LL Series
Chillers and
Outdoor Mechanical Rooms
Engineering Catalog

Evaporative-Cooled Condenser

Air-Cooled Condenser

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Features and Benefits

Flexibility of Design
With model sizes ranging from 35 to 540 tons the AAON LL Series chiller can suit any application.

Convenience and Serviceability
The AAON LL Series chiller was designed with convenient installation and servicing in mind. The LL Series chiller is delivered to the jobsite ready for installation and startup. AAON offers a wide variety of standard and optional features, including pumping packages, boilers and compression/expansion tanks. All of these components are piped, wired and run tested before they are shipped from the factory.

All models feature lockable, hinged access doors to the cabinet interior. A lighted walk-in controls vestibule provides indoor access to vital controls components, the electrical system and compressors. Vestibule fan, chilled water coil and electric heater options are available. All controls components are labeled and connected with color-coded wiring to match the unit wiring diagram. Water connections may be specified in the front or back of the cabinet, which may be rooftop, platform or ground-level slab mounted. With all components internal to the cabinet, the LL Series chiller does not require mounting in a remote location or a screened, protected area to prevent contact with building or visiting personnel.

Figure 1 - Walk-in Compressor and Control Compartment

Reliability
The cabinet's composite construction, galvanized G-90 sheet steel paneling surrounding insulating foam, provides strength, rigidity and excellent thermal characteristics. Corrosion resistant external polyurethane paint surpasses a 2,500 hour salt spray test. The evaporative-cooled condenser section 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 section is slope mounted to reduce any potential fin damage, and additional coil corrosion protection is offered with an optional polymer e-coating

which surpasses a 6,000 hour salt spray test. AAON integrates the latest in scroll compressor technology into its all of its products for greater operational reliability than comparable reciprocating compressors. Each chiller is factory inspected and checked for leaks before leaving the factory.

Quiet Operation

In addition to being dependable, the hermetic scroll compressors included in each LL Series chiller offer quieter operation than comparable reciprocating compressors. Each compressor is placed on raised structural decks and rubber isolation mounted minimizing vibration. The chiller cabinet construction, composite paneling with 2" thick foam insulation, not only provides good thermal insulation, but also minimizes excessive exterior sound levels. A standard feature on all AAON chillers is axial flow condenser fans with adjustable pitch blades providing maximum airflow with minimal noise levels. For quieter condenser section operation, Variable Frequency Drives (VFDs) are available to reduce condenser fan energy consumption and noise at part load operation.

Efficiency

All condenser fans utilize direct drive motors for maximum efficiency. VFDs are available on all pump motors and condenser fans for efficient operation at part load conditions. In addition to providing energy savings of 20 to 40% over the air-cooled model, the evaporative-cooled condenser contains a standard de-superheater 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. Variable capacity oil-free magnetic bearing centrifugal compressors provide load matching cooling capacity, with quiet energy efficient operation and oil free design is highly reliable. Variable capacity VFD controlled scroll compressors also provide load matching cooling capacity, with quiet energy efficient operation. The LL Series chiller maintains control on the leaving water temperature by cycling compressors on and off at part load conditions, maintaining efficient operation across the entire range of operation.

Smart Controls

Every model is furnished with a Micro Control Systems (MCS) Magnum controller that cycles the compressors to maintain the leaving water temperature over a wide range of operating conditions. A convenient interface is provided with a large LCD display. Inputs are made using 9 large keys with menu driven prompts. Schedules are available with a seven day built-in time clock. Terminals are provided for remote stop-start and for remote reset of the leaving water temperature setpoint. The controller features 12 analog and 4 digital inputs, 10 relay outputs and 4 analog outputs. Non-volatile memory is used for all control functions. Optional features include diagnostic sensors for pressure and temperature on each refrigerant circuit, current sensors for each compressor, a full color touchscreen interface and a RS-485 port and Ethernet port allowing communication with a building management system.

Figure 2 - LCD Control and Display Panel

Factory Installed Pumping Packages
AAON has taken the lead with factory engineered and installed pumping packages that save time and expenses associated with the details of the jobsite construction of the equipment room. The LL Series effectively becomes a packaged outdoor mechanical room and eliminates the need to use valuable indoor floor space.

The factory installed piping package is configurable, it can include primary and secondary pumps with a factory mounted air separator, compression/expansion tanks, and piping access to the building through the sides or bottom. Grooved end piping and fittings are furnished as a standard feature, and the insulated compartment can even be provided with heating or cooling for technician comfort while periodic maintenance is performed. Primary pumping packages include: an Armstrong® pumps, butterfly valves, strainers, ball valves, pressure relief valves and makeup water pressure reduction valve with backflow prevention. Primary/Secondary pumping packages for variable flow systems include all the primary pumping package components listed above plus a secondary pump and associated additional components.

Figure 3 - Chilled Water Pumping Package Piping

Individual redundant pumps or dualArm pumps are also available. The dualArm Armstrong pump is available for both the primary or secondary pumps. The inlet and outlet ports on the casing are at least one size larger than a single pump size, so that both units may operate in parallel with no loss of single pump efficiency. Each port is fitted with an isolation valve that allows the units to operate in parallel or standby, and may also be used to isolate one pumping unit for servicing or removal, with the other pump still operating.

Figure 4 - Chilled Water Pumping Package with dualArm Pump

For added convenience, selection of pumping packages is handled through the AAON selection software, AAON Ecat.

Pumps are selectable for primary or primary/secondary pumping arrangements. When a compression/expansion tank option is selected, the appropriate compression/expansion tank size for the package will be selected. Refer to the AAON website for further information and the AAON Ecat selection software. Manual selection of the pumping package components is not possible due to the many combinations and applications conditions that may be selected. All the primary and primary/secondary pumping systems are supported throughout the LL Series chiller sizes and associated flow rates. After pump selection is made, the AAON Ecat software will generate a rating sheet, pump performance curves, and a piping diagram.

Factory Installed Boilers

AAON offers factory installed boilers for the LL Series. The boilers are available in capacities from 500,000 to 1,500,000 Btu/h input, and as many as four boilers are available for installation within the LL Series cabinet for up to 6,000,000 Btu/h input. The design takes the very best of existing copper-finned boiler technology to the next level. Real-life serviceability, innovative heat exchanger design, clean and efficient advanced combustion, and unique timesaving controls are all combined in a compact quick-connect package with efficiencies of up to 88%. Central to the boiler's highly efficient operation is the design of its copper-tube heat exchanger. Not only does it efficiently maintain heat transfer, but the innovative gasket-less carbon steel header provides for easy inspection, cleaning and individual tube replacement. The combustion chamber is also completely enclosed in a stainless steel compartment and features collection/evaporation components to effectively handle cold start condensate.

Designed to operate at 88% thermal efficiency with NOx ratings less than 9.9 ppm, the noiseless ceramic radiant burner runs at minimal excess air levels creating highly efficient, trouble-free operation. The rugged industrial cast aluminum blower and fan wheel are equipped with a replaceable combustion air filter, which is 99% efficient to one micron, to create excellent combustion characteristics and even air distribution. The boiler can even be operated with its jacket panels removed for easy inspection or maintenance.

Figure 5 - Factory Installed Boiler

Unique Timesaving Controls

Instead of using a series of relays, the boiler utilizes state-of-the-art microprocessor flame safeguard controls to provide extensive diagnostic information including first-out fault annunciation using an LED diagnostic display. The proven spark-to-

pilot ignition system ensures that the pilot is lit before allowing the main gas valve to open. The display unit provides operational information and history. Full modulation is achieved using a VFD and an air-fuel ratio modulating control valve. The control valve is actuated by an air signal from the fan - as the fan varies so does the gas valve. It is truly a linkage-less system and allows for safe fuel-air combustion. Full modulation is available on all models.

Application Information

Heat Exchanger Design Data

The system can start and pull down with up to 80°F entering water temperature. For continuous operation, it is recommended that the entering water temperature not exceed 70°F. The chiller must not be operated with a leaving water temperature of less than 42°F for a plain water application. When lower leaving fluid temperatures are required, an appropriate glycol solution must be used. The solution must have a freezing point at least 15°F lower than the design leaving fluid temperature. The temperature difference between fluid entering and leaving the chiller must be in the range of 6 to 16°F. The absolute maximum fluid temperature that can be circulated continuously through the heat exchanger is 110°F.

Dual Ended Units

Some chiller models are composed of two smaller chiller models in a configuration with the condenser sections located at each end, and a common area between containing the chilled water heat exchangers.

Table 1 - Dual Ended Scroll Compressor Chiller Composition

Dual Ended Chiller Models	Composed of two Chiller Models
LL-067	LL-035
LL-092	LL-050
LL-104	LL-055
LL-118	LL-060
LL-210	LL-105
LL-230	LL-115
LL-245	LL-125
LL-275	LL-140
LL-300	LL-150
LL-335	LL-170
LL-365	LL-185

A single controller is standard for the dual ended condenser units, however, a two controller option is available (via Special Pricing Authorization or SPA) that operates each chiller independently. Water connections can be factory piped together for connection to the building. Boilers are not available in dual ended units. The model sizes LL-067, LL-092, LL-104 and LL-118 may be used in applications where a maximum motor size limit of 15 hp exists.

Fluid Volume

Consideration must be given to the total volume of fluid in the system. In close coupled, low volume systems, the leaving fluid temperature will change quickly with steps of capacity control. This is not acceptable if close control is desired for a conditioned space or an industrial process. In order to accurately determine the fluid volume needed for the application, you must resolve and agree on the amount of swing in fluid temperature that can be tolerated. This will depend on the control system, the terminal equipment operation, and use. The scroll compressor LL Series chiller models contain 4 to 8 compressors. Use the following example as a guide to determine swing in fluid temperature tolerable.

Use the information in Table 2, which lists the maximum step of capacity in each model size, and a factor for that model.

Loop Volume Example
An LL-075 is rated at 77 tons at the operating conditions. It is desired to have no greater than a +/- 3°F leaving water temperature variation due to compressor unloading. What is the minimum water volume required in the chilled water loop?

Solution: Use the following equation to determine the minimum allowable water loop volume.

Minimum Water Loop Volume = Actual Tons x (Min. Volume Gal-°F Swing/Ton) / Allowable °F Swing

Allowable °F Swing is specified in the problem statement. With a tolerance of +/- 3°F, the total allowable swing is 6°F.

Select the value of Min. Volume Gal-°F Swing/ton from Table 2.

Table 2 - Scroll Compressor Chiller Minimum Water Loop Volume

Model	Maximum % Capacity Step	Minimum Volume (Gal-°F Swing)/ton
LL-035	25.00	30.01
LL-050	25.00	30.02
LL-055	28.20	33.83
LL-060	25.00	30.01
LL-075	30.40	36.47
LL-085	18.00	21.63
LL-090*	16.70	20.01
LL-105	21.80	26.19
LL-115	20.00	24.01
LL-125	18.90	22.69
LL-140	16.70	20.02
LL-150*	15.20	18.23
LL-170	13.70	16.46
LL-185	12.50	15.01

*Scroll compressor models

Minimum Volume = 36.47 (Gal - °F Swing)/ton

Compute the Minimum Water Loop Volume with the known performance of 77 tons of cooling at the application conditions:

Minimum Water Loop Volume = 77 x 36.47 / 6 = 445 gallons

Notice if this system was selected for a 45°F leaving water temperature, the temperature will vary between 42°F to 48°F (recall the variation tolerance +/- 3°F) with the cycling of the compressors at the water loop volume of 445 gallons. The final selection should ensure the leaving water temperature does not drop below 42°F. If a leaving water temperature below 42°F is indicated then the loop volume should be increased or glycol should be included with the design.

If the fluid loop contains glycol, the above **water loop volume** should be multiplied by the correction factor in Table 3.

Table 3 - Glycol Volume Correction Factors

% by Weight	Glycol Volume Correction Factor	
	Ethylene	Propylene
10	1.038	1.017
20	1.066	1.033
30	1.100	1.058
40	1.140	1.092
50	1.192	1.142

It may be necessary to install a storage tank in the system to provide the necessary volume for close temperature control. When this is done, the tank should be installed in the loop between the fluid leaving from the chiller and the supply to the building. Figure 6 illustrates a proper storage tank usage.

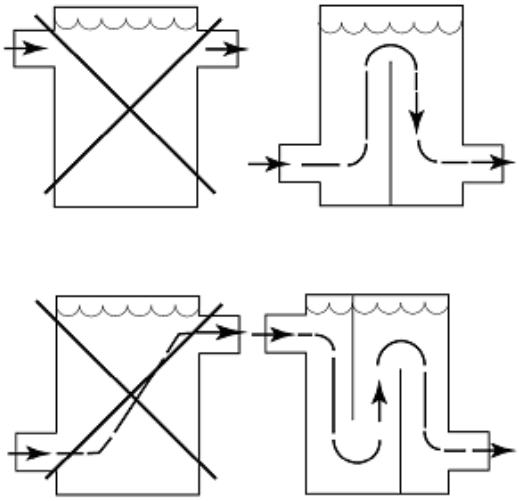


Figure 6 - Storage Tank Usage

Oversizing Chillers

Generally speaking, fully loaded equipment operates more efficiently than large equipment running at or near minimum capacity. When selecting a chiller, the anticipated part load operation of the system should be evaluated with respect to the NPLV rating of the equipment under consideration. Larger future loading requirements may cause temporary oversizing of equipment that is initially selected and installed. This should be done with care, although the AAON LL Series chiller, with multiple scroll compressors, is more tolerant than older designs that use a single compressor.

Chiller Placement

The AAON LL Series chiller is designed for outdoor applications and mounting at ground level or on a roof. It must be placed on a level and solid foundation that has been prepared to support its weight. When installed at ground level, a one-piece concrete slab should be used with footings that extend below the frost line. With ground level installation, care must be taken to protect the coil fins from damage due to vandalism or other causes. The placement relative to the building air intakes and other structures is critical and must be carefully selected. .

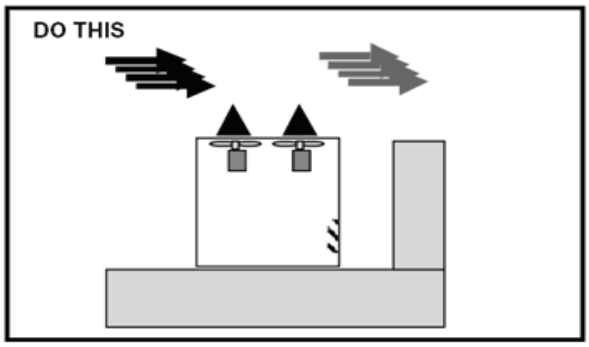


Figure 7 - Proper Chiller Placement

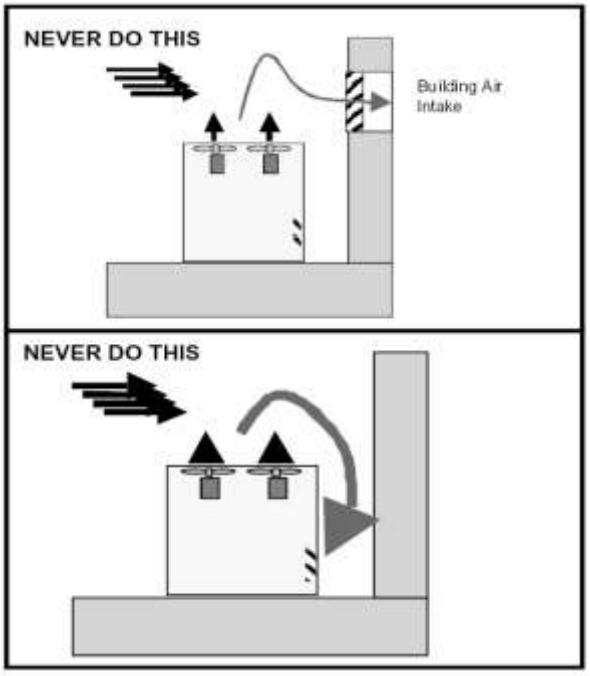


Figure 8- Improper Chiller Placement

Be sure to observe the dimensions that are on the rating plate of the chiller for operational and service clearances. For proper unit operation, the immediate area must remain free of debris that may be drawn in and obstruct airflow in the condensing section. Table 4 shows the typical clearances found on the rating plate of each unit.

Table 4 - Service Clearances

Location	35-540 tons
Front - Controls Access Side	100”
Back	100”
Ends	100”
Top	Unobstructed

Always remember, there should be no obstruction above the unit that could deflect the discharge air downward where it could recirculate to the inlet of the condensing section. The position of the chiller must provide sufficient side and end clearance to allow air to enter, as well as, to permit the access for any future service. This is particularly important on evaporative-cooled condenser models where clearance on the back side (opposite the controls vestibule door) must allow free access to the condensing section. If the low ambient option has been ordered with the equipment then special consideration must be given to snow accumulation when placing the unit. Condenser coils and fans must be free of snow or any other obstructions in order to start and operate properly with a correct amount of airflow.

Access Doors

When planning the placement of the chiller, take into consideration the access doors to the equipment. A lockable access door is provided to the compressor and controls vestibule. A separate access door is also provided to the evaporator/heat exchanger compartment. A light switch is on the wall of the compressor and controls vestibule.

Mounting Isolation

For roof mounted applications or anytime vibration transmission may be a factor, vibration isolators may be considered.

Electrical Power Supply

A disconnect switch that is accessible from the outside of the cabinet is available factory installed. The single point electrical power connections are made in the compressor/electrical controls vestibule. The power and control wiring is brought up through the utility entry to either the power supply terminal blocks or the disconnect switch. The controller furnished with the unit is supplied with its own power supply factory wired to the main power of the chiller. The voltage to the chiller must be within plus or minus 10% of the nameplate rating value on the unit.

All units are furnished with a single point power supply standard, but dual point power is available on dual ended condensing unit models. The largest capacity single point power supply terminal supplied from AAON is rated at 1200 amps. The larger dual ended condenser LL Series chiller model sizes rated at 208 or 230 volts would have an amp draw above this amount and therefore are supplied with the power supply terminal blocks in each end. Two power supplies must be connected to these models.

Electrical Data
When a pumping package is selected, the amp draw of the pumps is added to the standard electrical data. This will increase the minimum circuit ampacity and the maximum fuse size. Consult AAON Ecat or the Electrical Service Sizing Data section of this catalog for electrical sizing information.

Dimensional Drawings
Equipment dimensions vary based on unit capacity, type of condenser, pumping system and if the unit includes a boiler system. AAON Ecat should be used with all the job application information in order to receive an accurate drawing for a specific model and feature set.

Optional Oversized Heat Exchangers
Oversized heat exchangers are available on all model sizes and may be selected to improved performance with water or to use with systems that contain glycol to aid in offsetting the decreased capacity due to the thermal properties of glycol.

Factory Insulated Evaporators
Shell and tube heat exchangers are insulated at the factory before shipment. The remaining components in the chilled fluid circuit are not insulated so that all piping connections and components can be leak checked before they are insulated.

Unit Selection

Selection Procedure
Chiller selection will require knowledge of:

Chiller
- Condenser Type
- Compressor Type
- Pumping System Type

Chiller Conditions
- System Load
- Ambient Conditions
- Entering Water/Glycol Temperature
- Leaving Water/Glycol Temperature (or Design Temperature Drop through the Chiller)
- Chiller Flow Rate
- Glycol Percentage
- Water Fouling Factor

Boiler Conditions
- System Load
- Entering Water Temperature
- Leaving Water Temperature (or Design Temperature Rise through the Boiler)
- Boiler Flow Rate

Pumping System Conditions
- Building Pressure Drop
- Building Flow Rate
- Minimum/Maximum Loop Temperature
- External Loop Volume

Water Fouling Factor
The standard fouling factor is assumed at 0.0001 ft^2 x hr °F/Btu with AAON Ecat. If calculating a solution with an alternative fouling factor, apply the appropriate correction factor shown in Table 7.

Glycol Chillers
A minimum leaving fluid temperature of 42°F is allowed when water is used as a heat transfer fluid to ensure freeze protection and continued operation of the heat exchanger. When lower leaving temperatures are desired, glycol must be added to the circulating fluid. AAON Ecat will calculate correction factors of propylene glycol systems based on the percentage of glycol input into the Unit Conditions window. If calculating a solution requiring ethylene glycol, apply the appropriate correction factor from Table 5. Propylene glycol correction factors are shown in Table 6.

Dual Ended Chillers
Application may require a dual ended condenser (dual ended chiller) model which is composed of two smaller chiller models in a configuration with the condenser sections located at each end. See Table 1 for composition of dual ended units.

Performance of a dual ended unit is approximately two times that of the single ended unit. Figure 9 and Figure 10 show the evaporator pressure drop for single ended models. Using the calculate gpm for each single ended model and the associated pressure drop for the single ended model, the total system pressure drop is approximately doubled through the two chiller evaporators.

Chilled Water Flow Rate
An approximation of the chilled water flow rate in gallons per minute (gpm) is given by the following equation:

GPM = (Tons x 24) / ΔT

Selection Example 1
An air-cooled condenser scroll compressor chiller is needed that can provide 120 tons of cooling capacity at 105°F DB and 77°F WB ambient air temperature. The leaving water temperature needed is 44°F, with a 10°F ΔT or entering water temperature of 54°F. Assume a standard fouling factor, a standard sized chiller heat exchanger and no glycol.

System Load = 120 tons
Ambient Dry Bulb Conditions = 105°F
Entering Water temperature = 54°F
Leaving Chilled Water Temperature = 44°F
ΔT = 10°F

Solution: The approximate water flow rate is computed from the equation:

GPM = (120 x 24)/10 = 288 gpm

Using AAON Ecat, the performance of a LL-140 at these specific unit conditions is 119.9 tons of cooling capacity, the associated power input is 165.3 kW, the EER is 8.7, the kW/ton NPLV is 0.96 and the pressure drop is 11.3 ft.

If an evaporative-cooled condenser is selected, using AAON Ecat, the performance of a LL-125 at these specific unit conditions is 122.3 tons of cooling capacity, the associated power input is 109.8 kW, the EER is 13.4, the kW/ton NPLV is 0.81 and the pressure drop is 14.7 ft.

Selection Example 2
An air-cooled condenser scroll compressor chiller is needed that can provide 100 tons of cooling capacity at 95°F DB ambient air temperature. The leaving water temperature needed is 44°F, with a 10°F ΔT or entering water temperature of 54°F. Assume a standard fouling factor and a standard sized chiller heat exchanger. The chiller fluid circuit needs to be protected down to 10°F.

System Load = 100 tons
Ambient Dry Bulb Conditions = 95°F
Entering Water temperature = 54°F
Leaving Chilled Water Temperature = 44°F
ΔT = 10°F

Solution: The approximate water flow rate is computed from the equation:

GPM = (100 x 24)/10 = 240 gpm

Using AAON Ecat, with a 30% propylene glycol to satisfy the freeze protection requirement down to 10°F, the performance of a LL-115 at these specific unit conditions is 98.3 tons of cooling capacity, the associated power input is 125.1 kW, the EER is 9.4, the kW/ton NPLV is 1.05 and the pressure drop is 15.0 ft.

If an oversized chiller heat exchanger is used, using AAON Ecat, the performance of a LL-115 at these specific unit conditions is 100.7 tons of cooling capacity, the associated power input is 125.5 kW, the EER is 9.6, the kW/ton NPLV is 1.03 and the pressure drop is 6.15 ft.

Using AAON Ecat, with water and a standard sized chiller heat exchanger, the performance of a LL-115 at these specific unit conditions is 103.7 tons of cooling capacity, the associated power input is 126.3 kW, the EER is 9.9, the kW/ton NPLV is 1.0 and the pressure drop is 10.7 ft.

Consulting Table 5, the correction factors applicable for a 30% ethylene mix are:

Capacity = 0.97, Power = 0.99, Pressure Drop = 1.15, and Flow Factor = 26.4

Applying the correction factors to the water performance:

Corrected Capacity = 103.7 tons x 0.97 = 100.6 tons
Corrected System kW = 126.3 kW x 0.99 = 125.0 kW
Corrected Flow Rate = (100.6 x 26.4)/10 = 265.6 gpm

Consulting Figure 9, the pressure drop of 265.6 gpm intersects about 8 ft along the LL-115 performance line.

Corrected pressure drop = (8 x 1.15) = 9.2 ft

Selection Example 3
An evaporative-cooled condenser scroll compressor chiller is needed that can provide 300 tons of cooling capacity at 95°F DB and 75°F WB ambient air temperature. The leaving water temperature needed is 44°F, with a 14°F ΔT or entering water temperature of 58°F. Assume an oversized chiller heat exchanger and no glycol. Assume the chiller has a water fouling factor of 0.00075 ft^2 x hr °F/Btu.

System Load = 300 tons
Ambient Dry Bulb Conditions = 95°F
Entering Water temperature = 58°F
Leaving Chilled Water Temperature = 44°F
ΔT = 14°F

Solution: The approximate water flow rate is computed from the equation:

GPM = (300 x 24)/14 = 514.3 gpm

Using AAON Ecat, the performance of a LL-300 at these specific unit conditions is 303.6 tons of cooling capacity, the associated power input is 276.9 kW, the EER is 13.16 and the pressure drop is 5.61 ft.

Consulting Table 7, the correction factors applicable for a 0.00075 ft^2 x hr °F/Btu water fouling factor with 14°F ΔT are:

Capacity = 0.980, Power = 0.996

Applying the correction factors to the water performance:

Corrected Capacity = 303.6 tons x 0.980 = 297.5 tons
Corrected System kW = 276.9 kW x 0.996 = 275.8 kW
Calculated EER = (297.5 x 12)/275.8 = 12.9 EER

Performance Correction Factors

Table 5 - Ethylene Glycol Correction Factors

% Ethylene Glycol by Weight	Freeze Point °F	Capacity Factor	Power Factor	Pressure Drop Factor	Flow Factor
10	26	0.998	0.998	1.03	24.9
20	17	0.995	0.997	1.09	25.6
30	5	0.970	0.990	1.15	26.4
40	-10	0.941	0.985	1.23	27.4
50	-32	0.950	0.970	1.31	28.6

Table 6 - Propylene Glycol Correction Factors

% Propylene Glycol by Weight	Freeze Point °F	Capacity Factor	Power Factor	Pressure Drop Factor	Flow Factor
10	26	0.998	0.996	1.08	24.4
20	19	0.975	0.975	1.21	24.8
30	9	0.960	0.985	1.40	25.4
40	-6	0.921	0.975	1.67	26.2
50	-28	0.910	0.965	1.98	27.4

Table 7 - Water Fouling Correction Factor

Chilled Water ΔT (°F)	0.0001		0.00025		0.00075		0.00175	
	Capacity Factor	Power Factor	Capacity Factor	Power Factor	Capacity Factor	Power Factor	Capacity Factor	Power Factor
6	0.990	0.998	0.989	0.996	0.962	0.986	0.920	0.973
8	0.994	0.999	0.991	0.998	0.965	0.988	0.923	0.975
10	1.000	1.000	0.993	0.999	0.970	0.991	0.928	0.978
12	1.005	1.001	0.999	1.000	0.975	0.993	0.933	0.980
14	1.008	1.002	1.005	1.001	0.980	0.996	0.937	0.983
16	1.010	1.003	1.008	1.003	0.984	0.998	0.941	0.985

Evaporator Pressure Drops

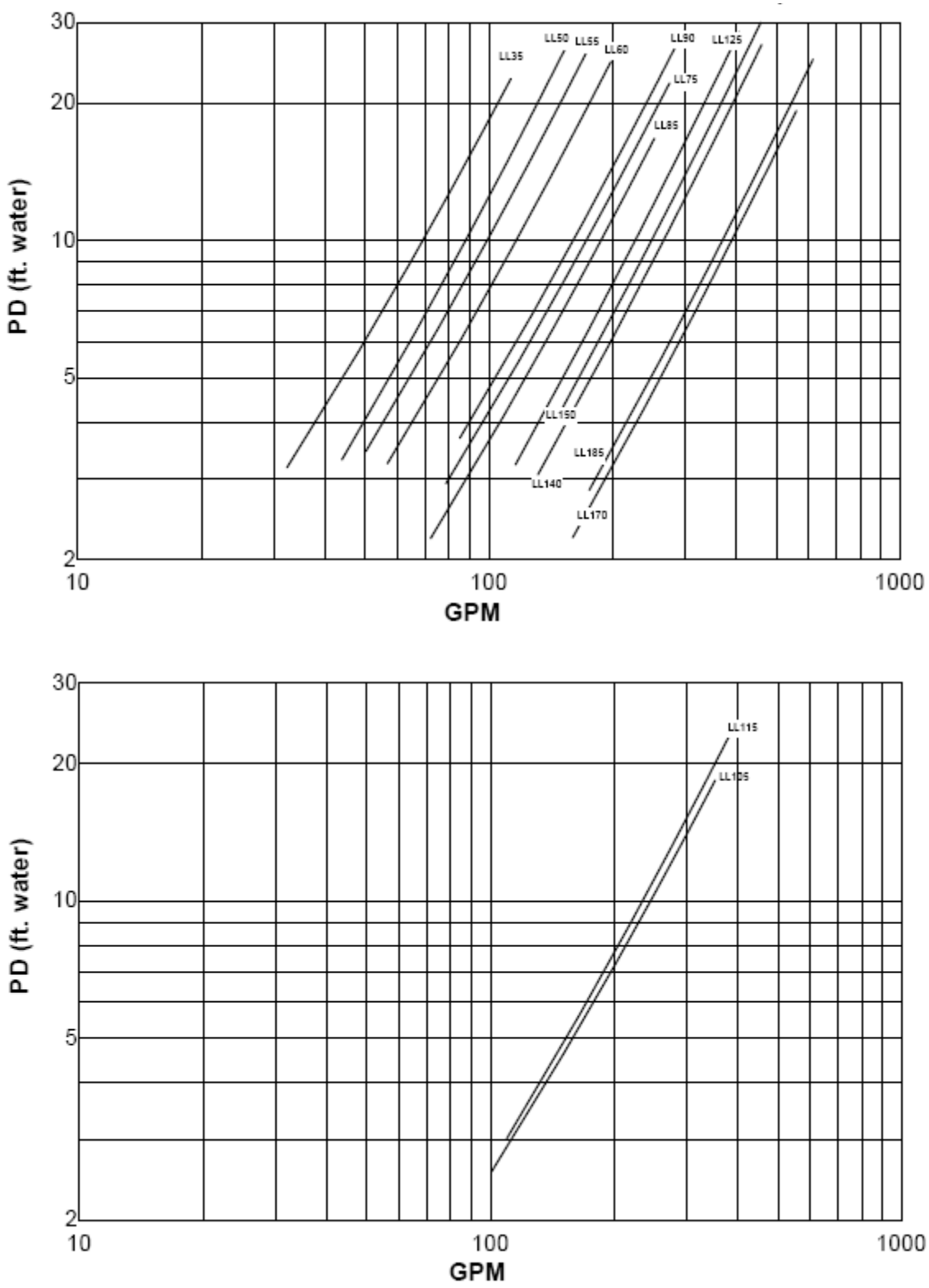
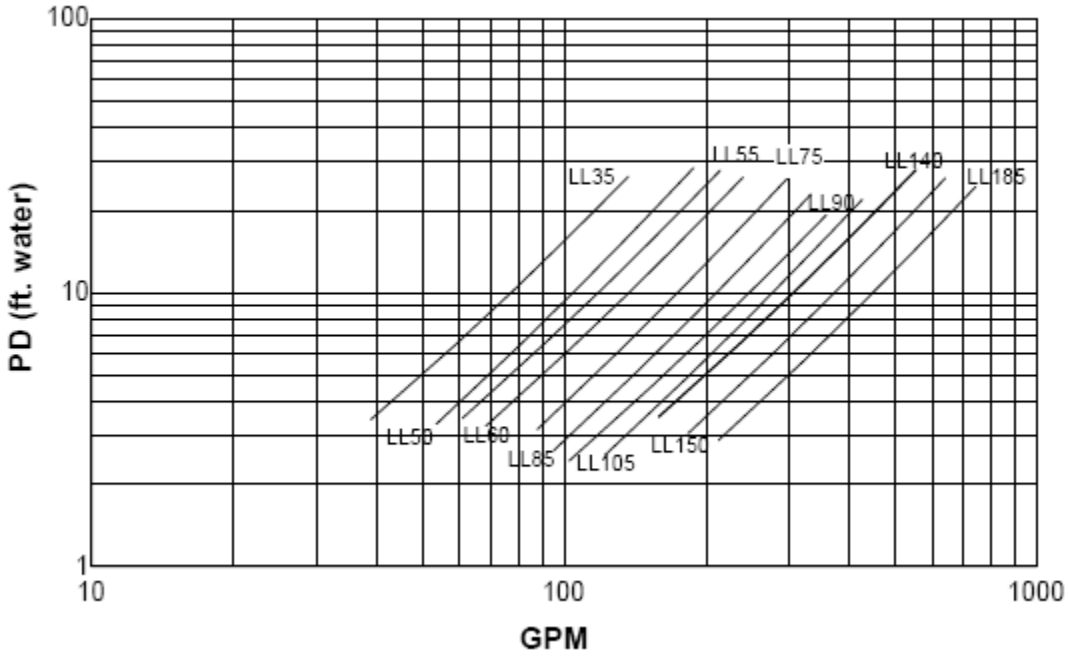


Figure 9 - Scroll Compressor Chiller Standard Shell and Tube Heat Exchanger Pressure Drop



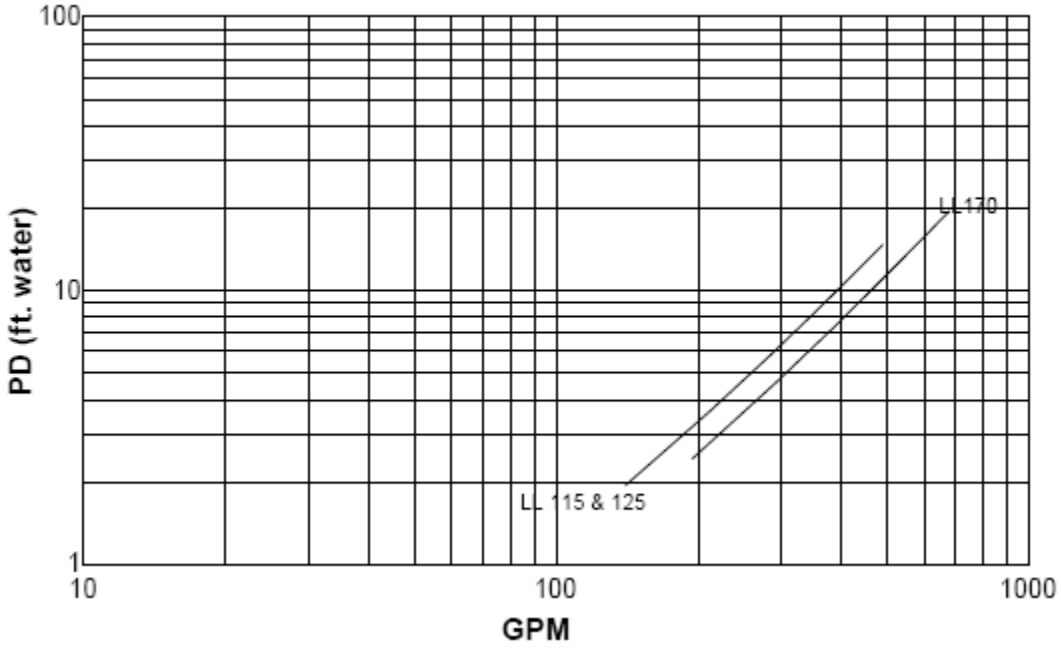
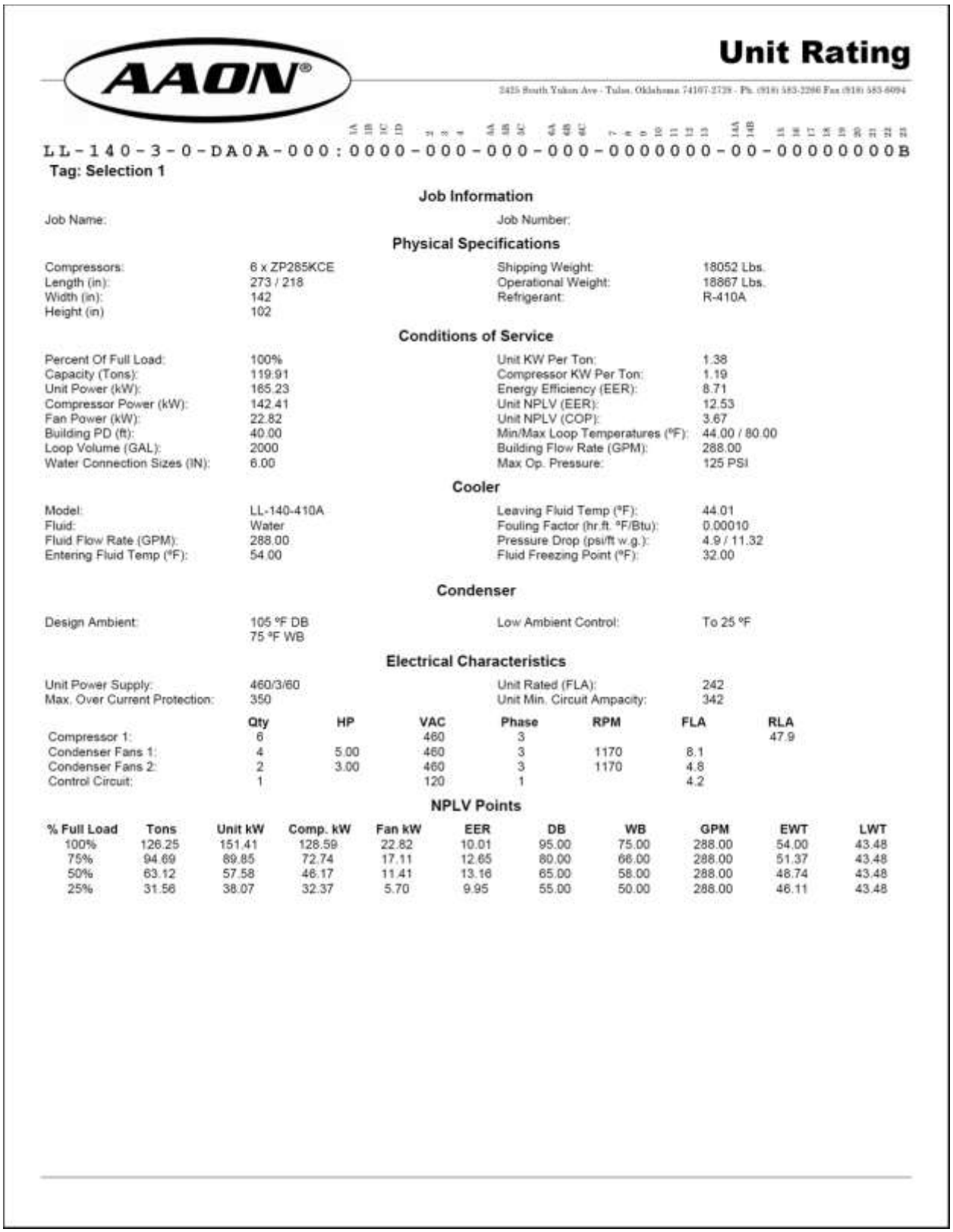


Figure 10 - Scroll Compressor Chiller Oversized Shell and Tube Heat Exchanger Pressure Drop



AAON®

Unit Rating

2425 South Yukon Ave - Tulsa, Oklahoma 74107-2728 - Ph. (918) 583-2266 Fax (918) 583-6094

LL-140-3-0-DA0A-000:0000-000-000-000-00000000-00-00000000B

Tag: Selection 1

Job Information

Job Name: Job Number:

Physical Specifications

Compressors:	6 x ZP285KCE	Shipping Weight:	18052 Lbs.
Length (in):	273 / 218	Operational Weight:	18867 Lbs.
Width (in):	142	Refrigerant:	R-410A
Height (in)	102		

Conditions of Service

Percent Of Full Load:	100%	Unit KW Per Ton:	1.38
Capacity (Tons):	119.91	Compressor KW Per Ton:	1.19
Unit Power (kW):	165.23	Energy Efficiency (EER):	8.71
Compressor Power (kW):	142.41	Unit NPLV (EER):	12.53
Fan Power (kW):	22.82	Unit NPLV (COP):	3.67
Building PD (ft):	40.00	Min/Max Loop Temperatures (°F):	44.00 / 80.00
Loop Volume (GAL):	2000	Building Flow Rate (GPM):	288.00
Water Connection Sizes (IN):	6.00	Max Op. Pressure:	125 PSI

Cooler

Model:	LL-140-410A	Leaving Fluid Temp (°F):	44.01
Fluid:	Water	Fouling Factor (hr.ft. °F/Btu):	0.00010
Fluid Flow Rate (GPM):	288.00	Pressure Drop (psi/ft w.g.):	4.9 / 11.32
Entering Fluid Temp (°F):	54.00	Fluid Freezing Point (°F):	32.00

Condenser

Design Ambient:	105 °F DB 75 °F WB	Low Ambient Control:	To 25 °F

Electrical Characteristics

Unit Power Supply:	460/3/60	Unit Rated (FLA):	242
Max. Over Current Protection:	350	Unit Min. Circuit Ampacity:	342

	Qty	HP	VAC	Phase	RPM	FLA	RLA
Compressor 1:	6		460	3			47.9
Condenser Fans 1:	4	5.00	460	3	1170	8.1	
Condenser Fans 2:	2	3.00	460	3	1170	4.8	
Control Circuit:	1		120	1		4.2	

NPLV Points

% Full Load	Tons	Unit kW	Comp. kW	Fan kW	EER	DB	WB	GPM	EWT	LWT
100%	126.25	151.41	128.59	22.82	10.01	95.00	75.00	288.00	54.00	43.48
75%	94.69	89.85	72.74	17.11	12.65	80.00	66.00	288.00	51.37	43.48
50%	63.12	57.58	46.17	11.41	13.16	65.00	58.00	288.00	48.74	43.48
25%	31.56	38.07	32.37	5.70	9.95	55.00	50.00	288.00	46.11	43.48

Figure 11 - Example 1 AAON Ecat Rating Sheet

LL Series Feature String Nomenclature

Model Options : Unit Feature Options

GEN	SIZE	VLT	CONFIG	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	15	16	17	18	19	20	21	22	23
LL	**–0 7 5**	**– 3**	**– 0**	**– D**	**B**	**0**	**A**	– A	2	C	: C	R	J	G	– 0	F	B	– K	5	E	– K	J	G	– A	0	C	0	C	B	A	– E	C	– 0	F	A	A	0	0	B	0	B

BASE MODEL

SERIES AND GENERATION

LL

UNIT SIZE

035 = 35 ton Capacity
050 = 50 ton Capacity
055 = 55 ton Capacity
060 = 60 ton Capacity
067 = 67 ton Capacity
075 = 75 ton Capacity
085 = 85 ton Capacity
090 = 90 ton Capacity
092 = 92 ton Capacity
104 = 104 ton Capacity
105 = 105 ton Capacity
115 = 115 ton Capacity
118 = 118 ton Capacity
120 = 120 ton Capacity
125 = 125 ton Capacity
140 = 140 ton Capacity
150 = 150 ton Capacity
170 = 170 ton Capacity
180 = 180 ton Capacity
181 = 181 ton Capacity
185 = 185 ton Capacity
210 = 210 ton Capacity
230 = 230 ton Capacity
240 = 240 ton Capacity
245 = 245 ton Capacity
275 = 275 ton Capacity
300 = 300 ton Capacity
335 = 335 ton Capacity
360 = 360 ton Capacity
365 = 365 ton Capacity
450 = 450 ton Capacity
540 = 540 ton Capacity

VOLTAGE

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

BLANK

0 = Standard

MODEL OPTION A: COOLING

A1: COOLING STYLE

B = R-134a Variable Capacity Oil-Free Magnetic Bearing Centrifugal Compressors
D = R-410A Dual Circuited Scroll Compressors
E = R-410A Independently Circuited Scroll Compressors
M = R-410A VFD Compatible Scroll Compressors

A2: COOLING CONFIGURATION

0 = Air-Cooled Condenser, Low Water Flow
A = Air-Cooled Condenser, High Water Flow
B = Evap-Cooled Condenser, Low Water Flow
C = Evap-Cooled Condenser, High Water Flow

A3: COOLING COATING

0 = Standard
1 = Polymer E-Coated Condenser Coil
2 = Stainless Steel Condenser Coil Casing

A4: COOLING STAGING

A = Shell and Tube Heat Exchanger
C = Oversized Shell and Tube Heat Exchanger (Glycol)
V = Shell and Tube Heat Exchanger + All Variable Speed Compressors
W = Oversized Shell and Tube Heat Exchanger (Glycol) + All Variable Speed Compressors

LL Series Feature String Nomenclature

Model Options : Unit Feature Options

GEN	SIZE	VLT	CONFIG	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	15	16	17	18	19	20	21	22	23
L	L	–	0	7	5	–	3	–	0	–	D	B	0	A	–	**A**	**2**	**C**	**:**	**C**	**R**	J	G	–	0	F	B	–	K	5	E	–	K	J	G	–	A	0	C	0	C	B	A	–	E	C	–	0	F	A	A	0	0	B	0	B

MODEL OPTION B: HEATING

B1: HEATING TYPE

0 = No Boiler
A = Natural Gas Fired Boiler
B = Propane Fired Boiler

B2: BOILER QUANTITY

0 = No Boiler
1 = 1 Boiler
2 = 2 Boilers
3 = 3 Boilers
4 = 4 Boilers

B3: BOILER HEATING CAPACITY

0 = No Boiler
A = 500 MBH Modulating High Flow
B = 750 MBH Modulating High Flow
C = 1,000 MBH Modulating High Flow
D = 1,500 MBH Modulating High Flow
E = 500 MBH Modulating Low Flow
F = 750 MBH Modulating Low Flow
G = 1,000 MBH Modulating Low Flow
H = 1,500 MBH Modulating Low Flow

FEATURE 1: BUILDING PUMPING

1A: PUMP OPTIONS

0 = Standard - No Building Pump
A = Common Water Connections
B = Primary Pumping System
C = Primary/Secondary Pumping System

1B: PUMP CONFIGURATION

0 = Standard - No Building Pump
D = 1 Pump - Prem Eff, 1170 RPM
E = 2 Single Pumps - Prem Eff, 1170 RPM
F = dualArm Pump - Prem Eff, 1170 RPM
G = 1 Pump w/ VFD - Prem Eff, 1170 RPM
H = 2 Single Pumps w/ 2 VFDs - Prem Eff, 1170 RPM
J = dualArm Pump w/ 2 VFDs - Prem Eff, 1170 RPM
N = 1 Pump - Prem Eff, 1760 RPM
P = 2 Single Pumps - Prem Eff, 1760 RPM
Q = dualArm Pump - Prem Eff, 1760 RPM
R = 1 Pump w/ VFD - Prem Eff, 1760 RPM
S = 2 Single Pumps w/ 2 VFDs - Prem Eff, 1760 RPM
T = dualArm Pump w/ 2 VFDs - Prem Eff, 1760 RPM
Y = 1 Pump - Prem Eff, 3520 RPM
Z = 2 Single Pumps - Prem Eff, 3520 RPM
1 = dualArm Pump - Prem Eff, 3520 RPM
2 = 1 Pump w/ VFD - Prem Eff, 3520 RPM
3 = 2 Single Pumps w/ 2 VFDs - Prem Eff, 3520 RPM
4 = dualArm Pump w/ 2 VFDs - Prem Eff, 3520 RPM

LL Series Feature String Nomenclature

Model Options : Unit Feature Options

GEN	SIZE	VLT	CONFIG	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	15	16	17	18	19	20	21	22	23
L	L	–	0	7	5	–	3	–	0	–	D	B	0	A	–	A	2	C	:	C	R	**J**	**G**	**–**	**0**	**F**	B	–	K	5	E	–	K	J	G	–	A	0	C	0	C	B	A	–	E	C	–	0	F	A	A	0	0	B	0	B

1C: PUMP SIZE

0 = Standard - No Building Pump
A = Pump 4360 1.5B
B = Pump 4360 2B
C = Pump 4360 2D
D = Pump 4380 1.5x1.5x6
E = Pump 4380 2x2x6
F = Pump 4380/4382 3x3x6
G = Pump 4380/4382 4x4x6
H = Pump 4380 1.5x1.5x8
J = Pump 4380 2x2x8
K = Pump 4380/4382 3x3x8
L = Pump 4380/4382 4x4x8
M = Pump 4380 5x5x8
N = Pump 4380/4382 6x6x8
P = Pump 4380 2x2x10
Q = Pump 4380/4382 3x3x10
R = Pump 4380/4382 4x4x10
S = Pump 4380/4382 6x6x10
T = Pump 4380/4382 8x8x10
U = Pump 4380 4x4x11.5
V = Pump 4380 5x5x11.5
W = Pump 4380 6x6x11.5
Y = Pump 4380 8x8x11.5
Z = Pump 4380 4x4x13
1 = Pump 4380 6x6x13
2 = Pump 4380 8x8x13
3 = Pump 4382 6x6x6
4 = Pump 4382 8x8x8
5 = Pump 4360 3D

1D: PUMP MOTOR

0=Standard - No Building Pump
A = 0.5 hp
B = 0.75 hp
C = 1 hp
D = 1.5 hp
E = 2 hp
F = 3 hp
G = 5 hp
H = 7.5 hp
J = 10 hp
K = 15 hp
L = 20 hp
M = 25 hp
N = 30 hp
P = 40 hp
Q = 50 hp
R = 60 hp
S = 75 hp

FEATURE 2: WATER CONNECTION LOCATION

0 = Back Water Connections
A = Front Water Connections
B = Bottom Water Connection

FEATURE 3: CHILLER ACCESSORIES

0 = Standard
A = Glycol System
D = Air Separator
E = Options A + D
F = Thermometers & Pressure Gauges + Option D
G = Thermometers & Pressure Gauges + Option E

LL Series Feature String Nomenclature

Model Options : Unit Feature Options

GEN	SIZE	VLT	CONFIG	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	15	16	17	18	19	20	21	22	23
L	L	–	0	7	5	–	3	–	0	–	D	B	0	A	–	A	2	C	:	C	R	J	G	–	0	F	**B**	**–**	**K**	**5**	**E**	–	K	J	G	–	A	0	C	0	C	B	A	–	E	C	–	0	F	A	A	0	0	B	0	B

FEATURE 4: LOW AMBIENT

0 = Standard - None
A = One Refrigerant Circuit
B = Two Refrigerant Circuits
C = Three Refrigerant Circuits
D = Four Refrigerant Circuits
E = Five Refrigerant Circuits
F = Six Refrigerant Circuits
G = Seven Refrigerant Circuits
H = Eight Refrigerant Circuits

FEATURE 5: RECIRCULATING PUMP

5A: PUMP CONFIGURATION

0 = Standard - No Recirculating Pump
D = 1 Pump/Barrel - Prem Eff, 1170 RPM
E = 2 Single Pumps/Barrel - Prem Eff, 1170 RPM
F = dualArm Pump/Barrel - Prem Eff, 1170 RPM
G = 1 Pump/Barrel w/ VFD - Prem Eff, 1170 RPM
H = 2 Single Pumps/Barrel w/ 2 VFDs - Prem Eff, 1170 RPM
J = dualArm Pump/Barrel w/ 2 VFDs - Prem Eff, 1170 RPM
N = 1 Pump/Barrel - Prem Eff, 1760 RPM
P = 2 Single Pumps/Barrel - Prem Eff, 1760 RPM
Q = dualArm Pump/Barrel - Prem Eff, 1760 RPM
R = 1 Pump/Barrel w/ VFD, Prem Eff, 1760 RPM
S = 2 Single Pumps/Barrel w/ 2 VFDs, Prem Eff, 1760 RPM
T = dualArm Pump/Barrel w/ 2 VFDs, Prem Eff, 1760 RPM
Y = 1 Pump/Barrel -Prem Eff, 3520 RPM
Z = 2 Single Pumps/Barrel - Prem Eff, 3520 RPM
1 = dualArm Pump/Barrel - Prem Eff, 3520 RPM
2 = 1 Pump/Barrel w/ VFD - Prem Eff, 3520 RPM
3 = 2 Single Pumps/Barrel w/ 2 VFDs - Prem Eff, 3520 RPM
4 = dualArm Pump/Barrel w/ 2 VFDs - 3520 RPM

5B: PUMP SIZE

0 = Standard - No Recirculating Pump
A = Pump 4360 1.5B
B = Pump 4360 2B
C = Pump 4360 2D
D = Pump 4380 1.5x1.5x6
E = Pump 4380 2x2x6
F = Pump 4380/4382 3x3x6
G = Pump 4380/4382 4x4x6
H = Pump 4380 1.5x1.5x8
J = Pump 4380 2x2x8
K = Pump 4380/4382 3x3x8
L = Pump 4380/4382 4x4x8
M = Pump 4380 5x5x8
N = Pump 4380/4382 6x6x8
P = Pump 4380 2x2x10
Q = Pump 4380/4382 3x3x10
R = Pump 4380/4382 4x4x10
S = Pump 4380/4382 6x6x10
T = Pump 4380/4382 8x8x10
U = Pump 4380 4x4x11.5
V = Pump 4380 5x5x11.5
W = Pump 4380 6x6x11.5
Y = Pump 4380 8x8x11.5
Z = Pump 4380 4x4x13
1 = Pump 4380 6x6x13
2 = Pump 4380 8x8x13
3 = Pump 4382 6x6x6
4 = Pump 4382 8x8x8
5 = Pump 4360 3D

5C: PUMP MOTOR

0=Standard - No Recirculating Pump
A = 0.50 hp
B = 0.75 hp
C = 1 hp
D = 1.5 hp
E = 2 hp
F = 3 hp
G = 5 hp
H = 7.5 hp
J = 10 hp
K = 15 hp
L = 20 hp
M = 25 hp
N = 30 hp
P = 40 hp
Q = 50 hp
R = 60 hp
S = 75 hp

LL Series Feature String Nomenclature

Model Options : Unit Feature Options

GEN	SIZE	VLT	CONFIG	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	15	16	17	18	19	20	21	22	23
L	L	–	0	7	5	–	3	–	0	–	D	B	0	A	–	A	2	C	:	C	R	J	G	–	0	F	B	–	K	5	E	–	**K**	**J**	**G**	**–**	**A**	0	C	0	C	B	A	–	E	C	–	0	F	A	A	0	0	B	0	B

FEATURE 6: BOILER BUILDING PUMP

6A: PUMP CONFIGURATION

0 = Standard - No Boiler
D = 1 Pump - Prem Eff, 1170 RPM
E = 2 Single Pumps - Prem Eff, 1170 RPM
F = dualArm Pump - Prem Eff, 1170 RPM
G = 1 Pump w/ VFD - Prem Eff, 1170 RPM
H = 2 Single Pumps w/ 2 VFDs - Prem Eff, 1170 RPM
J = dualArm Pump w/ 2 VFDs - Prem Eff, 1170 RPM
N = 1 Pump - Prem Eff, 1760 RPM
P = 2 Single Pumps - Prem Eff, 1760 RPM
Q = dualArm Pump - Prem Eff, 1760 RPM
R = 1 Pump w/ VFD - Prem Eff, 1760 RPM
S = 2 Single Pumps w/ 2 VFDs - Prem Eff, 1760 RPM
T = dualArm Pump w/ 2 VFDs - Prem Eff, 1760 RPM
Y = 1 Pump - Prem Eff - 3520 RPM
Z = 2 Single Pumps - Prem Eff, 3520 RPM
1 = dualArm Pump - Prem Eff, 3520 RPM
2 = 1 Pump w/ VFD - Prem Eff, 3520 RPM
3 = 2 Single Pumps w/ 2 VFDs - Prem Eff, 3520 RPM
4 = dualArm Pump w/ 2 VFDs - Prem Eff, 3520 RPM

6B: PUMP SIZE

0 = Standard - No Boiler
A = Pump 4360 1.5B
B = Pump 4360 2B
C = Pump 4360 2D
D = Pump 4380 1.5x1.5x6
E = Pump 4380 2x2x6
F = Pump 4380/4382 3x3x6
G = Pump 4380/4382 4x4x6
H = Pump 4380 1.5x1.5x8
J = Pump 4380 2x2x8
K = Pump 4380/4382 3x3x8
L = Pump 4380/4382 4x4x8
M = Pump 4380 5x5x8
N = Pump 4380/4382 6x6x8
P = Pump 4380 2x2x10
Q = Pump 4380/4382 3x3x10
R = Pump 4380/4382 4x4x10
S = Pump 4380/4382 6x6x10
T = Pump 4380/4382 8x8x10
U = Pump 4380 4x4x11.5
V = Pump 4380 5x5x11.5
W = Pump 4380 6x6x11.5
Y = Pump 4380 8x8x11.5
Z = Pump 4380 4x4x13
1 = Pump 4380 6x6x13
2 = Pump 4380 8x8x13
3 = Pump 4382 6x6x6
4 = Pump 4382 8x8x8
5 = Pump 4360 3D

6C: PUMP MOTOR

0 = Standard - No Boiler
A = 0.50 hp
B = 0.75 hp
C = 1 hp
D = 1.5 hp
E = 2 hp
F = 3 hp
G = 5 hp
H = 7.5 hp
J = 10 hp
K = 15 hp
L = 20 hp
M = 25 hp
N = 30 hp
P = 40 hp
Q = 50 hp
R = 60 hp
S = 75 hp

FEATURE 7: SERVICE OPTIONS

0 = Standard
A = 115V Outlet, Factory Wired
B = 115V Outlet, Field Wired

LL Series Feature String Nomenclature

Model Options : Unit Feature Options

GEN	SIZE	VLT	CONFIG	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	15	16	17	18	19	20	21	22	23
L L	– 0 7 5	– 3	– 0	– D	B	0	A	– A 2	C	:	C	R	J	G	– 0	F	B	– K	5	E	– K	J	G	– A	**0**	**C**	**0**	**C**	**B**	**A**	– E	C	– 0	F	A	A	0	0	B	0	B

FEATURE 8: REFRIGERATION OPTIONS

0 = Standard
B = VFD Controlled Condenser Fans (Air-Cooled)
D = Hot Gas Bypass - All Circuits
E = Options B + D

FEATURE 9: REFRIGERATION ACCESSORIES

0 = Standard
A = Sight Glass
B = Compressor Isolation Valves
C = Options A + B

FEATURE 10: POWER OPTIONS

0 = Standard Power Block
A = Power Switch (225 Amps)
B = Power Switch (400 Amps)
C = Power Switch (600 Amps)
D = Power Switch (800 Amps)
E = Power Switch (1200 Amps)
F = Dual Point Power Block (2)
G = Dual Point Power Switch (2 x 225 Amps)
H = Dual Point Power Switch (2 x 400 Amps)
J = Dual Point Power Switch (2 x 600 Amps)
K = Dual Point Power Switch (2 x 800 Amps)
L = Dual Point Power Switch (2 x 1200 Amps)

FEATURE 11: SAFETY OPTIONS

0 = No Boiler
A = Standard, Boiler w/ UL/FM/CSD-1 Certification
B = Boiler w/ IRI Gas Train
C = Boiler w/ IRI Gas Train and Proof of Closure
D = Boiler w/ Low Water Cutoff
E = Options B + D
F = Options C + D

FEATURE 12: CONTROLS

0 = Standard
A = Touchscreen Unit Controls Interface
B = Phase and Brown Out Protection
F = Options A + B

FEATURE 13: SPECIAL CONTROLS

0 = MCS Magnum Controller
A = w/ Diagnostics
C = w/ Diagnostics and Modbus Connection
D = w/ Diagnostics and N2 Connection
E = w/ Diagnostics and LonTalk Connection
G = w/ Modem
H = w/ Diagnostics and Modem
K = w/ Diagnostics, Modbus Connection and Modem
L = w/ Diagnostics, N2 Connection and Modem
M = w/ Diagnostics, LonTalk Connection and Modem
Q = w/ Modbus Connection
R = w/ N2 Connection
S = w/ LonTalk Connection
V = w/ Modbus Connection and Modem
W = w/ N2 Connection and Modem
Y = w/ LonTalk Connection and Modem
1 = w/ BACnet IP Connection
2 = w/ Diagnostics and BACnet IP Connections
3 = w/ Diagnostics, BACnet IP Connection and Modem
4 = w/ BACnet IP Connection and Modem
5 = w/ BACnet MS/TP Connection
6 = w/ Diagnostics and BACnet MS/TP Connection
7 = w/ Diagnostics, BACnet MS/TP Connection and Modem
8 = w/ BACnet MS/TP Connection and Modem

LL Series Feature String Nomenclature

Model Options : Unit Feature Options

GEN	SIZE	VLT	CONFIG	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**	**15**	**16**	**17**	**18**	19	20	21	22	23
L	L	–	0	7	5	–	3	–	0	–	D	B	0	A	–	A	2	C	:	C	R	J	G	–	0	F	B	–	K	5	E	–	K	J	G	–	A	0	C	0	C	B	A	–	**E**	**C**	**–**	**0**	**F**	**A**	**A**	0	0	B	0	B

FEATURE 14: COMPRESSION TANK

14A: CHILLER COMPRESSION TANK

0 = No Chiller Compression Tank
A = AX-15V
B = AX-20V
C = AX-40V
D = AX-60V
E = AX-80V
F = AX-100V
G = AX-120V
H = AX-180V
J = AX-200V
K = AX-240V
L = AX-260V
M = AX-280V
N = 1000-L
P = 1200-L
Q = 1600-L
R = 2000-L

14B: BOILER COMPRESSION TANK

0 = No Boiler Compression Tank
A = AX-15V
B = AX-20V
C = AX-40V
D = AX-60V
E = AX-80V
F = AX-100V
G = AX-120V
H = AX-180V
J = AX-200V
K = AX-240V
L = AX-260V
M = AX-280V
N = 1000-L
P = 1200-L
Q = 1600-L
R = 2000-L

FEATURE 15: OPTION BOXES

0 = Standard
A = 2ft Option Box
B = 4ft Option Box
C = 6ft Option Box
D = 8ft Option Box
E = 10ft Option Box
F = 12ft Option Box

FEATURE 16: CABINET OPTIONS

0 = Standard
A = Electrical Vestibule Heating
B = Fan/Coil Vestibule Cooling
F = Options A + B

FEATURE 17: CABINET OPTIONS

0 = Standard
A = Access Door Windows

FEATURE 18: CUSTOMER CODE

0 = Standard
A = Second to Fifth Year Extended Compressor Warranty

LL Series Feature String Nomenclature

Model Options : Unit Feature Options

GEN	SIZE	VLT	CONFIG	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	15	16	17	18	**19**	**20**	**21**	**22**	**23**
L	L	–	0	7	5	–	3	–	0	–	D	B	0	A	–	A	2	C	:	C	R	J	G	–	0	F	B	–	K	5	E	–	K	J	G	–	A	0	C	0	C	B	A	–	E	C	–	0	F	A	A	**0**	**0**	**B**	**0**	**B**

FEATURE 19: CODE OPTIONS

0 = Standard - ETL U.S.A. Listing
A = M.E.A. (New York)
B = Chicago - Cool + Gas
H = ETL U.S.A. + Canada Listing

FEATURE 20: UNIT CONFIGURATION

0 = Standard (One Piece Unit)
A = Two Piece Unit

FEATURE 21: EVAPORATIVE-COOLED CONDENSER

0 = Standard - No Evaporative-Cooled Condenser
A = No Sump Heater
B = Sump Heater

FEATURE 22: BLANK

0 = Standard

FEATURE 23: TYPE

B = Standard Paint
U = Special Price Authorization and Special Paint
X = Special Price Authorization and Standard Paint

Model Number
Unit Size

Example: LL-**075**-3-0-DB0A-A2C:CRJG-0FB-K5E-KJG-A0C0CBA-EC-0FAA00B0B

The first number of the model string designates nominal tons of cooling capacity at AHRI conditions for an evaporative-cooled condenser unit. Actual capacities will vary with conditions. Refer to the AAON Ecat™ software for performance and cooling capacities at design conditions.

Table 8 - Model Sizes

Model (Nominal Capacity)	Condenser	Compressors	Boiler Capacity
LL-**035**	Single Ended Air-Cooled or Evaporative-Cooled Condenser	2, 3, or 4 Scroll Compressors and 2 or 4 Refrigeration Circuits	500-6,000 MBH
LL-**050**			
LL-**055**			
LL-**060**			
LL-**075**			
LL-**067**	Dual Ended Air-Cooled or Evaporative-Cooled Condenser	8 Scroll Compressors and 4 or 8 Refrigeration Circuits	NA
LL-**092**			
LL-**104**			
LL-**118**			
LL-**085**	Single Ended Air-Cooled or Evaporative-Cooled Condenser	3, 4, 5, or 6 Scroll Compressors and 3 Refrigeration Circuits	500-6,000 MBH
LL-**090**			
LL-**105**			
LL-**115**			
LL-**125**			
LL-**140**			
LL-**150**		6, 7, or 8 Scroll Compressors and 4 Refrigeration Circuits	
LL-**170**			
LL-**185**			
LL-**210**	Dual Ended Air-Cooled or Evaporative-Cooled Condenser	8, 10, or 12 Scroll Compressors and 6 Refrigeration Circuits	NA
LL-**230**			
LL-**245**			
LL-**275**			
LL-**300**		12, 14, or 16 Scroll Compressors and 8 Refrigeration Circuits	
LL-**335**			
LL-**365**			
LL-**090**	Single Ended Evaporative-Cooled Condenser	1 Variable Capacity Oil-Free Magnetic Bearing Centrifugal	500-6,000 MBH
LL-**120**			
LL-**150**			
LL-**180**			
LL-**181**		2 Variable Capacity Oil-Free Magnetic Bearing Centrifugal	
LL-**240**			
LL-**300**			
LL-**360**			
LL-**450**		3 Variable Capacity Oil-Free Magnetic Bearing Centrifugal	
LL-**540**			

Model Number
Voltage

Example: LL-075-**3**-0-DB0A-A2C:CRJG-0FB-K5E-KJG-A0C0CBA-EC-0FAA00B0B

All units have single point power blocks with grounding lugs and 120 VAC control circuits. Dual ended condenser units are available with dual point power (Feature 10).

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

Model Number
Blank

Example: LL-075-3-**0**-DB0A-A2C:CRJG-0FB-K5E-KJG-A0C0CBA-EC-0FAA00B0B

0 = *Standard*

Model Number
Model Option A1 - Cooling Style

Example: LL-075-3-0-**D**B0A-A2C:CRJG-0FB-K5E-KJG-A0C0CBA-EC-0FAA00B0B

B = *R-134a Variable Capacity Oil-Free Magnetic Bearing Centrifugal Compressors* - R-134a variable capacity oil-free magnetic bearing centrifugal compressors. Option is available from 90-540 tons. See Table 8.
D = *R-410A Dual Circuited Scroll Compressors* - R-410A scroll compressors circuited in tandem. Option is available from 35-365 tons. See Table 8.
E = *R-410A Independently Circuited Scroll Compressors* - R-410A scroll compressors individually circuited. Option is available on units with 4 scroll compressors and dual ended condenser units with 8 scroll compressors (35, 50, 55, 60, 75, 67, 92, 104 and 118 tons). See Table 8.
M = *R-410A VFD Compatible Scroll Compressors* - R-410A scroll compressors which can be factory provided with VFD speed control. Option is available on 50, 55, 60, 75, 85, 90, 105, 115, 125, 140, 150, 170, 185, 210, 230, 245, 275, 300, 335, and 365 ton units. See Table 8 and General Data section.

Model Number
Model Option A2 - Cooling Configuration

Example: LL-075-3-0-D**B**0A-A2C:CRJG-0FB-K5E-KJG-A0C0CBA-EC-0FAA00B0B

0 = *Air-Cooled Condenser, Low Water Flow* - Air-cooled condenser unit with a 14°F temperature drop across the chiller evaporator.
A = *Air-Cooled Condenser, High Water Flow* - Air-cooled condenser unit with a 10°F temperature drop across the chiller evaporator.
B = *Evaporative-Cooled Condenser, Low Water Flow* - Evaporative-cooled condenser unit with a 14°F temperature drop across the chiller evaporator.
C = *Evaporative-Cooled Condenser, High Water Flow* - Evaporative-cooled condenser unit with a 10°F temperature drop across the chiller evaporator.

Model Number
Model Option A3 - Cooling Coating

Example: LL-075-3-0-DB**0**A-A2C:CRJG-0FB-K5E-KJG-A0C0CBA-EC-0FAA00B0B

0 = *Standard*
1 = *Polymer E-Coated Condenser Coil* - Polymer e-coating applied to the condenser coils. Complete coil and casing are coated. Coating surpasses a 6,000 hour salt spray test per ASTM B117-90 requirements, 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 non-prorated warranty. Option is available on air-cooled condenser units.
2 = *Stainless Steel Condenser Coil Casing* - 18GA 304 stainless steel casing on the condenser coils. Option improves coil casing corrosion protection. Option is available on air-cooled condenser units.

Model Number
Model Option A4 - Cooling Staging

Example: LL-075-3-0-DB0**A**-A2C:CRJG-0FB-K5E-KJG-A0C0CBA-EC-0FAA00B0B

A = *Shell and Tube Heat Exchanger - No Variable Speed Compressors* - Shell and tube heat exchanger evaporator with grooved end piping, fittings and water connections and 3/4 inch closed cell polymer insulation with a minimum R-value of 3.5. Option includes a 3/4 inch manual operation drain valve.
C = *Oversized Shell and Tube Heat Exchanger (Glycol) - No Variable Speed Compressors* - Oversized shell and tube heat exchanger evaporator, for glycol applications, with grooved end piping, fittings and water connections and 3/4 inch closed cell polymer insulation with a minimum R-value of 3.5. Option includes a 3/4 inch manual operation drain valve.
V = *Shell and Tube Heat Exchanger and All Variable Speed Compressors* - Shell and tube heat exchanger evaporator with grooved end piping, fittings and water connections and 3/4 inch closed cell polymer insulation with a minimum R-value of 3.5. Option includes a 3/4 inch manual operation drain valve. All scroll compressors will be variable capacity with VFD speed control. With an air-cooled condenser, the VFD controlled condenser fan option is required (Feature 8).
W = *Oversized Shell and Tube Heat Exchanger (Glycol) and All Variable Speed Compressors* - Oversized shell and tube heat exchanger evaporator, for glycol applications, with grooved end piping, fittings and water connections and 3/4 inch closed cell polymer insulation with a minimum R-value of 3.5. Option includes a 3/4 inch manual operation drain valve. All scroll compressors will be variable capacity with VFD speed control. With an air-cooled condenser, the VFD controlled condenser fan option is required (Feature 8).

Model Number
Model Option B1 - Heating Type

Example: LL-075-3-0-DB0A-**A**2C:CRJG-0FB-K5E-KJG-A0C0CBA-EC-0FAA00B0B

0 = *No Boiler*
A = *Natural Gas Boiler* - Natural gas boiler hot water system. Boiler pumping package is required with this option. Option is available on single ended condenser units. See Table 8.
B = *Propane Boiler* - Propane boiler hot water system. Boiler pumping package is required with this option. Option is available on single ended condenser units. See Table 8.

Model Number
Model Option B2 - Boiler Quantity

Example: LL-075-3-0-DB0A-A**2**C:CRJG-0FB-K5E-KJG-A0C0CBA-EC-0FAA00B0B

0 = *No Boiler*
1 = *1 Boiler*
2 = *2 Boilers*
3 = *3 Boilers*
4 = *4 Boilers*

Model Number
Model Option B3 - Boiler Heating Capacity

Example: LL-075-3-0-DB0A-A2**C**:CRJG-0FB-K5E-KJG-A0C0CBA-EC-0FAA00B0B

0 = *No Boiler*
A = *500 MBH Modulating High Flow* - 500 MBH boiler operating with a 20°F temperature rise across the boiler.
B = *750 MBH Modulating High Flow* - *7*50 MBH boiler operating with a 20°F temperature rise across the boiler.
C = *1,000 MBH Modulating High Flow* - 1,000 MBH boiler operating with a 20°F temperature rise across the boiler.
D = *1,500 MBH Modulating High Flow* - 1,500 MBH boiler operating with a 20°F temperature rise across the boiler.
E = *500 MBH Modulating Low Flow* - 500 MBH boiler operating with a 40°F temperature rise across the boiler.
F = *750 MBH Modulating Low Flow* - *7*50 MBH boiler operating with a 40°F temperature rise across the boiler.
G = *1,000 MBH Modulating Low Flow* - 1,000 MBH boiler operating with a 40°F temperature rise across the boiler.
H = *1,500 MBH Modulating Low Flow* - 1,500 MBH boiler operating with a 40°F temperature rise across the boiler.

Table 9 - Selectable Quantity of Boilers

Input Capacity (MBH)	500 MBH	750 MBH	1,000 MBH	1,500 MBH
500	1			
750		1		
1,000	2		1	
1,500	3	2		1
2,000	4		2	
2,250		3		
3,000		4	3	2
4,000			4	
4,500				3
6,000				4

Feature 1A
Building Pump Options

Example: LL-075-3-0-DB0A-A2C:**C**RJG-0FB-K5E-KJG-A0C0CBA-EC-0FAA00B0B

0 = *Standard* - Water piping connections for each chiller barrel. No building or recirculating pumps.
A = *Common Water Connections* - Water piping connected within the cabinet to a single point on units with two chiller barrels. Option is available on dual ended condenser scroll compressor units (67, 92, 104, 118, 210, 230, 245, 275, 300, 335, 365 tons). Select this option if water flow to the building is constant.
B = *Primary Pumping System* - Primary only pumping package which includes a building pump, butterfly valves, strainers, ball valves, pressure relief valves, a pressure reduction valve, combination valves (isolation, check and balancing) and city make-up water connection with backflow preventer. Glycol chillers do not include a city make-up connection. Grooved end piping and fittings and Armstrong pumps are standard. Select this option if water flow to the building is constant.
C = *Primary/Secondary Pumping System* - Primary and secondary pumping package for variable flow systems which includes a building pump, recirculating pump, butterfly valves, strainers, ball valves, pressure relief valves, a pressure reduction valve, combination valves (isolation, check and balancing) and city make-up water connection with backflow preventer. Glycol chillers do not include a city make-up connection. Grooved end piping and fittings and Armstrong pumps are standard. Select this option if the loads will vary as the building unit's cycle on and off, to modulate the flow of water to the building.

Feature 1B
Building Pump Configuration

Example: LL-075-3-0-DB0A-A2C:C**R**JG-0FB-K5E-KJG-A0C0CBA-EC-0FAA00B0B

0 = *Standard - No Building Pump*
D = *1 Pump - Premium Efficiency, 1170 RPM Motor*
E = *2 Single Pumps - Premium Efficiency, 1170 RPM Motors*
F = *dualArm Pump - Premium Efficiency, 1170 RPM Motors*
G = *1 Pump w/ VFD - Premium Efficiency, 1170 RPM Motor*
H = *2 Single Pumps w/ 2 VFDs - Premium Efficiency, 1170 RPM Motors*
J = *dualArm Pump w/ 2 VFDs - Premium Efficiency, 1170 RPM Motors*
N = *1 Pump - Premium Efficiency, 1760 RPM Motor*
P = *2 Single Pumps - Premium Efficiency, 1760 RPM Motors*
Q = *dualArm Pump - Premium Efficiency, 1760 RPM Motors*
R = *1 Pump w/ VFD - Premium Efficiency, 1760 RPM Motor*
S = *2 Single Pumps w/ 2 VFDs - Premium Efficiency, 1760 RPM Motors*
T = *dualArm Pump w/ 2 VFDs - Premium Efficiency, 1760 RPM Motors*
Y= *1 Pump - Premium Efficiency, 3520 RPM Motor*
Z = *2 Single Pumps - Premium Efficiency, 3520 RPM Motors*
1 = *dualArm Pump - Premium Efficiency, 3520 RPM Motors*
2 = *1 Pump w/ VFD - Premium Efficiency, 3520 RPM Motor*
3 = *2 Single Pumps w/ 2 VFDs - Premium Efficiency, 3520 RPM Motors*
4 = *dualArm Pump w/ 2 VFDs - Premium Efficiency, 3520 RPM Motors*

Note: Two single pumps and dualArm pump options include a redundant, or backup, pump for parallel or standby pumping.

AAON Ecat will select the correct available options for Feature 1B based on unit conditions and the input from the pump selection program. To create a pump configuration select a pump option in Feature 1A and after all other features have been selected, input water conditions into the Unit Conditions window. Next, in the Pump Selection and Rating window, select the quantity and size of pumps, select the quantity and size of motors, select VFDs, and view pump curves.

Feature 1C
Building Pump Size

Example: LL-075-3-0-DB0A-A2C:CR**J**G-0FB-K5E-KJG-A0C0CBA-EC-0FAA00B0B

0 = *Standard - No Building Pump*
A = *Pump 4360 1.5B*
B = *Pump 4360 2B*
C = *Pump 4360 2D*
D = *Pump 4380 1.5x1.5x6*
E = *Pump 4380 2x2x6*
F = *Pump 4380 3x3x6*
G = *Pump 4380/4382 4x4x6*
H = *Pump 4380 1.5x1.5x8*
J = *Pump 4380 2x2x8*
K = *Pump 4380/4382 3x3x8*
L = *Pump 4380/4382 4x4x8*
M = *Pump 4380 5x5x8*
N = *Pump 4380/4382 6x6x8*
P = *Pump 4380 2x2x10*
Q = *Pump 4380/4382 3x3x10*
R = *Pump 4380/4382 4x4x10*
S = *Pump 4380/4382 6x6x10*
T = *Pump 4380/4382 8x8x10*
U = *Pump 4380 4x4x11.5*
V = *Pump 4380 5x5x11.5*
W = *Pump 4380 6x6x11.5*
Y = *Pump 4380 8x8x11.5*
Z = *Pump 4380 4x4x13*
1 = *Pump 4380 6x6x13*
2 = *Pump 4380 8x8x13*
3 = *Pump 4380 6x6x6*
4 = *Pump 4380 8x8x8*
5 = *Pump 4360 3D*

AAON Ecat will select the correct available options for Feature 1C based on unit conditions and the input from the pump selection program. To create a pump configuration select a pump option in Feature 1A and after all other features have been selected, input water conditions into the Unit Conditions window. Next, in the Pump Selection and Rating window, select the quantity and size of pumps, select the quantity and size of motors, select VFDs, and view pump curves.

Feature 1D
Building Pump Motor

Example: LL-075-3-0-DB0A-A2C:CRJ**G**-0FB-K5E-KJG-A0C0CBA-EC-0FAA00B0B

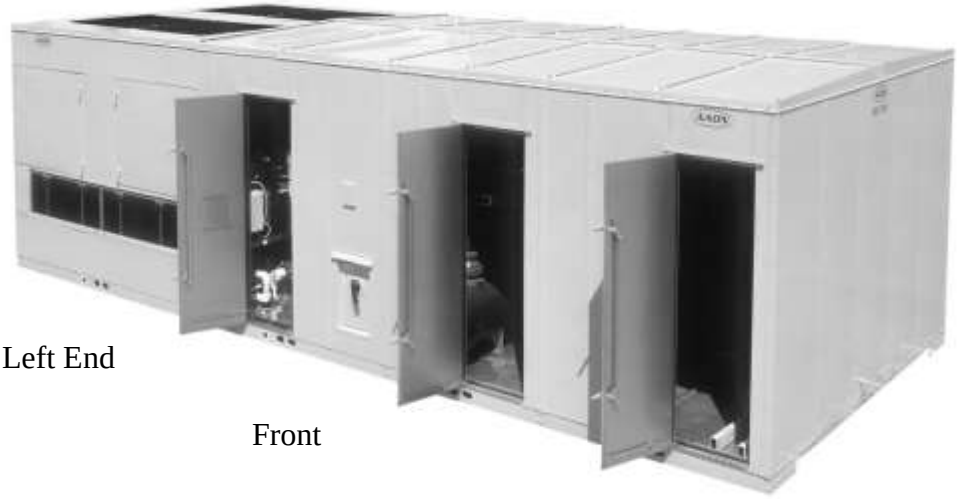
0 = *Standard - No Building Pump*
A = *0.5 hp*
B = *0.75 hp*
C = *1 hp*
D = *1.5 hp*
E = *2 hp*
F = *3 hp*
G = *5 hp*
H = *7.5 hp*
J = *10 hp*
K = *15 hp*
L = *20 hp*
M = *25 hp*
N = *30 hp*
P = *40 hp*
Q = *50 hp*
R = *60 hp*
S = *75 hp*

AAON Ecat will select the correct available options for Feature 1D based on unit conditions and the input from the pump selection program. To create a pump configuration select a pump option in Feature 1A and after all other features have been selected, input water conditions into the Unit Conditions window. Next, in the Pump Selection and Rating window, select the quantity and size of pumps, select the quantity and size of motors, select VFDs, and view pump curves.

Feature 2
Water Connection Location

Example: LL-075-3-0-DB0A-A2C:CRJG-**0**FB-K5E-KJG-A0C0CBA-EC-0FAA00B0B

0 = *Back Water Connection* - Water connections located at the back of the unit. The back of the unit does not have service access doors to the water piping and the condenser will be on the right hand side.
A = *Front Water Connection* - Water connections located at the front of the unit. The front of the unit has service access doors to the water piping and the condenser will be on the left hand side.
B = *Bottom Water Connection* - Water connections located in the floor of the unit. Option is available on 90-540 ton variable capacity centrifugal compressor units.



Condenser on the Left End

Front

Figure 12 - LL Series Orientation

Feature 3
Chiller Accessories

Example: LL-075-3-0-DB0A-A2C:CRJG-0**F**B-K5E-KJG-A0C0CBA-EC-0FAA00B0B

0 = *Standard* - Chilled water system which includes city make up water connections.
A = *Glycol System* - Propylene glycol chiller system which does not include city make up water connections. Glycol is selected within the unit conditions window.
D = *Air Separator* - Chilled water system and pumping package with air separator factory installed upstream of the primary pump to remove air bubbles from the system. Air separator is required with a pumping package. This option includes city make up water connections.
E = *Glycol System + Air Separator* - Propylene glycol chiller system with pumping package and air separator factory installed upstream of the primary pump to remove air bubbles from the system. Air separator is required with a pumping package. This option does not include city make up water connections.
F = *Thermometers and Pressure Gauges + Air Separator* - Chilled water system with pumping package and thermometers and pressure gauges factory installed on the pumping package to indicate water temperature and pressure drop of various components. Air separator is factory installed upstream of the primary pump to remove air bubbles from the system. Air separator is required with a pumping package. Thermometers and pressure gauges are optional with a pumping package. This option includes city make up water connections.

Feature 3 - Chiller Accessories Continued

G = *Glycol System + Thermometers and Pressure Gauges + Air Separator* - Propylene glycol chiller system with pumping package and thermometers and pressure gauges factory installed on the pumping package to indicate water temperature and pressure drop of various components. Air separator is factory installed upstream of the primary pump to remove air bubbles from the system. Air separator is required with a pumping package. Thermometers and pressure gauges are optional with a pumping package. This option does not include city make up water connections.

Feature 4
Low Ambient

Example: LL-075-3-0-DB0A-A2C:CRJG-0F**B**-K5E-KJG-A0C0CBA-EC-0FAA00B0B

0 = *Standard - None* - Air-cooled condenser units can operate down to 25°F by cycling condenser fans with a standard ambient temperature activated switch. Evaporative-cooled condenser units can operate down to 35°F with standard VFD condenser fan speed control.
A = *One Refrigerant Circuit* - Factory installed, flooded condenser, head pressure control option which allows cooling operation down to 0°F ambient, on one refrigerant circuit. When the ambient temperature drops, the condensing temperature drops. A three-way pressure activated valve then allows discharge gas to bypass around the condenser. Mixing of the discharge gas with liquid creates a high pressure at the condenser outlet, reducing the flow and causing liquid to back up into the condenser. Flooding the condenser reduces the area available for condensing, resulting in a rise in condensing pressure.
B = *Two Refrigerant Circuits* - Factory installed, flooded condenser, head pressure control option which allows cooling operation down to 0°F ambient, on two refrigerant circuits. When the ambient temperature drops, the condensing temperature drops. A three-way pressure activated valve then allows discharge gas to bypass around the condenser. Mixing of the discharge gas with liquid creates a high pressure at the condenser outlet, reducing the flow and causing liquid to back up into the condenser. Flooding the condenser reduces the area available for condensing, resulting in a rise in condensing pressure.
C = *Three Refrigerant Circuits* - Factory installed, flooded condenser, head pressure control option which allows cooling operation down to 0°F ambient, on three refrigerant circuits. When the ambient temperature drops, the condensing temperature drops. A three-way pressure activated valve then allows discharge gas to bypass around the condenser. Mixing of the discharge gas with liquid creates a high pressure at the condenser outlet, reducing the flow and causing liquid to back up into the condenser. Flooding the condenser reduces the area available for condensing, resulting in a rise in condensing pressure.

Feature 4 - Low Ambient Continued

D = *Four Refrigerant Circuits* - Factory installed, flooded condenser, head pressure control option which allows cooling operation down to 0°F ambient, on four refrigerant circuits. When the ambient temperature drops, the condensing temperature drops. A three-way pressure activated valve then allows discharge gas to bypass around the condenser. Mixing of the discharge gas with liquid creates a high pressure at the condenser outlet, reducing the flow and causing liquid to back up into the condenser. Flooding the condenser reduces the area available for condensing, resulting in a rise in condensing pressure.
E = *Five Refrigerant Circuits* - Factory installed, flooded condenser, head pressure control option which allows cooling operation down to 0°F ambient, on five refrigerant circuits. When the ambient temperature drops, the condensing temperature drops. A three-way pressure activated valve then allows discharge gas to bypass around the condenser. Mixing of the discharge gas with liquid creates a high pressure at the condenser outlet, reducing the flow and causing liquid to back up into the condenser. Flooding the condenser reduces the area available for condensing, resulting in a rise in condensing pressure.
F = *Six Refrigerant Circuits* - Factory installed, flooded condenser, head pressure control option which allows cooling operation down to 0°F ambient, on six refrigerant circuits. When the ambient temperature drops, the condensing temperature drops. A three-way pressure activated valve then allows discharge gas to bypass around the condenser. Mixing of the discharge gas with liquid creates a high pressure at the condenser outlet, reducing the flow and causing liquid to back up into the condenser. Flooding the condenser reduces the area available for condensing, resulting in a rise in condensing pressure.
G = *Seven Refrigerant Circuits* - Factory installed, flooded condenser, head pressure control option which allows cooling operation down to 0°F ambient, on seven refrigerant circuits. When the ambient temperature drops, the condensing temperature drops. A three-way pressure activated valve then allows discharge gas to bypass around the condenser. Mixing of the discharge gas with liquid creates a high pressure at the condenser outlet, reducing the flow and causing liquid to back up into the condenser. Flooding the condenser reduces the area available for condensing, resulting in a rise in condensing pressure.
H = *Eight Refrigerant Circuits* - Factory installed, flooded condenser, head pressure control option which allows cooling operation down to 0°F ambient, on eight refrigerant circuits. When the ambient temperature drops, the condensing temperature drops. A three-way pressure activated valve then allows discharge gas to bypass around the condenser. Mixing of the discharge gas with liquid creates a high pressure at the condenser outlet, reducing the flow and causing liquid to back up into the condenser. Flooding the condenser reduces the area available for condensing, resulting in a rise in condensing pressure.

Feature 5A
Recirculating Pump Options

Example: LL-075-3-0-DB0A-A2C:CRJG-0FB-**K**5E-KJG-A0C0CBA-EC-0FAA00B0B

0 = *Standard - No Recirculating Pump*
D = *1 Pump - Premium Efficiency, 1170 RPM Motor*
E = *2 Single Pumps - Premium Efficiency, 1170 RPM Motors*
F = *dualArm Pump - Premium Efficiency, 1170 RPM Motors*
G = *1 Pump w/ VFD - Premium Efficiency, 1170 RPM Motor*
H = *2 Single Pumps w/ 2 VFDs - Premium Efficiency, 1170 RPM Motors*
J = *dualArm Pump w/ 2 VFDs - Premium Efficiency, 1170 RPM Motors*
N = *1 Pump - Premium Efficiency, 1760 RPM Motor*
P = *2 Single Pumps - Premium Efficiency, 1760 RPM Motors*
Q = *dualArm Pump - Premium Efficiency, 1760 RPM Motors*
R = *1 Pump w/ VFD - Premium Efficiency, 1760 RPM Motor*
S = *2 Single Pumps w/ 2 VFDs - Premium Efficiency, 1760 RPM Motors*
T = *dualArm Pump w/ 2 VFDs - Premium Efficiency, 1760 RPM Motors*
Y= *1 Pump - Premium Efficiency, 3520 RPM Motor*
Z = *2 Single Pumps - Premium Efficiency, 3520 RPM Motors*
1 = *dualArm Pump - Premium Efficiency, 3520 RPM Motors*
2 = *1 Pump w/ VFD - Premium Efficiency, 3520 RPM Motor*
3 = *2 Single Pumps w/ 2 VFDs - Premium Efficiency, 3520 RPM Motors*
4 = *dualArm Pump w/ 2 VFDs - Premium Efficiency, 3520 RPM Motors*

Note: Two single pumps and dualArm pump options include a redundant, or backup, pump for parallel or standby pumping.

AAON Ecat will select the correct available options for Feature 5A based on unit conditions and the input from the pump selection program. To create a pump configuration select a pump option in Feature 1A and after all other features have been selected, input water conditions into the Unit Conditions window. Next, in the Pump Selection and Rating window, select the quantity and size of pumps, select the quantity and size of motors, select VFDs, and view pump curves.

Feature 5B
Recirculating Pump Size

Example: LL-075-3-0-DB0A-A2C:CRJG-0FB-K**5**E-KJG-A0C0CBA-EC-0FAA00B0B

0 = *Standard - No Recirculating Pump*
A = *Pump 4360 1.5B*
B = *Pump 4360 2B*
C = *Pump 4360 2D*
D = *Pump 4380 1.5x1.5x6*
E = *Pump 4380 2x2x6*
F = *Pump 4380 3x3x6*
G = *Pump 4380/4382 4x4x6*
H = *Pump 4380 1.5x1.5x8*
J = *Pump 4380 2x2x8*
K = *Pump 4380/4382 3x3x8*
L = *Pump 4380/4382 4x4x8*
M = *Pump 4380 5x5x8*
N = *Pump 4380/4382 6x6x8*
P = *Pump 4380 2x2x10*
Q = *Pump 4380/4382 3x3x10*
R = *Pump 4380/4382 4x4x10*
S = *Pump 4380/4382 6x6x10*
T = *Pump 4380/4382 8x8x10*
U = *Pump 4380 4x4x11.5*
V = *Pump 4380 5x5x11.5*
W = *Pump 4380 6x6x11.5*
Y = *Pump 4380 8x8x11.5*
Z = *Pump 4380 4x4x13*
1 = *Pump 4380 6x6x13*
2 = *Pump 4380 8x8x13*
3 = *Pump 4380 6x6x6*
4 = *Pump 4380 8x8x8*
5 = *Pump 4360 3D*

AAON Ecat will select the correct available options for Feature 5B based on unit conditions and the input from the pump selection program. To create a pump configuration select a pump option in Feature 1A and after all other features have been selected, input water conditions into the Unit Conditions window. Next, in the Pump Selection and Rating window, select the quantity and size of pumps, select the quantity and size of motors, select VFDs, and view pump curves.

Feature 5C
Recirculating Pump Motor

Example: LL-075-3-0-DB0A-A2C:CRJG-0FB-K5**E**-KJG-A0C0CBA-EC-0FAA00B0B

0 = *Standard - No Recirculating Pump*
A = *0.5 hp*
B = *0.75 hp*
C = *1 hp*
D = *1.5 hp*
E = *2 hp*
F = *3 hp*
G = *5 hp*
H = *7.5 hp*
J = *10 hp*
K = *15 hp*
L = *20 hp*
M = *25 hp*
N = *30 hp*
P = *40 hp*
Q = *50 hp*
R = *60 hp*
S = *75 hp*

AAON Ecat will select the correct available options for Feature 5C based on unit conditions and the input from the pump selection program. To create a pump configuration select a pump option in Feature 1A and after all other features have been selected, input water conditions into the Unit Conditions window. Next, in the Pump Selection and Rating window, select the quantity and size of pumps, select the quantity and size of motors, select VFDs, and view pump curves.

Feature 6A
Boiler Building Pump Configuration

Example: LL-075-3-0-DB0A-A2C:CRJG-0FB-K5E-**K**JG-A0C0CBA-EC-0FAA00B0B

0 = *Standard - No Boiler*
D = *1 Pump - Premium Efficiency, 1170 RPM Motor*
E = *2 Single Pumps - Premium Efficiency, 1170 RPM Motors*
F = *dualArm Pump - Premium Efficiency, 1170 RPM Motors*
G = *1 Pump w/ VFD - Premium Efficiency, 1170 RPM Motor*
H = *2 Single Pumps w/ 2 VFDs - Premium Efficiency, 1170 RPM Motors*
J = *dualArm Pump w/ 2 VFDs - Premium Efficiency, 1170 RPM Motors*
N = *1 Pump - Premium Efficiency, 1760 RPM Motor*
P = *2 Single Pumps - Premium Efficiency, 1760 RPM Motors*
Q = *dualArm Pump - Premium Efficiency, 1760 RPM Motors*
R = *1 Pump w/ VFD - Premium Efficiency, 1760 RPM Motor*
S = *2 Single Pumps w/ 2 VFDs - Premium Efficiency, 1760 RPM Motors*
T = *dualArm Pump w/ 2 VFDs - Premium Efficiency, 1760 RPM Motors*
Y= *1 Pump - Premium Efficiency, 3520 RPM Motor*
Z = *2 Single Pumps - Premium Efficiency, 3520 RPM Motors*
1 = *dualArm Pump - Premium Efficiency, 3520 RPM Motors*
2 = *1 Pump w/ VFD - Premium Efficiency, 3520 RPM Motor*
3 = *2 Single Pumps w/ 2 VFDs - Premium Efficiency, 3520 RPM Motors*
4 = *dualArm Pump w/ 2 VFDs - Premium Efficiency, 3520 RPM Motors*

Note: Two single pumps and dualArm pump options include a redundant, or backup, pump for parallel or standby pumping.

AAON Ecat will select the correct available options for Feature 6A based on unit conditions and the input from the pump selection program. To create a pump configuration select a boiler option in Model Option B and after all other features have been selected, input water conditions into the Unit Conditions window. Next, in the Pump Selection and Rating window, select the quantity and size of pumps, select the quantity and size of motors, select VFDs, and view pump curves.

Feature 6B
Boiler Building Pump Size

Example: LL-075-3-0-DB0A-A2C:CRJG-0FB-K5E-K**J**G-A0C0CBA-EC-0FAA00B0B

0 = *Standard - No Boiler*
A = *Pump 4360 1.5B*
B = *Pump 4360 2B*
C = *Pump 4360 2D*
D = *Pump 4380 1.5x1.5x6*
E = *Pump 4380 2x2x6*
F = *Pump 4380 3x3x6*
G = *Pump 4380/4382 4x4x6*
H = *Pump 4380 1.5x1.5x8*
J = *Pump 4380 2x2x8*
K = *Pump 4380/4382 3x3x8*
L = *Pump 4380/4382 4x4x8*
M = *Pump 4380 5x5x8*
N = *Pump 4380/4382 6x6x8*
P = *Pump 4380 2x2x10*
Q = *Pump 4380/4382 3x3x10*
R = *Pump 4380/4382 4x4x10*
S = *Pump 4380/4382 6x6x10*
T = *Pump 4380/4382 8x8x10*
U = *Pump 4380 4x4x11.5*
V = *Pump 4380 5x5x11.5*
W = *Pump 4380 6x6x11.5*
Y = *Pump 4380 8x8x11.5*
Z = *Pump 4380 4x4x13*
1 = *Pump 4380 6x6x13*
2 = *Pump 4380 8x8x13*
3 = *Pump 4380 6x6x6*
4 = *Pump 4380 8x8x8*
5 = *Pump 4360 3D*

AAON Ecat will select the correct available options for Feature 6B based on unit conditions and the input from the pump selection program. To create a pump configuration select a boiler option in Model Option B and after all other features have been selected, input water conditions into the Unit Conditions window. Next, in the Pump Selection and Rating window, select the quantity and size of pumps, select the quantity and size of motors, select VFDs, and view pump curves.

Feature 6C
Boiler Building Pump Motor

Example: LL-075-3-0-DB0A-A2C:CRJG-0FB-K5E-KJ**G**-A0C0CBA-EC-0FAA00B0B

0 = *Standard - No Boiler*
A = *0.5 hp*
B = *0.75 hp*
C = *1 hp*
D = *1.5 hp*
E = *2 hp*
F = *3 hp*
G = *5 hp*
H = *7.5 hp*
J = *10 hp*
K = *15 hp*
L = *20 hp*
M = *25 hp*
N = *30 hp*
P = *40 hp*
Q = *50 hp*
R = *60 hp*
S = *75 hp*

AAON Ecat will select the correct available options for Feature 6C based on unit conditions and the input from the pump selection program. To create a pump configuration select a boiler option in Model Option B and after all other features have been selected, input water conditions into the Unit Conditions window. Next, in the Pump Selection and Rating window, select the quantity and size of pumps, select the quantity and size of motors, select VFDs, and view pump curves.

Feature 7
Service Options

Example: LL-075-3-0-DB0A-A2C:CRJG-0FB-K5E-KJG-**A**0C0CBA-EC-0FAA00B0B

0 = *Standard* - Compressors, controls, evaporators and pumps are accessible in a convenient service vestibule that includes hinged access doors with lockable handles, a color-coded wiring diagram to match color-coded unit wiring and unit nameplate. All components are labeled to improve serviceability.
A = *Factory Wired 115V Convenience Outlet* - Factory wired 2x4 inch electrical box with ground fault interrupter receptacle located within the controls vestibule. 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 with the factory installed unit power switch, the convenience outlet will remain live.**

Feature 7 - Service Options Continued

B = *Field Wired 115V Convenience Outlet* - Field wired 2x4 inch electrical box with ground fault interrupter receptacle, located within the controls vestibule. Receptacle is rated for 20 amps. The outlet must be field wired to a 115 VAC power supply.

Figure 13 - Factory Wired Convenience Outlet

Feature 8
Refrigeration Options

Example: LL-075-3-0-DB0A-A2C:CRJG-0FB-K5E-KJG-A**0**C0CBA-EC-0FAA00B0B

0 = *Standard* - Standard refrigeration options include manual reset high pressure cutouts, automatic reset low pressure cutouts and internal overload protection on compressors. Electronic expansion valves are standard. Air-cooled condenser units include fan cycling as standard and evaporative-cooled condenser units include VFD controlled variable speed condenser fans as standard.
B = *VFD Controlled Air-Cooled Condenser Fans* - VFD controlled variable speed air-cooled condenser fans. This option requires controller diagnostics (Feature 13). This option is only available on air-cooled condenser units because VFD controlled variable speed condenser fans are standard on evaporative-cooled condenser units.
D = *Hot Gas Bypass - All Stages* - Field adjustable pressure activated bypass valve on all refrigerant circuits factory setup to divert hot compressor discharge gas to the evaporator if the 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 6 degrees of differential (28°F at sea level). This option prevents coil freeze-up during periods of low flow or cold entering heat exchanger conditions. This option is used for refrigerant system protection only and cannot be used for cooling capacity modulation.
E = *HGB + VFD Controlled Air-Cooled Condenser Fans* - Options B + D

Feature 9
Refrigeration Accessories

Example: LL-075-3-0-DB0A-A2C:CRJG-0FB-K5E-KJG-A0**C**0CBA-EC-0FAA00B0B

0 = *Standard* - All compressors are mounted in the service vestibule on raised, vibration reducing platforms for quiet operation and convenient access.
A = *Sight Glass* - Moisture indication sight glass attached to the refrigeration circuit liquid lines. The moisture indicator shows a green color when refrigerant is dry, a chartreuse color (green with a yellow tint or bright green) indicates caution and a yellow color indicates a wet condition. The sight glass is not a charge indicator.
B = *Compressor Isolations Valves* - Ball type service valves mounted on the refrigeration circuit discharge and suction lines permitting isolation of the compressor for service or replacement. The valves are located close to the compressors and work 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.
C = *Sight Glass + Compressor Isolations Valves* - Options A + B

Table 10 - Moisture Content in the Refrigerant

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

Feature 10
Power Options

Example: LL-075-3-0-DB0A-A2C:CRJG-0FB-K5E-KJG-A0C**0**CBA-EC-0FAA00B0B

0 = *Standard Power Block*

A = *225 Amp Power Switch*

B = *150 Amp Power Switch*

C = *600 Amp Power Switch*

D = *800 Amp Power Switch*

E = *1,200 Amp Power Switch*

F = *Dual Point Power Block [2]*

G = *225 Amp Dual Point Power Switch [2]*

H = *400 Amp Dual Point Power Switch [2]*

J = *600 Amp Dual Point Power Switch [2]*

K = *800 Amp Dual Point Power Switch [2]*

L = *1,200 Amp Dual Point Power Switch [2]*

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 pump program is completed AAON Ecat will automatically calculate the minimum allowable ampacity and choose the correct size switch.

Dual point power options include two power blocks/switches mounted near the control vestibule of each condenser section of a dual ended condenser unit. Dual point power is only available on dual ended condenser units and permits servicing of one condenser while the other remains in operation.

Feature 11
Safety Options

Example: LL-075-3-0-DB0A-A2C:CRJG-0FB-K5E-KJG-A0C0**C**BA-EC-0FAA00B0B

0 = *No Boiler*
A = *Standard, Boiler with UL/FM/CSD-1 Certification* - Meets ASME regulation of controls and safety devices for automatically fired boilers, UL Standard 795 Commercial-Industrial Gas Heating Equipment and CSD-1.
B = *Boiler with IRI Gas Train* - This option includes boiler gas train with motorized automatic main and redundant gas valves and a normally open vent valve in between.
C = *Boiler with IRI Gas Train and Proof of Closure* - This option includes boiler gas train with motorized automatic main and redundant gas valves with proof of closure contacts, normally open vent valve in between, and flame safeguard that reads the proof of closure end switches.
D = *Boiler with Low Water Cutoff* - This option includes boiler with water flow switch which prevents boiler operation during low water flow conditions.
E = *Boiler with IRI Gas Train and Low Water Cutoff* - Options B + D
F = *Boiler with IRI Gas Train, Proof of Closure, and Low Water Cutoff* - Options C + D

Feature 12
Controls

Example: LL-075-3-0-DB0A-A2C:CRJG-0FB-K5E-KJG-A0C0C**B**A-EC-0FAA00B0B

0 = *Standard*
A = *Touchscreen Unit Control Interface* - Full color 15" 1024x768 pixel touchscreen interface included within the control compartment for unit configuration, setpoint adjustment, sensor status viewing, unit alarm view and occupancy scheduling. Graphical user interface allows for easy monitoring and troubleshooting of the chiller. Unit, controls, compressor and VFD literature can be viewed from the touchscreen. Touchscreen is required with variable capacity oil-free magnetic bearing centrifugal compressors.
B = *Phase and Brown Out Protection* - Voltage monitor that is used to protect motors and compressors from voltage imbalance, over/under voltage and phase loss. Reset is automatic.
F = *Touchscreen + Phase and Brown Out Protection* - Options A + B

Feature 13
Special Controls

Example: LL-075-3-0-DB0A-A2C:CRJG-0FB-K5E-KJG-A0C0CB**A**-EC-0FAA00B0B

0 = *MCS Magnum Controller* - Micro Control Systems (MCS) Magnum controller which maintains the chiller leaving water temperature. LCD interface is included within the controls compartment for unit configuration, setpoint adjustment, sensor status viewing, unit alarm viewing, and occupancy scheduling. PC with MCS-Connect software connected to the controller via RS-232 or Ethernet can also be used for unit configuration, setpoint adjustment, sensor status viewing, unit alarm view, and occupancy scheduling.
A = *MCS Magnum Controller with Diagnostics* - MCS Magnum controller with a diagnostics package of suction, discharge and liquid pressure transducers, temperature sensors that monitor compressor performance and current sensors that confirm mode of operation.
C = *MCS Magnum Controller with Diagnostics and Modbus Connection* - Option A + Ethernet communications port for end user interfacing via the Modbus IP protocol and EIA-485 communications port for end user interfacing via the Modbus RTU protocol.
D = *MCS Magnum Controller with Diagnostics and N2 Connection* - Option A + EIA-485 communications port for end user interfacing via the N2 protocol.
E = *MCS Magnum Controller with Diagnostics and LonTalk Connection* - Option A + Adapter communications port for end user interfacing via the LonTalk protocol.
G = *MCS Magnum Controller with Modem* - MCS Magnum controller with a 56K modem which can allow MCS, AAON or customer to remotely communicate with the unit in order to assist service in the field. This option can reduce field diagnostic time and allow field update of the unit program.
H = *MCS Magnum Controller with Diagnostics and Modem* - MCS Magnum controller with a diagnostics package of suction and discharge pressure transducers, temperature sensors that monitor compressor performance and current sensors that confirm mode of operation. This option also includes a 56K modem which can allow MCS, AAON or customer to remotely communicate with the unit in order to assist service in the field. This option can reduce field diagnostic time and allow field update of the unit program.
K = *MCS Magnum Controller with Diagnostics, Modbus Connection and Modem* - Options H + Ethernet communications port for end user interfacing via the Modbus IP protocol and EIA-485 communications port for end user interfacing via the Modbus RTU protocol.
L = *MCS Magnum Controller with Diagnostics, N2 Connection and Modem* - Options H + EIA-485 communications port for end user interfacing via the N2 protocol.
M = *MCS Magnum Controller with Diagnostics. LonTalk Connection and Modem* - Options H + Adapter communications port for end user interfacing via the LonTalk protocol.
Q = *MCS Magnum Controller with Modbus Connection* - Option 0 + Ethernet communications port for end user interfacing via the Modbus IP protocol and EIA-485 communications port for end user interfacing via the Modbus RTU protocol.
R = *MCS Magnum Controller with N2 Connection* - Option 0 + EIA-485 communications port for end user interfacing via the N2 protocol.

Feature 13 - Special Controls Continued

S = *MCS Magnum Controller with LonTalk Connection* - Option 0 + Adapter communications port for end user interfacing via the LonTalk protocol.
V = *MCS Magnum Controller with Modbus Connection and Modem* - Options G + Ethernet communications port for end user interfacing via the Modbus IP protocol and EIA-485 communications port for end user interfacing via the Modbus RTU protocol.
W = *MCS Magnum Controller with N2 Connection and Modem* - Options G + EIA-485 communications port for end user interfacing via the N2 protocol.
Y = *MCS Magnum Controller with LonTalk Connection and Modem* - Options G + Adapter communications port for end user interfacing via the LonTalk protocol.
1 = *MCS Magnum Controller with BACnet IP Connection* - Option 0 + Ethernet communications port for end user interfacing via the BACnet IP protocol.
2 = *MCS Magnum Controller with Diagnostics and BACnet IP Connection* - Option A + Ethernet communications port for end user interfacing via the BACnet IP protocol.
3 = *MCS Magnum Controller with Diagnostics, BACnet IP Connection and Modem* - Option H + Ethernet communications port for end user interfacing via the BACnet IP protocol.
4 = *MCS Magnum Controller with BACnet IP Connection and Modem* - Option G + Ethernet communications port for end user interfacing via the BACnet IP protocol.
5 = *MCS Magnum Controller with BACnet MSTP Connection* - Option 0 + Adapter EIA-485 communications port for end user interfacing via the BACnet MS/TP protocol.
6 = *MCS Magnum Controller with Diagnostics and BACnet MSTP Connection* - Option A + Adapter EIA-485 communications port for end user interfacing via the BACnet MS/TP protocol.
7 = *MCS Magnum Controller with Diagnostics, BACnet MSTP Connection and Modem* - Option H + Adapter EIA-485 communications port for end user interfacing via the BACnet MS/TP protocol.
8 = *MCS Magnum Controller with BACnet MSTP Connection and Modem* - Option G + Adapter EIA-485 communications port for end user interfacing via the BACnet MS/TP protocol.

Feature 14A
Chiller Compression Tank

Example: LL-075-3-0-DB0A-A2C:CRJG-0FB-K5E-KJG-A0C0CBA-**E**C-0FAA00B0B

0 = *No Chiller Compression Tank*
A = *AX-15V*
B = *AX-20V*
C = *AX-40V*
D = *AX-60V*
E = *AX-80V*
F = *AX-100V*
G = *AX-120V*
H = *AX-180V*
J = *AX-200V*
K = *AX-240V*
L = *AX-260V*
M = *AX-280V*
N = *1000-L*
P = *1200-L*
Q = *1600-L*
R = *2000-L*

To add a chiller compression tank, choose any tank and after all options have been selected and the pump program is completed AAON Ecat will automatically calculate the correct size, based on unit conditions.

Feature 14B
Boiler Compression Tank

Example: LL-075-3-0-DB0A-A2C:CRJG-0FB-K5E-KJG-A0C0CBA-E**C**-0FAA00B0B

0 = *No Boiler Compression Tank*
A = *AX-15V*
B = *AX-20V*
C = *AX-40V*
D = *AX-60V*
E = *AX-80V*
F = *AX-100V*
G = *AX-120V*
H = *AX-180V*
J = *AX-200V*
K = *AX-240V*
L = *AX-260V*
M = *AX-280V*
N = *1000-L*
P = *1200-L*
Q = *1600-L*
R = *2000-L*

To add a boiler compression tank, choose any tank and after all options have been selected and the pump program is completed AAON Ecat will automatically calculate the correct size, based on unit conditions.

Feature 15
Option Boxes

Example: LL-075-3-0-DB0A-A2C:CRJG-0FB-K5E-KJG-A0C0CBA-EC-**0**FAA00B0B

0 = *Standard* - No option box
A = *2 ft Option Box*
B = *4 ft Option Box*
C = *6 ft Option Box*
D = *8 ft Option Box*
E = *10 ft Option Box*
F = *12 ft Option Box*

These additional cabinet sections are for the installation of items not currently offered in the LL Series equipment. On single ended condenser chillers, the option box is located on the end opposite the condenser. On dual ended condenser units, the option box is located between the vestibules in the center of the unit. A Special Pricing Authorization (SPA) is required if the factory is to install customer supplied equipment.

Feature 16
Interior Cabinet Options

Example: LL-075-3-0-DB0A-A2C:CRJG-0FB-K5E-KJG-A0C0CBA-EC-0**F**AA00B0B

0 = *Standard*
A = *Electric Vestibule Heating* - Air-cooled condenser units include a single 1kW base board heater mounted in the chiller mechanical room. Single ended evaporative-cooled condenser units include two 1 kW base board heaters, one in the controls vestibule and one in the chiller mechanical room. Dual ended evaporative-cooled condenser units include three 1kW base board heaters, one in each controls vestibule and one in the center chiller mechanical room section.
B = *Fan/Coil Vestibule Cooling* - This option includes a thermostatically controlled fan/coil unit. This fan/coil unit is connected to the chilled water circuit if a pumping package is ordered.
F = *Electric Vestibule Heating + Fan/Cool Vestibule Cooling* - Options A + B

Feature 17
Exterior Cabinet Options

Example: LL-075-3-0-DB0A-A2C:CRJG-0FB-K5E-KJG-A0C0CBA-EC-0F**A**A00B0B

0 = *Standard* - Cabinet is constructed of double wall rigid polyurethane foam insulated panels.
A = *Access Door Windows* - 12" x 12", wire reinforced glass, double pane windows which permit visual inspection of cabinet interior while the access doors are closed. A window is included on all cabinet access doors of the unit.

Feature 18
Customer Code

Example: LL-075-3-0-DB0A-A2C:CRJG-0FB-K5E-KJG-A0C0CBA-EC-0FA**A**00B0B

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

Feature 19
Code Options

Example: LL-075-3-0-DB0A-A2C:CRJG-0FB-K5E-KJG-A0C0CBA-EC-0FAA**0**0B0B

0 = *Standard ETL USA Listing* - All AAON equipment is 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.
B = *Chicago Cool & Gas* - Chicago code for a unit with cooling and gas heat. 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 pump warnings will be in English and French.

Feature 20
Unit Configuration

Example: LL-075-3-0-DB0A-A2C:CRJG-0FB-K5E-KJG-A0C0CBA-EC-0FAA0**0**B0B

0 = *Standard - One Piece Unit* - Unit shipped in one piece.
A = *Two Piece Unit* - If weight or length is a rigging or shipping problem, the unit may be shipped in two pieces. Refer to AAON Ecat drawings for sizes of individual pieces.

Feature 21
Evaporative-Cooled Condenser

Example: LL-075-3-0-DB0A-A2C:CRJG-0FB-K5E-KJG-A0C0CBA-EC-0FAA00**B**0B

0 = *Standard* - No evaporative-cooled condenser.
A = *No Sump Heater* - Evaporative-cooled condenser without electric immersion sump heater. This option is for applications where the evaporative-cooled condenser will not contain water during freezing conditions.
B = *Sump Heater* - 5 kW electric immersion sump heater included in the evaporative-cooled condenser sump. This option is for applications where the evaporative-cooled condenser may contain water during freezing conditions.

Feature 22
Blank

Example: LL-075-3-0-DB0A-A2C:CRJG-0FB-K5E-KJG-A0C0CBA-EC-0FAA00B**0**B

0 = *Standard*

Feature 23
Type

Example: LL-075-3-0-DB0A-A2C:CRJG-0FB-K5E-KJG-A0C0CBA-EC-0FAA00B0**B**

0 = *Standard* - Cabinet exterior is primer washed then spray coated with a two part polyurethane, heat-baked exterior paint. The paint is gray in color and is capable of withstanding at least 2,500 hours, with no visible corrosive effects, when tested in a salt spray and fog atmosphere in accordance with the ASTM B 117-95 test procedure.
U = *Special Price Authorization with Special Paint* - If a special paint color is specified, a set-up charge and price add per unit is required. Use this designation if other special paint options are necessary. The Applications Department must issue a Special Pricing Authorization (SPA) to include a non-standard option.
X = *Special Price Authorization with Standard Paint* - The Applications Department must issue a Special Pricing Authorization (SPA) to include a non-standard option.

General Data
Unit Information

Table 11 - 35-75 tons (Single Ended Scroll Compressor Units) Compressor and Evaporator Information

	Model				
	LL-035	LL-050	LL-055	LL-060	LL-075
R-410A Scroll Compressors					
Quantity/Nominal tons	4/9	4/12	2/12, 2/16	4/16	2/16, 2/25
Quantity of Circuits	2 or 4				
R-410A VFD Compatible Scroll Compressors					
Quantity/Nominal tons		2/25	1/25, 1/32	2/32	1/32, 2/25
Quantity of Circuits		2			
Compressor VFD Range					
208V, 230V, 460V, & 575V		35-60 Hz			
Evaporator					
Quantity	1				
Max Water Pressure	125 psig				
Connection Sizes	3”	4”			
Standard - Shell and Tube					
Max gpm	97.57	132.70	151.90	171.10	218.10
Min gpm	60.48	82.26	94.14	106.00	135.20
Oversized - Shell and Tube					
Max gpm	136.60	187.90	213.50	239.10	307.30
Min gpm	48.80	67.10	76.25	85.40	109.80

Table 12 - 35-75 tons (Single Ended Scroll Compressor Units) Condenser and Boiler Information

	Model				
	LL-035	LL-050	LL-055	LL-060	LL-075
Air-Cooled Condenser Fans					
Quantity	2			3	4
Type	36” Propeller Fan				
hp	2	3			
Evaporative-Cooled Condenser Fans					
Quantity	1		2		
Type	36” Propeller Fan				
hp	2				3
Evaporative-Cooled Condenser Pump					
Quantity/hp	1/1			1/1.5	
Boilers					
Input Capacity/Output Capacity (MBH)	500/450, 750/675, 1000/900, 1500/1350, 2000/1800, 2250/2025, 3000/2700, 4000/3600, 4500/4050, 6000/5400				
Boiler Quantity	1, 2, 3, 4				

Table 13 - 67-118 tons (Dual Ended Scroll Compressor Units) Compressor and Evaporator Information

	Model			
	LL-067	LL-092	LL-104	LL-118
R-410A Scroll Compressors				
Quantity/Nominal tons	8/9	8/12	4/12, 4/16	8/16
Quantity of Circuits	4 or 8			
Evaporator				
Quantity	2			
Max Water Pressure	125 psig			
Connection Sizes	3	4		
Standard - Shell and Tube				
Max gpm	195.14	265.40	303.80	342.20
Min gpm	120.96	164.52	188.28	212.00
Oversized - Shell and Tube				
Max gpm	273.20	375.80	427.00	478.20
Min gpm	97.60	134.20	152.50	170.80

Table 14 - 67-118 tons (Dual Ended Scroll Compressor Units) Condenser and Boiler Information

	Model			
	LL-067	LL-092	LL-104	LL-118
Air-Cooled Condenser Fans				
Quantity	4			6
Type	36” Propeller Fan			
hp	2	3		
Evaporative-Cooled Condenser Fans				
Quantity	2		4	
Type	36” Propeller Fan			
hp	2			
Evaporative-Cooled Condenser Pump				
Quantity/hp	2/1			2/1.5
Boilers				
Input Capacity/Output Capacity (MBH)				
Quantity				

Table 15 - 85-115 tons (Single Ended Scroll Compressor Units) Compressor and Evaporator Information

	Model			
	LL-085	LL-090	LL-105	LL-115
R-410A Scroll Compressors				
Quantity/Nominal tons	2/12, 4/16	6/16	4/16, 2/25	2/16, 4/25
Quantity of Circuits	3			
R-410A VFD Compatible Scroll Compressors				
Quantity/Nominal tons	1/25, 2/32	3/32	2/32, 2/25	5/25
Quantity of Circuits	3			
Compressor VFD Range				
208V, 230V, 460 V, & 575V	35-60 Hz			
Evaporator				
Quantity	1			
Max Water Pressure	125 psig			
Connection Sizes	5		6	
Standard - Shell and Tube				
Max gpm	237.6	256.7	303.8	331.1
Min gpm	147.2	159.1	188.3	205.2
Oversized - Shell and Tube				
Max gpm	332.9	358.5	426.9	465.4
Min gpm	118.9	128.1	152.5	166.2

Table 16 - 85-115 tons (Single Ended Scroll Compressor Units) Condenser and Boiler Information

	Model			
	LL-085	LL-090	LL-105	LL-115
Air-Cooled Condenser Fans				
Quantity	4			
Type	36” Propeller Fan		42” Propeller Fan	
hp	3		5	
Evaporative-Cooled Condenser Fans				
Quantity	2			
Type	36” Propeller Fan			
hp	3			
Evaporative-Cooled Condenser Pump				
Quantity/hp	1/3			2/1.5
Boilers				
Input Capacity/Output Capacity (MBH)	500/450, 750/675, 1000/900, 1500/1350, 2000/1800, 2250/2025, 3000/2700, 4000/3600, 4500/4050, 6000/5400			
Quantity	1, 2, 3, 4			

Table 17 - 125-185 tons (Single Ended Scroll Compressor Units) Compressor and Evaporator Information

	Model				
	LL-125	LL-140	LL-150	LL-170	LL-185
R-410A Scroll Compressors					
Quantity/Nominal tons	2/16, 4/25	6/25	4/16, 4/25	2/16, 6/25	8/25
Quantity of Circuits	3		4		
R-410A VFD Compatible Scroll Compressors					
Quantity/Nominal tons	1/32, 4/25	6/25	2/32, 4/25	1/32, 6/25	8/25
Quantity of Circuits	3		4		
Compressor VFD Range					
208V, 230V, 460 V, & 575V	35-60 Hz				
Evaporator					
Quantity	1				
Max Water Pressure	125 psig				
Connection Sizes	6			8	
Standard - Shell and Tube					
Max gpm	350.8	397.7	436.2	483.2	530.3
Min gpm	217.4	246.6	270.4	299.5	328.7
Oversized - Shell and Tube					
Max gpm	491.0	555.0	640.4	678.7	742.8
Min gpm	175.3	198.2	228.7	242.4	265.3

Table 18 - 125-185 tons (Single Ended Scroll Compressor Units) Condenser and Boiler Information

	Model				
	LL-125	LL-140	LL-150	LL-170	LL-185
Air-Cooled Condenser Fans					
Quantity	1, 4	2, 4	4, 2		2, 4
Type	36” Propeller Fan, 42” Propeller Fan				
hp	3, 5		3, 7.5		
Evaporative-Cooled Condenser Fans					
Quantity	3		4		
Type	36” Propeller Fan				
hp	3				
Evaporative-Cooled Condenser Pump					
Quantity/hp	1/5				
Boilers					
Input Capacity/Output Capacity (MBH)	500/450, 750/675, 1000/900, 1500/1350, 2000/1800, 2250/2025, 3000/2700, 4000/3600, 4500/4050, 6000/5400				
Quantity	1, 2, 3, 4				

Table 19 - 210-275 tons (Dual Ended Scroll Compressor Units) Compressor and Evaporator Information

	Model			
	LL-210	LL-230	LL-245	LL-275
R-410A Scroll Compressors				
Quantity/Nominal tons	8/16, 4/25	4/12, 8/25	4/16, 8/25	12/25
Quantity of Circuits	6			
R-410A VFD Compatible Scroll Compressors				
Quantity/Nominal tons	4/32, 4/25	10/25	2/32, 8/25	12/25
Quantity of Circuits	6			
Compressor VFD Range	35-60Hz			
208V, 230V, 460 V, & 575V				
Evaporator				
Quantity	2			
Max Water Pressure	125 psig			
Connection Sizes	6			
Standard - Shell and Tube				
Max gpm	607.6	662.2	701.6	795.4
Min gpm	376.6	410.4	434.8	493.2
Oversized - Shell and Tube				
Max gpm	853.8	930.8	982.0	1110.0
Min gpm	305.0	332.4	350.6	396.4

Table 20 - 210-275 tons (Dual Ended Scroll Compressor Units) Condenser and Boiler Information

	Model			
	LL-210	LL-230	LL-245	LL-275
Air-Cooled Condenser Fans				
Quantity	10, 0	0, 10	2, 8	4, 8
Type	36” Propeller Fan, 42” Propeller Fan			
hp	3, 0	0, 3	3, 5	
Evaporative-Cooled Condenser Fans				
Quantity	4		6	
Type	36” Propeller Fan			
hp	3			
Evaporative-Cooled Condenser Pump				
Quantity/hp	2/5			
Boilers				
Input Capacity/Output Capacity (MBH)				
Quantity				

Table 21 - 300-365 tons, Dual Ended Scroll Compressor Units

	Model		
	LL-300	LL-335	LL-365
Compressors			
Quantity/Nominal tons			
R-410A Scroll	8/16, 8/25	4/16, 12/25	16/25
R-410A VFD Compatible Scroll	4/32, 8/25	2/32, 12/25	16/25
Quantity of Circuits	8		
Capacity Steps	16 or Variable capacity with variable speed controlled		
Evaporator			
Quantity	2		
Max Water Pressure	125		
Connection Sizes	6	8	
Standard - Shell and Tube			
Max gpm	872.4	966.4	1060.6
Min gpm	540.8	599.0	657.4
Oversized - Shell and Tube			
Max gpm	1280.8	1357.4	1485.6
Min gpm	457.4	484.8	530.6
Air-Cooled Condenser Fans			
Quantity	8, 4		4, 8
Type	36” Propeller Fan, 42” Propeller Fan		
hp	3, 7.5		
Evaporative-Cooled Condenser Fans			
Quantity	8		
Type	36” Propeller Fan		
hp	3		
Evaporative-Cooled Condenser Pump			
Quantity/hp	2/5		
Boilers			
Input Capacity/Output Capacity (MBH)			
Quantity			

Table 22 - 90-180 tons, Variable Capacity Centrifugal Compressor Units

	Model			
	LL-090	LL-120	LL-150	LL-180
Compressors				
Quantity/Nominal tons				
R-134a Oil-Free Magnetic Bearing Centrifugal	1/90	1/120	1/150	1/180
Quantity of Circuits	1			
Capacity Steps	Variable Capacity			
Evaporator				
Quantity	1			
Max Water Pressure	125 psig			
Connection Sizes		5		6
Standard - Shell and Tube				
Max gpm		130	185	220
Min gpm		330	430	470
Oversized - Shell and Tube				
Max gpm				
Min gpm				
Evaporative-Cooled Condenser Fans				
Quantity		3	4	
Type	36” Propeller Fan			
hp		3		
Evaporative-Cooled Condenser Pump				
Quantity/hp		1/5		
Boilers				
Input Capacity/Output Capacity (MBH)	500/450, 750/675, 1000/900, 1500/1350, 2000/1800, 2250/2025, 3000/2700, 4000/3600, 4500/4050, 6000/5400			
Quantity	1, 2, 3, 4			

Table 23 - 181-360 tons, Variable Capacity Centrifugal Compressor Units

	Model			
	LL-181	LL-240	LL-300	LL-360
Compressors				
Quantity/Nominal tons				
R-134a Oil-Free Magnetic Bearing Centrifugal	2/90	2/120	2/150	2/180
Quantity of Circuits	1			
Capacity Steps	Variable Capacity			
Evaporator				
Quantity	1			
Max Water Pressure	125 psig			
Connection Sizes	6		8	
Standard - Shell and Tube				
Max gpm	220	290	360	430
Min gpm	470	680	820	1070
Oversized - Shell and Tube				
Max gpm				
Min gpm				
Evaporative-Cooled Condenser Fans				
Quantity	4	6	8	
Type	36” Propeller Fan			
hp	3		3	
Evaporative-Cooled Condenser Pump				
Quantity/hp	1/5	2/5		
Boilers				
Input Capacity/Output Capacity (MBH)	500/450, 750/675, 1000/900, 1500/1350, 2000/1800, 2250/2025, 3000/2700, 4000/3600, 4500/4050, 6000/5400			
Quantity	1, 2, 3, 4			

Table 24 - 450-540 tons, Variable Capacity Centrifugal Compressor Units

	Model	
	LL-450	LL-540
Compressors		
Quantity/Nominal tons		
R-134a Oil-Free Magnetic Bearing Centrifugal	3/150	3/180
Quantity of Circuits	1	
Capacity Steps	Variable Capacity	
Evaporator		
Quantity	1	
Max Water Pressure	125 psig	
Connection Sizes	10	
Standard - Shell and Tube		
Max gpm	1290	1620
Min gpm	540	650
Oversized - Shell and Tube		
Max gpm		
Min gpm		
Evaporative-Cooled Condenser Fans		
Quantity	12	
Type	36” Propeller Fan	
hp	3	
Evaporative-Cooled Condenser Pump		
Quantity/hp	2/5	2/10
Boilers		
Input Capacity/Output Capacity (MBH)	500/450, 750/675, 1000/900, 1500/1350, 2000/1800, 2250/2025, 3000/2700, 4000/3600, 4500/4050, 6000/5400	
Quantity	1, 2, 3, 4	

Control Vendors

Micro Control Systems (MCS) Magnum Control System

Figure 14 - LCD Interface, MCS Magnum Controller, and Touchscreen Interface

The MCS Magnum controller is factory provided on all AAON chiller systems. The controller efficiently varies the cooling capacity of the compressors to maintain a leaving water temperature over a wide variety of operating conditions for VAV, Constant Volume, or Make Up Air applications.

Configuration
Standard LCD interface is included within the controls compartment for unit configuration, setpoint adjustment, sensor status viewing, unit alarm viewing, and occupancy scheduling. PC with free MCS-Connect software can be connected to the controller via RS-232 or Ethernet for unit configuration, setpoint adjustment, sensor status viewing, unit alarm viewing, and occupancy scheduling. Optional full color 15" 1024x768 pixel touchscreen interface is available, and includes graphical user interface that allows for easy monitoring and troubleshooting of the chiller. Unit, controls, compressor, and VFD literature can be viewed from the touchscreen.

Diagnostics
Optional diagnostic sensors are available to provide each refrigerant circuit's suction, discharge and liquid temperature and pressure and also monitor each compressor's current. These sensors can be monitored from the MCS-Connect software.

Network Capability
The MCS Magnum controller can be directly integrated with BACnet IP or Modbus IP protocols via Ethernet port and Modbus RTU or Johnson N2 protocols via EIA-485 port. With adapter, the controller can be integrated with BACnet MS/TP or LonTalk protocols. Optional 56K modem allows remote communication to the unit from MCS, AAON, or the customer to assist with service, diagnosis, and program updates.

Electrical Service Sizing Data

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

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

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 chiller pump motors, compressors, evaporative-cooled condenser pump motors, boiler building pump motors and boiler recirculating pump motors
Load 3 = Additional currents, including evaporative-cooled condenser sump heaters and boilers

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

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.

Disconnect (Power) Switch Size

To calculate the disconnect switch size use the equation shown below.

DSS $\geq$ MOP

Select the standard switch size equal to the calculated Disconnect Switch Size (DSS) value. If this value is not a standard size, select the next larger size.

Unit Dimensional Information

Chiller/Outdoor mechanical room dimensions vary based on capacity and features. Table 25 and Table 26 show the standard model dimensions with no boilers or pumping packages. Table 27, Table 28 and Table 29 show the length which must added to the standard length dimension with boilers or pumping packages.

Due to the angled coil arrangement of the air-cooled condenser section, the top (overall) and bottom (base) dimensions are unequal. Both dimensions must be considered in the unit's placement and clearance. Evaporative-cooled condenser units have a single overall length dimension which is equal at the top and bottom.

Chiller primary or primary/secondary pumping package are available (Feature 1A), single or dual pumps are available (Feature 1B, Feature 5A) and boilers with boiler pumping package are available (Model Option B1, Feature 6A). Dual pumps are available as two single redundant pumps or one dualArm pump.

Sample unit drawings are provided in the next section for reference.

Table 25 - LL Series Scroll Compressor Chiller Standard Dimensional Data

<table>
<tr><th rowspan="2">Model</th><th rowspan="2">Compressor Type</th><th rowspan="2">Width</th><th rowspan="2">Height</th><th colspan="2">Air-Cooled Condenser</th><th>Evaporative-Cooled Condenser</th></tr>
<tr><th>Overall Length</th><th>Base Length</th><th>Overall Length</th></tr>
<tr><td>LL-035</td><td rowspan="31">Scroll</td><td rowspan="16">100”</td><td rowspan="31">102”</td><td rowspan="3">212”</td><td rowspan="3">140”</td><td rowspan="3">189”</td></tr>
<tr><td>LL-050</td></tr>
<tr><td>LL-055</td></tr>
<tr><td>LL-060</td><td rowspan="2">235”</td><td rowspan="2">190”</td><td rowspan="2">214”</td></tr>
<tr><td>LL-075</td></tr>
<tr><td>LL-067</td><td rowspan="3">389”</td><td rowspan="3">244”</td><td rowspan="3">342”</td></tr>
<tr><td>LL-092</td></tr>
<tr><td>LL-104</td></tr>
<tr><td>LL-118</td><td>433”</td><td>344”</td><td>392”</td></tr>
<tr><td>LL-085</td><td rowspan="4">275”</td><td rowspan="4">216”</td><td rowspan="4">260”</td></tr>
<tr><td>LL-090</td></tr>
<tr><td>LL-105</td></tr>
<tr><td>LL-115</td></tr>
<tr><td>LL-125</td><td rowspan="15">142”</td><td rowspan="2">237”</td><td rowspan="2">218”</td><td rowspan="2">243”</td></tr>
<tr><td>LL-140</td></tr>
<tr><td>LL-150</td><td rowspan="3">256”</td><td rowspan="3">235”</td><td rowspan="3">271”</td></tr>
<tr><td>LL-170</td></tr>
<tr><td>LL-185</td></tr>
<tr><td>LL-210</td><td rowspan="4">510”</td><td rowspan="4">400”</td><td rowspan="4">450”</td></tr>
<tr><td>LL-230</td></tr>
<tr><td>LL-245</td></tr>
<tr><td>LL-275</td></tr>
<tr><td>LL-300</td><td rowspan="3">476”</td><td rowspan="3">434”</td><td rowspan="3">506”</td></tr>
<tr><td>LL-335</td></tr>
<tr><td>LL-365</td></tr>
</table>

Table 26 - LL Series Centrifugal Compressor Chiller Standard Dimensional Data

Model	Compressor Type	Width	Height	Air-Cooled Condenser		Evaporative-Cooled Condenser
				Overall Length	Base Length	Overall Length
LL-090	Centrifugal	142”	102”			241”
LL-120						
LL-150						271”
LL-180						273”
LL-181						
LL-240						387”
LL-300						445”
LL-360						449”
LL-450						572”
LL-540						576”

Table 27 - LL Series Scroll Compressor Chiller Pumping Package Additional Length

Model	Compressor Type	Primary Pumping Package		Primary/Secondary Pumping Package		
		Single	Dual	Single/Single	Dual/Dual	Dual/Single
LL-035	Scroll	0”	48”	24”	96”	
LL-050						
LL-055						
LL-060						
LL-075						
LL-067		24”			120”	48”
LL-092						
LL-104						
LL-118						
LL-085		0”			96”	
LL-090						
LL-105						
LL-115						
LL-125					72”	
LL-140						
LL-150						
LL-170						
LL-185						
LL-210		24”	72”		120”	72”
LL-230						
LL-245						
LL-275						
LL-300						
LL-335						
LL-365						

Table 28 - LL Series Scroll Compressor Chiller Boiler and Pumping Package Additional Length

Model	Compressor Type	1 Boiler	2 Boilers	3 Boilers	4 Boilers
LL-035	Scroll	108”	144”	180”	216”
LL-050					
LL-055					
LL-060					
LL-075					
LL-067					
LL-092					
LL-104					
LL-118					
LL-085		108”	144”	180”	216”
LL-090					
LL-105					
LL-115					
LL-125					
LL-140					
LL-150					
LL-170					
LL-185					
LL-210					
LL-230					
LL-245					
LL-275					
LL-300					
LL-335					
LL-365					

Table 29 - LL Series Centrifugal Compressor Chiller Boiler and Pumping Package Additional Length

Model	Compressor Type	1 Boiler	2 Boilers	3 Boilers	4 Boilers
LL-090	Centrifugal	108”	144”	180”	216”
LL-120					
LL-150					
LL-180					
LL-181					
LL-240					
LL-300					
LL-360					
LL-450					
LL-540					

Dimension Example:

Problem: From Selection Example 1, a 140 ton unit with an air-cooled condenser was selected. A chiller primary/secondary pumping package and a boiler and pumping package are added to this system. Two boilers are required and, for redundancy, dualArm pumps are needed in the pumping configurations.

Solution:
From Table 25, the dimensions of the base LL-140:

Width = 142 inches
Height = 102 inches
Length across the top = 273 inches
Length across the bottom = 218 inches

Using Table 27 and Table 28 the additional length which needs to be added for the pumping package and boiler:

Primary/Secondary Pumping Package with Dual/Dual Redundant Pumping = 72 inches
2 Boilers and Boiler Pumping Package = 144 inches

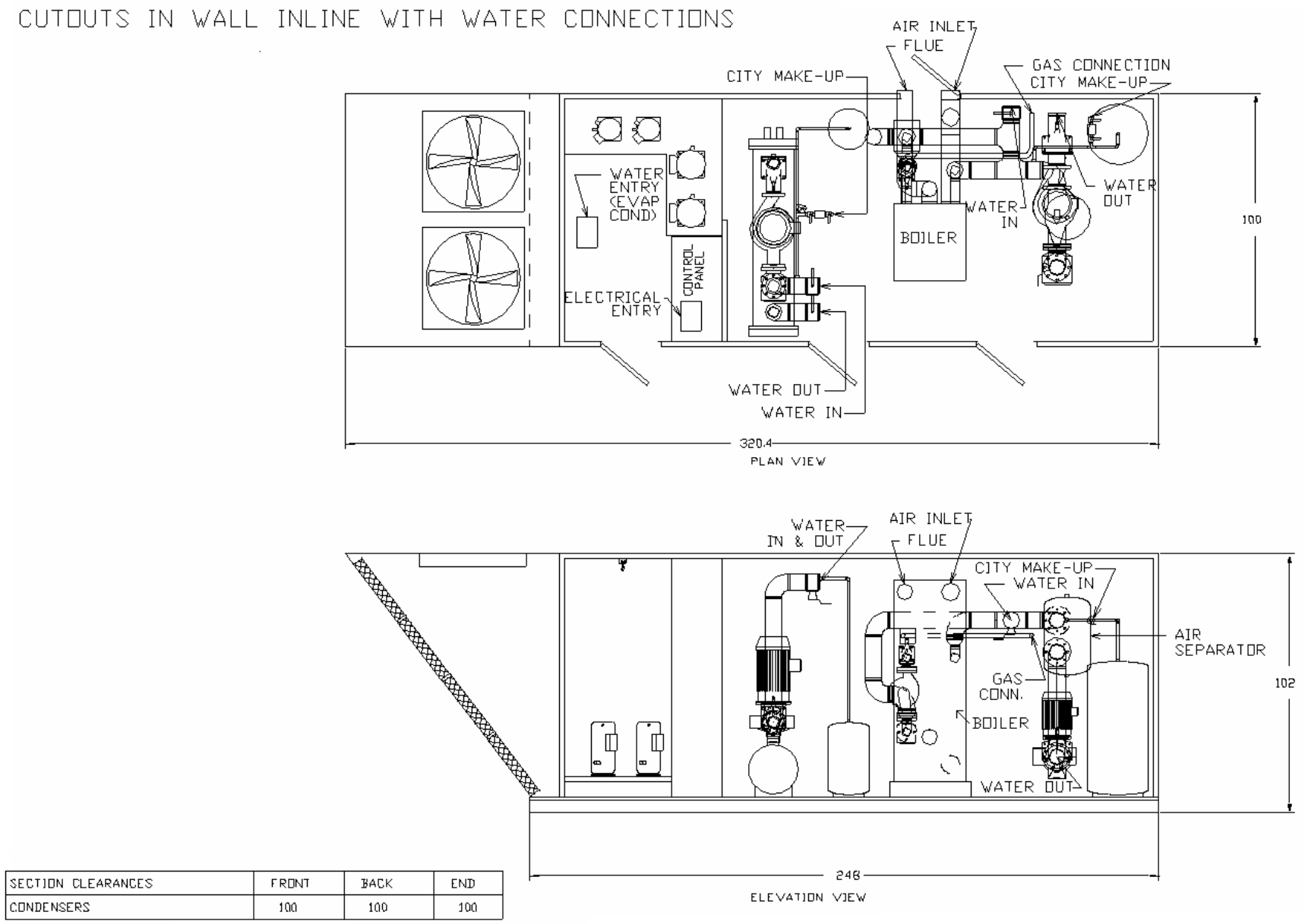
Total Length = Base Model Length + Additional Pump Length + Additional Boiler Length

Total Overall Length = 273 + 72 + 144 = 489 inches

Total Base Length = 218 + 72 + 144 = 434 inches

Unit Drawings

Unit drawings of some possible LL Series chiller configurations are included. These typical unit drawings include single and dual ended condenser units, air-cooled and evaporative-cooled condenser units and boilers and pumping packages. Note the variations in unit length with boiler and pumping packages.



SECTION CLEARANCES	FRONT	BACK	END
CONDENSERS	100	100	100

Figure 15 - LL-035 with an Air-Cooled Condenser, Single Chiller Building Pump, One Boiler and Single Boiler Building Pump

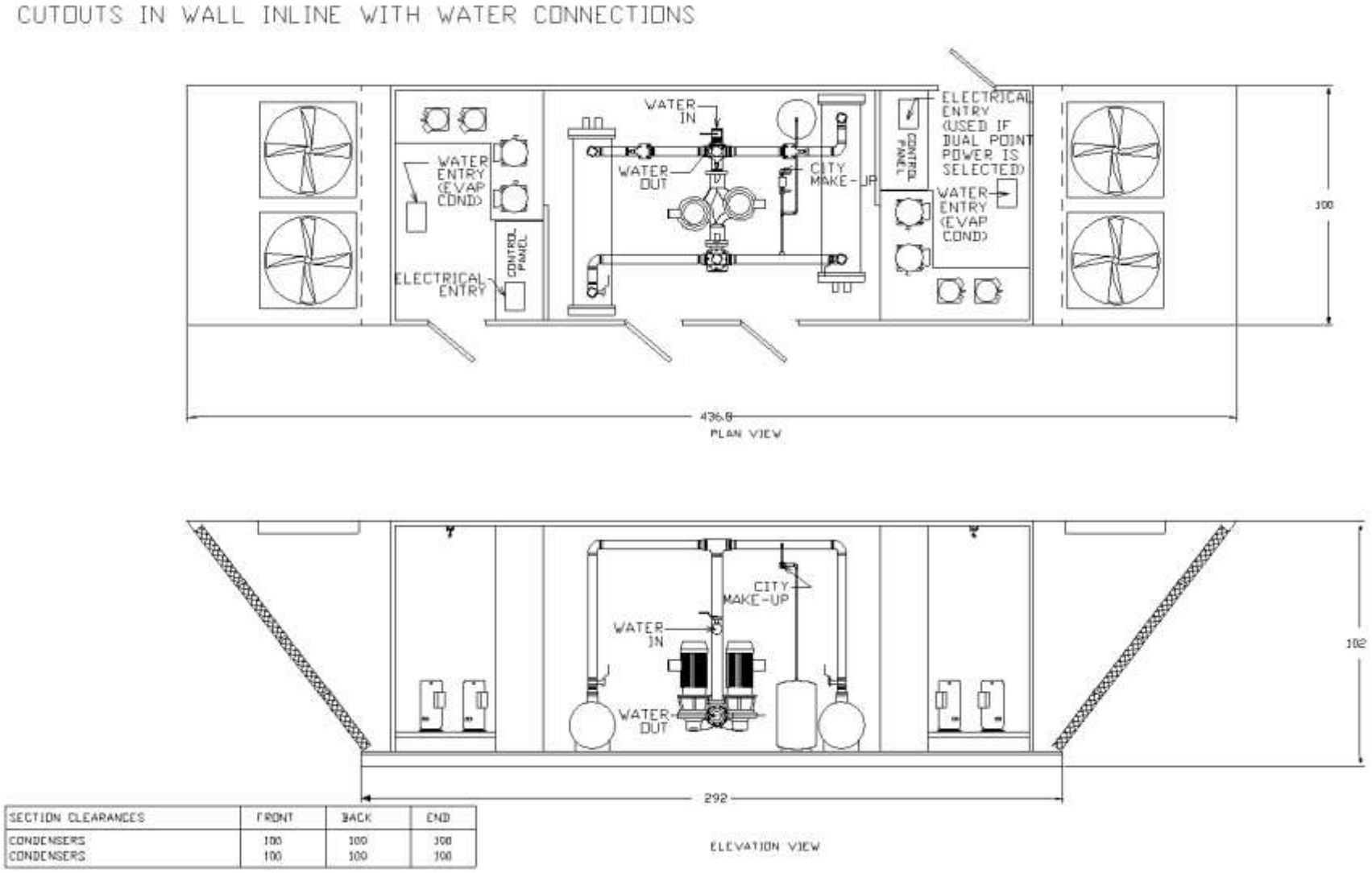
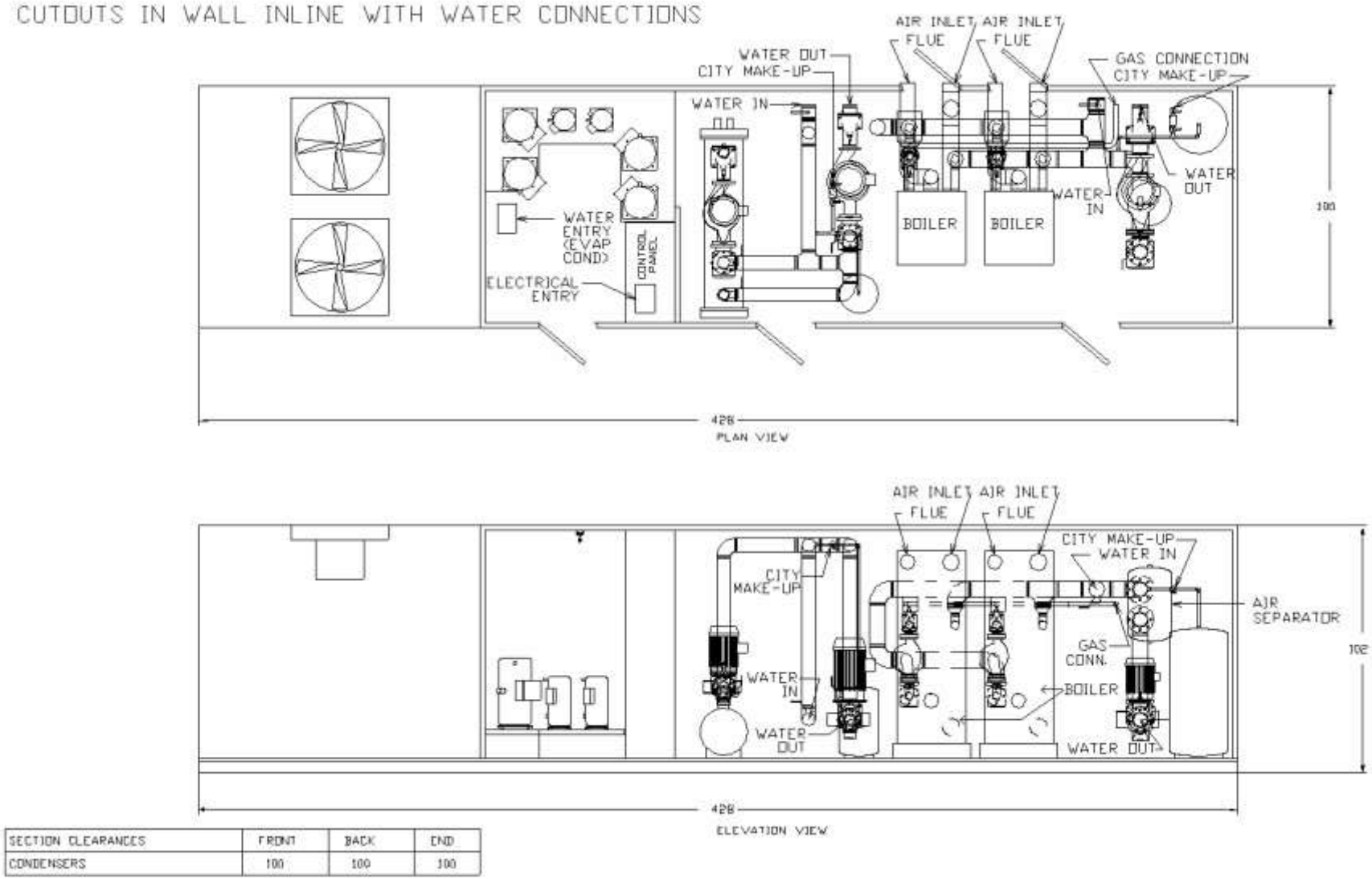


Figure 16 - LL-067 Dual Ended Unit with Air-Cooled Condensers and dualArm Chiller Building Pump



SECTION CLEARANCES	FRONT	BACK	END
CONDENSERS	100	100	100

Figure 17 - LL-115 with an Evaporative-Cooled Condenser, Single Chiller Building Pump, Single Chiller Recirculating Pump, Two Boilers and Single Boiler Building Pump

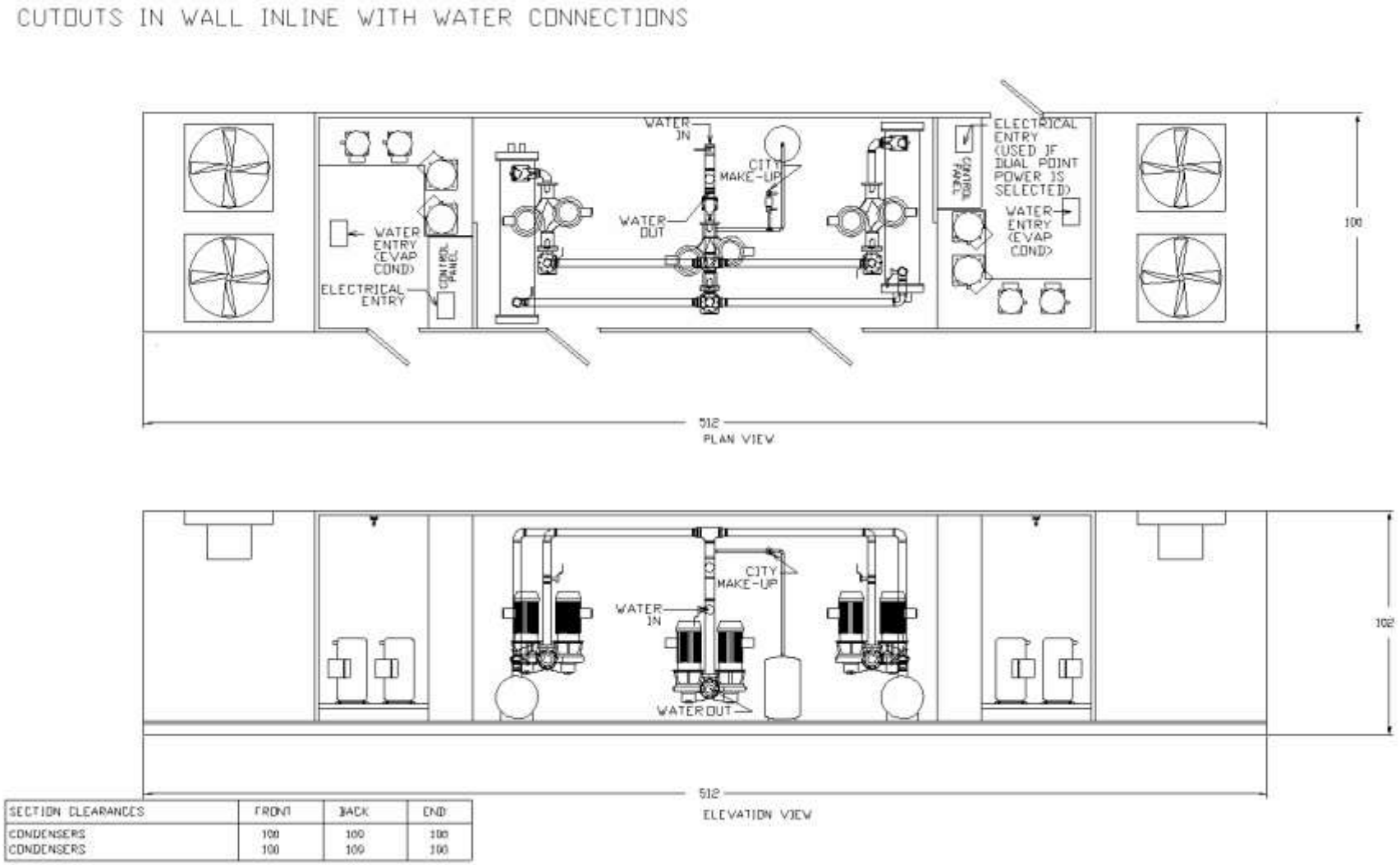


Figure 18 - LL-0118 Dual Ended Unit with Evaporative-Cooled Condensers, dualArm Chiller Building Pump and dualArm Chiller Recirculating Pumps

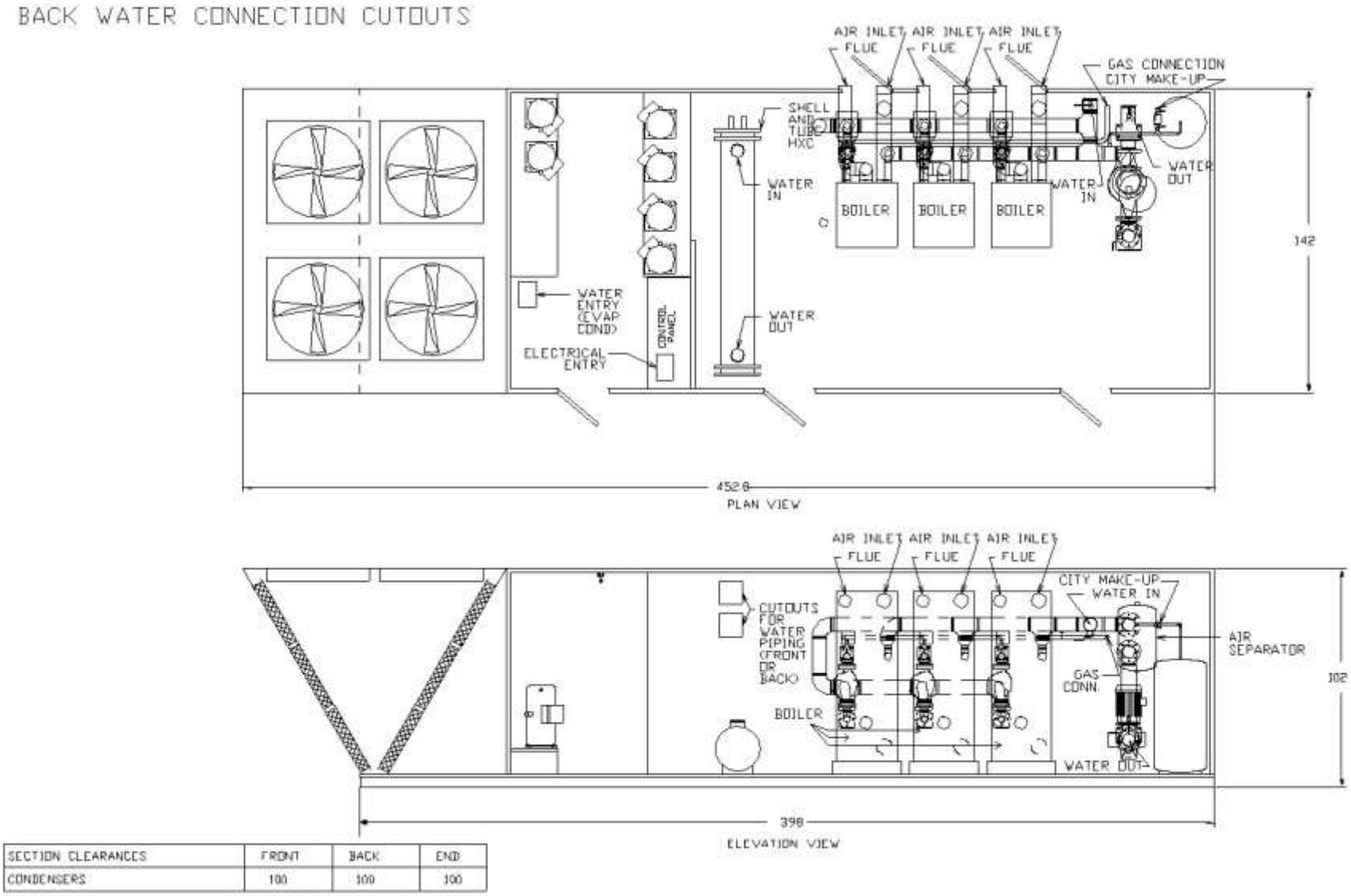


Figure 19 - LL-125 with an Air-Cooled Condenser, Three Boilers and Single Boiler Building Pump

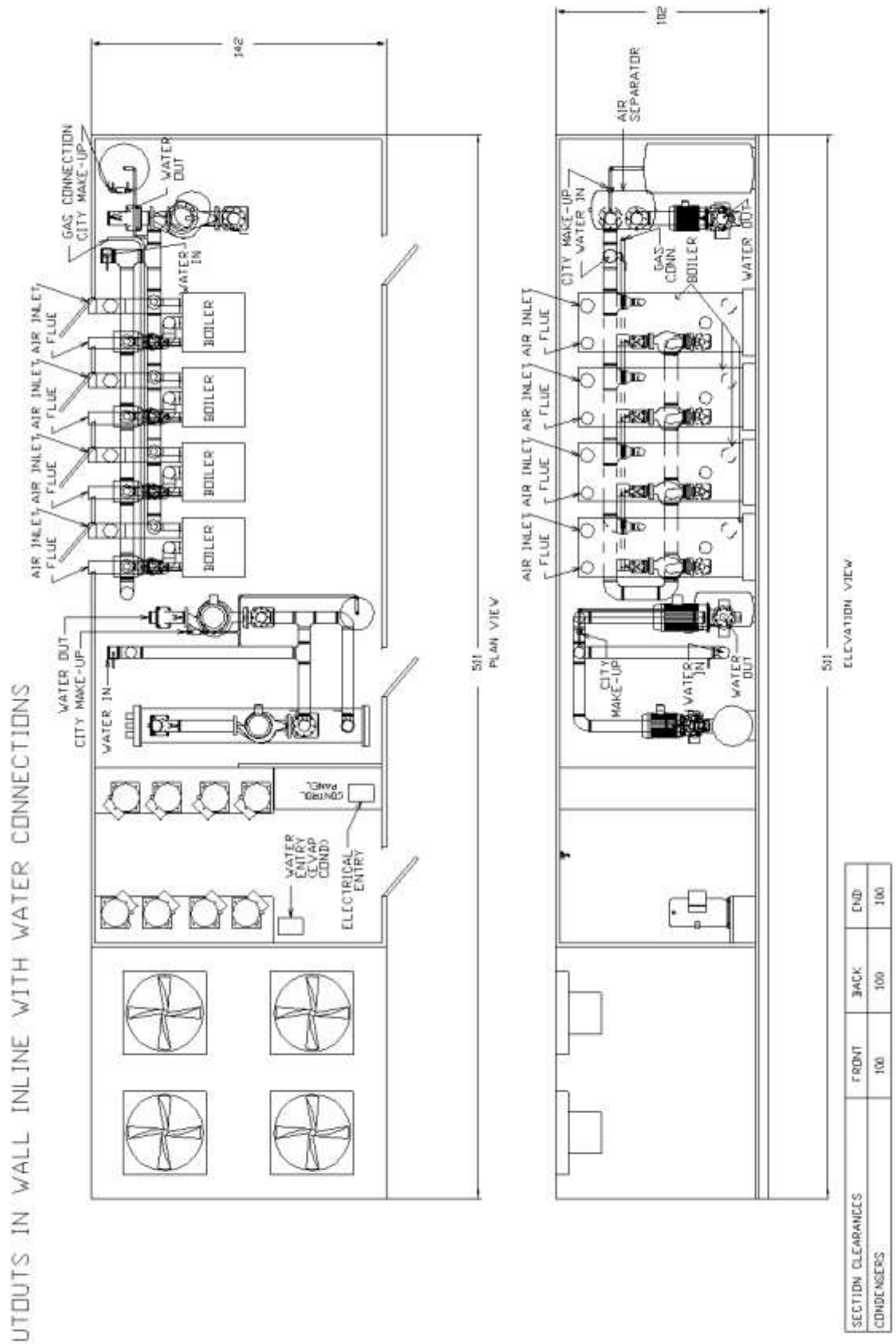
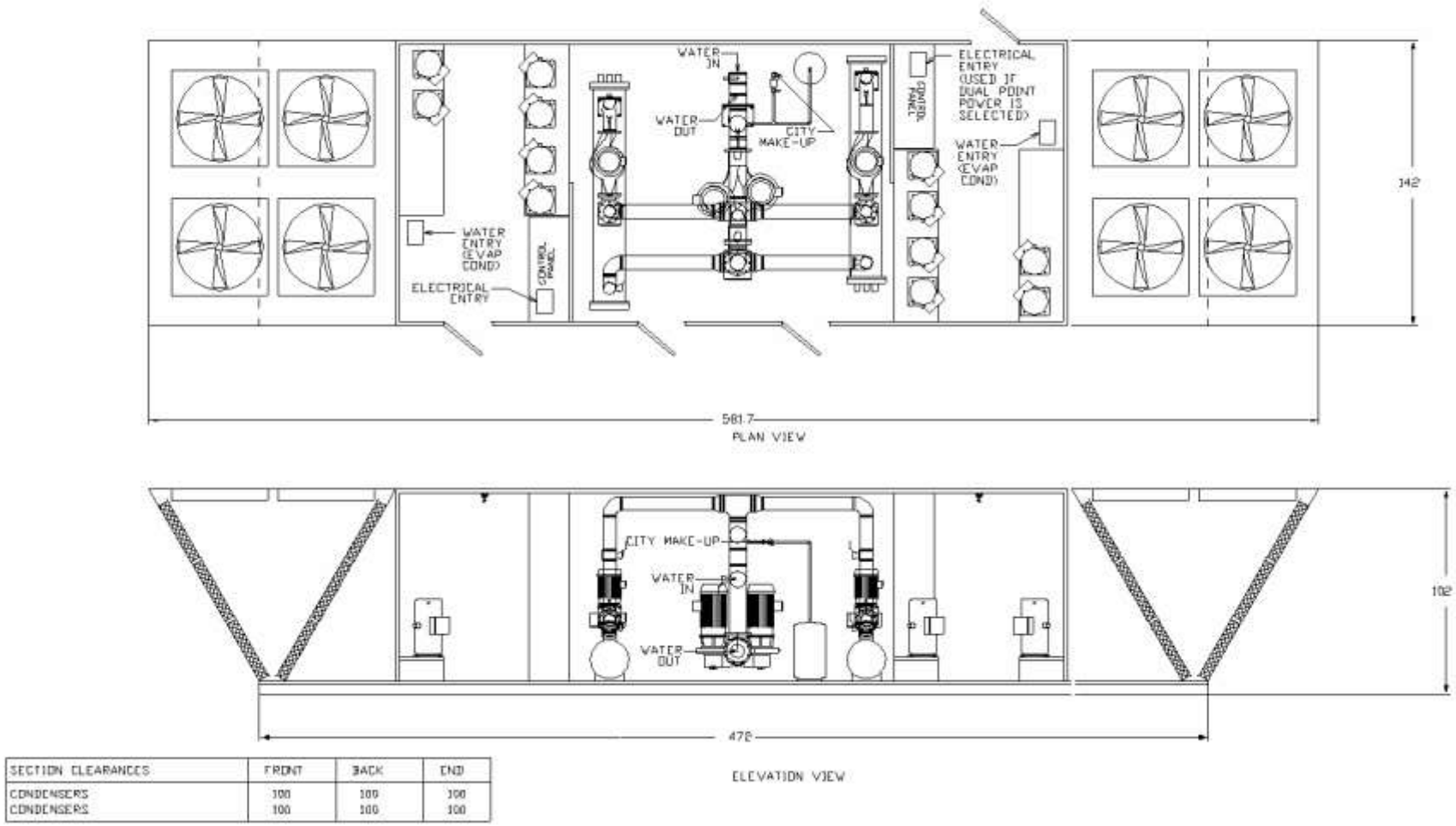


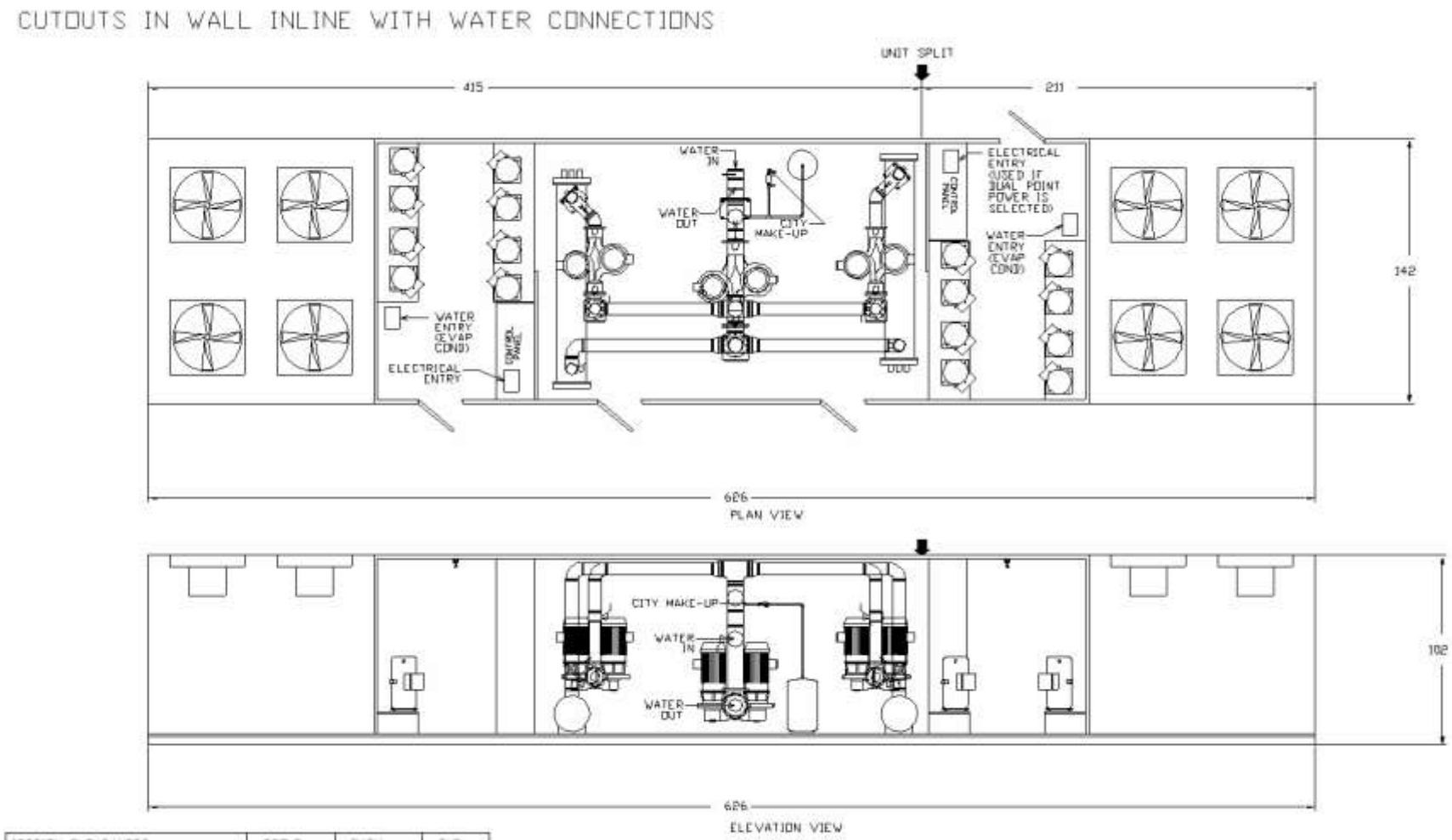
Figure 20 - LL-185 with an Evaporative-Cooled Condenser, Single Chiller Building Pump, Single Chiller Recirculating Pump, Four Boilers and Single Boiler Building Pump

CUTOUTS IN WALL INLINE WITH WATER CONNECTIONS



SECTION CLEARANCES	FRONT	BACK	END
CONDENSERS	100	100	100
CONDENSERS	100	100	100

Figure 21 - LL-210 Dual Ended Unit with Air-Cooled Condensers, dualArm Chiller Building Pump and Single Chiller Recirculating Pumps



SECTION CLEARANCES	FRONT	BACK	END
CONDENSERS	100	100	100
CONDENSERS	100	100	100

Figure 22 - LL-365 Dual Ended Unit with Evaporative-Cooled Condensers, dualArm Chiller Building Pump and dualArm Chiller Recirculating Pumps

AAON Evaporative-Cooled Condenser Features and Water Treatment

The AAON evaporative-cooled condenser is the only evaporative-cooled condenser 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-cooled condenser 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. The sub-cooling circuit is integral to the wetted coil section.

8. The AAON cabinet is all 304 stainless steel. This includes the sump, all structural members and all interior.

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

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

11. 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 Langelier saturation index 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 $CO3^{2-}$ 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.

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 $CaCO_3$]

AAON Ecat 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.

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-cooled condenser, 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.

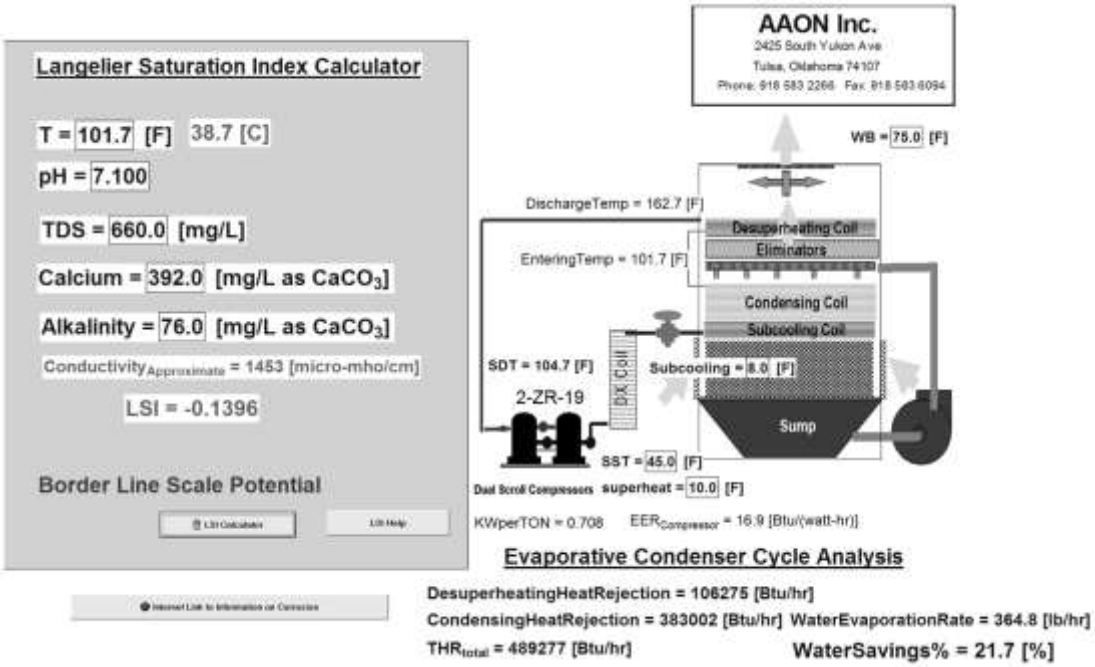


Figure 23 - Example Evaporative-Cooled Condenser with De-superheater

Let's assume that the desuperheater 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:

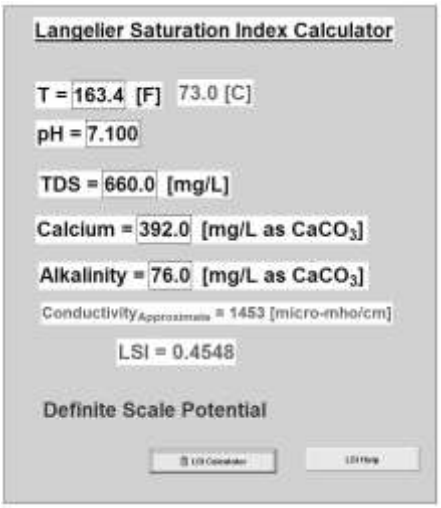


Figure 24 - Example Evaporative-Cooled Condenser without De-superheater

Literature Change History

June 2007
Update of the catalog for correction of the Electrical Service Sizing Data Table E3, Pump Motor Amps

February 2008
Update of catalog to give it a more consistent look to the other engineering catalogs.

December 2010
Update of the catalog removing the standard efficiency pump motor options and R-22 compressor options.

June 2011
Update of the catalog adding information about the variable capacity oil-free magnetic bearing centrifugal compressor and MCS Magnum control options.

August 2011
Update of the catalog to specify that electronic expansion valves are standard on all LL Series chiller systems (Feature 8).

November 2011
Update of the catalog adding information about the variable capacity VFD controlled scroll compressor options (Model Option A1 and A4) and additional information about the MCS Magnum controller.

December 2012
Update of the catalog adding the information about the VFD controlled scroll compressor turndown.

August 2015
Updated the evaporator quantity to 2 for 210-275 ton units in the General Data section. Updated the formatting of the Feature String Nomenclature.

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