APPLICATION FOR HCAI SPECIAL SEISMIC CERTIFICATION PREAPPROVAL (OSP)

OFFICE USE ONLY

APPLICATION #: OSP-0850

HCAI Special Seismic Certification Preapproval (OSP)

Type: [X] New [ ] Renewal

Manufacturer Information

Manufacturer: Trane

Manufacturer's Technical Representative: Wyatt Martinez

Mailing Address: 101 William White Blvd., Pueblo, CO 81001

Telephone: (719) 585-4374 Email: Wyatt.Martinez@trane.com

Product Information

Product Name: ACR 150 - ACR 550

Product Model Number(s): ACR 150 - ACR 550

Product Category: Chillers

Product Sub-Category: Chillers - Air Cooled

General Description: Air cooled chillers ranging with nominal tonnage ranging from 150 to 550

Mounting Description: Rigid mounting from unit base to rigid structure and Elastomeric Pad Base Mounting From Unit Base To

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: U.S. ARMY ENGINEER RESEARCH AND DEVELOPMENT CENTER, CONSTRUCTION ENGINEERING RESEARCH LABORATORY (CERL)

Contact Person: James Wilcoski

Mailing Address: 2902 Newmark Dr., Champaign IL 61822-1076

Telephone: (217) 373-4565 Email: James.wilcoski@usace.army.mil

Seismic Parameters

Design Basis of Equipment or Components (F_p/W_p) = 1.8

S_{DS} (Design spectral response acceleration at short period, g) = 1.0

a_p (Amplification factor) = 2.5

R_p (Response modification factor) = 2.5

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 06/30/2031

Date: 6/30/2025

Name: Timothy Piland Title: Senior Structural Engineer

Special Seismic Certification Valid Up to: S_{DS} (g) = 1.0 z/h = 1

Condition of Approval (if applicable):

Table 1 - ACR Air Cooled Chiller Matrix

Configuration	Nominal Capacity [Tons]	Number of V Coils	# of Supporting legs (2/coil V)	Length [in]	Width [in]	Height [in]	Max Operating Weight [lbs]	Unit
STD	150	4	8	228.9	88.0	98.3	12,000	Extrapolated
Matrix Filter	150	4	8	281.7	88.0	98.3	14,400	Extrapolated
STD	165	5	10	281.7	88.0	98.3	13,200	Extrapolated
DFC	165	5	10	281.7	88.0	98.3	17,200	Extrapolated
DFC+1	165	6	12	334.5	88.0	98.3	19,100	Extrapolated
DFC+2	165	7	14	387.4	88.0	98.3	20,000	Extrapolated
Matrix Filter	165	5	10	334.5	88.0	98.3	15,400	Extrapolated
DFC, Matrix Filter	165	5	10	334.5	88.0	98.3	20,000	Extrapolated
DFC+1, Matrix Filter	165	6	12	387.4	88.0	98.3	21,800	Extrapolated
DFC+2, Matrix Filter	165	7	14	440.2	88.0	98.3	22,600	Extrapolated
STD	180	5	10	281.7	88.0	98.3	13,500	Interpolated
DFC	180	5	10	281.7	88.0	98.3	18,000	Interpolated
DFC+1	180	6	12	334.5	88.0	98.3	19,600	Interpolated
DFC+2	180	7	14	387.4	88.0	98.3	21,000	Interpolated
Matrix Filter	180	5	10	334.5	88.0	98.3	15,700	Interpolated
DFC, Matrix Filter	180	5	10	329.0	88.5	93.0	18,047	UUT-1
DFC, Matrix Filter	180	5	10	334.5	88.0	98.3	20,300	Interpolated
DFC+1, Matrix Filter	180	6	12	387.4	88.0	98.3	22,100	Interpolated
DFC+2, Matrix Filter	180	7	14	440.2	88.0	98.3	22,900	Interpolated
STD	200	6	12	334.5	88.0	98.3	14,800	Interpolated
DFC	200	6	12	334.5	88.0	98.3	20,000	Interpolated
DFC+1	200	7	14	387.1	88.0	98.3	22,400	Interpolated
DFC+2	200	8	16	440.2	88.0	98.3	23,600	Interpolated
Matrix Filter	200	6	12	387.4	88.0	98.3	16,800	Interpolated
DFC, Matrix Filter	200	6	12	387.4	88.0	98.3	22,400	Interpolated
DFC+1, Matrix Filter	200	7	14	440.2	88.0	98.3	25,000	Interpolated
DFC+2, Matrix Filter	200	8	16	510.4	88.0	98.3	26,200	Interpolated
STD	225	6	12	334.5	88.0	98.3	16,100	Interpolated
DFC	225	6	12	334.5	88.0	98.3	21,300	Interpolated
DFC+1	225	7	14	387.1	88.0	98.3	22,800	Interpolated
DFC+2	225	8	16	440.2	88.0	98.3	23,900	Interpolated
Matrix Filter	225	6	12	387.4	88.0	98.3	18,300	Interpolated
DFC, Matrix Filter	225	6	12	387.4	88.0	98.3	23,800	Interpolated
DFC+1, Matrix Filter	225	7	14	440.2	88.0	98.3	25,300	Interpolated
DFC+2, Matrix Filter	225	8	16	510.4	88.0	98.3	26,600	Interpolated
STD	250	6	12	334.5	88.0	98.3	16,500	Interpolated
DFC	250	6	12	334.5	88.0	98.3	21,700	Interpolated
DFC+1	250	7	14	387.1	88.0	98.3	22,900	Interpolated
DFC+2	250	8	16	440.2	88.0	98.3	24,000	Interpolated
Matrix Filter	250	6	12	387.4	88.0	98.3	18,700	Interpolated
DFC, Matrix Filter	250	6	12	387.4	88.0	98.3	24,200	Interpolated
DFC+1, Matrix Filter	250	7	14	440.2	88.0	98.3	25,400	Interpolated
DFC+2, Matrix Filter	250	8	16	510.4	88.0	98.3	26,700	Interpolated
STD	275	6	12	334.5	88.0	98.3	16,700	Interpolated
DFC	275	6	12	334.5	88.0	98.3	21,800	Interpolated
Matrix Filter	275	6	12	387.4	88.0	98.3	18,800	Interpolated
DFC, Matrix Filter	275	6	12	387.4	88.0	98.3	24,500	Interpolated
STD	275	7	14	387.4	88.0	98.3	17,700	Interpolated
DFC	275	7	14	387.4	88.0	98.3	23,800	Interpolated

Notes:
1) STD: standard configuration of chiller
2) DFC: direct free cooling configuration of chiller

Table 1 - ACR Air Cooled Chiller Matrix (Continued)

Configuration	Nominal Capacity [Tons]	Number of V Coils	# of Supporting legs (2/coil V)	Length [in]	Width [in]	Height [in]	Max Operating Weight [lbs]	Unit
DFC+1	275	8	16	440.2	88.0	98.3	24,900	Interpolated
DFC+2	275	9	18	510.4	88.0	98.3	26,200	Interpolated
Matrix Filter	275	7	14	440.2	88.0	98.3	19,800	Interpolated
DFC, Matrix Filter	275	7	14	440.2	88.0	98.3	26,400	Interpolated
DFC+1, Matrix Filter	275	8	16	510.4	88.0	98.3	27,500	Interpolated
DFC+2, Matrix Filter	275	9	18	563.3	88.0	98.3	28,400	Interpolated
STD	300	7	14	387.4	88.0	98.3	17,700	Interpolated
DFC	300	7	14	387.4	88.0	98.3	23,900	Interpolated
Matrix Filter	300	7	14	440.2	88.0	98.3	19,900	Interpolated
DFC, Matrix Filter	300	7	14	440.2	88.0	98.3	26,500	Interpolated
STD	300	8	16	440.2	88.0	98.3	18,800	Interpolated
DFC	300	8	16	440.2	88.0	98.3	25,500	Interpolated
DFC+1	300	9	18	510.4	88.0	98.3	27,000	Interpolated
DFC+2	300	10	20	563.3	88.0	98.3	28,200	Interpolated
Matrix Filter	300	8	16	493.0	88.0	98.3	20,900	Interpolated
DFC, Matrix Filter	300	8	16	493.0	88.0	98.3	27,900	Interpolated
DFC+1, Matrix Filter	300	9	18	563.3	88.0	98.3	29,300	Interpolated
DFC+2, Matrix Filter	300	10	20	610.0	88.0	98.3	30,400	Interpolated
STD	330	8	16	440.2	88.0	98.3	19,500	Interpolated
DFC	330	8	16	440.2	88.0	98.3	26,000	Interpolated
Matrix Filter	330	8	16	493.0	88.0	98.3	21,800	Interpolated
DFC, Matrix Filter	330	8	16	493.0	88.0	98.3	28,600	Interpolated
STD	330	9	18	510.4	88.0	98.3	20,800	Interpolated
DFC, Single Panel Only	330	9	18	510.4	88.0	98.3	27,900	Interpolated
DFC+1	330	10	20	563.3	88.0	98.3	28,700	Interpolated
Matrix Filter	330	9	18	563.3	88.0	98.3	22,700	Interpolated
DFC, Matrix Filter	330	9	18	563.3	88.0	98.3	30,100	Interpolated
DFC+1, Matrix Filter	330	10	20	610.0	88.0	98.3	30,500	Interpolated
STD	375	9	18	510.4	88.0	98.3	23,300	Interpolated
Matrix Filter, Non-CP end	375	9	18	563.3	88.0	98.3	25,900	Interpolated
STD	440	9	18	510.4	88.0	98.3	23,300	Interpolated
Matrix Filter, Non-CP end	440	9	18	563.3	88.0	98.3	25,900	Interpolated
STD	380	11	22	610.0	88.0	98.3	25,500	Interpolated
DFC	380	11	22	610.0	99.0	98.3	33,200	Interpolated
Matrix Filter, No length Change	380	11	22	610.0	88.0	98.3	27,600	Interpolated
DFC, Matrix Filter	380	11	22	610.0	99.0	98.3	35,500	Interpolated
STD	450	11	22	610.0	88.0	98.3	25,500	Interpolated
DFC	450	11	22	610.0	99.0	98.3	33,200	Interpolated
Matrix Filter, No length Change	450	11	22	610.0	88.0	98.3	27,600	Interpolated
DFC, Matrix Filter	450	11	22	610.0	99.0	98.3	35,500	Interpolated
STD	500	11	22	610.0	88.0	98.3	27,900	Interpolated
DFC	500	11	22	610.0	99.0	98.3	35,500	Interpolated
Matrix Filter, No length Change	500	11	22	610.0	88.0	98.3	29,900	Interpolated
DFC, Matrix Filter	500	11	22	610.0	99.0	98.3	37,600	Interpolated
STD	550	11	22	610.0	88.0	98.3	27,900	Interpolated
DFC	550	11	22	610.0	99.0	98.3	35,500	Interpolated
Matrix Filter, No length Change	550	11	22	610.0	88.0	98.3	29,900	Interpolated
DFC, Matrix Filter	550	11	22	610.0	99.0	98.3	37,600	Interpolated
DFC, Matrix Filter	550	11	22	605.0	88.0	93.5	40,350	UUT- 2

Notes:
1) STD: standard configuration of chiller
2) DFC: direct free cooling configuration of chiller

Table 2 - Compressors (513A)

Part Number	Manufacturer	Material	Weight [lbs]	Type	Nominal Capacity [Tons]	Voltage [V]	Unit
573244090001	Trane	Steel, cast iron	1665	Screw Compressor	165	460	UUT-2 x 2
573244090002	Trane	Steel, cast iron	1665	Screw Compressor	165	460	Interpolated
573244040001	Trane	Steel, cast iron	1260	Screw Compressor	100	460	UUT-1 x 2
573244040002	Trane	Steel, cast iron	1260	Screw Compressor	100	460	Interpolated
573254170001	Trane	Steel, cast iron	1594	Screw Compressor	120	460	UUT-2 x 2

Table 3 - Condenser Coils

Part Number	Manufacturer	Material	Weight [lbs]	Height x Depth [in]	Tube Diameter [in]	Rows	Length [in]	Unit
573247940001	Trane	Aluminum	170	52" x 6"	3/8"	N/A	82"	UUT-1, UUT-2
573247930001	Trane	Aluminum	170	52" x 6"	3/8"	N/A	82"	UUT-1, UUT-2

Table 4 - Condenser Fans

Part Number	Manufacturer	Blade Material	Weight [lbs]	Blade Quantity	Voltage [V]	Unit
X38011139010	Trane	Nylon	20	9	380, 400, 460	UUT-1 & UUT-2

Note: The tested voltage for UUT-1 & UUT-2 was 460 V.

Table 5 - Condenser Fan Motors

Part Number	Manufacturer	Material	Weight [lbs]	Output [hp]	Type	Voltage	Unit
X70378086001	Regal Beloit	Carbon steel and copper	40	2.1	variable speed	380, 400, 460	UUT-1, UUT-2

Note: The tested voltage for UUT-1 & UUT-2 was 460 V.

Table 6 - Evaporators

Part Number	Manufacturer	Material	Weight [lbs]	Shell Diameter & Wall Thickness [in]	Evaporator Diameter [in]	Unit
57323095	Trane Technologies	Carbon steel, copper	1240	0.2	17.5	Extrapolated
57323096	Trane Technologies	Carbon steel, copper	1540	0.2	19.5	UUT-1
57323097	Trane Technologies	Carbon steel, copper	1810	0.25	21.6	Interpolated
57324090	Trane Technologies	Carbon steel, copper	2040	0.25	23.6	Interpolated
57325598	Trane Technologies	Carbon steel, copper	2000	0.25	23.6	Interpolated
57325599	Trane Technologies	Carbon steel, copper	2200	0.25	25.2	UUT-2

Table 7 - Variable Frequency Drives

Part Number	Manufacturer	Material	Weight [lbs]	Width x Height x Depth [in]	Input Voltage [V]	Input Phase	Output [hp]	Unit
X13612126003	Danfoss	Plastic, copper, aluminium, carbon steel	135	10"x34.5"x15.5"	380-480	3	250	UUT-1
X13612127002	Danfoss	Plastic, copper, aluminium, carbon steel	275	10"x34.5"x15.5"	380-480	3	350	Interpolated
X13612127003	Danfoss	Plastic, copper, aluminium, carbon steel	275	10"x34.5"x15.5"	380-480	3	450	UUT-2

Note: The tested voltage for UUT-1 & UUT-2 was 460 V.

Table 8 - Control Box Assembly

Part Number	Manufacturer	Material	Weight [lbs]	Width x Height x Depth [in]	Unit
57323310	Trane Technologies	Plastic, copper, aluminium, carbon steel	1500	86.5"x77"x19.5"	UUT-1, UUT-2

Table 9 - Oil Seperator

Part Number	Manufacturer	Material	Weight [lbs]	Diameter	Unit
57324562	Trane Technologies	Carbon Steel	197	10"	UUT-1
57324483	Trane Technologies	Carbon Steel	251	12"	Interpolated
57324571	Trane Technologies	Carbon Steel	338	14"	UUT-2

UNIT UNDER TEST (UUT)
Summary Sheet

UUT-1

Test Report: DCL-25822-2401

Model Line	Model Number	Manufacturer
Air Cooled Chiller	180-ton	Trane

Product Construction Summary

Skid Base Channels and Supports: Grade 37 G90 Phosphatized Steel

Options / Subcomponent Summary

Compressors (513A): Trane; Condenser Coils: Trane; Condenser Fan Motors: Regal Beloit; Variable Frequency Drives: Danfoss; Condenser Fans: Trane; Evaporators: Trane Technologies; Direct Free Cooling Assembly: Trane Technologies; Control Box Assembly: Trane Technologies; Oil Separator: Trane Technologies; Matrix Filter (Electronic Harmonic Filter): MTE; Remote Communications: Trane; Sound Attenuation Package: Trane; Insulation: Trane; Circuit Breaker: Schneider; Hard Wired Communication: Trane; Architectural Louvers: Trane; Single Point Power Assembly: Trane

UUT Properties

Weight [lbs]	Dimensions [in]			Lowest Nat. Freq. [Hz]		
	Length	Width	Height	F-B	S-S	V
18,047	329.0	88.5	93.0	10.5	5.5	12.0

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	2.00	1.0	1.5	3.20	2.40	0.67	0.27

Test Mounting Details

UUT-1 was rigidly mounted to the shake table using (8) 9/16" diameter Grade 8 bolts.

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

UNIT UNDER TEST (UUT)
Summary Sheet

UUT-2

Test Report: DCL-25822-2401

Model Line	Model Number	Manufacturer
Air Cooled Chiller	550-ton	Trane

Product Construction Summary

Skid Base Channels and Supports: Grade 37 G90 Phosphatized Steel

Options / Subcomponent Summary

Compressors (513A): Trane; Condenser Coils: Trane; Condenser Fan Motors: Regal Beloit; Variable Frequency Drives: Danfoss; Condenser Fans: Trane; Evaporators: Trane Technologies; Direct Free Cooling Assembly: Trane Technologies; Control Box Assembly: Trane Technologies; Oil Separator: Trane Technologies; Matrix Filter (Electronic Harmonic Filter): MTE; Remote Communications: Trane; Sound Attenuation Package: Trane; Insulation: Trane; Circuit Breaker: Schneider; Hard Wired Communication: Trane; Architectural Louvers: Trane; Single Point Power Assembly: Trane

UUT Properties

Weight [lbs]	Dimensions [in]			Lowest Nat. Freq. [Hz]		
	Length	Width	Height	F-B	S-S	V
40,350	605.0	88.0	93.5	2.5	4.0	9.5

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	1.00	1.0	1.5	1.60	1.20	0.67	0.27

Test Mounting Details

UUT-2 was isolated base mounted using (12) 6.0” x 6.0” neoprene pads, (12) 9/16” Grade 8 bolts, (12) 6.0” x 6.0” x 0.3” plate washers, with two nuts and one flat washer per bolt.
DCR: Added expansion valve support bracket to be implemented for production units in order to address anomaly from testing.

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