APPLICATION FOR OSHPD PREAPPROVAL OF MANUFACTURER'S CERTIFICATION (OPM)

OFFICE USE ONLY

APPLICATION #: OPM-0561

OSHPD Preapproval of Manufacturer's Certification (OPM)

Type: [X] New [ ] Renewal/Update

Manufacturer Information

Manufacturer: California Dynamics Corporation

Manufacturer's Technical Representative: Efrain Escobedo

Mailing Address: 5572 Alhambra Avenue,, Los Angeles, CA 90032

Telephone: (323) 223-3882 Email: ee@caldyn.com

Product Information

Product Name: CalDyn CQB for HVAC equipment by Loren Cook Company

Product Type: Support under Cook Fans

Product Model Number: CPV 150 – CPV 490

General Description: CalDyn Vibration Isolator With Seismic Restraint (VIWR) Strength and Stiffness that can potentially be

Applicant Information

Applicant Company Name: California Dynamics Corporation

Contact Person: Tim Benkert

Mailing Address: 5572 Alhambra Avenue, Los Angeles, CA 90032

Telephone: (323) 223-3882 Email: tbenkert@caldyn.com

Title:

Registered Design Professonal Preparing Engineering Recommendations

Company Name: Independent Consulting Engineer

Name: Said Amirsolaimany California License Number: CE37835

Mailing Address: 196 The Masters Circle, Costa Mesa, CA 92627

Telephone: (818) 239-6180 Email: samamir1234@yahoo.com

OSHPD Special Seismic Certification Preapproval (OSP)

[X] Special Seismic Certification is preapproved under OSP OSP Number: OSP-0102-10

Certification Method

Testing in accordance with: [X] ICC-ES AC156 [X] FM 1950-16

[ ] Other(s) (Please Specify):

*Use of criteria other than those adopted by the California Building Standards Code, 2019 (CBSC 2019) for component supports and attachments are not permitted. For distribution system, interior partition wall, and suspended ceiling seismic bracings, test criteria other than those adopted in the CBSC 2019 may be used when approved by OSHPD prior to testing.

[ ] Analysis

[ ] Experience Data

[ ] Combination of Testing, Analysis, and/or Experience Data (Please Specify):

OSHPD Approval

Date: 12/30/2020

Name: Jeffrey Kikumoto Title: Senior Structural Engineer

Condition of Approval (if applicable):

CALIFORNIA DYNAMICS CORP.

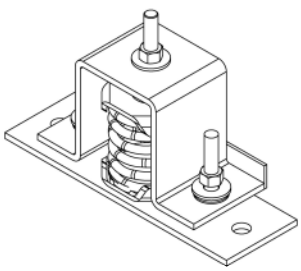
OSHPD PREAPPROVAL OF MANUFACTURER'S CERTIFICATION (OPM)

OPM-0561-19

CALIFORNIA BUILDING CODE 2019

(CBC 2019)

REGISTERED PROFESSIONAL ENGINEER
AMIRSOLAIMANY SAID
NO. C037835
CIVIL
STATE OF CALIFORNIA



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Loren Cook Company CPV60 to CPV150 HVAC Fans w/ CalDyn CQB Vibration Isolator with Restraint (CQB Style V VIWR)

Code: CBC 2019, ASCE 7-16

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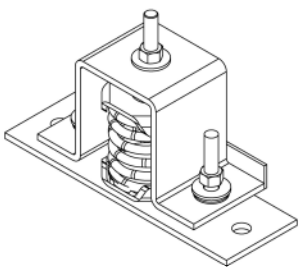

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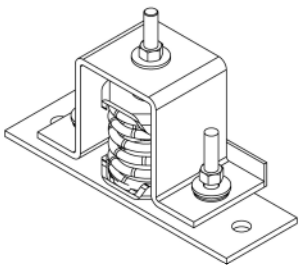
GENERAL NOTES

1. **This OSHPD Preapproval of Manufacturer's Certification (OPM) is based on the CBC 2019. The demand (design forces) for use with this OPM must be based on the CBC 2019.**

2. **For support and attachment of Cook Fans (applicable to various models as listed on this report), the maximum seismic parameters are as follows:**
   S_{DS} = 2.0 (Design Short Period Spectral Acceleration)
   z/h ≤ 1.0 (Component Located at Roof or below)
   a_p = 2.5 (Component Amplification Factor)
   R_p = 2.0 (Response Modification Coefficient)
   I_p = 1.5 (Component Importance Factor)
   Ω_0 = 2.0 (Overstrength Factor)

3. **Strength and Stiffness for CalDyn Vibration Isolator with Restraints (VIWRs) are applicable to any z/h & S_{DS} ≤ 2.0, subject to project specific review and OSHPD approval of supports and attachments design. Registered Design Professional (RDP) must coordinate with CalDyn in selection of VIWRs.**

4. **The Structural Engineer of Record (SEOR) must verify the adequacy of the supporting structure and must be responsible for obtaining project specific OSHPD approval for structures, components, supports and attachments.**



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VIWR DESIGN PROCEDURE EXAMPLE

1) Determine "g" Force

BUILDING CODE

CBC-2019

LOAD COMBINATION

1.2D + 1.0E (CBC 2019 EQ. 16A-5)
0.9D - 1.0E (CBC 2019 EQ. 16A-7)

SEISMIC DESIGN

S_{DS} = 2.0
I_p = 1.5
a_p = 2.5
R_p = 2.0

BLDG. ELEVATION / EQUIPMENT LOCATION

$z/h \leq 1.0$ (ROOF Level installation)
WORST CASE

I_p (COMPONENT IMPORTANCE FACTOR PER CBC 2019 S1616A.1.17)

a_p (COMPONENT AMPLIFICATION FACTOR PER ASCE 7-16, SECTION 13.6 TABLE 13.6-1)

R_p (COMPONENT RESPONSE FACTOR PER ASCE 7-16, SECTION 13.6 TABLE 13.6-1)

z (HEIGHT IN STRUCTURE OF POINT OF ATTACHMENT OF COMPONENT WITH RESPECT TO THE BASE)

h (AVERAGE ROOF HEIGHT OF STRUCTURE WITH RESPECT TO THE BASE)

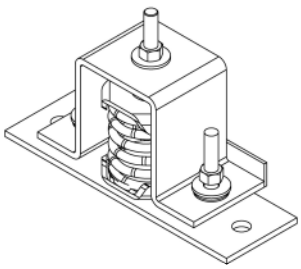
W_p = 344 LBS (EXAMPLE LOREN COOK FAN)

$$F_p / W_p = \frac{(0.4)\, a_p\, S_{DS}}{\left(\frac{R_p}{I_p}\right)}\left(1+2\frac{z}{h}\right) \quad \text{.....(EQUATION 13.3-1)}$$

$$= \frac{(0.4 * 2.5 * 2.0)}{\left(\frac{2.0}{1.5}\right)} * \left(1 + 2[1.0]\right) = \mathbf{4.5}$$

$F_{p\,(MAX)} / W_P = 1.6\ S_{DS}\ I_p$ .....(EQUATION 13.3-2)
$= 1.6 * 2.0 * 1.5 = 4.8$ (MAX.)

$F_{p\,(MIN)} / W_P = 0.3\ S_{DS}\ I_p$ .....(EQUATION 13.3-3)
$= 0.3 * 2.0 * 1.5 = 0.9$ (MIN.)



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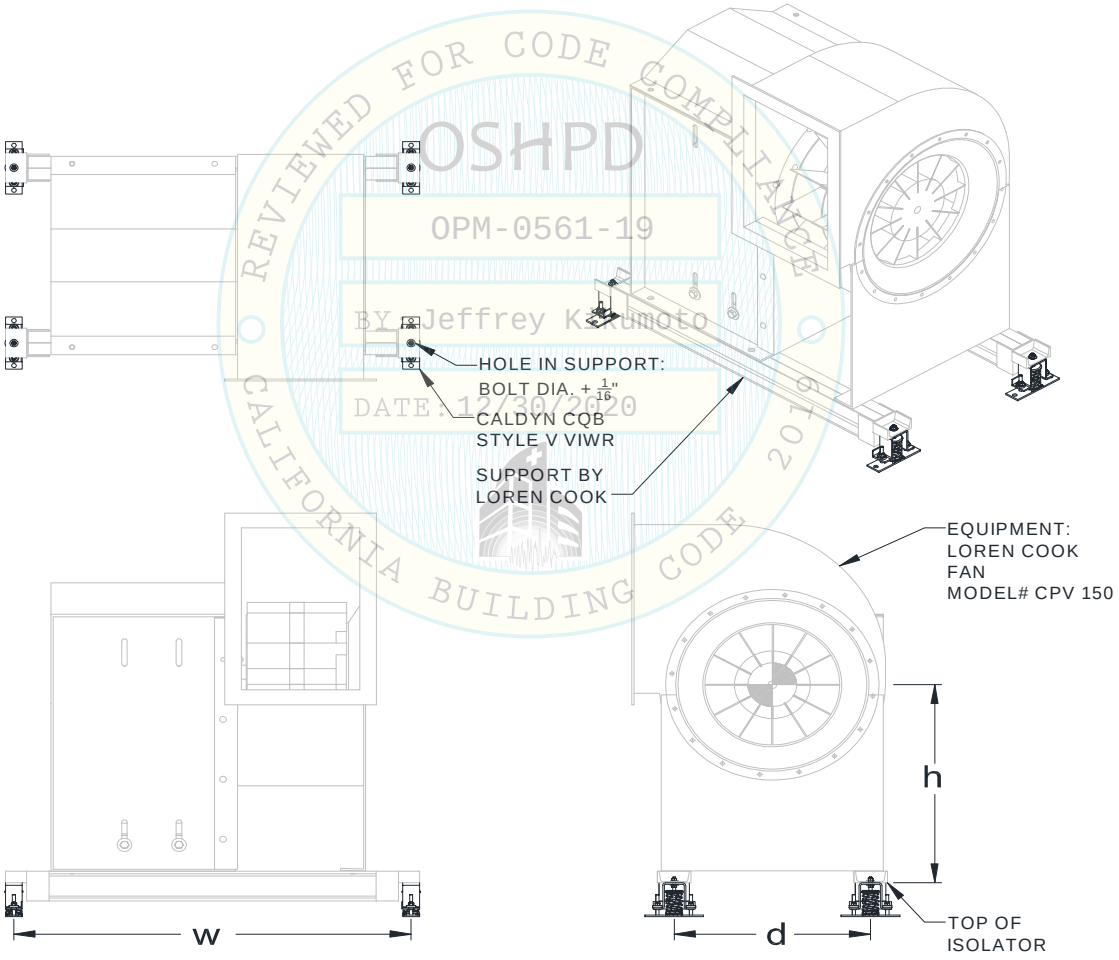
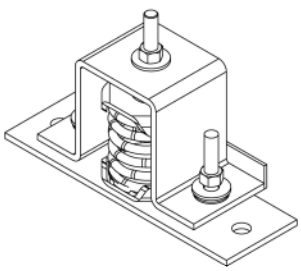
VIWR DESIGN PROCEDURE EXAMPLE - CONTINUE

2) Determine dimensions & operating weight from Manufacturer's literature.

Example: Loren Cook Fan MODEL# CPV 150

W_p = Operating Weight = 344 lbs
d = VIWR Mounting Depth = 28.0 in. (approx.)
w = VIWR Mounting Width = 40.0 in. (approx.)
h = Vertical Center of Gravity = 20.7 in.
R = VIWR Quantity along Width = 2
Q = VIWR Quantity along Depth = 2
N = Total VIWR Quantity = 4





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VIWR DESIGN PROCEDURE EXAMPLE - CONTINUE

TABLE 1: Loren Cook Fan information

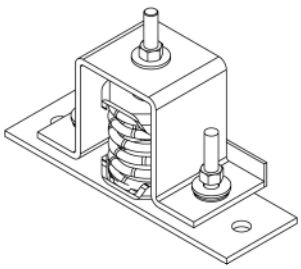
Mode Line	Model	Dimensions (in.)			Weight
		Depth	Width	Height	(lb)
CPV (Belt Drive)	60	22.3	25.6	36.8	250
	70	22.3	25.6	36.8	250
	80	22.3	25.6	36.8	250
	100	22.3	25.6	36.8	250
	120	24.8	29.6	36.8	265
	135	26.7	31.7	37.8	297
	150	29.6	35.7	41.4	344

NOTES:

1) Equipment data from **OSP-0102-10**.

2) Equipment models listed in **Table 1** represent **Loren Cook Fans** that could be supported on **CQB Style V VIWRS**.

3) Equipment depth and width dimensions do not correspond to w & d VIWR placement dimensions as noted on page 5 of this report.



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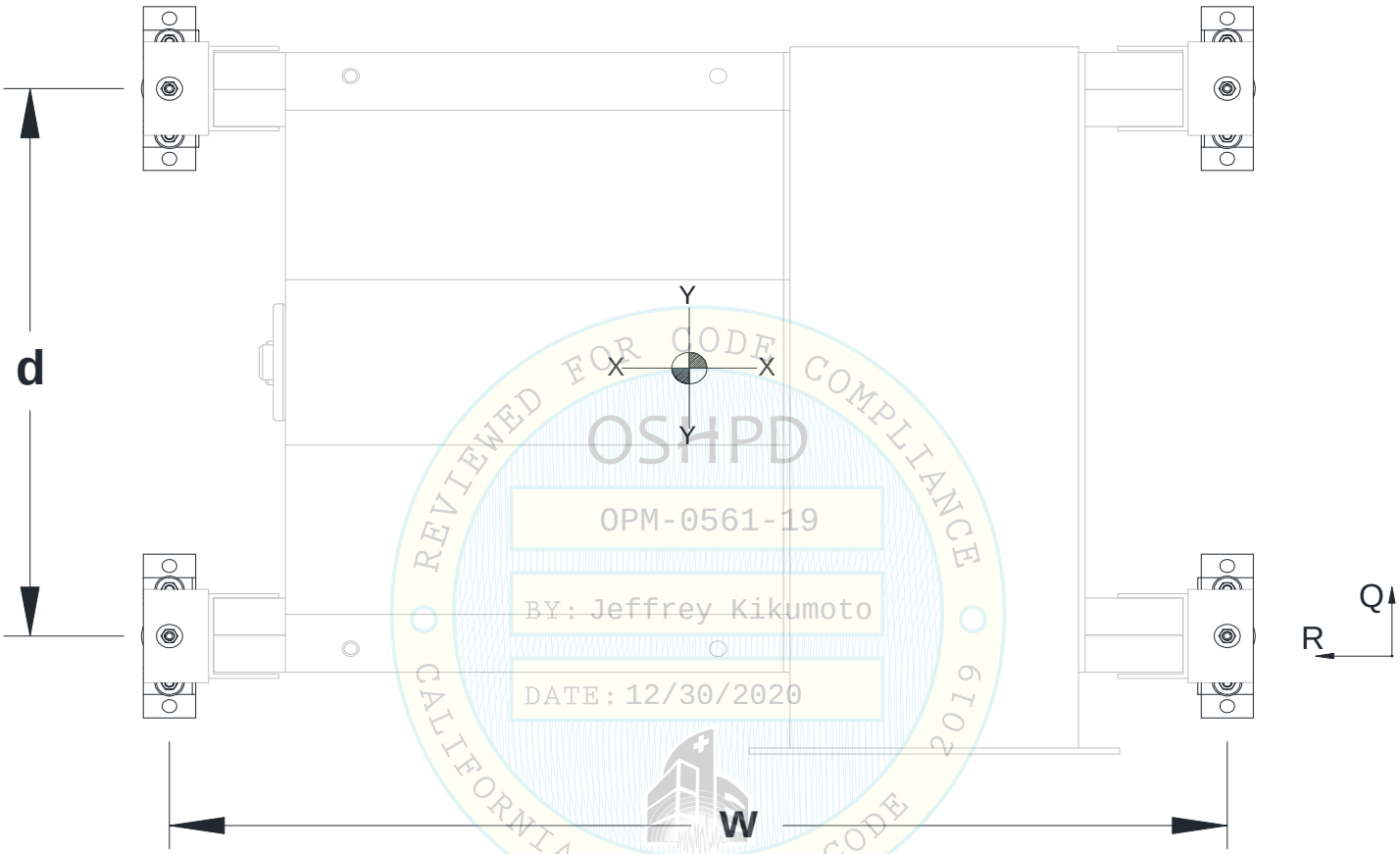
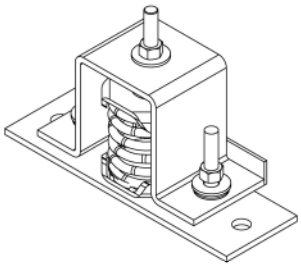
VIWR DESIGN PROCEDURE EXAMPLE - CONTINUE

3) Determine seismic forces T_u & V_u using the sum of the moments overturning method.



PLAN VIEW (EQUIPMENT ON VIWRs)



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VIWR DESIGN PROCEDURE EXAMPLE - CONTINUE

APPLIED SEISMIC FORCE / CALCULATION:

$z / h \leq 1.0$; $S_{DS} = 2.0$

$\mathbf{F_{ph}}$ = Applied Lateral Seismic Force = $(\mathbf{F_p / W_p}) * W_p$
= 4.5 * 344 lbs = 1,548 lbs

$\mathbf{F_{pv}}$ = Applied Component of Seismic Force (E_v) = $0.2 * S_{ds} * W_p$
= 0.2 * 2.0 * 344 lbs = 138 lbs

$(0.9 * W_p) - E_V = (0.9 * 344) - 138 = 172$ lbs
$(1.2 * W_p) + E_V = (1.2 * 344) + 138 = 551$ lbs

CALCULATE PULLOUT LOAD DUE TO OVERTURNING (WORST CASE @ VIWR):

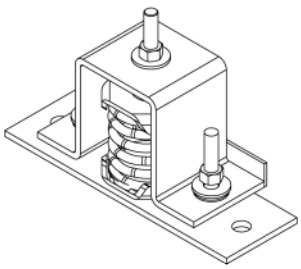
$\mathbf{M_{OT}}$ = Overturning Moment = $(F_{ph} * h_{cg})$ = 1,548 lbs * 20.7 in = 32,044 lb-in.

$\mathbf{T_{Ux}}$ = Pullout Load Demand (about X-X) = $(M_{OT}) / (d * R)$
= (32,044 lb-in) / (28 in * 2) = 572 lbs

$\mathbf{T_{Uy}}$ = Pullout Load Demand (about Y-Y) = $(M_{OT}) / (w * Q)$
= (32,044 lb-in) / (40 in * 2) = 401 lbs

CALCULATE SHEAR LOAD (WORST CASE):

$\mathbf{V_U}$ = Applied Lateral Seismic Force / Total VIWR Quantity =
= (F_{ph} / N) = 1,548 lbs / 4 = 387 lbs



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VIWR DESIGN PROCEDURE EXAMPLE - CONTINUE

T_u & V_u with orthogonality effect (ASCE 7-16 Section 13.3-1):

T_{UO} = [572 + (0.3 * 401)] * Ω_o = (692.3) * Ω_o = 1,385 lbs.

V_{UO} = [1.3 * 387] * Ω_o = (503.1) * Ω_o = 1,006 lbs.

LRFD TENSION & SHEAR using 0.9D-1.0E :

T_{Uxt} = (-572 * Ω_o) + (172 / 4) = -1,101 lbs; V_U = 387 * Ω_o = 774 lbs

T_{Uyt} = (-401 * Ω_o) + (172 / 4) = -759 lbs; V_U = 387 * Ω_o = 774 lbs

T_{Uot} = (-692.3 * Ω_o) + (172 / 4) = -1,342 lbs; V_{UO} = [1.3 * 387] * Ω_o = 1,006 lbs

LRFD TENSION & SHEAR using 1.2D-1.0E :

T_{Uxc} = (572 * Ω_o) + (551 / 4) = 1,282 lbs; V_U = 387 * Ω_o = 774 lbs

T_{Uyc} = (401 * Ω_o) + (551 / 4) = 940 lbs; V_U = 387 * Ω_o = 774 lbs

T_{Uoc} = (692.3 * Ω_o) + (551 / 4) = 1,522 lbs; V_{UO} = [1.3 * 387] * Ω_o = 1,006 lbs

4) Select VIWR size based on seismic forces T_u & V_u in X, Y & Orthogonal directions (Capacity at 45° is permitted to be used for orthogonal direction) using the interaction graph or equation.

T_{UX} – V_U, T_{UY} – V_U, and T_{UO} – V_{UO} all must satisfy the following LRFD Demand to Capacity Ratio (DCR) equation:

$(T_U / T_S) + (V_U / V_S) < 1.0$

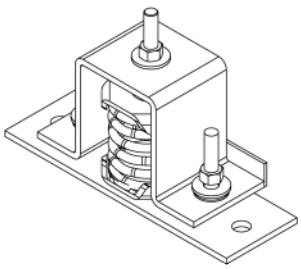
T_S = LRFD Vertical Seismic Strength Rating in Tables 2 & 3 (on page 10 & 11 of this report)

V_S = LRFD Horizontal Seismic Strength Rating in Tables 2 & 3 (on page 10 & 11 of this report)

DCR_X = (1282 / 6284) + (774 / 2424) = 0.52 < 1.0

DCR_Y = (940 / 6284) + (774 / 1834) = 0.57 < 1.0

DCR_O = (1522 / 6284) + (1006 / 2085) = 0.72 < 1.0



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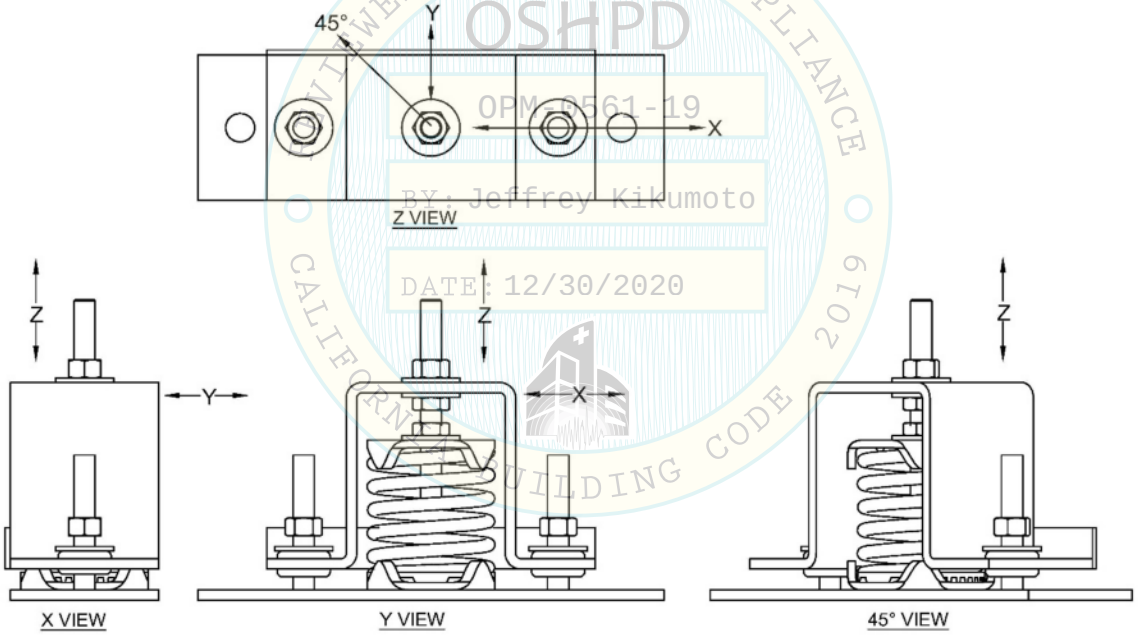
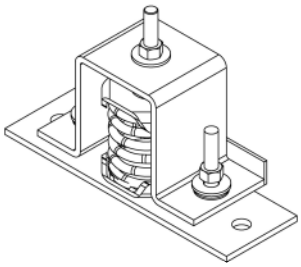
VIWR DESIGN PROCEDURE EXAMPLE - CONTINUE

Table 2: CQB Seismic Capacity (LRFD)

VIWR	Rated Vertical (Z) Seismic Capacity lbs	Rated Perpendicular (X) Horizontal Seismic Capacity lbs	Rated Parallel (Y) Horizontal Seismic Capacity lbs	Rated Orthogonal (45° to X-Y) Horizontal Seismic Capacity lbs
CQB	**6,284**	**2,424**	**1,834**	**2,085**



CQB STYLE V
X, Y, Z & 45° DIRECTIONS



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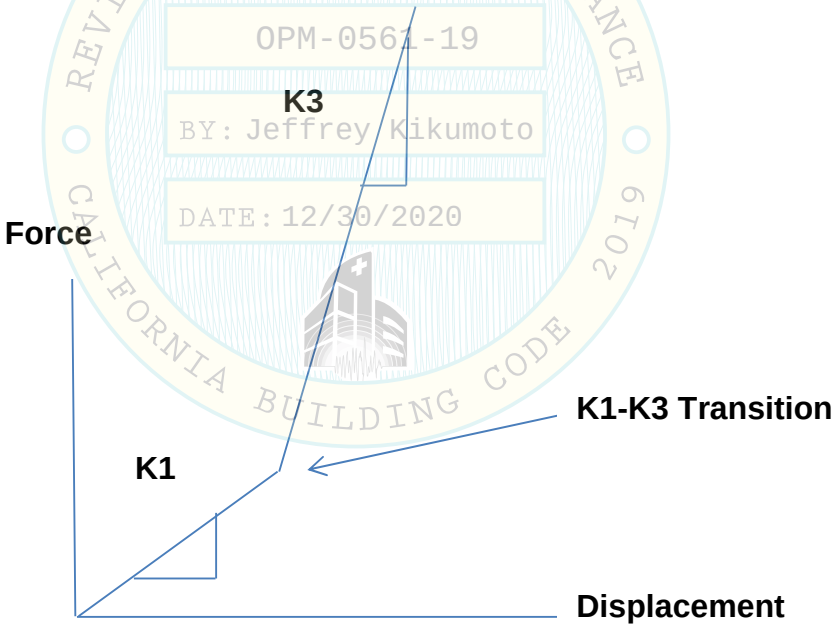
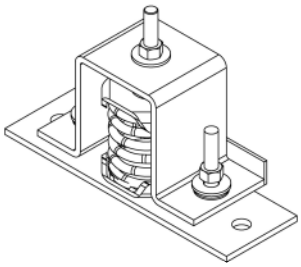
VIWR DESIGN PROCEDURE EXAMPLE – CONTINUE

Table 3: CQB Stiffness for X, Y, Z & 45° Direction with the weakest spring

CQB	Rated K1 Stiffness (lbs/in)	Rated K3 Stiffness (lbs/in)	Rated K1-K3 Transition Load (lbs)	Rated K1-K3 Transition Displacement (in.)
X Direction	4,127	3,485	1,733	0.42
Y Direction	5,342	2,314	1,633	0.31
Z Direction	10,691	9,148	4,700	0.44
45° Direction	4,742	2,980	1,433	0.30



K1, K3 and K1-K3 Transition in Graphical Form



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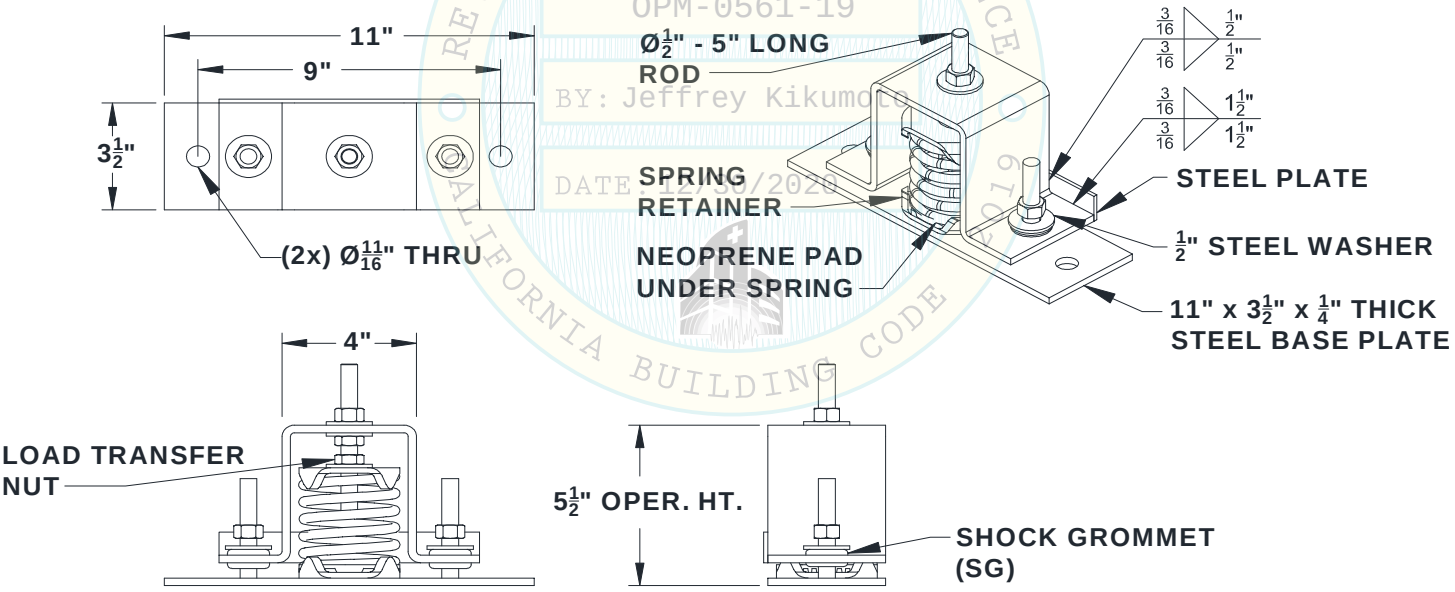
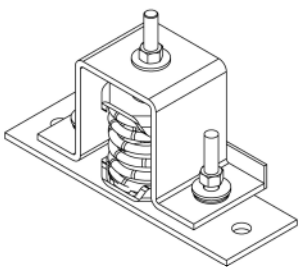
VIWR DESIGN PROCEDURE EXAMPLE – CONTINUE

5) Select Spring Capacity using the spring Selection Procedure.

Project Name:	**Example**
Equipment Mark:	**Example**
Equipment Make / Model:	**Loren Cook Fan / CPV 150**
Maximum Weight:	**344 lbs**
CQB VIWR Selection:	**See Table 4 (on page 13)**
Average Gravity Load Per VIWR:	**103.2 lbs**
Number of CQB VIWR:	**4**
CQB Seismic Capacity:	**See Table 2 (on page 10)**
CQB X, Y, Z & 45° Stiffness:	**See Table 3 (on page 11)**



CQB STYLE V



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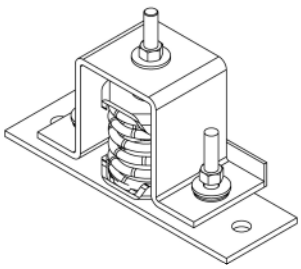
VIWR DESIGN PROCEDURE EXAMPLE – CONTINUE

Table 4: CQB VIWR Gravity Load Rating

CQB VIWR NUMBER	Pounds Theoretical Rated	Design Load Ratings (lbs)	Theoretical (K1) Spring Rate (lbs/in.)	Spring Arrangement
CQB-F171	171	166	73	Single Spring
CQB-F241	241	234	116	Single Spring
CQB-F348	348	338	162	Single Spring
CQB-F453	453	439	221	Single Spring
CQB-F590	590	572	258	Single Spring
CQB-F787	787	779	325	Double Spring
CQB-F918	918	909	344	Double Spring

6) Instructions For Use:

- Add 20% to the weight of the Non-Structural Component & divide by the number of VIWRs to get average weight per VIWR.
- Select Spring number closest to average weight per VIWR based on theoretical rating.
- Enter as **CQB-F171 VIWR Selection**.



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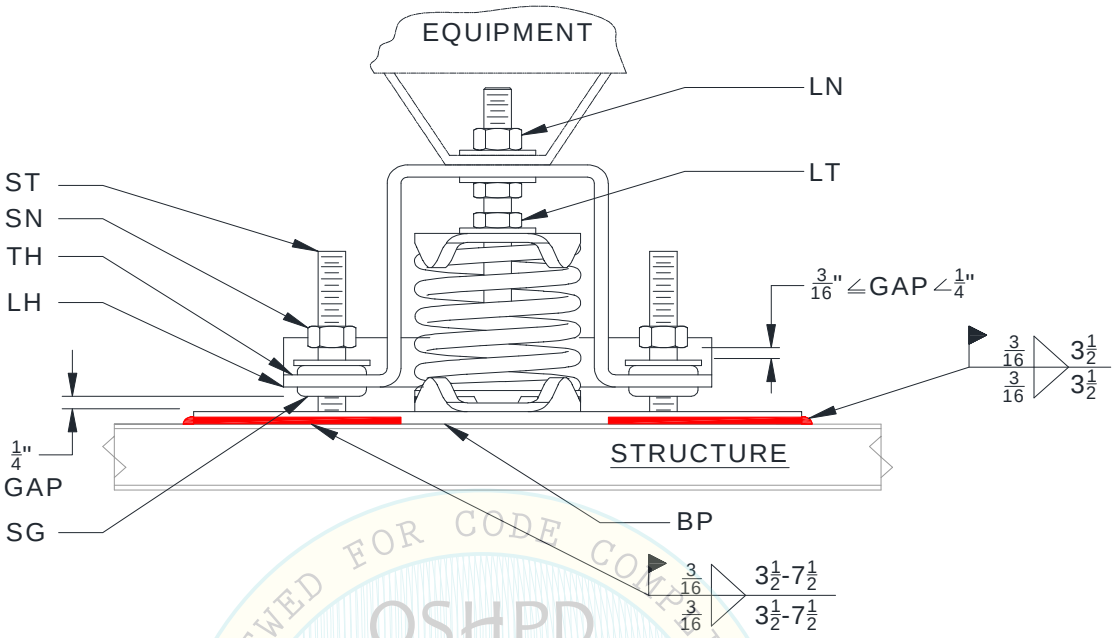
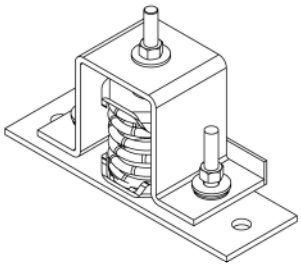
VIWR INSTALLATION INSTRUCTIONS



1. Position the equipment squarely on the CQB VIWRs.
2. Secure the CQB VIWRs to the STRUCTURE (STEEL BEAMS) using WELD JOINTS AS PER THE DETAIL SHOWN ABOVE. STEEL BEAMS are part of the primary structure to be provided by the SEOR to support the weights and forces.
3. Run up the two STOP NUTS (SN) to the top of the STABILIZER STUD (ST).
4. Run down the LOCKING NUTS (LN) to tighten the equipment in place to the CQB VIWRS.
5. Adjust the LOAD TRANSFER NUT (LT) on each CQB VIWR to level the equipment, allowing for a gap of $\frac{1}{4}$" between the BASE PLATE (BP) and the LOWER TOP HOUSING (LH); i.e., bottom of SHOCK GROMMET (SG) to top of BASE PLATE (BP).
6. Run down the STOP NUTS (SN) until the gap is between a minimum of $\frac{3}{16}$" and MAXIMUM of $\frac{1}{4}$" between the SN and the TOP HOUSING (TH); i.e., bottom nut to top of washer.



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Loren Cook Company CPV60 to CPV150 HVAC Fans w/ CalDyn CQB Vibration Isolator with Restraint (CQB Style V VIWR)

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