SPIRE STRUCTURAL ENGINEERING inc

February 21, 2019

STRUCTURAL DESIGN CALCULATIONS

TI-2019-00049

County of San Bernardino
BUILDING AND SAFETY
THESE PLANS AND DETAILS ARE
APPROVED
THE APPROVAL OF THESE PLANS SHALL NOT BE CONSTRUED TO BE A PERMIT FOR ANY VIOLATION OF ANY CODE OR ORDINANCE OF THIS COUNTY
By Elie R
Date 06/13/2019
THESE PLANS SHALL BE ON THE JOB FOR ALL REQUESTED INSPECTIONS

Arrowhead Regional Medical Center
Ambulatory Clinic
Spire Job #: 19SHA11
400 North Pepper Avenue
Colton, CA 92324

Project Description:

Provide structural engineering services for the anchorage of miscellaneous equipment on the 2nd Floor of an existing 3-story building.

REGISTERED PROFESSIONAL ENGINEER
JEREMY C. WELTON
No. S4614
STRUCTURAL
STATE OF CALIFORNIA

02.21.19

--- REVIEWED ---
This review is intended only to verify conformity to the 2016 edition of the California Building Standards. It does not relieve Contractor and Applicant of responsibility for requirements of Project drawings and specifications. No responsibility is assumed for fabrication or construction techniques, correctness of quantities or dimensions, or coordination of work with other trades. Omissions & Errors on documents shall not be valid and all codes and Laws must be complied with.

Digitally signed by Eric Rodriguez, SE
DN: cn=Eric Rodriguez, SE, o=NV5, Inc., ou=Energy, email=eric.rodriguez@nv5.com, c=US
Reason: Reviewed for Code Compliance.
Date: 2019.06.12 09:20:55 -07'00'

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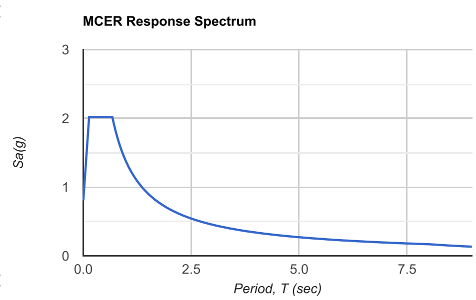
Arrowhead Regional Ambulatory Clinic

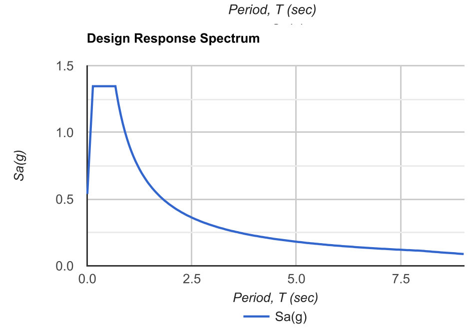
400 N Pepper Ave, Colton, CA 92324, USA

Latitude, Longitude: 34.0740531, -117.35105900000002

Date	2/13/2019, 4:21:21 PM
Design Code Reference Document	ASCE7-10
Risk Category	II
Site Class	D - Stiff Soil

Type	Value	Description
S_S	2.02	MCE_R ground motion. (for 0.2 second period)
S_1	0.905	MCE_R ground motion. (for 1.0s period)
S_{MS}	2.02	Site-modified spectral acceleration value
S_{M1}	1.358	Site-modified spectral acceleration value
S_{DS}	1.347	Numeric seismic design value at 0.2 second SA
S_{D1}	0.905	Numeric seismic design value at 1.0 second SA



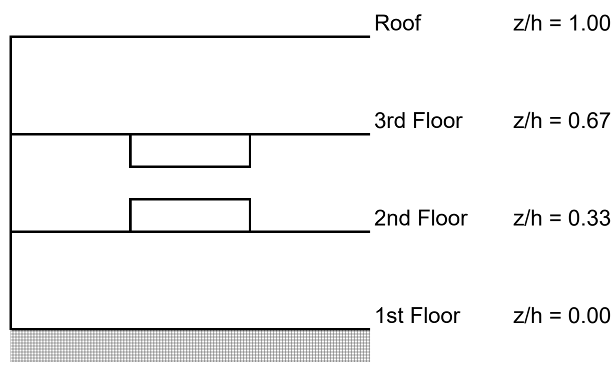


Type	Value	Description
SDC	F	Seismic design category
F_a	1	Site amplification factor at 0.2 second
F_v	1.5	Site amplification factor at 1.0 second
PGA	0.784	MCE_G peak ground acceleration
F_{PGA}	1	Site amplification factor at PGA
PGA_M	0.784	Site modified peak ground acceleration
T_L	8	Long-period transition period in seconds
SsRT	2.779	Probabilistic risk-targeted ground motion. (0.2 second)
SsUH	2.693	Factored uniform-hazard (2% probability of exceedance in 50 years) spectral acceleration
SsD	2.02	Factored deterministic acceleration value. (0.2 second)
S1RT	1.139	Probabilistic risk-targeted ground motion. (1.0 second)
S1UH	1.154	Factored uniform-hazard (2% probability of exceedance in 50 years) spectral acceleration.
S1D	0.905	Factored deterministic acceleration value. (1.0 second)
PGAd	0.784	Factored deterministic acceleration value. (Peak Ground Acceleration)
C_{RS}	1.032	Mapped value of the risk coefficient at short periods

Type	Value	Description
C_{R1}	0.987	Mapped value of the risk coefficient at a period of 1 s

Non-Structural Component Seismic Design - Height Ratio (z/h)

n_{top} =	3	Top floor number
$Level_1$ =	2nd Floor	First level above grade floor name?
$Level_0$ =	1st Floor	Ground level floor name?
Bsmt. =	No	Basement?
Floor =	2nd Floor	What floor is the project on?
Susp. =	Yes	Suspended equipment?
Roof =	No	Rooftop equipment?



Anchorage to Topside of Concrete - Hilti KB-TZ (ESR-1917)

Mark =	1						
Conc =	NWC						Normal or lightweight concrete
Metal deck =	Yes						Concrete over metal deck?
f'_c =	4,000					psi	Concrete compressive strength
Anchor =	CS 3/8 (1 1/2)						Hilti KB-TZ anchor
Steel Type =	Carbon						Carbon steel or Stainless steel
d_o =	3/8					in	Anchor O.D.
h_{ef} =	1 1/2					in	Effective min anchor embedment
h =	2 3/4					in	Concrete thickness
h_{min} =	2 1/4					in	Min member thickness
ϕ_s =	0.75						Seismic reduction per ACI Ch. 17
λ =	1.0						LWC reduction per ACI Ch. 17
k_{cr} =	17						Effectiveness factor
k_{cp} =	1						Coefficient for pryout strength
$N_{p,eq}$ =	NA					Lbs	Adjusted by $(f'_c/2500)^{0.5}$
$N_{p,cr}$ =	NA					Lbs	Adjusted by $(f'_c/2500)^{0.5}$
N_b =	1,975					Lbs	$= k_{cr}\cdot(f'_c)^{0.5}\cdot h_{ef}^{1.5}$
s_{min} =	8					in	Min anchor spacing
c_{min} =	16					in	Min. edge distance
A_n =	20					in^2	$= 3h_{ef}\cdot(\min(1.5h_{ef},s/2)+\min(1.5h_{ef},c))$
A_{no} =	20					in^2	$= 9\cdot h_{ef}^2$
N_{sa} =	6,500					lbs	Steel strength in tension
V_{sa} =	2,180					lbs	Steel strength in shear
$\phi P_{n,conc}$ =	815					Lbs	$= \phi_s\lambda\phi_{t,conc}\cdot\min(N_{p,eq},N_{p,cr},N_b)\cdot(A_n/A_{no})$
$\phi V_{n,conc}$ =	1,383					Lbs	$= \lambda\phi_{v,conc}\cdot k_{cp}\cdot N_b\cdot(A_n/A_{no})$
$\phi P_{n,steel}$ =	4,875					Lbs	$= \phi_{t,steel}\cdot N_{sa}$
$\phi V_{n,steel}$ =	1,417					Lbs	$= \phi_{v,steel}\cdot V_{sa}$

$\phi_{t,conc}$ =	0.55	$\phi_{t,steel}$ =	0.75
$\phi_{v,conc}$ =	0.70	$\phi_{v,steel}$ =	0.65

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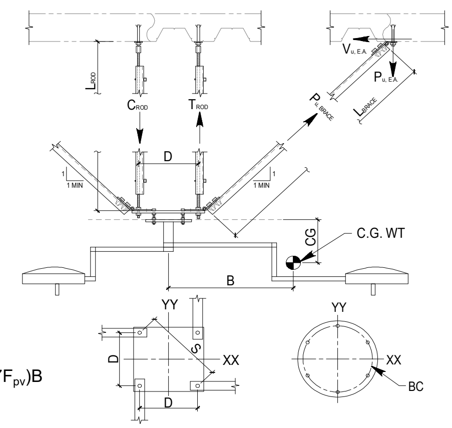
Job:	18SHA11 ARMC Ambulatory Clinic		Sheet: 5
Calc By:	ISG	Date:	02/21/19

Suspended Ceiling Equipment - Single Procedure Light	DETAIL 1/S301

Design =	City			
S_{DS} =	1.35	See USGS Sheet	F_{pv} = 0.27 $W_{p\,(ult)}$	$= 0.2\,S_{DS}\,W_p$
I_p =	1.0	ASCE 7 Table 11.5-1	$F_{ph\,(MIN)}$ = 0.41 $W_{p\,(ult)}$	$= 0.3\,S_{DS}\cdot I_p\cdot W_p$

Mark =	1				
a_p =	2.5				ASCE 7 Table 13.5-1
R_p =	2.5				ASCE 7 Table 13.5-1
Ω_o =	2.5				ASCE 7 Table 13.5-1
z/h =	0.67				z = height of attachment, h = roof height
F_{ph} =	1.26				
W_p =	47			Lbs	Equip weight
CG =	30.2			in	Vert. dist. to centroid
B =	24.0			in	Horiz. dist. to centroid
D =	12.0			in (min)	Vert. hgr. spacing
S =	17.0			in	Diag. dist. btwn hgrs
n_{RODS}=	4				Number of hgrs
L_{BOLT} =	3.0			in (max)	Length of bolt
BC =	8.0			in	Bolt circle diameter
$I_{xx,\,RODS}$ =	144			in^2	$I_{xx} = n_{RODS}(D/2)^2$
$I_{yy,\,RODS}$ =	144			in^2	$I_{yy} = n_{RODS}(D/2)^2$
$I_{zz,\,RODS}$ =	288			in^2	$I_{zz} = I_{xx} + I_{yy}$
F_{ph} =	59			Lbs (ULT)	Lateral seismic force (ult)
F_{pv} =	13			Lbs (ULT)	Vertical seismic force (ult)

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



Vertical Hanger Rod Design (See Unistrut Catalog, page 70)

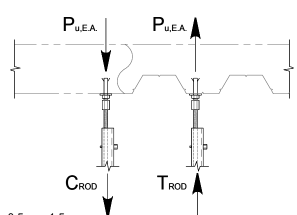
M_{yy} =	2,812			Lbs (ASD)	$M_{yy} = 0.7F_{ph}(CG+L_{bolt})+(W_p+0.7F_{pv})B$
Diameter =	1/2			in	Rod diameter
s_{clip} =	12			in oc	Spacing of stiffener cradle clips
% =	100%				Percentage of tensile capacity for compression
T =	110			Lbs (ASD)	Rod Tension
T' =	3,750			Lbs (ASD)	Rod Tensile Capacity
DCR_T =	0.03			< 1.0 OK	
C =	88			Lbs (ASD)	Rod Compression
C' =	3,750			Lbs (ASD)	Rod Compressive Capacity
DCR_C =	0.02			< 1.0 OK	

$$T = \frac{(W_p + 0.7F_{pv})}{n_{RODS}} + \frac{M_{yy}(D/2)}{I_{yyRODS}} - \frac{0.7F_{ph}}{2}$$

$$C = \frac{(0.7F_{pv} - 0.9W_p)}{n_{RODS}} + \frac{M_{yy}(D/2)}{I_{yyRODS}} - \frac{0.7F_{ph}}{2}$$

Vertical Hanger Anchorage (Hilti KB-TZ, ICC ESR-1917)

M_{uyy} =	6,583			Lb-in (ULT)	$M_{uyy} = \Omega_o\cdot F_{ph}(CG+L_{bolt})+(1.2W_p+F_{pv})B$
α =	0.75				Seismic reduction per ACI Ch.17
Stl Deck =	Below				
h_{conc} =	4 3/4			in	Concrete thickness
f'_c =	4,000			psi	Concrete strength (2,500 psi min)
Conc =	NWC				$\phi_{t,conc}$ = 0.65
λ =	1.00				Reduction for LWC; $\phi_{v,conc}$ = 0.70
Steel =	Carbon				Carbon or stainless; $\phi_{t,steel}$ = 0.75
Dia =	1/2			in	Anchor diameter; $\phi_{v,steel}$ = 0.65
h_{ef} =	2			in	Effective embedment
h_{min} =	4			in	Minimum concrete thickness
s =	12.0			in	Anchor spacing
s_{min} =	2.75			in	Minimum anchor spacing
A_{no} =	36.0			in^2	$= 9\cdot h_{ef}^2$ $A_n = \min[(3\cdot h_{ef})(1.5\cdot h_{ef}+s/2), A_{no}]$
A_n =	36.0			in^2	(assuming no close edges)
A_{se} =	0.101			in^2	Anchor effective area
F_u =	106,000			psi	Anchor tensile strength
k_{cr} =	17				
k_{cp} =	1.0				
$N_{p,cr}$ =	1,847			Lbs	
N_b =	3,041			Lbs	Concrete breakout strength
$\Omega_o\cdot P_u$ =	217			Lbs (ULT)	Tension Demand
$\phi P_{n,conc}$ =	900			Lbs (ULT)	$= 0.75\cdot\lambda\ \phi_{t,conc}\cdot\min(N_b,N_{p,cr})(A_n/A_{no})$
$\phi P_{n,steel}$ =	8,030			Lbs (ULT)	$= \phi_{t,steel}\cdot A_{se}\cdot f_u$
DCR_P =	0.24			< 1.0 OK	$= \Omega_o P_u/\phi P_{n,conc}$
DCR_P =	0.03			< 1.0 OK	$= \Omega_o P_u/\phi P_{n,steel}$



$$N_b = k_{cr}\cdot(f'_c)^{0.5}\cdot h_{ef}^{1.5}$$

$$P_u = \frac{(1.2W_p + F_{pv})}{n_{RODS}} + \frac{M_{uyy}(S/2)}{I_{yy,RODS}} - \frac{\Omega_o\cdot F_{ph}}{2}$$

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Suspended Ceiling Equipment - Single Procedure Light	DETAIL 1/S301

Bracing Design (Unistrut P1000, Lmax = 9'-6", rmin = 0.577, KL/r = 198, load applied at slotted face, 4 total)

M_{zz} =	998			Lb-in $_{(ASD)}$	$M_{zz} = 0.7 \cdot F_{ph} \cdot B$
C =	59			Lbs $_{(ASD)}$	$C = \left(\frac{0.7F_{ph}}{2} + \frac{M_{zz}(D/2)}{I_{zz,RODS}}\right)\sqrt{2}$
C' =	1,380			Lbs $_{(ASD)}$	Brace compression capacity, based on 10'-0" length
DCR =	0.04			< 1.0 OK	Unistrut Catalog, pg 20

Brace Anchorage (Same anchor parameters as vertical anchor)

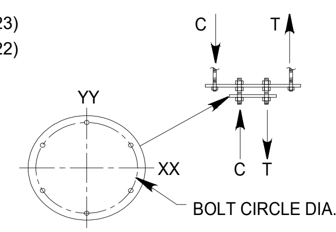
$$P_u = V_u = \frac{\Omega_o F_{ph}}{2} + \frac{\Omega_o F_{ph} B(D/2)}{I_{zz,RODS}}$$

$\Omega_o \cdot P_u$ =	148			Lbs $_{(ULT)}$	Tension Demand
$\Omega_o \cdot V_u$ =	148			Lbs $_{(ULT)}$	Shear Demand
V_s =	3,000			Lbs	
$\phi V_{n,conc}$ =	2,129			Lbs $_{(ULT)}$	$= \lambda\, \phi_{v,conc} \cdot k_{cp} \cdot N_b\, (A_n/A_{no})$
$\phi V_{n,steel}$ =	1,950			Lbs $_{(ULT)}$	$= \phi_{v,steel} \cdot V_{seis}$
DCR_P =	0.16			< 1.0 OK	$= \Omega_o P_u / \phi P_{n,conc}$
DCR_V =	0.07			< 1.0 OK	$= \Omega_o V_u / \phi V_{n,conc}$
DCR_P =	0.02			< 1.0 OK	$= \Omega_o P_u / \phi P_{n,steel}$
DCR_V =	0.08			< 1.0 OK	$= \Omega_o V_u / \phi V_{n,steel}$
DCR =	0.06			< 1.0 OK	$(DCR_{P,max})^{5/3} + (DCR_{v,max})^{5/3} \leq 1.0$

Bolt/Rod Design (Between Mounting Plates):

$$V = \sqrt{\left(\frac{0.7 \cdot F_{ph}}{n_{BOLTS}} + \frac{M_{zz} x}{I_{zz,BOLTS}}\right)^2 + \left(\frac{M_{zz} y}{I_{zz,BOLTS}}\right)^2}$$

Type =	A325-X					
Diameter d =	3/8			in	Bolt diameter	
n_{BOLTS} =	3				Number of bolts	
A_{BOLT} =	0.110			in^2	Bolt Area	
S_{BOLT} =	0.005			in^3	$S_{BOLT} = \pi \cdot (d/2)^3/4$	
$I_{yy,\ BOLTS}$ =	24.0			in^2		
$I_{zz,\ BOLTS}$ =	48.0			in^2		
x =	4.0			in	Max distance from center of bolt circle - XX axis	
y =	3.5			in	Max distance from center of bolt circle - YY axis	
M_{zz} =	998			Lb-in $_{(ASD)}$	$M_{zz} = 0.7 \cdot F_{ph} \cdot B$	
M_{yy} =	2,812			Lb-in $_{(ASD)}$	$M_{yy} = 0.7F_{ph}(CG+L_{bolt})+(W_p+0.7F_{pv})B$	
V =	121			Lbs $_{(ASD)}$		
M_{BOLT} =	181			Lb-in $_{(ASD)}$	$M_{BOLT} = V \cdot (L_{BOLT}/2)$	
T =	487			Lbs $_{(ASD)}$	$T = (M_{yy} \cdot x)/I_{yy,BOLTS} + (W_p+0.7 \cdot F_{pv})/n_{bolts}$	
f_t =	39.4			ksi	$f_t = M_{BOLT}/S_{BOLT} + T/A_{BOLT}$	
f_v =	1.1			ksi	$f_v = V/A_{BOLT}$	
F_u =	150			ksi		
F_t =	56.3			ksi	$F_t = F_{nt}/\Omega$	(AISC 13 Ed., Pg. 7-23)
F_v =	30.0			ksi	$F_v = F_{nv}/\Omega$	(AISC 13 Ed., Pg. 7-22)
DCR =	0.74			< 1.0 OK	$f_t/F_t + f_v/F_v < 1.0$	



Mounting Plate Design:

t =	1/4			in (min)	Plate thickness	
b =	3.0			in	b = 12 t	
Z =	0.05			in^3	$Z = b \cdot t^2/4$	
$I_{yy,\ BOLTS}$ =	24			in^2		
M_{yy} =	2,595			Lb-in $_{(ASD)}$	$M_{yy} = 0.7F_{ph} \cdot CG+(W_p+0.7F_{pv}) \cdot B$	
T =	325			Lbs	$T = M_{yy} \cdot (BC \cdot 2^{1/2})/(2 \cdot I_{yy,BOLTS})+(W_p+0.7F_{pv})/n_{BOLTS}$	
C =	287			Lbs	$C = M_{yy} \cdot (BC \cdot 2^{1/2})/(2 \cdot I_{yy,BOLTS}) - (W_p+0.7F_{pv})/n_{BOLTS}$	
M =	0.34			k-in $_{(ASD)}$	$M = T \cdot (D\text{-}BC/2) - C \cdot [(D\text{-}BC)/(2D)] \cdot (D\text{-}BC)/2$	
M_n/Ω =	1.01			k-in $_{(ASD)}$	$M_n/\Omega = F_y \cdot Z/\Omega$	F_y = 36 ksi
DCR =	0.33			< 1.0 OK		

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Sheet:

Job:	18SHA11 ARMC Ambulatory Clinic			7
Calc By:	ISG	Date:	02/21/19	

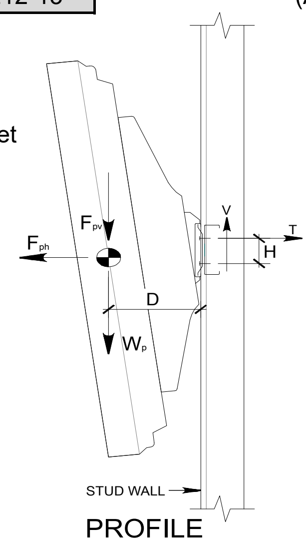
DETAIL

Wall Mounted Monitor - 29" TV on Peerless Bracket SA730P — 3/S301

OPM: 0212-13 (ASD)

GENERAL INPUT

Design =	City		
W_p =	29	Lbs (max)	Equip weight (including bracket)
H =	6.5	in (min)	Vert distance between anchors
B =	1.6	in (min)	Distance between anchors and edge of bracket
D =	23.2	in (max)	Distance to centroid
	Equip	Wall	
a_p =	1.0	1.0	ASCE 7 Tables 13.5-1
R_p =	1.5	2.5	and 13.6-1
S_{DS} =	1.35		See USGS sheet
I_p =	1.00		ASCE 7 Table 1.5-2
z_1/h =	0.33		2nd Floor
z_2/h =	0.67		3rd Floor



PROFILE

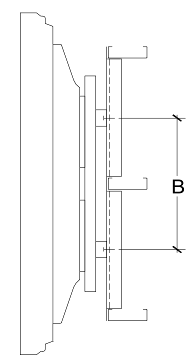
SEISMIC FORCES

$F_{ph,min}$ =	0.28	W_p		
$F_{ph,1}$ =	0.42		0.25	W_p
$F_{ph,2}$ =	0.59		0.35	W_p
F_{ph} =	0.50		0.32	W_p
F_{pv} =	0.19	W_p		
F_{ph} =	14	lbs		
F_{pv} =	6	lbs		

$F_{ph,min} = 0.7 \cdot 0.3 S_{DS} \cdot I_p \cdot W_p$

$$F_{ph} = 0.7 \frac{0.4 S_{DS} a_p}{R_p / I_p} \left(1 + 2\frac{z}{h}\right) W_p$$

$F_{pv} = 0.7 \cdot 0.2 S_{DS} \cdot W_p$



PLAN

FRONT-TO-BACK

V =	34	Lbs	$= W_p + F_{pv}$
P =	129	Lbs	$= [(W_p + F_{pv}) \cdot CG + F_{ph} \cdot (H/2)]/H$

SIDE-TO-SIDE

V =	37	Lbs	$= [(W_p + F_{pv})^2 + F_{ph}^2]^{0.5}$
P =	336	Lbs	$= [(W_p + F_{pv}) \cdot CG]/H + (F_{ph} \cdot CG)/B$

Screws into Backing Plate

n_{wall} = 2 No. of screws into backing (min)

Metal = 16 ga backing

SMS =	1/4"ϕ	(min)	
V =	18	Lbs/screw	Shear demand (in-plane)
P =	336	Lbs/screw	Pull-out
V' =	613	Lbs	Screw shear capacity per SSMA allowable loads table, p.60
P' =	261	Lbs	Screw pull-out capacity per SSMA allowable loads table, p.60
DCR =	1.32	(NG)	DCR = V/V' + P/P' ≤ 1.0

A307 Bolts at Bracket to Backing

n_{bkg} = 2 No. of bolts into backing (F_u = 45 ksi, Ω = 2.5)

t = 0.0566 in Backing thickness

Metal =	16 ga	backing		
d =	1/4	in (min)	Bolt diameter	
m_f =	0.75		Modification factor per AISI Table E3.3.1-2	
C =	3.0		Bearing factor per AISI Table E3.3.1-1	
P =	**168**	Lbs/bolt	Pull-out per bolt	
V =	18	Lbs/bolt	Shear per bolt	
P' =	573	Lbs	Bearing capacity (AISI Eqn. E3.3.1-1)	$= [m_f \cdot C \cdot d \cdot t \cdot F_u]/\Omega$
V' =	509	Lbs	Shear capacity (AISI Eqn. E4.3.1-1)	$= [4.2(t^3 \cdot d)^{1/2} \cdot F_u]/\Omega$
DCR =	0.33	≤ 1.0 (OK)		= max[P_{F-B}/P', (P_{S-S}/P' + \

DETAIL

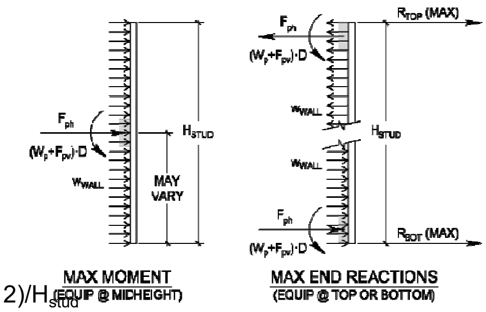
Wall Mounted Monitor - 29" TV on Peerless Bracket SA730P	3/S301

Screws into Metal Studs

n_{wall} =	12	No. of screws into metal studs	
SMS =	#10	(min)	
Metal =	16 ga	studs (min)	
V =	3	Lbs	Shear demand (in-plane)
P =	56	Lbs	Pull-out
V' =	613	Lbs	Screw shear capacity per SSMA allowable loads table, p.60
P' =	261	Lbs	Screw pull-out capacity per SSMA allowable loads table, p.60
DCR =	0.22	(OK)	

STUD DESIGN

n_{stud} =	2		Number of studs engaged
$H_{partial}$ =	4.0	ft	Height of stud (maximum)
$W_{p,wall}$ =	8.0	psf	Unit wt of partition wall
s_{stud} =	16	in	Stud spacing
F_{ph} =	5.0	psf	= Max[$(F_{ph})(W_{p,wall})$, 5psf min]
w_{wall} =	6.7	plf/stud	= $F_{ph}\cdot(s_{stud}/12)$
M =	0.6	kip-in	Max Moment (per stud)
R_{TOP} =	29	lbs	= $w_{wall}\cdot H_{stud}/2+F_{ph}+(W_p+F_{pv})\cdot(D/12)/H_{stud}$
R_{BOT} =	29	lbs	= $w_{wall}\cdot H_{stud}/2+F_{ph}+(W_p+F_{pv})\cdot(D/12)/H_{stud}$
Stud =	400S125-54		(min)
S_e =	0.361	in^3	
I_e =	0.830	in^4	
M' =	10.8	kip-in	= S_eF_y/Ω_b, Ω_b =1.67
Δ =	0.00	in (L/16146)	Maximum Deflection (Limit to L/120)



Stud Wall Top & Bot Track Connections (ASD)

-Connected to a top and bottom track with 2- #10 SMS. Loads are minimal therefore ok by isnpection.

-See A7/S601 for additional information.

SPIRE STRUCTURAL ENGINEERING inc

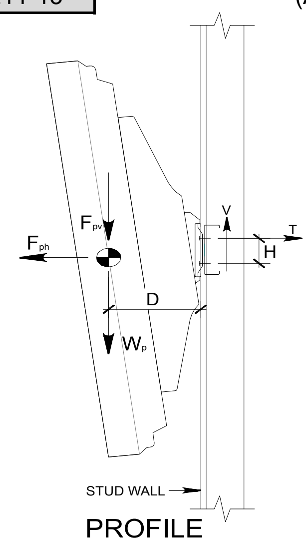
Job:	18SHA11 ARMC Ambulatory Clinic			Sheet: 9
Calc By:	ISG	Date:	02/21/19	

	DETAIL
Wall Mounted Monitor - 42" TV on Peerless Bracket ST640	**4/S301**

OPM: 0211-13 (ASD)

GENERAL INPUT

Design =	City		
W_p =	50	Lbs (max)	Equip weight (including bracket)
H =	5.0	in (min)	Vert distance between anchors
B =	16.0	in (min)	Horiz distance between anchors
D =	6.0	in	Distance to centroid
	Equip	Wall	
a_p =	1.0	1.0	ASCE 7 Tables 13.5-1
R_p =	1.5	2.5	and 13.6-1
S_{DS} =	1.35		See USGS sheet
I_p =	1.00		ASCE 7 Table 1.5-2
z_1/h =	0.33		2nd Floor
z_2/h =	0.67		3rd Floor



PROFILE

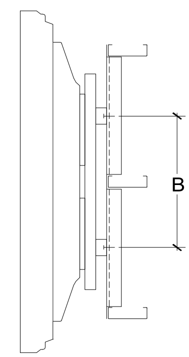
SEISMIC FORCES

$F_{ph,min}$ =	0.28 W_p		
$F_{ph,1}$ =	0.42	0.25	W_p
$F_{ph,2}$ =	0.59	0.35	W_p
F_{ph} =	0.50	0.32	W_p
F_{pv} =	0.19 W_p		
F_{ph} =	25 lbs		
F_{pv} =	10 lbs		

$F_{ph,min} = 0.7 \cdot 0.3 S_{DS} \cdot I_p \cdot W_p$

$$F_{ph} = 0.7\frac{0.4 S_{DS} a_p}{R_p / I_p}\left(1 + 2\frac{z}{h}\right)W_p$$

$F_{pv} = 0.7 \cdot 0.2 S_{DS} \cdot W_p$



PLAN

FRONT-TO-BACK

V =	60	Lbs	$= W_p + F_{pv}$
P =	84	Lbs	$= [(W_p + F_{pv}) \cdot CG + F_{ph} \cdot (H/2)]/H$

SIDE-TO-SIDE

V =	65	Lbs	$= [(W_p + F_{pv})^2 + F_{ph}^2]^{0.5}$
P =	81	Lbs	$= [(W_p + F_{pv}) \cdot CG]/H + (F_{ph} \cdot CG)/B$

Screws into Backing Plate

n_{wall} = 4 No. of screws into backing (min)

Metal = 16 ga backing

SMS =	1/4"ϕ	(min)	
V =	16	Lbs/screw	Shear demand (in-plane)
P =	42	Lbs/screw	Pull-out
V' =	613	Lbs	Screw shear capacity per SSMA allowable loads table, p.60
P' =	261	Lbs	Screw pull-out capacity per SSMA allowable loads table, p.60
DCR =	0.19	(OK)	

DCR = V/V' + P/P' ≤ 1.0

Screws into Metal Studs

n_{wall} = 18 No. of screws into metal studs

Metal = 16 ga studs (min)

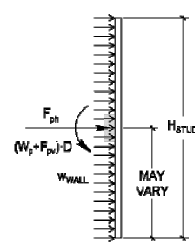
SMS =	#10	(min)	
V =	4	Lbs	Shear demand (in-plane)
P =	9	Lbs	Pull-out
V' =	613	Lbs	Screw shear capacity per SSMA allowable loads table, p.60
P' =	261	Lbs	Screw pull-out capacity per SSMA allowable loads table, p.60
DCR =	0.04	(OK)	

SPIRE STRUCTURAL ENGINEERING inc

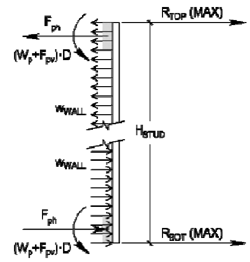
Job:	18SHA11 ARMC Ambulatory Clinic			Sheet: 10
Calc By:	ISG	Date:	02/21/19	

DETAIL

Wall Mounted Monitor - 42" TV on Peerless Bracket ST640 | 4/S301



MAX MOMENT
(EQUIP @ MIDHEIGHT)



MAX END REACTIONS
(EQUIP @ TOP OR BOTTOM)

STUD DESIGN

n_{stud} =	3		Number of studs engaged
H_{stud} =	13.7	ft	Height of stud (maximum)
$H_{partial}$ =	9.5	ft	Height of stud (partial height wall)
$W_{p,wall}$ =	8.0	psf	Unit wt of partition wall
s_{stud} =	16	in	Stud spacing
F_{ph} =	5.0	psf	= Max[$(F_{ph})(W_{p,wall})$, 5psf min]
w_{wall} =	6.7	plf/stud	= $F_{ph}\cdot(s_{stud}/12)$
M =	2.3	kip-in	Max Moment (per stud)
R_{TOP} =	55	lbs	= $w_{wall}\cdot H_{stud}/2+F_{ph}+(W_p+F_{pv})\cdot(D/12)/H_{stud}$
R_{BOT} =	55	lbs	= $w_{wall}\cdot H_{stud}/2+F_{ph}+(W_p+F_{pv})\cdot(D/12)/H_{stud}$
Stud =	400S125-54		(min)
S_e =	0.361	in^3	
I_e =	0.830	in^4	
M' =	10.8	kip-in	= S_eF_y/Ω_b, Ω_b =1.67
Δ =	0.31	in (L/522)	Maximum Deflection (Limit to L/120)

Stud Wall Top & Bot Track Connections (ASD)

Top Connection: 0.157"ϕ Hilti X-U w/ 1" Embed (ICC ESR-2269) Above: NWC o/ Mtl Deck

s_{top} =	24	in	Anchor spacing at top of wall
n_{top} =	2		Total number of anchors engaged at top of wall
V =	82	Lbs/anchor	= $R_{TOP}\cdot(n_{stud}/n_{top})$
V' =	90	Lbs/anchor	Shear capacity (ASD)

Top Connection: Braced

s_{top} =	48	in	Brace spacing at top of wall
n_{braces} =	2		Total number of braces engaged at top of wall
V =	51	Lbs/brace	= $[w_{wall}\cdot H_{partial}/2+0.7F_{ph}+(W_p+0.7F_{pv})\cdot(D/12)/H_{partial}]\cdot(n_{stud}/n_{top})$

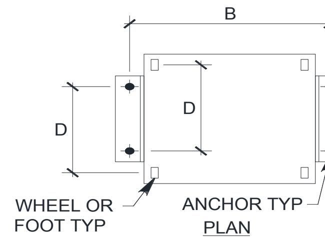
Bottom Connection: 0.157"ϕ Hilti X-U w/ 1" Embed (ICC ESR-2269) Below: NWC o/ Mtl Deck

s_{bot} =	24	in	Anchors spacing at bottom of wall
n_{bot} =	2		Total number of anchors engaged at bottom of wall
V =	82	Lbs/anchor	= $R_{BOT}\cdot(n_{stud}/n_{bot})$
V' =	90	Lbs/anchor	Shear capacity (ASD)

DETAIL

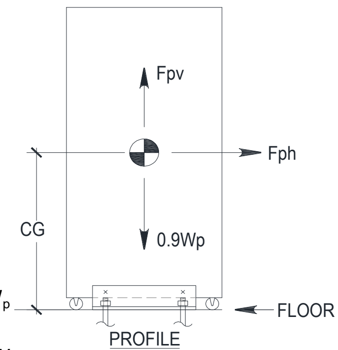
Floor Mounted Equipment - Refrigerator (GE) — 7/S301

(ULT)



Design =	City		
a_p =	1.0		ASCE 7 Table 13.5-1 & Table 13.6-1
R_p =	2.5		ASCE 7 Table 13.5-1 & Table 13.6-1
Ω_o =	2.5		ASCE 7 Table 13.5-1 & Table 13.6-1
S_{DS} =	1.35	g	See USGS sheet
I_p =	1.00		ASCE 7 Table 11.5-1
z/h =	0.33		2rd Floor

Dimensions



W_p =	800	Lbs*	Equip weight
B =	39.0	in	Dist between anchors (36" + 2·1.5")
D =	22.0	in (min)	Dist between anchors & edge of unit (28"/2+8")
CG =	36.0	in	Dist to centroid
n =	6	(min)	No. of anchors
n_t =	3	(min)	No. of anchors in tension

*Wp includes 480 Lbs of contents

*2 middle anchors count as one anchor

Forces

$F_{ph,min}$ =	0.41	W_p	(Governs)	$F_{ph,min} = 0.3 \cdot S_{DS} \cdot I_p \cdot W_p$
F_{ph} =	0.36	W_p		$F_{ph} = \frac{0.4 S_{DS} a_p}{(R_p/I_p)}\left(1+2\frac{z}{h}\right)W_p$
F_{ph} =	324	Lbs		
$\Omega_o \cdot F_{ph}$ =	810	Lbs		
F_{pv} =	0.27	W_p		$F_{pv} = 0.2 \cdot S_{DS} \cdot W_p$
F_{pv} =	216	Lbs		
V_u =	54	Lbs	Shear per anchor	$V_u = F_{ph}/n$
$\Omega_o \cdot V_u$ =	135	Lbs	Shear per anchor w/ Ω_o	$\Omega_o \cdot V_u = \Omega_o \cdot F_{ph}/n$
P_u =	93	Lbs	Tension per anchor	$P_{u,1} = (F_{ph} \cdot CG) / [\min(B,D) \cdot n_t] - (0.9W_p - F_{pv}) / n$
$\Omega_o \cdot P_u$ =	358	Lbs	Tension per anchor w/ Ω_o	$\Omega_o \cdot P_{u,1} = (\Omega_o \cdot F_{ph} \cdot CG) / [\min(B,D) \cdot n_t] - (0.9W_p - F_{pv}) / n$

Connection of Angle Brackets to Equipment Frame: ($\Omega = 3.0$, $\phi = 0.5$)

Fastener =	Screw		Type of fastener (Screw or Bolt)	
n_{conn} =	1	(min)	No. of screws per anchorage point	
SMS =	1/4"ϕ		Size of sheet metal screw	
Metal =	20 ga	(min)	Equipment frame gauge	
t =	0.0346	in	Equipment frame thickness	
F_u =	45	ksi	Ultimate strength of steel (min)	
$V_{u,conn}$ =	107	Lbs	Shear demand per screw	$V_{u,conn} = (P_u^2+V_u^2)^{1/2} \div n_{conn}$
$\phi V_{n,conn}$ =	305	Lbs	Screw shear capacity (per SSMA p.60, converted to ULT)	
DCR =	0.35	(OK)	$V_{u,conn} / \phi V_{n,conn} \le 1.0$	

Angle Bracket Design ($\phi = 0.90$)

P_u =	0.1	kips	Tension per angle
d =	4.0	in (max)	Distance from bottom of angle to SMS conn.
b =	1.5	in	Distance from centerline of anchor to angle leg
p =	3.0	in	Tributary angle width
d_{anchor} =	3/8	in	Anchor diameter
b' =	1.13	in	Distance from edge of hole to center of angle leg
t_{min} =	0.07	in	Min thickness for no prying action (AISC Section 9-10)
t =	1/4	in (min)	Thickness
$M_{u,angle}$ =	0.10	kip-in	Moment demand
Z =	0.047	in^3	Plastic section modulus
F_y =	36	ksi	Yield stress
$\phi M_{n,angle}$ =	1.52	kip-in	Moment capacity
DCR =	0.07	(OK)	$M_{u,angle} / \phi M_{n,angle} \le 1.0$

Floor Mounted Equipment - Refrigerator (GE)	DETAIL 7/S301

Hilti KB-TZ Expansion Anchors: (ICC ESR-1917) Anchor Mark = 1 *

** See "Anchorage to Topside of Concrete - Hilti KB-TZ (ESR-1917)" calculation sheet for additional info.*

Anchor = CS 3/8 (1 1/2) — 3/8"ϕ Hilti KB-TZ (Carbon Steel) w/ 1 1/2" Embedment

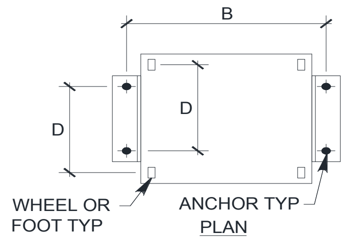
	Concrete	Steel		
ϕP_n =	815	4,875	Lbs	(Concrete tension capacity has been multiplied by 0.75 for seismic)
ϕV_n =	1,383	1,417	Lbs	
DCR_P =	0.44	0.07		$\Omega_o P_u / \phi P_n \leq 1.0$
DCR_V =	0.10	0.10		$\Omega_o V_u / \phi V_n \leq 1.0$

DCR_{P+V} = 0.27 $(DCR_{P,max})^{5/3} + (DCR_{v,max})^{5/3} \leq 1.0$

DETAIL

Floor Mounted Equipment - Warming Cabinet (Steris) — 8/S301

(ULT)



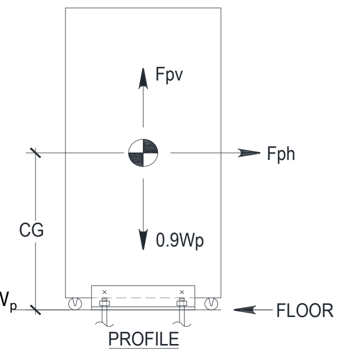
Design =	City		
a_p =	1.0		ASCE 7 Table 13.5-1 & Table 13.6-1
R_p =	2.5		ASCE 7 Table 13.5-1 & Table 13.6-1
Ω_o =	2.5		ASCE 7 Table 13.5-1 & Table 13.6-1
S_{DS} =	1.35	g	See USGS sheet
I_p =	1.00		ASCE 7 Table 11.5-1
z/h =	0.00		

Dimensions

W_p =	691	Lbs*	Equip weight
B =	33.0	in	Dist between anchors (30" + 2·1.5")
D =	20.0	in (min)	Dist between anchors & edge of unit (24"/2+8")
CG =	37.4	in	Dist to centroid
n =	6	(min)	No. of anchors
n_t =	3	(min)	No. of anchors in tension

*Wp includes 158 Lbs of contents

*2 middle anchors count as one anchor



Forces

$F_{ph,min}$ =	0.41	W_p	(Governs)	$F_{ph,min} = 0.3 \cdot S_{DS} \cdot I_p \cdot W_p$
F_{ph} =	0.22	W_p		$F_{ph} = \frac{0.4 S_{DS} a_p}{(R_p/I_p)}\left(1+2\frac{z}{h}\right)W_p$
F_{ph} =	280	Lbs		
$\Omega_o \cdot F_{ph}$ =	700	Lbs		
F_{pv} =	0.27	W_p		$F_{pv} = 0.2 \cdot S_{DS} \cdot W_p$
F_{pv} =	187	Lbs		
V_u =	47	Lbs	Shear per anchor	$V_u = F_{ph}/n$
$\Omega_o \cdot V_u$ =	117	Lbs	Shear per anchor w/ Ω_o	$\Omega_o \cdot V_u = \Omega_o \cdot F_{ph}/n$
P_u =	102	Lbs	Tension per anchor	$P_{u,1} = (F_{ph} \cdot CG) / [\min(B,D) \cdot n_t] - (0.9W_p - F_{pv}) / n$
$\Omega_o \cdot P_u$ =	363	Lbs	Tension per anchor w/ Ω_o	$\Omega_o \cdot P_{u,1} = (\Omega_o \cdot F_{ph} \cdot CG) / [\min(B,D) \cdot n_t] - (0.9W_p - F_{pv}) / n$

Connection of Angle Brackets to Equipment Frame: ($\Omega = 3.0$, $\phi = 0.5$)

Fastener =	Screw		Type of fastener (Screw or Bolt)	
n_{conn} =	1	(min)	No. of screws per anchorage point	
SMS =	1/4"ϕ		Size of sheet metal screw	
Metal =	20 ga	(min)	Equipment frame gauge	
t =	0.0346	in	Equipment frame thickness	
F_u =	45	ksi	Ultimate strength of steel (min)	
$V_{u,conn}$ =	112	Lbs	Shear demand per screw	$V_{u,conn} = (P_u^2+V_u^2)^{1/2} \div n_{conn}$
$\phi V_{n,conn}$ =	305	Lbs	Screw shear capacity (per SSMA p.60, converted to ULT)	
DCR =	0.37	(OK)	$V_{u,conn} / \phi V_{n,conn} \le 1.0$	

Angle Bracket Design ($\phi = 0.90$)

P_u =	0.1	kips	Tension per angle
d =	4.0	in (max)	Distance from bottom of angle to SMS conn.
b =	1.5	in	Distance from centerline of anchor to angle leg
p =	3.0	in	Tributary angle width
d_{anchor} =	3/8	in	Anchor diameter
b' =	1.13	in	Distance from edge of hole to center of angle leg
t_{min} =	0.07	in	Min thickness for no prying action (AISC Section 9-10)
t =	1/4	in (min)	Thickness
$M_{u,angle}$ =	0.11	kip-in	Moment demand
Z =	0.047	in^3	Plastic section modulus
F_y =	36	ksi	Yield stress
$\phi M_{n,angle}$ =	1.52	kip-in	Moment capacity
DCR =	0.08	(OK)	$M_{u,angle} / \phi M_{n,angle} \le 1.0$

DETAIL

Floor Mounted Equipment - Warming Cabinet (Steris) | 8/S301

Hilti KB-TZ Expansion Anchors: (ICC ESR-1917) Anchor Mark = 1 *

** See "Anchorage to Topside of Concrete - Hilti KB-TZ (ESR-1917)" calculation sheet for additional info.*

Anchor = CS 3/8 (1 1/2) — 3/8"ϕ Hilti KB-TZ (Carbon Steel) w/ 1 1/2" Embedment

	Concrete	Steel		
ϕP_n =	815	4,875	Lbs	(Concrete tension capacity has been multiplied by 0.75 for seismic)
ϕV_n =	1,383	1,417	Lbs	
DCR_P =	0.45	0.07		$\Omega_o P_u/\phi P_n \le 1.0$
DCR_V =	0.08	0.08		$\Omega_o V_u/\phi V_n \le 1.0$

DCR_{P+V} = 0.28 $(DCR_{P,max})^{5/3} + (DCR_{v,max})^{5/3} \le 1.0$

SPIRE STRUCTURAL ENGINEERING inc

Sheet:

Job:	18SHA11 ARMC Ambulatory Clinic			15
Calc By:	ISG	Date:	02/21/19	

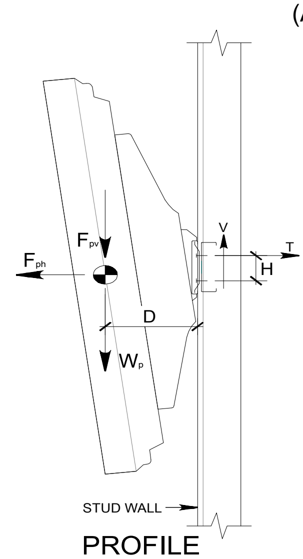
DETAIL

Wall Mounted Monitor - TV on Ergotron Bracket — 9/S301

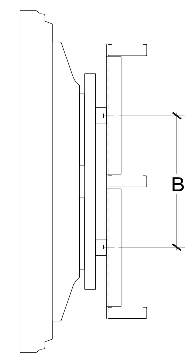
GENERAL INPUT (ASD)

Design =	City		
W_p =	34	Lbs (max)	Equip weight (including bracket)
H =	27.8	in (min)	Vert distance between anchors
B =	7.8	in (min)	Horiz distance between anchors
D =	11.9	in (max)	Distance to centroid

	Equip	Wall	
a_p =	1.0	1.0	ASCE 7 Tables 13.5-1
R_p =	2.5	2.5	and 13.6-1
S_{DS} =	1.35		See USGS sheet
I_p =	1.00		ASCE 7 Table 1.5-2
z_1/h =	0.33		2nd Floor
z_2/h =	0.67		3rd Floor



PROFILE



PLAN

SEISMIC FORCES

$F_{ph,min}$ =	0.28		W_p
$F_{ph,1}$ =	0.25	0.25	W_p
$F_{ph,2}$ =	0.35	0.35	W_p
F_{ph} =	0.32	0.32	W_p
F_{pv} =	0.19		W_p
F_{ph} =	11		lbs
F_{pv} =	7		lbs

$F_{ph,min} = 0.7 \cdot 0.3 S_{DS} \cdot I_p \cdot W_p$

$$F_{ph} = 0.7\frac{0.4 S_{DS} a_p}{R_p/I_p}\left(1+2\frac{z}{h}\right)W_p$$

$F_{pv} = 0.7 \cdot 0.2 S_{DS} \cdot W_p$

FRONT-TO-BACK

V =	41	Lbs	$= W_p + F_{pv}$
P =	23	Lbs	$= [(W_p + F_{pv}) \cdot CG + F_{ph} \cdot (H/2)]/H$

SIDE-TO-SIDE

V =	42	Lbs	$= [(W_p + F_{pv})^2 + F_{ph}^2]^{0.5}$
P =	34	Lbs	$= [(W_p + F_{pv}) \cdot CG]/H + (F_{ph} \cdot CG)/B$

Screws into Backing Plate

n_{wall} = 4 No. of screws into backing (min)

Metal = 16 ga backing

SMS =	1/4"ϕ	(min)	
V =	10	Lbs/screw	Shear demand (in-plane)
P =	17	Lbs/screw	Pull-out
V' =	613	Lbs	Screw shear capacity per SSMA allowable loads table, p.60
P' =	261	Lbs	Screw pull-out capacity per SSMA allowable loads table, p.60
DCR =	0.08	(OK)	$DCR = V/V' + P/P' \le 1.0$

Screws into Metal Studs

n_{wall} = 12 No. of screws into metal studs

Metal = 16 ga studs (min)

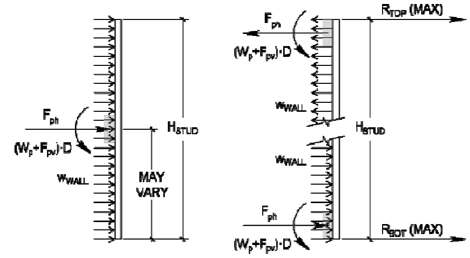
SMS =	#10	(min)	
V =	3	Lbs	Shear demand (in-plane)
P =	6	Lbs	Pull-out
V' =	613	Lbs	Screw shear capacity per SSMA allowable loads table, p.60
P' =	261	Lbs	Screw pull-out capacity per SSMA allowable loads table, p.60
DCR =	0.03	(OK)	

Sheet:

Job:	18SHA11 ARMC Ambulatory Clinic			16
Calc By:	ISG	Date:	02/21/19	

DETAIL

Wall Mounted Monitor - TV on Ergotron Bracket | 9/S301



MAX MOMENT (EQUIP @ MIDHEIGHT)

MAX END REACTIONS (EQUIP @ TOP OR BOTTOM)

STUD DESIGN

n_{stud} =	2		Number of studs engaged
H_{stud} =	13.7	ft	Height of stud (maximum)
$H_{partial}$ =	9.5	ft	Height of stud (partial height wall)
$W_{p,wall}$ =	8.0	psf	Unit wt of partition wall
s_{stud} =	16	in	Stud spacing
F_{ph} =	5.0	psf	= Max[$(F_{ph})(W_{p,wall})$, 5psf min]
w_{wall} =	6.7	plf/stud	$= F_{ph}\cdot(s_{stud}/12)$
M =	2.3	kip-in	Max Moment (per stud)
R_{TOP} =	52	lbs	$= w_{wall}\cdot H_{stud}/2+F_{ph}+(W_p+F_{pv})\cdot(D/12)/H_{stud}$
R_{BOT} =	52	lbs	$= w_{wall}\cdot H_{stud}/2+F_{ph}+(W_p+F_{pv})\cdot(D/12)/H_{stud}$
Stud =	400S125-54		(min)
S_e =	0.361	in^3	
I_e =	0.830	in^4	
M' =	10.8	kip-in	$= S_eF_y/\Omega_b$, Ω_b =1.67
Δ =	0.26	in (L/633)	Maximum Deflection (Limit to L/120)

Stud Wall Top & Bot Track Connections (ASD)

Top Connection: 0.157"ϕ Hilti X-U w/ 1" Embed (ICC ESR-2269) Above: NWC o/ Mtl Deck

s_{top} =	24	in	Anchor spacing at top of wall
n_{top} =	2		Total number of anchors engaged at top of wall
V =	52	Lbs/anchor	$= R_{TOP}\cdot(n_{stud}/n_{top})$
V' =	90	Lbs/anchor	Shear capacity (ASD)

Top Connection: Braced

s_{top} =	48	in	Brace spacing at top of wall
n_{braces} =	2		Total number of braces engaged at top of wall
V =	34	Lbs/brace	$= [w_{wall}\cdot H_{partial}/2+0.7F_{ph}+(W_p+0.7F_{pv})\cdot(D/12)/H_{partial}]\cdot(n_{stud}/n_{top})$

Bottom Connection: 0.157"ϕ Hilti X-U w/ 1" Embed (ICC ESR-2269) Below: NWC o/ Mtl Deck

s_{bot} =	24	in	Anchors spacing at bottom of wall
n_{bot} =	2		Total number of anchors engaged at bottom of wall
V =	52	Lbs/anchor	$= R_{BOT}\cdot(n_{stud}/n_{bot})$
V' =	90	Lbs/anchor	Shear capacity (ASD)

SPIRE STRUCTURAL ENGINEERING inc

Job:	18SHA11 ARMC Ambulatory Clinic			Sheet: 17
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DETAIL

Suspended Ceiling Equipment- (EF-1 & RF-1)

See Mech Dwgs

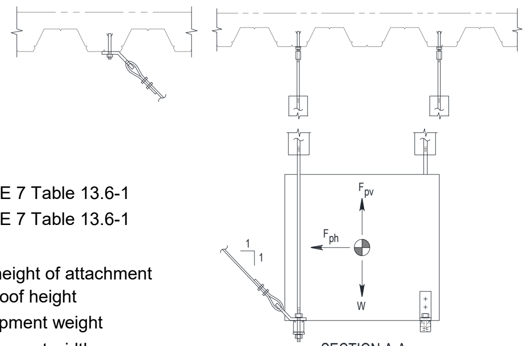
Design =	City		
S_{DS} =	1.35	See USGS sheet	
I_p =	1.0	ASCE 7 Table 11.5-1	

F_{pv} = 0.27 $W_{p\,(ULT)}$ $= 0.2S_{DS}\cdot W_p$

$F_{ph\,(MIN)}$ = 0.41 $W_{p\,(ULT)}$ $= 0.3S_{DS}\cdot I_p\cdot W_p$

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

Mark	Description
EF-1	Exhaust Fan (Cook SQI-B)
RF-1	Exhaust Fan (Cook SQI-B)



SECTION A-A

Assumptions & Dimensions:

Mark	EF-1	RF-1				
Equipment	Flexible	Flexible				
Isolators	Yes	Yes				
a_p =	2.5	2.5				ASCE 7 Table 13.6-1
R_p =	2.5	2.5				ASCE 7 Table 13.6-1
Ω_o =	2.5	2.5				
z/h	0.67	0.67				z = height of attachment
F_{ph} =	1.26	1.26			$W_{p\,(ULT)}$	h = roof height
W_p =	208	431			Lbs	Equipment weight
B =	24.8	47.4			in	Equipment width
D =	32.9	52.5			in	Equipment depth
H =	26.9	46.5			in	Equipment height
CG =	13.5	23.3			in	Center of gravity (CG) height
F_{ph} =	263	545			Lbs (ULT)	Lateral seismic force
$\Omega_o\cdot F_{ph}$ =	657	1,362			Lbs (ULT)	Lateral seismic force (w/ overstrength factor)
F_{pv} =	56	116			Lbs (ULT)	Vertical sesimic force

Equipment Screw Conn to P1538A (Unistrut Angle) on Trapeze

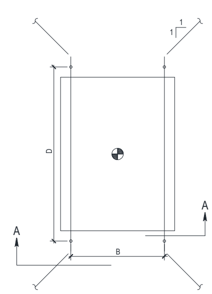
Screws	#12	#12				Sheet metal screws (SMS)
Stl. Gage	18 ga	18 ga				Base material thickness
n_{conn} =	8	8				Number of screws to equipment (total)
V =	23	48			Lbs (ASD)	$= 0.7F_{ph}/n_{conn}$
V' =	124	124			Lbs (ASD)	Screw shear capacity (SSMA Catalog pg. 60)
T =	14	25			Lbs (ASD)	$= [0.7F_{ph}\cdot CG - (0.6W_p - 0.7F_{pv})\cdot(\min(B,D)/2)] / (\min(B,D)\cdot n_{conn}/2)$
T' =	263	263			Lbs (ASD)	Screw Pullout Capacity (SSMA Catalog pg. 60)
DCR =	0.24	0.48				= V/V' + T/T' < 1.0

Equipment Spring Nut Conn to Trapeze

Diameter =	1/4	1/4			in	HHCS diameter
n_{HHCS} =	4	4				Number of HHCS to unistrut (total)
P =	29	49			Lbs (ASD)	$= [0.7F_{ph}\cdot CG - (0.6W_p - 0.7F_{pv})\cdot(\min(B,D)/2)] / (\min(B,D)\cdot n_{conn}/2)$
V =	46	95			Lbs (ASD)	$= 0.7F_{ph}/n_{conn}$
P' =	600	600			Lbs (ASD)	Spring nut pull-out capacity
V' =	300	300			Lbs (ASD)	Spring nut shear capacity
DCR =	0.20	0.40				= V/V' + T/T' < 1.0

Unistrut Trapeze

Unistrut =	P1000	P1000				
$n_{trapeze}$ =	2	2				Total number of trapeze
L =	36	48			in (min)	Toal length of trapeze
w =	41	64			plf	$w = (W_p + 0.7F_{pv}) / (n_{trapeze} \times L)$
M =	556	1,537			Lb-in (ASD)	
M' =	5,080	5,080			Lb-in (ASD)	
I =	0.185	0.185			in^4	
Δ =	0.014	0.069			in	Total load deflection
	L/2571	L/698			(L/240 Max)	



REFLECTED PLAN @ EQUIP BASE

Sheet:

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Calc By:	ISG	Date:	02/21/19	

DETAIL

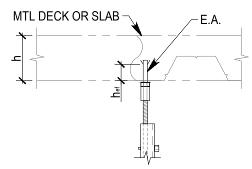
Suspended Ceiling Equipment- (EF-1 & RF-1)

See Mech Dwgs

Vertical Hanger Rod Design (See Unistrut Catalog, page 70)

Diameter =	1/2	1/2			in	Rod diameter	
s_{clip} =	12	12			in oc	Spacing of stiffener cradle clips	
%	100%	100%				Percentage of tensile capacity for compression	
n_{rods} =	4	4				Number of rods per trapeze	
M =	2,478	8,864			Lb-in	Overturning moment	$= 0.7F_{ph}\cdot CG$
T =	296	603			Lbs (ASD)	Rod tension	$= M/(2\cdot\min[B,D])+(W_p+0.7F_{pv})/n_{rods}+0.7F_{ph}$
T' =	1,350	1,350			Lbs (ASD)	Rod tensile capacity	
DCR_T =	0.22	0.45					
C =	213	430			Lbs (ASD)	Rod compression	$= M/(2\cdot\min[B,D])+(0.7F_{pv}-0.6W_p)/n_{rods}+0.7F_{ph}$
C' =	1,350	1,350			Lbs (ASD)	Rod compressive capacity	
DCR_C =	0.16	0.32					

Anchorage to Underside of Concrete - Hilti KB-TZ (ICC ESR-1917)



Conc =	NWC	NWC				Normal or lightweight concrete	
Metal deck =	W2 Deck	W2 Deck				Concrete over metal deck?	
f'_c =	4,000	4,000			psi	Concrete compressive strength	
Anchor =	CS 1/2 (3 1/4)	CS 1/2 (3 1/4)				Hilti KB-TZ anchor	
Steel Type =	Carbon	Carbon				Carbon steel or Stainless steel	
d_o =	1/2	1/2			in	Anchor O.D.	
h_{ef} =	3 1/4	3 1/4			in	Effective min anchor embedment	
h =	4 3/4	4 3/4			in	Concrete thickness	
h_{min} =	4 5/8	4 5/8			in	Min member thickness	
ϕ_s =	0.75	0.75				Seismic reduction per ACI App. D	
λ =	N/A	N/A				LWC reduction per ACI App. D	
k_{cr} =	17	17				Effectiveness factor	
k_{cp} =	2	2				Coefficient for pryout strength	
$N_{p,cr}$[1] =	3,025	3,025			Lbs		
N_b =	6,299	6,299			Lbs	$= k_{cr}\cdot(f'_c)^{0.5}\cdot h_{ef}^{1.5}$	
s_{min} =	9 3/4	9 3/4			in	Min anchor spacing	
c_{min} =	7 1/2	7 1/2			in	Min. edge distance	
A_n =	95	95			in^2	$= 3h_{ef}\cdot(\min(1.5h_{ef},s/2)+\min(1.5h_{ef},c))$	
A_{no} =	95	95			in^2	$= 9\cdot h_{ef}^2$	
N_{sa} =	10,705	10,705			lbs	Steel strength in tension	
$V_{sa,eq}$[2] =	4,945	4,945			lbs	Steel strength in shear	
$\phi P_{n,conc}$ =	1,475	1,475			Lbs	$= \phi_s\lambda\phi_{t,conc}\cdot\min(N_{p,cr},N_b)\cdot(A_n/A_{no})$	$\phi_{t,conc}$ = 0.65
$\phi V_{n,conc}$ =	N/A	N/A			Lbs	$= \lambda\phi_{v,conc}\cdot k_{cp}\cdot N_b\cdot(A_n/A_{no})$	$\phi_{v,conc}$ = 0.70
$\phi P_{n,steel}$ =	8,029	8,029			Lbs	$= \phi_{t,steel}\cdot N_{sa}$	$\phi_{t,steel}$ = 0.75
$\phi V_{n,steel}$ =	3,214	3,214			Lbs	$= \phi_{v,steel}\cdot V_{sa}$	$\phi_{v,steel}$ = 0.65

[1] If anchor is into concrete over metal deck this value refers to "$N_{p,deck,cr}$"

[2] If anchor is into concrete over metal deck this value refers to "$V_{sa,deck,eq}$"

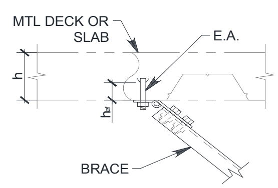
Vertical Hanger Anchorage (Hilti KB-TZ, ICC ESR-1917)

n =	1	2			(min)	Total number of anchors	
$\Omega_o\cdot P_u$ =	778	802			Lbs (ULT)	Tension	$= (\Omega_o\cdot F_{ph}\cdot CG/(2\cdot\min[B,D]) + 1.2W_p + F_{pv})/n_{rods} + \Omega_o\cdot F_{ph}$
$DCR_{P,conc}$ =	0.53	0.54				$\Omega_oP_u/\phi P_{n,conc} \le 1.0$	
$DCR_{P,steel}$ =	0.10	0.10				$\Omega_oP_u/\phi P_{n,steel} \le 1.0$	

Cable Bracing Design

Diameter =	1/8	1/8			in	Prestretched Aircraft cable diameter	
T =	260	539			Lbs (ASD)	Tension per cable	$= (0.7F_{ph})\cdot 2^{0.5}$
T' =	1,000	1,000			Lbs (ASD)	Per ASHRAE	
DCR =	0.26	0.54					

Brace Anchorage (Same anchor parameters as vertical anchor)



n =	1	2			(min)	Total number of anchors	
$\Omega_o\cdot P_u$ =	657	681			Lbs (ULT)	Tension Demand	$= \Omega_o\cdot F_{ph}/n$
$\Omega_o\cdot V_u$ =	657	340			Lbs (ULT)	Shear Demand	$= \Omega_o\cdot F_{ph}/n$
$DCR_{P,conc}$ =	0.45	0.46				$\Omega_oP_u/\phi P_{n,conc} \le 1.0$	
$DCR_{V,conc}$ =	N/A	N/A				$\Omega_oV_u/\phi V_{n,conc} \le 1.0$	
$DCR_{P,steel}$ =	0.08	0.08				$\Omega_oP_u/\phi P_{n,steel} \le 1.0$	
$DCR_{V,steel}$ =	0.20	0.11				$\Omega_oV_u/\phi V_{n,steel} \le 1.0$	
DCR_{P+V} =	0.33	0.30				$\max[DCR_{P,conc}, DCR_{P,steel}]^{5/3} + \max[DCR_{V,conc}, DCR_{V,steel}]^{5/3} \le 1.0$	

Sheet:

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Calc By:	ISG	Date:	02/21/19	

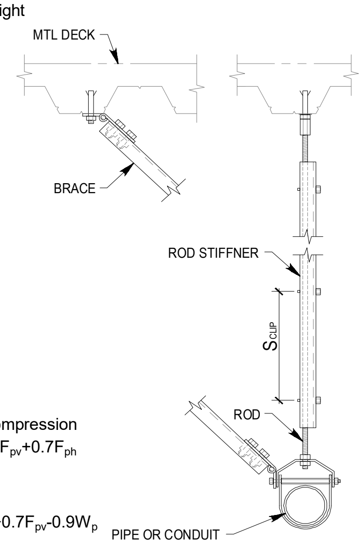
DETAIL

Typical Suspended Single Pipe/Conduit Support Under Concrete over Steel Deck — 4/S101

Design =	City					
S_{DS} =	1.35 g	See USGS sheet	I_p =	1.00		(1.5 for essential or hazardous)
a_p =	2.5	ASCE 7 Table 13.6-1	F_{pv} =	0.27	$W_{p\,(ULT)}$	$= 0.2S_{DS}\cdot W_p$
R_p =	6.0	ASCE 7 Table 13.6-1	$F_{ph\,(MIN)}$ =	0.41	$W_{p\,(ULT)}$	$= 0.3S_{DS}\cdot I_p\cdot W_p$
Ω_o =	2.5	ASCE 7 Table 13.6-1				

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

z/h =	0.67			z = height of attachment, h = roof height
$F_{ph\,(calc)}$ =	0.53		$W_{p\,(ULT)}$	ASCE 7 (13.3-1)
F_{ph} =	0.53		$W_{p\,(ULT)}$	Governing F_{ph} coefficient
$\Omega_o\cdot F_{ph}$ =	1.32		$W_{p\,(ULT)}$	
ϕ_{PIPE} =	4		in (max)	Pipe diameter
w_{PIPE} =	16.3		plf	Std pipe full of water used
s_{HGR} =	10.0		ft	Hanger spacing
s_{TRANS} =	20.0		ft	Transverse brace spacing
s_{LONG} =	40.0		ft	Longitudinal brace spacing (pairs)
W_{PIPE} =	163		Lbs	$= w_{PIPE}\,(s_{HGR})$
F_{ph} =	172		$Lbs_{(ULT)}$	$= F_{ph}\,W_{PIPE}\,(s_{TRANS}/s_{HGR})$
$\Omega_o\cdot F_{ph}$ =	429		$Lbs_{(ULT)}$	$= \Omega_o\cdot F_{ph}\,W_{PIPE}\,(s_{TRANS}/s_{HGR})$
F_{pv} =	44		$Lbs_{(ULT)}$	$= F_{pv}\,W_{PIPE}$

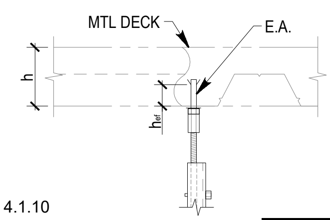


Vertical Hanger Rod Design (See Unistrut Catalog, page 70)

Diameter =	1/2	in	Rod diameter	
s_{clip} =	12	in oc	Spacing of stiffener cradle clips	
% =	100%		Percentage of tensile capacity for compression	
T =	314	$Lbs_{(ASD)}$	Rod tension	$T = W_p+0.7F_{pv}+0.7F_{ph}$
T' =	1,350	$Lbs_{(ASD)}$	Rod tensile capacity	
DCR_T =	0.23			
C =	4	$Lbs_{(ASD)}$	Rod compression	$C = 0.7F_{ph}+0.7F_{pv}-0.9W_p$
C' =	1,350	$Lbs_{(ASD)}$	Rod compression capacity	
DCR_C =	0.00			

Vertical Hanger Anchorage (Hilti KB-TZ, ICC ESR-1917, Table 5)

Conc =	NWC		Normal or lightweight concrete	
Metal deck =	W2 Deck		Figure 5A	
f'_c =	4,000	psi	Concrete compressive strength	
Anchor =	CS 1/2 (3 1/4)		Hilti KB-TZ anchor	
Steel Type =	Carbon		Carbon steel or Stainless steel	
d_o =	1/2	in	Anchor O.D.	
h_{ef} =	3 1/4	in	Effective min anchor embedment	
h =	2 3/4	in	Concrete thickness o/ deck	
$h_{min,top}$ =	2 5/8	in	Min concrete thickness o/ deck per section 4.1.10	
ϕ_s =	0.75		Seismic reduction per ACI Ch.17	
$N_{p,deck,cr}$ =	3,025	Lbs	$= N_{p,cr}(f'_c/3000)$	
s_{min} =	2 3/8	in	Min anchor spacing per sections	
c_{min} =	2 3/8	in	Min. edge distance	
N_{sa} =	10,705	lbs	Steel strength in tension (table 3 or 4)	
$V_{sa,deck,eq}$ =	4,945	lbs	Steel strength in shear	
$\phi P_{n,conc}$ =	1,475	Lbs	$= \phi_s\lambda\phi_{t,conc}\cdot N_{p,deck,cr}$	
$\phi P_{n,steel}$ =	8,029	Lbs	$= \phi_{t,steel}\cdot N_{sa}$	
$\phi V_{n,steel}$ =	3,214	Lbs	$= \phi_{v,steel}\cdot V_{sa,deck,eq}$	
$\Omega_o\cdot P_u$ =	669	Lbs	Tension demand	$\Omega_o\cdot P_u = 1.2W_p+F_{pv}+\Omega_o\cdot F_{ph}$
$DCR_{P,conc}$ =	0.45		$\Omega_oP_u/\phi P_{n,conc} \le 1.0$	
$DCR_{P,steel}$ =	0.08		$\Omega_oP_u/\phi P_{n,steel} \le 1.0$	



$\phi_{t,steel}$ =	0.75
$\phi_{v,steel}$ =	0.65
$\phi_{t,conc}$ =	0.65

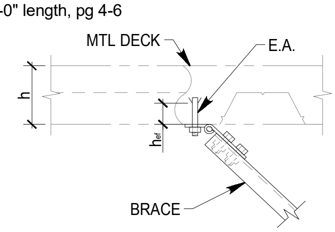
Note: All values are calculated based on tabulated values found in ICC-ESR 1917. Based on this report, concrete breakout and shear are not applicable. See Table 5, footnote 8 for additional information. No reduction for LWC required per section 4.1.12, last paragraph.

Bracing Design (Unistrut P1000, Lmax = 9'-6", r_{min} = 0.577, KL/r = 198, load applied at slotted face)

C =	170	$Lbs_{(ASD)}$	Brace compression	$C = (0.7F_{ph})\cdot 2^{0.5}$
C' =	1,200	$Lbs_{(ASD)}$	Brace compression capacity, based on 10'-0" length, pg 4-6	
DCR =	0.14			

Brace Anchorage (Same anchor parameters as vertical anchor)

$\Omega_o\cdot P_u$ =	429	Lbs	Tension demand	$\Omega_o\cdot P_u = \Omega_o\cdot F_{ph}$
$\Omega_o\cdot V_u$ =	429	Lbs	Shear Demand	$\Omega_o\cdot V_u = \Omega_o\cdot F_{ph}$
$DCR_{P,conc}$ =	0.29		$\Omega_oP_u/\phi P_{n,conc} \le 1.0$	
$DCR_{P,steel}$ =	0.05		$\Omega_oP_u/\phi P_{n,steel} \le 1.0$	
$DCR_{V,steel}$ =	0.13		$\Omega_oV_u/\phi V_{n,steel} \le 1.0$	
$DCR_{P+V,steel}$ =	0.04		$(\Omega_oP_u/\phi P_{n,steel})^{5/3} + (\Omega_oV_u/\phi V_{n,steel})^{5/3} \le 1.0$	



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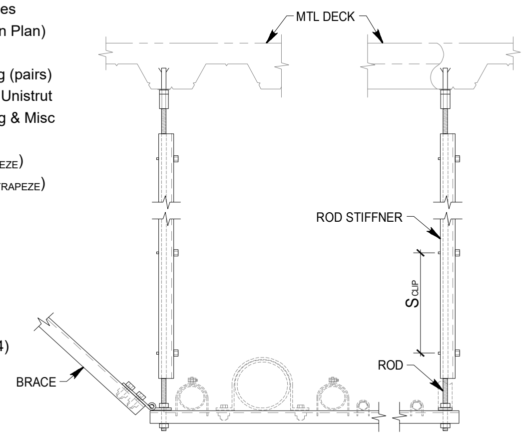
Calc By:	ISG	Date:	02/21/19

Typical Suspended Pipe/Conduit Trapeze Support Under Concrete over Steel Deck

DETAIL 5/S101

Design =	City			
S_{DS} =	1.35	See USGS sheet	I_p = 1.00	ASCE 7 Table 11.5-1
a_p =	2.5	ASCE 7 Tables 13.6-1	F_{pv} = 0.27 $W_{p\,(ULT)}$	$= 0.2S_{DS}\cdot W_p$
R_p =	6.0	ASCE 7 Tables 13.6-1	$F_{ph\,(MIN)}$ = 0.41 $W_{p\,(ULT)}$	$= 0.3S_{DS}\cdot I_p\cdot W_p$
Ω_o =	2.0	ASCE 7 Table 13.6-1		

z/h =	0.67		z = height of attachment, h = roof height
$F_{ph\,(calc)}$ =	0.53	$W_{p\,(ULT)}$	ASCE 7 (13.3-1)
F_{ph} =	0.53	$W_{p\,(ULT)}$	Governing F_{ph} coefficient $F_{ph}=\frac{0.4S_{DS}a_p}{(R_p/I_p)}\left(1+2\frac{z}{h}\right)W_p$
$\Omega_o\cdot F_{ph}$ =	1.05	$W_{p\,(ULT)}$	
w_{PIPES} =	35	plf	Total Linear Weight of Pipes
$s_{TRAPEZE}$ =	10	ft	Trapeze Linear Spacing (in Plan)
s_{TRANS} =	20	ft	Transverse brace spacing
s_{LONG} =	40	ft	Longitudinal brace spacing (pairs)
W_{PIPES} =	350	Lbs	Weight of Pipes on Horiz. Unistrut
$W_{TRAPEZE}$ =	5	Lbs	Weight of Unistrut Framing & Misc
W_{TOTAL} =	355	Lbs	$= W_{PIPES} + W_{TRAPEZE}$
F_{ph} =	374	$Lbs_{(ULT)}$	$= F_{ph}\,W_{TOTAL}\,(s_{TRANS}/s_{TRAPEZE})$
$\Omega_o\cdot F_{ph}$ =	748	$Lbs_{(ULT)}$	$= \Omega_o\cdot F_{ph}\,W_{TOTAL}\,(s_{TRANS}/s_{TRAPEZE})$
F_{pv} =	96	$Lbs_{(ULT)}$	$= F_{pv}\,W_{TOTAL}$



Unistrut Trapeze (ASD)

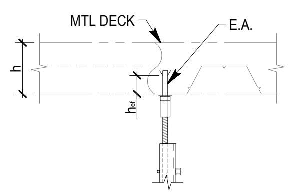
Unistrut	P1000		
L =	4.0	ft (max)	
w =	106	plf	$= (W_{TOTAL}+0.7F_{pv})/L$
M =	2,533	Lb-in $_{(ASD)}$	$= (w/12)\cdot L^2/8$
M' =	5,080	Lb-in $_{(ASD)}$	(Per Unistrut Catalog p. 24)
I =	0.185	in^4	
Δ_{DL} =	0.10	in	Dead load deflection
	L/504	(L/240 Max)	

Vertical Hanger Rod Design (See Unistrut Catalog, page 70)

Diameter =	1/2	in	Rod diameter
s_{clip} =	12	in oc	Spacing of stiffener cradle clips
% =	100%		Percentage of tensile capacity for compression
T =	473	$Lbs_{(ASD)}$	Rod Tension $T = (W_p+0.7F_{pv})/2+0.7F_{ph}$
T' =	1,350	$Lbs_{(ASD)}$	Rod Tensile Capacity
DCR_T =	0.35		
C =	335	$Lbs_{(ASD)}$	Rod Compression $C = 0.7F_{ph}+(0.6W_p-0.7F_{pv})/2$
C' =	1,350	$Lbs_{(ASD)}$	Rod Compressive Capacity
DCR_C =	0.25		

Vertical Hanger Anchorage (Hilti KB-TZ, ICC ESR-1917)

Conc =	NWC		Normal or lightweight concrete
Metal deck =	W2 Deck		Figure 5A
f'c =	4,000	psi	Concrete compressive strength
Anchor =	CS 1/2 (3 1/4)		Hilti KB-TZ anchor
Steel Type =	Carbon		Carbon steel or Stainless steel
d_o =	1/2	in	Anchor O.D.
h_{ef} =	3 1/4	in	Effective min anchor embedment
h =	2 3/4	in	Concrete thickness o/ deck
$h_{min,top}$ =	2 5/8	in	Min concrete thickness o/ deck per section 4.1.10
ϕ_s =	0.75		Seismic reduction per ACI Ch.17
$N_{p,deck,cr}$ =	3,025	Lbs	$= N_{p,cr}(f'c/3000)$
s_{min} =	2 3/8	in	Min anchor spacing per sections
c_{min} =	2 3/8	in	Min. edge distance
N_{sa} =	10,705	lbs	Steel strength in tension (table 3 or 4)
$V_{sa,deck,eq}$ =	4,945	lbs	Steel strength in shear
$\phi P_{n,conc}$ =	1,475	Lbs	$= \phi_s\lambda\phi_{t,conc}\cdot N_{p,deck,cr}$
$\phi P_{n,steel}$ =	8,029	Lbs	$= \phi_{t,steel}\cdot N_{sa}$
$\phi V_{n,steel}$ =	3,214	Lbs	$= \phi_{v,steel}\cdot V_{sa,deck,eq}$
$\Omega_o\cdot P_u$ =	1,009	Lbs	Tension Demand $\Omega_o\cdot P_u = (1.2W_p+F_{pv})/2+\Omega_o\cdot F_{ph}$
$DCR_{P,conc}$ =	0.68		$\Omega_oP_u/\phi P_{n,conc} \le 1.0$
$DCR_{P,steel}$ =	0.13		$\Omega_oP_u/\phi P_{n,steel} \le 1.0$



$\phi_{t,steel}$ =	0.75
$\phi_{v,steel}$ =	0.65
$\phi_{t,conc}$ =	0.65

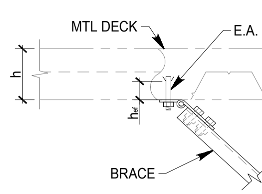
Note: All values are calculated based on tabulated values found in ICC-ESR 1917. Based on this report, concrete breakout and shear are not applicable. See Table 5, footnote 8 for additional information. No reduction for LWC required per section 4.1.12, last paragraph.

Bracing Design (Unistrut P1000, Lmax = 9'-6", rmin = 0.577, KL/r = 198, load applied at slotted face)

C =	370	$Lbs_{(ASD)}$	$C = (0.7F_{ph})\cdot 2^{0.5}$
C' =	1,380	$Lbs_{(ASD)}$	Brace compression capacity, based on 10'-0" length
DCR =	0.27		Unistrut Catalog, pg 20

Brace Anchorage (Same anchor parameters as vertical anchor)

$\Omega_o\cdot P_u$ =	748	Lbs	Tension demand $\Omega_o\cdot P_u = \Omega_o\cdot F_{ph}$
$\Omega_o\cdot V_u$ =	748	Lbs	Shear Demand $\Omega_o\cdot V_u = \Omega_o\cdot F_{ph}$
$DCR_{P,conc}$ =	0.51		$\Omega_oP_u/\phi P_{n,conc} \le 1.0$
$DCR_{P,steel}$ =	0.09		$\Omega_oP_u/\phi P_{n,steel} \le 1.0$
$DCR_{V,steel}$ =	0.23		$\Omega_oV_u/\phi V_{n,steel} \le 1.0$
$DCR_{P+V,steel}$ =	0.11		$(\Omega_oP_u/\phi P_{n,steel})^{5/3} + (\Omega_oV_u/\phi V_{n,steel})^{5/3} \le 1.0$



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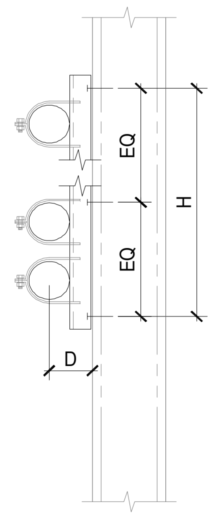
Job:	18SHA11 ARMC Ambulatory Clinic		Sheet: 21
Calc By:	ISG	Date: 02/21/19	

DETAIL

Typical Wall-Mounted Pipe/Conduit Unistrut Support — 10/S101

(ASD)



Seismic Input

Design =	City		
a_p =	2.5		ASCE 7 Tables 13.5-1
R_p =	6.0		and 13.6-1
S_{DS} =	1.35		See USGS sheet
I_p =	1.00		ASCE 7 Table 11.5-1
z_1/h =	0.33		Floor below (2nd Floor)
z_2/h =	0.67		Floor above (3rd Floor)

Weight & Dimensions

W_{pipes} =	100	Lbs (max)	Total weight of pipes/conduit @ strut support
W_{strut} =	5	Lbs (max)	Weight of strut support
W_p =	105	Lbs (max)	Total weight (W_{pipes} + W_{strut})
H =	24	in (min)	Distance between top & bottom screws
D =	5	in (max)	Distance from face of wall to center of pipe/conduit

Seismic Forces

$F_{ph,min}$ =	0.41	W_p	$= 0.3S_{DS} \cdot I_p \cdot W_p$
$F_{ph,1}$ =	0.37	W_p	F_{ph} at floor below (z_1/h)
$F_{ph,2}$ =	0.53	W_p	F_{ph} at floor above (z_2/h)
$F_{ph,avg}$ =	0.45	W_p	Average of $F_{ph,1}$ & $F_{ph,2}$
F_{ph} =	0.45	W_p	Max of $F_{ph,min}$ & $F_{ph,avg}$
F_{pv} =	0.27	W_p	$= 0.2S_{DS} \cdot W_p$
F_{ph} =	47	Lbs	Horizontal seismic force
F_{pv} =	28	Lbs	Vertical seismic force

Screws into Stud

n = 3 No. of screws at strut to stud (min)

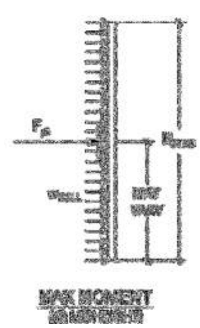
Metal = 16 ga studs (min)

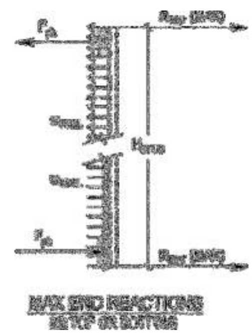
SMS =	1/4"ϕ			
V_{VERT} =	42	Lbs	Shear per screw (vertical, gravity loads)	$= (W_p + 0.7F_{pv}) \div n$
V_{HORIZ} =	11	Lbs	Shear per screw (horizontal, side-to-side)	$= 0.7F_{ph} \div n$
$P_{F\text{-}B}$ =	37	Lbs	Tension per screw (front-to-back)	$= (W_p + 0.7F_{pv}) \cdot D/H + 0.7F_{ph}/n$
$P_{S\text{-}S}$ =	26	Lbs	Tension per screw (side-to-side)	$= (W_p + 0.7F_{pv}) \cdot D/H$
V'_{VERT} =	613	Lbs	Screw shear capacity per SSMA allowable loads table, p.60	
V'_{HORIZ} =	613	Lbs	Screw shear capacity per SSMA allowable loads table, p.60	
P' =	261	Lbs	Screw pull-out capacity per SSMA allowable loads table, p.60	
DCR =	0.21	(OK)		

$$DCR = \max\left[\left(\frac{V_{VERT}}{V'_{VERT}} + \frac{P_{F-B}}{P'}\right), \left(\frac{V_{VERT}}{V'_{VERT}} + \frac{V_{HORIZ}}{V'_{HORIZ}} + \frac{P_{S-S}}{P'}\right)\right] \le 1.0$$

Stud Design

H_{stud} =	13.7	ft	Height of stud (maximum)
$H_{partial}$ =	9.5	ft	Height of stud (partial height wall)
$W_{p,wall}$ =	8.0	psf	Unit wt of partition wall
s_{stud} =	16	in	Stud spacing
Stud =	400S125-54	(min)	
S_e =	0.361	in^3	
I_e =	0.830	in^4	
M' =	10.8	kip-in	$= S_eF_y/\Omega_b$, Ω_b =1.67
$0.7F_{ph,wall}$ =	2.5	psf	= 0.7(0.45) $W_{p,wall}$
Live =	5.0	psf	





Load Case 1: (D+0.7E)

w_{wall} =	3.4	plf / stud	$= 0.7F_{ph,wall} \cdot (s_{stud}/12)$
R_{TOP} =	60	Lbs / stud	$= w_{wall} \cdot H_{stud}/2 + 0.7F_{ph} + (W_p+0.7F_{pv}) \cdot (D/12)/H_{stud}$
$R_{PARTIAL}$ =	55	Lbs / stud	$= w_{wall} \cdot H_{partial}/2 + 0.7F_{ph} + (W_p+0.7F_{pv}) \cdot (D/12)/H_{partial}$
R_{BOT} =	60	Lbs / stud	$= w_{wall} \cdot H_{stud}/2 + 0.7F_{ph} + (W_p+0.7F_{pv}) \cdot (D/12)/H_{stud}$
M =	2.6	kip-in	$= w_{wall} \cdot H_{stud}^2/8 + 0.7F_{ph} \cdot H_{stud}/4 + (W_p+0.7F_{pv}) \cdot (D/12)/2$
DCR_M =	0.24	≤ 1.0 (OK)	= M/M' ≤ 1.0
Δ =	0.24	in (L/694)	Maximum Deflection (Limit to L/120)

Load Case 2: (D+L)

w_{wall} =	6.7	plf / stud	$= Live \cdot (s_{stud}/12)$
R_{TOP} =	49	Lbs / stud	$= w_{wall} \cdot H_{stud}/2 + W_p \cdot (D/12)/H_{stud}$
$R_{PARTIAL}$ =	36	Lbs / stud	$= w_{wall} \cdot H_{partial}/2 + W_p \cdot (D/12)/H_{partial}$
R_{BOT} =	49	Lbs / stud	$= w_{wall} \cdot H_{stud}/2 + W_p \cdot (D/12)/H_{stud}$
M =	2.1	kip-in	$= w_{wall} \cdot H_{stud}^2/8 + W_p \cdot (D/12)/2$
DCR_M =	0.20	≤ 1.0 (OK)	= M/M' ≤ 1.0
Δ =	0.22	in (L/754)	Maximum Deflection (Limit to L/120)

Typical Wall-Mounted Pipe/Conduit Unistrut Support — 10/S101

Connections at Top Track of Full-Height Wall - Load Case 1: (D+0.7E) Governs

NWC o/ Mtl Deck			Type of existing floor/roof structure above
$Conn_{(E)}$ =	PAF		Existing connections at top track are power-actuated fasteners (PAF)
$s_{(E)}$ =	24	in	Spacing of existing PAF along top track of full-height wall (max)
$n_{(E)}$ =	1		Number of existing PAF resisting out-of-plane reaction from pipe/conduit loads
$V_{(5\ psf)}$ =	68	Lbs / PAF	Existing shear demand at top of wall (based on 5 psf out-of-plane live load)
V_{wall} =	34	Lbs / PAF	Shear demand at top of wall from uniform wall loads (based on 2.5 psf out-of-plane seismic load)
V_{pipe} =	37	Lbs / PAF	Additional shear demand from pipe/conduit only (based on Load Case 1)
$V_{(E)}$ =	71	Lbs / PAF	$= V_{wall} + V_{pipe}$
$V'_{(E)}$ =	90	Lbs	0.157"ϕ Hilti X-U w/ 1" Embed (ICC ESR-2269)
DCR =	0.79	≤ 1.0 (OK)	$= V_{(E)}/V'_{(E)} \leq 1.0$

Braces at Top Track of Partial-Height Wall - Load Case 1: (D+0.7E) Governs

s_{brace} =	48	in	Spacing of existing braces along top track of partial-height wall (max)
n_{brace} =	1		Number of existing braces resisting out-of-plane reaction at top track (min)
$V_{(5\ psf)}$ =	95	Lbs / brace	Existing horizontal reaction force at brace (based on 5 psf out-of-plane live load)
V_{wall} =	48	Lbs / brace	Horizontal reaction force at brace from uniform wall loads (based on 2.5 psf out-of-plane seismic load)
V_{pipe} =	39	Lbs / brace	Additional horizontal reaction force at brace from pipe/conduit only (based on Load Case 1)
V_{brace} =	87	Lbs / brace	$= V_{wall} + V_{pipe}$ 87 Lbs ≤ 95 Lbs (from 5 psf live), therefore braces are adequate by inspection

Connections at Bottom Track - Load Case 1: (D+0.7E) Governs

NWC o/ Mtl Deck			Type of existing floor structure below
$Conn_{(E)}$ =	PAF		Existing connections at bottom track are power-actuated fasteners (PAF)
$s_{(E)}$ =	24	in	Spacing of existing PAF along bottom track (max)
$n_{(E)}$ =	1		Number of existing PAF resisting out-of-plane reaction from pipe/conduit loads
$V_{(5\ psf)}$ =	68	Lbs / PAF	Existing shear demand at bottom of wall (based on 5 psf out-of-plane live load)
V_{wall} =	34	Lbs / PAF	Shear demand at bottom of wall from uniform wall loads (based on 2.5 psf out-of-plane seismic load)
V_{pipe} =	37	Lbs / PAF	Additional shear demand from pipe/conduit only (based on Load Case 1)
$V_{(E)}$ =	71	Lbs / PAF	$= V_{wall} + V_{pipe}$
$V'_{(E)}$ =	90	Lbs	0.157"ϕ Hilti X-U w/ 1" Embed (ICC ESR-2269)
DCR =	0.79	≤ 1.0 (OK)	$= V_{(E)}/V'_{(E)} \leq 1.0$

SPIRE STRUCTURAL ENGINEERING inc

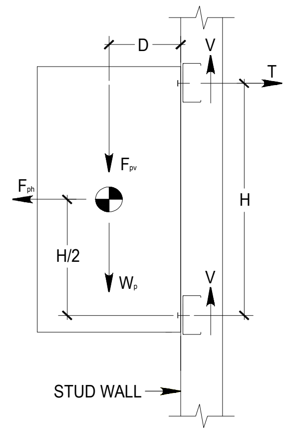
Sheet: 23

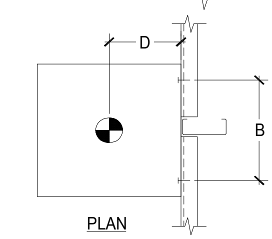
Job:	18SHA11 ARMC Ambulatory Clinic		
Calc By:	ISG	Date:	02/21/19

Typical Wall-Mounted Equipment (150 Lbs max)

DETAIL 12/S101

(ASD)





Seismic Input

Design =	City		
a_p =	2.5		ASCE 7 Tables 13.5-1
R_p =	6.0		and 13.6-1
S_{DS} =	1.35		See USGS sheet
I_p =	1.00		ASCE 7 Table 11.5-1
z_1/h =	0.33		Floor below (2nd Floor)
z_2/h =	0.67		Floor above (3rd Floor)

Weight & Dimensions

W_p =	150	Lbs (max)	Equipment weight
H =	8.0	in (min)	Height between top & bottom connections to backing
B =	6.0	in (min)	Width between left and right connections to backing
D =	8.0	in (max)	Depth to centroid

Seismic Forces

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

$F_{ph,min}$ =	0.41	W_p	$= 0.3S_{DS}\cdot I_p\cdot W_p$
$F_{ph,1}$ =	0.37	W_p	F_{ph} at floor below (z_1/h)
$F_{ph,2}$ =	0.53	W_p	F_{ph} at floor above (z_2/h)
$F_{ph,avg}$ =	0.45	W_p	Average of $F_{ph,1}$ & $F_{ph,2}$
F_{ph} =	0.45	W_p	Max of $F_{ph,min}$ & $F_{ph,avg}$
F_{pv} =	0.27	W_p	$= 0.2S_{DS}\cdot W_p$
F_{ph} =	68	Lbs	Horizontal seismic force
F_{pv} =	41	Lbs	Vertical seismic force

Screws into Backing

n_{bkg} = 4 No. of screws into backing (min)

Metal = 16 ga backing (min)

SMS =	1/4"φ			
$V_{F\text{-}B}$ =	45	Lbs	Shear per screw (front-to-back)	$= (W_p + 0.7F_{pv}) \div n_{bkg}$
$V_{S\text{-}S}$ =	46	Lbs	Shear per screw (side-to-side)	$= [(W_p + 0.7F_{pv})^2 + 0.7F_{ph}{}^2]^{0.5} \div n_{bkg}$
$P_{F\text{-}B}$ =	101	Lbs	Tension per screw (front-to-back)	$= [(W_p + 0.7F_{pv})\cdot D/H + 0.7F_{ph}/2] \div (n_{bkg}/2)$
$P_{S\text{-}S}$ =	121	Lbs	Tension per screw (side-to-side)	$= [(W_p + 0.7F_{pv})\cdot D/H + 0.7F_{ph}\cdot D/B] \div (n_{bkg}/2)$
V' =	613	Lbs	Screw shear capacity per SSMA allowable loads table, p.90	
P' =	261	Lbs	Screw pull-out capacity per SSMA allowable loads table, p.90	
DCR =	0.54	≤ 1.0 (OK)	$= \max[\, V_{F\text{-}B}/V' + P_{F\text{-}B}/P' ,\ V_{S\text{-}S}/V' + P_{S\text{-}S}/P' \,] \le 1.0$	

Screws into Metal Studs

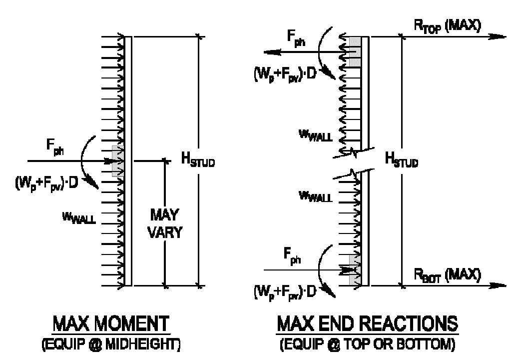
n_{wall} = 18 No. of screws into metal studs (min)

Metal = 16 ga studs (min)

SMS =	#10			
$V_{F\text{-}B}$ =	10	Lbs	Shear per screw (front-to-back)	$= (W_p + 0.7F_{pv}) \div n_{wall}$
$V_{S\text{-}S}$ =	10	Lbs	Shear per screw (side-to-side)	$= [(W_p + 0.7F_{pv})^2 + 0.7F_{ph}{}^2]^{0.5} \div n_{wall}$
$P_{F\text{-}B}$ =	22	Lbs	Tension per screw (front-to-back)	$= [(W_p + 0.7F_{pv})\cdot D/H + 0.7F_{ph}/2] \div (n_{wall}/2)$
$P_{S\text{-}S}$ =	27	Lbs	Tension per screw (side-to-side)	$= [(W_p + 0.7F_{pv})\cdot D/H + 0.7F_{ph}\cdot D/B] \div (n_{wall}/2)$
V' =	534	Lbs	Screw shear capacity per SSMA allowable loads table, p.90	
P' =	198	Lbs	Screw pull-out capacity per SSMA allowable loads table, p.90	
DCR =	0.15	≤ 1.0 (OK)	$= \max[\, V_{F\text{-}B}/V' + P_{F\text{-}B}/P' ,\ V_{S\text{-}S}/V' + P_{S\text{-}S}/P' \,] \le 1.0$	

Stud Design

n_{stud} =	3		Number of studs engaged
H_{stud} =	13.7	ft	Height of stud (maximum)
$H_{partial}$ =	9.5	ft	Height of stud (partial height wall)
$W_{p,wall}$ =	8.0	psf	Unit weight of partition wall
s_{stud} =	16	in	Stud spacing
Stud =	400S125-54		(min)
S_e =	0.361	in^3	
I_e =	0.830	in^4	
M' =	10.8	kip-in	$= S_eF_y/\Omega_b$, $\Omega_b = 1.67$
$0.7F_{ph,wall}$ =	2.5	psf	$= 0.7(0.45)\ W_{p,wall}$
Live =	5.0	psf	Uniform live load on wall (CBC 1607.14)



DETAIL

Typical Wall-Mounted Equipment (150 Lbs max) — 12/S101

Load Case 1: (D+0.7E)

w_{wall} =	3.4	plf / stud	$= 0.7F_{ph,wall}\cdot(s_{stud}/12)$
R_{TOP} =	42	Lbs / stud	$= w_{wall}\cdot H_{stud}/2 + [0.7F_{ph} + (W_p+0.7F_{pv})\cdot(D/12)/H_{stud}] / n_{stud}$
$R_{PARTIAL}$ =	36	Lbs / stud	$= w_{wall}\cdot H_{partial}/2 + [0.7F_{ph} + (W_p+0.7F_{pv})\cdot(D/12)/H_{partial}] / n_{stud}$
R_{BOT} =	42	Lbs / stud	$= w_{wall}\cdot H_{stud}/2 + [0.7F_{ph} + (W_p+0.7F_{pv})\cdot(D/12)/H_{stud}] / n_{stud}$
M =	1.8	kip-in	$= w_{wall}\cdot H_{stud}^2/8 + [0.7F_{ph}\cdot H_{stud}/4 + (W_p+0.7F_{pv})\cdot(D/12)/2] / n_{stud}$
DCR_M =	0.17	≤ 1.0 (OK)	= M/M' ≤ 1.0
Δ =	0.17	in (L/966)	Maximum Deflection (Limit to L/120)

Load Case 2: (D+L)

w_{wall} =	6.7	plf / stud	$= Live\cdot(s_{stud}/12)$
R_{TOP} =	48	Lbs / stud	$= w_{wall}\cdot H_{stud}/2+W_p\cdot(D/12)/(H_{stud}\cdot n_{stud})$
$R_{PARTIAL}$ =	35	Lbs / stud	$= w_{wall}\cdot H_{partial}/2+W_p\cdot(D/12)/(H_{partial}\cdot n_{stud})$
R_{BOT} =	48	Lbs / stud	$= w_{wall}\cdot H_{stud}/2+W_p\cdot(D/12)/(H_{stud}\cdot n_{stud})$
M =	2.1	kip-in	$= w_{wall}\cdot H_{stud}^2/8 + W_p\cdot(D/12)/(2\cdot n_{stud})$
DCR_M =	0.19	≤ 1.0 (OK)	= M/M' ≤ 1.0
Δ =	0.22	in (L/754)	Maximum Deflection (Limit to L/120)

Connections at Top Track of Full-Height Wall - Load Case 2: (D+L) Governs

NWC o/ Mtl Deck			Type of existing floor/roof structure above
$Conn_{(E)}$ =	PAF		Existing connections at top track are power-actuated fasteners (PAF)
$s_{(E)}$ =	24	in	Spacing of existing PAF along top track of full-height wall (max)
$n_{(E)}$ =	2		Number of existing PAF resisting reaction from equipment loads (distributed by backing & top track)
$V_{(5\ psf)}$ =	68	Lbs / PAF	Existing shear demand at top of wall (based on 5 psf out-of-plane live load)
V_{wall} =	68	Lbs / PAF	Shear demand at top of wall from uniform wall loads (based on 5 psf out-of-plane live load)
V_{equip} =	4	Lbs / PAF	Additional shear demand from equipment only (based on Load Case 2)
$V_{(E)}$ =	72	Lbs / PAF	$= V_{wall} + V_{equip}$
$V'_{(E)}$ =	90	Lbs	0.157"ϕ Hilti X-U w/ 1" Embed (ICC ESR-2269)
DCR =	0.80	≤ 1.0 (OK)	$= V_{(E)}/V'_{(E)} \le 1.0$

Braces at Top Track of Partial-Height Wall - Load Case 2: (D+L) Governs

s_{brace} =	48	in	Spacing of existing braces along top track of partial-height wall (max)
n_{brace} =	2		Number of existing braces supporting section of top track at equipment (min)
$V_{(5\ psf)}$ =	95	Lbs / brace	Existing horizontal reaction force at brace (based on 5 psf out-of-plane live load)
V_{wall} =	48	Lbs / brace	Horizontal reaction force at brace from uniform wall loads (based on 5 psf out-of-plane live load)
V_{equip} =	30	Lbs / brace	Additional horizontal reaction force at brace from equipment only (based on Load Case 2)
V_{brace} =	78	Lbs / brace	$= V_{wall} + V_{equip}$ 78 Lbs ≤ 95 Lbs (from 5 psf live), therefore braces are adequate by inspection

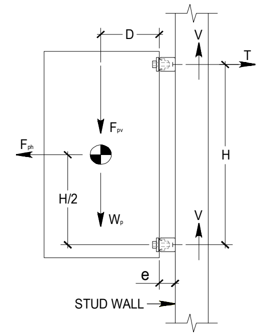
Connections at Bottom Track - Load Case 2: (D+L) Governs

NWC o/ Mtl Deck			Type of existing floor structure below
$Conn_{(E)}$ =	PAF		Existing connections at bottom track are power-actuated fasteners (PAF)
$s_{(E)}$ =	24	in	Spacing of existing PAF along bottom track (max)
$n_{(E)}$ =	2		Number of existing PAF resisting reaction from equipment loads (distributed by backing & bottom track)
$V_{(5\ psf)}$ =	68	Lbs / PAF	Existing shear demand at bottom of wall (based on 5 psf out-of-plane live load)
V_{wall} =	68	Lbs / PAF	Shear demand at bottom of wall from uniform wall loads (based on 5 psf out-of-plane live load)
V_{equip} =	4	Lbs / PAF	Additional shear demand from equipment only (based on Load Case 2)
$V_{(E)}$ =	72	Lbs / PAF	$= V_{wall} + V_{equip}$
$V'_{(E)}$ =	90	Lbs	0.157"ϕ Hilti X-U w/ 1" Embed (ICC ESR-2269)
DCR =	0.80	≤ 1.0 (OK)	$= V_{(E)}/V'_{(E)} \le 1.0$

Typical Unistrut Wall-Mounted Equipment (150 Lbs max)

DETAIL 13/S101

(ASD)

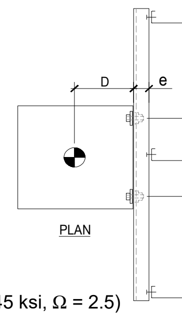


Seismic Input

Design =	City		
a_p =	2.5		ASCE 7 Tables 13.5-1
R_p =	6.0		and 13.6-1
S_{DS} =	1.35		See USGS sheet
I_p =	1.00		ASCE 7 Table 11.5-1
z_1/h =	0.33		Floor below (2nd Floor)
z_2/h =	0.67		Floor above (3rd Floor)

Weight & Dimensions

W_p =	150	Lbs (max)	Equipment weight
H =	8.0	in (min)	Height between top & bottom connections to backing
B =	6.0	in (min)	Width between left and right connections to backing
D =	8.0	in (max)	Depth to centroid
e =	1.6	in	Eccentricity from Unistrut



Seismic Forces

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

$F_{ph,min}$ =	0.41	W_p	$= 0.3S_{DS}\cdot I_p\cdot W_p$
$F_{ph,1}$ =	0.37	W_p	F_{ph} at floor below (z_1/h)
$F_{ph,2}$ =	0.53	W_p	F_{ph} at floor above (z_2/h)
$F_{ph,avg}$ =	0.45	W_p	Average of $F_{ph,1}$ & $F_{ph,2}$
F_{ph} =	0.45	W_p	Max of $F_{ph,min}$ & $F_{ph,avg}$
F_{pv} =	0.27	W_p	$= 0.2S_{DS}\cdot W_p$
F_{ph} =	68	Lbs	Horizontal seismic force
F_{pv} =	41	Lbs	Vertical seismic force

HHCS Equip Conn to Unistrut

n_{HHCS} = 4 No. of HHCS to Unistrut (F_u = 45 ksi, Ω = 2.5)

t = 0.0451 in Equipment metal thickness (min)

Metal =	18 ga	(min)		
d =	1/4	in	Bolt diameter	
m_f =	0.75		Modification factor per AISI Table E3.3.1-2	
C =	3.0		Bearing factor per AISI Table E3.3.1-1	
V_{F-B} =	45	Lbs	Shear per HHCS (front-to-back)	$= (W_p + 0.7F_{pv}) \div n_{HHCS}$
V_{S-S} =	46	Lbs	Shear per HHCS (side-to-side)	$= [(W_p + 0.7F_{pv})^2 + 0.7F_{ph}^2]^{0.5} \div n_{HHCS}$
P_{F-B} =	101	Lbs	Tension per HHCS (front-to-back)	$= [(W_p + 0.7F_{pv})\cdot D/H + 0.7F_{ph}/2] \div (n_{HHCS}/2)$
P_{S-S} =	121	Lbs	Tension per HHCS (side-to-side)	$= [(W_p + 0.7F_{pv})\cdot D/H + 0.7F_{ph}\cdot D/B] \div (n_{HHCS}/2)$
V'_b =	362	Lbs	Shear capacity of metal (AISI Eqn. E4.3.1-1)	$= [4.2(t^3\cdot d)^{1/2}\cdot F_u]/\Omega$
V'_s =	300	Lbs	Slip resistance capacity of spring nut connection to strut per Unistrut catalog	
P'_b =	457	Lbs	Bearing capacity of metal (AISI Eqn. E3.3.1-1)	$= [m_f\cdot C\cdot d\cdot t\cdot F_u]/\Omega$
P'_s =	600	Lbs	Pullout capacity of spring nut connection to strut per Unistrut catalog	
DCR =	0.60	≤ 1.0 (OK)	$= \max[\, V_{F-B}/\min(V'_b, V'_s) + P_{F-B}/\min(P'_b, P'_s)\ ,\ V_{S-S}/\min(V'_b, V'_s) + P_{S-S}/\min(P'_b, P'_s)\,] \le 1.0$	

Screws into Metal Studs

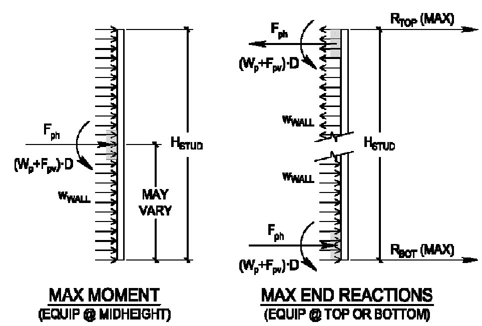
n_{wall} = 12 No. of screws into metal studs (2 screws into each stud at each Unistrut)

Metal = 16 ga studs (min)

SMS =	1/4"ϕ			
V_{F-B} =	15	Lbs	Shear per screw (front-to-back)	$= (W_p + 0.7F_{pv}) \div n_{wall}$
V_{S-S} =	**15**	Lbs	Shear per screw (side-to-side)	$= [(W_p + 0.7F_{pv})^2 + 0.7F_{ph}^2]^{0.5} \div n_{wall}$
P_{F-B} =	40	Lbs	Tension per screw (front-to-back)	$= [(W_p + 0.7F_{pv})\cdot(D+e)/H + 0.7F_{ph}/2] \div (n_{wall}/2)$
P_{S-S} =	46	Lbs	Tension per screw (side-to-side)	$= [(W_p + 0.7F_{pv})\cdot(D+e)/H + 0.7F_{ph}\cdot(D+e)/B] \div (n_{wall}/2)$
V' =	613	Lbs	Screw shear capacity per SSMA allowable loads table, p.90	
P' =	261	Lbs	Screw pull-out capacity per SSMA allowable loads table, p.90	
DCR =	0.20	≤ 1.0 (OK)	$= \max[\, V_{F-B}/V' + P_{F-B}/P'\ ,\ V_{S-S}/V' + P_{S-S}/P'\,] \le 1.0$	

Stud Design

n_{stud} =	3		Number of studs engaged
H_{stud} =	13.7	ft	Height of stud (maximum)
$H_{partial}$ =	9.5	ft	Height of stud (partial height wall)
$W_{p,wall}$ =	8.0	psf	Unit weight of partition wall
s_{stud} =	16	in	Stud spacing
Stud =	400S125-54		(min)
S_e =	0.361	in^3	
I_e =	0.830	in^4	
M' =	10.8	kip-in	$= S_eF_y/\Omega_b$, Ω_b =1.67
$0.7F_{ph,wall}$ =	2.5	psf	$= 0.7(0.45)\ W_{p,wall}$
Live =	5.0	psf	Uniform live load on wall (CBC 1607.14)



Typical Unistrut Wall-Mounted Equipment (150 Lbs max)

DETAIL 13/S101

Load Case 1: (D+0.7E)

w_{wall} =	3.4	plf / stud	$= 0.7F_{ph,wall}\cdot(s_{stud}/12)$
R_{TOP} =	42	Lbs / stud	$= w_{wall}\cdot H_{stud}/2 + [0.7F_{ph} + (W_p+0.7F_{pv})\cdot(D/12)/H_{stud}] / n_{stud}$
$R_{PARTIAL}$ =	36	Lbs / stud	$= w_{wall}\cdot H_{partial}/2 + [0.7F_{ph} + (W_p+0.7F_{pv})\cdot(D/12)/H_{partial}] / n_{stud}$
R_{BOT} =	42	Lbs / stud	$= w_{wall}\cdot H_{stud}/2 + [0.7F_{ph} + (W_p+0.7F_{pv})\cdot(D/12)/H_{stud}] / n_{stud}$
M =	1.8	kip-in	$= w_{wall}\cdot H_{stud}^2/8 + [0.7F_{ph}\cdot H_{stud}/4 + (W_p+0.7F_{pv})\cdot(D/12)/2] / n_{stud}$
DCR_M =	0.17	≤ 1.0 (OK)	= M/M' ≤ 1.0
Δ =	0.17	in (L/966)	Maximum Deflection (Limit to L/120)

Load Case 2: (D+L)

w_{wall} =	6.7	plf / stud	$= Live\cdot(s_{stud}/12)$
R_{TOP} =	48	Lbs / stud	$= w_{wall}\cdot H_{stud}/2+W_p\cdot(D/12)/(H_{stud}\cdot n_{stud})$
$R_{PARTIAL}$ =	35	Lbs / stud	$= w_{wall}\cdot H_{partial}/2+W_p\cdot(D/12)/(H_{partial}\cdot n_{stud})$
R_{BOT} =	48	Lbs / stud	$= w_{wall}\cdot H_{stud}/2+W_p\cdot(D/12)/(H_{stud}\cdot n_{stud})$
M =	2.1	kip-in	$= w_{wall}\cdot H_{stud}^2/8 + W_p\cdot(D/12)/(2\cdot n_{stud})$
DCR_M =	0.19	≤ 1.0 (OK)	= M/M' ≤ 1.0
Δ =	0.22	in (L/754)	Maximum Deflection (Limit to L/120)

Connections at Top Track of Full-Height Wall - Load Case 2: (D+L) Governs

NWC o/ Mtl Deck			Type of existing floor/roof structure above
$Conn_{(E)}$ =	PAF		Existing connections at top track are power-actuated fasteners (PAF)
$s_{(E)}$ =	24	in	Spacing of existing PAF along top track of full-height wall (max)
$n_{(E)}$ =	2		Number of existing PAF resisting reaction from equipment loads (distributed by backing & top track)
$V_{(5\ psf)}$ =	68	Lbs / PAF	Existing shear demand at top of wall (based on 5 psf out-of-plane live load)
V_{wall} =	68	Lbs / PAF	Shear demand at top of wall from uniform wall loads (based on 5 psf out-of-plane live load)
V_{equip} =	4	Lbs / PAF	Additional shear demand from equipment only (based on Load Case 2)
$V_{(E)}$ =	72	Lbs / PAF	$= V_{wall} + V_{equip}$
$V'_{(E)}$ =	90	Lbs	0.157"ϕ Hilti X-U w/ 1" Embed (ICC ESR-2269)
DCR =	0.80	≤ 1.0 (OK)	$= V_{(E)}/V'_{(E)} \leq 1.0$

Braces at Top Track of Partial-Height Wall - Load Case 2: (D+L) Governs

s_{brace} =	48	in	Spacing of existing braces along top track of partial-height wall (max)
n_{brace} =	2		Number of existing braces supporting section of top track at equipment (min)
$V_{(5\ psf)}$ =	95	Lbs / brace	Existing horizontal reaction force at brace (based on 5 psf out-of-plane live load)
V_{wall} =	48	Lbs / brace	Horizontal reaction force at brace from uniform wall loads (based on 5 psf out-of-plane live load)
V_{equip} =	30	Lbs / brace	Additional horizontal reaction force at brace from equipment only (based on Load Case 2)
V_{brace} =	78	Lbs / brace	$= V_{wall} + V_{equip}$ 78 Lbs ≤ 95 Lbs (from 5 psf live), therefore braces are adequate by inspection

Connections at Bottom Track - Load Case 2: (D+L) Governs

NWC o/ Mtl Deck			Type of existing floor structure below
$Conn_{(E)}$ =	PAF		Existing connections at bottom track are power-actuated fasteners (PAF)
$s_{(E)}$ =	24	in	Spacing of existing PAF along bottom track (max)
$n_{(E)}$ =	2		Number of existing PAF resisting reaction from equipment loads (distributed by backing & bottom track)
$V_{(5\ psf)}$ =	68	Lbs / PAF	Existing shear demand at bottom of wall (based on 5 psf out-of-plane live load)
V_{wall} =	68	Lbs / PAF	Shear demand at bottom of wall from uniform wall loads (based on 5 psf out-of-plane live load)
V_{equip} =	4	Lbs / PAF	Additional shear demand from equipment only (based on Load Case 2)
$V_{(E)}$ =	72	Lbs / PAF	$= V_{wall} + V_{equip}$
$V'_{(E)}$ =	90	Lbs	0.157"ϕ Hilti X-U w/ 1" Embed (ICC ESR-2269)
DCR =	0.80	≤ 1.0 (OK)	$= V_{(E)}/V'_{(E)} \leq 1.0$

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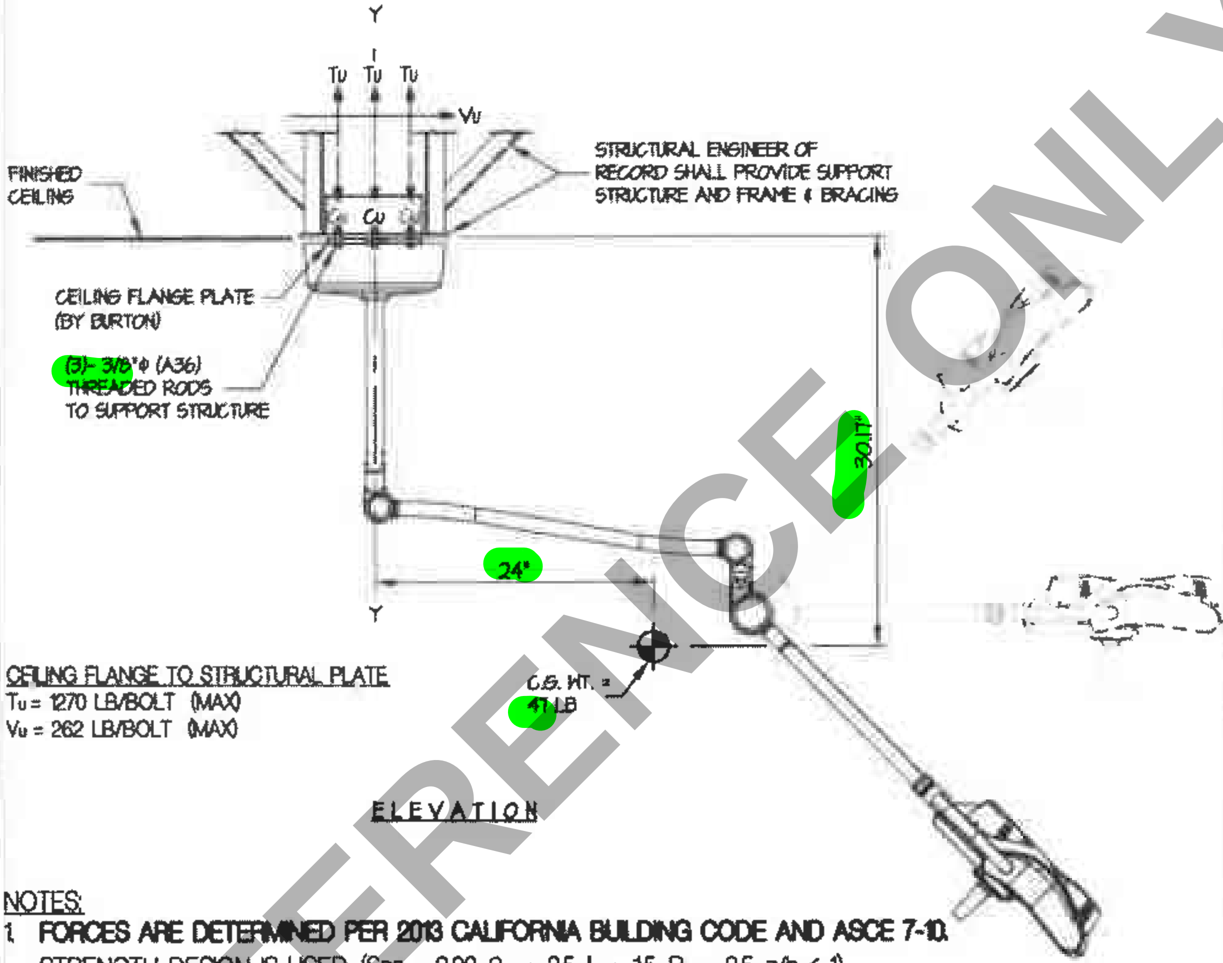
PHILIPS BURTON

AIM SERIES SINGLE CEILING MOUNT

DWN. J. ROBERSON
JOB NO. 13-1608
DATE 5/26/16
SHEET 1 OF 2 SHEETS

SEISMIC ANCHORAGE

CEILING MOUNTED



CEILING FLANGE TO STRUCTURAL PLATE
T_u = 1270 LB/BOLT (MAX)
V_u = 262 LB/BOLT (MAX)

ELEVATION

NOTES:

1. FORCES ARE DETERMINED PER 2013 CALIFORNIA BUILDING CODE AND ASCE 7-10. STRENGTH DESIGN IS USED. (S_{DS} = 2.20, a_p = 2.5, I_p = 1.5, R_p = 2.5, $z/h \leq 1$)

   HORIZONTAL FORCE (E_h) = 3.96 W_p
   VERTICAL FORCE (E_v) = 0.44 W_p

2. CENTER OF GRAVITY (C.G.) AND WEIGHT ARE THE GOVERNING PARAMETERS FOR DESIGN. THESE CALCULATIONS ENCOMPASS ALL WEIGHTS UP TO THE MAXIMUM WEIGHT SHOWN.
3. STRUCTURAL ENGINEER OF RECORD FOR THE BUILDING SHALL PROVIDE SUPPORT STRUCTURE DESIGNED TO SUPPORT WEIGHTS AND FORCES SHOWN IN COMBINATION WITH ALL OTHER LOADS THAT MAY BE PRESENT.

REGISTERED PROFESSIONAL ENGINEER JONATHAN ROBERSON No. 4197 EXP. 6-30-2018 5/26/16 STRUCTURAL STATE OF CALIFORNIA

PHILIPS burton
PHILIPS BURTON
11500 MELROSE AVE
FRANKLIN PARK, IL 60131
TEL: 800.444.9909
FAX: 800.765.1770
BURTONMEDICAL.COM
LIT-0096 REV 01

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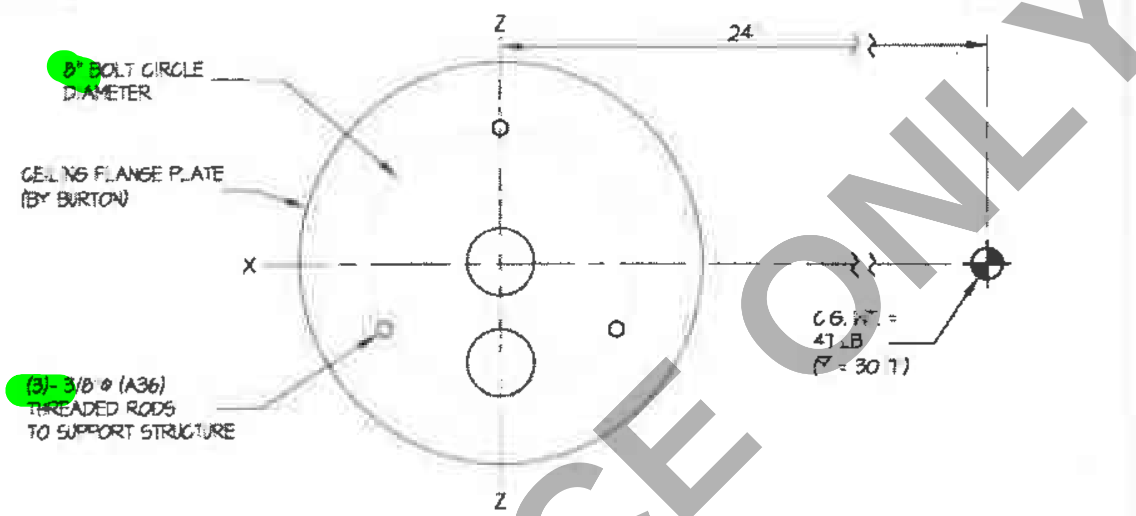
PHILIPS BURTON	DES. J. ROBERSON	SHEET 2
AIM SERIES SINGLE CEILING MOUNT	JOB NO. 13-1808	
	DATE 5/26/16	OF 2 SHEETS

SEISMIC ANCHORAGE

CEILING MOUNTED



PLAN AT CEILING FLANGE

LOADS:
WEIGHT = 47 LB
HORIZONTAL FORCE (E_H) = 3.96 W_P = 186 LB
VERTICAL FORCE (E_V) = 0.44 W_P = 21 LB

BOLT FORCES:

BOLT GROUP PROPERTIES:

$I_{x\text{-}x}$ = 24 in⁴
$I_{z\text{-}z}$ = 24 in⁴
$I_{y\text{-}y}$ = 48 in⁴

MOMENTS:

M_{xx} = 186#(30.17") + (1.2(47#) + 21#)23.97" = 7467"#
M_{zz} = 186#(30.17") + (1.2(47#) + 21#)23.97" = 7467"#
M_{yy} = 100#(23.97") = 2397"#

NOTE: BRAKING SYSTEM RELEASES WITH APPLIED LOAD OF 25 LBS. AT C.G. LOCATION, CALCULATION USES 100 LBS. FOR A SAFETY FACTOR OF 4.

BOLT SPEC: 3/8⌀ (A36) THREADED ROD.
⌀T = 3589 LB/BOLT
⌀V = 1914 LB/BOLT

TENSION (T)

$$T_u = \frac{7467"\#(4")}{24} + \frac{47\#(1.2) + 21\#}{3_{\text{BOLTS}}} = 1270 \text{ LB/ROD (MAX)}$$

SHEAR (V)

$$V_u = \frac{186\#}{3_{\text{BOLTS}}} + \frac{2397"\#(4")}{48} = 262 \text{ LB/ROD (MAX)}$$

(PER AISC J3.7, LESS THAN 20% STRESS)

Figure 46: Anchorage & Seismic single ceiling model.

Model Numbers

WARRANTY: Limited 5-year

SA730P	SmartMount® Articulating Wall Mount for 10" to 29" Displays

Product Specifications

	DIMENSIONS (W x H x D)	PRODUCT WEIGHT	LOAD CAPACITY	FINISH	AVAILABLE COLORS
SA730P	10.01" x 8.06" x 2.77"-16.99" (254 x 205 x 70-432mm)	3.55lb (1.61kg)	25lb (11kg)	Scratch Resistant Fused Epoxy	Semi-Gloss Black

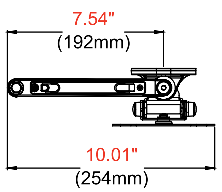
Package Specifications

	PACKAGE SIZE (W x H x D)	PACKAGE SHIP WEIGHT	PACKAGE UPC CODE	PACKAGE CONTENTS	UNITS IN PACKAGE
SA730P	14.13" x 3.75" x 10.38" (358 x 95 x 263mm)	4.75lb (2.15kg)	735029237389	Wall Mount, Wall and Display Installation Hardware, Installation Instructions	1

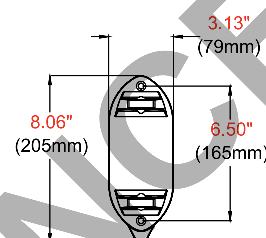
Accessories

ACC918:	Security Fasteners	IBA4-W:	Easy Mount Recessed Low Voltage Cable Plate
ACC2X1:	VESA® 200 x 100mm Adaptor Plate	IBA5-W:	Recessed Low Voltage Media Plate with Duplex Surge Suppressor
ESHV models:	AV Wall Shelves	WSP700/WSP701:	Metal Stud Wall Plates for 16"/24" Center Metal Studs

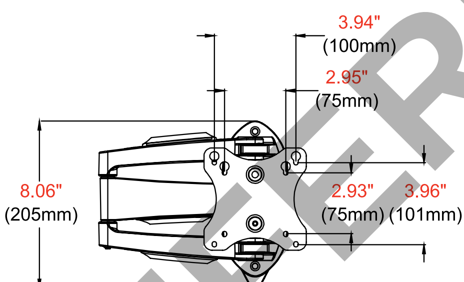
All dimensions = inch (mm)



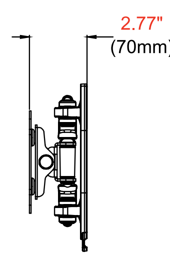
TOP VIEW



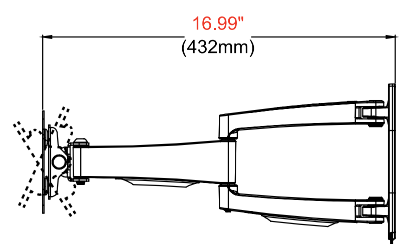
WALL PLATE DETAIL



FRONT VIEW



SIDE VIEW COLLAPSED



SIDE VIEW EXTENDED +/-35° TILT

Architect Specifications

The SmartMount® Articulating Wall Mount shall be a Peerless-AV model SA730P and shall be located where indicated on the plans. Assembly and installation shall be done according to instructions provided by the manufacturer.

Visit peerless-av.com to see the complete line of AV solutions from Peerless-AV, including outdoor displays, wireless, kiosks, digital audio, display mounts, projector mounts, carts/stands, and a full assortment of accessories.

Peerless-AV
2300 White Oak Circle
Aurora, IL 60502 USA

(800) 865-2112
(630) 375-5100
Fax: (800) 359-6500

Peerless-AV EMEA
Unit 3 Watford Interchange
Colonial Way, Watford
Herts, WD24 4WP
United Kingdom
+44 (0) 1923 200100
Fax: +44 (0) 1923 200101

Peerless-AV Latin America
Ave de las Industrias 413
Parque Industrial Escobedo
Escobedo, N.L.,
Mexico 66062
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Fax: +52 (81) 8384-8360

peerless-AV® Driving Technology Through Innovation

LIT-1386 rev.2

EQUIPMENT ANCHORAGE & SEISMIC ENGINEERING

5877 Pine Ave, Ste. 210
Chino Hills, CA. 91709
Phn: (909) 606-7622

Office of Statewide Health Planning and Development

PREAPPROVAL OF MANUFACTURER'S CERTIFICATION

OPM-0212-13

THIS PREAPPROVAL CONFORMS TO THE 2013 CALIFORNIA BUILDING CODE

MANUFACTURER: **PEERLESS INDUSTRIES, INC.**

EQUIPMENT NAME: **SMARTMOUNT ARTICULATING WALL ARM**

Sheet: 1 of 6
Date: 7/27/15

GENERAL NOTES

1. THIS OSHPD PREAPPROVAL OF MANUFACTURER'S CERTIFICATION (OPM) IS BASED ON THE 2013 CBC. THE DEMANDS (DESIGN FORCES) FOR USE WITH THIS OPM SHALL BE BASED ON THE 2013 CBC
2. THIS DOCUMENT MAY ONLY BE USED WITH THE EXPRESS WRITTEN CONSENT OF THE MANUFACTURER LISTED ABOVE FOR THE SPECIFIC PROJECT SITE AND INSTALLATION LOCATION. THIS DOCUMENT IS INVALID WITHOUT SUCH CONSENT.
3. THIS PREAPPROVAL CONFORMS TO THE 2013 CALIFORNIA BUILDING CODE WHERE S_{DS} IS NOT GREATER THAN 1.60, 2.20
4. FORCES PER ASCE 7-10 SECTION 13.3.1, EQUATIONS 13.3-1, 13.3-2 & 13.3-3,
   WHERE S_{DS} = 1.60, a_p = 1.0, I_p = 1.5, R_p = 1.5, z/h $\leq$ 1 CONCRETE WALL. SEE FOLLOWING SHEETS FOR Ω_0
   WHERE S_{DS} = 2.20, a_p = 1.0, I_p = 1.5, R_p = 1.5, z/h $\leq$ 1 SEE FOLLOWING SHEETS FOR Ω_0
5. THIS PREAPPROVAL COVERS ONLY THE SUPPORTS AND ATTACHMENTS OF THE EQUIPMENT TO THE STRUCTURE.
6. ALL DESIGN FORCES SHOWN ON THE DRAWINGS ARE FACTORED LOADS THAT SHALL BE USED FOR STRENGTH DESIGN.
7. CONCRETE WALL VALID FOR DEMANDS SHOWN AT ANY ELEVATION (i.e. z/h $\leq$ 1)
8. **RESPONSIBILITIES OF THE STRUCTURAL ENGINEER OF RECORD OF THE BUILDING**

   A. PROVIDE SUPPORTING STRUCTURE TO SUPPORT WEIGHTS AND FORCES SHOWN IN ADDITION TO ALL OTHER LOADS.
   B. VERIFY THAT THE INSTALLATION IS IN CONFORMANCE WITH THE 2013 CBC AND WITH THE DETAILS, MATERIAL AND GAGE OF THE UNIT WHERE ATTACHMENTS ARE MADE AGREE WITH THE INFORMATION SHOWN ON THE PREAPPROVAL DOCUMENTS.
   C. VERIFY THAT PROJECT SPECIFIC VALUES OF S_{DS} & z/h RESULT IN SEISMIC FORCES (E_h, E_v) THAT DO NOT EXCEED THE VALUES ON THE DETAILS.
   D. VERIFY THAT THE CONCRETE WALL TO WHICH THE EQUIPMENT IS ANCHORED MEETS THE REQUIREMENTS OF THE APPLICABLE ICC ESR.
   E. VERIFY THAT THE ANCHORS ARE AN ADEQUATE DISTANCE FROM ANY CONCRETE WALL EDGES OR OPENINGS (SEE TYPICAL DETAIL ON SHEET 2).
   F. VERIFY THAT ALL NEW OR EXISTING ANCHORS ARE AN ADEQUATE DISTANCE FROM THE UNIT ATTACHMENTS AND CHECK FOR INTERACTION WHERE OTHER ANCHORS ARE WITHIN 18" OR 6hef FROM THIS UNIT'S ANCHORS.
   G. DESIGN BACKING BARS, STUDS, ETC. WHICH THE UNITS ARE ATTACHED TO AS NOTED ON THE DRAWINGS.

REGISTERED PROFESSIONAL ENGINEER
JONATHAN ROBERSON
No. 4197
EXP. 6-30-2016
7/27/15
STRUCTURAL
STATE OF CALIFORNIA

SPIRE STRUCTURAL ENGINEERING inc

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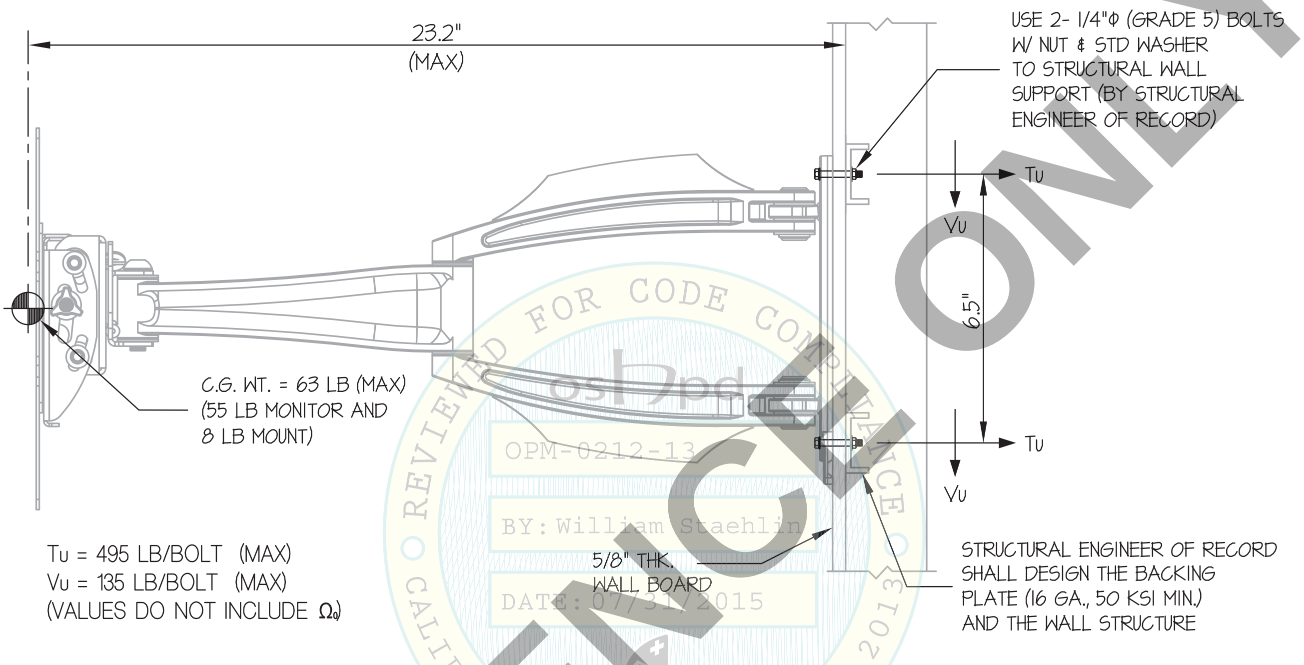
PEERLESS INDUSTRIES, INC.	DES. J. ROBERSON	SHEET 3
SMARTMOUNT ARTICULATING WALL ARM	JOB NO. 11-1502	
	DATE 7/27/15	OF 6 SHEETS

SEISMIC SUPPORTS & ATTACHMENTS

WALL MOUNTED



STEEL STUD WALL SECTION

NOTES:

1. FORCES ARE DETERMINED PER 2013 CALIFORNIA BUILDING CODE AND ASCE 7-10. STRENGTH DESIGN IS USED. (S_{DS} = 2.20, a_p = 2.5, I_p = 1.5, R_p = 2.5, $z/h \le 1$)

   HORIZONTAL FORCE (E_h) = 3.96 W_p
   VERTICAL FORCE (E_v) = 0.44 W_p

2. CENTER OF GRAVITY (C.G.) AND WEIGHT ARE THE GOVERNING PARAMETERS FOR DESIGN. THIS PREAPPROVAL ENCOMPASSES ALL WEIGHTS UP TO THE MAXIMUM WEIGHT SHOWN.
3. STRUCTURAL ENGINEER OF RECORD FOR THE BUILDING SHALL PROVIDE SUPPORT STRUCTURE DESIGNED TO SUPPORT WEIGHTS AND FORCES SHOWN IN COMBINATION WITH ALL OTHER LOADS THAT MAY BE PRESENT.
4. SEE GENERAL NOTES: SHEETS 1 AND 2

REGISTERED PROFESSIONAL ENGINEER JONATHAN ROBERSON No. 4197 EXP. 6-30-2016 7/27/15 STRUCTURAL STATE OF CALIFORNIA

26461 Rancho Parkway South, Lake Forest, CA 92630 949.916.3440 www.spirestructures.com

SPIRE STRUCTURAL ENGINEERING Inc

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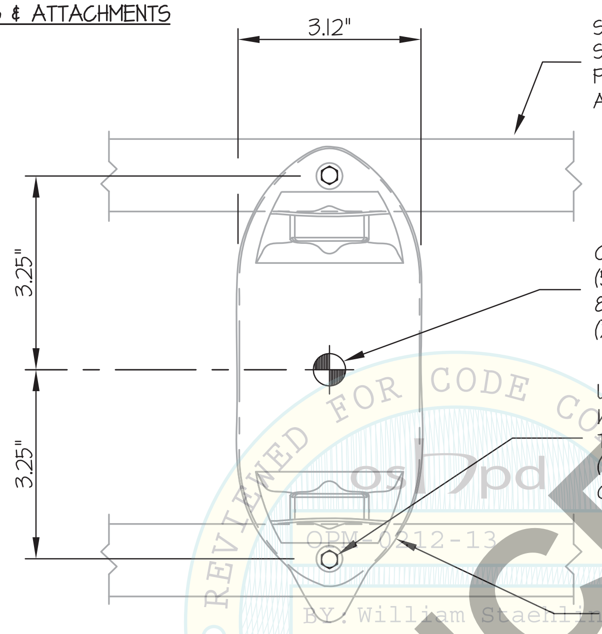
www.EquipmentAnchorage.com

PEERLESS INDUSTRIES, INC.	DES. J. ROBERSON	SHEET 4 OF 6 SHEETS
SMARTMOUNT ARTICULATING WALL ARM	JOB NO. 11-1502	
	DATE 7/27/15	

SEISMIC SUPPORTS & ATTACHMENTS

WALL MOUNTED



ELEVATION AT WALL PLATE
(MODEL SA740P)

26461 Rancho Parkway South, Lake Forest, CA 92630 949.916.3440 www.spirestructures.com

peerless-AV®

B2B (HTTPS://B2B.PEERLESS-AV.COM/USER/LOGIN.ASPX?

SmartMount® Universal Tilt Wall Mount

for 32" to 50" Displays

SKU: ST640

Price: $180.00

1 ADD TO CART

Share:

Certifications: RoHS

California Residents:

WARNING: Cancer and reproductive harm- See www.P65Warnings.ca.gov for more information.

Name	Value
Minimum to Maximum Screen Size	32" to 50"
VESA Pattern	400 x 400
Weight Capacity	150lb (68.0kg)
Color	Black
Finish	Powder Coat
Distance from Wall	2.63 - 5.71" (67 - 145mm)
Increlock Increments	-5, 0, 5, 10, 15
Mounting Pattern	458 x 405mm (18.02 x 15.95")
Security Features	Security Hardware
Tilt	+15 / -5
Product Dimensions	21.69 X 10.71 X 2.95" (550 X 272 X 75mm)
Shipping Weight	7.82lb (7.82kg)
Ship Dimensions	10.71 x 2.95 x 21.69" (272.0 x 74.9 x 550.9mm)
UPC Code	735029235699

EASE EQUIPMENT ANCHORAGE & SEISMIC ENGINEERING

5877 Pine Ave, Ste. 210
Chino Hills, CA. 91709
Phn: (909) 606-7622

Office of Statewide Health Planning and Development

PREAPPROVAL OF MANUFACTURER'S CERTIFICATION

OPM-0211-13

THIS PREAPPROVAL CONFORMS TO THE 2013 CALIFORNIA BUILDING CODE

MANUFACTURER: **PEERLESS INDUSTRIES, INC.**
EQUIPMENT NAME: **UNIVERSAL FLAT AND TILT WALL MOUNT FOR FLAT TV WEIGHT UP TO 175 LB**

Sheet: 1 of 8
Date: 7/27/15

GENERAL NOTES

1. THIS OSHPD PREAPPROVAL OF MANUFACTURER'S CERTIFICATION (OPM) IS BASED ON THE 2013 CBC. THE DEMANDS (DESIGN FORCES) FOR USE WITH THIS OPM SHALL BE BASED ON THE 2013 CBC
2. THIS DOCUMENT MAY ONLY BE USED WITH THE EXPRESS WRITTEN CONSENT OF THE MANUFACTURER LISTED ABOVE FOR THE SPECIFIC PROJECT SITE AND INSTALLATION LOCATION. THIS DOCUMENT IS INVALID WITHOUT SUCH CONSENT.
3. THIS PREAPPROVAL CONFORMS TO THE 2013 CALIFORNIA BUILDING CODE WHERE S_{DS} IS NOT GREATER THAN 2.20.
4. FORCES PER ASCE 7-10 SECTION 13.3.1, EQUATIONS 13.3-1, 13.3-2 & 13.3-3, WHERE S_{DS} = 2.20, a_p = 1.0, I_p = 1.5, R_p = 1.5, $z/h \leq 1$ CONCRETE WALL. SEE FOLLOWING SHEETS FOR Ω_0
5. THIS PREAPPROVAL COVERS ONLY THE SUPPORTS AND ATTACHMENTS OF THE EQUIPMENT TO THE STRUCTURE.
6. ALL DESIGN FORCES SHOWN ON THE DRAWINGS ARE FACTORED LOADS THAT SHALL BE USED FOR STRENGTH DESIGN.
7. CONCRETE WALL DETAIL VALID FOR DEMANDS SHOWN AT ANY ELEVATION. (i.e. $z/h \leq 1$)
8. **RESPONSIBILITIES OF THE STRUCTURAL ENGINEER OF RECORD OF THE BUILDING**

   A. PROVIDE SUPPORTING STRUCTURE TO SUPPORT WEIGHTS AND FORCES SHOWN IN ADDITION TO ALL OTHER LOADS.
   B. VERIFY THAT THE INSTALLATION IS IN CONFORMANCE WITH THE 2013 CBC AND WITH THE DETAILS, MATERIAL AND GAGE OF THE UNIT WHERE ATTACHMENTS ARE MADE AGREE WITH THE INFORMATION SHOWN ON THE PREAPPROVAL DOCUMENTS.
   C. VERIFY THAT PROJECT SPECIFIC VALUES OF S_{DS} & z/h RESULT IN SEISMIC FORCES (E_h, E_v) THAT DO NOT EXCEED THE VALUES ON THE DETAILS.
   D. VERIFY THAT THE CONCRETE WALL TO WHICH THE EQUIPMENT IS ANCHORED MEETS THE REQUIREMENTS OF THE APPLICABLE ICC ESR.
   E. VERIFY THAT THE ANCHORS ARE AN ADEQUATE DISTANCE FROM ANY CONCRETE WALL EDGES OR OPENINGS (SEE TYPICAL DETAIL ON SHEET 2).
   F. VERIFY THAT ALL NEW OR EXISTING ANCHORS ARE AN ADEQUATE DISTANCE FROM THE UNIT ATTACHMENTS AND CHECK FOR INTERACTION WHERE OTHER ANCHORS ARE WITHIN 18" OR 6hef FROM THIS UNIT'S ANCHORS.
   G. DESIGN BACKING BARS, STUDS, ETC. WHICH THE UNITS ARE ATTACHED TO AS NOTED ON THE DRAWINGS.

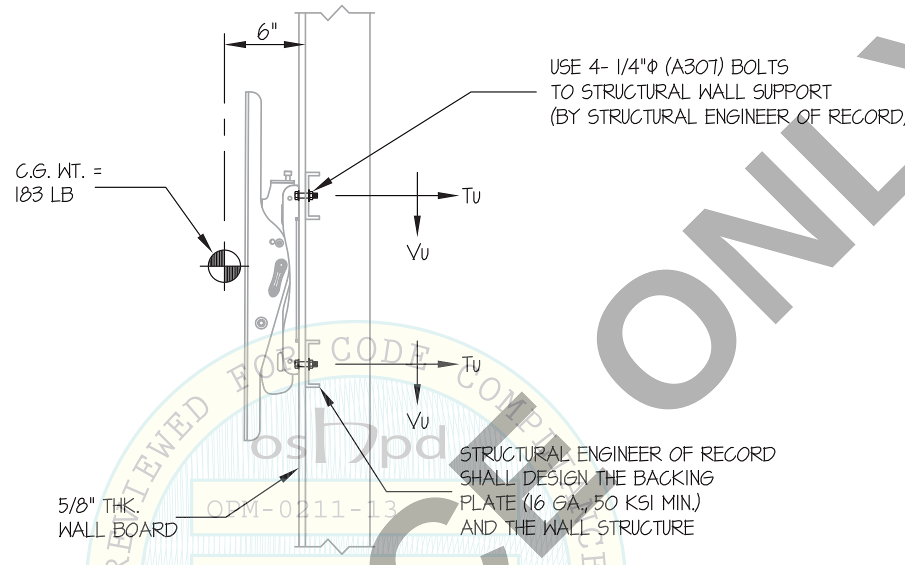
REGISTERED PROFESSIONAL ENGINEER JONATHAN ROBERSON No. 4197 EXP. 6-30-2016 7/27/15 STRUCTURAL STATE OF CALIFORNIA

26461 Rancho Parkway South, Lake Forest, CA 92630 949.916.3440 www.spirestructures.com

EASE — EQUIPMENT ANCHORAGE & SEISMIC ENGINEERING
www.EquipmentAnchorage.com

PEERLESS INDUSTRIES, INC.	DES. J. ROBERSON	SHEET 3
UNIVERSAL FLAT AND TILT WALL MOUNT FOR FLAT TV WEIGHT UP TO 175 LB	JOB NO. 11-1502	
	DATE 7/27/15	OF 8 SHEETS

SEISMIC SUPPORTS & ATTACHMENTS — WALL MOUNTED



STEEL STUD WALL SECTION
(FLAT MOUNT)

NOTES:

1. FORCES ARE DETERMINED PER 2013 CALIFORNIA BUILDING CODE AND ASCE 7-10 STRENGTH DESIGN IS USED. (S_{DS} = 2.20, a_p = 1.0, I_p = 1.5, R_p = 1.5, Ω_o = 1.5, $z/h \leq 1$)

   HORIZONTAL FORCE (E_h) = 2.64 W_p
   HORIZONTAL FORCE (E_{mh}) = 3.96 W_p (FOR CONCRETE ANCHORAGE)
   VERTICAL FORCE (E_v) = 0.44 W_p

2. CENTER OF GRAVITY (C.G.) AND WEIGHT ARE THE GOVERNING PARAMETERS FOR DESIGN. THIS PREAPPROVAL ENCOMPASSES ALL WEIGHTS UP TO THE MAXIMUM WEIGHT SHOWN.
3. STRUCTURAL ENGINEER OF RECORD FOR THE BUILDING SHALL PROVIDE SUPPORT STRUCTURE DESIGNED TO SUPPORT WEIGHTS AND FORCES SHOWN, IN COMBINATION WITH ALL OTHER LOADS THAT MAY BE PRESENT.
4. SEE GENERAL NOTES: SHEETS 1 AND 2

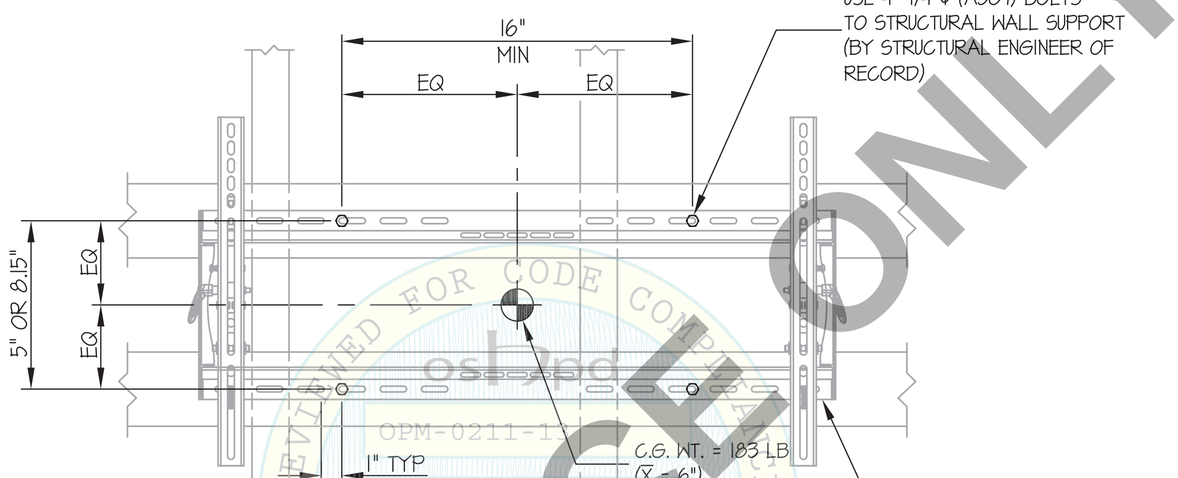
REGISTERED PROFESSIONAL ENGINEER — JONATHAN ROBERSON — No. 4197 — EXP. 6-30-2016 — 7/27/15 — STRUCTURAL — STATE OF CALIFORNIA

EQUIPMENT ANCHORAGE & SEISMIC ENGINEERING
www.EquipmentAnchorage.com

PEERLESS INDUSTRIES, INC.	DES. J. ROBERSON	SHEET 4
UNIVERSAL FLAT AND TILT WALL MOUNT FOR FLAT TV WEIGHT UP TO 175 LB	JOB NO. 11-1502	
	DATE 7/27/15	OF 8 SHEETS

SEISMIC SUPPORTS & ATTACHMENTS

WALL MOUNTED



T_u = 328 LB/BOLT (MAX)
V_u = 253 LB/BOLT (MAX)
(VALUES DO NOT INCLUDE Ω_0)

ELEVATION AT WALL PLATE
(FLAT MOUNT)

REGISTERED PROFESSIONAL ENGINEER JONATHAN ROBERSON No. 4197 EXP. 6-30-2016 7/27/15 STRUCTURAL STATE OF CALIFORNIA

NOT STRUCTURAL ENGINEER OF RECORD

Corners and intersections on the face of the cabinet and door are structurally formed for rigidity, cleanability and appearance. Both models are supported on a stainless-steel integral subbase. The cabinet doors are available in solid vinyl coated galvanized steel material with stainless steel inside and include optional tempered double pane glass window(s). Interior cabinet shelves (wire racks) are polyester powder coated steel. Interior air ducts and fan guards are flame retardant Acrylonitrile Butadiene Styrene (ABS) material. If a freestanding model, the cabinet top and side panels are vinyl coated galvanized steel.

Doors are of double-wall construction with 1-1/2" (38 mm) thick insulation between the walls. Right-hand door swing is provided; swing is reversible. Door closes against a heat-resistant, magnet-imbedded, vinyl gasket. Pivot type hinges are stainless steel.

Heating chamber compartment is insulated with 1" (25 mm) thick, fiberglass blanket. An impedance protected fan circulates air within the chamber to provide even heat distribution.

Lower chamber (dual-compartment model) includes two polyester powder coated steel wire rack shelves, adjustable in 3" (76 mm) increments. Door structure mounting, gasket and hinges are the same as the door on the upper chamber.

Chamber(s) is heated by an electric rod heater operating on 120 or 230 Volt, 50/60 Hz power.

ENGINEERING DATA

Unit	Approx. Unit Wt. lb (kg)
Single-Compartment:*	
18" (457 mm) Wall/Counter Mounting	131 (60)
18" (457 mm) Recess Mounting	105 (48)
24" (610 mm) Wall/Counter Mounting	142 (65)
24" (610 mm) Recess Mounting	115 (52)
Dual-Compartment:†	
18" (457 mm) Open-Mounted	324 (147)
18" (457 mm) Recessed Mounting	288 (131)
24" (610 mm) Open-Mounted	375 (170)
24" (610 mm) Recessed Mounting	328 (149)
24" (610 mm) Mobile Base	483 (219)

** For glass door option, add 6 lb (2.7 kg).*

† For all glass door options except 18" (457 mm), add 14 lb (6 kg); for 18" (457 mm) glass door option, add 48 lb (22 kg).

CONTROLS

Cabinet controls are digital and similar for single- and dual-compartment configurations. Both controls have a Main Power on/off switch.

The double cabinet control panel has control and temperature display functions for both cabinets. The upper cabinet control includes an on/standby key and digital temperature display. Also included is a °F/°C temperature display selection key and a SET temperature key with incremental raise/lower temperature set keys. LED lights indicate the on/standby status for cabinet heating, door ajar indication and SET selections have been made. The lower cabinet control includes an on/standby switch and digital temperature display. The lower cabinet also includes a SET temperature switch with incremental raise/lower temperature set keys. Temperature control lockout designates user adjustment.

The single cabinet control panel has control and temperature display functions including an on/standby switch, digital temperature display, °F/°C selection key and a SET temperature key with incremental raise/lower temperature set keys. LED lights indicate the on/standby status for cabinet heating, door ajar position and when SET selections have been made.

Upper compartment and single compartment controls include IV and IRR/Blanket mode setting switches, limiting temperature set ranges to 90-110°F (32.2-43.3°C) and 90-160°F (32.2-71.1°C), respectively. For lower compartment controls, the temperature selection range is 90-160°F (32.2-71.1°C).

Both controls monitor and regulate the heating of the interior compartment(s). The control for upper or single compartment ensures a temperature accuracy of ±3°F (±1.7°C) when warming IV/irrigation solution. The control for lower compartment ensures a temperature accuracy of ±5°F (±2.8°C) when warming irrigation solution.

An overtemperature alarm visually and audibly alerts operator should an overtemperature condition occur (chamber temperature greater than 10°F [5.5°C] above set temperature). In the event of an overtemperature condition, the overtemperature control automatically turns off the heater(s).

An optional USB peripheral connection allows Customer to plug a PC or laptop computer into the warming cabinet to retrieve stored temperature data from control memory. The data is stored or printed from the computer. Data capture software for use on PC is provided with the warming cabinet.

MOUNTING ARRANGEMENT

Dual-compartment models may be installed as freestanding or recessing into a partition wall. If model is recess installed, a synthetic-rubber sealing gasket is provided to ensure close fit of cabinet front to the face of the wall partition. Recessed cabinet requires no supplementary supports behind the wall partition (except in seismic locations).

Single-compartment models may be installed freestanding on shelf or counter surfaces or recessed into a partition wall.

OPTIONS

Mobile base with bumpers (for dual 24" [610 mm] deep cabinets only). Casters are used to allow warming cabinet mobility. Press foot lever down to lock; push foot lever in to unlock.

USB port for temperature recording.

Electrical numeric keypad door locks are available for keyless entry.

PREVENTIVE MAINTENANCE

A global network of skilled service specialists can provide periodic inspections and adjustments to help ensure cost-effective performance. STERIS representatives can provide information regarding annual maintenance agreements.

NOTES

1. Due to the variety of building constructions employed, fasteners for mounting cabinet to wall are not provided by STERIS. Wall(s) must be adequately reinforced to support operating weight of cabinet.
2. Customer must ensure warming cabinet is installed per applicable seismic requirements.

INTERNAL DIMENSIONS AND CAPACITY

Unit	Upper Chamber Single Chamber Unit (Height x Width x Depth)	Lower Chamber Double Chamber Unit (Height x Width x Depth)
18" Depth	13-1/2 x 24 x 16-7/8" = 3.1 cu. ft. (343 x 610 x 429 mm)	36-1/2 x 24 x 16-7/8" = 8.5 cu. ft. (927 x 610 x 429 mm)
24" Depth	13-1/2 x 24 x 22-7/8 = 4.2 cu. ft. (343 x 603 x 581 mm)	36-1/2 x 24 x 22-7/8" = 11.6 cu. ft. (927 x 603 x 581 mm)

UTILITY REQUIREMENTS – Single Compartment Model

Electricity (E)

120 Volt, 50/60 Hz, 1-Phase, 7.0 Amps, 840 Watts; or
230 Volts, 50/60 Hz, 1-Phase, 3.6 Amps, 869 Watts

CUSTOMER IS RESPONSIBLE FOR COMPLIANCE WITH APPLICABLE LOCAL AND NATIONAL CODES AND REGULATIONS.

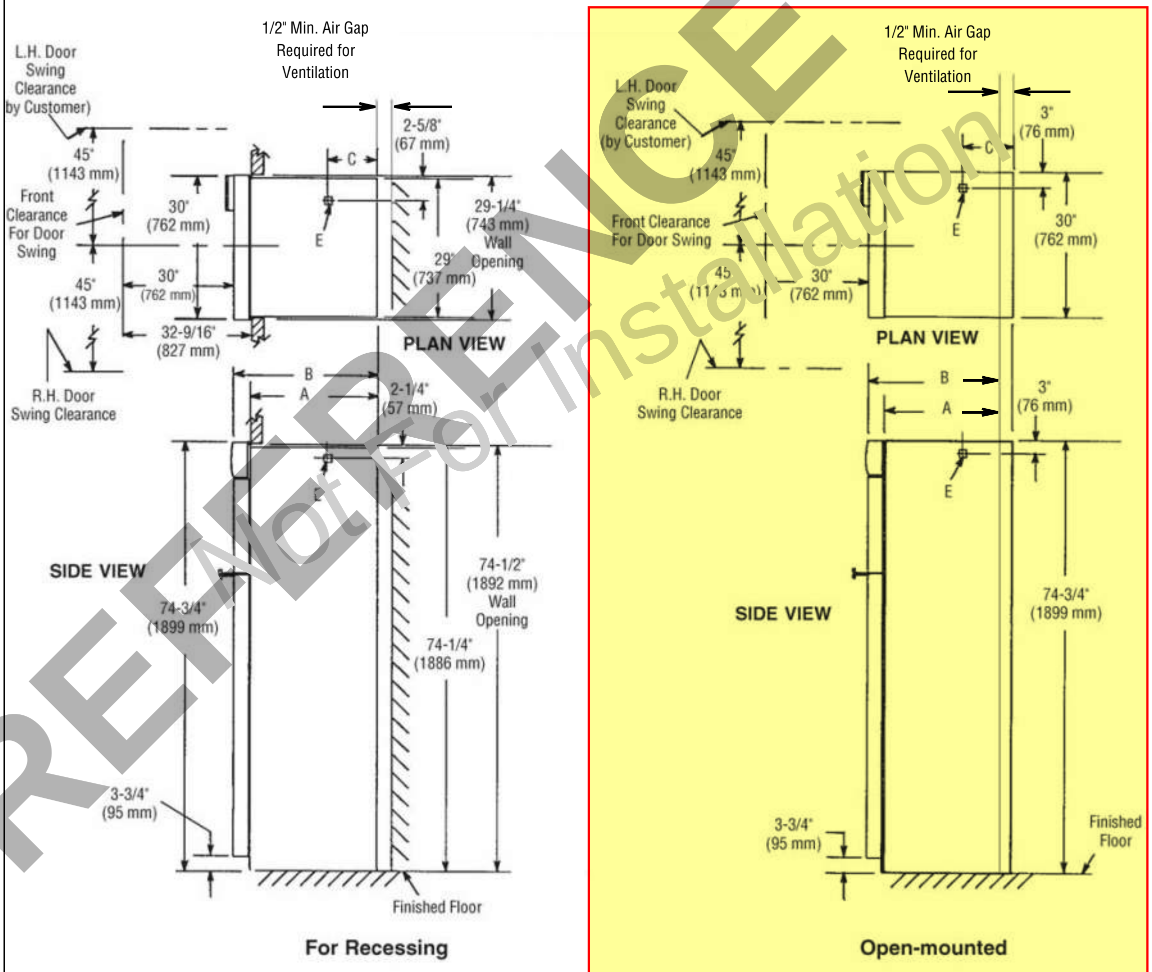
Reference listed equipment drawing for detailed installation specifications.
Obtain this drawing from your STERIS Representative.

Equip. Dwg. No.	Equipment Drawing Title
413726-638	30 x 18 x 74" Warming Cabinet Electric, Freestanding or Recessed Dual Compartment
413726-640	30 x 24 x 74" Warming Cabinet Electric, Freestanding or Recessed Dual Compartment

Dimensions are typical – drawing is not to scale.

DUAL-COMPARTMENT MODEL

Model	Dimensions – inches (mm)		
	A	B	C
18" (457 mm)	18 (517)	20-1/2" (521)	7 (178)
24" (610 mm)	24 (610)	26-1/2 (673)	10 (254)



Sheet:

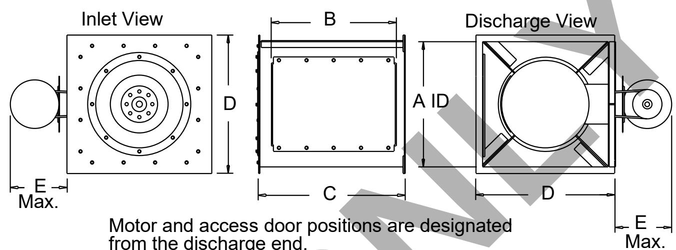
Job:	18SHA11 ARMC Ambulatory Clinic			A14
Calc By:	ISG	Date:	02/21/19	

MARK: EF-1
PROJECT: COOK FANS
DATE: 1/10/2019

SQI-B

Square Centrifugal
Inline
Belt Drive

STANDARD CONSTRUCTION FEATURES:
All aluminum wheel - Minimum 18 gauge Lorenized steel housing - Hinged access door sizes 90 thru 180 - Removable access door sizes 195 thru 402 - Straightening vanes - Bearings rated at 200,000 hours average life - Adjustable pitch drives through 5 hp - All fans factory adjusted to specified fan RPM.



Motor and access door positions are designated from the discharge end.
3:00 motor & 9:00 access door positions shown.

Performance (*Bhp includes 7% drive loss)

Qty	Catalog Number	Flow (CFM)	SP (inwc)	Fan RPM	Power* (HP)	FEG
1	165SQIB	3700	1.00	1617	1.75	56

Altitude (ft): 0 Temperature (F): 70

Motor Information

HP	RPM	Volts/Ph/Hz	Enclosure	FLA	Position	Mounted
2	1725	208/1/60	ODP -SE	13.2	3:00	Yes

FLA based on NEC (2014) Table 430.248

Fan Information

Fan Mount	Access
Horz. Ceiling	9:00

Sound Data Inlet Sound Power by Octave Band

1	2	3	4	5	6	7	8	LwA	dBA	Sones
91	95	92	88	82	78	74	69	89	78	30

Accessories:
DRIVES (1.5 SF) @ 1617 RPM
GRAV DAMPER-165 SQI

Dimensions (inches)

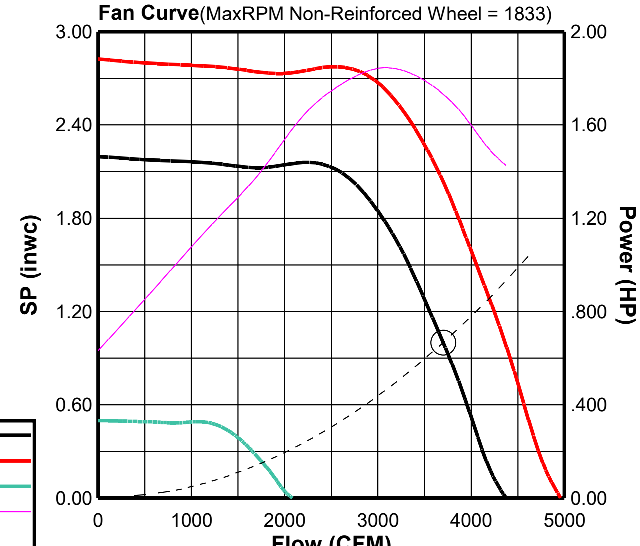
A	23-13/16
B	25-5/16
C	27-3/4
D	26-15/16
E	14-5/16

NOTE: Accessories may affect dimensions shown.

Weight(lbs)***	Shipping	310	Unit	208

***Includes fan, motor & accessories.

Fan Curve(MaxRPM Non-Reinforced Wheel = 1833)



Fan Curve Legend

CFM vs SP (1617)	
MaxRPM(1833)	
MinRPM(771)	
CFM vs HP	
Point of Operation	◯
System Curve	---------------

v9.8.136.0

Job:	18SHA11 ARMC Ambulatory Clinic			Sheet: A15
Calc By:	ISG	Date:	02/21/19	

SPIRE STRUCTURAL ENGINEERING inc

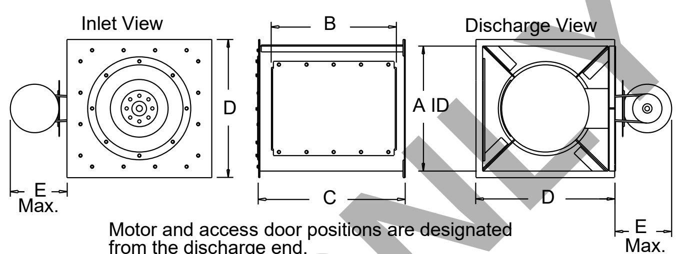
COOK

MARK: RF-1
PROJECT: COOK FANS
DATE: 1/10/2019

SQI-B

Square Centrifugal
Inline
Belt Drive

STANDARD CONSTRUCTION FEATURES:
All aluminum wheel - Minimum 18 gauge Lorenized steel housing - Hinged access door sizes 90 thru 180 - Removable access door sizes 195 thru 402 - Straightening vanes - Bearings rated at 200,000 hours average life - Adjustable pitch drives through 5 hp - All fans factory adjusted to specified fan RPM.



Motor and access door positions are designated from the discharge end.
3:00 motor & 9:00 access door positions shown.

Performance (*Bhp includes 5% drive loss)

Qty	Catalog Number	Flow (CFM)	SP (inwc)	Fan RPM	Power* (HP)	FEG
1	300SQIB	14500	1.50	949	7.37	63

Altitude (ft): 0   Temperature (F): 70

Motor Information

HP	RPM	Volts/Ph/Hz	Enclosure	FLA	Position	Mounted
7-1/2	1725	460/3/60	ODP -PE	11	3:00	Yes

NEMA Premium® efficiency motor per MG-1 (2014) Table 12-12
FLA based on NEC (2014) Table 430.250

Dimensions (inches)

A	43-7/16
B	47-13/16
C	50-7/16
D	46-1/2
E	17-1/2

NOTE: Accessories may affect dimensions shown.

Weight(lbs)***	Shipping	615	Unit	431

***Includes fan, motor & accessories.

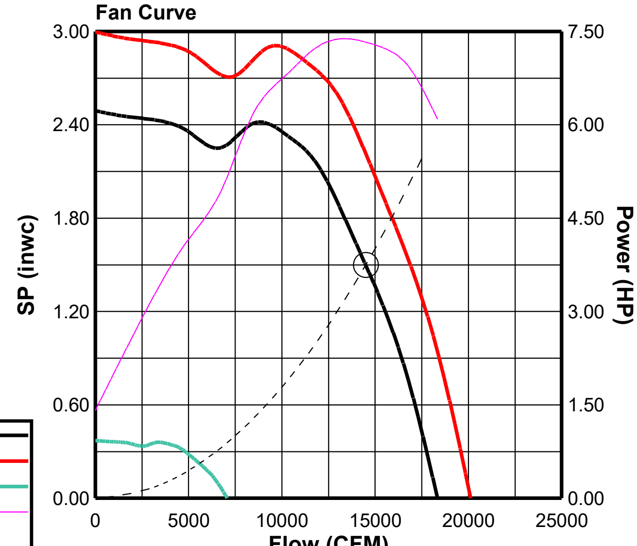
Fan Information

Fan Mount	Access
Horz. Ceiling	9:00

Sound Data Inlet Sound Power by Octave Band

1	2	3	4	5	6	7	8	LwA	dBA	Sones
88	91	94	85	83	80	73	66	90	78	30

Accessories:
Premium Efficiency Motor (Min. 91.0%)
DRIVES (1.5 SF) @ 949 RPM
REINFORCED WHEEL



Fan Curve Legend

CFM vs SP (949)
MaxRPM(1041)
MinRPM(366)
CFM vs HP
Point of Operation
System Curve

v9.8.136.0