APPLICATION FOR HCAI SPECIAL SEISMIC CERTIFICATION PREAPPROVAL (OSP)

OFFICE USE ONLY

APPLICATION #: OSP-0168

HCAI Special Seismic Certification Preapproval (OSP)

Type: ☐ New ☒ Renewal

Manufacturer Information

Manufacturer: Trane

Manufacturer's Technical Representative: Kristoffer Knickrehm

Mailing Address: 2213 South 20th Street, La Crosse, WI 54601-7599

Telephone: (608) 787-3304 Email: KKnickrehm@trane.com

Product Information

Product Name: Chillers

Product Type: Chillers - Water Cooled

Product Model Number: EarthWise CenTraVac (CTV)

General Description: Cataloged Shell & Tube Chillers with Single Compressor.

Mounting Description: Base Mounted upon either elastomeric pads or spring vibration 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.

Applicant Information

Applicant Company Name: VMC Group

Contact Person: John Giuliano

Mailing Address: 113 Main Street, Bloomingdale, NJ 07403

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

Title: President

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: UNIVERSITY OF CALIFORNIA, BERKELEY (PEER)

Contact Person: Amarnath Kasalanti

Mailing Address: 325 Davis Hall, Berkeley CA 94720-1729

Telephone: (510) 642-6475 Email: amarnath1@berkeley.edu

Company Name: UNIVERSITY OF CALIFORNIA, SAN DIEGO (UCSD)

Contact Person: G. Benzoni

Mailing Address: 9500 Gilman Drive, #0826, La Jolla CA 92093-0826

Telephone: Email: nheri@eng.ucsd.edu

Seismic Parameters

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

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

a_p (Amplification factor) = 2.5

R_p (Response modification factor) = 2.0 (Spring Isolated); 2.5 (Elastomeric Pads)

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

HCAI Approval (For Office Use Only) - Approval Expires on 10/10/2028

Date: 10/10/2022

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):

Table 1 - Certified Chiller Matrix

Model	Rating [Ton]	MFR	Shells		Maximum Dimensions [in][1]			Max. Weight [lb]	S_{DS} @ z/h = 0	S_{DS} @ z/h = 1.0	F_P/W_P	Installation Method[2,3]	UUT
			Size	Configuration	Length	Width	Height						
CVHE	320	Trane	032	Starter MV and Starter LV, Control Panel, Purge	165	83	94	14370	0.92	0.92	2.07	Spring Isolated	UUT-2A
									1.35	1.35	2.43	Elastomeric Pads	UUT-2B
	230-500		032-080	Starter MV, Starter LV, AFD Option, Control Panel, Purge	237	96	115	31840	0.92	0.92	2.07	Spring Isolated	Interpolated
									1.16	1.16	2.09	Elastomeric Pads	Interpolated
CVHL	380-1800		050-250	Starter MV, Starter LV, AFD Option, Control Panel, Purge	274	139	142	68597	0.92	0.92	2.07	Spring Isolated	Interpolated
									1.16	1.16	2.09	Elastomeric Pads	Interpolated
CVHF	350-1720		050-250	Starter MV, Starter LV, AFD Option, Control Panel, Purge	274	139	142	69475	0.92	0.92	2.07	Spring Isolated	Interpolated
									1.16	1.16	2.09	Elastomeric Pads	Interpolated
	1470		250	AFD option, Control Panel, Purge	274	139	142	69475	1.16	1.16	2.61	Spring Isolated	UUT-1B
									1.16	1.16	2.09	Elastomeric Pads	UUT-1A

1) As tested UUT dimensions are listed.
2) Installation method = Base mounted on VMC Dunnage & Spring Isolators.
3) Installation method = Base mounted on Elastomeric Pads with extended base plate.

Table 2 - Certified Shells

Size	MFR	Max Dimensions [in]									Material	UUT
		Evaporator			Condenser			Economizer				
		Outside Diameter	Length	Weight [lb]	Outside Diameter	Length	Weight [lb]	Outside Diameter	Length	Weight [lb]		
032S	Trane	28	135	2900	20	135	2460	14	48	404	Carbon Steel	UUT-2A, UUT-2B
032L		28	180	3500	20	180	3006	14	48	404	Carbon Steel	Interpolated
050S		35	135	4900	25	135	3526	18	59	420	Carbon Steel	Interpolated
050L		35	180	6000	25	180	4436	18	59	420	Carbon Steel	Interpolated
080S		49	135	7200	31	135	5280	22	74	420	Carbon Steel	Interpolated
080L		49	180	9000	31	180	6776	22	74	420	Carbon Steel	Interpolated
142M		53	160	11036	N/A	N/A	N/A	26	140	878	Carbon Steel	Interpolated
142L		53	180	11938	41	180	10995	26	140	878	Carbon Steel	Interpolated
142E		53	203	12921	N/A	N/A	N/A	26	140	878	Carbon Steel	Interpolated
210L		60	180	14755	46	180	14154	26	140	878	Carbon Steel	Interpolated
250E		67	203	20068	N/A	N/A	N/A	26	140	878	Carbon Steel	UUT-1A, UUT-1B
250L		N/A	N/A	N/A	50	180	17341	26	140	878	Carbon Steel	UUT-1A, UUT-1B

Table 3 - Certified Compressors

Size	MFR	Configuration	Max. Weight [lb]	Material	UUT
380-600	Trane	1-Stage Single	4628	Cast Iron / Aluminum	Extrapolated
620-870		2-Stage Single	5756		Extrapolated
700-950		1-Stage Single	6045		Extrapolated
820-990		1-Stage Single	6155		Extrapolated
350-570		2-Stage Single	8013		Extrapolated
230-320		3-Stage Single	8185	Cast Iron/ Aluminum	UUT-2A, UUT-2B
1200		1-Stage Single	8736	Cast Iron / Aluminum	Interpolated
360-500		3-Stage Single	8803		Interpolated
650-910		2-Stage Single	9900		Interpolated
1070-1300		2-Stage Single	10714		Interpolated
1550-1800		1-Stage Single	11360		Interpolated
1470-1720		2-Stage Single	13932	Cast Iron/ Aluminum	UUT-1A, UUT-1B

Table 4 - Certified Miscelleneous Components

Desc.	MFR	Type/ Model	Max. Weight [lb]	Material	UUT
Starter	Trane	LV	600	Carbon Steel	UUT-2A
		MV	1702	Carbon Steel	UUT-2A, UUT-2B
AFD		Unit Mounted Drive	3000	Carbon Steel	UUT-1A, UUT-1B
Control Panel		CNTL	131	Carbon Steel	UUT-1A, UUT-1B, UUT-2A, UUT-2B
Purge		PRGC	140	Carbon Steel	UUT-1A, UUT-1B, UUT-2A, UUT-2B

1) LV = 3 Phase input voltage up to 600V, with up to 1316A current draw.

2) MV = 3 Phase input voltage range 600V - 13800V, with up to 360A current draw.

3) Starter and AFD are mounted onto the chiller and Trane controls the bracketing from the drive to chiller.

UNIT UNDER TEST (UUT)
Summary Sheet

UUT-1A

UCSD SRMD-2011-01; UUT-1A

Model Line	Model Number	Manufacturer
CTV	CVHF1470T	Trane

Product Construction Summary

Carbon Steel Base Frame

Options / Subcomponent Summary

Evaporator: Trane; Condenser: Trane; Economizer: Trane; Compressor: Trane; AFD: Trane; Control Panel: Trane; Purge: Trane

UUT Properties

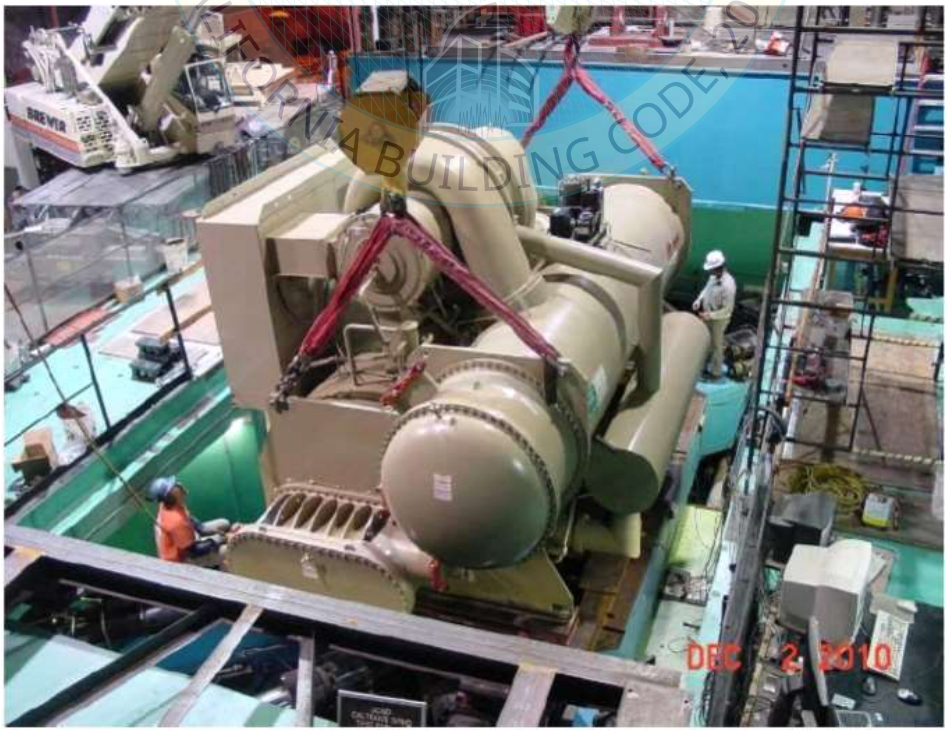
Weight [lbs]	Dimensions [in]			Lowest Nat. Freq. [Hz]		
	Length	Width	Height	F-B	S-S	V
69,475	274.0	139.0	142.0	11.43	8.17	20.26

UUT Highest Passed Seismic Run Information

Building Code	Test Criteria	S_{DS}	z/h	I_P	A_{FLX-H}	A_{RIG-H}	A_{FLX-V}	A_{RIG-V}
CBC 2022	ICC-ES AC156	1.16	1.0	1.50	1.86	1.39	0.77	0.31

Test Mounting Details

UUT-1A bolted to VMC Shear-Flex Black 165 PSI Elastomeric Pads, Pads bolted to shake table.



All units were filled with contents and maintained structural integrity and functionality after AC-156 test.

UNIT UNDER TEST (UUT)
Summary Sheet

UUT-1B

UCSD SRMD-2011-01; UUT1-B

Model Line	Model Number	Manufacturer
CTV	CVHF1470T	Trane

Product Construction Summary

Carbon Steel Base Frame

Options / Subcomponent Summary

Evaporator: Trane; Condenser: Trane; Economizer: Trane; Compressor: Trane; AFD: Trane; Control Panel: Trane; Purge: Trane

UUT Properties

Weight [lbs]	Dimensions [in]			Lowest Nat. Freq. [Hz]		
	Length	Width	Height	F-B	S-S	V
69,475	274.0	139.0	142.0	2.89	2.41	5.06

UUT Highest Passed Seismic Run Information

Building Code	Test Criteria	S_{DS}	z/h	I_P	A_{FLX-H}	A_{RIG-H}	A_{FLX-V}	A_{RIG-V}
CBC 2022	ICC-ES AC156	1.16	1.0	1.50	1.86	1.39	0.77	0.31

Test Mounting Details

UUT-1B bolted to Dunnage, Dunnage bolted to (10) VMC M6SH-1E Spring Vibration Isolators. Isolators bolted to shake table.

All units were filled with contents and maintained structural integrity and functionality after AC-156 test.

UNIT UNDER TEST (UUT)
Summary Sheet

UUT-2A

UCSD SRMD-2011-01; UUT-2A

Model Line	Model Number	Manufacturer
CTV	CVHE320T	Trane

Product Construction Summary

Carbon Steel Base Frame

Options / Subcomponent Summary

Evaporator: Trane; Condenser: Trane; Economizer: Trane; Compressor: Trane; Starter: Trane; Control Panel: Trane; Purge: Trane

UUT Properties

Weight [lbs]	Dimensions [in]			Lowest Nat. Freq. [Hz]		
	Length	Width	Height	F-B	S-S	V
14,370	165.0	83.0	94.0	2.28	1.34	3.97

UUT Highest Passed Seismic Run Information

Building Code	Test Criteria	S_{DS}	z/h	I_P	A_{FLX-H}	A_{RIG-H}	A_{FLX-V}	A_{RIG-V}
CBC 2022	ICC-ES AC156	0.92	1.0	1.50	1.47	1.1	0.62	0.25

Test Mounting Details

UUT-2A bolted to Dunnage, Dunnage bolted to (4) VMC M2SSH-1E Spring Vibration Isolators. Isolators bolted to shake table.

All units were filled with contents and maintained structural integrity and functionality after AC-156 test.

UNIT UNDER TEST (UUT)
Summary Sheet

UUT-2B

PEER-STI-2011-2; UUT-1

Model Line	Model Number	Manufacturer
CTV	CVHE320T	Trane

Product Construction Summary

Carbon Steel Base Frame

Options / Subcomponent Summary

Evaporator: Trane; Condenser: Trane; Economizer: Trane; Compressor: Trane; Starter: Trane; Control Panel: Trane; Purge: Trane

UUT-2B is the same as UUT-2A, retested a second time at a different lab.

UUT Properties

Weight [lbs]	Dimensions [in]			Lowest Nat. Freq. [Hz]		
	Length	Width	Height	F-B	S-S	V
14,370	165.0	83.0	94.0	8.59	5.37	8.59

UUT Highest Passed Seismic Run Information

Building Code	Test Criteria	S_{DS}	z/h	I_P	A_{FLX-H}	A_{RIG-H}	A_{FLX-V}	A_{RIG-V}
CBC 2022	ICC-ES AC156	1.35	1.0	1.50	2.16	1.62	0.9	0.36

Test Mounting Details

UUT-2B bolted to Shear Flex Black 165 PSI Elastomeric Pads. Pads bolted to shake table. (16) 3/4" Dia. SAE Grade 8 Bolts.

All units were filled with contents and maintained structural integrity and functionality after AC-156 test.