LIFTING DEVICE

DEVICE NAME: TGT. GALLERIES / MAGNET LIFTING FIXT. ASSY

ENGINEERING NOTE NUMBER: 7a

DRAWING NUMBER: 7210.300-ME-201817

APPLICABLE STANDARD: ANSI/ASME B30.20-1985 BELOW THE HOOK LIFTING DEVICES
MANUAL OF STEEL CONSTRUCTION AISC 9 ED

RATED LOAD: * 20 TON & ** 16 TON

TEST LOAD: * 25 TON & ** 20 TON

TEST LOAD PERCENT: 125%

LAST LOAD TEST DATE: SEE Pg #2

COLOR: YELLOW

STRESS CALCULATIONS:

Done by: E. M. Villegas

Date: 7/8/93

Reviewed by: Tom Stamp

Date: 7/27/93

REMARKS:

* 20 TON RATED LOAD & 25 TON TEST LOAD ARE FOR CENTER LIFT & LOAD ON HOOKS

** 16 TON RATED LOAD & 20 TON TEST LOAD ARE FOR END LIFT & LOAD ON HOOKS

IDENTIFICATION:

Engineering Note Number & Rated Load Must be Clearly Marked On a Conspicuous Surface.

FERMILAB
ENGINEERING NOTE

SECTION	PROJECT	SERIAL-CATEGORY	PAGE

SUBJECT

NAME: E.M. Willyard

DATE: 7/8/93 | REVISION DATE:

NOTE:

THIS ENG'G. NOTE (7a THRU 7c, DATED 7/8/93) SUPERSEDES ENG'G NOTES 7a THRU 7d AUTHORED BY BOSCH & HIRANDA, DATED AUG. 1988.

PICK POINTS, LOAD POINTS AND SIZE OF CHANNELS USED FOR STRESS CALCULATIONS WERE NOT CONSISTENT WITH ORIGINAL DESIGN PARAMETERS.

FERMILAB

ENGINEERING NOTE

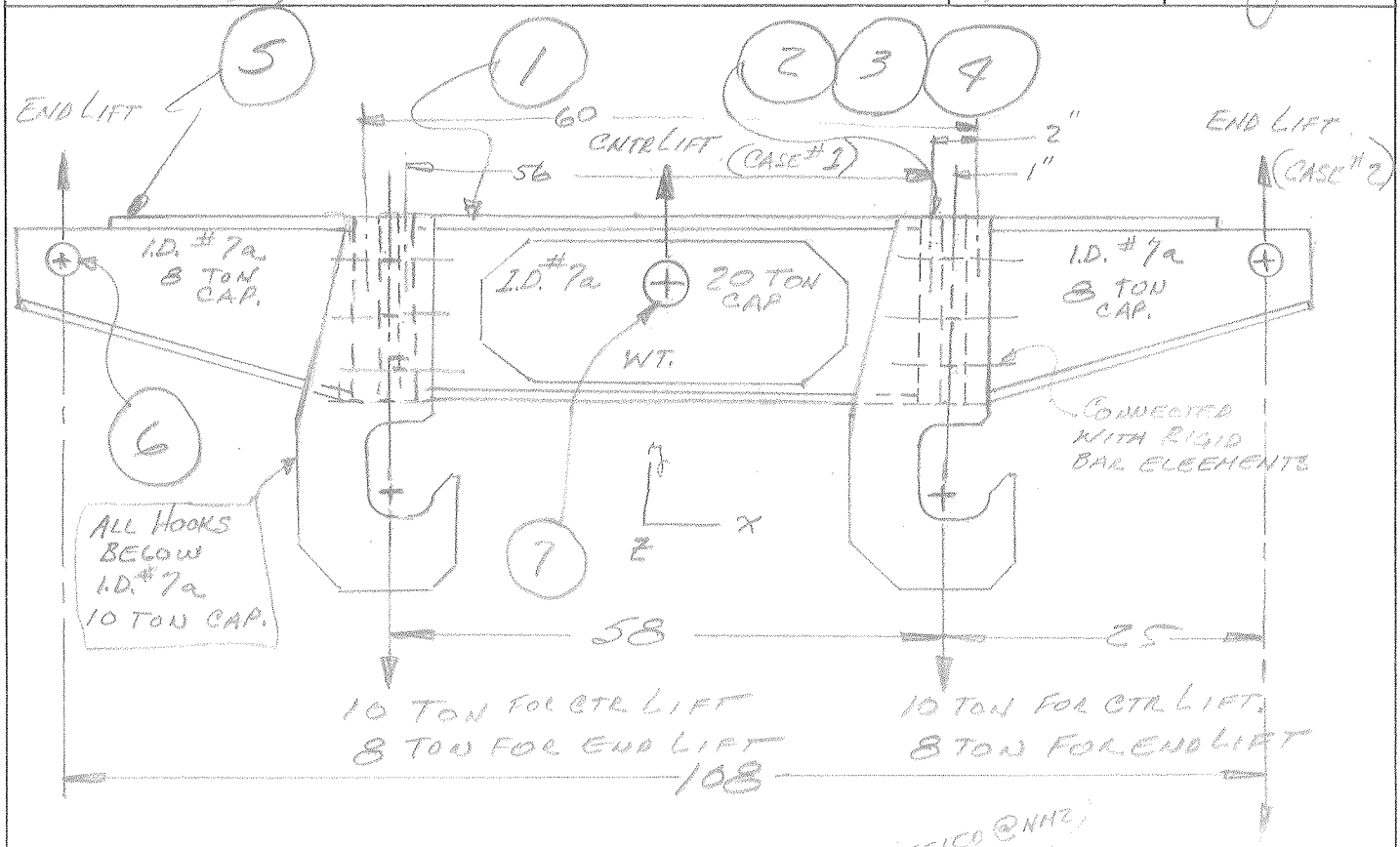
SECTION	PROJECT	SERIAL-CATEGORY	PAGE
			2

SUBJECT: MAGNET LIFTING FIXT ASSY, ME-201817
EQUIP. HANDLING, LIFTING DEVICES
RQ 450

NAME: E.M. Colby

DATE: 1/15/93

REVISION DATE:



1) CENTER FRAME, ME-201818 (TESTED @ NH2 12/6/93)

2) HOOK, 31", HORIZ. MAGNET, ME-201827 (TESTED @ NH2 12/6/93) → GRADE A HOOK

3) HOOK, 21", VERT MAGNET, ME-201823 (TESTED @ MP9 1/4/94) → GRADE A HOOK

4) HOOK, 22⅛, SPL. VERT MAGNET, (E-731) ME-201157 (TESTED @ NH2 12/6/93)

5) END WELDMNT, ME-201820 (USED FOR END LIFTS ONLY)

6) END PIN, 2" ϕ, ME-201822 (TESTED @ MP9 1/4/94)

7) CENTER PIN, 2⅜ ϕ, ME-201821 (TESTED @ NH2 12/6/93)

FERMILAB
ENGINEERING NOTE

SECTION	PROJECT	SERIAL-CATEGORY	PAGE
MSG	SSW ABUTMENT		3

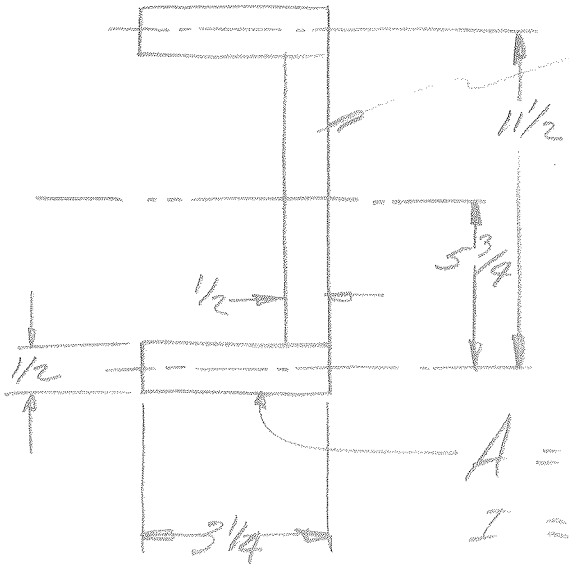
SUBJECT: CENTER, MDL, ME-201818 EQUIP. HANDLING, LIFTING DEVICES RD / MSD

NAME: E Willis

DATE: 1/15/23 REVISION DATE:

CHANNEL — C12 × 30, ASTM A36 STL.

$I_x = 162$



$A = 5.57 in^2$

$I = 55.96 in^4$

$A = 1.625 in^2$

$I = .0338 in^4$

$I_{MDL} = \Sigma (I_o + A d^2)$

$= 55.96 + 2(.0338 + 1.625 \times 5.75^2)$

$= 163$ VERY NEARLY EQUAL TO I_x OF ACTUAL CHANNEL

FERMILAB

ENGINEERING NOTE

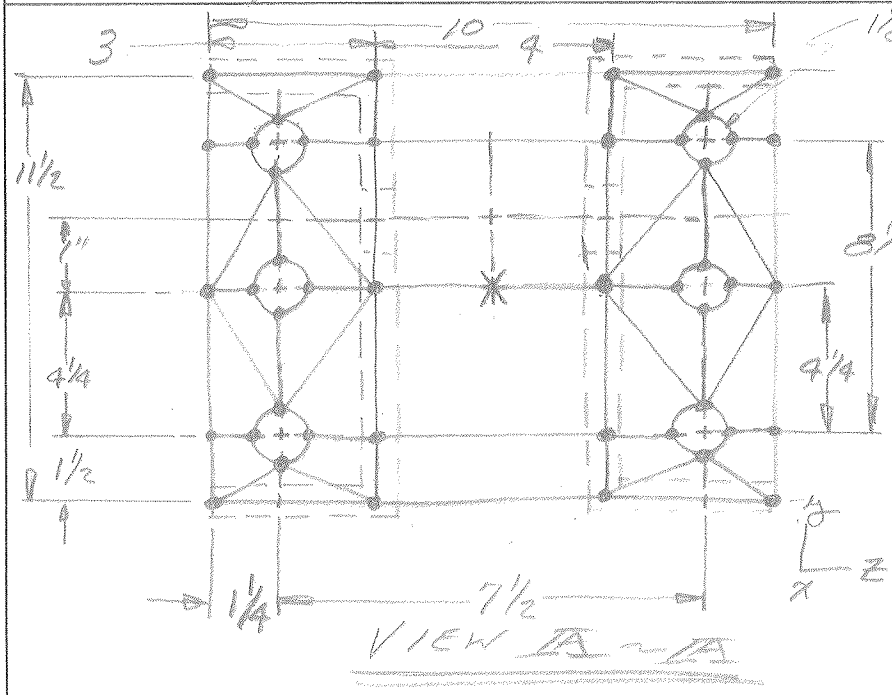
SECTION	PROJECT	SERIAL-CATEGORY	PAGE
MSG	E5 & H ABUTMENT		4

SUBJECT: CENTER, MDL, ME-201818
COUP. HANDLING, LIFTING DEVICES
ED/MSD

NAME: E. McKillop

DATE: 11/15/93

REVISION DATE:



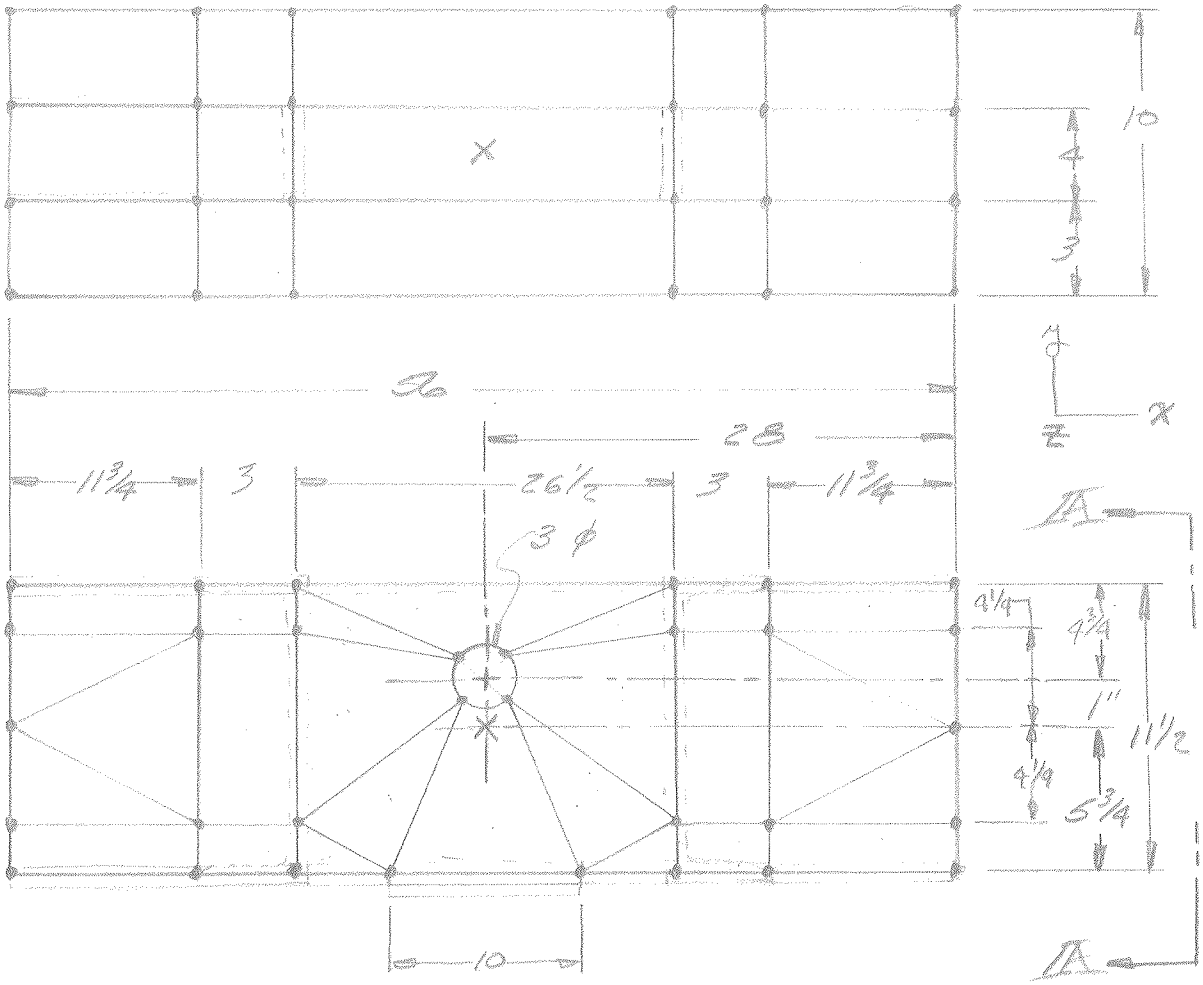
GROUP	# SAME	THK.	MAT'L.
RT. END	32	5/16	1018 c.d
LFT. END	32	"	"
CENTER	54	½	A36
REINF. CTR.	20	1"	"
CTR BRACE	10	½	"
BOTT. BRACE	3	¾	"
	151		

$F_v = F_b = \frac{36 \times 10^3}{3}$

$= 12 \times 10^3$ psi ALLOWED

$f_{v_M} = 8.7 \times 10^3 < F_b$

$f_v = 4.7 \times 10^3 < F_v$



SDRC I-DEAS VI.i(s): FE_Modeling_&_Analysis 09-NOV-93 09:05:20
./engrg_notes/tgt_galleries

Group ID : CNTR_EL → # ME-201818
Analysis Dataset : 2 - CASE 1,LOAD 1,STRESSES
Report Type : Contour
Dataset Type : Stress
Frame of Reference: Global
Surface Type : Bottom
Units : IN
Load Set : 1
Data Component: Max Shear

	Max Prin	Mid Prin	Min Prin	Max Shear	Von Mises
	898	375	213	237	898
Maximum	7.253E+03	1.348E+03	1.236E+03	3.602E+03	7.121E+03
	644	576	220	686	686
Minimum	-8.000E+02	-8.109E+02	-6.376E+03	1.176E+01	2.183E+01
Average	1.484E+03	-1.869E+00	-1.292E+03	1.388E+03	2.682E+03

Allowed

12×10^3

Magnet Lifting Fixt. Assy # ME-201817
Center Lift, 20 Ton on Hooks
Note: Stresses Shown Are For
Center Frame Only.

MAGNET LIFTING FIXT # ME-201817
CENTER LIFT 20 TON ON HOOKS
CENTER FRAME # ME-201818

SDRC I-DEAS VI.i(s): FE_Modeling_&_Analysis 08-NOV-93 08:39:01

Database: ./engrg_notes/tgt_galleries
View : No stored View
Task: Post Processing
Model: 1-MAGNET_LFTG_FXT_ASSY_ME-201817
Units : IN
Display : No stored Option
Model Bin: 1-MAIN
Associated Workset: 1-WORKING_SET1

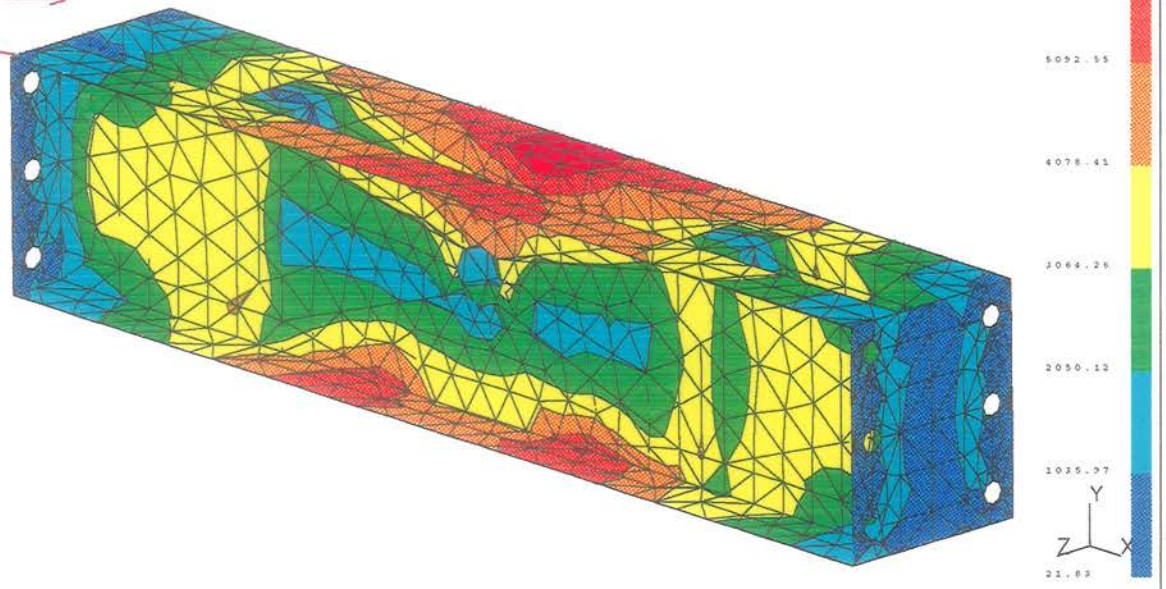
./engrg_notes/tgt_galleries

LOAD SET: 1 - 20TON_ON_HOOKS
FRAME OF REF: GLOBAL
STRESS - VON MISES MIN: 21.83 MAX: 7120.85

SHELL SURFACE: BOTTOM

$F_{VM} = \frac{36 \times 10^3}{3} = 12 \times 10^3$ ALLOWED

$f_{VM} = 7.1 \times 10^3 < F_{VM}$



#44

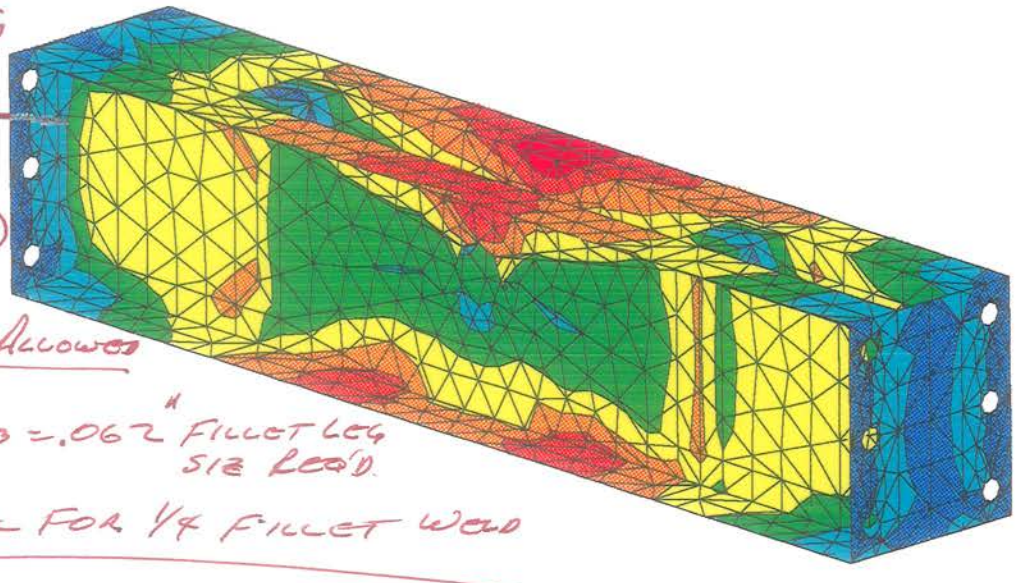
MAGNET LIFTING FIXT #ME-201817
CENTER LIFT, 20 TON ON HOOKS
CENTER FRAME #ME-201818

SDRC I-DEAS VI.i(s): FE_Modeling_&_Analysis 08-NOV-93 08:40:55

Database: ./engrg_notes/tgt_galleries
View : No stored View
Task: Post Processing
Model: 1-MAGNET_LFTG_FXT_ASSY_ME-201817
Units : IN
Display : No stored Option
Model Bin: 1-MAIN
Associated Workset: 1-WORKING_SET1

./engrg_notes/tgt_galleries

LOAD SET: 1 - 20TON_ON_HOOKS
FRAME OF REF: GLOBAL
STRESS - MAX SHEAR MIN: 11.76 MAX: 3601.57
SHELL SURFACE: BOTTOM



$F_v = \frac{36 \times 10^3}{3} = 12 \times 10^3$ psi° ALLOWED

$f_v = 3.6 \times 10^3 < F_v$

WELD SIZE @ END PLATES & CHNL. JUNCTION

ASSUME E60XX (DRWG DOES NOT IDENTIFY WELD METAL)

$F_w = \text{Cos } 45° \left(\frac{50 \times 10^3}{3}\right)$

$= 11.8 \times 10^3$ #/IN ALLOWED

$w = \frac{f_w}{F_w} = \frac{734}{11.8 \times 10^3} = .062"$ FILLET LEG SIZE REQ'D.

DRWG CALL FOR 1/4 FILLET WELD

1038 psi° @ WELD JUNCTION

$f_w = \text{Cos } 45° \times 1038$

$= 734$ #/IN

$\frac{5}{16}$ #A

FERMILAB

ENGINEERING NOTE

SECTION	PROJECT	SERIAL-CATEGORY	PAGE
150	E.S.H. ABATEMENT		5

SUBJECT: HOOK, WEDGE NUT, HDG, HOUSE, MC-201827 EQUIP HANDLING & LIFTING DEVICES PE/ESD

NAME: E M Dalgar

DATE: 1/18/23

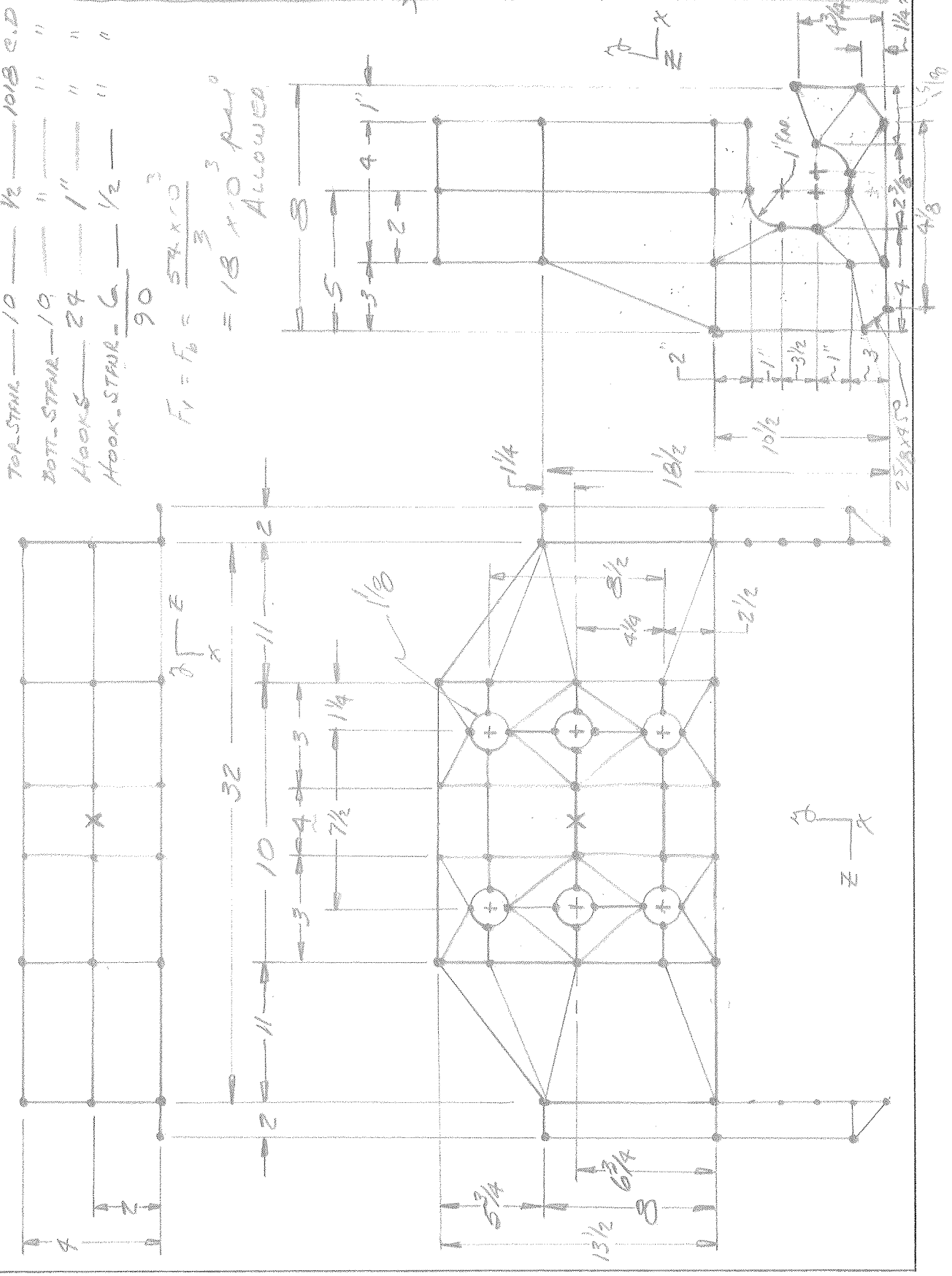
REVISION DATE:

NOTE: GRANDFATHERED TO HOOK, WEDGE NUT, VERT, MC-201823

GROUP	SURF.	THICK'S	MAT'L
INNER CURV.	32	1/8	1018 MS
OUTER CURV.	8	3/8	"
TOP STRAP	10	1/2	1018 C.D
BOTT. STRAP	10	"	"
HOOKS	24	1"	"
HOOK STRAP	6	1/2	"
	90		

$f_v = f_b = \frac{54 \times 10}{3} = 180$ psi

Allowed



 #Sa

SDRC I-DEAS VI.i(s): FE_Modeling_&_Analysis 29-JUN-93 14:26:34
./engrg_notes/tgt_galleries

Group ID : HOOK_EL → #ME-201827
Analysis Dataset : 4 - CASE 2,LOAD 1,STRESSES
Report Type : Contour
Dataset Type : Stress
Frame of Reference: Global
Surface Type : Bottom
Units : IN
Load Set : 1
Data Component: Max Shear

	Max Prin	Mid Prin	Min Prin	Max Shear	Von Mises
	1561	1093	1131	1561	1561
Maximum	1.347E+04	2.000E+03	3.177E+03	6.369E+03	1.312E+04
	1290	1102	1586	1700	1599
Minimum	-2.627E+03	-1.150E+03	-6.317E+03	2.544E+01	9.600E+01
Average	1.553E+03	2.723E+01	-9.643E+02	1.259E+03	2.468E+03

Allowed 18×10^3 psi

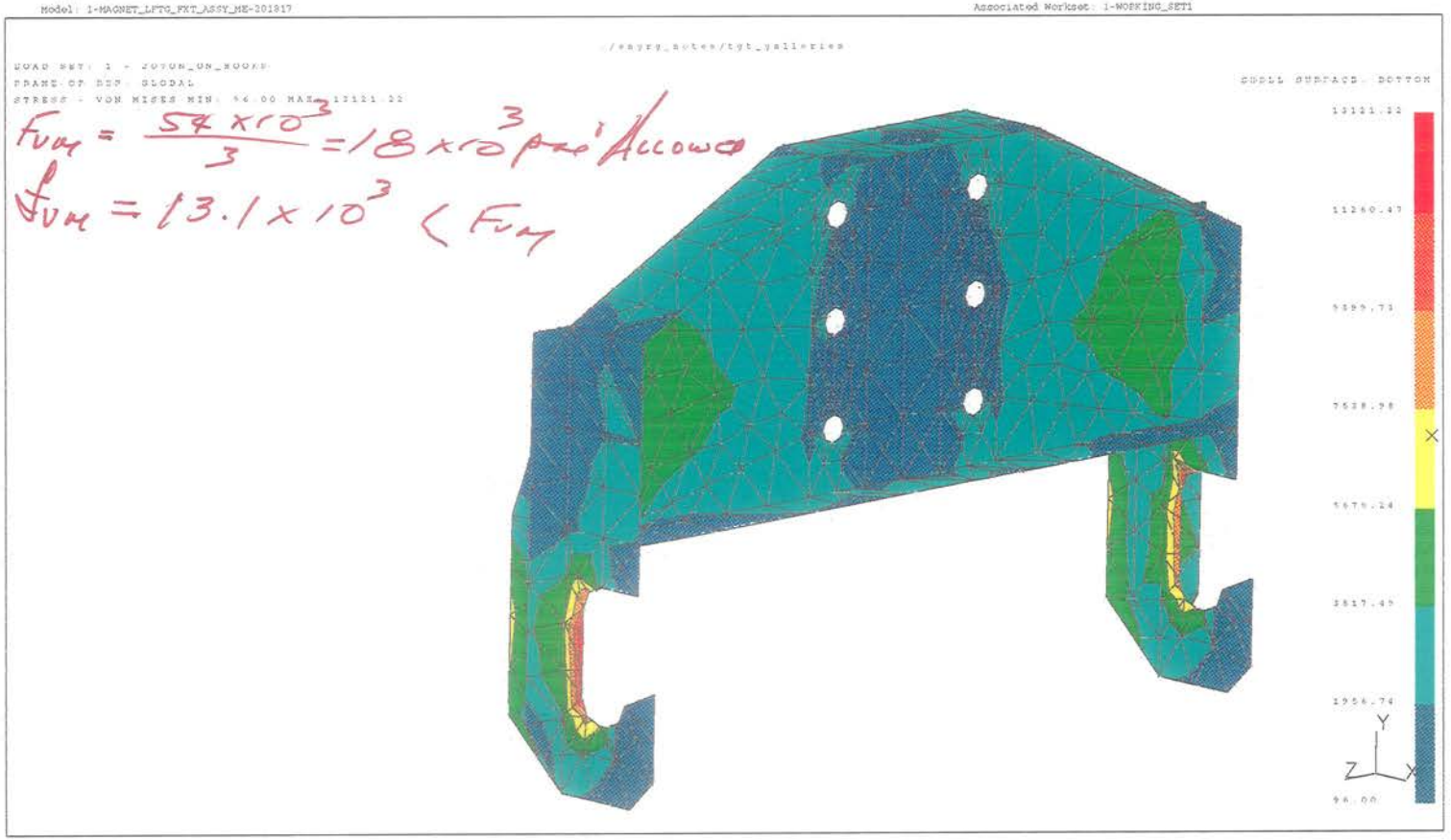
Magnet Lifting Fixt. Assy. #ME-201817
Center Lift, 20 Ton on Hooks

Note: Stresses should be for Hooks only.

MAGNET LIFTING FIXT #ME 201817
CENTER LIFT, 20 TON ON HOOKS
HOOKS, 31" SPREAD) #ME-201827
GRAND FATHER TO
#ME-201823
& ME-201157

SDRC I-DEAS VI.1(s): FE_Modeling_&_Analysis 29-JUN-93 14:22:59

Database: /engrg_notes/tgt_galleries Units : IN
View : No stored View Display : No stored Option
Task: Post Processing Model Bin: 1-MAIN
Model: 1-MAGNET_LFTG_FXT_ASSY_ME-201817 Associated Workset: 1-WORKING_SET1



$F_{VM} = \frac{54 \times 10^3}{3} = 18 \times 10^3$ psi Allowed

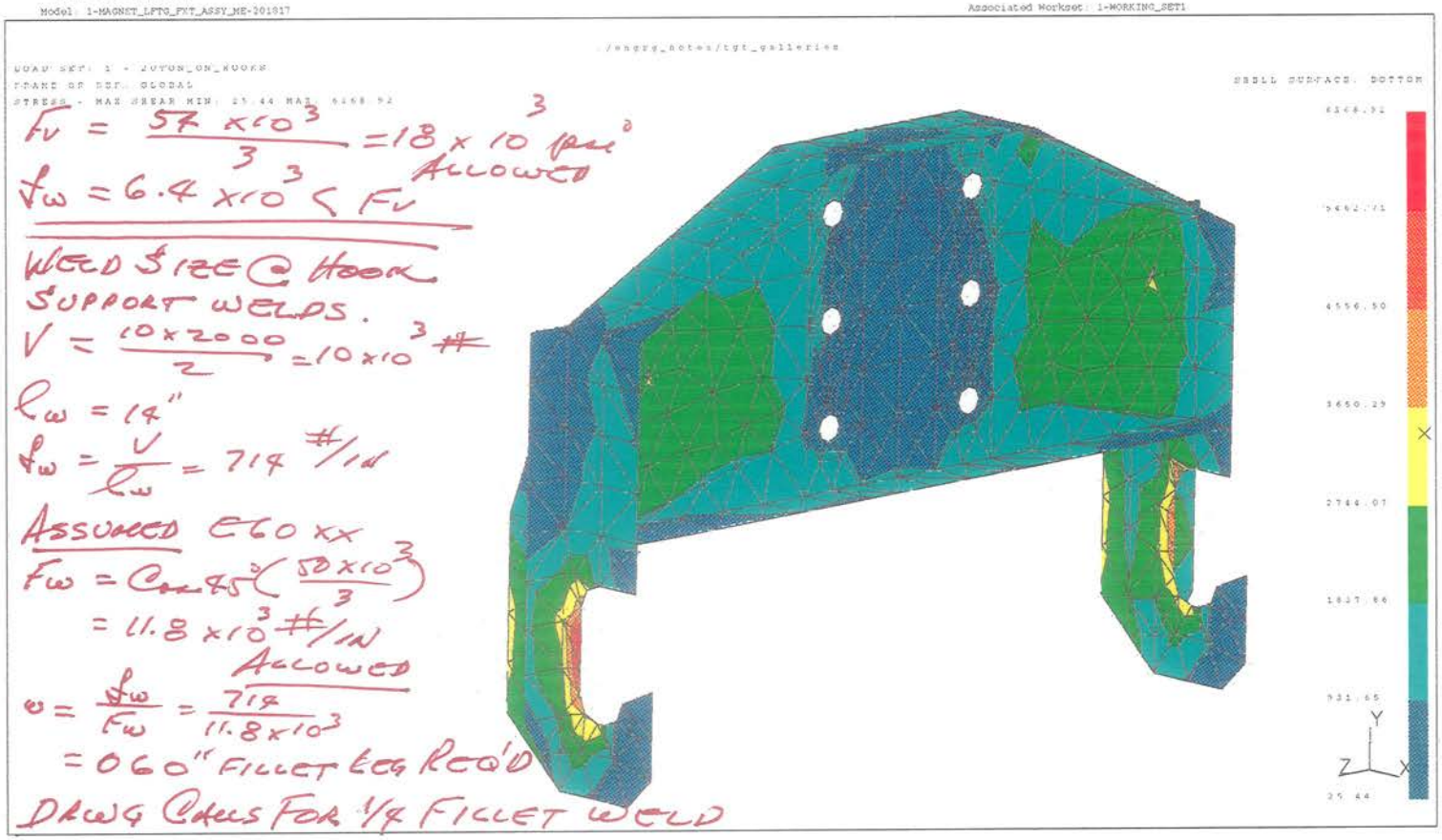
$f_{VM} = 13.1 \times 10^3 < F_{VM}$

#9 of 95

MAGNET LIFTING FIXT. #ME-201817
CENTER LIFT, 20 TON ON HOOKS
HOOKS, 31 SPREAD, # ME-201827
GRANDFATHER TO
ME-201823
& ME-201157

SDRC I-DEAS VI.i(s): FE_Modeling_&_Analysis 29-JUN-93 14:24:16

Database: /engrg_notes/tgt_galleries
View : No stored View
Task: Post Processing
Model: 1-MAGNET_LFTG_FXT_ASSY_ME-201817
Units : IN
Display : No stored Option
Model Bin: 1-MAIN
Associated Workset: 1-WORKING_SET1



$F_v = \frac{57 \times 10^3}{3} = 18 \times 10^3$ #/in ALLOWED

$f_w = 6.4 \times 10^3 < F_v$

WELD SIZE @ HOOK SUPPORT WELDS.

$V = \frac{10 \times 2000}{2} = 10 \times 10^3$ #

$l_w = 14"$

$f_w = \frac{V}{l_w} = 714$ #/in

ASSUMED E60 XX

$F_w = C_{\cos 45^\circ}\left(\frac{50 \times 10^3}{3}\right)$

$= 11.8 \times 10^3$ #/in ALLOWED

$w = \frac{f_w}{F_w} = \frac{714}{11.8 \times 10^3}$

$= .060"$ FILLET E60 REQ'D

DRWG CALLS FOR 1/4 FILLET WELD

pg #52

FERMILAB

ENGINEERING NOTE

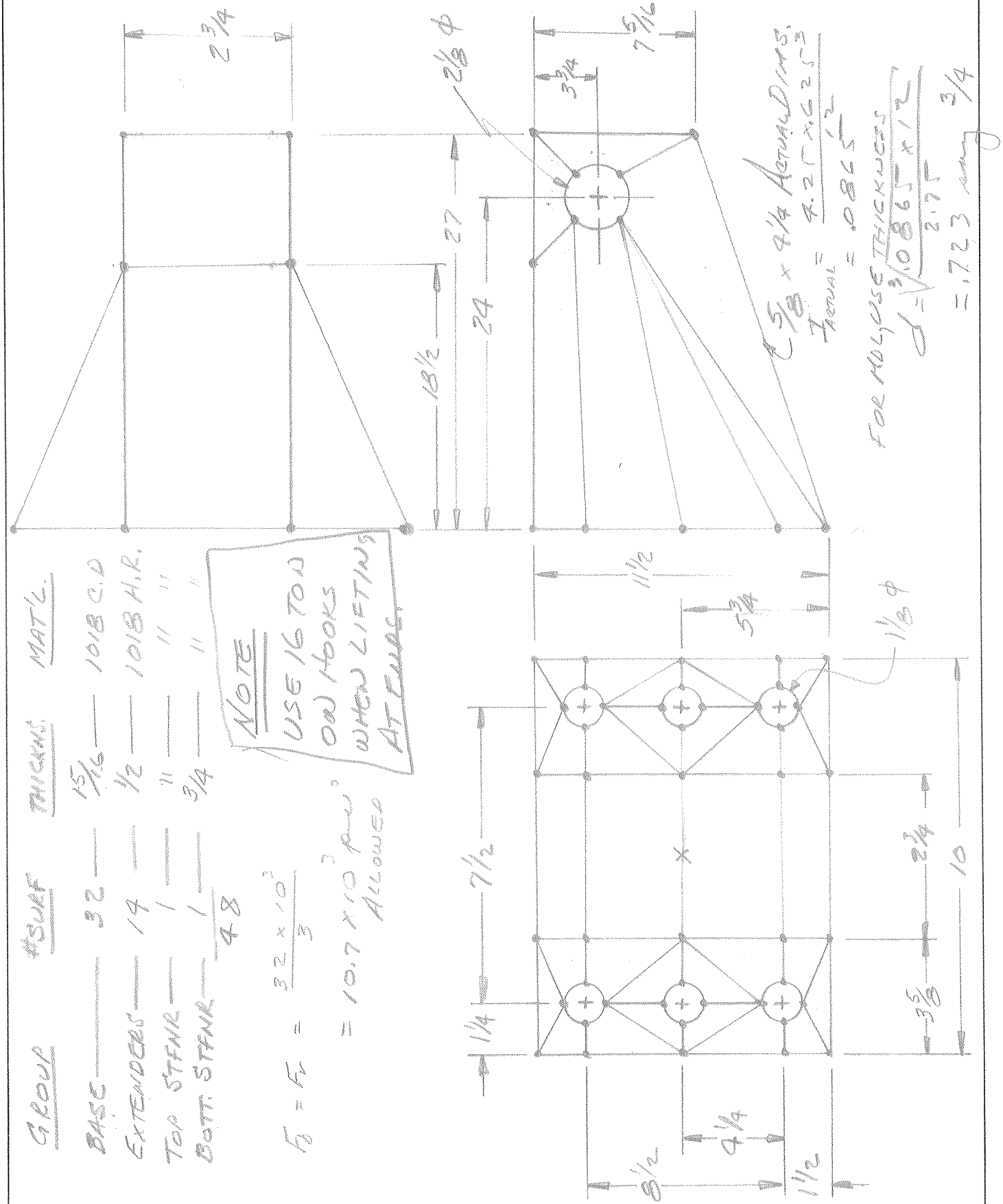
SECTION	PROJECT	SERIAL-CATEGORY	PAGE
			6

SUBJECT: END MDL, MD-201820
EQUIP. HANDLING, LIFTING DEVICES
EQ # 450

NAME: E. Wildman

DATE: 1/18/93

REVISION DATE:



Group	#Surf	Thickness	Matl.
Base	32	1 5/16	1018 C.D
Extenders	14	1/2	1018 H.R.
Top Stfnr	1	11	11
Bott Stfnr	1	3/4	11
	48		

NOTE
USE 16 TOOL OR HOOKS WHEN LIFTING AT CORNERS

$\sigma_b = F_y / 3 = 32 \times 10^3 / 3$

$= 10.7 \times 10^3$ psi Allowed

SDRC I-DEAS VI.i(s): FE_Modeling_&_Analysis 08-NOV-93 10:38:41
./engrg_notes/tgt_galleries

Group ID : ENDS_EL → ME-201820
Analysis Dataset : 4 - CASE 2,LOAD 2,STRESSES
Report Type : Contour
Dataset Type : Stress
Frame of Reference: Global
Surface Type : Bottom
Units : IN
Load Set : 2
Data Component: Von Mises

	Max Prin	Mid Prin	Min Prin	Max Shear	Von Mises
	1900	2014	1859	1912	1912
Maximum	8.587E+03	1.434E+03	2.575E+03	5.839E+03	1.012E+04
	1872	1950	1914	2596	2596
Minimum	-2.514E+03	-1.199E+03	-7.145E+03	3.874E+01	7.687E+01
Average	1.960E+03	6.726E+00	-9.960E+02	1.478E+03	2.770E+03

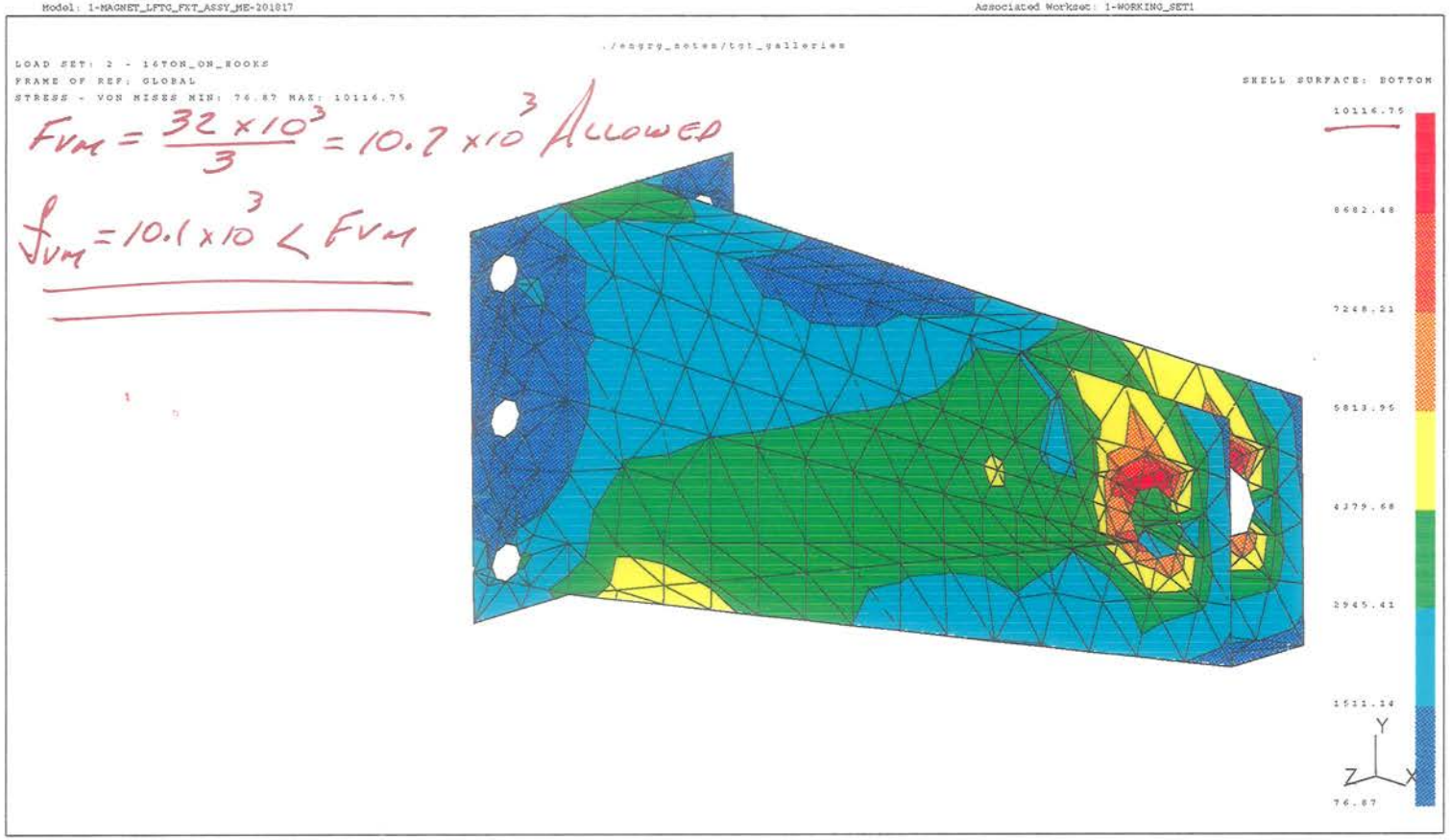
Allowed 10.7×10^3

Magnet Lifting Fixt. Assy # ME-201817
End Lift, 16 Ton on Hooks

MAGNET LIFTING FIXT ASSY # ME-201817
END LIFT, 16 TON ON HOOKS

SDRC I-DEAS VI.i(s): FE_Modeling_&_Analysis 05-NOV-93 14:52:55

Database: ./engrg_notes/tgt_galleries Units : IN
View : No stored View Display : No stored Option
Task: Post Processing Model Bin: 1-MAIN
Model: 1-MAGNET_LFTG_FXT_ASSY_ME-201817 Associated Workset: 1-WORKING_SET1



$F_{VM} = \frac{32 \times 10^3}{3} = 10.7 \times 10^3$ ALLOWED

$f_{VM} = 10.1 \times 10^3 < F_{VM}$

Pg #66

MAGNET LIFTING FIXT ASSY # ME-201817
END LIFT, 16 TON ON HOOKS

SDRC I-DEAS VI.i(s): FE_Modeling_&_Analysis

05-NOV-93 14:54:38

Units : IN

Database: ./engrg_notes/tgt_galleries

View : No stored View

Task: Post Processing

Model: 1-MAGNET_LFTG_FXT_ASSY_ME-201817

Display : No stored Option

Model Bin: 1-MAIN

Associated Workset: 1-WORKING_SET1

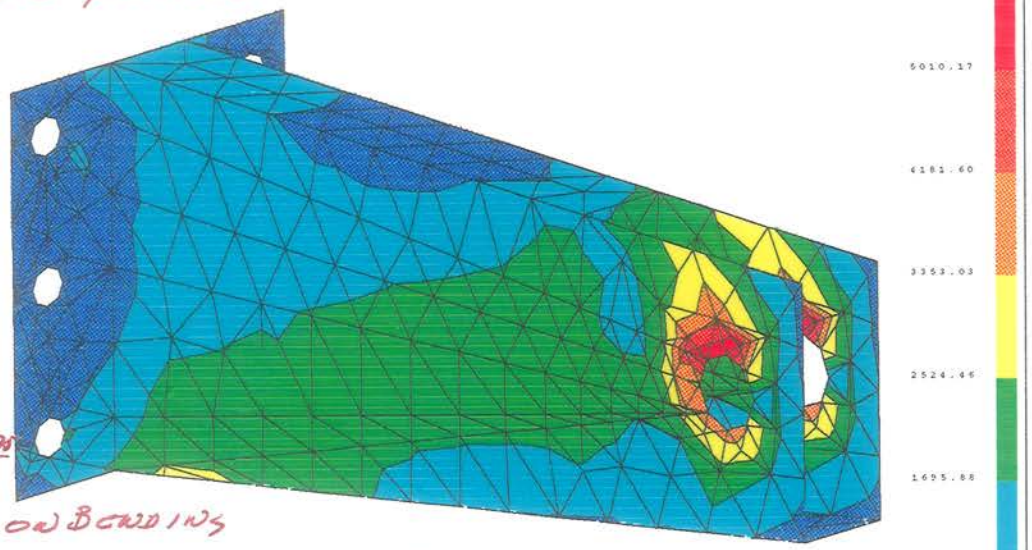
./engrg_notes/tgt_galleries

LOAD SET: 2 - 16TON_ON_HOOKS

FRAME OF REF: GLOBAL

STRESS - MAX SHEAR MIN: 36.74 MAX: 5838.75

SHELL SURFACE: BOTTOM



$F_v = \frac{32 \times 10^2}{3} = 10.7 \times 10^3$ ALLOWED

$f_v = 5.8 \times 10^3 < F_v$

WELD SIZE @ JUNCTION OF END PLATES & VERTICAL EXTENDERS,

$V = 8 \times 2000 = 16 \times 10^3 \#$

$l_w = 10.875 \times 2 = 21.75$

$f_{w_v} = \frac{V}{l_w} = 736 \#/IN$ BASED ON SHEAR

$f_{w_b} = \frac{P}{l_w} = \frac{23.25 \times 2000 \times 8/5.4375}{21.75}$

$= 3.1 \times 10^3 \#/IN$ BASED ON BENDING

ASSUME E60XX

$F_w = \phi_{ow} .85 \left(\frac{60 \times 10^3}{3}\right) = 11.8 \times 10^3 \#/IN$ ALLOWED

$\omega = \frac{f_{wb}}{F_w} = .26$ (DRWG CALLS FOR 1/4 FILLET)

P # 6c

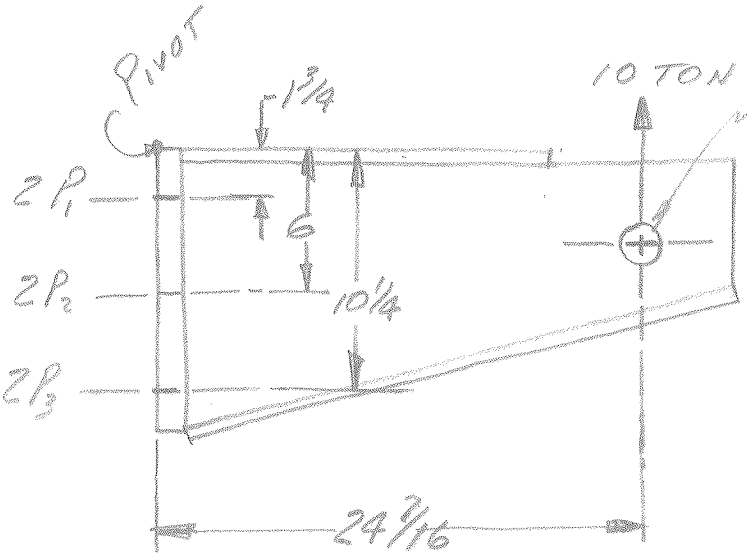
FERMILAB
ENGINEERING NOTE

SECTION	PROJECT	SERIAL-CATEGORY	PAGE
			1

SUBJECT: BOLT LOAD, ME-20817 EQUIP. HANDLING, LIFTING DEVICES FD / MSD

NAME: E.M. Gallagher

DATE: 1/19/93 REVISION DATE:



BOLTS & NUTS
SAE 1"-8 UNC
GRADE 8

$$F_y = \frac{120 \times 10^3}{3} = 40 \times 10^3 \text{ psi}$$

ALLOWED
(SEE ATTACHMENT A)

$$1.75(2P_1) + 6(2P_2) + 10.25(2P_3) = 29.4375 \times 10.2000$$

$$\text{SINCE } \frac{2P_1}{1.75} = \frac{2P_3}{10.25} \rightarrow 2P_1 = \frac{3.5P_3}{10.25}$$

$$\frac{2P_2}{6} = \frac{2P_3}{10.25} \rightarrow 2P_2 = \frac{12P_3}{10.25}$$

$$\therefore \frac{1.75 \times 3.5P_3}{10.25} + \frac{72P_3}{10.25} + 20.5P_3 = 488.75 \times 10^3$$

$$\text{THEN } P_3 = 17.4 \times 10^3 \#$$

$$P_2 = 10.2 \times 10^3 \#$$

$$P_1 = 3.0 \times 10^3 \#$$

$$\text{IF } f_y = \frac{17.4 \times 10^3}{.606} = 28.7 \times 10^3 \text{ psi} < F_y$$

(Root Area of Thread)

OK

ATTACHMENT A

Table 7-5 SAE specifications for bolts, cap screws, and studs

Grade	Bolt size, diameter, in.	Proof strength, psi	Tensile strength, min, psi	Hardness		Material—heat-treatment
				Brinell	Rockwell	
0	¼ to 1½	...	...	...	...	No requirements.
1	¼ to 1½	...	55,000	207 max	95 B max	Commercial steel.
2	¼ to ½	55,000	69,000	241 max	100 B max	This is intended to be a cold-headed product made from low-carbon steel; C 0.28 max, P 0.04 max, and S 0.05 max. Lengths over 6 in. may be hot-headed from medium carbon steel, C 0.55 max. Deviation from specified chemistry may be made by agreement between producer and consumer.
	Over ½ to ¾	52,000	64,000			
	Over ¾ to 1½	28,000	55,000	207 max	...	Commercial steel.
3	¼ to ½	85,000	110,000	207–269	95–101 B	Produced by the cold-heading process, up to and including 6 in. in length from medium-carbon steel; C 0.28 to 0.55, P 0.04 max, and S 0.05 max.
	Over ½ to ⅝	80,000	100,000			
5	¼ to ¾	85,000	120,000	241–302	23–32 C	Medium-carbon steel; C 0.28 to 0.55, P 0.01 max, and S 0.05 max. Quenched and tempered at a minimum temperature of 800 F.
	Over ¾ to 1	78,000	115,000	235–302	22–32 C	
	Over 1 to 1½	74,000	105,000	223–285	19–30 C	
6	¼ to ⅝	110,000	140,000	285–331	30–36 C	Medium carbon steel; C 0.28 to 0.55, P 0.01 max, and S 0.05 max. Oil quenched and tempered at a minimum temperature of 800 F.
	Over ⅝ to ¾	105,000	133,000	269–331	28–36 C	
7	¼ to 1½	105,000	133,000	269–321	28–34 C	Medium-carbon fine-grain alloy steel,* C 0.28 to 0.55, P 0.04 max, and S 0.05 max, providing sufficient hardenability to have a minimum oil-quenched hardness of 47 RC at the center of the threaded section one diameter from the end of the bolt. Oil quenched and tempered at a minimum temperature of 800 F. Roll-threaded after heat-treatment.
8	¼ to 1½	120,000	150,000	302–352	32–38 C	Medium-carbon fine-grain alloy steel,* C 0.28 to 0.55, P 0.04 max and S 0.05 max, providing sufficient hardenability to have a minimum oil-quenched hardness of 47 RC at the center of the threaded section one diameter from the end of the bolt. Oil-quenched and tempered at a minimum temperature of 800 F.

* Carbon steel may be used by agreement between producer and consumer. *Note:* Carbon range is for check analysis of product.

FERMILAB
ENGINEERING NOTE

SECTION	PROJECT	SERIAL-CATEGORY	PAGE
			8

SUBJECT: F-N3 EQUIP HANDLING, LIFTING DEVICES

NAME: E. Hidley

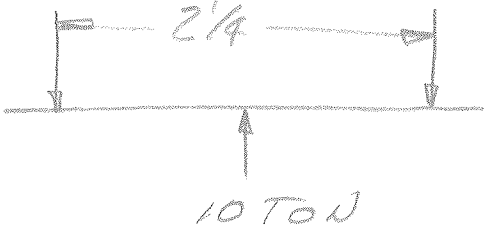
DATE: 1/12/83

REVISION DATE:

2" ϕ END PINS, MC-201827

MAT'L. AISI 1018 C.D STEEL

$F_b = F_v = \frac{58 \times 10^3}{3} = 18 \times 10^3$ psi ALLOWED



$I = \frac{2^4 \pi}{64} = .785\ in^4$

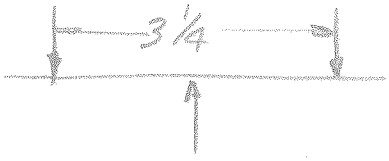
$M = 11.25 \times 10^3$ in-lb

$f_b = \frac{Mc}{I} = 14.33 \times 10^3 < F_b$

$f_v = \frac{10 \times 2000}{2\left(\frac{2^2\pi}{4}\right)} = 3.2 \times 10^3 < F_v$

2 7/8" ϕ CENTER PIN, MC-201821

MAT'L SAME AS ABOVE



$I = \frac{2.875^4 \pi}{64} = 3.35\ in^4$

$M = 32.5 \times 10^3$ in-lb

$f_b = 13.9 \times 10^3$ psi $< F_b$

$f_v = \frac{20 \times 2000}{2\left(\frac{2.875^2\pi}{4}\right)} = 3.1 \times 10^3 < F_v$