Facilities Development Division www.oshpd.ca.gov/fdd
400 R Street. Suite 200, Sacramento, California 95811-6213 Phone (916) 440-8300 Fax (916) 654-2973

APPLICATION FOR PREAPPROVAL

SPECIAL SEISMIC CERTIFICATION OF EQUIPMENT AND COMPONENTS

For Office Use Only

APPLICATION NO.

OSP-0181-10

Check whether application is: NEW [X] RENEWAL [ ]

1.0

AAON, Inc
Manufacturer

C. Hunter Mattocks
Manufacturer's Technical Representative

2425 South Yukon Avenue, Tulsa, OK 94107-2728
Mailing Address

918.583.2266
Telephone

hunterm@aaon.com
E-mail Address

2.0

CB/CC Condensing Units & LC Chillers
Product Name

Condensers & Chillers
Product Type

Various (See Attachment)
Product model No (List all unique product identification numbers and/or serial numbers)

General Description: Galvanized steel panel cabinets w/ internal & external components as outlined in Attachment A. 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.

3.0

Tobolski Watkins Engineering, Inc.
Applicant Company Name

Matthew J. Tobolski, Ph.D., S.E.
Contact Person

9246 Lightwave Avenue, San Diego, CA 92123
Mailing Address

858.381.5843
Telephone

mtobolski@tobolskiwatkins.com
E-mail Address

I hereby agree to reimburse the Office of Statewide Health Planning and Development for the actual costs incurred by the department for review.

Signature of Applicant

03/14/12
Date

President & CEO
Title

Tobolski Watkins Engineering, Inc.
Company Name

4.0 ***Registered Design Professional Preparing the Report***

Tobolski Watkins Engineering Inc.
Company Name

Daniel A. Junker, P.E. — *Contact Name*
C 78406 — *California License Number*

9246 Lightwave Avenue, San Diego, CA 92123
Mailing Address

858.381.5843 — *Telephone*
djunker@tobolskiwatkins.com — *E-mail Address*

5.0 ***California Licensed Structural Engineer Review and Acceptance of the Report***

Tobolski Watkins Engineering Inc.
Company Name

Matthew J Tobolski, Ph.D., S.E. — *Contact Name*
S 5648 — *California License Number*

9246 Lightwave Avenue, San Diego, CA 92123
Mailing Address

858.381.5843 — *Telephone*
mtobolski@tobolskiwatkins.com — *E-mail Address*

6.0 ***Anchorage Pre-Approval***

☐ *Anchorage is pre-approved under OPA-*
(Separate application for anchorage pre-approval is required)

☒ Anchorage is not Pre-approved

7.0 ***Certification Method***

☐ *Testing in accordance with:* ☒ *ICC-ES AC-156* ☐ *Other (Please Specify):*

☐ *Analysis*
☐ *Experience data*
☐ *Combination of Testing, Analysis, and/or Experience Data (Please Specify):*

8.0 ***Testing Laboratory (if applicable)***

Clark Dynamic Test Laboratory, Inc. — *Company Name*
J.R. Antenucci — *Contact Name*

1801 Route 51 South, Building 8, Jefferson Hills, PA 15025
Mailing Address

412.387.1001 — *Telephone*
jrantenucci@clarkdynamic.com — E-mail:

9.0 ***Approval Parameters***

Design in accordance with ASCE 7-05 Chapter 13: ☒ Yes ☐ No

Design Basis of Equipment or Components (F_p/W_p) = ***1.80***

S_{DS} (Spectral response acceleration at short period) = ***2.5g***

a_p (In-structure equipment or component amplification factor) = ***1.0***

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

I_p (Importance factor) = ***1.5***

z/h (Height factor ratio)= ***1.0***

Equipment or Component fundamental period(s) = ***[See Attachment]***

Building period limits (if any) = ***None***

Overall dimensions and weight (or range thereof) = ***[See Attachment]***

Equipment or Components @ grade designed in accordance with ASCE 7-05 Chapter 15: ☐ Yes ☒ No

Design Basis of Equipment or Components (V/W) =

S_{DS} (Spectral response acceleration at short period) =

S_1 (Spectral response acceleration at 1 second period) =

R (Response modification coefficient)=1.0

Ω_0 (System overstrength factor) =1.0

C_d (Deflection amplification factor) =1.0

I_p (Importance factor) =1.5

Height to Center of Gravity above base =

Equipment or Component fundamental period(s) = Sec

Overall dimensions and weight (or range thereof) =

Tank(s) designed in accordance with ASME BPVC, 2007: ☐ Yes ☒ No

10.0 ***List of attachments supporting the special seismic certification of equipment or components:***

☒ *Test Report* ☐ *Drawings* ☐ *Manufacturer's Catalog*

☐ *Calculations* ☒ *Others (Please Specify):* ***Attachment A***

11.0 ***OSHPD Approval*** *(For Office Use Only)*

5/3/2012	**December 31, 2016**
Signature & Date	*Approval Expiration Date*
M. R. Karim, SHFR	S_{DS} (g) = **2.5** z/h = **1.0**
Name & Title	*Special Seismic Certification Valid Up to*

Condition of Approval (if any):

TOBOLSKI WATKINS ENGINEERING

UUT – 9

UNIT UNDER TEST (UUT) Summary Sheet

TWEI Project No.: 2010-0112-CO-005

Manufacturer: AAON

Model Line: CB/CC Packaged Condensing Units

Model Number: CC-B-002 (CC-B-002-1-B-1:BG00000)

Product Construction Summary:
Painted carbon steel enclosure.

Options/Subcomponent Summary:
Compressor: Copeland ZPS20K4E; **Fan Motor:** GE 1/2HP; **Fan:** LAU T12E07A; **Coil:** 3 Row Tube and Fin; **Heat Exchanger:** None; **Controls:** None; **VFD:** None; **Pump:** None; **Sensors:** JCI P352PN-4C

* Internal Components 208/230V
* Where applicable, components were filled with contents during seismic testing
*Unit satisfied post-test structural integrity and functionality requirements

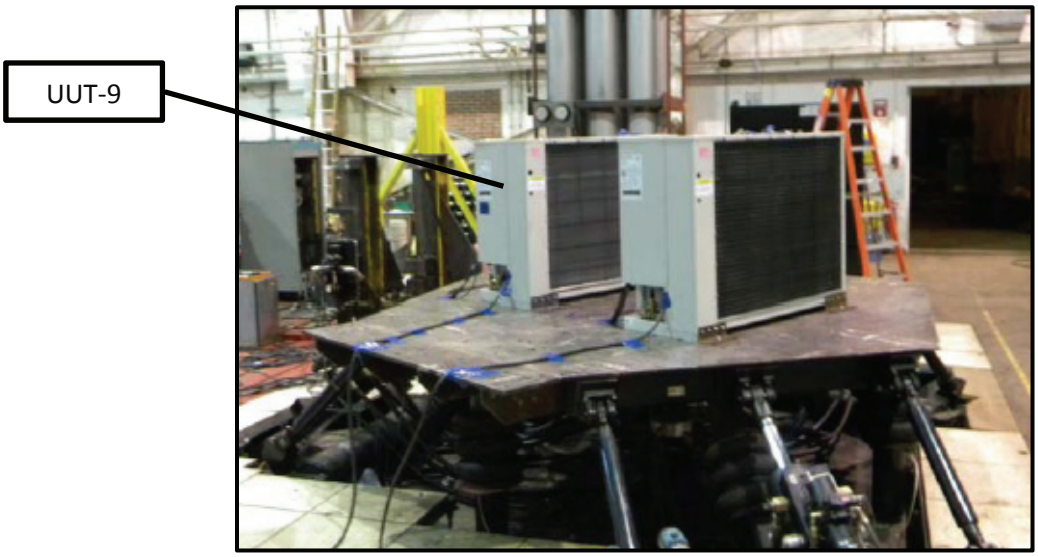
UUT Properties

Weight (lb)	Dimensions (in)			Lowest Natural Frequency (Hz)		
	Depth	Width	Height	Front-Back	Side-Side	Vertical
325	20.19	50.13	38.56	25.1	11.8	N/A

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 2010	ICC-ES AC 156	2.5	1.0	1.5	4.0	3.0	1.67	0.67

Test Mounting Details:



Unit mounted to shake table platen using (4) ½”-13 Grade 5 bolts.

© 2010 Tobolski Watkins Engineering, Inc.

TOBOLSKI WATKINS ENGINEERING

UUT – 10

UNIT UNDER TEST (UUT) Summary Sheet

TWEI Project No.: 2010-0112-CO-005

Manufacturer: AAON

Model Line: CB/CC Packaged Condensing Units

Model Number: CC-B-005 (CC-B-005-3-B-1:0DB000X)

Product Construction Summary:
Painted carbon steel enclosure.

Options/Subcomponent Summary:
Compressor: Copeland ZPS51K4E; **Fan Motor:** GE 1/2HP; **Fan:** LAU 6123840001; **Coil:** Delphi Microchannel; **Heat Exchanger:** None; **Controls:** None; **VFD:** None; **Pump:** None; **Sensors:** JCI P352PN-4C

* Internal Components 460V
* Where applicable, components were filled with contents during seismic testing
*Unit satisfied post-test structural integrity and functionality requirements

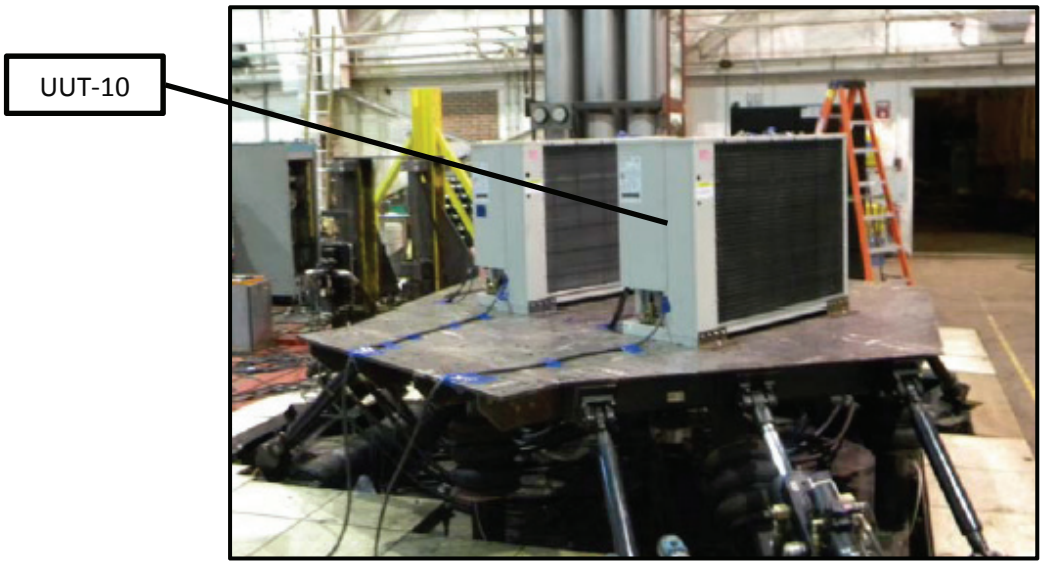
UUT Properties

Weight (lb)	Dimensions (in)			Lowest Natural Frequency (Hz)		
	Depth	Width	Height	Front-Back	Side-Side	Vertical
330	20.19	50.13	38.56	15.4	11.2	12.6

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 2010	ICC-ES AC 156	2.5	1.0	1.5	4.0	3.0	1.67	0.67

Test Mounting Details:



Unit mounted to shake table platen using (4) ½”-13 Grade 5 bolts.

© 2010 Tobolski Watkins Engineering, Inc.

TOBOLSKI WATKINS ENGINEERING, INC. - 858-381-5843 - INFO@TOBOLSKIWATKINS.COM

TOBOLSKI WATKINS ENGINEERING

UUT – 11

UNIT UNDER TEST (UUT) Summary Sheet

TWEI Project No.: 2010-0112-CO-005

Manufacturer: AAON

Model Line: LC Packaged Chiller Units

Model Number: LC-005 (LC-005-3-0-AA0B-000:BKDA-0EA-000-000-00A0000-00-00000000X)

Product Construction Summary:
Painted carbon steel enclosure.

Options/Subcomponent Summary:
Compressor: Copeland ZPS34K5E; **Fan Motor:** Regal Beloit 1HP; **Fan:** LAU T12E10A; **Coil:** 2 Row Tube and Fin; **Heat Exchanger:** SWEP DB200x26; **Controls:** MCS & Evolution; **VFD:** None; **Pump:** Armstrong 1/2HP; **Sensors:** MCS & Copeland

* Internal Components 460V
* Where applicable, components were filled with contents during seismic testing
*Unit satisfied post-test structural integrity and functionality requirements

UUT Properties

Weight (lb)	Dimensions (in)			Lowest Natural Frequency (Hz)		
	Depth	Width	Height	Front-Back	Side-Side	Vertical
930	55.0	42.0	45.0	10.7	22.5	N/A

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 2010	ICC-ES AC 156	2.5	1.0	1.5	4.0	3.0	1.67	0.67

Test Mounting Details:

Unit mounted to shake table platen using (4) ½”-13 Grade 5 bolts.

© 2010 Tobolski Watkins Engineering, Inc.

TOBOLSKI WATKINS ENGINEERING

UUT – 12

UNIT UNDER TEST (UUT) Summary Sheet

TWEI Project No.: 2010-0112-CO-005

Manufacturer: AAON

Model Line: LC Packaged Chiller Units

Model Number: LC-007 (LC-007-3-0-AA0A-000:0000-0A0-000-000-A000000-00-00000000B)

Product Construction Summary:
Painted carbon steel enclosure.

Options/Subcomponent Summary:
Compressor: Copeland ZPS42K5E; **Fan Motor:** Regal Beloit 1HP; **Fan:** LAU T12E10A; **Coil:** Delphi Microchannel; **Heat Exchanger:** Standard Refrigeration Shell and Tube TX4503E22T; **Controls:** MCS & Evolution; **VFD:** None; **Pump:** None; **Sensors:** MCS

* Internal Components 460V
* Where applicable, components were filled with contents during seismic testing
*Unit satisfied post-test structural integrity and functionality requirements

UUT Properties

Weight (lb)	Dimensions (in)			Lowest Natural Frequency (Hz)		
	Depth	Width	Height	Front-Back	Side-Side	Vertical
2,005	86.0	44.0	50.0	7.3	19.9	N/A

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 2010	ICC-ES AC 156	2.5	1.0	1.5	4.0	3.0	1.67	0.67

Test Mounting Details:

Unit mounted to shake table platen using (4) ½”-13 Grade 5 bolts.

© 2010 Tobolski Watkins Engineering, Inc.

TOBOLSKI WATKINS ENGINEERING

UUT – 13

UNIT UNDER TEST (UUT) Summary Sheet

TWEI Project No.: 2010-0112-CO-005

Manufacturer: AAON

Model Line: LC Packaged Chiller Units

Model Number: LC-029 (LC-029-3-0-AA0D-000:0000-0AB-000-000-00A0000-00-00000000B)

Product Construction Summary:
Painted carbon steel enclosure.

Options/Subcomponent Summary:
Compressor: Copeland ZPS34K5E; **Fan Motor:** Regal Beloit 1HP; **Fan:** LAU T12E10A; **Coil:** 4 Row Tube and Fin; **Heat Exchanger:** Standard Refrigeration & Tube TXG1003A22R; **Controls:** MCS & Evolution; **VFD:** None; **Pump:** None; **Sensors:** MCS & Copeland

* Internal Components 460V
* Where applicable, components were filled with contents during seismic testing
*Unit satisfied post-test structural integrity and functionality requirements

UUT Properties

Weight (lb)	Dimensions (in)			Lowest Natural Frequency (Hz)		
	Depth	Width	Height	Front-Back	Side-Side	Vertical
2,695	105.0	78.0	59.0	7.1	16.8	24.7

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 2010	ICC-ES AC 156	2.5	1.0	1.5	4.0	3.0	1.67	0.67

Test Mounting Details:

Unit mounted to shake table platen using (6) ½”-13 Grade 5 bolts.

© 2010 Tobolski Watkins Engineering, Inc.

TOBOLSKI WATKINS ENGINEERING

UUT – 14

UNIT UNDER TEST (UUT) Summary Sheet

TWEI Project No.: 2010-0112-CO-005

Manufacturer: AAON

Model Line: LC Packaged Chiller Units

Model Number: LC-029 (LC-029-2-0-AA0C-000:BNPH-0E0-000-000-000000C-00-00000000X)

Product Construction Summary:
Painted carbon steel enclosure.

Options/Subcomponent Summary:
Compressor: Copeland ZPS34K5E; **Fan Motor:** Regal Beloit 1HP; **Fan:** LAU T12E10A; **Coil:** Delphi Microchannel; **Heat Exchanger:** None; **Controls:** MCS; **VFD:** Yaskawa CIMR-VU2A0030FAA; **Pump:** Armstrong 7.5 HP; **Sensors:** MCS & Copeland

* Internal Components 208/230V
* Where applicable, components were filled with contents during seismic testing
*Unit satisfied post-test structural integrity and functionality requirements

UUT Properties

Weight (lb)	Dimensions (in)			Lowest Natural Frequency (Hz)		
	Depth	Width	Height	Front-Back	Side-Side	Vertical
2,650	105.0	78.0	59.0	5.6	17.6	14.9

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 2010	ICC-ES AC 156	2.5	1.0	1.5	4.0	3.0	1.67	0.67

Test Mounting Details:

Unit mounted to shake table platen using (14) ½”-13 Grade 5 bolts.

© 2010 Tobolski Watkins Engineering, Inc.

TOBOLSKI WATKINS ENGINEERING

UUT – 15

UNIT UNDER TEST (UUT) Summary Sheet

TWEI Project No.: 2010-0112-CO-005

Manufacturer: AAON

Model Line: LE Packaged Chiller Units

Model Number: LE-037

Product Construction Summary:
Painted carbon steel enclosure.

Options/Subcomponent Summary:
Compressor: Copeland ZPT36MCE; **Fan Motor:** Regal Beloit 1HP; **Fan:** LAU T10HS8-2634; **Coil:** 4 Row Tube and Fin; **Heat Exchanger:** SWEP F200x76; **Controls:** MCS & Evolution; **VFD:** Yaskawa CIMR-VU4A0002FAA; **Pump:** Armstrong 3/4 HP; **Sensors:** MCS & Copeland

* Internal Components 208/230V
* Where applicable, components were filled with contents during seismic testing
*Unit satisfied post-test structural integrity and functionality requirements

UUT Properties

Weight (lb)	Dimensions (in)			Lowest Natural Frequency (Hz)		
	Depth	Width	Height	Front-Back	Side-Side	Vertical
8,715	105.0	78.0	72.0	11.1	5.4	14.8

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 2010	ICC-ES AC 156	2.5	1.0	1.5	4.0	3.0	1.67	0.67

Test Mounting Details:

Unit mounted to shake table platen using (32) 3/8”-13 Grade 5 bolts.

© 2010 Tobolski Watkins Engineering, Inc.

TOBOLSKI WATKINS ENGINEERING

UUT – 16

UNIT UNDER TEST (UUT) Summary Sheet

TWEI Project No.: 2010-0112-CO-005

Manufacturer: AAON

Model Line: LE Packaged Chiller Units

Model Number: LE-027

Product Construction Summary:
Painted carbon steel enclosure.

Options/Subcomponent Summary:
Compressor: Copeland ZP182KCE; **Fan Motor:** Regal Beloit 1HP; **Fan:** LAU T10HS8-2634; **Coil:** Delphi Microchannel; **Heat Exchanger:** SWEP F120Tx66; **Controls:** MCS & Evolution; **VFD:** Yaskawa CIMR-VU2A0040FAA; **Pump:** Armstrong 7.5HP; **Sensors:** MCS & Copeland
* Internal Components 460V
* Where applicable, components were filled with contents during seismic testing
*Unit satisfied post-test structural integrity and functionality requirements

UUT Properties

Weight (lb)	Dimensions (in)			Lowest Natural Frequency (Hz)		
	Depth	Width	Height	Front-Back	Side-Side	Vertical
6,285	105.0	78.0	59.0	7.5	8.7	13.2

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 2010	ICC-ES AC 156	2.5	1.0	1.5	4.0	3.0	1.67	0.67

Test Mounting Details:

Unit mounted to shake table platen using (24) 3/8”-16 Grade 5 bolts.

© 2010 Tobolski Watkins Engineering, Inc.

TOBOLSKI WATKINS ENGINEERING

Table 1.1

Special Seismic Certification Certified Product Matrix

TWEI Project No.: 2010-0112-CO-009

Manufacturer: AAON

Model Line: CB & CC Packaged Condensing Units

Certified Product Construction Summary:
Galvanized steel panel construction.
*Weights listed below are calculated weights. Actual operating weights may vary +/- 10%.

Certified Options Summary:
Vertical or horizontal discharge and return. Interior corrosion protection. Single or three phase 208, 230, or 460V system.

Certified Mounting Summary:
Rigid Mount. Weight listed below is a maximum weight considering all different internal component selections& does not include curb weight. SEOR to design unit anchorage.

Building Code: CBC 2010 | ***Seismic Certification Limits:*** S_{DS} =2.5g | z/h = 1.0 | I_p = 1.5

Model Line	Model	Dimension (in)			Weight (lb)*	Notes	UUT
		Depth	Width	Height			
CB	CB-B-024	36.28	31.01	36.66	237		
	CB-B-036	36.28	31.01	36.66	237		
	CB-B-048	36.44	37.01	40.46	260		
	CB-B-060	36.44	37.01	40.46	281		
CC	CC-B-002	20.19	50.13	38.56	237		9
	CC-B-003	20.19	50.13	38.56	237		
	CC-B-004	20.19	50.13	38.56	260		
	CC-B-005	20.19	50.13	38.56	281		10
	CC-B-006	42.25	55.25	44.63	534		
	CC-B-007	42.25	55.25	44.63	534		
	CC-B-008	44.25	85.50	50.00	844		
	CC-B-010	44.25	85.50	50.00	854		
	CC-B-014	44.25	98.88	50.00	980		
	CC-B-017	44.25	98.88	50.00	1,054		
	CC-B-022	44.25	98.88	50.00	1,074		
	CC-B-025	44.25	98.88	50.00	1,100		
	CC-B-030	44.25	98.88	50.00	1,160		
	CC-B-031	78.00	105	54.25	2065		
	CC-B-034	78.00	105	54.25	2,095		
	CC-B-045	78.00	105	54.25	2,283		

© 2010 Tobolski Watkins Engineering, Inc.

TOBOLSKI WATKINS ENGINEERING

Table 1.2

Special Seismic Certification Certified Product Matrix

TWEI Project No.: 2010-0112-CO-009

Manufacturer: AAON

Model Line: LC Packaged Chiller Units

Certified Product Construction Summary:
Galvanized steel panel construction.
*Weights listed below are calculated weights. Actual operating weights may vary +/- 10%.

Certified Options Summary:
Vertical or horizontal discharge and return. Interior corrosion protection. Single or three phase 208, 230, or 460V system.

Certified Mounting Summary:
Rigid Mount. Weight listed below is a maximum weight considering all different internal component selections& does not include curb weight. SEOR to design unit anchorage.

Building Code: CBC 2010 | ***Seismic Certification Limits:*** S_{DS} =2.5g | ***z/h*** = 1.0 | I_p = 1.5

Model Line	Model	Dimension (in)			Weight (lb)*	Notes	UUT
		Depth	Width	Height			
LC	LC-005	55	42	45	774		11
	LC-006	55	42	45	804		
	LC-007	86	44	50	1074		12
	LC-008	86	44	50	1098		
	LC-012	99	44	44	1397		
	LC-015	99	44	50	1477		
	LC-019	99	44	50	1503		
	LC-021	99	44	50	1535		
	LC-026	99	44	50	1589		
	LC-027	105	78	59	2501		
	LC-029	105	78	59	2596		13,14

© 2010 Tobolski Watkins Engineering, Inc.

TOBOLSKI WATKINS ENGINEERING, INC. - 858-381-5843 - INFO@TOBOLSKIWATKINS.COM

TOBOLSKI WATKINS ENGINEERING

Table 2.1

Special Seismic Certification Certified Product Matrix

TWEI Project No.: 2010-0112-CO-005

Manufacturer: AAON

Model Line: CB/CC Packaged Condensing Units & LC Packaged Chiller Units

COMPRESSOR DETAIL

Certified Product Construction Summary:
Component construction is specific to model numbers listed below.

Certified Options Summary:
410A Refrigerant, 208/230V-460V, 1 or 3 phase, 50/60Hz

Certified Mounting Summary:
Mounted in Equipment.

Building Code: CBC 2010 | ***Seismic Certification Limits:*** S_{DS} =2.5g | ***z/h*** = 1.0 | I_p = 1.5

Component Manufacturer	Model	Dimension (in)			Weight (lb)*	Notes	UUT
		Depth	Width	Height			
Copeland	ZPS20K4E	9.5	9.5	16.0	67		9
	ZPS30K4E	9.5	9.5	16.0	68.2		
	ZPD34K5E	9.57	9.57	17.66	68.2		11
	ZPS40K4E	9.5	9.5	16.0	68.2		
	ZPD42K5E	9.26	9.26	18.39	68.2		12,13,14
	ZPS51K4E	9.56	9.56	16.94	76.6		10
	ZPD54K5E	9.26	9.26	18.39	76.6		
	ZPT166KCE	24.62	11.56	20.49	147		
	ZPT180KCE	24.66	12.12	20.55	147		
	ZP182KCE	12.83	11.61	21.71	147		16
	ZPD154KCE	12.83	11.61	21.71	147		
	ZPD182KCE	12.83	11.61	21.71	147		
	ZPD120KCE	11.54	11.21	21.00	136		
	ZPDT36MCE	29.37	17.29	23.50	292		15
	ZPDT21MCE	29.37	15.87	22.70	289		
	ZPDT24MCE	29.37	15.87	22.70	289		

© 2010 Tobolski Watkins Engineering, Inc.

TOBOLSKI WATKINS ENGINEERING

Table 2.2

Special Seismic Certification Certified Product Matrix

TWEI Project No.: 2010-0112-CO-005

Manufacturer: AAON

Model Line: CB/CC Packaged Condensing Units & LC Packaged Chiller Units

FAN MOTOR DETAIL

Certified Product Construction Summary:
Component construction is specific to vendor listed below.

Certified Options Summary:
208/230V-460V. 850 to 1800 rpm motors.

Certified Mounting Summary:
Mounted in Equipment.

Building Code: CBC 2010 | ***Seismic Certification Limits:*** S_{DS} = 2.5g | ***z/h*** = 1.0 | I_p = 1.5

Component Manufacturer	Model	Dimension (in)			Weight (lb)*	Notes	UUT
		Depth	Width	Height			
Genteq	0.167 HP	10.5	5.6	5.6	11.8	Certified per OSP-0180-10	
	…						
	1 HP	11.5	5.5	5.5	21.1		
SN-Tech	1/4 HP	10.6	5.2	5.2	11		
	…						
	1 HP	12.4	5.6	5.6	20.2		
Emerson	1/4 HP	10.4	5.6	5.6	14		
	…						
	1 HP	11.7	5.8	5.9	42		
Baldor	1/4 HP	9.5	6.7	10.2	22		
	…						
	1 HP	12.3	10.3	6.8	39		
AO Smith	1/4 HP	8.1	5.7	5.7	16		
	…						
	1 HP	12.6	6.5	6.8	30		
Marathon	1/4 HP	10.9	5.9	7.2	22		
	…						
	1 HP	11.7	5.8	5.9	43		
US Motors	1/4 HP	9.2	5.8	6.2	19		
	…						
	1 HP	12.2	6.6	7.0	35		

© 2010 Tobolski Watkins Engineering, Inc.

TOBOLSKI WATKINS ENGINEERING

Table 3.2

Special Seismic Certification Certified Product Matrix

TWEI Project No.: 2010-0112-CO-005

Manufacturer: AAON

Model Line: CB/CC Packaged Condensing Units & LC Packaged Chiller Units

FAN MOTOR DETAIL

Certified Product Construction Summary:
Component construction is specific to vendor listed below.

Certified Options Summary:
208/230/460 voltage corresponding to overall unit voltage presented in UUT Summaries. 850 to 1800 rpm motors.

Certified Mounting Summary:
Mounted to manufacturers fabricated fan assembly.

Building Code: CBC 2010 | ***Seismic Certification Limits:*** S_{DS} = 2.5g | ***z/h*** = 1.0 | I_p = 1.5

Component Manufacturer	Model	Dimension (in)			Weight (lb)*	Notes	UUT
		Depth	Width	Height			
GE	1/3 HP	5.5	5.5	11.0	14	Smallest	
	…						
	1/2 HP	5.5	5.5	11.0	17	Tested	9,10
	…						
	1/2 HP	5.5	5.5	11.0	17	Largest	
Regal Beloit	1/2 HP	5.5	5.5	11.0	16	Smallest	
	…						
	1 HP	5.5	5.5	11.0	32	Tested	11,12,13,14,15,16
	…						
	1 HP	5.5	5.5	11.0	32	Largest	

© 2010 Tobolski Watkins Engineering, Inc.

TOBOLSKI WATKINS ENGINEERING

Table 2.3

Special Seismic Certification Certified Product Matrix

TWEI Project No.: 2010-0112-CO-005

Manufacturer: AAON

Model Line: CB/CC Packaged Condensing Units & LC Packaged Chiller Units

FAN DETAIL

Certified Product Construction Summary:

Certified Options Summary:
All fans listed below are direct drive.

Certified Mounting Summary:
Mounted in Equipment.

Building Code: CBC 2010 | ***Seismic Certification Limits:*** S_{DS} =2.5g | ***z/h*** = 1.0 | I_p = 1.5

Component Manufacturer	Model	Dimension (in)			Weight (lb)*	Notes	UUT
		Diam	Blades	Width			
LAU	T12E07A	22.0	3	8.0	2.1		9
	6088190	22.0	3	8.0	2.1		
	T5082630	26.0	3	8.0	2.3		
	6123840001	26.0	3	8.0	2.3		10
	T2603-30	26.0	3	8.0	2.3		
	T10S082638	26.0	3	8.0	2.3		
	T10HS8-2634	26.0	3	8.0	2.3		15,16
	T12E10A	30.0	3	8.0	2.6		11,12,13,14

© 2010 Tobolski Watkins Engineering, Inc.

TOBOLSKI WATKINS ENGINEERING

Table 2.4

Special Seismic Certification Certified Product Matrix

TWEI Project No.: 2010-0112-CO-005

Manufacturer: AAON

Model Line: CB/CC Packaged Condensing Units & LC Packaged Chiller Units | ***COIL DETAIL***

Certified Product Construction Summary:
AAON: Copper tube aluminum fin in galvanized steel casing; **Delphi:**All aluminum microchannel construction.

Certified Options Summary:
Tube Wall Thickness: .017-.049 smooth, .012-.016 rifled; **Fin Thickness:** .0060-.0100 aluminum; **Fins per Inch:** 6-24

Certified Mounting Summary:
Mounted in Equipment.

Building Code:CBC 2010 | ***Seismic Certification Limits:*** S_{DS} =2.5g | ***z/h*** = 1.0 | I_p = 1.5

Component Manufacturer	Model	Dimension (in)			Weight (lb)*	Notes	UUT
		Depth	Width	Height			
AAON, Inc. (Tube and Fin)	Coils	1 row	97	36	58	2 - 3 TON CB AC	
		1 row	97	36	58	2 - 3 TON CB HEATPUMP	
		1 row	108	40	70	4 - 5 T CB AC	
		1 row	108	40	70	4 - 5 T CB HEAT PUMP	
		2 row	36.0	34.0	41	6 - 7 TON AC / LC 5-6	11
		2 row	36.0	34.0	41	6 - TON HEAT PUMP	
		2 row	61.0	40.0	77	8 TON AC / LC7	
		2 row	61.0	40.0	77	8 TON HEAT PUMP	
		3 row	43.0	34.0	58	2-3 TON CC AC	
		3 row	43.0	34.0	67	2-3 TON CC HEAT PUMP	9
		3 row	61	40	109	10 TON CC AC / LC 8	
		3 row	59	40	130	10 TON CC HEATPUMP	
		3 row	74.3	40	130	14 - 30 TON CC AC / LC 12 -26	
		3 row	72.3	40	130	14 - 30 TON CC HEATPUMP	
		4 row	43.0	34.0	58	4-5 TON CC AC	
		4 row	43.0	34.0	86	4-5 TON CC HEAT PUMP	
		4 row	79.3	46.0	212	31-34 TON CC AC / LC 27-29	13
		4 row	79.3	46.0	212	31-34 TON CC HEAT PUMP	
		4 row	79.3	60.0	267	40 - 45 TON CC AC / LC 38	
		4 row	79.3	60.0	267	40 - 45 TON CC HEAT PUMP	
		4 row	120	60.0	400	55 - 63 TON CC AC / LC 47 - 54	
		4 row	118	60.0	400	55 -63 TON CC HEAT PUMP	
		4 row	90	44	232	10 - 30 TON LE	15

© 2010 Tobolski Watkins Engineering, Inc.

TOBOLSKI WATKINS ENGINEERING

Table 3.4

Special Seismic Certification Certified Product Matrix

TWEI Project No.: 2010-0112-CO-005

Manufacturer: AAON

Model Line: CB/CC Packaged Condensing Units & LC Packaged Chiller Units | ***COIL DETAIL***

Certified Product Construction Summary:
Delphi: All aluminum microchannel construction.

Certified Options Summary:
Standard construction per MFR.'s standard detailing.

Certified Mounting Summary:
Mounted to AHU cabinetry (walls, roof or floor per MFR.'s Standard details)

Building Code:CBC 2010 | ***Seismic Certification Limits:*** S_{DS} =2.5g | ***z/h*** = 1.0 | I_p = 1.5

Component Manufacturer	Model	Dimension (in)			Weight (lb)*	Notes	UUT
		Depth	Width	Height			
Delphi (Microchannel)	Coils		20.0	15.5	10	Smallest	
					…		
			24.0	74.0	35	Certified per OSP-0180-10	
			61.0	101.25	150		
			33.8	43	30	2-5 Ton CC A/C	10
			33.8	36	24	6-7 Ton CC AC/LC 5-6	
			45.7	79.5	115	31 - 34 Ton CC / LC 27-29	14
			43.9	90	145	10-30 Ton LE	16
			61.0	102.0	150	55-60 Ton CC / LC 47-54	
			61	40.1	100	8 - 10 Ton CC / LC 7-8	12
			74	40.1	110	14 - 24 Ton CC / LC 12-21	
					…		
			74.5	61	115	40- 45 Ton CC / LC 38	

© 2010 Tobolski Watkins Engineering, Inc.

TOBOLSKI WATKINS ENGINEERING, INC. - 858-381-5843 - INFO@TOBOLSKIWATKINS.COM

TOBOLSKI WATKINS ENGINEERING

Table 2.5

Special Seismic Certification Certified Product Matrix

TWEI Project No.: 2010-0112-CO-005

Manufacturer: AAON

Model Line: CB/CC Packaged Condensing Units & LC Packaged Chiller Units

HEAT EXCHANGER DETAIL

Certified Product Construction Summary:
Component construction is specific to model numbers listed below.

Certified Options Summary:
Options are specific to model numbers listed below.

Certified Mounting Summary:
Mounted in Equipment.

Building Code: CBC 2010 | ***Seismic Certification Limits:*** S_{DS} =2.5g | ***z/h*** = 1.0 | I_p = 1.5

Component Manufacturer	Model	Dimension (in)			Weight (lb)*	Notes	UUT
		Depth	Width	Height			
SWEP Brazed Plate Heat Exchanger	DB200 X 18	9.6	2.1	20.7	37		
	DB200 X 26	9.6	2.9	20.7	43		11
	F120T x 66	9.6	7.7	20.7	90		16
	DP200 x 86.1375	9.6	8.3	20.7	99		
	DP200 x 94.1375	9.6	9.0	20.7	107		
	F200 x 76	9.6	7.7	20.7	120		15
Standard Refrigeration Shell and Tube Heat Exchanger	TX4503E22T	41.5	7.50	11.50	180		12
	TX4503D22T	41.5	7.50	11.50	180		
	TX6503A22T	44	10.38	14.00	200		
	TX6503B22T	43.5	10.38	14.00	200		
	TX6503C22T	43.5	10.38	14.00	200		
	TX6503D22T	43.5	10.38	14.00	200		
	TXG8503A22R	43.2	11.63	11.58	220		
	TXG1003A22R	43.8	14.25	14.00	250		13
	QTXG1054-2-410	61.8	14.25	14.25	290		

© 2010 Tobolski Watkins Engineering, Inc.

TOBOLSKI WATKINS ENGINEERING

Table 2.6

Special Seismic Certification Certified Product Matrix

TWEI Project No.: 2010-0112-CO-005

Manufacturer: AAON

Model Line: CB/CC Packaged Condensing Units & LC Packaged Chiller Units

CONTROLLER DETAIL

Certified Product Construction Summary:
Component construction is specific to model numbers listed below.

Certified Options Summary:
208/230V-460V.

Certified Mounting Summary:
Mounted in Equipment.

Building Code: CBC 2010 | ***Seismic Certification Limits:*** S_{DS} =2.5g | ***z/h*** = 1.0 | I_p = 1.5

Component Manufacturer	Model	Dimension (in)			Weight (lb)*	Notes	UUT
		Depth	Width	Height			
MCS Controls	MCS-S116A04-24	10.87	4.00	2.50	2.5		
	MCS-BACNET-ROUTER2	2.3125	4.1875	4.00	1.7		
	MCS-R010	10.87	4.00	2.50	2.2		
	MCS-COMPACT	2.75	2.875	.75	1.7		11,12,13,14,15,16
	MCS-MAGNUM-PANL-24-CD	2.0	12.0	8.0	3.5		11,12,13,15,16
Evolution Controls	ECM-ACU-S1	.6175	2.50	1.70	1.0		11,12,13,15,16
	ECM-CBL-08	72	.139	N/A	1.3		15,16

© 2010 Tobolski Watkins Engineering, Inc.

TOBOLSKI WATKINS ENGINEERING

Table 2.7

Special Seismic Certification Certified Product Matrix

TWEI Project No.: 2010-0112-CO-005

Manufacturer: AAON

Model Line: CB/CC Packaged Condensing Units & LC Packaged Chiller Units | ***VFD DETAIL***

Certified Product Construction Summary:
Component construction is specific to model numbers listed below.

Certified Options Summary:
E7 VFD's are equivalent to Z1000 models. 208/230V-460V.

Certified Mounting Summary:
Mounted in Equipment.

Building Code: CBC 2010 | ***Seismic Certification Limits:*** S_{DS} =2.5g | ***z/h*** = 1.0 | I_p = 1.5

Component Manufacturer	Model	Dimension (in)			Weight (lb)*	HP	Voltage	UUT
		Depth	Width	Height				
Yaskawa Series: E7, J1000, V1000, Z1000 (Certified Models Listed)	CIMR-JU4A0002BAA	3.9	5	4.3	2.7	1	460	Certified per OSP-0180-10
	CIMR-JU4A0004BAA	5.4	5	4.3	3.8	2	460	
	CIMR-JU4A0005BAA	6.1	5	4.3	3.8	3	460	
	CIMR-JU4A0009BAA	6.1	5	4.3	3.8	5	460	
	CIMR-JU4A0011BAA	5.6	5	5.5	5.3	5/7.5	460	
	CIMR-VU4A0002FAA	4.3	4.7	3.8	3.1	1	460	
	CIMR-VU4A0004FAA	4.3	4.7	3.8	4.2	2	460	
	CIMR-VU4A0005FAA	4.3	4.7	3.8	4.2	3	460	
	CIMR-VU4A0009FAA	4.3	4.7	3.8	4.2	5	460	
	CIMR-VU4A0018FAA	5.5	9.8	4.8	8.4	7.5/10	460	
	CIMR-VU4A0023FAA	5.5	9.8	4.8	8.4	15	460	
	CIMR-VU4A0038FAA	7.1	11.2	6.3	12.1	20	460	
	CIMR-E7U40P7	6.3	5.5	11	6.6	1	460	
	CIMR-E7U41P5	6.3	5.5	11	6.6	2	460	
	CIMR-E7U42P2	7.1	5.5	11	6.6	3	460	
	CIMR-E7U43P7	7.1	5.5	11	8.8	5	460	
	CIMR-E7U45P5	7.1	5.5	11	8.8	7.5	460	
	CIMR-E7U47P5	7.9	7.9	11.8	13.2	10	460	
	CIMR-E7U49P0	7.9	7.9	11.8	15.4	15	460	
	CIMR-E7U4011	7.9	7.9	11.8	24.2	20	460	
	CIMR-JU2A0006BAA	5.1	5	4.3	3.8	1	230/208	
	CIMR-JU2A0010BAA	5.1	5	4.3	3.8	2	230/208	
	CIMR-JU2A0012BAA	5.6	5	4.3	3.8	3	230/208	
	CIMR-JU2A0020BAA	5.6	5	5.5	5.3	5	230/208	
	CIMR-VU2A0006FAA	4.3	4.7	3.8	4.2	1	230/208	
	CIMR-VU2A0010FAA	4.3	4.7	3.8	4.2	2	230/208	
	CIMR-VU2A0012FAA	4.3	4.7	3.8	4.2	3	230/208	

© 2010 Tobolski Watkins Engineering, Inc.

TOBOLSKI WATKINS ENGINEERING

Table 2.7

Special Seismic Certification Certified Product Matrix

TWEI Project No.: 2010-0112-CO-005

Manufacturer: AAON

Model Line: CB/CC Packaged Condensing Units & LC Packaged Chiller Units | ***VFD DETAIL***

Certified Product Construction Summary:
Component construction is specific to model numbers listed below.

Certified Options Summary:
E7 VFD's are equivalent to Z1000 models. 208/230V-460V.

Certified Mounting Summary:
Mounted in Equipment.

Building Code: CBC 2010 | ***Seismic Certification Limits:*** S_{DS} =2.5g | ***z/h*** = 1.0 | I_p = 1.5

Component Manufacturer	Model	Dimension (in)			Weight (lb)*	HP	Voltage	UUT
		Depth	Width	Height				
Yaskawa Series: E7, J1000, V1000, Z1000 (Certified Models Listed)	CIMR-VU2A0020FAA	5.5	4.7	5	5.7	5	230/208	Certified per OSP-0180-10
	CIMR-VU2A0030FAA	5.5	9.7	4.8	8.4	7.5	230/208	
	CIMR-VU2A0040FAA	5.5	9.7	4.8	8.4	10	230/208	
	CIMR-VU2A0056FAA	7.1	11.2	6.3	12.1	15	230/208	
	CIMR-VU2A0069FAA	8.7	13.2	7.6	20.3	20	230/208	
	CIMR-E7U20P7	6.3	5.5	11	6.6	1	230/208	
	CIMR-E7U21P5	6.3	5.5	11	6.6	2	230/208	
	CIMR-E7U22P2	6.3	5.5	11	6.6	3	230/208	
	CIMR-E7U23P7	7.1	5.5	11	8.8	5	230/208	
	CIMR-E7U25P5	7.1	5.5	11	8.8	7.5	230/208	
	CIMR-E7U27P5	7.8	7.8	11.8	13.2	10	230/208	
	CIMR-E7U2011	7.8	7.8	12.2	13.2	15	230/208	
	CIMR-E7U2015	8.3	9.5	13.8	13.2	20	230/208	
	CIMR-VU2A0006FAA	5.04	2.68	5.89	2.9	1	230/208	
	CIMR-VU4A0002FAA	3.90	4.25	5.89	3.1	1	460	15
	CIMR-VA2A0010FAA	5.08	4.25	5.89	4.2	2	230/208	
	CIMR-VU4A0004FAA	5.41	4.25	5.89	3.5	2	460	
	CIMR-VU2A0012FAA	5.41	4.25	5.89	4.2	3	230/208	
	CIMR-VU4A0005FAA	6.06	4.25	5.89	4.2	3	460	
	CIMR-ZU4A0005FAA					3	460	
	CIMR-VU2A0020FAA	5.63	5.51	6.02	5.7	5	230/208	
	CIMR-VU4A0009FAA					5	230/208	
	CIMR-VU4A0009FAA	6.06	4.25	5.89	4.2	5	460	

© 2010 Tobolski Watkins Engineering, Inc.

TOBOLSKI WATKINS ENGINEERING

Table 3.7

Special Seismic Certification Certified Product Matrix

TWEI Project No.: 2010-0112-CO-005

Manufacturer: AAON

Model Line: CB/CC Packaged Condensing Units & LC Packaged Chiller Units | ***VFD DETAIL***

Certified Product Construction Summary:
Component construction is specific to model numbers listed below.

Certified Options Summary:
E7 VFD's are equivalent to Z1000 models.

Certified Mounting Summary:
Mounted to AHU cabinet wall.

Building Code: CBC 2010 | ***Seismic Certification Limits:*** S_{DS} =2.5g | ***z/h*** = 1.0 | I_p = 1.5

Component Manufacturer	Model	Dimension (in)			Weight (lb)*	HP	Voltage	UUT
		Depth	Width	Height				
Yaskawa Series: E7, J1000, V1000, Z1000 (Certified Models Listed)	CIMR-ZU4A0008FAA	8.6	4.9	14.1	12.60	5	460	
	CIMR-VU2A0030FAA	5.63	5.51	10.00	5.70	7.5	230/208	14
	CIMR-VU4A0011FAA	5.63	5.51	6.02	5.70	7.5	460	
	CIMR-ZU4A0011FAA	8.6	4.9	14.1	13.40	7.5	460	
	CIMR-VU2A0040FAA	5.51	5.51	10.00	8.40	10	230/208	16
	CIMR-ZU4A0014FAA	9.2	4.9	17.60	16.10	10	460	
	CIMR-VU4A0023FAA	5.51	5.51	10.00	8.40	15	230/208	
	CIMR-ZU4A0021FAA	9.2	4.9	17.60	16.80	15	460	
	CIMR-VU4A0038FAA	6.42	7.09	11.42	12.10	20	230/208	
	CIMR-ZU4A0027FAA	9.2	4.9	17.60	18.50	20	460	

© 2010 Tobolski Watkins Engineering, Inc.

TOBOLSKI WATKINS ENGINEERING

Table 2.8

Special Seismic Certification Certified Product Matrix

TWEI Project No.: 2010-0112-CO-005

Manufacturer: AAON

Model Line: CB/CC Packaged Condensing Units & LC Packaged Chiller Units | ***PUMP DETAIL***

Certified Product Construction Summary:
Component construction is specific to model numbers listed below.

Certified Options Summary:
208/230V-460V.

Certified Mounting Summary:
Mounted in Equipment.

Building Code: CBC 2010 | ***Seismic Certification Limits:*** S_{DS} =2.5g | ***z/h*** = 1.0 | I_p = 1.5

Component Manufacturer	Model	Dimension (in)			Weight (lb)*	Notes	UUT
		Depth	Width	Height			
Armstrong	4382-3X3X6	18.25	23.76	22.19	294	3/4 HP	15
	4380-1.5X1.5X6	9.25	14.25	16.63	254	1/2 HP	11
	4382-3X3X10	25.75	36.76	30.88	750	7.5 HP	16
	4380-2X2X10	13.50	19.00	31.00	680	7.5 HP	14

© 2010 Tobolski Watkins Engineering, Inc.

TOBOLSKI WATKINS ENGINEERING, INC. - 858-381-5843 - INFO@TOBOLSKIWATKINS.COM

TOBOLSKI WATKINS ENGINEERING

Table 2.9

Special Seismic Certification Certified Product Matrix

TWEI Project No.: 2010-0112-CO-005

Manufacturer: AAON

Model Line: CB/CC Packaged Condensing Units & LC Packaged Chiller Units

SENSOR DETAIL

Certified Product Construction Summary:
Component construction is specific to model numbers listed below.

Certified Options Summary:

Certified Mounting Summary:
Mounted in Equipment.

Building Code: CBC 2010 | ***Seismic Certification Limits:*** S_{DS} =2.5g | ***z/h*** = 1.0 | I_p = 1.5

Component Manufacturer	Model	Dimension (in)			Weight (lb)*	Notes	UUT
		Depth	Width	Height			
Johnson Controls, Inc.	P352PN-4C	2.375	2.40	5.0	1.0		9,10
MCS	TI-667A-20	480	.187	N/A	2.6		11,13,14,15,16
	MCS-T100-20	480	.187	N/A	2.6		11,12,13,14,15,16
	MCS-CT300	1.56	2.38	4.00	1.1		14,15,16
	TI-200F-W-20	1.31	2.94	3.31	1.8		14,15,16
	MCS-VOLTAGE	4.00	2.125	1.50	1.0		11,12,13,14,15,16
	MCS-T100-40-A	480	.187	N/A	1.0		11,12,13,14,15,16
	TI-500F-20	240	.875	2.1875	1.5		11,12,13,14,15,16
Copeland	085-0199-00	480	1.00	1.875	2.1		13,14,15,16

© 2010 Tobolski Watkins Engineering, Inc.

TOBOLSKI WATKINS ENGINEERING, INC. - 858-381-5843 - INFO@TOBOLSKIWATKINS.COM

TOBOLSKI WATKINS ENGINEERING

Table 2.10

Special Seismic Certification Certified Product Matrix

TWEI Project No.: 2010-0112-CO-005

Manufacturer: AAON

Model Line: CB/CC Packaged Condensing Units & LC Packaged Chiller Units

EXPANSION VALVE DETAIL

Certified Product Construction Summary:
Component construction is specific to model numbers listed below.

Certified Options Summary:
Expansion valves listed below consist of both Thermal Expansion Valves (TXV) and Electronic Expansion Valves (EXV). These are specific to the model numbers listed below. 208/230V-460V where applicable.

Certified Mounting Summary:
Mounted in Equipment.

Building Code: CBC 2010 | ***Seismic Certification Limits:*** S_{DS} =2.5g | ***z/h*** = 1.0 | I_p = 1.5

Component Manufacturer	Model	Dimension (in)			Weight (lb)	Notes	UTT
		Depth	Width	Height			
Sporlan	CBBIZE-2	1.48	1.94	2.91	0.9		9
	CBBIZE-3	1.48	1.94	2.91	0.9		
	CBBIZE-4	1.48	1.94	2.91	1.2		
	CBBIZE-5	1.48	1.94	2.91	1.2		
	BBIZE-2	1.48	1.94	2.91	0.9		
	BBIZE-3	1.48	1.94	2.91	0.9		11
	BBIZE-4	1.48	1.94	2.91	1.2		12
	BBIZE-5	1.48	1.94	2.91	1.2		
	BBIZE-6	3.33	1.94	2.89	1.6		
	BBIZE-8	3.18	1.94	2.89	1.6		
	BBIZE-12 1/2	4.01	1.94	3.04	1.8		
	OZE-20	4.32	2.31	5.84	2.0		13, 14
	OZE-35	4.48	2.31	5.84	4.0		
	OZE-25	4.48	2.31	5.84	2.0		
	SER-C-3/8" x 5/8"	3.58	1.55	6.2	1.4		
	SER-D-5/8" x 7/8"	4.83	1.55	4.5	1.8		
	SERI-G-7/8" x 1-1/8"	4.73	1.59	8.82	2.3		15,16
	SERI-J-1-1/8" x 1-3/8"	4.89	1.59	9.19	3.2		16

© 2010 Tobolski Watkins Engineering, Inc.

TOBOLSKI WATKINS ENGINEERING, INC. - 858-381-5843 - INFO@TOBOLSKIWATKINS.COM