BELOW-THE-HOOK LIFTING DEVICE
Engineering Note Cover Page

Lifting Device Numbers:

FNAL Site No.:_____ if applicable Div. Specific No.: 95 if applicable Asset No. _____ if applicable

ASME B30.20 Group: (check one)
- (X) 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: _____

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: _____
- (X) Provided by a User or Other Laboratory
- ( ) Other. Describe: _____

Engineering Note Prepared by: James Kuhlen Date: 8/19/99

Engineering Note Reviewed by: [signature] Date: 8/20/99

Lifting Device Data:

Capacity: 220 lbs

Fixture Weight: _____

Service: (X) 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: _____

Rated Load Test by FNAL (if applicable): Date: _____ Load: 275 lbs

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

Satisfactory Load Test Witnessed by: Charles D. Paul

Signature (of Load Test Witness): _____

Notes or Special Information:

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ENGINEERING NOTE

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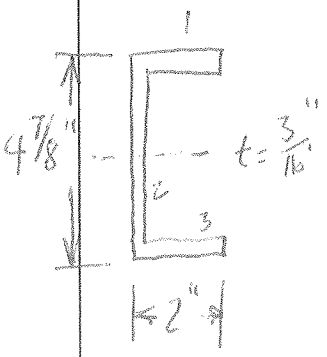
SUBJECT

KEK SPREADER BAR

NAME: JIM KICMER

DATE: 8/19/99 | REVISION DATE:

THIS FIXTURE WAS MADE IN JAPAN AT THE KEK LAB TO ASSEMBLE A HANGING FILE TYPE CALORIMETER FOR THE TEST BEAM IN MESON LAB. THE MATERIAL IS ALUMINUM AND APPEARS TO BE A STANDARD CHANNEL. ASSUME THE ALUMINUM TO BE 6061-T6



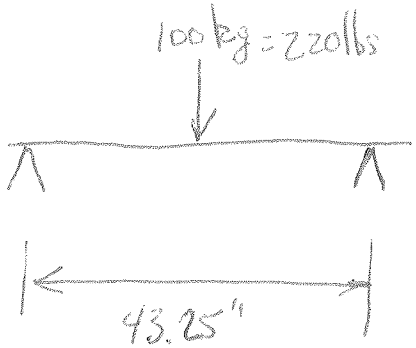
CALCULATE I_x

SHAPE		$\bar{I}$	A	d	Ad^2
1		$\frac{1}{12}(2)(.1875)^3$	(2)(.1875)	2.34	
		1.1×10^{-3}	.375		2.05
~~2~~	~~1~~				
2		$\frac{1}{12}(.1875)(4.5)^3$	(4.5)(.1875)	0	0
		1.42	.844		
3		$\frac{1}{12}(2)(.1875)^3$	(2)(.1875)		
		1.1×10^{-3}	.375	2.34	2.05

$\Sigma \bar{I} = 1.42$ $\quad \Sigma Ad^2 = 4.1$

$I_x = \Sigma \bar{I} + \Sigma Ad^2$

$= 1.42 + 4.1 = 5.52 \text{ in}^4$



USE SIMPLY SUPPORTED BEAM FORMULA

$$M = \frac{PL}{4}$$

$$= \frac{(220 \text{ lbs})\left(\frac{43.25"}{2}\right)}{4}$$

$$= 1190 \text{ lb-in}$$

$$\sigma = \frac{Mc}{I}$$

$$= \frac{(1190 \text{ lb-in})(2.34'')}{5.52 \text{ in}^4}$$

$$= 504 \text{ PSI}$$

$c = d = 2.34''$

$I = 5.52 \text{ in}^4$

6061 ALUMINUM YIELD = 35KSI

ALLOWABLE FOR LIFTING FIXTURES = 11.7 KSI

$\Rightarrow$ BENDING IS OK

LOOK AT BEARING STRESS ON END BOLTS

BOLTS ARE 5/16" ϕ

LOAD AREA IS THEN $5/16'' \times 3/16'' = .313 \text{in} \times .1875 \text{in}$
$= .0586 \text{ in}^2$

LOAD = 110lbs

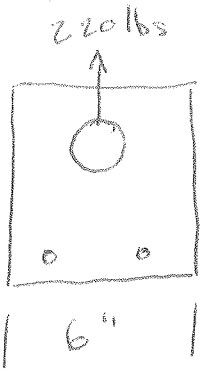
$$\sigma = \frac{\text{LOAD}}{\text{AREA}} = \frac{110 \text{ lbs}}{.0586 \text{ in}^2}$$

$$= 1880 \text{ PSI}$$

$\Rightarrow$ BEARING LOAD IS OK

BOLTS AT PICK POINT ARE 3/8" (LARGER) SO STRESS IS EVEN LESS.

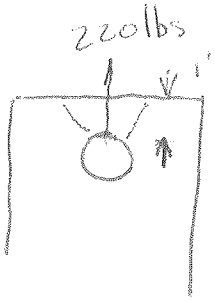
TENSION ON PICK POINT BAR



$$\sigma = \frac{\text{LOAD}}{\text{AREA}} = \frac{220 \text{ lbs}}{6'' \times 3/8''}$$

$$= 97.8 \text{ PSI}$$

~~PLATE~~ BLOCK SHEAR ON PICK POINT



$$\sigma = \frac{\text{LOAD}}{\text{AREA}}$$

$$= \frac{220\,\text{lbs}}{1" \times \frac{5}{8}" \times 2}$$

$$= 293\,\text{PSI} \text{ IN SHEAR}$$

~~6061~~ 6 SHEAR YIELD STRENGTH = 20 KSI

ALLOWABLE SHEAR ON LIFTING FIXTURE = 6.67 KSI

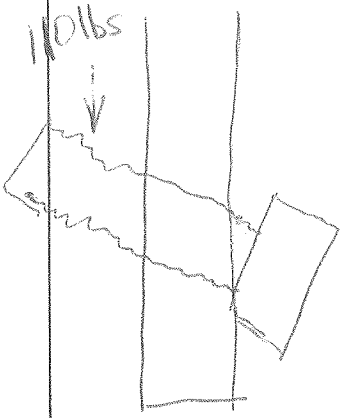
$\Rightarrow$ BLOCK SHEAR IS OK

PICKING EARS ARE STAINLESS STEEL $2" \times \frac{3}{8}"$

$$\text{STRESS} = \frac{220\,\text{lbs}/2}{2" \times \frac{3}{8}"} = 147\,\text{PSI}$$

$\Rightarrow$ OK

$\frac{3}{8}"$ STAINLESS BOLTS ARE USED AS A HOOK ON EACH PICKING EAR



LOOK AT LOAD AS SHEAR

$$A = \frac{\pi}{4} d^2 = \frac{\pi}{4}(.294\,in)^2 = .068\,in^2$$

$$\sigma = \frac{F}{A}$$

$$\sigma = \frac{110\,\text{lbs}}{.068\,in^2}$$

$$= 1620\,\text{PSI}$$

$$\text{STAINLESS ALLOWABLE} = \frac{F_y}{3} = \frac{30\,\text{KSI}}{3} = 10\,\text{KSI}$$

$\Rightarrow$ BOLT SHEAR OK

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ENGINEERING NOTE

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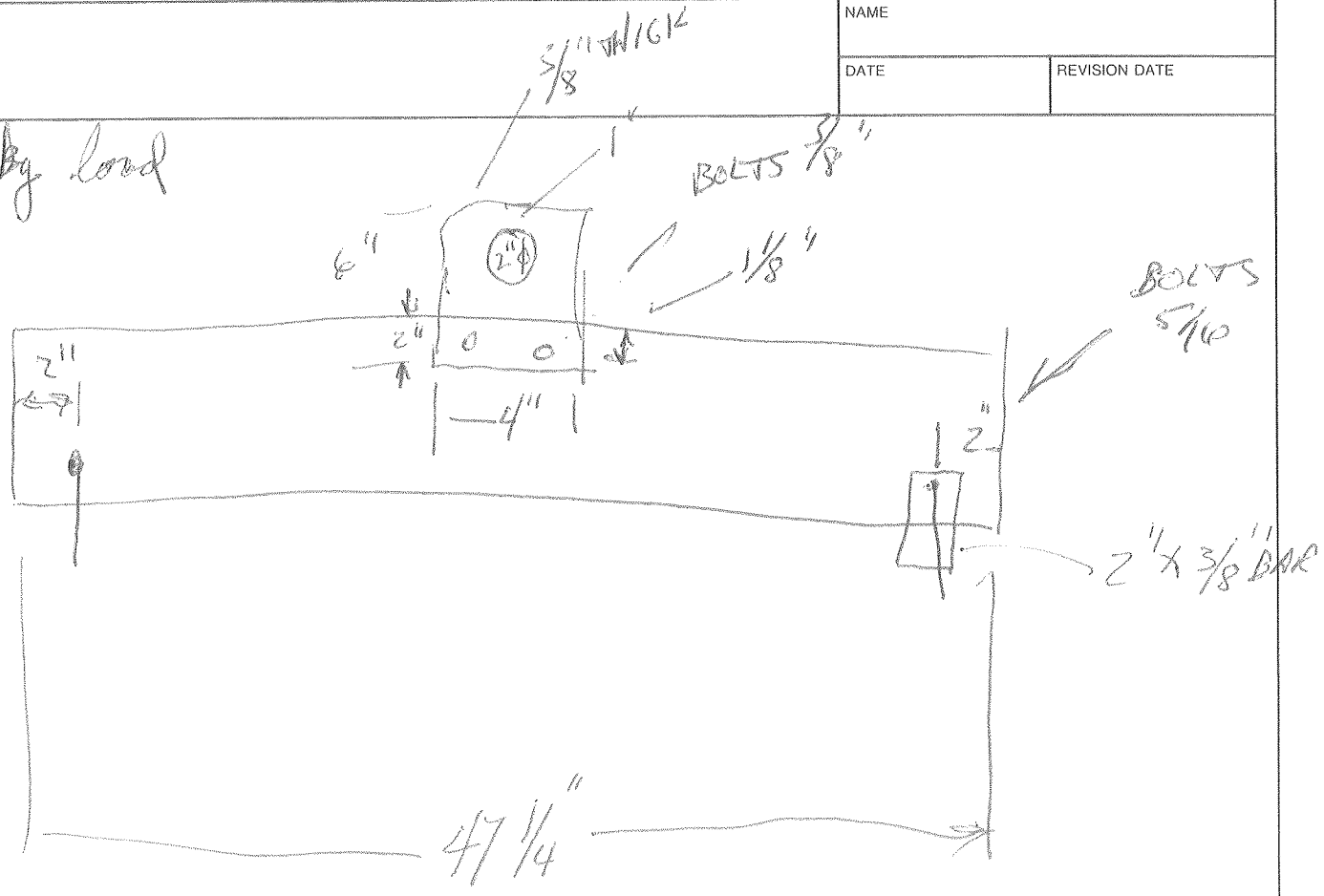
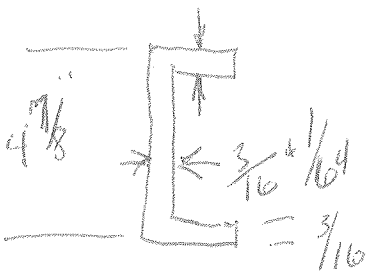
SUBJECT

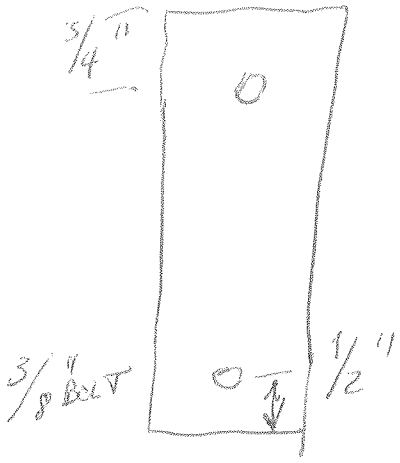
NAME

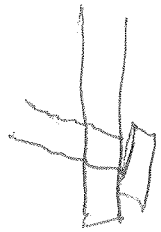
DATE | REVISION DATE

NO by Load









HP Fujii

RESPONSIBLE FOR FIXTURE