LIFTING DEVICE

DEVICE NAME: PDG LIFTING ADAPTER

ENGINEERING NOTE NUMBER: 80

DRAWING NUMBER: —

APPLICABLE STANDARD: ANSI/ASME B30.20-1985

—

RATED LOAD: 150 lb

TEST LOAD: 190 lb

TEST LOAD PERCENT: 26.7%

LAST LOAD TEST DATE: AUGUST/15/1995

COLOR: —

STRESS CALCULATIONS:

Done by: RAFAEL SILVA

Date: AUGUST/10/1995

Reviewed by: ZHIJING TANG

Date: AUGUST/14/1995

REMARKS:

IDENTIFICATION:

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

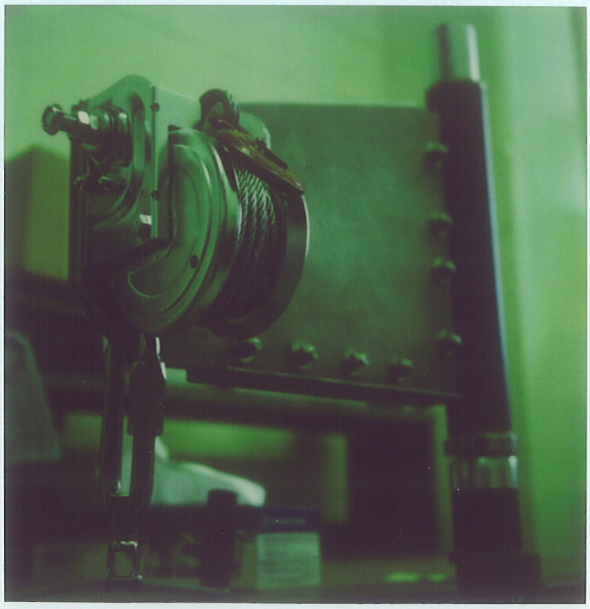
PDG Vacuum Deposition System Modification.

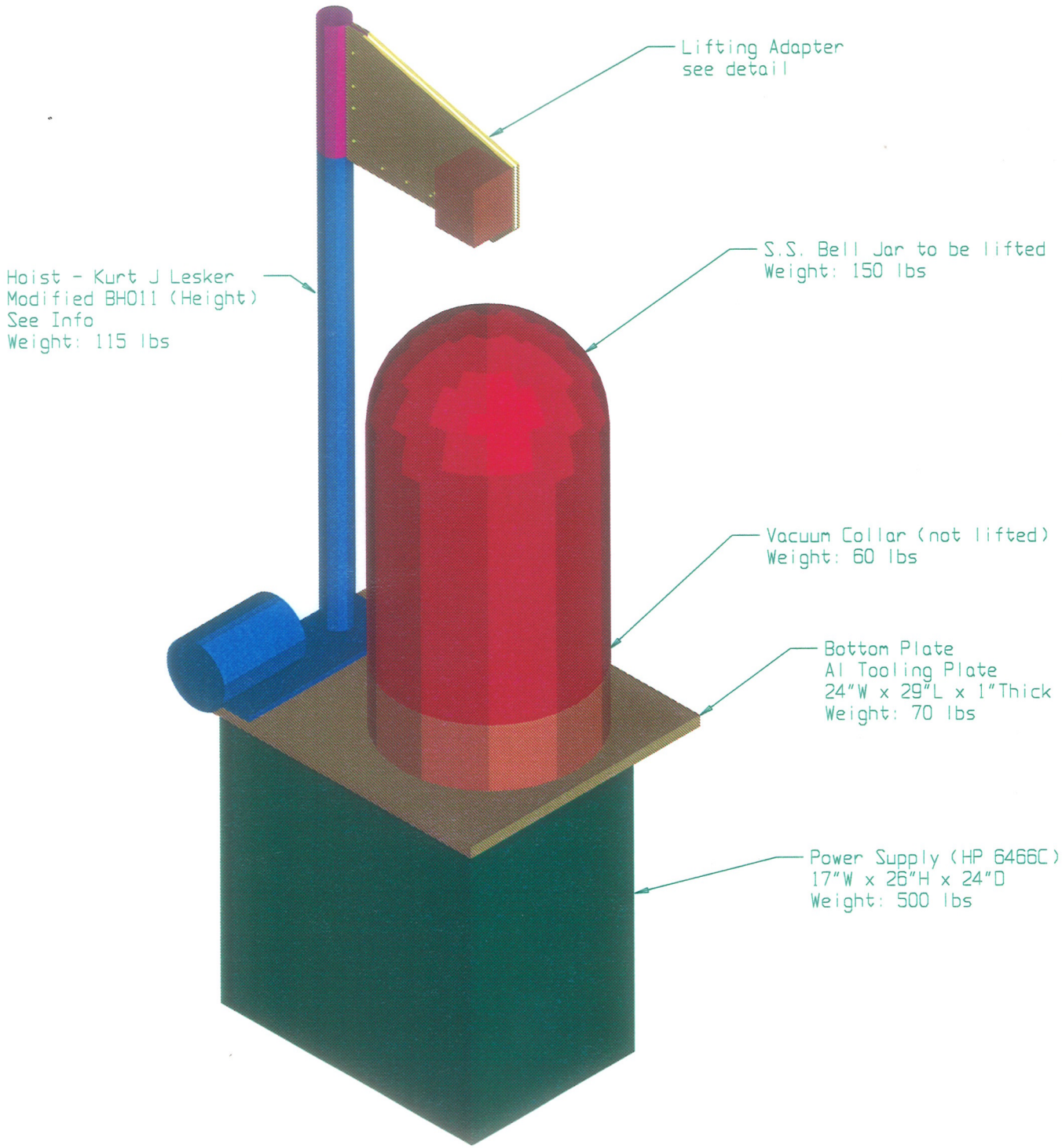
This is a description of the modification of the PDG group vacuum deposition system that will now incorporate its own hoist and lifting adapter.

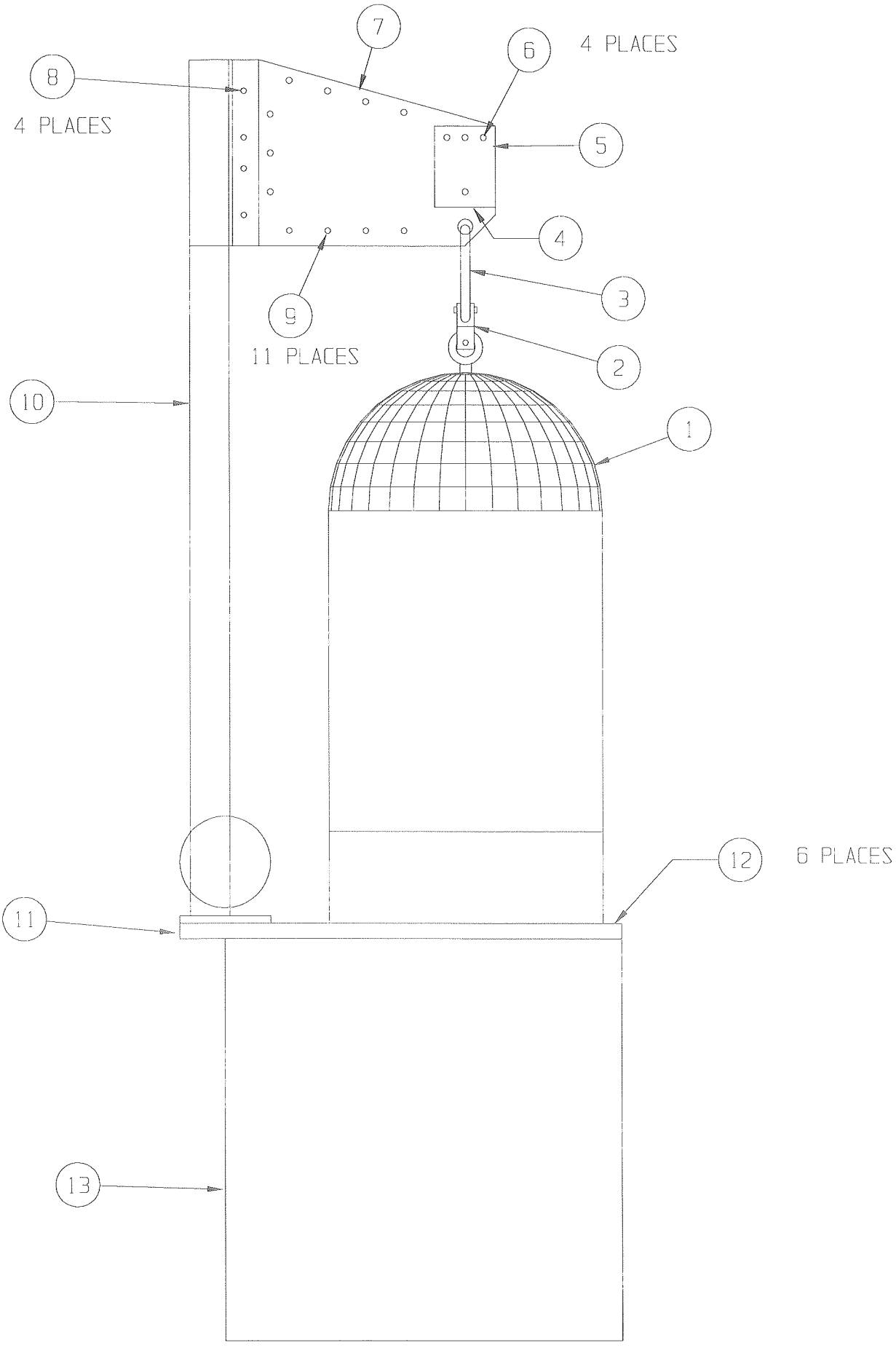
The vacuum deposition system as it was originally configured consists of a HP 6466 power supply with a stainless steel bell jar on top of it. The necessary movement of the jar was done with the help of the crane present in the ground floor lab. The vacuum deposition system is now going to operate in the 14th floor lab where there is no crane. To make its operation possible, a hoist will be coupled to the system to work as the ground floor crane.

An electric hoist purchased from Kurt J. Lesker will be mounted on top of the power supply. The hoist was bought with the height shortened to accommodate the lower ceiling heights in the 14th floor lab. The lifting adapter that links the hoist to the load is also modified. The normal lifting adapter sold with this unit is for a vacuum system cover plate (or bell jar) which weighs 228 lbs.

The new lifting adapter is designed for two types of operation. In the "normal" mode a stainless steel chain connected to a swivel directly links the lifting adapter to the bell jar. In the "eventual" mode a hand winch that is mounted on the lifting adapter allows lowering the bell jar to the floor or a cart for cleaning. In this last mode the bell jar should not be lifted by the electric lift and must not be lifted over people.




Lifting Adapter
see detail
Hoist - Kurt J Lesker
Modified BH011 (Height)
See Info
Weight: 115 lbs
S.S. Bell Jar to be lifted
Weight: 150 lbs
Vacuum Collar (not lifted)
Weight: 60 lbs
Bottom Plate
Al Tooling Plate
24"W x 29"L x 1"Thick
Weight: 70 lbs
Power Supply (HP 6466C)
17"W x 26"H x 24"D
Weight: 500 lbs


7
6
4 PLACES
8
4 PLACES
5
4
3
9
11 PLACES
2
10
1
12
6 PLACES
11
13

Vacuum Deposition Hoist Parts List			
#	Name	Procedence	Load Rating
1	Bell Jar	MDC, Stainless Steel	"
2	Swivel	McMaster-Carr part #8928T58	McMaster-Carr #100, p. 618, W.L.= 2310lb
3	Chain Connector	McMaster-Carr part #3711T39	McMaster-Carr #100, p.627, W.L.= 8820lb
4	Hand Winch Cable	McMaster-Carr part #3308T22	McMaster-Carr #100, p.555, W.L.= 7000lb
5	Hand Winch	McMaster-Carr part #3196T42	McMaster-Carr #100, p.554, W.L.= 1000lb
6	Bolts	3/8" S.S. Fermi Stock 1226-0593	see Fulton manual attached
7	Lift Adapter	Fermi Built	see E.N. item 1
8	Bolts	3/8" S.S. Fermi Stock 1226-0593	see E.N. item 2
9	Bolts	3/8" S.S. Fermi Stock 1226-0593	see E.N. item 2
10	Electric Hoist	Kurt J Lesker BH011	Kurt J Lesker letter attached
11	Bottom Plate	Cast AL Plate Fermi Stock 1510-6540	see E.N. item 3
12	Bolts	3/8" S.S. Fermi Stock 1226-1150	see E.N. item 3
13	Power Supply	HP6466C	"

∅) ALLOWABLE STRESSES

- STAINLESS STEEL AISI 316L, PLATE
ASME, SECTION II, TABLE 1A, FOR USE ON SECTION VIII, DIVISION 1, AT ROOM TEMPERATURE =>
MAXIMUM ALLOWABLE STRESS = 16.7 ksi

- STAINLESS STEEL BOLTS
ACCORDING TO THE PRELIMINARY VERSION 2 (08/01/89) OF THE FERMILAB GUIDELINES FOR STRUCTURAL BOLTING (TM-1664 06/06/90), ITEM 3.1, "ALL BOLTS USED SHALL HAVE IDENTIFICATION (...) AS IDENTIFIED BY IFI GUIDE (..) OF THE ATTACHED IFI STANDARD." THE IFI STANDARD INCLUDES VARIOUS GRADES OF CARBON STEEL AND DIFFERENT TYPES OF STAINLESS STEEL. HENCE THE FERMI GUIDELINES WILL BE APPLIED.
THE MOST CONSERVATIVE IS TO APPLY THE CRITERIA FOR SHEAR WITH A BEARING-TYPE CONNECTION, WITH THREADS IN SHEAR PLANE, ITEM 3.11.1, WHERE $F_v \leq 0.17 F_u$.
STOCK BOLTS: "18-8 TYPE" => $F_u = 75$ ksi ($\times 0.17 = 12.8$ ksi)
$F_y = 30$ ksi ($\times 0.60 = 18.0$ ksi)
SO IT WILL BE ASSUMED $F_a = 12.8$ ksi

1) TRIANGULAR BRACKET

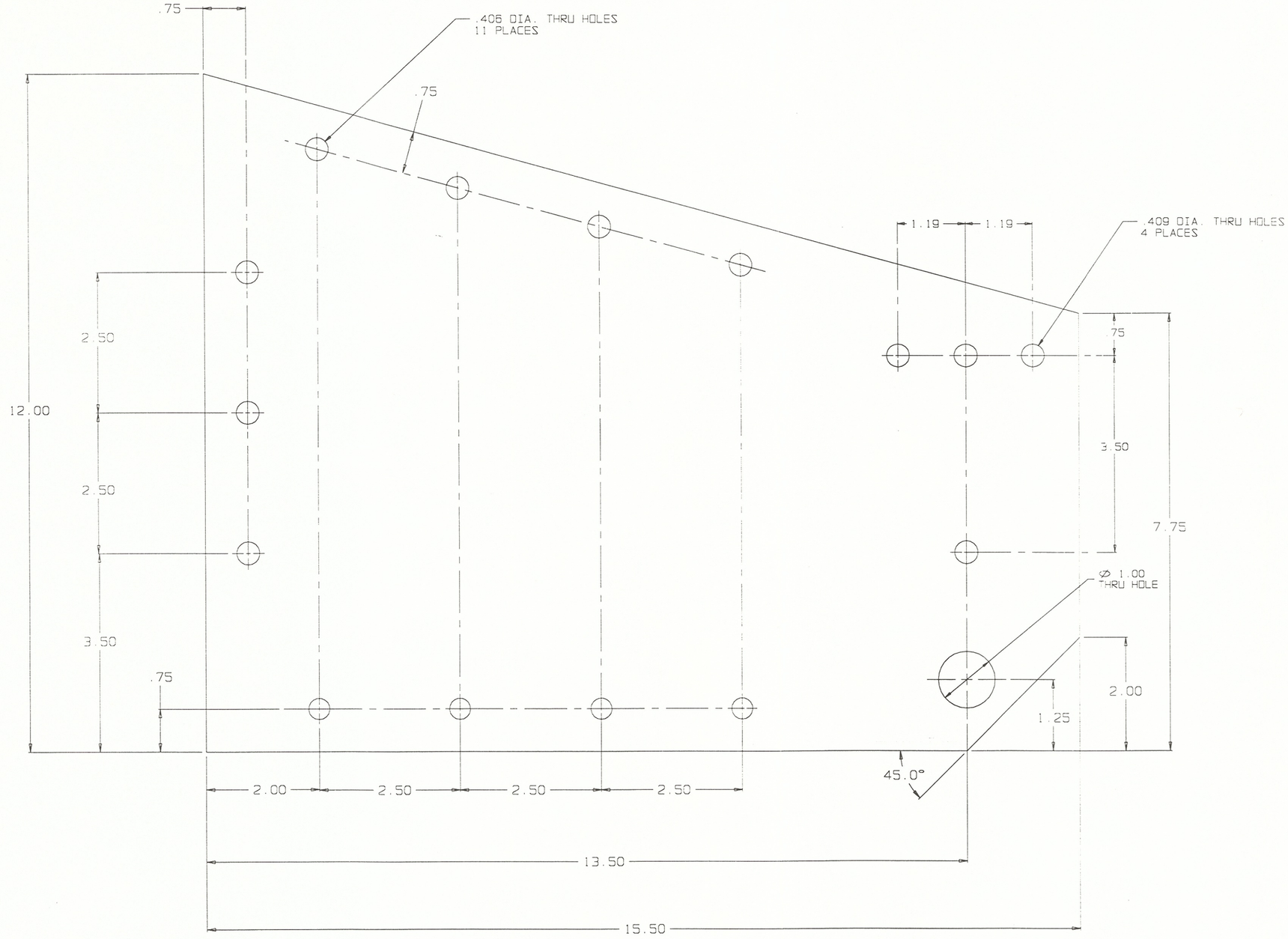
MAXIMUM STRESS (SEE ANSYS ANALYSIS ATTACHED):

NORMAL MODE: ~ 5.4 ksi
EVENTUAL MODE: ~ 13.9 ksi
} < 16.7 ksi => OK

NOTE:

13.9 ksi OCCURS IN A VERY LOCALIZED AREA, THEREFORE SUSCEPTIBLE TO PLASTIFICATION.

REV.	DESCRIPTION	DRAWN	DATE
		APPD.	DATE



ITEM	PART NO.	DESCRIPTION OR SIZE	QTY.

PARTS LIST

UNLESS OTHERWISE SPECIFIED	ORIGINATOR	JERRY ZIMMERMAN	X4571
FRACTIONS DECIMALS ANGLES	DRAWN	JERRY ZIMMERMAN	X4571
XX +-.015 +- .5	CHECKED		
1. BREAK ALL SHARP EDGES .5MM MAX.	APPROVED		
2. DO NOT SCALE DRAWING	USED ON: VACUUM DEPOSITION SYSTEM		
3. DIMENSIONS BASED UPON ANSI Y14.5M-1982			
4 MAX. ALL MACH. SURFACES √	MATERIAL: 316L S.S. 1/4" PLATE FERMI STOCK 1550-6260		

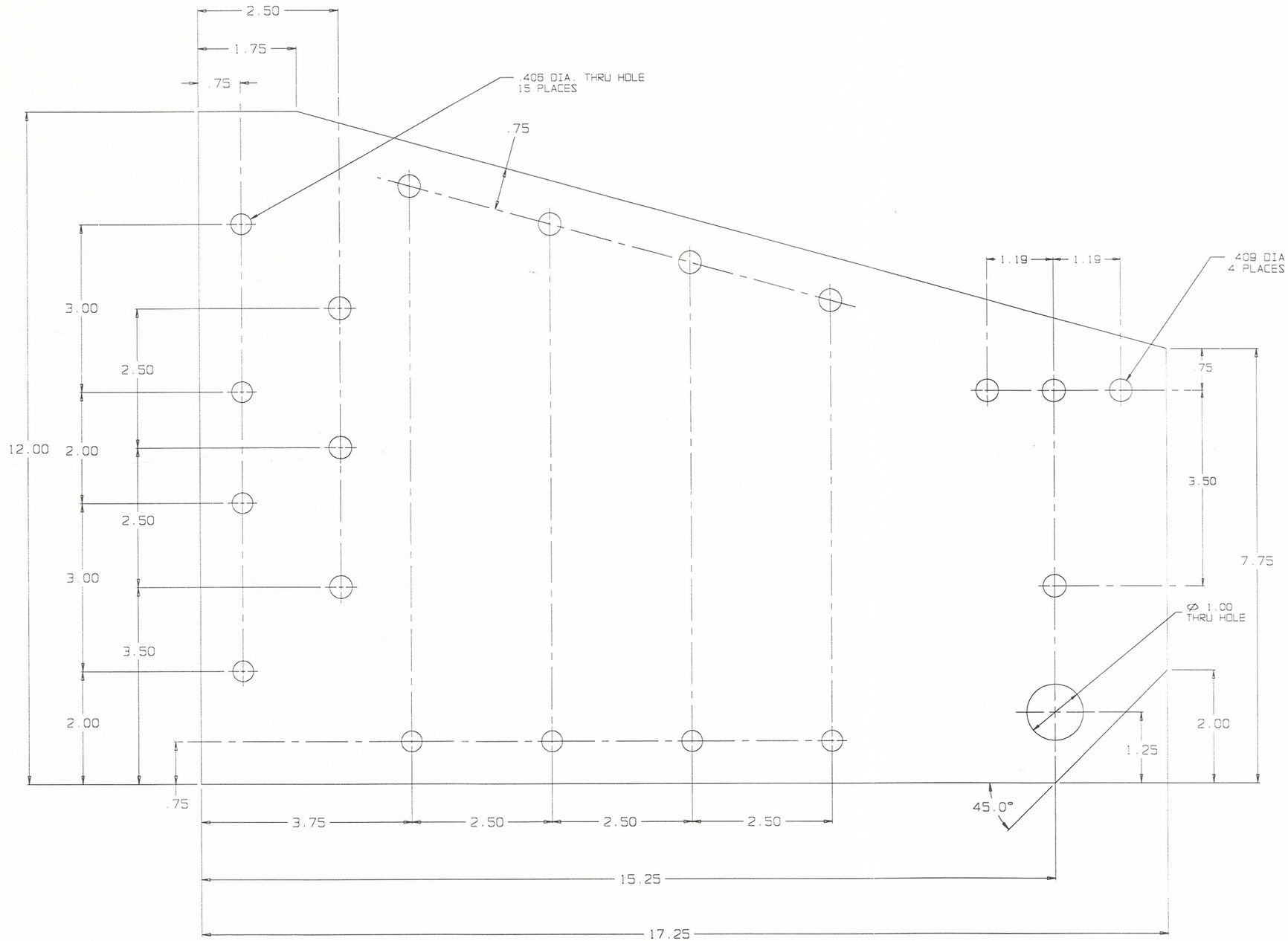
FERMI NATIONAL ACCELERATOR LABORATORY
UNITED STATES DEPARTMENT OF ENERGY

BACKING PLATE - VACUUM DEPOSITION HOIST

SCALE	SOFTWARE	DRAWING NUMBER	REV.
NONE	CADKEY	259212	

FILE: VD_SYSTM.PRT

REV.	DESCRIPTION	DRAWN	DATE
		APPD.	DATE
A	Mounting Holes for Hand Winch		
B	Add Holes for New Backing Plate		



ITEM	PART NO.	DESCRIPTION OR SIZE	QTY.

PARTS LIST

UNLESS OTHERWISE SPECIFIED	ORIGINATOR	JERRY ZIMMERMAN	X4571
FRACTIONS / DECIMALS / ANGLES	DRAWN	JERRY ZIMMERMAN	X4571
XX +- .015 / +- .5	CHECKED		
1. BREAK ALL SHARP EDGES .5MM MAX.	APPROVED		
2. DO NOT SCALE DRAWING	USED ON: VACUUM DEPOSITION SYSTEM		
3. DIMENSIONS BASED UPON ANSI Y14.5M-1982			
4. MAX. ALL MACH. SURFACES √	MATERIAL: 316L S.S. 1/4" PLATE FERMI STOCK 1550-6260		

FERMI NATIONAL ACCELERATOR LABORATORY
UNITED STATES DEPARTMENT OF ENERGY

LIFTING ADAPTER - VACUUM DEPOSITION HOIST

SCALE	SOFTWARE	DRAWING NUMBER	REV.
NONE	CADKEY	259209	B

FILE: VD_SYSTM.PRT

```
c****** File    : liftn.dat
c****** Analysis: Lifting adapter - case "normal" mode

/prep7
/tit,lifting adapter - "normal" mode, 3000 lbin torque per plate

acel,0,-1,0             ****** y acel (g): F=ma, F=lbf &  m=lb => a=1!

c****** constants
EM=30e6                 ****** AISI 316L Stainless Steel: E=30000ksi
nu=0.3                  ****** S.S: nu = 0.3 (conservative)
den=0.291               ****** 0.291 lb/cuin
th=3/8                  ****** thickness
la=12                   ****** left height
lb=17.25                ****** length
lc=7.75                 ****** right height
ld=1.75                 ****** top flat
le=2                    ****** chanfer
lf=7                    ****** top mounting
lg=3.5                  ****** bottom mounting
lh=15.25                ****** mounting position
li=2                    ****** bottom support
lj=8                    ****** top support
lk=1.19                 ****** top mounting spacing
rad=0.5                 ****** hole radius
ll=1.25                 ****** hole height
lm=3.5/2                ****** arm
l1=900/2                ****** load 1
torq=l1/lm              ****** torque resultant force

c****** Element
et,1,63
mp,ex,1,EM
mp,nuxy,1,nu
mp,dens,1,den
r,1,th

c****** X-Y Keypoints
k,1,0,0,0
k,2,(lb-le),0,0
k,3,lb,le,0
k,4,lb,lc,0
k,5,ld,la,0
k,6,0,la
k,7,lh,ll,0
k,8,(lh+rad),ll,0
k,9,lh,(ll+rad),0
k,10,(lh-rad),ll,0
k,11,lh,(ll-rad),0
k,12,0,ll,0
k,13,lh,lg,0
k,14,lh,lf,0
k,15,lb,lf,0
k,16,0,lf,0
larc,8,9,7,rad
larc,9,10,7,rad
larc,10,11,7,rad
larc,11,8,7,rad

c****** Areas
```

```
a,1,2,11,10,12
a,12,10,9,13,14,16
a,16,14,15,4,5,6
a,13,3,15,14
a,2,3,13,9,8,11

c****** Size of elements
esize,0.5

c****** Area to mesh
type,1
mat,1
real,1
amesh,all

c****** Constrains
allsel,all
nsel,s,loc,x,0
nsel,r,loc,y,2,10
d,all,all,0
allsel,all

c****** Loading
allsel,all
nsel,s,loc,x,lh
nsel,r,loc,y,lf
f,all,fz,-torq
allsel,all
nsel,s,loc,x,lh
nsel,r,loc,y,lg
f,all,fz,torq
allsel,all

c****** Save model files
save
fini

c****** Solve
/solu
lumpm,off
antype,static
nlgeom,on
sstif,on
nropt,auto
cnvtol,f,,0.0001
neqit,40
solve
fini

c****** Post processing
/show,x11,,0
/post1
set,1
/view,1,0,0,1
/pbc,all,1
/edge,,1
plnsol,si
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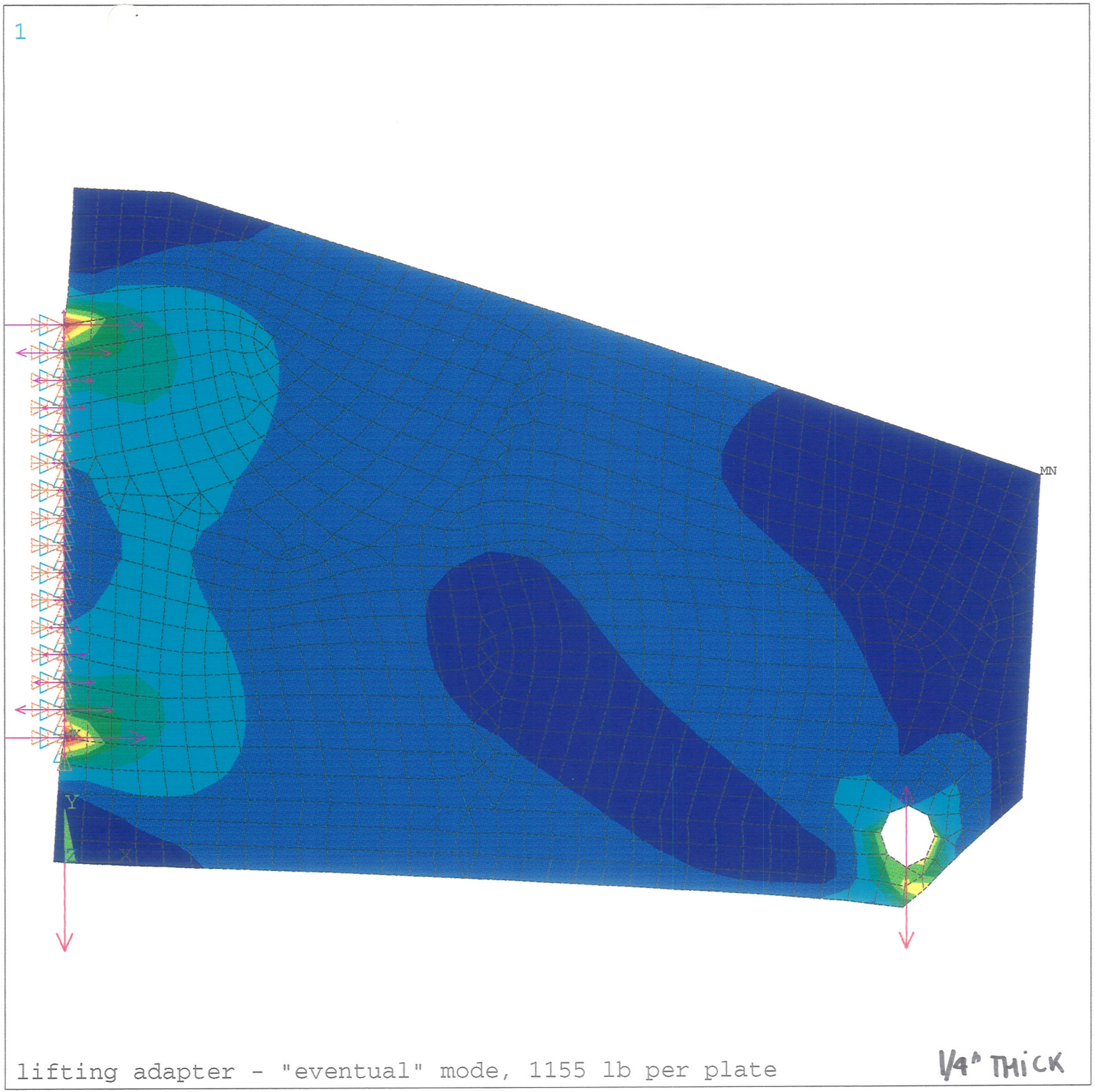
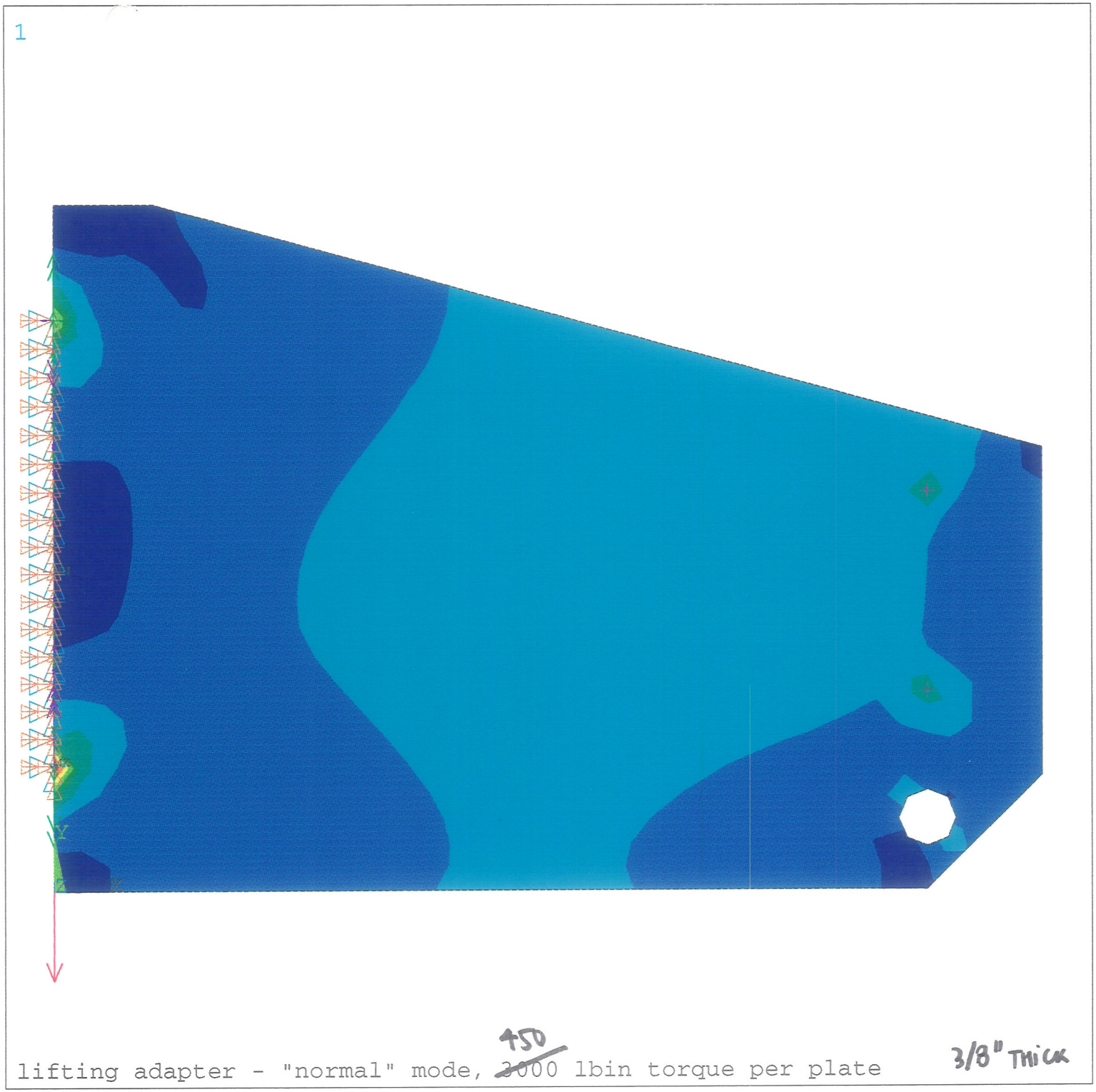


ANSYS 5.0 A
JUL 28 1995
16:12:19
PLOT NO. 1
NODAL SOLUTION
STEP=1
SUB =1
TIME=1
SINT (AVG)
TOP
DMX =0.002142
SMN =5.549
SMX =5358
U
ROT
F
NFOR
NMOM
RFOR
RMOM
ACEL

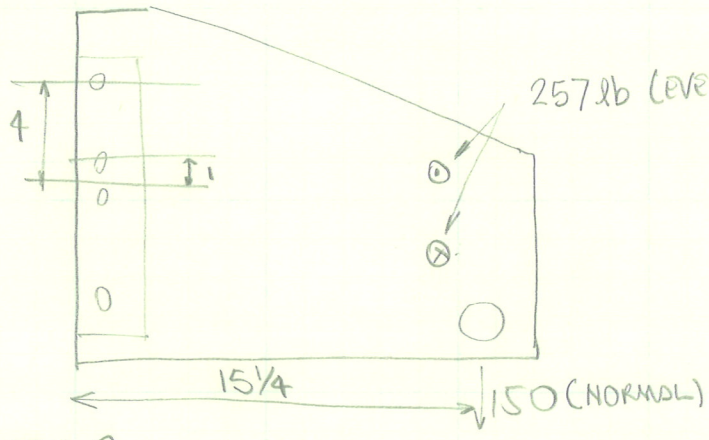
5.549
600.213
1195
1790
2384
2979
3574
4168
4763
5358

lifting adapter - "eventual" mode, 1155 lb per plate

1/4" THICK


1
ANSYS 5.0 A
JUL 28 1995
20:28:10
PLOT NO. 1
NODAL SOLUTION
STEP=1
SUB =999999
TIME=1
SINT (AVG)
TOP
DMX =0.030797
SMN =141.297
SMX =13855
U
ROT
F
NFOR
NMOM
RFOR
RMOM
ACEL
141.297
1665
3189
4712
6236
7760
9284
10807
12331
13855
lifting adapter - "normal" mode, ~~2000~~ 450 lbin torque per plate
3/8" Thick

2) BOLTS



$A_n = 0.1104\ in^2$

ITEM 8

(CASE 1) NORMAL MODE:

MOMENT = $150 \times 15.25 = 2,288$ lb-in.

$d_1 = 4$, $d_2 = 1$, $\Sigma d^2 = 4^2 + 1^2 = 17$

$R_1 = \frac{M d_1}{\Sigma d^2} = \frac{(2,288)4}{17} = 538$ lb

$R_2 = \frac{M d_2}{\Sigma d^2} = \frac{(2,288)1}{17} = 135$ lb

(CASE 2) EVENTUAL MODE

$R_1 = \frac{257}{2} = 129$ lb

BOLTS: 3/8" S.S $\Rightarrow A_n = 0.1104$

STRESSES: CASE 1 $\rightarrow \frac{538}{0.1104} = 4,871$ psi $< 12,800$ psi

CASE 2 $\rightarrow \frac{129}{0.1104} = 1,164$ psi $< 12,800$ psi

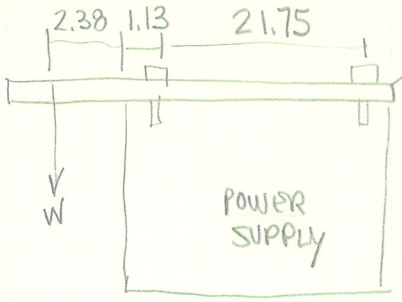
$\Rightarrow$ OK.

ITEM 9

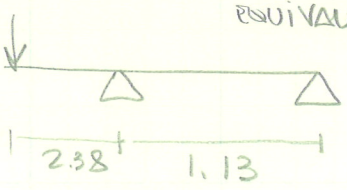
SEE ITEM 8.

PDG LIFTING ADAPTER

3) BASE PLATE



→ STOCK #1550-6540 → σ_u = 24 KSI, σ_y = 19 KSI (min)
(MUELLER METAL, 312·378·8120)
EQUIVALET TO 2,000 SERIES



$M_{MAX} = W \cdot (2.38)$

BELJAR + DEVICE = 150 + 115 = 265 lb.

M_{MAX} = 631 lbin. (NORMAL MODE)

M_{MAX} = 900 lbin (EVENTUAL MODE).

AA # 30. Tb. 3.3.6., p. 19, spec 4, $\left\{ 1.3\frac{F_{ty}}{n_y} \text{ OR } 1.42\frac{F_{tu}}{K_t n_u} \right.$

F_{ty} = 19, n_y = 1.85 (Tb. 3.3.3, CONSERVATIVELY, BEAMS)

F_{tu} = 24, n_u = 2.20, K_t = 1.25 (Tb 3.3.5, p. 18)

So $\sigma_A = \begin{cases} \frac{1.3}{1.85} \cdot 19 = \underline{13.4 \text{ ksi}} \leftarrow \\ \frac{1.42}{2.20} \cdot 24 = 15.5 \text{ ksi} \end{cases}$

$S = \frac{bh^2}{6} = \frac{15 \cdot (1)^2}{6} = 2.5 \text{ in}^3$ (CONSERVATIVELY)

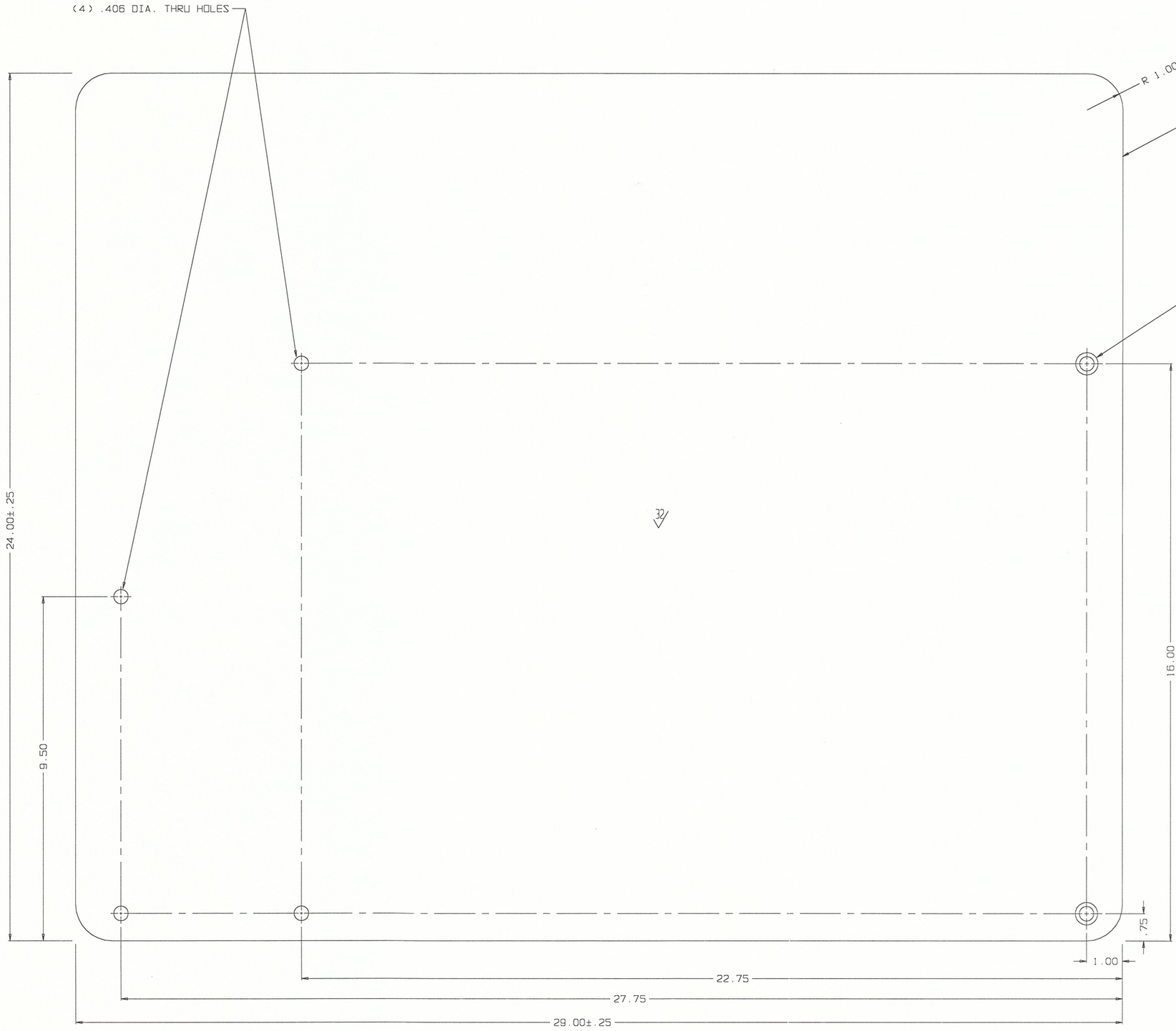
$\Rightarrow \sigma = \frac{900}{2.5} = 360 \text{ psi} \ll 13{,}400 \text{ psi} \Rightarrow \underline{\text{OK}}$

4) BOLTS:

MAX. FORCE (CONS.) = 265 lb $\Rightarrow \sigma = \frac{265}{0.1104} = 2.4 \text{ ksi} < 12.8 \text{ ksi}$

$\Rightarrow \underline{\text{OK}}$.

REV.	DESCRIPTION	DRAWN	DATE
		APPD.	DATE



ITEM	PART NO.	DESCRIPTION OR SIZE	QTY.

PARTS LIST

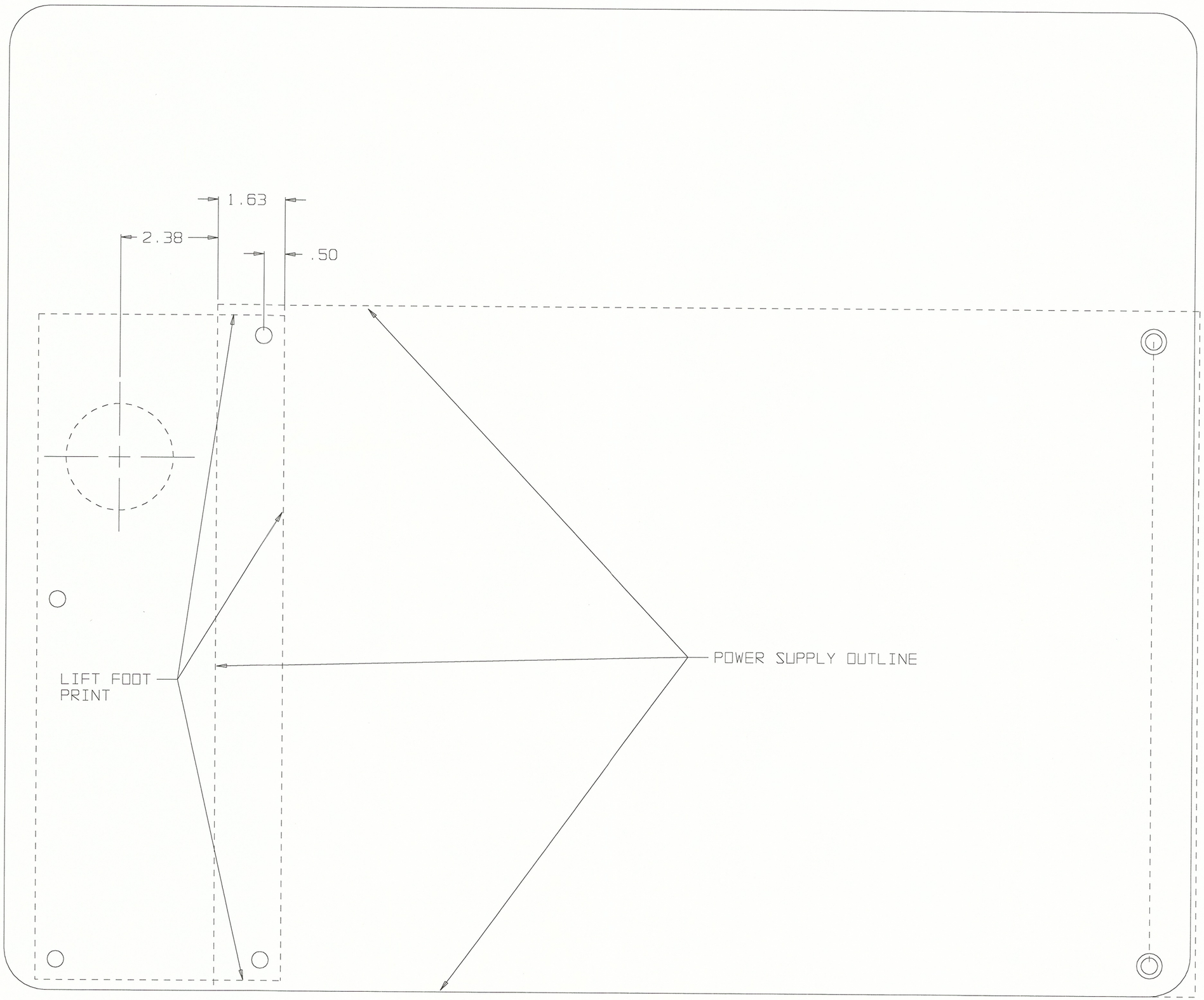
UNLESS OTHERWISE SPECIFIED			ORIGINATOR	JERRY ZIMMERMAN	(X4571)
FRACTIONS	DECIMALS	ANGLES	DRAWN	JERRY ZIMMERMAN	(X4571)
			CHECKED		
1. BREAK ALL SHARP EDGES .5MM MAX.			APPROVED		
2. DO NOT SCALE DRAWING			USED ON: VACUUM DEPOSITION SYSTEM		
3. DIMENSIONS BASED UPON ANSI Y14.5M-1982					
4. MAX. ALL MACH. SURFACES √			MATERIAL: CAST AL, TOOL & JIG 1.00 THICK FLATTENED		

FERMI NATIONAL ACCELERATOR LABORATORY
UNITED STATES DEPARTMENT OF ENERGY

VACUUM DEPOSITION BOTTOM PLATE

SCALE	SOFTWARE	DRAWING NUMBER	REV.
NONE	CADKEY	259208	

FILE: VD-BOT.PRT


1.63
2.38
.50
LIFT FOOT
PRINT
POWER SUPPLY OUTLINE

Kurt J. Lesker Company
1515 Worthington Avenue, Clairton, Pennsylvania 15025 USA
SALES: (800) 245-1656
(412) 233-4200 FAX: (412) 233-4275

June 21, 1995

Mr. Rafeal Silvia
Fermi Natn'l Lab
PO Box 500, MS 219
Batavia IL 60510

Dear Sir,

This letter serves to certify that the BH011 hoist, Serial #136, that your organization has recently purchased is rated for moments of 600 ft-lbs.

Regards,

Justin Johnson
Customer Support

JJ/mg

Kurt J. Lesker Company
1515 Worthington Avenue, Clairton, Pennsylvania 15025 USA
SALES: (800) 245-1656
(412) 233-4200 FAX: (412) 233-4275

August 21, 1995

Mr. Raphael Silva
Fermi Labs

Phone: 708/840-8311
Fax: 708/840-3684

Dear Mr. Silva,

I have made inquiries with regard to the observations you made during the operation of the modified BH011 hoist. The stock units, as assembled, do show a small wobble in the inner and outer shaft components of the assembly when the lift and lower operations are performed.

The maximum movement from the centerline is approximately .250" in any direction. This is when the unit is not loaded. If the three screws at the bottom of the outer shaft are loosened, there is more significant movement possible when the shafts are moved by hand.

Your observations that the hoist assembly is fixed at the mounting plate only, could account for what appears to be a greater movement during lifting and lowering operations. In system assemblies, we have traditionally provided an additional support point higher up on the outer shaft. This minimizes the movement of the outer shaft.

Based on your observations, it would be prudent to minimize the movement in the whole assembly by providing additional support near the top of the outer shaft, if possible.

This style of hoist has been used on a variety of applications over the past ten years. To the best of our knowledge, the few problems experienced have been related to operating the unit past the normal operating range. There have been no reported cases of failure of the outer shaft mounting screws. There is need to periodically check tightness of these screws the same as any mounted components in a vacuum system.

I hope that this will help develop confidence in our product and look forward to many years of quality service.

Regards,

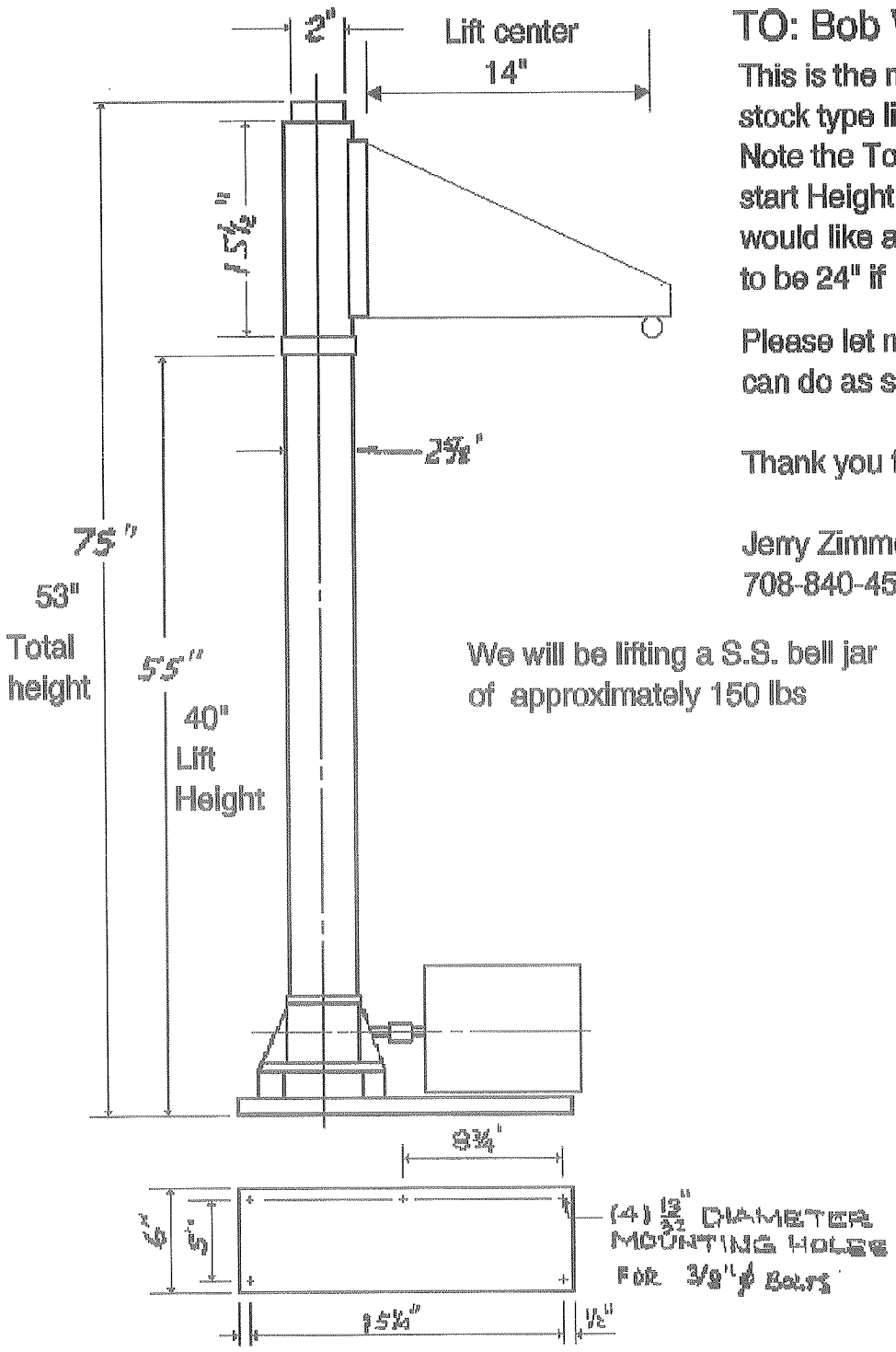
George Dumm
Product Manager

GD/mg

Fermilab

Fermi National Accelerator Laboratory
P. O. Box 500 Batavia, Illinois 60510

FAX: (708)840-8066



TO: Bob Wehrle

This is the modifications to the stock type lift we talked about. Note the Total Height and lift start Height are differant. We would like a total lifting height to be 24" if possible.

Please let me know what you can do as soon as possible.

Thank you for your help.

Jerry Zimmerman
708-840-4571

We will be lifting a S.S. bell jar of approximately 150 lbs

THIS TRANSMISSION CONSISTS OF _____ PAGES EXCLUDING THIS COVER SHEET

FULTON Performance Products

MADE IN USA

K1051/KX1051 STANDARD WORK WINCH OWNERS' MANUAL

⚠ WARNING ⚠

This winch is of a general purpose design for **manual** operation only and the load rating is based on a intermittent duty cycle. This winch **is not** designed to be a human hoist and should never be operated when there are persons positioned on or under the load being lifted or moved.

Obey crank rotation instructions as disregard could cause bodily harm or property damage. When facing the crank handle side of the winch, crank **clockwise to lift or move the load, counter-clockwise to lower the load**. Never release the crank handle unless the ratchet pawl is fully engaged and supporting the load.

⚠ CAUTION ⚠

Never exceed the **maximum rated capacity** shown below and on the winch frame.

Maintain a **minimum of three wraps of cable on the drum** at all times.

Never use worn, kinked, or frayed cable. These conditions are unsafe. **Replace the cable immediately.**

Be sure that the cable on the winch is strong enough to support the load to be lifted. Always inspect the cable and hook before each use to make sure they are not damaged. If the cable or hook breaks, the cable can act like a whip and inflict serious injury to anyone in it's path.

Never stand along side the winch cable , or guide the cable with your hands.

Never permit anyone on or under the load that is being pulled or lifted.

Never operate with wet or oily hands and always use a firm grip on the handle.

Never leave a weight hanging by the winch while the winch is unattended, as unauthorized persons may attempt to operate the winch, thereby, creating an unsafe condition.

TECHNICAL SPECIFICATIONS

Load Capacity first layer 1000 lbs. (4.5kN)
Load Capacity top layer 500 lbs. (2.2kN)
Cable 7/32" Dia. 7 x 19 Aircraft (5mm)
4.1:1 Gear Ratio, Maximum Mechanical Advantage 27:1
Automatic load holding brake system

When cranking counter-clockwise this winch incorporates a mechanical brake by-pass system that winds cable off the drum when the load is very light. The brake will reset when the load is increased.

INSTALLATION

1 Assemble handle onto flatted input shaft end. Tighten the 1/2-13 locknut against handle. Note: Do not remove the double locknuts on long end of input shaft. They are an important part of the load-lok braking system and must be intact. See Fig. 1.

2 Bolt or weld the winch to a structure capable of supporting at least 5 times the load the winch will be pulling. Frame halves must be aligned with min. gap.

When bolting the winch down, use at least grade 5, 3/8 dia. bolts, flat washers and locknut (not supplied).

Always use the outer slots at the end opposite the direction of line pull. Use large flat washer if using center slot at opposite end.

CABLE TO DRUM

1 Feed cable over the top of drum, thru hole, and through cable clamp with one inch extending past clamp.

2 With keeper nuts and lockwashers outside the drum side, tighten nuts until adequate cable clamping is acquired.

3 Always be sure the cable is pulling straight off the winch not at an angle. This will prevent the cable from rubbing against the sides of the drum, which can damage the cable.

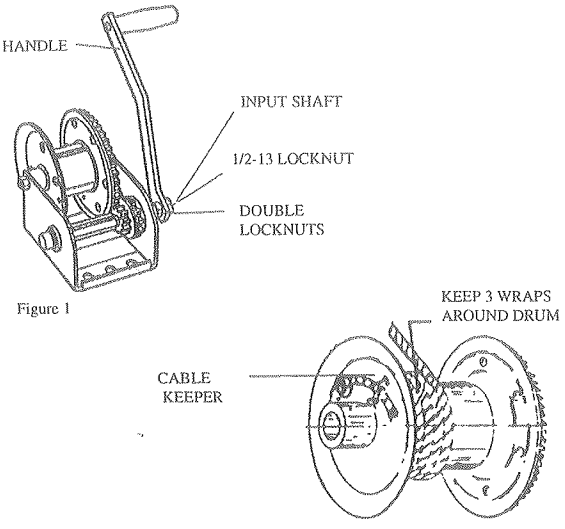


Figure 1

OPERATION

The brake is actuated by turning the handle. The load-lok brake is designed to hold the load whenever the handle is released.

A TO PULL CABLE IN OR RAISE LOAD

1 The cable must be securely fastened to the object being moved or lifted and to the winch drum.

2 Always be sure that the cable and cable attachments are not damaged and are strong enough for the load. Assure there is adequate safety factor for all components used.

3 Referring to the "Load-Unload" decal on side of winch, crank handle clockwise to move or lift, making sure the clicking sound of the ratchet is heard.

B TO LET CABLE OUT OR LOWER LOAD

1 Referring to the "Load-Unload" decal on side of winch, crank handle counterclockwise. No clicking sound will be heard because the load-lok braking system is now activated.

MAINTENANCE

1 Apply automotive type gease to both the pinion and drum gear teeth, and to the O.D. of drum bearing, Item 17. Keep this light film of grease on gear teeth at all times.

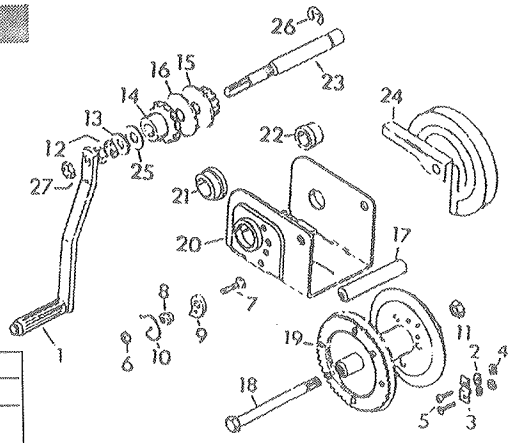
2 Keep ratchet pawl pivot, bushings, and pinion threads lubricated with automotive engine oil at all times.

3 Check brake friction disc, Item 16, for wear. If less than 1/16 of an inch thick, cracked, or broken, it should be replaced.

4 During each usage, check for proper ratchet operation as follows: When cranking cable in, a loud clicking sound should be heard. When cranking cable out, there is no clicking and the ratchet pawl should be fully engaged into the ratchet gear teeth.

PARTS LIST

When repairing the winch, mark all parts in the order of disassembly to insure proper re-assembly.



ITEM	DESCRIPTION	K1051	KX1051	QTY
1	HANDLE	0463402-01	0463402-01	1
2	WASHER	Cable Keeper	Cable Keeper	
3	ROPE KEEPER CLAMP	Kit	Kit	1
4	HEX NUT	5621-01	5621-01	
5	CARRIAGE BOLT -#10-24			
6	LOCKNUT-HEX 5/16-18			
7	CAPSCREW HEX 5/16-18x1.00			
8	SPACER-P/M .44 ID x.38	Ratchet Kit	Ratchet Kit	1
9	RATCHET PAWL	1650S00	6731S00	
10	SPRING-RATCHET .047 DIA.		(Requires 2 Kits)	
11	LOCKNUT-HEX 3/8-16	907-01	907-01	1
12	LOCKNUT-HEX 1/2-13	952-01	952-01	2
13	BRAKE DISC	2552-01	2552-01	1
14	RACHET ASSM.	2555-01	2555-01	1
15	PINION GEAR ASSM.	0434003-01	0434003-01	1
16	FRICTION DISC KIT	1621S00	1621S00	1
17	SPACER-DRUM	6284-00	6284-00	1
18	CAPSCREW HEX 3/8-16	6299-01	6299-01	1
19	DRUM ASSEMBLY	9186-01	9186-01	1
20	K1051/KX1051 FRAME ASSM.	0436001-01	0436001-01	1
21	BUSHING 1.25 ID x .50	4592-29	4592-29	1
22	BUSHING .75 ID x .50	5790-29	5790-29	1
23	PINION SHAFT	0469001-01	0469001-01	1
24	GEAR COVER ASSEM.	N/A	9560-01	1
25	WASHER - THRUST	178-00	178-00	1
26	RETAINING RING	57-01	57-01	1
27	LOCKNUT-HANDLE	0927021-01	0927021-01	1

HOW TO ORDER REPAIR PARTS

Always replace broken or bent parts before using this product. Replacement parts are available through Fulton Performance Product's Customer Service Department, 715-693-1700. Please specify product model number, name of part, and part number.

LIMITED WARRANTY

Fulton products are warranted to the original consumer purchaser to be free from defects in material and workmanship under normal use and service, ordinary wear and tear excepted, for a period of one (1) year from the date of purchase as shown on the Customer's receipt. This warranty shall not apply to any defects caused by: (1) physical abuse of the goods or any component or acts of vandalism by any persons other than Fulton, it's employees, agents, or subcontractors; (II) alterations, modifications, additions, or repairs made during the applicable warranty period by anyone other than Fulton employees, agents or subcontractors; (III) improper installation or use contrary to Fulton's instruction; or (IV) accidents or damage resulting from fire, water, wind, hail, lightning, electrical surge or failure, earthquake, theft or similar causes not caused or contributed to by the negligence of Fulton or it's employees, agents, or subcontractors.

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