APPLICATION FOR HCAI SPECIAL SEISMIC CERTIFICATION PREAPPROVAL (OSP)

OFFICE USE ONLY

APPLICATION #: OSP-0150

HCAI Special Seismic Certification Preapproval (OSP)

Type: ☐ New ☒ Renewal

Manufacturer Information

Manufacturer: Multistack

Manufacturer's Technical Representative: Darrin Anderson

Mailing Address: 1065 Maple Ave, Sparta, WI 54656

Telephone: (608) 366-2411 Email: DAnderson@multistack.com

Product Information

Product Name: Chillers

Product Type: Chillers - Water Cooled

Product Model Number: See attachment

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.

Mounting Description: Rigid base mount or flexible base mount (neoprene pads or spring isolators)

Tested Seismic Enhancements: Seismic enhancements made to the test units and/or modifications required to address anomalies during the tests shall be incorporated into the production units.

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BY: Mohammad Ahsan
DATE: 03/15/2022
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Applicant Information

Applicant Company Name: Dynamic Certification Laboratories

Contact Person: Kelly Laplace

Mailing Address: 1315 Greg Parkway #109, Sparks, NV 89431

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

Title: Business Manager

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

Company Name: THE VMC GROUP

Name: Kenneth Tarlow California License Number: S2851

Mailing Address: 980 9th Street, 16th Floor, Sacramento, CA 95814

Telephone: (832) 627-2214 Email: ken.tarlow@thevmcgroup.com

Certification Method

☐ GR-63-Core ☒ ICC-ES AC156 ☐ IEEE 344 ☐ IEEE 693 ☐ NEBS 3

☐ Other (Please Specify):

Testing Laboratory

Company Name: DYNAMIC CERTIFICATION LABORATORY (DCL)

Contact Person: Kelly Laplace

Mailing Address: 1315 Greg St., Ste 109, Sparks NV 89431

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

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Seismic Parameters

Design Basis of Equipment or Components (F_p/W_p) =	1.39 (Modular – Standard, rigid) and (Centrifugal, rigid); 3.6 (Modular – Total Access, isolated w/neoprene pad); 4.5 (Modular – Total Access, isolated w/spring isolators); 0.72 (VME Modules, rigid)
S_{DS} (Design spectral response acceleration at short period, g) =	1.93 (Water Cooled Modular Chiller – Standard) and (Water Cooled Centrifugal Chiller); 2.00 (Water Cooled Modular Chiller – Total Access); 1.00 (VME Modules, rigid)
a_p (Amplification factor) =	1.0 (rigid), 2.5 (isolated)
R_p (Response modification factor) =	2.5 (rigid or isolated w/neoprene pads), 2.0 (isolated w/spring isolators)
Ω_0 (System overstrength factor) =	2.0
I_p (Importance factor) =	1.5
z/h (Height ratio factor) =	1
Natural frequencies (Hz) =	See Attachment
Overall dimensions and weight =	See Attachment

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HCAI Approval (For Office Use Only) - Approval Expires on 03/15/2028

Date: 3/15/2022

Name: Mohammad Karim Title: Supervisor, Health Facilities

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

Condition of Approval (if applicable):

Special Seismic Certification
Table 1 - Certified Components - Water Cooled Modular Chiller - Standard

DCL Project Number: 13465-2101

Manufacturer: Multistack

Product Type: Water Cooled Modular Chiller - Standard

Product Line: Water Cooled Modular Chillers

Mounting Configuration: Rigid base mounted

Certification Level: S_{DS} = 1.93g, z/h=1.0

Cabinet Type	Old Model Number	New Model Number[1]	Construction Material	Max. Dimensions (in)			Max. Weight (lb.)	Unit
				Depth	Width	Height		
Water Cooled Modular Chiller - Standard	MS10X N 1	MSS010XNHXFX MSH010XNHXFX	Powder-coated carbon steel	49.1	28.0	89.0	1,150	UUT1
	MS15X N 1	MSS015XNXXFX MSH015XNXXFX		49.1	28.0	89.0	1,200	Interpolated
	MS20X N 1	MSS020XNXXFX MSH020XNXXFX		49.1	28.0	89.0	1,200	Interpolated
	MS30X N 1	MSS030XNXXFX MSH030XNXXFX		49.1	28.0	89.0	1,625	Interpolated
	MS40X N 1	MSS040XNXXFX MSH040XNXXFX		49.1	28.0	89.0	2,000	Interpolated
	MS50X N 1	MSS050XNXXFX MSH050XNXXFX		49.1	28.0	89.0	2,000	Interpolated
	MS70X N 1	MSS070XNCXFX MSH070XNCXFX		49.1	28.0	89.0	2,270	UUT2
	MS105X N 1	MSS105XNHXNX MSH105XNHXNX		102.4	50.0	78.0	5,930	UUT3
	MS135X N 1	MSS135XNXXNX MSH135XNXXNX		102.4	50.0	78.0	6,300	Interpolated
	MS145X N 1	MSS145XNXXNX MSH145XNXXNX		102.4	50.0	78.0	6,700	Interpolated
	MS160X N 1 (MS165X N 1)[2]	MSS165XNHXNX MSH165XNHXNX		102.4	50.0	78.0	6,730	UUT4

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Notes:

1. The two new model numbers for each old model number designate the operating conditions. Software change only.
2. The MS160X N 1 is called the MS165X N 1 in Multistack literature.

Special Seismic Certification

Table 2 - Nomenclature Chart - Water Cooled Modular Chiller - Standard

DCL Project No. 13465-2101

Manufacturer: Multistack

Product Line: Water Cooled Modular Chiller

Mounting Description: Rigid Base Mount

Sample Part Number

MS	S	020	X	N	A	B	C	E
1	2	3	4	5	6	7	8	9

Character	Category	Allowable Value	Description	Unit
1	Product Line	MS		UUT1, UUT2, UUT3, UUT4
2[3]	Operating Condition	S	Water cooled	UUT1, UUT2, UUT3, UUT4
		H	Heat recovery	UUT1, UUT2, UUT3, UUT4
3	Nominal Capacity	010	10 Tons of refrigeration	UUT1
		015	15 Tons refrigeration	Interpolated
		020	20 Tons refrigeration	Interpolated
		030	30 Tons refrigeration	Interpolated
		040	40 Tons refrigeration	Interpolated
		050	50 Tons refrigeration	Interpolated
		070	70 Tons refrigeration	UUT2
		105	105 Tons refrigeration	UUT3
		135	135 Tons refrigeration	Interpolated
		145	145 Tons refrigeration	Interpolated
		165	165 Tons refrigeration	UUT4
4	Refrigerant Type	X	R410A	UUT1, UUT2, UUT3, UUT4
5	AHRI Certification	N	Non-Certified	UUT1, UUT2, UUT3, UUT4
		C	Certified	Branding Change Only
6	Voltage	A	208/3/60	Extrapolated
		B	24/1/60	Extrapolated
		C	575/3/60	UUT2
		D	200/3/50	Extrapolated
		E	380/3/50	Extrapolated
		F	380/3/60	Extrapolated
		G	120/1/60	Extrapolated
		H	460/3/60	UUT1, UUT3, UUT4
		I	400/3/50	Extrapolated
		J	415/3/50	Extrapolated
		K	400/3/60	Extrapolated
		L	230/3/60	Extrapolated
		M	208/1/60	Extrapolated
		N	575/1/60	Interpolated
		O	200/1/50	Extrapolated
		P	380/1/50	Extrapolated
		Q	380/1/60	Extrapolated
		R	460/1/60	Extrapolated
		S	230/1/60 - Single phase	Extrapolated
		T	400/1/50	Extrapolated
		U	415/1/50	Extrapolated
7[3]	Compressor RLA due to Condenser Application	A	Low (below 105 LCW)	UUT1, UUT2, UUT3, UUT4
		B	Medium (between 105 & 120 LCW (below 125 SCT))	UUT1, UUT2, UUT3, UUT4
		C	High (above 120 LCW (above 125 SCT))	UUT1, UUT2, UUT3, UUT4
8	Frame Size	F	28"	UUT1,UUT2
		H	32"	Interpolated
		J	34"	Interpolated
		N	50"	UUT3,UUT4
9[4]	Configuration/ Module Type	A	Standard/ Single	UUT1, UUT2, UUT3, UUT4
		B	Standard/ Multiple (bussbar)	UUT1, UUT2, UUT3, UUT4
		C	Standard/ Multiple (wire whips)	UUT1, UUT2, UUT3, UUT4
		D	Standard Conduit Raceway/ Multiple (wire whips)	UUT1, UUT2, UUT3, UUT4

Notes:

3. Digits 2 and 7 are software changes only.
4. Digit 9 configuration refers how power is distributed to the unit, no change to units.

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Table 3 - Certified Components - Water Cooled Modular Chiller - Total Access

DCL Project Number: 13465-2101

Manufacturer: Multistack

Product Type: Water Cooled Modular Chiller - Total Access

Product Line: Water Cooled Modular Chillers

Mounting Configuration: Flexible base mounted (neoprene pads or spring isolators)

Certification Level: S_{DS} = 2.0g, z/h=1.0

Cabinet Type	Old Model Number	New Model Number[5]	Construction Material	Max. Dimensions (in)			Max. Weight (lb.)	Unit
				Depth	Width	Height		
Water Cooled Modular Chiller - Total Access	MS20X N 2	MSS020XNAXHX MSH020XNAXHX	Powder-coated carbon steel	56.0	32.0	64.0	1,300	UUT8
	MS30X N 2	MSS030XNXXHX MSH030XNXXHX		56.0	32.0	64.0	1,740	Interpolated
	MS40X N 2	MSS040XNXXHX MSH040XNXXHX		56.0	32.0	66.0	2,100	Interpolated
	MS50X N 2	MSS050XNXXHX MSH050XNXXHX		56.0	32.0	66.0	2,100	Interpolated
	MS70X N 2	MSS070XNHXJX MSH070XNHXJX		56.0	34.1	66.0	2,750	UUT9

Notes:

5. The two new model numbers for each old model number designate the operating conditions. Software change only.

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Table 4 - Nomenclature Chart - Water Cooled Modular Chiller - Total Access

DCL Project No. 13465-2101

Manufacturer: Multistack

Product Line: Water Cooled Modular Chiller

Mounting Description: Flexible Base Mount

Sample Part Number

MS	S	020	X	N	A	B	C	E
1	2	3	4	5	6	7	8	9

Character	Category	Allowable Value	Description	Unit
1	Product Line	MS		UUT8, UUT9
2[6]	Operating Condition	S	Water cooled	UUT8, UUT9
		H	Heat recovery	UUT8, UUT9
3	Nominal Capacity	020	20 Tons refrigeration	UUT8
		030	30 Tons refrigeration	Interpolated
		040	40 Tons refrigeration	Interpolated
		050	50 Tons refrigeration	Interpolated
		070	70 Tons refrigeration	UUT9
4	Refrigerant Type	X	R410A	UUT8, UUT9
5	AHRI Certification	N	Non-Certified	UUT8, UUT9
		C	Certified	Branding Change Only
6	Voltage	A	208/3/60	UUT8
		B	24/1/60	Extrapolated
		D	200/3/50	Extrapolated
		E	380/3/50	Interpolated
		F	380/3/60	Interpolated
		G	120/1/60	Extrapolated
		H	460/3/60	UUT9
		I	400/3/50	Interpolated
		J	415/3/50	Interpolated
		K	400/3/60	Interpolated
		L	230/3/60	Interpolated
		M	208/1/60	Extrapolated
		O	200/1/50	Extrapolated
		P	380/1/50	Interpolated
		Q	380/1/60	Interpolated
		R	460/1/60	Interpolated
		S	230/1/60 - Single phase	Interpolated
		T	400/1/50	Interpolated
		U	415/1/50	Interpolated
7[6]	Compressor RLA due to Condenser Application	A	Low (below 105 LCW)	UUT8, UUT9
		B	Medium (between 105 & 120 LCW (below 125 SCT))	UUT8, UUT9
		C	High (above 120 LCW (above 125 SCT))	UUT8, UUT9
8	Frame Size	H	32"	UUT8
		J	34"	UUT9
9[7]	Configuration/ Module Type	E	Total Access/ Single	UUT8, UUT9
		F	Total Access/ Multiple (bussbar)	UUT8, UUT9
		G	Total Access/ Multiple (wire whips)	UUT8, UUT9
		H	Total Access Conduit Raceway/ Multiple (wire whips)	UUT8, UUT9

Notes:

6. Digits 2 and 7 are based on software changes only.
7. Digit 9 configuration refers how power is distributed to and between the units, no change to units.

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Table 5 - Certified Components - Water Cooled Centrifugal Chiller

DCL Project Number: 13465-2101

Manufacturer: Multistack
Product Type: Water Cooled Centrifugal Chiller
Product Line: Water Cooled Modular Chillers
Mounting Configuration: Rigid base mounted
Certification Level: S_{DS} = 1.93g, z/h=1.0

Cabinet Type	Model Number	Construction Material	Max. Dimensions (in)			Max. Weight (lb.)	Unit
			Depth	Width	Height		
Water Cooled Centrifugal Chiller	MS80T	Powder-coated carbon steel	66.0	35.0	60.5	2,520	UUT5

Special Seismic Certification
Table 6 - Certified Components - VME Modules

DCL Project Number: 13465-2101

Manufacturer: Multistack
Product Type: VME Modules
Product Line: Water Cooled Modular Chillers
Mounting Configuration: Rigid base mounted
Certification Level: S_{DS} = 1.00g, z/h=1.0

Cabinet Type	Model Number	Construction Material	Max. Dimensions (in)			Max. Weight (lb.)	Unit
			Depth	Width	Height		
VME Modules	VME1H4-5	Powder-coated carbon steel	76.6	14.0	64.0	310	UUT6
	VME2H4-5		76.6	14.0	64.0	370	Interpolated
	VME1H6-5		76.6	14.0	64.0	460	Interpolated
	VME2H6-2		56.0	14.0	64.0	700	Interpolated
	VME2H6-5		76.6	14.0	64.0	720	Interpolated
	VME1H8-5		76.6	18.0	64.0	920	Interpolated
	VME2H8-5		102.4	24.0	80.0	1,850	Interpolated
	VME2H10-5		102.4	24.0	80.0	2,120	UUT7

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Table 7 - Certified Subcomponents - Water Cooled Modular Chiller - Standard

DCL Project Number: 13465-2101

Certification Level: S_{DS} = 1.93g, z/h=1.0

Model Number	Manufacturer	Description	Material	Weight (lb)	Unit
Condensers					
DB300x38	SWEP	Brazed Plate Heat Exchanger	Stainless Steel	48	Extrapolated
DB200x94				103	UUT1
DB200x134				138	Interpolated
DP700x266				396	UUT3
DP700x326				477	Interpolated
DP700x362				535	UUT4
Evaporators					
DP300x34	SWEP	Brazed Plate Heat Exchanger	Stainless Steel	46	Extrapolated
DP200x62				77	UUT1
DP200x94				107	Interpolated
DP700x214				326	UUT3
DP700x266				396	Interpolated
DP700x280				414	Interpolated
DP700x362				535	UUT4
Compressors					
ZP61K5E[8]	Emerson Climate Technologies/ Copeland	6 HP	Carbon Steel	77	UUT1
ZR67KCE[8]				88	Interpolated
ZP104KCE[8]		9 HP		106	Interpolated
ZR108KCE[8]				132	Interpolated
ZP103KCE[8]				134	Interpolated
ZP122KCE[8]		10 HP		108	Interpolated
ZP120KCE[8]				135	Interpolated
ZR125KCE[8]				135	Interpolated
ZP182KCE[8]		15 HP		146	Interpolated
ZR190KCE[8]				146	Interpolated
ZP296KCE[8]		25 HP		293	Interpolated
ZP296KWE[8]				296	Interpolated
ZP295KCE[8]				353	Interpolated
ZR300KCE[8]				406	Interpolated
ZR380KCE[8]		32 HP		390	Interpolated
ZP385KCE[8]				390	UUT2
ZP385KWE[8]				400	Interpolated
ZPT592[8]		50 HP		631	Interpolated
ZPT590KCE[8]				752	UUT3
ZRT600KCE[8]				864	Interpolated
ZPT770KCE[8]		64 HP		826	Interpolated
ZRT760KCE[8]				826	Interpolated
ZPU870KCE[8]		70 HP		878	Interpolated
ZPT970KCE[8]		80 HP		932	UUT4

Notes:

8. 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.

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Special Seismic Certification
Table 7 Continued - Certified Subcomponents - Water Cooled Modular Chiller - Standard

DCL Project Number: 13465-2101

Certification Level: S_{DS} = 1.93g, z/h=1.0

Model Number	Manufacturer	Description	Material	Weight (lb)	Unit
Headers					
1000-3926	USEMCO	6"	Carbon Steel	47	UUT1
1000-3927				47	UUT1
1000-3978				47	Interpolated
1000-3979				47	Interpolated
1000-2315-41A				50	UUT2
1000-2311-41B				52	UUT2
1000-4484				55	Interpolated
1000-4485				55	Interpolated
1000-6447		10"		175	Interpolated
1000-6448				175	Interpolated
1000-5332		12"		230	UUT3, UUT4
1000-5333				230	UUT3, UUT4
1000-2315-41ASS		6"	Stainless Steel	50	UUT2
1000-2311-41BSS				52	UUT2
1000-6447SS		10"		175	Interpolated
1000-6448SS				175	Interpolated
1000-5332-SS		12"		230	UUT3, UUT4
1000-5333-SS				230	UUT3, UUT4
Controllers					
cPCO	Carel	Controllers	Plastic/ Electronics	2	Interpolated[9]
pCO5				2	UUT3, UUT4
Expansion Valves					
ERZE-4	Sporlan	4 Ton Valve, R-410A	Brass/ Carbon Steel	1	UUT1
ERZE-6		6 Ton Valve, R-410A		1	Interpolated
ERZE-8		8 Ton Valve, R-410A		1	Interpolated
ERZE-12.5		12.5 Ton Valve. R-410A		1	Interpolated
BBIZE-15		15 Ton Valve, 410A		2	Interpolated
OZE-20		20 Ton Valve, R-410A		2	Interpolated
OZE-25		25 Ton Valve, R-410A		2	Interpolated
OZE-35		35 Ton Valve, R-410A		2	UUT2
OZE-50		50 Ton Valve, R-410A		4	Extrapolated[10]
OZE-60		60 Ton Valve, R-410A		4	Extrapolated[10]
SER-C	Sporlan	2-10 Ton Valve, R-410A	Carbon Steel/ Brass/ Copper	1	Extrapolated
SER-D		8-15 Ton Valve, R-410A		1	Extrapolated
SERI-G		15-20 Ton Valve, R-410A		1	Extrapolated
SERI-J		20-30 Ton Valve, R-410A		1	Extrapolated
SERI-K		85 Ton Valve, R-410A		1	UUT3, UUT4

Notes:

9. Interpolated controller is bookended by the tested controller in Table 8.

10. Extrapolated valves are identical in construction and similar in weight (within 2 lb) to the OZE-20 to 35 ton valves.

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Special Seismic Certification
Table 8 - Certified Subcomponents - Water Cooled Modular Chiller - Total Access

DCL Project Number: 13465-2101

Certification Level: S_{DS} = 2.00g, z/h=1.0

Model Number	Manufacturer	Description	Material	Weight (lb)	Unit
Condensers					
DB300x78	SWEP	Brazed Plate Heat Exchanger	Stainless Steel	78	UUT8
DB300x106				98	Interpolated
DB400x118				195	Interpolated
DBD400Hx182				306	UUT9
Evaporators					
DP300x58	SWEP	Brazed Plate Heat Exchanger	Stainless Steel	64	UUT8
DP300x82				83	Interpolated
DP400x98				172	Interpolated
DP400x130				218	UUT9
Compressors					
ZP122KCE[11]	Emerson Climate Technologies/ Copeland	10 HP	Carbon Steel	108	UUT8
ZP182KCE[11]		15 HP		146	Interpolated
ZR190KCE[11]				146	Interpolated
ZP296KCE[11]		25 HP		293	Interpolated
ZP296KWE[11]				296	Interpolated
ZP295KCE[11]				353	Interpolated
ZR300KCE[11]				390	Interpolated
ZR380KCE[11]		32 HP		390	Interpolated
ZP385KCE[11]				390	Interpolated
ZP385KWE[11]				400	UUT9
Headers					
1000-7319	USEMCO	6"	Carbon Steel	52	UUT8
1000-7320				54	UUT8
1000-5505				60	UUT9
1000-5506				60	UUT9
1000-3978-SS			Stainless Steel	47	Extrapolated
1000-3979-SS				47	Extrapolated
1000-7319-SS				52	UUT8
1000-7320-SS				54	UUT8
1000-4484-SS				55	Extrapolated
1000-4485-SS				55	Extrapolated
1000-5505-SS				60	UUT9
1000-5506-SS				60	UUT9
Controller					
pCO3	Carel	Controller	Plastic/ Electronics	1.5	UUT8, UUT9
Actuated Valve					
GRB24-MFT	Belimo	2-3" Valve	Carbon Steel	16	UUT8/UUT9

Notes:

11. 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.

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Table 9 - Certified Subcomponents - Water Cooled Centrifugal Chiller

DCL Project Number: 13465-2101

Certification Level: S_{DS} = 1.93g, z/h=1.0

Model Number	Manufacturer	Description	Material	Weight (lb)	Unit
Evaporator					
S400Tx220	SWEP	Brazed Plate Heat Exchanger	Stainless Steel	384	UUT5
Condenser					
B400Tx240	SWEP	Brazed Plate Heat Exchanger	Stainless Steel	383	UUT5
Compressor					
TT350-G61HL	Danfoss Turbocor	300 to 400 kW Nominal Capacity	Carbon Steel	265	UUT5
Headers					
C1000-2087-41	USEMCO	8"	Carbon Steel	80	UUT5
1000-2752-41B				80	UUT5
2088-41SS			Stainless Steel	80	UUT5
1000-2756-41ASS				80	UUT5
Controller					
pCO1	Carel	Controllers	Plastic/ Electronics	1	UUT5
Line Reactor					
KDRG3H	TCI	Line Reactor	Iron/ Copper	55	UUT5
Electric Expansion Valve					
SEI-50	Sporlan	50 Ton Valve, R-410A	Carbon Steel/ Brass/ Copper	1	UUT5

Special Seismic Certification
Table 10 - Certified Subcomponents - VME Modules

DCL Project Number: 13465-2101

Certification Level: S_{DS} = 1.00g, z/h=1.0

Model Number	Manufacturer	Description	Material	Weight (lb)	Unit
Actuated Valves					
SY1-24	Belimo	2"-3" Valve	Carbon Steel	16	Extrapolated
SY2-24		4" Valve		47	UUT6
SY3-24		6" Valve		56	Interpolated
SY4-24		8" Valve		64	Interpolated
SY5-24		10" Valve		81	UUT7
Power Control Transformers					
B250-0086-1	Micron	Multitap 250 VA Transformer	Iron/ Copper	10	UUT6
B500-2266-GAF		Multitap 500 VA Transformer		21	UUT7

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Special Seismic Certification
Table 11 - Tested Units

DCL Project Number: 13465-2101

Manufacturer: Multistack

Product Line: Water Cooled Modular Chillers

Cabinet Type	Model Numbers	Dimensions (in)			Weight (lb.)	Mounting Configuration	Sds (g) z/h=1	Unit
		Depth	Width	Height				
Water Cooled Modular Chiller - Standard	MS10X N 1	49.1	28.0	89.0	1,150	Rigid Base Mounted	1.93	UUT1
Water Cooled Modular Chiller - Standard	MS70X N 1	49.1	28.0	89.0	2,270		1.93	UUT2
Water Cooled Modular Chiller - Standard	MS105X N 1	102.4	50.0	78.0	5,930		1.93	UUT3
Water Cooled Modular Chiller - Standard	MS160X N 1 (MS165X N 1)[12]	102.4	50.0	78.0	6,730		1.93	UUT4
Water Cooled Modular Chiller - Total Access	MS20X N 2	56.0	32.0	64.0	1,300	Flexible Base Mounted (neoprene pads)	2.00	UUT8
Water Cooled Modular Chiller - Total Access	MS70X N 2	56.0	34.1	66.0	2,750	Flexible Base Mounted (spring isolators)	2.00	UUT9
Water Cooled Centrifugal Chiller	MS80T	66.0	35.0	60.5	2,520	Rigid Base Mounted	1.93	UUT5
VME Modules	VME1H4-5	76.6	14.0	64.0	310		1.00	UUT6
VME Modules	VME2H10-5	102.4	24.0	80.0	2,120		1.00	UUT7

Notes:

12. The MS160X N 1 is called the MS165X N 1 in Multistack literature.

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UNIT UNDER TEST (UUT)
Summary Sheet
UUT-01

DCL Project Number: 13465-2101

Manufacturer: Multistack

Product Line: Water Cooled Modular Chiller***s***

Old Model Number: MS10X N 1	***New Model Number:*** MSS010XNHXFX / MSH010XNHXFX

Mounting: Rigid Base Mount

Product Construction Summary: Powder Coated Carbon Steel Frame

Options / Component Summary:
460V, R-410A refrigerant, condenser, evaporator, compressor, headers, controller and expansion valves

Unit Mounting Description:

The unit was mounted to the DCL shake table interface plate with (6) 1/2" diameter A307 bolts, (3) bolts on each long side of the unit spaced approximately 22 1/2" on center.

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UUT Properties

Operating Weight (lb)	Dimensions (inches)			Lowest Natural Frequency (Hz)		
	Depth	Width	Height	Front-Back	Side-Side	Vertical
1,150	49.1	28.0	89.0	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 2019	ICC-ES AC156	1.93	1.0	1.5	3.09	3.32	1.29	0.51



Overall view of UUT-01

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

UNIT UNDER TEST (UUT)
Summary Sheet
UUT-02

DCL Project Number: 13465-2101

Manufacturer: Multistack

Product Line: Water Cooled Modular Chiller***s***

Old Model Number: MS70X N 1	***New Model Number:*** MSS070XNCXFX / MSH070XNCXFX

Mounting: Rigid Base Mount

Product Construction Summary: Powder Coated Carbon Steel Frame

Options / Component Summary:
575V, R-410a refrigerant, condenser, evaporator, compressor, headers, controller and expansion valves

Unit Mounting Description:

The unit was mounted to the DCL shake table interface plate with (6) 1/2" diameter A307 bolts, (3) bolts on each long side of the unit spaced approximately 22 1/2" on center.

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UUT Properties

Operating Weight (lb)	Dimensions (inches)			Lowest Natural Frequency (Hz)		
	Depth	Width	Height	Front-Back	Side-Side	Vertical
2,270	49.1	28.0	89.0	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 2019	ICC-ES AC156	1.93	1.0	1.5	3.09	2.32	1.29	0.51



Overall view of UUT-02

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

UNIT UNDER TEST (UUT)
Summary Sheet
UUT-03

DCL Project Number: 13465-2101

Manufacturer: Multistack

Product Line: Water Cooled Modular Chiller***s***

Old Model Number: MS105X N 1	***New Model Number:*** MSS105XNHXNX / MSH105XNHXNX

Mounting: Rigid Base Mount

Product Construction Summary: Powder Coated Carbon Steel Frame

Options / Component Summary:
460V, R-410a refrigerant, condenser, evaporator, compressor, headers, controller and expansion valves

Unit Mounting Description:

The unit was mounted to the DCL shake table interface frame with (6) 3/4" diameter A307 bolts, (3) bolts on each long side of the unit spaced approximately 47" on center.

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UUT Properties

Operating Weight (lb)	Dimensions (inches)			Lowest Natural Frequency (Hz)		
	Depth	Width	Height	Front-Back	Side-Side	Vertical
5,930	102.4	50.0	78.0	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 2019	ICC-ES AC156	1.93	1.0	1.5	3.09	2.32	1.29	0.51



Overall view of UUT-03

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

UNIT UNDER TEST (UUT)
Summary Sheet
UUT-04

DCL Project Number: 13465-2101

Manufacturer: Multistack

Product Line: Water Cooled Modular Chiller***s***

Old Model Number: MS160X N 1	***New Model Number:*** MSS165XNHXNX / MSH165XNHXNX

Mounting: Rigid Base Mount

Product Construction Summary: Powder Coated Carbon Steel Frame

Options / Component Summary:
460V, R-410A refrigerant, condenser, evaporator, compressor, headers, controller and expansion valves

Unit Mounting Description:

The unit was mounted to the DCL shake table interface frame with (6) 3/4" diameter A307 bolts, (3) bolts on each long side of the unit spaced approximately 47" on center.

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UUT Properties

Operating Weight (lb)	Dimensions (inches)			Lowest Natural Frequency (Hz)		
	Depth	Width	Height	Front-Back	Side-Side	Vertical
6,730	102.4	50.0	78.0	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 2019	ICC-ES AC156	1.93	1.0	1.5	3.09	2.32	1.29	0.51



Overall view of UUT-04

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

UNIT UNDER TEST (UUT)
Summary Sheet
UUT-05

DCL Project Number: 13465-2101

Manufacturer: Multistack

Product Line: Water Cooled Modular Chiller***s***

Model Number: MS80T

Mounting: Rigid Base Mount

Product Construction Summary: Powder Coated Carbon Steel Frame

Options / Component Summary:
460V, R-410A refrigerant, condenser, evaporator, compressor, headers, controller and expansion valves

Unit Mounting Description:

The unit was mounted to the DCL shake table interface plate with six 5/8" diameter A307 bolts, (3) bolts on each long side of the unit spaced approximately 30" on center.

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UUT Properties

Operating Weight (lb)	Dimensions (inches)			Lowest Natural Frequency (Hz)		
	Depth	Width	Height	Front-Back	Side-Side	Vertical
2,520	66.0	35.0	60.5	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 2019	ICC-ES AC156	1.93	1.0	1.5	3.09	2.32	1.29	0.51



Overall view of UUT-05

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

UNIT UNDER TEST (UUT)
Summary Sheet
UUT-06

DCL Project Number: 13465-2101

Manufacturer: Multistack

Product Line: Water Cooled Modular Chiller***s***

Model Number: VME1H4-5

Mounting: Rigid Base Mount

Product Construction Summary: Powder Coated Carbon Steel Frame

Options / Component Summary:
460V, VME 1 with two 4-inch diameter valves, 250VA transformer and controller

Unit Mounting Description:

The unit was mounted to the DCL shake table interface plate with (6) 3/8" diameter Grade 5 bolts, (3) bolts on each long side of the unit spaced approximately 20" on center.

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UUT Properties

Operating Weight (lb)	Dimensions (inches)			Lowest Natural Frequency (Hz)		
	Depth	Width	Height	Front-Back	Side-Side	Vertical
310	76.6	14.0	64.0	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 2019	ICC-ES AC156	1.00	1.0	1.5	1.60	1.20	0.67	0.27



Overall view of UUT-06

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

UNIT UNDER TEST (UUT)
Summary Sheet
UUT-07

DCL Project Number: 13465-2101

Manufacturer: Multistack

Product Line: Water Cooled Modular Chiller***s***

Model Number: VME2H10-5

Mounting: Rigid Base Mount

Product Construction Summary: Powder Coated Carbon Steel Frame

Options / Component Summary:
460V, VME 2 with four 10-inch diameter valves, 500VA transformer and controller

Unit Mounting Description:

The unit was mounted to the DCL shake table interface frame with (4) 1/2" diameter Grade 5 bolts, (2) bolts on each long side of the unit spaced approximately 93" on center.

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UUT Properties

Operating Weight (lb)	Dimensions (inches)			Lowest Natural Frequency (Hz)		
	Depth	Width	Height	Front-Back	Side-Side	Vertical
2,120	102.4	24.0	80.0	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 2019	ICC-ES AC156	1.00	1.0	1.5	1.60	1.20	0.67	0.27



Overall view of UUT-07

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

UNIT UNDER TEST (UUT)
Summary Sheet
UUT-08

DCL Project Number: 13465-2101

Manufacturer: Multistack

Product Line: Water Cooled Modular Chiller***s***

Old Model Number: MS20X N 2	***New Model Number:*** MSS020XNAXHX / MSH020XNAXHX

Mounting: Flexible Base Mount (with neoprene pads)

Product Construction Summary: Powder Coated Carbon Steel Frame

Options / Component Summary:
460V, condenser, evaporator, 10 HP compressor, 6" headers, pC03 controller, 2-3" actuated valve

Unit Mounting Description:

The unit was flexibly base mounted with (6) 3/8" thick, 4"x4" rubber pads (Bramec model 6434) and (6) 1/2" diameter Grade 5 bolts, (3) bolts on each long side of the unit spaced approximately 26" on center.

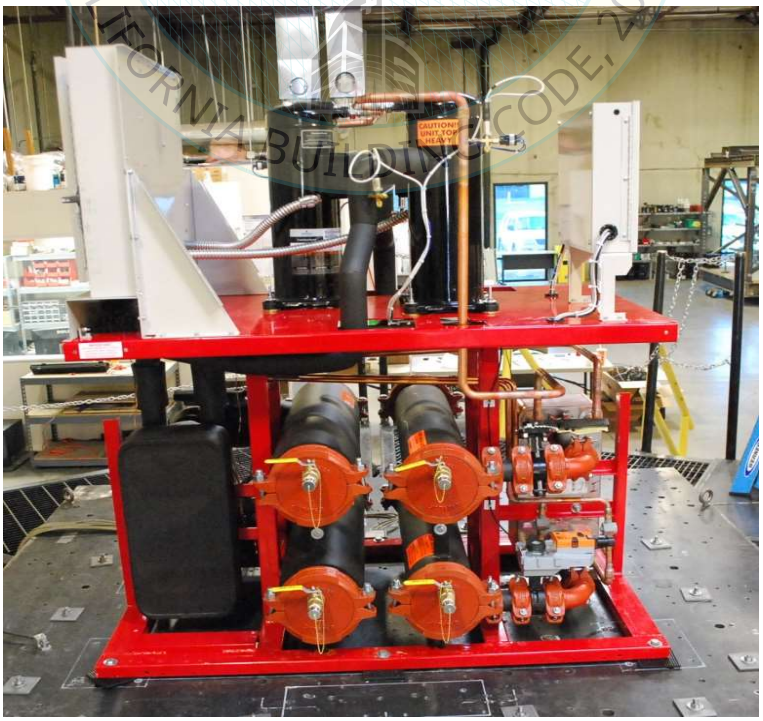
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UUT Properties

Operating Weight (lb)	Dimensions (inches)			Lowest Natural Frequency (Hz)		
	Depth	Width	Height	Front-Back	Side-Side	Vertical
1,300	56.0	32.0	64.0	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 2019	ICC-ES AC156	2.00	1.0	1.5	3.20	2.40	1.33	0.53



Overall view of UUT-08

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

UNIT UNDER TEST (UUT)
Summary Sheet
UUT-09

DCL DYNAMIC CERTIFICATION LABORATORIES,LLC

DCL Project Number: 13465-2101

Manufacturer: Multistack

Product Line: Water Cooled Modular Chiller***s***

Old Model Number: MS70X N 2 | ***New Model Number:*** MSS070XNHXJX / MSH070XNHXJX

Mounting: Flexible Base Mount (with spring isolators)

Product Construction Summary: Powder Coated Carbon Steel Frame

Options / Component Summary:
460V, condenser, evaporator, 32 HP compressor, 6" headers, pC03 controller, 2-3" actuated valve

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.

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UUT Properties

Operating Weight (lb)	Dimensions (inches)			Lowest Natural Frequency (Hz)		
	Depth	Width	Height	Front-Back	Side-Side	Vertical
2,750	56.0	34.0	66.0	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 2019	ICC-ES AC156	2.00	1.0	1.5	3.20	2.40	1.33	0.53



Overall view of UUT-09

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