



OFFICE OF STATEWIDE HEALTH PLANNING AND DEVELOPMENT
FACILITIES DEVELOPMENT DIVISION

APPLICATION FOR OSHPD SPECIAL SEISMIC
CERTIFICATION PREAPPROVAL (OSP)

OFFICE USE ONLY

APPLICATION #: OSP – 0150-10

OSHPD Special Seismic Certification Preapproval (OSP)

Type: ☐ New ☒ Renewal

Manufacturer Information

Manufacturer: Multistack

Manufacturer's Technical Representative: Rachel Kenyon

Mailing Address: 1065 Maple Avenue, Sparta, WI 54656

Telephone: (608) 366-2400 Email: rkenyon@multistack.com

Product Information

Product Name: Water Cooled Chiller Modules

Product Type: Chillers

Product Model Number: See attachment

(List all unique product identification numbers and/or part numbers)

General Description: Water cooled chiller modules containing condensers, evaporators, compressors, headers, controllers, line reactors, thermostatic expansion valves or electric expansion valves, actuated valves and power control transformers. 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: Rigid base mount or flexible base mount (neoprene pads or spring isolators)

Applicant Information

Applicant Company Name: The VMC Group

Contact Person: John Giuliano

Mailing Address: 113 Main Street, Bloomingdale, NJ 07403

Telephone: (973) 838-1780 Email: john.giuliano@thevmcgroup.com

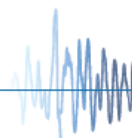
I hereby agree to reimburse the Office of Statewide Health Planning and Development review fees in accordance with the California Administrative Code, 2016.

Signature of Applicant:  Date: 2/3/17

Title: President Company Name: The VMC Group

"Access to Safe, Quality Healthcare Environments that Meet California's Diverse and Dynamic Needs"

STATE OF CALIFORNIA – HEALTH AND HUMAN SERVICES AGENCY
OSH-FD-759 (REV 12/16/15)



OSHPD

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**OFFICE OF STATEWIDE HEALTH PLANNING AND DEVELOPMENT
FACILITIES DEVELOPMENT DIVISION**

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

Company Name: The VMC Group

Name: Ken Tarlow California License Number: SE-2851

Mailing Address: 980 9th Street, Sacramento, CA 95814

Telephone: (973) 838-1780 Email: Ken.tarlow@thevmcgroup.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): _____

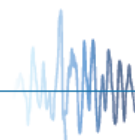
Testing Laboratory

Company Name: Dynamic Certification Laboratories

Contact Name: Kelly Laplace, Project Manager

Mailing Address: 1315 Greg Street, Suite 109, Sparks, NV 89431

Telephone: (775) 358-5085 Email: Kelly@shaketest.com





OFFICE OF STATEWIDE HEALTH PLANNING AND DEVELOPMENT
FACILITIES DEVELOPMENT DIVISION

Seismic Parameters

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

Design Basis of Equipment or Components (F_p/W_p) = See attached

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

a_p (In-structure equipment or component amplification factor) = 1.0(rigid mount); 2.5(flexible mount)

R_p (Equipment or component response modification factor) = 2.5(rigid mount or flexible mount with neoprene);
2.0(flexible mount with spring isolators)

Ω_0 (System overstrength factor) = 2.0

I_p (Importance factor) = 1.5

z/h (Height factor ratio) = 1.0

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

Equipment or Component Natural Frequencies (Hz) = _____

Overall dimensions and weight (or range thereof) = _____

Tank(s) designed in accordance with ASME BPVC, 2015: ☐ Yes ☒ No

List of Attachments Supporting Special Seismic Certification

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

☒ Other(s) (Please Specify): Existing OSP

OSHPD Approval (For Office Use Only) – Approval Expires on December 31, 2022

Signature: M. R. Karim

Date: 2/9/2017

Print Name: M. R. Karim

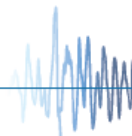
Title: SHFR

Special Seismic Certification Valid Up to : S_{DS} (g) = See Above

z/h = 1.0

Condition of Approval (if applicable): _____

"Access to Safe, Quality Healthcare Environments that Meet California's Diverse and Dynamic Needs"



Special Seismic Certification Certified Components



Manufacturer: Multistack

Product Line: Water Cooled Chiller Modules

Certified Product Construction: Powder-coated carbon steel

Certified Options and Subcomponents: 460V-575V, condensers, evaporators, compressors, headers, controllers, line reactor, actuated valves and transformers

Mounting Description: Rigid base mount, flexible base mount with neoprene pads, or flexible base mount with spring isolators

Type	Model ¹	Dimensions (in.)			Max. Operating Weight (lb)	Mounting	Sds (g), z/h=1	Fp/Wp	Unit
		Length	Width	Height					
Water Cooled Modular Chiller - Total Access	MS20X N 2	56	32	64	1,300	Flexible base mounted (neoprene pads or spring isolators)	2.00	4.5 (spring isolators), 3.6 (neoprene pads)	UUT8
	MS30X N 2	56	32	64	1,740				Interpolated
	MS40X N 2	56	32	66	2,100				Interpolated
	MS50X N 2	56	32	66	2,100				Interpolated
	MS70X N 2	56	34	66	2,750				UUT9
Water Cooled Modular Chiller - Standard	MS10X N 1	47 5/8	28	63	1,150	Rigid base mounted	1.93	1.39	UUT1
	MS15X N 1	47 5/8	28	63	1,200				Interpolated
	MS20X N 1	47 5/8	28	63	1,200				Interpolated
	MS30X N 1	47 5/8	28	63	1,625				Interpolated
	MS40X N 1	47 5/8	28	63	2,000				Interpolated
	MS50X N 1	47 5/8	28	63	2,000				Interpolated
	MS70X N 1	47 5/8	28	63	2,270				UUT2
	MS105X N 1	100	50	80	5,930				UUT3
	MS135X N 1	100	50	80	6,300				Interpolated
	MS145X N 1	100	50	80	6,700				Interpolated
	MS160X N 1 (MS165X N 1) ²	100	50	80	6,730				UUT4
									UUT5
Water Cooled Centrifugal Chiller	MS80T	64	32	64	2,520				
VME Modules	VME1H4-5	76 5/8	14	64	310	Rigid base mounted	2.50	1.80	UUT6
	VME2H4-5	76 5/8	14	64	370		1.00	0.72	Interpolated
	VME1H6-5	76 5/8	14	64	460				Interpolated
	VME2H6-2	56	14	64	700				Interpolated
	VME2H6-5	76 5/8	14	64	720				Interpolated
	VME1H8-5	76 5/8	18	64	920				Interpolated
	VME2H8-5	102 3/8	24	80	1,850				Interpolated
	VME2H10-5	102 3/8	24	80	2,120				UUT7

Notes:

1. The "N" in the model number for water cooled modular chillers represents the AHRI certification status of the unit (C - certified, N - not certified). Certified and non-certified units are physically identical.
2. The MS160X N 1 is now called the MS165X N 1 in Multistack literature.
3. Certification level is limited to the lower rating of either the Certified Component tables, as listed here, or the internal subcomponents, as listed on the Certified Subcomponent tables.

Special Seismic Certification Certified Subcomponents



Manufacturer: Multistack

Product Line: Water Cooled Chiller Modules

Subcomponents: Condenser and Evaporator

Condenser					
Model Number	Manufacturer	Description	Material	Sds (g), z/h=1	Unit
DB200x94	SWEP	Brazed Plate Heat Exchanger	Stainless Steel	1.93	UUT1
DB200x134					Interpolated
DB300x38					Interpolated
DB300x78				2.00	UUT8
DB300x106					Interpolated
DB400x118					Interpolated
DBD400Hx182					UUT9
DP700x266				1.93	UUT3
DP700x326					Interpolated
DP700x362					UUT4
B400Tx240					UUT5
Evaporator					
Model Number	Manufacturer	Description	Material	Sds (g), z/h=1	Unit
DP200x62	SWEP	Brazed Plate Heat Exchanger	Stainless Steel	1.93	UUT1
DP200x94					Interpolated
DP300x34					Interpolated
DP300x58				2.00	UUT8
DP300x82					Interpolated
DP400x98					Interpolated
DP400x130					UUT9
DP700x214				1.93	UUT3
DP700x266					Interpolated
DP400x280					Interpolated
DP700x362					UUT4
S400Tx220					UUT5

Note:

Certification level is limited to the lower rating of either the internal subcomponents, as listed here, or the components, as listed on the Certified Component Table.

Special Seismic Certification Certified Subcomponents



Manufacturer: Multistack

Product Line: Water Cooled Chiller Modules

Subcomponents: Compressors

Compressors - Total Access Chillers

Model Number ¹	Manufacturer	Description	Material	Sds (g), z/h=1	Unit
ZP122KCE	Emerson Climate Technologies/Copeland	10 HP	Carbon steel	2.00	UUT8
ZP182KCE		15 HP			Interpolated
ZR190KCE		15 HP			Interpolated
ZP295KCE		25 HP			Interpolated
ZP296KCE		25 HP			Interpolated
ZP296KWE		25 HP			Interpolated
ZR300KCE		25 HP			Interpolated
ZR380KCE		32 HP			Interpolated
ZP385KCE		32 HP			Interpolated
ZP385KWE		32 HP			UUT9

Compressors - Standard Chillers

Model Number ¹	Manufacturer	Description	Material	Sds (g), z/h=1	Unit
ZP61K5E	Emerson Climate Technologies/Copeland	6 HP	Carbon steel	1.93	UUT1
ZR67KCE		6 HP			Interpolated
ZP103KCE		9 HP			Interpolated
ZP104KCE		9 HP			Interpolated
ZR108KCE		9 HP			Interpolated
ZP120KCE		10 HP			Interpolated
ZP122KCE		10 HP			Interpolated
ZR125KCE		10 HP			Interpolated
ZP182KCE		15 HP			Interpolated
ZR190KCE		15 HP			Interpolated
ZP295KCE		25 HP			Interpolated
ZP296KCE		25 HP			Interpolated
ZP296KWE		25 HP			Interpolated
ZR300KCE		25 HP			Interpolated
ZR380KCE		32 HP			Interpolated
ZP385KCE		32 HP			UUT2
ZP385KWE		32 HP			Interpolated
ZPT590KCE		50 HP			UUT3
ZPT592		50 HP			Interpolated
ZRT600KCE		50 HP			Interpolated
ZPT770KCE		64 HP			Interpolated
ZRT760KCE		64 HP			Interpolated
ZPU870KCE		70 HP			Interpolated
ZPT970KCE		80 HP			UUT4
TT350-G61HL	Danfoss Turbocor	300 to 400 kW nominal capacity			UUT5

Notes:

- Compressors whose part numbers begin with ZP contain R-410A refrigerant and those beginning with ZR contain R-134a or R-407c refrigerant. The heavier refrigerant was tested. Except for liquid type, the listed compressors for each module are identical.
- Certification level is limited to the lower rating of either the internal subcomponents, as listed here, or the components, as listed on the Certified Component Table.

Special Seismic Certification Certified Subcomponents



Manufacturer: Multistack

Product Line: Water Cooled Chiller Modules

Subcomponents: Headers

Headers					
Model Number	Manufacturer	Size	Material	Sds (g), z/h=1	Unit
1000-3926	USEMCO	6"	Carbon Steel	1.93	UUT1
1000-3927					UUT1
1000-3978					Interpolated
1000-3979					Interpolated
1000-4484					Interpolated
1000-4485					Interpolated
1000-5505				2.00	UUT9
1000-5506					UUT9
1000-7319					UUT8
1000-7320					UUT8
1000-2311-41B				1.93	UUT2
1000-2315-41A					UUT2
1000-3978-SS		6"	Stainless Steel	2.00	Extrapolated
1000-3979-SS					Extrapolated
1000-4484-SS					Extrapolated
1000-4485-SS					Extrapolated
1000-5505-SS					UUT9
1000-5506-SS					UUT9
1000-7319-SS					UUT8
1000-7320-SS					UUT8
1000-2311-41BSS				1.93	UUT2
1000-2315-41ASS				1.93	UUT2
C1000-2087-41		8"	Carbon Steel	1.93	UUT5
1000-2752-41B					UUT5
2088-41SS		8"	Stainless Steel	1.93	UUT5
1000-2756-41ASS					UUT5
1000-5332		10"	Carbon Steel	1.93	UUT3, UUT4
1000-5333					UUT3, UUT4
1000-6447					Extrapolated
1000-6448					Extrapolated
1000-5332-SS		10"	Stainless Steel	1.93	UUT3, UUT4
1000-5333-SS					UUT3, UUT4
1000-6447SS					Extrapolated
1000-6448SS					Extrapolated

Notes:

1. Interpolated/extrapolated valves for each size are identical in mass, dimension, construction and manufacturer to the tested valves.
2. Certification level is limited to the lower rating of either the internal subcomponents, as listed here, or the components, as listed on the Certified Component Table.

Special Seismic Certification Certified Subcomponents



Manufacturer: Multistack

Product Line: Water Cooled Chiller Modules

Subcomponents: Controllers, line reactor and thermostatic expansion valves

Controllers					
Model Number	Manufacturer	Description	Material	Sds (g), z/h=1	Unit
pCO1	Carel	Controllers	Plastic/Electronics	1.93	UUT5
pCO3				2.00	UUT8, UUT9
pCO5				1.93	UUT3, UUT4
cPCO				1.93	Extrapolated ¹

Line Reactor					
Model Number	Manufacturer	Description	Material	Sds (g), z/h=1	Unit
KDRG3H	TCI	Line Reactor	Iron/Copper	1.93	UUT5

Thermostatic Expansion Valves					
Model Number	Manufacturer	Description	Material	Sds (g), z/h=1	Unit
ERZE-4	Sporlan	4 Ton Valve, R-410A	Brass / carbon steel	1.93	UUT1
ERZE-6		6 Ton Valve, R-410A			Interpolated
ERZE-8		8 Ton Valve, R-410A			Interpolated
ERZE-12.5		12.5 Ton Valve, R-410A			Interpolated
BBIZE-15		15 Ton Valve, 410A			Interpolated
OZE-20		20 Ton Valve, R-410A			Interpolated
OZE-25		25 Ton Valve, R-410A			Interpolated
OZE-35		35 Ton Valve, R-410A			UUT2
OZE-50		50 Ton Valve, R-410A			Extrapolated ²
OZE-60		60 Ton Valve, R-410A			Extrapolated ²

Notes:

1. Extrapolated controller is bookended by the tested controllers.
2. Extrapolated valves are identical in construction and similar in weight (within 2 lb) to the OZE-20 to 35 ton valves.
3. Certification level is limited to the lower rating of either the internal subcomponents, as listed here, or the components, as listed on the Certified Component Table.

Special Seismic Certification Certified Subcomponents



Manufacturer: Multistack

Product Line: Water Cooled Chiller Modules

Subcomponents: Electric expansion valves, actuated valves and power control transformers

Electric Expansion Valves

Model Number	Manufacturer	Description	Material	Sds (g), z/h=1	Unit
SEI-50	Sporlan	50 Ton Valve, R-410A	Carbon steel/brass/copper	1.93	UUT5
SER-C		2-10 Ton Valve, R-410A			Extrapolated
SER-D		8-15 Ton Valve, R-410A			Extrapolated
SERI-G		15-20 Ton Valve, R-410A			Extrapolated
SERI-J		20-30 Ton Valve, R-410A			Extrapolated
SERI-K		85 Ton Valve, R-410A			UUT3, UUT4

Actuated Valves

Model Number	Manufacturer	Description	Material	Sds (g), z/h=1	Unit
SY1-24	Belimo	2"-3" Valve	Carbon steel	1.93	Extrapolated
SY2-24		4" Valve		2.50	UUT6
SY3-24		6" Valve		1.93	Interpolated
SY4-24		8" Valve			
SY5-24		10" Valve			
GRB24-MFT	Belimo	2-3" Valve		2.00	UUT8/UUT9

Power Control Transformers

Model Number	Manufacturer	Description	Material	Sds (g), z/h=1	Unit
B250-0086-1	Micron	Multitap 250 VA Transformer	Iron/Copper	2.50	UUT6
B500-2266-GAF		Multitap 500 VA Transformer		1.93	UUT7

Nots:

Certification level is limited to the lower rating of either the internal subcomponents, as listed here, or the components, as listed on the Certified Component Table.

Special Seismic Certification

Tested Components



Manufacturer: Multistack

Product Line: Water Cooled Chiller Modules

Tested Product Construction: Powder-coated carbon steel

Tested Options and Subcomponents: 460V-575V, condensers, evaporators, compressors, headers, controllers, line reactor, actuated valves and transformers

Mounting Description: Rigid base mount, flexible base mount with neoprene pads, or flexible base mount with spring isolators

Model	Frame / Enclosure Dimensions (in.)			Operating Weight (lb)	Mounting	Sds (g), z/h=1	Unit
	Length	Width	Height				
MS10X N 1	47 5/8	28	63	1,150	Rigid base mounted	1.93	UUT1
MS70X N 1	47 5/8	28	63	2,270		1.93	UUT2
MS105X N 1	100	50	80	5,930		1.93	UUT3
MS160X N 1	100	50	80	6,730		1.93	UUT4
MS80T	64	32	64	2,520		1.93	UUT5
VME1H4-5	76 5/8	14	64	310		2.50	UUT6
VME2H10-5	102 3/8	24	80	2,120		1.00	UUT7
MS20X N 2	56	32	64	1,300	Flexible base mounted (neoprene pads)	2.00	UUT8
MS70X N 2	56	34	66	2,750	Flexible base mounted (spring isolators)	2.00	UUT9

UUT1

UNIT UNDER TEST (UUT) Summary Sheet



Manufacturer: Multistack

Product Line: Water Cooled Chiller Modules

Model Number: MS10X N 1

Product Construction Summary:

Powder-coated carbon steel frame

Options / Subcomponent Summary:

460V, R-410A refrigerant, condenser, evaporator, compressor, headers, controller and expansion valves

Note: The UUT was operational before and after shaking. The structural integrity of the component attachment system and force-resisting systems was maintained.

UUT Properties

Operating Weight (lb)	Dimensions (inches)			Lowest Natural Frequency (Hz)		
	Length	Width	Height	Front-Back	Side-Side	Vertical
1,150	47 5/8	28	63	11.0	13.3	>33.3

Seismic Test Parameters

Building Code	Test Criteria	Sds (g)	z/h	Ip	Aflx-H (g)	Arig-H (g)	Aflx-V (g)	Arig-V (g)
CBC 2016	ICC-ES AC156	1.93	1.0	1.5	3.09	2.32	1.29	0.51

Unit Mounting Description:



The unit was mounted to the DCL shake table interface plate with six 1/2" diameter A307 bolts.

UUT2

UNIT UNDER TEST (UUT) Summary Sheet



Manufacturer: Multistack

Product Line: Water Cooled Chiller Modules

Model Number: MS70X N 1

Product Construction Summary:

Powder-coated carbon steel frame

Options / Subcomponent Summary:

575V, R-410a refrigerant, condenser, evaporator, compressor, headers, controller and expansion valves

Note: The UUT was operational before and after shaking. The structural integrity of the component attachment system and force-resisting systems was maintained.

UUT Properties

Operating Weight (lb)	Dimensions (inches)			Lowest Natural Frequency (Hz)		
	Length	Width	Height	Front-Back	Side-Side	Vertical
2,270	47 5/8	28	63	4.3	11.0	>33.3

Seismic Test Parameters

Building Code	Test Criteria	Sds (g)	z/h	Ip	Aflx-H (g)	Arig-H (g)	Aflx-V (g)	Arig-V (g)
CBC 2016	ICC-ES AC156	1.93	1.0	1.5	3.09	2.32	1.29	0.51

Unit Mounting Description:



The unit was mounted to the DCL shake table interface plate with six 1/2" diameter A307 bolts.

UUT3

UNIT UNDER TEST (UUT) Summary Sheet



Manufacturer: Multistack

Product Line: Water Cooled Chiller Modules

Model Number: MS105X N 1

Product Construction Summary:

Powder-coated carbon steel frame

Options / Subcomponent Summary:

460V, R-410a refrigerant, condenser, evaporator, compressor, headers, controller and expansion valves

Note: The UUT was operational before and after shaking. The structural integrity of the component attachment system and force-resisting systems was maintained.

UUT Properties

Operating Weight (lb)	Dimensions (inches)			Lowest Natural Frequency (Hz)		
	Length	Width	Height	Front-Back	Side-Side	Vertical
5,930	100	50	80	4.5	6.6	19.0

Seismic Test Parameters

Building Code	Test Criteria	Sds (g)	z/h	Ip	Aflx-H (g)	Arig-H (g)	Aflx-V (g)	Arig-V (g)
CBC 2016	ICC-ES AC156	1.93	1.0	1.5	3.09	2.32	1.29	0.51

Unit Mounting Description:



The unit was mounted to the DCL shake table interface frame with six 3/4" diameter A307 bolts.

UUT4

UNIT UNDER TEST (UUT) Summary Sheet



Manufacturer: Multistack

Product Line: Water Cooled Chiller Modules

Model Number: MS160X N 1

Product Construction Summary:

Powder-coated carbon steel frame

Options / Subcomponent Summary:

460V, R-410a refrigerant, condenser, evaporator, compressor, headers, controller and expansion valves

Note: The UUT was operational before and after shaking. The structural integrity of the component attachment system and force-resisting systems was maintained.

UUT Properties

Operating Weight (lb)	Dimensions (inches)			Lowest Natural Frequency (Hz)		
	Length	Width	Height	Front-Back	Side-Side	Vertical
6,730	100	50	80	5.2	7.2	20.4

Seismic Test Parameters

Building Code	Test Criteria	Sds (g)	z/h	Ip	Aflx-H (g)	Arig-H (g)	Aflx-V (g)	Arig-V (g)
CBC 2016	ICC-ES AC156	1.93	1.0	1.5	3.09	2.32	1.29	0.51

Unit Mounting Description (side panels removed in photograph):



The unit was mounted to the DCL shake table interface frame with six 3/4" diameter A307 bolts.

UUT5**UNIT UNDER TEST (UUT) Summary Sheet****Manufacturer:** Multistack**Product Line:** Water Cooled Chiller Modules**Model Number:** MS80T**Product Construction Summary:**

Powder-coated carbon steel frame

Options / Subcomponent Summary:

460V, R-134a refrigerant, condenser, evaporator, compressor, headers, controller, expansion valves and line reactor

Note: The UUT was operational before and after shaking. The structural integrity of the component attachment system and force-resisting systems was maintained.**UUT Properties**

Operating Weight (lb)	Dimensions (inches)			Lowest Natural Frequency (Hz)		
	Length	Width	Height	Front-Back	Side-Side	Vertical
2,520	64	32	64	6.9	20.7	>33.3

Seismic Test Parameters

Building Code	Test Criteria	Sds (g)	z/h	Ip	Aflx-H (g)	Arig-H (g)	Aflx-V (g)	Arig-V (g)
CBC 2016	ICC-ES AC156	1.93	1.0	1.5	3.09	2.32	1.29	0.51

Unit Mounting Description:

The unit was mounted to the DCL shake table interface plate with six 5/8" diameter A307 bolts.

UUT6

UNIT UNDER TEST (UUT) Summary Sheet



Manufacturer: Multistack

Product Line: Water Cooled Chiller Modules

Model Number: VME1H4-5

Product Construction Summary:

Powder-coated carbon steel frame

Options / Subcomponent Summary:

460V, VME 1 with two 4-inch diameter valves, 250VA transformer and controller

Note: The UUT was operational before and after shaking. The structural integrity of the component attachment system and force-resisting systems was maintained.

UUT Properties

Operating Weight (lb)	Dimensions (inches)			Lowest Natural Frequency (Hz)		
	Length	Width	Height	Front-Back	Side-Side	Vertical
310	76 5/8	14	64	5.8	5.5	13.3

Seismic Test Parameters

Building Code	Test Criteria	Sds (g)	z/h	Ip	Aflx-H (g)	Arig-H (g)	Aflx-V (g)	Arig-V (g)
CBC 2016	ICC-ES AC156	2.5	1.0	1.5	4.00	3.00	1.67	0.67

Unit Mounting Description:



The unit was mounted to the DCL shake table interface plate with six 3/8" diameter Grade 5 bolts.

UUT7**UNIT UNDER TEST (UUT) Summary Sheet****Manufacturer:** Multistack**Product Line:** Water Cooled Chiller Modules**Model Number:** VME2H10-5**Product Construction Summary:**

Powder-coated carbon steel frame

Options / Subcomponent Summary:

460V, VME 2 with four 10-inch diameter valves, 500VA transformer and controller

Note: The UUT was operational before and after shaking. The structural integrity of the component attachment system and force-resisting systems was maintained.**UUT Properties**

Operating Weight (lb)	Dimensions (inches)			Lowest Natural Frequency (Hz)		
	Length	Width	Height	Front-Back	Side-Side	Vertical
2,120	102 3/8	24	80	5.3	3.0	28.0

Seismic Test Parameters

Building Code	Test Criteria	Sds (g)	z/h	Ip	Aflx-H (g)	Arig-H (g)	Aflx-V (g)	Arig-V (g)
CBC 2016	ICC-ES AC156	1.00	1.0	1.5	1.60	1.20	0.67	0.27

Unit Mounting Description:

The unit was mounted to the DCL shake table interface frame with four 1/2" diameter Grade 5 bolts.

UUT8

UNIT UNDER TEST (UUT) Summary Sheet



Manufacturer: Multistack

Product Line: Water Cooled Chiller Modules

Model Number: MS20X N 2

Product Construction Summary:

Powder-coated carbon steel frame

Options / Subcomponent Summary:

460V, condenser, evaporator, 10 HP compressor, 6" headers, pC03 controller, 2-3" actuated valve

Note: The UUT was operational before and after shaking. The structural integrity of the component attachment system and force-resisting systems was maintained.

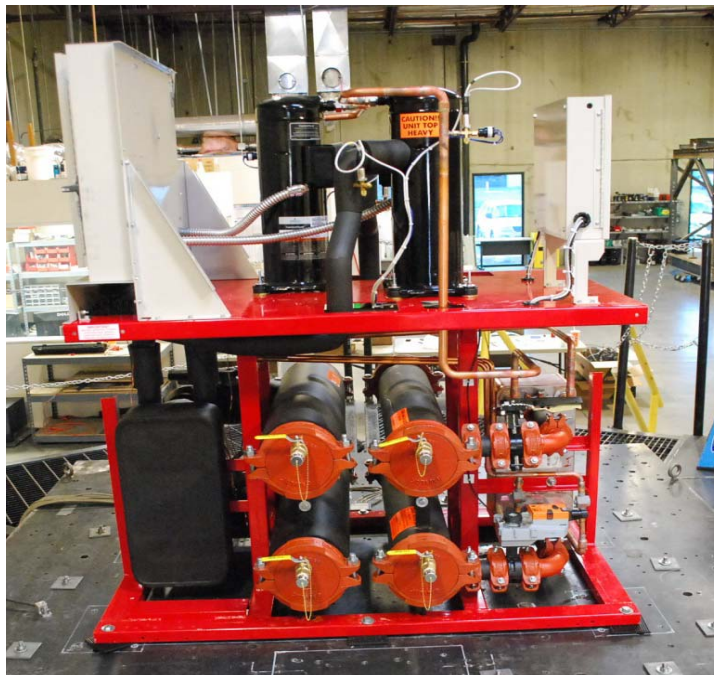
UUT Properties

Operating Weight (lb)	Dimensions (inches)			Lowest Natural Frequency (Hz)		
	Length	Width	Height	Front-Back	Side-Side	Vertical
1,300	56	32	64	6.0	6.0	23.0

Seismic Test Parameters

Building Code	Test Criteria	Sds (g)	z/h	Ip	Aflx-H (g)	Arig-H (g)	Aflx-V (g)	Arig-V (g)
CBC 2016	ICC-ES AC156	2.00	1.0	1.5	3.20	2.40	1.33	0.53

Unit Mounting Description:



The unit was flexibly base mounted with six 3/8" thick, 4"x4" rubber pads (Bramec model 6434) and six 1/2" diameter Grade 5 bolts.

UUT9**UNIT UNDER TEST (UUT) Summary Sheet****Manufacturer:** Multistack**Product Line:** Water Cooled Chiller Modules**Model Number:** MS70X N 2**Product Construction Summary:**

Powder-coated carbon steel frame

Options / Subcomponent Summary:

460V, condenser, evaporator, 32 HP compressor, 6" headers, pC03 controller, 2-3" actuated valve

Note: The UUT was operational before and after shaking. The structural integrity of the component attachment system and force-resisting systems was maintained.**UUT Properties**

Operating Weight (lb)	Dimensions (inches)			Lowest Natural Frequency (Hz)		
	Length	Width	Height	Front-Back	Side-Side	Vertical
2,750	56	34	66	4.0	3.0	12.0

Seismic Test Parameters

Building Code	Test Criteria	Sds (g)	z/h	Ip	Aflx-H (g)	Arig-H (g)	Aflx-V (g)	Arig-V (g)
CBC 2016	ICC-ES AC156	2.00	1.0	1.5	3.20	2.40	1.33	0.53

Unit Mounting Description:

The unit arrived at DCL pre-mounted to a steel lifting frame with four 1/2" diameter Grade 5 bolts. The lifting frame was attached to four isolators (VMC model MSH-1E-825N) with one 5/8" diameter Grade 5 bolt per isolator. Each isolator was attached to the shake table interface plate with four 1/2" diameter Grade 5 bolts.