# APPLICATION FOR OSHPD SPECIAL SEISMIC CERTIFICATION PREAPPROVAL (OSP)

| OFFICE USE ONLY | |
|---|---|
| APPLICATION #: | OSP – 0167 – 10 |

## OSHPD Special Seismic Certification Preapproval (OSP)

**Type:** ☐ New ☒ Renewal

## Manufacturer Information

Manufacturer: SMARDT, Inc.

Manufacturer's Technical Representative: Greg Tutwiler

Mailing Address: 1840 Trans Canada Highway, Dorval, Quebec H9P 1H7

Telephone: 514-519-6012 Email: Greg.Tutwiler@smardt.com

## Product Information

Product Name: SMARDT water-cooled chillers

Product Type: Water-cooled chillers

Product Model Number: WA026, WA044, WA095 through WA400, WB120 through WB500
(List all unique product identification numbers and/or part numbers)

General Description: Narrow and side-by-side water-cooled chillers. Seismic enhancements made to the test units and modifications required to address the anomalies observed during the tests shall be incorporated into the production units.

Mounting Description: Floor mounted on neoprene pads.

## Applicant Information

Applicant Company Name: SMARDT, Inc.

Contact Person: Greg Tutwiler

Mailing Address: 1840 Trans Canada Highway, Dorval, Quebec H9P 1H7

Telephone: 514-519-6012 Email: Greg.Tutwiler@smardt.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: Greg Tutwiler Date: March 29, 2017

Title: Chief Technology Officer Company Name: SMARDT, Inc.

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

Company Name: Degenkolb Engineers

Name: Adrian Nacamuli California License Number: S4857

Mailing Address: 1300 Clay Street, Suite 900, Oakland, California 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): _____

## Testing Laboratory

Company Name: State University of New York at Buffalo, SEESL

Contact Name: Mark Pitman

Mailing Address: 212 Ketter Hall, North Campus, Buffalo, New York 14260

Telephone: 716-645-4377 Email: mpitman@buffalo.edu

Company Name: United States Army Corps of Engineers, Construction Engineering Research Laboratory

Contact Name: James Wilcoski

Mailing Address: 2902 Newmark Drive, Champaign, Illinois 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 ($F_p/W_p$) = 3.53

$S_{DS}$ (Design spectral response acceleration at short period, g) = 1.96

$a_p$ (In-structure equipment or component amplification factor) = 2.5

$R_p$ (Equipment or component response modification factor) = 2.5

$\Omega_0$ (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 attachment

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 ) =

$\Omega_0$ (System overstrength factor) =

$C_d$ (Deflection amplification factor) =

$I_p$ (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

## List of Attachments Supporting Special Seismic Certification

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

☐ Other(s) (Please Specify):

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

Signature: Timothy J. Piland Date: August 16, 2017

Print Name: Timothy J. Piland Title: SSE

Special Seismic Certification Valid Up to : $S_{DS}$ (g) = 1.96 z/h = 1

Condition of Approval (if applicable):

**Table 1 – Certified Product List**

# OSHPD Special Seismic Certification Summary of Certified Units

**Manufacturer:** SMARDT, Inc.

**Product Line:** Water-cooled Chiller

**Mounting Condition Tested:**

Chiller base rigidly bolted with neoprene pads.

| UUT | MODEL NUMBERS | AVAILABLE CONFIGURATIONS | NOMINAL TONS | TESTED / INTERPOLATED | NOMINAL LENGTH (in) | LENGTH (in) | WIDTH (in) | HEIGHT (in) | OPERATING WEIGHT (Lbs) | Sds(g) | z/h |
|---|---|---|---|---|---|---|---|---|---|---|---|
| UUT-2 | WA026 | N | 75 | Tested | 78 | 90 | 46 | 80 | 4,700 | 2.00 | 1 |
| | WA044 | N | 170 | Interpolated | 126 | 149 | 50 | 81 | 5,100 | 2.00 | 1 |
| | WA095 | S | 290 | Interpolated | 126 | 147 | 64 | 69 | 10,300 | 2.00 | 1 |
| | WB120 | S | 341 | Interpolated | 157 | 182 | 74 | 72 | 14,650 | 2.00 | 1 |
| | WA130 | S | 390 | Interpolated | 142 | 167 | 64 | 71 | 12,910 | 2.00 | 1 |
| | WB130 | S | 390 | Interpolated | 126 | 153 | 54 | 94 | 10,810 | 2.00 | 1 |
| | WA140 | S | 422 | Interpolated | 142 | 166 | 78 | 77 | 14,900 | 2.00 | 1 |
| | WA180 | S | 511 | Interpolated | 197 | 221 | 80 | 83 | 16,675 | 2.00 | 1 |
| | WA190 | S | 599 | Interpolated | 157 | 182 | 77 | 74 | 18,300 | 2.00 | 1 |
| | WB190 | S | 568 | Interpolated | 157 | 182 | 77 | 74 | 18,300 | 2.00 | 1 |
| | WA200 | S | 580 | Interpolated | 157 | 181 | 79 | 74 | 17,500 | 2.00 | 1 |
| | WB200 | S | 580 | Interpolated | 157 | 182 | 79 | 74 | 17,475 | 2.00 | 1 |
| UUT-1 | WA240 | S | 646 | Tested | 197 | 239 | 87 | 78 | 21,000 | 2.00 | 1 |
| | WA240 | S | 597 | Interpolated | 197 | 221 | 84 | 74 | 21,640 | 1.96 | 1 |
| | WB240 | S | 700 | Interpolated | 157 | 182 | 89 | 80 | 22,180 | 1.96 | 1 |
| | WA260 | S | 739 | Interpolated | 197 | 203 | 99 | 77 | 23,320 | 1.96 | 1 |
| | WA260 | S | 750 | Interpolated | 236 | 260 | 75 | 97 | 26,650 | 1.96 | 1 |
| | WA340 | S | 841 | Interpolated | 197 | 225 | 89 | 77 | 29,775 | 1.96 | 1 |
| | WB400 | S | 1050 | Interpolated | 197 | 228 | 104 | 99 | 34,250 | 1.96 | 1 |
| UUT-3 | WB500 | S | 1400 | Tested | 197 | 229 | 113 | 106 | 42,800 | 1.96 | 1 |

**Table 2 – Summary of Certified Subcomponents**

## OSHPD Special Seismic Certification Summary of Certified Subcomponents

**Manufacturer:** SMARDT, Inc.

**Product Line:** Water-cooled Chiller

**Seismic Certification Limits:**

$S_{DS}$ = 1.96, z/h = 1.0, $I_p$ = 1.5

| Component Type | Manufacturer | Model or Part Number | Description | Size (L x W x H) | Weight (lbs) | Material | UUT |
|---|---|---|---|---|---|---|---|
| Compressor | Danfoss | TG-310 | Turbocor compressor | 31 in x 20 in x 19 in | 290 | Aluminum | Interpolated |
| | Danfoss | TT-300 | Turbocor compressor | 31 in x 20 in x 19 in | 265 | Aluminum | 2 |
| | Danfoss | TT-350 | Turbocor compressor | 31 in x 20 in x 19 in | 290 | Aluminum | Interpolated |
| | Danfoss | TT-400 | Turbocor compressor | 31 in x 20 in x 19 in | 290 | Aluminum | 1 |
| | Danfoss | TT-500 | Turbocor compressor | 31 in x 20 in x 19 in | 300 | Aluminum | Interpolated |
| | Danfoss | TT 700 | Turbocor compressor | 31 in x 20 in x 19 in | 300 | Aluminum | Interpolated |
| | Danfoss | VTT 1200 | Turbocor compressor | 43in x 26in x 30in | 1600 | Aluminum | 3 |
| Flow Controls | IFM | SI15010 | Therminal dispersion flow switch | 113mm x 50mm x 63mm | 1 | Carbon Steel | 1 |
| | Veris Industries | PW2XX05S | Differential pressure transmitter | 5.8in x 4in x 2.2in | 1 | Copper, Brass | 1,2,3 |
| Economizers | SMARDT | 31-0103 | Flash Tank Economizer | 16 in x 31.5 in | 287 | Carbon Steel | 3 |
| Ball Valves | Henry Tech | 937409 | Ball Valve 1-1/8" | 1 1/8" | 4 | Copper, Brass | 1 |
| | GB Industries | P03344 | Ball Valve 3-1/8" | 3 1/8" | 8 | Copper, Brass | 1 |
| Check Valves | RFF | P00769 | CHECK VALVE 3-1/8" | 3-1/8" | 8 | Cast Iron | 2 |
| | RFF | P02907 | CHECK VALVE 4-1/8" | 4-1/8" | 12 | Cast Iron | 1 |
| | Bray | P04281 | Waffer CHECK VALVE 6" | 6" | 17 | Cast Iron | 3 |
| Butterfly Valves | Bray | P04604 | BUTTERFLY VALVE 4" | 4" | 5 | Cast Iron | 2 |
| | Bray | P04603 | BUTTERFLY VALVE 6" | 6" | 12 | Cast Iron | 1 |
| | Bray | P05100 | BUTTERFLY VALVE 10" | 10" | 66 | Cast Iron | 3 |
| Solenoid Valve | Danfoss | P04279 | SOLENOID VALVE | 1-5/8" | 10 | Copper, Brass | 1,2,3 |
| Control Panel | Kiltech | E00586 | 2X Boxes | 30in X 26in X 6in | 290 | Steel/Copper | 2 |
| | Kiltech | E00765 | 6X Boxes | 30in X 26in X 6in | 920 | Steel/Copper | 1 |
| | Kiltech | E05450 | 7 Boxes | 30in X 26in X 6in | 800 | Steel/Copper | 3 |
| Expansion Valve | Parker | P03102 | EXPENSION VALVE 1-1/8 TO 1-5/8 | 1-1/8 to 1-5/8 | 6 | Copper, Brass | 1,2 |
| | Danfoss | P03808 | ICM Valve 65B Module | 1/8/2003 | 14 | Steel/Plastic | 3 |
| Float Chamber Sensor | Henry Tech | P02852 | Liquid Level Probe | 7.75 + (10 to 60) | 2.5 | Aluminum & Stainless steel | 1,2,3 |
| Filter | Parker | P00327 | Refrigerant Dryer Filter 1-1/8" | 41 cu. in. | 3 | Copper | 1,2,3 |
| Cast Elbow Suction | Smardt | P04168 | SUCT CAST ELBOW 4" | 2-5/8in to 4in | 11.22 | Cast Aluminum | 2 |
| | | P03658 | SUCT CAST ELBOW 6" | 3in to 6in | 20.46 | Cast Aluminum | 1 |
| | | P05047 | SUCT CAST ELBOW 10" | 6in to 9.75in | 61.82 | Cast Aluminum | 3 |
| Cast Elbow Discharge | Smardt | P03235 | DISCH. CAST ELBOW 3-1/8" | 2.125in to 3.125in | 11.44 | Cast Aluminum | 1,2 |
| | | P05046 | DISCH. CAST ELBOW 6" | 4in to 5.75in | 31.68 | Cast Aluminum | 3 |

**Table 2, Continued – Summary of Certified Subcomponents**

## OSHPD Special Seismic Certification Summary of Certified Subcomponents

**Manufacturer:** SMARDT, Inc.

**Product Line:** Water-cooled Chiller

**Seismic Certification Limits:**

$S_{DS}$ = 1.96, z/h = 1.0, $I_p$ = 1.5

| Component Type | Manufacturer | Model or Part Number | Description | Size (L x W x H) | Weight (lbs) | Material | UUT |
|---|---|---|---|---|---|---|---|
| Evaporators | SMARDT | WA026 | Shell and Tube - Flooded | 78"L x 20"D | 2600 | Carbon Steel | 1 |
| | SMARDT | WB044 | Shell and Tube - Flooded | 126"L x 22"D | 3780 | Carbon Steel | Interpolated |
| | SMARDT | WB095 | Shell and Tube - Flooded | 126"L x 26"D | 5000 | Carbon Steel | Interpolated |
| | SMARDT | WB120 | Shell and Tube - Flooded | 157"L x 26"D | 6150 | Carbon Steel | Interpolated |
| | SMARDT | WA130 | Shell and Tube - Flooded | 142"L x 26"D | 5450 | Carbon Steel | Interpolated |
| | SMARDT | WB130 | Shell and Tube - Flooded | 126"L x 26"D | 5080 | Carbon Steel | Interpolated |
| | SMARDT | WB140 | Shell and Tube - Flooded | 142"L x 30"D | 5760 | Carbon Steel | Interpolated |
| | SMARDT | WB180 | Shell and Tube - Flooded | 197"L x 28"D | 8900 | Carbon Steel | Interpolated |
| | SMARDT | WA190 | Shell and Tube - Flooded | 157"L x 30"D | 8620 | Carbon Steel | Interpolated |
| | SMARDT | WB190 | Shell and Tube - Flooded | 157"L x 30"D | 7900 | Carbon Steel | Interpolated |
| | SMARDT | WA200 | Shell and Tube - Flooded | 157"L x 30"D | 9550 | Carbon Steel | Interpolated |
| | SMARDT | WB200 | Shell and Tube - Flooded | 157"L x 30"D | 7900 | Carbon Steel | Interpolated |
| | SMARDT | WA240 | Shell and Tube - Flooded | 197"L x 32"D | 10170 | Carbon Steel | 2 |
| | SMARDT | WB240 | Shell and Tube - Flooded | 197"L x 32"D | 9050 | Carbon Steel | Interpolated |
| | SMARDT | WA260 | Shell and Tube - Flooded | 157"L x 32"D | 11120 | Carbon Steel | Interpolated |
| | SMARDT | WB260 | Shell and Tube - Flooded | 197"L x 30"D | 17470 | Carbon Steel | Interpolated |
| | SMARDT | WB340 | Shell and Tube - Flooded | 236"L x 34"D | 11500 | Carbon Steel | Interpolated |
| | SMARDT | WB400 | Shell and Tube - Flooded | 197"L x 40"D | 14500 | Carbon Steel | Interpolated |
| | SMARDT | WB500 | Shell and Tube - Flooded | 197"L x 44"D | 17680 | Carbon Steel | 3 |
| Condensers | SMARDT | WA026 | Shell and Tube - Flooded | 78"L x 16"D | 2050 | Carbon Steel | 1 |
| | SMARDT | WB044 | Shell and Tube - Flooded | 126"L x 16"D | 2750 | Carbon Steel | Interpolated |
| | SMARDT | WB095 | Shell and Tube - Flooded | 126"L x 20"D | 3750 | Carbon Steel | Interpolated |
| | SMARDT | WB120 | Shell and Tube - Flooded | 157"L x 22"D | 5550 | Carbon Steel | Interpolated |
| | SMARDT | WA130 | Shell and Tube - Flooded | 142"L x 22"D | 3900 | Carbon Steel | Interpolated |
| | SMARDT | WB130 | Shell and Tube - Flooded | 126"L x 20"D | 3780 | Carbon Steel | Interpolated |
| | SMARDT | WB140 | Shell and Tube - Flooded | 142"L x 26"D | 4950 | Carbon Steel | Interpolated |
| | SMARDT | WB180 | Shell and Tube - Flooded | 197"L x 24"D | 7650 | Carbon Steel | Interpolated |
| | SMARDT | WA190 | Shell and Tube - Flooded | 157"L x 24"D | 8100 | Carbon Steel | Interpolated |
| | SMARDT | WB190 | Shell and Tube - Flooded | 157"L x 24"D | 6650 | Carbon Steel | Interpolated |
| | SMARDT | WA200 | Shell and Tube - Flooded | 157"L x 24"D | 6650 | Carbon Steel | Interpolated |
| | SMARDT | WB200 | Shell and Tube - Flooded | 157"L x 24"D | 6650 | Carbon Steel | Interpolated |
| | SMARDT | WA240 | Shell and Tube - Flooded | 197"L x 26"D | 8520 | Carbon Steel | 2 |
| | SMARDT | WB240 | Shell and Tube - Flooded | 197"L x 26"D | 7950 | Carbon Steel | Interpolated |
| | SMARDT | WA260 | Shell and Tube - Flooded | 157"L x 26"D | 11950 | Carbon Steel | Interpolated |
| | SMARDT | WB260 | Shell and Tube - Flooded | 197"L x 26"D | 13350 | Carbon Steel | Interpolated |
| | SMARDT | WB340 | Shell and Tube - Flooded | 236"L x 32"D | 12150 | Carbon Steel | Interpolated |
| | SMARDT | WB400 | Shell and Tube - Flooded | 197"L x 32"D | 11550 | Carbon Steel | Interpolated |
| | SMARDT | WB500 | Shell and Tube - Flooded | 197"L x 36"D | 15500 | Carbon Steel | 3 |

**Table 3 – UUT-1 Product Summary**

## OSHPD Special Seismic Certification
## Unit Under Test Summary
## UUT-1

| | |
|---|---|
| **Unit Number:** | UUT-1 |
| **Manufacturer:** | SMARDT Inc. |
| **Product Line:** | Water Cooled Chiller |
| **Product Description:** | 'S' Configuration water-cooled centrifugal chiller design consists of a shell and tube evaporator, shell and tube condenser, twin turbine centrifugal compressors, compressor controllers, hot gas bypass valves, refrigerant level sensors, electronic expansion valves, interconnecting refrigerant piping, and safety features such as triple freeze protection. Chiller Model WA240 |

**Product Construction Summary:**
Carbon steel

**Options and Sub-component Summary:**
Provided in Table 4

### Unit Properties

| Operating Weight (lbs) | Length (in) | Width (in) | Height (in) |
|---|---|---|---|
| 21,000 | 239 | 87 | 78 |

| | |
|---|---|
| **Unit Mounting:** | Rigidly mounted to shake table with ½" thick neoprene pad and (14) 1-1/8" diameter steel bolts per leg (28 bolts total) through 1" steel base plate |

### 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 |

*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 SMARDT at their factory.

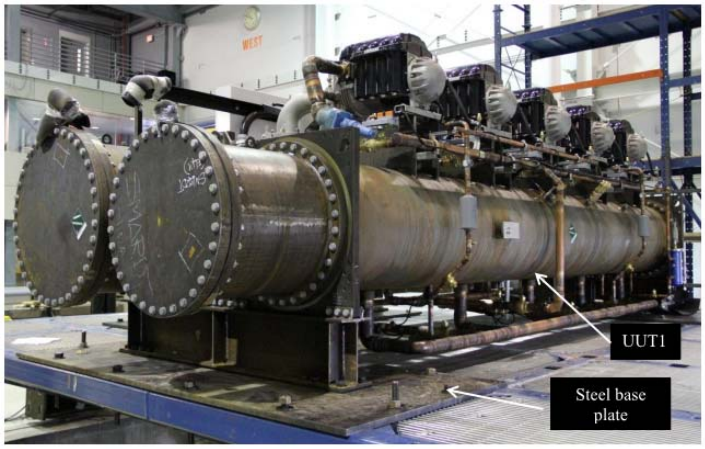


**Figure 1 – UUT-1 Test Configuration**

**Table 4 – Summary of Tested Subcomponents for UUT-1**

| DESCRIPTION | PART NUMBER | MANUFACTURER |
|---|---|---|
| **UUT-1** | | |
| Evap Assy VVA240,5HG5.22S | P01519 | SMARDT |
| Cond Assy WA240.5HG5.22S | P01520 | SMARDT |
| Seismic SxS Bracket | M01997 | SMARDT |
| VVboxiMAR Assy 26" | MO2209 | SMARDT |
| 'Nbox/MAR Assy 30" | MO2211 | SMARDT |
| Std Wbox Assy 26" | M00440 | SMARDT |
| Std VVbox Assy 30" | M01286 | SMARDT |
| Flow Sensor Eflector 300 | P01408 | IFM |
| Differential Pressr Xmtr Dwyer | P00239 | DWYER |
| Seismic Feet Package WA240 | M01999 | SMARDT |
| HGBP WA190, WA240 P&ID | P00816 | SMARDT |
| Disch w/ Staging Ln WA240 | P01328 | SMARDT |
| Liquid Ln VVA240E | P01329 | SMARDT |
| LL Pipe Support | M01998 | SMARDT |
| Float Li WA240 | P01330 | SMARDT |
| MCL WA240 | P01331 | SMARDT |
| Suct Ln WA240 SXS | P01999 | SMARDT |
| Electrical WA240.5HG8.22E (SEISMIC) | E00765 | SMARDT |
| Electrical WA240 (SEISMIC) | E00765 | SMARDT |
| CTRL Panel Box VERIGREEN | E01032 | BEL |
| ELECTRICAL SPL BOX | E00169 | BEL |
| L Box Comp M176 | E00190 | BEL |
| KIT KILTECH CTRL VERIGREEN | E00662 | SMARDT |
| TERMINAL BLOCK TOPJOB SERIES | E01999 | WAGO |
| TT350-G12-1-HL-A-0-NC (7Turn ) | DTC-171269 | DANFOSS-TURBOCOR |
| 71-400-G6-1-ST-C-0-NC 46C Volts | DTC-170396 | DANFOSS-TURBOCOR |
| TT500-G10-1-ST-A-0-NC | DTC-170022 | DANFOSS-TURBOCOR |

**Table 5 – UUT-2 Product Summary**

## OSHPD Special Seismic Certification
## Unit Under Test Summary
## UUT-2

| | |
|---|---|
| **Unit Number:** | UUT-2 |
| **Manufacturer:** | SMARDT Inc. |
| **Product Line:** | Water Cooled Chiller |
| **Product Description:** | 'N' Configuration water-cooled centrifugal chiller design consists of a shell and tube evaporator, shell and tube condenser, twin turbine centrifugal compressor, compressor controller, hot gas bypass valves, refrigerant level sensors, electronic expansion valves, interconnecting refrigerant piping, and safety features such as triple freeze protection. Chiller Model WA026. |

**Product Construction Summary:**
Carbon steel

**Options and Sub-Component Summary:**
Provided in Table 6

### Unit Properties

| Operating Weight (lbs) | Length (in) | Width (in) | Height (in) |
|---|---|---|---|
| 4,700 | 90 | 46 | 80 |

| | |
|---|---|
| **Unit Mounting:** | Rigidly mounted to shake table with ½" thick neoprene pad and (2) 1-1/8" diameter steel bolts per leg (8 bolts total) through 1" steel base plate |

### 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 |

*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 SMARDT at their factory.


**Figure 2- UUT-2 Test Configuration**

**Table 6 – Summary of Tested Subcomponents for UUT-2**

| DESCRIPTION | PART NUMBER | MANUFACTURER |
|---|---|---|
| **UUT-2** | | |
| EvapAssy 20"X71" 170T 2.4P 1B | P01138 | SMARDT |
| CondAssy 16"X71" 182T 4P 1B | P01115 | SMARDT |
| Wbox/MAR Assy 16" | MO2204 | SMARDT |
| Wbox/MAR Assy 20" | MO2206 | SMARDT |
| Std Wbox Assy 16" | M00993 | SMARDT |
| Std Wbox Assy 20" | M00522 | SMARDT |
| Pressur Sw Differential RT262A | P01026 | DANFOSS |
| Foot Chilr SBS SEISMIC | M01217 | SMARDT |
| Suct Ln-VVA030 | P01473 | SMARDT |
| MCL Ln WA030 | P01475 | SMARDT |
| HGBP Ln-WA030 | P01476 | SMARDT |
| Float Ln -WA030 | P01477 | SMARDT |
| Disch Ln WA030 | P01478 | SMARDT |
| Licuid Ln WA030 | P01479 | SMARDT |
| Electrical VVA026 (SEISMIC) | E00630 | SMARDT |
| CTRL Panel Box Boser | E00611 | BEL |
| ELECTRICAL SPL BOX | E00169 | BEL |
| 1 Box Comp M175 | E00988 | BEL |
| TERMINAL BLOCK Z SERIES | E00760 | WEIDMULLER |
| Kit Kiltech CTRL GEN#3 | E00586 | SMARDT |
| TT300-F2-1-ST-C-O-NC 575 Volts | DTC-170388 | DANFOSS-TURBOCOR |

**Table 7 – UUT-3 Product Summary**

## OSHPD Special Seismic Certification
## Unit Under Test Summary
## UUT-3

| | |
|---|---|
| **Unit Number:** | UUT-3 |
| **Manufacturer:** | SMARDT Inc. |
| **Product Line:** | Water Cooled Chiller |
| **Product Description:** | 'S' Configuration water-cooled centrifugal chiller design consists of a shell and tube evaporator, shell and tube condenser, twin turbine centrifugal compressors, compressor controllers, hot gas bypass valves, refrigerant level sensors, electronic expansion valves, interconnecting refrigerant piping, and safety features such as triple freeze protection. Chiller Model WB500. |

**Product Construction Summary:**
Carbon steel

**Options and Sub-Component Summary:**
Provided in Table 8

### Unit Properties

| Operating Weight (lbs) | Length (in) | Width (in) | Height (in) |
|---|---|---|---|
| 42,800 | 229 | 113 | 106 |

| | |
|---|---|
| **Unit Mounting:** | Rigidly mounted to shake table with ½" neoprene pad and (8) 1-1/8" diameter steel bolts per leg (16 bolts total) through steel frame |

### 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) |
|---|---|---|---|---|---|---|
| 1.96 | 1.5 | 1.0 | 2.35 | 3.14 | 0.53 | 1.31 |

*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 SMARDT at their factory.


**Figure 3 UUT-3 Test Configuration**

**Table 8 – Summary of Tested Subcomponents for UUT-3**

| DESCRIPTION | PART NUMBER | MANUFACTURER |
|---|---|---|
| **UUT-3** | | |
| EVAP ASSY 44"x197" 504TB 4VTT+1H | M07966 | SMARDT |
| COND ASSY 36"x197" 606TB 4VTT+1H | M07972 | SMARDT |
| ECONO 16" ASSY 1200mm DISH HD WV500 | M07976 | SMARDT |
| EVAP WBOX ASSY 44" 504TB 2P 14" | M07986 | SMARDT |
| EVAP WBOX ASSY 44" 2P RET | M07989 | SMARDT |
| COND WBOX ASSY 36" 607TB 2P 12" | M07995 | SMARDT |
| COND WBOX ASSY 36" 2P RET | M07996 | SMARDT |
| MCL-1 WV500.4UXX | P04574 | SMARDT |
| MCL-2 WV500.4UXX | P04575 | SMARDT |
| MCL-RET-1 WV500.4UXX | P04577 | SMARDT |
| MCL-RET-2 WV500.4UXX | P04578 | SMARDT |
| DISCH LN - 01 WV500.4UXX | P04581 | SMARDT |
| DISCH LN - 02 WV500.4UXX | P04582 | SMARDT |
| FLOAT LN WV500.4UXX | P04583 | SMARDT |
| SUCT - 1 LN WV500.4UXX | P04584 | SMARDT |
| SUCT - 2 LN WV500.4UXX | P04585 | SMARDT |
| LIQUID LN WV500.4UXX | P04586 | SMARDT |
| STAGING LN - 1 WV500.4UXX | P04587 | SMARDT |
| STAGING LN - 2 WV500.4UXX | P04588 | SMARDT |
| ECONO LN WV500.4UXX | P04589 | SMARDT |
| Press Switch MPS-26/50 | E01116 | SAGINOMIYA |
| Water Proo Pres Sw MPS-130/174 | E01117 | SAGINOMIYA |
| KILTECH KIT | E05450 | KILTECH |
| Box EMI/Filter Encl | E01913 | TECHNOCONTACT |
| WV500.4UXX.2B2BS-P1859 ELECTRICAL | W00710-E | SMARDT |
| COMPRESSOR VTT1200C5S-00A0001 | DTC-VTT1200C5S | DANFOSS |
| COMPRESSOR TT400-G-1-ST-E-O-NC | DTC-196146 | DANFOSS |

**Table 9 – Summary of UUT Resonant Frequencies**

| UUT | Longitudinal (x-direction) | Lateral (y-direction) | Vertical (z-direction) |
|---|---|---|---|
| UUT-1 | 8.4 Hz | 4.9 Hz | 8.0 Hz |
| UUT-2 | 7.8 Hz | 11.3 Hz | 13.6 Hz |
| UUT-3 | 9.3 Hz | 9.5 Hz | 8.7 Hz |

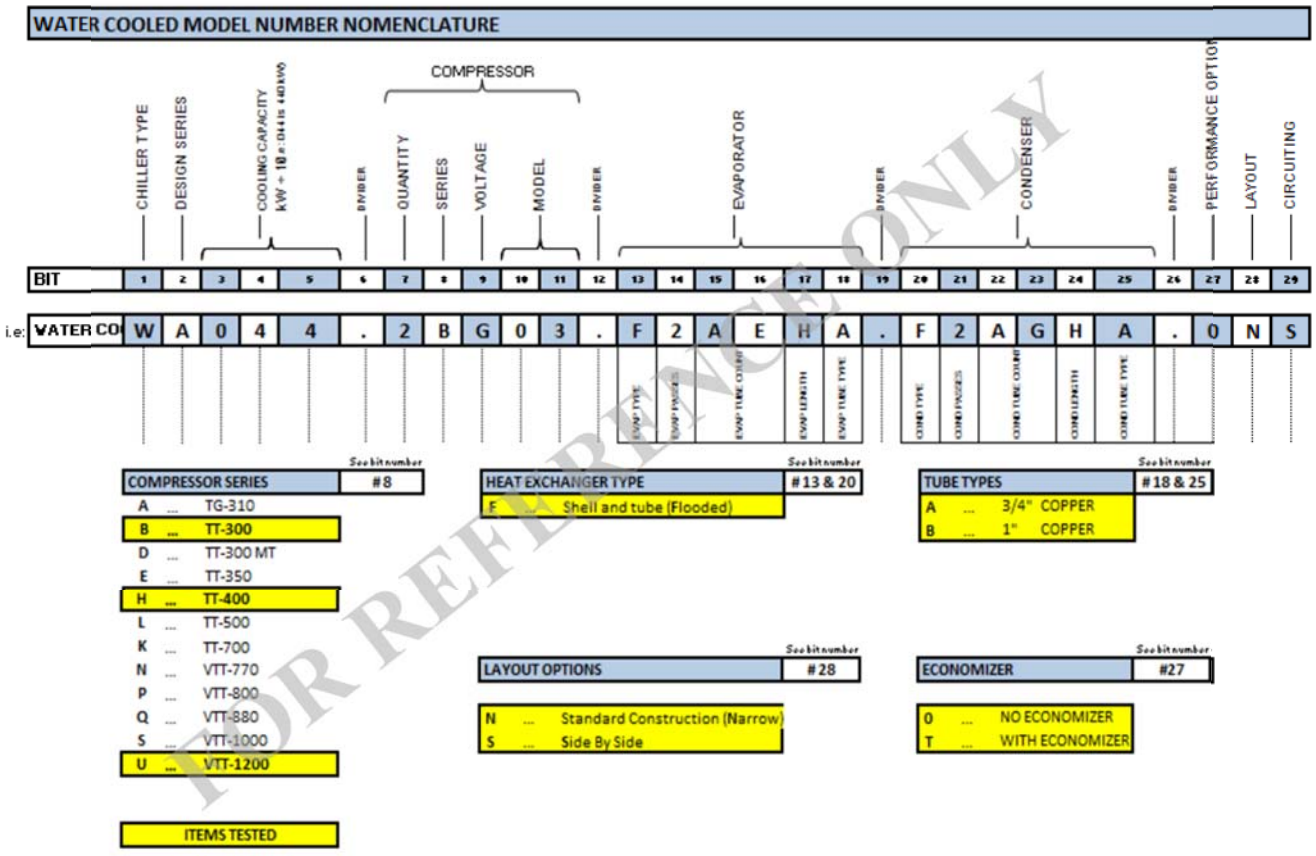


**Figure 4 – SMARDT Water-Cooled Chiller Model Number Nomenclature for Reference Only**