ANALYSIS OF A LIFTING FIXTURE TO HOLD A STEEL MANDREL HORIZONTALLY FROM ONE END SUPPORT

D-ZERO ENGINEERING NOTE 3823.113-EN-510

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Approved By:_____
PPD/ETT/D-Zero Project Mech. Support Leader

SUMMARY:

A lifting fixture (drawing number 3823.113-MD-372382) that lifts large steel mandrels from one end through the mandrel's end support web is described. The mandrels are used as a mold to form carbon fiber cylinders. The mandrels are held from one end to allow the carbon cylinder to be pulled horizontally off the mandrel. Only mandrels as described in drawing #'s 3823.113-MD-358992 and 3823.113-MD-358994 are lifted by the fixture. The largest mandrel is 41 inches in diameter, 120 inches long, and weighs approximately 3,000 lbs. A detailed procedure for removing the carbon cylinder from the steel mandrel is given in the Appendix.

The fixture is to be supported only using Fermilab Forklift #10207 or equivalent. The forklift has a nameplate capacity of 12,000 lbs 24 inches from the mast at an elevation of 130 inches from the floor. The forklift forks must be removed from the truck prior to using the fixture. The forklift is to be used to support the mandrels only during the lifting operation and is not to be used to transport the mandrels.

Stresses at the lifting fixture are shear stresses on the support brackets due to the overall weight of the mandrel and moment loads due to the cantilever style support. The moment on the forklift due to the overhanging weight of the mandrel is calculated. Stresses in the mandrel due to the method of support are also described.

ANALYSIS:

Expected Size and Weight of the Mandrels:

The total weight of a mandrel is based on the weight of the rolled skin that forms the outside barrel and the support webs. The journals are stubs welded into the end support webs and do not significantly contribute to the weight of the mandrel. The length of mandrels #1 and #2 is approximately 76 inches and of mandrels #3 thru #8 is 110 inches. The expected wall thickness for each mandrel is a ½ inch. The end support webs are 1" thick (weight calculations are conservatively based on solid support webs). Mandrels #3 thru #8 also have a 1" thick center web for additional support. The density of steel used is 0.284 lb/in^3. Weights and dimensions of all mandrels are given in Table 1. The total moment on the lifting fixture is calculated as the total mandrel weight multiplied by half the mandrel length.

Table 1. Mandrel Weights and Dimensions.

MANDREL #	OUTER DIAMETER	MANDREL LENGTH	WALL WEIGHT	SUPPORT WEB WEIGHT	TOTAL MANDREL WEIGHT	MOMENT ON LIFTING FIXTURE
	(in)	(in)	(lbs)	(lbs)	(lbs)	(in.lbs)
1	15.156	76	515	89	604	22,952
2	19.018	76	645	145	790	30,020
3	22.864	110	1,122	320	1,442	79,310
4	26.738	110	1,314	443	1,757	96,635
5	30.602	110	1,502	586	2,088	114,840
6	34.464	110	1,691	749	2,440	134,200
7	38.326	110	1,881	932	2,813	154,715
8	40.292	110	1,977	1,033	3,010	165,550

Forklift Capacity:

The forklift has a nameplate capacity of 12,000 lbs with the load centered 24 inches from the mast at 130 inches of elevation. The total moment the Forklift can support is 288,000 in lbs. Using Table 1, the lowest safety factor on the load capacity is approximately 4 and the lowest safety factor on the moment capacity is 1.7.

Calculation of Allowable Material Stresses:

The maximum allowable stress on any material in the lifting system is 0.33 x Yield Stress according to ASME B30.20 – Below-The-Hook lifting devices[2]. The fixture brackets are constructed using a mild steel which is assumed to have a yield strength of 30,000 psi. The welds in the mandrel are also assumed to have a yield strength of 30,000 psi. The brackets are attached to the base plate using ANSI Grade 5 bolts with a yield strength of 120,000 psi[1]. The base plate is constructed of Aluminum to reduce the overall weight, however it has no significant stresses due to its large size. According to the above guidelines, the maximum allowable stress for the steel and welds in the fixture is 10,000 psi and 40,000 psi for the attaching bolts.

Stresses on the Mandrel Web Due to the Lifting Fixture:

The lifting fixture brackets are inserted into the top opening of the end support web, see Figures 1 and 2. The mandrel then sticks horizontally out from the lifting fixture and puts a moment on the lifting fixture. The moment creates a pullout force on the end support web where the lifting fixture brackets attach. The pullout force on the support web is equal to the weight of the mandrel times half the length divided by the mandrel diameter. The end support web is attached to the I.D. of the mandrel using ¼" fillet welds that are 2 inches long every 4 inches around the circumference. The shear stress on the weld is the pullout force divided by the area of the weld. The pullout force calculated in Table 2 assumes that all of the load is transmitted through only one of the skip welds. The shear stress in the weld is then calculated. For each case listed, the stress in the weld is less than the maximum allowable stress of 10,000 psi

Table 2. Shear stresses in the mandrel web due to potential web pullout.

MANDREL #	MANDREL OUTER DIAMETER	MANDREL HALF LENGTH	TOTAL MANDREL WEIGHT	PULLOUT FORCE ON WEB	STRESS IN WELD 2" X 1/4"
1	15.156 in	38 in	604 lbs	1514 lbs	3028 psi
2	19.018	38	790	1578	3156
3	22.864	55	1,442	3469	6938
4	26.738	55	1,757	3614	7228
5	30.602	55	2,088	3752	7504
6	34.464	55	2,440	3894	7788
7	38.326	55	2,813	4037	8074
8	40.292	55	3,010	4109	8218

Stresses on the Lifting Fixture Bracket:

The lifting fixture brackets (dwg #'s 3823.113-MC-372383 and 3823.113-MC-372411) are used to support the mandrel at the end support webs. The forces and stresses on the brackets are calculated:

Bracket for Mandrels #1 and #2:
The maximum shear stress on the bracket due to gravity is the weight of the mandrel divided by the cross sectional area of the bracket. The weight of mandrel #2 is 790 lbs and the cross sectional area of the bracket is 2.26 inch^2 producing a stress in the bracket of 350 psi.

The maximum shear stress on the bracket due to the moment of the mandrel is the web pull out force divided by the cross sectional area of the bracket. The pullout force for mandrel #2 is 1,578 lbs and the cross sectional area of the bracket is 1.5 inch^2 producing a stress in the bracket of 1,052 psi.

Bracket for Mandrels #3 thru #8:
The maximum shear stress on the bracket due to gravity is the weight of the mandrel divided by the cross sectional area of the bracket. The weight of mandrel #8 is 3,010 lbs. The cross sectional area of the bracket is 6.84 $inch^2$ producing a stress in the bracket of 440 psi.

The maximum shear stress on the bracket due to the moment of the mandrel is the web pull out force divided by the cross sectional area of the bracket. The pullout force for mandrel #8 is 4,109 lbs and the cross sectional area of the bracket is 3.56 $inch^2$ producing a stress in the bracket of 1,154 psi.

All of the above calculated stresses in the brackets used to couple the mandrel to the lifting fixture are less than the maximum allowable stress of 10,000 psi.

The Stresses in the Lifting Bracket Bolts:

Bracket for Mandrels #1 and #2:
There are four Grade 5 ANSI 7/16 inch bolts used to attach the bracket for mandrels #1 and #2. Assuming that only one of the bolts carry load, the maximum shear stress in the bolt due to gravity is the weight of the mandrel divided by the cross sectional area of the bolt. The weight of mandrel #2 is 790 lbs and the cross sectional area of one bolt is 0.1063 $inch^2$ producing a stress in the bolt of 7,432 psi.

Assuming that only one of the bolts carry the load, the maximum tensile stress in the bolt is the pull out force divided by the cross sectional area of the bolt. The force due to the moment of mandrel #2 is 1,578 lbs and the cross sectional area of one bolt is 0.1063 $inch^2$ producing a stress in the bolt of 14,845 psi.

Bracket for Mandrels #3 thru #8:
There are eight Grade 5 ANSI 7/16 inch bolts used to attach the bracket for mandrels 3 thru 8. Assuming that only one of the bolts carry load, the maximum shear stress in the bolt due to gravity is the weight of the mandrel divided by the cross sectional area of the bolt. The weight of mandrel #8 is 3,010 lbs and the cross sectional area of one bolt is 0.1063 $inch^2$ producing a stress in the bolt of 28,316 psi.

Assuming that only one of the bolts carry the load, the maximum tensile stress in the bolt is the pull out force divided by the cross sectional area of the bolt. The force due to the moment of mandrel #8 is 4,109 lbs and the cross sectional area of one bolt is 0.1063 $inch^2$ producing a stress in the bolt of 38,654 psi.

All of the calculated stresses in the lifting bracket bolts are less than the maximum allowable stress of 40,000 psi.

Stresses on the Forklift Supports:

The forklift supports (dwg #'s 382.113-MB-372481 and 3823.113-MC-372384) are used to attach the lifting plate to the forklift. The cross sectional area of each support bar is 3.75 $inch^2$ giving a shear stress due to gravity of 3,200 psi at the forklift nameplate load.

The force on the support due to the overhanging moment is calculated. For mandrels #3 thru #8 the lifting bracket is in line with the forklift support bracket so the pullout force calculated in Table 2 can be used as this force. However the position of the lifting bracket for mandrels #1 and #2 is much higher than the forklift support and so the pullout force given in Table 2 needs to be adjusted to compensate for the difference in height. The pullout force applied to the forklift support becomes the weight of the mandrel times half the mandrel length divided by the distance from the bottom of the mandrel to the support hook. The adjusted force on the support bracket for mandrel #1 is 6,750 lbs and for mandrel #2 is 4,363 lbs. The shear stress in support bracket due to the overhanging mandrel moment is the maximum force (6,750 lbs for mandrel #1) divided by the cross-sectional area of the bracket (30 in^2). The force applied to the support bracket when lifting mandrel #1 creates a shear stress in the bracket of 225 psi.

All of the calculated stresses in the Forklift Supports are less than the maximum allowable stress of 10,000 psi.

Eight 7/16 inch ANSI Grade 5 bolts are used to attach the support bar to the lifting plate. The bolt shear stress due to gravity when lifting mandrel #8 is 28,316 psi assuming that all of the load is carried by one bolt. The tensile stress in one bolt due to the overhanging moment when lifting mandrel #1 is 41,044 psi. Assuming two bolts in the bolt system share the load the stress in one of the two bolts would be 20,500 psi which is less than the maximum allowable stress of 40,000 psi.

Bolt Torques:

The 7/16 inch ANSI Grade 5 bolts should not be over-torqued because it increases the tensile stress in the bolt.

Torque (in.lbs) = 1/5 bolt diam. (in) X clamping force (lbs)
Or substituting in stress instead of force
Torque (in.lbs) = 1/5 bolt diam. (in) X tensile stress (psi) X bolt cross sectional area (in^2)

where 1/5 is the friction coefficient assumed for steel bolts and sliding surfaces.

Using the above formula [3] a maximum bolt torque of 180 inch.lbs should be used on all bolts. This produces and additional 19,400 psi of tensile strength on the bolt. In the case of one bolt carrying all of the mandrel load, the maximum allowable stress in the bolt can be exceeded. However if the load is shared over at least two bolts in the bolt system the maximum allowable stress of 40,000 psi is not exceeded.

CONCLUSION:

A lifting fixture is constructed that horizontally lifts large steel mandrels from one end through the mandrel's end support web. The dropping hazard is minimized using this fixture. The hazard is reduced by securely attaching the lifting fixture to the forklift. Also, 2"x4" lumber is used as anti-rocking studs across the face of the lifting fixture to prevent the mandrel from "swaying" as it is being supported. Only mandrels as described in drawing #'s 3823.113-MD-358992 and 3823.113-MD-358994 are lifted by the fixture. The fixture is to be supported only with Fermilab Forklift #10207 or equivalent. The forklift is to be used to support the mandrels only during the lifting operation and is not to be used to transport the mandrels. The fixture is constructed using 30,000 psi yield strength steel. The brackets are attached using ANSI Grade 5 bolts with a yield strength of 120,000 psi[1]. The maximum allowable stress on any of the features in the lifting system is 0.33 x Yield Stress. The maximum allowable stress for the steel and welds in the fixture is 10,000 psi and 40,000 psi for the attaching bolts. All stresses in the system are below these values. The fixture is to be inspected prior to each use including identifying any loose or damaged bolts, brackets, supports or anti- rocking studs.

References:

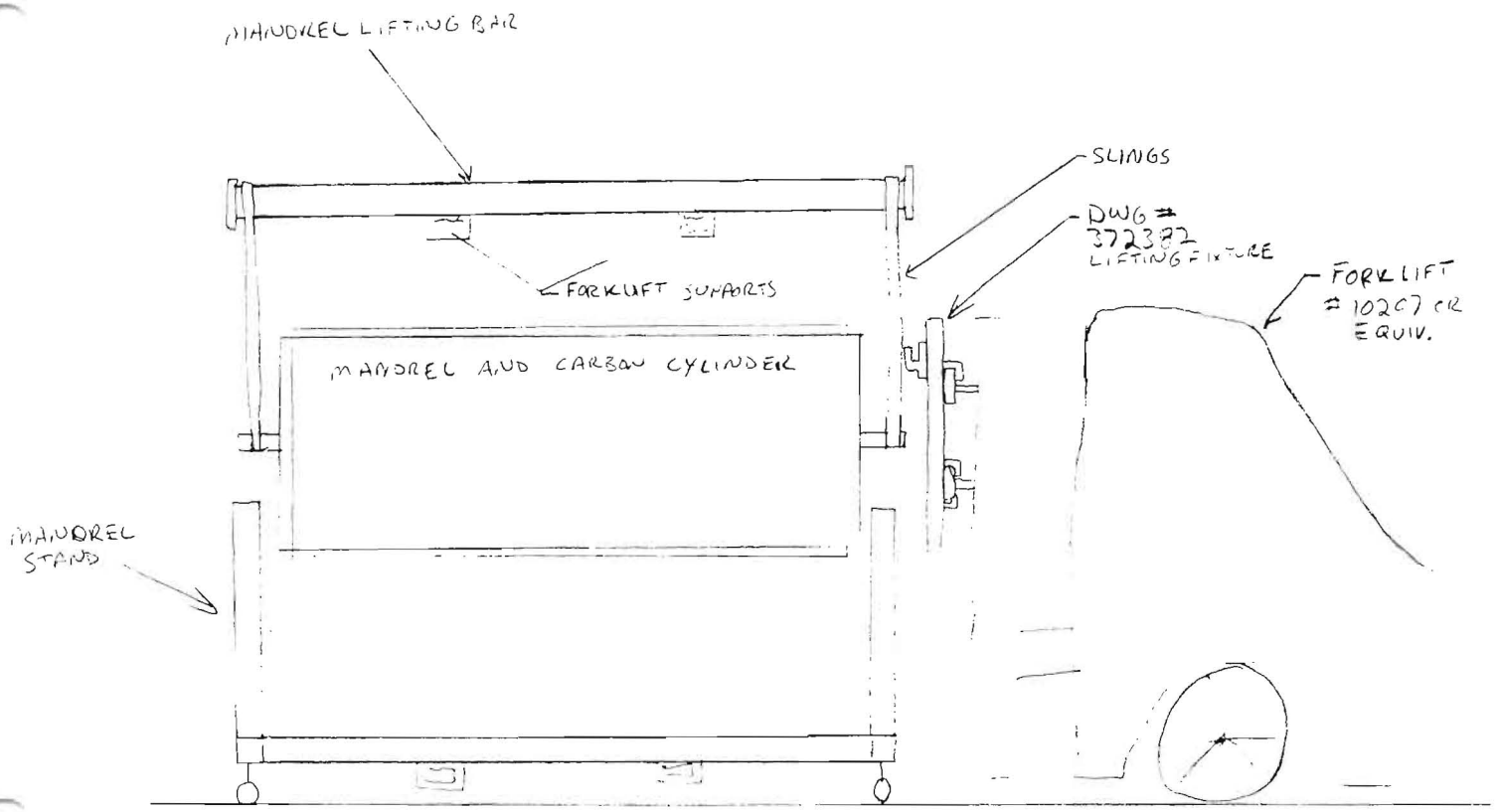
1) Mark's Standard Handbook For Mechanical Engineers 8th ed.

2) ASME B30.20 Below-The-Hook Lifting Devices.

3) What Every Engineer Should Know About Threaded Fasteners, Blake

Appendix – Procedure for removing the carbon fiber cylinder from the mandrels.

1) Inspect all fixtures and lifting devices for damage.
2) Mount the lifting fixture (#3823.113-MD-372382)to forklift #10207 or equivalent.
3) Position forklift #10207 at one end of the mandrel while the mandrel is still on the mandrel stand and secure the wheels to prevent the forklift from moving.
4) Using the mandrel lifting bar as described in the Engineering Note #3823.113 EN-500 and a second forklift, slightly raise the mandrel out of the mandrel stand. The slings used should be around the mandrel journals so as not to damage the surface of the mandrel or carbon cylinder.
5) Using forklift #10207, insert the lifting fixture into the web openings at the end of the mandrel.
6) Slightly raise the mandrel out of the slings and then loosen the slings from around the mandrel journals. Do not completely remove the slings.
7) Slide the carbon tube from the mandrel and through the sling.
8) Repeat steps 3 thru 5 in reverse to place the mandrel back in the mandrel stand.



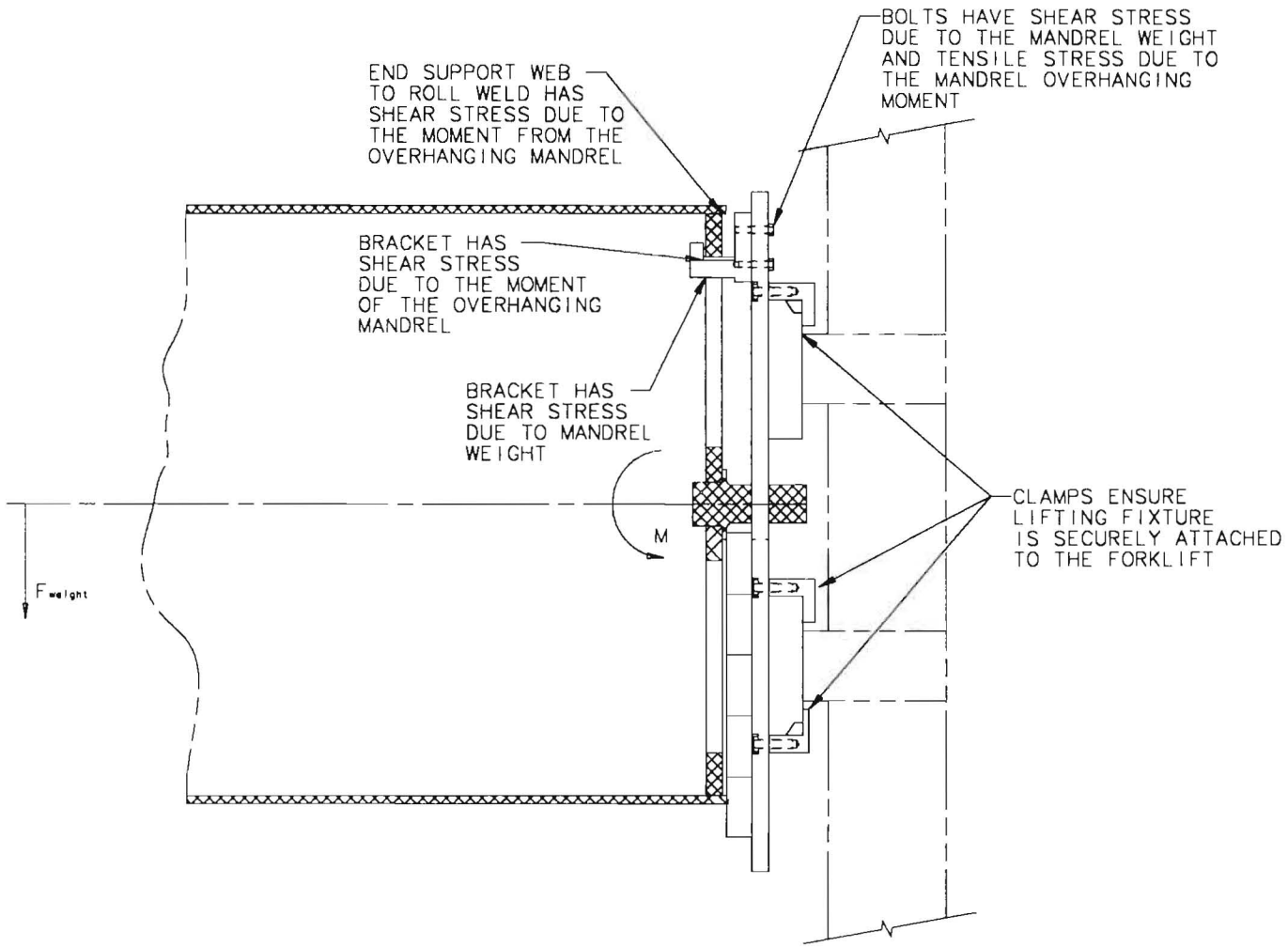


FIGURE 1
MANDRELS #3 THRU #8 SUPPORT

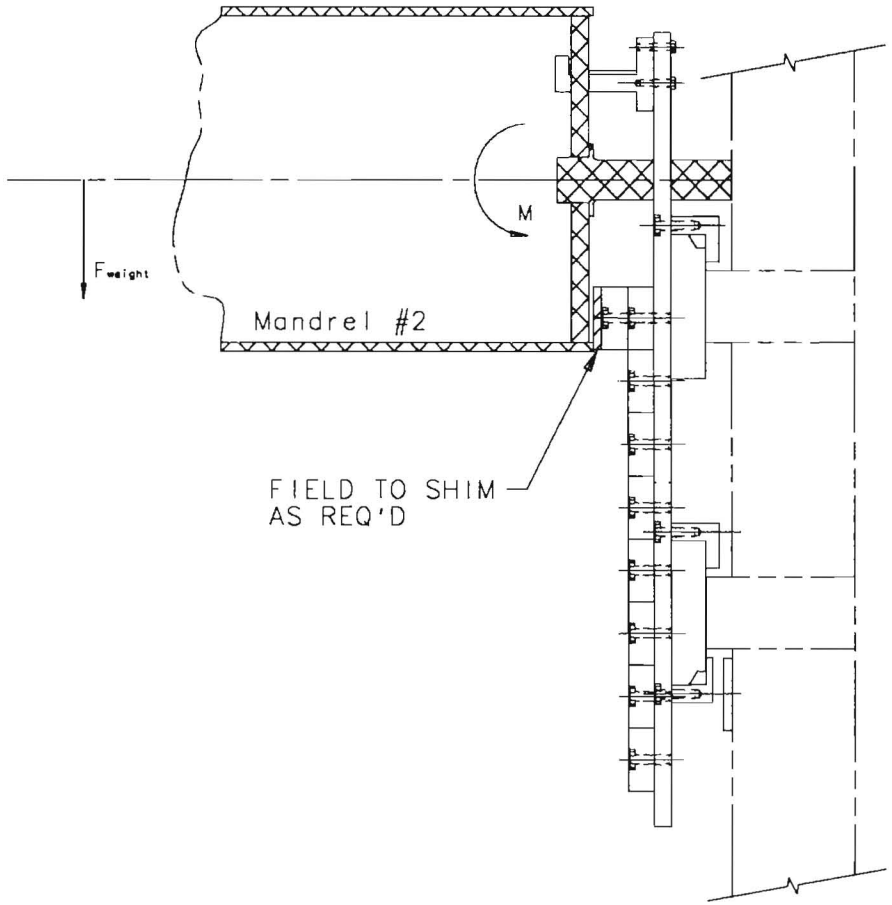
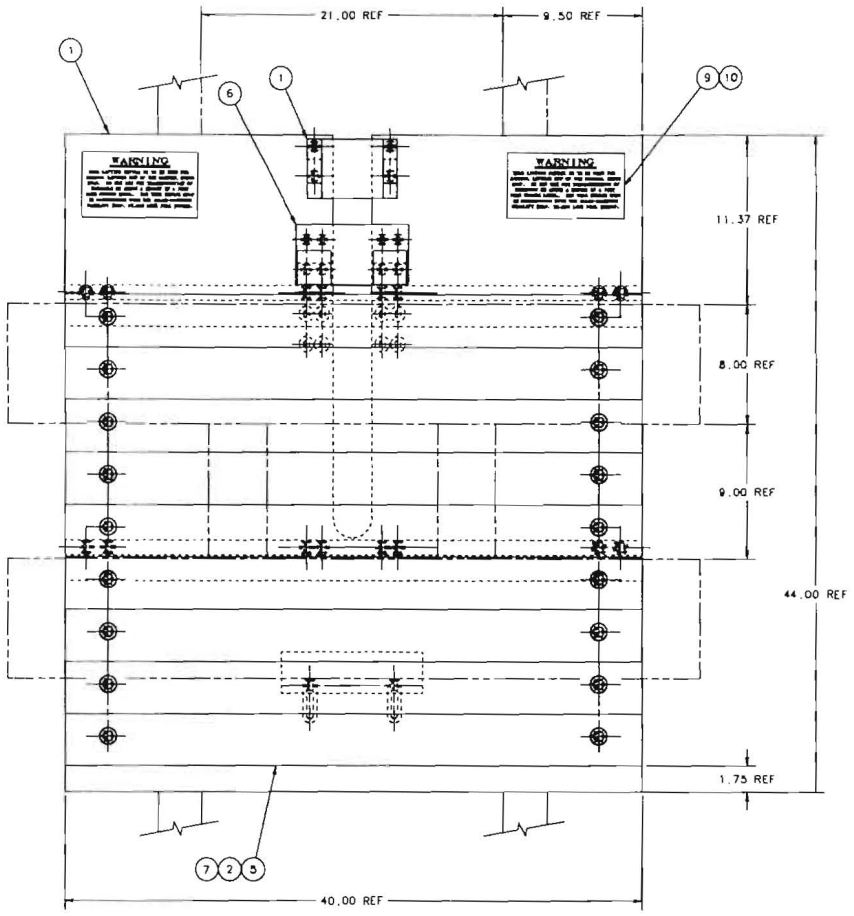
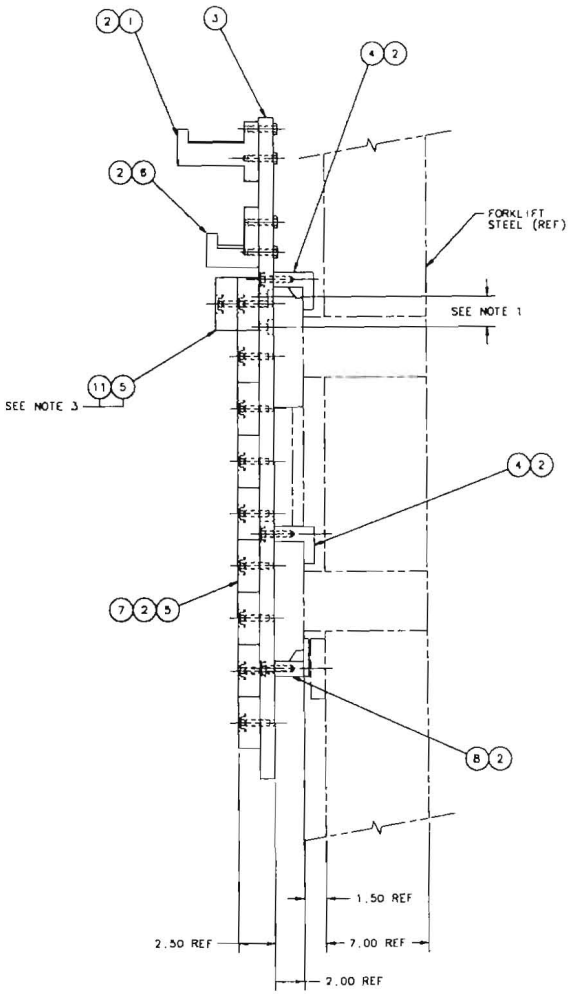


FIGURE 2
MANDRELS #1 & #2 SUPPORT





REV	DESCRIPTION	DRAWN	DATE
		APPROVED	DATE
A	CHG'D ITEM #2-5 QUAN FROM 32 TO 48. UPDATED ITEMS #3 & #4 TO THEIR CURRENT REVISION STATUS.	D. FRIEND	3/9/99
		K.K.	3/9/99

ITEM NO.	PART NO.	DESCRIPTION OR SIZE	QTY. REQ.
11	COML	CAP SCREW, HEX HD., ALLOY STEEL GRADE 5, 7/16-14 UNC-2A x 3.00 LG.	2
10	1825-0500	CLEAR PROTECTIVE COATING FOR ELECTRONICS, KRYLON #1301	AS REQ'D
9	MB-372488	WARNING LABEL	2
8	MB-372481	FORKLIFT BOTTOM CLAMP	1
7	1218-0680	WASHER, FLAT, 18-8 S.S. 7/16 SCREW	18
6	MC-372411	MANDREL #3-8 LIFTING BRACKET	1
5	MB-372412	MANDREL ANTI-ROCKING STUD	9
4	MB-372384	FORKLIFT BRACKET	2
3	MD-372385	MANDREL LIFTING PLATE	1
2	COML	CAP SCREW, HEX HD., ALLOY STEEL GRADE 5, 7/16-14 UNC-2A x 1.50 LG.	48
1	MC-372383	MANDREL #1-2 LIFTING BRACKET	1

PARTS LIST

UNLESS OTHERWISE SPECIFIED			ORIGINATOR	H. CEASE	12/98
.XX	.XXX	ANGLES	DRAWN	D. FRIEND	12/21/98
± .28	± --	± --	CHECKED	H. CEASE	12/22/98
			APPROVED	K. KREMPETZ	1/14/99

1. BREAK ALL SHARP EDGES (0.5 MAX.)
2. DO NOT SCALE DRWG.
3. DIMENSIONING IN ACCORD WITH ANSI Y14.5M-1982 SIO.
4. ALL DIMENSIONS ARE IN INCHES.

USED ON

MATERIAL: AS NOTED ABOVE

MAX. ALL MACHINED SURFACES

FERMI NATIONAL ACCELERATOR LABORATORY
UNITED STATES DEPARTMENT OF ENERGY

DO DETECTOR UPGRADE
CENTRAL FIBER TRACKER
MANDREL LIFTING DEVICE ASSEMBLY

SCALE	DRAWING NUMBER	SHEET NO.	REV.
1/4	3823.113-MD-372382	1 OF 1	A

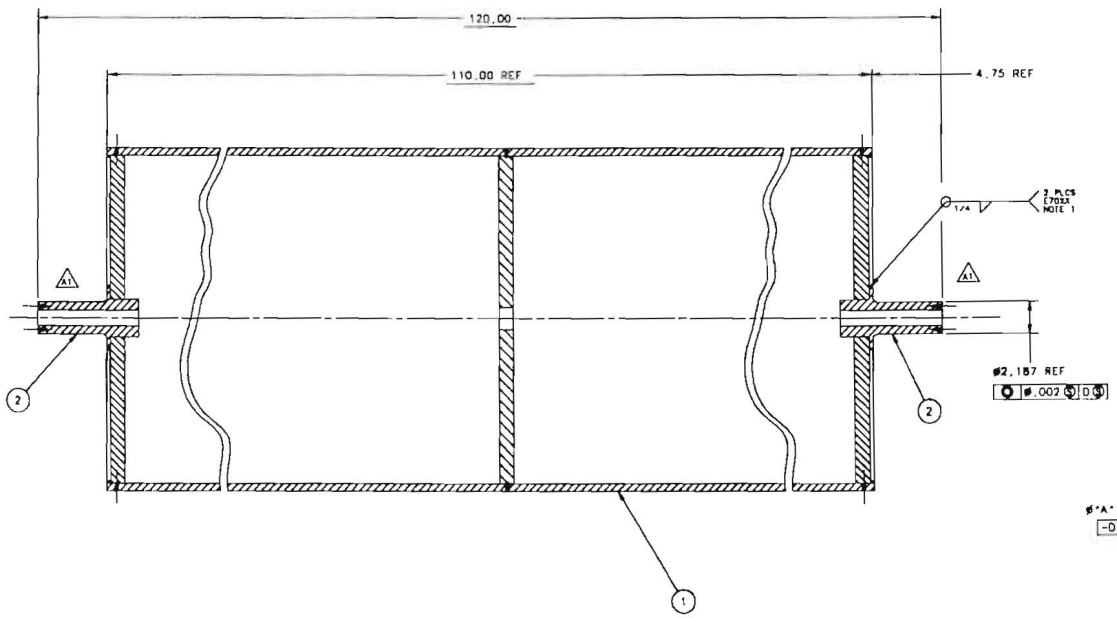
3 WHEN USING LIFTING DEVICE FOR MANDRELS #1 & #2 USE TWO ANTI-ROCKING STUDS (ITEM #5) AND 3" LONG BOLTS (ITEM #11) IN LIEU OF THE SHORTER BOLTS (ITEM #2) AT THE TOP MOST LEVEL AND RELOCATION OF A LOWER ANTI-ROCKING STUD IS PERMISSIBLE.

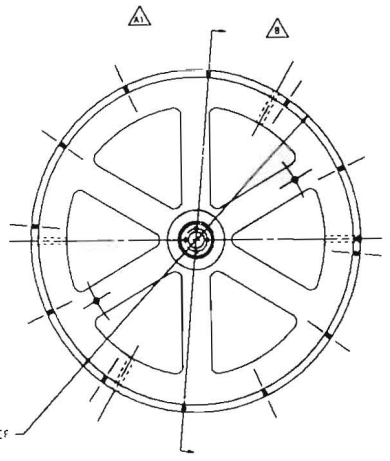
2 THIS ASSEMBLY TO BE USED ONLY IN CONJUNCTION WITH THE ALLIS CHALMERS FORK LIFT VEHICLE (FNAL #10207) 12,000 LBS. CAP. OR EQUIVALENT.

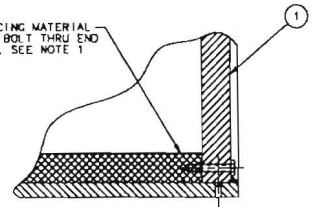
1. FOR MANDRELS #3 & #4 MOVE ITEM #8 TO THIS LOCATION. REMOVAL OF ANTI-ROCKING STUDS (ITEM #5) SHALL BE NECESSARY TO ACCOMMODATE MANDREL SHAFT. FIELD TO VERIFY QUAN. OF REMOVAL FOR ANY MANDREL.

NOTES:

REV.	DESCRIPTION	DRAWN / APPROVED	DATE
A	CORRECTED SHAFT (ITEM 2) GEOMETRY. UPDATED ITEM #1 TO ITS CURRENT REVISION.	D. FRIEDO / K.K.	8/26/98 / 8/29/98
B	UPDATED ITEM #1 TO ITS CURRENT REVISION.	D. FRIEDO	10/21/98







DETAIL "A"
SCALE: 1/2

SUFFIX NO.	"A"	"B"
-4	26.738	ME-3589991-4
-5	30.602	ME-3589991-5
-6	34.484	ME-3589991-6
-7	38.326	ME-3589991-7
-8	40.292	ME-3589991-8

NOTES:

1. AFTER WELDING SHAFTS (ITEM #2) TO THE MANDREL (ITEM #1), STATICALLY BALANCE ASSEMBLY. MATERIAL ADDITION SHALL BE DONE ON END PLATES OF MANDREL SUB-ASSEMBLY (ITEM #1) ONLY. SEE DETAIL "A".

ITEM NO.	PART NO.	DESCRIPTION OR SIZE	QTY. REQ.
2	ME-358997	MANDREL SHAFT	2
1	"B"	MANDREL SUB-ASSEMBLY	1

PARTS LIST

UNLESS OTHERWISE SPECIFIED			ORIGINATOR	H. CEASE	7/98
.XX	.XXX	ANGLES	DRAWN	D. FRIEDO	7/29/98
± .06	± ---	± ---	CHECKED	H. CEASE	7/30/98
			APPROVED	K. KREMPETZ	7/31/98

1. BREAK ALL SHARP EDGES .015 MAX.
2. DO NOT SCALE DRWG.
3. DIMENSIONING IN ACCORD WITH ANSI Y14.5M-1982 STD'S.
4. ALL DIMENSIONS ARE IN INCHES.

LEGO ON

MATERIAL: AS NOTED ABOVE

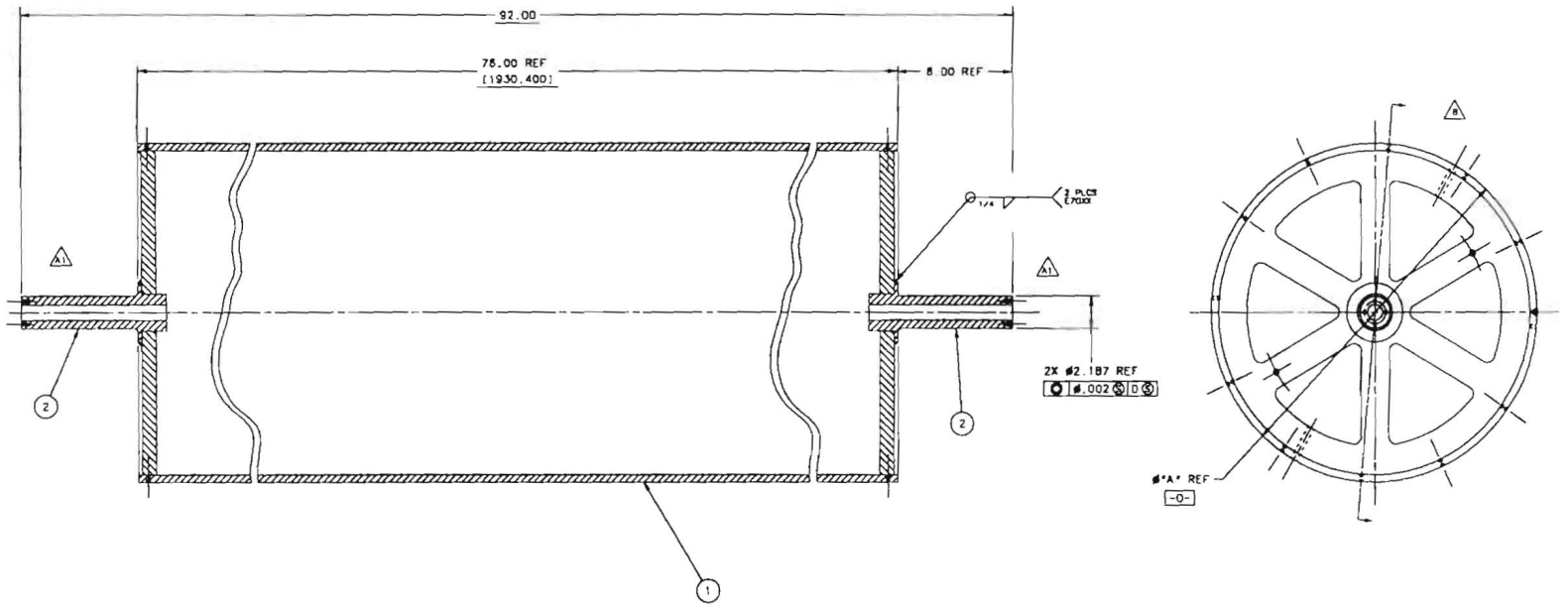
MAX. ALL MACHINED SURFACES

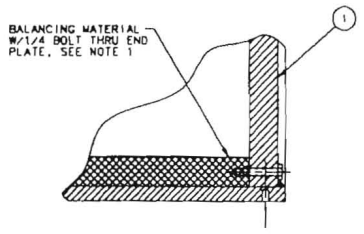
FERMI NATIONAL ACCELERATOR LABORATORY
UNITED STATES DEPARTMENT OF ENERGY

DO DETECTOR UPGRADE
CENTRAL FIBER TRACKER
MANDREL #4 THRU #8 ASSEMBLY

SCALE	DRAWING NUMBER	SHEET NO.	REV.
1/4	3823.113-MD-358992	1 OF 1	B

REV	DESCRIPTION	DRAWN / APPROVED	DATE
A	CORRECTED SHAFT (ITEM 2) GEOMETRY.	D. FRIEND	8/28/98
		K.K.	8/28/98
B	UPDATED ITEM #1 TO ITS CURRENT REVISION	D. FRIEND	10/21/98





DETAIL "A"
SCALE: 1/2

SUFFIX NO.	"A"	"B"
-1	15.158	ME-358990-1
-2	19.018	ME-358990-2

NOTES:

1. AFTER WELDING SHAFTS (ITEM #2) TO THE MANDREL (ITEM #1), STATICALLY BALANCE ASSEMBLY. MATERIAL ADDITION SHALL BE DONE ON END PLATES OF MANDREL SUB-ASSEMBLY (ITEM #1) ONLY. SEE DETAIL "A".

ITEM NO.	PART NO.	DESCRIPTION OR SIZE	QTY. REQ.
2	MB-358993	MANDREL SHAFT	2
1	"B"	MANDREL SUB-ASSEMBLY	1

PARTS LIST

UNLESS OTHERWISE SPECIFIED			ORIGINATOR	H. CEASE	7/98
XX	XXX	ANG. ±1°	DRAWN	D. FRIEND	7/29/98
± .06	± ---	± ---	CHECKED	HERMAN CEASE	7/30/98
			APPROVED	K. KREMPETZ	7/31/98

1. BREAK ALL SHARP EDGES @ 0.015.
2. DO NOT SCALE DRAWING
3. DIMENSIONING IN ACCORD WITH ANSI Y14.5M-1982 STD'S.
4. ALL DIMENSIONS ARE IN INCHES.

LOCO CM

MATERIAL: AS NOTED ABOVE

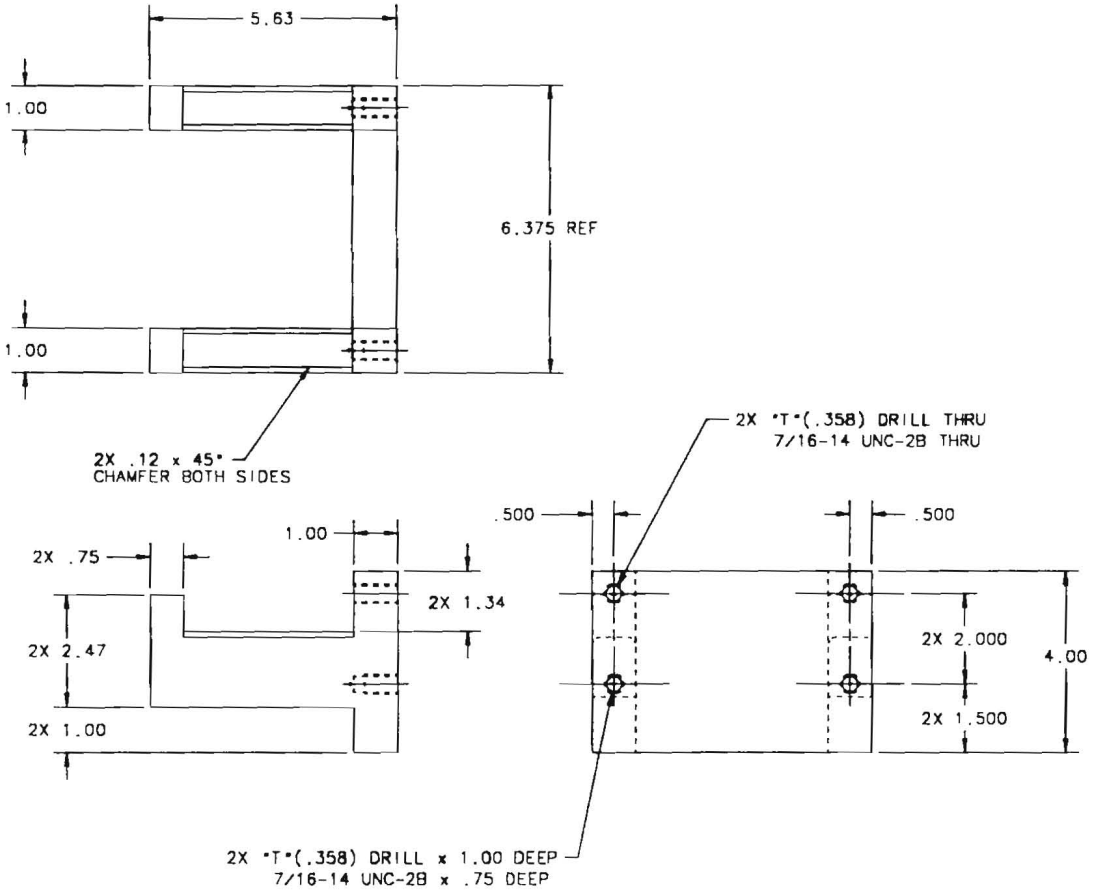
✓ MAX ALL MACHINED SURFACES

FERMI NATIONAL ACCELERATOR LABORATORY
UNITED STATES DEPARTMENT OF ENERGY

DO DETECTOR UPGRADE
CENTRAL FIBER TRACKER
MANDREL #1 & #2 ASSEMBLY

SCALE	DRAWING NUMBER	SHEET NO.	REV
1/4	3823.113-MD-358994	1 OF 1	B

REV.	DESCRIPTION	DRAWN	DATE
		APPROVED	DATE



ITEM NO.	PART NO.	DESCRIPTION OR SIZE	QTY. REQ.

PARTS LIST

UNLESS OTHERWISE SPECIFIED					
.XX	.XXX	ANGLES	ORIGINATOR	H. CEASE	12/98
± .03	± .010	± 1°	DRAWN	D. FRIEND	12/21/98
			CHECKED	H. CEASE	12/22/98
			APPROVED	K. KREMPETZ	1/14/99

1. BREAK ALL SHARP EDGES .015 MAX.
2. DO NOT SCALE DRWG.
3. DIMENSIONING IN ACCORD WITH ANSI Y14.5M-1982 STD'S.
4. ALL DIMENSIONS ARE IN INCHES.

125 √ MAX. ALL MACHINED SURFACES

USED ON: MD-372382

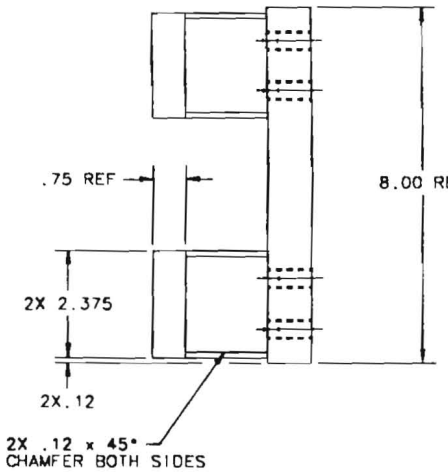
MATERIAL: SQUARE 6 x 6 x 6.375 LG. AISI 1018 C.F. STEEL

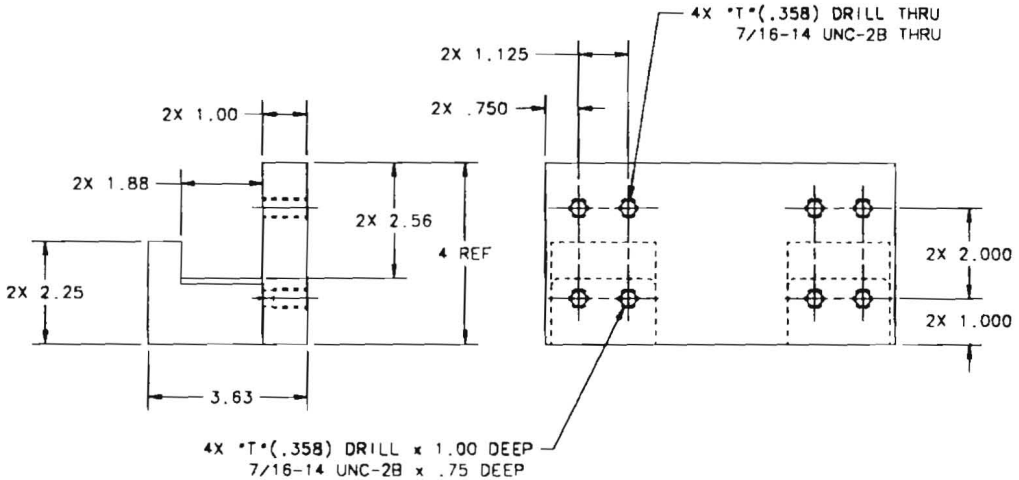
FERMI NATIONAL ACCELERATOR LABORATORY
UNITED STATES DEPARTMENT OF ENERGY

D0 DETECTOR UPGRADE
CENTRAL FIBER TRACKER
MANDREL #1-2 LIFTING BRACKET

SCALE	DRAWING NUMBER	SHEET NO.	REV.
1/2	3823.113-MC-372383	1 OF 1	

REV.	DESCRIPTION	DRAWN	DATE
		APPROVED	DATE





ITEM NO.	PART NO.	DESCRIPTION OR SIZE	QTY. REQ.
		PARTS LIST	

UNLESS OTHERWISE SPECIFIED			ORIGINATOR	H. CEASE	12/98
.XX	.XXX	ANGLES	DRAWN	O. FRIEND	12/1/98
± .03	± .010	± 1°	CHECKED	H. CEASE	12/3/98
			APPROVED	K. KREMPETZ	1/14/99

1. BREAK ALL SHARP EDGES .015 MAX.
2. DO NOT SCALE DRWG.
3. DIMENSIONING IN ACCORD WITH ANSI Y14.5M-1982 STD'S.
4. ALL DIMENSIONS ARE IN INCHES.

125 √ MAX. ALL MACHINED SURFACES

USED ON: MD-372382

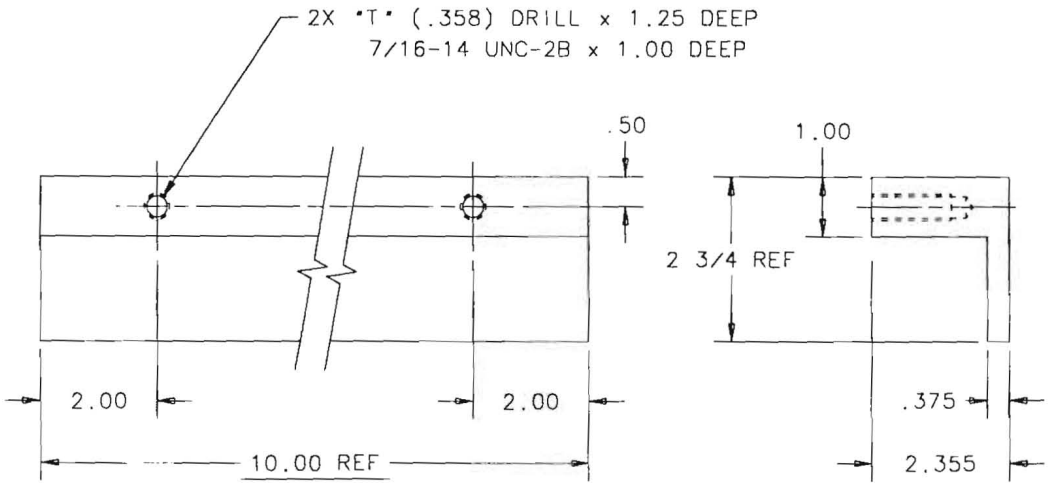
MATERIAL: SQUARE 4 x 4 x 8.00 LG. AISI 1018 C.F. STEEL

FERMI NATIONAL ACCELERATOR LABORATORY
UNITED STATES DEPARTMENT OF ENERGY

DO DETECTOR UPGRADE
CENTRAL FIBER TRACKER
MANDREL #3-8 LIFTING BRACKET

SCALE	DRAWING NUMBER	SHEET NO.	REV.
1/2	3823.113-MC-372411	1 OF 1	

REV.	DESCRIPTION	DRAWN	DATE
		APPROVED	DATE



ITEM NO.	PART NO.	DESCRIPTION OR SIZE	QTY. REQ.

PARTS LIST

UNLESS OTHERWISE SPECIFIED			ORIGINATOR	H. CEASE	12/98
.XX	.XXX	ANGLES	DRAWN	D. FRIEND	12/18/98
± .03	± .010	± ---	CHECKED	H. CEASE	12/18/98
			APPROVED	K. KREMPETZ	1/14/99

1. BREAK ALL SHARP EDGES .015 MAX.
2. DO NOT SCALE DRWG.
3. DIMENSIONING IN ACCORD WITH ANSI Y14.5M-1982 STD'S
4. ALL DIMENSIONS ARE IN INCHES.

125 √ MAX. ALL MACHINED SURFACES

USED ON: MD-372382

MATERIAL: SQUARE 2-3/4 x 10.00 LG. AISI 1018 C.F. STEEL

FERMI NATIONAL ACCELERATOR LABORATORY
UNITED STATES DEPARTMENT OF ENERGY

DO DETECTOR UPGRADE
CENTRAL FIBER TRACKER
FORKLIFT BOTTOM CLAMP

SCALE	DRAWING NUMBER	SHEET NO.	REV.
1/2	3823.113-MB-372481	1 OF 1	

Fermilab

April 3, 1999

TO: Sam Segler
Chair, D-Zero ES&H Review Committee

FROM: Harry Carter
Chair, D-Zero Mechanical Safety Review Panel

SUBJECT: Review of Mandrel Lifting Fixture for D0 CFT

I have completed a review of D0 Engineering Note #3823.113-EN-510 for a CFT Mandrel Lifting Fixture which is used in conjunction with a fork lift in order to facilitate removal of the completed carbon fiber tube from the mandrel. I conclude that the design is sound and should not constitute a safety hazard to equipment or personnel when fabricated, load tested, and operated in accordance with the information that was reviewed.

I therefore recommend that load testing of the lifting fixture be permitted. Upon the successful completion of the load test and the subsequent sign-off on the Engineering Note, I further recommend that the fixture be permitted to be placed in service for its intended use.

xc. Bill Freeman
Kurt Krempetz

Fermilab

To: Harry Carter

From: Bill Freeman WLF

Date: 04/27/99

Re: Review of DØ Engineering Note 3823.113-EN-510 for Mandrel Lifting Fixture

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The above referenced engineering note is attached for your review. Please contact Herman Cease at DØ with any questions or concerns. Herman would like to perform the load test next week, if possible, so we would appreciate a timely review. Thanks.

wsf

CC: Sam Segler w/o att

Herman Cease w/o att

Kurt Krempetz w/o att

BELOW-THE-HOOK LIFTING DEVICE
Engineering Note Cover Page

Lifting Device Numbers:

FNAL Site No.:_____ if applicable Div. Specific No.: _____ if applicable Asset No. _____ if applicable

ASME B30.20 Group: (check one)
- (●) Group I Structural and Mechanical Lifting Devices
- ☐ Group II Vacuum Lifting Devices
- ☐ Group III Magnets, Close Proximity Operated
- ☐ Group IV Magnets, Remote Operated

Device Name or Description: MANDREL LIFTING FIXTURE

Device was: (check all applicable)
- ☐ Purchased from a Commercial Lifting Device Manufacturer
  mfg. name: _____
- ☐ Designed and Built at Fermilab
- (●) Designed by Fermilab and Built by a Vendor
  Assy drawing number: 3823.113-MD-372382
- ☐ Provided by a User or Other Laboratory
- ☐ Other. Describe: _____

Engineering Note Prepared by: HERMAN CEASE Date: 04/07/99

Engineering Note Reviewed by: HARRY CARTER Date: 05/03/99

Lifting Device Data:

Capacity: USED TO LIFT MANDRELS 3823.113-MD-358992 ONLY -358994

Fixture Weight: 310 lbs

Service: (●) normal ☐ heavy ☐ severe (refer to B30.20 for definitions)

Duty Cycle: _____ 8, 16 or 24 hour rating (applicable to groups III, and IV)

Inspections Frequency: BEFORE USE

Rated Load Test by FNAL (if applicable): Date: 5-4-99 Load: MANDREL #8 + 650 lbs @ 50" from forklift

☐ Check if Load Test was by Vendor and attach the certificate.

Satisfactory Load Test Witnessed by: HARRY CARTER

Signature (of Load Test Witness): Harry F. Carter

Notes or Special Information: