APPLICATION FOR OSHPD SPECIAL SEISMIC CERTIFICATION PREAPPROVAL (OSP)

OFFICE USE ONLY	
APPLICATION #:	OSP – 0352

OSHPD Special Seismic Certification Preapproval (OSP)

Type: ☐ New ☒ Renewal

Manufacturer Information

Manufacturer: Titus HVAC (Air System Components)

Manufacturer's Technical Representative: Gary Minor

Mailing Address: 605 Shiloh Road, Plano TX 75074

Telephone: (972)-212-4815 Email: gminor@titus-hvac.com

Product Information

Product Name: Dual Duct, Single Duct, and Series Fan Powered

Product Type: VAV and Fan Powered Air Terminal Units

Product Model Number: Dual Duct (PEDV, DEDV), Single Duct (PESV, EESV, AESV, DESV), Series Fan Powered (PTFS, ATFS, DTFS, PTFS-A, ATFS-A, DTFS-A, PTFS-G, ATFS-G, DTFS-G, PTFS-F, ATFS-F, DTFS-F)
(List all unique product identification numbers and/or part numbers)

General Description: Suspended cataloged VAV terminal units with dampers and controls. No fans, motors or coils. Suspended cataloged fan terminal units. Seismic enhancements made to the test units and modifications required to address anomalies observed during the tests shall be incorporated into the production units

Mounting Description: Rigidly suspended units (No vibration isolation) restrained with seismic cable kits & Vibration Isolated suspended units, restrained with seismic cable kits.

RENEWED FOR CBC COMPLIANCE OSHPD OSP-0352 Richmond Piland DATE: 04/29/2020 CALIFORNIA BUILDING CODE 2019

Applicant Information

Applicant Company Name: Titus HVAC (Air System Components)

Contact Person: Gary Minor, Robert Simmons

Mailing Address: 605 Shiloh Road, Plano TX 75074

Telephone: (972)-212-4815 Email: gminor@titus-hvac.com; rsimmons@petraseismicdesign.com

I hereby agree to reimburse the Office of Statewide Health Planning and Development review fees in accordance with the California Administrative Code, 2013.

Signature of Applicant: Gary Minor Date: 9/16/19

Title: Design Engineering Manager Company Name: Titus HVAC (Air System Components)

California Licensed Structural Engineer Responsible for the Engineering and Test Report(s)

Company Name: Petra Seismic Design

Name: Todd G. Kemen, SE California License Number: S5409

Mailing Address: 5441 Fair Oaks Blvd Suite G2, Carmichael, CA 95608

Telephone: (916) 680-9922 Email: toddk@response-eng.com;

Supports and Attachments Preapproval

☐ Supports and attachments are preapproved under OPM- _____
(Separate application for OSHPD Preapproval of Manufacturer's Certification (OPM) of Supports and attachments is required)

☒ Supports and attachments are not preapproved

Certification Method

☒ Testing in accordance with: ☒ ICC-ES AC156

☐ Other (Please Specify): _____

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Testing Laboratory

Company Name: Environmental Testing Laboratories

Contact Name: Jeremy Lange

Mailing Address: 14525 FM 529 Suite 205, Houston TX, 77095 / 11034 Indian Trail, Dallas, TX 75229

Telephone: (281)-656-1439 / (972)-247-9657 Email: jeremy@etldallas.com

Seismic Parameters

Design in accordance with ASCE 7-10 Chapter 13: ☒ Yes ☐ No

Design Basis of Equipment or Components (F_p/W_p) = 1.50 (rigid); 3.60 (isolated)

S_{DS} (Design spectral response acceleration at short period, g) = 2.00

a_p (In-structure equipment or component amplification factor) = 2.5

R_p (Equipment or component response modification factor) 6.0 (rigid); 2.5 (isolated)

Ω_0 (System overstrength factor) = 2.0

I_p (Importance factor) = 1.5

z/h (Height factor ratio) = 1

Equipment or Component Natural Frequencies (Hz) See Attachments

Overall dimensions and weight (or range thereof) = See Attachments

Equipment or Components @ grade designed in accordance with ASCE 7-10 Chapter 15: ☐ Yes ☒ No

Design Basis of Equipment or Components (V/W) =

S_{DS} (Design spectral response acceleration at short period, g) =

S_{D1} (Design spectral response acceleration at 1 second period, g)

R (Response modification coefficient) =

Ω_0 (System overstrength factor) =

C_d (Deflection amplification factor) =

I_p (Importance factor) = 1.5

Height to Center of Gravity above base =

Equipment or Component Natural Frequencies (Hz) =

Overall dimensions and weight (or range thereof) =

Tank(s) designed in accordance with ASME BPVC, 2010: ☐ Yes ☒ No

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List of Attachments Supporting Special Seismic Certification

☒ Test Report(s) ☒ Drawings ☐ Calculations ☒ Manufacturer's Catalog

☒ Other(s) (Please Specify): See Attachments

OSHPD Approval (For Office Use Only) – Approval Expires on December 31, 2025

Signature: _____ Date: April 29, 2020

Print Name: Timothy J. Piland Title: SSE

Special Seismic Certification Valid Up to: S_{DS} (g) = 2.00 z/h = 1

Condition of Approval (if applicable):

Table DD-1 Certified Product (Dual Duct)

Product Family	Model [1]	Mixing Box (Y/N)	Model (Inlet) Size (in)	Height (in)	Width (in)	Length (in)	Max Weight (lb)	Mounting Configuration: Suspended w/isolators	Mounting Configuration: Suspended Rigidly	SDS	z/h	UUT
Dual Duct with Mix Attenuator	DEDV-S_XX1XXX0404	Y	4	12.4	32	21	80.5	N/A	X	2.00	1.0	Extrapolated
	DEDV-S_XX1XXX0505	Y	5	12.4	32	21	80.5	N/A	X	2.00	1.0	Extrapolated
	DEDV-S_3A102R0606	Y	6	12.4	32	21	80.5	N/A	X	2.00	1.0	1
	DEDV-S_XX1XXX0707	Y	7	12.4	36	23.25	92	N/A	X	2.00	1.0	Interpolated
	DEDV-S_XX1XXX0808	Y	8	12.4	36	23.25	92	N/A	X	2.00	1.0	Interpolated
	DEDV-S_XX1XXX0909	Y	9	12.4	40	27.1	111	N/A	X	2.00	1.0	Interpolated
	DEDV-S_XX1XXX1010	Y	10	12.4	40	27.1	111	N/A	X	2.00	1.0	Interpolated
	DEDV-S_XX1XXX1212	Y	12	15.125	44	31.1	133	N/A	X	2.00	1.0	Interpolated
	DEDV-S_XX1XXX1414	Y	14	18.125	48	35.2	161	N/A	X	2.00	1.0	Interpolated
	DEDV-S_XX1XXX1616	Y	16	18.125	49	38	192	N/A	X	2.00	1.0	Interpolated
	PEDV-S_XX1XXX0404	Y	4	15.1	28.9	19	81	N/A	X	2.00	1.0	Extrapolated
	PEDV-S_XX1XXX0505	Y	5	15.1	28.9	19	81	N/A	X	2.00	1.0	Extrapolated
	PEDV-S_XX1XXX0606	Y	6	15.1	28.9	19	81	N/A	X	2.00	1.0	Interpolated
	PEDV-S_XX1XXX0707	Y	7	15.1	32.9	23	92	N/A	X	2.00	1.0	Interpolated
	PEDV-S_XX1XXX0808	Y	8	15.1	32.9	23	92	N/A	X	2.00	1.0	Interpolated
	PEDV-S_XX1XXX0909	Y	9	15.1	36.9	27	111	N/A	X	2.00	1.0	Interpolated
	PEDV-S_XX1XXX1010	Y	10	15.1	39.6	27	111	N/A	X	2.00	1.0	Interpolated
	PEDV-S_XX1XXX1212	Y	12	15.1	40.9	31	133	N/A	X	2.00	1.0	Interpolated
	PEDV-S_XX1XXX1414	Y	14	17.5	44.9	35	161	N/A	X	2.00	1.0	Interpolated
	PEDV-S_3A142R1616	Y	16	18.125	49	38	192	N/A	X	2.00	1.0	2

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Product Family	Model [1]	Mixing Box (Y/N)	Model (Inlet) Size (in)	Height (in)	Width (in)	Length (in)	Max Weight (lb)	Mounting Configuration: Suspended w/isolators	Mounting Configuration: Suspended Rigidly	SDS	z/h	UUT
Dual Duct without Mixer Attenuator	PEDV-S_XX0XXX0404	N	4	8	33	15.5	66	N/A	X	2.00	1.0	Extrapolated
	PEDV-S_XX0XXX0505	N	5	8	33	15.5	66	N/A	X	2.00	1.0	Extrapolated
	PEDV-S_3A002R0606	N	6	8	33	16.7	66	N/A	X	2.00	1.0	3
	PEDV-S_XX0XXX0707	N	7	15.1	33	16.7	85	N/A	X	2.00	1.0	Interpolated
	PEDV-S_XX0XXX0808	N	8	15.1	33	16.7	85	N/A	X	2.00	1.0	Interpolated
	PEDV-S_XX0XXX0909	N	9	15.1	37.1	15.5	99	N/A	X	2.00	1.0	Interpolated
	PEDV-S_XX0XXX1010	N	10	15.1	37.1	15.5	99	N/A	X	2.00	1.0	Interpolated
	PEDV-S_XX0XXX1212	N	12	15.1	42.1	15.5	114	N/A	X	2.00	1.0	Interpolated
	PEDV-S_XX0XXX1414	N	14	17.6	49	15.5	137	N/A	X	2.00	1.0	Interpolated
	PEDV-S_XX0XXX1616	N	16	18	57	15.5	151	N/A	X	2.00	1.0	Interpolated
	DEDV-S_XX0XXX0404	N	4	8	24.125	15.5	66	N/A	X	2.00	1.0	Extrapolated
	DEDV-S_XX0XXX0505	N	5	8	24.125	15.5	66	N/A	X	2.00	1.0	Extrapolated
	DEDV-S_XX0XXX0606	N	6	8	33	15.5	66	N/A	X	2.00	1.0	Interpolated
	DEDV-S_XX0XXX0707	N	7	12.4	37.1	15.5	85	N/A	X	2.00	1.0	Interpolated
	DEDV-S_XX0XXX0808	N	8	12.4	37.1	15.5	85	N/A	X	2.00	1.0	Interpolated
	DEDV-S_XX0XXX0909	N	9	12.5	41.1	15.5	99	N/A	X	2.00	1.0	Interpolated
	DEDV-S_XX0XXX1010	N	10	12.5	41.1	15.5	99	N/A	X	2.00	1.0	Interpolated
	DEDV-S_XX0XXX1212	N	12	15	45.1	15.5	114	N/A	X	2.00	1.0	Interpolated
	DEDV-S_XX0XXX1414	N	14	17.5	53.1	15.5	137	N/A	X	2.00	1.0	Interpolated
	DEDV-S_3A042R1616	N	16	18	61.1	18.9	151.5	N/A	X	2.00	1.0	4

Notes:
1) First letter in the Model indicates the controller type. D=Digital controller, P=Pneumatic controller, X=see Figure DD-1 Model Number Nomenclature page 8
2) Neither coils or silencers are included with the EDV units and are not in the scope of this OSP.

Table DD-2 Certified External Box (Dual Duct)

Exterior Wall/Roof/Floor Panel Material	Thickness	UUT
Galvanized Carbon Steel	20 ga	1,2,3,4

Table DD-3 Certified Liners (Dual Duct)

Material	UUT
No Liner	Extrapolated
Standard 1/2"	1,3
1"	Interpolated
Steriloc	Interpolated
Ultraloc (Double Wall)	2,4
FibreFree	Interpolated
EcoShield 1"	Interpolated
EcoShield Foil 1/2"	Interpolated
EcoShield Foil 1"	Interpolated
EcoShield 1/2"	Interpolated

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Table DD-4 Certified Controls (Dual Duct)

Type	Model Number	Height (in)	Width (in)	Length (in)	Voltage	MFR	UUT
Pneumatic (actuator)	MCP-8031	4.25 dia	4.25 dia	5.5	N/A	Titus	Extrapolated
Pneumatic (controller)	CSC-3004	3.5 dia	3.5 dia	4	N/A	Titus	2,3
Pneumatic (controller)	CSC-3017	3.5	4.25	2	N/A	Titus	Interpolated
Digital (controller/actuator)	BAC-8005-03	6.5	4.25	2.25	24	Titus	1,4

Notes:
1)Pneumatic actuator/controller may have a Krueter manufacturer label. Krueter is an identical actuator/controller private label manufactured by Titus.

Table DD-5 Certified Disconnect (Dual Duct)

Type	Model Number	Height (in)	Width (in)	Length (in)	Voltage	Amperes	MFR	UUT
Non-Fusable, 3 poles	ABBITPN63EP	2.89	2.07	3.25	600	30-60	ABB	1,2,3,4

Table DD-6 Certified Transformers (Dual Duct)

Type	Model Number	Height (in)	Width (in)	Length (in)	VA	Voltage	MFR	UUT
AirCore Class 2	HCT-01DBB06132	3.125	2.125	3.5	0.07 or 50VA	120/24V	Hartland Cntrls	1,2,3,4

Notes:
1)Each size and model mixing box includes transformers which may vary in model number based on voltage. The transformer subcomponents are less than 3 pounds and less than 1amp. They are all of the same form, function, shape, configuration, c.g., and mounting to the housing. Per CBC2019,1705A.13.3.1, Exceptions:7, the other transformers are excluded from the subcomponent list as they may be substituted without testing.

Table DD-7 Certified Relays (Dual Duct)

Type	Height (in)	Width (in)	Length (in)	Amperes	Voltage	MFR	UUT
SPST	2.37	2.1	2.1	0.75	277V	Hartland Cntrls	1,2,3,4

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Table DD-8 Certified Airflow Switch (Dual Duct)

Type	Height (in)	Width (in)	Length (in)	Amperes	Voltage	MFR	UUT
ElectroPneumatic	2.94	3.25	6.12	5.6	277V	Cleveland Controls	1,2,3,4

Table DD-9 Certified Dampers (Dual Duct)

Damper Model	Height (in)	Width (in)	Quantity	MFR	UUT
A06	5.875 dia	5.875 dia	1	Titus	1
B06	5.875 dia	5.875 dia	1	Titus	3
B12	11.875 dia	11.875 dia	1	Titus	Interpolated
E12	11.875 dia	11.875 dia	1	Titus	Interpolated
E16	15.785 dia	15.785 dia	1	Titus	2,4
E8	7.875 dia	7.875 dia	1	Titus	Interpolated

Damper Material		UUT
Frame	Blades	
N/A	Galvanized Carbon Steel	1,2,3,4

Table DD-10 Certified Sensor

Model	Manufacturer	UUT
Aerocross Multipoint Sensor	Titus	1,2,3,4

DD-UUT-1 TEST RESULTS SUMMARY

Manufacturer: TITUS HVAC

Model/ Series: DEDV-S

Model Number: DEDV-S_3A102R0606

Product Construction Summary
Cabinet: 20 gauge zinc coated
Inlet Size: 5-7/8" single

Options/ Subcomponent Summary
-Controller: Digital
-Damper: Butterfly Valve
-Disconnect
-Transformer
-Relay

Mixing Box: Yes
Airflow Switch
Aerocross Sensor

UUT Properties

Operating Weight (lb)	UUT Dimensions (Inches) (see mounting description below for support/brace dimensions)			Lowest Natural Frequency (Hz)		
	Width	Length	Height	Front-Back	Side-Side	Vertical
80.5	32	21	12.4	N/A	N/A	N/A

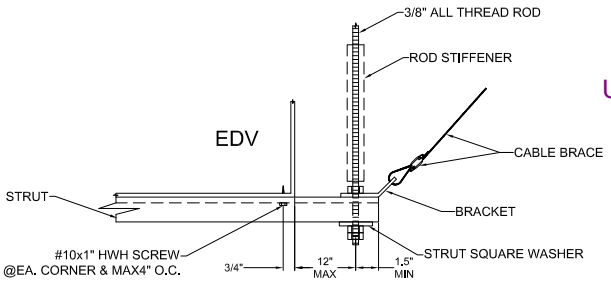
Seismic Test Parameter

Test Criteria	Sds (g)	z/h	Ip	Aflx-H (g)	Arig-H (g)	Aflx-V (g)	Arig-V (g)
ICC-ES AC 156	2.0	1.0	1.5	3.2	2.4	1.34	0.54

Pre Test Functionality	PASS	Post Test Functionality	PASS

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Unit Mounting Description:
Rigid suspended unit on (2) 1-5/8" Unistrut P1000 trapeze. (4) 3/8" ASTM-A307 rods at 35"x15" aspect ratio support the trapeze up to the fixture, fastened with 3/8" square washers and nuts. Unistrut P1000 used to stiffen the rods were fastened with Mason (2 per rod) UC-1 Rod Stiffening Clamps. Seismic bracing with (4) SCB-1(1/8") Mason Seismic Cable Kits. SCB-1's are attached to structure using 1/2" A307 hardware. Unit was attached to the 1-5/8" Unistrut P1000 trapeze with (10)#10 TEK ASTM ASTM A510 Grade 1018-1022, at ea. corner and evenly spaced @ 4" O.C along the trapeze.

DD-UUT-2 TEST RESULTS SUMMARY

Manufacturer: TITUS HVAC

Model/ Series: PEDV-S

Model Number: PEDV-S_3A142R1616

Product Construction Summary
Cabinet: 20 gauge zinc coated
Inlet Size: 15-7/8" single

Options/ Subcomponent Summary

-Controller: Pneumatic
-Damper: Butterfly Valve
-Disconnect
-Transformer
-Relay

Mixing Box: Yes
Airflow Switch
Aerocross Sensor

UUT Properties

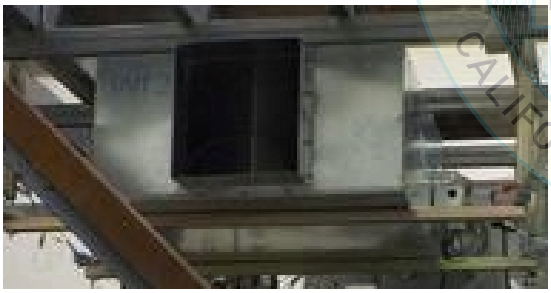
Operating Weight (lb)	UUT Dimensions (Inches) (see mounting description below for support/brace dimension)			Lowest Natural Frequency (Hz)		
	Width	Length	Height	Front-Back	Side-Side	Vertical
191.5	49	38	18.125	N/A	N/A	N/A

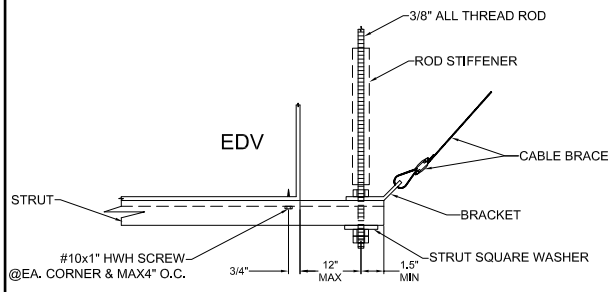
Seismic Test Parameter

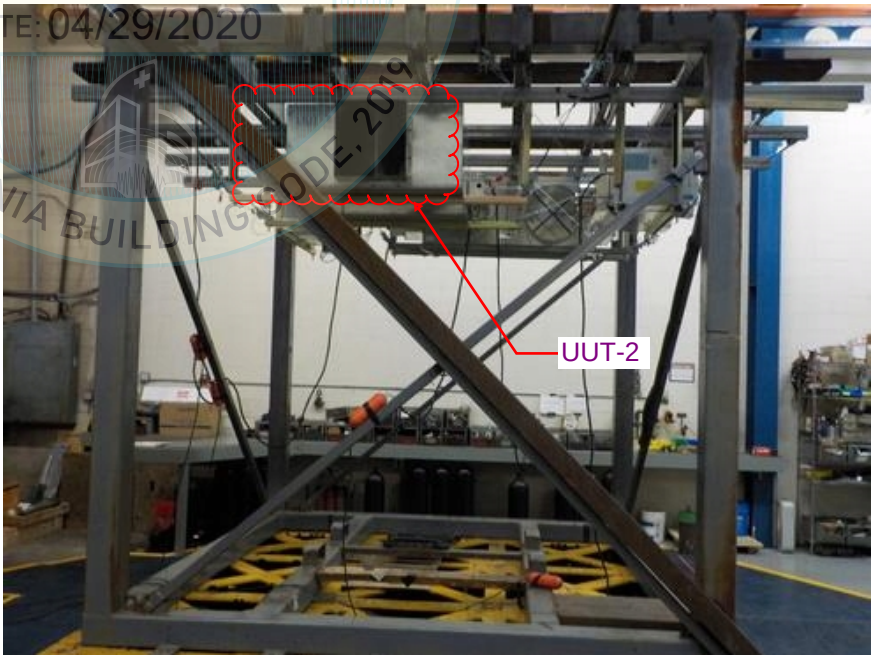
Test Criteria	Sds (g)	z/h	Ip	Aflx-H (g)	Arig-H (g)	Aflx-V (g)	Arig-V (g)
ICC-ES AC 156	2.0	1.0	1.5	3.2	2.4	1.34	0.54

Pre Test Functionality	PASS	Post Test Functionality	PASS

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Unit Mounting Description:

Rigid suspended unit on (2) 1-5/8" Unistrut P1000 trapeze. (4) 3/8" ASTM-A307 rods at 58.5"x26" aspect ratio support the trapeze up to the fixture, fastened with 3/8" square washers and nuts. Unistrut P1000 used to stiffen the rods were fastened with Mason (2 per rod) UC-1 Rod Stiffening Clamps. Seismic bracing with (4) SCB-2(3/16") Mason Seismic Cable Kits. SCB-2s are attached to structure using 1/2" A307 hardware. Unit was attached to the 1-5/8" Unistrut P1000 trapeze with (18)#10 TEK ASTM ASTM A510 Grade 1018-1022, at ea. corner and evenly spaced @ 4" O.C along the trapeze.

DD-UUT-3 TEST RESULTS SUMMARY

Manufacturer: TITUS HVAC

Model/ Series: PEDV-S

Model Number: PEDV-S_3A002R0606

Product Construction Summary
Cabinet: 20 gauge zinc coated
Inlet Size: 5-7/8 Dual

Options/ Subcomponent Summary
-Controller: Pneumatic
-Damper: Butterfly Valve
-Disconnect
-Transformer
-Relay

Mixing Box: No
Airflow Switch
Aerocross Sensor

UUT Properties

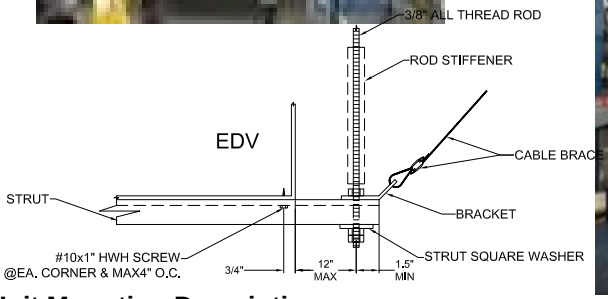
Operating Weight (lb)	UUT Dimensions (Inches) (see mounting description below for support/brace dimension)			Lowest Natural Frequency (Hz)		
	Width	Length	Height	Front-Back	Side-Side	Vertical
66.0	33	16.7	8	N/A	N/A	N/A

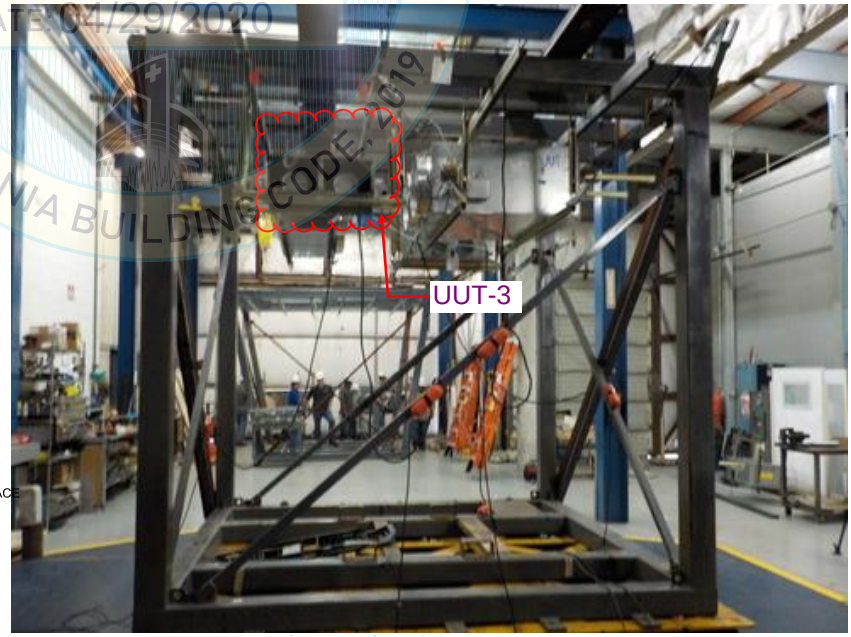
Seismic Test Parameter

Test Criteria	Sds (g)	z/h	Ip	Aflx-H (g)	Arig-H (g)	Aflx-V (g)	Arig-V (g)
ICC-ES AC 156	2.0	1.0	1.5	3.2	2.4	1.34	0.54

Pre Test Functionality	PASS	Post Test Functionality	PASS







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Unit Mounting Description:
Rigid suspended unit on (2) 1-5/8" Unistrut P1000 trapeze. (4) 3/8" ASTM-A307 rods at 40"x12.5" aspect ratio support the trapeze up to the fixture, fastened with 3/8" square washers and nuts. Unistrut P1000 used to stiffen the rods were fastened with Mason (2 per rod) UC-1 Rod Stiffening Clamps. Seismic bracing with (4) GS10(1/8") Gripple Seismic Cable Kits. GSS4 cable brackets are attached to structure using 1/2" A307 hardware. Unit was attached to the 1-5/8" Unistrut P1000 trapeze with (12)#10 TEK ASTM ASTM A510 Grade 1018-1022, at ea. corner and evenly spaced @ 4" O.C along the trapeze.

DD-UUT-4 TEST RESULTS SUMMARY

Manufacturer: TITUS HVAC

Model/ Series: DEDV-S

Model Number: DEDV-S_3A042R1616

Product Construction Summary
Cabinet: 20 gauge zinc coated
Inlet Size: 15-7/8" Dual

Options/ Subcomponent Summary
-Controller: Digital
-Damper: Butterfly Valve
-Disconnect
-Transformer
-Relay

Mixing Box: No
Airflow Switch
Aerocross Sensor

UUT Properties

Operating Weight (lb)	UUT Dimensions (Inches) (see mounting description below for support/brace dimension)			Lowest Natural Frequency (Hz)		
	Width	Length	Height	Front-Back	Side-Side	Vertical
151.5	61.1	18.9	18	N/A	N/A	N/A

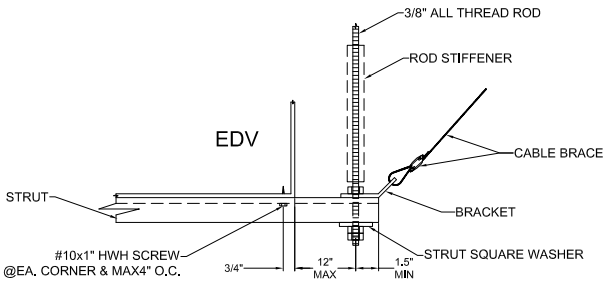
Seismic Test Parameter

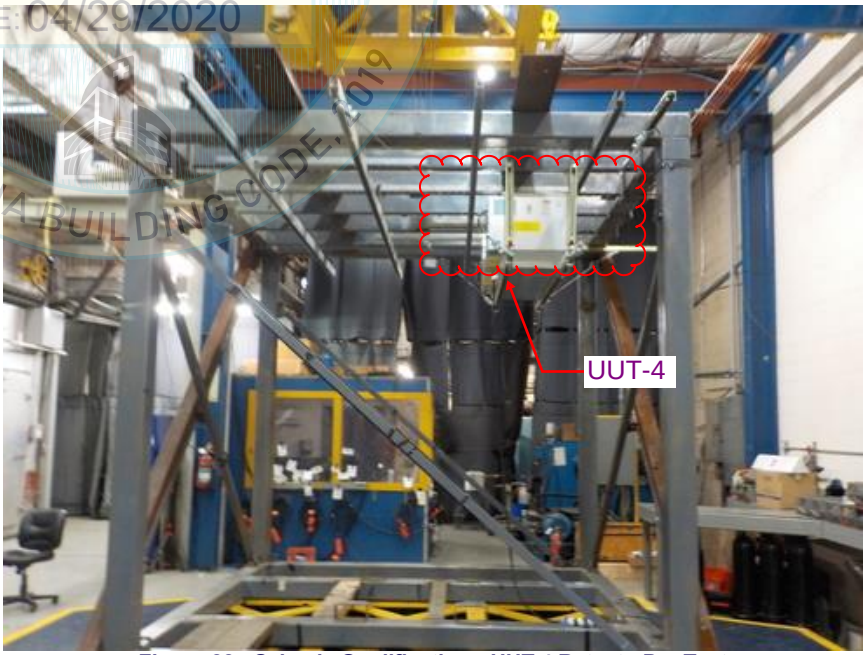
Test Criteria	Sds (g)	z/h	Ip	Aflx-H (g)	Arig-H (g)	Aflx-V (g)	Arig-V (g)
ICC-ES AC 156	2.0	1.0	1.5	3.2	2.4	1.34	0.54

Pre Test Functionality	PASS	Post Test Functionality	PASS

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OSP-0352
BY: Timothy J Piland
DATE: 04/29/2020
CALIFORNIA BUILDING CODE, 2019







Unit Mounting Description:
Rigid suspended unit on (2) 1-5/8" Unistrut P1000 trapeze. (4) 3/8" ASTM-A307 rods at 63"x11.5" aspect ratio support the trapeze up to the fixture, fastened with 3/8" square washers and nuts. Unistrut P1000 used to stiffen the rods were fastened with Mason (2 per rod) UC-1 Rod Stiffening Clamps. Seismic bracing with (4) SCB-1(1/8") Mason Seismic Cable Kits. SCB-1's are attached to structure using 1/2" A307 hardware. Unit was attached to the 1-5/8" Unistrut P1000 trapeze with (22)#10 TEK ASTM ASTM A510 Grade 1018-1022, at ea. corner and evenly spaced @ 4" O.C along the trapeze.

Figure DD-1 Model Number Nomenclature

Code	Sensor Location
3A[1]	Multipoint Sensor located in Cold and Hot Inlet
3B[2]	Multipoint Sensor located in Hot Inlet and Total Discharge Duct
3C[2]	Multipoint Sensor located in Cold Inlet and Total Discharge Duct
3D[2]	Multipoint Sensor located in Total Discharge Duct
3E[2]	Multipoint Sensor located in Cold Inlet, Hot Inlet, and Total Discharge Duct

Code	Unit Configuration
0	No Attenuator/Mixer
1	Integral Attenuator/Mixer
2	Integral Attenuator/Mixer with Baffle

Code	Liner Option
Default	
0	½" Fiberglass
1	1" Fiberglass
2	SteriLoc
4	UltraLoc
6	No Liner
7	½" Fibre Free
8	1" Fibre Free
9	3/8" Fibre Free
J	½" EcoShield*
K	1" EcoShield*
L	½" EcoShield w/Foil Face
M	1" EcoShield w/Foil Face

Code	Casing Configuration
2R	20 ga. Cold Duct ,RH
2L	20 ga. Cold Duct, LH

Cold Inlet Size Code	Size	Available Hot Inlet Size Codes	
		Default	Unequal Inlet Sizes
04	4"	04	
05	5"	05	04
06	6"	06	05, 04
07	7"	07	06, 05
08	8"	08	07, 06, 05
09	9"	09	08, 07, 06, 05
10	10"	10	09, 08, 07, 06
12	12"	12	10, 09, 08
14	14"	14	12, 10
16	16"	16	14, 12

Example:

	Model	Sensor Code	Unit Config	Liner Config.	Casing Config.	Cold Inlet Size	Hot Inlet Size
UUT-1	DEDV-S	3A	1	0	2R	06	06
UUT-2	PEDV-S	3A	1	4	2R	16	16
UTT-3	PEDV-S	3A	0	0	2R	06	06
UTT-4	DEDV-S	3A	0	4	2R	16	16

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Titus Air Terminal Units
Certified Product Table (Single Duct)

Table 1 - Cabinet Sizes

								Mounting Configuration			
Product Family	**Model**	**Unit Size**	**Inlet Size (in)**	**Height (in)**	**Width (in)**	**Max Depth (in)**	**Max Weight (lbs)**	**Suspended w/ Isolators**	**Suspended Rigidly**	**SDS**	**z/h**
Series Fan Powered	TFS-A	A	6	10.5	48	21	120	X	X	2.00	1.00
	TFS & TFS-F	B	6	16	43	37	180	X	X	2.00	1.00
			8	16	43	37	180	X	X	2.00	1.00
			10	16	43	37	180	X	X	2.00	1.00
			12	16	43	37	180	X	X	2.00	1.00
		C	6	16	43	37	185	X	X	2.00	1.00
			8	16	43	37	185	X	X	2.00	1.00
			10	16	43	37	185	X	X	2.00	1.00
			12	16	43	37	185	X	X	2.00	1.00
		D	10	20	47.5	39	260	X	X	2.00	1.00
			12	20	47.5	39	260	X	X	2.00	1.00
			14	20	47.5	39	260	X	X	2.00	1.00
			16	20	47.5	39	260	X	X	2.00	1.00
		E	12	20	47.5	39	260	X	X	2.00	1.00
			14	20	47.5	39	260	X	X	2.00	1.00
			16	20	47.5	39	260	X	X	2.00	1.00
	TFS-G	G	16	18	52	39	240	X	X	2.00	1.00
Single Duct	ESV	na	4	8	15.5	12	23	X	X	2.00	1.00
			5	8	15.5	12	23	X	X	2.00	1.00
			6	8	15.5	12	23	X	X	2.00	1.00
			7	10	15.5	12	25	X	X	2.00	1.00
			8	10	15.5	12	25	X	X	2.00	1.00
			9	12.5	15.5	14	30	X	X	2.00	1.00
			10	12.5	15.5	14	30	X	X	2.00	1.00
			12	15	16	15.5	35	X	X	2.00	1.00
			14	17.5	20	15.5	35	X	X	2.00	1.00
			16	18	24	15.5	47	X	X	2.00	1.00
			24x16	18	38	15.5	74	X	X	2.00	1.00

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Titus Air Terminal Units
Certified Product Subcomponent Tables (Single Duct)

Table 2 - External Sheeting

EXTERIOR Wall/Roof/Floor Panel Material	Thickness	UUT
Galvanized Carbon Steel	20 ga	1,2,3,4,5,6,7

Table 3 - Liner

Material	UUT
No Liner	extrapolated
Standard 1/2"	1, 6
1"	2
Steriloc	3
Ultraloc	7
FibreFree	interpolated
EcoShield 1"	interpolated
EcoShield Foil 1/2"	interpolated
EcoShield Foil 1"	interpolated
EcoShield 1/2"	4, 5

Table 4a - Hydronic Coils

	Height (in)	Width (in)	MFR	UUT
Dimensions	10"	12"	Great American Coil	6
	10"	18-1/2"		interpolated
	12 1/2"	20-1/2"		2
	12 1/2"	20-1/2"		interpolated
	17-1/2"	25"		4
	17-1/2"	25"		interpolated
	18"	38"		7

Table 4b - Hydronic Coil Options

		UUT
Casing Material	Galvanized Carbon Steel	2,4,6,7
Tube Material	Copper	2,4,6,7
Tube Outer Diameter	0.5"	2,4,6,7
Tube Wall Thickness	0.032"	2,4,6,7
Fin Material	Aluminum	2,4,6,7
Fin Thickness	0.0045"	2,4,6,7
Fin Pitch	10	2,4,6,7
	12	extrapolated
Pipe Qty	2	2,4,6,7
Tube Rows	1	2, 6
	2	4, 7
	3	extrapolated
	4	extrapolated
Header Material	Copper	2,4,6,7

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Titus Air Terminal Units
Certified Product Subcomponent Tables (Single Duct)

Table 5 - Fan Motor

Model	Phase	Rating [HP]	Voltage Rating	Weight	MFR	UUT
PSC	single	1/10	120, 208/240, 277	8.2	Regal Beloit	1 (208/240)
PSC	single	1/6	120, 208/240, 277	8.4	Regal Beloit	3 (277)
PSC	single	1/4	120, 208/240, 277	10.4	Regal Beloit	interpolated
ECM	single	1/3	120, 208/240, 277	10.4	Regal Beloit	2 (277)
PSC	single	1/3	120, 208/240, 277	12.2	Regal Beloit	interpolated
ECM	single	1/3	120, 208/240, 277	10.4	Regal Beloit	interpolated
ECM	single	1/2	120, 208/240, 277	12.2	Regal Beloit	interpolated
PSC	single	3/4	120, 208/240, 277	17.2	Regal Beloit	4 (120)
ECM	single	3/4	120, 208/240, 277	13.2	Regal Beloit	5 (277)

Table 6 - Housed Fans (Direct Drive) - All Manufactured by Lau Fans

	HP	0.10	0.17	0.25	0.33	0.50	0.75	UUT
	Motor Weight	8.2	8.4	10.4	12.2	12.2	17.2	
Fan Size (Dia - Width)		DD9-4A 12.8X12.5X6.8						1
Fan Weight		8.2						
Fan Size (Dia - Width)					DD9-4A 12.8X12.5X6.8			2
Fan Weight					8.2			
Fan Size (Dia - Width)			DD9-4A 12.8X12.5X6.8					3
Fan Weight			8.2					
Fan Size (Dia - Width)				DD10-4A 17.4X16.6X6.81	DD10-4A 17.4X16.6X6.81			interpolated
Fan Weight				9.5	9.5			
Fan Size (Dia - Width)					DD10-8A 17.4X16.6X10.5	DD10-8A 17.4X16.6X10.5		interpolated
Fan Weight					14.6	14.6		
Fan Size (Dia - Width)							DD10-10A 17.4X16.6X13.1	4,5
Fan Weight							17.8	

Wheel Material	UUT
Galvanized Carbon Steel	1,2,3,4,5

Housing Material	UUT
Galvanized Carbon Steel	1,2,3,4,5

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Titus Air Terminal Units
Certified Product Subcomponent Tables (Single Duct)

Table 7a - Flat Filter Rack

Type	Quantity	Frame Material Options	Dimensions [in]		MFR	UUT
			Width	Height		
Side Load	1	Galvanized Carbon Steel	16	10	KOCH/ FLANDERS	1
Side Load	1	Galvanized Carbon Steel	16	14		2,3
Side Load	1	Galvanized Carbon Steel	14	18		4,5

Table 7b - Flat Filter Media Options

Type	Filter Material	MFR	UUT
DISPOSABLE	FIBERGLASS	KOCH/FLANDERS	1, 2, 3, 4, 5

Table 8a - Electric Heat

Model	Stage	Output (kW)	Dimensions [in]			Weight [lbs]	MFR	UUT
			H	W	D			
TFS / TFS-F	3	4	8-7/16"	10-1/2"	9-11/16"	23.0	TITUS	1
TFS / TFS-F	3	4	11-3/8"	14-1/2"	9-3/4"	25.0		3
TFS / TFS-F	1 (SCR)	11	11"	17	9-3/4"	30.0		5
ESV	1	7	9	6-1/2"	8	18.0		6
ESV	3	35	17	6-1/2"	34	30.0		7

Table 8b - Electric Heat

Electrical Heat (kW)	Voltage		UUT
	115-277 Single Phase	208-600 Three Phase	
208V /1/ 4kw/ 3 stage	0.5 kw - 13.0kw	0.5 kw - 36.0kw	1
277V /1/ 4kw/ 3 stage	0.5 kw - 13.0kw	0.5 kw - 36.0kw	3
277V /1/ 11kw/ scr heat	0.5 kw - 13.0kw	0.5 kw - 36.0kw	5
240V /1/ 7kw/ 1 stage	0.5 kw - 13.0kw	0.5 kw - 36.0kw	6
480V /3/ 35kw/ 3 stage	0.5 kw - 13.0kw	0.5 kw - 36.0kw	7

Table 9 - Controls

Type	Height [in]	Width [in]	Depth [in]	Voltage	MFR	UUT
Pneumatic (actuator)	4.25 dia	4.25 dia	5.5	N/A	Krueter/Titus	3
Pneumatic (controller)	3.5 dia	3.5 dia	4	N/A	Krueter/Titus	3
Pneumatic (actuator)	4.25 dia	4.25 dia	5.5	N/A	Krueter/Titus	6
Pneumatic (controller)	3.5	4.25	2	N/A	Krueter/Titus	6
Digital (controller / actuator)	6.5	4.25	2.25	24	Titus	1,2,4,5,7

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Certified Product Subcomponent Tables (Single Duct)

Table 10 - Disconnect

Type	Height [in]	Width [in]	Depth [in]	Amperes	Voltage	MFR	UUT
Non-fusable, 3 poles	2.89	2.07	3.25	30 - 60	600	ABB	1, 2, 3, 4, 5

Table 11 - Fusing

Type	Height [in]	Width [in]	Depth [in]	Amperes	Voltage	MFR	UUT
KLK, Fast Acting, Line Fuse	0.41	0.41	1.5	8	600	Little fuse	1
KLK, Fast Acting, Line Fuse	0.41	0.41	1.5	16	600	Little fuse	2
KLK, Fast Acting, Line Fuse	0.41	0.41	1.5	24	600	Little fuse	3
KLK, Fast Acting, Line Fuse	0.41	0.41	1.5	32	600	Little fuse	4
KLK, Fast Acting, Line Fuse	0.41	0.41	1.5	40	600	Little fuse	5

Table 12 - Contactors

Type	Height [in]	Width [in]	Depth [in]	HP	Voltage	MFR	UUT
Magnetic	2.44	1.63	3.25	11/16	277/480V	Hartland Cntrls	1
Magnetic	2.44	1.63	3.25	11	120V	Hartland Cntrls	2,4,5
Magnetic	2.44	1.63	3.25	11/16	277/480V	Hartland Cntrls	3

Table 13 - Transformer

Type	Height [in]	Width [in]	Depth [in]	VA	Voltage	MFR	UUT
AirCore Class 2	3.125	2.125	3.5	.07 or 50VA	120/24V	Hartland Cntrls	extrapolated
AirCore Class 2	3.125	2.125	3.5	.07 or 50VA	277/24V	Hartland Cntrls	3,5
AirCore Class 2	3.125	2.125	3.5	.07 or 50VA	480/24V	Hartland Cntrls	7
AirCore Class 2	3.125	2.125	3.5	.07 or 50VA	208/240/24V	Hartland Cntrls	1,6

Table 14 - Relay

Type	Height [in]	Width [in]	Depth [in]	HP	Voltage	MFR	UUT
SPST	2.37	2.1	2.1	0.75	277V	Hartland Cntrls	1, 2, 3, 4, 5

Table 15 - Airflow Switch

Type	Height [in]	Width [in]	Depth [in]	HP	Voltage	MFR	UUT
ElectroPneumatic	2.94	3.25	6.12	5.6	277V	Cleveland Controls	1,2,3,4,5,6,7

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Titus Air Terminal Units
Certified Product Subcomponent Tables (Single Duct)

Table 16 - Inductors

HP	Amperes	Voltage	MFR	UUT
1/3	12	120 - 208/277	Tyco (Products Unlimited)	2
1/2	5.9	120 - 208/277	Tyco (Products Unlimited)	interpolated
3/4	5.5	120 - 208/277	Tyco (Products Unlimited)	5
1	3	120 - 208/277	Tyco (Products Unlimited)	extrapolated

Note: Used with ECM Motors only.

Table 17 - Dampers

Unit Size	Height	Width	Qty	MFG	UUT
A06	5.875 dia	5.875 dia	1	Titus	1
B06	5.875 dia	5.875 dia	1		2
B12	11.875 dia	11.875 dia	1		3
E12	11.875 dia	11.875 dia	1		4
E16	15.875 dia	15.875 dia	1		5
8	7.875 dia	7.875 dia	1		6
24 X 16 (40)	16	24	1	Ruskin	7

Damper Material		UUT
Frame	Blades	
N/A	Galvanized Carbon Steel	1,2,3,4,5,6
Aluminum	Aluminum	7

Actuator MFR	UUT
ref table 9	1,2,3,4,5,6,7

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UUT #1a

Manufacturer: Titus

Model Series: TFS-A Unit A Size 6"

Cabinet Construction Summary:

Base:	20 Gauge galvanized carbon steel
Walls:	20 Gauge galvanized carbon steel
Roof:	20 Gauge galvanized carbon steel

Subcomponent Summary

Item	Dimensions				Lowest Natural Frequency		
	Depth	Width	Height	Weight	F-B	S-S	V
Cabinet	21"	48"	10.5"	100 lbs	10.6	18.2	na
Fan							
Filter							
Electric Heat							
Control							
Disconnect							
Fuses							
Contactors							
Transformer							
Relays							
Airflow Switch							
Damper							
Fan Speed Control							
Inlet Sensor							
Control Enclosure							

Seismic Test Parameters:

Qualification Method	Sds	z/h	Ip	Aflx-H	Arig-H	Aflx-V	Arig-V
ICC-ES AC156 (2010)	2.00	1.0	1.5	3.20	2.40	1.33	0.53

Pre/Post Shake Functionality Test Results:

Pre:	PASSED
Post:	All units were filled with contents and maintained structural integrity and functionality.



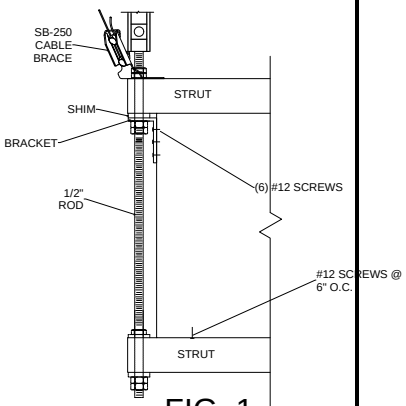


FIG. 1

UUT Mounting Description:

Suspended unit on (4) 1/2" ASTM-A307 rod, with VMC HRSA Hangers, (4) SB-250 (1/4") Seismic Cable Kits and (3 per rod) SRBC-1 Rod Stiffening Clamps. SB-250's are attached to structure using 5/8" hardware. SRBC-1's are fastened to L1x1x1/4 ASTM-A36 angle.

Ea. Rod is double nutted to 1-5/8"-12ga strut fastened to the bottom of the unit with #12 screws at min 6" O.C., and it is double nutted to 1-5/8"-12ga strut fastened to the top with 2"x2"x10ga A36 angle bracket attached to the side-top-corner of the unit with (6) #12 screws. Shims fill gap between top bracket and strut. Brackets are placed on common side for rectangular attachment pattern. (Fig. 1)

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UUT #1b

Manufacturer: Titus

Model Series: TFS-A Unit A Size 6"

Cabinet Construction Summary:

Base:	20 Gauge galvanized carbon steel
Walls:	20 Gauge galvanized carbon steel
Roof:	20 Gauge galvanized carbon steel

Subcomponent Summary

Item	Dimensions				Lowest Natural Frequency		
	Depth	Width	Height	Weight	F-B	S-S	V
Cabinet	21"	48"	10.5"	100 lbs	7.3	3.6	10.8
Fan							
Filter							
Electric Heat							
Control							
Disconnect							
Fuses							
Contactors							
Transformer							
Relays							
Airflow Switch							
Damper							
Fan Speed Control							
Inlet Sensor							
Control Enclosure							

Seismic Test Parameters:

Qualification Method	Sds	z/h	Ip	Aflx-H	Arig-H	Aflx-V	Arig-V
ICC-ES AC156 (2010)	2.00	1.0	1.5	3.20	2.40	1.33	0.53

Pre/Post Shake Functionality Test Results:

Pre:	PASSED
Post:	All units were filled with contents and maintained structural integrity and functionality.



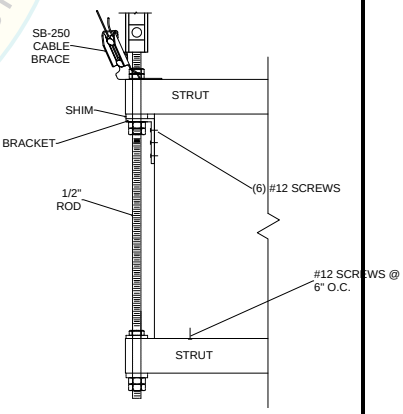


FIG. 1

UUT Mounting Description:

Suspended unit on (4) 1/2" ASTM-A307 rod, with (4) VMC SB-250 (1/4") Seismic Cable Kits and (3 per rod) SRBC-1 Rod Stiffening Clamps. SB-250's are attached to structure using 5/8" hardware. SRBC-1's are fastened to L1x1x1/4 ASTM-A36 angle.

Ea. Rod is double nutted to 1-5/8"-12ga strut fastened to the bottom of the unit with #12 screws at min 6" O.C., and it is double nutted to 1-5/8"-12ga strut fastened to the top with 2"x2"x10ga A36 angle bracket attached to the side-top-corner of the unit with (6) #12 screws. Shims fill gap between top bracket and strut. Brackets are placed on common side for rectangular attachment pattern. (Fig. 1)

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UUT #2a

Manufacturer: Titus

Model Series: TFS Unit B Size 6"

Cabinet Construction Summary:

Base:	20 Gauge galvanized carbon steel
Walls:	20 Gauge galvanized carbon steel
Roof:	20 Gauge galvanized carbon steel

Subcomponent Summary

Item	Dimensions				Lowest Natural Frequency		
	Depth	Width	Height	Weight	F-B	S-S	V
Cabinet	37"	43"	16"	210 lbs	3.7	4.1	8.2
Coil (water coils, Flange attached w/#10 SMS @ 4" O.C. perimeter)							
Fan							
Filter							
Control							
Disconnect							
Fuses							
Contactors							
Transformer							
Relays							
Airflow Switch							
Inductor							
Damper							
Fan Speed Control							
Inlet Sensor							
Control Enclosure							

Seismic Test Parameters:

Qualification Method	Sds	z/h	Ip	Aflx-H	Arig-H	Aflx-V	Arig-V
ICC-ES AC156 (2010)	2.00	1.0	1.5	3.20	2.40	1.33	0.53

Pre/Post Shake Functionality Test Results:

Pre:	PASSED
Post:	All units were filled with contents and maintained structural integrity and functionality.



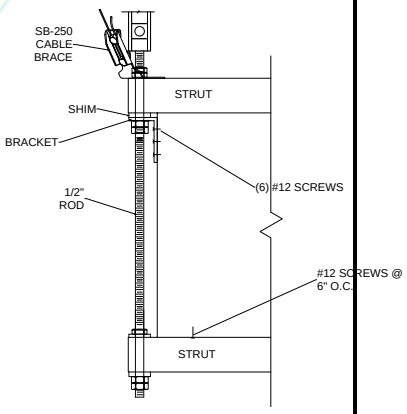


FIG. 1

UUT Mounting Description:

Suspended unit on (4) 3/8" ASTM-A307 rod, with VMC HRSA Hangers, (4) SB-250 (1/4") Seismic Cable Kits and (3 per rod) SRBC-1 Rod Stiffening Clamps. SB-250's are attached to structure using 5/8" hardware. SRBC-1's are fastened to L1x1x1/4 ASTM-A36 angle.

Ea. Rod is double nutted to 1-5/8"-12ga strut fastened to the bottom of the unit with #12 screws at min 6" O.C., and it is double nutted to 1-5/8"-12ga strut fastened to the top with 2"x2"x10ga A36 angle bracket attached to the side-top-corner of the unit with (6) #12 screws. Shims fill gap between top bracket and strut. Brackets are placed on common side for rectangular attachment pattern. (Fig. 1)

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UUT #2b

Manufacturer: Titus

Model Series: TFS Unit B Size 6"

Cabinet Construction Summary:

Base:	20 Gauge galvanized carbon steel
Walls:	20 Gauge galvanized carbon steel
Roof:	20 Gauge galvanized carbon steel

Subcomponent Summary

Item	Dimensions				Lowest Natural Frequency		
	Depth	Width	Height	Weight	F-B	S-S	V
Cabinet	37"	43"	16"	210 lbs	5.4	4.2	10.6
Coil (water coils, Flange attached w/#10 SMS @ 4" O.C. perimeter)							
Fan							
Filter							
Control							
Disconnect							
Fuses							
Contactors							
Transformer							
Relays							
Airflow Switch							
Inductor							
Damper							
Fan Speed Control							
Inlet Sensor							
Control Enclosure							

Seismic Test Parameters:

Qualification Method	Sds	z/h	Ip	Aflx-H	Arig-H	Aflx-V	Arig-V
ICC-ES AC156 (2010)	2.00	1.0	1.5	3.20	2.40	1.33	0.53

Pre/Post Shake Functionality Test Results:

Pre:	PASSED
Post:	All units were filled with contents and maintained structural integrity and functionality.



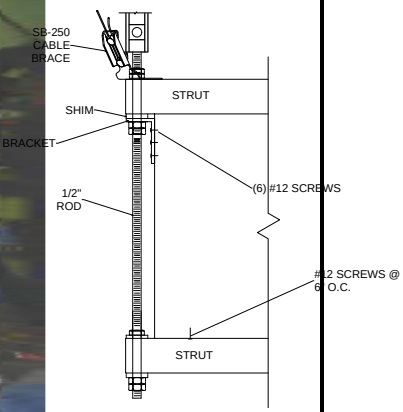


FIG. 1

UUT Mounting Description:

Suspended unit on (4) 3/8" ASTM-A307 rod, with (4) VMC SB-250 (1/4") Seismic Cable Kits and (3 per rod) SRBC-1 Rod Stiffening Clamps. SB-250's are attached to structure using 5/8" hardware. SRBC-1's are fastened to L1x1x1/4 ASTM-A36 angle.

Ea. Rod is double nutted to 1-5/8"-12ga strut fastened to the bottom of the unit with #12 screws at min 6" O.C., and it is double nutted to 1-5/8"-12ga strut fastened to the top with 2"x2"x10ga A36 angle bracket attached to the side-top-corner of the unit with (6) #12 screws. Shims fill gap between top bracket and strut. Brackets are placed on common side for rectangular attachment pattern. (Fig. 1)

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OSHPD
OSP-0352
BY: Timothy J. Piland
DATE: 04/29/2020
CALIFORNIA BUILDING CODE, 2019

UUT #3a

Manufacturer: Titus

Model Series: TFS Unit B Size 12"

Cabinet Construction Summary:

Base:	20 Gauge galvanized carbon steel
Walls:	20 Gauge galvanized carbon steel
Roof:	20 Gauge galvanized carbon steel

Subcomponent Summary

Item	Dimensions				Lowest Natural Frequency		
	Depth	Width	Height	Weight	F-B	S-S	V
Cabinet	37"	43"	16"	200 lbs	2.4	2.7	11.2
Fan							
Filter							
Electric Heat							
Control							
Disconnect							
Fuses							
Contactors							
Transformer							
Relays							
Airflow Switch							
Damper							
Fan Speed Control							
Inlet Sensor							
Control Enclosure							

Seismic Test Parameters:

Qualification Method	Sds	z/h	Ip	Aflx-H	Arig-H	Aflx-V	Arig-V
ICC-ES AC156 (2010)	2.00	1.0	1.5	3.20	2.40	1.33	0.53

Pre/Post Shake Functionality Test Results:

Pre:	PASSED
Post:	All units were filled with contents and maintained structural integrity and functionality.



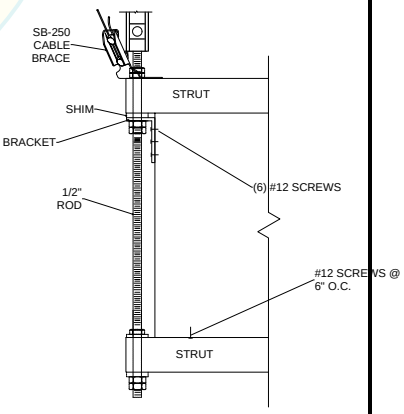


FIG. 1

UUT Mounting Description:

Suspended unit on (4) 3/8" ASTM-A307 rod, with VMC HRSA Hangers, (4) SB-250 (1/4") Seismic Cable Kits and (3 per rod) SRBC-1 Rod Stiffening Clamps. SB-250's are attached to structure using 5/8" hardware. SRBC-1's are fastened to L1x1x1/4 ASTM-A36 angle.

Ea. Rod is double nutted to 1-5/8"-12ga strut fastened to the bottom of the unit with #12 screws at min 6" O.C., and it is double nutted to 1-5/8"-12ga strut fastened to the top with 2"x2"x10ga A36 angle bracket attached to the side-top-corner of the unit with (6) #12 screws. Shims fill gap between top bracket and strut. Brackets are placed on common side for rectangular attachment pattern. (Fig. 1)

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OSP-0352
BY: Timothy J. Piland
DATE: 04/29/2020
CALIFORNIA BUILDING CODE, 2019

UUT #3b

Manufacturer: Titus

Model Series: TFS Unit B Size 12"

Cabinet Construction Summary:

Base:	20 Gauge galvanized carbon steel
Walls:	20 Gauge galvanized carbon steel
Roof:	20 Gauge galvanized carbon steel

Subcomponent Summary

Item	Dimensions				Lowest Natural Frequency		
	Depth	Width	Height	Weight	F-B	S-S	V
Cabinet	37"	43"	16"	200 lbs	5	3.1	10.6
Fan							
Filter							
Electric Heat							
Control							
Disconnect							
Fuses							
Contactors							
Transformer							
Relays							
Airflow Switch							
Damper							
Fan Speed Control							
Inlet Sensor							
Control Enclosure							

Seismic Test Parameters:

Qualification Method	Sds	z/h	Ip	Aflx-H	Arig-H	Aflx-V	Arig-V
ICC-ES AC156 (2010)	2.00	1.0	1.5	3.20	2.40	1.33	0.53

Pre/Post Shake Functionality Test Results:

Pre:	PASSED
Post:	All units were filled with contents and maintained structural integrity and functionality.



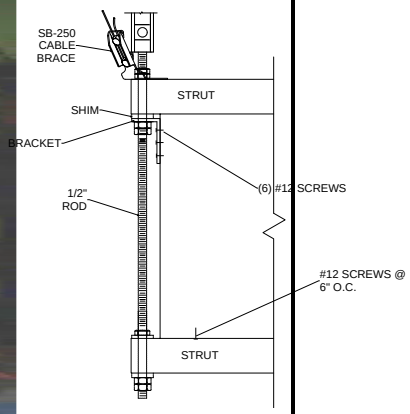


FIG. 1

UUT Mounting Description:

Suspended unit on (4) 3/8" ASTM-A307 rod, with (4) VMC SB-250 (1/4") Seismic Cable Kits and (3 per rod) SRBC-1 Rod Stiffening Clamps. SB-250's are attached to structure using 5/8" hardware. SRBC-1's are fastened to L1x1x1/4 ASTM-A36 angle.

Ea. Rod is double nutted to 1-5/8"-12ga strut fastened to the bottom of the unit with #12 screws at min 6" O.C., and it is double nutted to 1-5/8"-12ga strut fastened to the top with 2"x2"x10ga A36 angle bracket attached to the side-top-corner of the unit with (6) #12 screws. Shims fill gap between top bracket and strut. Brackets are placed on common side for rectangular attachment pattern. (Fig. 1)

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BY: Timothy J. Piland
DATE: 04/29/2020
CALIFORNIA BUILDING CODE, 2019

UUT #4a

Manufacturer: Titus

Model Series: TFS Unit E Size 12"

Cabinet Construction Summary:

Base:	20 Gauge galvanized carbon steel
Walls:	20 Gauge galvanized carbon steel
Roof:	20 Gauge galvanized carbon steel

Subcomponent Summary

Item	Dimensions				Lowest Natural Frequency		
	Depth	Width	Height	Weight	F-B	S-S	V
Cabinet	39"	47.5"	20"	285 lbs	2.0	2.0	6.5
Coil (water coils, Flange attached w/#10 SMS @ 4" O.C. perimeter)							
Fan							
Filter							
Control							
Disconnect							
Fuses							
Contactors							
Transformer							
Relays							
Airflow Switch							
Damper							
Fan Speed Control							
Inlet Sensor							
Control Enclosure							

Seismic Test Parameters:

Qualification Method	Sds	z/h	Ip	Aflx-H	Arig-H	Aflx-V	Arig-V
ICC-ES AC156 (2010)	2.00	1.0	1.5	3.20	2.40	1.33	0.53

Pre/Post Shake Functionality Test Results:

Pre:	PASSED
Post:	All units were filled with contents and maintained structural integrity and functionality.



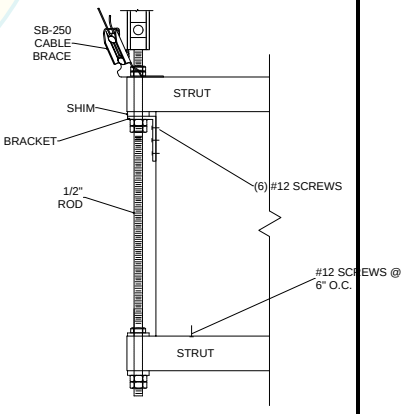


FIG. 1

UUT Mounting Description:

Suspended unit on (4) 1/2" ASTM-A307 rod, with VMC HRSA Hangers, (4) SB-250 (1/4") Seismic Cable Kits and (3 per rod) SRBC-1 Rod Stiffening Clamps. SB-250's are attached to structure using 5/8" hardware. SRBC-1's are fastened to L1x1x1/4 ASTM-A36 angle.

Ea. Rod is double nutted to 1-5/8"-12ga strut fastened to the bottom of the unit with #12 screws at min 6" O.C., and it is double nutted to 1-5/8"-12ga strut fastened to the top with 2"x2"x10ga A36 angle bracket attached to the side-top-corner of the unit with (6) #12 screws. Shims fill gap between top bracket and strut. Brackets are placed on common side for rectangular attachment pattern. (Fig. 1)

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UUT #4b

Manufacturer: Titus

Model Series: TFS Unit E Size 12"

Cabinet Construction Summary:

Base:	20 Gauge galvanized carbon steel
Walls:	20 Gauge galvanized carbon steel
Roof:	20 Gauge galvanized carbon steel

Subcomponent Summary

Item	Dimensions				Lowest Natural Frequency		
	Depth	Width	Height	Weight	F-B	S-S	V
Cabinet	39"	47.5"	20"	285 lbs	2.5	4.4	10.7
Coil (water coils, Flange attached w/#10 SMS @ 4" O.C. perimeter)							
Fan							
Filter							
Control							
Disconnect							
Fuses							
Contactors							
Transformer							
Relays							
Airflow Switch							
Damper							
Fan Speed Control							
Inlet Sensor							
Control Enclosure							

Seismic Test Parameters:

Qualification Method	Sds	z/h	Ip	Aflx-H	Arig-H	Aflx-V	Arig-V
ICC-ES AC156 (2010)	2.00	1.0	1.5	3.20	2.40	1.33	0.53

Pre/Post Shake Functionality Test Results:

Pre:	PASSED
Post:	All units were filled with contents and maintained structural integrity and functionality.



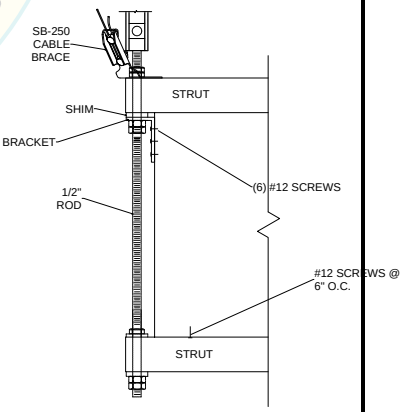


FIG. 1

UUT Mounting Description:

Suspended unit on (4) 1/2" ASTM-A307 rod, with (4) VMC SB-250 (1/4") Seismic Cable Kits and (3 per rod) SRBC-1 Rod Stiffening Clamps. SB-250's are attached to structure using 5/8" hardware. SRBC-1's are fastened to L1x1x1/4 ASTM-A36 angle.

Ea. Rod is double nutted to 1-5/8"-12ga strut fastened to the bottom of the unit with #12 screws at min 6" O.C., and it is double nutted to 1-5/8"-12ga strut fastened to the top with 2"x2"x10ga A36 angle bracket attached to the side-top-corner of the unit with (6) #12 screws. Shims fill gap between top bracket and strut. Brackets are placed on common side for rectangular attachment pattern. (Fig. 1)

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BY: Timothy J. Piland
DATE: 04/29/2020
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UUT #5a

Manufacturer: Titus

Model Series: TFS Unit E Size 16"

Cabinet Construction Summary:

Base:	20 Gauge galvanized carbon steel
Walls:	20 Gauge galvanized carbon steel
Roof:	20 Gauge galvanized carbon steel

Subcomponent Summary

Item	Dimensions				Lowest Natural Frequency		
	Depth	Width	Height	Weight	F-B	S-S	V
Cabinet	39"	47.5"	20"	240 lbs	2.8	2.8	5.1
Fan							
Filter							
Electric Heat							
Control							
Disconnect							
Fuses							
Contactors							
Transformer							
Relays							
Airflow Switch							
Inductor							
Damper							
Fan Speed Control							
Inlet Sensor							
Control Enclosure							

Seismic Test Parameters:

Qualification Method	Sds	z/h	Ip	Aflx-H	Arig-H	Aflx-V	Arig-V
ICC-ES AC156 (2010)	2.00	1.0	1.5	3.20	2.40	1.33	0.53

Pre/Post Shake Functionality Test Results:

Pre:	PASSED
Post:	All units were filled with contents and maintained structural integrity and functionality.



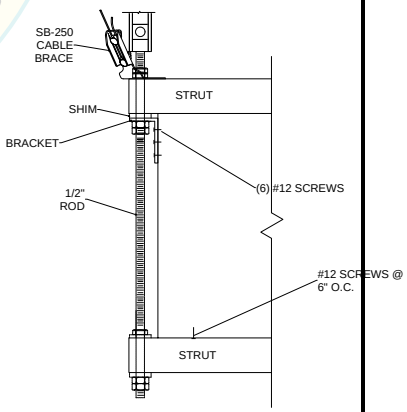


FIG. 1

UUT Mounting Description:

Suspended unit on (4) 1/2" ASTM-A307 rod, with VMC HRSA Hangers, (4) SB-250 (1/4") Seismic Cable Kits and (3 per rod) SRBC-1 Rod Stiffening Clamps. SB-250's are attached to structure using 5/8" hardware. SRBC-1's are fastened to L1x1x1/4 ASTM-A36 angle.

Ea. Rod is double nutted to 1-5/8"-12ga strut fastened to the bottom of the unit with #12 screws at min 6" O.C., and it is double nutted to 1-5/8"-12ga strut fastened to the top with 2"x2"x10ga A36 angle bracket attached to the side-top-corner of the unit with (6) #12 screws. Shims fill gap between top bracket and strut. Brackets are placed on common side for rectangular attachment pattern. (Fig. 1)

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OSHPD
OSP-0352
BY: Timothy J. Piland
DATE: 07/27/2020
CALIFORNIA BUILDING CODE 2019

UUT #5b

Manufacturer: Titus

Model Series: TFS Unit E Size 16"

Cabinet Construction Summary:

Base:	20 Gauge galvanized carbon steel
Walls:	20 Gauge galvanized carbon steel
Roof:	20 Gauge galvanized carbon steel

Subcomponent Summary

Item	Dimensions				Lowest Natural Frequency		
	Depth	Width	Height	Weight	F-B	S-S	V
Cabinet	39"	47.5"	20"	240 lbs	5.1	3.4	10.7
Fan							
Filter							
Electric Heat							
Control							
Disconnect							
Fuses							
Contactors							
Transformer							
Relays							
Airflow Switch							
Inductor							
Damper							
Fan Speed Control							
Inlet Sensor							
Control Enclosure							

Seismic Test Parameters:

Qualification Method	Sds	z/h	Ip	Aflx-H	Arig-H	Aflx-V	Arig-V
ICC-ES AC156 (2010)	2.00	1.0	1.5	3.20	2.40	1.33	0.53

Pre/Post Shake Functionality Test Results:

Pre:	PASSED
Post:	All units were filled with contents and maintained structural integrity and functionality.



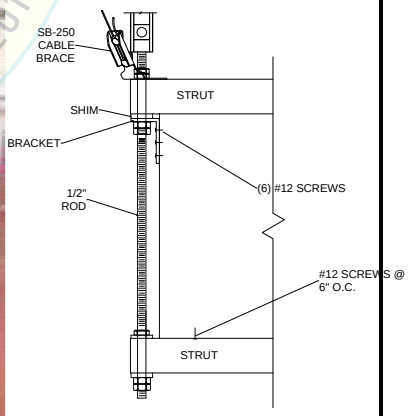


FIG. 1

UUT Mounting Description:

Suspended unit on (4) 1/2" ASTM-A307 rod, with (4) VMC SB-250 (1/4") Seismic Cable Kits and (3 per rod) SRBC-1 Rod Stiffening Clamps. SB-250's are attached to structure using 5/8" hardware. SRBC-1's are fastened to L1x1x1/4 ASTM-A36 angle.

Ea. Rod is double nutted to 1-5/8"-12ga strut fastened to the bottom of the unit with #12 screws at min 6" O.C., and it is double nutted to 1-5/8"-12ga strut fastened to the top with 2"x2"x10ga A36 angle bracket attached to the side-top-corner of the unit with (6) #12 screws. Shims fill gap between top bracket and strut. Brackets are placed on common side for rectangular attachment pattern. (Fig. 1)

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REVIEWED FOR CODE COMPLIANCE OSHPD OSP-0352 BY: Timothy J. Piland DATE: 04/29/2020 CALIFORNIA BUILDING CODE 2019

UUT #6a

Manufacturer: Titus

Model Series: ESV Size 8"

Cabinet Construction Summary:

Base:	20 Gauge galvanized carbon steel
Walls:	20 Gauge galvanized carbon steel
Roof:	20 Gauge galvanized carbon steel

Subcomponent Summary

Item	Dimensions				Lowest Natural Frequency		
	Depth	Width	Height	Weight	F-B	S-S	V
Cabinet	12"	15.5"	10"	60 lbs	3.7	7.2	6.4
Coil (water coils, Flange attached w/#10 SMS @ 4" O.C. perimeter)							
Electric Heat							
Control							
Transformer							
Airflow Switch							
Damper							
Inlet Sensor							
Sound Attenuator							
Control Enclosure							

Seismic Test Parameters:

Qualification Method	Sds	z/h	Ip	Aflx-H	Arig-H	Aflx-V	Arig-V
ICC-ES AC156 (2010)	2.00	1.0	1.5	3.20	2.40	1.33	0.53

Pre/Post Shake Functionality Test Results:

Pre:	PASSED
Post:	All units were filled with contents and maintained structural integrity and functionality.



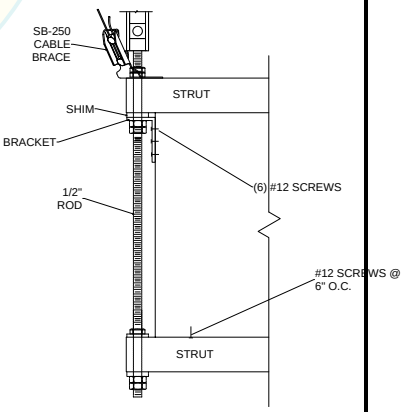


FIG. 1

UUT Mounting Description:

Suspended unit on (4) 3/8" ASTM-A307 rod, with VMC HRSA Hangers, (4) SB-250 (1/4") Seismic Cable Kits and (3 per rod) SRBC-1 Rod Stiffening Clamps. SB-250's are attached to structure using 5/8" hardware. SRBC-1's are fastened to L1x1x1/4 ASTM-A36 angle.

Ea. Rod is double nutted to 1-5/8"-12ga strut fastened to the bottom of the unit with #12 screws at min 6" O.C., and it is double nutted to 1-5/8"-12ga strut fastened to the top with 2"x2"x10ga A36 angle bracket attached to the side-top-corner of the unit with (6) #12 screws. Shims fill gap between top bracket and strut. Brackets are placed on common side for rectangular attachment pattern. (Fig. 1)
Note: For DESV-4 to -8 (digital controller), the bracket @ the controler corner is mounted to front-top corner due to controller box interference (still within tolerance of rectangular pattern)

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REVIEWED FOR CODE COMPLIANCE OSHPD OSP-0352 BY: Timothy J. Piland DATE: 04/29/2020 CALIFORNIA BUILDING CODE, 2019

UUT #6b

Manufacturer: Titus

Model Series: ESV Size 8"

Cabinet Construction Summary:

Base:	20 Gauge galvanized carbon steel
Walls:	20 Gauge galvanized carbon steel
Roof:	20 Gauge galvanized carbon steel

Subcomponent Summary

Item	Dimensions				Lowest Natural Frequency		
	Depth	Width	Height	Weight	F-B	S-S	V
Cabinet	12"	15.5"	10"	60 lbs	6.1	5.0	10.6
Coil (water coils, Flange attached w/#10 SMS @ 4" O.C. perimeter)							
Electric Heat							
Control							
Transformer							
Airflow Switch							
Damper							
Inlet Sensor							
Sound Attenuator							
Control Enclosure							

Seismic Test Parameters:

Qualification Method	Sds	z/h	Ip	Aflx-H	Arig-H	Aflx-V	Arig-V
ICC-ES AC156 (2010)	2.00	1.0	1.5	3.20	2.40	1.33	0.53

Pre/Post Shake Functionality Test Results:

Pre:	PASSED
Post:	All units were filled with contents and maintained structural integrity and functionality.



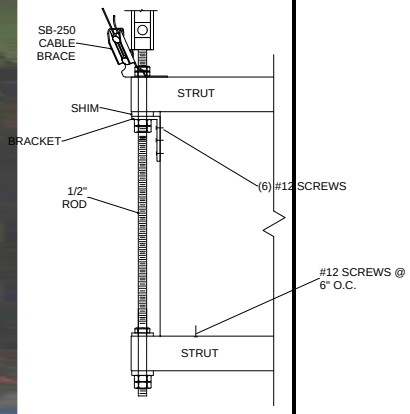


FIG. 1

UUT Mounting Description:

Suspended unit on (4) 3/8" ASTM-A307 rod, with (4) VMC SB-250 (1/4") Seismic Cable Kits and (3 per rod) SRBC-1 Rod Stiffening Clamps. SB-250's are attached to structure using 5/8" hardware. SRBC-1's are fastened to L1x1x1/4 ASTM-A36 angle.

Ea. Rod is double nutted to 1-5/8"-12ga strut fastened to the bottom of the unit with #12 screws at min 6" O.C., and it is double nutted to 1-5/8"-12ga strut fastened to the top with 2"x2"x10ga A36 angle bracket attached to the side-top-corner of the unit with (6) #12 screws. Shims fill gap between top bracket and strut. Brackets are placed on common side for rectangular attachment pattern. (Fig. 1)
Note: For DESV-4 to -8 (digital controller), the bracket @ the controler corner is mounted to front-top corner due to controller box interference (still within tolerance of rectangular pattern)

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OSP-0352
BY: Timothy J. Piland
DATE: 04/29/2020
CALIFORNIA BUILDING CODE, 2019

UUT #7a

Manufacturer: Titus

Model Series: ESV Size 24"x16"

Cabinet Construction Summary:

Base:	20 Gauge galvanized carbon steel
Walls:	20 Gauge galvanized carbon steel
Roof:	20 Gauge galvanized carbon steel

Subcomponent Summary

Item	Dimensions				Lowest Natural Frequency		
	Depth	Width	Height	Weight	F-B	S-S	V
Cabinet	15.5"	38"	18"	250 lbs	4.4	2.8	6.9
Coil (water coils, Flange attached w/#10 SMS @ 4" O.C. perimeter)							
Electric Heat							
Control							
Transformer							
Airflow Switch							
Damper							
Sound Attenuator							
Inlet Sensor							
Control Enclosure							

Seismic Test Parameters:

Qualification Method	Sds	z/h	Ip	Aflx-H	Arig-H	Aflx-V	Arig-V
ICC-ES AC156 (2010)	2.00	1.0	1.5	3.20	2.40	1.33	0.53

Pre/Post Shake Functionality Test Results:

Pre:	PASSED
Post:	All units were filled with contents and maintained structural integrity and functionality.



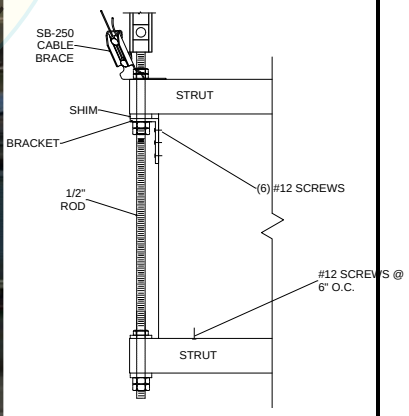


FIG. 1

UUT Mounting Description:

Suspended unit on (4) 3/8" ASTM-A307 rod, with VMC HRSA Hangers, (4) SB-250 (1/4") Seismic Cable Kits and (3 per rod) SRBC-1 Rod Stiffening Clamps. SB-250's are attached to structure using 5/8" hardware. SRBC-1's are fastened to L1x1x1/4 ASTM-A36 angle.

Ea. Rod is double nutted to 1-5/8"-12ga strut fastened to the bottom of the unit with #12 screws at min 6" O.C., and it is double nutted to 1-5/8"-12ga strut fastened to the top with 2"x2"x10ga A36 angle bracket attached to the side-top-corner of the unit with (6) #12 screws. Shims fill gap between top bracket and strut. Brackets are placed on common side for rectangular attachment pattern. (Fig. 1)

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OSP-0352
BY: Timothy J. Piland
DATE: 04/29/2020
CALIFORNIA BUILDING CODE, 2019

UUT #7b

Manufacturer: Titus

Model Series: ESV Size 24"x16"

Cabinet Construction Summary:

Base:	20 Gauge galvanized carbon steel
Walls:	20 Gauge galvanized carbon steel
Roof:	20 Gauge galvanized carbon steel

Subcomponent Summary

Item	Dimensions				Lowest Natural Frequency		
	Depth	Width	Height	Weight	F-B	S-S	V
Cabinet	15.5"	38"	18"	250 lbs	3.7	4.2	10.6
Coil (water coils, Flange attached w/#10 SMS @ 4" O.C. perimeter)							
Electric Heat							
Control							
Transformer							
Airflow Switch							
Damper							
Sound Attenuator							
Inlet Sensor							
Control Enclosure							

Seismic Test Parameters:

Qualification Method	Sds	z/h	Ip	Aflx-H	Arig-H	Aflx-V	Arig-V
ICC-ES AC156 (2010)	2.00	1.0	1.5	3.20	2.40	1.33	0.53

Pre/Post Shake Functionality Test Results:

Pre:	PASSED
Post:	All units were filled with contents and maintained structural integrity and functionality.



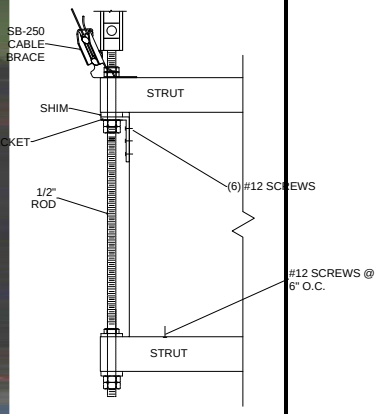


FIG. 1

UUT Mounting Description:

Suspended unit on (4) 3/8" ASTM-A307 rod, with (4) VMC SB-250 (1/4") Seismic Cable Kits and (3 per rod) SRBC-1 Rod Stiffening Clamps. SB-250's are attached to structure using 5/8" hardware. SRBC-1's are fastened to L1x1x1/4 ASTM-A36 angle.

Ea. Rod is double nutted to 1-5/8"-12ga strut fastened to the bottom of the unit with #12 screws at min 6" O.C., and it is double nutted to 1-5/8"-12ga strut fastened to the top with 2"x2"x10ga A36 angle bracket attached to the side-top-corner of the unit with (6) #12 screws. Shims fill gap between top bracket and strut. Brackets are placed on common side for rectangular attachment pattern. (Fig. 1)

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