



MASON INDUSTRIES, Inc
Manufacturers of Vibration Control Products
350 Rabro Drive 2101 W Crescent St, Suite D
Hauppauge, NY 11788 Anaheim, CA 92801
516/348-0282 714/535-2727
FAX 516/348-0279 FAX 714/535-5738
TELEX 96-8464

CERTIFIED FOR

JOB NAME MATISSE

CUSTOMER MASON OREGON

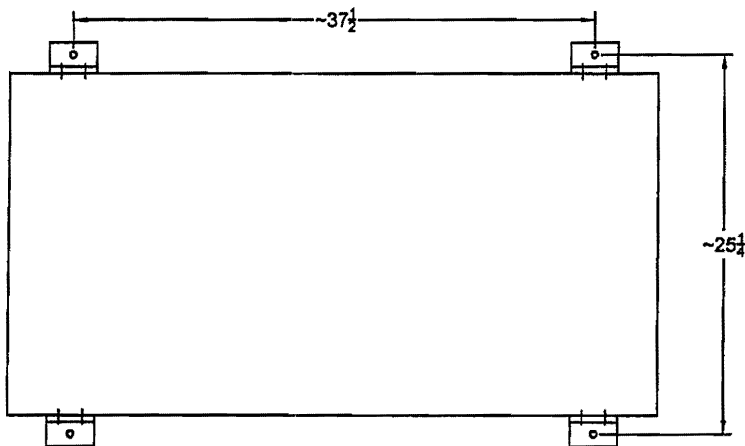
CUSTOMER P O _____ JOB NO _____

MASON E O 24899 DWG NO WF-24899-01

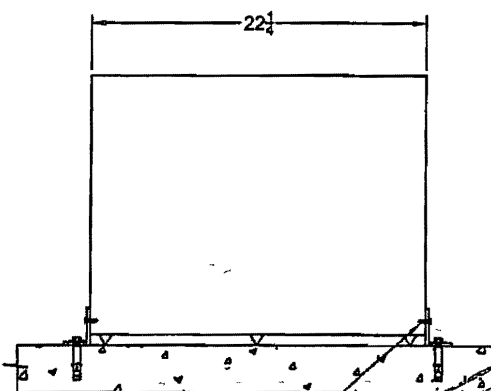
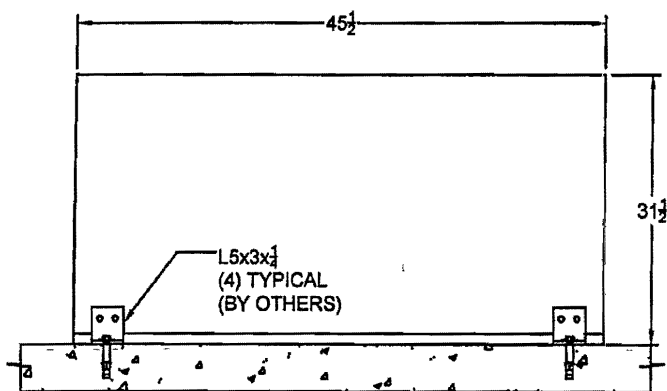
REQUIRED (4) TAG GWH-1 TO 4

EQUIPMENT ANCHORAGE DETAIL

UNIT LOCHINVAR CFN501PM **(A)**
WEIGHT 480 LBS



PLAN VIEW



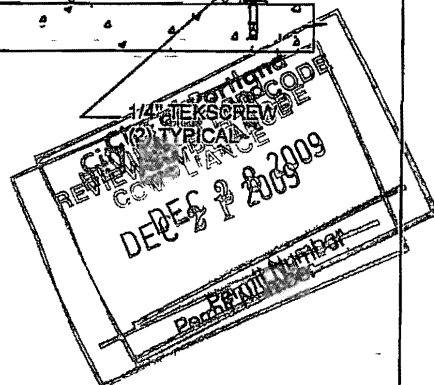
ELEVATION VIEW

THIS DOCUMENT HAS BEEN REVIEWED FOR GENERAL
COMPATIBILITY WITH DESIGN CONCEPT AND THE FOLLOWING
IS NOTED:

- ☒ NO EXCEPTIONS TAKEN
- ☐ REVISE AS NOTED
- ☐ REVISE AND RE-SUBMIT
- ☐ REJECTED

BY D. TIMPSON DATE 12/10/09

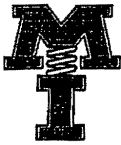
ANCHORAGE REQUIREMENT
(4) 3/8" HILTI KWIK BOLT-TZ,
2 1/4" EMBEDMENT,
5" EDGE DISTANCE
INSTALLED PER ICC ESR-1917



REVIEWED: 8 PAGES
DATED 10/30/2009

DWN IB CHKD MD DATE 10/30/09

DWG NO WF-24899-01



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CUSTOMER MASON OREGON

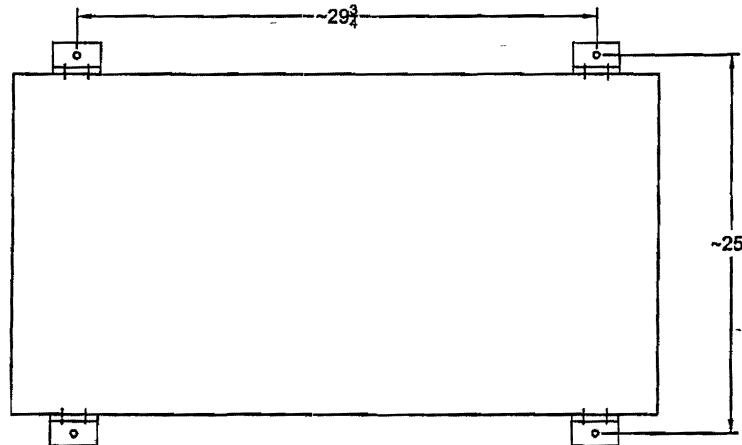
CUSTOMER P O _____ JOB NO _____

MASON E O 24899 DWG NO WF-24899-02

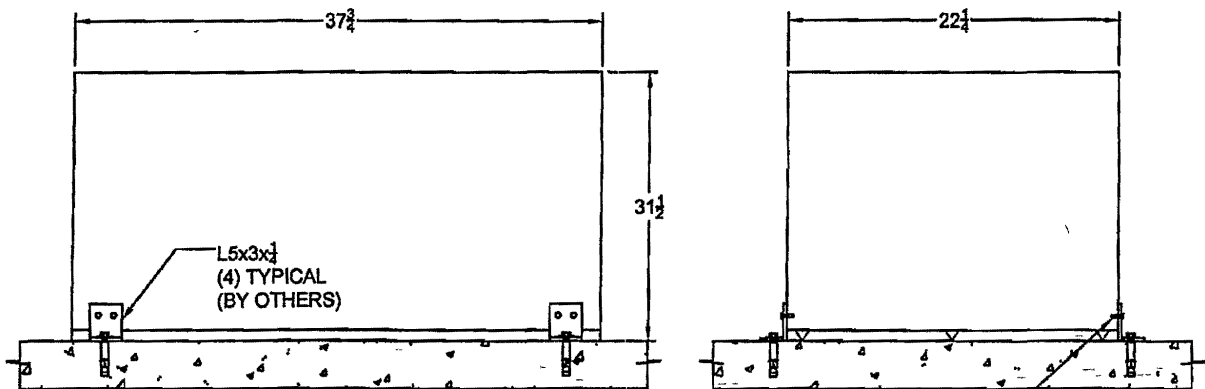
REQUIRED (2) TAG GWH-5, 6

EQUIPMENT ANCHORAGE DETAIL

UNIT LOCHINVAR CFN401PM **(A)**
WEIGHT 430 LBS

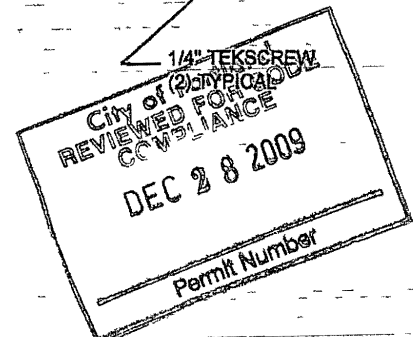


PLAN VIEW



ELEVATION VIEW

ANCHORAGE REQUIREMENT
(4) 3/8" HILTI KWIK BOLT-TZ,
2 1/4" EMBEDMENT,
5" EDGE DISTANCE
INSTALLED PER ICC ESR-1917



DWN IB CHKD MD DATE 10/30/09

DWG NO WF-24899-02



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 TELEX 96-8464

SEISMIC OVERTURNING CALCULATIONS

SEISMIC RESTRAINT TYPE DIRECT ANCHORAGE
 CODE(S) IBC 2006, CBC 2007, OSSC 2007

PAGE 1

Equipment overturning calculations based on seismic load applied at a critical angle
 As defined in the 2006 International Building Code, Chapter 16, Section 1613, the seismic Horizontal force, F_{ph} , may be calculated using the following formula

$$F_{ph(calc)} = \frac{0.4 a_p S_{DS} W_p}{\left(\frac{R_p}{I_p} \right)} \left(1 + 2 \frac{z}{h} \right)$$

Except that F_{ph} shall not be less than $F_{ph(min)} = 0.3 S_{Dslp} W_p$ and need not be more than $F_{ph(max)} = 1.6 S_{Dslp} W_p$

Where W_p = Component operating weight

a_p = Component Amplification Factor, refer to ASCE 7-05, Table 13.6-1

R_p = Component Response Modification Factor,
 refer to ASCE 7-05, Table 13.6-1

S_{DS} = Design spectra response acceleration at short period, refer to ASCE 7-05, section 11.4.4

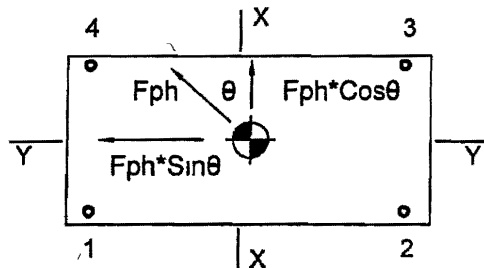
I_p = Component Importance Factor, refer to ASCE 7-05, section 13.1.3

z = Component Attachment Elevation with respect to grade

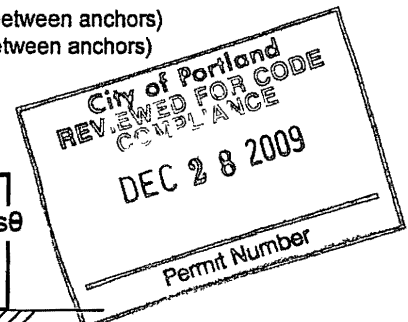
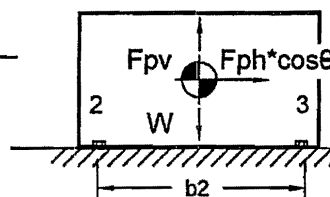
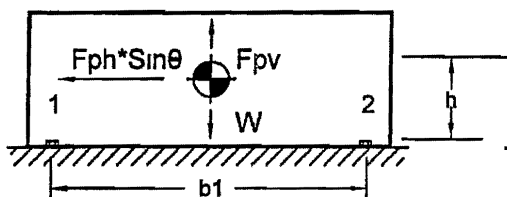
h = Structure Roof Elevation with respect to grade

Convert from Design Strength to Allowable Stress Design $F_{ph(a)} = \frac{F_{ph(calc)}}{1.4}$

Vertical Uplift Force $F_{pv} = 0.2 S_{DS} W_p$



b_1 = Maximum Length (between anchors)
 b_2 = Maximum Width (between anchors)
 h = C G Height
 N = Number of Anchors



Consider load applied in any horizontal direction

Transverse component = $F_{ph(a)} * \cos \theta$

Longitudinal component = $F_{ph(a)} * \sin \theta$

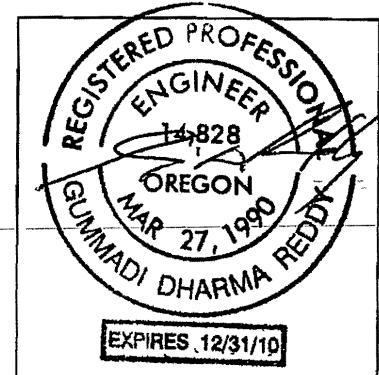
The net uplift load on anchor location 2

$$P_t = \frac{W - F_{pv(a)}}{N} - \frac{F_{ph(a)} * \cos \theta * h}{I_{yy}} \left(\frac{b_2}{2} \right) - \frac{F_{ph(a)} * \sin \theta * h}{I_{xx}} \left(\frac{b_1}{2} \right)$$

The net compressive load on anchor location 4

$$P_c = \frac{W + F_{pv(a)}}{N} + \frac{F_{ph(a)} * \cos \theta * h}{I_{yy}} \left(\frac{b_2}{2} \right) + \frac{F_{ph(a)} * \sin \theta * h}{I_{xx}} \left(\frac{b_1}{2} \right)$$

Where $I_{xx} = \frac{N(N+2)}{12(N-2)} b_1^2$ and $I_{yy} = \frac{N}{4} b_2^2$





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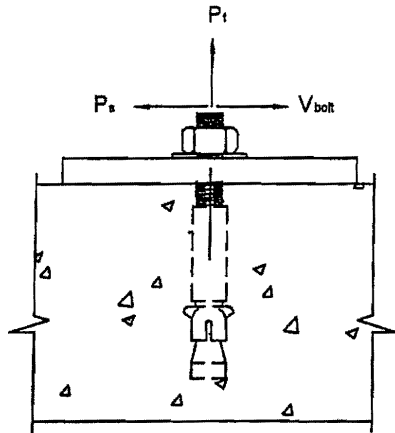
SEISMIC OVERTURNING CALCULATIONS

SEISMIC RESTRAINT TYPE DIRECT ANCHORAGE

STRUCTURE CONCRETE

CONNECTION HILTI TZ ANCHORS

PAGE 2



Maximum shear per location

$$P_s = \frac{F_{ph}}{N}$$

To maximize the values

$$\frac{dP_t}{d\theta} = 0 \quad \& \quad \frac{dP_s}{d\theta} = 0 \quad \text{will yield a condition}$$

To combine seismic anchor loads

Based on maximum P_t and maximum shear P_s

P_t = Tension on location

P_s = Shear on location

n = Number of anchors per location

T = Tension per anchor

V = Shear per anchor

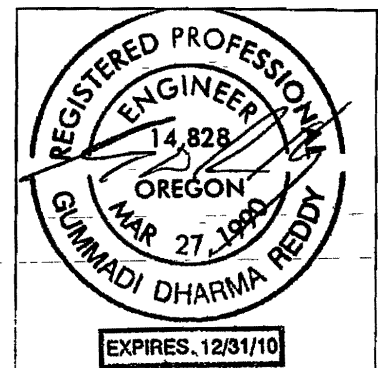
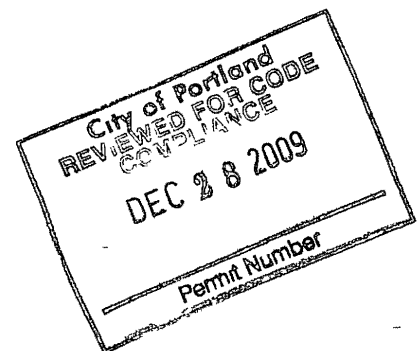
$$\tan \theta = \frac{I_{yy} * b_1}{I_{xx} * b_2} \quad \theta = \tan^{-1} \left(\frac{I_{yy} * b_1}{I_{xx} * b_2} \right)$$

Analysis of Bolt

$$T_{bolt} = \frac{P_t}{n} * 1.3 \quad \text{And} \quad V_{bolt} = \frac{P_s}{n} * 1.3$$

Combining the loads for the unity check

$$\left(\frac{T_{bolt}}{T_{allow}} \right) + \left(\frac{V_{bolt}}{V_{allow}} \right) \leq 1.2$$



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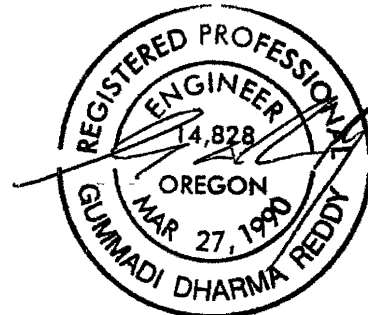
SEISMIC OVERTURNING CALCULATIONS

JOB NAME Matisse
CUSTOMER Mason Oregon
EO NUMBER 24899

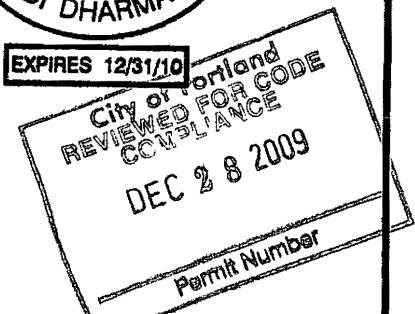
10/30/2009

PAGE 3

Tag	GWH-1 TO 4	GWH-5, 6
Wp=	480	430
ap=	1 00	1 00
Rp=	2 50	2 50
Sds=	0 73	0 73
Ip=	1 00	1 00
z=	2 00	2 00
h=	2 00	2 00
Fph (calc) =	167	150
Fph (min.) =	105	94
Fph (max) =	558	499
Fph(a)=	119	107
Fpv(a)=	70	62
Seismic Force Ratio=	0 25	0 25
b1=	37 50	29 75
b2=	25 25	25 25
h=	15 75	15 75
N=	4	4
Req. Edge Distance=	5	5
Tbolt(max allow)=	1102	1102
Vbolt(max allow)=	1257	1257
n=	1	1
Anchor Diameter	3/8	3/8
Anchor Embedment=	2 1/4	2 1/4
Ixx=	1406	885
Iyy=	638	638
Tan(theta)=	0 67	0 85
theta(rad)=	0 59	0 70
theta(deg)=	33 95	40 32
Pt=	58	48
Pc=	182	167
Ps=	30	27
*Tbolt=	0	0
*Vbolt=	39	35
Interaction Check=	0 03	0 03



EXPIRES 12/31/10

**Hilti Kwik Bolt TZ (ICC ESR-1917 & ACI 318-08, Appendix D)**Stone Aggregate, $f_c=3000$ psi concrete, with inspection

*Values multiplied by 1.3

Note Anchorage calculations are based on the above anchors size, edge distance, and embedment. If other anchors bolts are used they must be selected by others to meet required tension and shear forces and installation requirements

PAGE 3



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JOB NAME MATISSE

CUSTOMER MASON OREGON

CUSTOMER P O _____ JOB NO _____

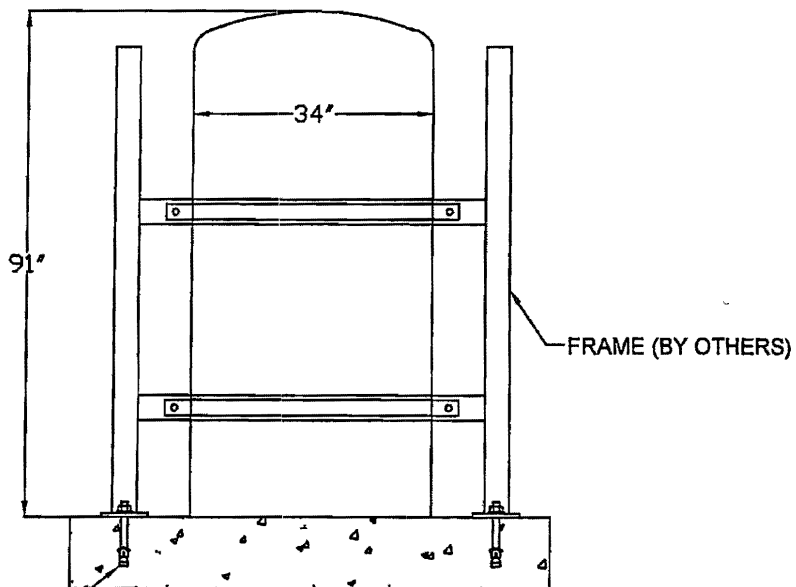
MASON E O 24899 DWG NO WF-24899-03

REQUIRED (6) TAG ST-1 TO 6

EQUIPMENT ANCHORAGE DETAILS

UNIT LOCHINVAR RGA0257 (8)

WEIGHT OF EQUIPMENT 3,054 LBS

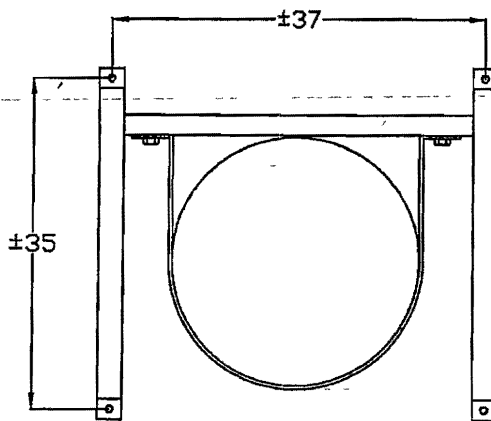


ELEVATION VIEW

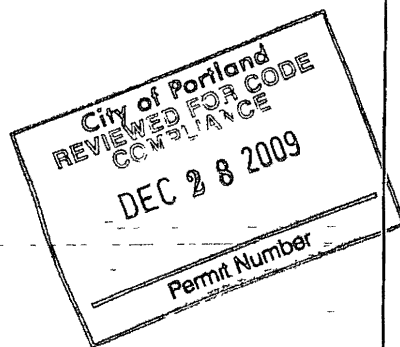
(4) 1/2" DIA HILTI KB - TZ
3 5/8" EMBEDMENT
6" EDGE DISTANCE

INSTALLED PER ICC ESR-1917

MASON IND CERTIFIED FOR ANCHORAGE ONLY



PLAN VIEW



DWN IB	CHKD WD	DATE 10/30/09
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DWG NO WF-24899-03



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 350 Robro Drive 2101 W Crescent St., Suite D
 Houppauge, NY 11788 Anaheim, CA 92801
 631/348-0282 714/535-2727
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CERTIFIED FOR

JOB NAME MATISSE

CUSTOMER MASON OREGON

CUSTOMER P O

MASON E O 24899 DWG NO CALC PAGE 1

Equipment overturning calculations based on seismic load applied at a critical angle

As defined in the OSSC 2007, the seismic Horizontal force, F_{ph} , may be calculated using the following formula

$$F_{ph(calc)} = \frac{0.4 a_p S_{DS} W_p}{\left(\frac{R_p}{I_p} \right)} \left(1 + 2 \frac{z}{h} \right)$$

Except that F_{ph} shall not be less than $F_{ph(min)} = 0.3 S_{Dsl} W_p$ and need not be more than $F_{ph(max)} = 1.6 S_{Dsl} W_p$

Where W_p = Component operating weight

a_p = Component Amplification Factor, refer to ASCE, table 13.6-1

R_p = Component Response Modification Factor,
refer to ASCE, table 13.6-1

S_{ds} = Design spectra response acceleration at short period, refer to ASCE section 11.4.4

I_p = Component Importance Factor, refer to ASCE section 13.1.3

z = Component Attachment Elevation with respect to grade

h = Structure Roof Elevation with respect to grade

Convert from Design Strength to Allowable Stress Design $F_{ph(a)} = \frac{F_{ph(calc)}}{1.4}$

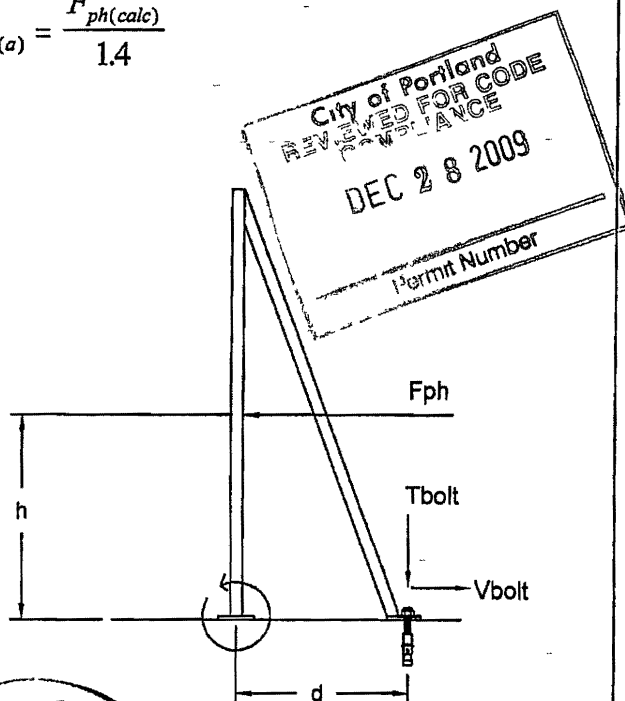
Vertical Uplift Force $F_{pv} = 0.2 S_{DS} W_p$

To combine seismic anchor loads

$$\text{Tension per anchor } T_{\text{bolt}} = \frac{(F_{ph}) * h}{d * n}$$

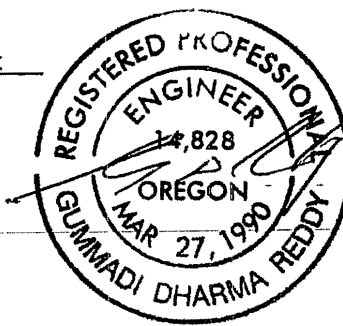
$$\text{Shear per anchor } V_{\text{bolt}} = \frac{F_{ph}}{n}$$

where n = Number of anchors per location



Combining the loads for the interaction check

$$\left(\frac{T_{\text{bolt}}}{T_{\text{allow}}} \right) + \left(\frac{V_{\text{bolt}}}{V_{\text{allow}}} \right) \leq 1.2$$



EXPIRES 12/31/10

DWN IB CHKD M> DATE 10/30/09

DWG NO CALC PAGE 1

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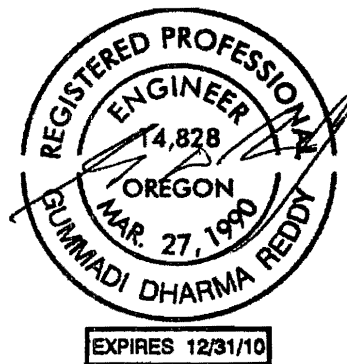
SEISMIC OVERTURNING CALCULATIONS

JOB NAME Matisse
CUSTOMER Mason Oregon
EO NUMBER 24899

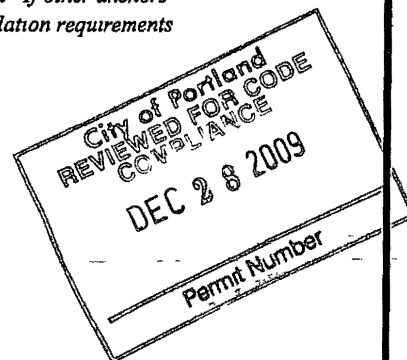
10/30/2009

PAGE 2

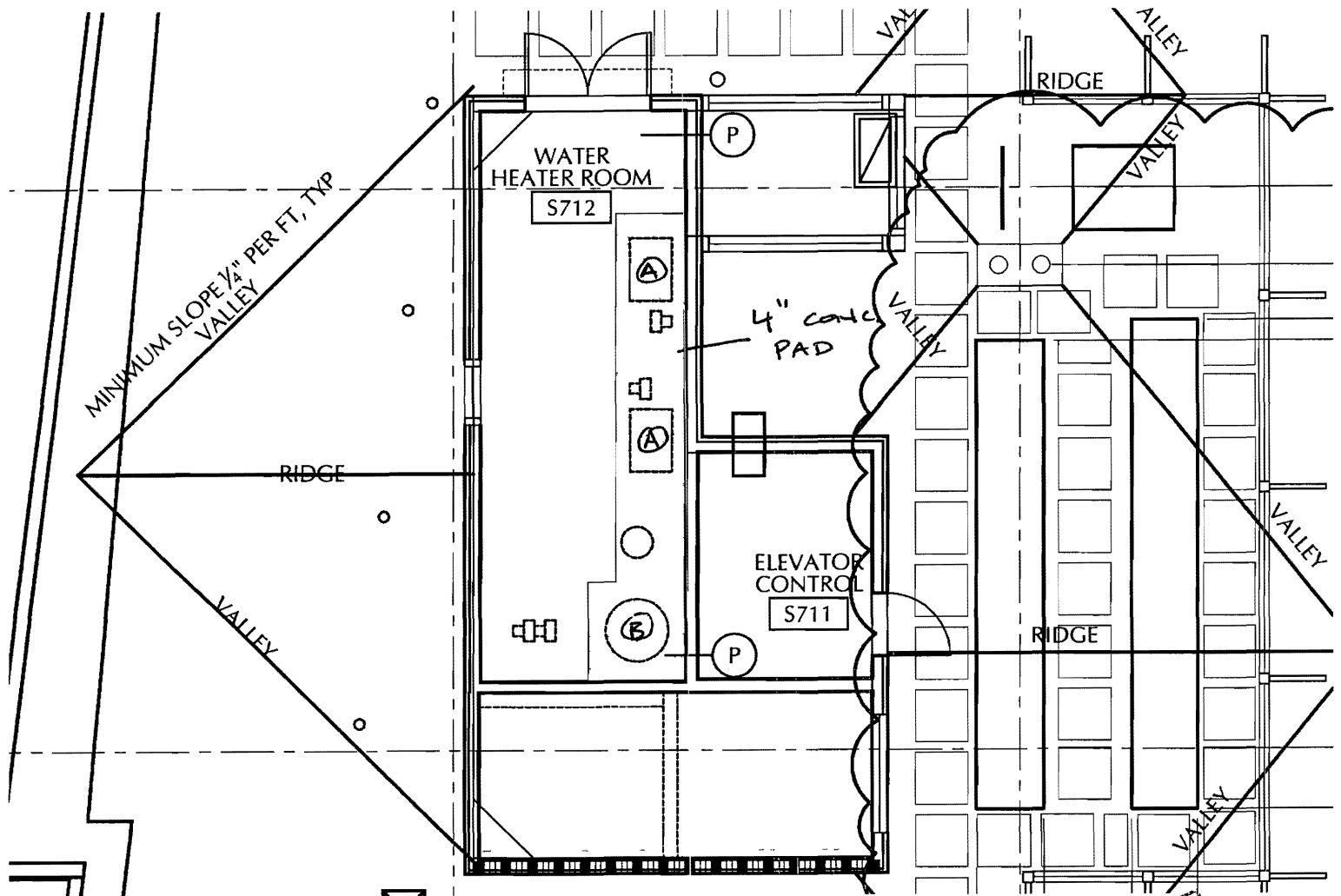
Tag	ST-1 TO 6
Wp=	3054
ap=	1 00
Rp=	2 50
Sds=	0 73
Ip=	1 00
z=	2 00
h=	2 00
Fph (calc) =	1064
Fph (min) =	665
Fph (max) =	3548
Fph(a)=	760
Fpv(a)=	443
Seismic Force Ratio=	0 25
h=	37 75
d=	37 00
n=	2 00
Anchor type=	Hilti TZ
Req Edge Distance=	6
Anchor Diameter	1/2
Anchor Embedment=	3 5/8
Tbolt(max allow)=	2386
Vbolt(max allow)=	2032
*Tbolt=	504
*Vbolt=	494
Interaction Check=	0 79

**Hilti Kwik Bolt TZ (ICC ESR-1917 & ACI 318-08, Appendix D)**Stone Aggregate, $f_c=3000$ psi concrete, with inspection***Values multiplied by 1.3**

Note Anchorage calculations are based on the above anchors size, edge distance, and embedment. If other anchors bolts are used they must be selected by others to meet required tension and shear forces and installation requirements.



PAGE 2



City of Portland
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COMPLIANCE
DEC 28 2009
Permit Number _____