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**Project:**

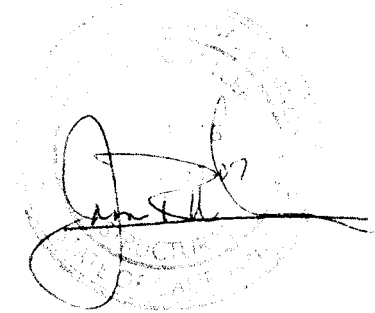
BMS Wall Mount  
Wood Studs, Masonry Wall

**Job No.**

J051004

**Client:**

Business Machine Security



**Date:**

5/10/2004

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REV	DESCRIPTION	DATE
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## Structural Calculations

### Commentary

This mounting bracket is designed to support a piece of audio-visual equipment which weighs 200 lb and an additional hanging load of 150 lb. Anchorage design is provided for wood studs and masonry walls. All design is based on the latest edition of the Uniform Building Code and C.A.C. Title 24.

### Description

Model: **WVT-25** The attached drawings provide construction and erection details of the proposed mounting bracket.

### Specifications

Lag screws (for wood stud installations): ANSI/ASME B18.2.1

Drilled anchors (for masonry installations): Hilti Kwik Bolt II expansion anchor  
 per ICC ES Legacy Report ER-5171

Sheet metal screws (for steel stud installations): OSHPD, "Suggested Capacity for Screws Connecting Steel to Steel", August 16, 1994

### Seismic Loading

$$V = (3.0 * Ca / R) * W$$

For UBC Zone 4,

$$Na = 1.5 \quad (< 2 \text{ km from "A" fault})$$

$$Ca = 0.44 * Na$$

$$= 0.66$$

$$R = 2.2$$

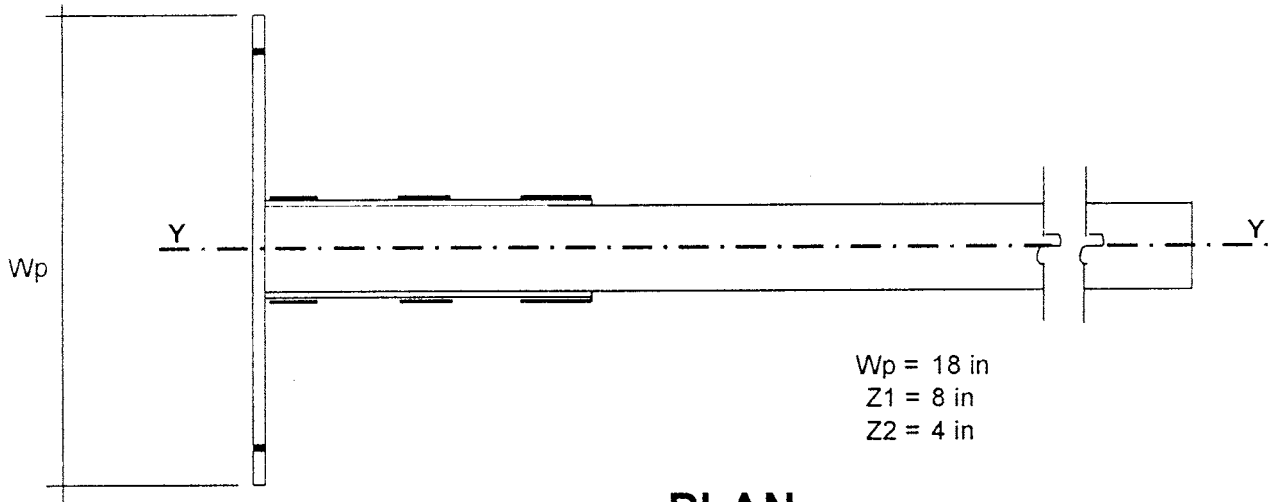
$$V = 0.90 * W$$

### Analysis

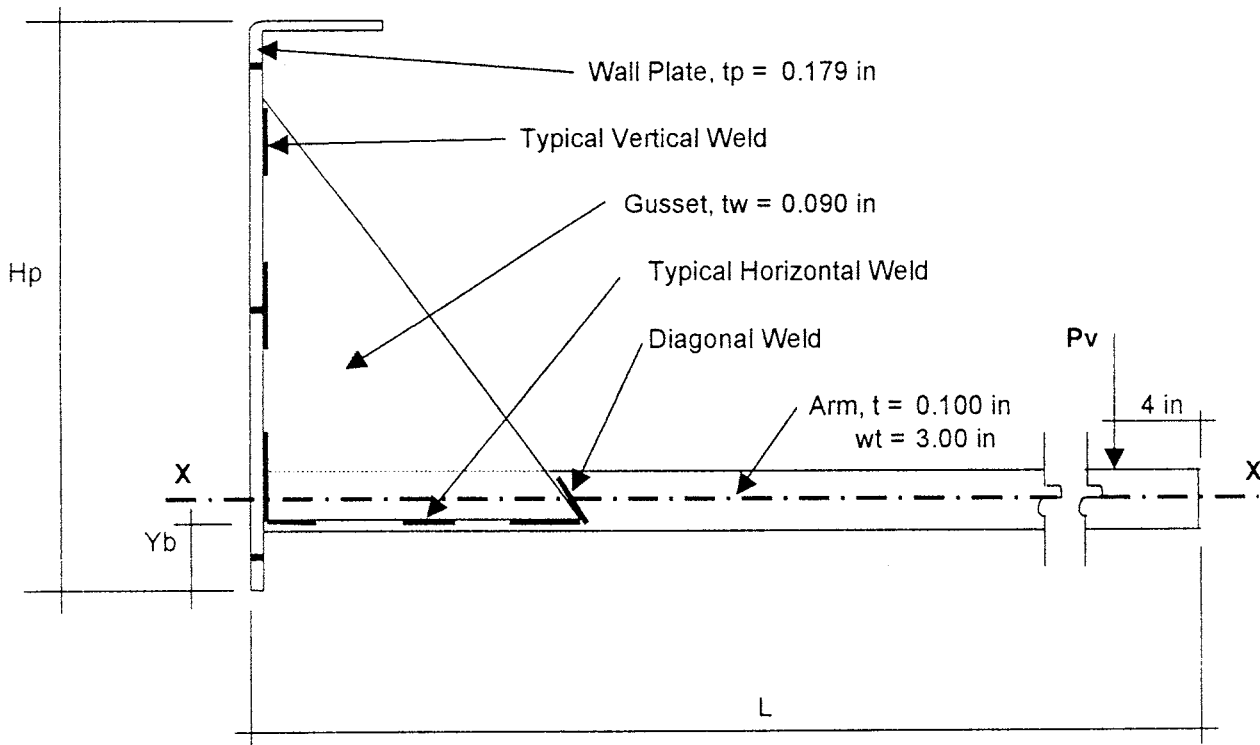
Load combination 1: Dead Load + Live Load

Load combination 2: Dead Load + Seismic Load

Comb 1	W = 350 lb	H = 0 lb
Comb 2	W = 200 lb	H = 180 lb



**PLAN**



$X_p = 4.00$  in  
 $Y_b = 2.00$  in  
 $X_t = 4.00$  in

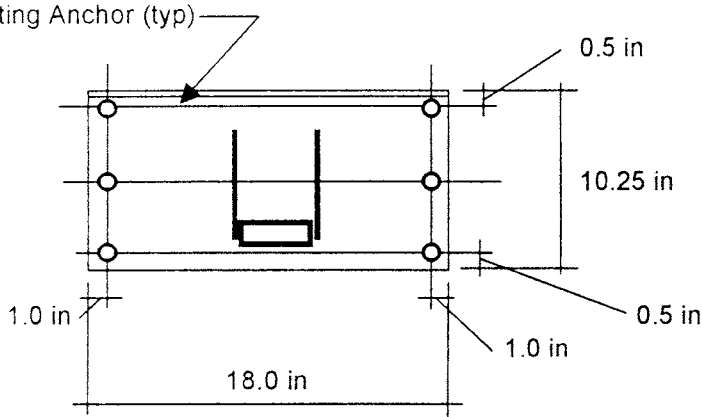
$H_p = 13.00$  in  
 $Y_t = 11.00$  in

$L = 22.00$  in

**SIDE ELEVATION**

Date: 05/10/04

Sheet 3 of 5



**FRONT ELEVATION**

**For wood stud installations**

**Center of gravity and moment of inertia of anchor system**

For 5 / 16" dia lag screw,

Bolt dia = 0.313 in

Abolt = 0.08 in<sup>2</sup>

no. of rows = 3

no. of bolts/row, n = 2

y1 = 0.50 in

y2 = 5.13 in

y3 = 9.75 in

tw = 0.090 in

tc1 = 0.269 in

tt = 0.100 in

tc2 = 0.279 in

Find neutral axis of configuration as shown:

$$Ay^2 + By + C = 0$$

$$A = tc1 = 0.269$$

$$B = -2tc1Yb + tc2wt + 4Ab = 0.069$$

$$C = -2Ab(Y3+Y2) + tc1Yb^2 - tc2wtYb = -2.88$$

$$y = 3.15 \text{ in}$$

Effective Section Properties:

Element	Area	d (in)	Ad <sup>2</sup>	Ix
Gussets	0.617	0.574	0.203	0.03
Arm	0.300	1.148	0.395	
Bolts Row 2	0.153	1.977	0.600	
Bolts Row 3	0.153	6.602	6.687	
Sum =	1.22 in <sup>2</sup>		7.88 in <sup>4</sup>	

**Determine anchor forces**

Bolt shear stress,  $f_v = V / A$

Bolt tension stress,  $f_t = Pa/A \pm Mb^*(c/l)$

Bolt force,  $T = f_t * A_b$

Load Comb.	Tension	Shear	Mb	$f_v$	Pa/A	$Mb^*(c/l)$	$f_t$	T
1	0.00 K	0.35 K	6.3 in-K	0.76 Ksi	0.00	5.28	5.28 ksi	0.40 K
2	0.18 K	0.20 K	3.6 in-K	0.43 Ksi	0.59	3.01	3.60 ksi	0.28 K

For 5/16" dia. lag screw into wood (3-1/2" penetration),

$V_{allow} = 150 \text{ lb}$

$T_{allow} = 822 \text{ lb}$

Comb 1      CSR = 0.88      < 1.0, OK

Comb 2      CSR = 0.56      < 1.0, OK

**For masonry installations**

**Center of gravity and moment of inertia of anchor system**

For 3 / 8" dia masonry anchors w/ 2-1/2" embedment,

Bolt dia = 0.375 in

$A_{bolt} = 0.11 \text{ in}^2$

no. of rows = 3

no. of bolts/row, n = 2

$y_1 = 0.50 \text{ in}$

$y_2 = 5.13 \text{ in}$

$y_3 = 9.75 \text{ in}$

$t_w = 0.188 \text{ in}$

$t_{c1} = 0.367 \text{ in}$

$t_t = 0.100 \text{ in}$

$t_{c2} = 0.279 \text{ in}$

Find neutral axis of configuration as shown:

$Ay^2 + By + C = 0$

$A = t_{c1} = 0.367$

$B = -2t_{c1}Y_b + t_{c2}w_t + 4A_b = -0.188$

$C = -2A_b(Y_3+Y_2) + t_{c1}Y_b^2 - t_{c2}w_tY_b = -3.49$

$y = 3.35 \text{ in}$

Effective Section Properties:

Element	Area	d (in)	$Ad^2$	$I_x$
Gussets	0.992	0.676	0.454	0.08
Arm	0.300	1.353	0.549	
Bolts Row 2	0.221	1.772	0.694	
Bolts Row 3	0.221	6.397	9.040	
Sum =	1.73 in <sup>2</sup>		10.7 in <sup>4</sup>	

**Determine anchor forces**

Load Comb.	Tension	Shear	Mb	f <sub>v</sub>	Pa/A	Mb*(c/l)	ft	T
1	0.00 K	0.35 K	6.3 in-K	0.53 Ksi	0.00	3.75	3.75 ksi	0.41 K
2	0.18 K	0.20 K	3.6 in-K	0.30 Ksi	0.41	2.14	2.55 ksi	0.28 K

For 3/8"dia. masonry anchors w/ 2-1/2" embedment,

Vallow = 485 lb      Tallow = 475 lb  
 Comb 1      CSR = 0.99      < 1.0, OK  
 Comb 2      CSR = 0.66      < 1.0, OK