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APC

Netshelter SX,
AR3100

Structural Calculations For Seismic Anchorage

Prepared for:
APC Corp.

January 27, 2006
RMJ Job No. 05240

103 Linden Avenue
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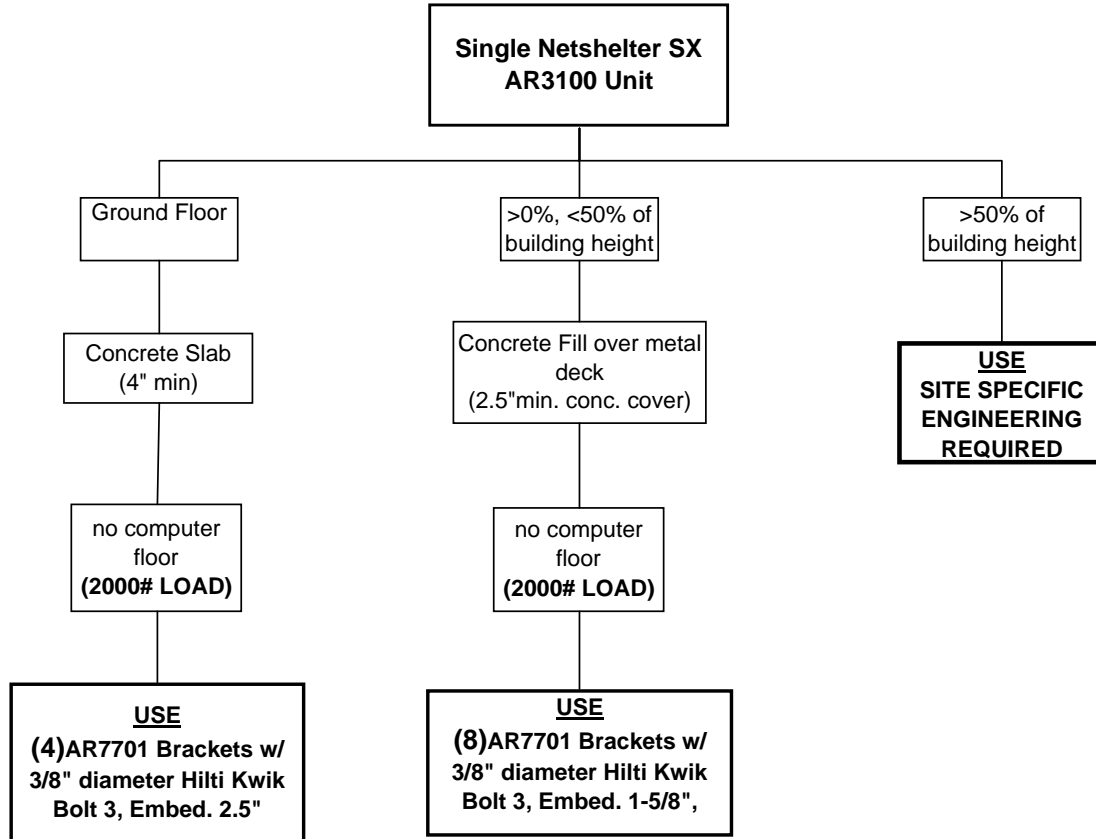
APC

Netshelter SX AR3100

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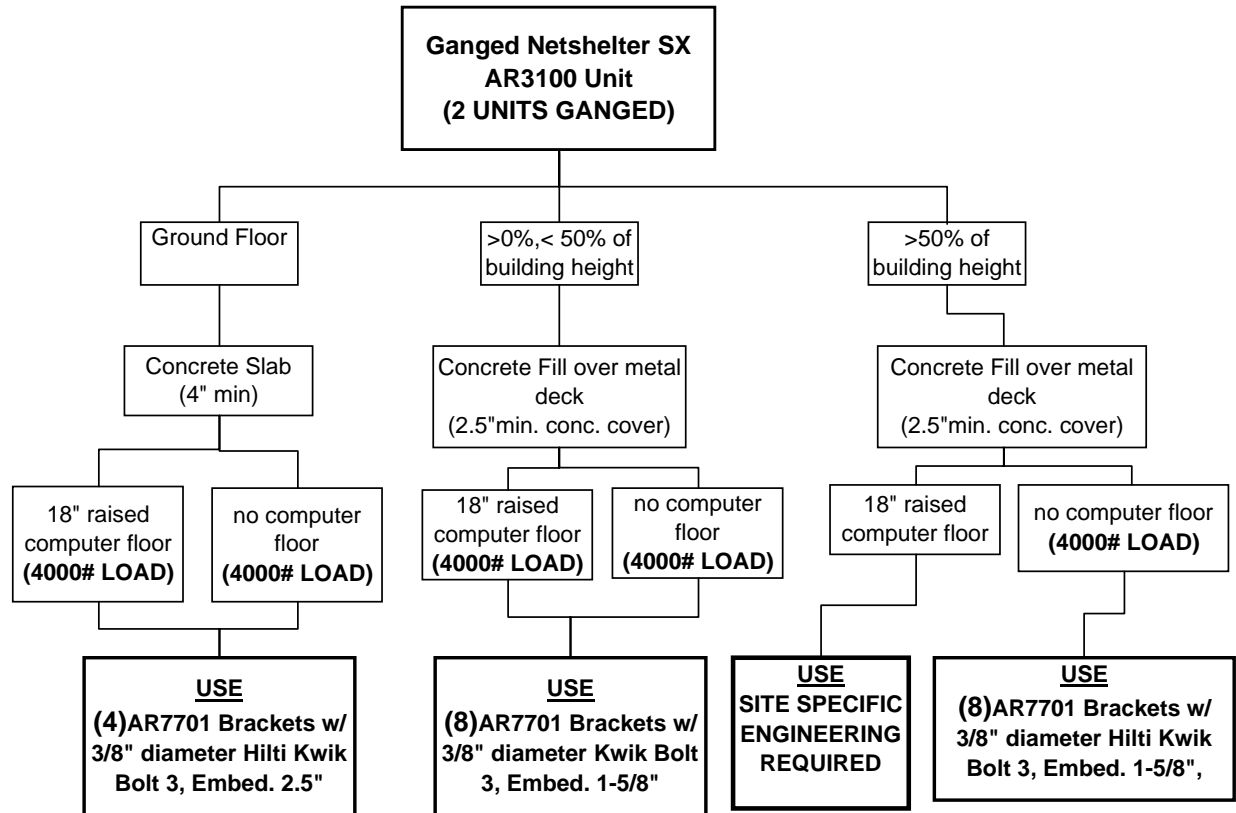
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Summary: AR3100 - Zone 4 (CALIFORNIA)



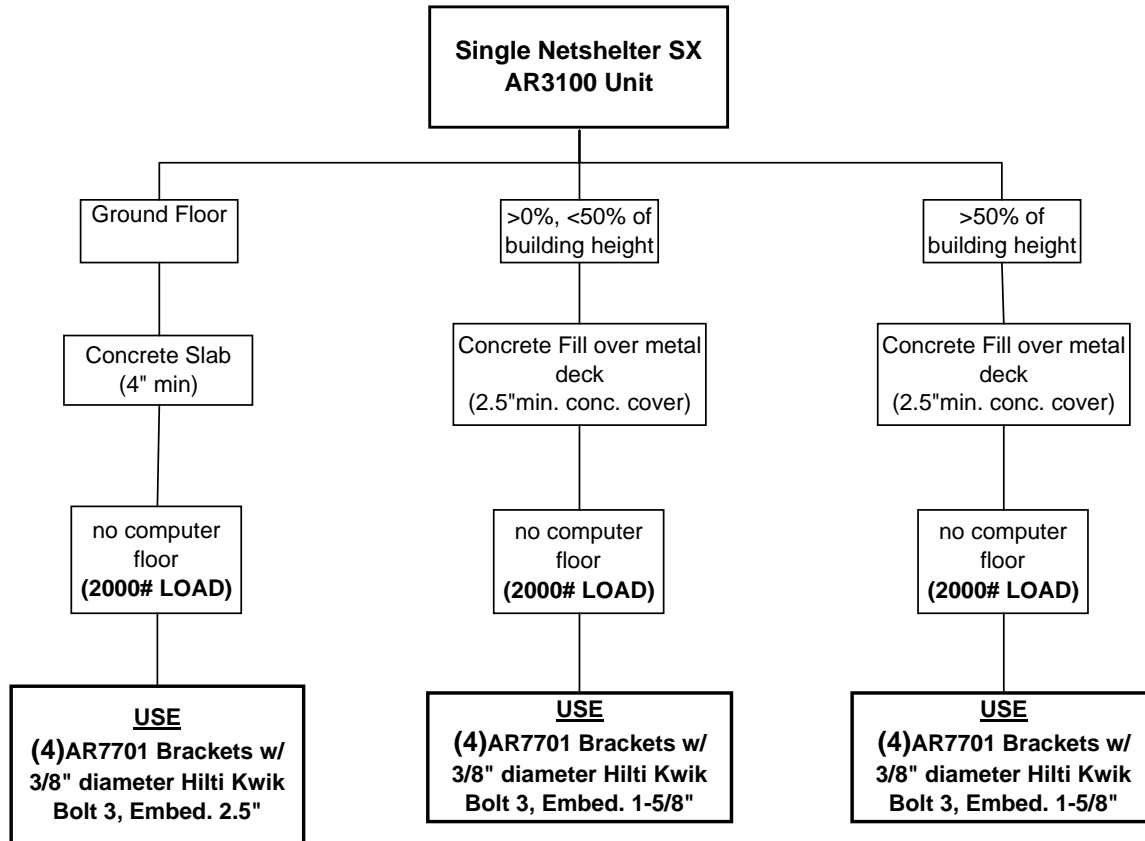
NOTE: (1) APC 870-11101A pallette bracket may be used in lieu of (2) APC7701 brackets : RAISED FLOORS >18" REQUIRE SITE SPECIFIC ENGINEERING

Summary: AR3100 - Zone 4 (CALIFORNIA)



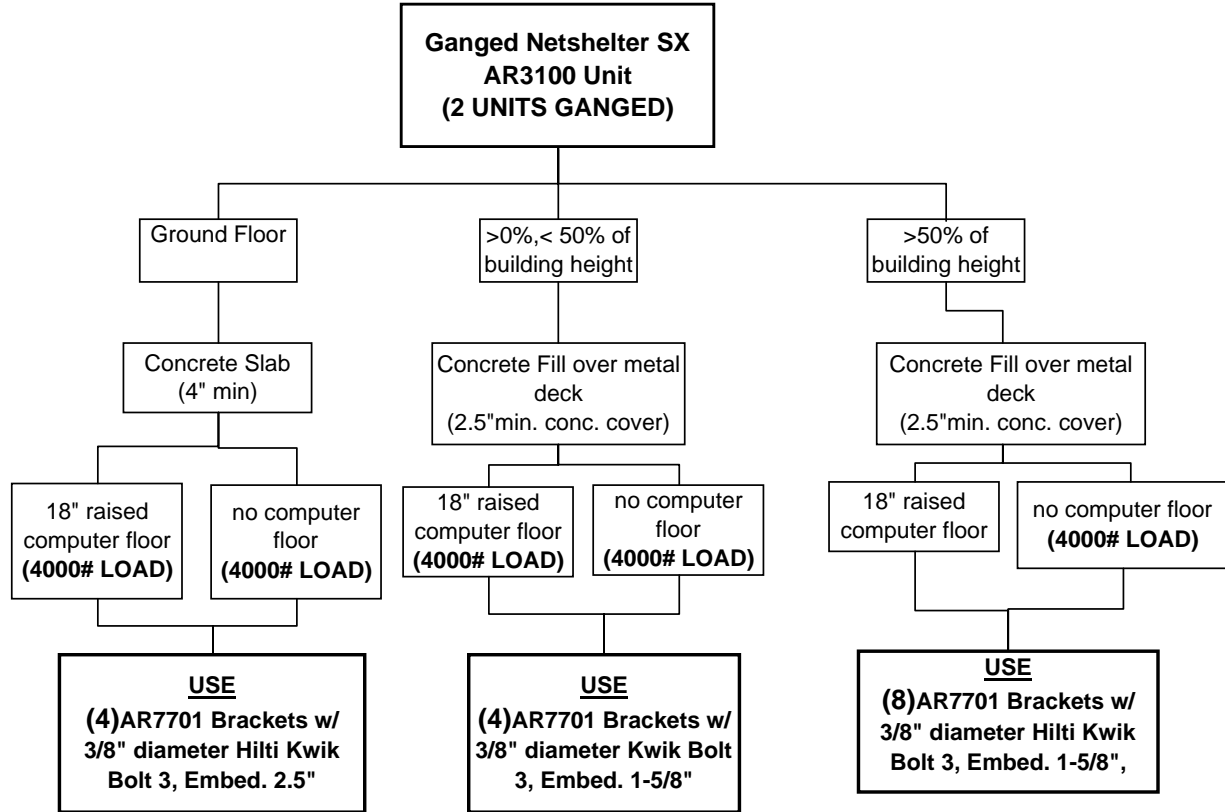
NOTE: (1) APC 870-11101A pallette bracket may be used in lieu of (2) APC7701 brackets : RAISED FLOORS >18" REQUIRE SITE SPECIFIC ENGINEERING

Summary: AR3100 - Zone 0-3 (NON-CALIFORNIA)



NOTE: (1) APC 870-11101A pallette bracket may be used in lieu of (2) APC7701 brackets : RAISED FLOORS >18" REQUIRE SITE SPECIFIC ENGINEERING

Summary: AR3100 - Zone 0-3 (NON-CALIFORNIA)



**NOTE: (1) APC 870-11101A pallette bracket may be used in lieu of (2) APC7701 brackets
: RAISED FLOORS >18" REQUIRE SITE SPECIFIC ENGINEERING**

NOTES:

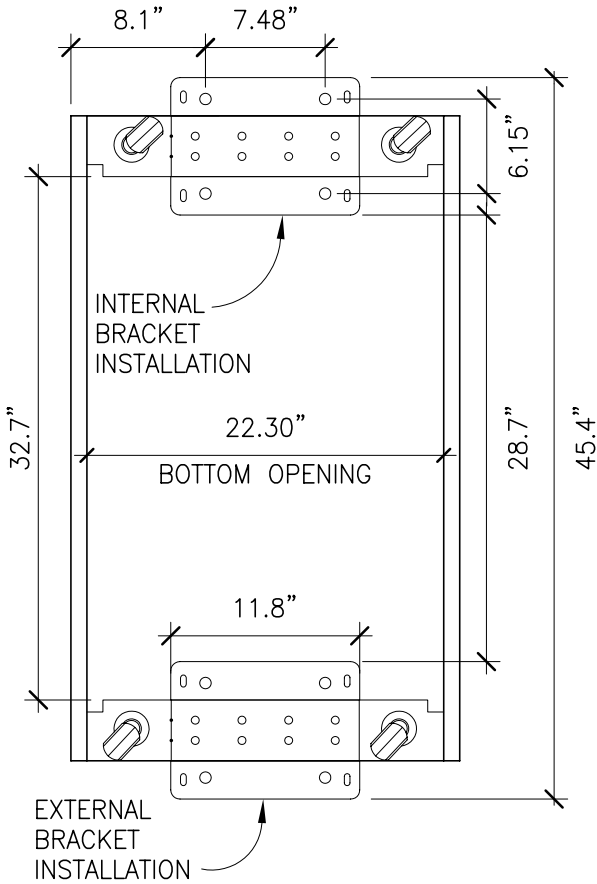
*SEE SUMMARY SHEET AND CONDITION SCHEDULE SCHEDULE FOR BOLTING AND BRACKET REQUIREMENTS.

*(1)870-1101A PALLET BRACKET MAY BE USED IN LIEU OF (2)AR7701 BOLT-DOWN BRACKETS

*POSITION BOLTS IN OUTER OR UPPER HALF OF SLOTTED BOLT HOLES WHERE APPLICABLE

CONDITION SCHEDULE

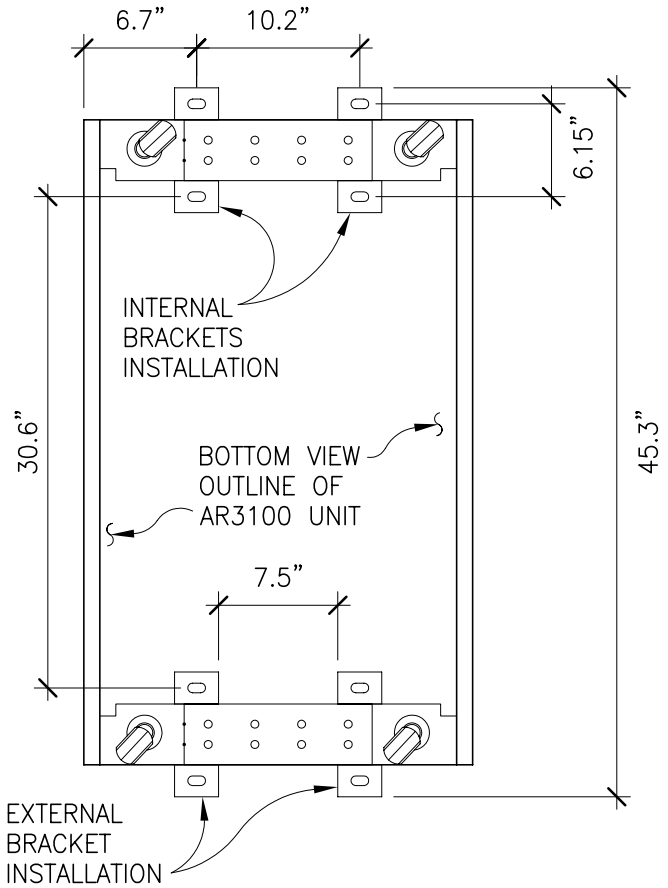
CONDITION	SEE
CONCRETE SLAB	SK3
CONCRETE FILL OVER METAL DECK	SK4



SHOWN w/870-11101A

PALLET BRACKETS

(2 BRACKETS INCLUDED)



SHOWN w/AR7701


BOLT-DOWN BRACKETS

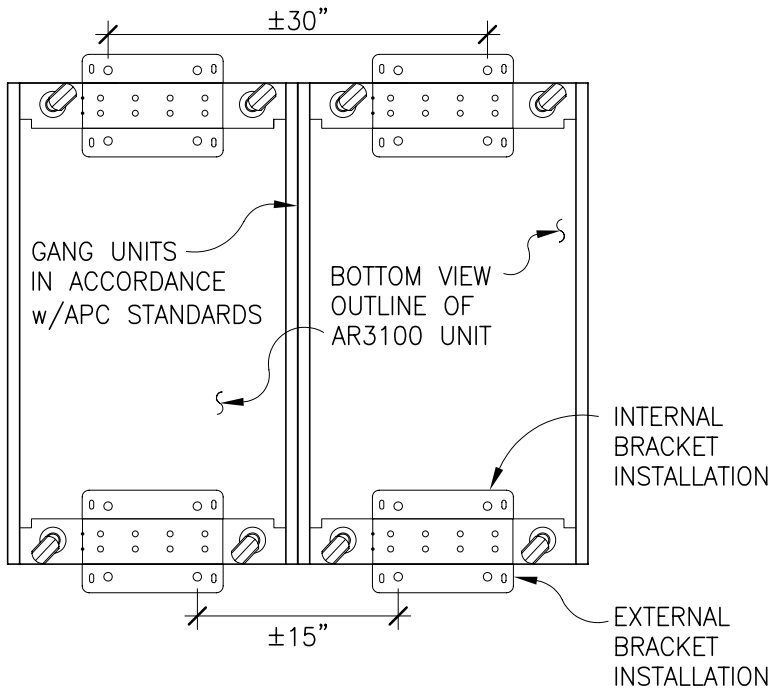
(QTY (4) SOLD SEPARATELY)



GANGED UNIT BOTTOM PLAN VIEW

(FOR EXACT UNIT DIMENSIONS SEE APC TECHNICAL INFORMATION)

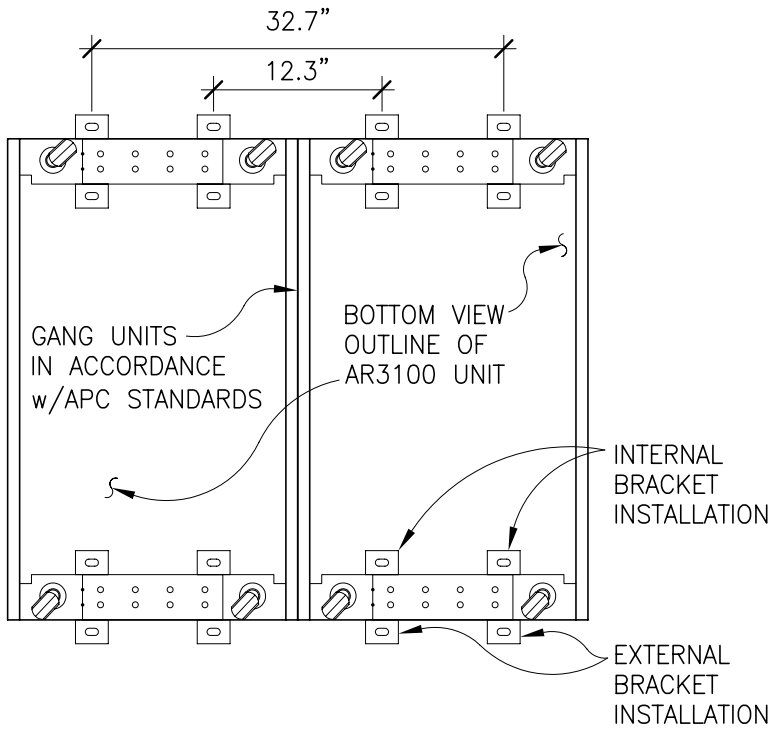
 <p>Robinson Meier Jullily & Associates 103 Linden Avenue So. San Francisco, CA 94080 650 871-2282 Fax: 871-2459</p>	<p>APC UNIT ANCHORAGE</p>	<p>Job No. 05240</p>
	<p>NETSHELTER SX AR3100</p>	<p>Sheet No. 6</p>
	<p>Signed by A.M. Date 12/2005</p>	



**SHOWN w/870-11101A
PALLET BRACKETS**

(2 PALLET BRACKETS INCLUDED w/EACH AR3100 UNIT, 8 SHOWN)

(FOR INFORMATION NOT SHOWN and ADDITIONAL NOTES REGARDING UNIT INSTALLATION, SEE (SK1))




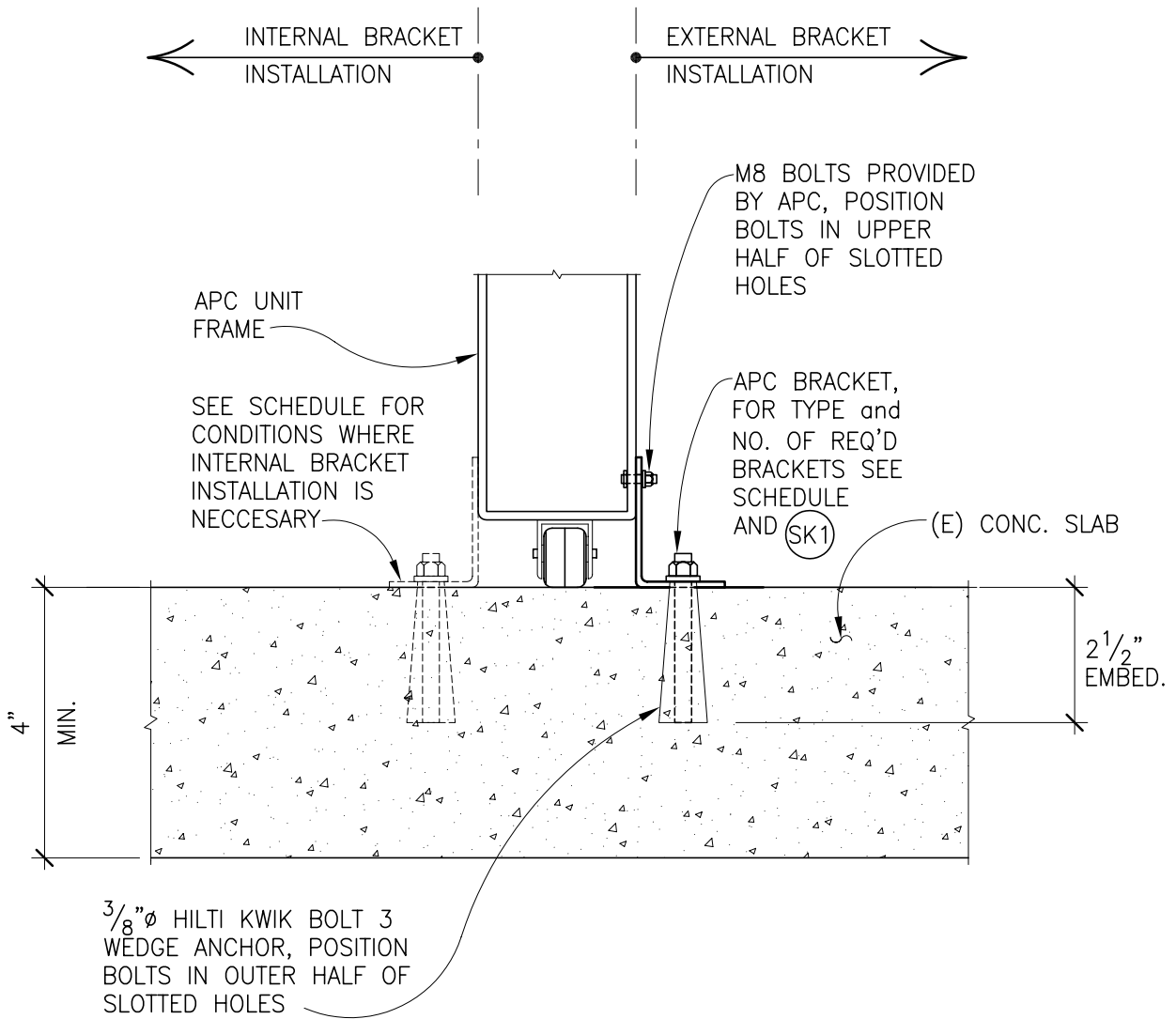
**SHOWN w/AR7701
BOLT-DOWN BRACKETS**
(4 BRACKETS INCL w/EA. UNIT, 16 BRACKETS SHOWN)

CONDITION SCHEDULE

CONDITION	SEE
CONCRETE SLAB	(SK3)
CONCRETE FILL OVER METAL DECK	(SK4)
COMP. FLOOR SYSTEM	(SK5)


**GANG UNIT BOTTOM PLAN VIEW
(2 UNITS MIN. GANGED TOGETHER)**

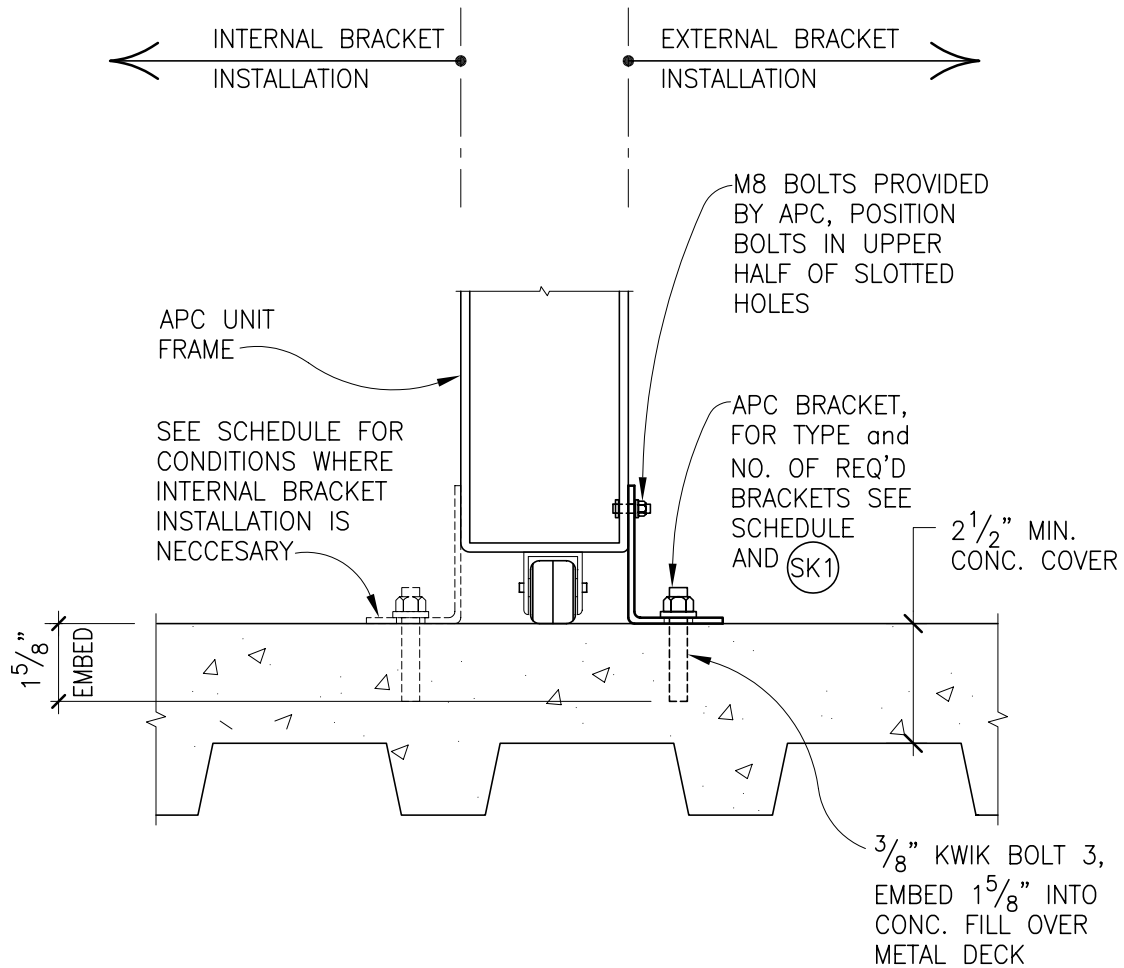
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**CONCRETE SLAB
INSTALLATION**


DETAIL
3" = 1'-0"

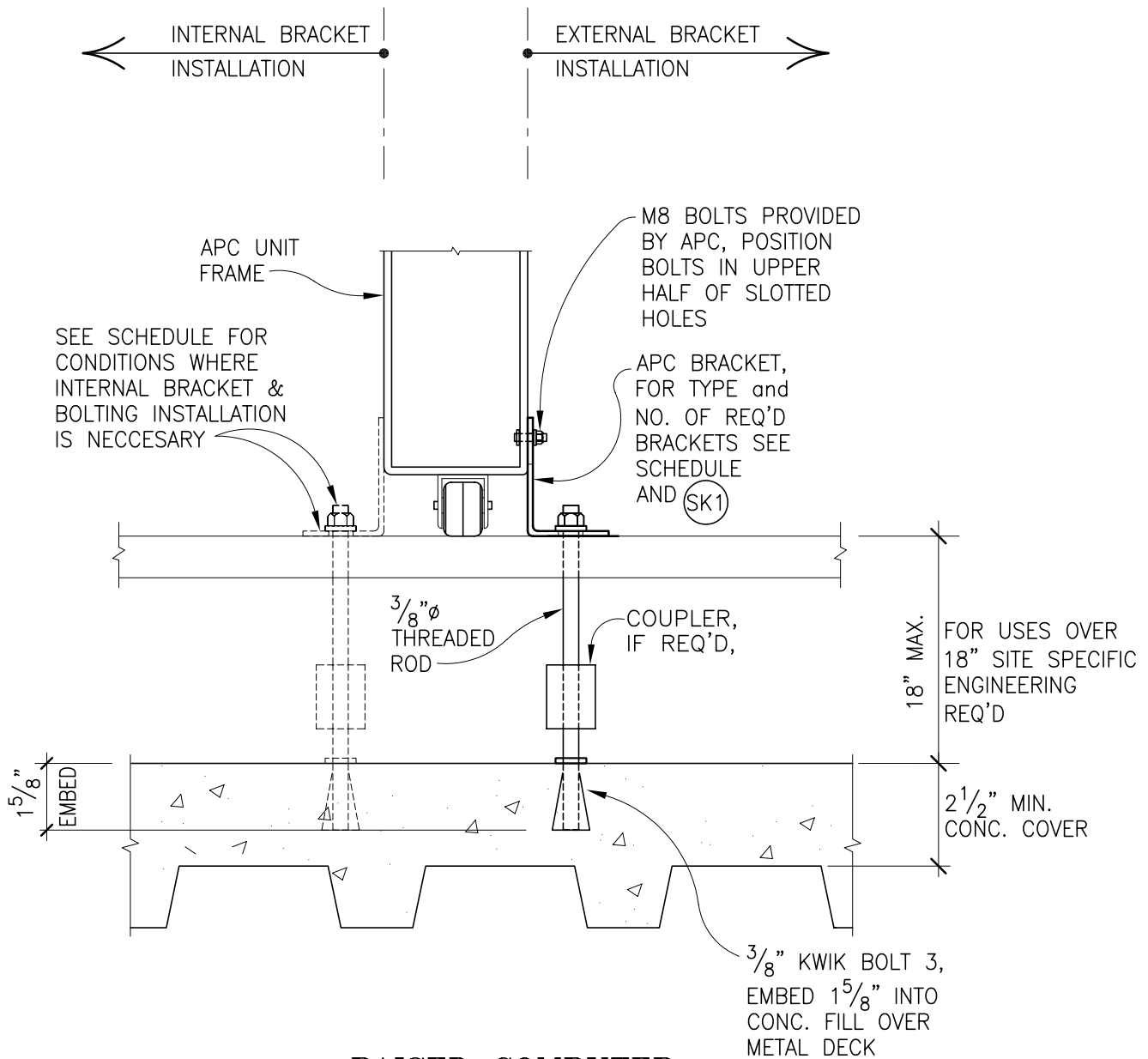
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**CONCRETE FILL
OVER METAL DECK
INSTALLATION**

DETAIL
3" = 1'-0"

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	NETSHELTER SX AR3100	Sheet No. 9
	Signed by A.M.	Date 12/2005




**RAISED COMPUTER
FLOOR INSTALLATION**

DETAIL

3" = 1'-0"

NOTE: FOR RAISED COMPUTER FLOORS OVER CONCRETE SLAB CONDITION, SEE (SK3) SIM.

 <p>Robinson Meier Jully & Associates</p> <p>103 Linden Avenue So. San Francisco, CA 94080 650 871-2282 Fax: 871-2459</p>	<p>APC UNIT ANCHORAGE</p>	<p>Job No. 05240</p>
	<p>NETSHELTER SX AR3100</p>	<p>Sheet No. 10</p>
	<p>Signed by A.M. Date 12/2005</p>	

Load Case: Single Fully Loaded Unit (Ground Floor)

Unit Dimensions	
Length (in) =	23.6
Width (in) =	42.1
Frame Height (in) =	77

Unit	Part	Weight (lbs)	Center of Gravity Location		
			X (in)	Y (in)	Z (in)
AR3100	Frame	275.2	11.8	21.05	38.5
	Max Load	2000			38.5

Longitudinal Anchorage Spacing (in) = 9.65
 Transverse Anchorage Spacing (in) = 30.6 (internal brackets)

Seismic Force	
	(Zone 4, $N_a=1.5$, <2km Type A Fault)
$C_a =$	0.66
$I_p =$	1.0 (Importance)
$a_p =$	1.0 (Cabinets)
$R_p =$	3.0 (Cabinets)
$h_x/h_r =$	0.0 (Floor)
$F_p =$	0.157 W
$F_{p,min} =$	0.33 W
$F_{p,max} =$	1.89 W
Use $F_p =$	0.33 W

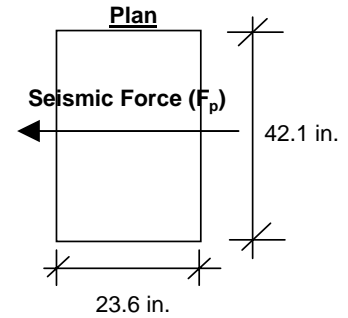
Longitudinal Overturning

Overturning Moment = $0.33 (77/2 \text{ in.} \times (275.2 \text{ lbs.} + 2000 \text{ lbs.})) = 28906 \text{ lb-in}$

0.9xResisting Moment = $0.9 (275.2 \text{ lbs.} + 2000 \text{ lbs.}) \times 11.8 \text{ in.} = 24163 \text{ lb-in}$

Anchorage Force =	491.6 lbs
Shear Force =	750.8 lbs.

Netshelter SX Unit



Design Bolts for 491.6 lbs tension, 750.8 lbs. shear, longitudinal direction, fully loaded

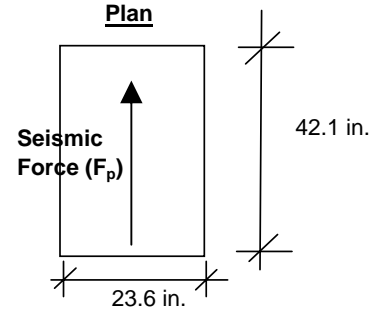
Transverse Overturning

Overturning Moment = $0.33 (77/2 \text{ in.} \times (275.2 \text{ lbs.} + 2000 \text{ lbs.})) = 28906 \text{ lb-in}$

0.9xResisting Moment = $0.9 (275.2 \text{ lbs.} + 2000 \text{ lbs.}) \times 21.05 \text{ in.} = 43104 \text{ lb-in}$

Anchorage Force =	0 lbs
Shear Force =	750.8 lbs.

Netshelter SX Unit



Design Bolts for 0 lbs tension, 750.8 lbs. shear, transverse direction, fully loaded



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APC Netshelter SX AR 3100
 Zone 4 Anchorage
 Job No. 05240
 By: AM Date: 1/27/2006

AR3100 Anchorage - Zone 4

Load Cases:

AR3100 Single Fully Loaded Unit (Ground Floor)

ANCHORAGE FORCES

CONDITION	ANCHORAGE FORCE (LBS.)	SHEAR FORCE (LBS.)
SINGLE UNIT	491.6	750.8

ANCHORAGE DESIGN

CONCRETE: Use Hilti Kwik Bolt 3 Anchors (ICC ESR-1385)

Number of Brackets Used: 4

Anchor Diameter (in²): 0.375

Embedment Length (in.): 2.5

Embed. length /Dia = 6.67

shallow anchor, increase load per UBC 1632.2

Min. Conc Slab Thickness (1.5x embed. Length) 3.75 in. slab, min.

(Note: If shallow Anchor applies, increase load by factor of 2, UBC97 1632.2)

Anchor Capacities:

with 1/3 seismic increase

Tension (lbs.) = 712 **949.3**
 Shear (lbs.) = 1255 **1673.3**

CHECK SHEAR & TENSION STRESS RATIO

T_{max} = 983.2 lbs.

V_{max} = 1501.6 lbs.

T_a = 2x949.3 lbs. = 1898.6 lbs.

V_{all} = 2x1673.3 lbs. = 3346.6 lbs.

<u>Tension</u>	983.2/1898.6 =	0.52	tension stress ratio
<u>Shear</u>	1501.6/3346.6 =	0.45	shear stress ratio

SUMMARY

CONCRETE:

3.75 in. slab, min. Use Hilti Kwik Bolt 3 Anchors (ICC ESR-1385), embed. 2.5 in.

Use 4 brackets total, one anchor/bracket

Load Case: Ganged Fully Loaded Unit (Ground Floor)

of Units ganged (max)= 2

Single Unit Dimension			Center of Gravity Location		
Length (in) =		23.6			
Width (in) =		42.1			
Frame Height (in) =		77			
Frame Weight (lb.) =		275.2			
Unit	Part	Weight (lbs)	X (in)	Y (in)	Z (in)
2 - AR3100	Frame	550.4	23.6	21.05	38.5
	Max Load	4000			38.5

Seismic Force	
	(Zone 4, $N_a=1.5$, <2km San Andreas Fault)
$C_a =$	0.66
$I_p =$	1.0 (Importance)
$a_p =$	1.0 (Cabinets)
$R_p =$	3.0 (Cabinets)
$h_x/h_r =$	0.0 (Floor)
$F_p =$	0.157 W
$F_{p,min} =$	0.33 W
$F_{p,max} =$	1.89 W
Use $F_p =$	0.33 W

(2000lbs.x 2units)
 Longitudinal Anchorage Spacing (in) = 33
 Transverse Anchorage Spacing (in) = 30.6 (internal brackets)

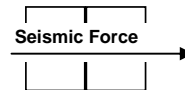
Longitudinal Overturning

Overturning Moment = 0.33 (77/2 in. x (550.4lbs. +4000 lbs.)) = 57813 lb-in

0.9xResisting Moment = 0.9 (550.4 lbs. + 4000 lbs.) x23.6 in. = 96650 lb-in

Anchorage Force =	0	lbs
Shear Force =	1501.6	lbs.

Netshelter SX plan



2 ganged units

Design Bolts for 0 lbs tension, 1501.6 lbs. shear, longitudinal direction, ganged fully loaded

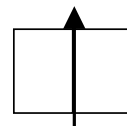
Transverse Overturning

Overturning Moment = 0.33 (77/2 in. x (550.4lbs. +4000 lbs.)) = 57813 lb-in

0.9xResisting Moment = 0.9 (550.4 lbs. + 4000 lbs.) x21.05 in. = 86207 lb-in

Anchorage Force =	0	lbs
Shear Force =	1501.6	lbs.

Seismic Force



2 ganged units

Netshelter SX plan

Design Bolts for 0 lbs tension, 1501.6 lbs. shear, transverse direction, ganged fully loaded

Load Case: Ganged Fully Loaded Unit (On 18" raised computer floor, Ground Floor)

of Units ganged (max)= 2

Single Unit Dimension			Center of Gravity Location		
Length (in) =		23.6			
Width (in) =		42.1			
Frame Height (in) =		77			
Frame Weight (lb.) =		275.2			
Unit	Part	Weight (lbs)	X (in)	Y (in)	Z (in)
2 - AR3100	Frame	550.4	23.6	21.05	56.5
	Max Load	4000			56.5

Seismic Force	
	(Zone 4, $N_a=1.5$, <2km San Andreas Fault)
$C_a =$	0.66
$I_p =$	1.0 (Importance)
$a_p =$	1.0 (Cabinets)
$R_p =$	3.0 (Cabinets)
$h_x/h_r =$	0.0 (Floor)
$F_p =$	0.157 W
$F_{p,min} =$	0.33 W
$F_{p,max} =$	1.89 W
Use $F_p =$	0.33 W

(2000lbs.x 2units)
 Longitudinal Anchorage Spacing (in) = 33
 Transverse Anchorage Spacing (in) = 30.6

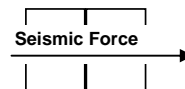
Longitudinal Overturning

Overturning Moment = $0.33 (77/2 \text{ in.} \times (550.4\text{lbs.} + 4000 \text{ lbs.})) = 84842 \text{ lb-in}$

0.9xResisting Moment = $0.9 (550.4 \text{ lbs.} + 4000 \text{ lbs.}) \times 23.6 \text{ in.} = 96650 \text{ lb-in}$

Anchorage Force =	0	lbs
Shear Force =	1501.6	lbs.

Netshelter SX plan



2 ganged units

Design Bolts for 0 lbs tension, 1501.6 lbs. shear, longitudinal direction, ganged fully loaded

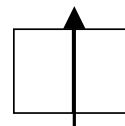
Transverse Overturning

Overturning Moment = $0.33 (77/2 \text{ in.} \times (550.4\text{lbs.} + 4000 \text{ lbs.})) = 84842 \text{ lb-in}$

0.9xResisting Moment = $0.9 (550.4 \text{ lbs.} + 4000 \text{ lbs.}) \times 21.05 \text{ in.} = 86207 \text{ lb-in}$

Anchorage Force =	0	lbs
Shear Force =	1501.6	lbs.

Seismic Force



2 ganged units

Netshelter SX plan

Design Bolts for 0 lbs tension, 1501.6 lbs. shear, transverse direction, ganged fully loaded



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 Zone 4 Anchorage
 Job No. 05240
 By: AM Date: 1/27/2006

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AR3100 Anchorage - Zone 4

Load Cases:

Ganged Fully Loaded Unit (Ground Floor)

Ganged Fully Loaded Unit (On 18" raised computer floor, Ground Floor)

ANCHORAGE FORCES

CONDITION	ANCHORAGE FORCE (LBS.)	SHEAR FORCE (LBS.)
GANGED UNIT	0	1501.6

ANCHORAGE DESIGN

CONCRETE: Use Hilti Kwik Bolt 3 Anchors (ICC ESR-1385)

Number of Brackets Used: 4

Anchor Diameter (in²): 0.375

Embedment Length (in.): 2.5

Embed. length /Dia = 6.67

shallow anchor, increase load per UBC 1632.2

Min. Conc Slab Thickness (1.5x embed. Length) 3.75 in. slab, min.

(Note: If shallow Anchor applies, increase load by factor of 2, UBC97 1632.2)

Anchor Capacities:

with 1/3 seismic increase

Tension (lbs.) = 712 949.3
 Shear (lbs.) = 1255 1673.3

CHECK SHEAR & TENSION STRESS RATIO

Tmax = 0.0 lbs.

Vmax = 3003.3 lbs.

Ta = 2x949.3 lbs. = 1898.6 lbs.

V_all = 2x1673.3 lbs. = 6693.2 lbs.

<u>Tension</u>	0.0/1898.6 =	0.00	tension stress ratio
<u>Shear</u>	3003.3/6693.2 =	0.45	shear stress ratio

SUMMARY

CONCRETE:

3.75 in. slab, min. Use Hilti Kwik Bolt 3 Anchors (ICC ESR-1385), embed. 2.5 in.

Use 4 brackets total, one anchor/bracket

Load Case: Single Fully Loaded Unit (<=50% OF BUILDING HEIGHT)

(note: 50% of building height means 2nd of 4 story building or 4th of 8th story building)

Unit Dimensions

Length (in) =	23.6
Width (in) =	42.1
Frame Height (in) =	77

Center of Gravity Location

Unit	Part	Weight (lbs)	X (in)	Y (in)	Z (in)
AR3100	Frame	275.2	11.8	21.05	38.5
	Max Load	2000			38.5

Longitudinal Anchorage Spacing (in) = 9.65
 Transverse Anchorage Spacing (in) = 30.6 (internal & external brackets)

Seismic Force	
	(Zone 4, $N_s=1.5$,
$C_a =$	0.66 <2km Type A Fault)
$I_p =$	1.0 (Importance)
$a_p =$	1.0 (Cabinets)
$R_p =$	3.0 (Cabinets)
$h_x/h_r =$	0.5 (50% of building height)
$F_p =$	0.393 W
$F_{p,min} =$	0.33 W
$F_{p,max} =$	1.89 W
Use $F_p =$	0.39 W

Longitudinal Overturning

Overturning

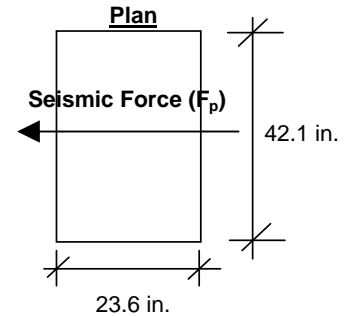
Moment = $0.39 (77/2 \text{ in.} \times (275.2 \text{ lbs.} + 2000 \text{ lbs.})) = 34412 \text{ lb-in}$

0.9xResisting

Moment = $0.9 (275.2 \text{ lbs.} + 2000 \text{ lbs.}) \times 11.8 \text{ in.} = 24163 \text{ lb-in}$

Anchorage Force =	1062.2 lbs
Shear Force =	750.8 lbs.

Netshelter SX Unit



Design Bolts for 1062.2 lbs tension, 750.8 lbs. shear, longitudinal direction, fully loaded

Transverse Overturning

Overturning

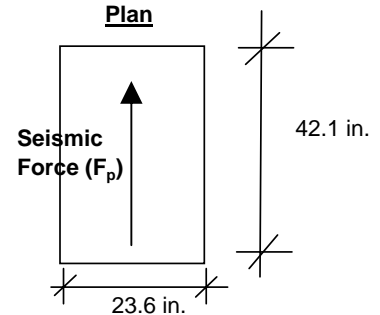
Moment = $0.39 (77/2 \text{ in.} \times (275.2 \text{ lbs.} + 2000 \text{ lbs.})) = 34412 \text{ lb-in}$

0.9xResisting

Moment = $0.9 (275.2 \text{ lbs.} + 2000 \text{ lbs.}) \times 21.05 \text{ in.} = 43104 \text{ lb-in}$

Anchorage Force =	0 lbs
Shear Force =	750.8 lbs.

Netshelter SX Unit



Design Bolts for 0 lbs tension, 750.8 lbs. shear, transverse direction, fully loaded



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APC Netshelter SX AR 3100
 Zone 4 Anchorage
 Job No. 05240
 By: AM Date: 1/27/2006

AR3100 Anchorage - Zone 4

Load Cases:

Single Fully Loaded Unit (<=50% OF BUILDING HEIGHT)

ANCHORAGE FORCES

CONDITION	ANCHORAGE FORCE (LBS.)	SHEAR FORCE (LBS.)
SINGLE UNIT	1062.2	750.8

ANCHORAGE DESIGN

CONC. FILL OVER METAL DECK: Use Hilti Kwik Bolt 3 Anchors (ICC ESR-1385)

Number of Brackets Used: **8**

Anchor Diameter (in²): **0.375**

Embedment Length (in.): **1.750**

Embed. length /Dia = **4.67**

(shallow anchor, increase load per UBC 1632.2)

Min. Conc Slab Thickness (1.5x embed. Length) **2.625 in. slab, min.**

(Note: If shallow Anchor applies, increase load by factor of 2, UBC97 1632.2)

Anchor Capacities:

Tension (lbs.) = **423**
 Shear (lbs.) = **1062**

with 1/3 seismic increase

564.0
1416.0

CHECK SHEAR & TENSION STRESS RATIO

Tmax = 2124.4 lbs.

Ta = 4x564.0 lbs. = 2256.0 lbs.

Vmax = 1501.6 lbs.

V_all = 4x1416.0 lbs. = 5664.0 lbs.

<u>Tension</u>	2124.4/2256.0 =	0.94	tension stress ratio
<u>Shear</u>	1501.6/5664.0 =	0.27	shear stress ratio

SUMMARY: AR3100 Anchorage - Zone 4

CONC. FILL OVER METAL DECK:

2.625 in. slab, min., Use Hilti Kwik Bolt 3 Anchors (ICC ESR-1385), embed. 1.75 in.

Use 8 brackets total, one anchor/bracket

Load Case: Ganged Fully Loaded Unit (<=50% OF BUILDING HEIGHT)

of Units ganged (max) = 2

Single Unit Dimension			Center of Gravity Location		
Length (in) =		23.6			
Width (in) =		42.1			
Frame Height (in) =		77			
Frame Weight (lb.) =		275.2			
Unit	Part	Weight (lbs)	X (in)	Y (in)	Z (in)
2 - AR3100	Frame	550.4	23.6	21.05	46.5
	Max Load	4000			46.5

Seismic Force	
	(Zone 4, $N_a=1.5$, <2km San Andreas Fault)
$C_a =$	0.66
$I_p =$	1.0 (Importance)
$a_p =$	1.0 (Cabinets)
$R_p =$	3.0 (Cabinets)
$h_x/h_r =$	0.5 (Floor)
$F_p =$	0.393 W
$F_{p,min} =$	0.33 W
$F_{p,max} =$	1.89 W
Use $F_p =$	0.39 W

(2000lbs.x 2units)
 Longitudinal Anchorage Spacing (in) = 32.95
 Transverse Anchorage Spacing (in) = 30.6

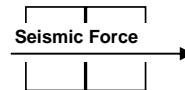
Longitudinal Overturning

Overturning Moment = $0.39 (77/2 \text{ in.} \times (550.4\text{lbs.} + 4000 \text{ lbs.})) = 83126 \text{ lb-in}$

0.9xResisting Moment = $0.9 (550.4 \text{ lbs.} + 4000 \text{ lbs.}) \times 23.6 \text{ in.} = 96650 \text{ lb-in}$

Anchorage Force =	0	lbs
Shear Force =	1787.7	lbs.

Netshelter SX plan



2 ganged units

Design Bolts for 0 lbs tension, 1787.7 lbs. shear, longitudinal direction, ganged fully loaded

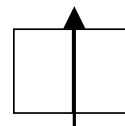
Transverse Overturning

Overturning Moment = $0.39 (77/2 \text{ in.} \times (550.4\text{lbs.} + 4000 \text{ lbs.})) = 83126 \text{ lb-in}$

0.9xResisting Moment = $0.9 (550.4 \text{ lbs.} + 4000 \text{ lbs.}) \times 21.05 \text{ in.} = 86207 \text{ lb-in}$

Anchorage Force =	0	lbs
Shear Force =	1787.7	lbs.

Seismic Force



2 ganged units

Netshelter SX plan

Design Bolts for 0 lbs tension, 1787.7 lbs. shear, transverse direction, ganged fully loaded

Load Case: Ganged Fully Loaded Unit
(On 18" RAISED COMPUTER FLOOR SYSTEM, <=50% OF BUILDING HEIGHT)

of Units ganged (max)= 2

Single Unit Dimension			Center of Gravity Location		
Length (in) =		23.6			
Width (in) =		42.1			
Frame Height (in) =		77			
Frame Weight (lb.) =		275.2			
Unit	Part	Weight (lbs)	X (in)	Y (in)	Z (in)
2 - AR3100	Frame	550.4	23.6	21.05	56.5
	Max Load	4000			56.5

Seismic Force	
	(Zone 4, $N_a=1.5$, <2km San Andreas Fault)
$C_a =$	0.66
$I_p =$	1.0 (Importance)
$a_p =$	1.0 (Cabinets)
$R_p =$	3.0 (Cabinets)
$h_x/h_r =$	0.5 (Floor)
$F_p =$	0.393 W
$F_{p,min} =$	0.33 W
$F_{p,max} =$	1.89 W
Use $F_p =$	0.39 W

(2000lbs.x 2units)
 Longitudinal Anchorage Spacing (in) = 32.95
 Transverse Anchorage Spacing (in) = 30.6

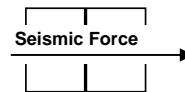
Longitudinal Overturning

Overturning Moment = $0.39 (77/2 \text{ in.} \times (550.4\text{lbs.} + 4000 \text{ lbs.})) = 101003 \text{ lb-in}$

0.9xResisting Moment = $0.9 (550.4 \text{ lbs.} + 4000 \text{ lbs.}) \times 23.6 \text{ in.} = 96650 \text{ lb-in}$

Anchorage Force = 132.1 lbs
 Shear Force = 1787.7 lbs.

Netshelter SX plan



2 ganged units

Design Bolts for 132.1 lbs tension, 1787.7 lbs. shear, longitudinal direction, ganged fully loaded

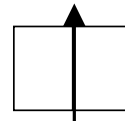
Transverse Overturning

Overturning Moment = $0.39 (77/2 \text{ in.} \times (550.4\text{lbs.} + 4000 \text{ lbs.})) = 101003 \text{ lb-in}$

0.9xResisting Moment = $0.9 (550.4 \text{ lbs.} + 4000 \text{ lbs.}) \times 21.05 \text{ in.} = 86207 \text{ lb-in}$

Anchorage Force = 483.5 lbs
 Shear Force = 1787.7 lbs.

Seismic Force



2 ganged units

Netshelter SX plan

Design Bolts for 483.5 lbs tension, 1787.7 lbs. shear, transverse direction, ganged fully loaded



103 Linden Avenue
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 (650) 871-2282 Fax 871-2459

APC Netselter SX AR 3100
 Zone 4 Anchorage
 Job No. 05240
 By: AM Date: 1/27/2006

AR3100 Anchorage - Zone 4

Load Cases:

Ganged Fully Loaded Unit (<=50% OF BUILDING HEIGHT)

Ganged Fully Loaded Unit (On 18" RAISED COMPUTER FLOOR SYSTEM, <=50% OF BUILDING HEIGHT)

ANCHORAGE FORCES

CONDITION	ANCHORAGE FORCE (LBS.)	SHEAR FORCE (LBS.)
GANGED UNIT	483.5	1787.7

ANCHORAGE DESIGN

CONC. FILL OVER METAL DECK: Use Hilti Kwik Bolt 3 Anchors (ICC ESR-1385)

Number of Brackets Used: **8**

Anchor Diameter (in²): **0.375**

Embedment Length (in.): **1.750**

Embed. length /Dia = **4.67**

(shallow anchor, increase load per UBC 1632.2)

Min. Conc Slab Thickness (1.5x embed. Length) **2.6 in. conc. cover, min.**

(Note: If shallow Anchor applies, increase load by factor of 2, UBC97 1632.2)

Anchor Capacities:

with 1/3 seismic increase

Tension (lbs.) = **423** **564.0**
 Shear (lbs.) = **1062** **1416.0**

CHECK SHEAR & TENSION STRESS RATIO

Tmax = 967.0 lbs.

Vmax = 3575.3 lbs.

Ta = 4x564.0 lbs. = 2256.0 lbs.

V_all = 4x1416.0 lbs. = 5664.0 lbs.

<u>Tension</u>	967.0/2256.0 =	0.43	tension stress ratio
<u>Shear</u>	3575.3/5664.0 =	0.63	shear stress ratio

SUMMARY:

CONC. FILL OVER METAL DECK:

2.6 in. conc. cover, min. Use Hilti Kwik Bolt 3 Anchors (ICC ESR-1385), embed. 1.75 in.

Use 8 brackets total, one anchor/bracket

Load Case: Ganged Fully Loaded Unit (<=90% OF BUILDING HEIGHT)

of Units ganged (max) = 2

Single Unit Dimension			Center of Gravity Location		
Length (in) =		23.6			
Width (in) =		42.1			
Frame Height (in) =		77			
Frame Weight (lb.) =		275.2			
Unit	Part	Weight (lbs)	X (in)	Y (in)	Z (in)
2 - AR3100	Frame	550.4	23.6	21.05	38.5
	Max Load	4000			38.5

Seismic Force	
	(Zone 4, $N_a=1.5$, <2km San Andreas Fault)
$C_a =$	0.66
$I_p =$	1.0 (Importance)
$a_p =$	1.0 (Cabinets)
$R_p =$	3.0 (Cabinets)
$h_x/h_r =$	0.9 (90% of building height)
$F_p =$	0.581 W
$F_{p,min} =$	0.33 W
$F_{p,max} =$	1.89 W
Use $F_p =$	0.58 W

(2000lbs.x 2units)

Longitudinal Anchorage Spacing (in) = 23.6
 Transverse Anchorage Spacing (in) = 30.6

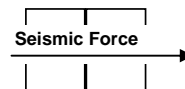
Longitudinal Overturning

Overturning Moment = 0.58 (77/2 in. x (550.4lbs. +4000 lbs.)) = 101861 lb-in

0.9xResisting Moment = 0.9 (550.4 lbs. + 4000 lbs.) x23.6 in. = 96650 lb-in

Anchorage Force = 220.8 lbs
Shear Force = 2645.7 lbs.

Netshelter SX plan



2 ganged units

Design Bolts for 220.8 lbs tension, 2645.7 lbs. shear, longitudinal direction, ganged fully loaded

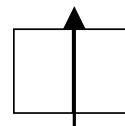
Transverse Overturning

Overturning Moment = 0.58 (77/2 in. x (550.4lbs. +4000 lbs.)) = 101861 lb-in

0.9xResisting Moment = 0.9 (550.4 lbs. + 4000 lbs.) x21.05 in. = 86207 lb-in

Anchorage Force = 511.5 lbs
Shear Force = 2645.7 lbs.

Seismic Force



2 ganged units

Netshelter SX plan

Design Bolts for 511.5 lbs tension, 2645.7 lbs. shear, transverse direction, ganged fully loaded



103 Linden Avenue
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 (650) 871-2282 Fax 871-2459

APC Netshelter SX AR 3100
 Zone 4 Anchorage
 Job No. 05240
 By: AM Date: 1/27/2006

AR3100 Anchorage - Zone 4

Load Cases:

Ganged Fully Loaded Unit (<=90% OF BUILDING HEIGHT)

ANCHORAGE FORCES

CONDITION	ANCHORAGE FORCE (LBS.)	SHEAR FORCE (LBS.)
SINGLE UNIT	511.5	2645.7

ANCHORAGE DESIGN

CONC. FILL OVER METAL DECK: Use Hilti Kwik Bolt 3 Anchors (ICC ESR-1385)

Number of Brackets Used: **8**

Anchor Diameter (in²): **0.375**

Embedment Length (in.): **1.625**

Embed. length /Dia = **4.33**

(shallow anchor, increase load per UBC 1632.2)

Min. Conc Slab Thickness (1.5x embed. Length) **2.4 in. conc. cover, min.**

(Note: If shallow Anchor applies, increase load by factor of 2, UBC97 1632.2)

Anchor Capacities:

Tension (lbs.) = **423**
 Shear (lbs.) = **1062**

with 1/3 seismic increase

564.0
1416.0

CHECK SHEAR & TENSION STRESS RATIO

Tmax = 1023.0 lbs.

Ta = 4x564.0 lbs. = 2256.0 lbs.

Vmax = 5291.5 lbs.

V_all = 4x1416.0 lbs. = 5664.0 lbs.

<u>Tension</u>	1023.0/2256.0 =	0.45	tension stress ratio
<u>Shear</u>	5291.5/5664.0 =	0.93	shear stress ratio

SUMMARY: AR3100 Anchorage - Zone 4 & Top Shelf Loaded

CONC. FILL OVER METAL DECK:

2.4 in. conc. cover, min., Use Hilti Kwik Bolt 3 Anchors (ICC ESR-1385)

Use 8 brackets total, one anchor/bracket

Load Case: Ganged Fully Loaded Unit
(On 18" RAISED COMPUTER FLOOR SYSTEM, <=90% OF BUILDING HEIGHT)

of Units ganged (max)= 2

Single Unit Dimension			Center of Gravity Location		
Length (in) =		23.6			
Width (in) =		42.1			
Frame Height (in) =		77			
Frame Weight (lb.) =		275.2			
Unit	Part	Weight (lbs)	X (in)	Y (in)	Z (in)
2 - AR3100	Frame	550.4	23.6	21.05	56.5
	Max Load	4000			56.5

Seismic Force	
	(Zone 4, $N_a=1.5$, <2km San Andreas Fault)
$C_a =$	0.66
$I_p =$	1.0 (Importance)
$a_p =$	1.0 (Cabinets)
$R_p =$	3.0 (Cabinets)
$h_x/h_r =$	0.9 (90% of building height)
$F_p =$	0.581 W
$F_{p,min} =$	0.33 W
$F_{p,max} =$	1.89 W
Use $F_p =$	0.58 W

(2000lbs.x 2units)
 Longitudinal Anchorage Spacing (in) = 23.6
 Transverse Anchorage Spacing (in) = 30.6

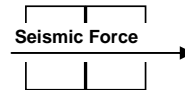
Longitudinal Overturning

Overturning Moment = $0.58 (77/2 \text{ in.} \times (550.4\text{lbs.} + 4000 \text{ lbs.})) = 149484 \text{ lb-in}$

0.9xResisting Moment = $0.9 (550.4 \text{ lbs.} + 4000 \text{ lbs.}) \times 23.6 \text{ in.} = 96650 \text{ lb-in}$

Anchorage Force = 2238.7 lbs
 Shear Force = 2645.7 lbs.

Netshelter SX plan



2 ganged units

Design Bolts for 2238.7 lbs tension, 2645.7 lbs. shear, longitudinal direction, ganged fully loaded

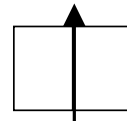
Transverse Overturning

Overturning Moment = $0.58 (77/2 \text{ in.} \times (550.4\text{lbs.} + 4000 \text{ lbs.})) = 149484 \text{ lb-in}$

0.9xResisting Moment = $0.9 (550.4 \text{ lbs.} + 4000 \text{ lbs.}) \times 21.05 \text{ in.} = 86207 \text{ lb-in}$

Anchorage Force = 2067.9 lbs
 Shear Force = 2645.7 lbs.

Seismic Force



2 ganged units

Netshelter SX plan

Design Bolts for 2067.9 lbs tension, 2645.7 lbs. shear, transverse direction, ganged fully loaded



103 Linden Avenue
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 (650) 871-2282 Fax 871-2459

APC Netshelter SX AR 3100
 Zone 4 Anchorage
 Job No. 05240
 By: AM Date: 1/27/2006

AR3100 Anchorage - Zone 4

Load Cases:

Ganged Fully Loaded Unit

(On 18" RAISED COMPUTER FLOOR SYSTEM, <=90% OF BUILDING HEIGHT)

ANCHORAGE FORCES

CONDITION	ANCHORAGE FORCE (LBS.)	SHEAR FORCE (LBS.)
SINGLE UNIT	2238.7	2645.7

ANCHORAGE DESIGN

CONC. FILL OVER METAL DECK: Use Hilti Kwik Bolt 3 Anchors (ICC ESR-1385)

Number of Brackets Used: **8**

Anchor Diameter (in²): **0.375**

Embedment Length (in.): **1.625**

Embed. length /Dia = **4.33**

(shallow anchor, increase load per UBC 1632.2)

Min. Conc Slab Thickness (1.5x embed. Length) **2.4 in. conc. cover, min.**

(Note: If shallow Anchor applies, increase load by factor of 2, UBC97 1632.2)

Anchor Capacities:

with 1/3 seismic increase & special inspection

Tension (lbs.) = **826** **1101.3**
 Shear (lbs.) = **1062** **1416.0**

CHECK SHEAR & TENSION STRESS RATIO

Tmax = 4477.4 lbs.
 Ta = 4x1101.3 lbs. = 4405.2 lbs.

Vmax = 5291.5 lbs.
 V_all = 4x1416.0 lbs. = 5664.0 lbs.

<u>Tension</u>	4477.4/4405.2 =	1.02	tension stress ratio
<u>Shear</u>	5291.5/5664.0 =	0.93	shear stress ratio

SUMMARY: AR3100 Anchorage - Zone 4 & Top Shelf Loaded

CONC. FILL OVER METAL DECK: AND SPECIAL INSPECTION

2.4 in. conc. cover, min., Use Hilti Kwik Bolt 3 Anchors (ICC ESR-1385)

Use 8 brackets total, one anchor/bracket

Worst Case AR7701 Bending

Worst Case Tension Force (lbs.) = 2239

No. Of Brackets resisting uplift = 4

Tension Force/Bracket (lbs.) = 560

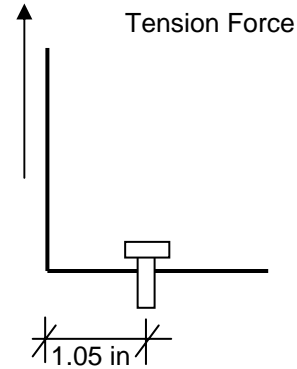
Moment Arm (in.) = 1.05

Moment= $P*L/2$ (lb-in.) = 294

S_x (in³) = 0.0066

Actual Bending Stress (ksi) = 44.52

Allowable Bending Stress (ksi) = 50



NOTE: (1) APC 870-11101A pallette bracket may be used in lieu of (2) APC7701 brackets

Load Case: Single Fully Loaded Unit (Ground Floor)

Unit Dimensions

Length (in) =	23.6
Width (in) =	42.1
Frame Height (in) =	77

Unit	Part	Weight (lbs)	Center of Gravity Location		
			X (in)	Y (in)	Z (in)
AR3100	Frame	275.2	11.8	21.05	38.5
	Max Load	2000			38.5

Longitudinal Anchorage Spacing (in) = 9.65
 Transverse Anchorage Spacing (in) = 30.6 (internal brackets)

Seismic Force	
$C_a =$	0.28 (Zone 0-3)
$I_p =$	1.0 (Importance)
$a_p =$	1.0 (Cabinets)
$R_p =$	3.0 (Cabinets)
$h_x/h_r =$	0.0 (Floor)
$F_p =$	0.067 W
$F_{p,min} =$	0.14 W
$F_{p,max} =$	0.80 W
Use $F_p = 0.14 W$	

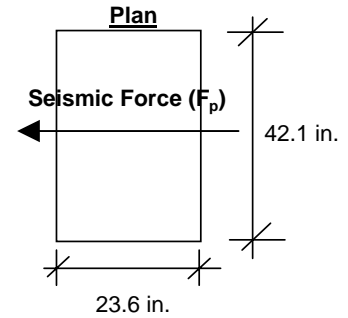
Longitudinal Overturning

Overturning Moment = 0.14 (77/2 in. x (275.2lbs. +2000 lbs.)) = 12263 lb-in

0.9xResisting Moment = 0.9 (275.2 lbs. + 2000 lbs.) x11.8 in. = 24163 lb-in

Anchorage Force =	0	lbs
Shear Force =	318.5	lbs.

Netshelter SX Unit



Design Bolts for 0 lbs tension, 318.5 lbs. shear, longitudinal direction, fully loaded

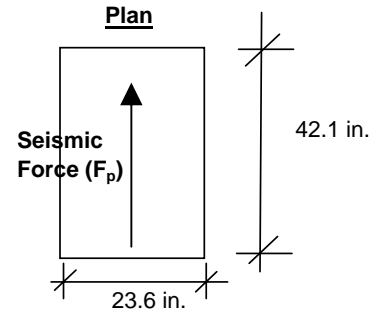
Transverse Overturning

Overturning Moment = 0.14 (77/2 in. x (275.2lbs. +2000 lbs.)) = 12263 lb-in

0.9xResisting Moment = 0.9 (275.2 lbs. + 2000 lbs.) x21.05 in. = 43104 lb-in

Anchorage Force =	0	lbs
Shear Force =	318.5	lbs.

Netshelter SX Unit



Design Bolts for 0 lbs tension, 318.5 lbs. shear, transverse direction, fully loaded



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APC Netshelter SX AR 3100
 Zone 0-3 Anchorage (Non-California)
 Job No. 05240
 By: AM Date: 1/27/2006

AR3100 Anchorage - Zone 0-3

Load Cases:

AR3100 Single Fully Loaded Unit (Ground Floor)

ANCHORAGE FORCES

CONDITION	ANCHORAGE FORCE (LBS.)	SHEAR FORCE (LBS.)
SINGLE UNIT	0	318.5

ANCHORAGE DESIGN

CONCRETE: Use Hilti Kwik Bolt 3 Anchors (ICC ESR-1385)

Number of Brackets Used: 4

Anchor Diameter (in²): 0.375

Embedment Length (in.): 2.5

Embed. length /Dia = 6.67

shallow anchor, increase load per UBC 1632.2

Min. Conc Slab Thickness (1.5x embed. Length) 3.75 in. slab, min.

(Note: If shallow Anchor applies, increase load by factor of 2, UBC97 1632.2)

Anchor Capacities:

with 1/3 seismic increase

Tension (lbs.) = 712 **949.3**
 Shear (lbs.) = 1255 **1673.3**

CHECK SHEAR & TENSION STRESS RATIO

Tmax = 0.0 lbs. Vmax = 637.1 lbs.
 Ta = 2x949.3 lbs. = 1898.6 lbs. V_all = 2x1673.3 lbs. = 3346.6 lbs.

<u>Tension</u>	0.0/1898.6 =	0.00	tension stress ratio
<u>Shear</u>	637.1/3346.6 =	0.19	shear stress ratio

SUMMARY

CONCRETE:

3.75 in. slab, min. Use Hilti Kwik Bolt 3 Anchors (ICC ESR-1385), embed. 2.5 in.
 Use 4 brackets total, one anchor/bracket

Load Case: Ganged Fully Loaded Unit (Ground Floor)

of Units ganged (max)= 2

Single Unit Dimension			Center of Gravity Location		
Length (in) =		23.6			
Width (in) =		42.1			
Frame Height (in) =		77			
Frame Weight (lb.) =		275.2			
Unit	Part	Weight (lbs)	X (in)	Y (in)	Z (in)
2 - AR3100	Frame	550.4	23.6	21.05	38.5
	Max Load	4000			38.5

(2000lbs.x 2units)

Longitudinal Anchorage Spacing (in) = 33
 Transverse Anchorage Spacing (in) = 30.6 (internal brackets)

Seismic Force	
$C_a =$	0.28 (Zone 0-3)
$I_p =$	1.0 (Importance)
$a_p =$	1.0 (Cabinets)
$R_p =$	3.0 (Cabinets)
$h_x/h_r =$	0.0 (Floor)
$F_p =$	0.067 W
$F_{p,min} =$	0.14 W
$F_{p,max} =$	0.80 W
Use $F_p = 0.14 W$	

Longitudinal Overturning

Overturning

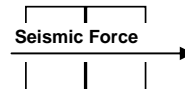
Moment = $0.14 (77/2 \text{ in.} \times (550.4\text{lbs.} + 4000 \text{ lbs.})) = 24527 \text{ lb-in}$

0.9xResisting

Moment = $0.9 (550.4 \text{ lbs.} + 4000 \text{ lbs.}) \times 23.6 \text{ in.} = 96650 \text{ lb-in}$

Anchorage Force =	0	lbs
Shear Force =	637.1	lbs.

Netshelter SX plan



2 ganged units

Design Bolts for 0 lbs tension, 637.1 lbs. shear, longitudinal direction, ganged fully loaded

Transverse Overturning

Overturning

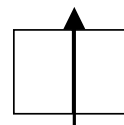
Moment = $0.14 (77/2 \text{ in.} \times (550.4\text{lbs.} + 4000 \text{ lbs.})) = 24527 \text{ lb-in}$

0.9xResisting

Moment = $0.9 (550.4 \text{ lbs.} + 4000 \text{ lbs.}) \times 21.05 \text{ in.} = 86207 \text{ lb-in}$

Anchorage Force =	0	lbs
Shear Force =	637.1	lbs.

Seismic Force



2 ganged units

Netshelter SX plan

Design Bolts for 0 lbs tension, 637.1 lbs. shear, transverse direction, ganged fully loaded

Load Case: Ganged Fully Loaded Unit (On 18" raised computer floor, Ground Floor)

of Units ganged (max)= 2

Single Unit Dimension			Center of Gravity Location		
Length (in) =		23.6			
Width (in) =		42.1			
Frame Height (in) =		77			
Frame Weight (lb.) =		275.2			
Unit	Part	Weight (lbs)	X (in)	Y (in)	Z (in)
2 - AR3100	Frame	550.4	23.6	21.05	56.5
	Max Load	4000			56.5

(2000lbs.x 2units)

Longitudinal Anchorage Spacing (in) = 33
 Transverse Anchorage Spacing (in) = 30.6

Seismic Force	
$C_a =$	0.28 (Zone 0-3)
$I_p =$	1.0 (Importance)
$a_p =$	1.0 (Cabinets)
$R_p =$	3.0 (Cabinets)
$h_x/h_r =$	0.0 (Floor)
$F_p =$	0.067 W
$F_{p,min} =$	0.14 W
$F_{p,max} =$	0.80 W
Use $F_p = 0.14 W$	

Longitudinal Overturning

Overturning

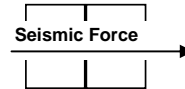
Moment = $0.14 (77/2 \text{ in.} \times (550.4\text{lbs.} + 4000 \text{ lbs.})) = 35994 \text{ lb-in}$

0.9xResisting

Moment = $0.9 (550.4 \text{ lbs.} + 4000 \text{ lbs.}) \times 23.6 \text{ in.} = 96650 \text{ lb-in}$

Anchorage Force =	0	lbs
Shear Force =	637.1	lbs.

Netshelter SX plan



2 ganged units

Design Bolts for 0 lbs tension, 637.1 lbs. shear, longitudinal direction, ganged fully loaded

Transverse Overturning

Overturning

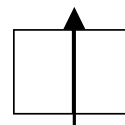
Moment = $0.14 (77/2 \text{ in.} \times (550.4\text{lbs.} + 4000 \text{ lbs.})) = 35994 \text{ lb-in}$

0.9xResisting

Moment = $0.9 (550.4 \text{ lbs.} + 4000 \text{ lbs.}) \times 21.05 \text{ in.} = 86207 \text{ lb-in}$

Anchorage Force =	0	lbs
Shear Force =	637.1	lbs.

Seismic Force



2 ganged units

Netshelter SX plan

Design Bolts for 0 lbs tension, 637.1 lbs. shear, transverse direction, ganged fully loaded



103 Linden Avenue
 South San Francisco, CA 94080
 (650) 871-2282 Fax 871-2459

APC Netshelter SX AR 3100
 Zone 0-3 Anchorage (Non-California)
 Job No. 05240
 By: AM Date: 1/27/2006

AR3100 Anchorage - Zone 0-3

Load Cases:

Ganged Fully Loaded Unit (Ground Floor)

Ganged Fully Loaded Unit (On 18" raised computer floor, Ground Floor)

ANCHORAGE FORCES

CONDITION	ANCHORAGE FORCE (LBS.)	SHEAR FORCE (LBS.)
GANGED UNIT	0	637.1

ANCHORAGE DESIGN

CONCRETE: Use Hilti Kwik Bolt 3 Anchors (ICC ESR-1385)

Number of Brackets Used: 4

Anchor Diameter (in²): 0.375

Embedment Length (in.): 2.5

Embed. length /Dia = 6.67

shallow anchor, increase load per UBC 1632.2

Min. Conc Slab Thickness (1.5x embed. Length) 3.75 in. slab, min.

(Note: If shallow Anchor applies, increase load by factor of 2, UBC97 1632.2)

Anchor Capacities:

with 1/3 seismic increase

Tension (lbs.) = 712 949.3
 Shear (lbs.) = 1255 1673.3

CHECK SHEAR & TENSION STRESS RATIO

Tmax = 0.0 lbs.

Vmax = 1274.1 lbs.

Ta = 2x949.3 lbs. = 1898.6 lbs.

V_all = 2x1673.3 lbs. = 6693.2 lbs.

<u>Tension</u>	0.0/1898.6 =	0.00	tension stress ratio
<u>Shear</u>	1274.1/6693.2 =	0.19	shear stress ratio

SUMMARY

CONCRETE:

3.75 in. slab, min. Use Hilti Kwik Bolt 3 Anchors (ICC ESR-1385), embed. 2.5 in.

Use 4 brackets total, one anchor/bracket

Load Case: Single Fully Loaded Unit (<=50% OF BUILDING HEIGHT)

(note: 50% of building height means 2nd of 4 story building or 4th of 8th story building)

Unit Dimensions

Length (in) =	23.6
Width (in) =	42.1
Frame Height (in) =	77

			Center of Gravity Location		
Unit	Part	Weight (lbs)	X (in)	Y (in)	Z (in)
AR3100	Frame	275.2	11.8	21.05	38.5
	Max Load	2000			38.5

Longitudinal Anchorage Spacing (in) = 9.65
 Transverse Anchorage Spacing (in) = 30.6 (internal & external brackets)

Seismic Force	
$C_a =$	0.28 (Zone 0-3)
$I_p =$	1.0 (Importance)
$a_p =$	1.0 (Cabinets)
$R_p =$	3.0 (Cabinets)
$h_x/h_r =$	0.5 (50% of building height)
$F_p =$	0.167 W
$F_{p,min} =$	0.14 W
$F_{p,max} =$	0.80 W
Use $F_p = 0.17 W$	

Longitudinal Overturning

Overturning

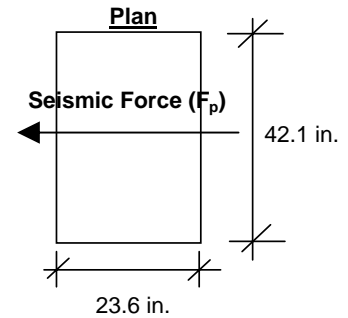
Moment = $0.17 (77/2 \text{ in.} \times (275.2 \text{ lbs.} + 2000 \text{ lbs.})) = 14599 \text{ lb-in}$

0.9xResisting

Moment = $0.9 (275.2 \text{ lbs.} + 2000 \text{ lbs.}) \times 11.8 \text{ in.} = 24163 \text{ lb-in}$

Anchorage Force =	0	lbs
Shear Force =	318.5	lbs.

Netshelter SX Unit



Design Bolts for 0 lbs tension, 318.5 lbs. shear, longitudinal direction, fully loaded

Transverse Overturning

Overturning

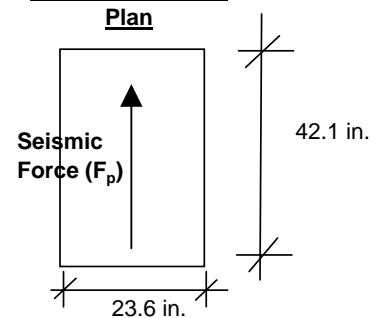
Moment = $0.17 (77/2 \text{ in.} \times (275.2 \text{ lbs.} + 2000 \text{ lbs.})) = 14599 \text{ lb-in}$

0.9xResisting

Moment = $0.9 (275.2 \text{ lbs.} + 2000 \text{ lbs.}) \times 21.05 \text{ in.} = 43104 \text{ lb-in}$

Anchorage Force =	0	lbs
Shear Force =	318.5	lbs.

Netshelter SX Unit



Design Bolts for 0 lbs tension, 318.5 lbs. shear, transverse direction, fully loaded



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APC Netshelter SX AR 3100
 Zone 0-3 Anchorage (Non-California)
 Job No. 05240
 By: AM Date: 1/27/2006

AR3100 Anchorage - Zone 0-3

Load Cases:

Single Fully Loaded Unit (<=50% OF BUILDING HEIGHT)

ANCHORAGE FORCES

CONDITION	ANCHORAGE FORCE (LBS.)	SHEAR FORCE (LBS.)
SINGLE UNIT	0	318.5

ANCHORAGE DESIGN

CONC. FILL OVER METAL DECK: Use Hilti Kwik Bolt 3 Anchors (ICC ESR-1385)

Number of Brackets Used: **4**

Anchor Diameter (in²): **0.375**

Embedment Length (in.): **1.750**

Embed. length /Dia = **4.67**

(shallow anchor, increase load per UBC 1632.2)

Min. Conc Slab Thickness (1.5x embed. Length) **2.625 in. slab, min.**

(Note: If shallow Anchor applies, increase load by factor of 2, UBC97 1632.2)

Anchor Capacities:

Tension (lbs.) = **423**
 Shear (lbs.) = **1062**

with 1/3 seismic increase

564.0
1416.0

CHECK SHEAR & TENSION STRESS RATIO

T_{max} = 0.0 lbs.

T_a = 2x564.0 lbs. = 1128.0 lbs.

V_{max} = 637.1 lbs.

V_{all} = 2x1416.0 lbs. = 2832.0 lbs.

<u>Tension</u>	0.0/1128.0 =	0.00	tension stress ratio
<u>Shear</u>	637.1/2832.0 =	0.22	shear stress ratio

SUMMARY: AR3100 Anchorage - Zone 0-3

CONC. FILL OVER METAL DECK:

2.625 in. slab, min., Use Hilti Kwik Bolt 3 Anchors (ICC ESR-1385), embed. 1.75 in.

Use 4 brackets total, one anchor/bracket

Load Case: Ganged Fully Loaded Unit (<=50% OF BUILDING HEIGHT)

of Units ganged (max)= 2

Single Unit Dimension			Center of Gravity Location		
Length (in) =		23.6			
Width (in) =		42.1			
Frame Height (in) =		77			
Frame Weight (lb.) =		275.2			
Unit	Part	Weight (lbs)	X (in)	Y (in)	Z (in)
2 - AR3100	Frame	550.4	23.6	21.05	46.5
	Max Load	4000			46.5

Seismic Force	
$C_a =$	0.28 (Zone 0-3)
$I_p =$	1.0 (Importance)
$a_p =$	1.0 (Cabinets)
$R_p =$	3.0 (Cabinets)
$h_x/h_r =$	0.5 (Floor)
$F_p =$	0.167 W
$F_{p,min} =$	0.14 W
$F_{p,max} =$	0.80 W
Use $F_p =$	0.17 W

(2000lbs.x 2units)
 Longitudinal Anchorage Spacing (in) = 32.95
 Transverse Anchorage Spacing (in) = 30.6

Longitudinal Overturning

Overturning

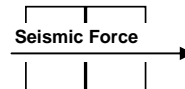
Moment = $0.17 (77/2 \text{ in.} \times (550.4\text{lbs.} + 4000 \text{ lbs.})) = 35266 \text{ lb-in}$

0.9xResisting

Moment = $0.9 (550.4 \text{ lbs.} + 4000 \text{ lbs.}) \times 23.6 \text{ in.} = 96650 \text{ lb-in}$

Anchorage Force =	0	lbs
Shear Force =	758.4	lbs.

Netshelter SX plan



2 ganged units

Design Bolts for 0 lbs tension, 758.4 lbs. shear, longitudinal direction, ganged fully loaded

Transverse Overturning

Overturning

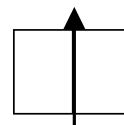
Moment = $0.17 (77/2 \text{ in.} \times (550.4\text{lbs.} + 4000 \text{ lbs.})) = 35266 \text{ lb-in}$

0.9xResisting

Moment = $0.9 (550.4 \text{ lbs.} + 4000 \text{ lbs.}) \times 21.05 \text{ in.} = 86207 \text{ lb-in}$

Anchorage Force =	0	lbs
Shear Force =	758.4	lbs.

Seismic Force



2 ganged units

Netshelter SX plan

Design Bolts for 0 lbs tension, 758.4 lbs. shear, transverse direction, ganged fully loaded

Load Case: Ganged Fully Loaded Unit
(On 18" RAISED COMPUTER FLOOR SYSTEM, <=50% OF BUILDING HEIGHT)

of Units ganged (max)= 2

Single Unit Dimension			Center of Gravity Location		
Length (in) =		23.6			
Width (in) =		42.1			
Frame Height (in) =		77			
Frame Weight (lb.) =		275.2			
Unit	Part	Weight (lbs)	X (in)	Y (in)	Z (in)
2 - AR3100	Frame	550.4	23.6	21.05	56.5
	Max Load	4000			56.5

Seismic Force		
$C_a =$	0.28	(Zone 0-3)
$I_p =$	1.0	(Importance)
$a_p =$	1.0	(Cabinets)
$R_p =$	3.0	(Cabinets)
$h_x/h_r =$	0.5	(Floor)
$F_p =$	0.167	W
$F_{p,min} =$	0.14	W
$F_{p,max} =$	0.80	W
Use $F_p = 0.17$ W		

(2000lbs.x 2units)
 Longitudinal Anchorage Spacing (in) = 32.95
 Transverse Anchorage Spacing (in) = 30.6

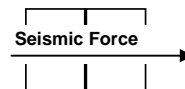
Longitudinal Overturning

Overturning Moment = $0.17 (77/2 \text{ in.} \times (550.4\text{lbs.} + 4000 \text{ lbs.})) = 42850 \text{ lb-in}$

0.9xResisting Moment = $0.9 (550.4 \text{ lbs.} + 4000 \text{ lbs.}) \times 23.6 \text{ in.} = 96650 \text{ lb-in}$

Anchorage Force =	0	lbs
Shear Force =	758.4	lbs.

Netshelter SX plan



2 ganged units

Design Bolts for 0 lbs tension, 758.4 lbs. shear, longitudinal direction, ganged fully loaded

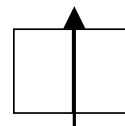
Transverse Overturning

Overturning Moment = $0.17 (77/2 \text{ in.} \times (550.4\text{lbs.} + 4000 \text{ lbs.})) = 42850 \text{ lb-in}$

0.9xResisting Moment = $0.9 (550.4 \text{ lbs.} + 4000 \text{ lbs.}) \times 21.05 \text{ in.} = 86207 \text{ lb-in}$

Anchorage Force =	0	lbs
Shear Force =	758.4	lbs.

Seismic Force



2 ganged units

Netshelter SX plan

Design Bolts for 0 lbs tension, 758.4 lbs. shear, transverse direction, ganged fully loaded



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 South San Francisco, CA 94080
 (650) 871-2282 Fax 871-2459

APC Netshelter SX AR 3100
 Zone 0-3 Anchorage (Non-California)
 Job No. 05240
 By: AM Date: 1/27/2006

AR3100 Anchorage - Zone 0-3

Load Cases:

Ganged Fully Loaded Unit (<=50% OF BUILDING HEIGHT)

Ganged Fully Loaded Unit (On 18" RAISED COMPUTER FLOOR SYSTEM, <=50% OF BUILDING HEIGHT)

ANCHORAGE FORCES

CONDITION	ANCHORAGE FORCE (LBS.)	SHEAR FORCE (LBS.)
GANGED UNIT	0	758.4

ANCHORAGE DESIGN

CONC. FILL OVER METAL DECK: Use Hilti Kwik Bolt 3 Anchors (ICC ESR-1385)

Number of Brackets Used: 4

Anchor Diameter (in²): 0.375

Embedment Length (in.): 1.750

Embed. length /Dia = 4.67

(shallow anchor, increase load per UBC 1632.2)

Min. Conc Slab Thickness (1.5x embed. Length) 2.6 in. conc. cover, min.

(Note: If shallow Anchor applies, increase load by factor of 2, UBC97 1632.2)

Anchor Capacities:

with 1/3 seismic increase

Tension (lbs.) = 423 564.0
 Shear (lbs.) = 1062 1416.0

CHECK SHEAR & TENSION STRESS RATIO

Tmax = 0.0 lbs.

Vmax = 1516.8 lbs.

Ta = 2x564.0 lbs. = 1128.0 lbs.

V_all = 2x1416.0 lbs. = 2832.0 lbs.

<u>Tension</u>	0.0/1128.0 =	0.00	tension stress ratio
<u>Shear</u>	1516.8/2832.0 =	0.54	shear stress ratio

SUMMARY:

CONC. FILL OVER METAL DECK:

2.6 in. conc. cover, min. Use Hilti Kwik Bolt 3 Anchors (ICC ESR-1385), embed. 1.75 in.

Use 4 brackets total, one anchor/bracket

Load Case: Single Fully Loaded Unit (<=90% OF BUILDING HEIGHT)

Unit Dimensions

Length (in) =	23.6
Width (in) =	42.1
Frame Height (in) =	77

			Center of Gravity Location		
Unit	Part	Weight (lbs)	X (in)	Y (in)	Z (in)
AR3100	Frame	275.2	11.8	21.05	38.5
	Max Load	2000			38.5

Longitudinal Anchorage Spacing (in) = 9.65
 Transverse Anchorage Spacing (in) = 30.6 (internal & external brackets)

Seismic Force	
$C_a =$	0.28 (Zone 0-3)
$I_p =$	1.0 (Importance)
$a_p =$	1.0 (Cabinets)
$R_p =$	3.0 (Cabinets)
$h_x/h_r =$	0.9 (90% of building height)
$F_p =$	0.247 W
$F_{p,min} =$	0.14 W
$F_{p,max} =$	0.80 W
Use $F_p = 0.25 W$	

Longitudinal Overturning

Overturning

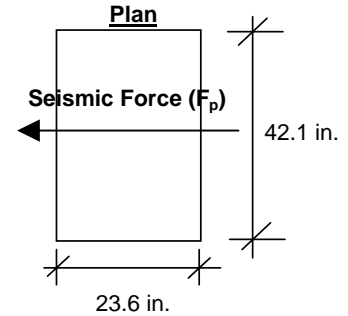
Moment = $0.25 (77/2 \text{ in.} \times (275.2 \text{ lbs.} + 2000 \text{ lbs.})) = 21607 \text{ lb-in}$

0.9xResisting

Moment = $0.9 (275.2 \text{ lbs.} + 2000 \text{ lbs.}) \times 11.8 \text{ in.} = 24163 \text{ lb-in}$

Anchorage Force =	0	lbs
Shear Force =	318.5	lbs.

Netshelter SX Unit



Design Bolts for 0 lbs tension, 318.5 lbs. shear, longitudinal direction, fully loaded

Transverse Overturning

Overturning

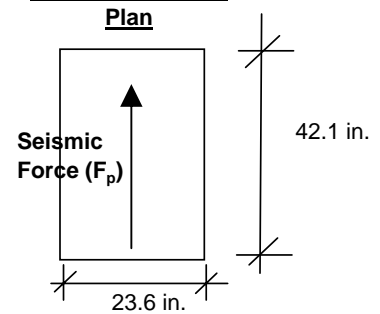
Moment = $0.25 (77/2 \text{ in.} \times (275.2 \text{ lbs.} + 2000 \text{ lbs.})) = 21607 \text{ lb-in}$

0.9xResisting

Moment = $0.9 (275.2 \text{ lbs.} + 2000 \text{ lbs.}) \times 21.05 \text{ in.} = 43104 \text{ lb-in}$

Anchorage Force =	0	lbs
Shear Force =	318.5	lbs.

Netshelter SX Unit



Design Bolts for 0 lbs tension, 318.5 lbs. shear, transverse direction, fully loaded



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APC Netshelter SX AR 3100
 Zone 0-3 Anchorage (Non-California)
 Job No. 05240
 By: AM Date: 1/27/2006

AR3100 Anchorage - Zone 0-3

Load Cases:

Single Fully Loaded Unit (<=90% OF BUILDING HEIGHT)

ANCHORAGE FORCES

CONDITION	ANCHORAGE FORCE (LBS.)	SHEAR FORCE (LBS.)
SINGLE UNIT	0	318.5

ANCHORAGE DESIGN

CONC. FILL OVER METAL DECK: Use Hilti Kwik Bolt 3 Anchors (ICC ESR-1385)

Number of Brackets Used: **4**

Anchor Diameter (in²): **0.375**

Embedment Length (in.): **1.625**

Embed. length /Dia = **4.33**

(shallow anchor, increase load per UBC 1632.2)

Min. Conc Slab Thickness (1.5x embed. Length) **2.4 in. conc. cover, min.**

(Note: If shallow Anchor applies, increase load by factor of 2, UBC97 1632.2)

Anchor Capacities:

with 1/3 seismic increase

Tension (lbs.) = **423** **564.0**
 Shear (lbs.) = **1062** **1416.0**

CHECK SHEAR & TENSION STRESS RATIO

Tmax = 0.0 lbs. Vmax = 637.1 lbs.
 Ta = 2x564.0 lbs. = 1128.0 lbs. V_all = 2x1416.0 lbs. = 2832.0 lbs.

<u>Tension</u>	0.0/1128.0 =	0.00	tension stress ratio
<u>Shear</u>	637.1/2832.0 =	0.22	shear stress ratio

SUMMARY: AR3100 Anchorage - Zone 0-3

CONC. FILL OVER METAL DECK:

2.4 in. conc. cover, min., Use Hilti Kwik Bolt 3 Anchors (ICC ESR-1385)

Use 4 brackets total, one anchor/bracket

Load Case: Ganged Fully Loaded Unit (<=90% OF BUILDING HEIGHT)

of Units ganged (max)= 2

Single Unit Dimension			Center of Gravity Location		
Length (in) =		23.6			
Width (in) =		42.1			
Frame Height (in) =		77			
Frame Weight (lb.) =		275.2			
Unit	Part	Weight (lbs)	X (in)	Y (in)	Z (in)
2 - AR3100	Frame	550.4	23.6	21.05	38.5
	Max Load	4000			38.5

Seismic Force	
$C_a =$	0.28 (Zone 0-3)
$I_p =$	1.0 (Importance)
$a_p =$	1.0 (Cabinets)
$R_p =$	3.0 (Cabinets)
$h_x/h_r =$	0.9 (90% of building height)
$F_p =$	0.247 W
$F_{p,min} =$	0.14 W
$F_{p,max} =$	0.80 W
Use $F_p =$	0.25 W

(2000lbs.x 2units)
 Longitudinal Anchorage Spacing (in) = 23.6
 Transverse Anchorage Spacing (in) = 30.6

Longitudinal Overturning

Overturning

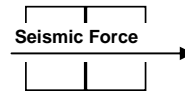
Moment = $0.25 (77/2 \text{ in.} \times (550.4\text{lbs.} + 4000 \text{ lbs.})) = 43214 \text{ lb-in}$

0.9xResisting

Moment = $0.9 (550.4 \text{ lbs.} + 4000 \text{ lbs.}) \times 23.6 \text{ in.} = 96650 \text{ lb-in}$

Anchorage Force =	0	lbs
Shear Force =	1122.4	lbs.

Netshelter SX plan



2 ganged units

Design Bolts for 0 lbs tension, 1122.4 lbs. shear, longitudinal direction, ganged fully loaded

Transverse Overturning

Overturning

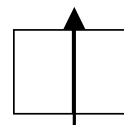
Moment = $0.25 (77/2 \text{ in.} \times (550.4\text{lbs.} + 4000 \text{ lbs.})) = 43214 \text{ lb-in}$

0.9xResisting

Moment = $0.9 (550.4 \text{ lbs.} + 4000 \text{ lbs.}) \times 21.05 \text{ in.} = 86207 \text{ lb-in}$

Anchorage Force =	0	lbs
Shear Force =	1122.4	lbs.

Seismic Force



2 ganged units

Netshelter SX plan

Design Bolts for 0 lbs tension, 1122.4 lbs. shear, transverse direction, ganged fully loaded



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APC Netshelter SX AR 3100
 Zone 0-3 Anchorage (Non-California)
 Job No. 05240
 By: AM Date: 1/27/2006

AR3100 Anchorage - Zone 0-3

Load Cases:
Ganged Fully Loaded Unit (<=90% OF BUILDING HEIGHT)

ANCHORAGE FORCES

CONDITION	ANCHORAGE FORCE (LBS.)	SHEAR FORCE (LBS.)
SINGLE UNIT	0	1122.4

ANCHORAGE DESIGN

CONC. FILL OVER METAL DECK: Use Hilti Kwik Bolt 3 Anchors (ICC ESR-1385)

Number of Brackets Used: **4**
 Anchor Diameter (in²): **0.375**
 Embedment Length (in.): **1.625**
 Embed. length /Dia = **4.33** (shallow anchor, increase load per UBC 1632.2)
 Min. Conc Slab Thickness (1.5x embed. Length) **2.4 in. conc. cover, min.**

(Note: If shallow Anchor applies, increase load by factor of 2, UBC97 1632.2)

Anchor Capacities: with 1/3 seismic increase

Tension (lbs.) = **423** **564.0**
 Shear (lbs.) = **1062** **1416.0**

CHECK SHEAR & TENSION STRESS RATIO

Tmax = 0.0 lbs. Vmax = 2244.9 lbs.
 Ta = 2x564.0 lbs. = 1128.0 lbs. V_all = 2x1416.0 lbs. = 2832.0 lbs.

<u>Tension</u>	0.0/1128.0 =	0.00	tension stress ratio
<u>Shear</u>	2244.9/2832.0 =	0.79	shear stress ratio

SUMMARY: AR3100 Anchorage - Zone 0-3 & Top Shelf Loaded

CONC. FILL OVER METAL DECK:
2.4 in. conc. cover, min., Use Hilti Kwik Bolt 3 Anchors (ICC ESR-1385)
Use 4 brackets total, one anchor/bracket

Load Case: Ganged Fully Loaded Unit
(On 18" RAISED COMPUTER FLOOR SYSTEM, <=90% OF BUILDING HEIGHT)

of Units ganged (max)= 2

Single Unit Dimension	
Length (in) =	23.6
Width (in) =	42.1
Frame Height (in) =	77
Frame Weight (lb.) =	275.2

Unit	Part	Weight (lbs)	Center of Gravity Location		
			X (in)	Y (in)	Z (in)
2 - AR3100	Frame	550.4	23.6	21.05	56.5
	Max Load	4000			56.5

(2000lbs.x 2units)

Longitudinal Anchorage Spacing (in) = 23.6
 Transverse Anchorage Spacing (in) = 30.6

Seismic Force	
$C_a =$	0.28 (Zone 0-3)
$I_p =$	1.0 (Importance)
$a_p =$	1.0 (Cabinets)
$R_p =$	3.0 (Cabinets)
$h_x/h_r =$	0.9 (90% of building height)
$F_p =$	0.247 W
$F_{p,min} =$	0.14 W
$F_{p,max} =$	0.80 W
Use $F_p =$	0.25 W

Longitudinal Overturning

Overturning

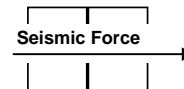
Moment = $0.25 (77/2 \text{ in.} \times (550.4\text{lbs.} + 4000 \text{ lbs.})) = 63417 \text{ lb-in}$

0.9xResisting

Moment = $0.9 (550.4 \text{ lbs.} + 4000 \text{ lbs.}) \times 23.6 \text{ in.} = 96650 \text{ lb-in}$

Anchorage Force =	0	lbs
Shear Force =	1122.4	lbs.

Netshelter SX plan



2 ganged units

Design Bolts for 0 lbs tension, 1122.4 lbs. shear, longitudinal direction, ganged fully loaded

Transverse Overturning

Overturning

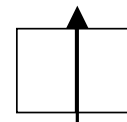
Moment = $0.25 (77/2 \text{ in.} \times (550.4\text{lbs.} + 4000 \text{ lbs.})) = 63417 \text{ lb-in}$

0.9xResisting

Moment = $0.9 (550.4 \text{ lbs.} + 4000 \text{ lbs.}) \times 21.05 \text{ in.} = 86207 \text{ lb-in}$

Anchorage Force =	0	lbs
Shear Force =	1122.4	lbs.

Seismic Force



2 ganged units

Netshelter SX plan

Design Bolts for 0 lbs tension, 1122.4 lbs. shear, transverse direction, ganged fully loaded



103 Linden Avenue
 South San Francisco, CA 94080
 (650) 871-2282 Fax 871-2459

APC Netshelter SX AR 3100
 Zone 0-3 Anchorage (Non-California)
 Job No. 05240
 By: AM Date: 1/27/2006

AR3100 Anchorage - Zone 0-3

Load Cases:

Ganged Fully Loaded Unit

(On 18" RAISED COMPUTER FLOOR SYSTEM, <=90% OF BUILDING HEIGHT)

ANCHORAGE FORCES

CONDITION	ANCHORAGE FORCE (LBS.)	SHEAR FORCE (LBS.)
SINGLE UNIT	0	1122.4

ANCHORAGE DESIGN

CONC. FILL OVER METAL DECK: Use Hilti Kwik Bolt 3 Anchors (ICC ESR-1385)

Number of Brackets Used: **4**

Anchor Diameter (in²): **0.375**

Embedment Length (in.): **1.625**

Embed. length /Dia = **4.33**

(shallow anchor, increase load per UBC 1632.2)

Min. Conc Slab Thickness (1.5x embed. Length) **2.4 in. conc. cover, min.**

(Note: If shallow Anchor applies, increase load by factor of 2, UBC97 1632.2)

Anchor Capacities:

with 1/3 seismic increase

Tension (lbs.) = **423** **564.0**
 Shear (lbs.) = **1062** **1416.0**

CHECK SHEAR & TENSION STRESS RATIO

Tmax = 0.0 lbs. Vmax = 2244.9 lbs.
 Ta = 2x564.0 lbs. = 1128.0 lbs. V_all = 2x1416.0 lbs. = 2832.0 lbs.

<u>Tension</u>	0.0/1128.0 =	0.00	tension stress ratio
<u>Shear</u>	2244.9/2832.0 =	0.79	shear stress ratio

SUMMARY: AR3100 Anchorage - Zone 0-3 & Top Shelf Loaded

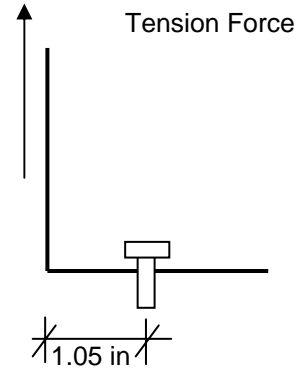
CONC. FILL OVER METAL DECK:

2.4 in. conc. cover, min., Use Hilti Kwik Bolt 3 Anchors (ICC ESR-1385)

Use 4 brackets total, one anchor/bracket

Worst Case AR7701 Bending

Worst Case Tension Force (lbs.) =	0
No. Of Brackets resisting uplift =	4
Tension Force/Bracket (lbs.) =	0
Moment Arm (in.) =	1.05
Moment= P*L/2 (lb-in.) =	0
Sx (in ³) =	0.0066
Actual Bending Stress (ksi) =	0.00
Allowable Bending Stress (ksi) =	50



NOTE: (1) APC 870-11101A pallette bracket may be used in lieu of (2) APC7701 brackets