

New Folder Name Support Bracket

Calculations

T950092

CHECK SHEAR ON BOLT GROUP

DUE TO LONGITUDINAL FORCES

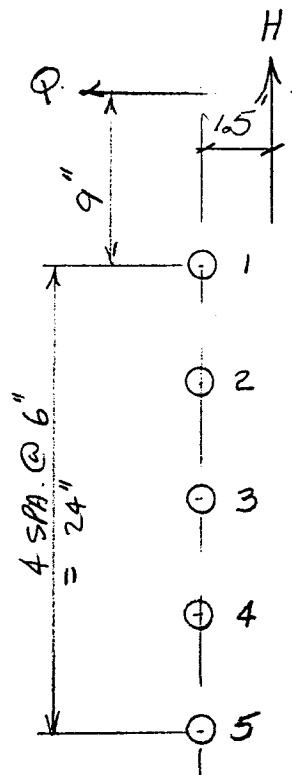
$H = 2650 \#$

$Q = 600 \#$

$J = \sum Ar^2$       LET  $A = 1$

$J = \sum r^2 = 2(6)^2 + 2(12)^2 = 360 \text{ IN}^2$

$r_1 = r_5 = 12" \quad r_2 = r_4 = 6" \quad r_3 = 0$



TORQUE (T) =  $(2650 \#)(1.5") + (600 \#)(9+12) = 16,575 \text{ IN-LBS}$

SHEAR (LONG.) =  $\frac{H}{N} + \frac{Tx}{J} = \frac{2650}{5} + \frac{(16,575)(0)}{360}$

SHEAR (LONG.) =  $530 \#/\text{BOLT}$

$\frac{T}{T_{MAX}} + \frac{V}{V_{MAX}} \leq 1$

$T_{MAX} = 1750 \# \quad V_{MAX} = 2875 \# \quad (\text{SEE NEXT SHEET})$

$\frac{1259}{1750} + \frac{530}{2875} = 0.90 < 1.0 \quad \text{OK}$

SUBJECT	OFFICE		REVISION		REFERENCE NO.
	CBI				
	MADE BY	CHKD BY	MADE BY	CHKD BY	SHT ___ OF ___
	MRS	DJS			
DATE	DATE	DATE	DATE		
10/16/94	12/1/14			10.5D	

INTERACTION - 5/8" DIA HILTI KB-II

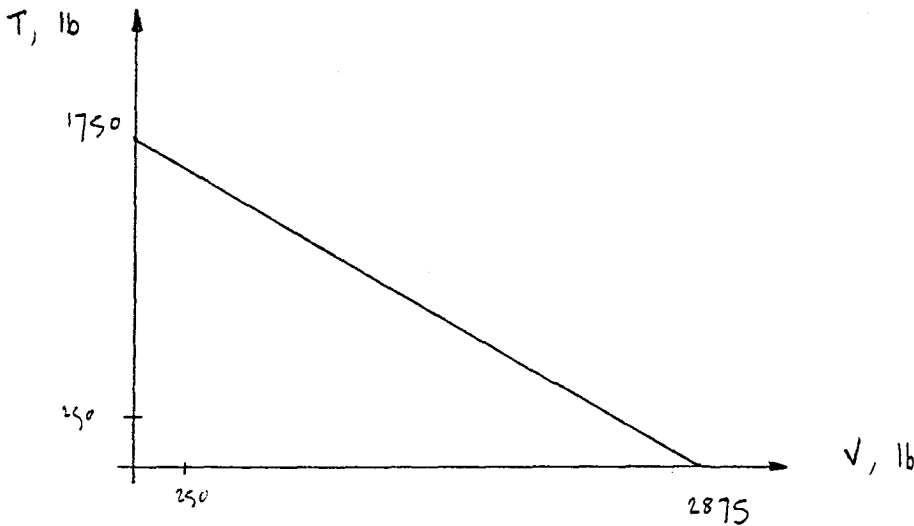
REF: HILTI PRODUCTS CATALOG  
 ICBO REPORT No. 4627 (Page 3 of 4)

for 5/8 IN DIA HILTI KB-II IN 3000 PSI CONCRETE WITH SPECIAL INSPECTION

$T_{max} = 1750 \text{ lb}$   
 $V_{max} = 2875 \text{ lb}$  } @ 8 IN SPACING &  
 2 3/4 IN EMBED DEPTH

INTERACTION, TENSION & SHEAR

$$\frac{T}{T_{max}} + \frac{V}{V_{max}} \leq 1$$



SUBJECT	<b>CEI</b> OFFICE		REVISION		REFERENCE NO.
	MADE BY WJC	CHKD BY DJS	MADE BY	CHKD BY	SHT ___ OF ___
	DATE 10-24-94	DATE 12/1/94	DATE	DATE	10.51

CHECK SHEAR IN TRANSVERSE DIRECTION (LOAD COMB. 3)

$$Q = 1730^{\#} \text{ (SEISMIC) (SHT. 10.13)}$$

$$\text{UPLIFT} = 0 \text{ (SHT. 10.13)}$$

$$H = \frac{2,158^{\#}}{2} = 1079 \text{ (SHT. 10.5)}$$

$$\text{SHEAR (TRANS)} = \frac{Q}{n} + \frac{T'Y}{J}$$

$$T' = 1730(9" + 12") + 1079(1.5") = 37,949 \text{ IN-LBS}$$

$$\text{SHEAR (TRANS)} = \frac{1730}{5} + \frac{37949(12)}{360} = 1,611^{\#} < 2875^{\#}/\text{BOLT} \\ \text{OK}$$

SUBJECT	CBI OFFICE		REVISION		REFERENCE NO.
	MADE BY MRS	CHKD BY DJS	MADE BY	CHKD BY	SHT. ___ OF ___
	DATE 10/16/94	DATE 12/1/94	DATE	DATE	10.52

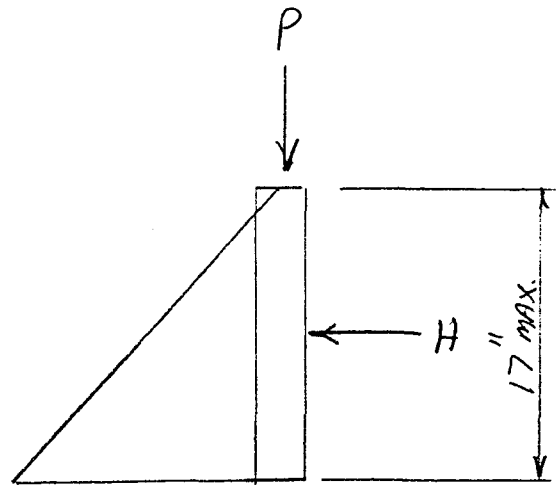
## DESIGN VERTICAL MEMBERS

$$P = 4281 \#$$

$$H = 2650 \#$$

$$M_{max} = \frac{HL}{4} = \frac{(2650 \#)(17'')}{4}$$

$$M_{max} = 11,263 \text{ IN-LBS}$$



$$F_b = 0.66F_y = 0.66(36,000) = 23,760 \text{ PSI (AISC F3 FOR TUBES)}$$

TRY 3 X 2 X 3/16 RECTANGULAR TUBE

$$A = 1.64 \text{ IN}^2 \quad I_x = 1.86 \text{ IN}^4 \quad S_x = 1.24 \text{ IN}^3 \quad r_x = 1.06''$$

$$I_y = 0.977 \text{ IN}^4 \quad S_y = 0.977 \text{ IN}^3 \quad r_y = 0.771'' \quad J = 2.16 \text{ IN}^4$$

$$L = 17'' \text{ MAX} \quad KL/r_y = \frac{(1.0)(17)}{0.771''} = 22$$

$$F_{ax} = 20,480 \text{ PSI (AISC TABLE C-36, PG 3-16)}$$

$$f_a = \frac{P}{2A} = \frac{4281 \#}{2(1.64 \text{ IN}^2)} = 1305 \text{ PSI (2 TUBES CARRY VERT. LOAD)}$$

$$f_{bx} = \frac{M/S}{1.2A} = \frac{11,263}{1.2A} = 9083 \text{ PSI (ONLY ONE TUBE IS BRACED OR ONLY ONE TUBE CARRIES HORIZ. LOAD)}$$

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	MRS	DJS			
DATE	DATE	DATE	DATE	10.53	
10/16/94	12/1/94				

CONSERVATIVELY ASSUME TRANSVERSE LOAD @ TOP

$$M_y = \frac{600^{\#}}{2} (17") = 5100 \text{ IN-LBS}$$

↳ TWO TUBES RESIST MY MOMENT

$$f_{by} = \frac{M_y}{S_y} = \frac{5100 \text{ IN-LBS}}{0.977 \text{ IN}^3} = 5,220 \text{ PSI}$$

### ALSC H1

$$f_y / F_y = \frac{1305 \text{ PSI}}{20,480 \text{ PSI}} = 0.064 < 0.15$$

EQ H1-3

$$\frac{f_y}{F_y} + \frac{f_{bx}}{F_{bx}} + \frac{f_{by}}{F_{by}} \leq 1.0$$

$$\frac{1305}{20,480} + \frac{9083}{23,760} + \frac{5220}{23760} = 0.67 < 1.0$$

∞ OK

### CHECK TRANSVERSE SEISMIC


$$M_x = 0 \quad M_y = \left( \frac{1730^{\#}}{2} \right) (17") = 14,705 \text{ IN-LBS}$$

$$P = 4892^{\#} \quad (\text{SHT. 10.13})$$

$$f_y = \frac{4892}{2(1.64)} = 1,492 \text{ PSI} \quad f_y / F_y = \frac{1492}{20480} = 0.073 < 0.15$$

$$f_{by} = \frac{M_y}{S_y} = \frac{14,705}{0.977} = 15,051 \text{ PSI}$$

$$\frac{f_y}{F_y} + \frac{f_{by}}{F_{by}} = 0.073 + \frac{15051}{23760} = 0.71 < 1.0 \quad \infty \text{ OK}$$

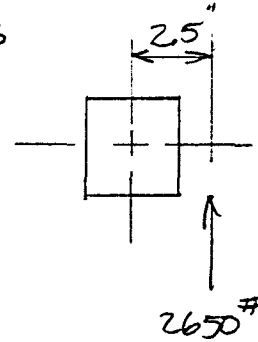
SUBJECT	OFFICE		REVISION		REFERENCE NO.
					
	MADE BY MRS	CHKD BY DJS	MADE BY	CHKD BY	SHT ___ OF ___
DATE 10/16/94	DATE 12/1/94	DATE	DATE	10.54	

CHECK VERTICAL TUBES FOR TORSION

ASSUME ONLY ONE TUBE PER PAIR RESISTS THE LONGITUDINAL FORCES

TORSION (T) = 2.5" (2650#) = 6,625 IN-LBS

REF: "DESIGN OF WELDED STRUCTURES" BY BLODGETT



SECTION 2.10

$$R = \frac{2tb^2d^2}{b+d}$$

b = 3 - 3/16 = 2.8125"

d = 2 - 3/16 = 1.8125"

t = .1875"

$$R = \frac{2(.1875)(2.8125)^2(1.8125)^2}{(2.8125 + 1.8125)} = 2.107 \text{ IN}^4$$

[A] = bd = (2.8125)(1.8125) = 5.097 IN<sup>2</sup>

$$\tau = \frac{T}{2[A]t_s} = \frac{6625}{2(5.097)(.1875)} = 3,466 \text{ PSI}$$

$\tau_{\text{TOTAL}} = (3466 \text{ PSI}) + \frac{2650\#}{2(3")(\frac{3}{16})} = 5,822 \text{ PSI} < .4F_y = 14,400 \text{ PSI}$   
 OK

$$\theta = \frac{TL}{GR} = \frac{(6625)(17")}{(12000000 \text{ PSI})(2.107)} = 0.00445 \text{ RAD} = 0.255^\circ$$

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DATE	DATE	DATE	DATE	10.55	
	10/17/94	12/1/94			

CHECK WEB BUCKLING OF VERTICAL TUBES

BOLTS WILL BE PRELOADED TO 12.2<sup>K</sup> EACH. (SHT. 10.39)

BEARING ON TUBE = 2(12.2) = 24.4<sup>K</sup>

REF: AISC K1-3b

$$\frac{R}{t_w (N + 2.5K)} \leq 0.66F_y$$

$R = \frac{24.4K}{2} = 12.2K$  (2 TUBES CARRY BOLT-UP LOADS)

$t_w = \frac{3}{16}$  FOR 3X2X $\frac{3}{16}$  TUBE

$N = 8$  LET  $K = 0$

$$\frac{12,200\#}{(\frac{3}{16})(8)} = 8,133 \text{ PSI} < 0.66F_y = 23,760 \text{ PSI}$$


AISC K1-4b

$$R = 34t_w^2 \left[ 1 + 3 \left( \frac{N}{d} \right) \left( \frac{t_w}{t_f} \right)^{1.5} \right] \sqrt{F_y \left( \frac{t_f}{t_w} \right)}$$

$t_w = t_f = \frac{3}{16}$   $d = 3$   $N = 8$

$$R = 34 \left( \frac{3}{16} \right)^2 \left[ 1 + 3 \left( \frac{8}{3} \right) (1)^{1.5} \right] \sqrt{36(1)} = 64.5K > 12.2K$$

OO OK

SUBJECT	OFFICE		REVISION		REFERENCE NO.
					
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	DATE 10/17/94	DATE 12/1/94	DATE	DATE	10.56



## DESIGN OF DIAGONAL BRACE

BRACE ANGLE =  $26^\circ$

HORIZONTAL LOAD ON BRACE =  $\frac{5300\#}{2} = 2650\#$  (BAKE OUT)  
 (ASSUME RESIST TOTAL LOAD)

AXIAL LOAD IN BRACE =  $\frac{2650\#}{\cos 26^\circ} = 2949\#$

TRY L 3x3x 3/16

$A = 1.09 \text{ in}^2$      $I = 0.962 \text{ in}^4$      $S = 0.441 \text{ in}^3$


$r_y = 0.939''$      $y = 0.820''$      $r_z = 0.596''$

$L \approx 32''$

$KL/r = \frac{(1.0)(32'')}{0.596} = 54$      $F_a = 17.99 \text{ KSI}$

$f_a = \frac{2949\#}{1.09 \text{ in}^2} = 2,706 \text{ PSI}$

$f_a/F_a = 0.15$

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	<i>mrs</i>	<i>DJS</i>			
	DATE	DATE	DATE	DATE	
	<i>10/17/94</i>	<i>12/1/94</i>			<i>10-57</i>

MOMENT ON SINGLE ANGLE =  $M = P_y$

$$y = 0.820" \quad P = 2949 \#$$

$$M = (2949 \#)(0.820") = 2418 \text{ IN-LBS}$$

$$f_b = M/S = \frac{2418 \text{ IN-LBS}}{0.441 \text{ IN}^3} = 5,483 \text{ PSI}$$

$$F_b = 0.60 F_y = 0.60(36,000 \text{ PSI}) = 21,600 \text{ PSI (AISC F1.2)}$$

$$\text{MAX. UNBRACED LENGTH (L_u)} = \frac{766A}{\sqrt{F_y}} = \frac{76(3)}{\sqrt{36}} = 38"$$

$$L \approx 32" \quad \circ \circ \quad F_b = 21,600 \text{ PSI}$$

AISC H1


$$f_a/f_a = 0.15$$

$$\text{(EQ. H1-3)} \quad \frac{f_a}{F_a} + \frac{f_b}{F_b} \leq 1.0$$

$$0.15 + \frac{5483}{21,600} = 0.40 < 1.0 \quad \circ \circ \quad \text{OK}$$

NOTE: ACTUAL ANGLE OF DIAGONAL BRACE IS  $24^\circ$ .

SINCE  $f_a/F_a + f_b/F_b \ll 1$  FOR  $\alpha = 26^\circ$ , BY OBSERVATION  
A  $24^\circ$  ANGLE WILL BE OK

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# BASEPLATE DESIGN

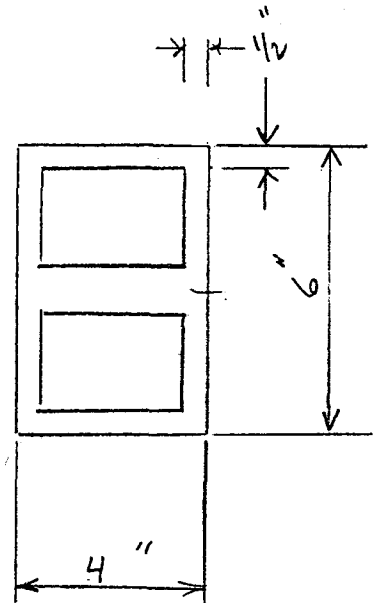
MAXIMUM VERTICAL LOAD =  $4281 \# + 2518 \# = 6,800 \#$

ASSUME AREA UNDER VERTICAL TUBES +  $\frac{1}{2}$ "  
CARRIES VERTICAL LOAD

BEARING PRESSURE ON CONCRETE

$$f_p = \frac{6800 \#}{(4)(6)} = 283 \text{ PSI} < 750 \text{ PSI} = 0.25 f'_c$$

OK



## CHECK BASE PLATE THICKNESS

$$M = \frac{(283 \text{ PSI})(1 \text{ inch})(\frac{1}{2} \text{ inch})}{2} = 71 \text{ IN-LBS}$$

$$F_b = .75 F_y = 27,000 \text{ PSI}$$

$$t_{\text{REQ'D}} = \frac{6M}{F_b} = 0.02 \text{ inch}$$

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	<b>CBI</b>				
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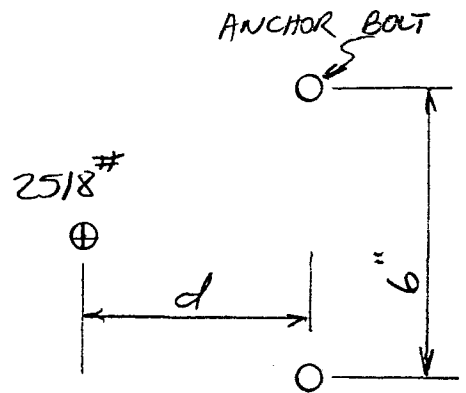
# CHECK UPLIFT ON BASEPLATE

ASSUME 2 BOLTS CARRY ALL UPLIFT

$$\text{UPLIFT} = 2518\#$$

ASSUME 6" WIDE X  $d$  LONG  
CANTILEVER RESISTS UPLIFT

$$d = 1\frac{1}{2} + 2\frac{1}{2} + 0.82 = 4.82"$$



$$M = (2518\#)(4.82") = 12,137 \text{ in-LBS}$$

$$S = \frac{bt^3}{6} \quad b = 6" \quad S = t^3$$

$$F_b = \frac{M}{S}$$

$$F_b = .75F_y = 27,000 \text{ PSI}$$

$$27,000 = \frac{12,137}{t^3}$$

$$t = 0.67" \quad \text{USE } t = \frac{3}{4}"$$

$$F_b = \frac{12,137 \text{ in-LBS}}{(.75)^3} = 21,577 \text{ PSI}$$

SUBJECT	OFFICE		REVISION		REFERENCE NO.
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	<i>MRS</i>	<i>DSS</i>			
DATE	DATE	DATE	DATE		
10/17/94	12/1/94				10.60

WELD DESIGN

L3x3x3/16 TO TUBE & BASE PLATE

$P = 2949 \#$

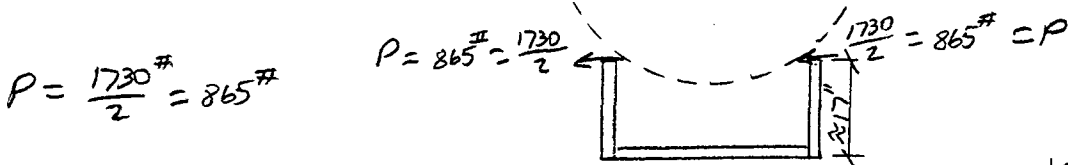
CBI WELD ALLOWABLE = 9600 #/IN / IN OF WELD SIZE

TRY 3/16" WELD  $f_{wa} = 9600 (3/16) = 1800 \#/IN$

$L_{REQ'D} = \frac{2949 \#}{1800 \#/IN} = 1.7"$

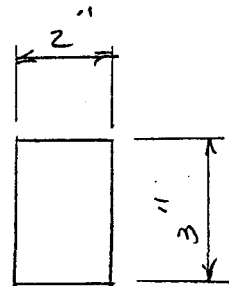
VERTICAL TUBE TO HORIZONTAL TUBE

TOTAL LATERAL SEISMIC LOAD = 1730# (SHT- 10.5)



MOMENT @ JOINT (M) = 17"(865#)

$M = 14,705 \#$



$f_w = \frac{P}{L_w} + \frac{M}{S_w} = \frac{865 \#}{10"} + \frac{14705}{9} = 1721 \#/IN$

WELD OUTLINE

$f_w = 1721 \#/IN < 1800 \#/IN$

$L_w = 10"$   
 $S_w = (3)(2) + \frac{3^2}{3} = 9 IN^2$

o o 3/16" WELD OK

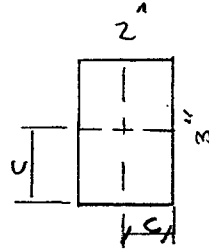
SUBJECT	OFFICE		REVISION		REFERENCE NO.
	CBI				
	MADE BY	CHKD BY	MADE BY	CHKD BY	SHT. OF
	MRS	DSS			
DATE	DATE	DATE	DATE		
10/18/94	12/1/94			10.61	

# VERTICAL TUBE TO BASE PLATE WELD

MAX LONG. SHEAR =  $\frac{5300^{\#}}{2} = 2650^{\#} = V$

MAX. TRANS. SHEAR =  $600/2 = 300^{\#}$

$$f_v = \frac{V}{L_w} + \frac{Tc}{J_w}$$



WELD OUTLINE

TORQUE (T) = 6625 IN-LBS (SHT. 10.55)

$c = 1''$  OR  $c = 1.5''$

$L_w = 70''$

$$J_w = \frac{(b+d)^3}{6} = \frac{(2+3)^3}{6}$$

$J_w = 20.8 \text{ IN}^3$

$$f_v = \frac{2650}{10''} + \frac{6625(1)}{20.8} = 584 \text{ \#/IN} < 1800 \text{ \#/IN (FOR } 3/16'' \text{ WELD)}$$

OR

$$f_v = \frac{300^{\#}}{10''} + \frac{6625(1.5)}{20.8} = 508 \text{ \#/IN} < 1800 \text{ \#/IN} \quad \text{OK}$$

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	DATE <i>10/18/94</i>	DATE <i>12/1/94</i>	DATE	DATE	<i>10.62</i>