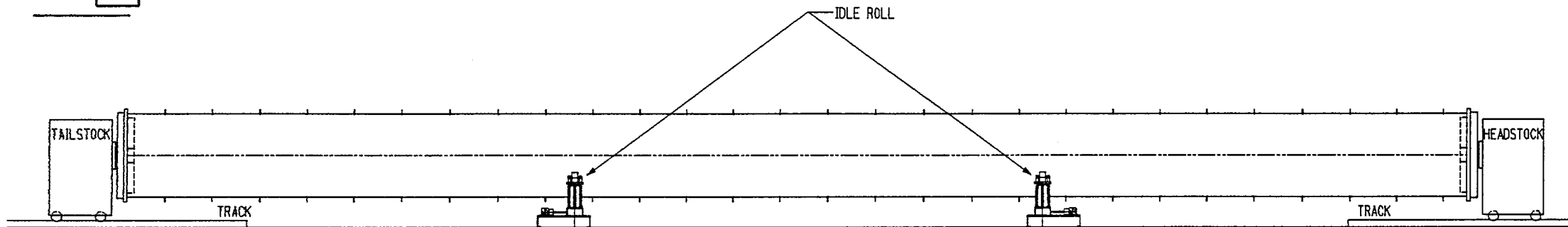
HEADSTOK - BY RANSOM:
 - VARIABLE SPEED 2 - 8 RPM
 - CAPACITY = 3 TON
 - PRESRAY SEALS



STEP 2

STEP 2

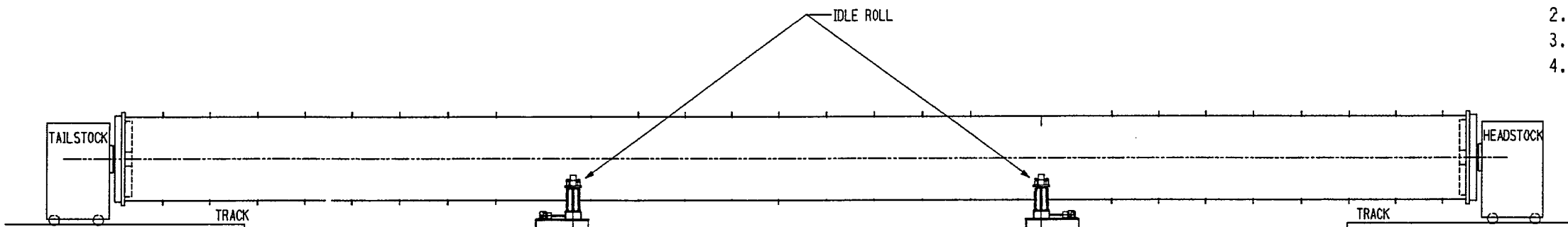
1. ENGAGE HEADSTOCK & TAILSTOCK AT ENDS OF TUBE.
2. LOWER IDLE ROLLS AWAY FROM THE PIPE.
3. SLIDE THE LOOSE STIFFENERS TO THEIR CORRECT LOCATIONS.



STEP 3

STEP 3

1. RAISE THE IDLE ROLLS.
2. PURGE INSIDE TUBE.
3. PROCEED TO FIT ALL STIFFENERS TIGHT AGAINST THE PIPE.
4. AFTER ALL STIFFENERS ARE FIT WELDING CAN START.



CAD FILE 30212020.DGN

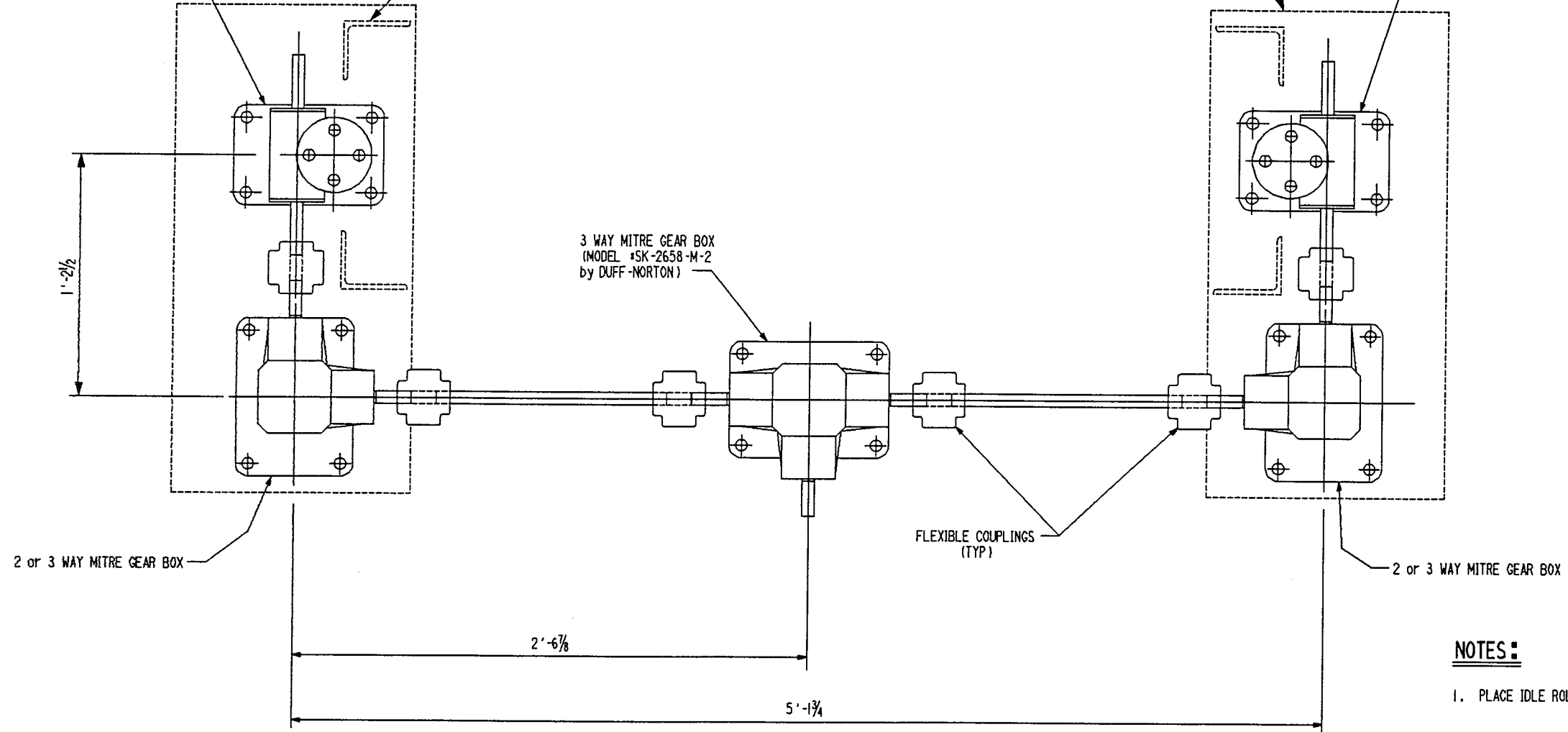
▶ INDICATES CHANGE FROM PREVIOUS ISSUE

Supplier's/Purchaser's No. _____	
CBI	
LIGO PROJECT	
EXTERNAL STIFFENER FITTING SEQUENCE	
Customer's No. _____	Contract No. 930212ER
By AVR Chkd _____ Date 04-NOV-93	Dwg. ER-20 Rev. 5
J.L. RINGELSTETTER Engineering Supervisor	
Sheet - _____	

MACHINE SCREW ACTUATOR
WITH 15" LIFT SCREW
(MODEL 9005 BY DUFF-NORTON)

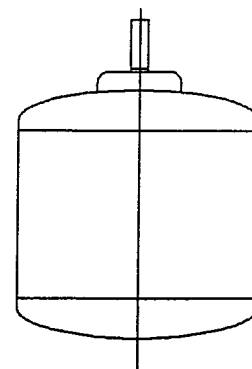
SEE ER-25 FOR DETAILS OF ANTI-SWAY GUIDE

MACHINE SCREW ACTUATOR
WITH 15" LIFT SCREW
(MODEL 9005 BY DUFF-NORTON)



NOTES:

- 1. PLACE IDLE ROLL ON THIS MECHANISM.

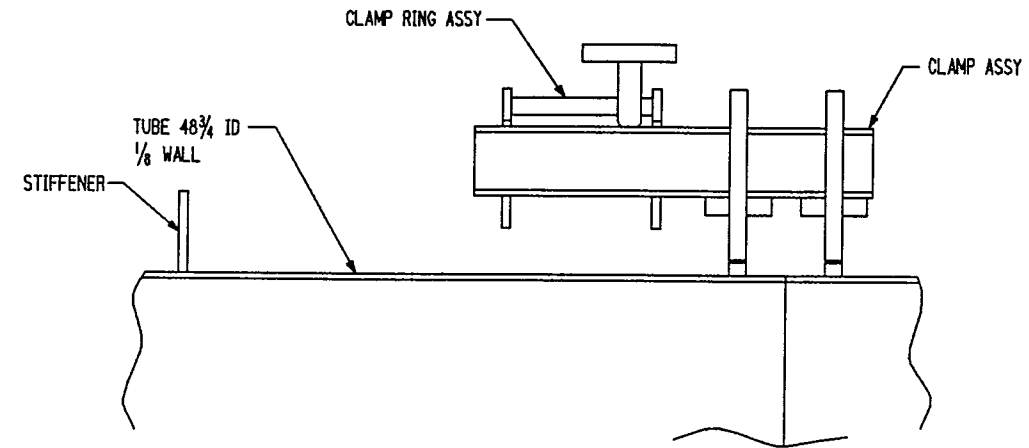
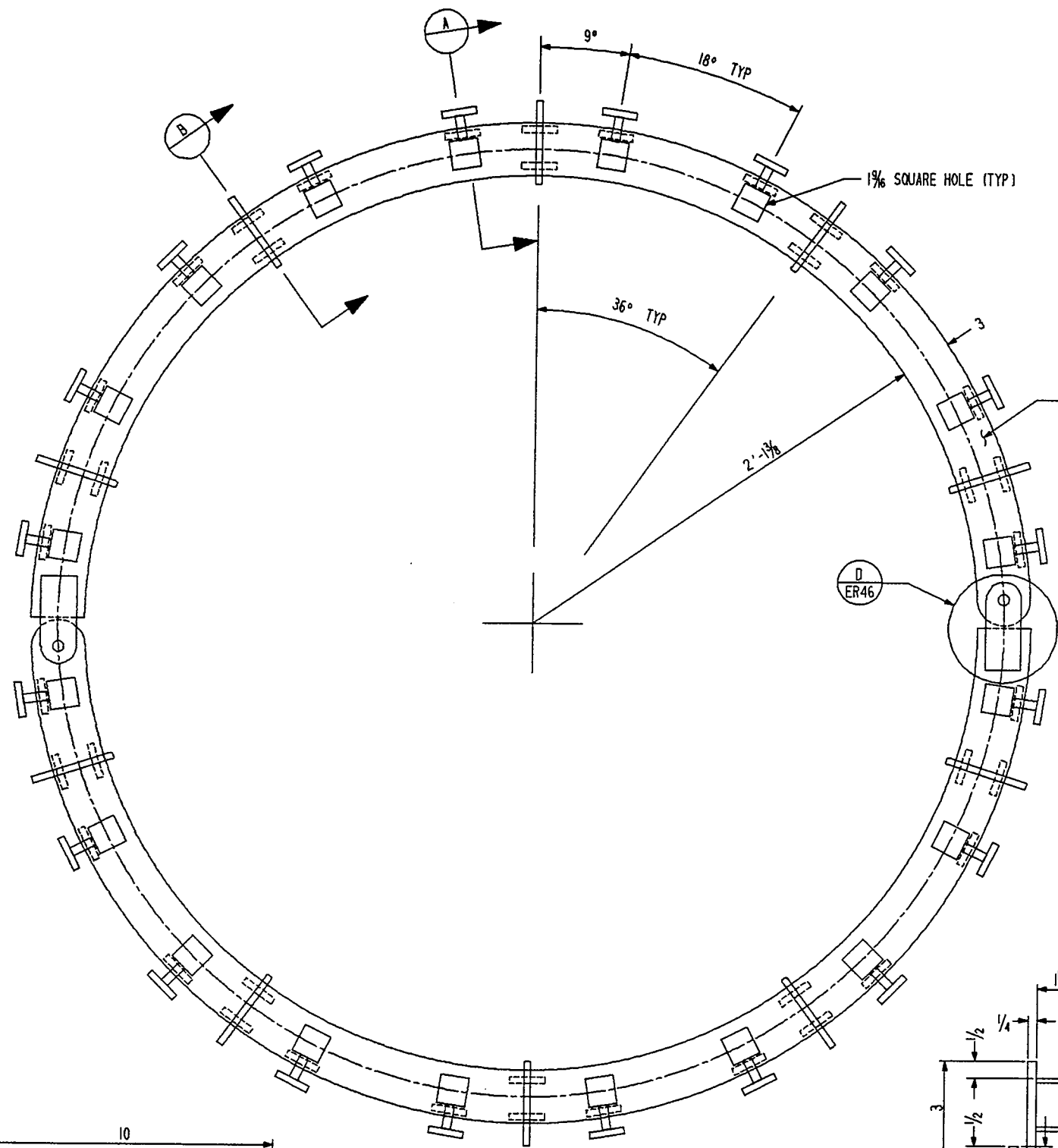


1800 RPM X 3/4 HORSEPOWER GEAR MOTOR
WITH GEAR REDUCTION RATIO OF 7.5:1
(THIS WILL PROVIDE A 15" LIFT IN 30 SECONDS)

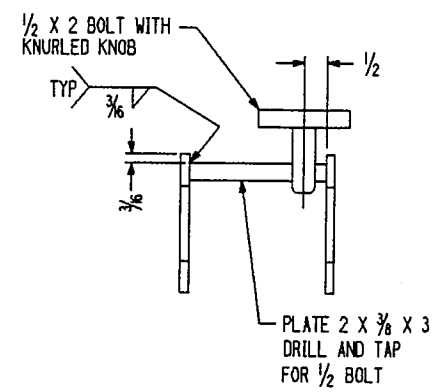
CAD FILE 30212024.DGN

▶ INDICATES CHANGE FROM PREVIOUS ISSUE

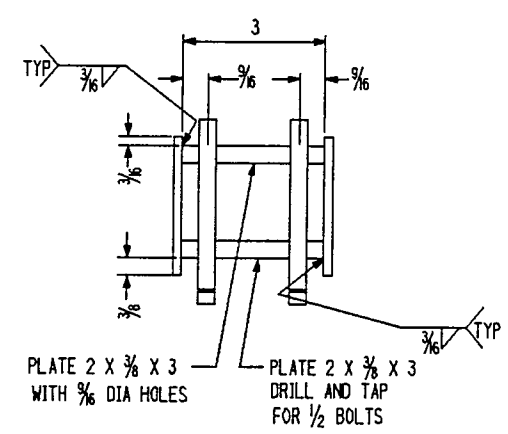
By		Date		CHKD		Date		BY		Date		Revisions	Remarks																																																																							
Date		Date		Date		Date		Date		Date																																																																										
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<table border="1"> <tr> <td colspan="12">Supplier's/Purchaser's No. _____</td> </tr> <tr> <td colspan="12" style="text-align: center;">CBI</td> </tr> <tr> <td colspan="12" style="text-align: center;">LIGO PROJECT PLAN VIEW OF ACTUATOR LAYOUT</td> </tr> <tr> <td colspan="6">Customer's No. _____</td> <td colspan="6">Contract No. 930212ER</td> </tr> <tr> <td colspan="6">By AVR Chkd _____ Date 2 DEC 93</td> <td colspan="6">Dwg. ER-24 Rev. _____</td> </tr> <tr> <td colspan="6">JIM RINGSTETTER Engineering Supervisor</td> <td colspan="6">Sheet - 2</td> </tr> </table>													Supplier's/Purchaser's No. _____												CBI												LIGO PROJECT PLAN VIEW OF ACTUATOR LAYOUT												Customer's No. _____						Contract No. 930212ER						By AVR Chkd _____ Date 2 DEC 93						Dwg. ER-24 Rev. _____						JIM RINGSTETTER Engineering Supervisor						Sheet - 2					
Supplier's/Purchaser's No. _____																																																																																				
CBI																																																																																				
LIGO PROJECT PLAN VIEW OF ACTUATOR LAYOUT																																																																																				
Customer's No. _____						Contract No. 930212ER																																																																														
By AVR Chkd _____ Date 2 DEC 93						Dwg. ER-24 Rev. _____																																																																														
JIM RINGSTETTER Engineering Supervisor						Sheet - 2																																																																														



SECTION A
W/CLAMP



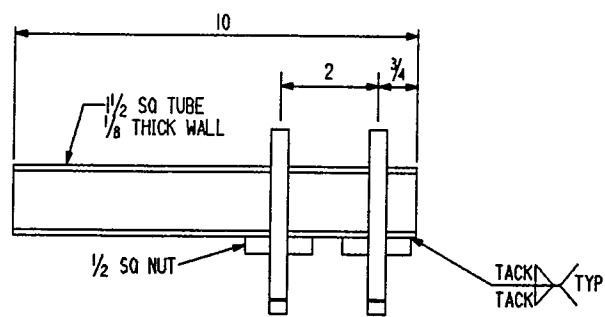
SECTION A
W/O CLAMP



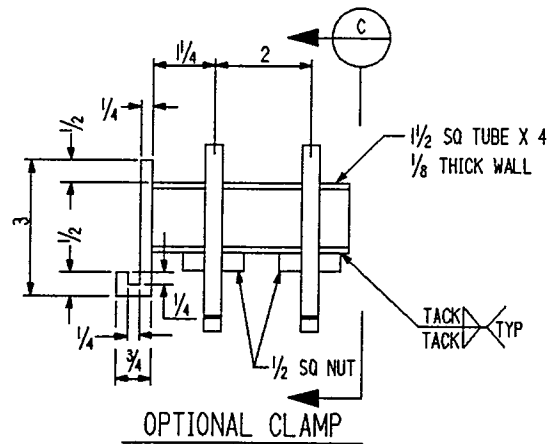
SECTION B

NOTES:

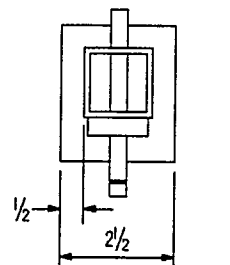
1. USE 1/2 DIA X 4 SWIVEL SCREW CLAMPS WITH SOCKET HEAD EXCEPT WHERE NOTED.
2. WORK WITH DRAWING ER-46.



CLAMP



OPTIONAL CLAMP



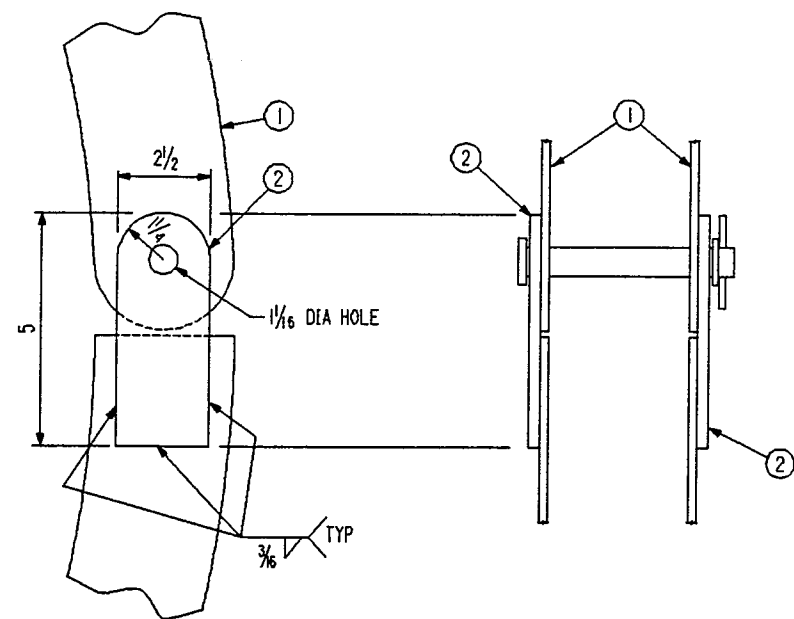
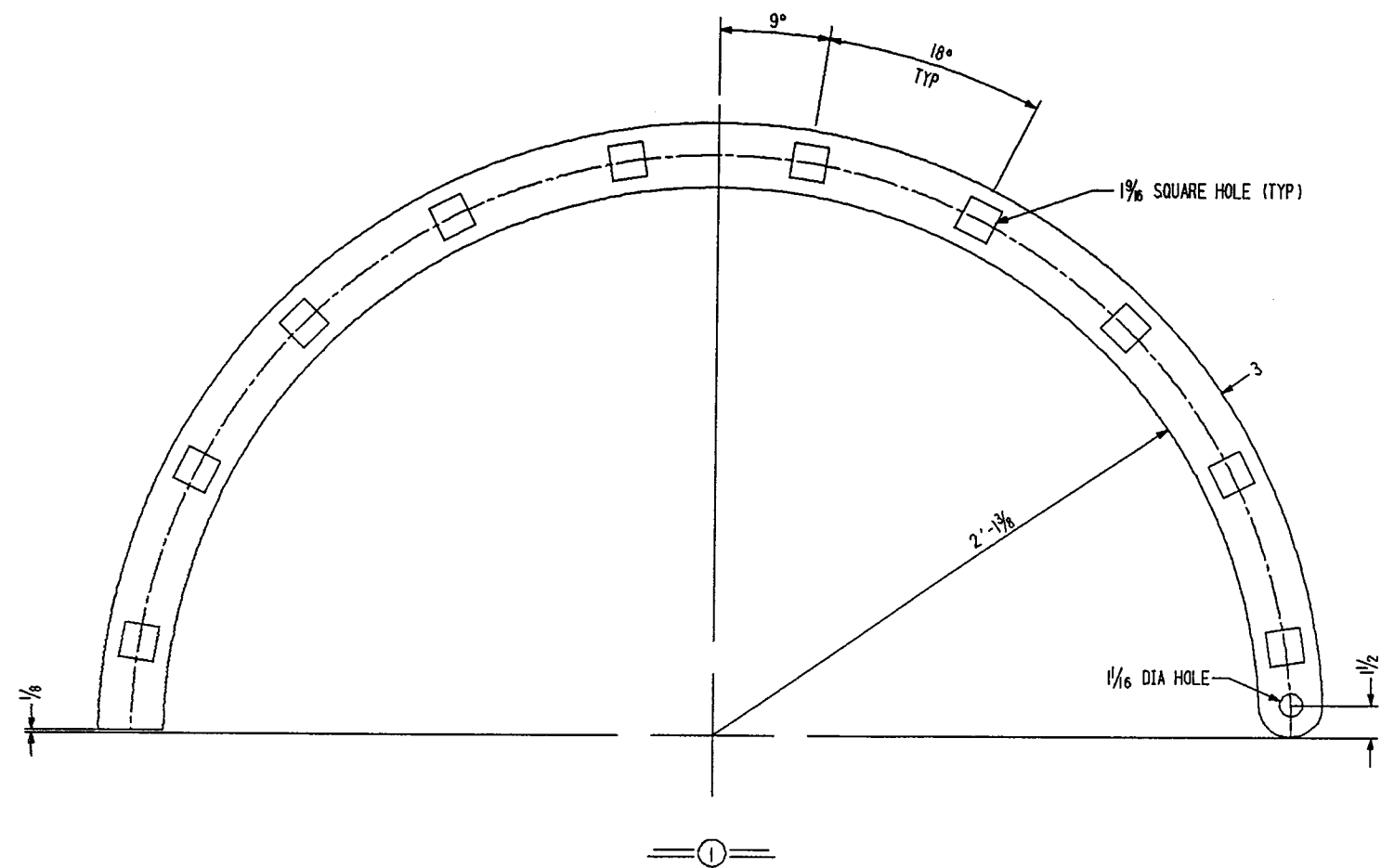
VIEW C

INDICATES CHANGE FROM PREVIOUS ISSUE

CAD FILE 30212045.DGN

Supplier's/Purchaser's No.		Contract No. 930212ER	
Customer's No.		Date 11-12-93	
By RER Chkd		J.L. RINGELSTETTER Engineering Supervisor	
Date 11-17-93		Dwg. ER-45 Rev. 3	
Revisions		Sheet - 3	
By	Chkd	Date	Remarks
3	AN	5-3-93	MODIFY TITLE BLOCK
2	BY	8-2-93	GENERAL
1	BY	4-1-93	CHANGED CLAMPING BOLTS.

SHIP PC	MARK	ASSY PC	DESCRIPTION	LENGTH		SPEC	EST WEIGHT
				FT	IN		
4	ER46-1		PL 3/8 X SK			A36	48
4	ER46-2		PL 1/4 X SK			A36	5
40			PL 2 X 3/8	0	3	A36	25
20			SQUARE TUBING 1/2 X 1/8 WALL	0	10	C.S.	20
4			SQUARE TUBING 1/2 X 1/8 WALL	0	4	C.S.	2
4			PL 2 1/2 X 3/4 X SK	0	3	C.S.	3
68			1/2 DIA SWIVEL SCREW CLAMPS (CARR LANE CL-40-SSC-S OR EQ)	0	4		
20			HAND KNOB ASSY W/ 1/2 DIA SCREW (CARR LANE CL-7C-HK4T OR EQUAL)	0	2		
48			1/2 DIA SO NUT				



NOTES:

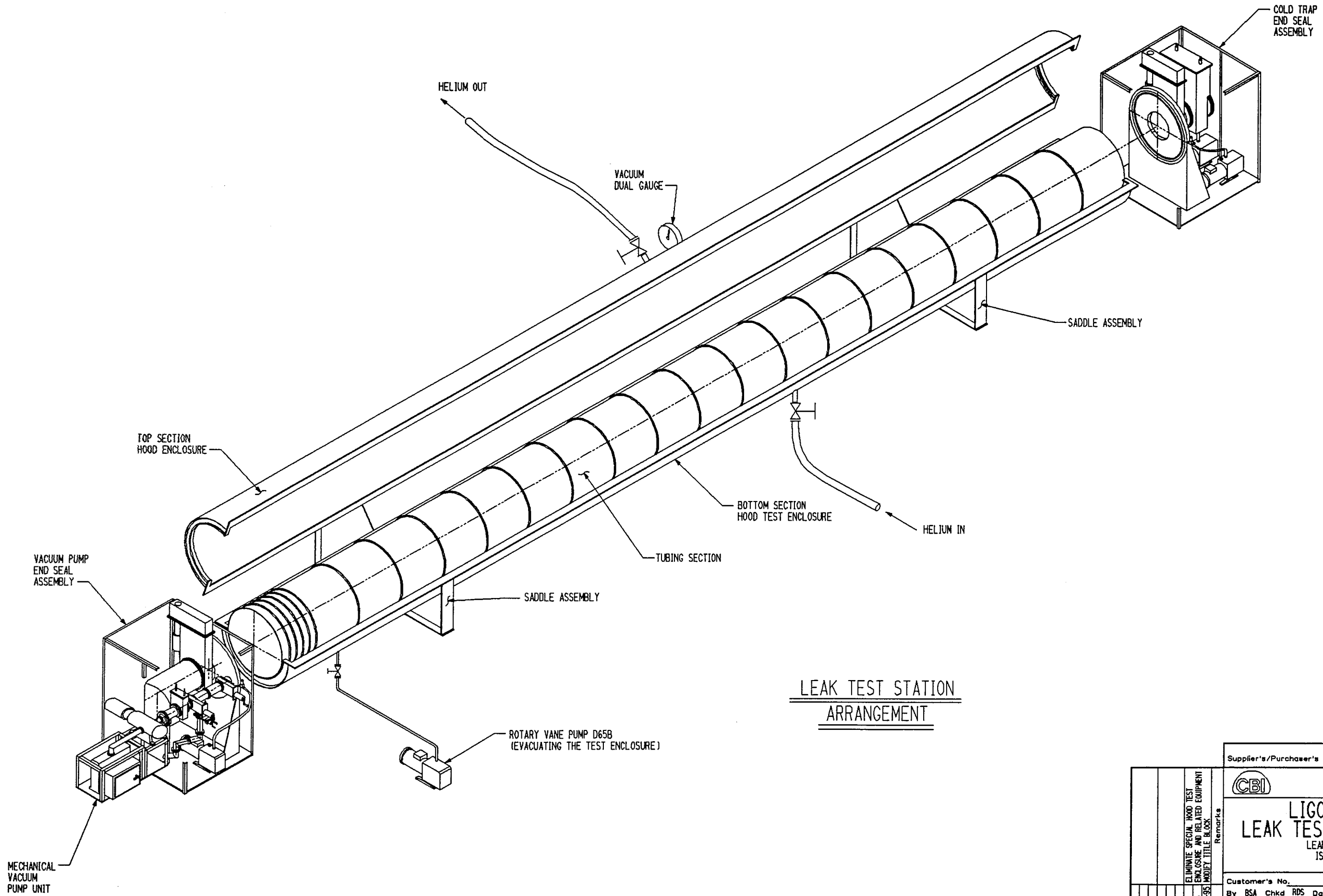
1. WORK WITH DRAWING ER45.

CAD FILE: 30212046.DGN

DETAIL D
ER45

INDICATES CHANGE FROM PREVIOUS ISSUE

MODIFY TITLE BLOCK		Supplier's/Purchaser's No.	
By	Chkd	CBI	
Date	Date	LIGO PROJECT	
5-1-95	5-1-95	FIT UP CLAMP DETAILS	
By	Chkd	Customer's No.	Contract No.
2-8-94	2-8-94	By RER Chkd	930212ER
By	Chkd	Date 11-12-93	Dwg. ER46
4-6-94	4-6-94	J. L. RINGELSTETTER	Rev. 3
By	Chkd	Engineering Supervisor	Sheet -
11-17-93	11-17-93		

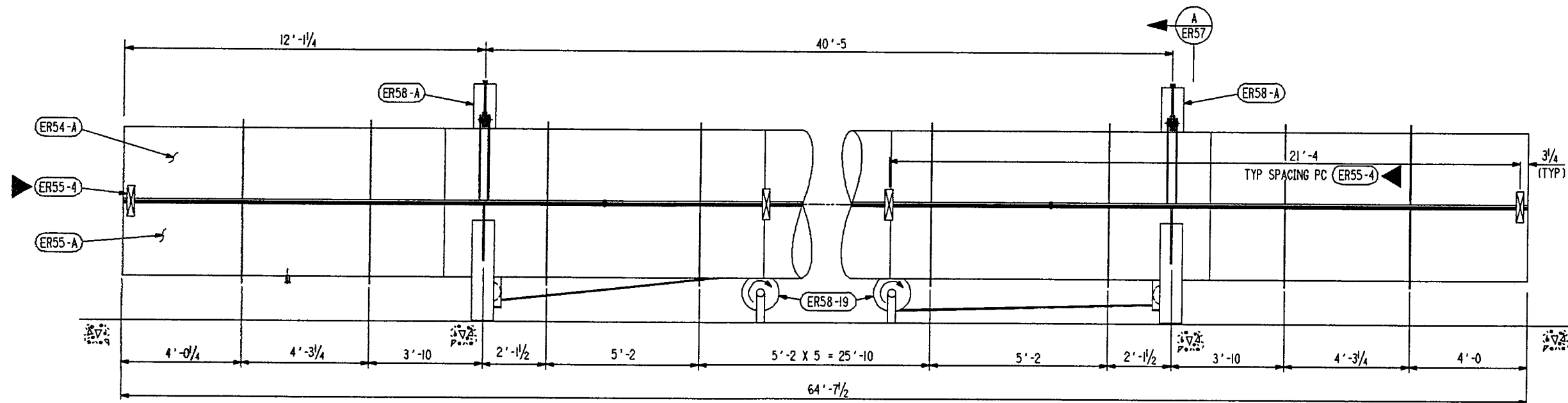


LEAK TEST STATION
ARRANGEMENT

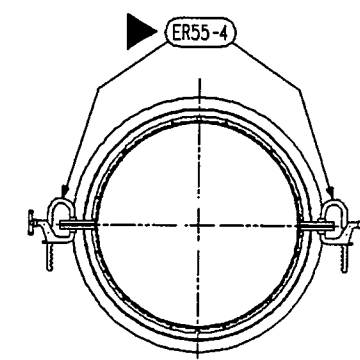
▶ INDICATES CHANGE FROM PREVIOUS ISSUE

CAD FILE 30212050.DGN

Supplier's/Purchaser's No.	
LIGO PROJECT LEAK TEST ARRANGEMENT LEAK TEST STATION ISOMETRIC VIEW	
Customer's No.	Contract No.
By BSA Chkd RDS Date 3-25-94	930212ER
J.L. RINKELSTETTER Engineering Supervisor	Dwg. ER-50 Rev. 1 Sheet - 1



ELEVATION VIEW
 STANDARD HOOD
 (3 REQUIRED)

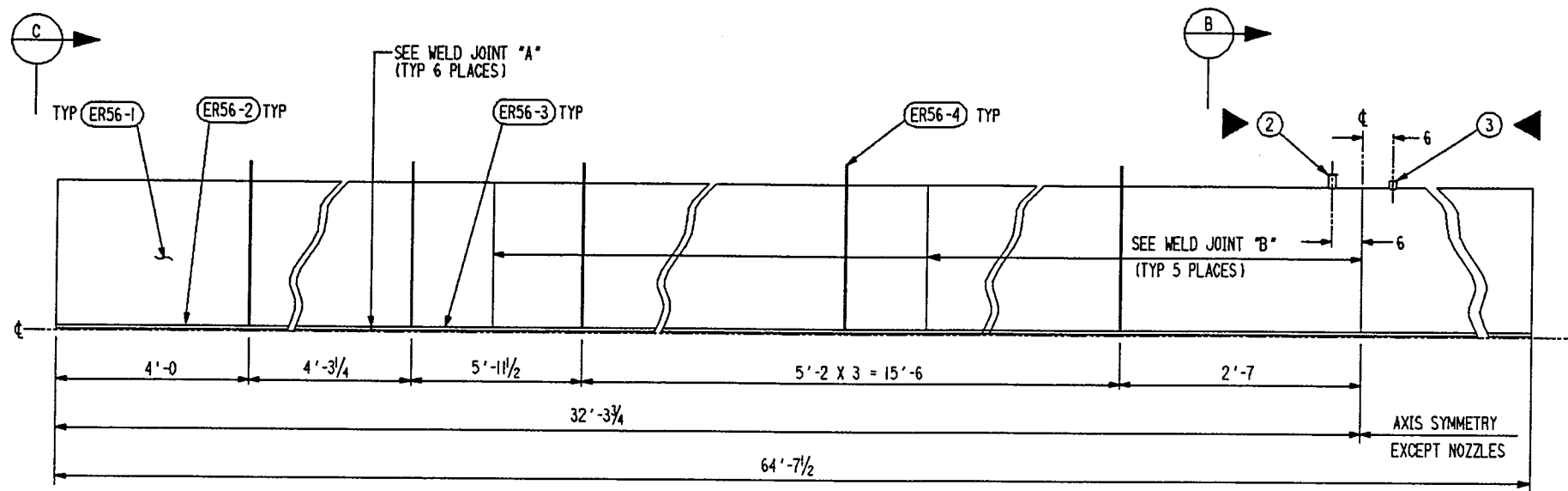


LEFT SIDE VIEW
 (SADDLE AND HOIST NOT SHOWN)

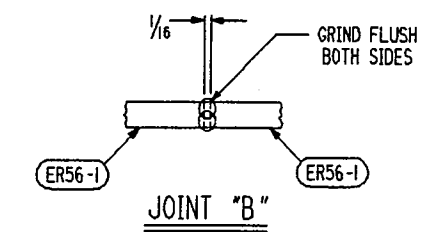
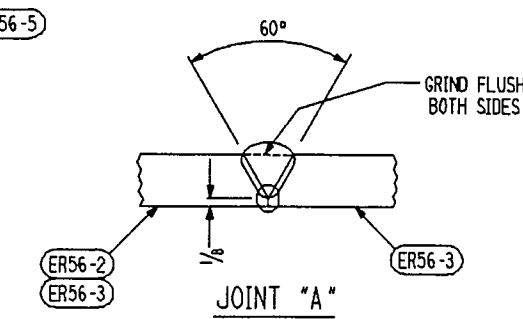
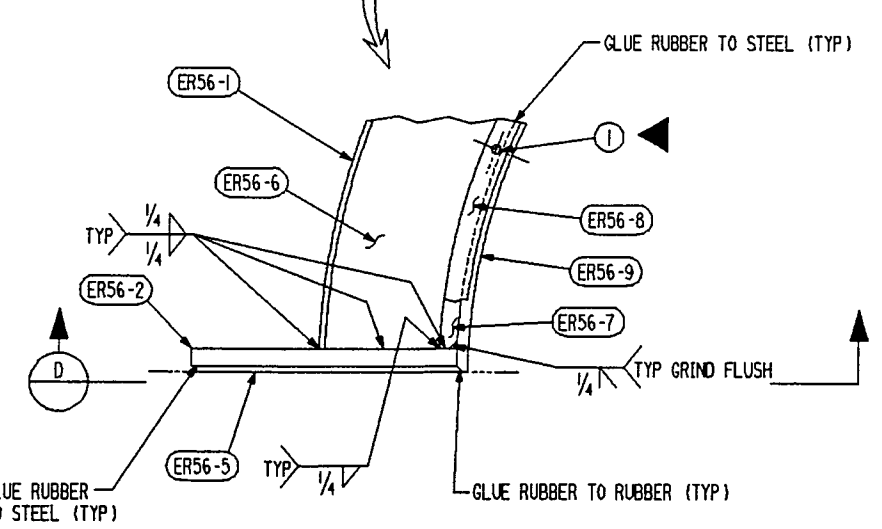
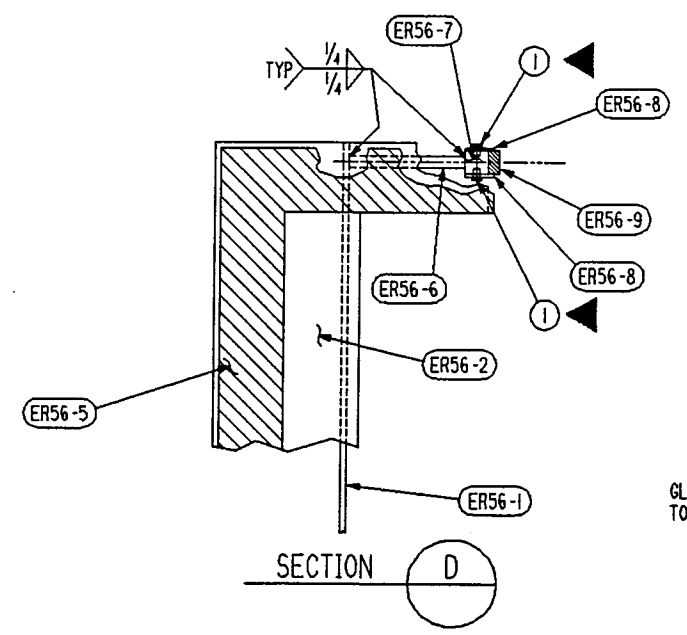
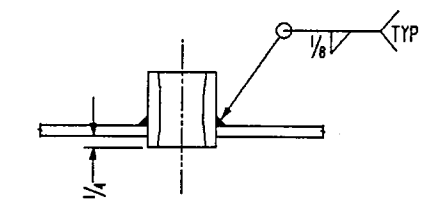
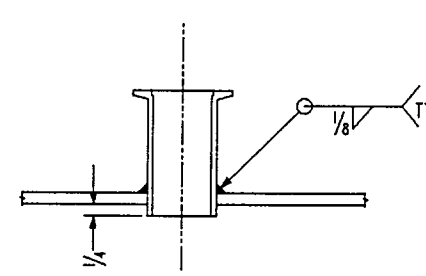
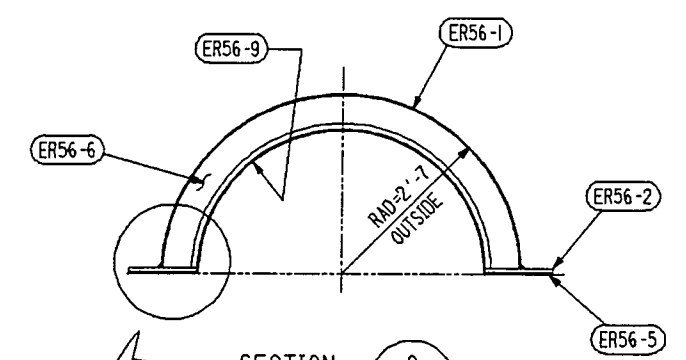
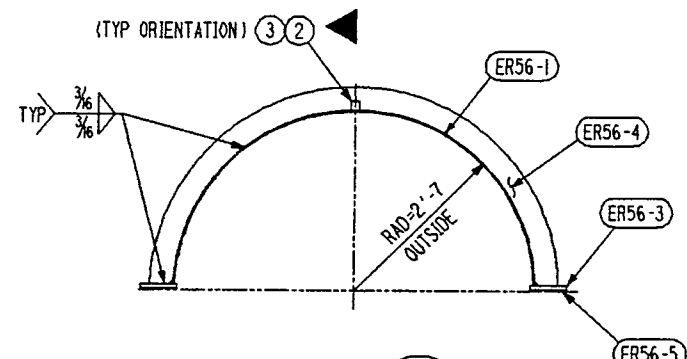
CAD FILE 30212051.DGN

INDICATES CHANGE FROM PREVIOUS ISSUE

GENERAL REV.		REVISIONS		REMARKS	
By	Chkd	Date	By	Chkd	Date
BSA	RDS	7-4-94	BSA	RDS	3-7-94
BSA	RDS	3-7-94	BSA	RDS	5-5-95
ILLUMINATE SPECIAL HOOD MODIFY TITLE BLOCK CHANGES AS NOTED					
Supplier's/Purchaser's No. _____					
LIGO PROJECT LEAK TEST ARRANGEMENT HELIUM HOOD LEAK TEST STATION					
Customer's No. _____		Contract No. 930212ER			
By RDS Chkd _____ Date 2-10-94		Dwg. ER-51 Rev. 4		Sheet - 4	
J. L. RINGELSTETTER Engineering Supervisor					



SHP PC	MARK	ASSY PC	DESCRIPTION	LENGTH		SPEC	EST WEIGHT
				FT	INCHES		
3	ERS4-A		STANDARD TOP HOOD ASSEMBLY				23769
	ER56-1	18	PLATE SK X 1/4 (ROLL TO 2'-6 3/4 RAD)	10	9 7/32	A36	15750
	ER56-2	12	PLATE 3/4 X SK (CF 80 1/2 X 16'-5 3/4 W/PC3 C8)	16	5	A36	3189
	ER56-3	12	PLATE 3/4 X SK (CF 80 1/2 X 16'-5 3/4 W/PC2 C4)	15	10 3/4	A36	3060
	ER56-4	36	PLATE 4 X 1/4 X SK	FIN	8	5 7/8	A36
			SHR		11	5 7/8	
	ER56-5	6	RUBBER 1/4 X SK (55-65 DUROMETER)	64	7		BUTYL
	ER56-6	6	PLATE 1/2 X SK (CF 31 1/4 X 5'-2 1/2 C1)				A36
	ER56-7	6	BAR 1" X SK ROLL	FIN	6	5 3/4	A36
			SHR		9	5 3/4	
	ER56-8	24	BAR 1/8 X SK	FIN	3	2 1/16	A36
			SHR		6	2 1/16	
	ER56-9	6	RUBBER 1" X 1/2 (55-65 DUROMETER) BBE	6	6 5/32		BUTYL
	ER54-1	72	CAP SCREW 1/4 DIA HEX HEAD	0	3/8		SAE GR 2
	ER54-2	3	SMALL FLANGE LONG DN 40 ISO-KF	0	1 9/16		CARB STL
			"BALZERS" NR. BP 217 216 (70 MM-LENGTH)				
			OR EQUAL				
	ER54-3	3	1/4 DIA NPT PIPE COUPLING	0	1 3/8		FORGED STL

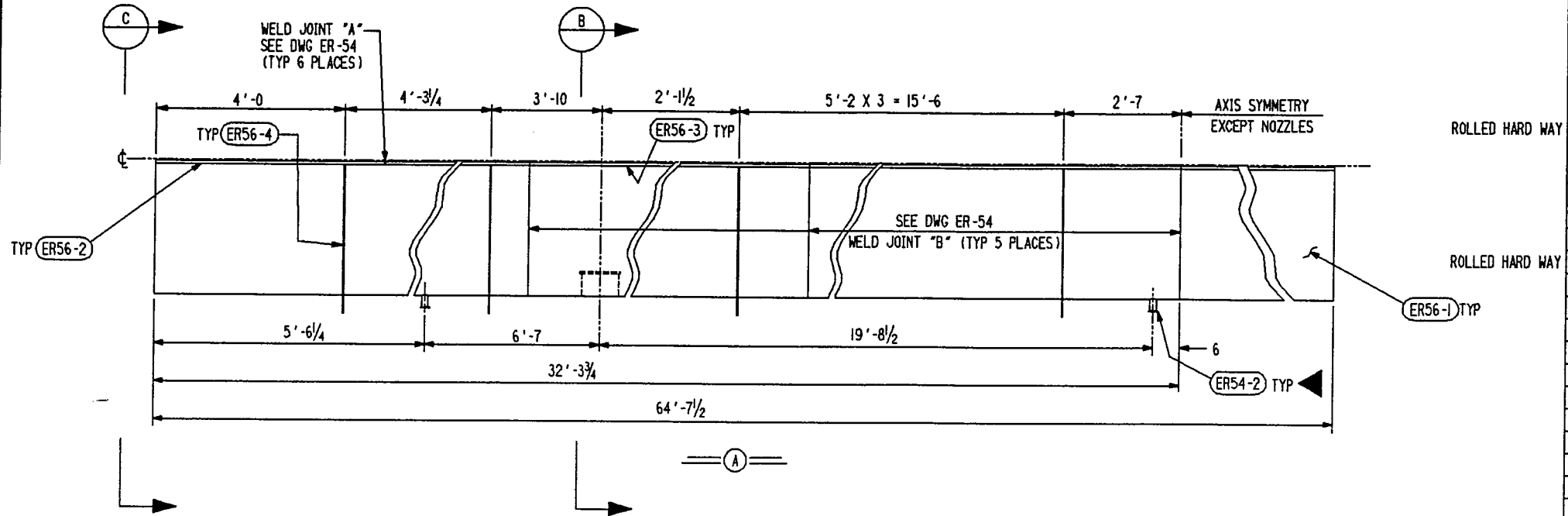


- NOTES:**
1. WORK THIS DWG WITH DWG ER-56.
 2. "C"-CLAMPS AND GLUE SUPPLY SEE DWG ER-55.

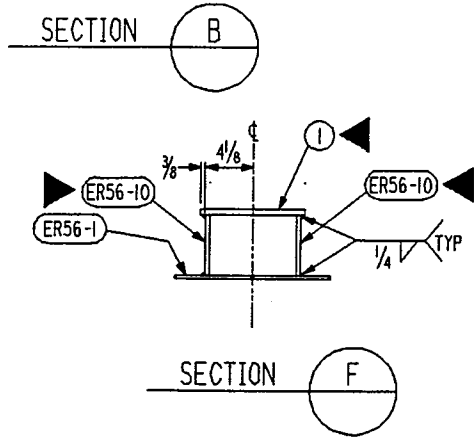
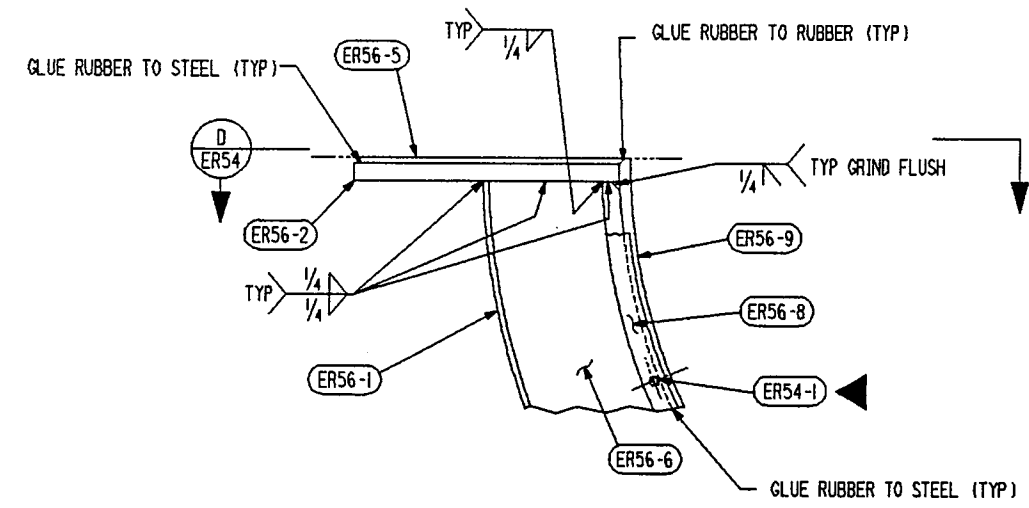
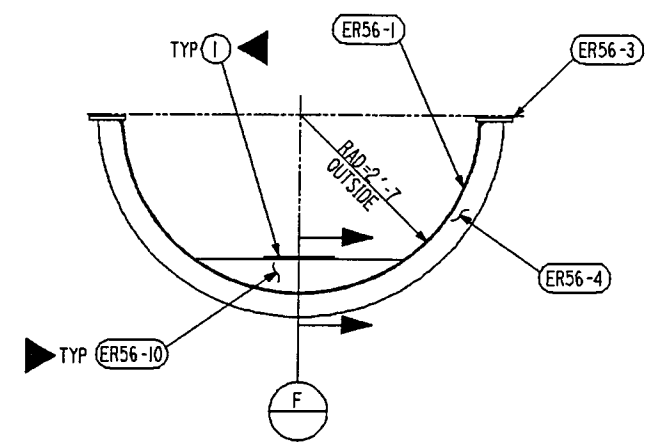
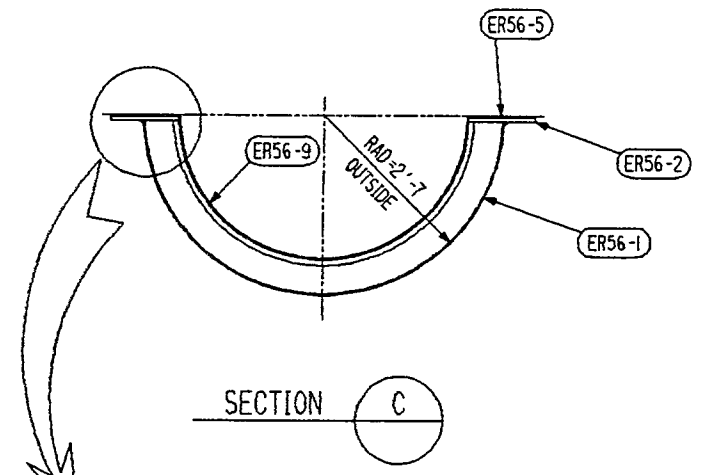
INDICATES CHANGE FROM PREVIOUS ISSUE

Supplier's/Purchaser's No.	
CBI	
LIGO PROJECT LEAK TEST ARRANGEMENT STANDARD HOOD TEST ENCLOSURE TOP SECTION	
Customer's No.	Contract No.
By BSA Chkd RDS Date 3-4-94	930212ER
J. L. RINGELSTETTER Engineering Supervisor	Dwg. ER-54 Rev. 2 Sheet - 2

CAD FILE 30212054.DGN



SHP PC	MARK	ASSY PC	DESCRIPTION	LENGTH		SPEC	EST WEIGHT
				FT	INCHES		
2	ER55-A		STANDARD BOTTOM HOOD ASSEMBLY				24042
	ER56-1	18	PLATE SK X 1/4 (ROLL TO 2'-6 3/4 RAD)	10	9/32	A36	15750
	ER56-2	12	PLATE 3/4 X SK (CF 80 1/2 X 16'-5 3/4 W/PC3 C8)	16	5	A36	3189
	ER56-3	12	PLATE 3/4 X SK (CF 80 1/2 X 16'-5 3/4 W/PC2 C4)	15	10 3/4	A36	3060
	ER56-4	36	PLATE 4 X 1/4 X SK	FIN	8	5 5/8	A36
				SHR	11	5 5/8	
	ER56-5	6	RUBBER 1/4 X SK (55-65 DUROMETER)	64	7	BUTYL	174
	ER56-6	6	PLATE 1/2 X SK BURN			A36	354
	ER56-7	6	BAR 1" X SK ROLL	FIN	6	5 3/4	A36
				SHR	9	5 3/4	
	ER56-8	24	BAR 1/8 X SK	FIN	3	2 1/16	A36
				SHR	6	2 1/16	
	ER56-9	6	RUBBER 1" X 1/2 (55-65 DUROMETER) BBE	6	6 5/32	BUTYL	15
	ER54-1	72	CAP SCREW 1/4 DIA HEX HEAD	0	3/8	SAE GR 2	3
	ER54-2	6	SMALL FLANGE LONG DN 40 ISO-KF	0	1 5/16	CARB STL	12
			BALZERS NR. BP 217 216 (70 MM-LENGTH)				
			OR EQUAL				
	ER55-1	6	PLATE 9 X 1/2	1	0	A36	90
	ER56-10	12	PLATE 3/8 X SK (CF 6 X 3'-1 CI)	2	11 5/16	A36	180
			SUPPLY FOR HOOD ASSY ER54-A AND ER55-A				
6	ER55-2		GLUE - RUBBER TO STEEL (1/2 PINT CAN)				6
6	ER55-3		GLUE - RUBBER TO RUBBER (5 OZ TUBE)				-
24	ER53-4		"C"-CLAMP "DE-STA-CO" MODEL T257-6				480
			OR EQUAL				



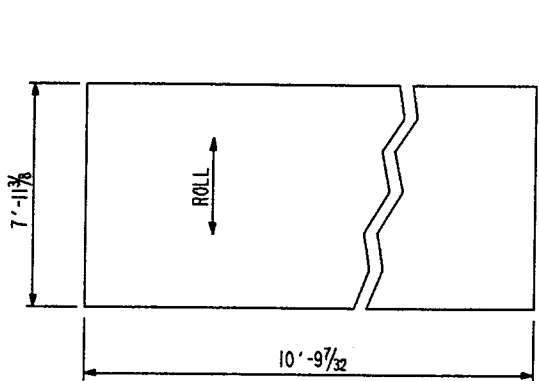
- NOTES:**
1. WORK THIS DWG WITH DWGS ER-54 AND ER-56.
 2. WELD DETAIL OF PC (ER54-2) TO HOOD SEE DWG ER-54.

INDICATES CHANGE FROM PREVIOUS ISSUE

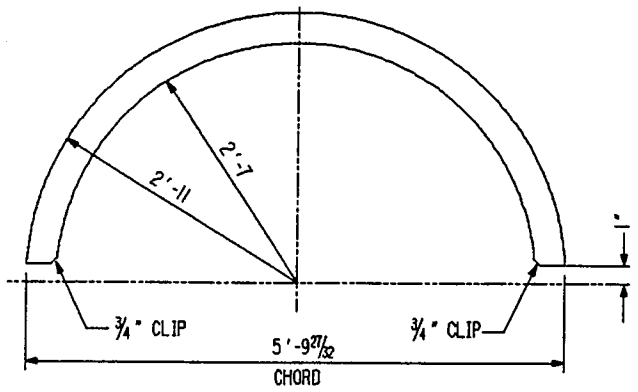
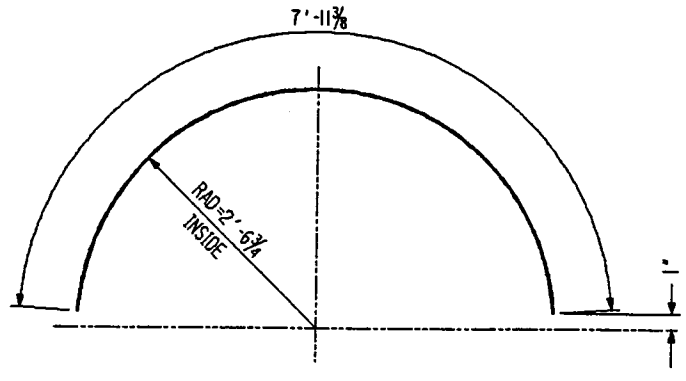
Supplier's/Purchaser's No.	
CBI	
LIGO PROJECT LEAK TEST ARRANGEMENT	
STANDARD HOOD TEST ENCLOSURE BOTTOM SECTION	
Customer's No.	Contract No.
By BSA Chkd RDS Date 3-4-94	930212ER
J. L. RINGELSTETTER Engineering Supervisor	Dwg. ER-55 Sheet - 2

CAD FILE 30212055.DGN

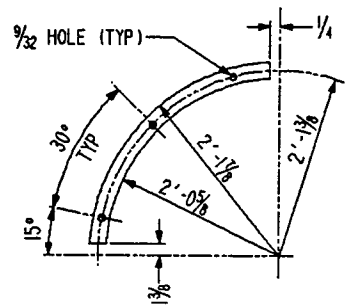
SHP PC	MARK	ASSY PC	DESCRIPTION	LENGTH		SPEC	EST WEIGHT
				FT	INCHES		
			SEE DWGS ER-54 AND ER-55 FOR BILLING				



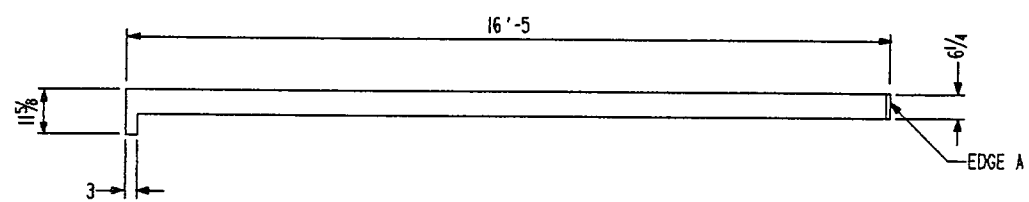
①
1/4 THICK



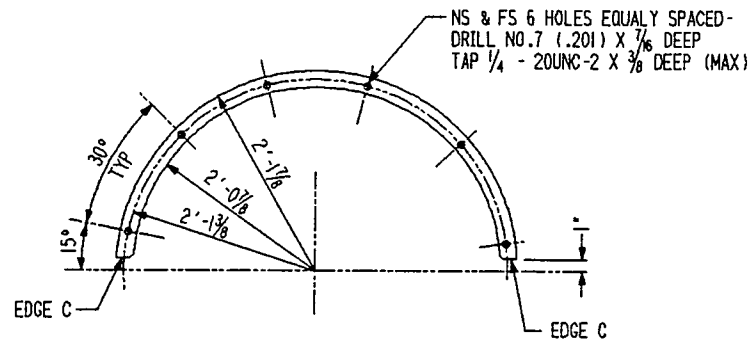
④
1/4 THICK



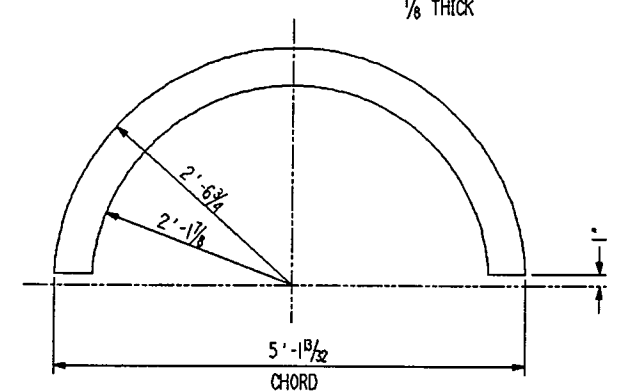
⑧
1/8 THICK



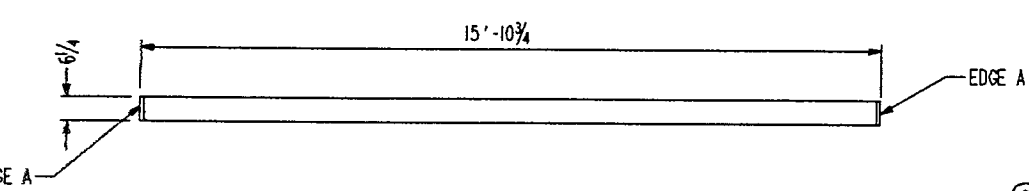
②
3/4 THICK



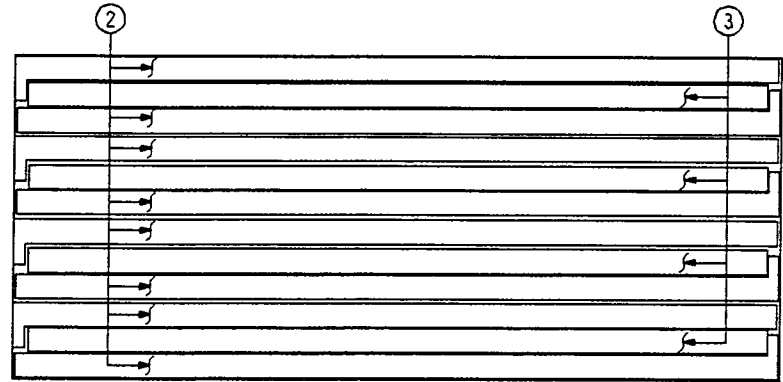
⑦
1" THICK



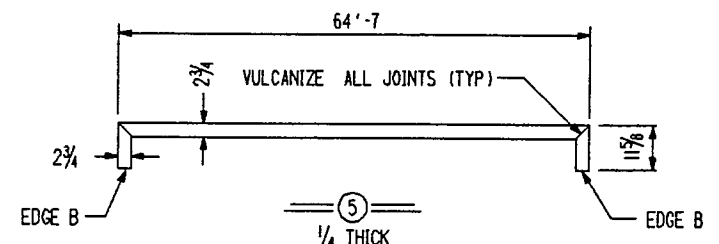
⑥
1/2 THICK



③
3/4 THICK



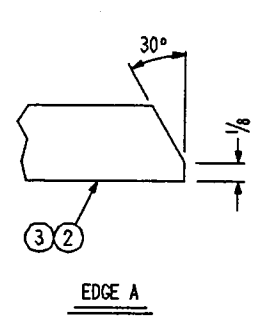
TEMPLATE FOR CUTTING PC ② AND PC ③
(SEE NOTE 2)



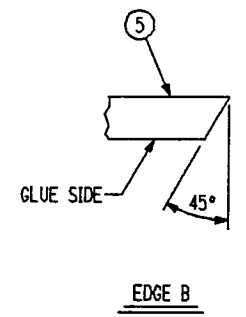
⑤
1/4 THICK

NOTES:

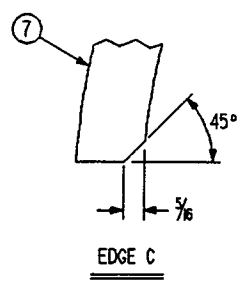
1. WORK THIS DWG WITH DWGS ER-54 AND ER-55.
2. CUTS 8 PC ② AND 4 PC ③ FROM PLATE 80 1/2 X 16'-5 3/4" X 3/4" THK.



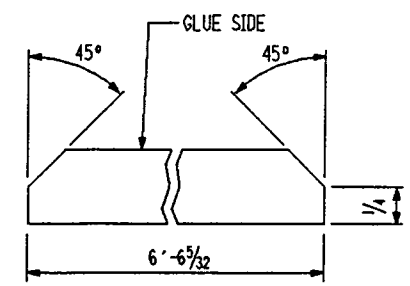
EDGE A



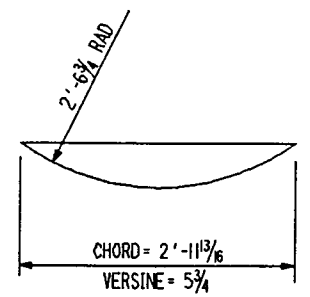
EDGE B



EDGE C



⑨

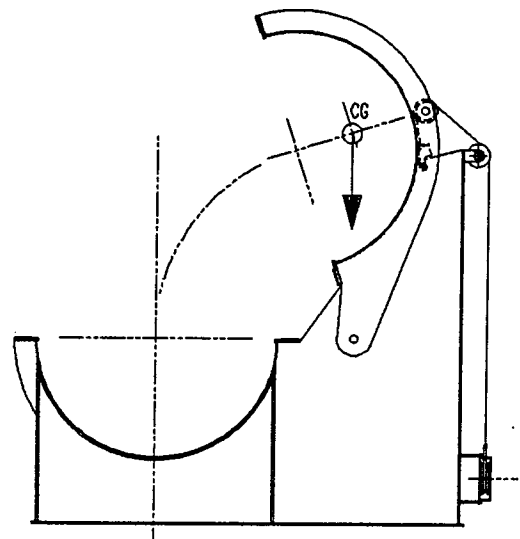


⑩
3/8 THICK

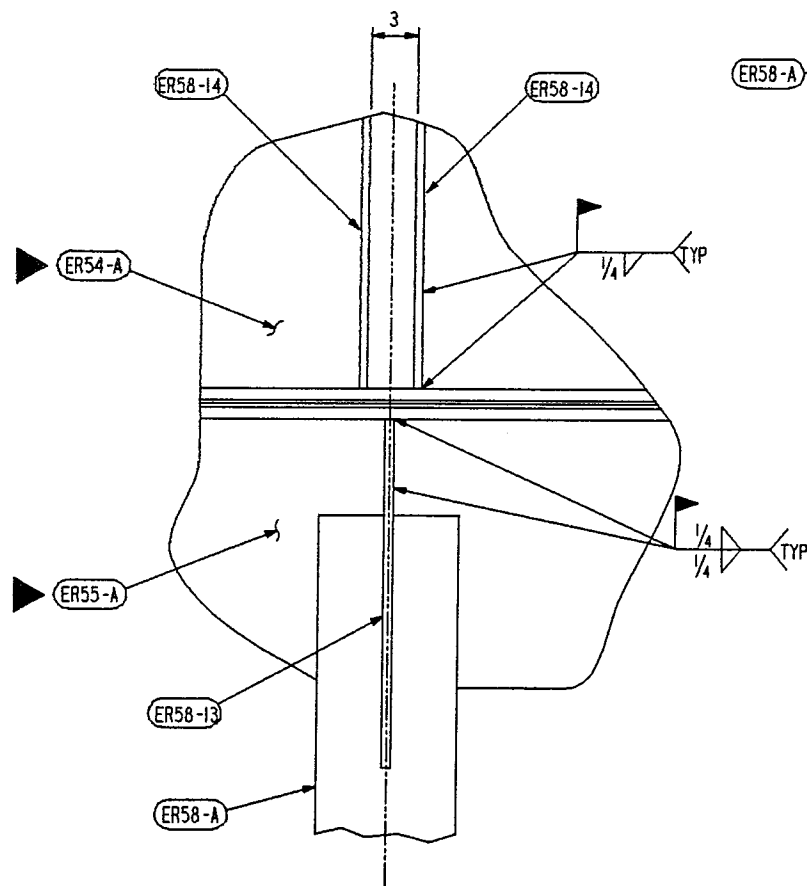
INDICATES CHANGE FROM PREVIOUS ISSUE

CAD FILE 30212056.DGN

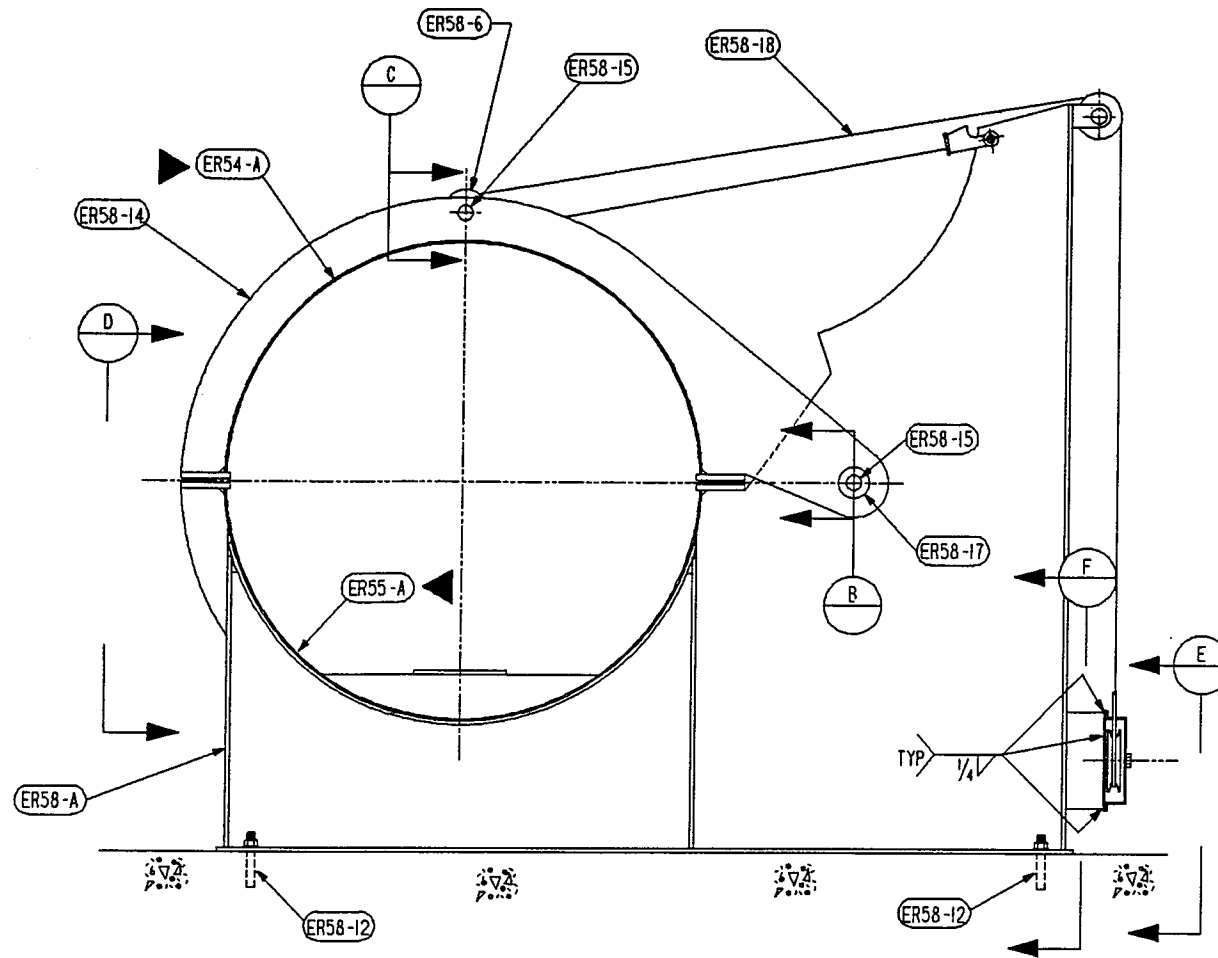
Supplier's/Purchaser's No. _____	
CBI	
LIGO PROJECT LEAK TEST ARRANGEMENT	
HOOD TEST ENCLOSURE HELIUM HOOD DETAILS	
Customer's No. _____	Contract No. 930212ER
By BSA Chkd RDS Date 3-4-94	Dwg. ER-56 Rev. 2
J. L. RINGELSTETTER Engineering Supervisor	
Sheet -	2



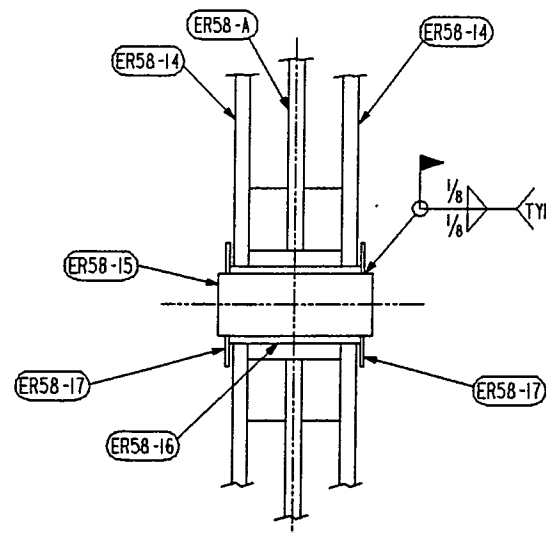
OPEN CONFIGURATION



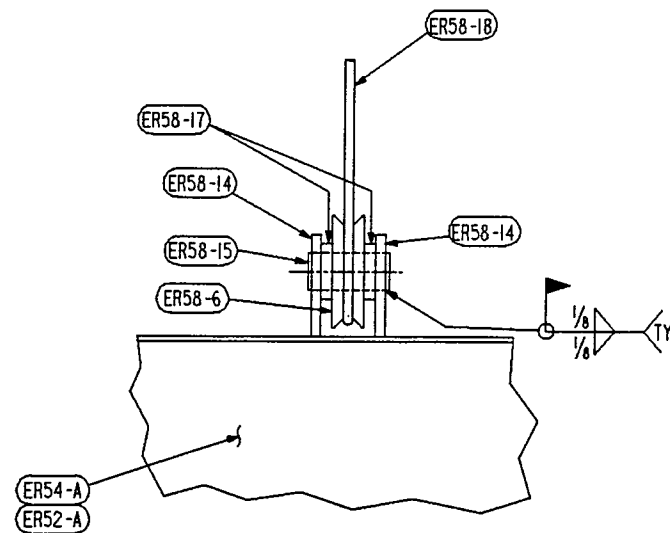
SECTION D



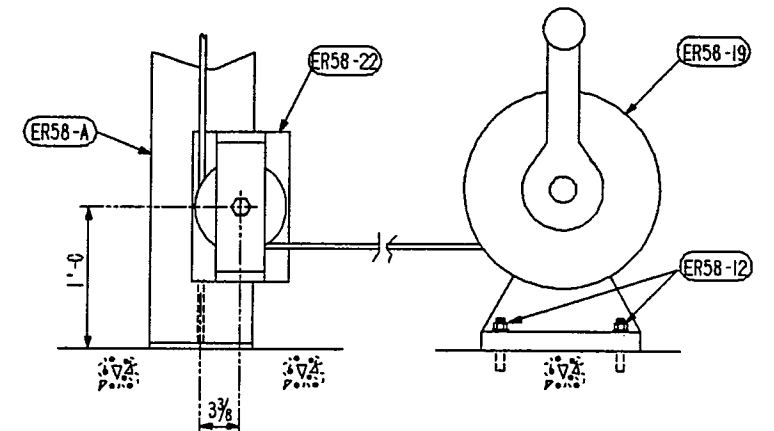
SECTION A
ER51



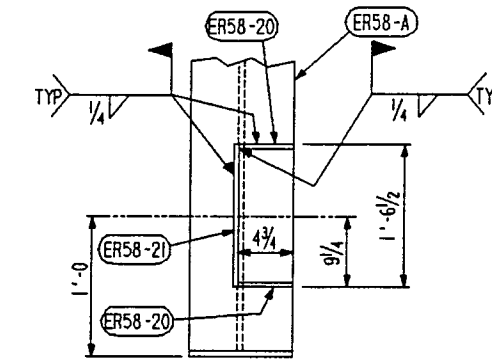
SECTION B



SECTION C



SECTION E



SECTION F

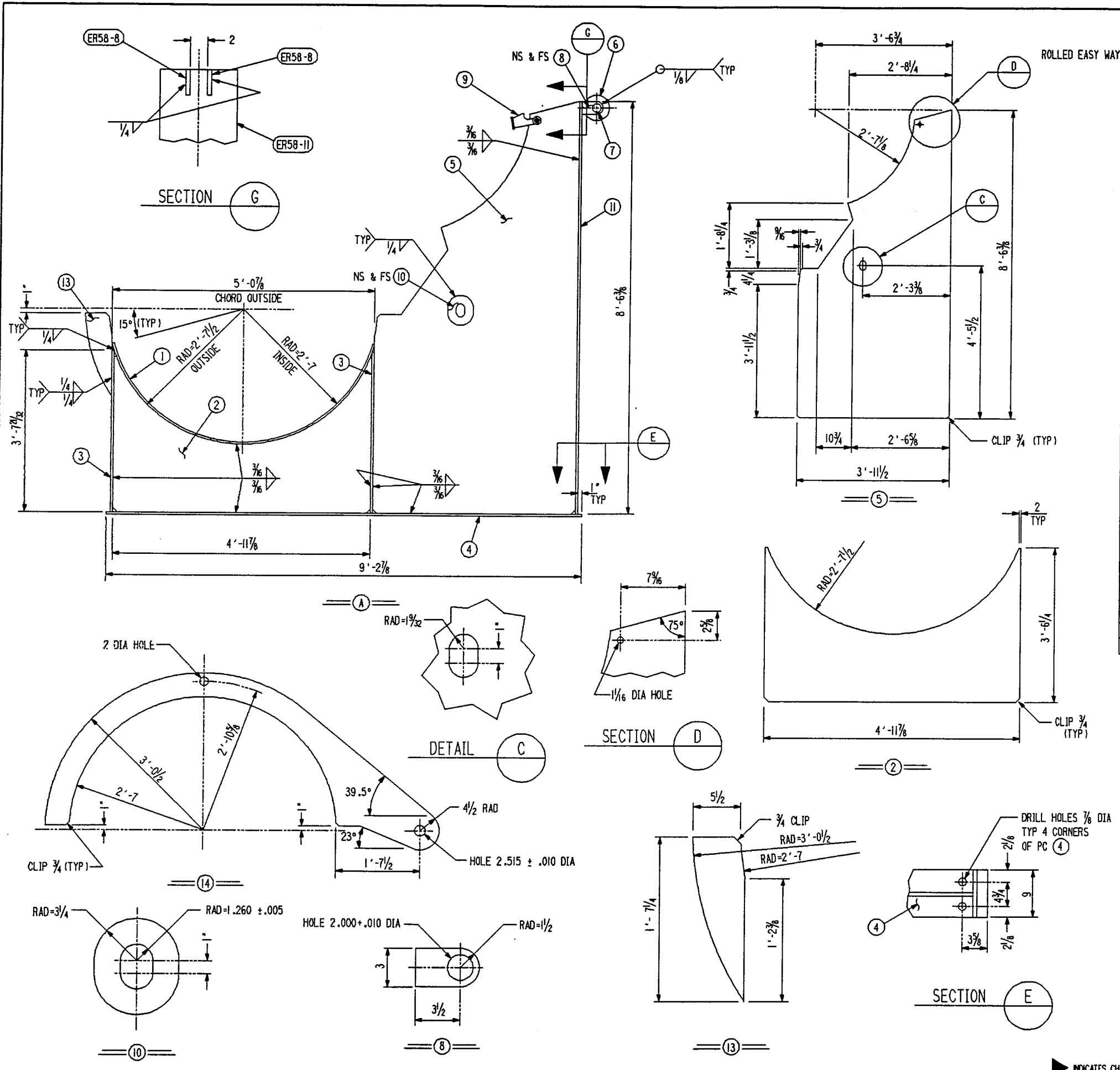
NOTES:

1. WORK THIS DWG WITH ER-51 AND ER-58.

CAD FILE: 30212057.DGN

Supplier's/Purchaser's No.		Contract No. 930212ER	
Customer's No.		Date 2-10-94	
By RDS Chkd RDS		Dwg. ER-57	
J. L. RINGELSTETTER Engineering Supervisor		Sheet - 4	

INDICATES CHANGE FROM PREVIOUS ISSUE



SHP PC	MARK	ASSY PC	DESCRIPTION	LENGTH		SPEC	EST WEIGHT
				FT	INCHES		
6	ER58-A		SADDLE ASSEMBLY				7690
	ER58-1	6	PLATE 9 X 1/2 ROLL TO 2'-7\"/>				

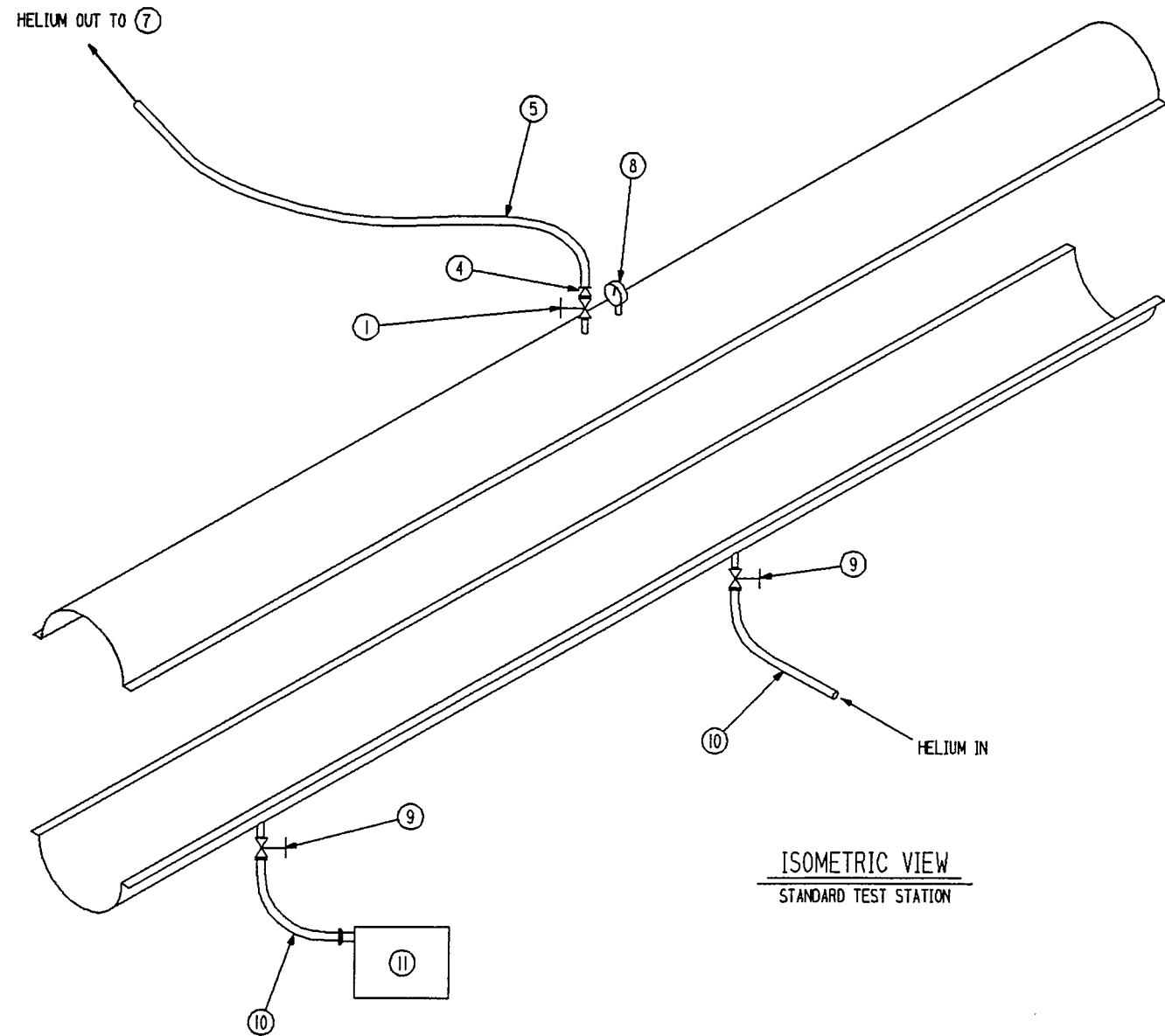
NOTES:

1. WORK THIS DWG WITH DWG ER57.

Supplier's/Purchaser's No. _____	
CBI	
LIGO PROJECT LEAK TEST ARRANGEMENT SADDLE AND HINGE DETAILS	
Customer's No. _____	Contract No. 930212ER
By RDS Chkd RDS Date 2-10-94	Dwg. ER-58 Rev. _____
J. L. RINGELSTETTER Engineering Supervisor	Sheet - 4

CAD FILE 302/2058.DGN

INDICATES CHANGE FROM PREVIOUS ISSUE



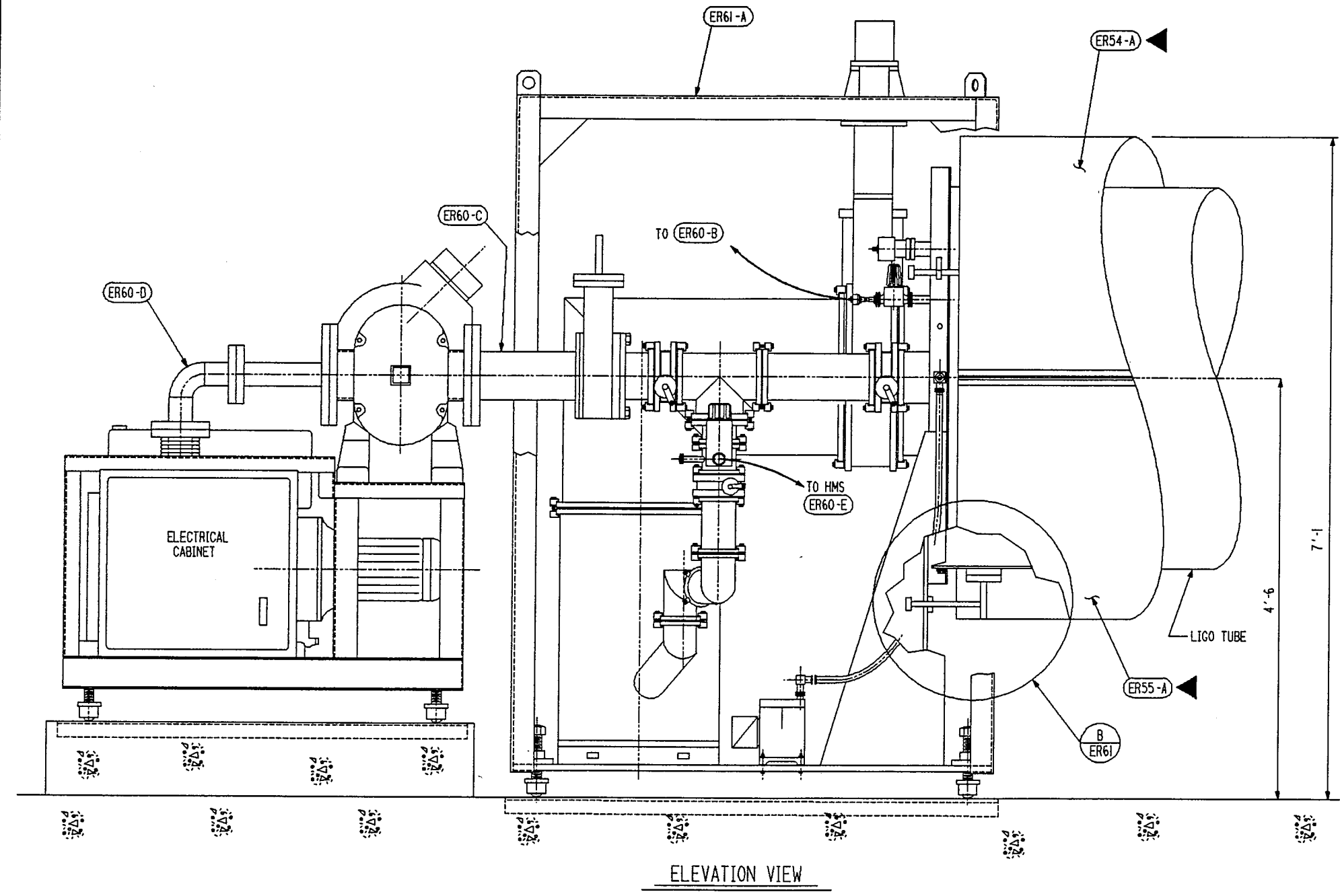
ISOMETRIC VIEW
STANDARD TEST STATION

SHIP PC	MARK	ASSY PC	DESCRIPTION	LENGTH		SPEC	EST. WEIGHT
				FT	INCHES		
			LEAK TEST STATION (3 REQUIRED)				X
3	ER59-A		EXHAUST LINE 40 MM				
	ER59-1	3	KF BELLOWS-SEALED STRAIT-THROUGH VALVE ELECTROPNEUMATICALLY OPERATED DN 40 KF "LEYBOLD" CAT. NO. 299 23 OR EQUAL			STN STL	X
	ER59-2	6	CLAMPING RING DN 40 ISO-KF "BALZERS" ORDER NO. BP 217 428-T OR EQUAL			ALUM	X
	ER59-3	6	CENTERING RING DN 40 ISO-KF "BALZERS" ORDER NO. BP 213 143-T OR EQUAL			STN/VITON	X
	ER59-4	3	HOSE NIPPLE DN 40 ISO-KF-45 "BALZERS" ORDER NO. BP 220 327 OR EQUAL	0	1/2	ALUM	X
	ER59-5	3	PVC HOSE WITH EMBEDDED STEEL WIRE SPIRAL -45 NOM. DIA "BALZERS" ORDER NO. B 2359 837BR OR EQUAL	40	0	PVC	X
	ER59-6	6	HOSE CLIP -45 NOM. DIA "BALZERS" ORDER NO. B 4163 111B OR EQUAL			STN STL	X
1	ER59-7		EXHAUST HOOD			CARB STL	X
3	ER59-8		6 DIA VACUUM DIAL GAUGE, WITH 1/4 MPT BOTTOM CONNECTION, HIGH ACCURACY "McMASTER-CARR" NO. 4105K2 OR EQUAL			BRONZE	X
3	ER59-B		EYACUATING ENCLOSURE LINE 40 MM				X
	ER59-9	3	KF BELLOWS-SEALED RIGHT-ANGLE VALVE W/QUICK-ACTING KNOB-MANUALLY OPERATED DN 40 KF "LEYBOLD" CAT. NO. 288 13 OR EQUAL			STN STL	X
	ER59-2	9	CLAMPING RING DN 40 ISO-KF "BALZERS" ORDER NO. BP 217 428-T OR EQUAL			ALUM	X
	ER59-3	9	CENTERING RING DN 40 ISO-KF "BALZERS" ORDER NO. BP 213 143-T OR EQUAL			STN/VITON	X
	ER59-10	3	PVC HOSE DN 40 ISO-KF "BALZERS" ORDER NO. BP 226 417-T OR EQAL	3	3/8	PVC	X
	ER59-11	3	TRIVAC B ROTARY VANE PUMP MODEL D65B 53.0 CFM (1500 LTR/MIN), POWER 3 HP, VOLTAGE 200-230/460 VAC, FREQ. 60 HZ, W/HYDROCARBON OIL, 40 KF FLANGE "LEYBOLD" CAT. NO. 91296-2 OR EQUAL				561
3	ER59-C		BACKFILLING LINE 40 MM				X
	ER59-9	3	KF BELLOWS-SEALED RIGHT-ANGLE VALVE W/QUICK-ACTING KNOB-MANUALLY OPERATED DN 40 KF "LEYBOLD" CAT. NO. 288 13 OR EQUAL			STN STL	X
	ER59-2	6	CLAMPING RING DN 40 ISO-KF "BALZERS" ORDER NO. BP 217 428-T OR EQUAL			ALUM	X
	ER59-3	6	CENTERING RING DN 40 ISO-KF "BALZERS" ORDER NO. BP 213 143-T OR EQUAL			STN/VITON	X
	ER59-10	3	PVC HOSE DN 40 ISO-KF "BALZERS" ORDER NO. BP 226 417-T OR EQAL	3	3/8	PVC	X

CAO FILE 30212059.DGN

INDICATES CHANGE FROM PREVIOUS ISSUE

ILLUSTRATE SPECIAL HOOD ENCLOSURE		Supplier's/Purchaser's No. _____	
By	Date	By	Date
BSA	3-9-94	J. L. RINGELSTETTER	3-9-94
CHD	5-3-95	Engineering Supervisor	
BSA	4-7-94		
CHD	4-7-94		
BSA	4-7-94		
CHD	4-7-94		
REVISIONS		Remarks	
		LIGO PROJECT LEAK TEST ARRANGEMENT HELIUM HOOD ENCLOSURE EQUIPMENT	
Customer's No. _____		Contract No. 930212ER	
By BSA Chkd RDS Date 3-9-94		Dwg. ER-59 Rev. 2	
J. L. RINGELSTETTER		Sheet - 2	
Engineering Supervisor			



SHP PC	MARK	ASSY PC	DESCRIPTION	LENGTH		SPEC	EST WEIGHT
				FT	INCHES		
* 1	ER61-A		ROLLING VACUUM END SEAL ASSEMBLY				X
* 1	ER60-B		UHV MULTI-GAUGE 115 VAC/60 HZ "VARIAN" PART NO. L8321301				X
* 1	ER60-C		SPOOL ASSEMBLY				X
	ER60-1	1	FULL NIPPLE WITH 8 ASA ROTTABLE TWO GROOVED FLANGES "LESKER" PART NO. AFN11X060L2R OR EQUAL			STN STL	X
	ER60-2	2	O-RING 6 ASA SIZE "LESKER" PART NO. O-V265 OR EQUAL			VITON	X
	ER60-3	16	BOLT 3/4 DIA REG FIN HEX HEAD	0	2 1/2	A307B	X
	ER60-4	16	PLAIN WASHER 3/4 DIA NARROW			CARB STL	X
	ER60-5	16	NUT 3/4 DIA REG FIN HEX			A563A	X
* 1	ER60-D		MECHANICAL VACUUM PUMP UNIT				2300
	ER60-6	1	ASSEMBLY OF "LEYBOLD" RUVAC WAU2001 SINGLE-STAGE ROOT PUMP CAT. NO. 91751-1 AND DK200 ROTARY PISTON PUMP CAT. NO. 89503-1 MOUNTING ON 32-INCH WIDE FRAME "INDELCO"				X
	ER60-7	4	ACME ROD 1/4 DIA - 5TPI RIGHT-HAND THD "McMASTER-CARR" NO. 98935A131	0	6	CARB STL	X
	ER60-8	4	FLANGE MOUNTED UNIT - 1/2 DIA BALL TRANSVER HIGH CAP. "McMASTER-CARR" NO. 2415T64 ZINC PLATED			CARB STL	X
	ER60-9	4	ACME NUT 1/4 DIA - 5TPI RIGHT-HAND THD "McMASTER-CARR" NO. 94815A116			CARB STL	X
	ER60-10	4	ACME BRONZE ROUND NUT 1/4 DIA - 5TPI RIGHT-HAND TRD "McMASTER-CARR" NO. 95072A118			BRONZE	X
	ER60-11	4	ACME MOUNTING FLANGE 1/4 DIA "McMASTER-CARR" NO. 95082A645			CARB STL	X
* 1	ER60-E		HELIUM MASS SPECTROMETER ULTRATEST UL400 HELIUM LEAK DETECTOR "LEYBOLD" CAT. NO. 89635-100 WITH OPTIONAL HIGH SENSITIVITY 2 X 10 ⁻¹² atm cc/sec OR EQUAL				330

* BILLING FOR 1: 3 REQUIRED.

NOTES:

1. WORK THIS DWG WITH DWG ER-61.
2. BALL TRANSFER UNIT DETAIL SEE DWG ER-63.
3. DIFFUSION PUMP SKID AND ROUGHING PUMP SKID CAN BE COMBINED IF DESIRABLE.

CAD FILE 30212060.DGN

By	Chkd	Date	ADD	REVISION
			CHANGE PC INK'S AS NOTED	
			MODIFY TITLE BLOCK	
			GENERAL REV.	

Supplier's/Purchaser's No. _____

CBI

**LIGO PROJECT
LEAK TEST ARRANGEMENT
VACUUM PUMP END SEAL**

Customer's No. _____ Contract No. **930212ER**

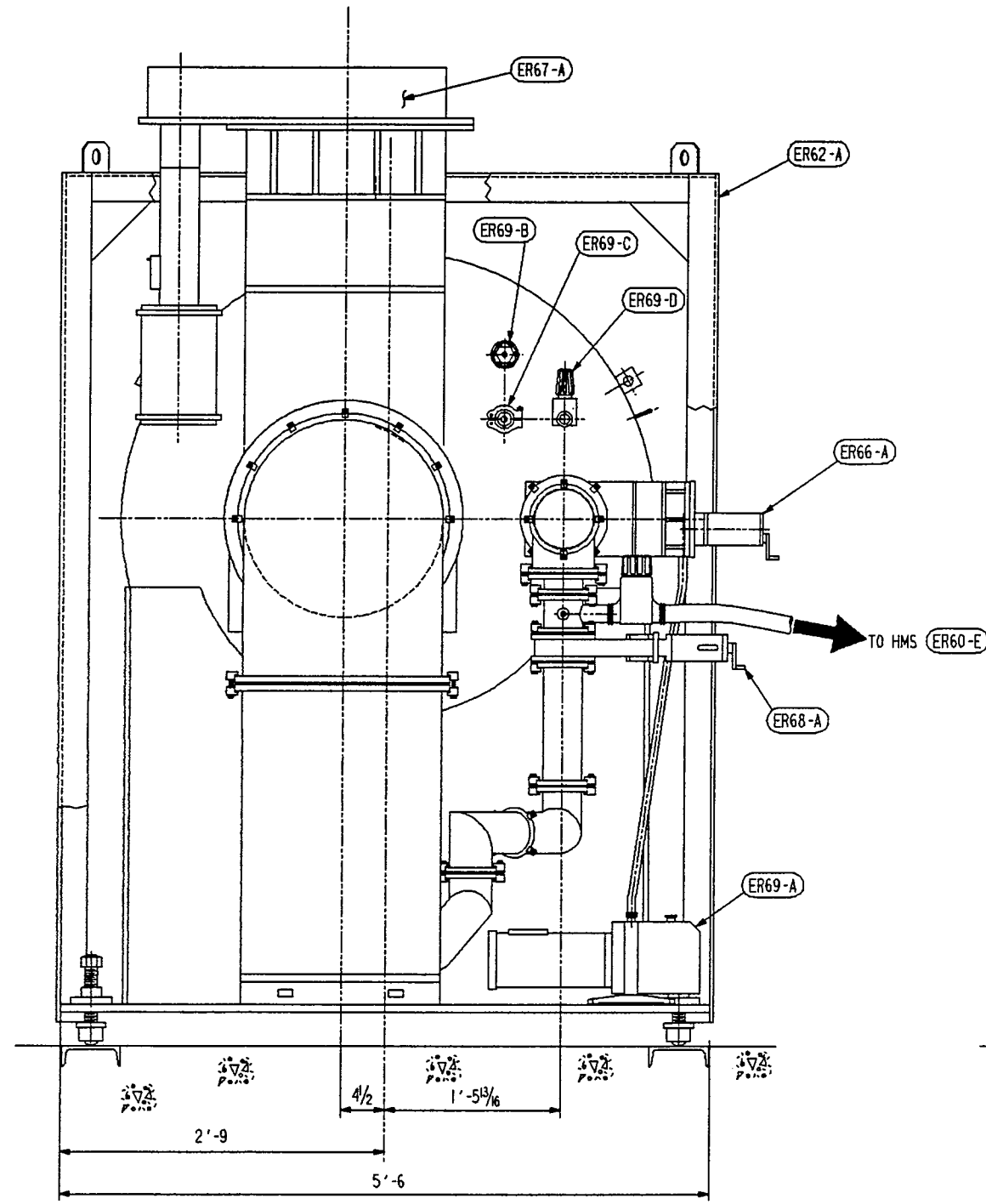
By **BSA** Chkd **RDS** Date **3-9-94** Dwg. **ER-60** Rev. **2**

J. L. RIGELSTETTER Engineering Supervisor Sheet - **2**

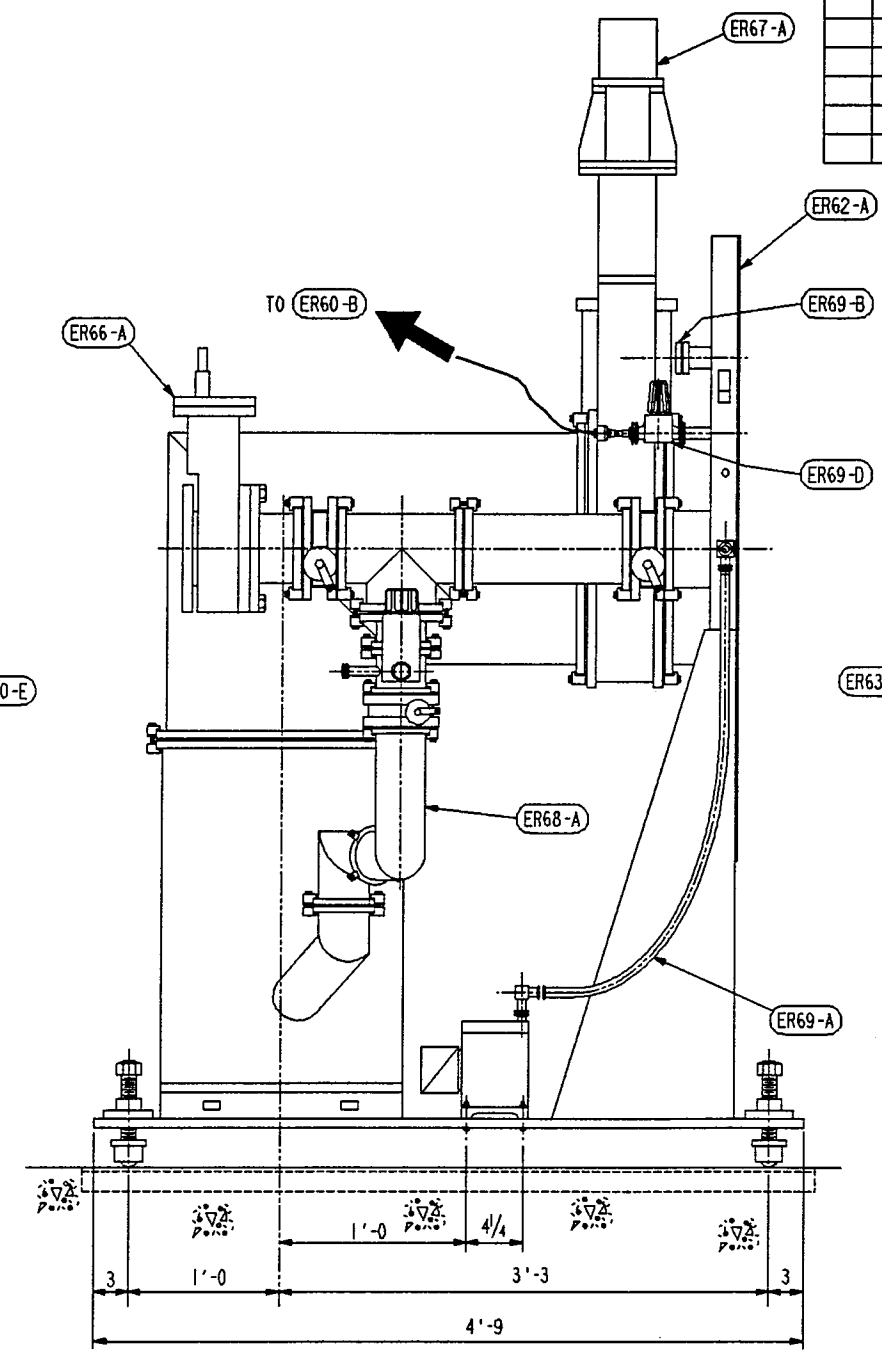
INDICATES CHANGE FROM PREVIOUS ISSUE

SHP PC	MARK	ASSY PC	DESCRIPTION	LENGTH		SPEC	EST WEIGHT
				FT	INCHES		
*	ER61-A		VACUUM END SEAL ASSEMBLY				X
	ER62-A	1	CARRIAGE SUBASSEMBLY				X
	ER66-A	1	MECHANICAL VACUUM LINE SUBASSEMBLY				X
	ER67-A	1	DIFFUSION PUMP LINE SUBASSEMBLY				X
	ER68-A	1	CROSSOVER LINE SUBASSEMBLY				X
	ER69-A	1	INTERSPACE VACUUM PUMP LINE SUBASSY				X
	ER69-B	1	RGA LINE SUBASSEMBLY				X
	ER69-C	1	IONIZATION GAUGE TUBE SUBASSEMBLY				X
	ER69-D	1	THERMAL CONDUCTIVITY GAUGE TUBE SUBASSEMBLY				X

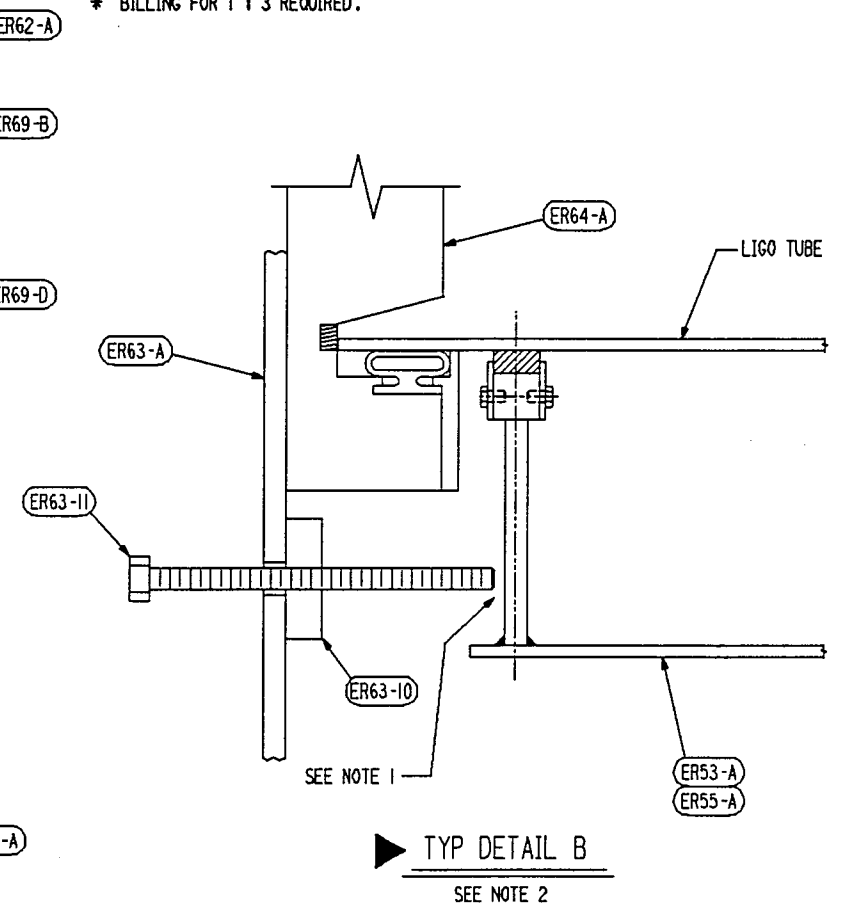
* BILLING FOR 1 : 3 REQUIRED.



(A)
ELEVATION VIEW



(A)
LEFT SIDE VIEW
LIFTING FRAME OMITTED FOR CLARITY



NOTES:

1. 1/4 GAP BEFORE VACUUM IN LIGO TUBE.
BOLT (ER63-II) BEARS AGAINST HELIUM HOOD DURING VACUUM.
2. TYP DETAIL AT 180° (BOTTOM). DETAIL SIMILAR AT 60° AND 300° EXCEPT PC (ER63-10) IS WELDED TO (ER64-A).

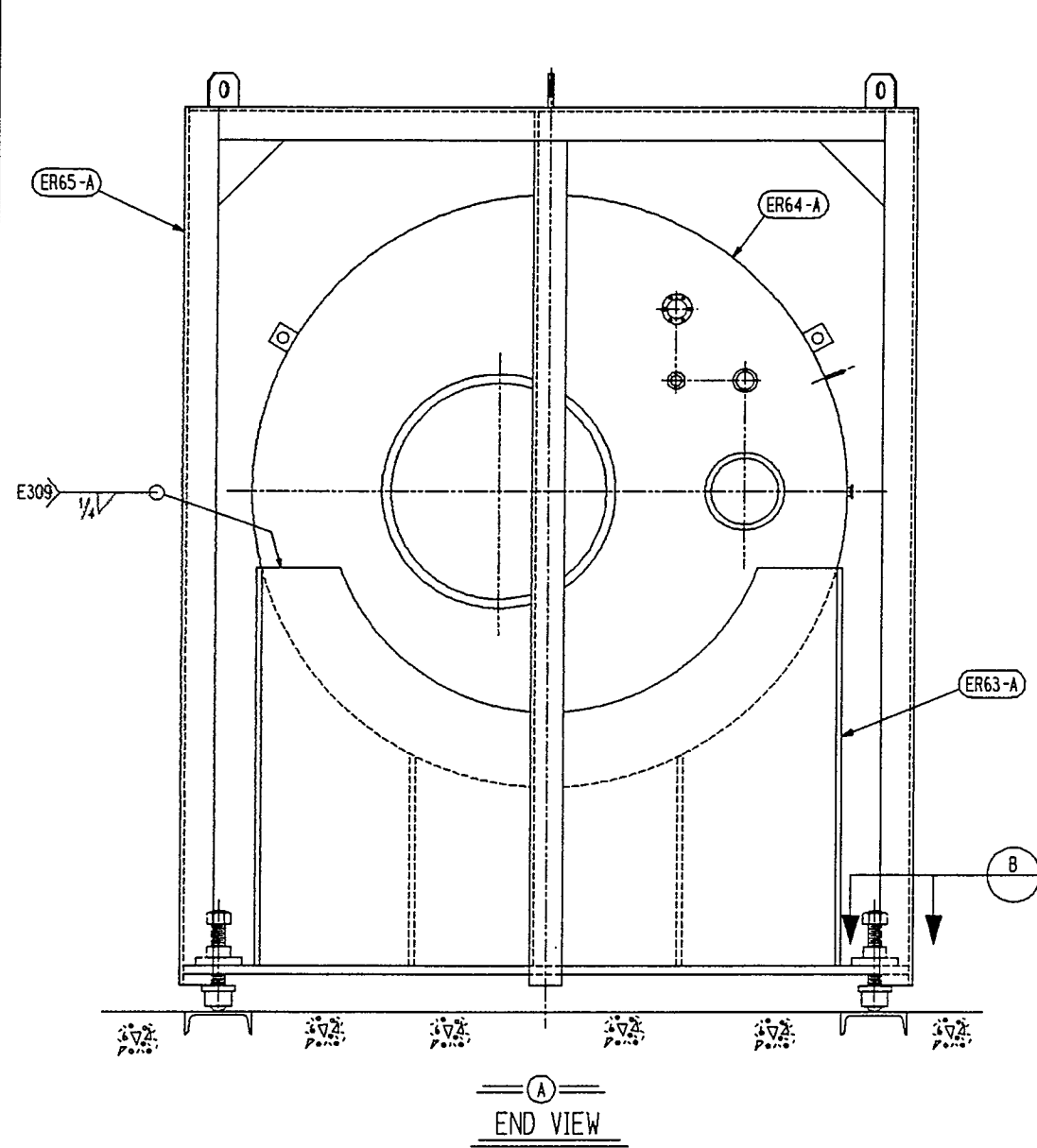
CAD FILE: 30212061.DGN

Supplier's/Purchaser's No. _____	
CBI	
LIGO PROJECT LEAK TEST ARRANGEMENT VACUUM PUMP END SEAL ASSEMBLY	
Customer's No. _____	Contract No. 930212ER
By BSA Chkd RDS Date 3-10-94	Dwg. ER-61 Rev. 2
J. L. RINGELSTETTER Engineering Supervisor	
Sheet - 2	

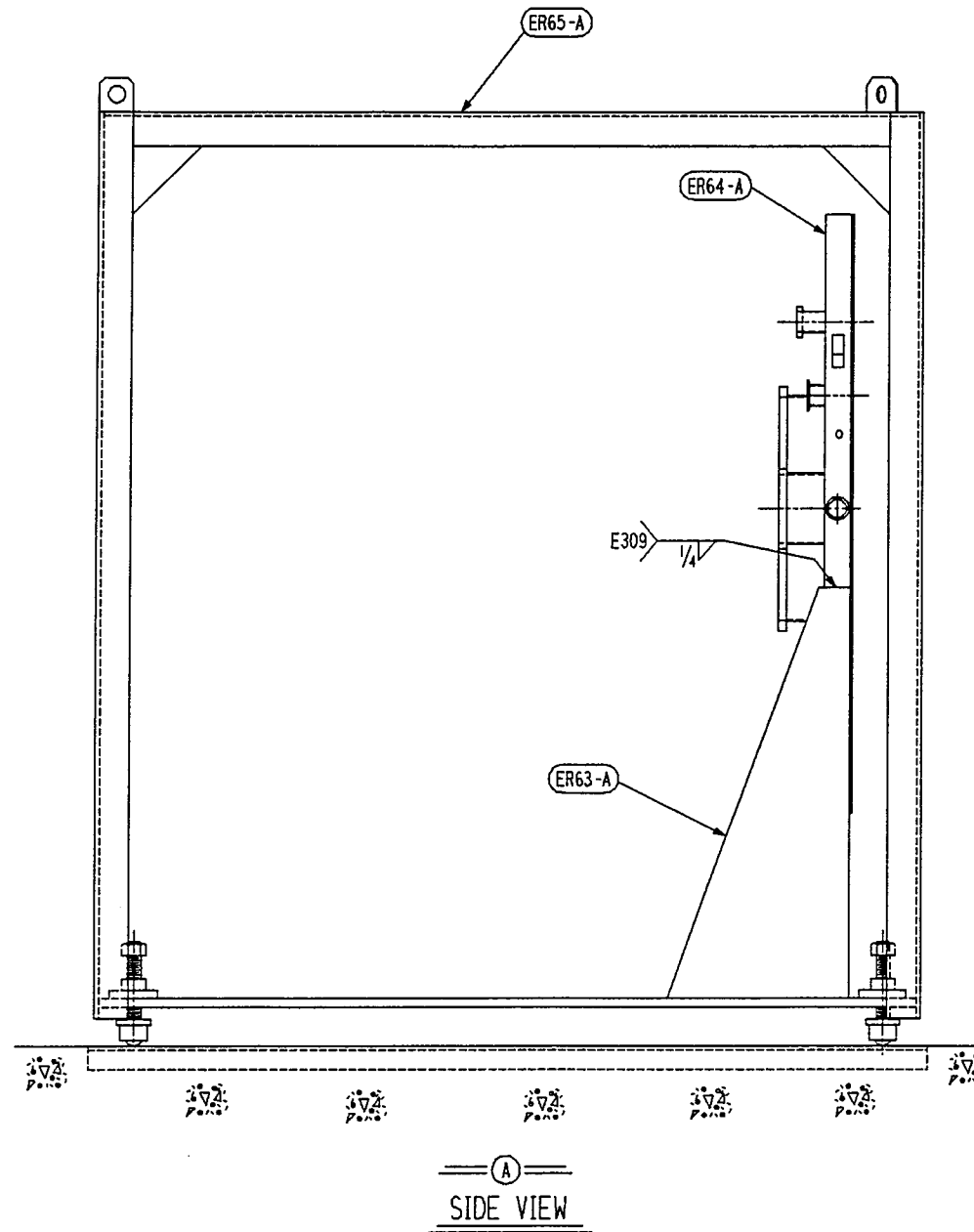
▶ INDICATES CHANGE FROM PREVIOUS ISSUE

SHP PC	MARK	ASSY PC	DESCRIPTION	LENGTH		SPEC	EST WEIGHT
				FT	INCHES		
* 1	ER62-A		CARRIAGE SUBASSEMBLY				X
	ER63-A	1	ROLLING BASE SUBASSEMBLY				X
	ER64-A	1	CAP SUBASSEMBLY				X
	ER65-A	1	LIFTING FRAME SUBASSEMBLY				X

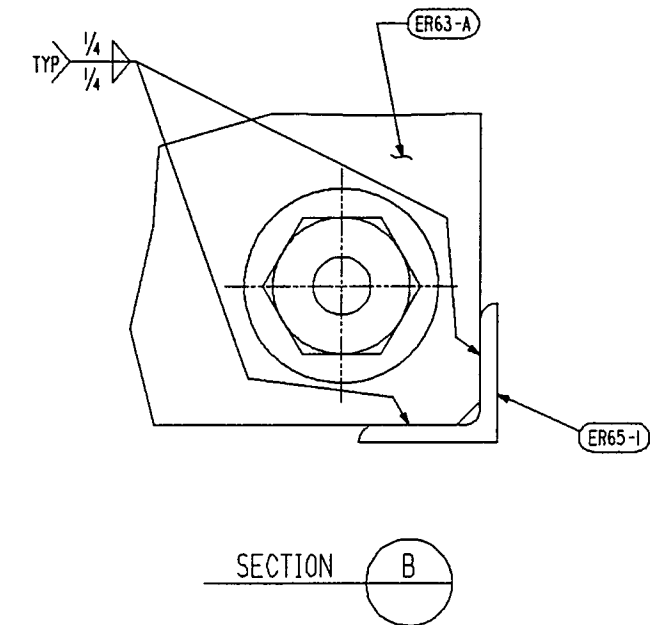
* BILLING FOR 1 + 3 REQUIRED.



END VIEW



SIDE VIEW



SECTION B

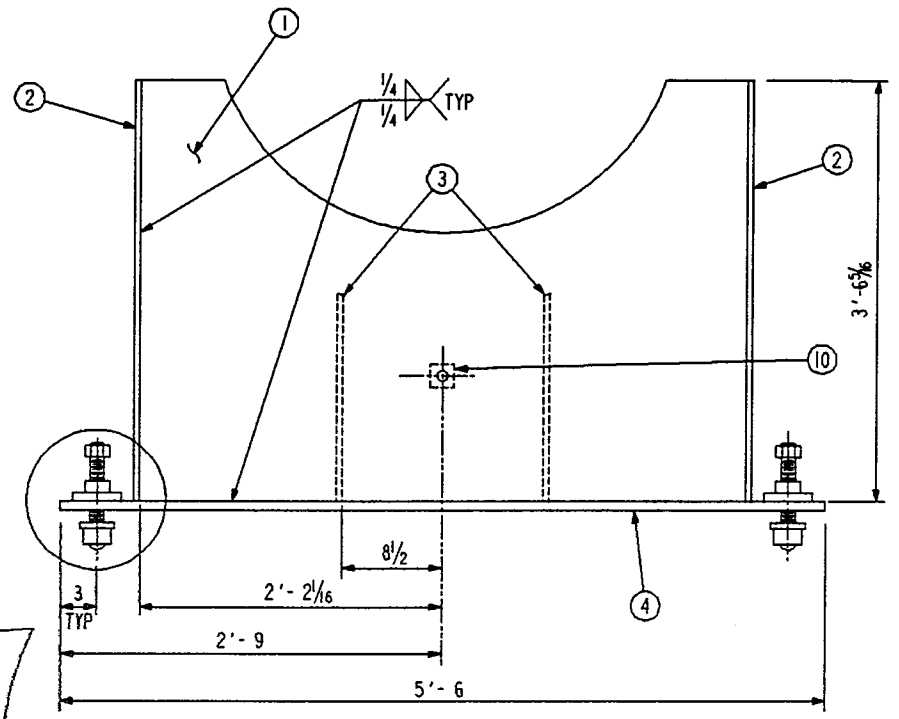
NOTES:

- 1. WORK THIS DWG WITH DWG ER-63, ER-64 AND ER-65.

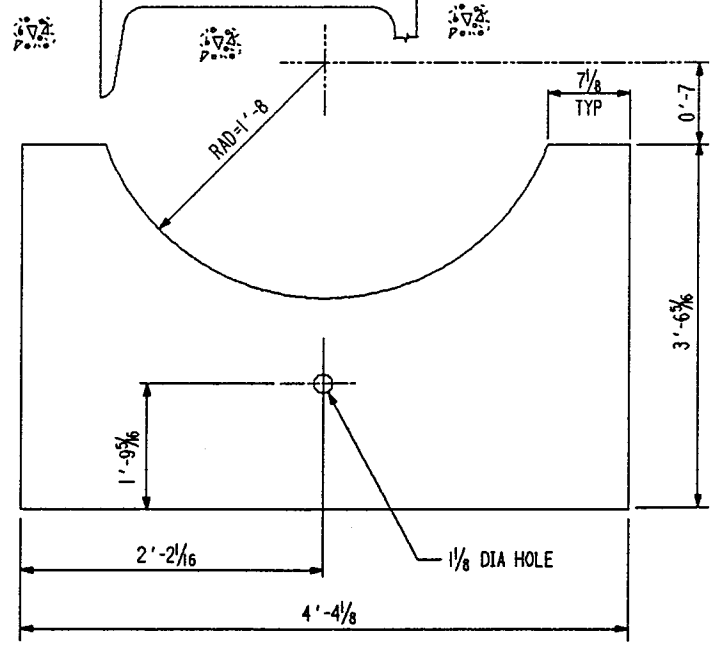
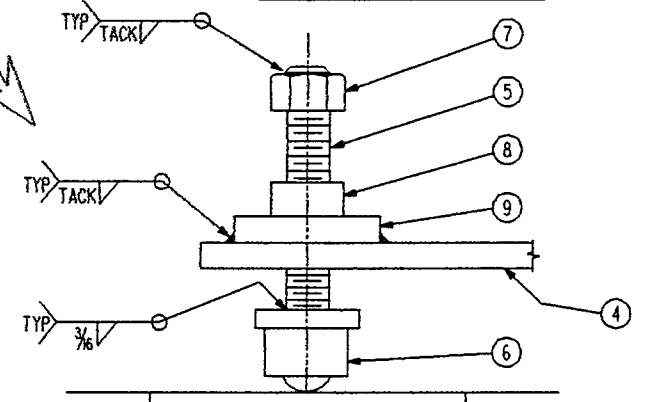
CAD FILE 30212062.DGN

INDICATES CHANGE FROM PREVIOUS ISSUE

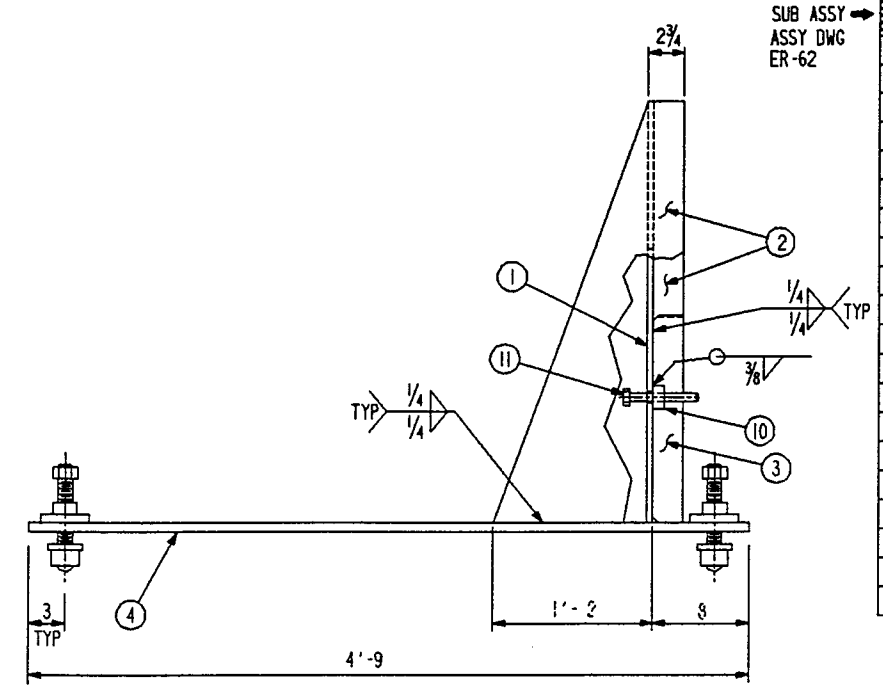
Supplier's/Purchaser's No. _____	
CBI	
LIGO PROJECT LEAK TEST ARRANGEMENT	
VACUUM PUMP END SEAL CARRIAGE SUBASSEMBLY	
Customer's No. _____	Contract No. 930212ER
By BSA Chkd RDS Date 3-10-94	Dwg. ER-62 Rev. 2
J. L. RINGELSTETTER Engineering Supervisor	Sheet -



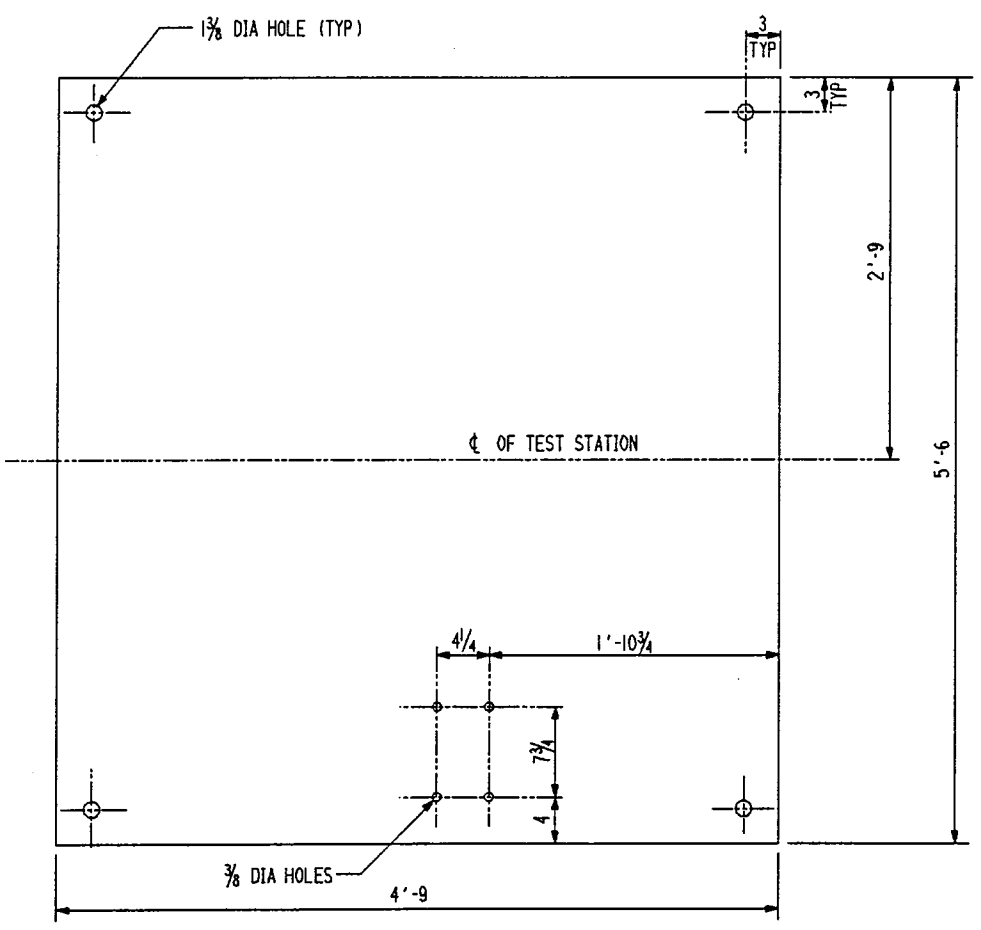
ELEVATION VIEW



1



SIDE VIEW

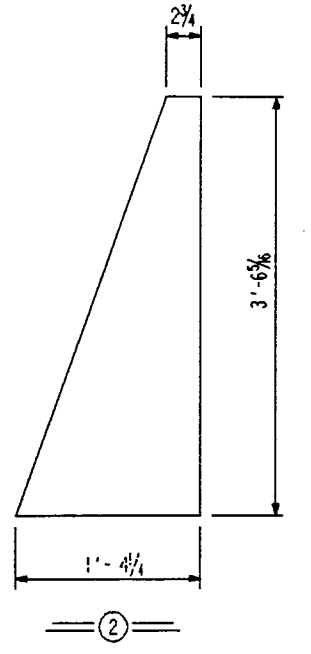
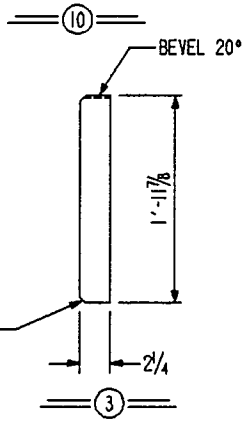
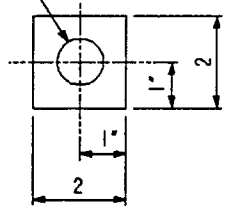


4

MARK	ASSY PC	DESCRIPTION	LENGTH		SPEC	EST WEIGHT
			FT	INCHES		
* 1	ER63-A	ROLLING BASE SUBASSEMBLY				X
	ER63-1	1 PLATE SK X 1/2 (CF 43" X 4'-4 1/8")			A36	X
	ER63-2	2 PLATE SK X 1/2 (CF 19" X 3'-7 C2)			A36	X
	ER63-3	2 PLATE 1/2 X SK (CF 3/4 X 2'-0")	1	11 1/8	A36	X
	ER63-4	1 PLATE 57 X 1/2 X SK	5	6	A36	X
	ER63-5	4 ACME ROD 1/4 DIA - 5TPI RIGHT-HAND THD "McMASTER-CARR" NO. 98935A131	0	6	CARB STL	X
	ER63-6	4 FLANGE MOUNTED UNIT - 1/2 DIA BALL TRANSFER HIGH CAP. "McMASTER-CARR" NO. 2415T64 ZINC PLATED			CARB STL	X
	ER63-7	4 ACME NUT 1/4 DIA - 5TPI RIGHT-HAND THD "McMASTER-CARR" NO. 94815A116			CARB STL	X
	ER63-8	4 ACME BRONZE ROUND NUT 1/4 DIA - 5TPI RIGHT-HAND TRD "McMASTER-CARR" NO. 95072A118			BRONZE	X
	ER63-9	4 ACME MOUNTING FLANGE 1/4 DIA "McMASTER-CARR" NO. 95082A645			CARB STL	X
	ER63-10	1 PLATE SK X 1" (CF 3 X 0'-3 C1)	0	2	A36	X
	ER63-11	1 BOLT 1" DIA REG FIN HEX HEAD THREAD FULL LENGTH	0	6	A307B	X

* BILLING FOR 1 + 3 REQUIRED.

TAPPED HOLE 1-8-UNC



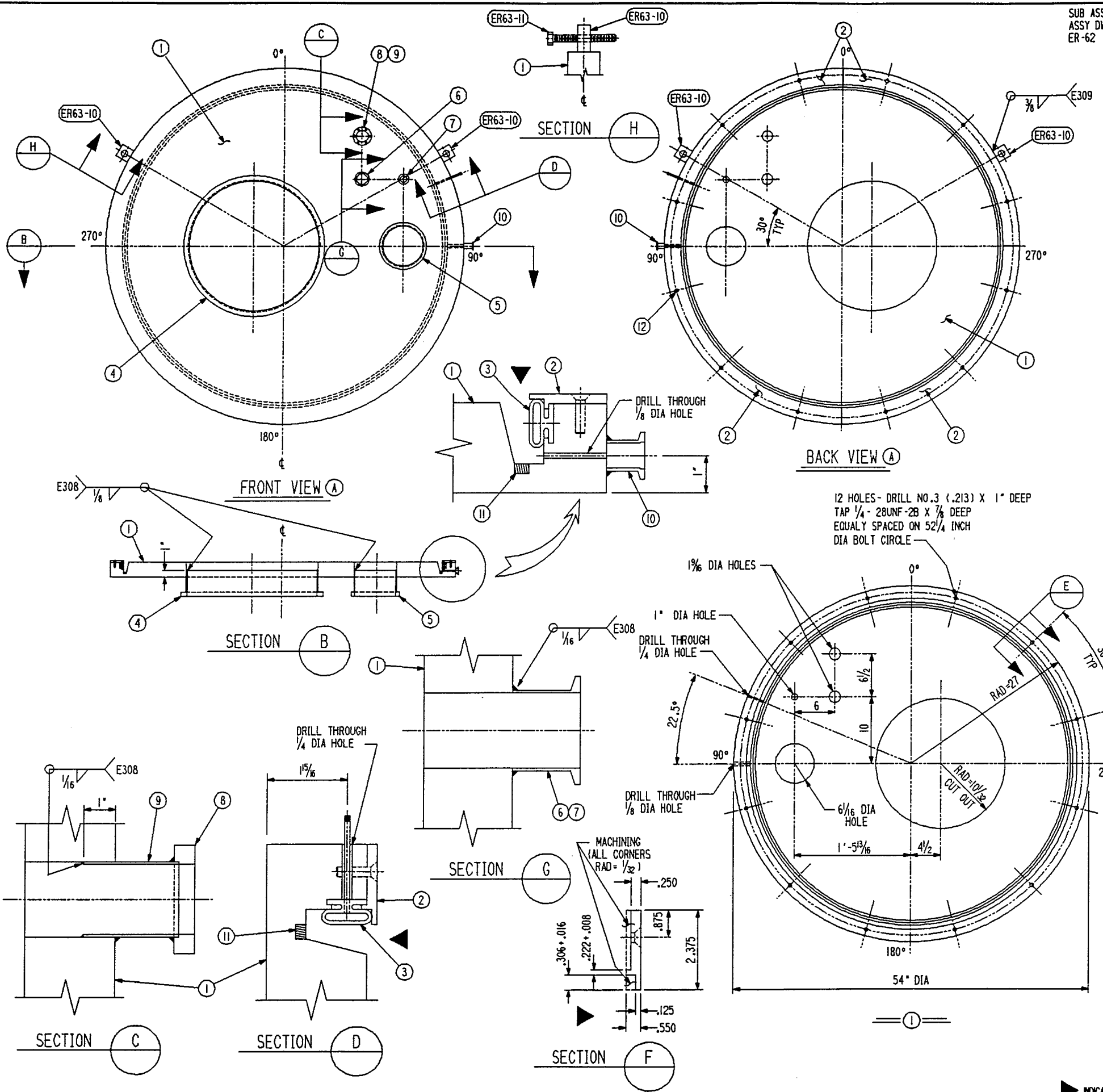
NOTES:

1. WORK THIS DWG WITH DWG ER-62.

CAD FILE 130212063.DGN

INDICATES CHANGE FROM PREVIOUS ISSUE

Supplier's/Purchaser's No.		CBI	
LIGO PROJECT LEAK TEST ARRANGEMENT			
VACUUM PUMP END SEAL ROLLING BASE SUBASSEMBLY			
Customer's No.		Contract No.	
By BSA Chkd RDS Date 1-2-94		930212ER	
J. L. RINGESTETTER Engineering Supervisor		Dwg. ER-63	Rev. 2
Sheet -			



SUB ASSY
ASSY DWG
ER-62

MARK	ASSY PC	DESCRIPTION	LENGTH		SPEC	EST WEIGHT
			FT	INCHES		
* 1 ER64-A		END CAP SUBASSY				X
ER64-1	1	PLATE 54 OD X 2 1/2 X SK (CF 54" X 4'-6") (MACHINING, DRILLING AND TAPPING)			SS-304 L	1298
ER64-2	4	PLATE SK X 9/16 (MACHINING AND DRILLING)			SS-304 L	X
ER64-3	1	INFLATABLE ROUND PNEUMA-SEAL 50 1/4 OD "PRESRAY" TYPE - PRS 537 W/ 1A STANDARD AIR CONNECTOR			EPDM	-
ER64-4	1	PORT FITTING DN 500 ISO-K "BALZERS" NO. BP 217 922-X (100 MM-LENGTH) OR EQUAL	0	3 1/2	STN STL	X
ER64-5	1	PORT FITTING DN 160 ISO-K "BALZERS" NO. BP 213 259-X (100 MM-LENGTH) OR EQUAL	0	3 1/2	STN STL	X
ER64-6	1	FLANGE, LONG WELD STUB DN 40 ISO-KF "LEYBOLD" CAT. NO. 899624 (40 MM-LENGTH) OR EQUAL	0	1 7/8	STN STL	X
ER64-7	1	FLANGE, LONG WELD STUB DN 25 ISO-KF "LEYBOLD" CAT. NO. 899622 (40 MM-LENGTH) OR EQUAL	0	1 7/8	STN STL	X
ER63-8	1	WELDING FLANGE DN 40 CF-F "BALZERS" NO. BP 414 306 (13 MM-LENGTH) OR EQUAL	0	1/2	STN STL	X
ER64-9	1	TUBE 1/2 OD X .065	0	3 3/8	STN STL	1
ER64-10	1	FLANGE, SHORT WELD STUB DN 16 ISO-KF "LEYBOLD" CAT. NO. 899611 (19 MM-LENGTH) OR EQUAL	0	1 7/8	STN STL	X
ER64-11	1	70 DUROMETER BUTYL RUBBER RING 49/4 OD 1/4 X 3/8 CROSS SECTION (VULCANIZED JOINT)			BUTYL RUBBER	1
ER64-12	12	1/4-28 X 1" SLOTTED FLAT COUNTERSUNK MACHINE SCREW	0	1	CARB STL	1
ER63-10	2	PLATE SK X 1" (CF 3 X 0'-3 CI)	0	2	A36	X
ER63-11	2	BOLT 1" DIA REG FIN HEX HEAD THREAD FULL LENGTH	0	6	A307B	X

* BILLING FOR 1 + 3 REQUIRED.

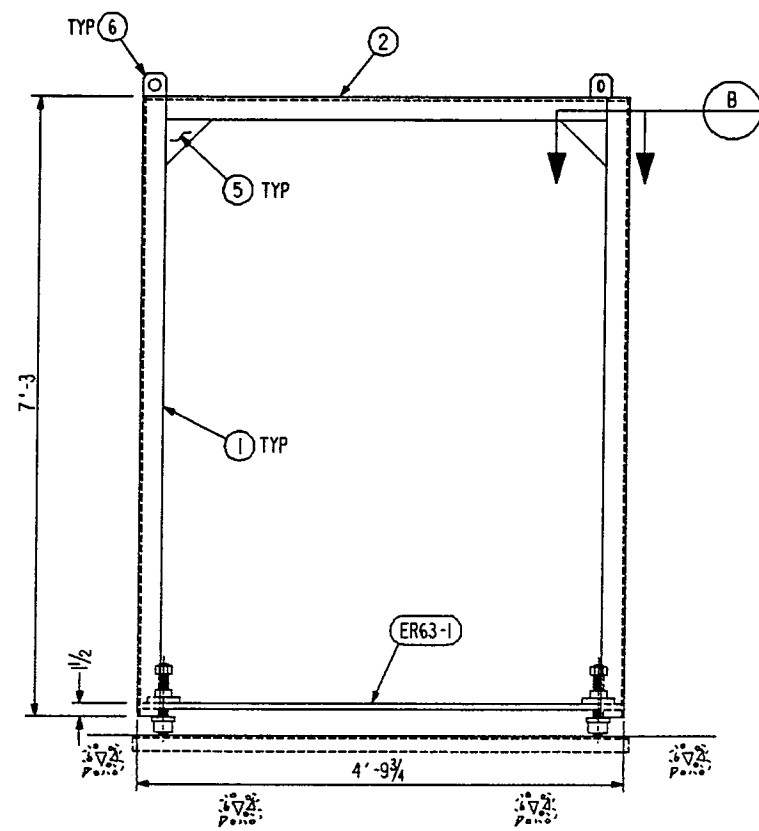
NOTES:

- TOLERANCES ON MACHINING DIMENSIONS X.XXX ± .015 UNLESS NOTED.
- WORK THIS DWG WITH DWG ER-62.

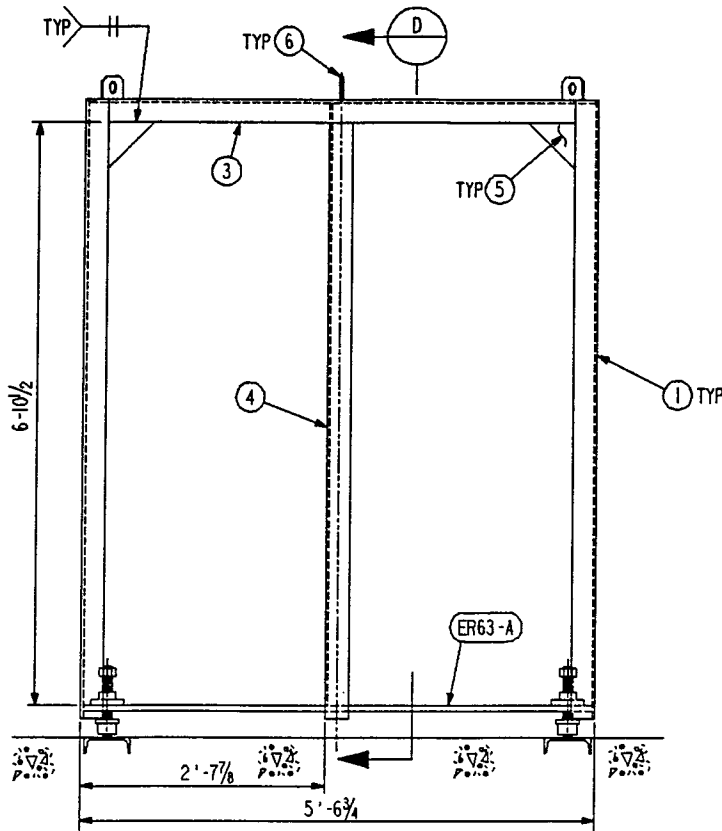
Supplier's/Purchaser's No. _____	
CBI	
LIGO PROJECT LEAK TEST ARRANGEMENT	
VACUUM PUMP END SEAL END CAP SUBASSEMBLY	
Customer's No. _____	Contract No. 930212ER
By BSA Chkd RDS Date 3-10-94	Dwg. ER-64 Rev. 2
J. L. RINGELSTETTER Engineering Supervisor	
By _____	Date _____
By _____	Date _____
By _____	Date _____
By _____	Date _____
By _____	Date _____

INDICATES CHANGE FROM PREVIOUS ISSUE

CAD FILE: 30212064.DGN



ELEVATION VIEW

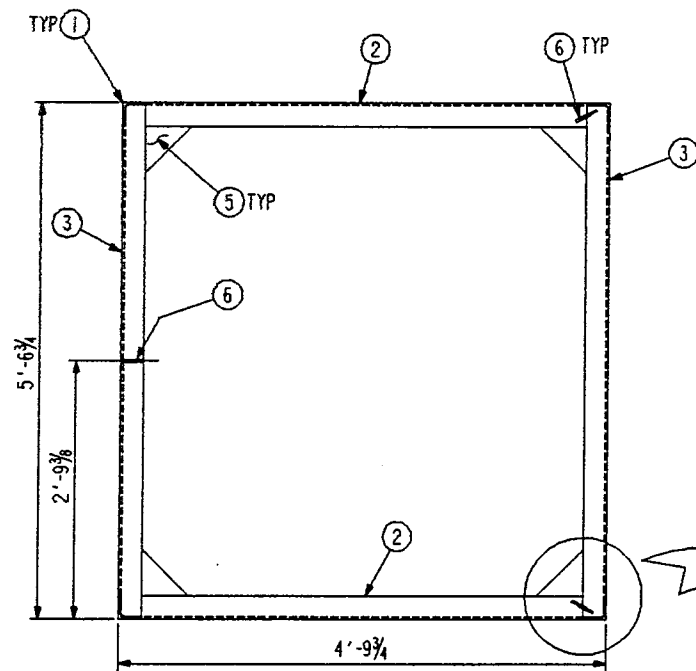
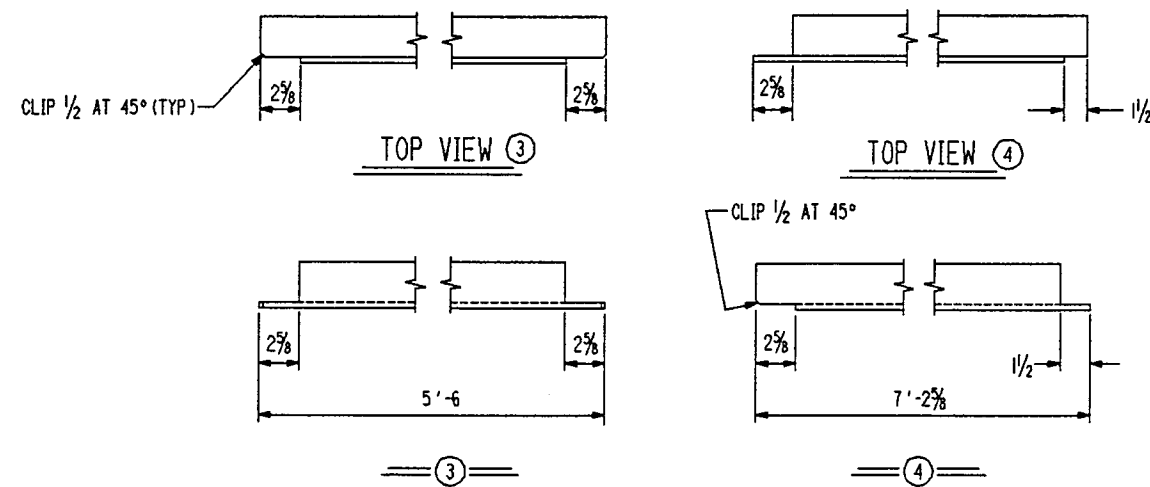


LEFT SIDE VIEW

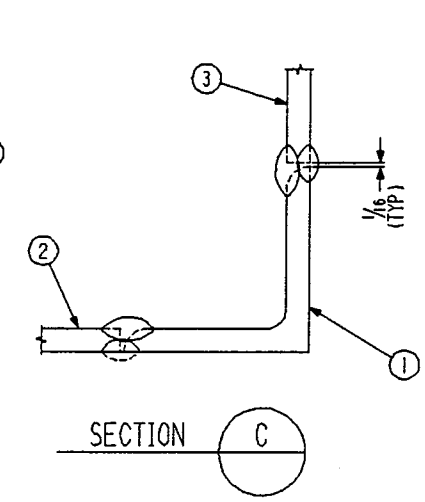
SUB ASSY →
ASSY DWG
ER-62

MARK	ASSY PC	DESCRIPTION	LENGTH		SPEC	EST WEIGHT
			FT	INCHES		
* 1	ER65-A	LIFTING FRAME ASSEMBLY				422
	ER65-1	4 L3 X 3 X 3/8	7	3	A36	208
	ER65-2	2 L3 X 3 X 3/8	4	3 1/4	A36	62
	ER65-3	2 L3 X 3 X 3/8 X SK	5	6	A36	79
	ER65-4	1 L3 X 3 X 3/8 X SK	7	2 1/2	A36	52
	ER65-5	12 PLATE 3/8 X SK (CF 6 X 0'-6 C2)			A36	23
	ER65-6	3 PLATE 1/2 X SK			A36	3

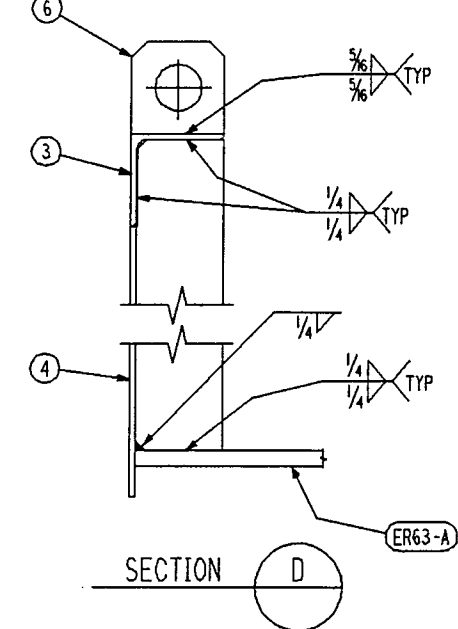
*BILLING FOR 1 + 3 REQUIRED.



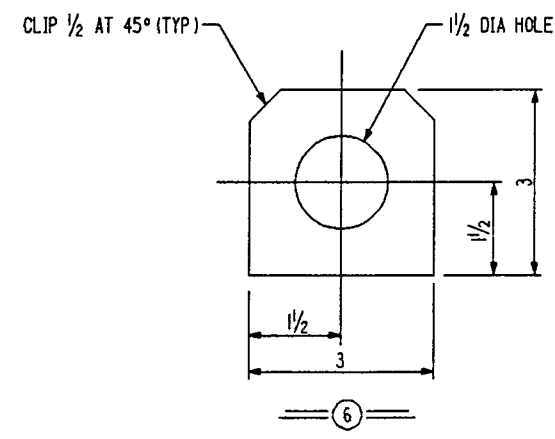
TOP VIEW



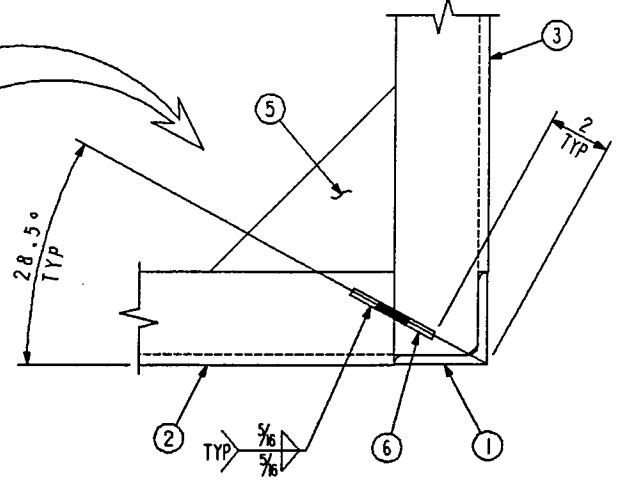
SECTION C



SECTION D



6



NOTES:

1. WORK THIS DWG WITH DWG ER-62 AND ER-63.

INDICATES CHANGE FROM PREVIOUS ISSUE

CAD FILE 1_30212065.DGN

Supplier's/Purchaser's No.		Contract No. 930212ER	
Customer's No.		By BSA Chkd RDS Date 3-10-94	
J. L. RINGELSTETTER Engineering Supervisor		Dwg. ER-65 Rev. 2 Sheet - 2	

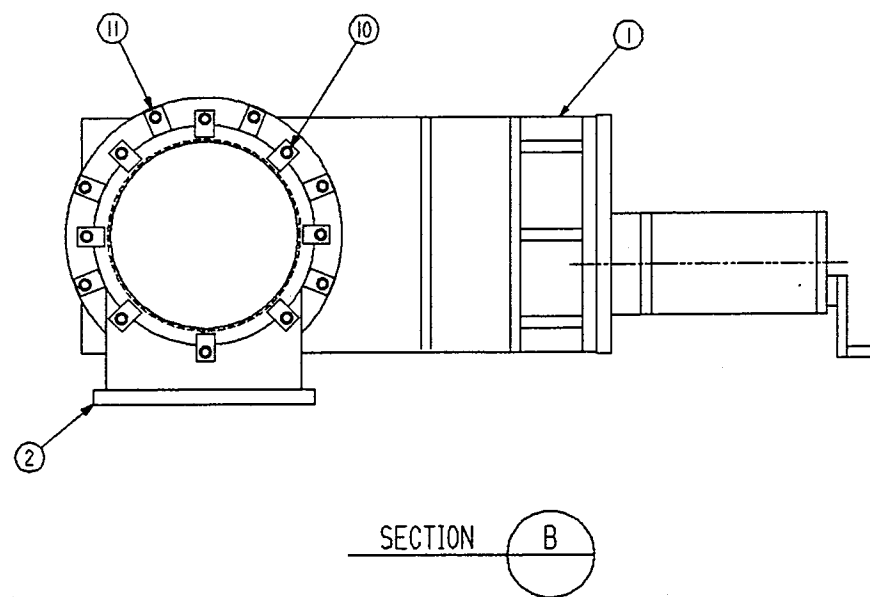
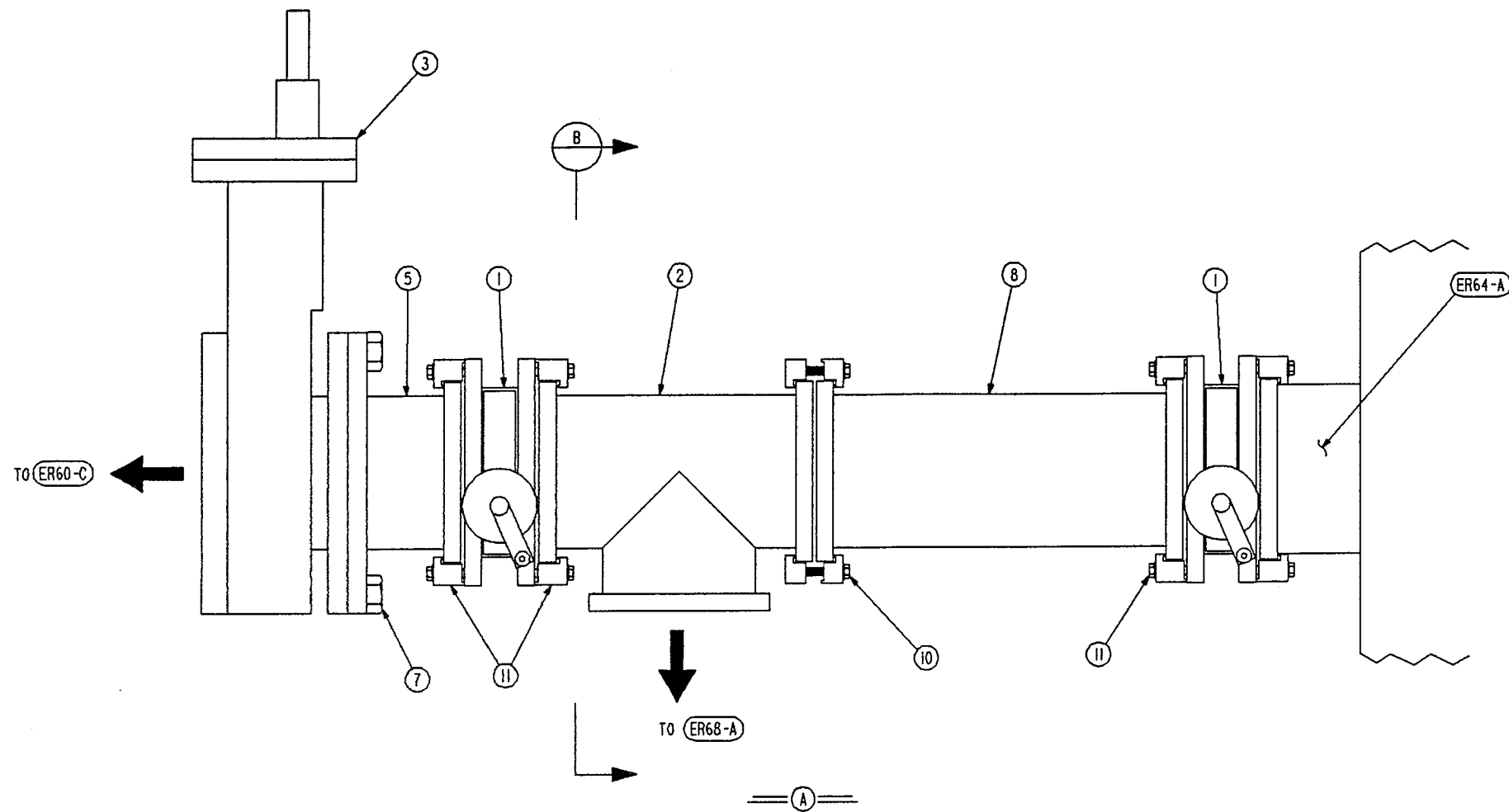
LIGO PROJECT
LEAK TEST ARRANGEMENT
VACUUM PUMP END SEAL
LIFTING FRAME
SUBASSEMBLY

Revisions:
By BSA Date 3-9-95
By BSA Date 3-29-94

SUB ASSY →
 ASSY DWG
 ER-62

MARK	ASSY PC	DESCRIPTION	LENGTH		SPEC	EST WEIGHT
			FT	INCHES		
* 1 ER66-A		MECHANICAL VACUUM PUMP LINE SUBASSY				X
ER66-1	2	UHV GATE VALVE DN 160 ISO-F (6 INCH) W/MANUAL ACTUATOR - "VAT" SERIES 10 ORDERING NO. 10844-PE01 OR EQUAL	0	2 3/4	STN STL	X
ER66-2	1	T-PIECE DN 160 ISO-K (6 INCH) "BALZERS" ORDER NO. BP 217 093-X OR EQUAL	0	10 7/8	STN STL	X
ER66-3	1	LIQUID NITROGEN TRAP W/ASA FLANGE "GNB" MODEL NO. LNT6. PART NO. 31714 OR EQUAL	0	6	STN STL	X
ER66-4	1	VITON O-RING - 1/4" NOM. SECTION 8.475 ID "LESKER" PART NO. 0-V446 OR EQUAL			VITON	-
ER66-5	1	"K" ISO 160 TO ASA 11 OD ADAPTER "LESKER" PART NO. QF160-ASAL OR EQUAL	0	4 7/8	STN STL	X
ER66-7	8	BOLT 3/4 DIA REG FIN HEX HEAD	0	2	A307B	X
ER66-8	1	FULL NIPPLE "K"-ISO 160 TUBE 6 OD "LESKER" PART NO. QF160-600-NL OR EQUAL	0	10 7/8	STN STL	X
ER66-9	5	STAINLESS/AL CENTERING RING (BUNA-N) FOR ISO FLANGE SIZE 160 (6 INCH) "LESKER" PART NO. QF160-SABR OR EQUAL	0	5/32	STN/AL	X
ER66-10	8	AL DOUBLE CLAMP "K"-STYLE FOR ISO FLANGE SIZE 160 (6 INCH) "LESKER" PART NO. QF-SDC-AL2 OR EQUAL			ALUM	X
ER66-11	32	AL SINGLE CLAMP (METRIC) "F"-STYLE FOR ISO FLANGE SIZE 160 (6 INCH) THREAD M10 "LESKER" PART NO. QF-MSC-ALM			ALUM	X
		OR EQUAL				

* BILLING FOR 1 + 3 REQUIRED.



NOTES:

1. WORK THIS DWG WITH DWG ER-62 AND ER-64.
2. THE O-RING WHICH CAN ALLOW HELIUM TO PERMEATE TO THE HMS MUST BE BAGGED AND PURGED WITH NITROGEN OR REPLACED WITH METAL SEAL IF HELIUM PERMEATED PREVENTS LEAK TESTING TO A SENSITIVITY OF 1×10^{-10} atmcc/sec.

CAD FILE 30212066.DGN

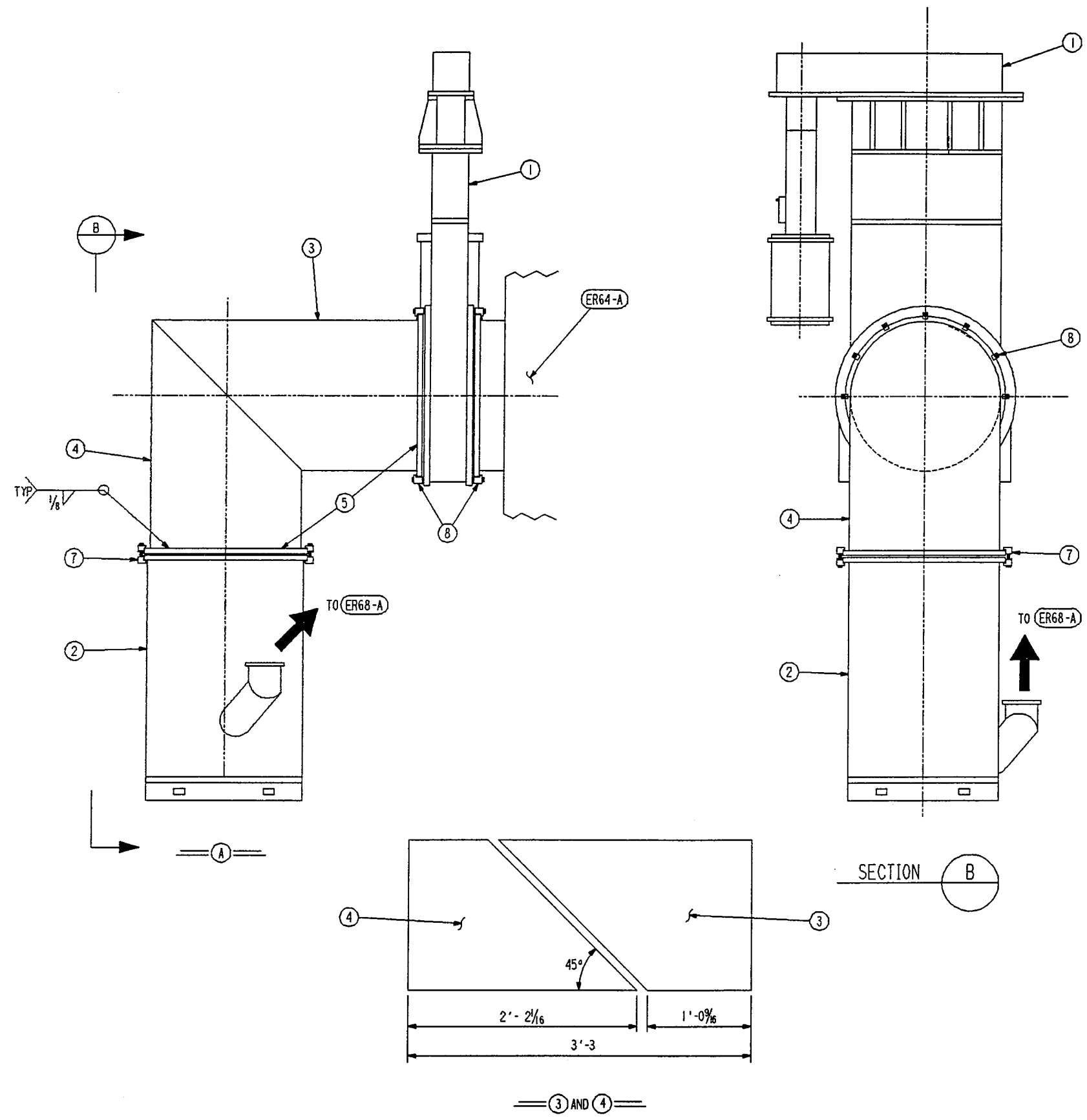
INDICATES CHANGE FROM PREVIOUS ISSUE

Supplier's/Purchaser's No.		Contract No. 930212ER	
Customer's No.		Dwg. ER-66 Rev. 2	
By BSA Chkd RDS Date 3-11-94 J. L. RINGELSTETTER Engineering Supervisor		Sheet *	
ADD NOTE 2	MODIFY TITLE BLOCK	GENERAL REV.	REVISIONS
By	Chkd	Date	Date
By	Chkd	Date	Date
By	Chkd	Date	Date
By	Chkd	Date	Date
By	Chkd	Date	Date
By	Chkd	Date	Date

SUB ASSY →
 ASSY DWG
 ER-62

MARK	ASSY PC	DESCRIPTION	LENGTH		SPEC	EST WEIGHT
			FT	INCHES		
* 1 ER67-A		DIFFUSION PUMP LINE SUBASSEMBLY				X
ER67-1	1	UHV GATE VALVE DN 500 ISO-F (20 INCH) W/PNEUMATIC ACTUATOR (115V/60 HZ) "VAT" SERIES 10 ORDERING NO. 10054-PF44 OR EQUAL	0	6 1/8	STN STL	X
ER67-2	1	DIFFUSION PUMP DIF 500A W/CONNECTIONS DNI - DN 500 ISO-K AND DN2-DN 100 ISO-K PUMPING SPEED 11 500 L/S "BALZERS" ORDERING DATA - BP D10 005 OR EQUAL	2	8 1/8	STN STL	122
ER67-3	1	PIPE 20 SCH 10 X SK (CF PIPE 39" LONG)			STN STL	X
ER67-4	1	PIPE 20 SCH 10 X SK (CUT WITH PC 3)			STN STL	X
ER67-5	2	FLANGE "K" WELD DN 500 ISO-K (20 INCH) TUBE 20 OD "LESKER" PART NO. QF500-SWK OR EQUAL	0	11/8	STN STL	X
ER67-6	3	STAINLESS/AL CENTERING RING (BUNA-N) FOR ISO FLANGE SIZE 500 (20 INCH) "LESKER" PART NO. QF500-SABR OR EQUAL	0	7/32	STN/AL	X
ER67-7	16	AL DOUBLE CLAMP "K"-STYLE FOR ISO FLANGE SIZE 500 (20 INCH) "LESKER" PART NO. QF-SDC-AL3 OR EQUAL			ALUM	X
ER67-8	32	AL SINGLE CLAMP (METRIC) "F"-STYLE FOR ISO FLANGE SIZE 500 (20 INCH) THREAD M12 "LESKER" PART NO. QF-LSC-ALM OR EQUAL			ALUM	X

* BILLING FOR 1 + 3 REQUIRED.



NOTES:

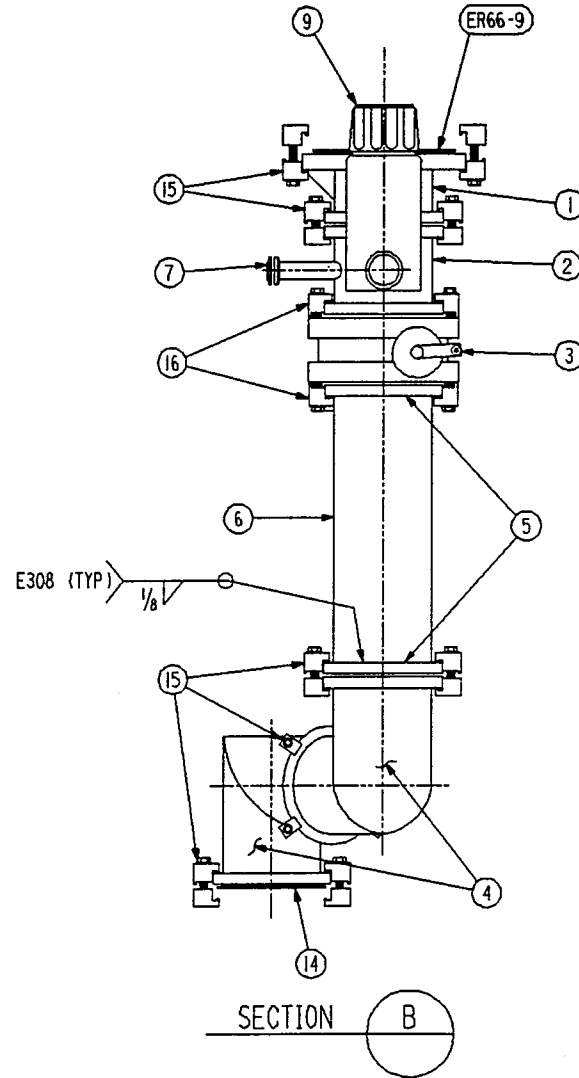
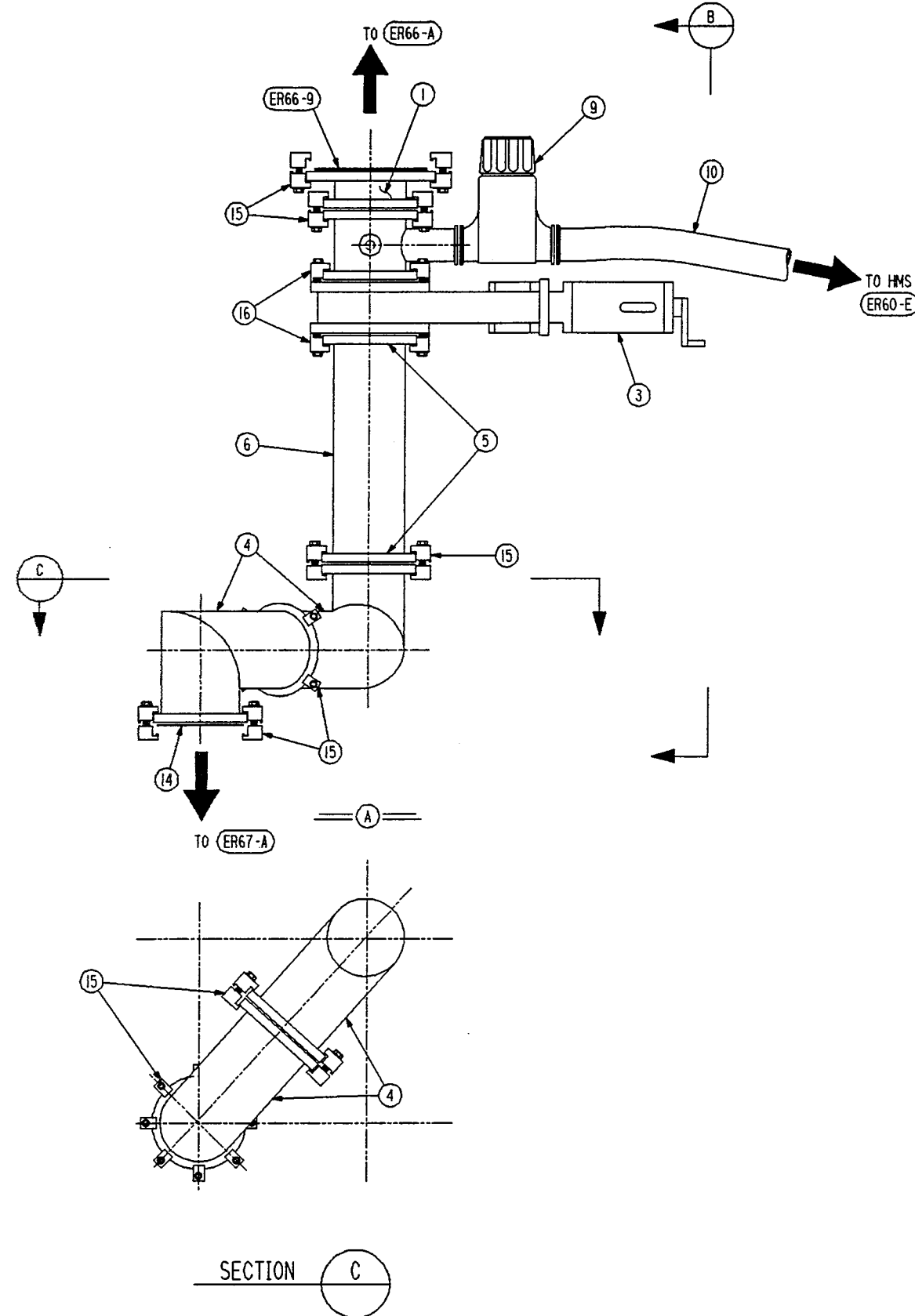
1. WORK THIS DWG WITH DWG ER-61 AND ER-64.
2. THE O-RING WHICH CAN ALLOW HELIUM TO PERMEATE TO THE HMS MUST BE BAGGED AND PURGED WITH NITROGEN OR REPLACED WITH METAL SEAL IF HELIUM PERMEATED PREVENTS LEAK TESTING TO A SENSITIVITY OF 1×10^{-8} atmcc/sec.

▶ INDICATES CHANGE FROM PREVIOUS ISSUE

CAD FILE 130212067.DGN

Supplier's/Purchaser's No. _____	
CBI	
LIGO PROJECT LEAK TEST ARRANGEMENT	
VACUUM PUMP END SEAL DIFFUSION PUMP LINE SUBASSEMBLY	
Customer's No. _____	Contract No. 930212ER
By BSA Chkd RDS Date 3-11-94	Dwg. ER-67 Rev. 2
J. L. RINGELSTETTER Engineering Supervisor	
Sheet -	2

SUB ASSY
ASSY DWG
ER-61



MARK	ASSY PC	DESCRIPTION	LENGTH		SPEC	EST WEIGHT
			FT	INCHES		
* 1 ER68-A		CROSS-OVER LINE SUBASSEMBLY				X
ER68-1	1	"K" ISO 160 TO ISO 100 REDUCER "LESKER" PART NO. QF100X160 OR EQUAL	0	2 ⁵ / ₁₆	STN STL	X
ER68-2	1	MEASURING PIECE DN 100 ISO-K (4 INCH) "BALZERS" ORDER NO. BP 217 566-X OR EQUAL	0	4 ¹ / ₄	STN STL	X
ER68-3	1	LVH GATE VALVE DN 100 ISO-F (4 INCH) W/MANUAL ACTUATOR - "VAT" SERIES 10 ORDERING NO. 10840-PE01 OR EQUAL	0	2 ³ / ₄	STN STL	X
ER68-4	2	90° MITERED ELBOW "K"-ISO 100 (4 INCH) "LESKER" PART NO. QF100-E90K OR EQUAL	0	4 ¹ / ₄	STN STL	X
ER68-5	2	FLANGE "K" WELD DN 100 ISO-K (4 INCH) "LESKER" PART NO. QF100-SMK OR EQUAL	0	5 ¹ / ₃₂	STN STL	X
ER68-6	1	TUBE 4 OD X 1 ¹ / ₁₆ PBE	0	5 ¹ / ₁₆	STN STL	X
ER68-7	1	BLANKING FLANGE DN 10 ISO-KF "BALZERS" ORDER NO. BP 212 015 OR EQUAL	0	1 ¹ / ₄	STN STL	X
ER68-8	1	CLAMPING RING DN 10 ISO-KF "BALZERS" ORDER NO. BP 217 426-T OR EQUAL			ALUM	X
ER68-9	1	KF BELLOWS-SEALED STRAIT-THROUGH VALVE W/QUICK-ACTING KNOB - MANUALLY OPERATED DN 40 KF "LEYBOLD" CAT. NO. 289 13 OR EQUAL	0	5 ¹ / ₈	STN STL	X
ER68-10	1	FLEXIBLE METAL HOSE DN 40 ISO-KF 1000 MM -LENGTH NOM. "BALZERS" ORDER NO. BP 217 498-X OR EQUAL	3	4	STN STL	X
ER68-11	2	CLAMPING RING DN 40 ISO-KF "BALZERS" ORDER NO. BP 217 428-T OR EQUAL			ALUM	X
ER68-12	2	CENTERING RING DN 40 ISO-KF "BALZERS" ORDER NO. BP 213 143-T OR EQUAL			STN/VITON	X
ER68-13	1	CENTERING RING DN 10 ISO-KF "BALZERS" ORDER NO. BP 213 265-T OR EQUAL			STN/VITON	X
ER68-14	6	STAINLESS/AL CENTERING RING (BUNA-N) FOR ISO FLANGE SIZE 100 (4 INCH) "LESKER" PART NO. QF100-SABR OR EQUAL			STN/AL	X
ER68-15	40	AL DOUBLE CLAMP "K"-STYLE FOR ISO FLANGE SIZE 100 (4 INCH) "LESKER" PART NO. QF-SDC-AL1 OR EQUAL				X
ER68-16	16	AL SINGLE CLAMP (METRIC) "F"-STYLE FOR ISO FLANGE SIZE 100 (4 INCH) THREAD M8 "LESKER" PART NO. QF-SSC-ALM PART NO. QF-SSC-ALM OR EQUAL				X
ER66-9	1	STAINLESS/AL CENTERING RING (BUNA-N) FOR ISO FLANGE SIZE 160 (6 INCH) "LESKER" PART NO. QF160-SABR OR EQUAL	0	5 ¹ / ₃₂	STN/AL	X

* BILLING FOR 1 + 3 REQUIRED.

NOTES:

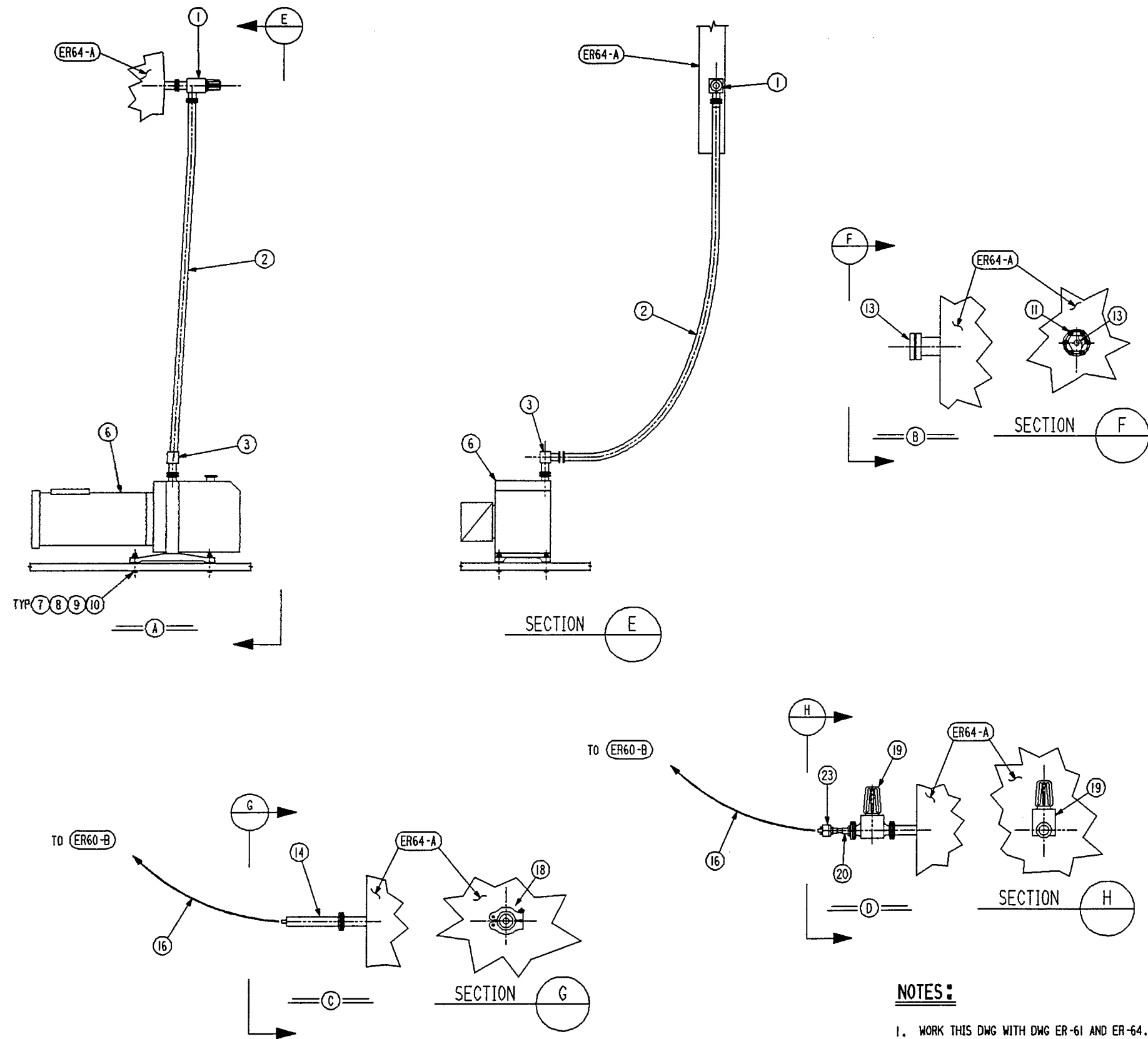
1. WORK THIS DWG WITH DWG ER-61.
2. THE O-RING WHICH CAN ALLOW HELIUM TO PERMEATE TO THE HMS MUST BE BAGGED AND PURGED WITH NITROGEN OR REPLACED WITH METAL SEAL IF HELIUM PERMEATED PREVENTS LEAK TESTING TO A SENSITIVITY OF 1 X 10⁻⁸ atmcc/sec.

CAD FILE 30212068.DGN

▶ INDICATES CHANGE FROM PREVIOUS ISSUE

Supplier's/Purchaser's No. _____	
 LIGO PROJECT LEAK TEST ARRANGEMENT VACUUM PUMP END SEAL CROSS-OVER LINE SUBASSEMBLY	
Customer's No. _____	Contract No. 930212ER
By BSA Chkd RDS Date 3-11-94	Dwg. ER-68 Rev. _____
J. L. RINGELSTETTER Engineering Supervisor	Sheet - 2

SUB ASSY
ASSY DWG
ER-61



MARK	ASSY PC	DESCRIPTION	LENGTH		SPEC	EST WEIGHT
			FT	INCHES		
* 1 ER69-A		INTERSPACE VACUUM PUMP LINE ASSEMBLY				X
ER69-1	1	KF BELLOWS-SEALED RIGHT-ANGLE VALVE W/QUICK-ACTING KNOB MANUALLY OPERATED DN 16 KF "LEYBOLD" CAT. NO. 288 II OR EQUAL	0	1 3/8	STN STL	X
ER69-2	1	PVC HOSE COMPLETE DN 16 ISO-KF 1000 MM -LENGTH NOM. "BALZERS" ORDER NO. BP 226 415-T OR EQUAL	3	4	PVC	X
ER69-3	1	ELBOW 90° DN 16 KF "LEYBOLD" CAT. NO. 88461 OR EQUAL	0	3/8	STN STL	X
ER69-4	4	CENTERING RING DN 16 ISO-KF "BALZERS" ORDER NO. BP 213 144-T OR EQUAL			STN/VITON	X
ER69-5	4	CLAMPING RING DN 16 ISO-KF "BALZERS" ORDER NO. BP 217 426-T OR EQUAL			ALUM	X
ER69-6	1	TRIVAC B ROTARY VANE PUMP MODEL D4B 3.4 CFM (96 LTR/MIN), POWER 1/3 HP, VOLTAGE 115/200-230 V(AC), FREQ. 50/60 HZ PHASE 1, WIRED FOR 115 V, W/HYDROCARBON OIL, "LEYBOLD" CAT. NO. 91245-1 OR EQUAL				51
ER69-7	4	BOLT 1/4 DIA REG FIN HEX HEAD	0	3	A307B	1
ER69-8	4	NUT 1/4 DIA HEAVY HEX			A563A	-
ER69-9	8	PLAIN WASHER 1/4 DIA WIDE			CARB STL	-
ER69-10	4	LOCK WASHER 1/4 DIA STD SPLIT TYPE			CARB STL	-
* 1 ER69-B		RGA SENSOR ASSEMBLY				X
ER69-11	1	SET OF HEX BOLTS W/DUO NUTS DN 40 CF "BALZERS" ORDER NO. BN 845 184-T OR EQUAL			STN STL	X
ER69-12	1	VITON SEAL RING DN 40 CF "BALZERS" ORDER NO. BN 845 324-T OR EQUAL			VITON	X
ER69-13	1	BLANKING FLANGE DN 40 CF-F "BALZERS" ORDER NO. BP 414 296 OR EQUAL			STN STL	X
* 1 ER69-C		IONIZATION GAUGE OUTLET ASSEMBLY				X
ER69-14	1	UHV-24 NUDE TUBE ON NW 40 KF FLANGE "VARIAN" ORDER NO. 0500-MSP-A2399				4
ER69-16	1	CABLE "VARIAN" PART NO. L6440310	10	0	X	X
ER69-17	1	CENTERING RING ASSY DN 40 KF "LEYBOLD" CAT. NO. 88348 OR EQUAL			X	X
ER69-18	1	CLAMP DN 40 KF "LEYBOLD" CAT. NO. 18343			ALUM	X
* 1 ER69-D		THERMAL CONDUCTIVITY GAUGE ASSY				X
ER69-19	1	KF BELLOWS-SEALED STRAIGHT-THROUGH VALVE - MANUALLY OPERATED DN 25 KF W/QUICK-ACTING KNOB "LEYBOLD" CAT. NO. 289 12 OR EQUAL	0	3 5/8	STN STL	X
ER69-20	1	KF/NPT FEMALE ADAPTER -1/8" DN 25 KF "LEYBOLD" CAT. NO. 899605 OR EQUAL	0	1	STN STL	X
ER69-21	2	CENTERING RING ASSY DN 25 KF "LEYBOLD" CAT. NO. 88347 OR EQUAL			STN/VITON	X
ER69-22	2	CLAMP DN 25 KF "LEYBOLD" CAT. NO. 18342			ALUM	X
ER69-23	1	531 THERMOCOUPLE GAUGE TUBE "VARIAN" PART NO. 0531-F0472-303			X	X
ER69-16	1	CABLE "VARIAN" PART NO. L6475312	10	0	X	X

* BILLING FOR 1 + 3 REQUIRED.

Supplier's/Purchaser's No. _____

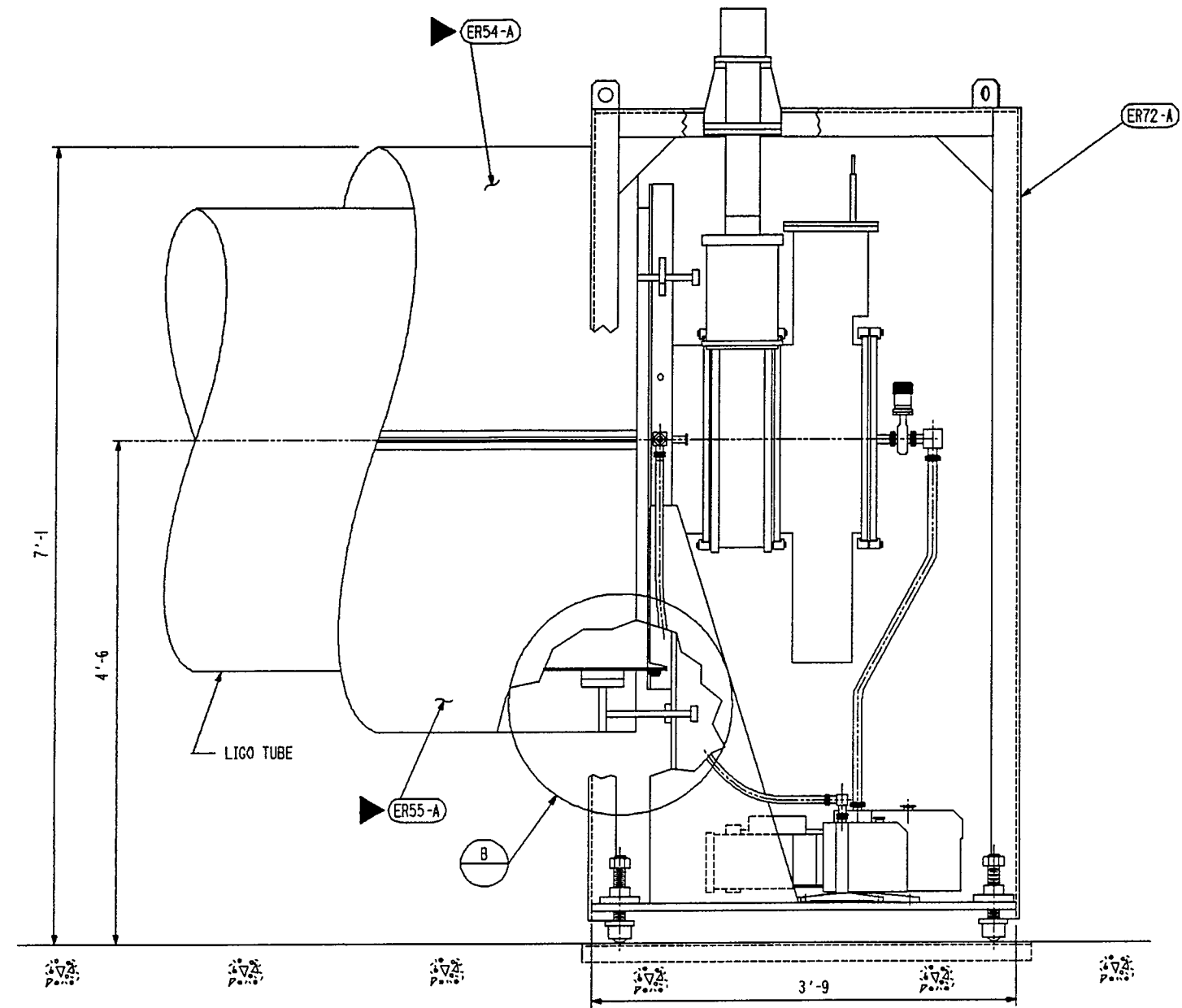
NOTES:

1. WORK THIS DWG WITH DWG ER-61 AND ER-64.
2. THE O-RING WHICH CAN ALLOW HELIUM TO PERMEATE TO THE HMS MUST BE BAGGED AND PURGED WITH NITROGEN OR REPLACED WITH METAL SEAL IF HELIUM PERMEATED PREVENTS LEAK TESTING TO A SENSITIVITY OF 1×10^{-8} atmcc/sec.

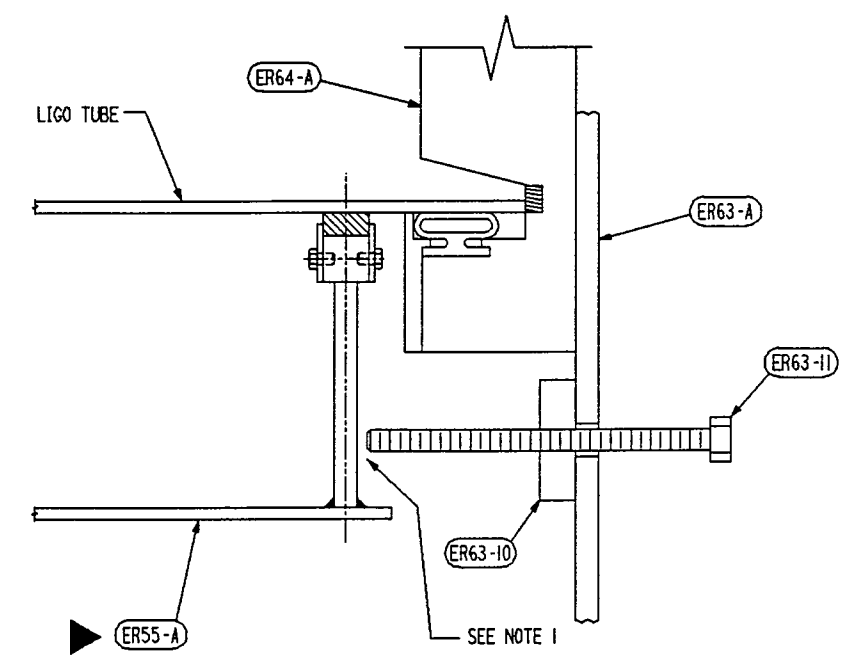
▶ INDICATES CHANGE FROM PREVIOUS ISSUE

<p>ADD NOTE 2 MODIFY TITLE BLOCK GENERAL REV.</p>		<p>Remarks</p>
<p>By: J.L. RINGELSTETTER Date: 3-14-94</p>	<p>By: J.L. RINGELSTETTER Date: 3-14-94</p>	
<p>Supplier's/Purchaser's No. _____</p>		
<p>CBI</p>		
<p>LIGO PROJECT LEAK TEST ARRANGEMENT</p>		
<p>VACUUM PUMP END SEAL INTERSPACE VACUUM PUMP LINE SUBASSY SENSORS CONNECTION SUBASSY</p>		
<p>Customer's No. _____</p>	<p>Contract No. 930212ER</p>	
<p>By: J.L. RINGELSTETTER Date: 3-14-94 Engineering Supervisor</p>	<p>Dwg. ER-69 Sheet - 2</p>	<p>Rev. 2</p>

CAD FILE 3022069.DGN



ELEVATION VIEW



TYP DETAIL B
SEE NOTE 2

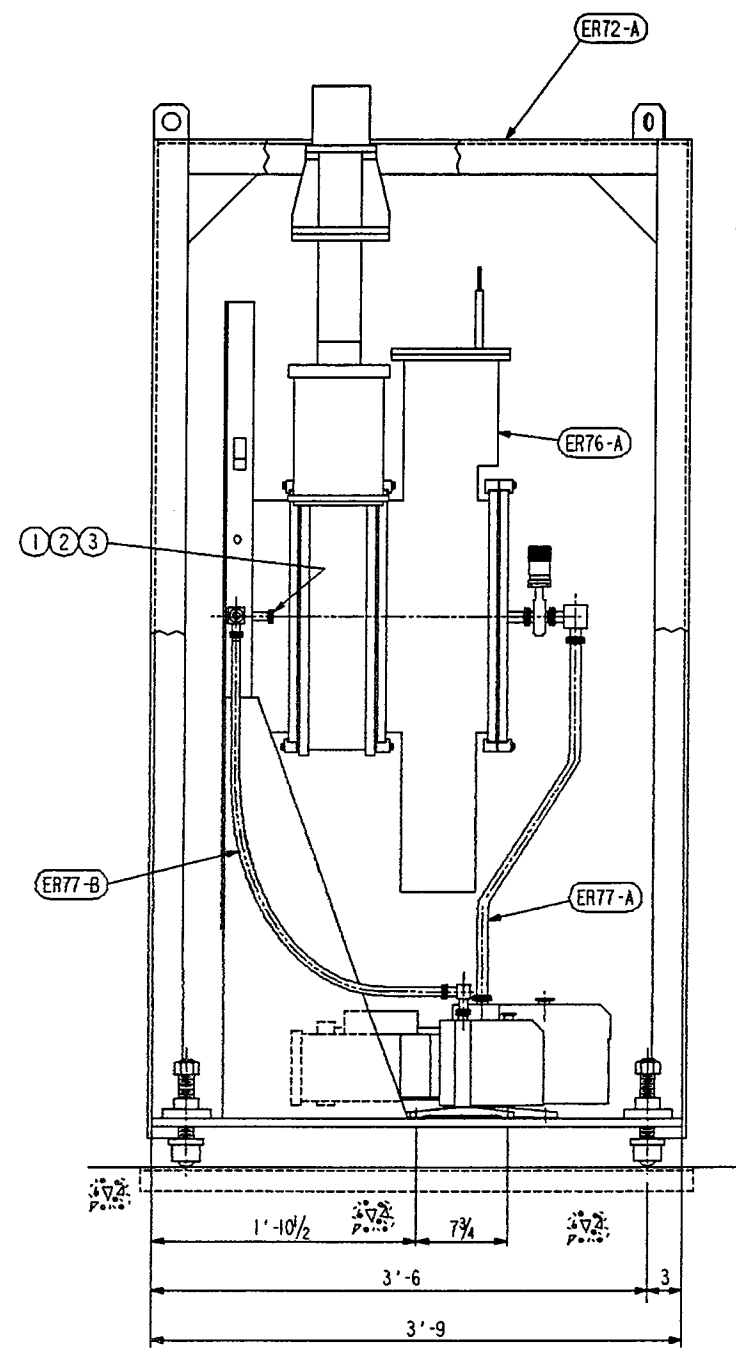
NOTES:

1. 1/4 GAP BEFORE VACUUM IN LIGO TUBE.
BOLT (ER63-11) BEARS AGAINST HELIUM HOOD DURING VACUUM.
2. TYP DETAIL AT 180° (BOTTOM). DETAIL SIMILAR AT 60° AND 300° EXCEPT PC (ER63-10) IS WELDED TO (ER64-A).
3. WORK THIS DWG WITH DWG ER-60 AND ER-61.

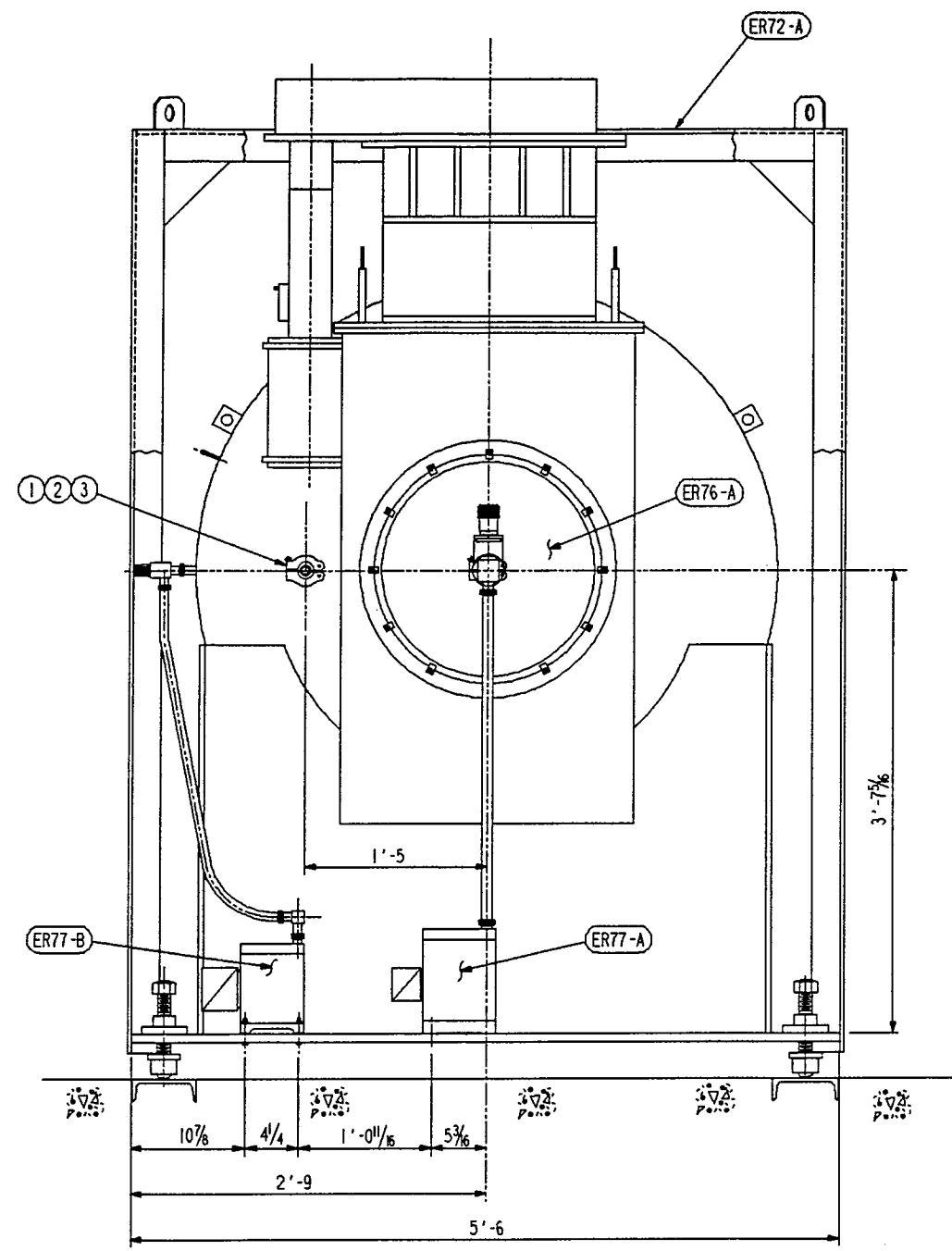
CAD FILE 30212070.DGN

▶ INDICATES CHANGE FROM PREVIOUS ISSUE

Supplier's/Purchaser's No. _____																					
LIGO PROJECT LEAK TEST ARRANGEMENT COLD TRAP END SEAL																					
Customer's No. _____	Contract No. 930212ER																				
By BSA Chkd RDS Date 3-15-94	Dwg. ER-70 Rev. _____																				
J.L. RINGELSTETTER Engineering Supervisor	Sheet - 2																				
<table border="1"> <thead> <tr> <th>By</th> <th>Date</th> <th>By</th> <th>Date</th> <th>By</th> <th>Date</th> <th>By</th> <th>Date</th> <th>By</th> <th>Date</th> </tr> </thead> <tbody> <tr> <td> </td> <td> </td> <td> </td> <td> </td> <td> </td> <td> </td> <td> </td> <td> </td> <td> </td> <td> </td> </tr> </tbody> </table>		By	Date	By	Date	By	Date	By	Date	By	Date										
By	Date	By	Date	By	Date	By	Date	By	Date												



RIGHT SIDE VIEW



A

SHP PC	MARK	ASSY PC	DESCRIPTION	LENGTH		SPEC	EST WEIGHT
				FT	INCHES		
*	ER71-A		COLD TRAP END SEAL ASSEMBLY				X
	ER72-A		CARRIAGE SUBASSEMBLY				X
	ER76-A		COLD TRAP LINE SUBASSEMBLY				X
	ER77-A		COLD TRAP EVACUATION LINE SUBASSY				X
	ER77-B		INTERSPACE VACUUM PUMP LINE				X
			PERMEATION HELIUM STANDARD LEAK CONNECTION				
	ER71-1		CENTERING RING DN 16 KF "LEYBOLD" CAT.NO. 88346 OR EQUAL			STN/VITON	X
	ER71-2		BLANK FLANGE DN 16 KF "LEYBOLD" CAT.NO. 88436 OR EQUAL			STN STL	X
	ER71-3		CLAMP DN 16 KF "LEYBOLD" CAT.NO.18341 OR EQUAL			ALUM	X

* BILLING FOR 1 + 3 REQUIRED.

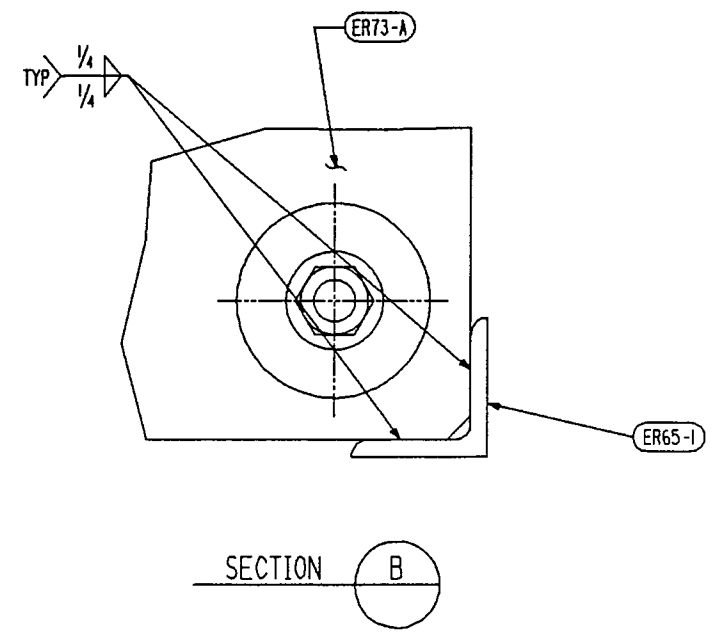
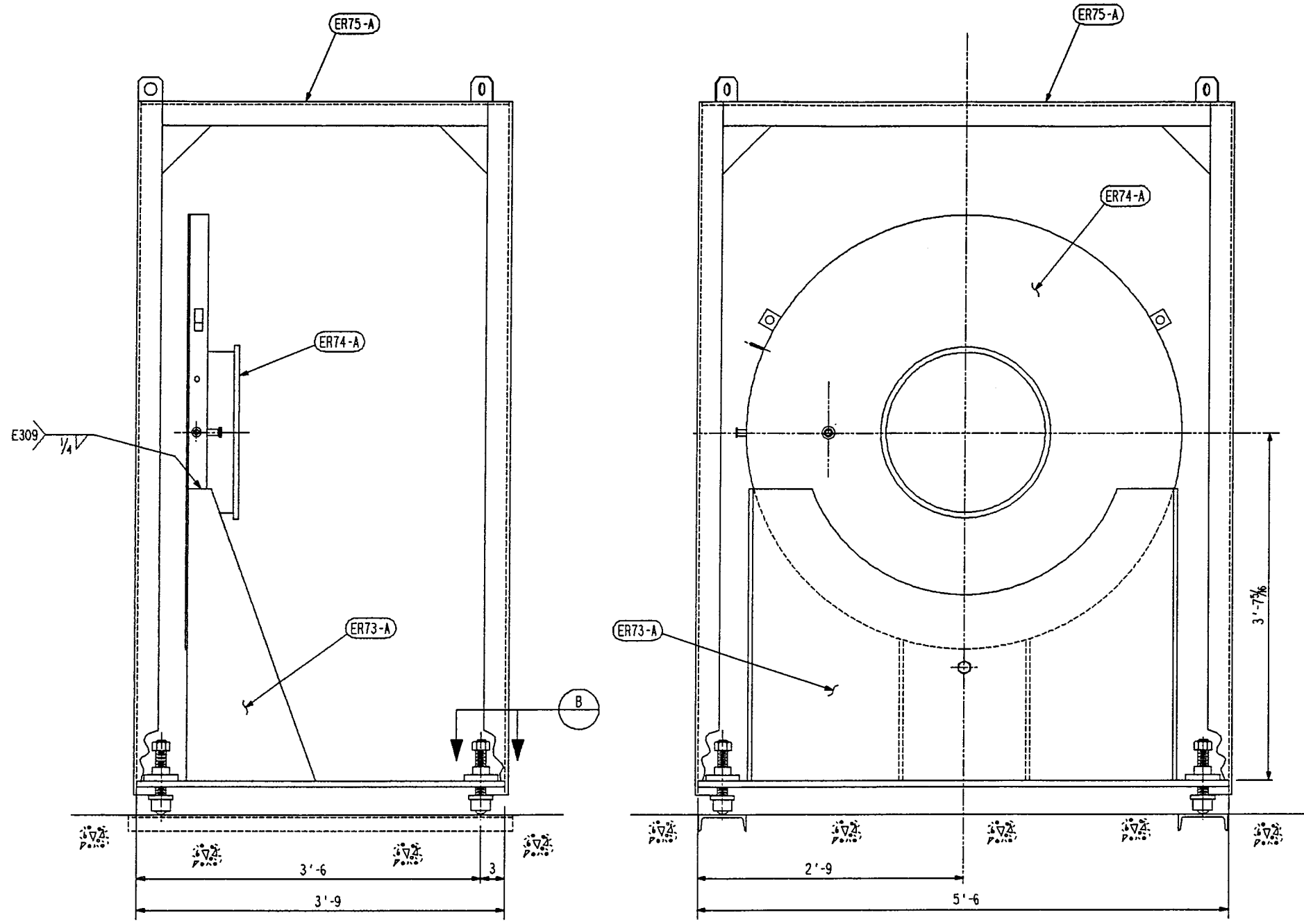
CAD FILE 30212071.DGN

Supplier's/Purchaser's No.	
LIGO PROJECT LEAK TEST ARRANGEMENT COLD TRAP END SEAL ASSEMBLY	
Customer's No.	Contract No.
By BSA Chkd RDS Date 3-1584	930212ER
J. L. RINGELSTETTER Engineering Supervisor	Dwg. ER-71 Rev. 2 Sheet - 2
Revisions By Chkd Date 1 IN UPDATE DRAWING 2 BY HRS MODIFY TITLE BLOCK 3 BY RJA GENERAL REV. Date 5-9-93 Date 3-1-94 Date 4-3-94	Remarks

INDICATES CHANGE FROM PREVIOUS ISSUE

SHIP PC	MARK	ASSY PC	DESCRIPTION	LENGTH		SPEC	EST WEIGHT
				FT	INCHES		
* 1	ER72-A		CARRIAGE SUBASSEMBLY				X
	ER73-A		ROLLING BASE SUBASSY				X
	ER74-A		END CAP SUBASSEMBLY				X
	ER75-A		LUFTING FRAME SUBASSEMBLY				X

* BILLING FOR 1 & 3 REQUIRED.



NOTES:

1. WORK THIS DWG WITH DWG ER-73, ER-74 AND ER-75.

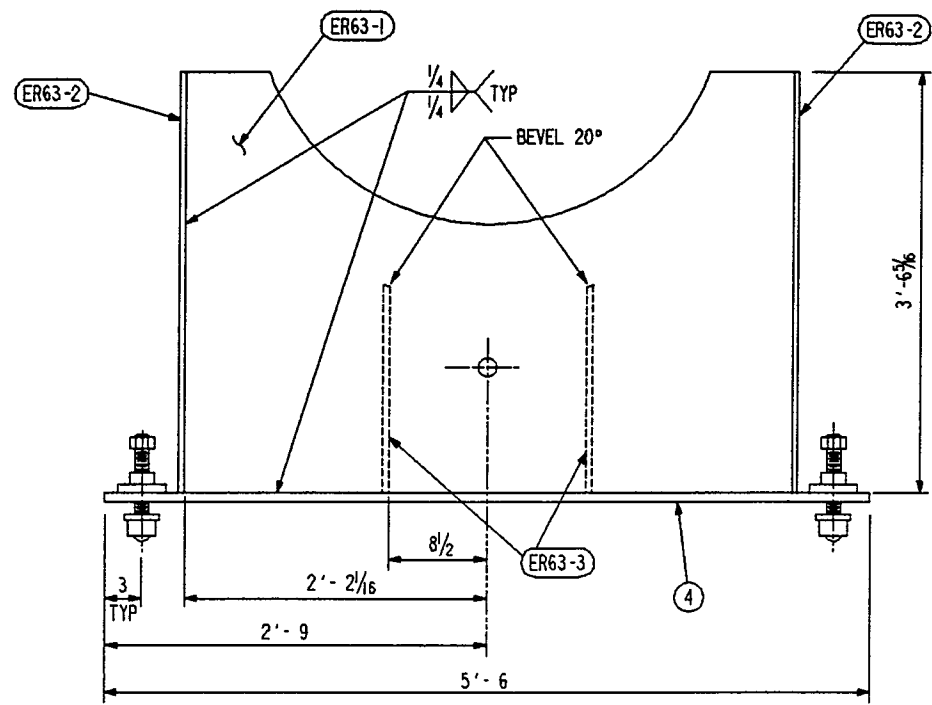
CAD FILE 30212072.DGN

— A —
RIGHT SIDE VIEW

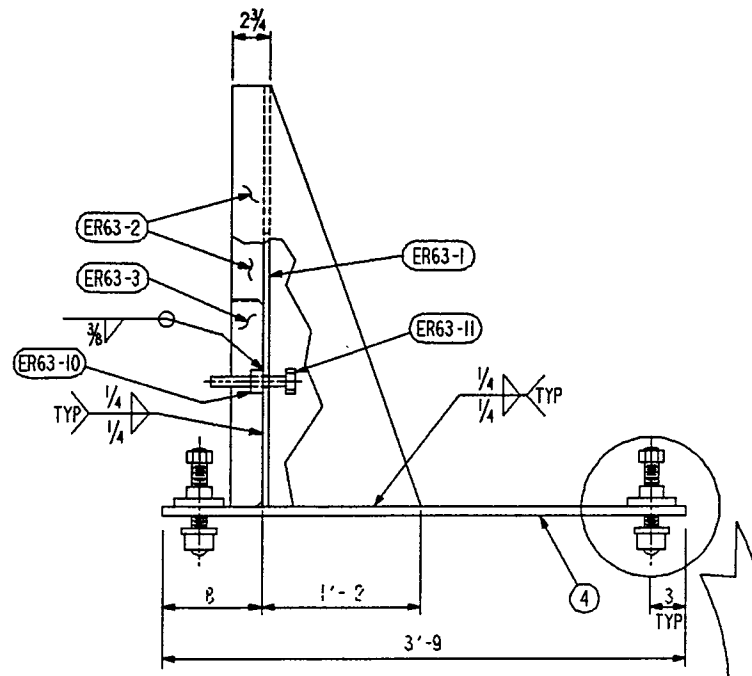
— A —

Supplier's/Purchaser's No. _____	
LIGO PROJECT LEAK TEST ARRANGEMENT COLD TRAP SEAL END CARRIAGE SUBASSEMBLY	
Customer's No. _____	Contract No. 930212ER
By BSA Chkd RDS Date 3-15-94	Dwg. ER-72 Rev. 2
J.L. RINDELSTETTER Engineering Supervisor	
Revisions By Chkd Dts Date 1. _____ 2. _____ 3. _____	

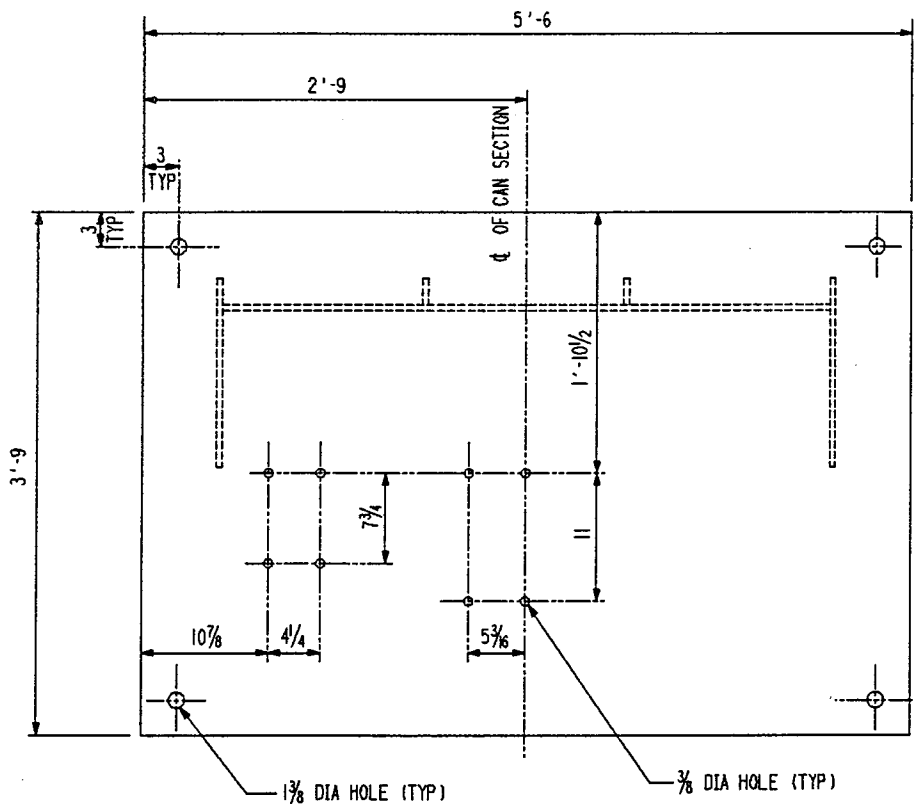
▶ INDICATES CHANGE FROM PREVIOUS ISSUE



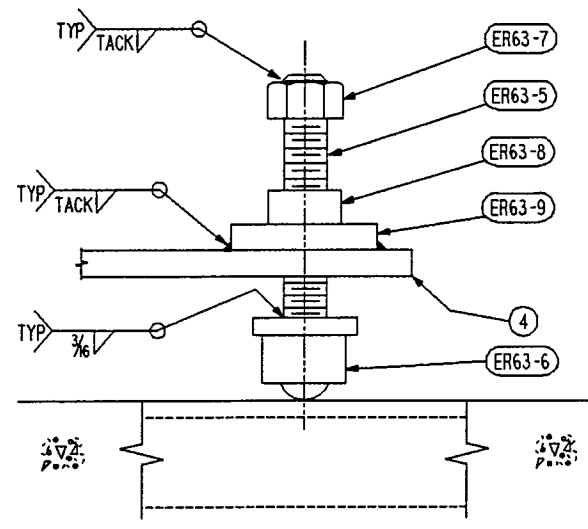
ELEVATION VIEW (A)



SIDE VIEW (A)



(4)



SUB ASSY →
ASSY DWG
ER-72

MARK	ASSY PC	DESCRIPTION	LENGTH		SPEC	EST WEIGHT
			FT	INCHES		
* 1	ER73-A	ROLLING BASE SUBASSEMBLY				X
	ER63-1	1 PLATE SK X 1/2 (CF 43" X 4'-4 1/8")			A36	X
	ER63-2	2 PLATE SK X 1/2 (CF 19" X 3'-7 C2)			A36	X
	ER63-3	2 PLATE 2 1/4 X 1/2 BOE 20°	1	11 1/8	A36	X
	ER72-4	1 PLATE 45 X 1/2 X SK	5	6	A36	X
	ER63-5	4 ACME ROD 1/4 DIA - 5TPI RIGHT-HAND THD "McMASTER-CARR" NO. 98935A131	0	6	CARB STL	X
	ER63-6	4 FLANGE MOUNTED UNIT - 1/2 DIA BALL TRANSFER HIGH CAP. "McMASTER-CARR" NO. 2415T64 ZINC PLATED			CARB STL	X
	ER63-7	4 ACME NUT 1/4 DIA - 5TPI RIGHT-HAND THD "McMASTER-CARR" NO. 94815A116			CARB STL	X
	ER63-8	4 ACME BRONZE ROUND NUT 1/4 DIA - 5TPI RIGHT-HAND TRD "McMASTER-CARR" NO. 95072A118			BRONZE	X
	ER63-9	4 ACME MOUNTING FLANGE 1/4 DIA "McMASTER-CARR" NO. 95082A645			CARB STL	X
	ER63-10	1 PLATE SK X 1" (CF 3 X 0'-3 C1)			A36	X
	ER63-11	1 BOLT 1" DIA REG FIN HEX HEAD THREAD FULL LENGTH	0	6	A307B	X

* BILLING FOR 1 : 3 REQUIRED.

NOTES:

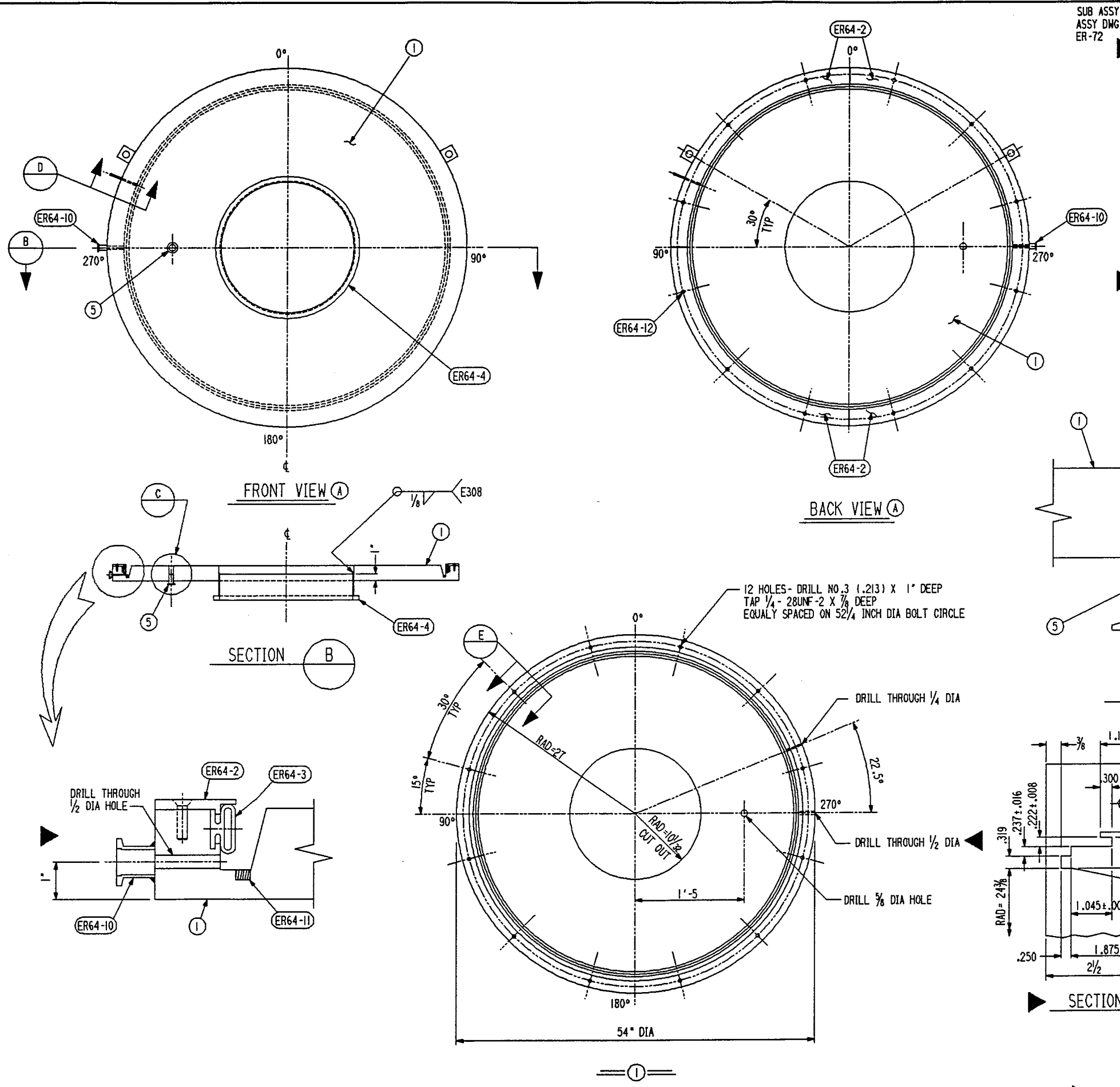
1. WORK THIS DWG WITH DWG ER-63 AND ER-72.

CAD FILE 30212073.DGN

INDICATES CHANGE FROM PREVIOUS ISSUE

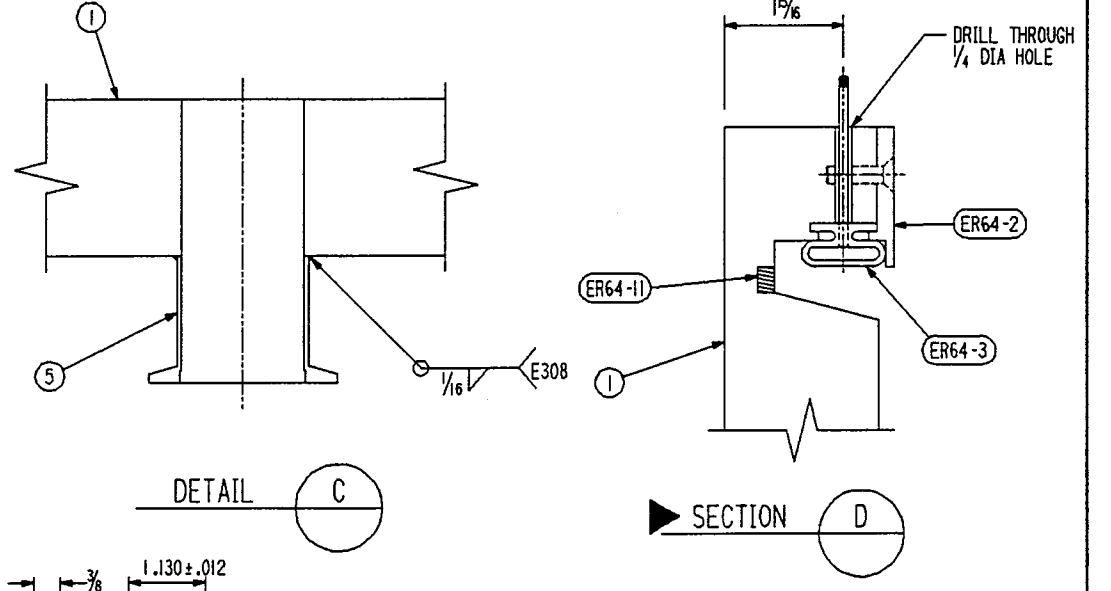
Supplier's/Purchaser's No. _____	
<p>LIGO PROJECT LEAK TEST ARRANGEMENT COLD TRAP END SEAL ROLLING BASE SUBASSEMBLY</p>	
Customer's No. _____	Contract No. 930212ER
By BSA Chkd RDS Date 3-15-94	Dwg. ER-73 Rev. 2
J. L. RINGESTETTER Engineering Supervisor	Sheet - 2

CAD FILE 30212074.DGN



MARK	ASSY PC	DESCRIPTION	LENGTH		SPEC	EST WEIGHT
			FT	INCHES		
ER74-A		END CAP SUBASSY				X
ER74-1	1	PLATE 54 OD X 2 1/2 X SK (CF 54\"/>				
ER64-2	4	PLATE SK X 9/16 (MACHINING AND DRILLING)			SS-304 L	X
ER64-3	1	INFLATABLE ROUND PNEUMA-SEAL 50 1/4 OD *PRESRAY* TYPE- PRS 537 W/ 1A STANDARD AIR CONNECTOR			EPDM	-
ER64-4	1	PORT FITTING DN 500 ISO-K *BALZERS* NO. BP 217 922-X (100 MM-LENGTH) OR EQUAL	0	3 5/8	STN STL	X
ER74-5	1	FLANGE, LONG WELD STUB DN 16 ISO-KF *LEYBOLD* CAT. NO. 899621 (40 MM-LENGTH) OR EQUAL	0	1 7/8	STN STL	X
ER64-10	1	FLANGE, SHORT WELD STUB DN 16 ISO-KF *LEYBOLD* CAT. NO. 899611 (19 MM-LENGTH) OR EQUAL	0	1 3/8	STN STL	X
ER64-11	1	70 DUROMETER BUTYL RUBBER RING 49/4 OD 1/4 X 3/8 CROSS SECTION (VULCANIZED JOINT)			BUTYL RUBBER	1
ER64-12	12	1/4-28 X 1\"/>				
ER63-10	2	PLATE SK X 1\"/>				
ER63-11	2	BOLT 1\"/>				

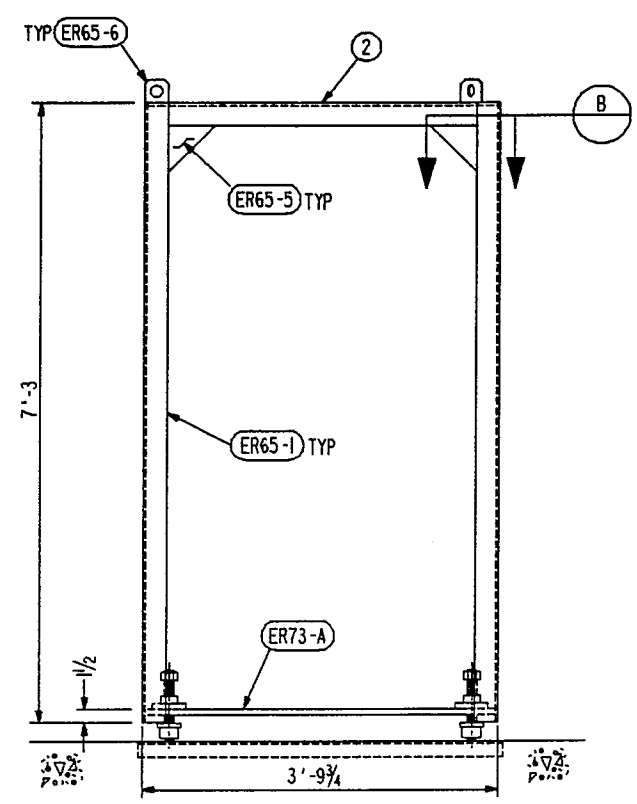
* BILLING FOR 1 + 3 REQUIRED.



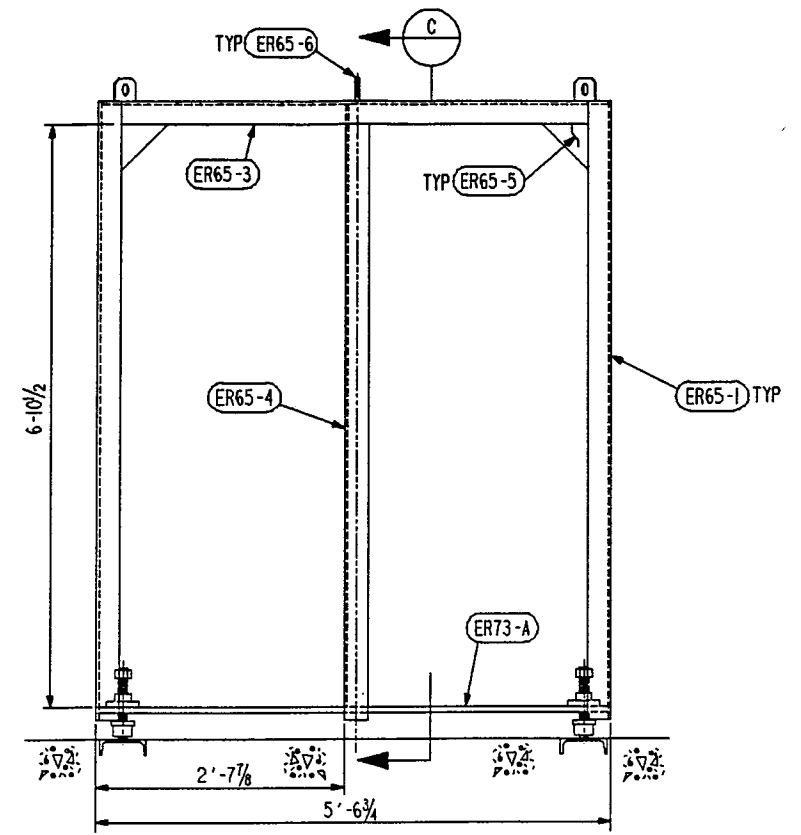
NOTES:
1. TOLERANCES ON MACHINING DIMENSIONS X.XXX ± .015 UNLESS NOTED.

Supplier's/Purchaser's No.	
CBI	
LIGO PROJECT LEAK TEST ARRANGEMENT	
COLD TRAP SEAL END END CAP SUBASSEMBLY	
Customer's No.	Contract No.
By BSA Chkd RRS Date 3-15-94	930212ER
J. L. RINGELSTETTER Engineering Supervisor	Dwg. ER-74 Rev. 2 Sheet - 2

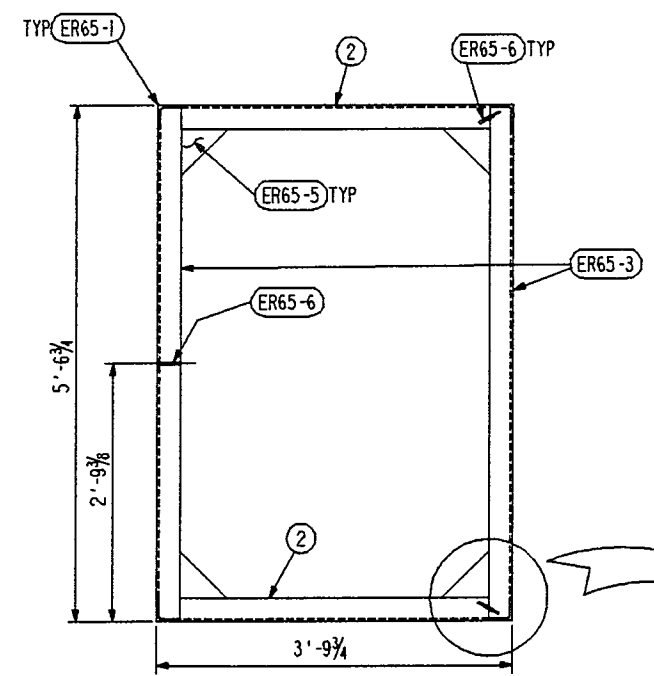
INDICATES CHANGE FROM PREVIOUS ISSUE



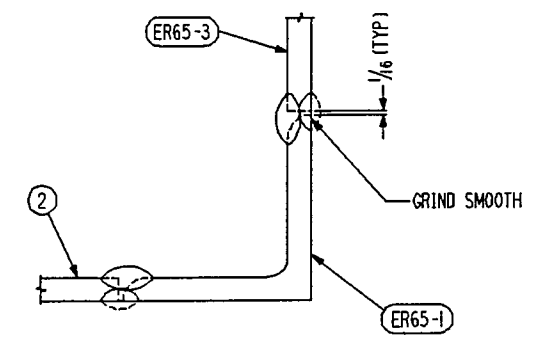
ELEVATION VIEW



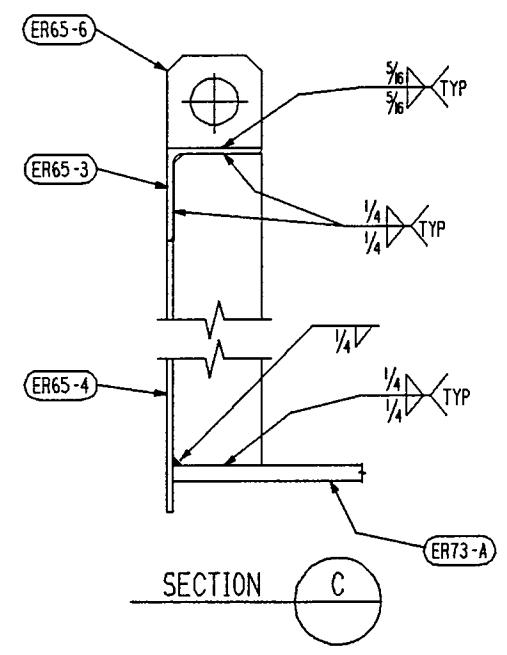
LEFT SIDE VIEW



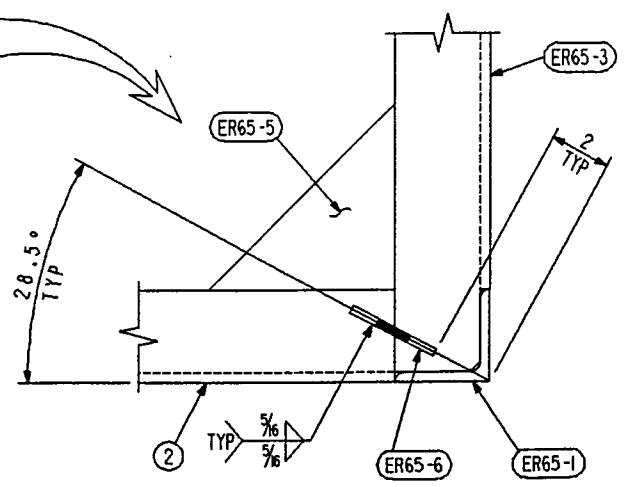
TOP VIEW



SECTION B



SECTION C



SUB ASSY
ASSY DWG
ER-72

#	MARK	ASSY PC	DESCRIPTION	LENGTH		SPEC	EST WEIGHT
				FT	INCHES		
* 1	ER75-A		LIFTING FRAME SUBASSEMBLY				413
	ER65-1	4	L3 X 3 X 3/8	7	3	A36	208
	ER75-2	2	L3 X 3 X 3/8	3	3 3/4	A36	48
	ER65-3	2	L3 X 3 X 3/8 X SK	5	6	A36	79
	ER65-4	1	L3 X 3 X 3/8 X SK	7	2 7/8	A36	52
	ER65-5	12	PLATE 3/8 X SK (CF 6 X 0'-6 C2)			A36	23
	ER65-6	3	PLATE 1/2 X SK			A36	3

* BILING FOR 1 + 3 REQUIRED.

NOTES:

1. WORK THIS DWG WITH DWG ER-65, ER-72, AND ER-73.

CAD FILE 30212075.DGN

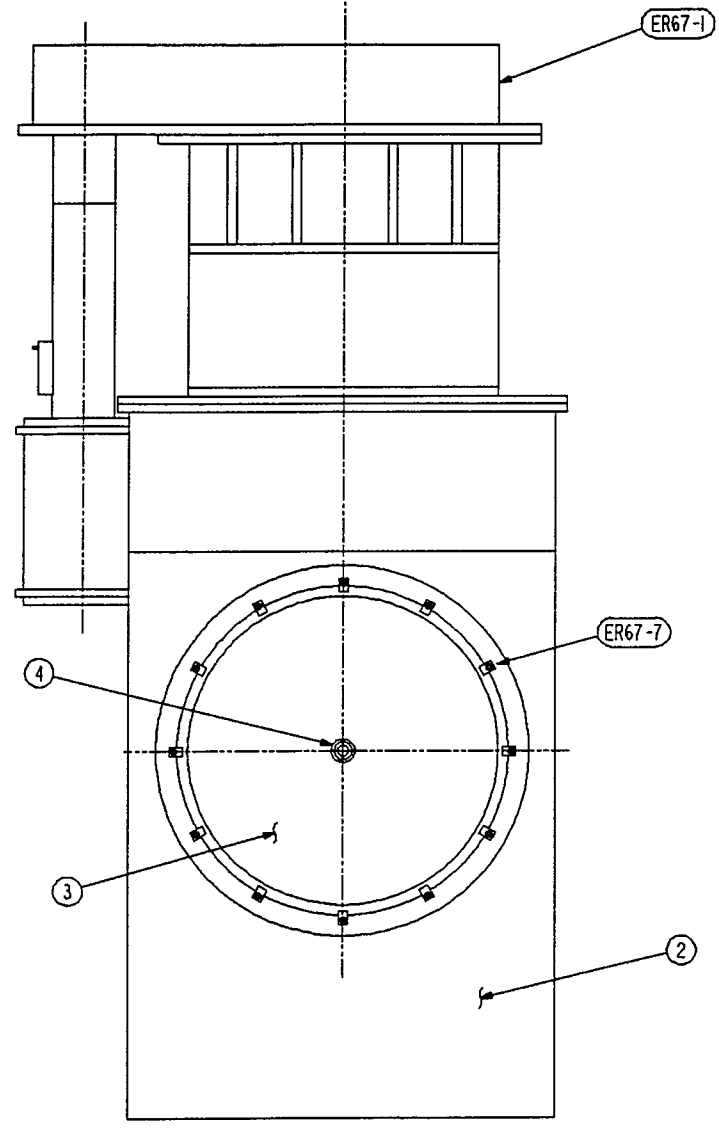
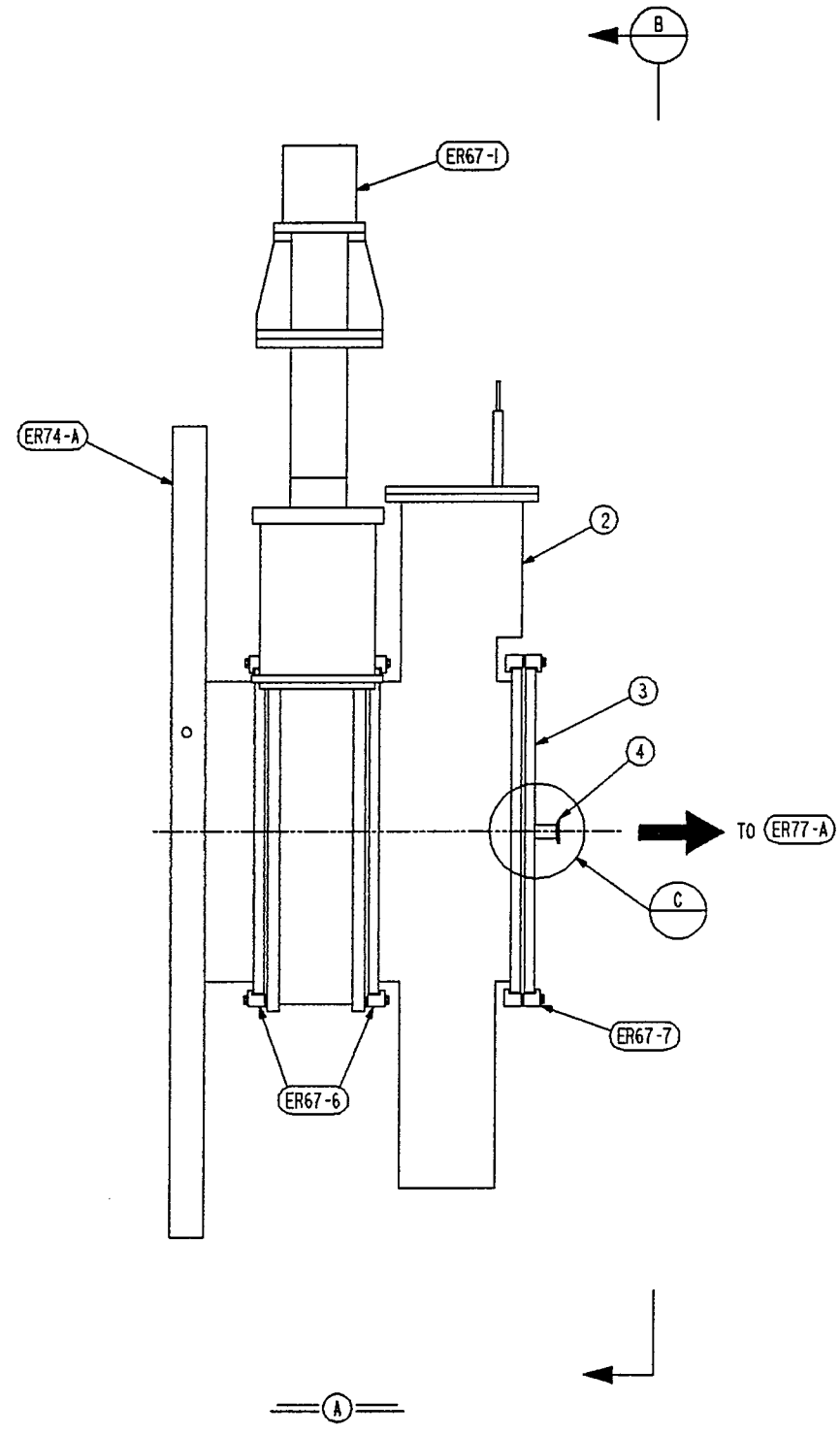
INDICATES CHANGE FROM PREVIOUS ISSUE

Supplier's/Purchaser's No.		Contract No. 930212ER	
<p>LIGO PROJECT LEAK TEST ARRANGEMENT COLD TRAP END SEAL LIFTING FRAME SUBASSEMBLY</p>		Customer's No.	Dwg. ER-75
		By BSA Chkd RDS Date 3-15-94 J. L. RINGELSTETTER Engineering Supervisor	Rev. 2
By Chkd Date	By Chkd Date	By Chkd Date	By Chkd Date
Update Drawing	BSA RDS	BSA RDS	BSA RDS
Modify Title Block	5-10-95	3-31-94	3-31-94
General Rev.			

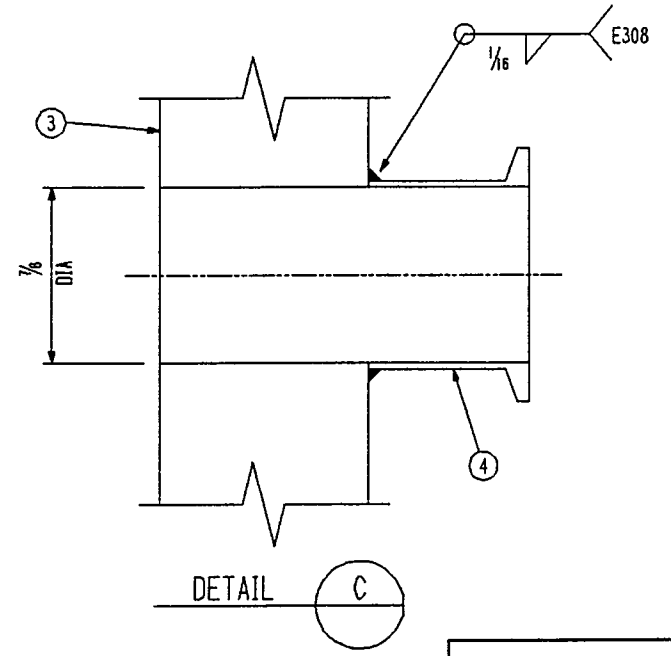
SUB ASSY →
 ASSY DWG
 ER-71

MARK	ASSY PC	DESCRIPTION	LENGTH		SPEC	EST WEIGHT
			FT	INCHES		
* 1 ER76-A		COLD TRAP LINE SUBASSEMBLY				X
ER67-1	1	UHV GATE VALVE DN 500 ISO-F (20 INCH) W/ELECTROPNEUMATIC ACTUATOR (115V/60 HZ) "VAT" SERIES 10, ORDER NO. 10054-PE44 OR EQUAL			STN STL	X
ER67-6	3	STAINLESS/AL CENTERING RING (BUNA-N) FOR ISO FLANGE SIZE 500 (20 INCH) "LESKER" PART NO. QF500-SABR OR EQUAL			STN/AL	X
ER67-7	8	AL DOUBLE CLAMP "K"-STYLE FOR ISO FLANGE SIZE 500 (20 INCH) "LESKER" PART NO. QF-SDC-AL3 OR EQUAL			ALUM	X
ER67-8	16	AL SINGLE CLAMP (METRIC) "F"-STYLE FOR ISO FLANGE SIZE 500 (20 INCH) THREAD M12 "LESKER" PART NO. QF-LSC-ALM OR EQUAL			ALUM	X
ER76-2	1	LIQUID NITROGEN TRAP "GNB CORP" MODEL LNT-20 W/ISO-K FLANGES PART NO. 35607 OR EQUAL			STN STL	X
ER76-3	1	BLANK FLANGE ISO 500-K W/HOLE 1/2 DIA "LESKER" PART NO. QF500-BK OR EQUAL			STN STL	X
ER76-4	1	SMALL LONG FLANGE DN 25 ISO-KF "BALZERS" ORDER NO. BP 217 220 OR EQUAL			STN STL	X

* BILLING FOR 1 + 3 REQUIRED.



SECTION B



DETAIL C

NOTES:

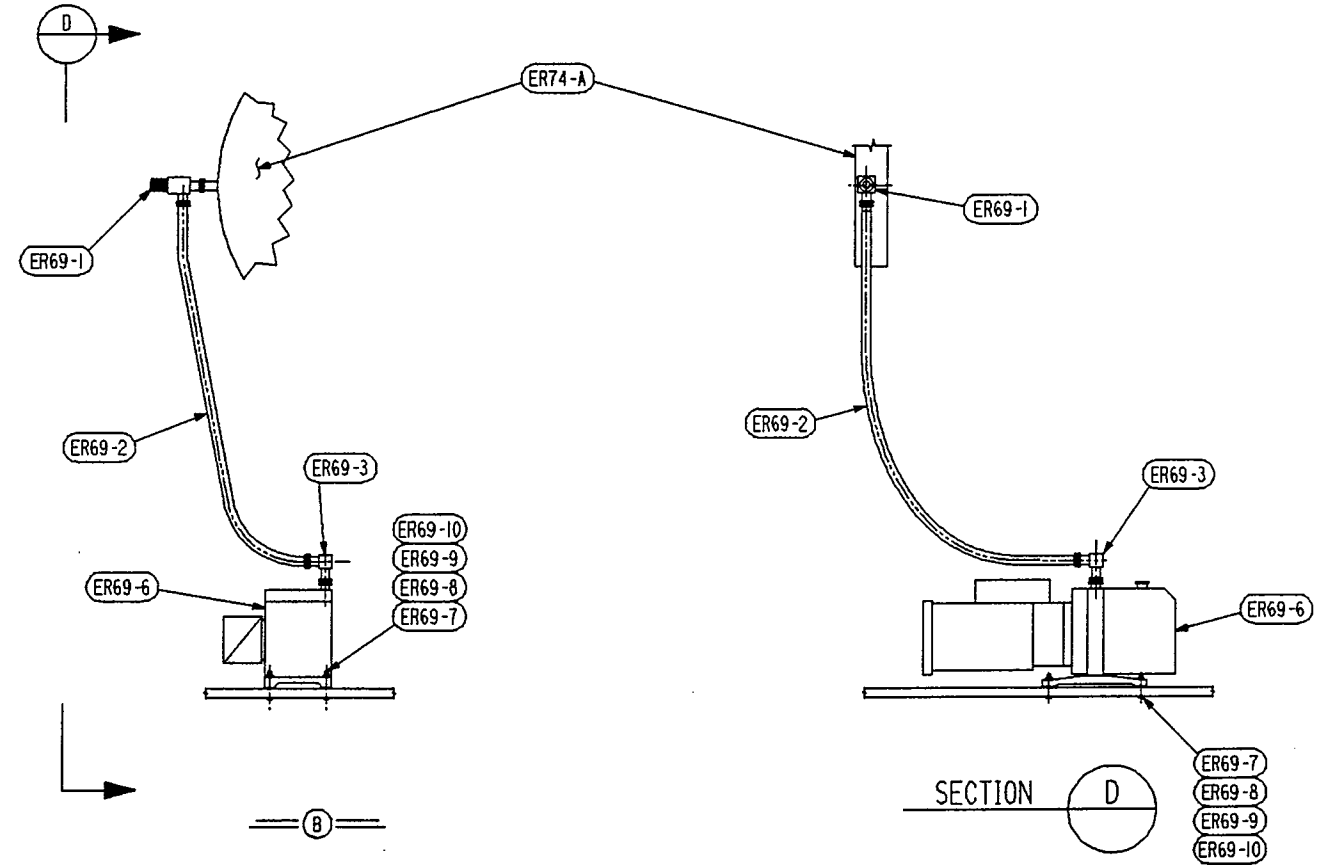
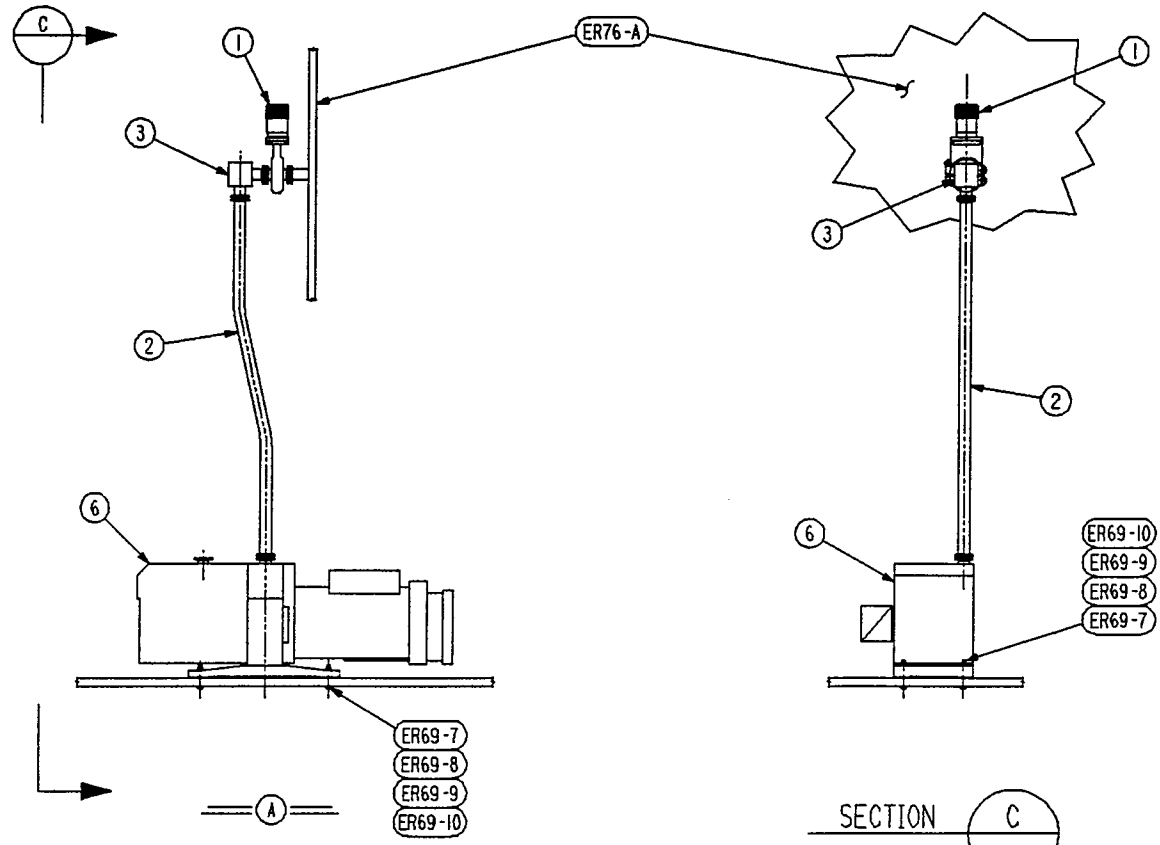
1. WORK THIS DWG WITH DWG ER-67 AND ER-71.

▶ INDICATES CHANGE FROM PREVIOUS ISSUE

CAD FILE 30212076.DGN

Supplier's/Purchaser's No. _____	
CBI	
LIGO PROJECT LEAK TEST ARRANGEMENT	
COLD TRAP END SEAL COLD TRAP LINE SUBASSEMBLY	
Customer's No. _____	Contract No. 930212ER
By BSA Chkd RDS Date 3-16-94	Dwg. ER-76 Rev. 2
J.L. RINGELSTETTER Engineering Supervisor	Sheet -

SUB ASSY →
ASSY DWG
ER-71



MARK	ASSY PC	DESCRIPTION	LENGTH		SPEC	EST WEIGHT
			FT	INCHES		
* 1	ER77-A	COLD TRAP EVACUATION LINE				X
	ER77-1	1 KF BELLOWS-SEALED STRAIGHT-THROUGH VALVE W/QUICK-ACTING KNOB MANUALLY OPERATED, DN 25 KF "LEYBOLD" CAT. NO. 289 12 OR EQUAL			STN STL	X
	ER77-2	1 METAL HOSE DN 25 KF "LEYBOLD" CAT. NO. 86803 OR EQUAL	3	4	STN STL	X
	ER77-3	1 ELBOW, 90° DN 25 KF "LEYBOLD" CAT. NO. 88462			STN STL	X
	ER77-4	4 CENTERING RING DN 25 KF "LEYBOLD" CAT. NO. 88347 OR EQUAL			STN/VITON	X
	ER77-5	4 CLAMP DN 25 KF "LEYBOLD" CAT. NO. 18342 OR EQUAL			ALUM	X
	ER77-6	1 TRIVAC B ROTARY VANE PUMP MODEL D25B 20.9 CFM (590 LTR/MIN), POWER 1/2 HP VOLTAGE 208-230/460 VAC, FREQ. 60 HZ CAT. NO. 91276-2 OR EQUAL				85
	ER69-7	4 BOLT 1/4 DIA REG FIN HEX HEAD	0	3	A307B	1
	ER69-8	4 NUT 1/4 DIA HEAVY HEX			A563A	-
	ER69-9	8 PLAIN WASHER 1/4 DIA WIDE			CARB STL	-
	ER69-10	4 LOCK WASHER 1/4 DIA STD SPLIT TYPE			CARB STL	-
* 1	ER77-B	INTERSPACE VACUUM PUMP LINE ASSEMBLY				X
	ER69-1	1 KF BELLOWS-SEALED RIGHT-ANGLE VALVE W/QUICK-ACTING KNOB MANUALLY OPERATED DN 16 KF "LEYBOLD" CAT. NO. 288 11 OR EQUAL	0	1 3/8	STN STL	X
	ER69-2	1 PVC HOSE COMPLETE DN 16 ISO-KF 1000 MM -LENGTH NOM. "BALZERS" ORDER NO. BP 226 415-T OR EQUAL	3	4	PVC	X
	ER69-3	1 ELBOW 90° DN 16 KF "LEYBOLD" CAT. NO. 88461 OR EQUAL	0	3/8	STN STL	X
	ER69-4	4 CENTERING RING DN 16 ISO-KF "BALZERS" ORDER NO. BP 213 144-T OR EQUAL			STN/VITON	X
	ER69-5	4 CLAMPING RING DN 16 ISO-KF "BALZERS" ORDER NO. BP 217 426-T OR EQUAL			ALUM	X
	ER69-6	1 TRIVAC B ROTARY VANE PUMP MODEL D4B 3.4 CFM (96 LTR/MIN), POWER 1/3 HP, VOLTAGE 115/200-230 V(AC), FREQ. 50/60 HZ PHASE 1, WIRED FOR 115 V, W/HYDROCARBON OIL, "LEYBOLD" CAT. NO. 91245-1 OR EQUAL				51
	ER69-7	4 BOLT 1/4 DIA REG FIN HEX HEAD	0	3	A307B	1
	ER69-8	4 NUT 1/4 DIA HEAVY HEX			A563A	-
	ER69-9	8 PLAIN WASHER 1/4 DIA WIDE			CARB STL	-
	ER69-10	4 LOCK WASHER 1/4 DIA STD SPLIT TYPE			CARB STL	-

* BILLING FOR 1 : 3 REQUIRED.

NOTES:

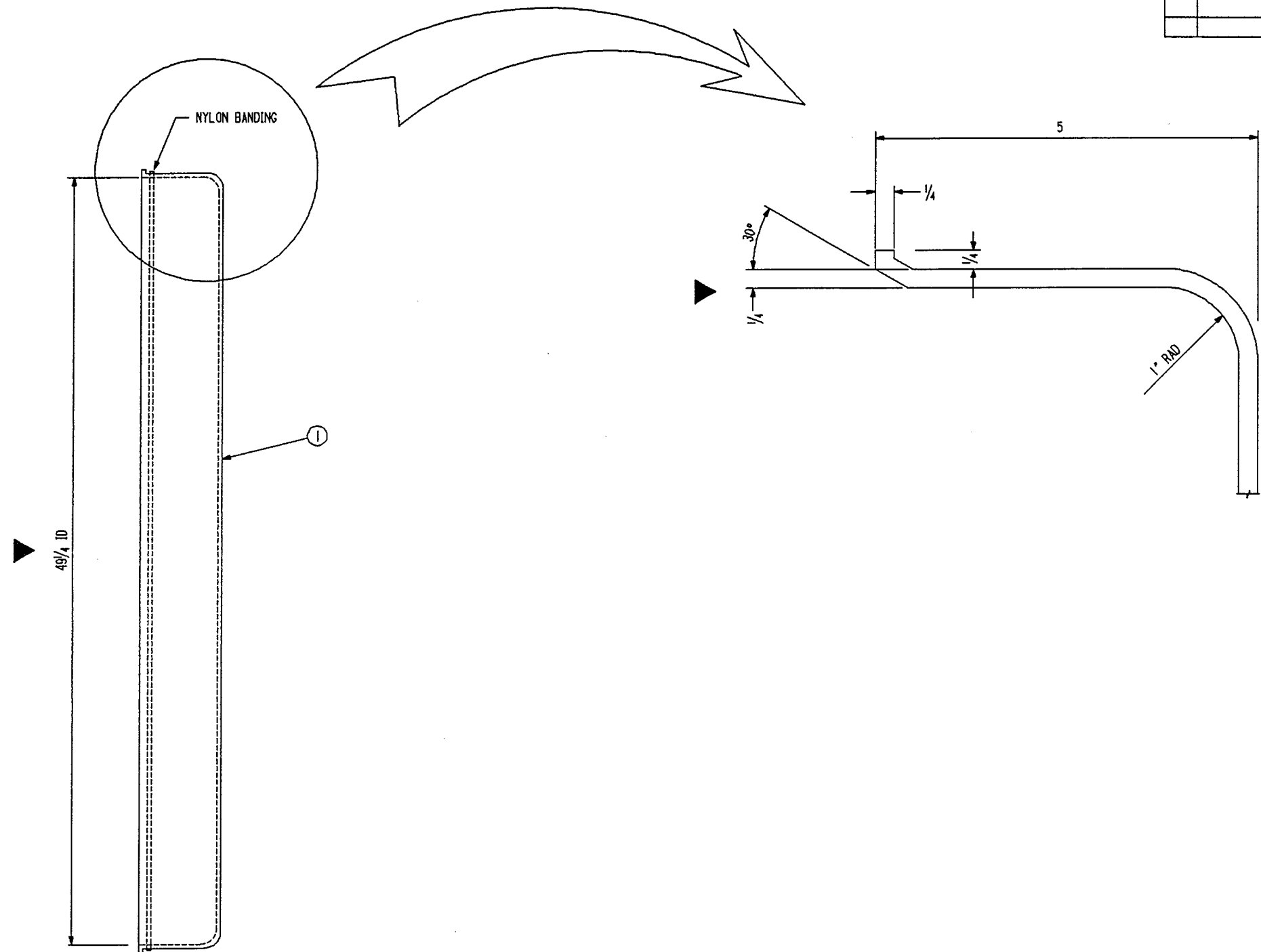
1. WORK THIS DWG WITH DWG ER-69 , ER-71, AND ER-76.

CAD FILE 130212077.DGN

▶ INDICATES CHANGE FROM PREVIOUS ISSUE

Supplier's/Purchaser's No. _____	
LIGO PROJECT LEAK TEST ARRANGEMENT COLD TRAP END SEAL COLD TRAP EVACUATION LINE SUBASSY INTERSPACE VACUUM PUMP LINE SUBASSY	
Customer's No. _____	Contract No. 930212ER
By BSA Chkd RDS Date 3-16-94 J.L. RINGELSTETTER Engineering Supervisor	Dwg. ER-77 Rev. 2 Sheet - 2

SHP PC	MARK	ASSY PC	DESCRIPTION	LENGTH		SPEC	EST_WEIGHT
				FT	INCHES		
1	ER96-1		PROTECTIVE COVER			POLYETHYLENE	

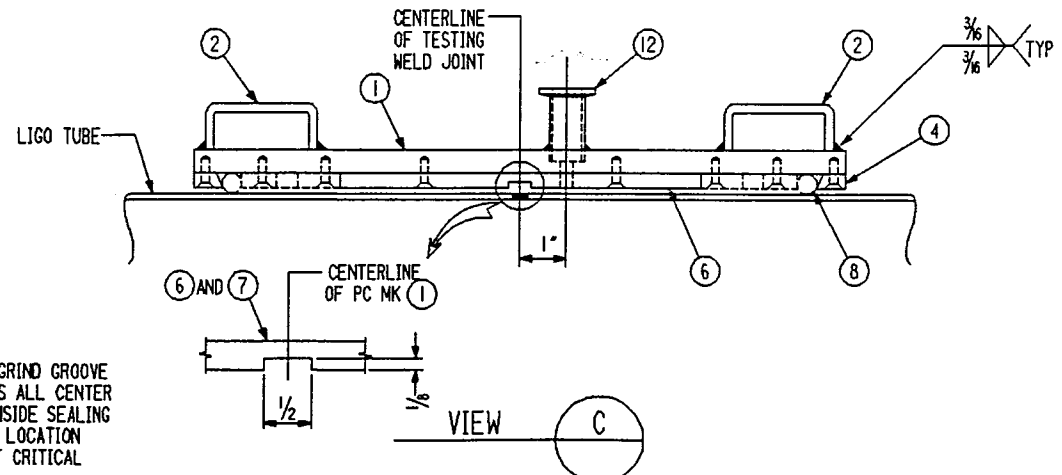
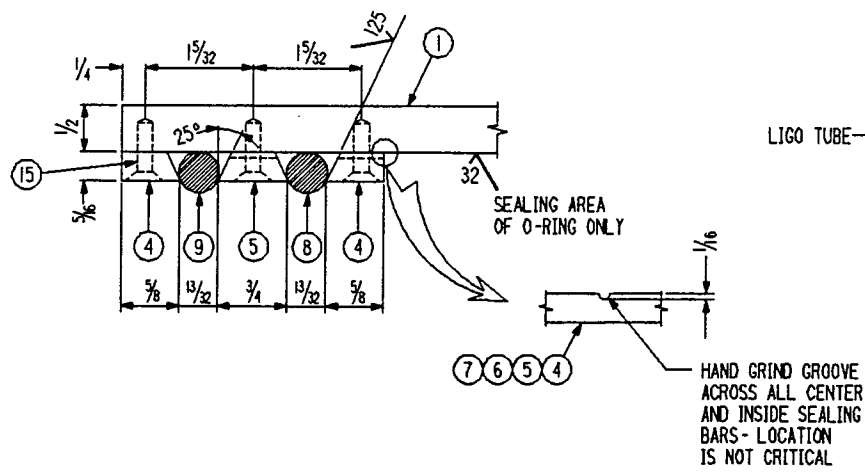
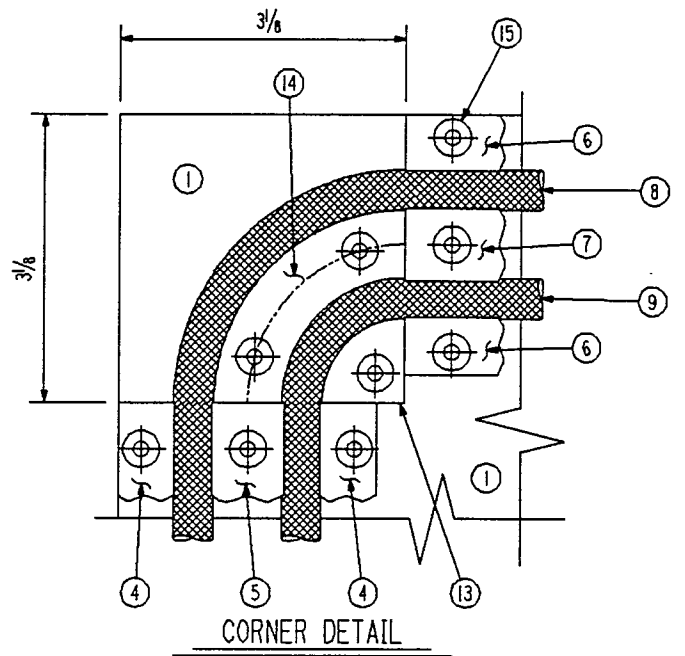
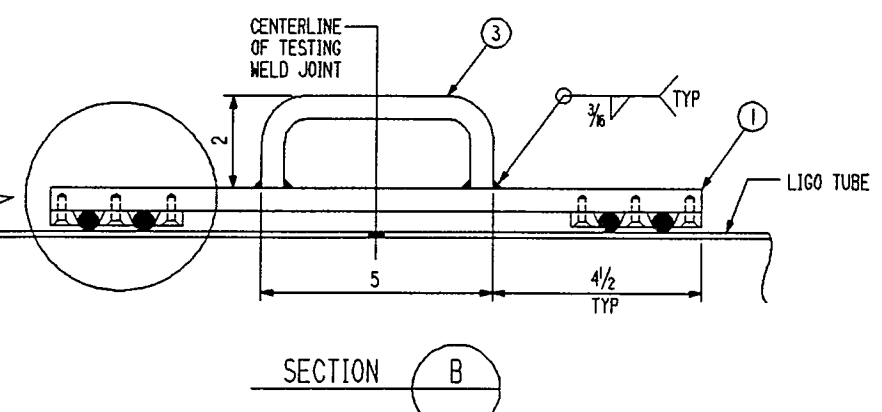
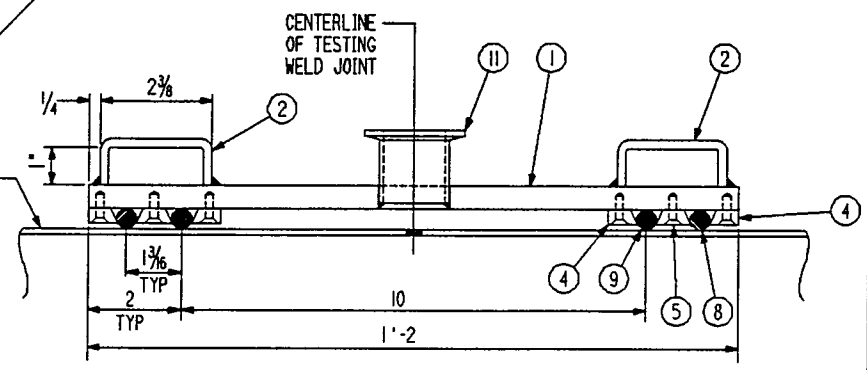
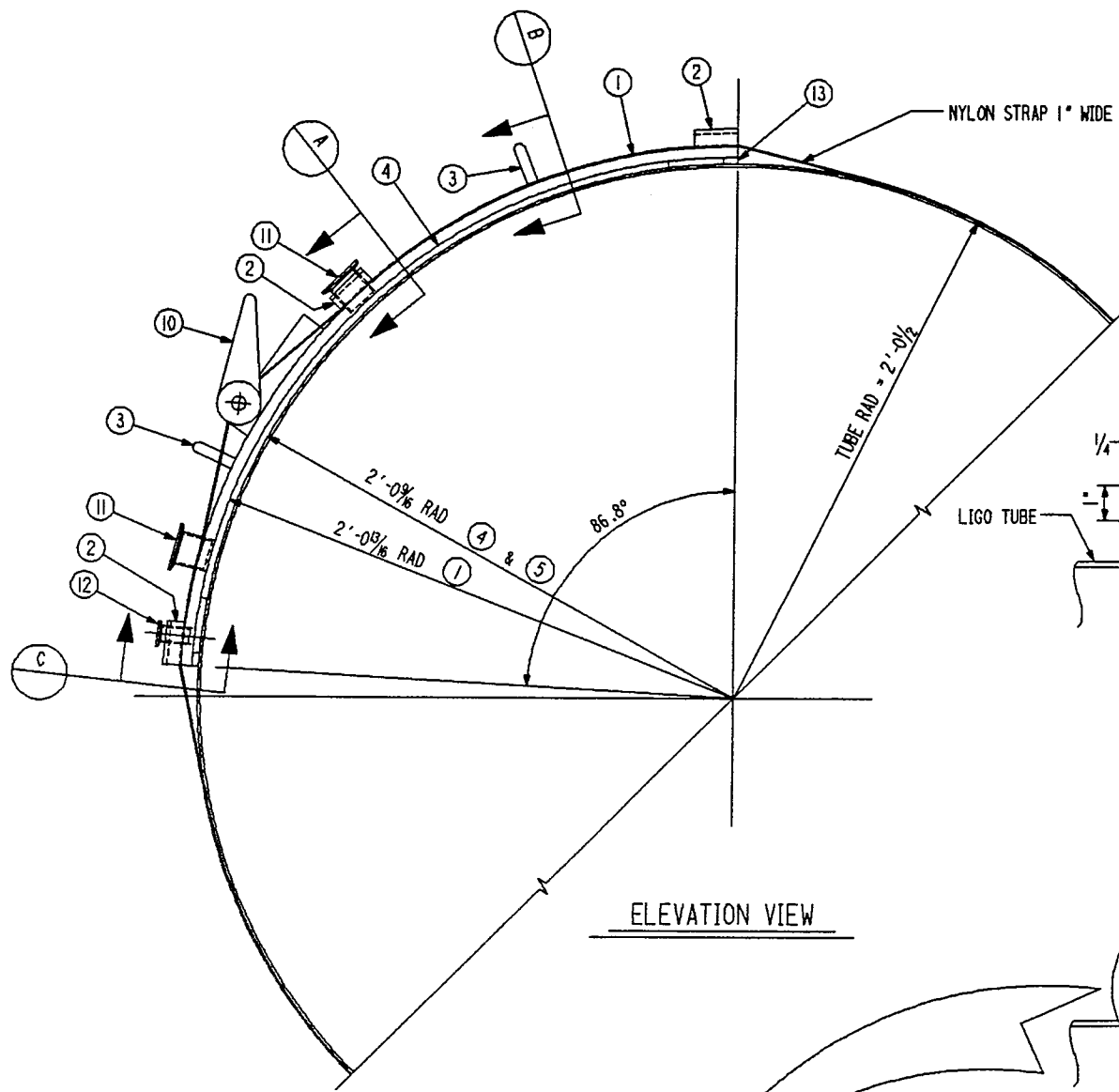


SIDE VIEW

CAD FILE 30212096.DGN

▶ INDICATES CHANGE FROM PREVIOUS ISSUE

Supplier's/Purchaser's No. _____	
<h3>LIGO PROJECT</h3> <p>PROTECTIVE END CAP</p>	
Customer's No. _____	Contract No. 930212ER
By <u>DKL</u> Chkd _____ Date 3-23-94	Dwg. ER-96 Rev. 1
<u>J.L. RINGELSTETTER</u> Engineering Supervisor	
Sheet -	1
<small>THIS DRAWING HAS BEEN PREPARED FOR AND IS THE PROPERTY OF CBI AND IS TO BE USED ONLY IN CONNECTION WITH PERFORMANCE OF WORK BY CBI. REPRODUCTION IN WHOLE OR IN PART FOR ANY OTHER PURPOSE IS EXPRESSLY FORBIDDEN.</small>	
<small>THIS DRAWING HAS BEEN PREPARED BY HOUSTON CONSTRUCTION SERVICES DEPT. (CHD) FORM CHG 30 A REV SEP 93</small>	



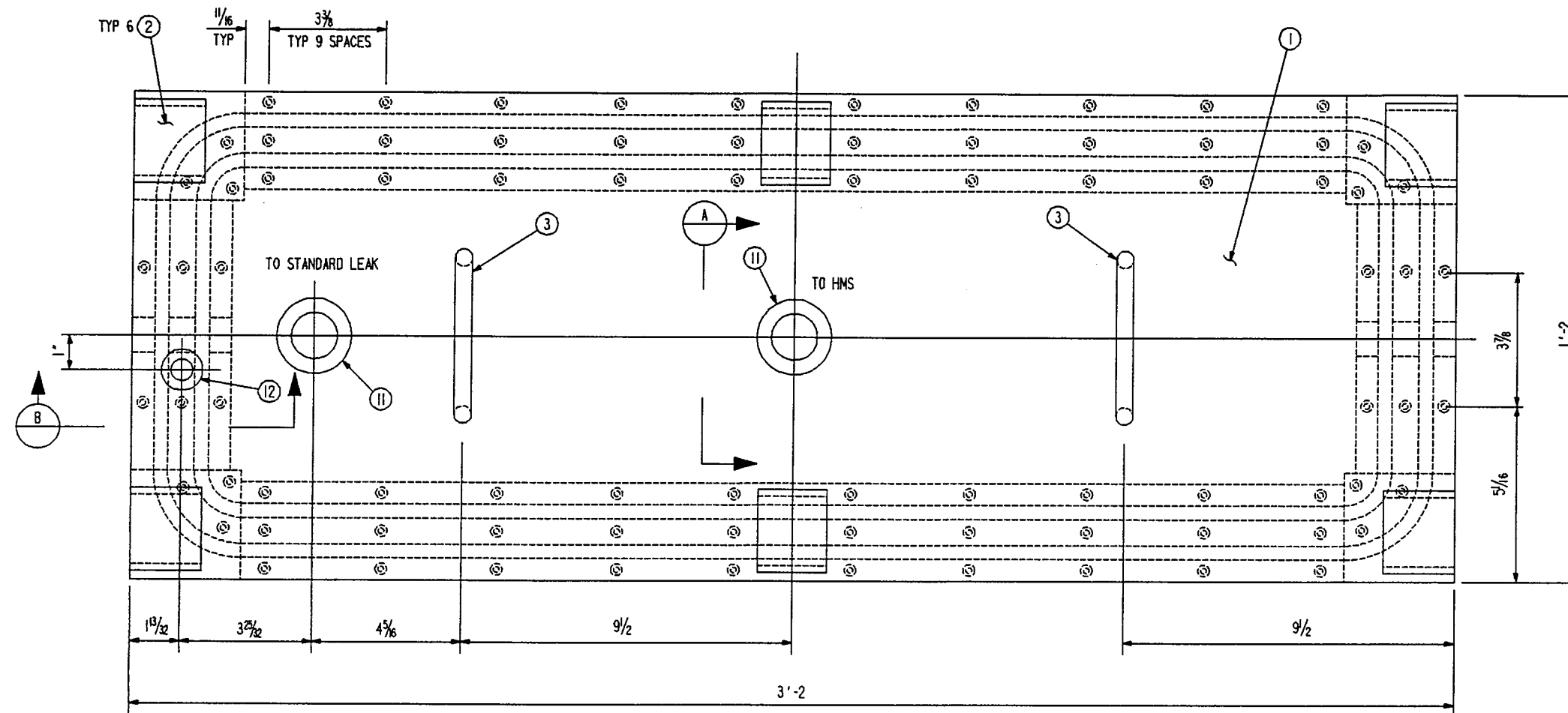
SHP PC	MARK	ASSY PC	DESCRIPTION	LENGTH		SPEC	EST WEIGHT
				FT	INCHES		
			HELIUM LEAK TEST BOX				X
	ER121-1	1	PLATE 14 X 1/2 ROLLED TO 2'-0 9/16" RADIUS DRILLED AND TAPPED	2	10 7/16	AL 6061-T6	X
	ER121-2	6	PLATE 2 X 3/8 X SK	0	3 3/8	AL 6061-T6	X
	ER121-3	2	ROD 1/2 DIA X SK	0	7 3/8	AL 6061-T6	X
	ER121-4	4	BAR 3/8 X SK ROLLED TO 2'-0 1/2" RADIUS MACHINED, DRILLED AND TAPPED	2	7 1/16	AL 6061-T6	X
	ER121-5	2	BAR 3/8 X SK ROLLED TO 2'-0 1/2" RADIUS MACHINED, DRILLED AND TAPPED	2	7 1/16	AL 6061-T6	X
	ER121-6	4	BAR 3/8 X SK MACHINED, GRINDED, DRILLED AND TAPPED	0	7 3/4	AL 6061-T6	X
	ER121-7	2	BAR 3/8 X SK MACHINED, GRINDED, DRILLED AND TAPPED	0	7 3/4	AL 6061-T6	X
	ER121-8	1	50 DUROMETR RUBBER O-RING SEC. 7/16 DIA	7	4 3/8	BUTIL	X
	ER121-9	1	50 DUROMETR RUBBER O-RING SEC. 7/16 DIA	7	2 3/8	BUTIL	X
	ER121-10	2	TIE DOWN RACHET W/NYLON STRAP 1" WIDE				X
	ER121-11	2	FLANGE, LONG WELD STUB DN 40 ISO-KF "LEYBOLD" CAT. NO. 899624 OR EQUAL	0	1.575	SS	X
	ER121-12	1	FLANGE, LONG WELD STUB DN 16 ISO-KF "LEYBOLD" CAT. NO. 899621 OR EQUAL	0	1.575	SS	X
	ER121-13	4	BAR 3/8 X SK MACHINED, DRILLED AND TAPPED			AL 6061-T6	X
	ER121-14	4	BAR 3/8 X SK MACHINED, DRILLED AND TAPPED			AL 6061-T6	X
	ER121-15	78	MACHINE SCREW 8-32 STD SLOTTED 100" FLAT COUNTERSUNK HEAD	0	7/8	ZINK PLTD	X

NOTES:
1. WORK THIS DWG WITH DWG ER-122 (FORMELY ER-123).

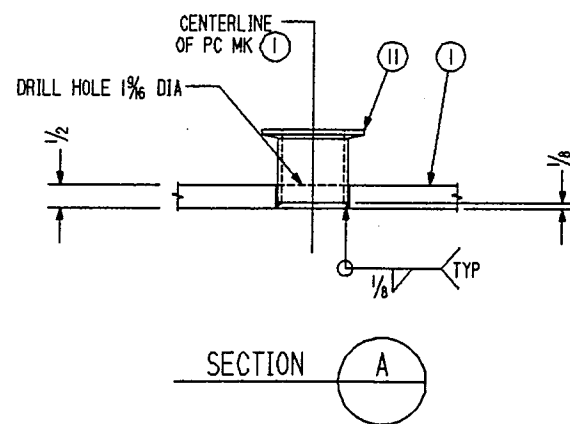
CAD FILE: 302121.DGN

INDICATES CHANGE FROM PREVIOUS ISSUE

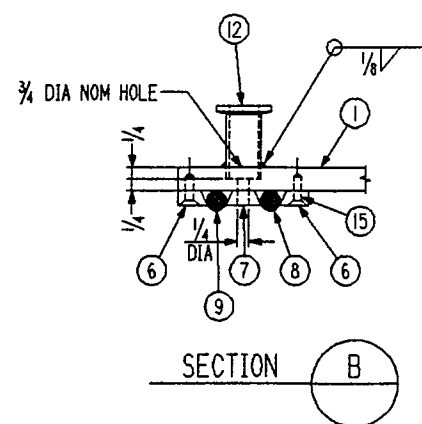
Supplier's/Purchaser's No.		Contract No.	
CBI		930212ER	
Customer's No.		By RMP Chkd CNS Date 6-1-94	
J. L. RINGELSTETTER Engineering Supervisor		Dwg. ER-121 Rev. 4 Sheet - 4	



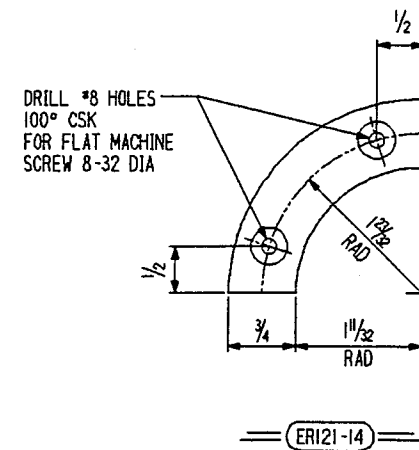
DEVELOPED VIEW



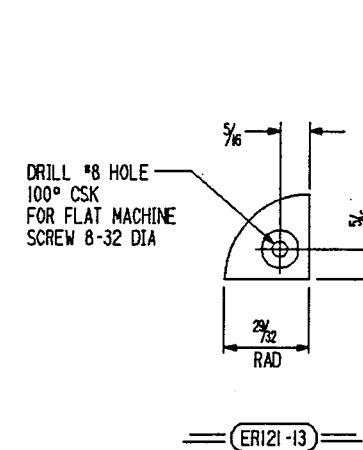
SECTION A



SECTION B



ERI21-14



ERI21-13

NOTES:

1. WORK THIS DWG WITH DWG ER-121.
2. ALL MACHINED SURFACES OF PC MK'S 13 AND 14 ARE 125 MICRONS.
3. SEE ER-121 FOR ROLL RADIUS.
4. HAND GRIND 1/16 DEEP GROOVES TO ALLOW FOR AIR PASSAGE. LOCATION NOT CRITICAL.

CAD FILE 302122.DGN

By	Date	Chkd	Date	By	Date	Chkd	Date	By	Date	Chkd	Date
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Supplier's/Purchaser's No. _____

CBI

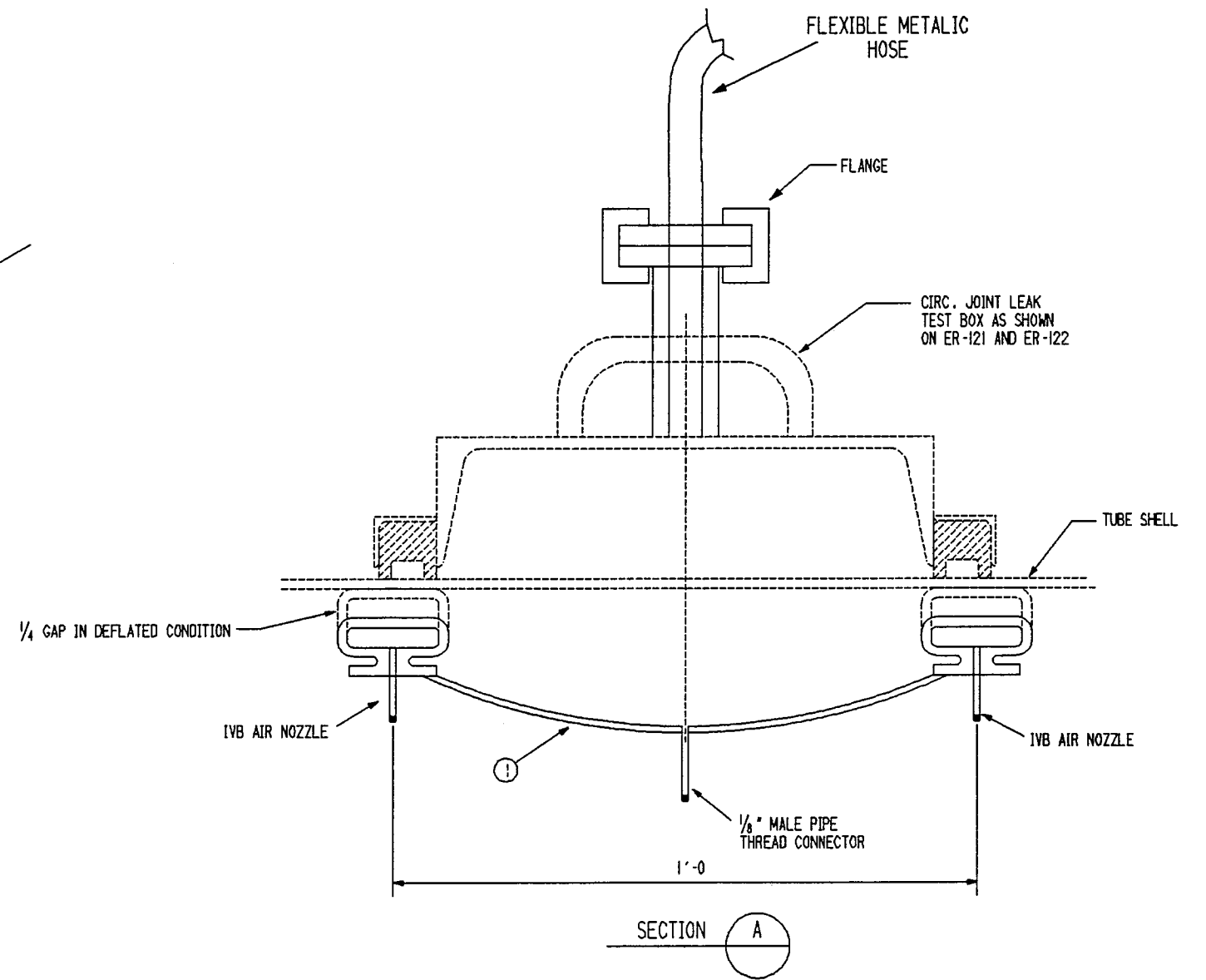
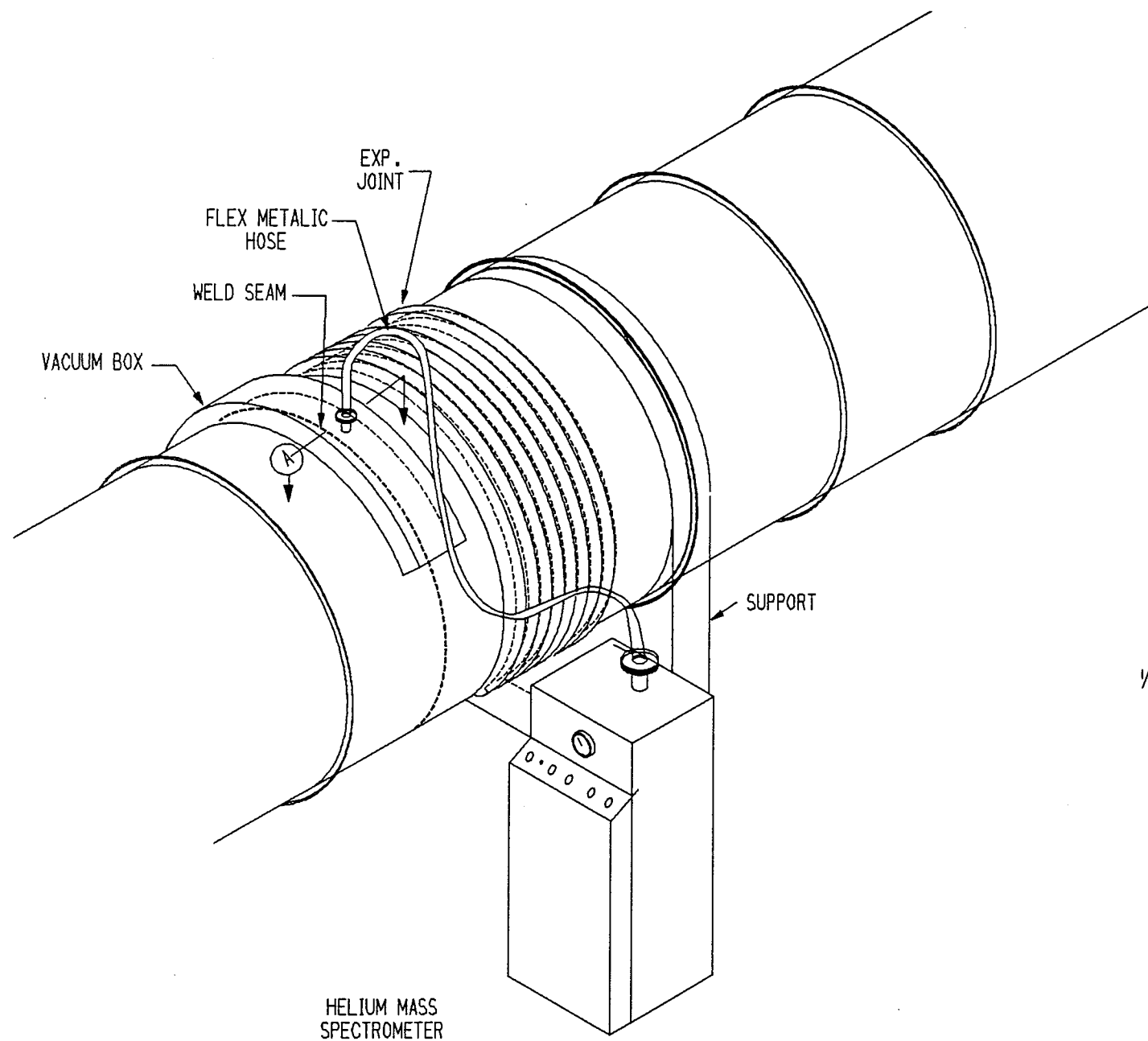
LIGO PROJECT
CIRCUMFERENTIAL LEAK TEST BOX
DETAILS
(FORMERLY ER-123)

Customer's No. _____ Contract No. 930212ER

By RMP Chkd CNS Date 6-1-94
J. L. RINGELSTEITER
Engineering Supervisor

Dwg. ER-122 Rev. 4
Sheet - 4

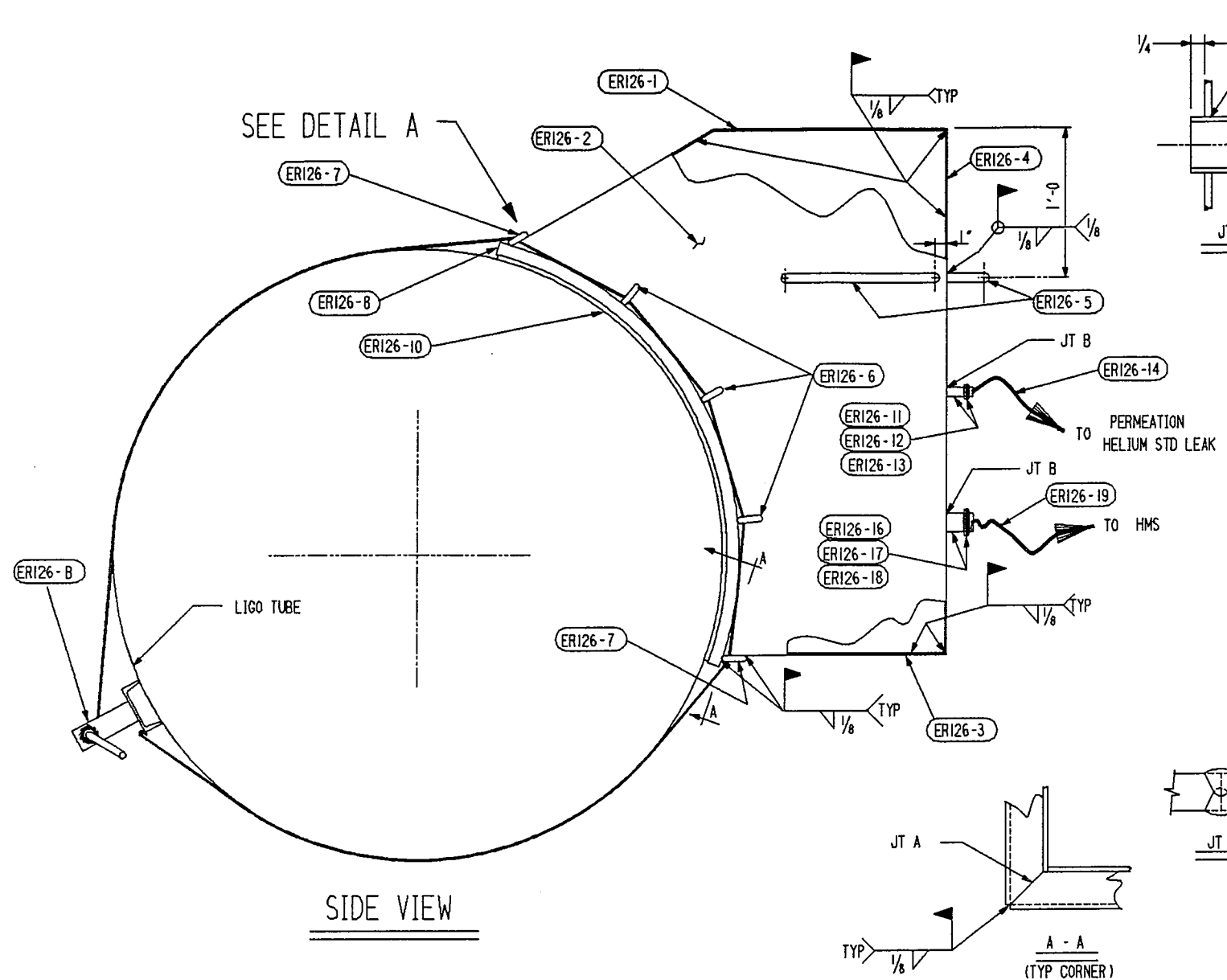
INDICATES CHANGE FROM PREVIOUS ISSUE



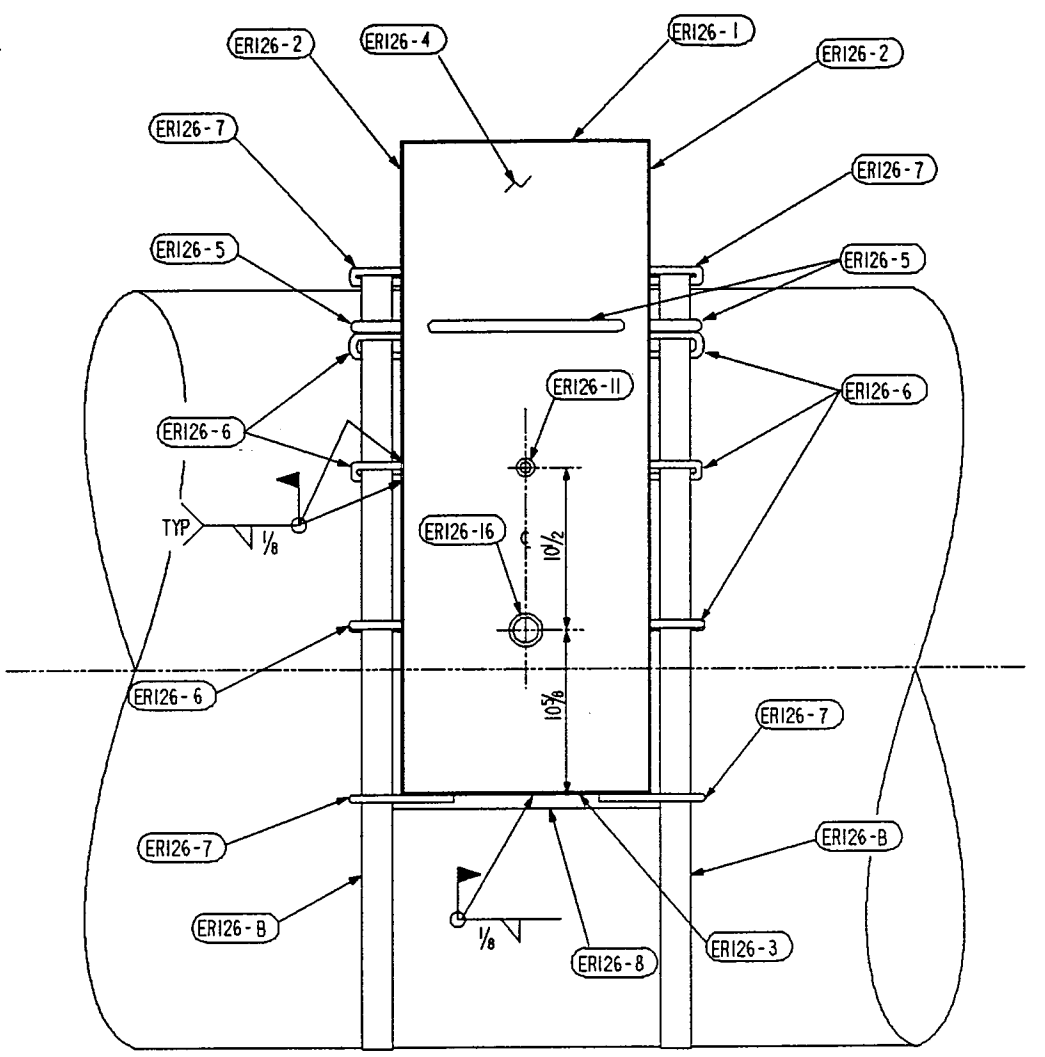
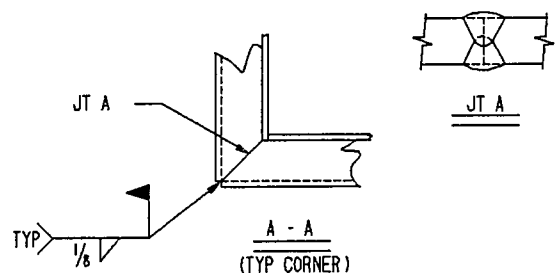
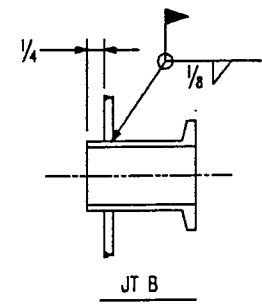
CAD FILE: 30212123.DGN

Supplier's/Purchaser's No. _____	
CBI	
He MASS SPECTROMETER TEST ARRANGEMENT LIGO PROJECT	
Customer's No. _____	Contract No. 930212ER
By <u>OKL</u> Chkd _____ Date <u>11-3-93</u>	Dwg. <u>ER-123</u> Rev. _____
J.L. RINGELSTETTER Engineering Supervisor	
Sheet _____	Rev. <u>1</u>

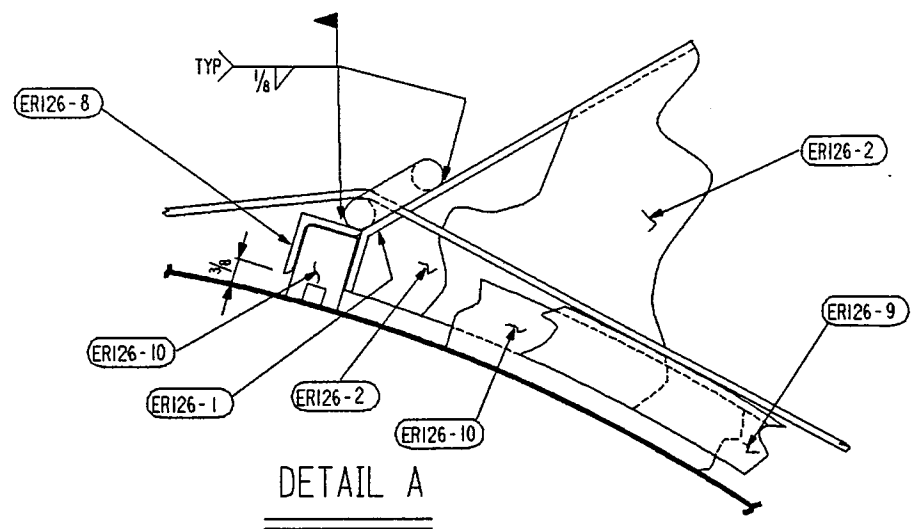
▶ INDICATES CHANGE FROM PREVIOUS ISSUE



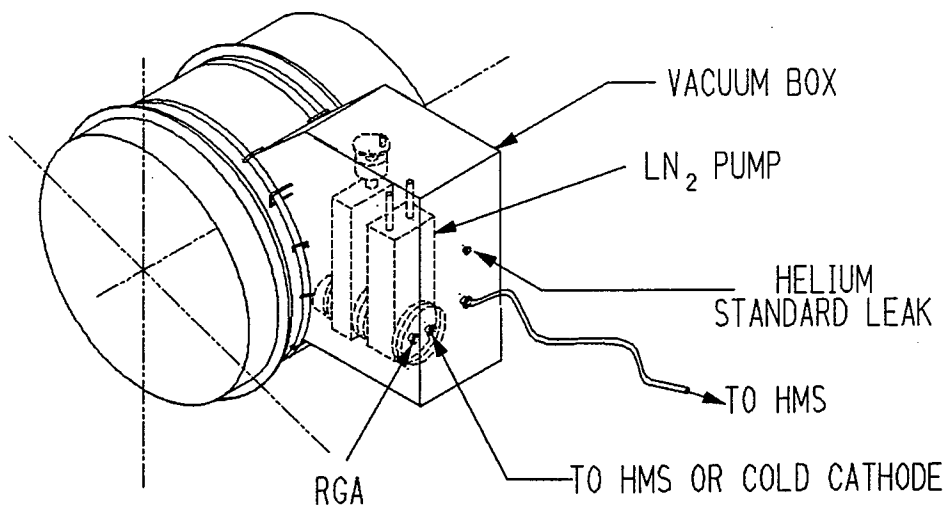
SIDE VIEW



ELEVATION



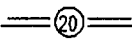
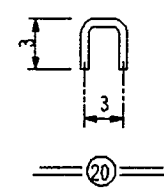
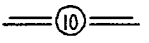
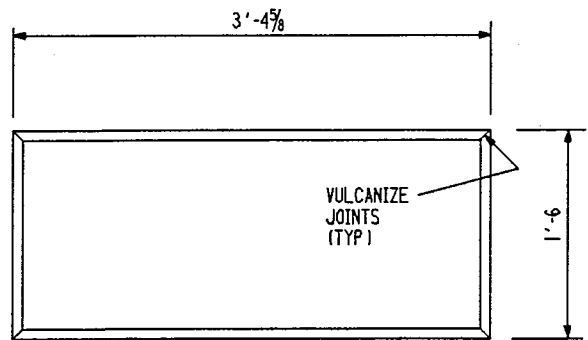
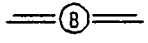
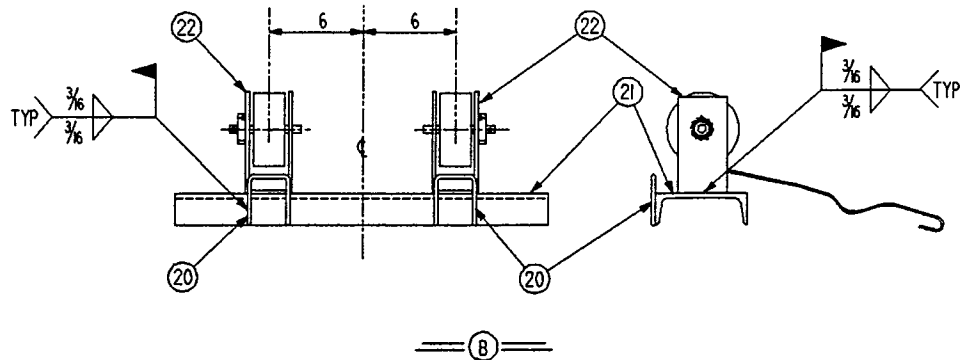
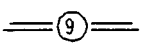
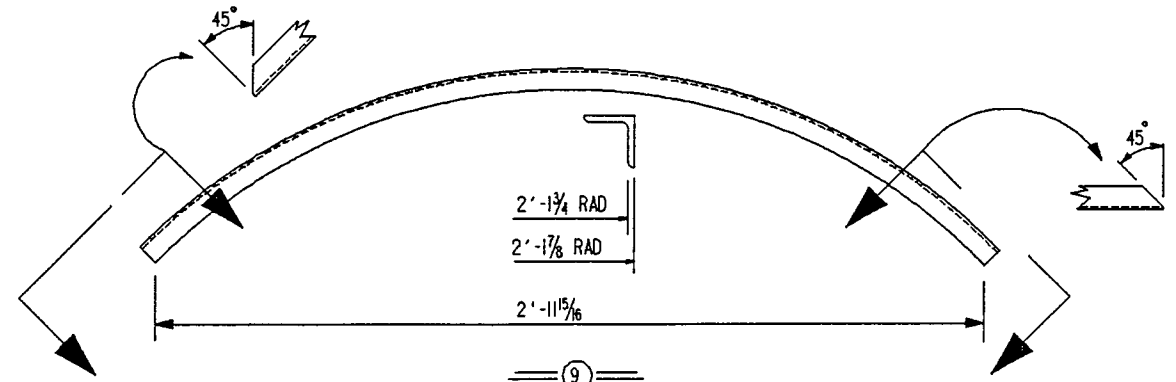
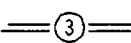
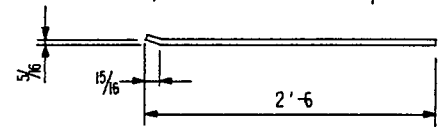
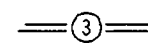
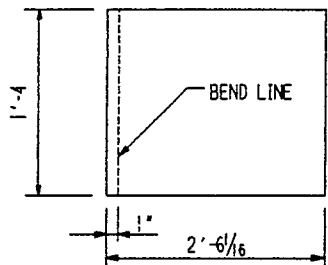
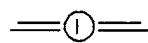
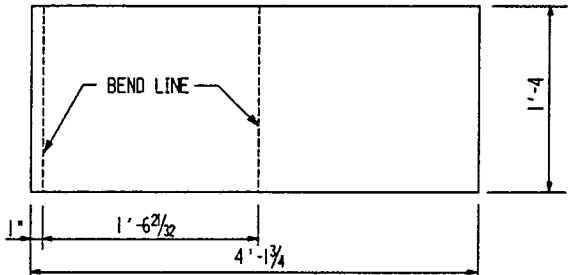
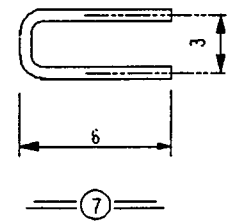
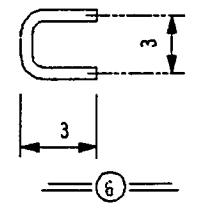
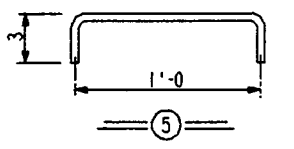
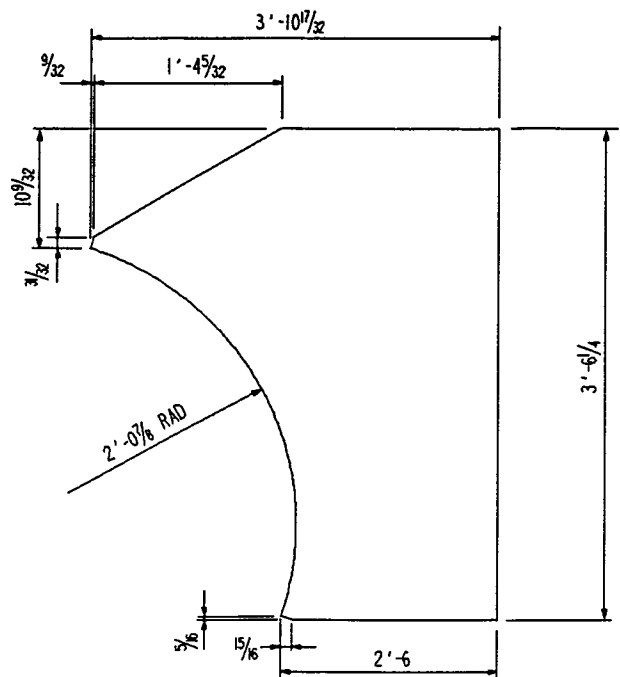
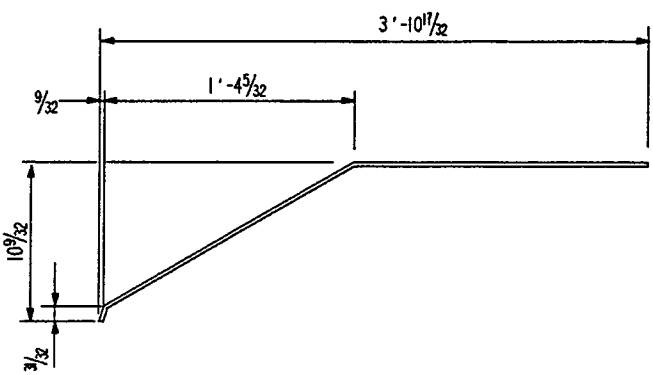
DETAIL A



▶ INDICATES CHANGE FROM PREVIOUS ISSUE

CAD FILE 302125.DGN

Supplier's/Purchaser's No. _____													
CBI													
VACUUM PORT LEAK TEST BOX													
Customer's No. _____	Contract No. 930212												
By RDS Chkd _____ Date 2-28-94	Dwg. ERI25 Rev. 2												
JIM RINGELSTETTER Engineering Supervisor													
<table border="1"> <tr> <th>By</th> <th>Chkd</th> <th>Date</th> <th>By</th> <th>Chkd</th> <th>Date</th> </tr> <tr> <td> </td> <td> </td> <td> </td> <td> </td> <td> </td> <td> </td> </tr> </table>		By	Chkd	Date	By	Chkd	Date						
By	Chkd	Date	By	Chkd	Date								
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Revisions	Remarks												

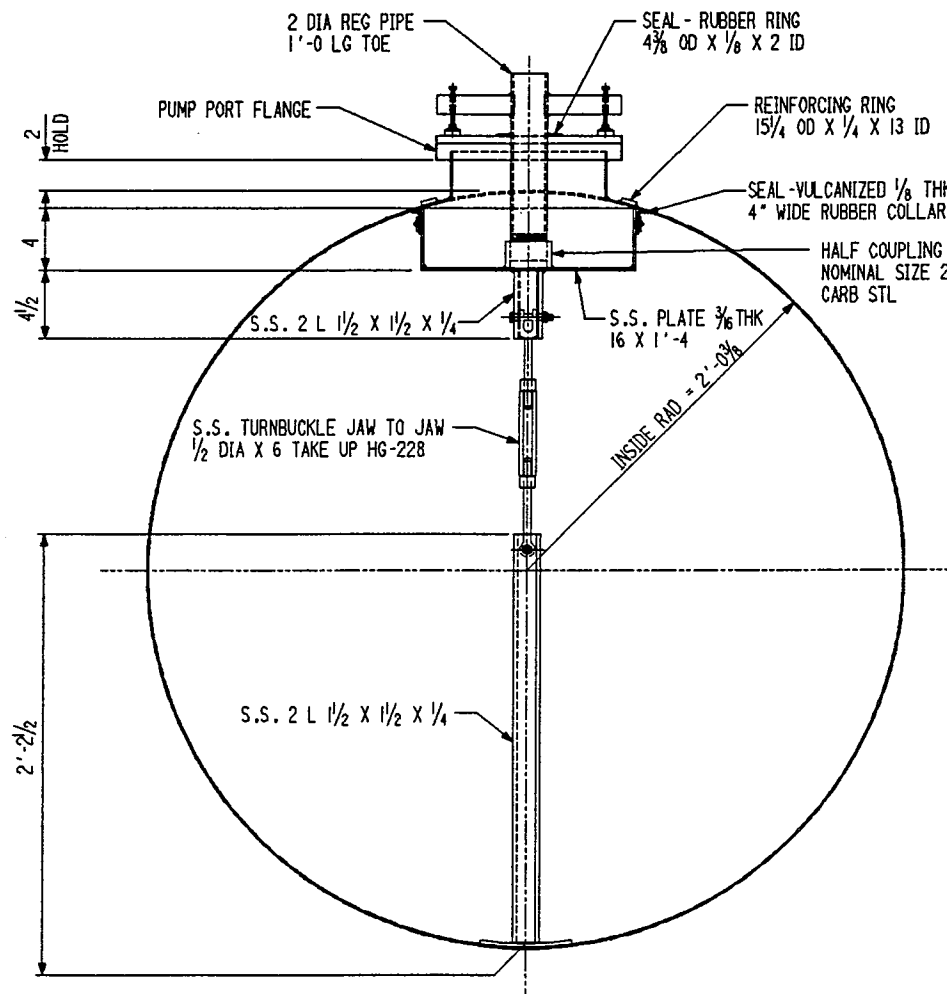


SHIP PC	MARK	ASSY PC	DESCRIPTION	LENGTH		SPEC	EST WEIGHT
				FT	INCHES		
1	ERI26-A		VACUUM BOX ASSEMBLY				(92)
	ERI26-1	1	PLATE 16 X 1/8 X SK BENT	4	1 3/4	6061-T6	10
	ERI26-2	2	PLATE 46 11/32 X 1/8 X SK	3	6 1/4	6061-T6	43
	ERI26-3	1	PLATE 16 X 1/8 X SK BENT	2	6 1/16	6061-T6	7
	ERI26-4	1	PLATE 16 X 1/8	3	6	6061-T6	8
	ERI26-5	3	ROD 1/2 DIA BENT	1	6	6061-T6	1
	ERI26-6	6	ROD 1/2 DIA BENT	0	9	6061-T6	1
	ERI26-7	4	ROD 1/2 DIA BENT	1	3	6061-T6	1
	ERI26-8	2	L1 X 1 X 1/8 MBE 45°	1	6	6061-T6	1
	ERI26-9	2	L1 X 1 X 1/8 ROLL MBE 45°	3	4 5/8	6061-T6	2
			SHR	6	4 5/8		
	ERI26-10	1	MOLDED RUBBER SEAL				1
	ERI26-11	1	16 KF HALF NIPPLE		1.575	ALUM	1
	ERI26-12	1	16 KF CLAMP			ALUM	-
	ERI26-13	1	16 KF CENTERING RING			ALUM	-
	ERI26-14	1	16 KF BRAIDED HOSE	4	0	STN STL	8
	ERI26-16	1	40 KF HALF NIPPLE		1.575	ALUM	2
	ERI26-17	1	40 KF CLAMP			ALUM	-
	ERI26-18	1	40 KF CENTERING RING			ALUM	-
	ERI26-19	1	40 KF BRAIDED HOSE	3	0	STN STL	6
1	ERI26-B		TIE DOWN ASSEMBLY				(38)
	ERI26-20	2	ROD 1/4 DIA	0	9	A36	1
	ERI26-21	1	C6 X 8.2	2	0	A36	17
	ERI26-22	2	SPOOL WELD ON TIE DOWN WINCH W/ 2" STRAP WITH FLAT HOOK AND WINCH BAR				20

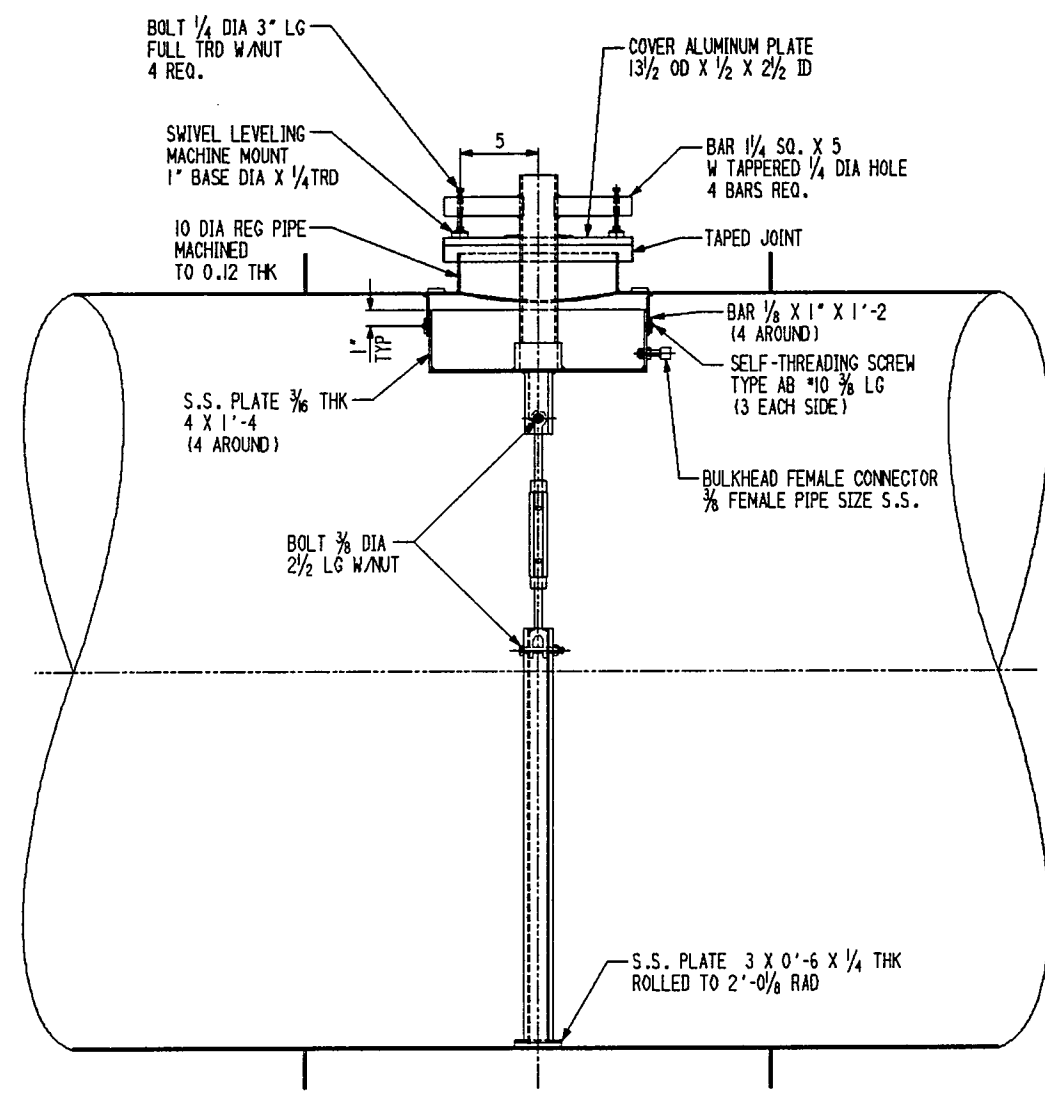
CAD FILE 302126.DGN

INDICATES CHANGE FROM PREVIOUS ISSUE

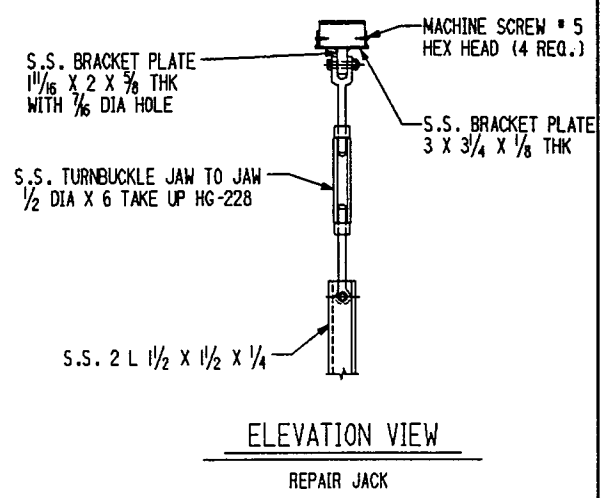
Supplier's/Purchaser's No. _____	
CBI	
PIECES VACUUM PORT LEAK TEST BOX	
Customer's No. _____	Contract No. 930212ER
By RDS Chkd _____ Date 3-1-94	Dwg. ERI26 Rev. 1
JIM RINGELSTETTER Engineering Supervisor	
Sheet	



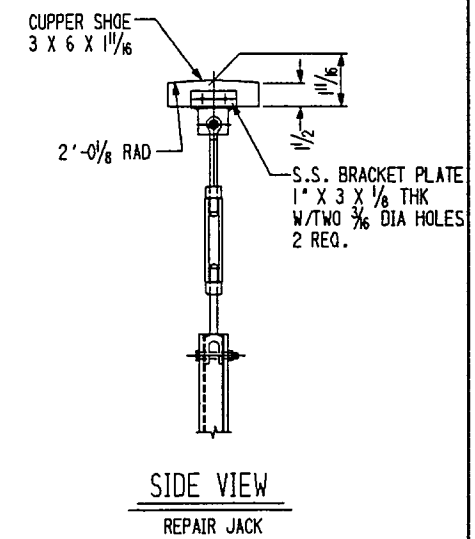
ELEVATION VIEW
PUMP PORT WELDING JIG



SIDE VIEW
PUMP PORT WELDING JIG



ELEVATION VIEW
REPAIR JACK



SIDE VIEW
REPAIR JACK

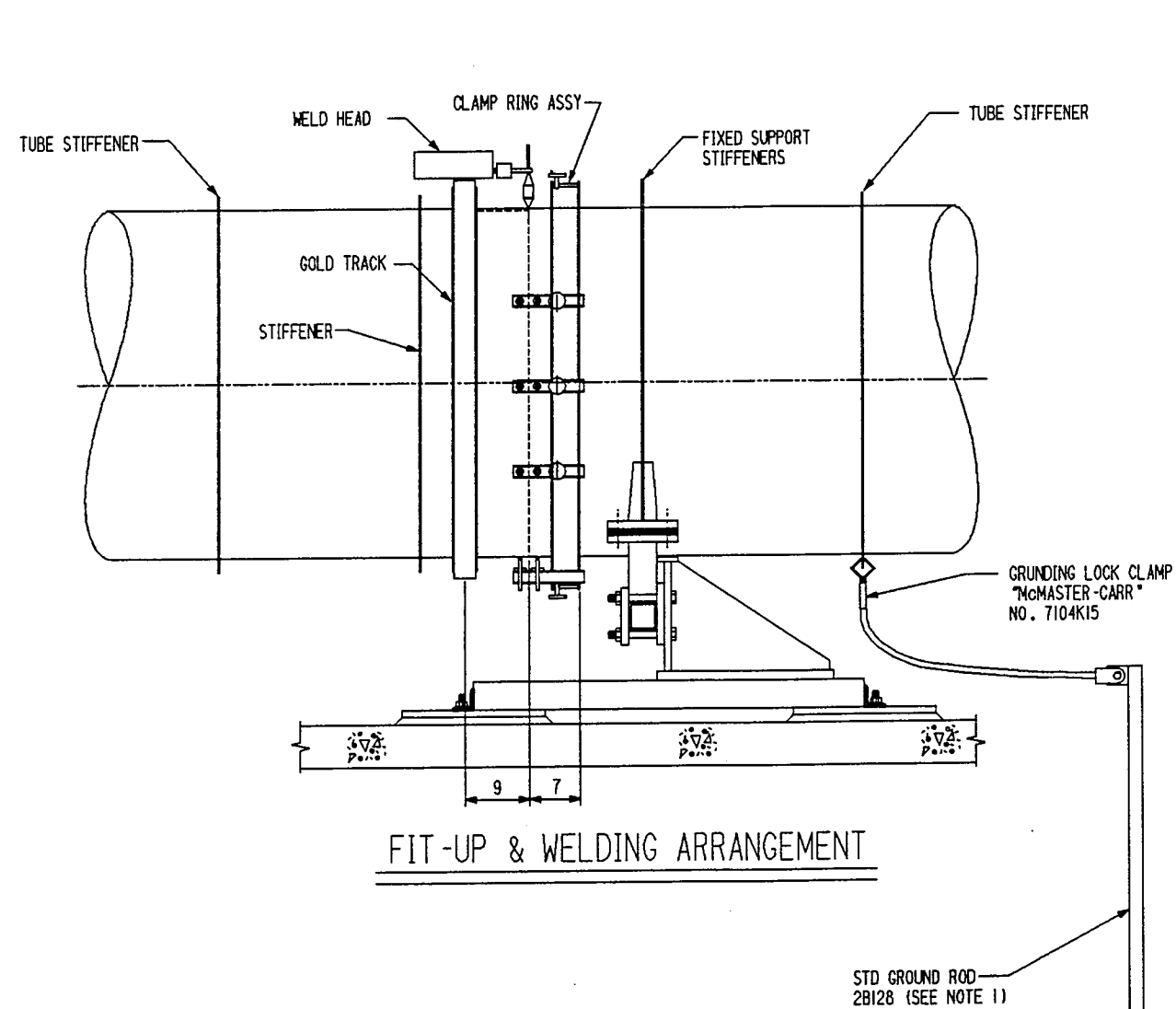
NOTES:

- ALL SHARP EDGES GRIND WITH RAD = 1/32

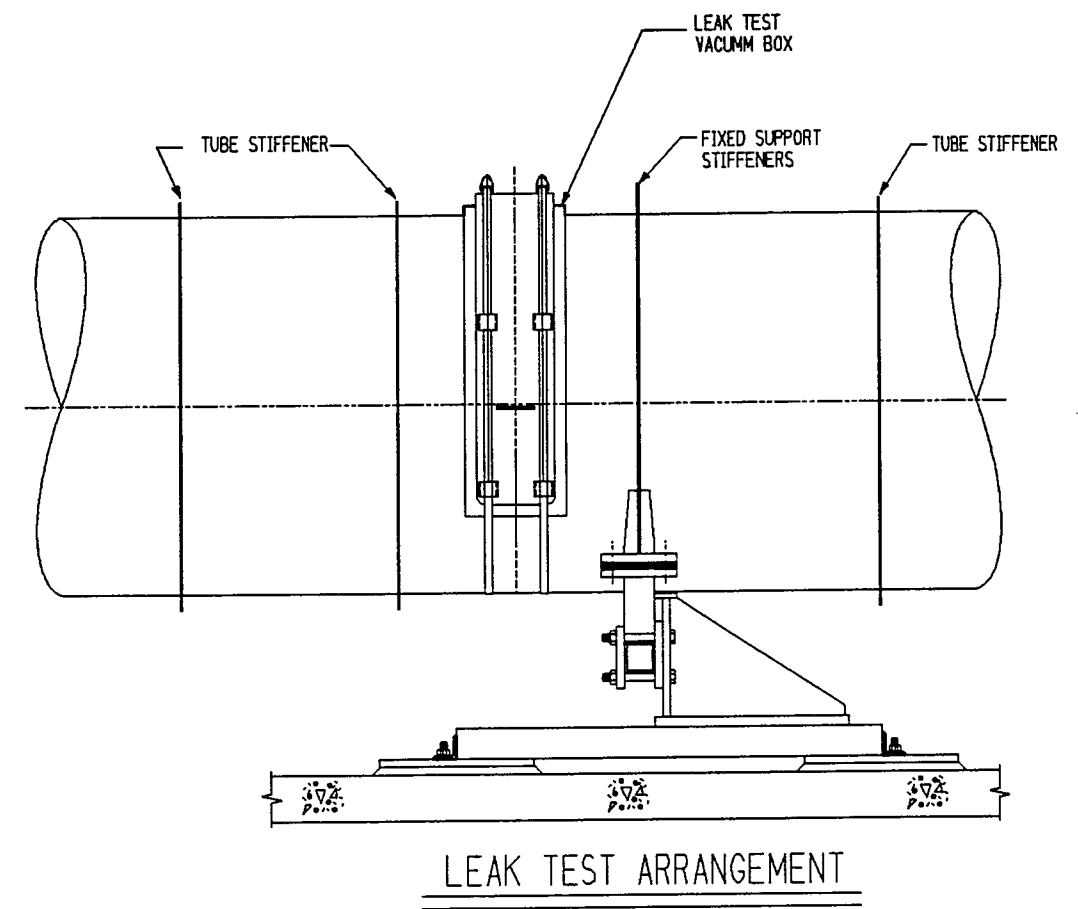
CAD FILE 302127.DGN

INDICATES CHANGE FROM PREVIOUS ISSUE

Supplier's/Purchaser's No. _____	
CBI	
LIGO PROJECT	
PUMP PORT WELDING JIG AND REPAIR JACK	
Customer's No. _____	Contract No. _____
By BSA Chkd RDS Date 5-15-95	930212ER
J. L. RINGELSTETTER Engineering Supervisor	Dwg. ER-127 Sheet - 0
Revisions	Remarks
By Chkd Date	
By Chkd Date	
By Chkd Date	
By Chkd Date	



FIT-UP & WELDING ARRANGEMENT



LEAK TEST ARRANGEMENT

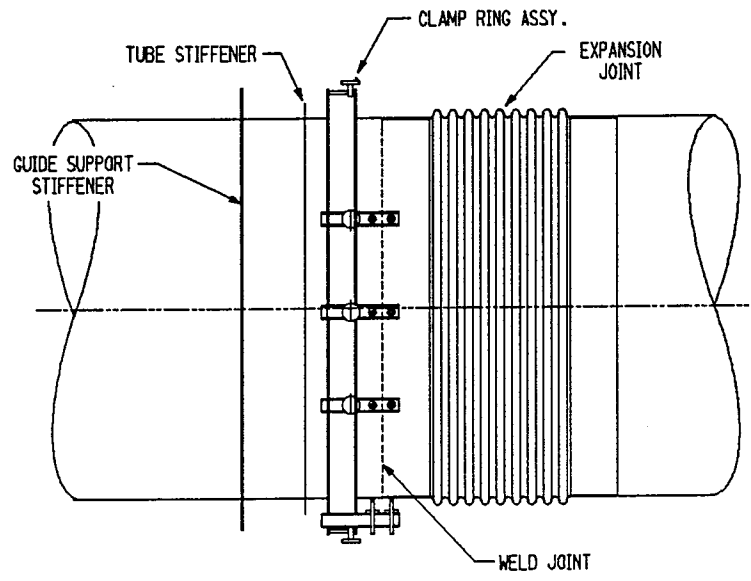
NOTES:

1. INSTALL GROUND ROD EVERY 250'-0.

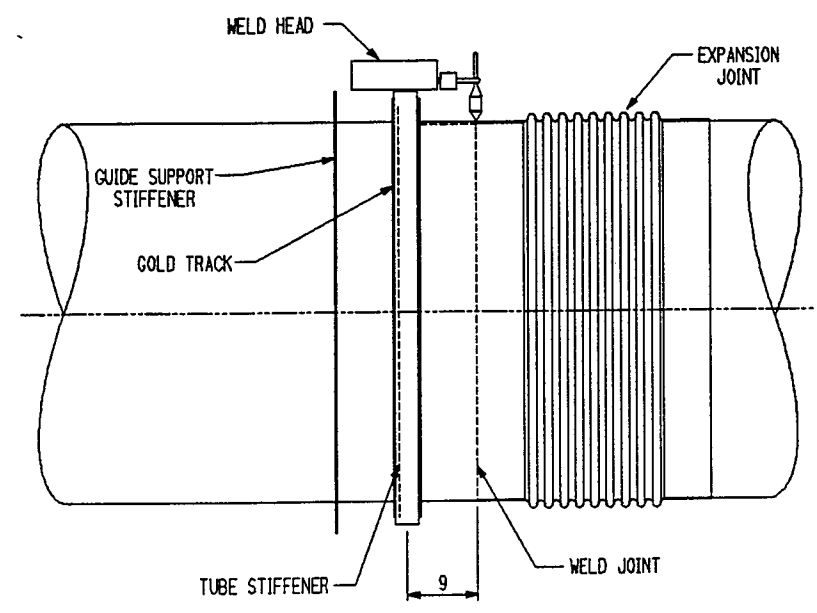
▶ INDICATES CHANGE FROM PREVIOUS ISSUE

CAD FILE 30212133.DGN

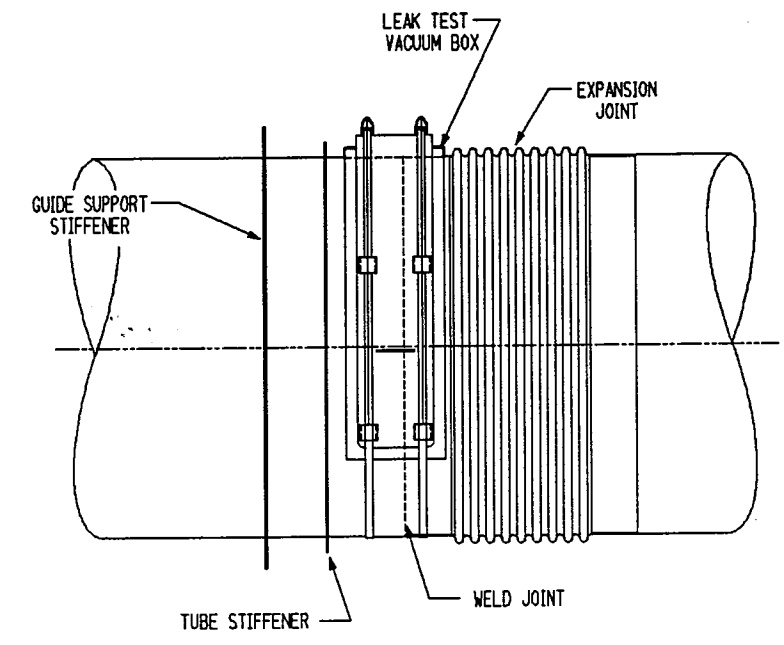
Supplier's/Purchaser's No. _____	
CBI	
LIGO PROJECT	
FIT-UP WELDING AND LEAK TESTING CONFIGURATIONS AT FIXED SUPPORTS	
Customer's No. _____	Contract No. 930212
By <u>DKL</u> Chkd _____ Date <u>2-10-94</u>	Dwg. <u>ERI33</u> Rev. <u>2</u>
J.J. RINGELSTETTER Engineering Supervisor	
Sheet -	2



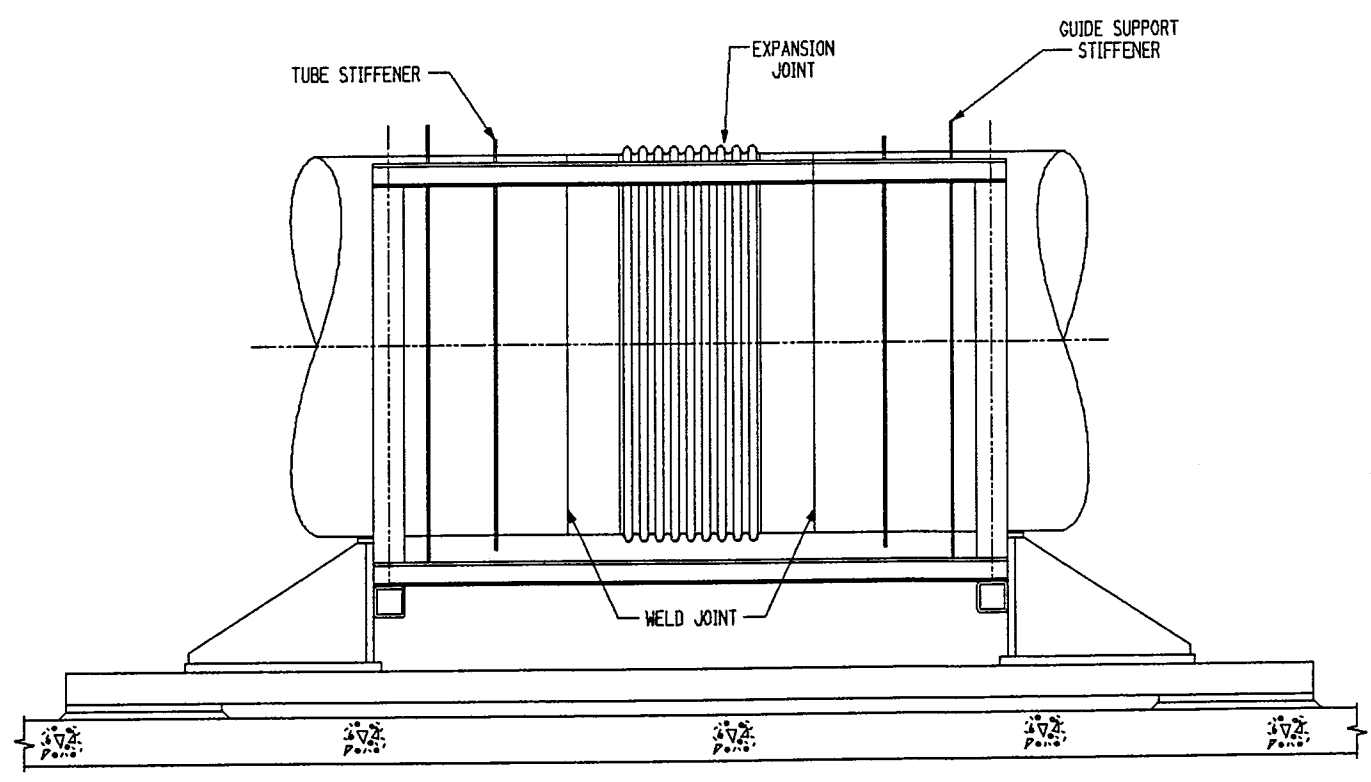
FIT-UP ARRANGEMENT



WELDING ARRANGEMENT



LEAK TEST ARRANGEMENT



FINAL POSITION GUIDED SUPPORT

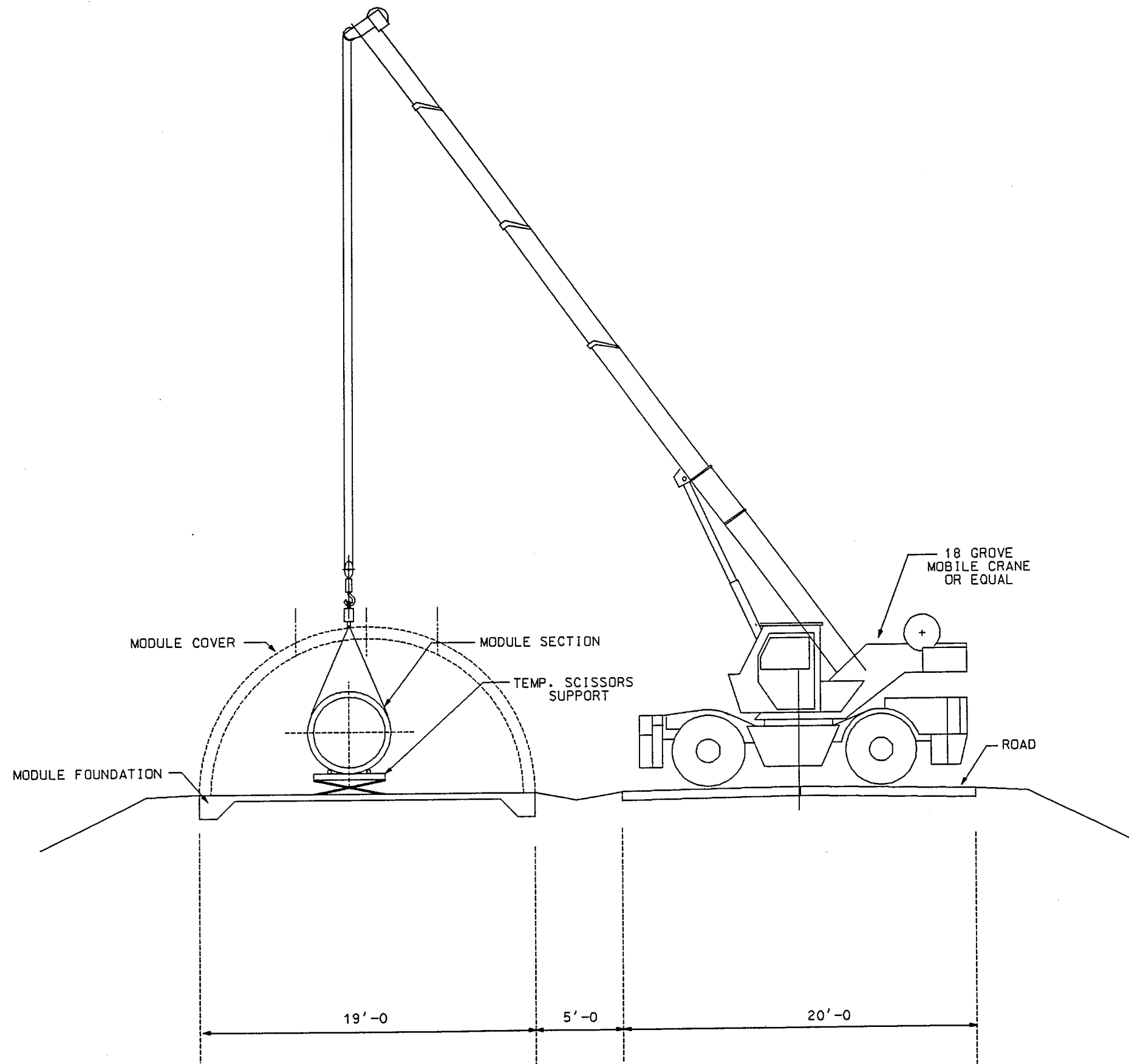
NOTES:

- GUIDE SUPPORTS ARE INSTALLED AFTER WELDING AND LEAK TESTING ARE COMPLETE

► INDICATES CHANGE FROM PREVIOUS ISSUE

CAD FILE 30212134.DGN

Supplier's/Purchaser's No.		Contract No.	
CBI		930212	
LIGO PROJECT			
FIT-UP WELDING AND LEAK TESTING CONFIGURATIONS AT GUIDE SUPPORTS			
Customer's No.		Contract No.	
By DKL Chkd Date 2-11-94		930212	
J.J. RINSELSLETTER		Dwg. ERI34	Rev. 2
Engineering Supervisor		Sheet -	
By	Date	Remarks	
Chkd	5-17-95	UPDATE DRAWING	
By	5-17-95	MODIFY TITLE BLOCK	
Chkd	3-30-94	NEW SUPPORT DESIGN	
By			
Chkd			




NOTES:

- CROSS SECTION OF ROAD/ TUBE & COVER IS SIMILAR FOR BOTH SITES

CAD FILE 30212140.DGN

▶ INDICATES CHANGE FROM PREVIOUS ISSUE

Supplier's/Purchaser's No. _____	
 LIGO PROJECT ELEVATION VIEW OF TUBE INSTALLATION	
Customer's No. _____	Contract No. 930212ER
By <u>DKL</u> Chkd _____ Date <u>2-4-94</u>	Dwg. <u>ER140</u> Rev. _____
By <u>J.L. RINGELSTETTER</u> Engineering Supervisor	
Sheet - <u>1</u>	

By	Chkd	Date	By	Chkd	Date	By	Chkd	Date	By	Chkd	Date

REVISIONS	REMARKS
1	UPDATE DRAWING
2	MODIFY TITLE BLOCK
3	DATE 5-12-95