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

OFFICE USE ONLY

APPLICATION #: OPM-0401

HCAI Preapproval of Manufacturer's Certification (OPM)

Type: ☐ New ☒ Renewal/Update

Manufacturer Information

Manufacturer: CalDyn

Manufacturer's Technical Representative: Efrain Escobedo

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

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

Product Information

Product Name: CalDyn CQA Vibration Isolator With Restraints (VIWR)

Product Type: CQA VIWR supporting HVAC / Fan Equipment (See OSP-0102-10)

Product Model Number: CPV 60 - CPV 135 (See OSP-0102-10)

General Description: HVAC / Fan Unit Supports and Attachments. This OPM includes CalDyn Vibration Isolator With Restraints (VIWR) Strength and Stiffness that can potentially be used with any equipment.

Applicant Information

Applicant Company Name: CalDyn

Contact Person: Efrain Escobedo

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

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

Title: Engineer

Registered Design Professonal Preparing Engineering Recommendations

Company Name: SAID AMIRSOLAIMANY, CIVIL ENGINEER

Name: Said Amirsolaimany California License Number: CE37835

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

Telephone: () - Email:

HCAI Special Seismic Certification Preapproval (OSP)

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

Certification Method

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

[X] Other(s) (Please Specify): Testing in accordance with FM 1950-10

*Use of criteria other than those adopted by the California Building Standards Code, 2022 (CBSC 2022) 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 2022 may be used when approved by HCAI prior to testing.

[ ] Analysis

[ ] Experience Data

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

HCAI Approval

Date: 6/5/2023

Name: Jeffrey Kikumoto Title: Senior Structural Engineer

Condition of Approval (if applicable):

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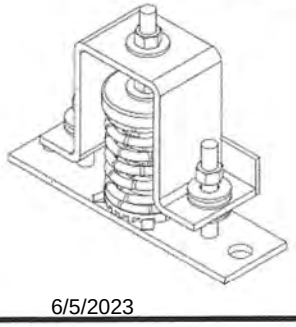
HCAi PREAPPROVAL OF MANUFACTURER'S CERTIFICATION (OPM)

OPM-0401

CALIFORNIA BUILDING CODE 2022

(CBC 2022)

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



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Loren Cook Company CPV60 to CPV135 HVAC Fans w/ CalDyn CQA Vibration Isolator With Restraint (CQA Style V VIWR)

Code: CBC 2022, ASCE 7-16

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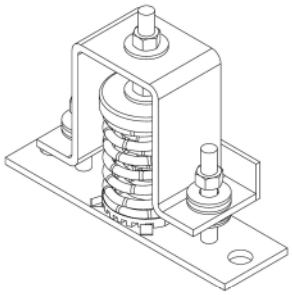

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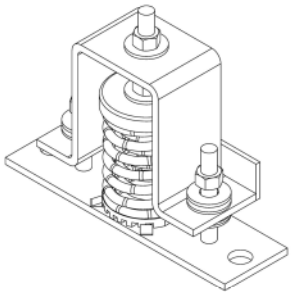
GENERAL NOTES

1. **This OSHPD Preapproval of Manufacturer's Certification (OPM) is based on the CBC 2022. The demand (design forces) for use with this OPM shall be based on the CBC 2022.**

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 (Overstrength Factor) ***
   ***** Ω_0 = 1.0 for VIWR attachment to steel supports (steel connection)**
   Ω_0 = 2.0 for VIWR attachment to concrete supports
   Note1: Overstrength factor (Ω_0) of 2.0 was applied to sample calculation herein to illustrate VIWR demands under a conservative overstrength factor for a steel connection

3. **Strength and Stiffness for CalDyn type CQA 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. <u>Registered Design Professional (RDP) shall coordinate with CalDyn in selection of VIWRs.</u>**

4. **The Structural Engineer of Record (SEOR) shall verify the adequacy of the supporting structure and shall 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:

LATERAL F_{ph} & VERTICAL F_{pv} USING ASCE 7-16, CHAPTER 13 NON-STRUCTURAL COMPONENTS, SITE SPECIFIC S_{DS} (5% DAMPED DESIGN SPECTRAL RESPONSE ACCELERATION AT SHORT PERIODS) AND z/h (HEIGHT IN STRUCTURE OF COMPONENT / AVERAGE ROOF HEIGHT).

EXAMPLE: DETERMINE THE "g" FORCES FOR EXAMPLE *LOREN COOK FAN MODEL # CPV 60*

BUILDING CODE

CBC-2022

LOAD COMBINATION

1.2D + 1.0E (CBC 2022, SECTION 1605A / ASCE 7-16, SECTION 2.3)
0.9D - 1.0E (CBC 2022, SECTION 1605A / ASCE 7-16, SECTION 2.3)

SEISMIC DESIGN

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

BLDG. ELEVATION / EQUIPMENT LOCATION

z/h ≤ 1.0 (ROOF Level installation)
WORST CASE

I_p (COMPONENT IMPORTANCE FACTOR PER CBC 2022 S1617A.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)

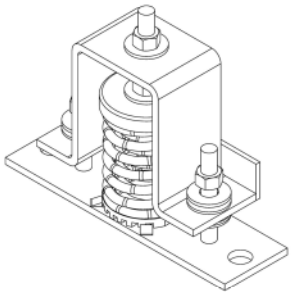
W_p = 250 LBS (EXAMPLE LOREN COOK FAN)

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

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

$F_{p\,(MAX)} / W_p = 1.6\ S_{DS}\ I_p$ .....(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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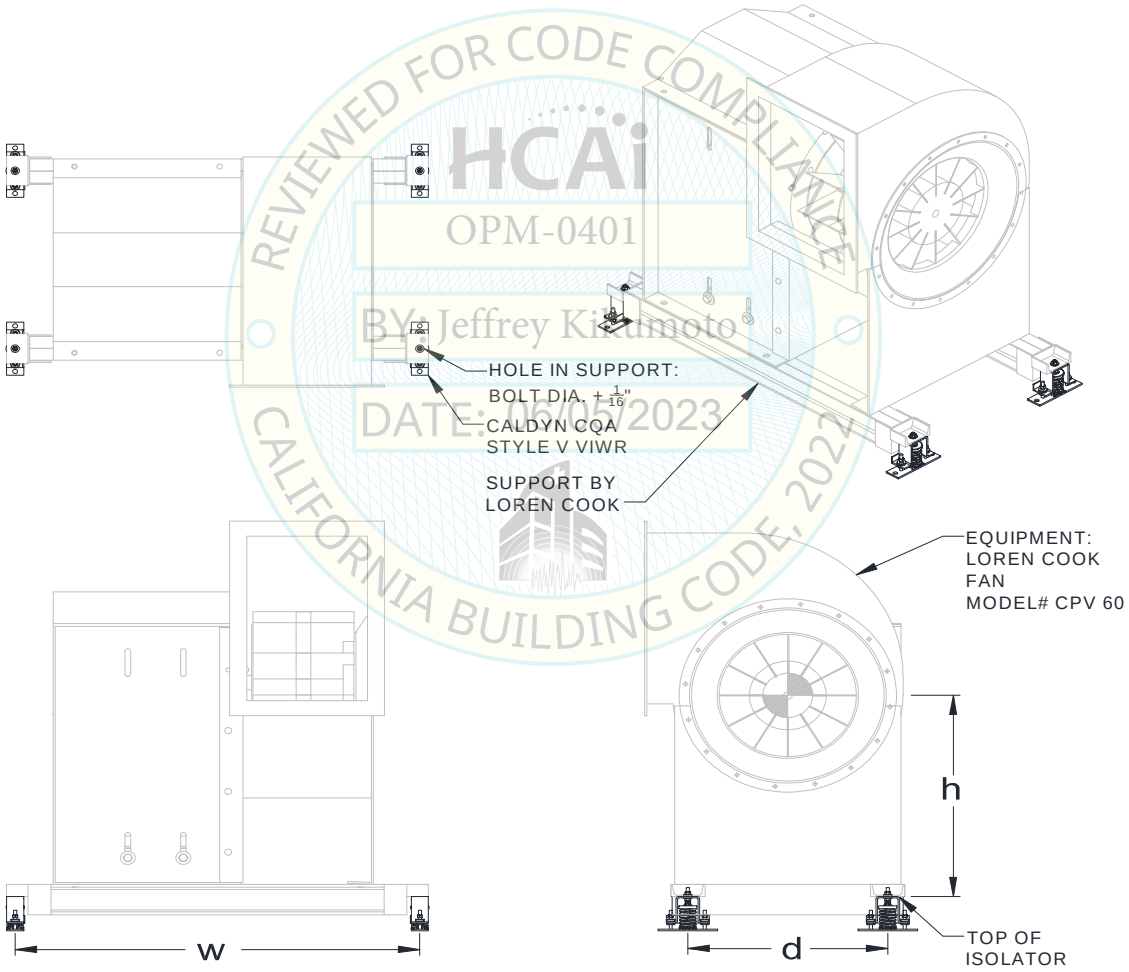
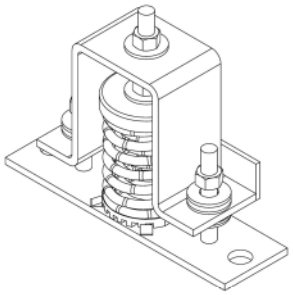
VIWR DESIGN PROCEDURE EXAMPLE - CONTINUE

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

Example: Loren Cook Fan MODEL# CPV 60

W_p = Operating Weight = 250 lbs
d = VIWR Mounting Depth = 24 in.
w = VIWR Mounting Width = 33.4 in.
h = Vertical Center of Gravity = 18 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

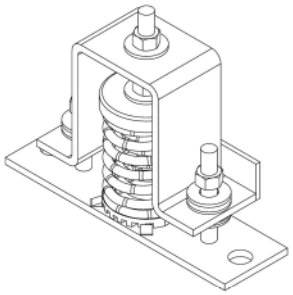
Mode Line	Model	Dimensions (in.)			Weight (lb)
		Depth	Width	Height	
CPV (Belt Drive)	60	22.3	25.6	36.8	250
	70	22.3	25.6	36.8	250
	80	22.3	25.6	36.8	250
	100	22.3	25.6	36.8	250
	120	24.8	29.6	36.8	265
	135	26.7	31.7	37.8	297

NOTES:

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

2) Equipment models listed in **Table 1** represent **Loren Cook Fans** that could be supported on CQA 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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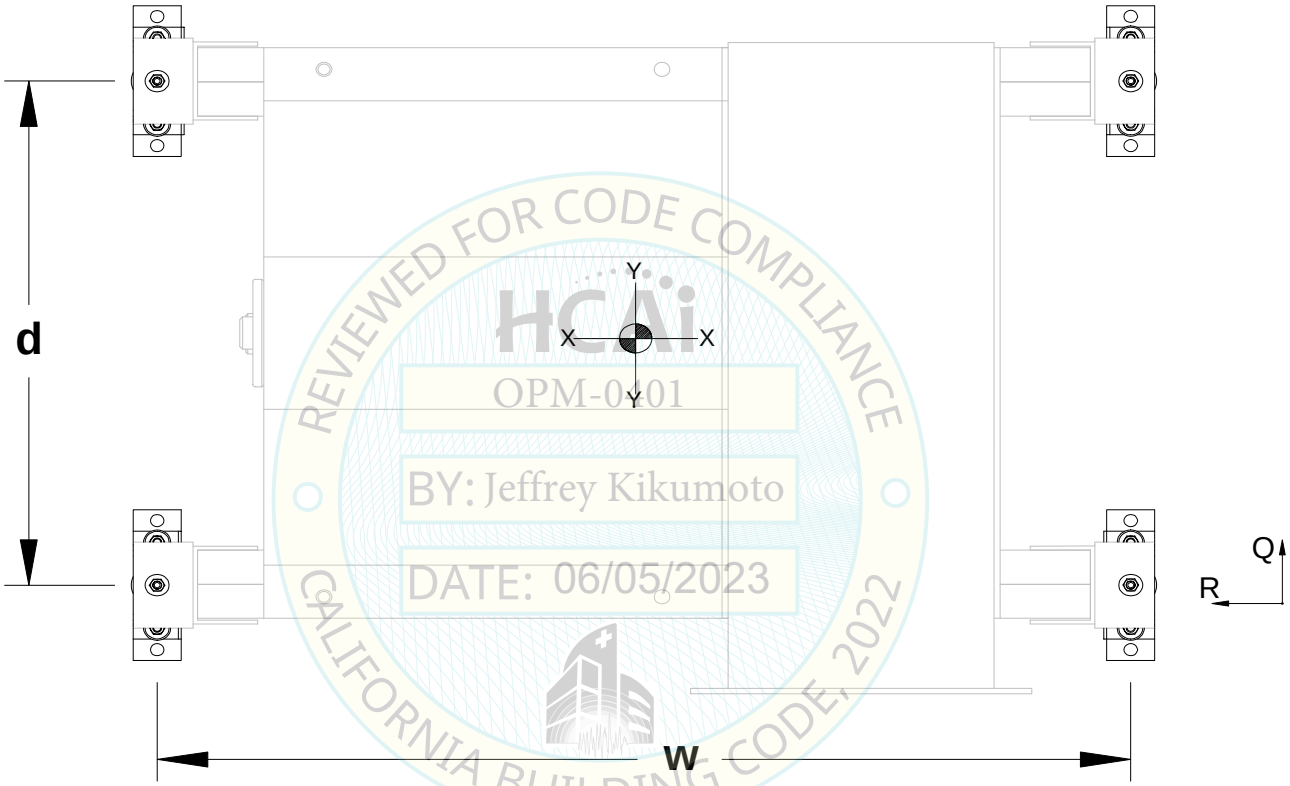
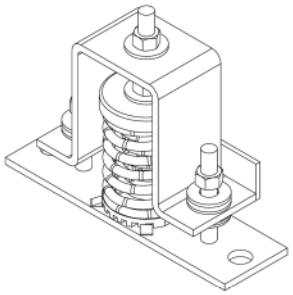
VIWR DESIGN PROCEDURE EXAMPLE - CONTINUE

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





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VIWR DESIGN PROCEDURE EXAMPLE - CONTINUE

APPLIED SEISMIC FORCE / CALCULATION:

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

F_{ph} = Applied Lateral Seismic Force = $(F_p / W_p) * W_p$
= 4.5 * 250 lbs = 1,125 lbs

F_{pv} = Applied Component of Seismic Force = $0.2 * S_{ds} * W_p$
= 0.2 * 2.0 * 250 lbs = 100 lbs

$(0.9 * W_p) - E_V = (0.9 * 250) - 100 = 125$ lbs
$(1.2 * W_p) + E_V = (1.2 * 250) + 100 = 400$ lbs

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

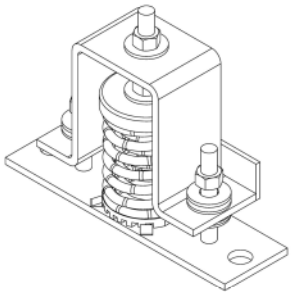
M_{OT} = Overturning Moment = $(F_{ph} * h_{cg})$ = 1,125 lbs * 18 inch = 20,250 lb-in.

T_{Ux} = Pullout Load Demand (about Y-Y) = $(M_{OT}) / (w * Q)$
= (20,250 lb-in) / (33.4 in * 2) = 303 lbs

T_{Uy} = Pullout Load Demand (about X-X) = $(M_{OT}) / (d * R)$
= (20,250 lb-in) / (24 in * 2) = 422 lbs

CALCULATE SHEAR LOAD (WORST CASE):

V_U = APPLIED LATERAL SEISMIC FORCE / TOTAL VIWR QUANTITY =
= (F_{ph} / N) = 1,125 lbs / 4 = 281 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} = [422 + (0.3 * 303)] * Ω_o = 1026 lbs.

V_{UO} = [1.3 * 281] * Ω_o = 731 lbs.

LRFD TENSION & SHEAR using 0.9D-1.0E :

T_{Uxt} = -303 * Ω_o + (125 / 4) = -575 lbs; V_U = 281 * Ω_o = 562 lbs

T_{Uyt} = -422 * Ω_o + (125 / 4) = -813 lbs; V_U = 281 * Ω_o = 562 lbs

T_{Uot} = -513 * Ω_o + (125 / 4) = -995 lbs; V_{UO} = 1.3 * 281 * Ω_o = 731 lbs

LRFD TENSION & SHEAR using 1.2D-1.0E :

T_{Uxc} = 303 * Ω_o + (400 / 4) = 706 lbs; V_U = 281 * Ω_o = 562 lbs

T_{Uyc} = 422 * Ω_o + (400 / 4) = 944 lbs; V_U = 281 * Ω_o = 562 lbs

T_{Uoc} = 513 * Ω_o + (400 / 4) = 1126 lbs; V_{UO} = 1.3 * 281 * Ω_o = 731 lbs

NOTE: Ω_o = 2.0 (a conservative overstrength factor was applied to this sample calculation to verify capacities under more conservative demands).

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:

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

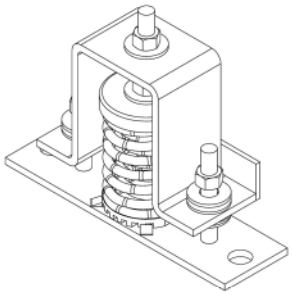
T_S = LRFD Vertical Seismic Strength Rating in Tables 2 & 3 (on page 10 & 11 of this report)

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

DCR_X = (706 / 3176) + (562 / 1983) = 0.51 < 1.0

DCR_Y = (944 / 3176) + (562 / 1163) = 0.78 < 1.0

DCR_O = (1126 / 3176) + (731 / 1212) = 0.96 < 1.0



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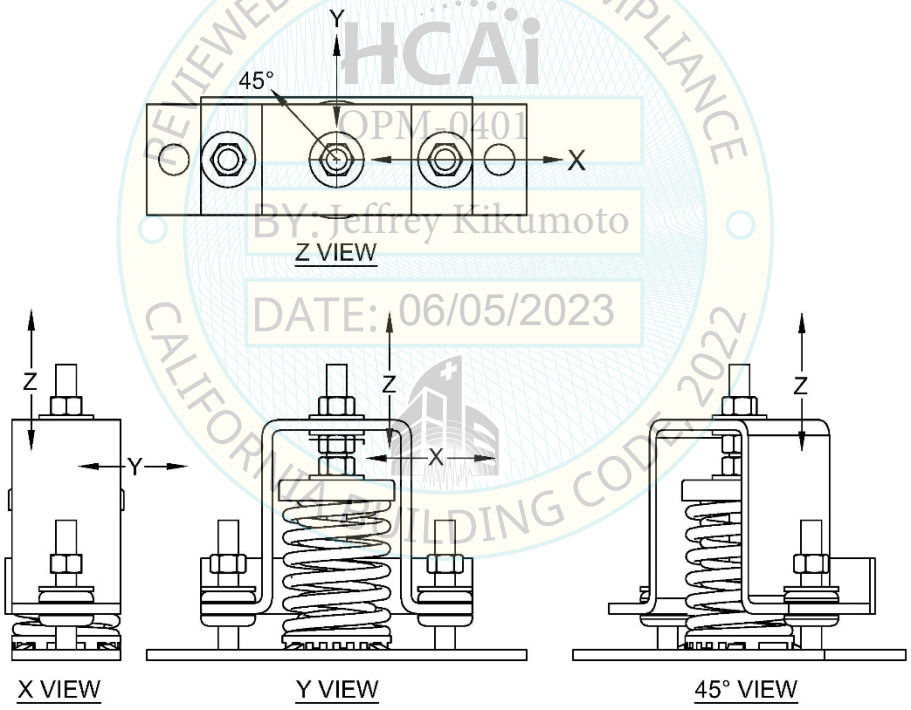
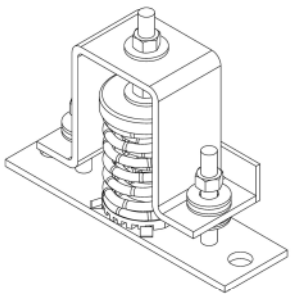
VIWR DESIGN PROCEDURE EXAMPLE - CONTINUE

Table 2: CQA 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
CQA	**3,176**	**1,983**	**1,163**	**1,212**



CQA STYLE V
X, Y, Z & 45° DIRECTIONS



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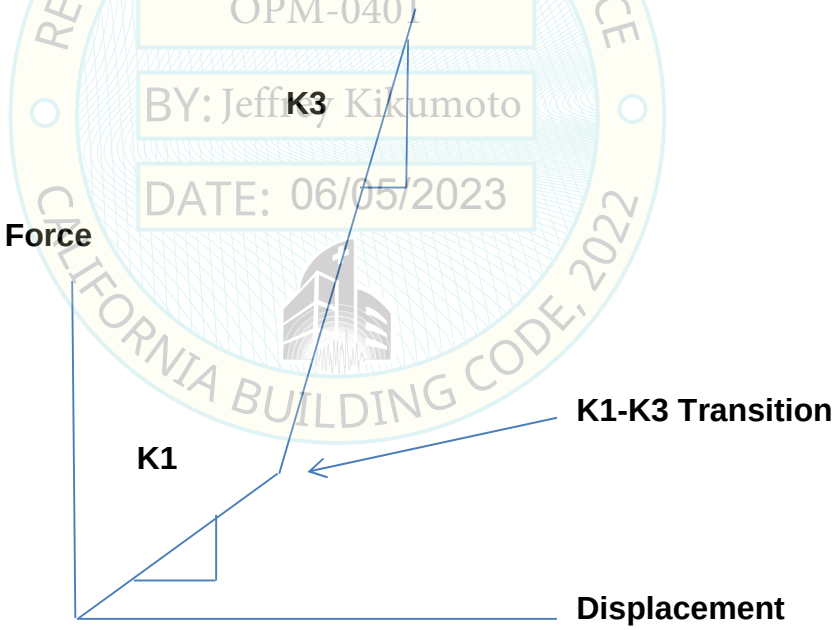
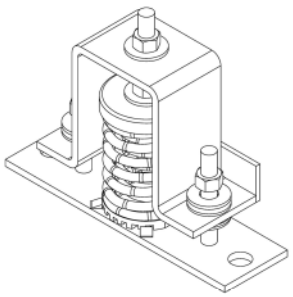
VIWR DESIGN PROCEDURE EXAMPLE – CONTINUE

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

CQA-	Rated K1 Stiffness (lbs/in)	Rated K3 Stiffness (lbs/in)	Rated K1-K3 Transition Load (lbs)	Rated K1-K3 Transition Displacement (in.)
X Direction	1,686	2,353	833	0.43
Y Direction	2,411	943	717	0.33
Z Direction	2,918	8,583	1,150	0.33
45° Direction	2,119	1,312	500	0.29



K1, K3 and K1-K3 Transition in Graphical Form



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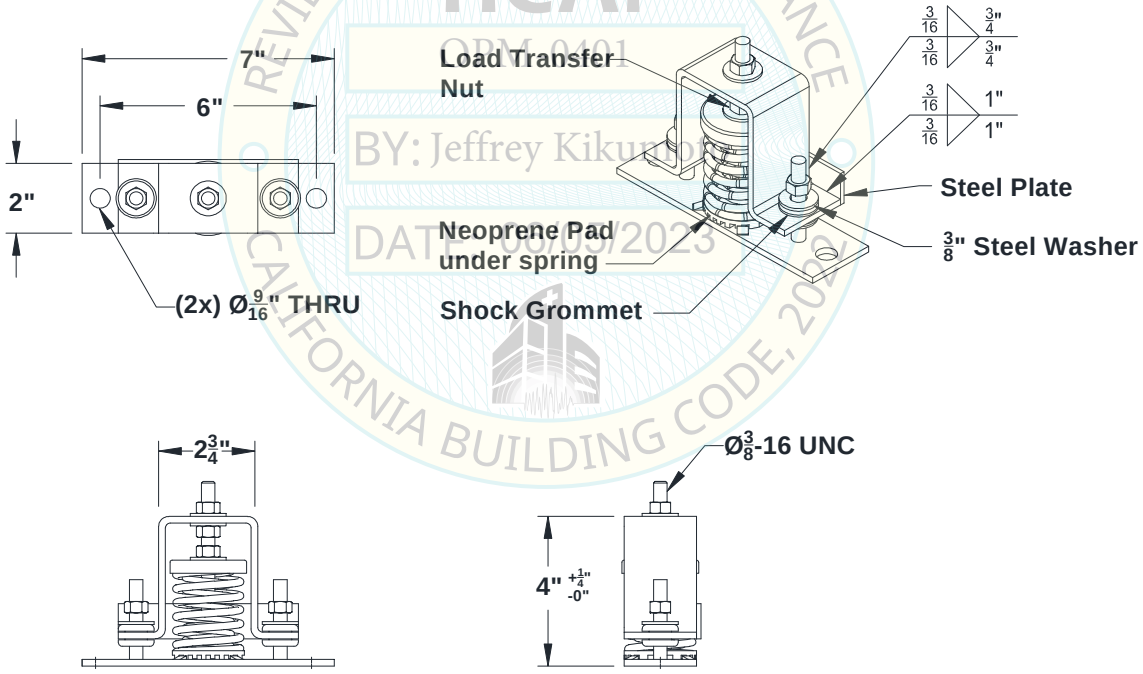
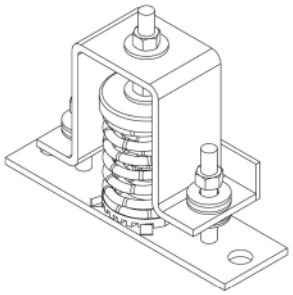
VIWR DESIGN PROCEDURE EXAMPLE – CONTINUE

5) Select Spring Capacity using the spring Selection Procedure.

Project Name:	Example
Equipment Mark:	Example
Equipment Make / Model:	Loren Cook Fan / CPV 60
Maximum Weight:	250 lbs
CQA VIWR Selection:	See Table 4 (on page 13)
Average Gravity Load Per VIWR:	75.0 lbs
Number of CQA VIWR:	4
CQA Seismic Capacity:	See Table 2 (on page 10)
CQA X, Y, Z & 45° Stiffness:	See Table 3 (on page 11)



CQA STYLE V



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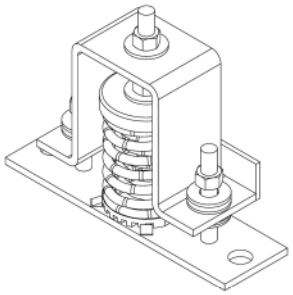
VIWR DESIGN PROCEDURE EXAMPLE – CONTINUE

Table 4: CQA VIWR Gravity Load Rating

CQA VIWR NUMBER	Pounds Theoretical Rated	Design Load Ratings (lbs)	Theoretical (K1) Spring Rate (lbs/in.)	Spring Arrangement
CQA-F59	59	47	27	Single Spring
CQA-F83	83	66	43	Single Spring
CQA-F120	120	96	56	Single Spring
CQA-F155	155	124	70	Single Spring
CQA-F195	195	156	85	Single Spring
CQA-F236	236	177	106	Double Spring
CQA-F300	300	225	139	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 **CQA-F83 VIWR Selection**.
  Note: CQA VIWR Number selection noted in Table 4 pertains to sample calculation only



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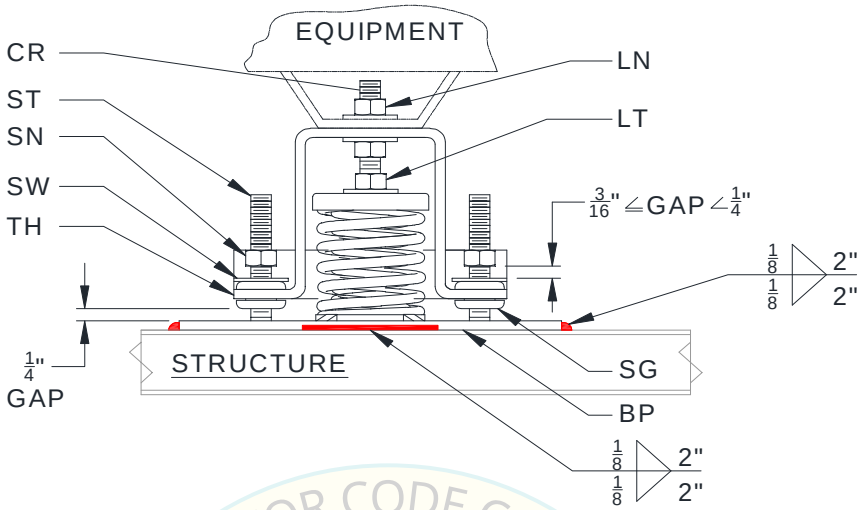
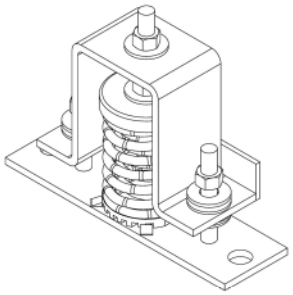
VIWR INSTALLATION INSTRUCTIONS



INSTALLATION PROCEDURE:

1. Position the equipment squarely on the CQA VIWRs.
2. Secure the CQA 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 STUDS (ST).
4. Adjust the LOAD TRANSFER NUT (LT) on each CQA VIWR to level the equipment, allowing for a gap of $\frac{1}{4}$" between the BASE PLATE (BP) and the lower surface of the SHOCK GROMMET (SG) connected to the TOP HOUSING (TH).
5. Run down the LOCKING NUTS (LN) to tighten the equipment in place to the CQA VIWRS.
   Note: If equipment does not include attachment holes for direct attachment to isolator's connecting rod (CR), CalDyn can provide the CQA variant with the flat top.
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 STEEL WASHER (SW).



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Loren Cook Company CPV60 to CPV135 HVAC Fans w/ CalDyn CQA Vibration Isolator With Restraint (CQA Style V VIWR)

Code: CBC 2022, ASCE 7-16