



**Structural Calculations  
For  
Vibration Isolated Roof Curbs  
Supporting HVAC Units  
York Units – Sunline 3-6 Series  
ProVent P/N:  
ISCALSUN367218,  
ISCALSUN367221,  
& ISCALSUN367224,  
Form No: ISCAL-126**



**Prepared for:  
ProVent  
3847 Wabash Dr.  
Mira Loma, CA 91725**

**Date: July 16, 2013  
Project Number: PRO1103**

PROVENT STEEL CURB DESIGN

HVAC UNIT: Sunline 3-6 Vibration Isolated Curbs

PROVENT PART NUMBER:ISCAL-126

**Curb Information**

Curb Number:

Hcurb	14	(Height from support structure to top of curb)
Lcurb	69	(Length of Curb)
Wcurb	33.25	(Width of Curb)
Lclip	60	(min Length in Long dir from end to clip)
Total Hcurb	34	H curb+isolator curb "B"
# clips Long Side	2	
# clips short side	0	

**Unit Information:**

Weight:	1175	(Weight of Unit)
W c-max	679	(Maximum corner weight)
W c-min	234	(Minimum corner weight)
W mid	96	
H unit	32.625	(Height of unit above curb)
H cm	16.3125	(Height from top of curb to center of mass of unit)
L unit	82.25	(Length of unit)
w unit	44.875	(Width of unit)

**Seismic Loading (CBC 2010 / IBC 2009)**

Ss	2	(Conservative value - most of California)
Fa	1	(worst case for site; Ss<0.25, Site Class E)
Sms	2	(=Fa*Ss)
Sds	1.33	(=2/3*Sms)
Ip	1.5	(=Worst case)
ap	2.5	(worst case ap and Rp for spring isolated curbs)
Rp	2	
Fp max	3.1 Wp	(=0.4*ap*Sds*Wp*(1+2*z/h)/(Rp/Ip))*Fp multiplier
Fp ASD	2530 lbs	(=0.7*Fpmax)

**Wind Loading (CBC 2010 / IBC 2009)**

Wind Exposure:	C	
V	100 mph	
Kzt	1	(No topographic effects for rooftop mounted units per ASCE 7-05)
Kd	0.9	
Kh	1.13	(Worst Case for 60 foot roof height)
Cf/transv	1.46	h/D 8.8
Cf/long	1.70	h/D 16.0
Iw	1.15	
G	0.85	
q	29.9 psf	
Ftransv	70.5 psf	
Flong	82.3 psf	
A net/transv.	30 sf	
Fwind transv	2120 lbs	
A net/long	16 sf	
Fwind long	1349 lbs	

**Controlling Lateral Load (Seismic vs. Wind)**

Transverse	2530 lbs
Long	2530 lbs

**Curb Loading:**

Transverse direction:

OTM:	3440 lb-ft	$F_{max} - transv * H_{cm}$
M res.	1050 lb-ft	$2 * W_{crnmin} * 0.6 * width\ unit$
Net OTM:	2390 lb-ft	OTM-RM
Max Comp	1997 lbs /side	$(2 * W_{crnmax} + (Mot-Mres)/W_{curb})$
Max Tension	862 lbs /side	$((Mot-Mres)/W_{curb})$
Max Tension	431 lbs /clip	Max tension/side /#clips
Max Corner:	854 lbs	$W_{c-max} + (Mot-Mres)/W_{curb}/L_{curb} * (N-corner)/2$
Max Interior:	446 lbs	$W_{mid} + (Mot-Mres)/W_{curb}/L_{curb} * (N-mid)$

Longitudinal direction:

OTM:	3440 lb-ft	$F_{max} long * H_{cm}$
RM	1925 lb-ft	$2 * W_{crnmin} * L_{unit} * 0.6$
Net OTM:	1515 lb-ft	OTM-RM
Max Comp =	1661 lbs /side	$(2 * W_{crnmax} + (Mot-Mres)/L_{clip})$
Max Tens = "	303 lbs	
Max Tension =	152 lbs /clip long side	

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**Curb info**

H curb	14	in, curb height
Fy	50	ksi
E	29000	ksi
Fu	65	ksi
gage:	16	ga
R	0.0849	
t	0.0566	t/BUS 0.1132
R/t	1.50	
h	13.77	in

**Interior Curb**

N	28	bearing length: 2*h
C	20	
C <sub>R</sub>	0.1	
C <sub>N</sub>	0.08	
C <sub>h</sub>	0.03	
φ <sub>w</sub>	0.85	
Ω <sub>w</sub>	1.75	
Pn	4.16 k	
Pall	2.38 k	
φPn	3.53 k	
Pmax	0.45 k	Pall>Pmax,curb OK,

**Exterior Curb:**

N total	28	2*curb height
N -BUS	7	bearing length with stiffener (built up section)
N - SWC	21	bearing length without stiffener (single web channel)

Exterior Curb SWC	
N	21
C	7.5
C <sub>R</sub>	0.08
C <sub>N</sub>	0.12
C <sub>h</sub>	0.05
φ <sub>w</sub>	0.85
Ω <sub>w</sub>	1.75
Pn	0.79 k
Pall	0.45 k
φPn	0.67 k

Exterior Curb BUS	
N	7
C	15.5
C <sub>R</sub>	0.09
C <sub>N</sub>	0.08
C <sub>h</sub>	0.04
φ <sub>w</sub>	0.75
Ω <sub>w</sub>	2
Pn	16.09 k
Pall	8.04 k
φPn	12.07 k

Corner:	
Pall	8.49 k
φPn	12.74 k
Pmax	0.85 k

Pall>Pmax,curb OK,

**Connection of Unit to Curb**

Screws: Long Side	(Attach with #12 SMS)	Vall=	525	lbs/screw
		Vall=	525	lbs/screw

Req scr # screws

Uplift = 431.2252 lbs/clip 0.8 1.0 min/clip

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**Connection of Curb to Supporting Structure**

Transverse:

Uplift = 1928 lbs (Max Tens)  
 Shear= 2530 lbs (Maximum Lateral Force)

Longitudinal:

Uplift = 777 lbs (Max Tens/0.9)  
 Shear= 2530 lbs (Maximum Lateral Force)

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<b>Wood Attachment: (Use 1/4" <math>\phi</math> x 3 1/2" Simpson SDS screws)</b>	Tall=	616 lbs
	Vall=	400 lbs

Transverse

Number Screws Required for Uplift= 4.8  
 Number Screws Required for Shear= 6.3 (This Value is for Entire Curb)  
 Number of Screws Required= 5.0 (Along Long Side of Curb)

Longitudinal

Number Screws Required for Uplift= 1.3  
 Number Screws Required for Shear= 6.3 (This Value is for Entire Curb)  
 Number of Screws Required= 2.0 (Along Short Side of Curb)

total wood screws required= 6.3

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<b>Concrete Attach.: (Use 1/2" <math>\phi</math> Simpson Titen HD w/ 3" Min. Embed)</b>	Tall=	1155 lbs
	Vall=	1605 lbs

Transverse:

Number Screws Required for Uplift= 1.2  
 Number Screws Required for Shear= 1.6 (This Value is for Entire Curb)  
 Number of Screws Required= 2.0 (Along Long Side of Curb)

Longitudinal:

Number Screws Required for Uplift= 0.7  
 Number Screws Required for Shear= 1.6 (This Value is for Entire Curb)  
 Number of Screws Required= 1.0 (Along Short Side of Curb)

total concrete attachments required= 1.6

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**Steel Deck Attach.: (Use 1/2"  $\phi$  A307 Bolts attached to L5x5x1/4 below deck at each conn.point)**

Tall=	2300 lbs
Vall=	4400 lbs

Transverse:

Number Screws Required for Uplift= 0.4  
 Number Screws Required for Shear= 0.6 (This Value is for Entire Curb)  
 Number of Screws Required= 1.0 (Along Long Side of Curb)

Longitudinal:

Number Screws Required for Uplift= 0.3  
 Number Screws Required for Shear= 0.6 (This Value is for Entire Curb)  
 Number of Screws Required= 1.0 (Along Short Side of Curb)

total steel attachments required= 0.6

**Tube Support and Isolator Information**

# Isolators long side	2	
# Isolators short side	0	
Total # isolators	4	
Edge dist/ long side	4	in (approximate)
Long side/spacing	40	max spacing btwn isolators (tube span)
Isolator bearing length	10.5	

**Isolators: JQA Assembly by CalDyn**

Rall= 1660 lbs  
 Vall= 800 lbs

Loading:

Vmax: 633 lbs /isolator Isolator OK for shear  
 Rmax- long side: 1110 lbs/isolator Isolator OK for load  
 Rmax- short side: N/A lbs/isolator

**Frame: 10 Ga Formed Tube Support**

Fy=50ksi  
 10 ga (t=0.1242in)  
 6inch x 1.125 in tube

Load/long side: 29 lb/in  
 Mmax 5.79 k-in  
 Vmax 0.7 k

Allowable:  
 Moment: 58.675 k-in OK  
 Max Lu: 84 in OK  
 Web Crippling: 5.5 k OK  
 Shear: 2.2 k OK  
 Tube Support OK