APPLICATION FOR OSHPD SPECIAL SEISMIC CERTIFICATION PREAPPROVAL (OSP)

OFFICE USE ONLY	
APPLICATION #:	OSP – 0204

OSHPD Special Seismic Certification Preapproval (OSP)

Type: ☐ New ☒ Renewal

Manufacturer Information

Manufacturer: Multistack, LLC

Manufacturer's Technical Representative: Dennis Manthei

Mailing Address: 1065 Maple Ave, Sparta, WI 54656

Telephone: 608.366.2400 Email: dmanthei@multistack.com

Product Information

Product Name: Mag Lev Flooded Chiller Line, Gen 2

Product Type: Water Cooled Chiller

Product Model Number: See attached summary table.
(List all unique product identification numbers and/or part numbers)

General Description: Water cooled mag lev flooded chillers in stacked and side-by-side configuration ranging in size from 4,500 pounds to 22,300 pounds.

Mounting Description: Flexible base mount with neoprene pads or rigidly bolted.

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OSHPD
OSP-0204
BY: Mohammad Aliaari
DATE: 05/12/2020
CALIFORNIA BUILDING CODE, 2016

Applicant Information

Applicant Company Name: Multistack, LLC

Contact Person: Dennis Manthei

Mailing Address: 1065 Maple Ave, Sparta, WI 54656

Telephone: 608.366.2400 Email: dmanthei@multistack.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: Dennis L Manthei Date: May 1, 2020

Title: Sr. Staff Engineer Company Name: Multistack, LLC

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

Company Name: Degenkolb Engineers

Name: Adrian Nacamuli California License Number: SE 4857

Mailing Address: 1300 Clay Street, Suite 900, Oakland, CA 94612

Telephone: 510.250.1216 Email: nacamuli@degenkolb.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: UC Berkeley, PEER Center (UUT-7)

Contact Name: Amarnath Kasalanti

Mailing Address: 1301 S. 46th Street, Richmond, CA 94804

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

Company Name: Dynamic Certification Laboratories (UUT-6)

Contact Name: Kelly Laplace

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

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

Company Name: Construction Engineering Research Laboratory (UUT-5)

Contact Name: James Wilcoski

Mailing Address: 2902 Newmark Drive, Champaign, IL 61822

Telephone: (217) 373-6763 Email: James.Wilcoski@usace.army.mil

Seismic Parameters

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

Design Basis of Equipment or Components (F_p/W_p) = 3.60

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) = 2.5

Ω_0 (System overstrength factor) = 2.5

I_p (Importance factor) = 1.5

z/h (Height factor ratio) = 1.0

Equipment or Component Natural Frequencies (Hz) = See attachment

s

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

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) = Mohammad Aliaari

Ω_0 (System overstrength factor) =

C_d (Deflection amplification factor) = DATE: 05/12/2020

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, 2015: ☐ 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): Component and Sub-component Tables

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

Signature: M. Aliaari Date: May 12, 2020

Print Name: Mohammad Aliaari Title: SSE

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

Condition of Approval (if applicable):

OSHPD Special Seismic Certification Summary of Certified Units

MULTISTACK

Manufacturer: Multistack, LLC

Product Line: MS_F MagLev Flooded Chiller: Gen 2

Product Construction Summary: Painted shell (carbon steel) and tube (copper) heat exchanger.

Mounting Condition Tested: Base mounted - bolted with neoprene pads.

Model Number (Old Model Number)	Length (in)	Width (in)	Height (in)	Operating Weight (lbs)	Unit
MSF0122 (MS0122FC1)	139 1/8	32 1/2	63 7/8	4,500	Extrapolated
MSF0132 (MS0132FC1)	139 1/8	32 1/2	63 3/4	4,670	UUT6
MSF0152 (MS0152FC1)	139 1/8	34 5/8	77 1/16	6,270	Interpolated
MSF0162 (MS0162FC1)	139 1/8	34 5/8	77	6,990	Interpolated
MSF0192 (MS0192FC1)	140 11/16	35 9/16	77 3/16	7,150	Interpolated
MSF0202 (MS0202FC1)	140 11/16	35 9/16	77 3/16	7,860	Interpolated
MSF0242 (MS0242FC1)	142 3/16	35 1/4	77 3/16	8,670	Interpolated
MSF0292 (MS0292FC1)	143 5/16	37 1/4	77 3/16	9,840	Interpolated
MSF0332 (MS0332FC1)	143 5/16	37 1/4	77 3/16	9,960	Interpolated
MSF0392 (MS0392FC1)	143 5/16	39 1/2	80 3/4	11,350	Interpolated
MSF0412 (MS0412FC1)	167 11/16	39 1/2	88 3/4	13,050	Interpolated
MSF0482 (MS0482FC1)	171 11/16	48	94 3/8	15,350	UUT5
MSF0542 (MS0542FC1)	171	82	82	17,660	Interpolated
MSF0602 (MS0602FC1)	171	86	86	19,560	Interpolated
MSF0612 (MS0612FC1)	171	86	86	20,100	Interpolated
MSF0622 (MS0622FC1)	171	86	86	20,160	Interpolated
MSF0702 (MS0702FC1)	147 3/16	89 3/4	85 5/8”	21,150	Interpolated
MSF0703 (MS0703FC1)	149	90	90	20,800	Interpolated
MSF0803 (MS0803FC1)	149	101	96	22,300	UUT-7

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Multistack MagLev Flooded Chillers - Certified Sub-Components

COMPRESSORS	MANUFACTURER: DANFOSS TURBOCOR				
PART NUMBER	**QUANTITY TESTED**	**DIMENSIONS**	**MATERIAL**	**WEIGHT (Lbs.)**	**UNIT**
TT-300	2	31.0 x 20.4 x 19.2	Fe, Al, Cu, Plastic	265	UUT-6
TT-350	N/A	31.0 x 20.4 x 19.2	Fe, Al, Cu, Plastic	290	Interpolated
TT-400	2	31.0 x 20.4 x 19.2	Fe, Al, Cu, Plastic	290	UUT-5
TT-500	1	31.0 x 20.4 x 19.2	Fe, Al, Cu, Plastic	318	UUT-5
TT-700	1	31.0 x 20.4 x 19.2	Fe, Al, Cu, Plastic	318	UUT-7
VTT-1200	2	44.5 x 26.9 x 29.5	Fe, Al, Cu, Plastic	977	UUT-7
CONDENSERS	**MANUFACTURER: STANDARD REFRIGERATION**				
PART NUMBER	**QUANTITY TESTED**	**DIMENSIONS**	**MATERIAL**	**WEIGHT (Lbs.)**	**UNIT**
HSE1210	N/A	12” dia x 10’ tube	Fe, Cu	1300	Extrapolated
HSE1410	1	14” dia x 10’ tube	Fe, Cu	1620	UUT-6
HSE1610	N/A	16” dia x 10’ tube	Fe, Cu	1910	Interpolated
HSE1810	N/A	18” dia x 10’ tube	Fe, Cu	2320	Interpolated
HSE2010	N/A	20” dia x 10’ tube	Fe, Cu	2570	Interpolated
HSE2212	N/A	22” dia x 12’ tube	Fe, Cu	3100	Interpolated
HSE2412	1	24” dia x 12’ tube	Fe, Cu	4620	UUT-5
HSE2612	N/A	26” dia x 12’ tube	Fe, Cu	5950	Interpolated
HSE2812	N/A	28” dia x 12’ tube	Fe, Cu	6510	Interpolated
HSE3010	N/A	30” dia x 10’ tube	Fe, Cu	6800	Interpolated
HSE3012	N/A	30” dia x 12’ tube	Fe, Cu	7520	Interpolated
HSE3210	1	32” dia x 10’ tube	Fe, Cu	7550	UUT-7
EVAPORATORS	**MANUFACTURER: STANDARD REFRIGERATION**				
PART NUMBER	**QUANTITY TESTED**	**DIMENSIONS**	**MATERIAL**	**WEIGHT (Lbs.)**	**UNIT**
FEV1410	N/A	14” dia x 10’ tube	Fe, Cu	1190	Extrapolated
FEV1610	1	16” dia x 10’ tube	Fe, Cu	1490	UUT-6
FEV1810	N/A	18” dia x 10’ tube	Fe, Cu	1810	Interpolated
FEV2010	N/A	20” dia x 10’ tube	Fe, Cu	2100	Interpolated
FEV2212	N/A	22” dia x 10’ tube	Fe, Cu	2970	Interpolated
FEV2412	N/A	24” dia x 12’ tube	Fe, Cu	3790	Interpolated
FEV2612	1	26” dia x 12’ tube	Fe, Cu	4120	UUT-5
FEV2812	N/A	28” dia x 12’ tube	Fe, Cu	7050	Interpolated
FEV3012	N/A	30” dia x 12’ tube	Fe, Cu	8070	Interpolated
FEV3210	1	32” dia x 10’ tube	Fe, Cu	8230	UUT-7

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CONDENSER/EVAPORATOR EXPANSION VALVES	MANUFACTURER: CAREL				
PART NUMBER	**QUANTITY TESTED**	**DIMENSIONS**	**MATERIAL**	**WEIGHT (Lbs.)**	**UNIT**
E7V	2	16.4 x 5.3 x 16.8	Cu, Fe, Brass, SS, Nylon	9	UUT-6
EXPANSION VALVES	**MANUFACTURER: SPORLAN**				
PART NUMBER	**QUANTITY TESTED**	**DIMENSIONS**	**MATERIAL**	**WEIGHT (Lbs.)**	**UNIT**
Y12-31	4	11.0x5.5x2.5	Cu, Fe, Brass, SS, Nylon	15	UUT-5
SEHI-T	2	14.4x6.5x3.5	Cu, Fe, Brass, SS, Nylon	20	UUT-7
ECONIMIZER	**MANUFACTURER: SWEP**				
PART NUMBER	**QUANTITY TESTED**	**DIMENSIONS, WxHxD, (in)**	**MATERIAL**	**WEIGHT (Lbs.)**	**UNIT**
V200THx40	1	9.6x20.6x4.0	316 SS	58	UUT-6
V200THx60	N/A	9.6x20.6x5.8	316 SS	76	Interpolated
V200THx80	N/A	9.6x20.6x7.6	316 SS	95	Interpolated
FS250x120	2	8.0x24.4x9.6	316 SS	111	UUT-7
V200THx130	N/A	9.6x20.6x12.1	316 SS	141	Interpolated
S400x120	N/A	12.0x27.3x11.5	316 SS	220	Interpolated
S400THx120	1	12.0x27.3x11.5	316 SS	219	UUT-5
ECONIMIZER EXPANSION VALVES	**MANUFACTURER: SPORLAN**				
PART NUMBER	**QUANTITY TESTED**	**DIMENSIONS WxHxD (in)**	**MATERIAL**	**WEIGHT (Lbs.)**	**UNIT**
SERI-G	1	7.3x4.6x1.9	Cu, Fe, Brass, SS, Nylon	5	UUT-6
SERI-J	2	7.5x4.8x1.9	Cu, Fe, Brass, SS, Nylon	6	UUT-7
SERI-K	1	7.9x4.9x1.9	Cu, Fe, Brass, SS, Nylon	7	UUT-5
FLEXSYS CONTROL SYSTEM	**MANUFACTURER: MULTISTACK**				
PART NUMBER	**QUANTITY TESTED**	**DIMENSIONS**	**MATERIAL**	**WEIGHT (Lbs.)**	**UNIT**
FLEXSYS	N/A	32 x 18 x 10, 22 x 44 x 10, 44 x 12 x 10, 32 x 32 x 10	Fe, Cu, Al, Plastic	60, 80, 80, 90 (310)	Extrapolated
FLEXSYS	N/A	36 x 22 x 8.5, 30 x 16 x 12, 40 x 13 x 8.5	Fe, Cu, Al, Plastic	90, 130,100 (320)	Extrapolated
FLEXSYS	4	30 x 16 x 12, 36 x 22 x 8.5, 30 x 16 x 12, 40 x 13 x 8.5	Fe, Cu, Al, Plastic	130, 90,130,100 (450)	UUT-6
FLEXSYS	5	30 x 16 x 12, 30 x 16 x 12, 36 x 22 x 8.5, 30 x 16 x 12, 40 x 13 x 8.5	Fe, Cu, Al, Plastic	130, 130, 90, 130, 100 (580)	UUT-5
FLEXSYS	N/A	30 x 16 x 12, 30 x 16 x 12, 30 x 16 x 12, 36 x 22 x 8.5, 30 x 16 x 12, 96 x 16 x 12	Fe, Cu, Al, Plastic	130(4), 90, 400 (1010)	Interpolated
FLEXSYS	N/A	60x36x14;44x17x14(2);22x44x14	Fe, Cu, Al, Plastic	400, 275, 110, 275 (1060)	Interpolated
FLEXSYS	5	60x36x14;44x17x14(2);22x44x14, 30 x 16 x 12	Fe, Cu, Al, Plastic	450, 275, 110, 275, 130 (1240)	UUT-7

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CALIFORNIA BUILDING CODE 2019

OSHPD Special Seismic Certification
Unit Under Test Summary
UUT-5

MULTISTACK

Unit Number:	UUT-5
Manufacturer:	Multistack, LLC
Product Line:	MS_F MagLev Flooded Chiller, Gen 2
Model Number:	MS0482FC1
Product Description:	Water cooled chiller with condensers, evaporators, expansion valves, economizers, compressors and controllers.

Product Construction Summary:
Painted shell (carbon steel) and tube (copper) heat exchanger.

Options and Sub-component Summary:
Compressor: (1) Danfoss TT-500, (1) Danfoss TT-400, Condenser: (1) Standard Refrigeration HSE2412
Evaporator: (1) Standard Refrigeration FEV2612, Expansion Valves: (4) Sporlan Y12-31
Econimizer: (1) SWEP S400THx120, Econimizer Expansion Valves: (1) Sporlan SERI-K
Flexsys Control System: (5) Multistack Flexsys

Note: Unit was tested at its operating weight and no damage was observed following shake table testing. Unit passed post shake table test functionality testing performed by Multistack at their factory.

Unit Properties

Operating Weight (lbs)	Dimensions (in)			Lowest Natural Frequency (Hz)		
	Length	Width	Height	Front-Back	Side-Side	Vertical
15,350	171 11/16	48”	94 3/8	6.5	5.5	18.3

Unit Mounting:	Bolted to shake table with 3/8” thick neoprene pads and four (4) 3/4" diameter Grade 5 steel bolts per support frame (8 bolts total) to the test fixture.

Seismic Test Parameters

Building Code:	2016 California Building Code
Test Criteria:	ICC-ES AC156

S_{DS} (g)	I_P	z/h	A_{RIG} (g) (horizontal)	A_{FLX} (g) (horizontal)	A_{RIG} (g) (vertical)	A_{FLX} (g) (vertical)
2.00	1.5	1.0	2.40	3.20	0.54	1.34

OSHPD REVIEW OF SEISMIC COMPLIANCE OSP-0204 By: Mohammad Aliaari DATE: 05/12/2020 CALIFORNIA BUILDING CODE, 2016



Figure 1 – UUT-5 Test Configuration

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OSHPD
OSP-0204
BY: Mohammad Aliaari
DATE: 05/12/2020
CALIFORNIA BUILDING CODE, 2019

OSHPD Special Seismic Certification
Unit Under Test Summary
UUT-6

MULTISTACK

Unit Number:	UUT-6
Manufacturer:	Multistack, LLC
Product Line:	MS_F MagLev Flooded Chiller, Gen 2
Model Number	MS0132FC1
Product Description:	Water cooled chiller with condensers, evaporators, expansion valves, economizers, compressors and controllers.

Product Construction Summary:

Painted shell (carbon steel) and tube (copper) heat exchanger.

Options and Sub-Component Summary:
Compressor: (2) Danfoss TT-300, Condenser: (1) Standard Refrigeration HSE1410
Evaporator: (1) Standard Refrigeration FEV1610,
Condenser/Evaporator Expansion Valves: (2) Carel E7V, Econimizer: (1) SWEP V200THx40,
Econimizer Expansion Valves: (1) Sporlan SERI-G
Flexsys Control System: (4) Multistack Flexsys

Note: Unit was tested at its operating weight and no damage was observed following shake table testing. Unit passed post shake table test functionality testing performed by Multistack at their factory.

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OSP 0204
BY: Mohammad Aliaari
EXP. DATE: 05/12/2020
CALIFORNIA BUILDING CODE 2019

Unit Properties

Operating Weight (lbs)	Dimensions (in)			Lowest Natural Frequency (Hz)		
	Length	Width	Height	Front-Back	Side-Side	Vertical
4,670	139 1/8	32 1/2	63 3/4	8.5	7.3	14.5

Unit Mounting:	Bolted to shake table with 3/8” thick neoprene pads and four (4) 5/8" diameter Grade 5 steel bolts per support frame (8 bolts total) to the test fixture.

Seismic Test Parameters

Building Code:	2016 California Building Code
Test Criteria:	ICC-ES AC156

S_{DS} (g)	I_P	z/h	A_{RIG} (g) (horizontal)	A_{FLX} (g) (horizontal)	A_{RIG} (g) (vertical)	A_{FLX} (g) (vertical)
2.00	1.5	1.0	2.40	3.20	0.54	1.34



Figure 2- UUT-6 Test Configuration

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CALIFORNIA BUILDING CODE, 2019

OSHPD Special Seismic Certification
Unit Under Test Summary
UUT-7

MULTISTACK

Unit Number:	UUT-7
Manufacturer:	Multistack, LLC
Product Line:	MS_F MagLev Flooded Chiller, Gen 2
Model Number:	MS0803FC1
Product Description:	Water cooled chiller with condensers, evaporators, expansion valves, economizers, compressors and controllers.

Product Construction Summary:

Painted shell (carbon steel) and tube (copper) heat exchanger.

Options and Sub-Component Summary:

Compressor: (1) Danfoss TT-700, (2) Danfoss VTT-1200, Condenser: (1) Standard Refrigeration HSE3210
Evaporator: (1) Standard Refrigeration FEV3210, Expansion Valves: (2) Sporlan SEHI-T
Econimizer: (2) SWEP FS250-120, Econimizer Expansion Valves: (2) Sporlan SERI-J
Flexsys Control System: (5) Multistack Flexsys

Note: Unit was tested at its operating weight and no damage was observed following shake table testing. Unit passed post shake table test functionality testing performed by Multistack at their factory.

Unit Properties

Operating Weight (lbs)	Dimensions (in)			Lowest Natural Frequency (Hz)		
	Length	Width	Height (in)	Front-Back	Side-Side	Vertical
22,300	149	101	96	13.0	11.8	11.2
Unit Mounting:	Bolted to shake table with (8) 3/4" diameter ASTM A325 steel bolts per leg (16 bolts total) to test fixture.					

Seismic Test Parameters

Building Code:	2016 California Building Code
Test Criteria:	ICC-ES AC156

S_{DS} (g)	I_P	z/h	A_{RIG} (g) (horizontal)	A_{FLX} (g) (horizontal)	A_{RIG} (g) (vertical)	A_{FLX} (g) (vertical)
2.00	1.5	1.0	2.4	3.2	0.54	1.34

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CALIFORNIA BUILDING CODE, 2019



Figure 3 UUT-7 Test Configuration

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CALIFORNIA BUILDING CODE, 2019