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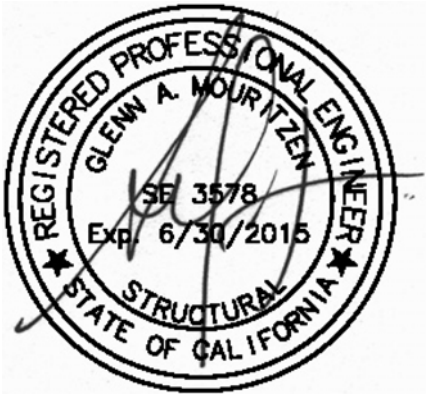
Structural Calculations
For
Vibration Isolated Roof Curbs
Supporting HVAC Units
York Units – Sunline Ultra Series
ProVent P/N:
ISCALSLSLU18019,
ISCALSLSLU18022,
& ISCALSLSLU18025,
Form No: ISCAL-128



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

Date: July 16, 2013
Project Number: PRO1103

PROVENT STEEL CURB DESIGN

HVAC UNIT: Sunshine Ultra Vibration Isolated Curbs PROVENT PART NUMBER:ISCAL-128

Curb Information

Curb Number:

Hcurb	14	(Height from support structure to top of curb)
Lcurb	111.25	(Length of Curb)
Wcurb	80	(Width of Curb)
Lclip	100	(min Length in Long dir from end to clip)
Total Hcurb	35	H curb+isolator curb "B"
# clips Long Side	3	
# clips short side	1	

Unit Information:

Weight:	2841	(Weight of Unit)
W c-max	1198	(Maximum corner weight)
W c-min	458	(Minimum corner weight)
W mid	318	
H unit	48.625	(Height of unit above curb)
H cm	24.3125	(Height from top of curb to center of mass of unit)
L unit	125.25	(Length of unit)
w unit	92	(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	6162 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	1.38	h/D	5.7
Cf/long	1.43	h/D	7.8
Iw	1.15		
G	0.85		
q	29.9 psf		
Ftransv	66.7 psf		
Flong	69.0 psf		
A net/transv.	61 sf		
Fwind transv	4039 lbs		
A net/long	44 sf		
Fwind long	3070 lbs		

Controlling Lateral Load (Seismic vs. Wind)

Transverse	6162 lbs
Long	6162 lbs

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Curb Loading:

Transverse direction:

OTM:	12485	lb-ft	F max - transv * Hcm
M res.	4214	lb-ft	2 * Wcrnmin *0.6* width unit
Net OTM:	8271	lb-ft	OTM-RM
Max Comp	3475	lbs /side	(2 x Wcrnmax + (Mot-Mres)/Wcurb)
Max Tension	1241	lbs /side	((Mot-Mres)/Wcurb)
Max Tension	414	lbs /clip	Max tension/side /#clips
Max Corner:	1354	lbs	W c-max+ (Mot-Mres)/Wcurb/Lcurb*(N-corner)/2
Max Interior:	630	lbs	W mid+ (Mot-Mres)/Wcurb/Lcurb*(N-mid)

Longitudinal direction:

OTM:	12485	lb-ft	F max long * Hcm
RM	5736	lb-ft	2 X Wcrnmin x Lunit x 0.6
Net OTM:	6749	lb-ft	OTM-RM
Max Comp =	3206	lbs /side	(2 x Wcrnmax + (Mot-Mres)/Lclip)
Max Tens = "	728	lbs '/side	
Max Tension =	728	lbs '/clip short side	
Max Corner:	1325	lbs	

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Curb info

H curb	14	in, curb height
Fy	50	ksi
E	29000	ksi
Fu	65	ksi
gage:	14	ga
R	0.1069	
t	0.0713	
R/t	1.50	
h	13.71	in

t/BUS	0.1426

Interior Curb

N	28	bearing length: 2*h
C	20	
C_R	0.1	
C_N	0.08	
C_h	0.03	
ϕ_w	0.85	
Ω_w	1.75	
Pn	6.73 k	
Pall	3.85 k	
ϕPn	5.72 k	
Pmax	0.63 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_R	0.08
C_N	0.12
C_h	0.05
ϕ_w	0.85
Ω_w	1.75
Pn	1.61 k
Pall	0.92 k
ϕPn	1.37 k

Exterior Curb BUS	
N	7
C	15.5
C_R	0.09
C_N	0.08
C_h	0.04
ϕ_w	0.75
Ω_w	2
Pn	26.60 k
Pall	13.30 k
ϕPn	19.95 k

Corner:	
Pall	14.22 k
ϕPn	21.32 k
Pmax	1.35 k

Pall>Pmax,curb OK,

Connection of Unit to Curb

Screws: Short Side	(Attach with #14 SMS)	Vall=	600 lbs/screw
Screws: Long Side	(Attach with #14 SMS)	Vall=	600 lbs/screw

		Req scr	# screws	
Uplift =	413.5739 lbs/clip	0.7	1.0	min/clip
Uplift/short side=	727.9418 lbs/clip	1.21	2.0	

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Connection of Curb to Supporting Structure

Transverse:

Uplift =	2319	lbs	(Max Tens)
Shear=	6162	lbs	(Maximum Lateral Force)

Longitudinal:

Uplift =	1503	lbs	(Max Tens/0.9)
Shear=	6162	lbs	(Maximum Lateral Force)

Wood Attachment: (Use 1/4" ϕ x 3 1/2" Simpson SDS screws)

Tall= 616 lbs
Vall= 400 lbs

Transverse

Number Screws Required for Uplift=	5.8	
Number Screws Required for Shear=	15.4	(This Value is for Entire Curb)
Number of Screws Required=	6.0	(Along Long Side of Curb)

Longitudinal

Number Screws Required for Uplift=	2.4	
Number Screws Required for Shear=	15.4	(This Value is for Entire Curb)
Number of Screws Required=	3.0	(Along Short Side of Curb)

total wood screws required= 15.4

Concrete Attach.: (Use 1/2"ϕ Simpson Titen HD w/ 3" Min. Embed)

Tall= 1155 lbs
Vall= 1605 lbs

Transverse:

Number Screws Required for Uplift=	1.4	
Number Screws Required for Shear=	3.8	(This Value is for Entire Curb)
Number of Screws Required=	2.0	(Along Long Side of Curb)

Longitudinal:

Number Screws Required for Uplift=	1.3	
Number Screws Required for Shear=	3.8	(This Value is for Entire Curb)
Number of Screws Required=	2.0	(Along Short Side of Curb)

total concrete attachments required= 3.8

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

Tall= 2300 lbs
Vall= 4400 lbs

Transverse:

Number Screws Required for Uplift=	0.5	
Number Screws Required for Shear=	1.4	(This Value is for Entire Curb)
Number of Screws Required=	1.0	(Along Long Side of Curb)

Longitudinal:

Number Screws Required for Uplift=	0.7	
Number Screws Required for Shear=	1.4	(This Value is for Entire Curb)
Number of Screws Required=	1.0	(Along Short Side of Curb)

total steel attachments required= 1.4

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Tube Support and Isolator Information

# Isolators long side	2	
# Isolators short side	2	
Total # isolators	8	
Edge dist/ long side	4	in (approximate)
Long side/spacing	82	max spacing btwn isolators (tube span)
Isolator bearing length	10.5	

Isolators: JQA Assembly by CalDyn

Rall=	1660	lbs
Vall=	800	lbs

Loading:

Vmax:	770	lbs /isolator	Isolator OK for shear
Rmax- long side:	1818	lbs/isolator	Isolator NO GOOD
Rmax- short side:	963	lbs/isolator	Isolator OK for load

Frame: 10 Ga Formed Tube Support

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

Load/long side:	31	lb/in	
Mmax	26.25	k-in	
Vmax	1.6	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

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