



ATHENA

Air Cooled Oil-Free Magnetic Bearing Chiller

ACM-AE Series 50/60Hz

Cooling Capacity: 81 to 540 TR (285 to 1899 kW)



INTRODUCTION

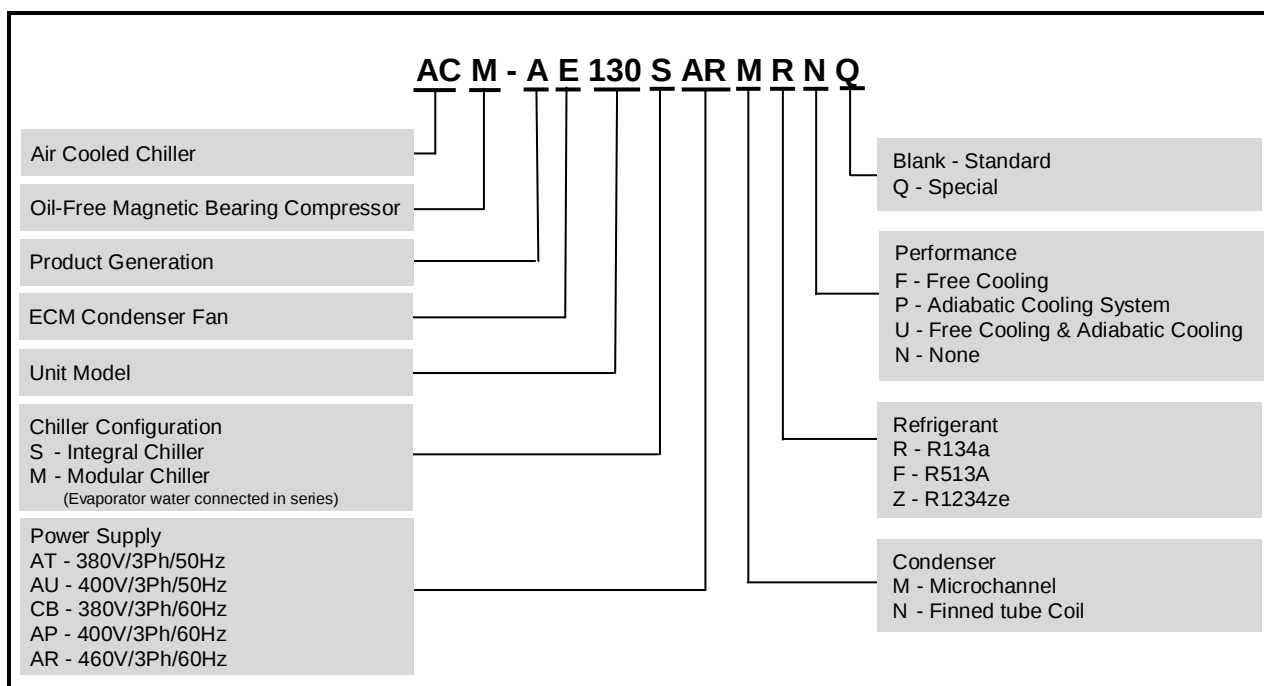
For more than 100 years, Dunham-Bush has focused on innovative product development. Today, we provide a full portfolio of HVAC/R products from Fan Coil Units to large centrifugal chillers as well as many other innovative green solutions. Our commitment to innovation, matched with an aggressive attitude toward growth, makes Dunham-Bush a leader in global markets. Our product development is tailored to meet the specific needs of customers. No other HVAC/R manufacturer takes this approach to meeting your performance expectations.

ATHENA, ACM-AE Air Cooled Oil-Free Magnetic Bearing Chiller, have a cooling capacity range from 87 to 501 TR [306 to 1762 kW] using environmentally friendly refrigerant which includes HFC-134a and HFO-513A. While with the ultra-low GWP HFO-R1234ze refrigerant, the cooling capacity ranged from 81 to 540 TR [285 to 1899 kW]. The entire product line features energy efficiency, installation ease, control flexibility, high reliability and advanced controller. The ACM-AE series are certified to AHRI Standard 550/590 and the unit's performance exceeds the ASHRAE Standard 90.1 requirements.

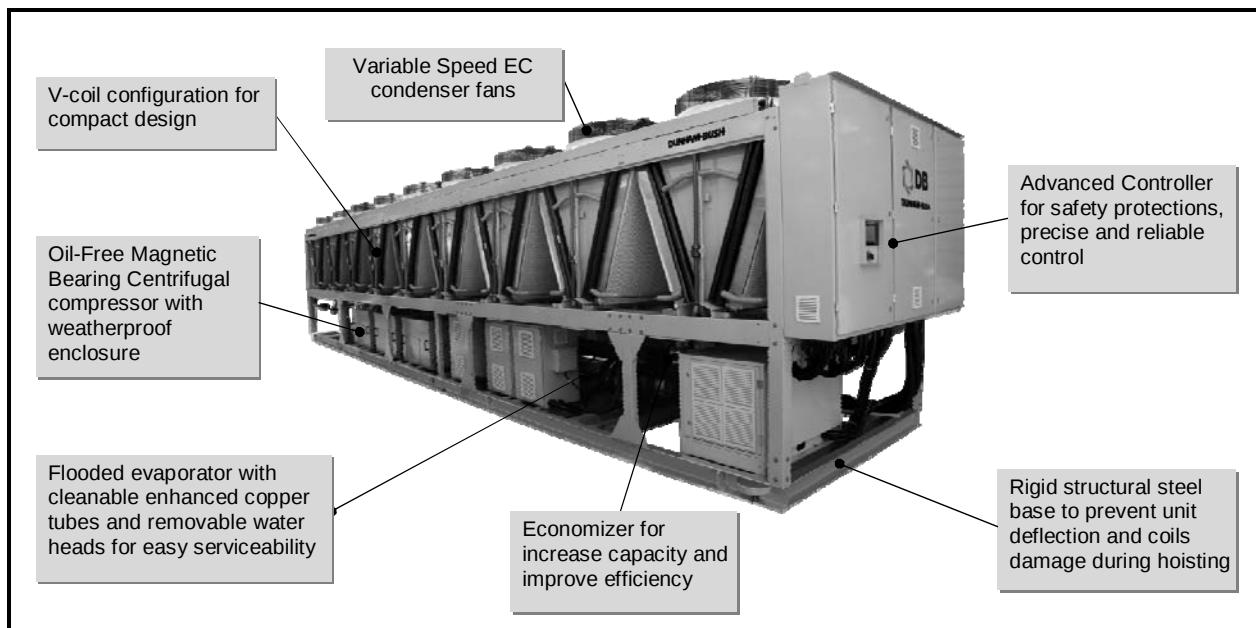
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NOMENCLATURE



GENERAL CHARACTERISTICS



UNIT FEATURES

General

- ✱ All models are rated in accordance with AHRI standard conditions.
- ✱ Compressor is two-stage, variable speed, magnetic bearing centrifugal compressor design requiring no oil for lubrication.
- ✱ Great improvement on Integrated Part Load Value (IPLV), which rated in accordance with AHRI Standards 550/590-2020.
- ✱ Single circuit models up to 375 TR [1319 kW]. Dual circuit models available from 330 TR [1161 kW] to 540 TR [1899 kW].
- ✱ Specific unit design to operate with HFC-134a/HFO-513A and HFO-1234ze. All three stated refrigerants are environment friendly refrigerant with zero ODP (Ozone Depletion Potential). R1234ze is ultra-low GWP refrigerant in which the GWP index is less than 1.
- ✱ Wide range of unit operating ambient temperature.

Compressor

- ✱ Semi-hermetic magnetic bearing centrifugal compressor.
- ✱ Two-stage compression, variable speed centrifugal compressor design.
- ✱ Oil-free compressor operation.
- ✱ Maglev technology – the magnetic bearing does not touch the shaft and therefore no mechanical friction is produced during the



operation. This greatly reduce the mechanical loss of compressor and boost up energy efficiency of the unit.

- ✱ Low starting current – compressor soft start module reduces high in-rush current at startup.

Evaporator

- ✱ Shell-and-tube flooded type heat exchanger.
- ✱ Two pass or one pass (for modular construction unit) evaporator design.
- ✱ Integral finned copper tubes to maximized heat transfer area.
- ✱ Cleanable copper tubes for easy serviceability.
- ✱ Removable water heads for service.
- ✱ Victaulic groove water connection comply to ANSI/AWWA C-606.
- ✱ Standard with 1" thick closed cell insulation.
- ✱ Standard relief valve(s) – 3/4" [19mm] FPT.
- ✱ Pressure test up to 220psig for refrigerant side, and 195psig for water side.

Condenser

- ✱ Condensers are constructed with seamless inner-grooved copper tubes expanded into die-formed aluminium fins in staggered configuration.
- ✱ "V" coil design to increase condensing surface area to maximize heat rejection.
- ✱ "V" coils arrangement with internal baffle for fan cycling and staging.
- ✱ Condenser coils are leak and pressure tested at 450psig [31bar].
- ✱ All Aluminium microchannel with anti-corrosion TCP coating or E-coating is available as option.

UNIT FEATURES

Fans

- ✿ EC condenser fans to regulate airflow and enhanced part load efficiency.
- ✿ Low noise operation.
- ✿ Better operation of chiller at low ambient condition.

Electronic Expansion Valve

- ✿ Advanced electronic expansion valve (EEV) is used for precise control of liquid refrigerant flow into the evaporator.
- ✿ Evaporation of liquid refrigerant in evaporator is controlled at precise level for optimum performance.

Economizer

- ✿ The economizer circuit consists of plate type heat exchanger, electronic expansion valve and mechanical isolation valve.
- ✿ Refrigerant is sub-cooled at economizer before entering the evaporator.
- ✿ The economizer increased subcooling thus greatly improve on the unit performance and efficiency.

Control Panel

- ✿ Weather tight electrical enclosure fabricated by heavy gauge sheet steel with powder coated baked finishing.
- ✿ Single point power connection for integral models (ACM-AE090S to ACM-AE360S). Dual points power connection for models (ACM-AE340M to ACM-AE510M).
- ✿ Circuit breaker for compressors and condenser fan motors
- ✿ Step down transformer for power supply to control circuit.
- ✿ Unit Mounted Main Disconnect Switch – Non-fused disconnect switch with external lockable handle is furnished to isolate unit main incoming power supply for servicing.
- ✿ Main power supply monitoring module. Protection on under or over voltage, phase reversal, phase losses and imbalance.
- ✿ Unit mounted Remote/Off/Local (R/O/L) selector, an operation and servicing friendly feature.
- ✿ Edge controller – the state-of-art Dunham-Bush proactive advanced controller that adapts to any abnormal operating conditions and for safety protections.
- ✿ Chilled water pump control.

EDGE CONTROLLER

Edge controller is an advance microprocessor controller designed specifically for the application and precise control of Dunham-Bush Oil-Free Air Cooled Magnetic Bearing Centrifugal chillers.

The controller is provided with a set of terminals that connect to various devices such as temperature sensors, pressure and current transducers, compressors staging and surge mitigations control relays, etc.

The unit algorithm program and operating parameters are stored in FLASH-MEMORY that does not require a back-up battery. The program can be loaded through USB.

Edge controller is equipped with a user-friendly responsive 7" touch screen interface that provides easy access to the unit operating conditions, control set points and alarm histories.

Display and User Terminal

The terminal display allows carrying out of the unit operations, and also allows the unit working conditions, compressor run times and alarm history to be displayed. Set points and other parameters can be modified via the user terminal. The display has an automatic self-test of the controller on system start-up. Messages are spelled out in English on the display terminal.

Easily accessible measurements include:

- ✿ Leaving and entering chilled water temperature.
- ✿ Rate of Change for leaving chilled water temperature.
- ✿ Suction and discharge pressure
- ✿ Compressor suction & discharge temperature and suction & discharge superheat.
- ✿ Ambient temperature.
- ✿ Current drawn by each compressor.
- ✿ Compressor capacity in terms of percentage.
- ✿ Run hours of each compressor.
- ✿ Number of starts of each compressor.
- ✿ Electronic Expansion Valve (EEV) Opening Percentage.
- ✿ Compressors and condenser fans motors status.
- ✿ Water Flow Switch Status, Remote Start/Stop Command Status.

Capacity Control

Leaving chilled water temperature control is accomplished by entering the water temperature setpoint and placing the controller in automatic control. Edge controller monitors all control functions and thus match the building cooling load demand.

The compressor ramp (loading) cycle is programmable and may be set for specific building requirements. Remote adjustment of the leaving chilled water setpoint is accomplished either through High Level Interfacing (HLI) via BMS communication, or Low Level Interfacing (LLI) via an external hardwired, 4 to 20mA chilled water reset control signal. Remote reset of compressor current limiting function can be accomplished in a similar fashion.

UNIT FEATURES

System Control

The unit may be started or stopped manually, or through the use of an external signal from a Building Automation System.

System Protection

The following system protection controls will automatically act to ensure system reliability:

- ✱ Low evaporator pressure
- ✱ High condenser pressure
- ✱ Freeze protection
- ✱ Compressor run error
- ✱ Power loss
- ✱ Chilled water flow loss
- ✱ Sensor error
- ✱ Compressor over current
- ✱ High motor temperature

The controller can retain up to 10,000 event histories complete with time of events. This tool will aid service technicians in troubleshooting tasks enabling downtime and nuisance trip-outs to be minimized.

Remote Monitoring And Control (Option)

Dunham-Bush, the leader of HVAC solution provider understands the arising focus on chiller plant performance and optimization. Several solutions as below are offered to the building owner to achieved optimized chiller plant room controls, operation and performance.

Dunham-Bush Chiller Plant Manager (CPM)

DB Chiller Plant Manager (**CPM**) is a trustworthy and headache-free solution for building owners and users on chiller plant control and automation system. **CPM**'s advanced controllers monitor and control equipments in chiller plant such as chillers, primary and secondary chilled water pumps, variable frequency drives (VFD), motorized valves, bypass modulating valves, and etc. Field devices such as flow meters, BTU meters, digital power meters, sensors & transducers can be interfaced with **CPM** via HLI or LLI. CPM controls chillers and pumps sequencing, as well as lead-lag, duty-standby and alarm changeover operations.

NetVisorPRO – Monitoring software of **CPM** system which allows system monitoring, historical trending, and alarm logging to be carry out at a PC terminal. Graphical animations on system operation, temperature and flow rate trend graphs, historical data and alarm history logs, settings changes are all available with **NetVisorPRO**.

Chiller plantroom control and automation by Dunham-Bush **CPM** provides the owners with a chiller system in stable operation, optimized performance and energy efficiency.

Building Management System (BMS) Communication

Edge controller is able to communicate to BMS through the add-on communication card via various common protocols as:

- ✱ Modbus RTU, ModBus TCP/IP
- ✱ BACnet over IP, BACnet MS/TP

OPTIONS AND ACCESSORIES

- ✱ **Free Cooling** – Additional free cooling coils are integrated to the condenser coils. Free cooling feature takes advantage of the temperature differential between the circulating fluid and the outdoor air to provide “free” cooling to the circulating fluid and reducing the mechanical cooling from the compressor. Please consult factory for unit layout and shipping arrangement.
- ✱ **Adiabatic cooling system** – Evaporative panels and adiabatic cooling water circulating system is installed to the chiller. When hot and dry air is drawn through the evaporative panels, the air will get cooled and therefore reducing the condensing temperature.
- ✱ **High Lift Compressor** – high lift compressor for high lift operation or high ambient operation up to 125°F [51.7°C].

- ✱ **Low Ambient Operation (LA2)** – Add-on low ambient kit to allow unit operation down to 0°F [-17.8°C] ambient temperature.
- ✱ **Service valve** – Compressor discharge and suction valve(s) is supplied for isolation purpose.
- ✱ **Dual PRV** – ¾” NPT connections dual shut off valves are provided with redundant pressure relief valves on discharge manifold and evaporator.
- ✱ **Microchannel Condenser TCP coating** – Optional TCP Coating which provides good anti-corrosion protective layer for microchannel coil.
- ✱ **Microchannel Condenser E-coating** – Optional E-Coating which provides an enhanced anti-corrosion protective layer for microchannel coil for harsh environment.

OPTIONS AND ACCESSORIES

- ❖ **Finned Tube Condenser Corrosion Protection** – Copper (CU) fin, coated fin OR DB-Coat finned tube condenser coil are provided to give better corrosion protection.
- ❖ **Double Thick Insulation** – Evaporator with double thick 2" [50mm] closed cell insulation, for extra resistance to condensation.
- ❖ **Evaporator Anti-Freeze Protection** – When chiller is not operating at ambient temperature 32°F [0°C] or below, the immersion heater and circulating pump will be in operation to prevent water freezing in evaporator **(Some of the model unit dimension may change for this option and subjected for additional price)**.
- ❖ **250psig Working Pressure Vessel** – Evaporator with 250psig working pressure on water side.
- ❖ **Condenser Coil Guard** – To protect condenser coil from unauthorized access.
- ❖ **2 Years Compressor Warranty** – 1 year standard compressor warranty plus 1 year extended compressor warranty.
- ❖ **5 Years Compressor Warranty** – 1 year standard compressor warranty plus 4 years extended compressor warranty.
- ❖ **Evaporator Flanged Water Connection** – ANSI Flanged water connection is available as option.
- ❖ **ASME Compliance** – Evaporator with ASME approval is available as option.
- ❖ **Thermal Dispersion Flow Switch** – Optional thermal dispersion flow switch (TDFS) can be installed at the evaporator leaving fluid connector. The TDFS function is to provide evaporator fluid flow indication for chiller startup.
- ❖ **Evaporator Option** – Optional evaporator model and size can be selected from the selection software drop down menu. This is required for situation whereby the default evaporator is not able to operate at the selected condition (for e.g. high concentration propylene glycol or ethylene glycol).

Electrical And Controls

- ❖ **Power meter** – Meter provides measurement for Energy, Reactive Power, Voltage, Current, Frequency and Power Factor.
- ❖ **Ground Fault Interrupt (GFI)** – Provides equipment with ground fault protection.
- ❖ **Chilled Water Reset/ Demand Limiting** – Low level interfacing with Building Automation System (BAS). Chilled Water Reset allows controlled temperature setpoint to be reset by a 4-20mA signal from BAS; while Demand Limiting will limit the maximum current

drawn by the compressors by 4-20mA signal from BAS.

- ❖ **IP55 Control Panel** – IP55 rated control panel can be supplied for harsh working environment.
- ❖ **BMS Communication** – Various add-on communication cards provide BMS communication via common protocols: Modbus RTU RS485 / TCP/IP, LONworks FTT10, BACnet over IP / MSTP / PTP.
- ❖ **EMI Filter** – EMI/EMC filter is installed on the input power line. Adding filter will reduce electrical noise on the power lines.
- ❖ **AHF Filter** – AHF filter is installed for harmonic mitigation purpose **(Some of the model unit dimension may change for this option and subjected for additional price)**.
- ❖ **High Efficiency/Static Condenser Fan** – High efficiency/static is available as option. This option is defaulted automatically selected if Free Cooling or Adiabatic Cooling.
- ❖ **UPS** - Uninterrupted power supply and battery are installed to provide power supply to the controller during power failure. This is required for chiller rapid restart feature if customer side unable to provide the required power supply to the controller during power failure.

Factory Supplied, Field Installed By The Customer

- ❖ **Evaporator Water Flow Switch** – Flow switch to be installed at evaporator outlet piping as safety interlock to evaporator water flow status. Two options are available: Weather tight flow switch with CE mark and NEMA 4 rated flow switch.
- ❖ **Rubber-In-Shear Isolators** – Designed for ease of installation. These one-piece molded rubber isolators are applicable for most installations.
- ❖ **Spring Isolators** – These housed spring assemblies have a neoprene friction pad at the bottom to prevent the passage of noise, and a spring locking levering bolt at the top. Neoprene inserts prevent contact between the steel upper and lower housings. Suitable for more critical application as compared to rubber-in-shear isolator.
- ❖ **DB-LAN Master Slave Sequencing Control (MSS)** – Pre-programmed at factory; field supplied and installed inter-connection wiring between chillers to provide communication bus among chillers' controllers to enable Master-Slave Sequencing Control.
- ❖ **Chiller Plant Manager (CPM)** – Factory supplied control panel; field supplied and installed interconnection wiring and field devices; for complete chiller plantroom automation.

OPERATING BENEFITS

EFFICIENCY AND RELIABILITY

Energy Efficiency

- ✿ Designed to provide the greatest amount of cooling for the least power input over the entire operating range of your building.
- ✿ Delivers outstanding efficiency and total energy savings through the utilization of economizer cycle and advanced controller staging; to produce greater capacity with fewer compressors.
- ✿ Maximized performance through computer-matched components and multiple compressors.
- ✿ Compressor requires no oil for lubrication, thus maximized heat exchanger efficiency.

Refrigerant Compatibility

- ✿ Designed to operate with environmentally sound and economically smart HFC-134a / HFO-513A / HFO-1234ze with proven efficiency.

Flooded Evaporator

- ✿ Flooded evaporator design that fully utilized and maximized the heat transfer area available in the evaporator; operates with lower suction superheat, smaller evaporator approach. These have greatly improved efficiency of chiller with flooded evaporator.
- ✿ Flooded evaporator water heads can be removed easily without dismantling the chilled water piping connections, for inspection and for mechanical tubes cleaning with brushes or auto-brush. This will enable low tube fouling factor in the evaporator to be ensured, thus maintaining system efficiency.

Operational Advantages

- ✿ Dramatic payback in reduced maintenance and overhaul costs both in downtime and in labor expenditures.
- ✿ Ease of troubleshooting through controller retention of monitored functions.

Factory Testing

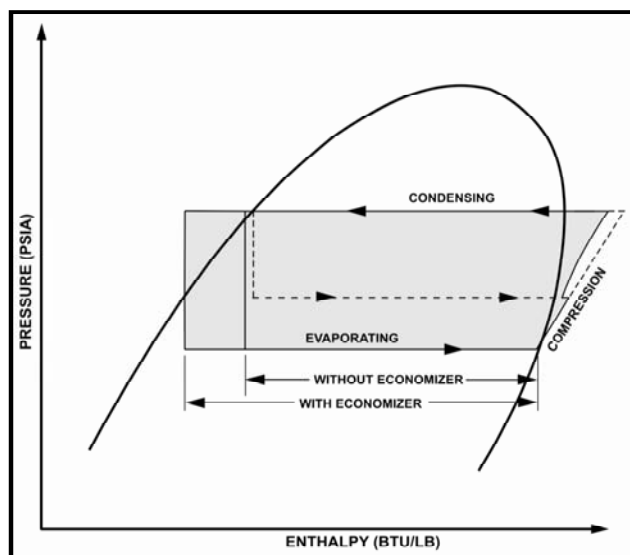
- ✿ Each chiller undergoes the factory testing prior to unit shipment. This assures consistencies of workmanship at highest quality.
- ✿ Thus, all units shipped are completely factory tested; charged and adjusted according to the design parameters, for ease of installation and minimal field start-up adjustments.

Control Flexibility

- ✿ Controller-based with DDC controller (direct digital control) features precise push button control over every aspect of operation with built-in standard features that maximized energy savings on start-up and throughout the life of your equipment.
- ✿ Ensured uniform compressor loading and optimal energy efficiency through controller.
- ✿ Lower energy costs resulting from automatic load monitoring and increased accuracy and efficiency in compressor loading.
- ✿ Various communication options for remote monitoring of the unit operation.
- ✿ Proactive control anticipates problems and takes corrective action before they occur. Controls will unload compressor(s) if head or suction pressure approach limits. This will enable unit to stay on line while warning operator of potential problems.
- ✿ Stable and efficient operation with precise chilled water temperature control. Chilled water temperature is controlled at $\pm 0.8^{\circ}\text{F}$ [0.5°C] range for your comfort cooling, with best energy saving.

REFRIGERATION CYCLE

- ✿ Dunham-Bush Air Cooled Magnetic Bearing Centrifugal chillers are designed for efficiency and reliability. The magnetic bearing centrifugal compressor is two-staged, variable speed centrifugal compressor.
- ✿ The refrigerant management system is shown in the refrigerant cycle diagram.



OPERATING BENEFITS

Liquid refrigerant enters the flooded evaporator uniformly where it absorbs heat from water flowing through the evaporator tubes. The vaporized refrigerant is then entering the suction side of the compressor as low-pressure, low-temperature, superheated gas. The refrigerant gas passes through a set of adjustable Inlet Guide Vanes (IGVs) that are used to control the compressor capacity at low load conditions.

The first compression element the gas encounters is the first-stage impeller. The centrifugal force produced by the rotating impeller results in an increase in both gas velocity and pressure. The high velocity gas discharging from the impeller is directed to the second-stage impeller through de-swirl vanes. The partially compressed gas is then combined with additional gas from the economizer port at an intermediate pressure. Combined refrigerant gas is further compressed by second-stage impeller and then discharged through a volute via a diffuser. From there, the high pressure/temperature gas exits the compressor at the discharge port.

Fully compressed and superheated refrigerant is then discharged into the condenser, where air is being drawn through the condenser by the EC fans cools and condenses the refrigerant. The exit liquid refrigerant from the condenser is divided into few paths/flows. The main flow will enter the economizer and being subcooled by the sub flow. Reason is the sub flow which tapped from the main flow passes through the electronic expansion valve and is evaporated at an intermediate pressure to cool the main flow. The cold intermediate gas enters the compressor economizer port.

There is another subcooled liquid refrigerant line tapped from the liquid manifold and is directed to compressor's liquid injection port. The subcooled liquid refrigerant is essential for compressor motor/electronics cooling.

The remaining subcooled liquid refrigerant then passes through electronic expansion valve which reduces refrigerant pressure to evaporator levels where it is then distributed evenly into the evaporator.

With the additional subcooling, the enthalpy of the refrigerant flowing into the evaporator is reduced which increases the refrigeration effect and improves the efficiency of the refrigeration cycle.

Economizer/ Vapor Injection Cycle for Increase Capacity and Higher EER

Dunham-Bush Air Cooled Magnetic Bearing Centrifugal Chillers' compressors allows for economizer vapor injection cycle to be incorporated, increasing capacity by significantly with marginal increase in kW-input. Thus, unit EER is improved!

PART-LOAD PERFORMANCE

Through the use of economizer, electronic expansion valve and multiple compressors, Dunham-Bush Air Cooled Magnetic Bearing Centrifugal Chiller have some of the best part-load performance characteristics in the industry when measured in accordance with AHRI Standard 550/590.

In most cases, actual building system loads are significantly less than full load design conditions, therefore chillers operate at part load most of the time.

Dunham-Bush air cooled chillers combine the efficient operation of compressors with economizer cycle and advanced controller to yield the best total energy efficiency and significant operating saving under any load.

When specifying air conditioning equipment, it is important to consider the system load characteristics for the building application. In a typical city, the air conditioning load will vary according to changes in the ambient temperature. Weather data compiled over many years will predict the number of hours that equipment will operate at various load percentages.

The Air Conditioning and Refrigeration Institute (AHRI) has established a system, in AHRI Standard 550/590, for measuring total chiller performance over full and part-load conditions. It defines the Integrated Part-Load Value (IPLV) as an excellent method of comparing diverse types of equipment on an equal basis. The IPLV is a single number estimate of a chiller's power use weighted for the number of hours the unit might spend at each part-load point. IPLV's are based on Standard Rating Conditions.

The formula for calculating an IPLV is:

$$IPLV = \frac{1}{\frac{0.01}{A} + \frac{0.42}{B} + \frac{0.45}{C} + \frac{0.12}{D}}$$

where: A= kW/ton at 100% load point
B= kW/ton at 75% load point
C= kW/ton at 50% load point
D= kW/ton at 25% load point

PHYSICAL SPECIFICATIONS

R134a

Model ACM-AE		090S	130S	160S	180S	220S	250S	310S	360S
Chiller Application: Standard Temperature									
Cooling Capacity	TR	87.0	122.0	160.0	178.0	220.0	245.0	310.0	356.0
	kW	306.0	429.1	562.7	626.0	773.7	861.6	1090	1252
Unit Power Input	kW	88.04	123.2	157.5	176.2	216.8	247.0	311.6	373.4
Efficiency	kW/ton	1.0120	1.0100	0.9845	0.9898	0.9854	1.0080	1.0050	1.0490
COP	kWo/kWi	3.475	3.482	3.572	3.553	3.569	3.489	3.499	3.353
Compressor (Standard Temperature)									
Type	Oil-Free Magnetic Bearing Centrifugal Compressor								
Quantity		1	1	2	2	2	2	3	3
No. of Refrigerant Circuits		1	1	1	1	1	1	1	1
Ref. Charge R134a (lb/circuit) [MCHX Condenser]	Circuit 1	123	205	260	295	352	379	471	488
	Circuit 2	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Ref. Charge R134a (lb/circuit) [Finned Tube Condenser]	Circuit 1	138	225	285	325	386	419	516	538
	Circuit 2	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Evaporator (Standard Temperature)									
Type	Flooded Evaporator								
Quantity	Circuit 1	1	1	1	1	1	1	1	1
	Circuit 2	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
No of Pass	Circuit 1	2	2	2	2	2	2	2	2
	Circuit 2	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Water Connector Size	Inches	4	4	6	6	6	6	8	8
	mm	101.6	101.6	152.4	152.4	152.4	152.4	203.2	203.2
Nominal Water Flow Rate	Usgpm	207.2	291.8	381.6	423.5	525.8	586.1	741.5	852.2
	l/s	13.1	18.4	24.1	26.7	33.2	37.0	46.8	53.8
Nominal Water Pressure Drop	psi	3.51	5.18	5.26	5.26	5.79	5.56	8.22	10.53
	ft.wg	8.1	11.9	12.1	12.1	13.4	12.8	19.0	24.3
	kPa	24.2	35.7	36.3	36.3	39.9	38.3	56.7	72.6
Min Water Flow Rate	Usgpm	140.0	190.0	255.0	283.0	332.4	379.0	397.6	397.6
	l/s	8.8	12.0	16.1	17.9	21.0	23.9	25.1	25.1
Min Water Pressure Drop	psi	1.77	2.442	2.607	2.607	2.607	2.607	2.739	2.739
	ft.wg	4.1	5.6	6.0	6.0	6.0	6.0	6.3	6.3
	kPa	12.2	16.8	18.0	18.0	18.0	18.0	18.9	18.9
Max Water Flow Rate	Usgpm	373.0	505.0	680.0	755.0	886.0	1011.0	1060.4	1060.4
	l/s	23.5	31.9	42.9	47.6	55.9	63.8	66.9	66.9
Max Water Pressure Drop	psi	10.04	13.673	14.652	14.641	14.652	14.652	15.499	15.499
	ft.wg	23.2	31.5	33.8	33.8	33.8	33.8	35.8	35.8
	kPa	69.2	94.3	101.0	100.9	101.0	101.0	106.9	106.9
Condenser									
Fan Motor Type	EC Motor								
Fan Type	Axial Fan								
Fan Power Input/fan (full load)	kW	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50
Total no. of Fans		6	8	10	12	14	16	18	20
Condenser Coil Quantity		6	8	10	12	14	16	18	20
General									
Unit Length	Inches	154 7/8	201 3/8	247 7/8	294 3/8	340 7/8	387 3/8	433 7/8	480 3/8
	mm	3934	5115	6296	7477	8658	9839	11020	12202
Unit Width	Inches	91	91	91	91	91	91	91	91
	mm	2,311	2,311	2,311	2,311	2,311	2,311	2,311	2,311
Unit Height	Inches	99	99	99	99	99	99	99	99
	mm	2,515	2,515	2,515	2,515	2,515	2,515	2,515	2,515
Shipping Weight (Finned Tube Coil)	lbs	6686	8569	11799	13078	14790	16102	18927	20092
	kg	3033	3887	5352	5932	6709	7304	8585	9113
Operating Weight (Finned Tube Coil)	lbs	6872	8909	12268	13588	15391	16770	19656	20820
	kg	3117	4041	5565	6163	6981	7607	8916	9444
Shipping Weight (MCHX)	lbs	6174	7886	10946	12054	13595	14736	17391	18385
	kg	2801	3577	4965	5468	6167	6684	7888	8339
Operating Weight (MCHX)	lbs	6360	8226	11416	12563	14196	15404	18120	19114
	kg	2885	3731	5178	5699	6439	6987	8219	8670

- Notes: 1. Standard Temperature Models Capacity and Efficiency rated at 54F/44F Evaporator Entering/Leaving Water Temp; Ambient Temperature is 95F; Refrigerant is R134a
2. Evaporator Fouling Factor is 0.0001 h.ft².F/Btu
3. To consult nearest Dunham-Bush sales office for computer selections other than above operating conditions

PHYSICAL SPECIFICATIONS

R134a

Model ACM-AE		340M	380M	410M	440M	510M
Chiller Application: Standard Temperature						
Cooling Capacity	TR	333.0	364.0	410.0	432.0	501.0
	kW	1171	1280	1442	1519	1762
Unit Power Input	kW	319.3	357.9	405.2	415.0	499.0
Efficiency	kW/ton	0.9590	0.9832	0.9882	0.9606	0.9961
COP	kWo/kWi	3.667	3.577	3.559	3.661	3.531
Compressor (Standard Temperature)						
Type	Oil-Free Magnetic Bearing Centrifugal Compressor					
Quantity		3	3	4	4	4
No. of Refrigerant Circuits		2	2	2	2	2
Ref. Charge R134a (lb/circuit) [MCHX Condenser]	Circuit 1	205	205	295	311	379
	Circuit 2	311	326	295	311	379
Ref. Charge R134a (lb/circuit) [Finned Tube Condenser]	Circuit 1	225	225	325	345	419
	Circuit 2	345	366	325	345	419
Evaporator (Standard Temperature)						
Type	Flooded Evaporator					
Quantity	Circuit 1	1	1	1	1	1
	Circuit 2	1	1	1	1	1
No of Pass	Circuit 1	1	1	1	1	1
	Circuit 2	1	1	1	1	1
Water Connector Size	Inches	8	8	8	8	10
	mm	203.2	203.2	203.2	203.2	254
Nominal Water Flow Rate	Usgpm	799.4	873.1	980.5	1032.9	1197.5
	l/s	50.4	55.1	61.9	65.2	75.5
Nominal Water Pressure Drop	psi	6.86	7.95	7.6	8.32	6.52
	ft.wg	15.8	18.3	17.5	19.2	15.0
	kPa	47.3	54.8	52.4	57.4	45.0
Min Water Flow Rate	Usgpm	566.0	566.0	566.0	566.0	762.0
	l/s	35.7	35.7	35.7	35.7	48.1
Min Water Pressure Drop	psi	4.059	4.059	3.267	3.267	3.256
	ft.wg	9.4	9.4	7.5	7.5	7.5
	kPa	28.0	28.0	22.5	22.5	22.4
Max Water Flow Rate	Usgpm	1128.0	1128.0	1500.0	1500.0	2012.0
	l/s	71.2	71.2	94.6	94.6	126.9
Max Water Pressure Drop	psi	12.518	12.518	15.939	15.939	15.994
	ft.wg	28.9	28.9	36.8	36.8	36.9
	kPa	86.3	86.3	109.9	109.9	110.3
Condenser						
Fan Motor Type	EC Motor					
Fan Type	Axial Fan					
Fan Power Input/fan (Full Load)	kW	2.50	2.50	2.50	2.50	2.50
Total no. of Fans		22	24	24	28	32
Condenser Coil Quantity		22	24	24	28	32
General						
Unit Length	Inches	527 1/4	573 3/4	573 3/4	666 3/4	759 3/4
	mm	13392	14573	14573	16935	19298
Unit Width	Inches	91	91	91	91	91
	mm	2,311	2,311	2,311	2,311	2,311
Unit Height	Inches	99	99	99	99	99
	mm	2,515	2,515	2,515	2,515	2,515
Shipping Weight (Finned Tube Coil)	lbs	22501	23662	25550	27872	31372
	kg	10206	10733	11589	12642	14230
Operating Weight (Finned Tube Coil)	lbs	23403	24564	26570	28892	32707
	kg	10615	11142	12052	13105	14836
Shipping Weight (MCHX)	lbs	20624	21614	23502	25482	28642
	kg	9355	9804	10660	11559	12992
Operating Weight (MCHX)	lbs	21526	22516	24522	26502	29976
	kg	9764	10213	11123	12021	13597

Notes: 1. Standard Temperature Models Capacity and Efficiency rated at 54F/44F Evaporator Entering/Leaving Water Temp; Ambient Temperature is 95F; Refrigerant is R134a
2. Evaporator Fouling Factor is 0.0001 h.ft².F/Btu
3. To consult nearest Dunham-Bush sales office for computer selections other than above operating conditions

PHYSICAL SPECIFICATIONS

R1234ze

Model ACM-AE		090S	130S	160S	180S	220S	250S	310S	360S
Chiller Application: Standard Temperature									
Cooling Capacity	TR	81.00	130.0	160.0	177.0	217.0	260.0	315.0	375.0
	kW	284.9	457.2	562.7	622.5	763.2	914.4	1108	1319
Unit Power Input	kW	78.34	121.7	157.6	174.7	212.1	242.5	307.3	356.3
Efficiency	kW/ton	0.9672	0.9365	0.9852	0.9871	0.9772	0.9328	0.9754	0.9502
COP	kW/kWi	3.636	3.755	3.570	3.563	3.599	3.770	3.606	3.701
Compressor (Standard Temperature)									
Type	Oil-Free Magnetic Bearing Centrifugal Compressor								
Quantity		1	1	2	2	2	2	3	3
No. of Refrigerant Circuits		1	1	1	1	1	1	1	1
Ref. Charge R1234ze (lb/circuit) [MCHX Condenser]	Circuit 1	123	205	260	295	352	379	471	488
	Circuit 2	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Ref. Charge R1234ze (lb/circuit) [Finned Tube Condenser]	Circuit 1	138	225	285	325	386	419	516	538
	Circuit 2	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Evaporator (Standard Temperature)									
Type	Flooded Evaporator								
Quantity	Circuit 1	1	1	1	1	1	1	1	1
	Circuit 2	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
No of Pass	Circuit 1	2	2	2	2	2	2	2	2
	Circuit 2	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Water Connector Size	Inches	4	4	6	6	6	6	8	8
	mm	101.6	101.6	152.4	152.4	152.4	152.4	203.2	203.2
Nominal Water Flow Rate	Usgpm	193.4	310.9	381.6	423.5	517.0	621.5	751.3	895.8
	l/s	12.2	19.6	24.1	26.7	32.6	39.2	47.4	56.5
Nominal Water Pressure Drop	psi	3.10	5.8	5.26	5.26	5.62	6.18	8.41	11.51
	ft.wg	7.2	13.4	12.1	12.1	13.0	14.3	19.4	26.5
	kPa	21.4	40.0	36.3	36.3	38.7	42.6	58.0	79.4
	Usgpm	140.0	190.0	255.0	283.0	332.4	379.0	397.6	397.6
Min Water Flow Rate	l/s	8.8	12.0	16.1	17.9	21.0	23.9	25.1	25.1
	psi	1.77	2.442	2.607	2.607	2.607	2.607	2.739	2.739
Min Water Pressure Drop	ft.wg	4.1	5.6	6.0	6.0	6.0	6.0	6.3	6.3
	kPa	12.2	16.8	18.0	18.0	18.0	18.0	18.9	18.9
Max Water Flow Rate	Usgpm	373.0	505.0	680.0	755.0	886.0	1011.0	1060.4	1060.4
	l/s	23.5	31.9	42.9	47.6	55.9	63.8	66.9	66.9
Max Water Pressure Drop	psi	10.04	13.673	14.652	14.641	14.652	14.652	15.499	15.499
	ft.wg	23.2	31.5	33.8	33.8	33.8	33.8	35.8	35.8
	kPa	69.2	94.3	101.0	100.9	101.0	101.0	106.9	106.9
Condenser									
Fan Motor Type	EC Motor								
Fan Type	Axial Fan								
Fan Power Input/fan (Full Load)	kW	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50
Total no. of Fans		6	8	10	12	14	16	18	20
Condenser Coil Quantity		6	8	10	12	14	16	18	20
General									
Unit Length	Inches	154 7/8	201 3/8	247 7/8	294 3/8	340 7/8	387 3/8	433 7/8	480 3/8
	mm	3934	5115	6296	7477	8658	9839	11020	12202
Unit Width	Inches	91	91	91	91	91	91	91	91
	mm	2,311	2,311	2,311	2,311	2,311	2,311	2,311	2,311
Unit Height	Inches	99	99	99	99	99	99	99	99
	mm	2,515	2,515	2,515	2,515	2,515	2,515	2,515	2,515
Shipping Weight (Finned Tube Coil)	lbs	6705	8603	11837	13116	14863	16170	19036	20194
	kg	3041	3902	5369	5949	6742	7335	8635	9160
Operating Weight (Finned Tube Coil)	lbs	6891	8943	12306	13626	15464	16839	19765	20923
	kg	3126	4057	5582	6180	7014	7638	8965	9491
Shipping Weight (MCHX)	lbs	6193	7921	10984	12092	13668	14805	17500	18488
	kg	2809	3593	4982	5485	6200	6715	7938	8386
Operating Weight (MCHX)	lbs	6379	8260	11454	12601	14269	15473	18230	19217
	kg	2893	3747	5195	5716	6472	7018	8269	8717

Notes: 1. Standard Temperature Models Capacity and Efficiency rated at 54F/44F Evaporator Entering/Leaving Water Temp; Ambient Temperature is 95F; Refrigerant is R1234ze
2. Evaporator Fouling Factor is 0.0001 h.ft².F/Btu
3. To consult nearest Dunham-Bush sales office for computer selections other than above operating conditions

PHYSICAL SPECIFICATIONS

R1234ze

Model ACM-AE		340M	380M	410M	440M	510M
Chiller Application: Standard Temperature						
Cooling Capacity	TR	330.0	395.0	415.0	440.0	540.0
	kW	1161	1389	1459	1547	1899
Unit Power Input	kW	315.3	371.3	392.0	424.3	507.9
Efficiency	kW/ton	0.9555	0.9399	0.9445	0.9643	0.9406
COP	kWo/kWi	3.681	3.742	3.724	3.647	3.739
Compressor (Standard Temperature)						
Type	Oil-Free Magnetic Bearing Centrifugal Compressor					
Quantity		3	3	4	4	4
No. of Refrigerant Circuits		2	2	2	2	2
Ref. Charge R1234ze (lb/circuit) [MCHX Condenser]	Circuit 1	205	205	295	311	379
	Circuit 2	311	326	295	311	379
Ref. Charge R1234ze (lb/circuit) [Finned Tube Condenser]	Circuit 1	225	225	325	345	419
	Circuit 2	345	366	325	345	419
Evaporator (Standard Temperature)						
Type	Flooded Evaporator					
Quantity	Circuit 1	1	1	1	1	1
	Circuit 2	1	1	1	1	1
No of Pass	Circuit 1	1	1	1	1	1
	Circuit 2	1	1	1	1	1
Water Connector Size	Inches	8	8	8	8	10
	mm	203.2	203.2	203.2	203.2	254
Nominal Water Flow Rate	Usgpm	789.7	944.8	991.8	1051.8	1289.9
	l/s	49.8	59.6	62.6	66.4	81.4
Nominal Water Pressure Drop	psi	6.75	9.1	7.77	8.59	7.41
	ft.wg	15.6	21.0	17.9	19.8	17.1
	kPa	46.5	62.7	53.6	59.2	51.1
Min Water Flow Rate	Usgpm	566.0	566.0	566.0	566.0	762.0
	l/s	35.7	35.7	35.7	35.7	48.1
Min Water Pressure Drop	psi	4.059	4.059	3.267	3.267	3.256
	ft.wg	9.4	9.4	7.5	7.5	7.5
	kPa	28.0	28.0	22.5	22.5	22.4
Max Water Flow Rate	Usgpm	1128.0	1128.0	1500.0	1500.0	2012.0
	l/s	71.2	71.2	94.6	94.6	126.9
Max Water Pressure Drop	psi	12.518	12.518	15.939	15.939	15.994
	ft.wg	28.9	28.9	36.8	36.8	36.9
	kPa	86.3	86.3	109.9	109.9	110.3
Condenser						
Fan Motor Type	EC Motor					
Fan Type	Axial Fan					
Fan Power Input/fan (Full Load)	kW	2.50	2.50	2.50	2.50	2.50
Total no. of Fans		22	24	24	28	32
Condenser Coil Quantity		22	24	24	28	32
General						
Unit Length	Inches	527 1/4	573 3/4	573 3/4	666 3/4	759 3/4
	mm	13392	14573	14573	16935	19298
Unit Width	Inches	91	91	91	91	91
	mm	2,311	2,311	2,311	2,311	2,311
Unit Height	Inches	99	99	99	99	99
	mm	2,515	2,515	2,515	2,515	2,515
Shipping Weight (Finned Tube Coil)	lbs	22610	23764	25696	28018	31509
	kg	10256	10779	11655	12709	14292
Operating Weight (Finned Tube Coil)	lbs	23512	24666	26716	29038	32844
	kg	10665	11189	12118	13171	14898
Shipping Weight (MCHX)	lbs	20733	21716	23648	25628	28779
	kg	9404	9850	10727	11625	13054
Operating Weight (MCHX)	lbs	21635	22618	24668	26648	30113
	kg	9813	10260	11189	12087	13659

Notes: 1. Standard Temperature Models Capacity and Efficiency rated at 54F/44F Evaporator Entering/Leaving Water Temp; Ambient Temperature is 95F; Refrigerant is R1234ze
2. Evaporator Fouling Factor is 0.0001 h.ft².F/Btu
3. To consult nearest Dunham-Bush sales office for computer selections other than above operating conditions

ELECTRICAL DATA

R134a

Model	Refrigerant Circuit	Compressor Data		Condenser Fan Motor Data			Unit Data		
ACM-AE		Qty	RLA (A)	Qty	kW	FLA (A)	RLA (A)	MCA (A)	MFS (A)
Power Supply: 380V-3Ph-50/60Hz									
090S	Circuit 1	1	145	6	2.2	4	169	205	350
130S	Circuit 1	1	209	8	2.2	4	241	293	500
160S	Circuit 1	2	126	10	2.2	4	291	322	400
180S	Circuit 1	2	144	12	2.2	4	336	372	500
220S	Circuit 1	2	181	14	2.2	4	418	463	600
250S	Circuit 1	2	209	16	2.2	4	483	535	700
310S	Circuit 1	3	173	18	2.2	4	592	635	800
360S	Circuit 1	3	210	20	2.2	4	709	761	800
340M	Circuit 1	1	186	8	2.2	4	218	265	450
	Circuit 2	2	177	14	2.2	4	410	455	600
380M	Circuit 1	1	209	8	2.2	4	241	293	500
	Circuit 2	2	202	16	2.2	4	468	518	700
410M	Circuit 1	2	167	12	2.2	4	382	423	500
	Circuit 2	2	168	12	2.2	4	384	425	500
440M	Circuit 1	2	175	14	2.2	4	406	450	600
	Circuit 2	2	173	14	2.2	4	402	445	600
510M	Circuit 1	2	210	16	2.2	4	484	536	700
	Circuit 2	2	208	16	2.2	4	480	531	700
Power Supply: 400Vac-3Ph-50/60Hz									
090S	Circuit 1	1	138	6	2.2	4	162	196	300
130S	Circuit 1	1	199	8	2.2	4	231	280	450
160S	Circuit 1	2	119	10	2.2	4	278	308	400
180S	Circuit 1	2	137	12	2.2	4	322	356	450
220S	Circuit 1	2	172	14	2.2	4	400	443	600
250S	Circuit 1	2	199	16	2.2	4	462	512	700
310S	Circuit 1	3	165	18	2.2	4	566	607	700
360S	Circuit 1	3	199	20	2.2	4	677	727	800
340M	Circuit 1	1	177	8	2.2	4	209	253	400
	Circuit 2	2	168	14	2.2	4	393	435	600
380M	Circuit 1	1	199	8	2.2	4	231	280	450
	Circuit 2	2	192	16	2.2	4	448	496	600
410M	Circuit 1	2	159	12	2.2	4	365	405	500
	Circuit 2	2	159	12	2.2	4	367	407	500
440M	Circuit 1	2	166	14	2.2	4	389	430	500
	Circuit 2	2	164	14	2.2	4	385	426	500
510M	Circuit 1	2	199	16	2.2	4	463	513	700
	Circuit 2	2	197	16	2.2	4	459	508	700
Power Supply: 460Vac-3Ph-60Hz									
090S	Circuit 1	1	120	6	2.2	4	144	174	250
130S	Circuit 1	1	173	8	2.2	4	205	248	400
160S	Circuit 1	2	104	10	2.2	4	247	273	350
180S	Circuit 1	2	119	12	2.2	4	286	316	400
220S	Circuit 1	2	149	14	2.2	4	355	392	500
250S	Circuit 1	2	173	16	2.2	4	410	453	600
310S	Circuit 1	3	143	18	2.2	4	501	537	600
360S	Circuit 1	3	173	20	2.2	4	599	643	800
340M	Circuit 1	1	154	8	2.2	4	186	224	350
	Circuit 2	2	146	14	2.2	4	349	385	500
380M	Circuit 1	1	173	8	2.2	4	205	248	400
	Circuit 2	2	167	16	2.2	4	398	439	600
410M	Circuit 1	2	138	12	2.2	4	324	358	450
	Circuit 2	2	139	12	2.2	4	325	360	450
440M	Circuit 1	2	145	14	2.2	4	345	381	500
	Circuit 2	2	143	14	2.2	4	342	378	500
510M	Circuit 1	2	173	16	2.2	4	411	454	600
	Circuit 2	2	172	16	2.2	4	407	450	600

Notes: RLA - Running Load Amps At 95 °F Ambient Temperature; MCA - Minimum Circuit Ampacity; MFS - Maximum Fuse Size; LRA - Lock Rotor Amp

ELECTRICAL DATA

R1234ze

Model	Refrigerant Circuit	Compressor Data		Condenser Fan Motor Data			Unit Data		
ACM-AE		Qty	RLA (A)	Qty	kW	FLA (A)	RLA (A)	MCA (A)	MFS (A)
Power Supply: 380V-3Ph-50/60Hz									
090S	Circuit 1	1	122	6	2.2	4	146	177	300
130S	Circuit 1	1	169	8	2.2	4	201	243	400
160S	Circuit 1	2	116	10	2.2	4	272	301	400
180S	Circuit 1	2	131	12	2.2	4	310	343	450
220S	Circuit 1	2	153	14	2.2	4	362	400	500
250S	Circuit 1	2	168	16	2.2	4	400	442	600
310S	Circuit 1	3	150	18	2.2	4	522	560	700
360S	Circuit 1	3	169	20	2.2	4	587	629	800
340M	Circuit 1	1	165	8	2.2	4	197	238	400
	Circuit 2	2	148	14	2.2	4	352	389	500
380M	Circuit 1	1	182	8	2.2	4	214	260	400
	Circuit 2	2	167	16	2.2	4	398	440	600
410M	Circuit 1	2	141	12	2.2	4	330	365	500
	Circuit 2	2	145	12	2.2	4	338	374	500
440M	Circuit 1	2	153	14	2.2	4	362	400	500
	Circuit 2	2	155	14	2.2	4	366	405	500
510M	Circuit 1	2	174	16	2.2	4	412	456	600
	Circuit 2	2	181	16	2.2	4	426	471	600
Power Supply: 400Vac-3Ph-50/60Hz									
090S	Circuit 1	1	116	6	2.2	4	140	169	250
130S	Circuit 1	1	160	8	2.2	4	192	232	400
160S	Circuit 1	2	111	10	2.2	4	262	290	400
180S	Circuit 1	2	124	12	2.2	4	296	327	450
220S	Circuit 1	2	146	14	2.2	4	348	385	500
250S	Circuit 1	2	160	16	2.2	4	384	424	600
310S	Circuit 1	3	143	18	2.2	4	501	537	600
360S	Circuit 1	3	161	20	2.2	4	563	603	700
340M	Circuit 1	1	156	8	2.2	4	188	227	350
	Circuit 2	2	141	14	2.2	4	338	373	500
380M	Circuit 1	1	173	8	2.2	4	205	248	400
	Circuit 2	2	159	16	2.2	4	382	422	600
410M	Circuit 1	2	134	12	2.2	4	316	350	500
	Circuit 2	2	138	12	2.2	4	324	359	500
440M	Circuit 1	2	146	14	2.2	4	348	385	500
	Circuit 2	2	147	14	2.2	4	350	387	500
510M	Circuit 1	2	165	16	2.2	4	394	435	600
	Circuit 2	2	172	16	2.2	4	408	451	600
Power Supply: 460Vac-3Ph-60Hz									
090S	Circuit 1	1	101	6	2.2	4	125	150	250
130S	Circuit 1	1	139	8	2.2	4	171	206	300
160S	Circuit 1	2	96	10	2.2	4	232	256	350
180S	Circuit 1	2	108	12	2.2	4	264	291	400
220S	Circuit 1	2	127	14	2.2	4	310	342	450
250S	Circuit 1	2	139	16	2.2	4	342	377	500
310S	Circuit 1	3	124	18	2.2	4	444	475	600
360S	Circuit 1	3	140	20	2.2	4	500	535	600
340M	Circuit 1	1	136	8	2.2	4	168	202	300
	Circuit 2	2	122	14	2.2	4	300	331	450
380M	Circuit 1	1	150	8	2.2	4	182	220	350
	Circuit 2	2	138	16	2.2	4	340	375	500
410M	Circuit 1	2	117	12	2.2	4	282	311	400
	Circuit 2	2	120	12	2.2	4	288	318	400
440M	Circuit 1	2	127	14	2.2	4	302	334	450
	Circuit 2	2	128	14	2.2	4	304	336	450
510M	Circuit 1	2	144	16	2.2	4	352	388	500
	Circuit 2	2	150	16	2.2	4	364	402	500

Notes: RLA - Running Load Amps At 95 °F Ambient Temperature; MCA - Minimum Circuit Ampacity; MFS - Maximum Fuse Size; LRA - Lock Rotor Amp

SOUND PRESSURE DATA

R134a / R513A

Standard Temperature

Model ACM-AE	Octave Band (Hz)								Total dB(A)
	63	125	250	500	1K	2K	4K	8K	
090S	47	46	48	50	54	50	45	46	58
130S	47	46	48	51	55	51	46	47	59
160S	50	49	50	53	56	53	47	48	61
180S	50	49	50	53	56	53	48	48	61
220S	50	49	50	53	57	53	48	49	61
250S	50	49	50	53	57	53	48	49	61
310S	51	50	52	54	59	54	49	51	63
360S	51	50	52	54	59	54	49	51	63
340M	51	50	51	55	59	54	49	51	63
380M	51	50	51	55	59	54	49	51	63
410M	52	51	53	55	60	55	50	52	64
440M	52	51	52	55	60	55	50	51	64
510M	52	51	52	55	60	55	50	51	64

Notes: 1. Sound pressure level dB(A) @ 10m (free field), ± 3 dB tolerance
 2. To consult nearest Dunham-Bush sales office for computer selections other than above operating conditions

R1234ze

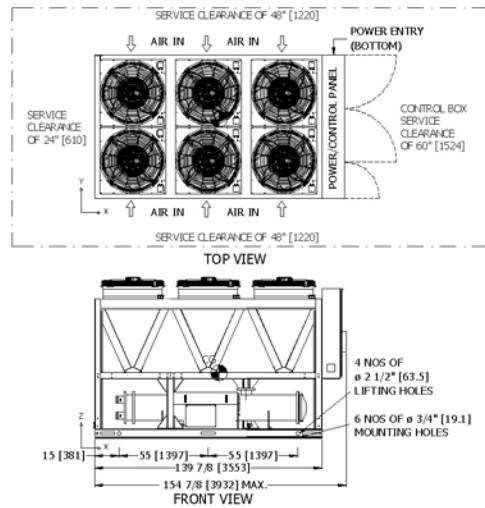
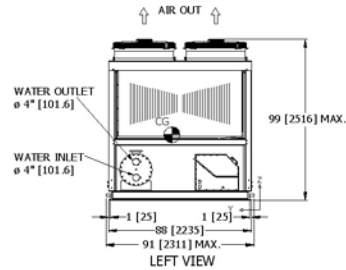
Standard Temperature

Model ACM-AE	Octave Band (Hz)								Total dB(A)
	63	125	250	500	1K	2K	4K	8K	
090S	35	35	37	47	51	47	48	48	56
130S	36	36	39	48	55	49	52	46	58
160S	36	37	39	49	53	49	51	50	58
180S	37	38	40	50	54	49	51	50	58
220S	38	38	40	51	56	51	49	48	59
250S	38	39	41	51	57	52	54	48	61
310S	38	39	41	52	58	52	50	49	60
360S	39	40	42	52	59	53	56	50	62
340M	39	40	42	52	58	52	50	49	61
380M	39	40	42	52	59	53	56	50	62
410M	39	40	42	53	58	53	51	50	61
440M	40	41	43	53	58	53	51	50	61
510M	40	41	43	53	60	54	57	51	63

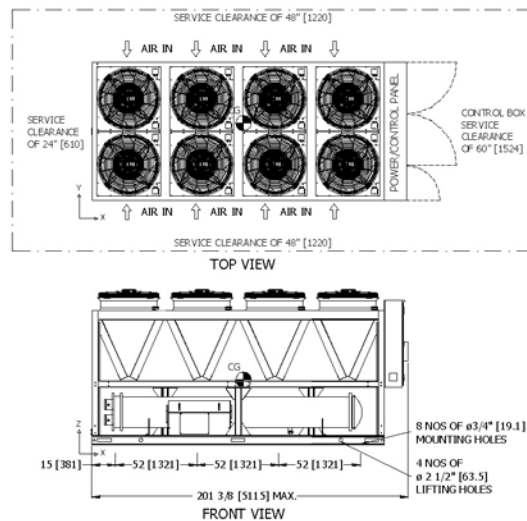
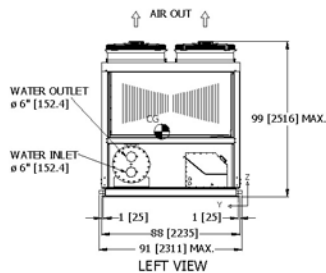
Notes: 1. Sound pressure level dB(A) @ 10m (free field), ± 3 dB tolerance
 2. To consult nearest Dunham-Bush sales office for computer selections other than above operating conditions

DIMENSIONAL DATA

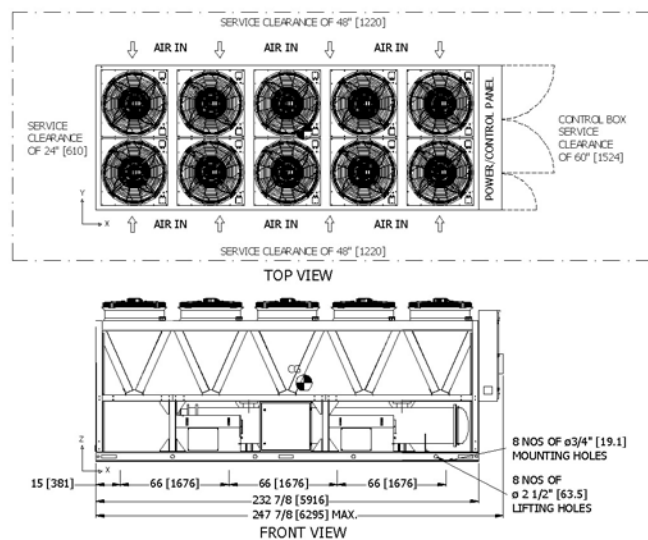
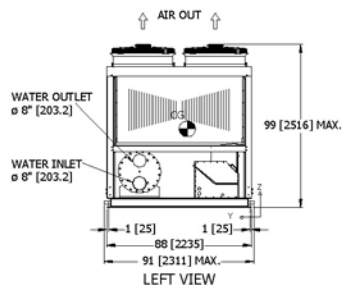
ACM-AE090S



ACM-AE130S



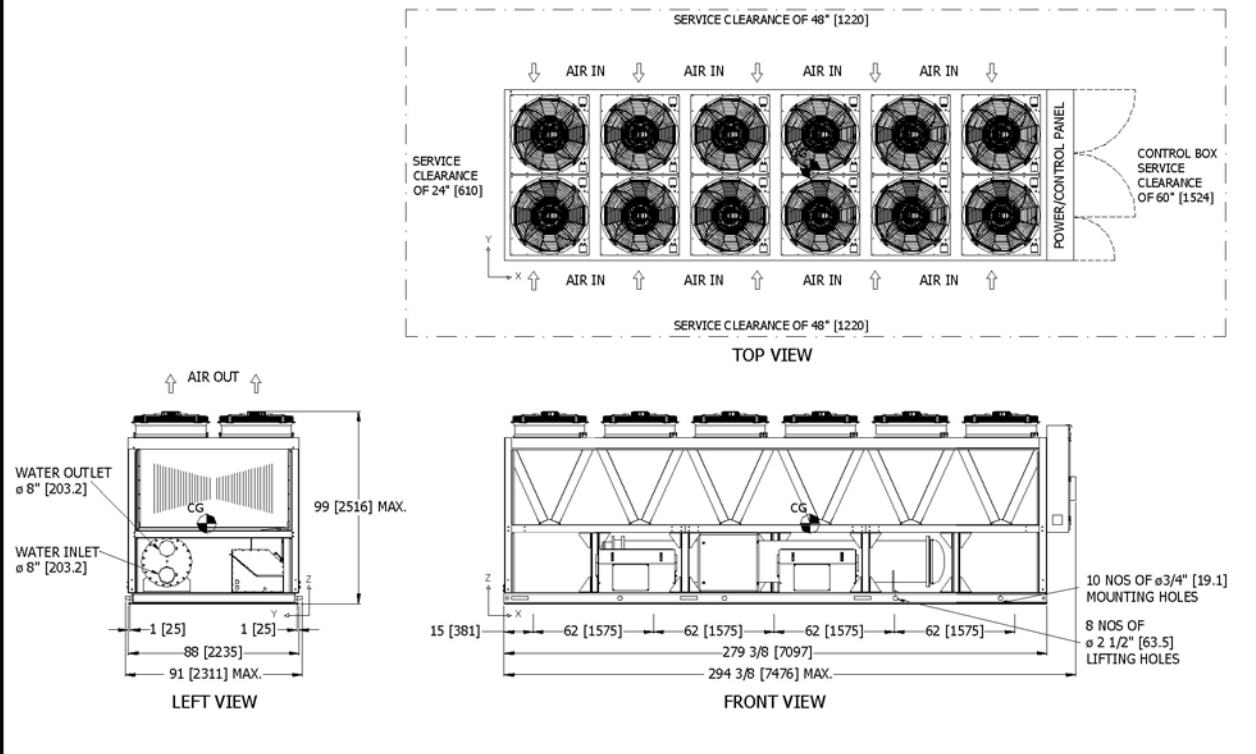
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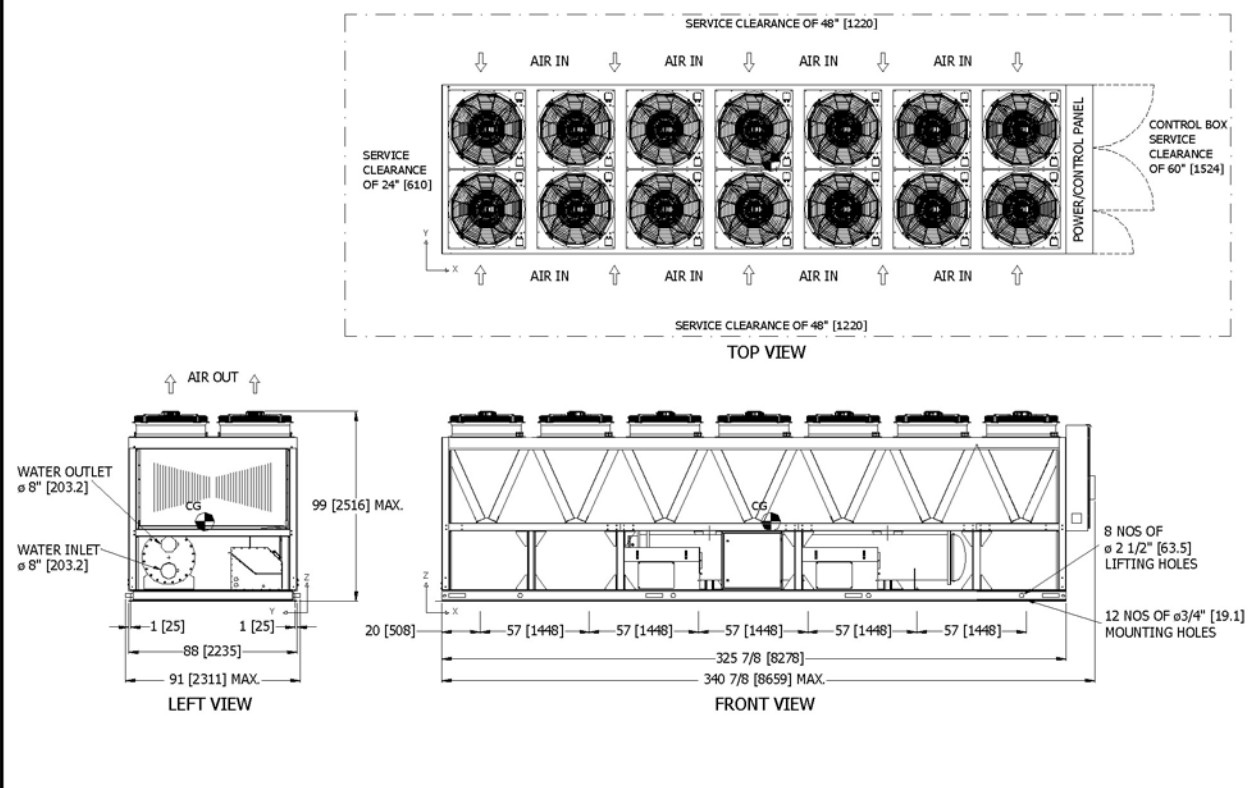
Note: All dimensions are in mm[inches].

DIMENSIONAL DATA

ACM-AE180S



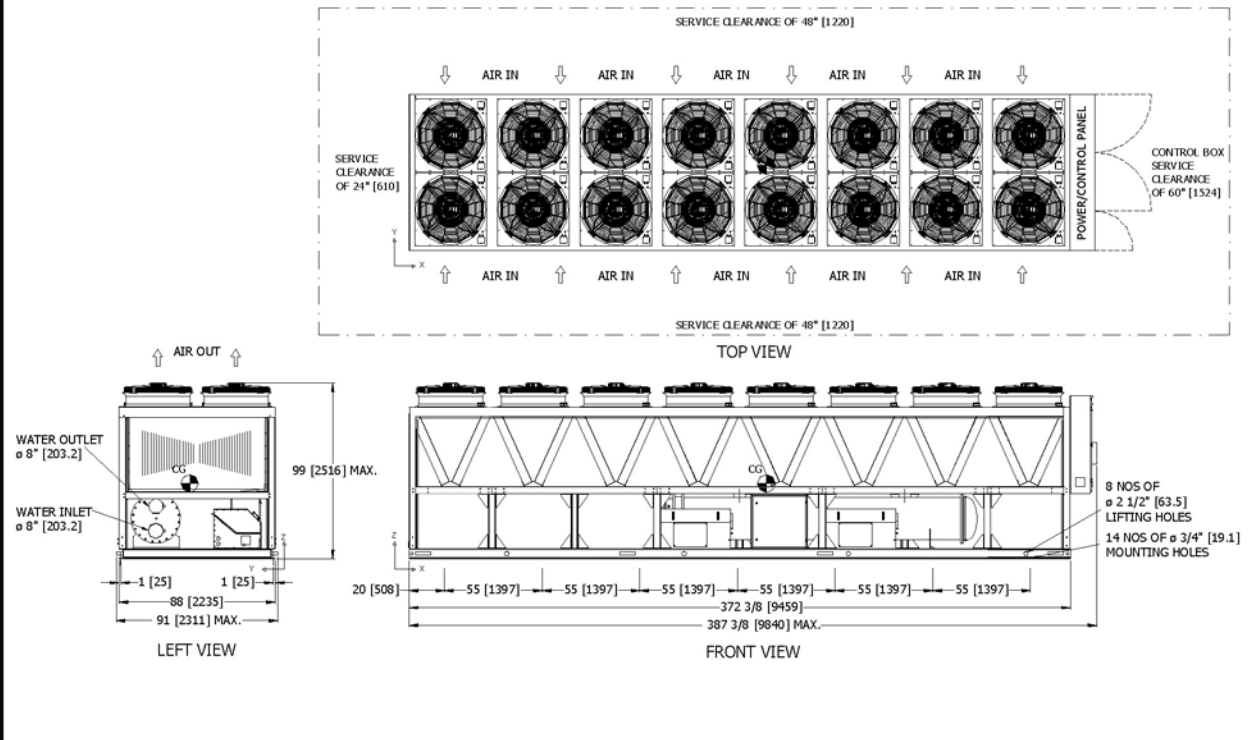
ACM-AE220S



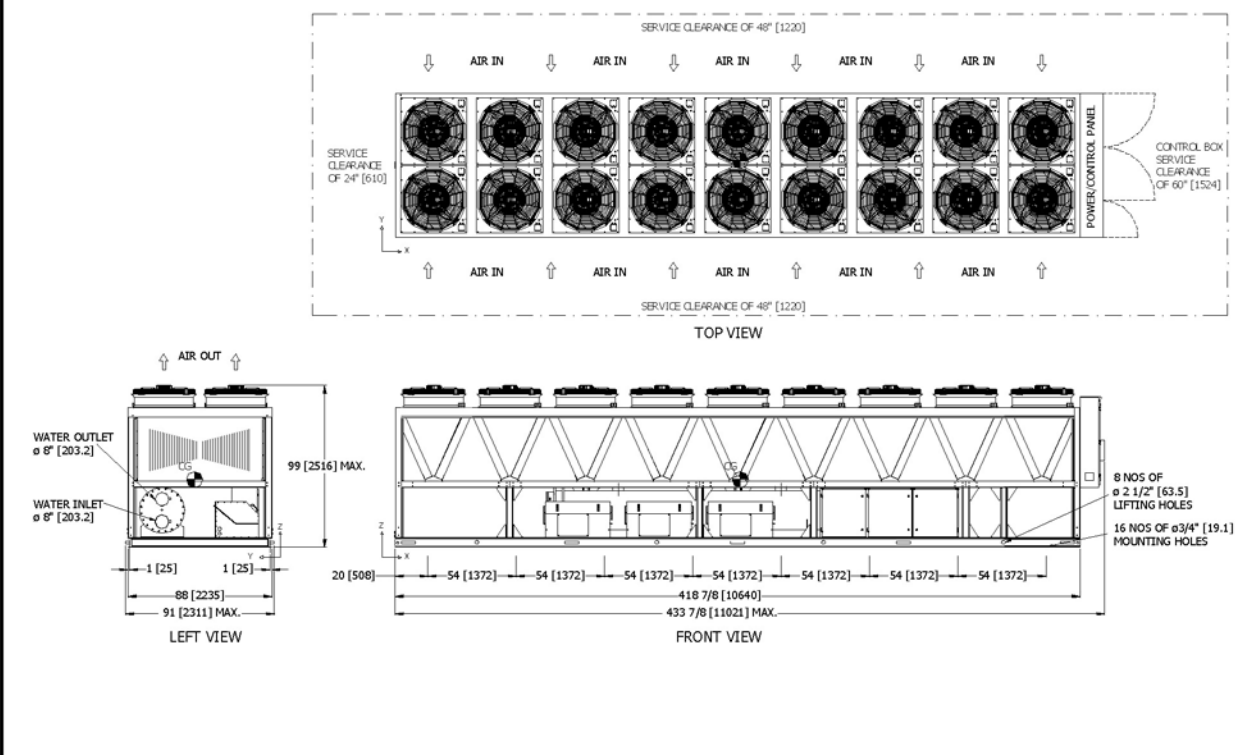
Note: All dimensions are in mm[inches].

DIMENSIONAL DATA

ACM-AE250S



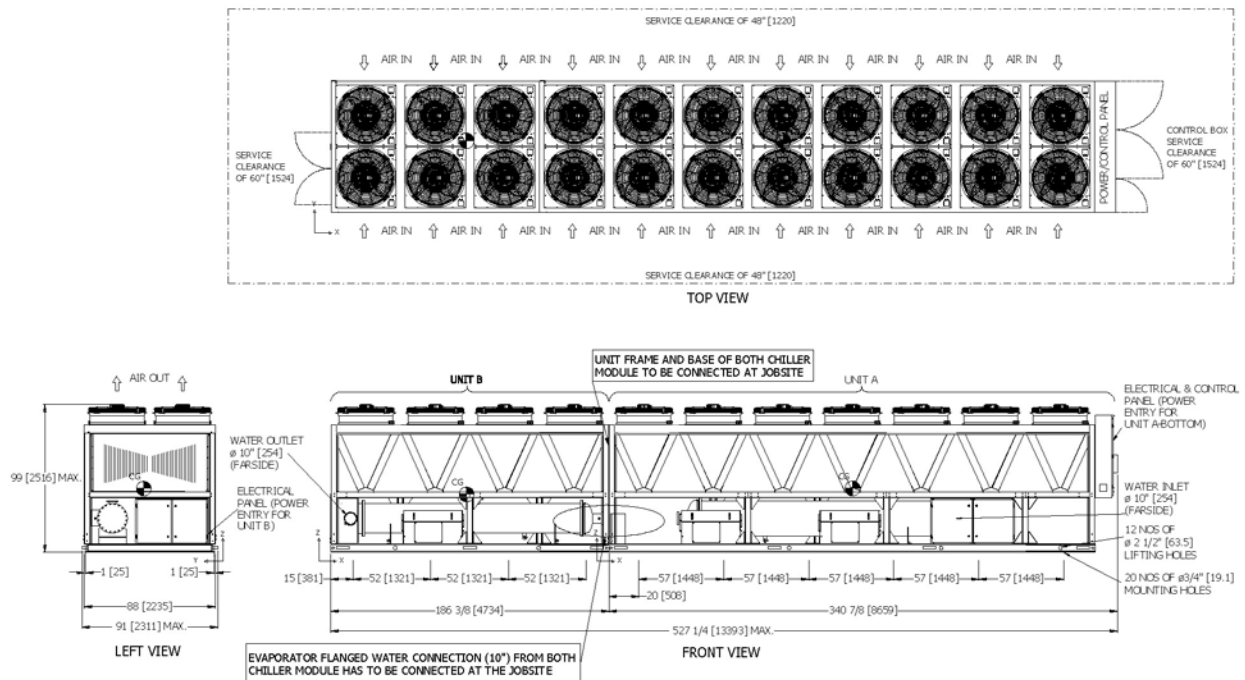
ACM-AE310S



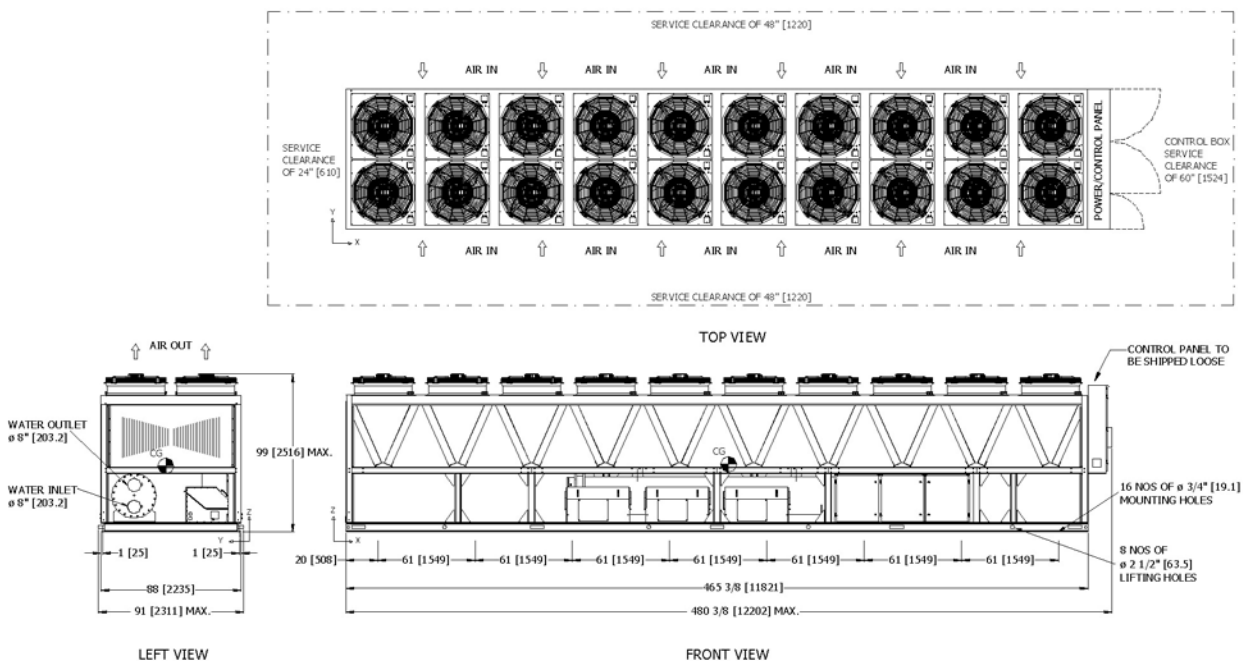
Note: All dimensions are in mm[inches].

DIMENSIONAL DATA

ACM-AE340M



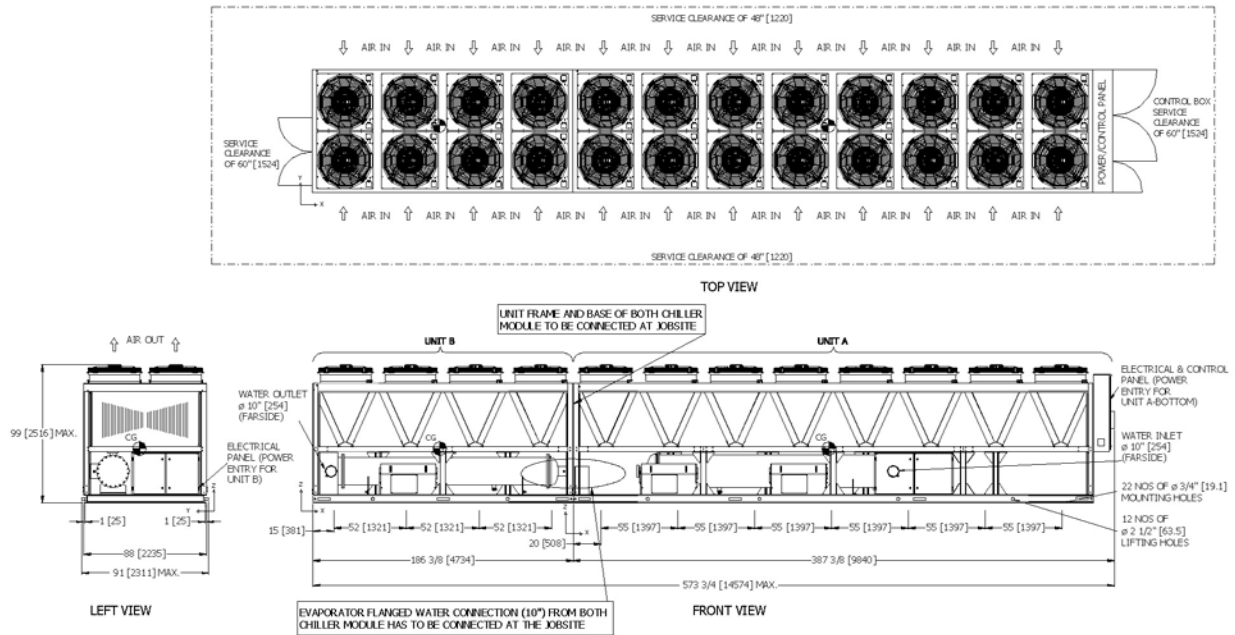
ACM-AE360S



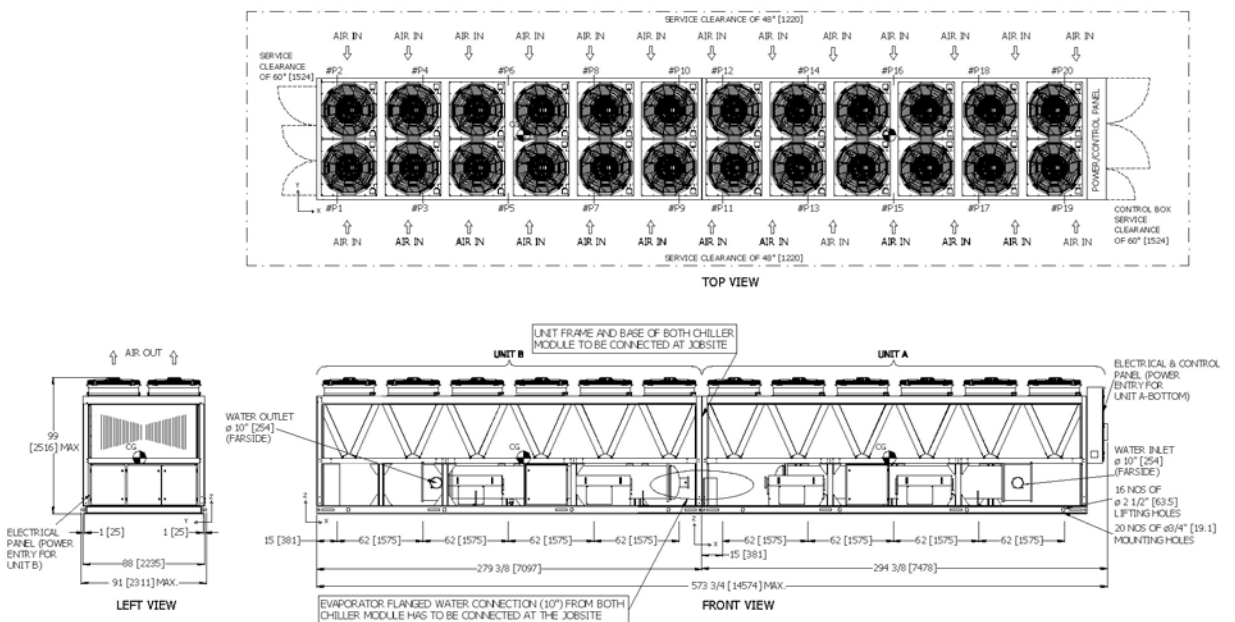
Note: All dimensions are in mm[inches].

DIMENSIONAL DATA

ACM-AE380M



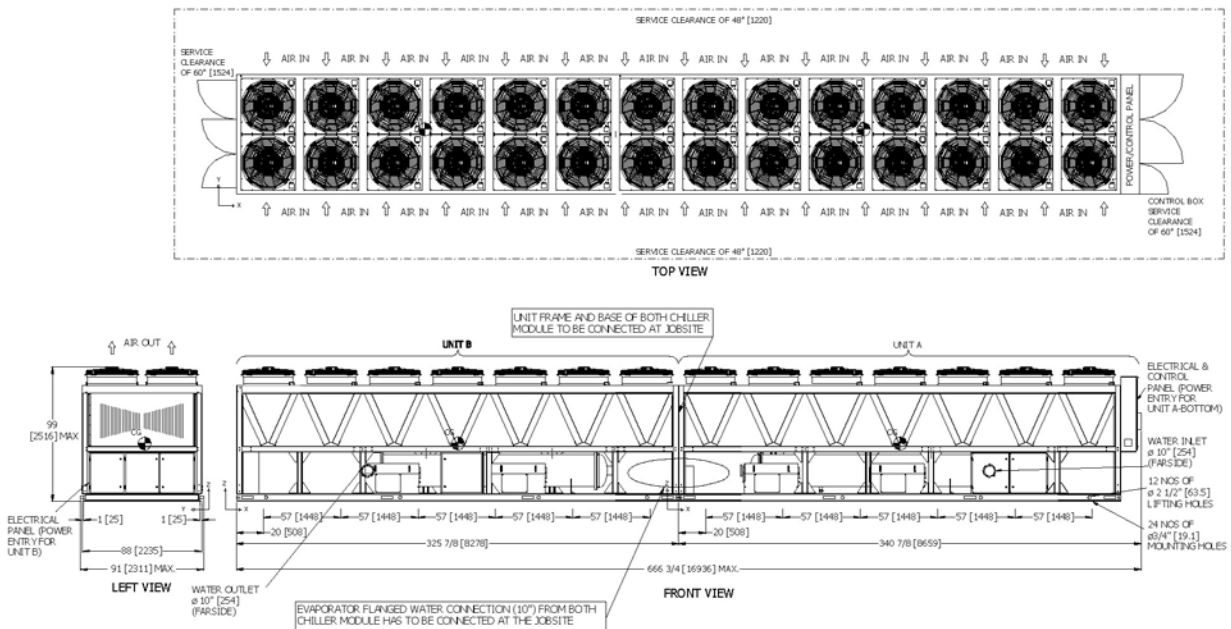
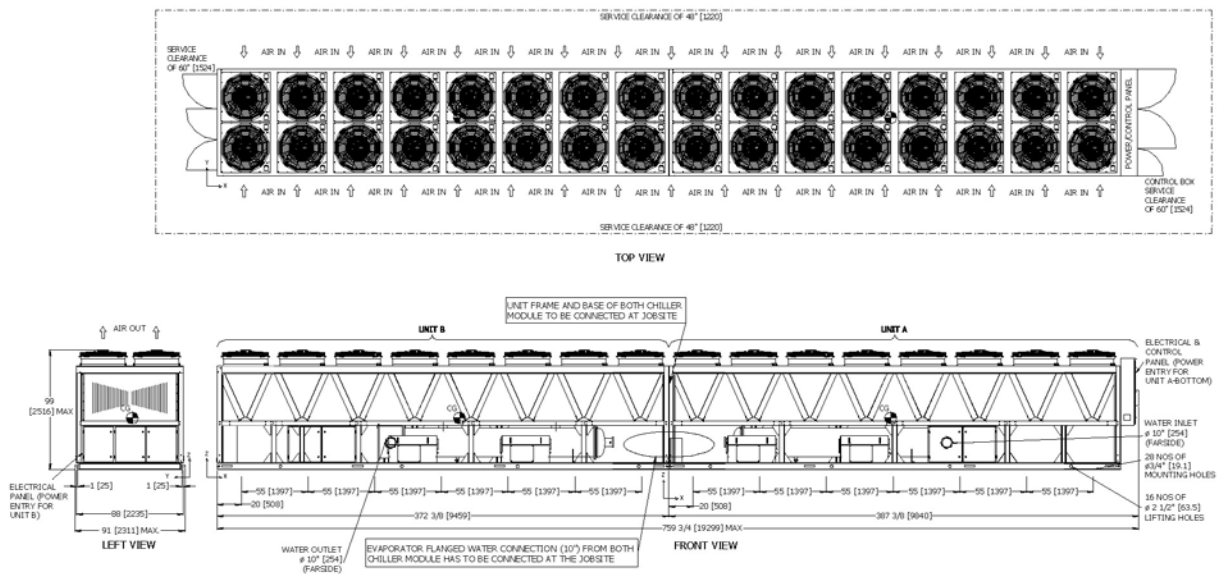
ACM-AE410M



Note: All dimensions are in mm[inches].

DIMENSIONAL DATA

ACM-AE440M

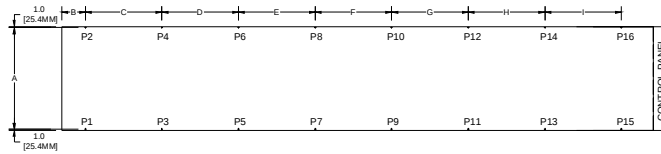
**ACM-AE510M**

Note: All dimensions are in mm[inches]

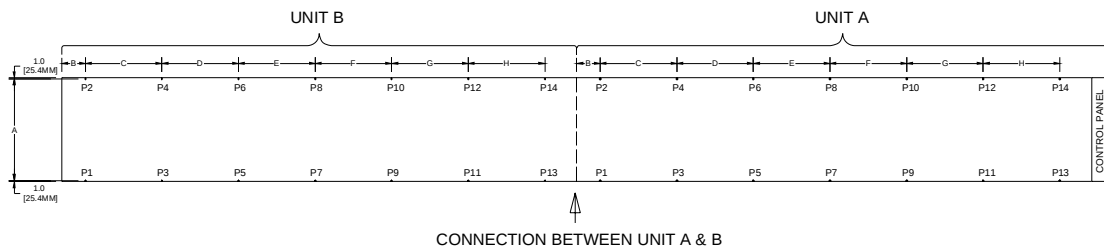
FLOOR LOADING DIAGRAM

R134a

Integral Unit (090S - 360S)



Modular Unit (340M, 380M, 410M, 440M, 510M)



a.) Point Load Location

Model ACM-AE		Integral/ Modular	A	B	C	D	E	F	G	H	I
090S	inches	Integral	88	15	55	55	-	-	-	-	-
	mm		2235	381	1397	1397	-	-	-	-	-
130S	inches	Integral	88	15	52	52	52	-	-	-	-
	mm		2235	381	1321	1321	1321	-	-	-	-
160S	inches	Integral	88	15	66	66	66	-	-	-	-
	mm		2235	381	1676	1676	1676	-	-	-	-
180S	inches	Integral	88	15	62	62	62	62	-	-	-
	mm		2235	381	1575	1575	1575	1575	-	-	-
220S	inches	Integral	88	20	57	57	57	57	57	-	-
	mm		2235	508	1448	1448	1448	1448	1448	-	-
250S	inches	Integral	88	20	55	55	55	55	55	55	-
	mm		2235	508	1397	1397	1397	1397	1397	1397	-
310S	inches	Integral	88	20	54	54	54	54	54	54	54
	mm		2235	508	1372	1372	1372	1372	1372	1372	1372
360S	inches	Integral	88	20	61	61	61	61	61	61	61
	mm		2235	508	1549	1549	1549	1549	1549	1549	1549
340M	inches	Unit A	88	20	57	57	57	57	57	-	-
	mm		2235	508	1448	1448	1448	1448	1448	-	-
	inches	Unit B	88	15	52	52	52	-	-	-	-
	mm		2235	381	1321	1321	1321	-	-	-	-
380M	inches	Unit A	88	20	55	55	55	55	55	55	-
	mm		2235	508	1397	1397	1397	1397	1397	1397	-
	inches	Unit B	88	15	52	52	52	-	-	-	-
	mm		2235	381	1321	1321	1321	-	-	-	-
410M	inches	Unit A	88	15	62	62	62	62	-	-	-
	mm		2235	381	1575	1575	1575	1575	-	-	-
	inches	Unit B	88	15	62	62	62	62	-	-	-
	mm		2235	381	1575	1575	1575	1575	-	-	-
440M	inches	Unit A	88	20	57	57	57	57	57	-	-
	mm		2235	508	1448	1448	1448	1448	1448	-	-
	inches	Unit B	88	20	57	57	57	57	57	-	-
	mm		2235	508	1448	1448	1448	1448	1448	-	-
510M	inches	Unit A	88	20	55	55	55	55	55	55	-
	mm		2235	508	1397	1397	1397	1397	1397	1397	-
	inches	Unit B	88	20	55	55	55	55	55	55	-
	mm		2235	508	1397	1397	1397	1397	1397	1397	-

FLOOR LOADING DIAGRAM

b.) Point Load Data (MCHX)

Model	ACM-AE	Integral/ Modular	P1	P2	P3	P4	P5	P6	P7	P8	P9	P10	P11	P12	P13	P14	P15	P16	Total Operating Weight
090S	kg	Integral	334	415	549	669	398	519	-	-	-	-	-	-	-	-	-	-	2885
	lbs		737	914	1,211	1,475	878	1,144	-	-	-	-	-	-	-	-	-	-	6360
130S	kg	Integral	319	412	528	621	412	595	372	473	-	-	-	-	-	-	-	-	3731
	lbs		702	908	1,163	1,370	908	1,311	819	1,044	-	-	-	-	-	-	-	-	8226
160S	kg	Integral	438	468	643	783	668	823	604	751	-	-	-	-	-	-	-	-	5178
	lbs		965	1,031	1,418	1,727	1,473	1,815	1,331	1,655	-	-	-	-	-	-	-	-	11416
180S	kg	Integral	396	424	597	715	582	732	559	713	464	516	-	-	-	-	-	-	5699
	lbs		874	934	1,317	1,576	1,284	1,615	1,232	1,572	1,022	1,138	-	-	-	-	-	-	12563
220S	kg	Integral	371	401	465	491	539	692	566	714	530	687	464	519	-	-	-	-	6439
	lbs		819	884	1,025	1,082	1,189	1,527	1,247	1,574	1,167	1,515	1,022	1,144	-	-	-	-	14196
250S	kg	Integral	341	365	388	419	439	476	509	674	544	696	502	666	454	512	-	-	6987
	lbs		752	805	856	924	968	1,049	1,121	1,487	1,200	1,535	1,108	1,469	1,002	1,129	-	-	15404
310S	kg	Integral	383	397	474	492	552	683	554	694	532	681	521	511	436	449	422	437	8219
	lbs		844	875	1,044	1,085	1,217	1,507	1,221	1,530	1,173	1,501	1,149	1,126	962	991	931	964	18120
360S	kg	Integral	379	409	447	466	547	593	678	802	616	779	571	590	437	477	424	454	8670
	lbs		836	902	986	1,028	1,207	1,307	1,494	1,768	1,357	1,717	1,259	1,302	964	1,051	935	1,001	19114
340M	kg	Unit A	398	420	520	631	486	640	484	631	511	485	409	436	-	-	-	-	6050
	lbs		876	925	1,147	1,392	1,070	1,411	1,066	1,392	1,126	1,069	902	961	-	-	-	-	13338
	kg	Unit B	386	444	529	641	398	599	298	420	-	-	-	-	-	-	-	-	3714
	lbs		851	978	1,166	1,413	876	1,321	656	925	-	-	-	-	-	-	-	-	8187
380M	kg	Unit A	375	395	504	597	452	600	459	597	479	458	378	405	391	410	-	-	6499
	lbs		827	871	1,110	1,317	996	1,323	1,012	1,316	1,056	1,010	834	892	861	905	-	-	14328
	kg	Unit B	390	439	537	632	406	591	303	415	-	-	-	-	-	-	-	-	3714
	lbs		861	969	1,184	1,394	895	1,303	667	914	-	-	-	-	-	-	-	-	8187
410M	kg	Unit A	396	416	597	693	586	709	555	688	438	484	-	-	-	-	-	-	5562
	lbs		872	918	1,316	1,529	1,291	1,563	1,223	1,517	966	1,066	-	-	-	-	-	-	12261
	kg	Unit B	450	482	512	548	555	708	640	749	414	503	-	-	-	-	-	-	5562
	lbs		993	1,063	1,128	1,208	1,224	1,562	1,410	1,651	912	1,110	-	-	-	-	-	-	12261
440M	kg	Unit A	401	419	527	623	493	631	490	623	465	474	419	445	-	-	-	-	6011
	lbs		885	923	1,161	1,373	1,087	1,391	1,080	1,374	1,025	1,045	925	982	-	-	-	-	13251
	kg	Unit B	440	462	458	469	508	625	533	639	485	606	371	414	-	-	-	-	6011
	lbs		971	1,018	1,009	1,035	1,120	1,378	1,176	1,409	1,069	1,336	818	912	-	-	-	-	13251
510M	kg	Unit A	387	416	527	644	478	653	483	649	448	474	380	416	408	434	-	-	6798
	lbs		854	917	1,162	1,419	1,055	1,439	1,066	1,431	988	1,044	838	918	900	957	-	-	14988
	kg	Unit B	419	438	426	427	437	466	477	643	511	660	470	623	373	428	-	-	6798
	lbs		924	966	939	942	964	1,028	1,051	1,418	1,128	1,455	1,036	1,374	821	942	-	-	14988

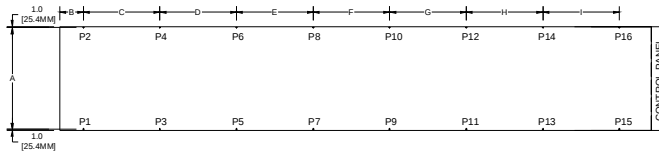
c.) Point Load Data (Finned Tube Coil Models)

Model		ACM-AE	Integral/ Modular	P1	P2	P3	P4	P5	P6	P7	P8	P9	P10	P11	P12	P13	P14	P15	P16	Total Operating Weight
090S	kg	Integral	369	449	598	717	432	553	-	-	-	-	-	-	-	-	-	-	-	3117
	lbs		812	989	1,317	1,581	953	1,219	-	-	-	-	-	-	-	-	-	-	-	6872
130S	kg	Integral	352	445	571	665	456	639	405	507	-	-	-	-	-	-	-	-	-	4041
	lbs		776	982	1,259	1,466	1,006	1,409	894	1,118	-	-	-	-	-	-	-	-	-	8909
160S	kg	Integral	482	512	694	834	716	871	655	802	-	-	-	-	-	-	-	-	-	5565
	lbs		1,062	1,129	1,530	1,839	1,579	1,920	1,443	1,767	-	-	-	-	-	-	-	-	-	12268
180S	kg	Integral	438	466	649	766	627	777	609	763	507	560	-	-	-	-	-	-	-	6163
	lbs		966	1,026	1,430	1,690	1,383	1,714	1,343	1,682	1,119	1,234	-	-	-	-	-	-	-	13588
220S	kg	Integral	418	447	512	537	582	735	608	756	575	733	512	567	-	-	-	-	-	6981
	lbs		921	986	1,128	1,185	1,282	1,620	1,339	1,667	1,268	1,616	1,128	1,250	-	-	-	-	-	15391
250S	kg	Integral	386	410	435	467	481	518	549	715	585	737	547	710	504	562	-	-	-	7607
	lbs		851	904	960	1,028	1,060	1,141	1,211	1,577	1,291	1,625	1,205	1,566	1,112	1,239	-	-	-	16770
310S	kg	Integral	427	441	521	540	594	725	594	734	572	721	563	552	483	496	468	484	8916	
	lbs		942	972	1,150	1,190	1,309	1,599	1,310	1,619	1,262	1,590	1,240	1,217	1,064	1,093	1,032	1,066	19656	
360S	kg	Integral	429	459	494	513	592	638	732	856	667	831	616	635	486	525	471	501	9444	
	lbs		945	1,011	1,090	1,131	1,305	1,406	1,613	1,886	1,471	1,831	1,358	1,400	1,071	1,158	1,039	1,104	20820	
340M	kg	Unit A	444	466	567	678	528	682	526	673	556	530	457	484	-	-	-	-	-	6592
	lbs		979	1,028	1,250	1,495	1,163	1,504	1,159	1,485	1,227	1,169	1,008	1,067	-	-	-	-	-	14533
	kg	Unit B	419	477	573	685	441	643	331	453	-	-	-	-	-	-	-	-	-	4023
	lbs		925	1,052	1,263	1,509	973	1,418	730	999	-	-	-	-	-	-	-	-	-	8870
380M	kg	Unit A	420	440	551	645	494	642	499	637	520	499	422	449	440	460	-	-	-	7119
	lbs		926	971	1,214	1,421	1,088	1,415	1,101	1,405	1,147	1,100	931	989	971	1,015	-	-	-	15694
	kg	Unit B	424	473	581	676	450	635	336	448	-	-	-	-	-	-	-	-	-	4023
	lbs		935	1,043	1,281	1,491	992	1,400	741	988	-	-	-	-	-	-	-	-	-	8870
410M	kg	Unit A	438	459	648	745	631	754	605	738	482	527	-	-	-	-	-	-	-	6026
	lbs		965	1,011	1,429	1,642	1,390	1,662	1,333	1,628	1,062	1,163	-	-	-	-	-	-	-	13285
	kg	Unit B	493	525	563	599	600	753	690	799	458	547	-	-	-	-	-	-	-	6026
	lbs		1,086	1,156	1,241	1,320	1,323	1,661	1,521	1,762	1,009	1,206	-	-	-	-	-	-	-	13285
440M	kg	Unit A	448	465	573	669	535	673	532	665	511	520	467	493	-	-	-	-	-	6553
	lbs		988	1,026	1,264	1,475	1,180	1,484	1,173	1,467	1,127	1,146	1,030	1,087	-	-	-	-	-	14446
	kg	Unit B	487	508	504	516	550	667	575	681	531	652	419	461	-	-	-	-	-	6553
	lbs		1,074	1,121	1,111	1,137	1,213	1,471	1,268	1,502	1,170	1,437	923	1,017	-	-	-	-	-	14446
510M	kg	Unit A	433	462	574	691	520	694	524	690	489	515	425	461	458	484	-	-	-	7418
	lbs		954	1,018	1,265	1,523	1,147	1,531	1,155	1,520	1,079	1,135	936	1,015	1,009	1,066	-	-	-	16353
	kg	Unit B	465	483	473	474	479	508	518	684	553	701	514	668	422	477	-	-	-	7418
	lbs		1,024	1,066	1,042	1,045	1,056	1,120	1,141	1,507	1,218	1,545	1,133	1,472	930	1,052	-	-	-	16353

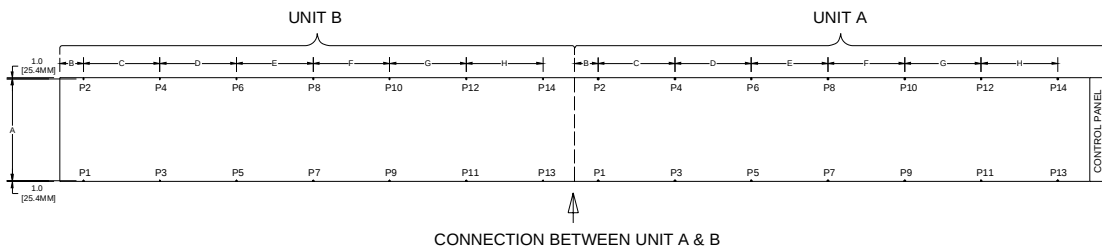
FLOOR LOADING DIAGRAM

R1234ze

Integral Unit (090S - 360S)



Modular Unit (340M, 380M, 410M, 440M, 510M)



a.) Point Load Location

Model ACM-AE		Integral/ Modular	A	B	C	D	E	F	G	H	I
090S	inches	Integral	88	15	55	55	-	-	-	-	-
	mm		2235	381	1397	1397	-	-	-	-	-
130S	inches	Integral	88	15	52	52	52	-	-	-	-
	mm		2235	381	1321	1321	1321	-	-	-	-
160S	inches	Integral	88	15	66	66	66	-	-	-	-
	mm		2235	381	1676	1676	1676	-	-	-	-
180S	inches	Integral	88	15	62	62	62	62	-	-	-
	mm		2235	381	1575	1575	1575	1575	-	-	-
220S	inches	Integral	88	20	57	57	57	57	57	-	-
	mm		2235	508	1448	1448	1448	1448	1448	-	-
250S	inches	Integral	88	20	55	55	55	55	55	55	-
	mm		2235	508	1397	1397	1397	1397	1397	1397	-
310S	inches	Integral	88	20	54	54	54	54	54	54	54
	mm		2235	508	1372	1372	1372	1372	1372	1372	1372
360S	inches	Integral	88	20	61	61	61	61	61	61	61
	mm		2235	508	1549	1549	1549	1549	1549	1549	1549
340M	inches	Unit A	88	20	57	57	57	57	57	-	-
	mm		2235	508	1448	1448	1448	1448	1448	-	-
	inches	Unit B	88	15	52	52	-	-	-	-	-
	mm		2235	381	1321	1321	-	-	-	-	-
380M	inches	Unit A	88	20	55	55	55	55	55	55	-
	mm		2235	508	1397	1397	1397	1397	1397	1397	-
	inches	Unit B	88	15	52	52	-	-	-	-	-
	mm		2235	381	1321	1321	-	-	-	-	-
410M	inches	Unit A	88	15	62	62	62	62	-	-	-
	mm		2235	381	1575	1575	1575	1575	-	-	-
	inches	Unit B	88	15	62	62	62	62	-	-	-
	mm		2235	381	1575	1575	1575	1575	-	-	-
440M	inches	Unit A	88	20	57	57	57	57	57	-	-
	mm		2235	508	1448	1448	1448	1448	1448	-	-
	inches	Unit B	88	20	57	57	57	57	57	-	-
	mm		2235	508	1448	1448	1448	1448	1448	-	-
510M	inches	Unit A	88	20	55	55	55	55	55	55	-
	mm		2235	508	1397	1397	1397	1397	1397	1397	-
	inches	Unit B	88	20	55	55	55	55	55	55	-
	mm		2235	508	1397	1397	1397	1397	1397	1397	-

FLOOR LOADING DIAGRAM

b.) Point Load Data (MCHX)

Model	ACM-AE	Integral/ Modular	P1	P2	P3	P4	P5	P6	P7	P8	P9	P10	P11	P12	P13	P14	P15	P16	Total Operating Weight
090S	kg	Integral	335	415	555	671	399	519	-	-	-	-	-	-	-	-	-	-	2893
	lbs		738	914	1,224	1,478	879	1,144	-	-	-	-	-	-	-	-	-	-	6379
130S	kg	Integral	327	414	530	622	413	595	372	473	-	-	-	-	-	-	-	-	3747
	lbs		721	912	1,169	1,371	911	1,312	821	1,044	-	-	-	-	-	-	-	-	8260
160S	kg	Integral	439	468	648	785	674	825	605	751	-	-	-	-	-	-	-	-	5195
	lbs		968	1,033	1,428	1,730	1,485	1,819	1,334	1,656	-	-	-	-	-	-	-	-	11454
180S	kg	Integral	398	424	602	717	586	734	561	714	464	516	-	-	-	-	-	-	5716
	lbs		877	935	1,328	1,580	1,293	1,618	1,236	1,573	1,024	1,138	-	-	-	-	-	-	12601
220S	kg	Integral	372	401	476	493	541	693	567	714	542	690	464	519	-	-	-	-	6472
	lbs		821	884	1,049	1,087	1,192	1,527	1,249	1,575	1,195	1,522	1,024	1,144	-	-	-	-	14269
250S	kg	Integral	342	365	390	420	447	478	510	675	545	696	515	669	455	512	-	-	7018
	lbs		754	805	859	925	985	1,053	1,124	1,488	1,202	1,535	1,135	1,475	1,003	1,130	-	-	15473
310S	kg	Integral	390	398	486	495	556	684	557	695	540	683	524	511	438	450	423	438	8269
	lbs		860	878	1,073	1,091	1,225	1,509	1,228	1,532	1,191	1,505	1,155	1,127	965	992	933	965	18230
360S	kg	Integral	381	410	465	470	560	596	680	802	617	779	572	591	438	477	425	454	8717
	lbs		841	903	1,024	1,036	1,234	1,313	1,500	1,769	1,360	1,718	1,262	1,302	966	1,052	936	1,001	19217
340M	kg	Unit A	408	422	523	632	488	641	492	633	513	485	410	436	-	-	-	-	6083
	lbs		899	930	1,153	1,394	1,075	1,412	1,084	1,396	1,131	1,070	904	962	-	-	-	-	13411
	kg	Unit B	394	446	532	642	399	600	298	420	-	-	-	-	-	-	-	-	3730
	lbs		870	983	1,173	1,414	879	1,322	658	926	-	-	-	-	-	-	-	-	8224
380M	kg	Unit A	385	397	506	598	454	600	465	598	482	459	380	405	391	411	-	-	6530
	lbs		849	876	1,115	1,318	1,001	1,324	1,025	1,318	1,063	1,011	837	893	863	905	-	-	14397
	kg	Unit B	399	441	540	633	407	591	303	415	-	-	-	-	-	-	-	-	3729
	lbs		879	973	1,190	1,395	897	1,304	669	915	-	-	-	-	-	-	-	-	8222
410M	kg	Unit A	405	418	600	694	587	709	567	691	439	484	-	-	-	-	-	-	5595
	lbs		892	922	1,322	1,530	1,295	1,564	1,251	1,523	968	1,067	-	-	-	-	-	-	12334
	kg	Unit B	452	483	524	550	557	709	643	750	422	505	-	-	-	-	-	-	5595
	lbs		996	1,064	1,154	1,213	1,228	1,563	1,418	1,653	931	1,114	-	-	-	-	-	-	12334
440M	kg	Unit A	412	421	529	623	495	632	498	625	467	475	421	446	-	-	-	-	6044
	lbs		908	928	1,167	1,374	1,092	1,392	1,098	1,378	1,031	1,046	927	983	-	-	-	-	13324
	kg	Unit B	441	462	469	472	509	625	534	640	497	609	372	414	-	-	-	-	6044
	lbs		973	1,018	1,033	1,040	1,123	1,379	1,178	1,410	1,097	1,342	819	913	-	-	-	-	13324
510M	kg	Unit A	398	418	529	644	480	653	489	650	451	474	381	417	409	434	-	-	6830
	lbs		876	922	1,167	1,420	1,059	1,440	1,079	1,434	995	1,046	841	918	902	957	-	-	15057
	kg	Unit B	420	438	428	428	445	468	478	643	512	660	482	626	373	428	-	-	6830
	lbs		926	966	943	943	981	1,032	1,054	1,419	1,129	1,455	1,063	1,381	823	943	-	-	15057

c.) Point Load Data (Finned Tube Coil Models)

Model	ACM-AE	Integral/ Modular	P1	P2	P3	P4	P5	P6	P7	P8	P9	P10	P11	P12	P13	P14	P15	P16	Total Operating Weight
090S	kg	Integral	369	449	603	719	433	553	-	-	-	-	-	-	-	-	-	-	3126
	lbs		814	990	1,330	1,584	954	1,219	-	-	-	-	-	-	-	-	-	-	6891
130S	kg	Integral	360	447	574	665	457	639	406	507	-	-	-	-	-	-	-	-	4057
	lbs		795	986	1,265	1,467	1,008	1,409	895	1,118	-	-	-	-	-	-	-	-	8943
160S	kg	Integral	483	512	699	836	721	873	656	802	-	-	-	-	-	-	-	-	5582
	lbs		1,066	1,130	1,540	1,842	1,590	1,924	1,446	1,768	-	-	-	-	-	-	-	-	12306
180S	kg	Integral	440	466	654	768	631	779	611	764	508	560	-	-	-	-	-	-	6180
	lbs		969	1,027	1,441	1,693	1,392	1,717	1,347	1,684	1,121	1,235	-	-	-	-	-	-	13626
220S	kg	Integral	419	447	523	540	583	735	609	756	588	736	512	567	-	-	-	-	7014
	lbs		923	986	1,152	1,190	1,285	1,620	1,342	1,667	1,296	1,622	1,129	1,250	-	-	-	-	15464
250S	kg	Integral	387	410	437	467	488	519	550	715	586	737	559	713	505	562	-	-	7638
	lbs		853	905	964	1,029	1,077	1,145	1,214	1,577	1,293	1,626	1,232	1,572	1,113	1,240	-	-	16839
310S	kg	Integral	435	443	534	543	597	726	597	735	580	723	565	553	484	496	469	484	8965
	lbs		958	976	1,178	1,197	1,317	1,601	1,317	1,621	1,280	1,594	1,246	1,219	1,068	1,094	1,035	1,067	19765
360S	kg	Integral	431	459	512	517	604	640	734	856	669	831	617	635	486	525	472	501	9491
	lbs		950	1,012	1,128	1,139	1,332	1,412	1,618	1,888	1,475	1,832	1,360	1,401	1,073	1,158	1,040	1,105	20923
340M	kg	Unit A	454	468	570	679	530	683	534	675	559	531	458	484	-	-	-	-	6625
	lbs		1,002	1,033	1,256	1,497	1,168	1,505	1,177	1,489	1,232	1,170	1,010	1,068	-	-	-	-	14606
	kg	Unit B	428	479	576	685	442	643	332	453	-	-	-	-	-	-	-	-	4040
	lbs		943	1,057	1,270	1,511	976	1,419	732	1,000	-	-	-	-	-	-	-	-	8906
380M	kg	Unit A	430	443	553	645	496	642	505	639	523	500	424	449	441	460	-	-	7150
	lbs		948	976	1,219	1,422	1,093	1,416	1,114	1,408	1,153	1,102	934	990	973	1,015	-	-	15762
	kg	Unit B	432	475	584	677	451	635	337	448	-	-	-	-	-	-	-	-	4039
	lbs		953	1,047	1,286	1,492	994	1,400	743	989	-	-	-	-	-	-	-	-	8904
410M	kg	Unit A	447	461	651	745	632	754	618	741	483	528	-	-	-	-	-	-	6059
	lbs		985	1,015	1,435	1,643	1,394	1,663	1,361	1,634	1,064	1,163	-	-	-	-	-	-	13358
	kg	Unit B	494	525	575	602	602	754	693	800	466	549	-	-	-	-	-	-	6059
	lbs		1,089	1,157	1,267	1,326	1,328	1,662	1,528	1,764	1,027	1,210	-	-	-	-	-	-	13358
440M	kg	Unit A	458	468	576	670	537	674	540	667	513	521	468	493	-	-	-	-	6586
	lbs		1,011	1,031	1,270	1,476	1,185	1,485	1,191	1,471	1,132	1,148	1,032	1,088	-	-	-	-	14519
	kg	Unit B	488	509	515	518	551	667	576	682	543	655	419	462	-	-	-	-	6586
	lbs		1,076	1,121	1,135	1,142	1,215	1,471	1,271	1,503	1,198	1,444	924	1,018	-	-	-	-	14519
510M	kg	Unit A	443	464	576	691	522	695	530	691	492	515	426	461	459	484	-	-	7449
	lbs		977	1,023	1,270	1,524	1,151	1,532	1,169	1,523	1,085	1,136	939	1,016	1,011	1,066	-	-	16422
	kg	Unit B	465	484	474	475	487	510	519	684	553	701	527	671	423	477	-	-	7449
	lbs		1,026	1,066	1,046	1,046	1,073	1,124	1,144	1,508	1,220	1,546	1,161	1,478	932	1,052	-	-	16422

APPLICATION DATA

UNIT DESIGNED OPERATING RANGE

Unit Operating Range – Ambient Temperature

The units are designed to operate at ambient temperature, 30~115°F [-1.1°C~46.1°C]. If the unit requires to be operated at lower ambient temperature, the optional **Low Ambient Operation (LA 2)** shall be incorporated for stable operation. For high ambient temperature up to 125°F [51.7°C], high lift compressor option should be selected.

Operating Limits – Ambient Temperature

Operating Ambient Temperature	Minimum	Maximum
Standard	30°F [-1.1°C]	115°F [46.1°C]
With LA 2	0°F [-17.8°C]	115°F [46.1°C]
With High Lift Compressor	30°F [-1.1°C]	125°F [51.7°C]

If wind velocity in the area is over 5 mph [8 kmph], wind barrier is recommended.

Unit Operating Range – Evaporator Temperature

The ACM-AE standard temperature models are designed to deliver chilled fluid temperature within 40~53°F [4.5~11.7°C]. While for ACM-AE high temperature models are designed to deliver chilled fluid temperature within 57~86°F [13.9~30°C].

For unit installation with minimum ambient temperature at 32°F [0°C] or below, **Evaporator Anti-Freeze Protection** option is recommended to prevent freezing of water in evaporator when the chiller is not in operation.

Operating Limits – Leaving Fluid Temperature

Leaving Fluid Temperature	Minimum	Maximum
Standard Temperature	40 °F [4.5 °C]	53 °F [11.7 °C]
High Temperature	57 °F [13.9 °C]	86 °F [30 °C]

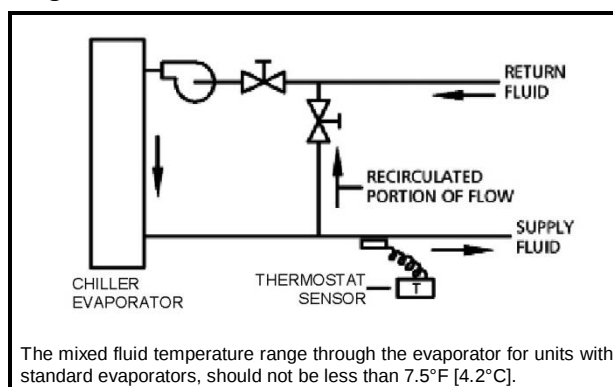
EVAPORATOR FLUID CIRCUIT

Wide Range ΔT - Low Flow Applications

Multiple smaller chillers may be applied in series, each providing a portion of the design temperature range typical 10°F [5.5°C] each.

Chilled fluid may be recirculated through the evaporator as shown below to allow the chiller to operate with acceptable flow rates and temperature ranges (Figure 1A).

Figure 1A

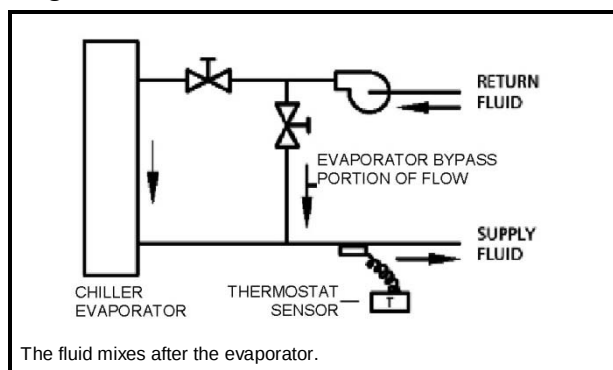


Narrow Range ΔT - High Flow Applications

For Narrow Range ΔT applications, a partial evaporator bypass piping and valve configuration can be used as shown below.

This permits a higher ΔT and lower ΔP (pressure drop) through the evaporator (Figure 1B).

Figure 1B



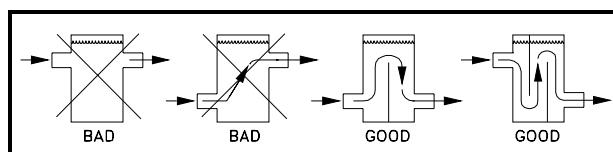
Minimum Chilled Fluid Loop Volume

The evaporator fluid circuit requires a minimum system fluid volume of 3 US gallons per Ton [3.3 liters/ cooling kW] for stable operation. The minimum system fluid volume may increase up to 10 US gallons per Ton [11 liters/ cooling kW] for process cooling, low load applications with small temperature range and/or vastly fluctuating load conditions.

Tanks for System Volume Enhancement

It may be necessary to install a tank in the system to provide sufficient system fluid volume, as shown below. The tank should be baffled and piped for proper fluid mixing to prevent stratification.

Figure 2A



APPLICATION DATA

Figure 2B Single Loop System with Storage Tank to Increase Loop Volume

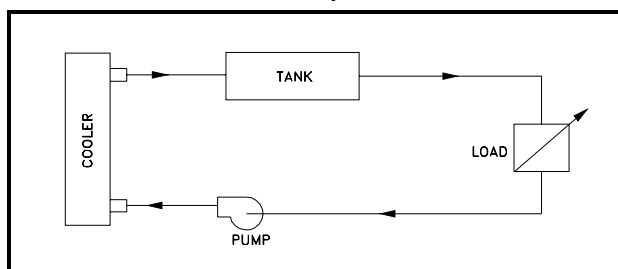
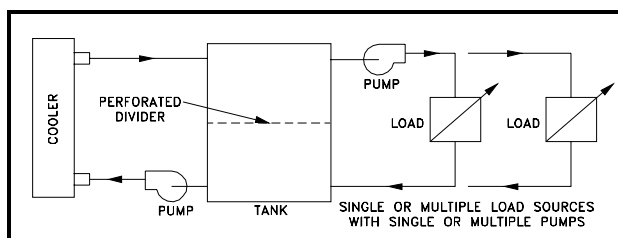


Figure 2C Primary and Secondary Loop Systems are normally used where the secondary system has variable flow and/or multiple loads. See example below.



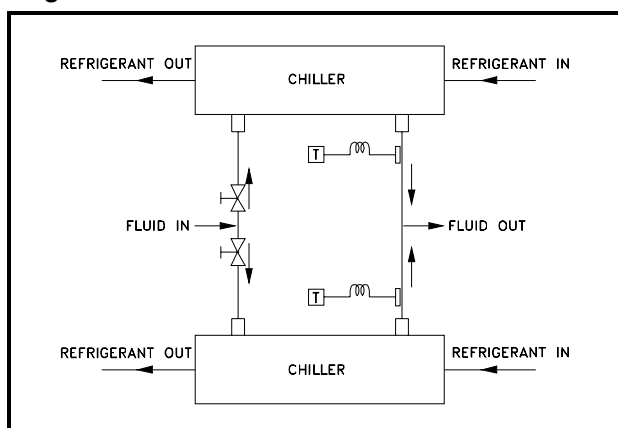
Multiple Chillers In A Chilled Water System

Where the load is greater than available from one ACM-AE, where standby capacity is required or the load profile dictates, multiple chillers may be piped in parallel. Units of equal size help to ensure fluid flow balance, but balancing valves ensure balanced flows even with dissimilar sized chillers.

Temperature controller sensors may or may not need to be moved to the common fluid piping depending on the specific application.

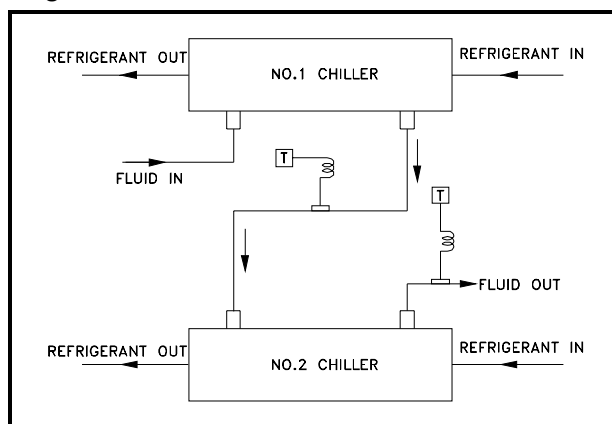
Parallel Chiller Applications – Both units operate simultaneously modulating with load variations. Each unit operates independently sensing its own leaving fluid temperature. The set point of each thermostat is set to maintain the desired loading scheme. (Figure 3A)

Figure 3A



Series Chiller Applications – Where a large temperature range is required (over 25 °F [13.9 °C]), the chiller may be piped in series. In this case the units are controlled independently. The load is progressive by temperature so the chiller selections are critical. (Figure 3B)

Figure 3B



Variable Evaporator Flow

Dunham-Bush chillers are capable for variable evaporator flow system. The chiller may operate to maintain constant leaving fluid temperature with evaporator flow rate changes, with below conditions fulfilled.

- ✿ Evaporator fluid flow rate is within minimum and maximum flow rate of the unit at all time during the operation
- ✿ Rate of flow changed shall not exceeded 10% per minute

Failure to comply with the above conditions will cause problem to the chiller operation and may cause the chiller to shutdown.

Table 1 : Correction Factor - Elevation

Elevation above Sea Level		Capacity Correction Factor	kW Correction Factor
Feet [m]	Meters Factor		
0	0	1.00	1.00
2000	600	0.99	1.01
4000	1200	0.98	1.02
6000	1800	0.97	1.03

Table 2 : Correction Factor - FF

Fouling Factor		Capacity Correction Factor	kW Correction Factor
Hr.ft. ² .°F/BTU	m ² .°C/kW		
0.0001	0.018	1.000	1.000
0.00025	0.044	0.993	0.997
0.00050	0.088	0.978	0.990
0.00100	0.176	0.951	0.978

Note: P.D. – Pressure drop across evaporator

APPLICATION DATA

Glycol Freeze Protection

If the chiller or fluid piping may be exposed to temperatures below freezing, glycol protection is recommended if the water is not drained. The recommended protection is 10°F [5.6°C] below the minimum ambient temperature in the equipment room and around piping. Use only glycol solutions approved for heat exchanger duty. DO NOT use automotive anti-freezing.

The use of glycol causes a performance derate as shown below (for quick reference only. Please use SPEC8 software for chiller performance calculation) which needs to be included in the unit selection procedure (Table 1 & 2 for quick reference only. Please use SPEC8 software for chiller performance calculation).

Table 1 : Ethylene Glycol

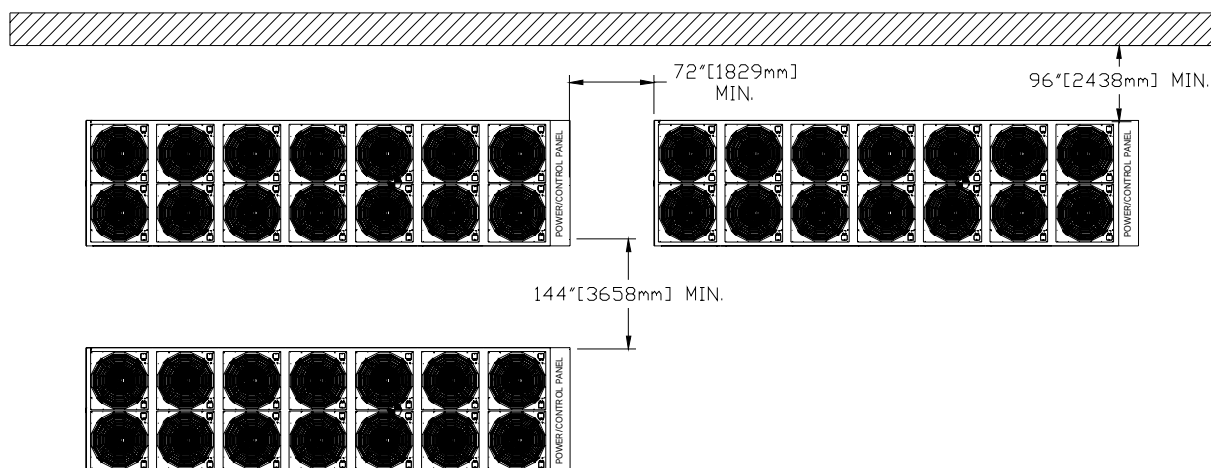
% E. G. By Weight	Freeze Point		C1 Capacity Factor	K1 kW Rate	G1 Flow Factor	P1 P.D. Factor
	°F	°C				
10	26.2	-3.2	0.995	0.998	1.019	1.050
15	22.4	-5.3	0.991	0.997	1.030	1.083
20	17.8	-7.9	0.988	0.996	1.044	1.121
25	12.6	-10.8	0.984	0.995	1.060	1.170
30	6.7	-14.1	0.981	0.994	1.077	1.219

Table 2 : Propylene Glycol

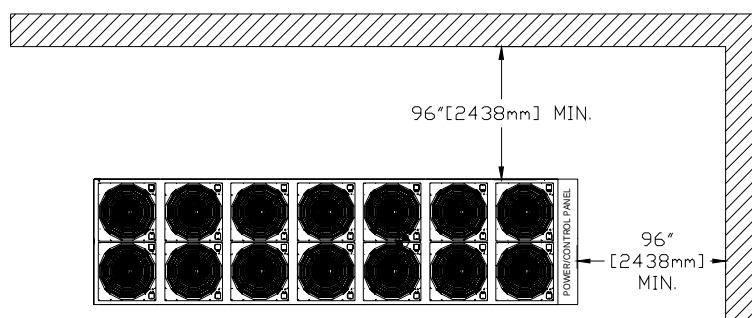
% P. G. By Weight	Freeze Point		C2 Capacity Factor	K2 kW Rate	G2 Flow Factor	P2 P.D. Factor
	°F	°C				
10	26.1	-3.3	0.988	0.994	1.005	1.019
15	22.8	-5.1	0.984	0.992	1.008	1.031
20	19.1	-7.2	0.978	0.990	1.010	1.051
25	14.5	-9.7	0.970	0.988	1.015	1.081
30	8.9	-12.8	0.962	0.986	1.021	1.120

MINIMUM CLEARANCE REQUIREMENTS

Multiple Units Clearance



Corner Wall



Notes: All dimensions are minimal, unless stated otherwise



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