CL Series
Condensing Units
Engineering Catalog

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Features and Benefits

Flexibility of Design
With model sizes ranging from 45 to 230 tons, Air-cooled and Evaporative-Condensing unit models, and the availability of environmentally friendly R-410A, AAON® CL Series condensing units suit a wide variety of job requirements.

Convenience and Serviceability
The AAON CL Series condensing unit is designed with convenient installation and servicing in mind. AAON offers a wide variety of standard and optional features, including controls and corrosion protection, and all of these components are wired and checked before they are shipped from the factory. Each AAON CL Series condensing unit is delivered to the jobsite ready for connection to the line set, charging, and startup. All models feature lockable, hinged access doors to the unit interior. A lighted walk-in control vestibule provides indoor access to controls components, the electrical system and compressors. All components are labeled and connected with color-coded wiring to match the wiring diagram.

Reliability
The cabinet's composite construction, galvanized G-90 steel paneling surrounding sound dampening foam, provides strength, rigidity and excellent acoustical characteristics. Corrosion resistant external polyurethane coating surpasses 2,500 hour salt spray testing. The evaporative-condensing unit is factory equipped with a three tank water treatment system (2 biocide, 1 scale protection) to maintain clean and efficient operation, and all wetted surfaces are 304 stainless steel, copper, or other non-corrosive material. The air-cooled condenser is slope mounted to reduce any potential fin damage, and additional coil protection is offered with corrosion resistant polymer e-coating as an optional feature. AAON integrates the latest in scroll compressor technology into its all of its products for greater operational reliability than comparable reciprocating compressors.

Quiet Operation
In addition to being dependable, the hermetic scroll compressors included in each CL Series condensing unit offer quieter operation than comparable reciprocating compressors. Each compressor is placed on raised structural decks, and rubber isolation mounted to minimize vibrations. The condensing unit cabinet construction, composite paneling with 2" thick foam insulation, not only provides good thermal insulation, but also minimizes excessive exterior sound levels. Another standard feature on all CL Series condensing units is axial flow condenser fans with adjustable pitch blades providing maximum airflow with minimal noise levels.

Efficiency
All condenser fans utilize direct drive motors for maximum efficiency. In addition to providing energy savings of 20 to 40% over the air-cooled condenser model, the evaporative-condensing unit model contains a standard de-superheater coil that reduces water consumption by 20% or more. The use of scroll compressors, while being both reliable and quiet, also boasts reduced frictional losses and improved efficiency over comparable reciprocating compressors.

CL Series Feature String Nomenclature

	Model Options														Feature Options																							
	GEN	SIZE	VLT	INT PRT	A1	A2	A3	A4	B1	B2	B3	1A	1B	1C	1D	2	3	4	5A	5B	5C	6A	6B	6C	7	8	9	10	11	12	13		14A	14B			
	CL	095	3	0	B	E	0	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	D	0	F	A	0	0	0	-	0	0	-		
																									0	0	0	A	0	0	A	0	B			
																									15	16	17	18	19	20	21	22	23			

MODEL OPTIONS

Series and Generation
CL

Unit Size
045 = 45 Nominal Tons
060 = 60 Nominal Tons
070 = 70 Nominal Tons
075 = 75 Nominal Tons
095 = 95 Nominal Tons
100 = 100 Nominal Tons
110 = 110 Nominal Tons
125 = 125 Nominal Tons
134 = 134 Nominal Tons
135 = 135 Nominal Tons
155 = 155 Nominal Tons
170 = 170 Nominal Tons
190 = 190 Nominal Tons
210 = 210 Nominal Tons
230 = 230 Nominal Tons

Voltage
2 = 230V/3Φ/60Hz
3 = 460V/3Φ/60Hz
4 = 575V/3Φ/60Hz
8 = 208V/3Φ/60Hz

Interior Corrosion Protection
0 = Standard

A1: Cooling - Compressor Style
B = R-410A Dual Circuited Scroll Compressor
R = R-410A Independently Circuited Compressors

A2: Cooling - Condenser Style
A = Air-Cooled Condenser
E = Evaporative-Condensing Unit

A3: Cooling - Coating
0 = Standard
B = Polmer E-Coated (Condenser)

A4: Cooling - Staging
2 = 2 Stage
3 = 3 Stage
4 = 4 Stage
6 = 6 Stage
8 = 8 Stage

B1: Heating - Type
0 = No Heat

B2: Heating - Designation
0 = No Heat

B3: Heating - Staging
0 = No Heat

UNIT FEATURE OPTIONS

1A: Blank
0 = Standard

1B: Blank
0 = Standard

1C: Blank
0 = Standard

1D: Blank
0 = Standard

2: Blank
0 = Standard

3: Blank
0 = Standard

4: Blank
0 = Standard

CL Series Feature String Nomenclature

Model Options | Feature Options

GEN	SIZE	VLT	INT PRT	A1	A2	A3	A4	B1	B2	B3	1A	1B	1C	1D	2	3	4	**5A**	**5B**	**5C**	**6A**	**6B**	**6C**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14A**	**14B**
CL	095	3	0	B	E	0	4	0	0	0	0	0	0	0	0	0	0	**0**	**0**	**0**	**0**	**0**	**0**	**D**	**0**	**F**	**A**	**0**	**0**	**0**	**0**	**0**
																															A	B
																		15	**16**	**17**	18	19	20	21	22	23						

5A: Blank
0 = Standard

5B: Blank
0 = Standard

5C: Blank
0 = Standard

6A: Blank
0 = Standard

6B: Blank
0 = Standard

6C: Blank
0 = Standard

7: Refrigeration Control
0 = Standard
A = 5 Min Time Delay Relay Off
B = 20 Sec Time Delay Relay
C = 115V Outlet, Field Wired
D = 115V Outlet, Factory Wired
E = Options A + B
F = Options A + C
G = Options A + D
H = Options A + B + C
J = Options A + B + D
K = Options B + C
L = Options B + D

8: Refrigeration Options
0 = Standard
A = Hot Gas Bypass on Lead Stage
D = Hot Gas Bypass on Lead and Lag Stages

9: Refrigeration Accessories
F = Compressor Isolation Valves + Condenser Fan VFDs
G = Compressor Isolation Valves + Condenser Fan VFDs + Sight Glass

10: Power Options
0 = Standard Single Point Power Block
A = Single Point Power Non-Fused Disconnect (250A)
B = Single Point Power Non-Fused Disconnect (400A)
C = Single Point Power Non-Fused Disconnect (600A)
D = Single Point Power Non-Fused Disconnect (800A)
E = Single Point Power Non-Fused Disconnect (1200A)

11: Blank
0 = Standard

12: Controls
0 = Standard
B = Phase & Brown Out Protection

13: Special Controls
0 = Standard
D = VAV Unit Controller
E = Constant Volume Unit Controller
F = Make up Air Unit Controller
H = Field Installed DDC Controls by Others
J = Factory Installed DDC Controls by Others

14A: Blank
0 = Standard

14B: Blank
0 = Standard

15: Blank
0 = Standard

16: Blank
0 = Standard

17: Blank
0 = Standard

CL Series Feature String Nomenclature

	Model Options														Feature Options																							
	GEN		SIZE		VLT		INT PRT		A1	A2	A3	A4		B1	B2	B3		1A	1B	1C	1D		2	3	4		5A	5B	5C		6A	6B	6C		7	8	9	10	11	12	13		14A	14B
	CL	-	095	-	3	-	0	-	B	E	0	4	-	0	0	0	:	0	0	0	0	-	0	0	0	-	0	0	0	-	0	0	0	-	D	0	F	A	0	0	0	-	0	0	-
																																			0	0	0	**A**	**0**	**0**	**A**	**0**	**B**	
																																			15	16	17	**18**	**19**	**20**	**21**	**22**	**23**	

18: Warranty
0 = Standard Warranty
A = Extended Compressor Warranty Years 2-5

19: Code Options
0 = Standard ETL USA Listing
A = M.E.A. (New York)
D = Chicago - Cool Only
H = ETL USA + Canada Listing

20: Blank
0 = Standard

21: Evaporative Condenser Option
0 = Standard, No Evaporative-Condensing Unit
A = Basic Package
B = Low Ambient Package

22: Blank
0 = Standard

23: Paint and Special Pricing Authorization
B = Standard Paint
U = Special Price Authorization and Special Paint
X = Special Price Authorization w/ Standard Paint

Model Option
Unit Size

Example: CL-**095**-3-0-BE04-000:0000-000-000-000-D0FA000-00-000A00A0B

Table 1 - Model Sizes

Model	Width	Height	Air-Cooled		Evaporative-Cooled	
			Length	Nominal Capacity*	Length	Nominal Capacity*
	(inches)	(inches)	(inches)	(Tons)	(inches)	(Tons)
CL-**045**	100	102	152	39.8	125	44.8
CL-**060**				51.4		57.9
CL-**070**				58.8		68.4
CL-**075**			175	69.9	150	77.7
CL-**095**				88.7		97.4
CL-**100**			215	95.7	195	106.5
CL-**110**				103.2		115.6
CL-**125**				122.8		134.6
CL-**134**	142		213	122.5	179	133.9
CL-**135**	100		215	130.4	195	144.3
CL-**155**	142		213	140.8	179	155.0
CL-**170**				159.1		174.0
CL-**190**			196	175.3	207	193.7
CL-**210**				191.0		212.8
CL-**230**				212.1		231.7

*Note: The nominal capacities reflect the use of R-410A refrigerant at 95°F Ambient Dry Bulb, 75°F Ambient Wet Bulb, and 50°F Saturated Suction.

Model Option
Voltage

Example: CL-095-**3**-0-BE04-000:0000-000-000-000-D0FA000-00-000A00A0B

All units have single point power blocks with grounding lugs and 24 VAC control circuits.

2 = 230V/3Φ/60Hz
3 = 460V/3Φ/60Hz
4 = 575V/3Φ/60Hz
8 = 208V/3Φ/60Hz

Model Option
Interior Protection

Example: CL-095-3-**0**-BE04-000:0000-000-000-000-000-D0FA000-00-000A00A0B

0 = *Standard* - Cabinet interior is constructed of uncoated galvanized G90 sheet metal.

Model Option
Model Option A1 - Cooling Style

Example: CL-095-3-0-**B**E04-000:0000-000-000-000-000-D0FA000-00-000A00A0B

B = *R-410A Dual Circuited Scroll Compressors* - Tandem R-410A scroll Compressors
R = *R-410A Independently Circuited Compressors* - Available on 4 compressor units only (45-95 Tons).

Model Option
Model Option A2 - Cooling Configuration

Example: CL-095-3-0-B**E**04-000:0000-000-000-000-000-D0FA000-00-000A00A0B

A = *Air-Cooled Condenser* - Air-cooled condensing unit
E = *Evaporative-Condensing Unit* - Evaporative-cooled condensing unit

Model Option
Model Option A3 - Cooling Coating

Example: CL-095-3-0-BE**0**4-000:0000-000-000-000-000-D0FA000-00-000A00A0B

0 = *Standard* - No coating

Model Option A3 - Cooling Coating Continued

Example: CL-095-3-0-BE**0**4-000:0000-000-000-000-000-D0FA000-00-000A00A0B

B = *Polymer E-Coated Condenser Coil* - Polymer e-coating applied to condenser coils. Complete coil and casing are coated. Coating capable of withstanding at least 10,000 hours of salt spray per ASTM B117, yet is only 0.8-1.2 mils thick and has excellent flexibility. Option is intended for use in coastal saltwater conditions under the stress of heat, salt, sand and wind and is applicable to all corrosive environments where a polymer e-coating is acceptable. Coating includes a 5 year warranty, from the date of original equipment shipment from the factory. Instructions coil cleaning, maintenance, and recording keeping must be followed. Refer to the unit Installation, Operation and Maintenance Manual.

Model Option

Model Option A4 - Cooling Staging

Example: CL-095-3-0-BE0**4**-000:0000-000-000-000-000-D0FA000-00-000A00A0B

2 = *2 stage* - Available on all air-cooled and evaporative-cooled condensing units.
3 = *3 stage* - Available on 100-170 ton air-cooled and evaporative-cooled condensing units only.
4 = *4 stage* - Available on all air-cooled and evaporative-cooled condensing units.
6 = *6 stage* - Available on 100-170 ton air-cooled and evaporative-cooled condensing units only.
8 = *8 stage* - Available on 190-230 ton air-cooled and evaporative-cooled condensing units only.

Model Option

Model Option B1 - Blank

Example: CL-095-3-0-BE04-**0**00:0000-000-000-000-000-D0FA000-00-000A00A0B

0 = *Standard*

Model Option

Model Option B2 - Blank

Example: CL-095-3-0-BE04-0**0**0:0000-000-000-000-D0FA000-00-000A00A0B

0 = *Standard*

Model Option

Model Option B3 - Blank

Example: CL-095-3-0-BE04-00**0**:0000-000-000-000-D0FA000-00-000A00A0B

0 = *Standard*

Unit Feature 1

Unit Feature Option 1A - Blank

Example: CL-095-3-0-BE04-000:**0**000-000-000-000-D0FA000-00-000A00A0B

0 = *Standard*

Unit Feature 1

Unit Feature Option 1B - Blank

Example: CL-095-3-0-BE04-000:0**0**00-000-000-000-D0FA000-00-000A00A0B

0 = *Standard*

Unit Feature 1
Unit Feature Option 1C - Blank

Example: CL-095-3-0-BE04-000:00**0**0-000-000-000-D0FA000-00-000A00A0B

0 = *Standard*

Unit Feature 1
Unit Feature option 1D - Blank

Example: CL-095-3-0-BE04-000:000**0**-000-000-000-D0FA000-00-000A00A0B

0 = *Standard*

Unit Feature 2
Unit Feature option 2 - Blank

Example: CL-095-3-0-BE04-000:0000-**0**00-000-000-D0FA000-00-000A00A0B

0 = *Standard*

Unit Feature 3
Unit Feature Option 3 - Blank

Example: CL-095-3-0-BE04-000:0000-0**0**0-000-000-D0FA000-00-000A00A0B

0 = *Standard*

Unit Feature 4

Unit Feature Option 4 - Blank

Example: CL-095-3-0-BE04-000:0000-00**0**-000-000-D0FA000-00-000A00A0B

0 = *Standard*

Unit Feature 5

Unit Feature Option 5A - Blank

Example: CL-095-3-0-BE04-000:0000-000-**0**00-000-D0FA000-00-000A00A0B

0 = *Standard*

Unit Feature 5

Unit Feature Option 5B - Blank

Example: CL-095-3-0-BE04-000:0000-000-0**0**0-000-D0FA000-00-000A00A0B

0 = *Standard*

Unit Feature 5

Unit Feature option 5C - Blank

Example: CL-095-3-0-BE04-000:0000-000-00**0**-000-D0FA000-00-000A00A0B

0 = *Standard*

Unit Feature 6

Unit Feature Option 6A - Blank

Example: CL-095-3-0-BE04-000:0000-000-000-000-**0**00-D0FA000-00-000A00A0B

0 = *Standard*

Unit Feature 6

Unit Feature Option 6B - Blank

Example: CL-095-3-0-BE04-000:0000-000-000-000-0**0**0-D0FA000-00-000A00A0B

0 = *Standard*

Unit Feature 6

Unit Feature Option 6C - Blank

Example: CL-095-3-0-BE04-000:0000-000-000-000-00**0**-D0FA000-00-000A00A0B

0 = *Standard*

Unit Feature 7

Unit Feature Option 7 - Refrigeration Control

Example: CL-095-3-0-BE04-000:0000-000-000-000-000-**D**0FA000-00-000A00A0B

0 = *Standard* - 55°F fixed compressor lockout.

Unit Feature Option 7 - Refrigeration Control Continued

Example: CL-095-3-0-BE04-000:0000-000-000-000-**D**0FA000-00-000A00A0B

A = *5 MTDR Off* - 5 minute time delay relay for minimum 5 minute compressor "off time". The delay timers are located in the low voltage section of the controls cabinet. There are no user adjustments. The timers prevent short cycling of the compressors, preventing undue stress and wear. Recommended where electromechanical thermostats are used. Used with some programmable thermostats or DDC controllers may cause excessive time delay.
B = *20 STDR* - The 20 second time delay relay is a guaranteed off delay timer that prevents multiple cooling stages from starting simultaneously. The delay timers are located in the low voltage section of the controls cabinet. The range of adjustment is 6 to 300 seconds. The timers limit current draw during cooling cycle start up.
C = *115V Convenience Outlet, Field Wired* - Field wired 2x4 electrical box with ground fault interrupter receptacle located inside the unit controls cabinet. Receptacle is rated for 20 amps. The outlet must be field wired with an 115VAC power supply.
D = *115V Convenience Outlet, Factory Wired* - Factory wired 2x4 electrical box with ground fault interrupter receptacle located inside the unit controls cabinet. The circuit is rated at 13 amps maximum, and is factory wired to a step-down transformer, fuse block and outlet disconnect. The circuit is wired to the line side of the unit power block or power switch permitting use of the outlet while power to the unit is shut off. **Caution: When the power to the unit is disconnected at the factory installed unit power switch, the convenience outlet will remain live.**
E = *5 MTDR + 20 STDR* - Options A + B
F = *5 MTDR + 115V Convenience Outlet, Field Wired* - Options A + C
G = *5 MTDR + 115V Convenience Outlet, Factory Wired* - Options A + D
H = *5 MTDR + 20 STDR + 115V Convenience Outlet, Field Wired* - Options A + B + C
J = *5 MTDR + 20 STDR + 115V Convenience Outlet, Factory Wired* - Options A + B + D
K = *20 STDR + 115V Convenience Outlet, Field Wired* - Options B + C
L = *20 STDR + 115V Convenience Outlet, Factory Wired* - Options B + D

Figure 1 - Factory Wired Convenience Outlet

Unit Feature 8

Unit Feature Option 8 - Refrigeration Options

Example: CL-095-3-0-BE04-000:0000-000-000-000-D**0**FA000-00-000A00A0B

0 = *Standard* - Manual reset high pressure cutouts, automatic reset low pressure cutouts, internal overload protection on compressors, thermal expansion valves.
A = *Hot Gas Bypass on Lead Stage* - Field adjustable pressure activated bypass valve on the lead cooling circuit(s) factory setup to divert hot compressor discharge gas to the evaporator coil if pressure on the evaporator side of the valve drops below 105 psi for R-410A (34°F at sea level). The bypass valve is at full capacity after six degrees of differential (28°F at sea level). This option prevents coil freeze-up during periods of low airflow or cold entering coil conditions. This option is used for refrigerant system protection only and cannot be used for cooling capacity modulation. Recommended on VAV and Makeup Air application units.
D = *Hot Gas Bypass Lead and Lag Stages* – Same as Option A, but with hot gas bypass valves on all stages. Recommended on VAV and Makeup Air application units.

Unit Feature 9

Unit Feature Option 9 – Refrigeration Accessories

Example: CL-095-3-0-BE04-000:0000-000-000-000-D0**F**A000-00-000A00A0B

F = *Compressor Isolation Valves + Condenser Fan VFDs* - All compressors are mounted in the service vestibule on raised, vibration reducing platforms for quiet operation and convenient access. Ball type service valves mounted on the cooling circuit discharge and suction lines permitting isolation of the compressor for service or replacement. The valves are located in close proximity to the compressors. The valve works through a quarter turn from open to closed. Teflon seals and gaskets are used with a nylon cap gasket to prevent accidental loss. This option reduces the amount of refrigerant that must be recovered during compressor service or replacement since valve closure isolates the compressor.

Factory provided and programmed VFDs receives inputs from pressure transducers on each refrigerant circuit and varies the fan speed based on the pressure inputs to maintain a discharge pressure. Standard pressure setpoint is 340 psi for standard air-cooled systems and 400 psi for modulating hot gas reheat air-cooled systems. With AAON unit controls, VFDs will be controlled directly by AAON Control System.

Unit Feature Option 9 - Refrigeration Accessories Continued

Example: CL-095-3-0-BE04-000:0000-000-000-000-D0**F**A000-00-000A00A0B

G = *Compressor Isolation Valves + Condenser Fan VFDs + Sight Glass* - All compressors are mounted in the service vestibule on raised, vibration reducing platforms for quiet operation and convenient access. Ball type service valves mounted on the cooling circuit discharge and suction lines permitting isolation of the compressor for service or replacement. The valves are located in close proximity to the compressors. The valve works through a quarter turn from open to closed. Teflon seals and gaskets are used with a nylon cap gasket to prevent accidental loss. This option reduces the amount of refrigerant that must be recovered during compressor service or replacement since valve closure isolates the compressor.

Factory provided and programmed VFDs receives inputs from pressure transducers on each refrigerant circuit and varies the fan speed based on the pressure inputs to maintain a discharge pressure. Standard pressure setpoint is 340 psi for standard air-cooled systems and 400 psi for modulating hot gas reheat air-cooled systems. With AAON unit controls, VFDs will be controlled directly by AAON Control System.

Moisture indication sight glass attached to the cooling circuit liquid line(s). The moisture indicator shows a green color when refrigerant is dry, a chartreuse color indicates caution and a yellow color indicates a wet condition. The sight glass is not a charge indicator.

Table 2 - Moisture Content Indication

Refrigerant / Indicator Color	75° F Liquid Line Temperature R-410A
Green DRY	Below 75ppm
Chartreuse CAUTION	75-150ppm
Yellow WET	Above 150ppm

Unit Feature 10

Unit Feature 10 - Power Options

Example: CL-095-3-0-BE04-000:0000-000-000-000-D0F**A**000-00-000A00A0B

0 = *Std Power Block*

A = *Power Switch (250 Amps)*

B = *Power Switch (400 Amps)*

C = *Power Switch (600 Amps)*

D = *Power Switch (800 Amps)*

E = *Power Switch (1,200 Amps)*

Individual components within the control cabinet are fused. Switch options include molded case, non-fused, disconnect switch externally mounted. The switch is accessible from the exterior of the unit. The switch disconnects high voltage service to the unit. To add a switch, choose any switch and after all options have been selected and the fan program is completed AAONEcat32™ will automatically calculate the minimum allowable ampacity and choose the correct size switch.

Unit Feature 11

Unit Feature 11- Blank

Example: CL-095-3-0-BE04-000:0000-000-000-000-D0FA**0**00-00-000A00A0B

0 = *Standard*

Unit Feature 12

Unit Feature 12 - Controls

Example: CL-095-3-0-BE04-000:0000-000-000-000-D0FA0**0**0-00-000A00A0B

0 = *Standard* - Terminal block for wiring standard controls.
B = *Phase & Brown Out Protection* - This selects a three phase power monitor that shuts down the unit if the supplied power phases are out of balance, or over/under voltage, or in case of a phase loss. It protects motors and compressors from electrical phase loss or low voltage brownout. Reset is automatic.

Unit Feature 13

Unit Feature 13- Special Controls

Example: CL-095-3-0-BE04-000:0000-000-000-000-D0FA00**0**-00-000A00A0B

0 = *Standard* - Terminal block for wiring standard controls
***D** = *VAV Unit Controller* - Variable Air Volume unit controller. Return and outside air temperature sensors, supply air static pressure probe, space temperature sensor, and supply air duct temperature sensor are supplied for field installation.
***E** = *Constant Volume Unit Controller* - Outside air temperature sensor, supply duct temperature sensor, and space temperature sensor are supplied for field installation.
***F =** *Make Up Air Unit Controller* - Outside air temperature sensor and supply duct temperature sensor are supplied for field installation.
H = *Field Installed DDC Controls by Others (SPA)* - Provides a terminal strip to interface with controls by others.
J = *Factory Installed DDC Controls Furnished by Others (SPA)* - Factory installed controls by others. Requires a Special Pricing Authorization (SPA) issued by the Applications Department. The AAON rep must provide a controls parts list, cut sheets and wiring diagrams before the SPA will be issued. Also requires a Special Parts Request Form. Once the order is entered a completed Special Parts Request Form is sent to the AAON rep with control numbers assigned. The AAON rep must then forward the form to the controls supplier who must then transfer these numbers to all parts and boxes that are sent to AAON. Proper routing of customer supplied parts to units in production will be delayed if this procedure is not followed. AAON will not deal directly with the controls provider; the rep must be the information conduit! See the "Policy Manual for Sales Representatives" for more detailed information on the proper procedure.

*See Controls section for more information about control options

Unit Feature 14A

Unit Feature 14A - Blank

Example: CL-095-3-0-BE04-000:0000-000-000-000-D0FA000-**0**0-000A00A0B

0 = *Standard*

Unit Feature 14B

Unit Feature 14B - Blank

Example: CL-095-3-0-BE04-000:0000-000-000-000-000-D0FA000-0**0**-000A00A0B

0 = *Standard*

Unit Feature 15

Unit Feature 15 - Blank

Example: CL-095-3-0-BE04-000:0000-000-000-000-000-D0FA000-00-**0**00A00A0B

0 = *Standard*

Unit Feature 16

Unit Feature 16 - Blank

Example: CL-095-3-0-BE04-000:0000-000-000-000-000-D0FA000-00-0**0**0A00A0B

0 = *Standard*

Unit Feature 17

Unit Feature 17 - Blank

Example: CL-095-3-0-BE04-000:0000-000-000-000-000-D0FA000-00-00**0**A00A0B

0 = *Standard*

Unit Feature 18

Unit Feature 18 - Customer Code

Example: CL-095-3-0-BE04-000:0000-000-000-000-D0FA000-00-000**A**00A0B

0 = *Standard*
A = *2-5 year Extended Compressor Warranty* - Extends warranty coverage of compressors for the second to fifth years of unit operation.

Used for groups of special features and options for national account customers.

Unit Feature 19

Unit Feature 19 - Code Options

Example: CL-095-3-0-BE04-000:0000-000-000-000-D0FA000-00-000A**0**0A0B

0 = *Standard ETL USA Listing* - AAON units are ETL listed and tested in accordance with the latest revision of UL 1995. If a Special Pricing Authorization (SPA) is applied there may be additional costs incurred to secure the ETL label.
A = *MEA (New York)* - Approval tag attached to the unit exterior, designating AAON specific units comply with the Material & Equipment Acceptance requirements for the City of New York.
D = *Chicago - Cool Only* - Chicago code for a unit with cooling only. Chicago code states that unit wiring to the condenser fan motors must be in flexible conduit and refrigerant pressure relief valves must be supplied.
H = *ETL USA + Canada Listing* - Canadian and USA listings for export. The nameplate, safety labels, drain and blower warnings will be in English and French.

Unit Feature 20

Unit Feature 20 - Blank

Example: CL-095-3-0-BE04-000:0000-000-000-000-D0FA000-00-000A0**0**A0B

0 = *Standard*

Unit Feature 21

Unit Feature 21 - Evaporative-Condensing Unit

Example: CL-095-3-0-BE04-000:0000-000-000-000-D0FA000-00-000A00**A**0B

0 = *Standard* - No evaporative-condensing unit.
A = *Basic Package* - For applications where the evaporative-condensing unit will not contain water during freezing conditions.
B = *Low Ambient Package* - Provides a 5kW electric immersion sump heater, and a 1kW electric base board heater for the controls vestibule.

Unit Feature 22

Unit Feature 22 - Blank

Example: CL-095-3-0-BE04-000:0000-000-000-000-D0FA000-00-000A00A**0**B

0 = *Standard*

Unit Feature 23

Unit Feature 23 - Type

Example: CL-095-3-0-BE04-000:0000-000-000-000-D0FA000-00-000A00A0**B**

0 = *Standard (Gray Paint)* - Cabinet exterior is primer washed then spray coated with a two part polyurethane, heat-baked coating. Polyurethane coating exceeds 2,500 hours when tested under ASTM B 117-95 requirements.
U = *Special Price Authorization + Special Paint* - When a special paint color is specified, a set-up charge and price add per unit is required. Also use this designation if other special paint options are necessary. The Special Pricing Authorization worksheet with comprehensive explanation of requirements must accompany the order documents.
X = *Special Price Authorization + Gray Paint* - The Applications Department must issue a Special Pricing Authorization (SPA) to include a non-standard option.

General Data
Unit Information

Table 3 - Unit Information for 45 to 95 Ton Condensing Units

	Unit Size (Nominal Tons)				
	45	60	70	75	95
Compressors					
Compressor 1 Quantity/Nominal Size (Tons)	4/ 9 Ton	4/ 12 Ton	2/12 Ton,	4/16 Ton	2/16 Ton
Compressor 2 Quantity/Nominal Size (Tons)			2/16 Ton		2/25 Ton
Capacity Steps	4				
Number of Circuits	2 or 4				
Condenser Fans - Air-Cooled					
Quantity	2			3	4
Diameter (Inch)	36				
Motor HP	2	3			
Drive Type	Direct				
Condenser Fans - Evaporative-Cooled					
Quantity	1		2		
Diameter (Inch)	36				
Motor HP	2				3
Drive Type	Direct				
Condenser Pump					
Quantity	1				
Motor HP	1			1.5	

Table 4 - Unit Information for 100 to 135 Ton Condensing Units

	Unit Size (Nominal Tons)			
	100	110	125	135
Compressors				
Compressor 1 Quantity/Nominal Size (Tons)	2/12 Ton	6/16 Ton	4/16 Ton	2/16 Ton
Compressor 2 Quantity/Nominal Size (Tons)	4/16 Ton		2/25 Ton	4/25 Ton
Capacity Steps	6			
Number of Circuits	3			
Condenser Fans - Air-Cooled				
Standard - Air Cooled- Quantity	4			
Diameter (Inch)	36		42	
Motor HP	3		5	
Drive Type	Direct			
Condenser Fans - Evaporative-Cooled				
Quantity	2			
Diameter (Inch)	36			
Motor HP	3			
Drive Type	Direct			
Condenser Pump				
Quantity	1			
Motor HP	3			

Table 5 - Unit Information for 134 to 230 Ton Condensing Units

	Unit Size (Nominal Tons)					
	134	155	170	190	210	230
Compressors						
Compressor 1 Quantity/Nominal Size (Tons)	4/16 Ton	2/16 Ton	6/25 Ton	4/16 Ton	2/16 Ton	8/25 Ton
Compressor 2 Quantity/Nominal Size (Tons)	2/25 Ton	4/25 Ton		4/25 Ton	6/25 Ton	
Capacity Steps	6			8		
Number of Circuits	3			4		
Condenser Fans - Air-Cooled						
Standard - Air Cooled- Quantity	5	4/1	4/2			
Diameter (Inch)	36	42/36		36/42		42/36
Motor HP	3	5/3		3/7.5		7.5/3
Drive Type	Direct					
Condenser Fans - Evaporative-Cooled						
Quantity	2	3		4		
Diameter (Inch)	36					
Motor HP	3					
Drive Type	Direct					
Condenser Pump						
Quantity	1					
Pipe Diameter (Inch)	4					
Motor HP	5					

Controls
Control Options

Terminal Block

Low voltage terminal block for field wiring controls

Required Features

Feature 13 - Field Installed DDC Controls by Others

Standard Terminals Labels

[R] - 24VAC control voltage
[E] - Common
[G] - Fan enable
[Y1], [Y2], … , [Y8] - Cooling stages' control signals
[W1], [W2], … , [W12] - Heating stages' control signals
[A1], [A2] - Economizer override contacts, factory wired together, used to control occupied/unoccupied operation.
[EC1], [EC2] - Economizer DDC actuator control signal, 4-20mA. Remove resistor for 0-10VDC operation.
[ST1], [ST2] - Remote start/stop contacts, must be closed for unit to operate.
[RH1] - Humidistat control signal, used with reheat coil.
[BI1], [BI2] - Field installed smoke detector contacts, must be closed for unit to operate.
[NO], [C], [NC] - Set of normally open and normally closed low voltage heat wheel rotation detection contacts.
[C1], [C2] - Clogged filter switch contacts, normally open.
[C6], [C7] - Supply air temperature sensor control signal, 0-10VDC.
[1], [2] - SCR supply air temperature control signal, 0-10VDC
[B1], [B2], [B3], [B4] - Exhaust fan VFD control contacts, 0-10VDC.
[S1], [S2], … , [S6] - Supply fan VFD control contacts, 0-10VDC or 4-20mA.

Figure 2 - Example Low Voltage Terminal Block

VAV (Variable Air Volume) Unit Controller

Operation

AAON VAV units provide constant temperature supply air to the system while varying the amount of air supplied. Factory mounted and tested supply fan VFDs are used to vary the speed of the supply fans, thus varying the amount of supply air. Because of the reduced speed, VAV units are more efficient at part load conditions. VAV units generally are used when serving spaces with diverse or changing heating and cooling requirements. Thus, only a single unit may be required for multiple zones. Space temperature sensor is used for supply air temperature setpoint reset and unoccupied override.

Required Features on CL Series Condensing Unit

Feature 13 - VAV Unit Controller

Feature 8 - Hot Gas Bypass Lead and Lag Stage – The hot gas bypass option should be selected when selecting a VAV or MUA controller.

Recommended Feature on matching Air Handler

Motorized Outside Air Damper or Economizer

Standard Supplied Sensors

Outside Air Temperature
Supply Air Temperature
Supply Air Static Pressure
Return Air Temperature
Space Temperature with Temperature Setpoint Reset and Unoccupied Override

Additional Recommended Features on matching Air Handler

Economizer
Energy Recovery Wheel
Fully Modulating Actuator
Constant Volume Outside Air - To maintain a minimum volume of outside air for ventilation.
Supply Blower(s) with VFD(s)
Modulating Hot Gas Reheat Coil

CV (Constant Volume) Unit Controller

Operation

AAON CV units provide a constant amount of tempered air to the system to maintain a temperature setpoint. CV units work best when serving spaces with uniform heating and cooling requirements. Thus, multiple units may be required for multiple zones allowing for redundancy. Space or supply air temperature sensor can be used as the controlling sensor. If supply air temperature is not used as the controlling sensor it is used as a temperature lockout. If supply air temperature sensor is used as the controlling sensor, space temperature sensor is used for supply air temperature setpoint reset and unoccupied override.

Required Feature on CL Series Condensing Unit

Feature 13 - Constant Volume Unit Controller

Recommended Feature on matching Air Handler

Motorized Outside Air Damper or Economizer

Standard Supplied Sensors

Outside Air Temperature
Supply Air Temperature
Space Temperature with Temperature Setpoint Reset and Unoccupied Override

Additional Recommended Features on matching Air Handler

Return Air Bypass
Economizer
Energy Recovery Wheel
Fully Modulating Actuator
Modulating Hot Gas Reheat Coil

MUA (Makeup Air) Unit Controller

Operation
AAON® MUA units are designed to provide 100% outside air to the system for ventilation purposes. MUA units improve indoor air quality (IAQ) and add positive pressure to the space.

Required Features on Condensing Unit
Feature 13 - Make Up Air Unit Controller
Feature 8 - Hot Gas Bypass Lead and Lag Stage – The hot gas bypass option should be selected when selecting a VAV or MUA controller.

Recommended Features on matching Air Handler
Motorized or Non-Motorized 100% Outside Air
Two Position Actuator (Only with Motorized 100% Outside Air)

Standard Supplied Sensors
Outside Air Temperature
Supply Air Temperature

Additional Recommended Feature on matching Air Handler
Energy Recovery Wheel
Modulating Hot Gas Reheat Coil

Control Vendors

VCCX2 Controls System

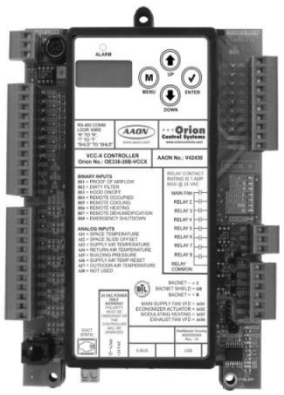

Figure 3 - VCCX2 Controller

The VCCX2 unit controller can be factory provided and factory installed in the AAON air handling unit while the Refrigerant System Module (RSM) board is factory installed in the matching AAON condensing unit. Combined, the boards provide advanced control features, without complexity, in an easy to install and setup package. The VCCX2 controllers can be individually configured, including setpoint adjustment, sensor status viewing, and occupancy scheduling. It can control Single Zone VAV, VAV with optional morning warm-up or supply air tempering, CAV with hood/on operation, MUA, and Space Temperature Control of High Percentage Outdoor Air. Additional features and options can be managed by the controller with the addition of modular expansion I/O boards for the controller. Space temperature sensor included with VCCX2 controller is used for supply air temperature setpoint reset and unoccupied override.

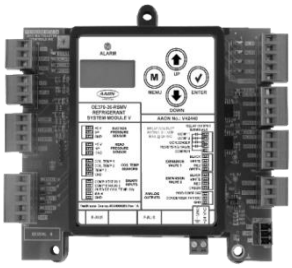

Figure 4 - RSM Board

The VCCX2 controller can be operated as a Stand Alone System, connected via modular cable to multiple VCCX2 controllers in an Interconnected System, or connected via modular cable to multiple VCCX2 controllers, VAV/Zone controllers, and Add-On controllers in a Networked System.

The VCCX2 controller has on-board BACnet® port for connection to an MS/TP network. LON is available with a field provided PT-Link.

Required Operator Interfaces

To configure the VCCX2 controller, an operator interface is needed. Available operator interfaces are the Modular Service Tool SD, Modular System Manager SD, System Manager TS-L, and a PC equipped with free Microsoft Windows® based Prism2 software connected via a CommLink 5. With optional USB-Link2, remote connectivity to the controller via Prism2 software can be accomplished.

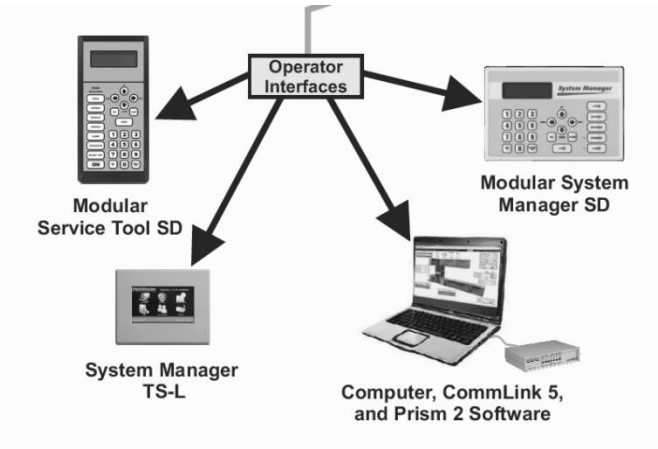

Figure 5 - VCCX2 Controller Operator Interfaces

Electrical Service Sizing Data

Use the following equations to correctly size the electrical service wiring for the unit.

To calculate the correct Minimum Circuit Ampacity (MCA) and Maximum Overcurrent Protection (MOP) values for units, use the equations for MCA and MOP listed.

MCA = 1.25(Load 1) + Load 2 + Load 3

MOP = 2.25(Load 1) + Load 2 + Load 3
where:

Load 1 = Current of the largest motor/compressor
Load 2 = Sum of the currents of the remaining motors (including pump motors) and compressors
Note: With an evaporative-condensing unit option, include the condenser pump motor.
Load 3 = Additional Currents (evaporative-condensing unit sump heater current)

Use Rated Load Amps (RLA) for compressors and Full Load Amps (FLA) for all other motors and electric heaters. Evaporative-condensing unit currents should be added only if the unit is equipped with an evaporative-condensing unit section.

Select a fuse rating equal to the MOP value. If the MOP does not equal a standard fuse rating select the next lower standard fuse rating. If the MOP is less than the MCA then select the fuse rating equal to or greater than the MCA.

Standard Ampere Ratings for Fuses (From NEC Handbook, 240-6)
The standard ratings for fuses shall be considered 15, 20, 25, 30, 35, 40, 45, 50, 60, 70, 80, 90, 100, 110, 125, 150, 175, 200, 225, 250, 300, 350, 400, 450, 500, 600, 700, 800 and 1000 amperes.

Select the appropriate component FLA (RLA) from the following data:

Table 6 - Compressor Rated Load Amps

Compressors		Three Phase Voltage			
		230	460	575	208
Air-Cooled Condenser					
(Tons)	(Refrigerant)				
9	R-410A	33.6	18.6	13.6	33.6
12	R-410A	53.6	20.7	16.4	53.6
16	R-410A	59.1	26.4	26	59.1
25	R-410A	99.3	47.9	35.7	99.3
Evaporative-Condensing Unit					
(Tons)	(Refrigerant)				
9	R-410A	26.3	13.2	10.2	29.1
12	R-410A	35	16.5	13.8	38.7
16	R-410A	42.3	21.2	16.9	46.8
25	R-410A	65.8	32.9	26.3	72.8

Table 7 - Evaporative-Condensing Unit Section Components Full Load Amps

Condenser Fan		Three Phase Voltage			
		230	460	575	208
Fan Size (inch)	Motor (hp)				
36	2	6.8	3.4	2.9	7.5
	3	9.9	4.8	3.6	10.6
42	5	16.3	8.1	6	16.7
	7.5	22	11	8.9	24.2
Condenser Pump Motor					
Motor (hp)					
1		4.2	2.1	1.3	4.6
3		9.6	4.8	3.9	10.6
5		15.2	7.6	6.1	16.7
Condenser Sump Heater		18.9	9.4	9.4	16.4

Unit Drawings

Base Length:116”
Overall Length:152”
Height: 102”
Width: 100”

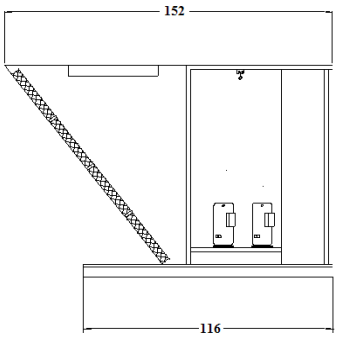

Figure 6 - 45, 60, and 70 Ton Air-Cooled Condensing Units

Overall Length:129”
Height: 102”
Width: 100”

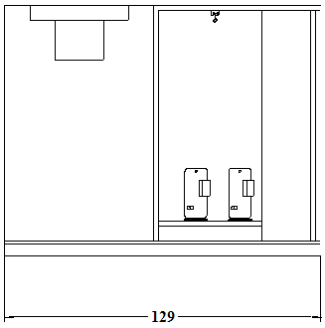

Figure 7 - 45, 60, and 70 Ton Evaporative-Condensing Units

Base Length: 130”
Overall Length: 175”
Height: 102”
Width: 100”

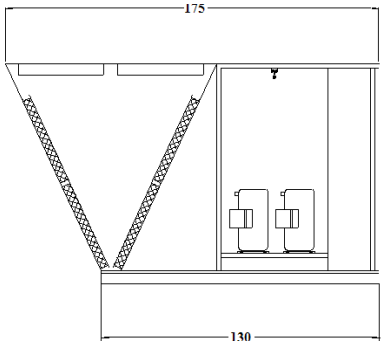

Figure 8 - 75 and 95 Ton Air-Cooled Condensing Units

Unit Drawings Continued

Overall Length: 154”
Height: 102”
Width: 100”

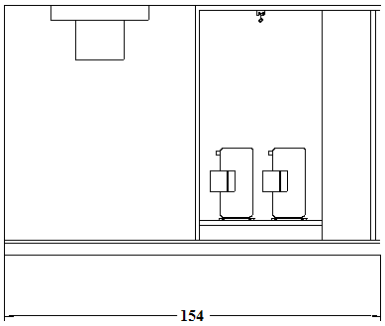

Figure 9 - 75 and 95 Ton Evaporative-Condensing Units

Base Length: 156”
Overall Length: 215”
Height: 102”
Width: 100”

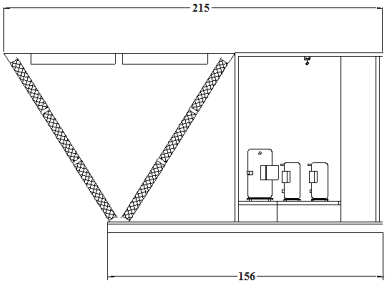

Figure 10 - 100, 110, 125, and 135 Ton Air-Cooled Condensing Units

Overall Length: 200”
Height: 102”
Width: 100”

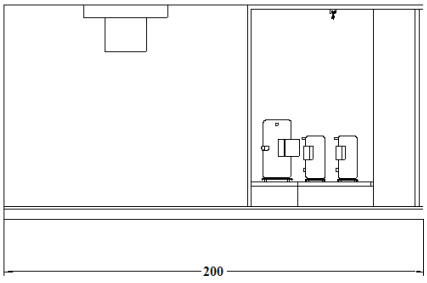

Figure 11 - 100, 110, 125, and 135 Ton Evaporative-Condensing Units

Unit Drawings Continued

Base Length: 158”
Overall Length: 213”
Height: 102”
Width: 142”

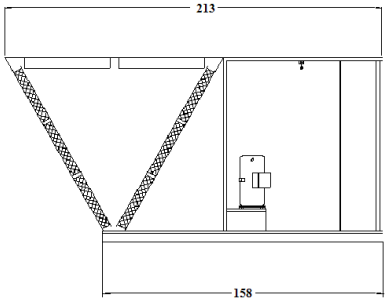

Figure 12 - 134, 155, and 170 Ton Air-Cooled Condensing Units

Overall Length: 183”
Height: 102”
Width: 142”

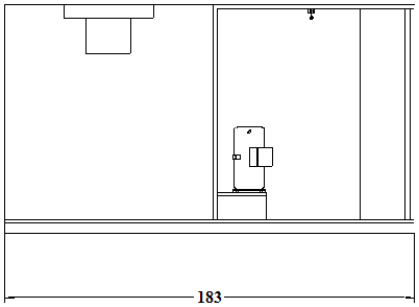

Figure 13 - 134, 155, and 170 Ton Evaporative-Condensing Units

Base Length: 175”
Overall Length: 196”
Height: 102”
Width: 142”

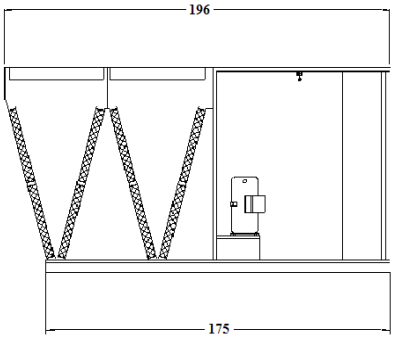

Figure 14 - 190, 210, and 230 Ton Air-Cooled Condensing Units

Unit Drawings Continued

Overall Length: 211”
Height: 102”
Width: 142”

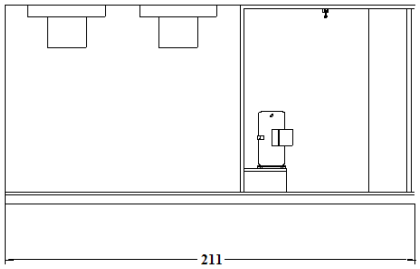

Figure 15 - 190, 210, 230 Ton Evaporative-Condensing Units

Evaporative-Condensing Unit
Features and Water Treatment

The AAON evaporative-condensing unit is the only evaporative-condensing unit sold in the HVAC business with an integral de-superheater coil located above moisture eliminators. The de-superheater coil reduces the refrigerant temperature by 50° to 70° before the refrigerant reaches the condensing coil. This creates several advantages:

1. A minimum of 22% of the heat of rejection is accomplished with the de-superheater as sensible heat transfer; therefore the evaporative-condensing unit uses over 22% less water.

2. A minimum of 22% less water usage reduces water and water treatment costs.

3. Scale formation is reduced in the wetted section of the condenser because the surface temperature of the tubes is lower. This reduced scale potential allows the condenser tubes to withstand recirculating water with greater mineral content, and as a result, requires less make up water, less water treatment, and lower operating costs.

4. The de-superheater has the effect of increasing the temperature of the air leaving the wetted section therefore the air passing over the fan motor is not 100% relative humidity as with other draw-through designs but is closer to 70%. With the motor in a non-condensing environment there are fewer tendencies for any water to infiltrate the motor.

5. All motors draw in surrounding air during the off cycle when using on/off control. AAON uses VFD control of the fan motors to keep the motors turning at reduced loads. Energized motors stay warm and prevent water from being drawn into the condenser.

6. AAON incorporates VFD control of the condenser fans for reduce energy consumption when compared with on-off control. Additional benefits of VFD control include: Energized motors stay warm and prevent water from being drawn into the condenser, and keep from spinning backwards and resulting in nuisance power trips.

7. Condenser fans are adjustable pitch, cast aluminum air foil with a cast aluminum hub.

8. The sub-cooling circuit is integral to the wetted coil section.

9. The AAON evaporative-condensing unit cabinet is all 304 stainless steel. This includes the sump, all structural members, and interior.

10. The AAON condenser tube bundles are built such that each independent refrigerant circuit can be removed separately for repair or replacement.

11. ABS tube sheet isolators are used to prevent contact between the copper tube bundle and the stainless steel tube sheet.

Evaporative-Condensing Unit
Features and Water Treatment Continued

12. Water treatment feed and control systems include 2 Biocide systems (feed) and 1 Corrosion system (control) are factory installed standard.

Water Treatment and Evaporative-Cooled Condensing

Langelier Saturation Index (LSI)
The LSI is an equilibrium model derived from the theoretical concept of saturation and provides an indicator of the degree of saturation of water with respect to calcium carbonate. It can be shown that the LSI approximates the base 10 logarithm of the calcite saturation level. The Langelier saturation level approaches the concept of saturation using pH as a main variable. The LSI can be interpreted, as the pH change required returning water to equilibrium.

Water with a LSI of 1.0 is one pH unit above saturation. Reducing the pH by 1 unit will bring the water into equilibrium. This occurs because the portion of total alkalinity present as CO_3^{2-} decreases as the pH decreases, according to the equilibriums describing the dissociation of carbonic acid:

$$H_2CO_3 \rightleftharpoons HCO_3^- + H^+$$

$$HCO_3^- \rightleftharpoons CO_3^{2-} + H^+$$

If LSI is negative: No potential to scale, the water will dissolve $CaCO_3$
If LSI is positive: Scale can form and $CaCO_3$ precipitation may occur
If LSI is close to zero: Borderline scale potential. Water quality or changes in temperature, or evaporation could change the index.

The LSI is probably the most widely used indicator of cooling water scale potential. It is purely an equilibrium index and deals only with the thermodynamic driving force for calcium carbonate scale formation and growth. It provides no indication of how much scale or calcium carbonate will actually precipitate to bring water to equilibrium. It simply indicates the driving force for scale formation and growth in terms of pH as a master variable.

Evaporative-Condensing Unit
Features and Water Treatment Continued

In order to calculate the LSI, it is necessary to know the alkalinity (mg/L as $CaCO_3$), the calcium hardness (mg/L Ca^{2+} as $CaCO_3$), the total dissolved solids (mg/L TDS), the actual pH, and the temperature of the water (°C). If TDS is unknown, but conductivity is, one can estimate mg/L TDS using a conversion table such as the one presented here. LSI is defined as:

LSI = pH - pHs

Where:
pH is the measured water pH
pHs is the pH at saturation in calcite or calcium carbonate and is defined as:
pHs = (9.3 + A + B) - (C + D)
Where:
A = (Log_{10} [TDS] - 1) / 10
B = -13.12 x Log_{10} (°C + 273) + 34.55
C = Log_{10} [Ca^{2+} as $CaCO_3$] - 0.4
D = Log_{10} [alkalinity as $CaCO_3$]

AAONECat32™ allows calculation of the LSI and can be used as a reference for understanding the impact of water treatment on the performance of the evaporative-cooled condensing system.

Evaporative-Condensing Unit
Features and Water Treatment Continued

As an example, the LSI is computed for a system using 3 cycles of concentration (mineral content of the refrigerant water is 3 times that of the makeup water) of Niagara River water. In the AAON evaporative-condensing unit, refrigerant exits the de-superheater at 90% quality (90% gas, 10% liquid) in the example following the refrigerant enters the wetted section of the condenser at 101.7°F.

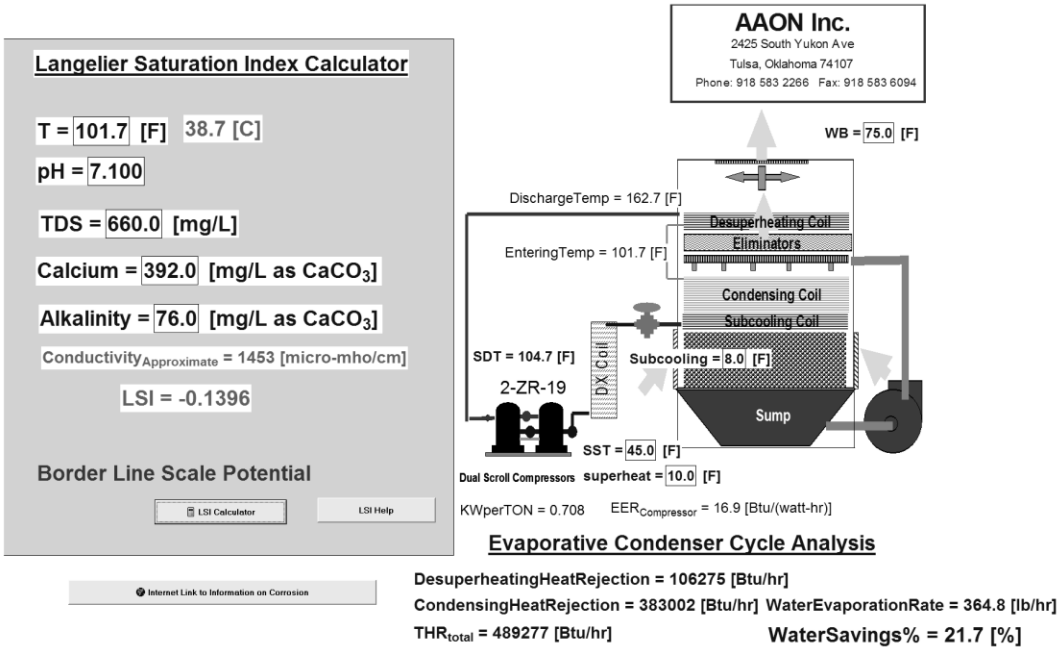

Figure 16 - Example Evaporative-Condensing Unit with De-superheater

Let's assume that the de-superheater is not in the system, and then 163.4°F refrigerant would enter the coil in the wetted section of the condenser. The LSI can be computed, resulting in definite scale potential:

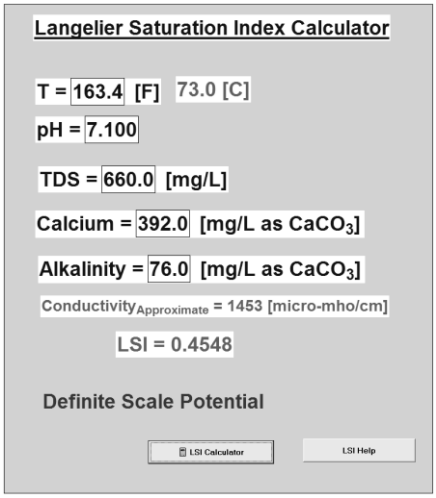

Figure 17 - Example Evaporative-Condensing Unit without De-superheater

Literature Change History

February 2008
Update of catalog correcting the description of hot gas bypass in Feature 8.

September 2008
Update of catalog correcting the evaporative-condensing unit performance data. The LWT label was changed to a SST label. Updated Tridium Niagara/JACE controls section.

July 2015
Removed R-22 refrigerant from all applicable options. Removed Options 0 and P from *Model Option A1- Cooling Style.* Updated Controls System section.

June 2018
Removed JENEsys and WattMaster VCM-X. Added AAON/WattMaster VCCX2.

November 2018
Removed Performance Data Tables. Updated Feature 9 – Refrigeration Accessories. VFD Condenser Fans are standard on all CL units. Updated the description for Polymer E-coated condenser coil.

June 2019
Updated e-coating description.

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Engineering Catalog CL Series
R53170 · Rev. E · 190628

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