



ZEUS

Air Cooled Scroll Chillers
ACDS 50/60Hz

Cooling Capacity: 10 to 180 TR (35 to 633 kW)



DUNHAM-BUSH®

Products that perform...By people who care

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, building-by-building, country-by-country and region-by-region. No other HVAC/R manufacturer takes this approach to meeting your performance expectations.

ZEUS series, ACDS Air Cooled Scroll Chillers, have a cooling capacity range from 10 to 180 TR [35 to 633 kW] version using environmentally sound HFC-410A refrigerant. The entire product line features energy efficiency, installation ease, control flexibility, high reliability, compact footprint and advanced controls.

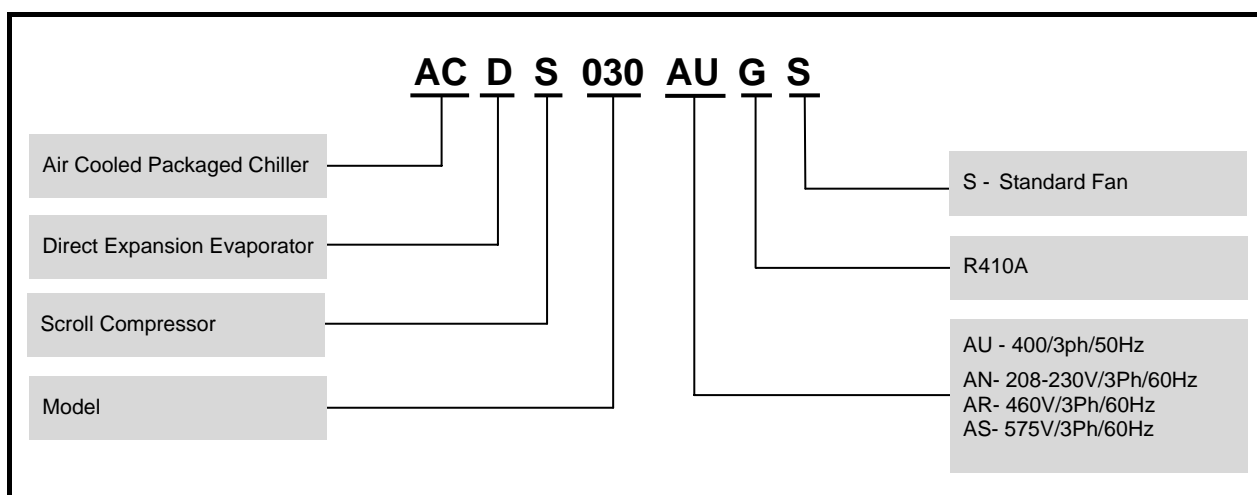
Scroll Compressors are designed for Commercial/Industrial Applications and provide the same high quality and efficiency as Reciprocating or Screw Compressors. They have been developed specifically for use in Packaged Chillers and Condensing Unit products.

Upon shipment, the new ACDS R410A unit is installation-ready with a compact size, reduced weight, and complete factory piping and wiring. Refrigerant charge is included and a thorough factory test under load is conducted on each unit to ensure trouble-free start-up and operation.

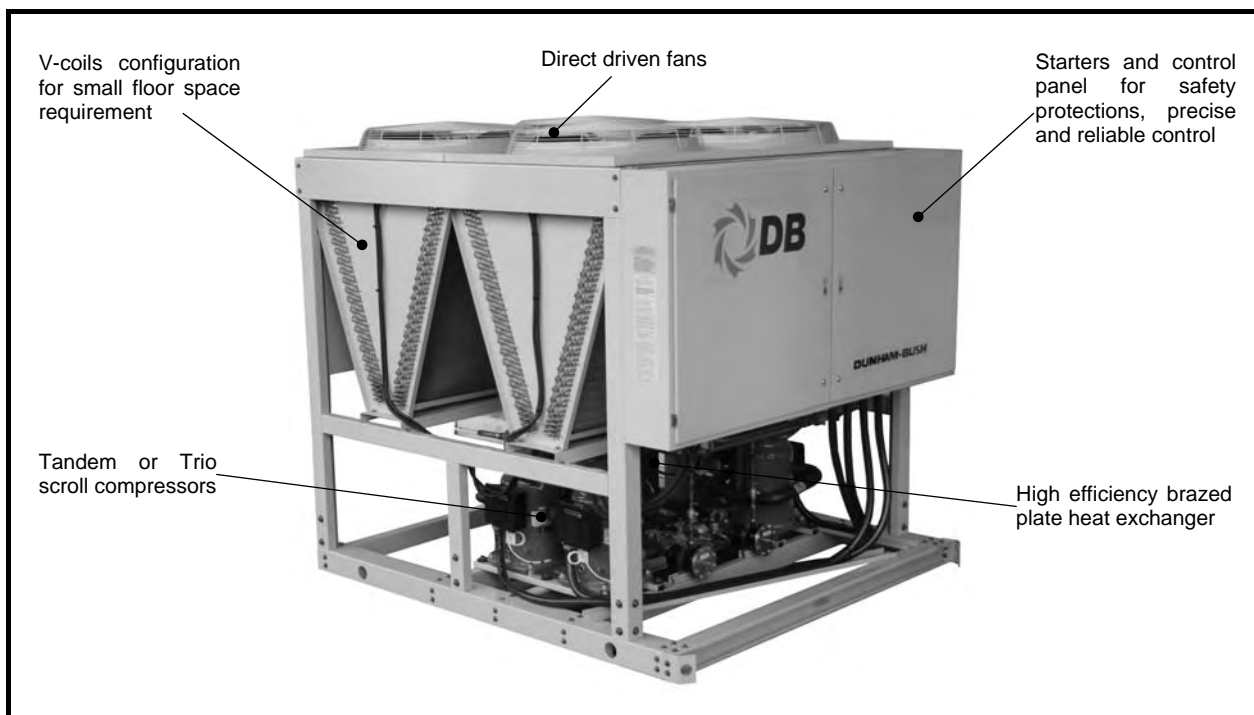
TABLE OF CONTENTS

	Page No		Page No
Introduction	2	Electrical Data	16
Nomenclature.....	2	Dimensional Data	17
General Characteristics	3	Floor Loading Diagram.....	28
Unit Features	3	Evaporator Water Pressure Drop	30
Options/ Accessories	6	Field Power & Control Wiring Schematic.....	32
Physical Specifications	8	Application Data	32
Performance Data	10	Guide Specifications.....	36
Sound Pressure Data.....	14		

NOMENCLATURE



GENERAL CHARACTERISTICS



UNIT FEATURES

GENERAL

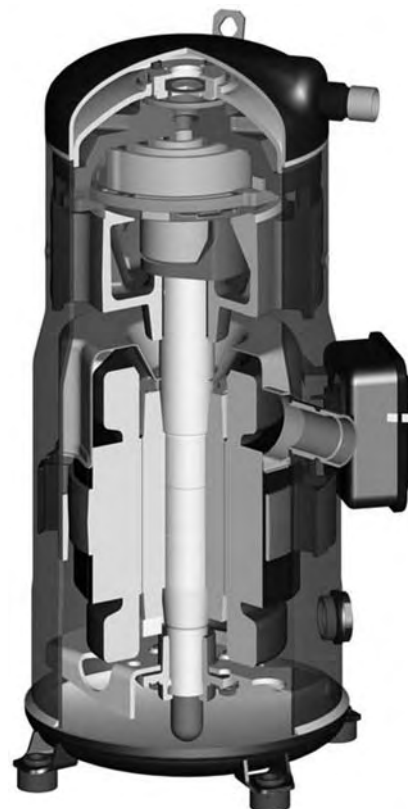
- ✦ 30 models from 10 up to 180 TR [35 to 633 kW] for 50Hz & 60Hz units
- ✦ The unit is designed to operate with R410a refrigerant, the environment friendly refrigerant with zero **ODP** (Ozone Depletion Potential)
- ✦ Units are rated and certified with AHRI standard 550/590
- ✦ ETL listed for 60Hz models
- ✦ Unit operating ambient temperature , 45 ~ 115°F [7 ~ 46°C]

COMPRESSORS

- ✦ Reliable Tandem or Trio scroll compressors
- ✦ Compressor lead-lag configuration on all models
- ✦ Suction gas cooled motor
- ✦ High EER
- ✦ Solid state motor protection module monitors motor winding temperature via embedded PTC sensors. This protects motor overheating caused by overload, low refrigerant flow and incorrect motor rotation
- ✦ Crankcase heaters are provided to minimized oil dilution and liquid refrigerant migration

UNIT CASING

- ✦ Casing are constructed from heavy gauge galvanized steel
- ✦ Powder coated baked finishing, offers excellent corrosion resistance for outdoor applications, which withstand up to 1000 hours salt spray test in accordance to ASTM B-117



UNIT FEATURES

EVAPORATOR



- ✦ Compact and high efficiency brazed plate heat exchanger
- ✦ Constructed with stainless steel plates
- ✦ Design pressure of 450 psig [31 bar] on refrigerant circuit
- ✦ Design pressure of 400 psig [28 bar] on fluid circuit
- ✦ Environment friendly with reduced refrigerant charged by its compact design
- ✦ Lower pressure drop on water side
- ✦ Victaulic groove water connection comply to ANSI/AWWA C-606, for 50Hz units
- ✦ NPT thread connection, for 60Hz units
- ✦ 1" [25mm] thick closed cell insulation

CONDENSER AND FANS

- ✦ Constructed with seamless inner-grooved copper tubes expanded into die-formed aluminum fins in staggered configuration.
- ✦ Leak and pressure test at 650psig [45bar]
- ✦ Coil design with sub-cooling enhancement to improve unit efficiency
- ✦ Low noise direct driven propeller fans
- ✦ IP 54 motor construction for outdoor applications

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

ELECTRICAL & CONTROL

- ✦ Weather tight electrical enclosure fabricated by heavy gauge sheet steel with powder coated baked finishing.
- ✦ Single point power connection for all models

- ✦ Circuit breaker for compressors and condenser fan motors.
- ✦ Unit mounted Direct On-Line (DOL) starter for compressors and condenser fans motors
- ✦ Thermal overload protection for compressor motors
- ✦ Step down transformer for control circuit
- ✦ Main power supply monitoring module (OUVR) giving protection on under or over voltage, phase reversal, phase losses and imbalance
- ✦ Built-in anti-recycle timer for compressors to avoid excessive motor winding temperature rise due to frequent motor startup
- ✦ Type of controller offered :-

50 Hz Units	
ACDS 010 – 095	Electromechanical
ACDS 105 – 175	Micro Vision

60 Hz Units	
ACDS 010 – 070	Electromechanical
ACDS 80 – 180	Micro Vision

60 Hz Units (For US Region)	
ACDS 010 – 180	Micro-Mag

MICRO VISION CONTROLLER

Micro Vision a flexible and advance programmable microprocessor controller designed specifically for the application and precise control of Dunham-Bush Scroll compressor chillers

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



Micro Vision controller is equipped with a user friendly terminal with a semi-graphic display and dedicated keys that provides easy access to the unit operating conditions, control set points and alarm histories.

Each unit's controller can be configured and connected to the Dunham-Bush DBLAN network that allows multiple chillers sequencing control without additional controller or panel. Dunham-Bush DBLAN is the local area network made up of several chillers' controller.

UNIT FEATURES

Display and User Terminal

The Micro Vision controller is designed to work with a user friendly back-lit 132 by 64 pixels PGDE Semi-Graphic Display panel connected with the controller through a telephone cable. 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. Multiple messages will be displayed automatically by scrolling from each message to the next. All of these messages are spelled out in English on the display terminal.

Easily accessible measurements include:

- ✿ Leaving chilled water temperature
- ✿ Rate of Change for leaving chilled water temperature
- ✿ Evaporator and condenser pressure
- ✿ Run hours of each compressor
- ✿ Number of starts of each compressor
- ✿ Compressors and condenser fans motors status
- ✿ Water Flow Switch Status, Remote Start/Stop Command Status

MICRO-MAG CONTROLLER (For US Region Only)

The Micro-Mag is a rugged microprocessor based controller designed for the hostile environment of the HVAC/R industry. The Micro-Mag provides flexibility with set points and control options that can be selected prior to commissioning a system or when the unit is live and functioning. Displays, alarms and other interfaces are accomplished in a clear and simple language that informs the user as to the status of the controller. The Micro-Mag controller is designed to work with a user friendly 2 by 16 back-lit on I²C Bus display panel with 6 keypad buttons for easy access and control.

The Micro-Mag has two other communication ports, a RS-232 and a RS-485 port. Both ports allow the user to interactively communicate with the Micro-Mag via MCSCONNECT. A BMS (Building Management System) running Modbus RTU or BACnet MSTP can also communicate with the Micro-Mag via the RS-485 port for monitoring purposes.

A complete software support package is available for user PC allowing for system configuration, dynamic on-line display screens, remote communication, graphing, and more. Because the terminal blocks are removable, board replacement requires no wires to be removed.

Capacity Control

Leaving chilled water temperature control is accomplished by entering the leaving water temperature setpoint and placing the controller in automatic control. Micro Vision monitors all control functions and determines number of running compressors to match the building cooling load demand.

The compressors staging 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.

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 Anti-recycle
- ✿ High motor temperature
- ✿ Compressor overload

Remote Monitoring & 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.

OPTIONS AND ACCESSORIES

DB-LAN Master Slave Sequencing Control (MSS)

In a chiller system with multiple Dunham-Bush ACDS chillers, Micro Vision controller of each chiller can be connected to the DB-LAN network via a communication bus without additional controller, to enable Master-Slave Sequencing Control of this chiller system. **MSS** will stage in/out chiller in operation to match building required cooling capacity. Chiller Lead-lag, duty-standby and alarm changeover controls are come with **MSS**, as well as the chilled water pumps control. Each **MSS** DB-LAN network can be connected up to 8 numbers of chillers.

Building Management System (BMS) Communication

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

- ✦ Modbus RTU RS485, ModBus TCP/IP
- ✦ BACnet over IP, MS/TP, or PTP
- ✦ LONworks FTT 10

Shell-And-Tube Evaporator (ST) – Shell-And-Tube vessel is supplied as evaporator in lieu of brazed plate heat exchanger. Shell-And-Tube evaporator is constructed in accordance with ASME Codes Sections VIII Division I for unfired pressure vessels. ASME stamp is available on request.

Double Thick Insulation – Evaporator with double thick 2" [50mm] closed cell insulation, for extra resistance to condensation

Dual Mode Operation – The unit with dual mode operation can deliver chilled fluid temperature down to 20 °F [-6.6 °C] during ice making mode. Units with Dual Mode Operation is used for Ice Thermal Storage System

Low Temp. Operation – The unit with Low Temp. Operation can deliver chilled fluid temperature down to 20 °F [-6.6 °C] for process cooling application

Low Noise Fan (LNF) – Incorporate low noise fans to reduce unit sound level

Compressor Acoustic Jacket (LN2) – Compressor acoustic jackets is added to further reduce the unit sound level. The acoustic jackets are made from high performing sound proof material and offer excellent high and low frequency attenuation.

Low Ambient Operation (LA 1) – Variable frequency drive (VFD) is incorporated to the condenser fan motor to allow unit operation down to 14 °F [-10 °C] ambient temperature

Extra Low Ambient Operation (LA 2) – Besides VFD at condenser fan motor, a refrigerant liquid receiver is incorporated into the refrigerant system to allow unit operation down to -20°F [-29°C] ambient temperature

Heat Recovery (DES) – The hot gas desuperheater; a brazed plate heat exchanger that reclaims 'waste' heat from compressor to produce hot water up to 55°C. Shell-and-tube desuperheater is available on request

Condenser Corrosion Protection – Copper (CU) fins or Hydrophilic coated fins are provided to give better corrosion protection. **DB-COAT**, the post-coated solution for condenser coil to provide extensive corrosion protection which pass 5000 hours salt spray testing as per ASTM B-117

Protective Grille for Condenser Coil – To protect condenser coil from unauthorized access

Hot Gas Bypass (HGBP) – To maintain unit operation below minimum unloaded capacity. This minimizes compressor cycling and extends component life, on low load conditions.

Pressure Gauges (GAG) – Pressure gauges are installed on the unit to display suction and discharge pressure readings

Evaporator Heater (EVH) – Strip heater is wrapped around the evaporator to provide anti-freeze protection down to -20°F[-28.9°C] ambient temperature

Hydronic Pump Package (HPP) – This package includes circulating pumps and fittings, completed with insulated expansion tank. Up to 50ft.wg pump head for the ease of installation. Dual pumps package is available for the ease of duty-standby operation

ELECTRICAL AND CONTROLS

Unit Mounted Main Disconnect Switch – Non-fused disconnect switch with external lockable handle is furnished to isolate unit main incoming power supply for servicing.

Soft-starter For Compressor Motors – Solid State starter comes with bypass contactor to reduced mechanical stress and inrush current at compressor start-up

IP55 Control Panel – Control panel with IP55 rating can be supplied for harsh working environment

Voltmeter (VM3) / Ammeter (AM3) – Analog ammeter or voltmeter with 3 phase selector switch for voltage / current indication, located inside the control panel

Ground Fault Interrupt (GFI) – Provides equipment with ground fault protection

Convenience Outlet (CON) – 115Vac GFCI convenience outlet with female receptacle is supplied for 60Hz units. For 50Hz units, 230Vac convenience outlet is supplied

Weather Proof Alarm Bell (WPA) – Audible alarm for common alarm fault alert

Micro Vision (V2C) – For models ACDS 095 and below (50Hz units), ACDS 070 and below (60Hz units), unit to equipped with Micro Vision intelligent controller in lieu of electromechanical controller

OPTIONS AND ACCESSORIES

Below options are available for units with intelligent controller.

Low Ambient Monitoring & Lock-Out (LAL) – Ambient temperature sensor is supplied and ambient temperature readout is used to lock-out unit to prevent unit operation at low ambient condition.

Entering Chilled Water Temperature Sensor – Temperature sensor is installed to monitors fluid temperature returns to unit evaporator

Chilled Water Pump Control – Primary chilled water pump is controlled by chiller's Micro Vision controller for enhanced safety operation

System Voltage Measurement (SVM) – Voltage of power supply is displayed on the unit display panel

Chilled Water Reset (RFTR) – 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

Demand Limiting (AMPL) – Low level interfacing with Building Automation System (BAS) to limit maximum running compressors

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

FACTORY SUPPLIED, FIELD INSTALLED BY CUSTOMER

Evaporator Water Flow Switch (WFS)–Shipped loose flow switch to be installed at evaporator outlet piping as safety interlock to evaporator water flow status. Three options are available: Weather tight flow switch with CE mark; NEMA 3R, and NEMA 4 rated flow switch

Rubber-in-shear Isolators (RIS) – Designed for ease of installation. These one-piece molded rubber isolators are applicable for most installations

Spring Isolators (SPG) – Spring isolator with 1" [25.4mm] deflection. 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

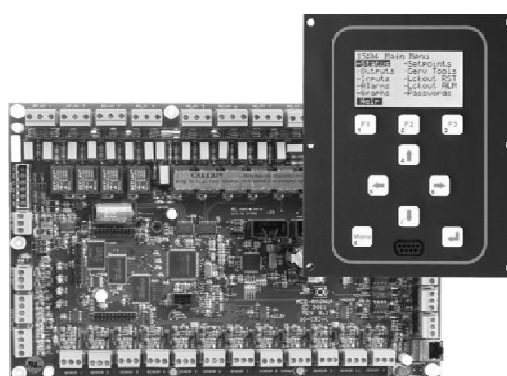
DB-LAN Master Slave Sequencing Control (MSS) – Pre-programmed at factory; field supplied and installed inter-connection wiring between chillers to provide communication bus among chillers' controllers to enable Master-Slave Sequencing Control

Chiller Plant Manager (CPM) – Factory supplied control panel; field supplied and installed interconnection wiring and field devices; for complete chiller plantroom automation.

DB DIRECTOR (For US Region Only)

DB-Director control system is offered to US region as an option to Micro-Mag control system.

DB-Director is a rugged microprocessor based controller designed for the the HVAC/R applications. DB-Director provides flexibility with setpoints and control options that can be selected prior to commissioning a system or when the unit is live and functioning. Displays, alarms and other interfaces are accomplished in a clear and simple language that informs the user as to the status of the controller.



DB-Director is equipped with 128 x 64 pixels monochrome graphics LCD display with 2.8" diagonal viewing area, and 9 dedicated keys that enable user to access information, base on security level of the password. The user terminal is allows displaying and easy access to the unit working conditions, compressor run times, alarm histories and modify the parameters. Multiple messages will be displayed by automatically scrolling from each message to the next. All of these messages are spelled out in English language on the display terminal.

The display also has an automatically self-test of the controller on system start-up. For more detail operation of the DB-Director keypad, please refer to the Unit operation Manual.

Remote Monitoring

DB-Director is equipped with RS485 and Ethernet communication ports as standard. This user friendly design allows Building Management System (BMS) to interface directly with the chiller via either of Modbus RTU, Modbus IP, or BACnet IP communication protocol. LONworks or BACnet MSTP communication protocol can be established with installation of external adapter.



PHYSICAL SPECIFICATIONS

50 Hz

Model ACDS		010	020	030	040	050	060	065	070
Unit Nominal Capacity	TR[kW]	9.4 [33]	18.6 [65]	25.9 [91]	38.8 [136]	52.3 [184]	61.1 [215]	66.2 [233]	68.9 [242]
Unit Nominal Power Input	kW	11.7	23.1	32.4	48.3	65.0	76.6	75.6	86.2
EER		9.71	9.65	9.57	9.63	9.66	9.57	10.51	9.59
COMPRESSOR									
RPM		2900							
Min. % Unit Capacity		50%	50%	50%	25%	25%	25%	25%	25%
No. Of Refrigerant Circuit		1	1	1	2	2	2	2	2
EVAPORATOR									
Water Connector	inches[mm]	2[50.8]	2[50.8]	2[50.8]	3[76.2]	3[76.2]	3[76.2]	3[76.2]	3[76.2]
Nominal Water Flow	USgpm[m ³ /hr]	22.3[5.1]	44.1[10.0]	60.2[13.7]	92.3[21.0]	121.9[27.6]	139.4[31.6]	159.0[36.1]	163.0[37.0]
Nominal Pressure Drop	ft.wg[kPa]	11.1[33.2]	10.3[30.8]	12.6[37.7]	14.5[43.4]	12.4[37.1]	9.5[28.3]	10.0[29.9]	10.8[32.3]
Min/Max. Water Flow	USgpm[m ³ /hr]	21.0/ 73.0 [4.8/ 16.6]	42.0/ 131.0 [9.5/ 29.8]	53.0/ 161.0 [12.0/ 36.6]	72.0/ 216.0 [16.4/ 49.1]	116.0/ 351.0 [26.3/ 79.7]	121.0/ 351.0 [27.5/ 79.7]	136.0/ 410.0 [30.9/ 93.1]	136.0/ 410.0 [30.9/ 93.1]
Min/Max. Water Pressure Drop	ft.wg[kPa]	9.5/ 78.7 [28.4/ 235.2]	8.1/ 65.6 [24.2/ 196.1]	8.3/ 72.0 [24.8/ 215.2]	8.8/ 62.6 [26.3/ 187.1]	8.6/ 63.0 [25.7/ 188.3]	8.7/ 62.6 [26.0/ 187.1]	8.5/ 61.9 [25.4/ 185.0]	8.5/ 61.9 [25.4/ 185.0]
CONDENSER									
Coil Rows Deep/ Total Face Area	ft ² [m ²]	3/ 20.0[1.9]	3/ 40.6[3.8]	4/ 47.1[4.4]	3/ 94.1[8.7]	4/ 94.1[8.7]	4/ 94.1[8.7]	4/ 133.0[12.4]	4/ 133.0[12.4]
Total Air Flow	cfm[m ³ /hr]	9850 [16737]	20150 [34239]	20000 [33984]	42200 [71706]	40000 [67968]	39200 [66609]	58902 [100086]	58902 [100086]
No Of Fan		1	2	2	4	4	4	6	6
Fan Diameter	inches[mm]	31.5[800]	31.5[800]	31.5[800]	31.5[800]	31.5[800]	31.5[800]	31.5[800]	31.5[800]
Fan Motor HP (Qty)		1.5 (1)	1.5 (2)	1.5 (2)	1.5 (4)	1.5 (4)	1.5 (4)	1.5 (6)	1.5 (6)
Fan Motor kW Input (Qty)		1.45 (1)	1.45 (2)	1.45 (2)	1.45 (4)	1.45 (4)	1.45 (4)	1.45 (6)	1.45 (6)
Fan FLA , Amp (Qty)		3.2 (1)	3.2 (2)	3.2 (2)	3.2 (4)	3.2 (4)	3.2 (4)	3.2 (6)	3.2 (6)
GENERAL									
Unit Length	inches[mm]	50 1/8[1280]	96[2440]	96[2440]	112 1/8[2850]	112 1/8[2850]	112 1/8[2850]	147 3/4[3750]	147 3/4[3750]
Unit Width	inches[mm]	44[1120]	49 1/4[1250]	52 3/4[1340]	89[2260]	89[2260]	89[2260]	89[2260]	89[2260]
Unit Height	inches[mm]	56 1/4[1430]	71[1800]	86[2180]	83 3/8[2120]	83 3/8[2120]	83 3/8[2120]	89 3/8[2270]	89 3/8[2270]
Shipping Weight	lbs[kg]	1031 [468]	1640 [744]	2049 [929]	3304 [1500]	3960 [1796]	4097 [1859]	5277 [2394]	5290 [2400]
Operating Weight	lbs[kg]	1036 [470]	1652 [749]	2064 [936]	3329 [1511]	3997 [1813]	4142 [1879]	5329 [2417]	5342 [2423]
Operating Charge R410A	lbs[kg]	26[12]	51[23]	77[35]	101[46]	128[58]	152[69]	168[76]	179[81]

Model ACDS		080	095	105	115	125	135	175
Unit Nominal Capacity	TR[kW]	78.1 [275]	93.2 [328]	101.7 [358]	110.2 [388]	125.3 [441]	136.3 [479]	173.3 [609]
Unit Nominal Power Input	kW	97.8	116.6	112.6	129.2	137.6	155.2	200.8
EER		9.58	9.60	10.11	9.86	10.07	9.74	9.65
COMPRESSOR								
RPM		2900						
Min. % Unit Capacity		25%	25%	16.70%	16.70%	16.70%	16.70%	16.70%
No. Of Refrigerant Circuit		2	2	2	2	2	2	2
EVAPORATOR								
Water Connector	inches[mm]	3[76.2]	3[76.2]	3[76.2]	3[76.2]	3[76.2]	3[76.2]	3[76.2]
Nominal Water Flow	USgpm[m ³ /hr]	181.0[41.1]	215.7[49.0]	245.7[55.8]	268.1[60.9]	303.5[68.9]	324.9[73.8]	415.8[94.4]
Nominal Pressure Drop	ft.wg[kPa]	10.4[31.1]	12.9[38.6]	7.8[23.3]	9.2[27.5]	10.1[30.2]	11.9[35.6]	15.1[45.1]
Min/Max. Water Flow	USgpm[m ³ /hr]	161.0/ 484.0 [36.6/ 109.9]	147.0/ 443.0 [33.4/ 100.6]	210.0/ 400.0 [47.7/ 90.8]	210.0/ 400.0 [47.7/ 90.8]	250.0/ 450.0 [56.8/ 102.2]	250.0/ 450.0 [56.8/ 102.2]	270.0/ 480.0 [61.3/ 109.0]
Min/Max. Water Pressure Drop	ft.wg[kPa]	8.3/ 60.0 [24.8/ 179.3]	8.4/ 61.2 [25.1/ 182.9]	5.1/ 30.0 [15.2/ 89.7]	5.1/ 30.0 [15.2/ 89.7]	5.1/ 30.0 [15.2/ 89.7]	5.1/ 30.0 [15.2/ 89.7]	5.1/ 30.0 [15.2/ 89.7]
CONDENSER								
Coil Rows Deep/ Total Face Area	ft ² [m ²]	4/ 133.0[12.4]	4/ 177.3[16.8]	4/ 188.2[17.4]	4/ 188.2[17.4]	4/ 235.3[21.9]	4/ 235.3[21.9]	4/ 282.3[26.2]
Total Air Flow	cfm[m ³ /hr]	57942 [98455]	77300 [131348]	79200 [134577]	78400 [133217]	98000 [166522]	100000 [169920]	120000 [203904]
No Of Fan		6	8	8	8	10	10	12
Fan Diameter	inches[mm]	31.5[800]	31.5[800]	31.5[800]	31.5[800]	31.5[800]	31.5[800]	31.5[800]
Fan Motor HP (Qty)		1.5 (6)	1.5 (8)	1.5 (8)	1.5 (8)	1.5 (10)	1.5 (10)	1.5 (12)
Fan Motor kW Input (Qty)		1.45 (6)	1.45 (8)	1.45 (8)	1.45 (8)	1.45 (10)	1.45 (10)	1.45 (12)
Fan FLA , Amp (Qty)		3.2 (6)	3.2 (8)	3.2 (8)	3.2 (8)	3.2 (10)	3.2 (10)	3.2 (12)
GENERAL								
Unit Length	inches[mm]	147 3/4[3750]	189 1/8[4800]	183 1/2[4660]	183 1/2[4660]	225 1/2[5730]	225 1/2[5730]	267 1/2[6800]
Unit Width	inches[mm]	89[2260]	89[2260]	88[2240]	88[2240]	88[2240]	88[2240]	88[2240]
Unit Height	inches[mm]	89 3/8[2270]	89 1/2[2270]	93[2360]	93[2360]	93[2360]	93[2360]	93[2360]
Shipping Weight	lbs[kg]	5551 [2517]	7042 [3195]	7805 [3540]	8130 [3688]	9326 [4230]	8831 [4006]	10662 [4836]
Operating Weight	lbs[kg]	5608 [2543]	7113 [3227]	7873 [3571]	8201 [3720]	9399 [4263]	8948 [4059]	10824 [4910]
Operating Charge R410A	lbs[kg]	203[92]	229[104]	259[117]	284[129]	322[146]	342[155]	441[200]

Notes: 1. The above data are rated in accordance with AHRI Standard 550/590 with following conditions:
Evaporator leaving fluid temperature 44°F with fluid flow rate 2.4 USgpm/ton; ambient temperature at 95°F; evaporator fouling factor 0.0001hr.ft.² °F/Btu
2. To consult nearest Dunham-Bush sales office for computer selections other than above operating conditions



PHYSICAL SPECIFICATIONS

60 Hz

Model ACDS	010	020	030	040	050	060	070	080
Unit Nominal Capacity TR[kW]	10.5[36.8]	22.2[77.9]	28.2[99.2]	44.3[155.8]	55.6[195.6]	64.9[228.3]	73.5[258.6]	84.1[295.7]
Unit Nominal Power Input kW	12.3	25.9	33.1	52.0	65.5	76.9	87.2	99.4
EER	10.23	10.27	10.22	10.22	10.18	10.13	10.12	10.14
COMPRESSOR								
RPM	3500							
Min. % Unit Capacity	50%	50%	50%	25%	25%	25%	25%	25%
No. Of Refrigerant Circuit	1	1	1	2	2	2	2	2
EVAPORATOR								
Water Connector inches[mm]	2.0 [50.8]	2.0 [50.8]	2.0 [50.8]	2.5 [63.5]	2.5 [63.5]	2.5 [63.5]	2.5 [63.5]	2.5 [63.5]
Nominal Water Flow USgpm[m ³ /hr]	25.1 [5.7]	53.2 [12.1]	67.7 [15.4]	106.3 [24.2]	133.5 [30.3]	155.8 [35.4]	176.5 [40.1]	201.8 [45.8]
Nominal Pressure Drop ft.wg[kPa]	12.6 [37.6]	13.4 [40.0]	14.3 [42.8]	17.1 [51.2]	17.1 [51.2]	17.6 [52.7]	13.2 [39.5]	14.5 [43.4]
Min/Max. Water Flow USgpm[m ³ /hr]	23.0/ 73.0 [5.2/ 16.6]	42.0/ 131.0 [9.5/ 29.8]	53.0/ 161.0 [12.0/ 36.6]	72.0/ 216.0 [16.4/ 49.1]	90.0/ 272.0 [20.4/ 61.8]	116.0/ 351.0 [26.3/ 79.7]	121.0/ 363.0 [27.5/ 82.4]	136.0/ 410.0 [30.9/ 93.1]
Min/Max. Water Pressure Drop ft.wg[kPa]	10.7/ 85.9 [32.0/ 256.8]	8.8/ 67.9 [26.3/ 203.0]	9.2/ 68.1 [27.5/ 203.5]	8.5/ 61.3 [25.4/ 183.2]	8.4/ 61.7 [25.1/ 184.4]	10.4/ 76.1 [31.1/ 227.5]	6.7/ 48.4 [20.0/ 144.7]	7.1/ 52.0 [21.2/ 155.4]
CONDENSER								
Coil Rows Deep/ Total Face Area ft ² [m ²]	3/ 20.0 [1.9]	3/ 40.6 [3.8]	4/ 47.1 [4.4]	3/ 94.1 [8.7]	3/ 94.1 [8.7]	4/ 94.1 [8.7]	4/ 94.1 [8.7]	4/ 133.0 [12.4]
Total Air Flow cfm[m ³ /hr]	10150 [17247]	24740 [42038]	24570 [41749]	51940 [88256]	50380 [85605]	49940 [84858]	48280 [82037]	71400 [121323]
No Of Fan	1	2	2	4	4	4	4	6
Fan Diameter inches[mm]	30.0 [762]	31.5 [800]	31.5 [800]	31.5 [800]	31.5 [800]	31.5 [800]	31.5 [800]	31.5 [800.0]
Motor kW ¹ (Qty)	1.41 (1)	1.85 (2)	1.85 (2)	1.85 (4)	1.85 (4)	1.85 (4)	1.85 (4)	1.85 (6)
Fan FLA , Amp (Qty)	2.7 (1)	3.4 (2)	3.4 (4)	3.4 (4)	3.4 (4)	3.4 (4)	3.4 (4)	3.4 (6)
GENERAL								
Unit Length inches[mm]	50 1/8 [1280]	96 [2440]	96 [2440]	112 1/8 [2850]	112 1/8 [2850]	112 1/8 [2850]	112 1/8 [2850]	147 3/4 [3750]
Unit Width inches[mm]	51 1/4 [1300]	49 1/4 [1250]	52 3/4 [1340]	89 [2260]	89 [2260]	89 [2260]	89 [2260]	89 [2260]
Unit Height inches[mm]	55 1/2 [1410]	69 3/4 [1770]	85 [2155]	82 1/2 [2100]	82 1/2 [2100]	82 1/2 [2100]	82 1/2 [2100]	88 [2240]
Shipping Weight lbs[kg]	929 [421]	1656 [751]	2407 [1092]	3030 [1375]	3501 [1588]	3661 [1661]	3767 [1709]	4865 [2207]
Operating Weight lbs[kg]	934 [424]	1669 [757]	2422 [1099]	3056 [1386]	3535 [1603]	3700 [1678]	3813 [1730]	4918 [2231]
Operating Charge R410A lbs[kg]	26 [12]	51 [23]	77 [35]	101 [46]	128 [58]	152 [69]	179 [81]	203 [92]

Model ACDS	090	100	120	135	150	165	180
Unit Nominal Capacity TR[kW]	92.1 [323.9]	105.0 [369.4]	113.2 [398.3]	127.7 [449.1]	142.8 [502.3]	156.4 [549.9]	171.0 [601.5]
Unit Nominal Power Input kW	109.1	123.4	133.6	146.5	162.6	182.5	200.5
EER	10.13	10.21	10.17	10.46	10.54	10.28	10.24
COMPRESSOR							
RPM	3500						
Min. % Unit Capacity	25%	25%	25%	16.7%	16.7%	16.7%	16.7%
No. Of Refrigerant Circuit	2	2	2	2	2	2	2
EVAPORATOR							
Water Connector inches[mm]	2.5 [63.5]	2.5 [63.5]	2.5 [63.5]	4.0 [101.6]	4.0 [101.6]	4.0 [101.6]	4.0 [101.6]
Nominal Water Flow USgpm[m ³ /hr]	221.0 [50.2]	252.1 [57.3]	271.8 [61.7]	306.5 [69.6]	342.8 [77.9]	375.3 [85.2]	410.5 [93.2]
Nominal Pressure Drop ft.wg[kPa]	13.8 [41.3]	17.5 [52.3]	17.9 [53.6]	11.6 [34.7]	14.2 [42.4]	15.1 [45.0]	14.3 [42.6]
Min/Max. Water Flow USgpm[m ³ /hr]	161.0/ 484.0 [36.6/ 109.9]	161.0/ 484.0 [36.6/ 109.9]	185.0/ 551.0 [42.0/ 125.1]	210.0/ 519.7 [47.7/ 118.0]	210.0/ 519.7 [47.7/ 118.0]	250.0/ 550.3 [56.8/ 125.0]	270.0/ 620.7 [61.3/ 141.0]
Min/Max. Water Pressure Drop ft.wg[kPa]	7.8/ 56.6 [23.3/ 169.2]	7.8/ 56.6 [23.3/ 169.2]	9.0/ 64.0 [26.9/ 191.3]	5.9/ 30.0 [17.6/ 89.7]	5.9/ 30.0 [17.6/ 89.7]	7.3/ 30.0 [21.8/ 89.7]	6.7/ 30.0 [20.0/ 89.7]
CONDENSER							
Coil Rows Deep/ Total Face Area ft ² [m ²]	4/ 133.0 [12.4]	4/ 177.3 [16.5]	4/ 177.3 [16.5]	4/ 235.6 [21.9]	4/ 235.6 [21.9]	4/ 282.6 [26.3]	4/ 282.6 [26.3]
Total Air Flow cfm[m ³ /hr]	71400 [121323]	96960 [164754]	95200 [161764]	124140 [210939]	122850 [208747]	147420 [250496]	147420 [250496]
No Of Fan	8	8	8	10	10	12	12
Fan Diameter inches[mm]	31.5 [800.0]	31.5 [800.0]	31.5 [800.0]	31.5 [800.0]	31.5 [800.0]	31.5 [800.0]	31.5 [800.0]
Motor kW ¹ (Qty)	1.85 (8)	1.85 (8)	1.85 (8)	1.85 (10)	1.85 (10)	1.85 (12)	1.85 (12)
Fan FLA , Amp (Qty)	3.4 (8)	3.4 (8)	3.4 (8)	3.4 (10)	3.4 (10)	3.4 (12)	3.4 (12)
GENERAL							
Unit Length inches[mm]	147 3/4 [3750]	189 1/8 [4800]	189 1/8 [4800]	225 1/2 [5730]	225 1/2 [5730]	267 5/8 [6800]	267 5/8 [6800]
Unit Width inches[mm]	89 [2260]	89 [2260]	89 [2260]	89 [2260]	89 [2260]	89 [2260]	89 [2260]
Unit Height inches[mm]	88 [2240]	88 [2240]	88 [2240]	93 [2360]	93 [2360]	93 [2360]	93 [2360]
Shipping Weight lbs[kg]	5231 [2373]	6196 [2811]	6309 [2862]	7336 [3328]	7888 [3578]	9120 [4137]	9844 [4465]
Operating Weight lbs[kg]	5290 [2400]	6264 [2841]	6383 [2895]	7454 [3381]	8005 [3631]	9251 [4196]	10007 [4539]
Operating Charge R410A lbs[kg]	229 [104]	254 [115]	304 [138]	342 [155]	381 [173]	419 [190]	456 [207]

Notes: 1. The above data are rated in accordance with AHRI Standard 550/590 with following conditions:
 Evaporator leaving fluid temperature 44°F with fluid flow rate 2.4 USgpm/ton; ambient temperature at 95°F; evaporator fouling factor 0.0001hr.ft.².°F/Btu
 2. To consult nearest Dunham-Bush sales office for computer selections other than above operating conditions



PERFORMANCE DATA

50 Hz

LWT °F	MODEL ACDS	AMBIENT TEMPERATURE, °F											
		85			95			105			115		
		TR	kW ¹	EER	TR	kW ¹	EER	TR	kW ¹	EER	TR	kW ¹	EER
40	010	9.4	9.1	10.73	8.7	10.1	9.04	8.0	11.2	7.61	7.2	12.4	6.25
	020	18.6	17.8	10.78	17.4	19.8	9.16	15.9	22.2	7.62	14.5	24.9	6.26
	030	26.1	25.8	10.90	24.1	28.9	9.09	22.1	32.4	7.52	20.1	36.4	6.13
	040	39.0	37.4	10.84	36.2	41.8	9.11	33.2	47.0	7.55	30.1	53.1	6.14
	050	52.4	51.8	10.93	48.8	58.0	9.19	44.8	65.0	7.59	40.6	73.0	6.18
	060	61.2	61.8	10.87	56.7	69.3	9.07	52.0	77.5	7.48	47.0	87.0	6.08
	065	65.4	58.6	11.65	61.4	65.3	9.96	55.9	73.0	8.20	50.7	81.6	6.74
	070	68.1	67.9	10.67	63.9	75.7	9.09	58.2	84.6	7.48	52.8	94.6	6.13
	080	78.3	75.9	11.11	72.8	86.7	9.16	67.1	93.7	7.86	61.0	104.5	6.46
	095	93.0	92.8	10.69	86.6	103.3	9.04	79.8	115.1	7.57	72.6	128.4	6.22
	105	102.4	95.8	11.44	95.3	106.6	9.68	87.5	119.3	8.02	79.4	133.5	6.57
	115	111.8	107.1	11.30	103.6	119.0	9.52	95.1	132.3	7.93	86.1	147.7	6.49
125	125.7	119.0	11.30	117.0	132.3	9.56	107.7	147.3	7.99	97.8	164.4	6.56	
135	136.6	135.3	10.94	126.9	150.6	9.22	116.5	167.8	7.67	105.6	187.1	6.29	
175	174.3	175.5	10.84	162.1	194.3	9.19	149.0	215.5	7.68	135.5	239.2	6.34	
42	010	9.7	9.2	11.02	9.0	10.2	9.34	8.3	11.3	7.86	7.5	12.4	6.49
	020	19.3	17.9	11.11	18.0	20.0	9.41	16.5	22.4	7.85	15.0	25.1	6.43
	030	26.9	26.0	11.15	25.0	29.2	9.37	23.0	32.7	7.75	20.8	36.7	6.30
	040	40.4	37.7	11.16	37.5	42.2	9.38	34.4	47.4	7.77	31.2	53.4	6.33
	050	54.4	52.2	11.25	50.6	58.5	9.44	46.5	65.5	7.82	42.0	73.5	6.36
	060	63.3	62.4	11.14	58.7	69.9	9.31	53.8	78.2	7.68	48.6	87.7	6.24
	065	67.7	59.2	11.96	63.6	66.0	10.22	57.9	73.5	8.45	52.5	82.3	6.92
	070	70.4	68.6	10.94	66.2	76.4	9.33	60.3	85.2	7.71	54.7	95.3	6.31
	080	81.1	76.6	11.41	75.2	87.6	9.37	69.5	94.5	8.08	63.2	105.4	6.64
	095	96.3	93.5	11.00	89.7	104.1	9.30	82.6	116.0	7.77	75.2	129.3	6.40
	105	106.0	96.7	11.75	98.5	107.9	9.89	90.5	120.4	8.23	82.2	134.6	6.75
	115	115.7	108.2	11.59	107.3	120.2	9.77	98.4	133.6	8.13	89.1	149.2	6.65
125	130.2	120.1	11.61	121.1	133.5	9.82	111.5	148.6	8.20	101.3	165.7	6.75	
135	141.5	136.6	11.24	131.3	152.0	9.46	120.7	169.1	7.89	109.3	188.8	6.45	
175	180.4	177.1	11.13	167.4	196.1	9.41	154.1	217.5	7.87	140.1	241.5	6.49	
44	010	10.1	9.2	11.43	9.4	10.2	9.71	8.7	11.3	8.21	7.8	12.5	6.72
	020	19.9	18.1	11.37	18.6	20.2	9.65	17.2	22.6	8.08	15.5	25.3	6.61
	030	27.9	26.3	11.48	25.9	29.5	9.57	23.8	33.0	7.96	21.5	37.0	6.48
	040	41.8	38.0	11.45	38.8	42.5	9.63	35.7	47.7	7.99	32.2	53.8	6.49
	050	56.3	52.7	11.56	52.3	59.2	9.66	48.0	66.1	8.02	43.5	74.2	6.52
	060	65.4	63.0	11.41	61.1	70.8	9.57	55.7	78.9	7.88	50.3	88.4	6.40
	065	70.0	59.8	12.27	66.2	66.9	10.51	59.9	74.2	8.66	54.4	83.0	7.12
	070	73.0	69.3	11.23	68.9	77.5	9.59	62.3	86.0	7.90	56.6	96.1	6.48
	080	83.9	77.4	11.69	78.1	89.1	9.58	71.9	95.4	8.29	65.3	106.3	6.82
	095	99.8	94.4	11.29	93.2	105.0	9.60	85.7	116.9	8.00	78.0	130.3	6.59
	105	109.7	97.7	12.04	101.7	109.1	10.11	93.7	121.4	8.45	85.1	135.7	6.93
	115	119.6	109.4	11.86	110.2	122.5	9.86	101.8	135.0	8.33	92.2	150.4	6.83
125	134.8	121.3	11.91	125.3	134.8	10.07	115.5	149.9	8.43	105.0	167.1	6.94	
135	146.4	138.0	11.52	136.3	153.4	9.74	124.9	170.7	8.09	113.3	190.3	6.64	
175	186.5	178.8	11.41	173.3	198.1	9.65	159.4	219.5	8.07	144.8	243.7	6.65	

LEGEND

LWT : Leaving Chilled Water Temperature

kW¹ : Compressor Power Input In kW

TR : Cooling Capacity In TR.

EER : Unit Energy Efficiency Ratio (Includes power input for compressors and fan motors.)

NOTES:

1. Rating is based on 10°F temperature different at evaporator inlet/outlet fluid temperature, and evaporator fouling factor 0.0001hr.ft².°F/Btu
2. Interpolation between ratings is permissible but extrapolation is NOT.



PERFORMANCE DATA

50 Hz

LWT °F	MODEL ACDS	AMBIENT TEMPERATURE, °F											
		85			95			105			115		
		TR	kW ¹	EER	TR	kW ¹	EER	TR	kW ¹	EER	TR	kW ¹	EER
46	010	10.4	9.2	11.72	9.7	10.3	9.97	9.0	11.4	8.45	8.1	12.6	6.95
	020	20.6	18.3	11.69	19.3	20.4	9.95	17.8	22.7	8.31	16.1	25.5	6.82
	030	28.8	26.5	11.76	26.8	29.7	9.87	24.6	33.2	8.18	22.2	37.3	6.65
	040	43.2	38.4	11.74	40.2	42.9	9.91	37.0	48.1	8.23	33.4	54.1	6.69
	050	58.2	53.2	11.83	54.1	59.5	9.94	49.6	66.7	8.22	45.0	74.7	6.71
	060	67.6	63.8	11.67	62.6	71.3	9.74	57.4	79.7	8.06	52.0	89.2	6.57
	065	72.4	60.4	12.58	68.1	67.2	10.76	62.0	74.9	8.90	56.3	83.7	7.31
	070	75.4	70.0	11.51	70.8	77.8	9.83	64.6	86.7	8.12	58.6	96.9	6.66
	080	86.8	78.2	11.98	80.6	89.4	9.86	74.6	96.2	8.53	67.6	107.2	7.00
	095	103.3	95.3	11.59	96.1	105.9	9.82	88.7	117.8	8.22	80.7	131.3	6.77
	105	113.4	98.7	12.34	105.4	109.9	10.41	96.9	122.5	8.67	88.0	136.9	7.11
	115	123.7	110.7	12.14	114.7	122.7	10.25	105.2	136.3	8.54	95.4	151.9	7.00
125	139.5	122.5	12.22	129.8	135.9	10.36	119.5	151.2	8.65	108.6	168.6	7.12	
135	151.5	139.3	11.82	140.6	154.9	9.96	129.2	172.2	8.30	117.2	192.0	6.81	
175	192.8	180.5	11.69	179.0	200.1	9.88	164.7	221.6	8.27	149.7	246.0	6.82	
48	010	10.8	9.3	12.11	10.0	10.3	10.23	9.3	11.4	8.69	8.4	12.6	7.17
	020	21.4	18.4	12.05	19.9	20.5	10.19	18.4	22.9	8.54	16.6	25.7	6.99
	030	29.8	26.8	12.04	27.7	29.9	10.13	25.4	33.5	8.38	23.1	37.6	6.84
	040	44.7	38.7	12.06	41.6	43.3	10.18	38.2	48.4	8.45	34.5	54.5	6.87
	050	60.3	53.7	12.16	55.9	60.0	10.20	51.4	67.1	8.46	46.6	75.3	6.89
	060	69.9	64.4	11.94	64.7	71.9	9.99	59.3	80.4	8.26	53.8	90.0	6.74
	065	74.9	61.0	12.89	70.3	67.8	11.03	64.1	75.5	9.13	58.2	84.3	7.50
	070	78.0	70.7	11.79	73.3	78.6	10.08	66.7	87.4	8.32	60.6	97.7	6.83
	080	89.8	79.1	12.28	83.3	90.3	10.10	76.9	97.1	8.73	70.0	108.2	7.19
	095	106.8	96.2	11.89	99.4	106.9	10.07	91.7	118.9	8.43	83.6	132.4	6.97
	105	117.3	99.7	12.65	109.0	110.9	10.68	100.2	123.6	8.89	91.1	138.0	7.31
	115	127.9	111.9	12.43	118.6	124.0	10.50	108.8	137.7	8.74	98.6	153.4	7.17
125	144.3	123.7	12.53	134.7	136.6	10.70	123.6	152.6	8.88	112.5	169.9	7.32	
135	156.6	140.7	12.11	145.4	156.3	10.22	133.7	173.7	8.52	121.3	193.7	6.99	
175	199.2	182.1	11.98	183.4	201.6	10.05	170.1	223.8	8.46	154.9	248.0	7.00	
50	010	11.2	9.3	12.40	10.4	10.4	10.60	9.6	11.5	8.94	8.7	12.7	7.40
	020	22.1	18.6	12.36	20.6	20.7	10.49	19.0	23.1	8.77	17.3	25.9	7.19
	030	30.8	27.0	12.34	28.6	30.2	10.39	26.3	33.8	8.60	23.8	37.9	7.00
	040	46.3	39.1	12.37	43.0	43.7	10.44	39.5	48.8	8.68	35.8	54.9	7.07
	050	62.2	54.2	12.44	57.8	60.6	10.44	53.0	67.8	8.65	48.1	76.0	7.06
	060	72.1	65.1	12.19	66.8	72.7	10.21	61.2	81.2	8.44	55.4	90.8	6.89
	065	77.4	61.6	13.21	72.7	68.5	11.29	66.2	76.2	9.36	60.1	85.1	7.69
	070	80.6	71.4	12.08	75.6	79.3	10.31	68.9	88.2	8.53	62.6	98.6	7.00
	080	92.8	79.9	12.57	86.0	91.3	10.32	79.4	98.1	8.93	72.4	109.1	7.37
	095	110.5	97.1	12.20	103.0	107.7	10.36	94.9	119.8	8.67	86.4	133.5	7.14
	105	121.2	100.8	12.94	112.6	112.0	10.93	103.6	124.8	9.11	94.2	139.2	7.50
	115	132.1	113.2	12.70	122.5	125.3	10.74	112.4	139.1	8.95	101.9	154.9	7.34
125	149.2	125.0	12.83	138.8	138.6	10.88	127.8	153.9	9.11	116.4	171.4	7.51	
135	161.9	142.2	12.40	150.2	157.9	10.45	138.2	175.3	8.74	125.4	195.5	7.17	
175	205.7	183.8	12.27	189.5	203.3	10.30	175.7	225.8	8.67	159.8	250.5	7.16	

LEGEND

LWT : Leaving Chilled Water Temperature

kW¹ : Compressor Power Input In kW

TR : Cooling Capacity In TR.

EER : Unit Energy Efficiency Ratio (Includes power input for compressors and fan motors.)

NOTES:

- Rating is based on 10°F temperature different at evaporator inlet/outlet fluid temperature, and evaporator fouling factor 0.0001hr.ft².°F/Btu
- Interpolation between ratings is permissible but extrapolation is NOT.



PERFORMANCE DATA

60 Hz

LWT °F	MODEL ACDS	AMBIENT TEMPERATURE, °F											
		85			95			105			115		
		TR	kW ⁱ	EER	TR	kW ⁱ	EER	TR	kW ⁱ	EER	TR	kW ⁱ	EER
40	010	10.4	9.6	11.39	9.7	10.7	9.64	9.0	12.0	8.07	8.1	13.3	6.63
	020	22.1	19.7	11.33	20.7	21.8	9.73	19.1	24.1	8.24	17.4	26.8	6.85
	030	28.2	25.9	11.42	26.2	28.9	9.64	24.1	32.4	8.02	21.9	36.4	6.54
	040	44.3	39.7	11.28	41.3	43.8	9.69	38.2	48.4	8.21	34.8	53.8	6.82
	050	55.7	51.3	11.40	51.7	57.2	9.61	47.5	64.1	7.97	42.9	72.1	6.48
	060	65.2	61.2	11.40	60.5	68.3	9.60	55.6	76.3	7.97	50.2	85.5	6.49
	070	74.2	70.1	11.49	68.8	78.1	9.65	63.2	87.1	8.02	57.1	97.2	6.55
	080	84.4	77.9	11.38	78.5	86.7	9.64	72.4	96.4	8.08	65.8	107.3	6.67
	090	92.5	86.6	11.37	86.0	96.0	9.63	79.2	106.6	8.08	71.9	118.4	6.66
	100	105.0	96.5	11.33	97.9	106.6	9.68	90.4	118.2	8.16	82.5	131.2	6.78
	120	113.2	105.6	11.28	105.5	116.6	9.63	97.3	128.9	8.13	88.5	143.1	6.73
	135	127.5	113.3	11.61	119.1	125.9	9.90	110.1	140.2	8.33	100.7	156.1	6.92
	150	142.9	127.8	11.72	133.2	141.6	9.98	123.0	157.3	8.40	112.3	174.7	6.97
165	156.0	142.6	11.35	145.7	157.5	9.73	134.7	174.6	8.21	123.1	193.8	6.84	
180	170.8	158.8	11.33	159.3	175.0	9.70	147.1	193.6	8.18	134.1	214.7	6.79	
42	010	10.8	9.6	11.74	10.1	10.8	9.93	9.3	12.0	8.32	8.4	13.4	6.83
	020	22.9	19.9	11.65	21.4	22.0	10.01	19.8	24.3	8.47	18.0	27.0	7.05
	030	29.2	26.1	11.77	27.2	29.2	9.93	25.0	32.6	8.26	22.7	36.7	6.74
	040	45.8	40.1	11.58	42.8	44.2	9.95	39.5	48.9	8.42	36.0	54.3	7.00
	050	57.7	51.7	11.73	53.6	57.7	9.88	49.2	64.6	8.20	44.5	72.6	6.67
	060	67.5	61.7	11.72	62.7	68.9	9.86	57.6	77.0	8.19	52.0	86.2	6.67
	070	76.7	70.8	11.77	71.1	78.9	9.89	65.3	88.0	8.22	59.0	98.2	6.71
	080	87.4	78.7	11.68	81.3	87.5	9.89	74.9	97.3	8.29	68.1	108.4	6.84
	090	95.7	87.5	11.66	89.0	97.0	9.88	81.9	107.7	8.28	74.4	119.7	6.83
	100	108.7	97.4	11.63	101.4	107.7	9.93	93.6	119.4	8.37	85.4	132.5	6.96
	120	117.4	106.5	11.61	109.3	117.6	9.91	100.9	130.0	8.36	91.8	144.3	6.92
	135	132.0	114.3	11.93	123.3	126.9	10.18	114.0	141.3	8.56	104.3	157.4	7.11
	150	148.0	128.9	12.05	138.0	142.9	10.26	127.4	158.7	8.63	116.3	176.3	7.17
165	161.5	144.0	11.66	150.9	159.0	9.99	139.5	176.3	8.43	127.5	195.6	7.03	
180	176.9	160.4	11.63	165.1	176.8	9.96	152.4	195.6	8.40	138.9	216.9	6.97	
44	010	11.2	9.7	12.10	10.5	10.9	10.23	9.7	12.1	8.57	8.7	13.5	7.04
	020	23.7	20.1	11.95	22.2	22.2	10.27	20.5	24.5	8.69	18.7	27.3	7.23
	030	30.3	26.3	12.12	28.2	29.4	10.22	25.9	32.9	8.50	23.5	37.0	6.94
	040	47.5	40.5	11.90	44.3	44.6	10.22	40.9	49.4	8.65	37.3	54.9	7.19
	050	59.9	52.1	12.09	55.6	58.1	10.18	51.0	65.1	8.45	46.1	73.2	6.87
	060	69.9	62.3	12.04	64.9	69.5	10.13	59.6	77.6	8.41	53.9	87.0	6.85
	070	79.3	71.5	12.05	73.5	79.8	10.12	67.5	88.9	8.41	61.0	99.2	6.86
	080	90.4	79.5	11.98	84.1	88.3	10.14	77.5	98.3	8.50	70.5	109.4	7.02
	090	99.1	88.3	11.96	92.1	98.0	10.13	84.8	108.7	8.49	77.0	120.8	7.00
	100	112.7	98.3	11.95	105.0	108.6	10.21	97.0	120.4	8.61	88.5	133.6	7.15
	120	121.6	107.6	11.92	113.2	118.8	10.17	104.5	131.3	8.58	95.1	145.8	7.11
	135	136.8	115.3	12.27	127.7	128.0	10.46	118.1	142.6	8.80	108.0	158.8	7.31
	150	153.2	130.1	12.37	142.8	144.1	10.54	131.9	160.1	8.86	120.4	177.8	7.36
165	167.4	145.2	12.00	156.4	160.3	10.28	144.6	177.7	8.68	132.2	197.3	7.23	
180	183.3	161.8	11.96	171.0	178.3	10.24	157.9	197.3	8.63	144.0	218.7	7.17	

LEGEND

LWT : Leaving Chilled Water Temperature

kWⁱ : Compressor Power Input In kW

TR : Cooling Capacity In TR.

EER : Unit Energy Efficiency Ratio (Includes power input for compressors and fan motors.)

NOTES:

1. Rating is based on 10°F temperature different at evaporator inlet/outlet fluid temperature, and evaporator fouling factor 0.0001hr.ft².°F/Btu
2. Interpolation between ratings is permissible but extrapolation is NOT.



PERFORMANCE DATA

60 Hz

LWT °F	MODEL ACDS	AMBIENT TEMPERATURE, °F											
		85			95			105			115		
		TR	kW ⁱ	EER	TR	kW ⁱ	EER	TR	kW ⁱ	EER	TR	kW ⁱ	EER
46	010	11.6	9.8	12.47	10.8	10.9	10.54	10.0	12.2	8.83	9.1	13.6	7.25
	020	24.6	20.3	12.26	22.9	22.4	10.53	21.2	24.8	8.91	19.3	27.6	7.41
	030	31.4	26.5	12.47	29.2	29.6	10.52	26.9	33.1	8.75	24.4	37.2	7.14
	040	49.1	40.9	12.20	45.8	45.1	10.48	42.3	49.9	8.87	38.6	55.4	7.37
	050	62.0	52.5	12.43	57.6	58.6	10.47	52.9	65.6	8.69	47.8	73.8	7.06
	060	72.3	62.9	12.33	67.1	70.2	10.38	61.6	78.4	8.61	55.7	87.9	7.02
	070	82.0	72.2	12.36	76.0	80.5	10.38	69.8	89.7	8.62	63.1	100.2	7.04
	080	93.6	80.2	12.31	87.0	89.1	10.42	80.2	99.1	8.73	72.9	110.4	7.21
	090	102.4	89.2	12.26	95.2	98.9	10.38	87.7	109.8	8.70	79.6	122.0	7.17
	100	116.6	99.2	12.28	108.8	109.6	10.49	100.4	121.5	8.84	91.6	134.8	7.35
	120	125.8	108.6	12.23	117.2	119.9	10.44	108.2	132.6	8.81	98.4	147.2	7.29
	135	141.6	116.3	12.60	132.2	129.2	10.74	122.2	143.8	9.03	111.8	160.2	7.51
150	158.5	131.4	12.68	147.7	145.6	10.80	136.5	161.7	9.08	124.5	179.7	7.54	
165	173.3	146.6	12.32	161.9	161.9	10.55	149.6	179.4	8.91	136.8	199.2	7.42	
180	189.8	163.4	12.27	177.1	180.0	10.51	163.4	199.2	8.86	149.0	220.9	7.36	
48	010	12.0	9.8	12.84	11.2	11.0	10.86	10.4	12.3	9.09	9.4	13.7	7.47
	020	25.4	20.6	12.56	23.7	22.7	10.79	21.9	25.1	9.13	20.0	27.9	7.59
	030	32.5	26.7	12.82	30.3	29.9	10.81	27.8	33.4	8.99	25.2	37.6	7.33
	040	50.8	41.3	12.51	47.4	45.6	10.74	43.8	50.4	9.09	39.9	56.0	7.55
	050	64.2	53.0	12.77	59.6	59.1	10.76	54.7	66.2	8.93	49.5	74.4	7.26
	060	74.8	63.5	12.66	69.4	70.8	10.65	63.8	79.1	8.84	57.6	88.6	7.20
	070	84.7	73.0	12.64	78.5	81.4	10.62	72.1	90.7	8.82	65.1	101.2	7.20
	080	96.7	80.9	12.61	90.0	90.0	10.68	82.9	100.1	8.95	75.4	111.5	7.38
	090	105.9	90.1	12.55	98.4	99.9	10.64	90.6	110.9	8.91	82.2	123.2	7.35
	100	120.7	100.2	12.59	112.5	110.7	10.76	103.9	122.7	9.06	94.8	136.2	7.53
	120	130.2	109.7	12.55	121.3	121.1	10.71	111.9	133.9	9.03	101.8	148.6	7.48
	135	146.5	117.3	12.94	136.8	130.3	11.03	126.4	145.1	9.27	115.6	161.6	7.71
150	164.0	132.6	13.02	152.8	146.9	11.09	141.2	163.2	9.32	128.8	181.3	7.74	
165	179.4	147.9	12.65	167.6	163.4	10.84	154.9	181.1	9.14	141.6	201.0	7.62	
180	196.5	165.0	12.60	183.3	181.8	10.78	169.2	201.2	9.09	154.3	223.1	7.55	
50	010	12.4	9.9	13.20	11.6	11.1	11.16	10.7	12.3	9.34	9.7	13.8	7.67
	020	26.3	20.8	12.87	24.5	22.9	11.05	22.6	25.3	9.35	20.6	28.2	7.77
	030	33.7	27.0	13.18	31.3	30.1	11.11	28.8	33.7	9.24	26.1	37.9	7.54
	040	52.5	41.8	12.81	49.0	46.1	11.00	45.3	50.9	9.31	41.3	56.6	7.74
	050	66.4	53.5	13.10	61.7	59.7	11.04	56.6	66.8	9.16	51.2	75.1	7.44
	060	77.3	64.2	12.96	71.7	71.6	10.90	65.9	80.0	9.05	59.6	89.6	7.37
	070	87.5	73.8	12.93	81.1	82.2	10.86	74.5	91.7	9.02	67.3	102.3	7.36
	080	99.9	81.7	12.92	93.0	90.9	10.94	85.7	101.1	9.16	77.9	112.6	7.56
	090	109.3	91.1	12.83	101.6	101.1	10.87	93.5	112.1	9.11	84.9	124.6	7.51
	100	124.8	101.2	12.91	116.3	111.8	11.02	107.4	124.0	9.29	98.0	137.6	7.72
	120	134.7	110.8	12.87	125.5	122.3	10.98	115.8	135.2	9.27	105.4	150.1	7.67
	135	151.4	118.4	13.27	141.4	131.5	11.31	130.7	146.5	9.51	119.6	163.1	7.90
150	169.4	134.0	13.33	157.9	148.4	11.35	145.9	164.9	9.55	133.1	183.2	7.92	
165	185.6	149.4	12.98	173.3	164.9	11.12	160.3	182.8	9.38	146.5	202.9	7.81	
180	203.2	166.6	12.92	189.6	183.6	11.05	175.0	203.2	9.32	159.6	225.3	7.74	

LEGEND

LWT : Leaving Chilled Water Temperature

kWⁱ : Compressor Power Input In kW

TR : Cooling Capacity In TR.

EER : Unit Energy Efficiency Ratio (Includes power input for compressors and fan motors.)

NOTES:

1. Rating is based on 10°F temperature different at evaporator inlet/outlet fluid temperature, and evaporator fouling factor 0.0001hr.ft².°F/Btu
2. Interpolation between ratings is permissible but extrapolation is NOT.

SOUND PRESSURE DATA

50 Hz

MODEL	BAND (Hz)								TOTAL
	63	125	250	500	1K	2K	4K	8K	
1. FOR STANDARD UNIT									
ACDS 010	26	31	41	45	46	44	41	36	51
ACDS 020	29	34	44	52	52	52	48	41	58
ACDS 030	29	34	43	49	49	49	44	39	55
ACDS 040	31	37	46	51	53	54	48	42	58
ACDS 050	31	37	46	52	52	52	47	42	58
ACDS 060	31	37	46	52	52	53	47	42	58
ACDS 065	33	38	48	53	54	53	49	44	59
ACDS 070	33	38	48	53	54	53	49	44	59
ACDS 080	33	38	48	53	54	53	49	44	59
ACDS 095	34	39	49	54	55	54	50	44	60
ACDS 105	34	39	49	54	55	55	50	45	60
ACDS 115	34	39	49	54	55	54	50	45	60
ACDS 125	35	40	50	55	56	55	51	45	61
ACDS 135	35	40	50	55	56	55	51	45	61
ACDS 175	36	41	50	58	59	56	52	46	63
2. FOR LOW NOISE FAN ONLY (WITH LNF OPTION)									
ACDS 010	6	27	32	34	36	37	32	25	42
ACDS 020	8	29	39	50	49	51	46	38	55
ACDS 030	8	29	36	45	41	46	38	32	50
ACDS 040	11	32	38	41	47	53	42	33	55
ACDS 050	11	32	38	48	44	48	41	35	53
ACDS 060	11	32	38	47	44	50	42	36	53
ACDS 065	13	34	40	48	47	49	42	36	54
ACDS 070	13	34	40	48	47	49	42	36	54
ACDS 080	13	34	39	45	49	50	42	36	54
ACDS 095	14	35	40	49	48	50	44	34	55
ACDS 105	14	35	40	48	49	51	43	37	55
ACDS 115	14	35	40	47	50	51	43	37	55
ACDS 125	15	36	41	49	50	51	45	36	56
ACDS 135	15	36	41	50	50	52	46	35	56
ACDS 175	15	36	42	55	56	52	47	34	60
3. FOR COMPRESSOR JACKET ONLY (WITH LN2 OPTION)									
ACDS 010	26	31	41	45	46	44	41	36	51
ACDS 020	29	34	44	52	52	52	48	41	58
ACDS 030	29	34	43	49	49	49	44	39	55
ACDS 040	31	37	46	51	53	54	48	42	58
ACDS 050	31	37	46	52	52	52	47	42	58
ACDS 060	31	37	46	50	52	50	47	42	57
ACDS 065	33	38	48	52	53	52	48	43	58
ACDS 070	33	38	48	52	53	52	48	43	58
ACDS 080	33	38	48	52	53	52	48	43	58
ACDS 095	34	39	49	53	54	53	49	44	59
ACDS 105	34	39	49	53	54	53	49	44	59
ACDS 115	34	39	49	53	54	53	49	44	59
ACDS 125	35	40	50	54	55	54	50	45	60
ACDS 135	35	40	50	54	55	54	50	45	60
ACDS 175	36	41	50	55	56	54	51	46	61
4. FOR LOW NOISE FAN + COMPRESSOR JACKET (WITH LNF + LN2 OPTIONS)									
ACDS 010	6	27	32	34	36	37	32	24	42
ACDS 020	8	29	35	39	42	44	37	28	47
ACDS 030	8	29	35	38	39	41	35	27	45
ACDS 040	11	32	38	40	43	46	38	30	49
ACDS 050	11	32	38	40	42	43	37	30	48
ACDS 060	11	32	38	40	42	44	38	30	48
ACDS 065	13	34	39	42	44	45	39	32	50
ACDS 070	13	34	39	42	44	45	39	32	50
ACDS 080	13	34	39	41	44	45	39	32	50
ACDS 095	14	35	40	43	45	46	40	33	51
ACDS 105	14	35	40	43	45	46	40	33	51
ACDS 115	14	35	40	43	45	46	40	33	51
ACDS 125	15	36	41	44	46	47	41	33	51
ACDS 135	15	36	41	44	46	47	41	33	52
ACDS 175	15	36	42	45	49	48	42	34	53

Note: Unit Sound Pressure Level (Lp) @ 30 FT [9m] (free field), ± 2 dB tolerance.

SOUND PRESSURE DATA

60 Hz

MODEL	OCTAVE BAND (Hz)								TOTAL dB (A)
	63	125	250	500	1K	2K	4K	8K	
1. FOR STANDARD UNIT									
ACDS 010	30	35	45	49	50	48	45	40	55
ACDS 020	33	38	47	52	53	54	48	43	59
ACDS 030	33	38	47	54	55	53	49	43	60
ACDS 040	35	41	50	55	56	56	51	46	61
ACDS 050	35	41	50	57	57	56	52	46	62
ACDS 060	35	41	51	57	57	57	52	47	63
ACDS 070	35	41	51	57	57	58	53	48	63
ACDS 080	37	42	52	58	58	58	53	48	64
ACDS 090	37	42	52	58	59	58	53	48	64
ACDS 100	38	43	53	60	62	60	55	49	66
ACDS 120	38	43	53	62	63	61	56	49	67
ACDS 135	39	44	54	62	63	61	56	50	67
ACDS 150	39	44	54	62	63	61	56	50	67
ACDS 165	40	45	54	62	63	61	56	50	68
ACDS 180	40	45	54	63	65	62	57	50	69
2. FOR LOW NOISE FAN ONLY (WITH LNF OPTION)									
ACDS 010	24	37	41	45	47	45	40	34	51
ACDS 020	26	40	44	48	51	52	44	37	56
ACDS 030	26	40	44	52	53	51	46	39	57
ACDS 040	29	43	47	50	53	55	46	40	59
ACDS 050	29	43	47	54	55	54	49	42	60
ACDS 060	29	43	48	55	55	56	49	44	61
ACDS 070	29	43	48	55	55	57	50	45	61
ACDS 080	31	44	49	55	56	57	50	44	61
ACDS 090	31	44	48	55	56	56	49	43	61
ACDS 100	32	45	49	59	60	59	52	43	65
ACDS 120	32	45	50	61	62	60	53	44	66
ACDS 135	33	46	51	61	62	60	53	46	66
ACDS 150	33	46	51	61	62	60	53	46	66
ACDS 165	33	47	51	62	62	60	53	46	66
ACDS 180	33	47	51	62	64	61	54	46	68
3. FOR COMPRESSOR JACKET ONLY (WITH LN2 OPTION)									
ACDS 010	30	35	45	49	50	48	45	40	55
ACDS 020	33	38	47	52	53	52	48	43	58
ACDS 030	33	38	47	52	53	51	48	43	58
ACDS 040	35	41	50	54	56	54	51	46	61
ACDS 050	35	41	50	55	56	54	51	46	61
ACDS 060	35	41	50	55	56	54	51	46	61
ACDS 070	35	41	50	55	56	55	51	46	61
ACDS 080	37	42	52	56	57	56	52	47	62
ACDS 090	37	42	52	56	57	56	52	47	62
ACDS 100	38	43	53	57	59	57	54	48	64
ACDS 120	38	43	53	57	59	57	54	48	64
ACDS 135	39	44	54	58	59	58	54	49	64
ACDS 150	39	44	54	58	59	58	54	49	64
ACDS 165	40	45	54	59	60	59	55	50	65
ACDS 180	40	45	54	59	61	59	55	50	65
4. FOR LOW NOISE FAN + COMPRESSOR JACKET (WITH LNF + LN2 OPTIONS)									
ACDS 010	24	37	41	45	47	45	39	34	51
ACDS 020	26	40	44	47	50	48	42	36	54
ACDS 030	26	40	44	47	50	48	43	36	54
ACDS 040	29	43	47	50	52	51	45	39	57
ACDS 050	29	43	47	50	53	51	45	39	57
ACDS 060	29	43	47	50	53	51	45	39	57
ACDS 070	29	43	47	50	53	51	45	39	57
ACDS 080	31	44	48	52	54	53	47	41	59
ACDS 090	31	44	48	52	54	53	47	41	59
ACDS 100	32	45	49	53	56	54	48	42	60
ACDS 120	32	45	49	53	57	55	48	42	61
ACDS 135	33	46	50	54	56	55	49	43	61
ACDS 150	33	46	50	54	56	55	49	43	61
ACDS 165	33	47	51	55	57	56	50	43	62
ACDS 180	33	47	51	55	58	56	50	43	62

Note: Unit Sound Pressure Level (Lp) @ 30 FT [9m] (free field), ± 2 dB tolerance.

ELECTRICAL DATA

Model	Unit Electrical Data (Standard Unit)				Compressor Data			Condenser Fan Motor Data		
	RLA	MCA	MFS	Max. Inrush	Qty	RLA	LRA	Qty	Hp	FLA/Mtr
Power Supply : 400Vac-3Ph-50Hz										
ACDS 010	25	28	32	114	2	11	100	1	1.5	3.2
ACDS 020	43	47	63	182	1	18	147	2	1.5	3.2
ACDS 030	62	68	80	246	1	25	170	2	1.5	3.2
ACDS 040	88	93	100	227	4	19	158	4	1.5	3.2
ACDS 050	124	131	150	308	2	25	170	4	1.5	3.2
ACDS 060	140	148	175	323	4	31	215	4	1.5	3.2
ACDS 065	146	154	175	328	4	32	215	6	1.5	3.2
ACDS 070	161	172	200	381	2	31	215	6	1.5	3.2
ACDS 080	183	193	225	402	4	41	260	6	1.5	3.2
ACDS 095	199	210	250	476	4	43	320	8	1.5	3.2
ACDS 105	239	249	300	458	3	30	215	8	1.5	3.2
ACDS 115	272	282	300	491	6	41	260	8	1.5	3.2
ACDS 125	281	292	350	557	3	39	260	10	1.5	3.2
ACDS 135	296	307	350	572	6	44	320	10	1.5	3.2
ACDS 175	380	395	450	736	6	57	413	12	1.5	3.2
Power Supply : 208~230Vac-3Ph-60Hz										
ACDS 010	55	62	80	175	2	25	145	1	1.5	5.4
ACDS 020	103	114	150	361	2	46	304	2	1.5	5.4
ACDS 030	126	140	175	390	2	56	320	2	2	7.2
ACDS 040	213	224	250	471	4	46	304	4	2	7.2
ACDS 050	253	267	300	517	4	56	320	4	2	7.2
ACDS 060	291	310	350	701	2	56	320	4	2	7.2
ACDS 070	329	348	400	739	4	75	485	4	2	7.2
ACDS 080	381	405	450	847	2	75	485	6	2	7.2
ACDS 090	419	443	500	885	4	94	560	6	2	7.2
ACDS 100	464	491	500	970	2	94	560	8	2	7.2
ACDS 120	494	521	600	1000	4	109	615	8	2	7.2
ACDS 135	579	603	700	1045	3	75	485	10	2	7.2
ACDS 150	636	660	700	1102	6	94	560	10	2	7.2
ACDS 165	695	723	800	1201	3	94	560	12	2	7.2
ACDS 180	740	768	800	1246	6	109	615	12	2	7.2
Power Supply : 460Vac-3Ph-60Hz										
ACDS 010	19	21	25	98	2	8	87	1	1.5	2.7
ACDS 020	47	53	70	194	2	21	147	2	1.5	2.7
ACDS 030	61	68	90	241	2	27	180	2	2	3.4
ACDS 040	98	103	110	245	4	21	147	4	2	3.4
ACDS 050	122	128	150	302	4	27	180	4	2	3.4
ACDS 060	140	149	175	319	2	27	180	4	2	3.4
ACDS 070	158	167	200	373	4	36	215	4	2	3.4
ACDS 080	184	196	225	398	2	36	215	6	2	3.4
ACDS 090	204	216	250	464	4	46	260	6	2	3.4
ACDS 100	231	245	300	495	2	46	260	8	2	3.4
ACDS 120	251	265	300	571	4	56	320	8	2	3.4
ACDS 135	280	292	300	494	3	36	215	10	2	3.4
ACDS 150	310	322	350	524	6	46	260	10	2	3.4
ACDS 165	347	361	400	611	3	46	260	12	2	3.4
ACDS 180	377	391	400	641	6	56	320	12	2	3.4
Power Supply : 575Vac-3Ph-60Hz										
ACDS 010	16	18	25	72	2	7	62	1	1.5	2.2
ACDS 020	42	47	60	145	2	19	122	2	1.5	2.2
ACDS 030	47	53	70	161	2	21	135	2	2	2.7
ACDS 040	87	92	110	190	4	19	122	4	2	2.7
ACDS 050	95	100	110	209	4	21	135	4	2	2.7
ACDS 060	111	118	125	257	2	21	135	4	2	2.7
ACDS 070	127	134	150	273	4	29	175	4	2	2.7
ACDS 080	150	160	175	322	2	29	175	6	2	2.7
ACDS 090	168	178	200	340	4	38	210	6	2	2.7
ACDS 100	184	194	225	376	2	38	210	8	2	2.7
ACDS 120	194	204	225	386	4	43	235	8	2	2.7
ACDS 135	228	238	275	400	3	29	175	10	2	2.7
ACDS 150	255	265	300	427	6	38	210	10	2	2.7
ACDS 165	275	286	300	467	3	38	210	12	2	2.7
ACDS 180	290	301	350	482	6	43	235	12	2	2.7

Note: MCA - Minimum Circuit Amps MFS - Maximum Fuse Size RLA - Running Load Amps FLA - Full Load Amps LRA - Locked Rotor Amps

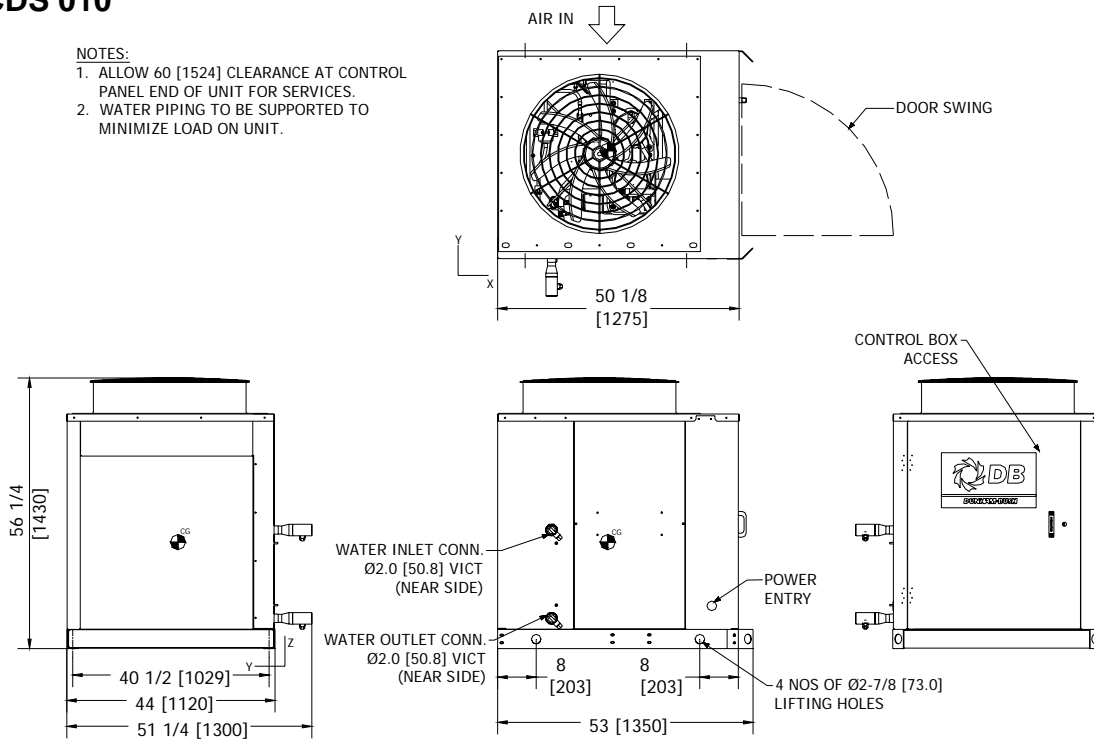
DIMENSIONAL DATA

50 Hz

ACDS 010

NOTES:

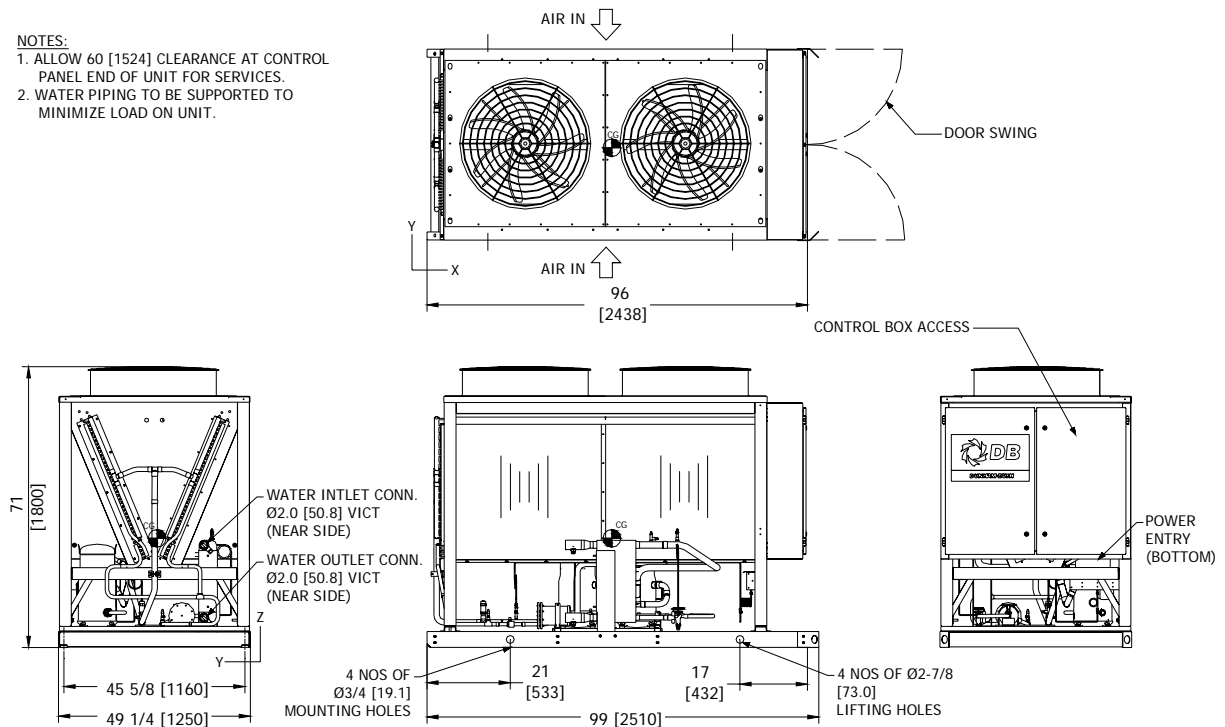
1. ALLOW 60 [1524] CLEARANCE AT CONTROL PANEL END OF UNIT FOR SERVICES.
2. WATER PIPING TO BE SUPPORTED TO MINIMIZE LOAD ON UNIT.



ACDS 020

NOTES:

1. ALLOW 60 [1524] CLEARANCE AT CONTROL PANEL END OF UNIT FOR SERVICES.
2. WATER PIPING TO BE SUPPORTED TO MINIMIZE LOAD ON UNIT.



Note: All dimensions are in inches [mm].

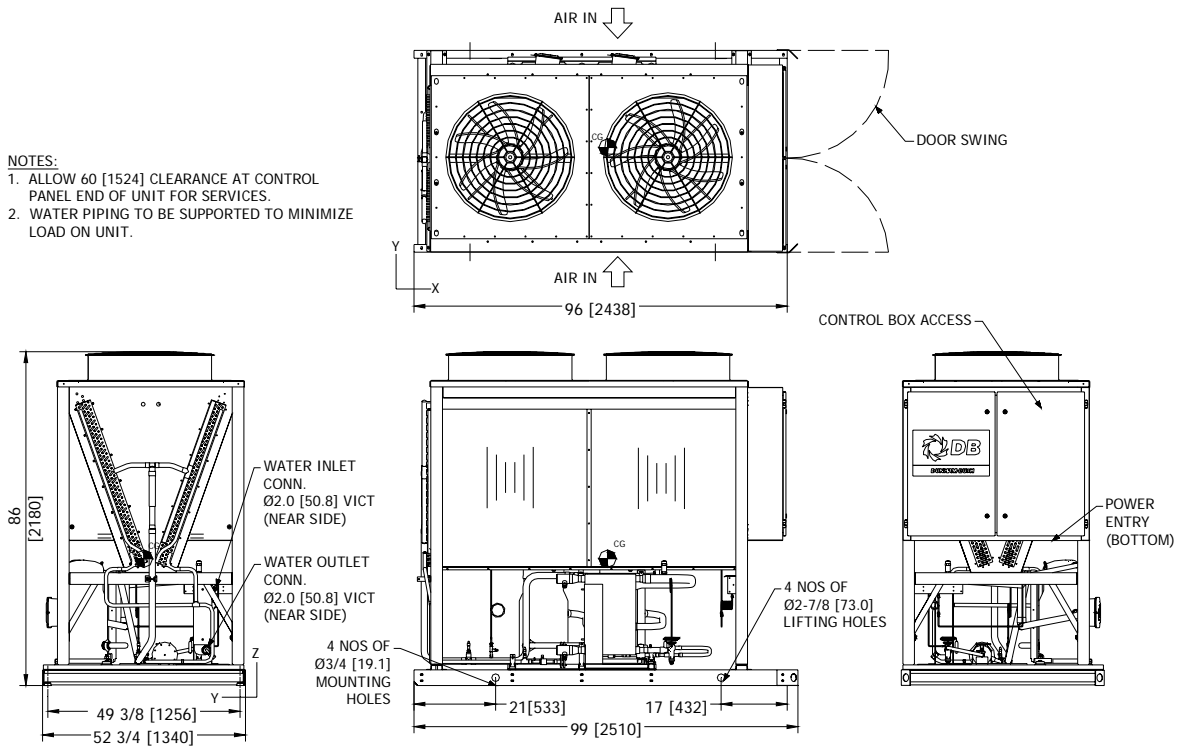
DIMENSIONAL DATA

50 Hz

ACDS 030

NOTES:

1. ALLOW 60 [1524] CLEARANCE AT CONTROL PANEL END OF UNIT FOR SERVICES.
2. WATER PIPING TO BE SUPPORTED TO MINIMIZE LOAD ON UNIT.

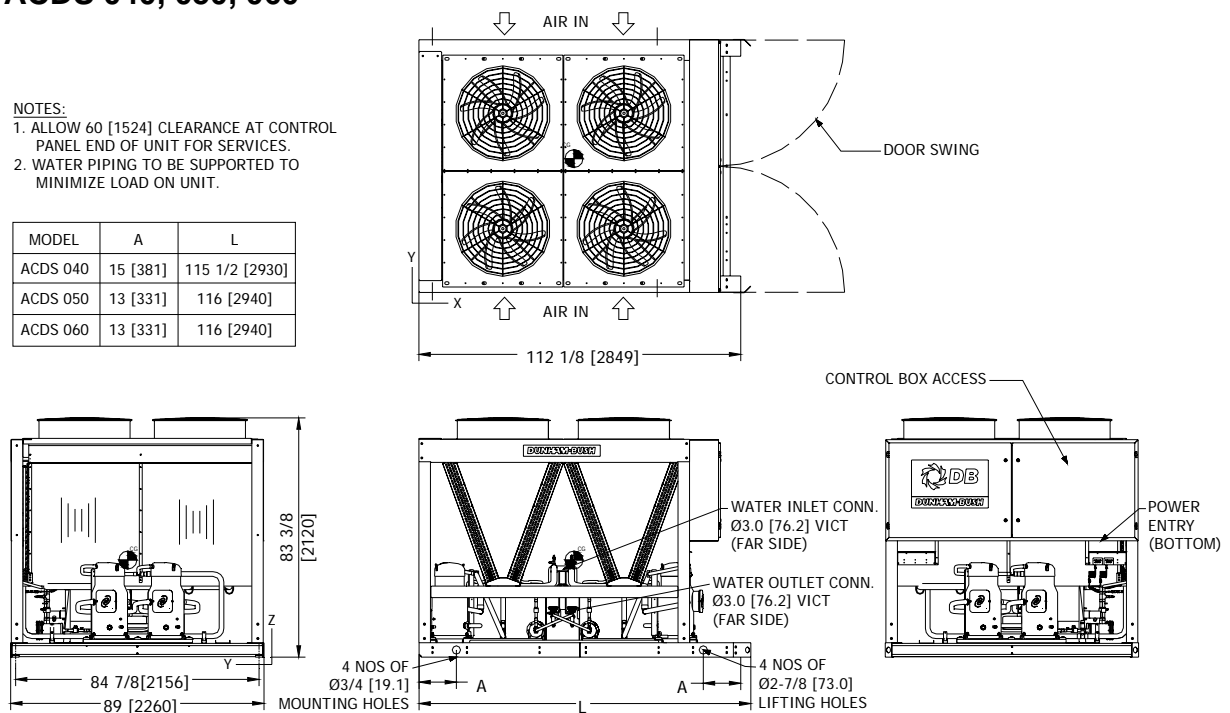


ACDS 040, 050, 060

NOTES:

1. ALLOW 60 [1524] CLEARANCE AT CONTROL PANEL END OF UNIT FOR SERVICES.
2. WATER PIPING TO BE SUPPORTED TO MINIMIZE LOAD ON UNIT.

MODEL	A	L
ACDS 040	15 [381]	115 1/2 [2930]
ACDS 050	13 [331]	116 [2940]
ACDS 060	13 [331]	116 [2940]



Note: All dimensions are in inches [mm].

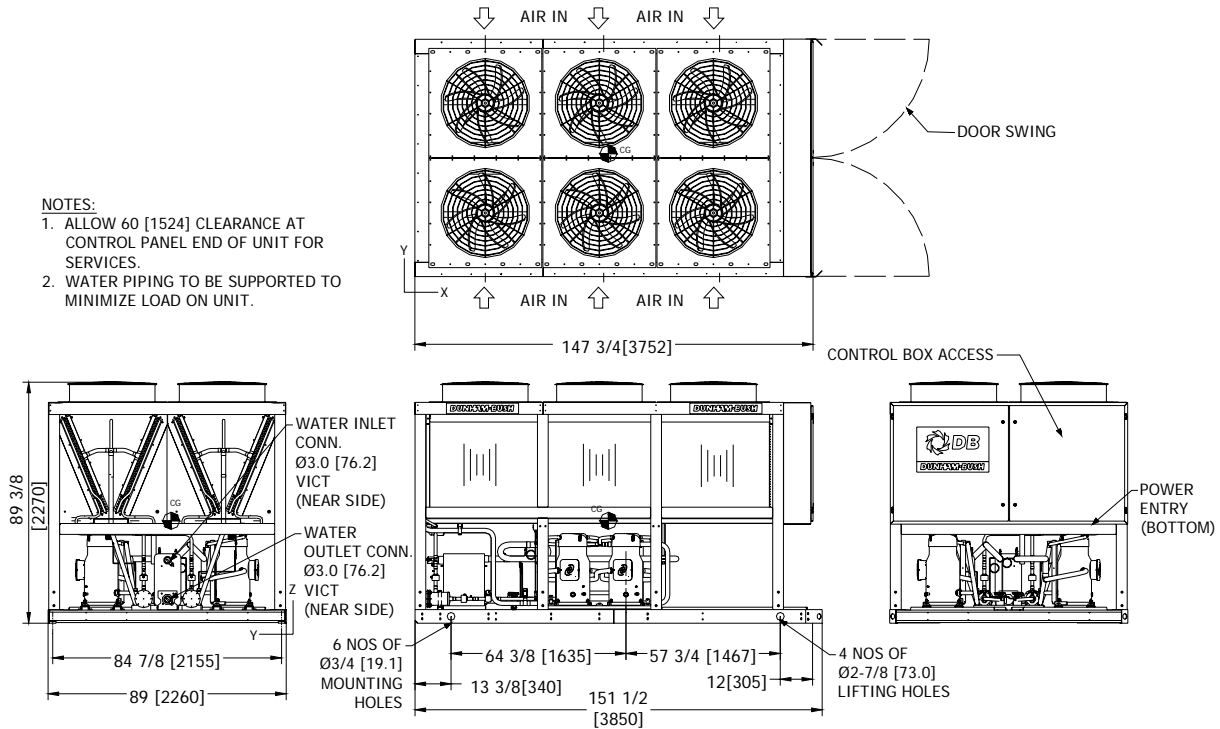
DIMENSIONAL DATA

50 Hz

ACDS 065, 070, 080

NOTES:

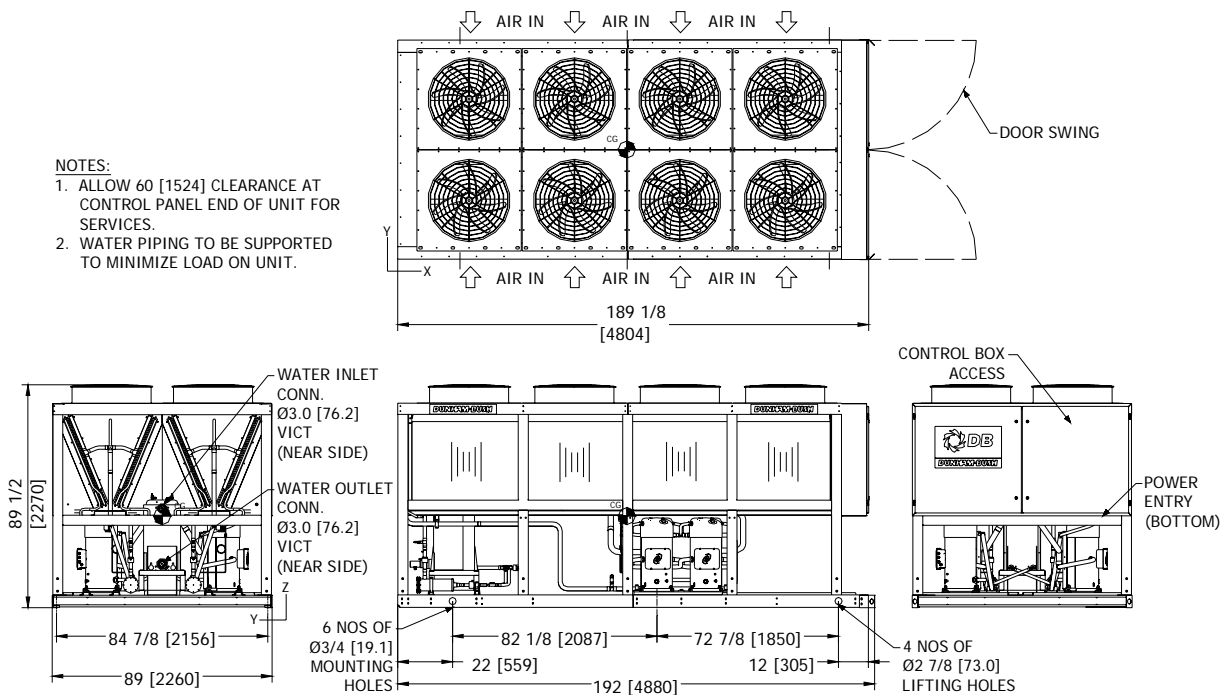
1. ALLOW 60 [1524] CLEARANCE AT CONTROL PANEL END OF UNIT FOR SERVICES.
2. WATER PIPING TO BE SUPPORTED TO MINIMIZE LOAD ON UNIT.



ACDS 095

NOTES:

1. ALLOW 60 [1524] CLEARANCE AT CONTROL PANEL END OF UNIT FOR SERVICES.
2. WATER PIPING TO BE SUPPORTED TO MINIMIZE LOAD ON UNIT.



Note: All dimensions are in inches [mm].

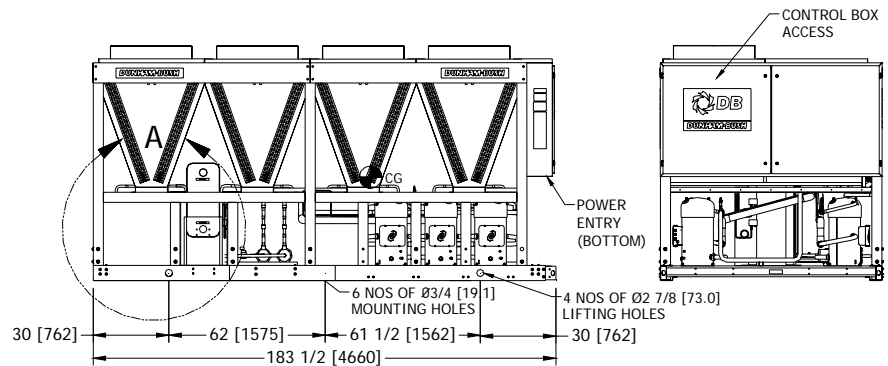
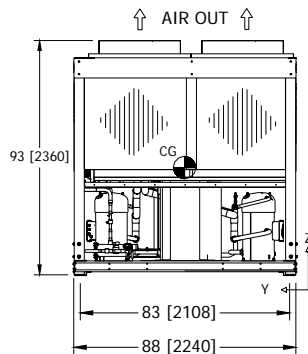
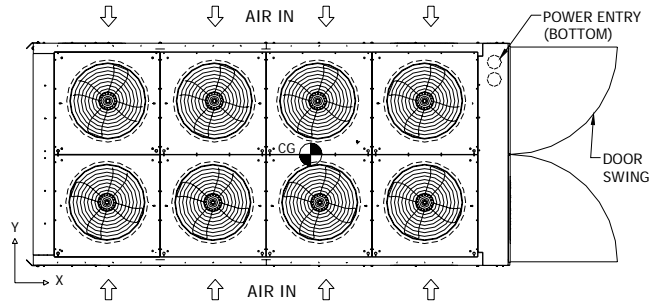
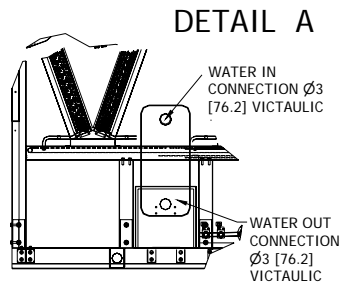
DIMENSIONAL DATA

50 Hz

ACDS 105

NOTES:

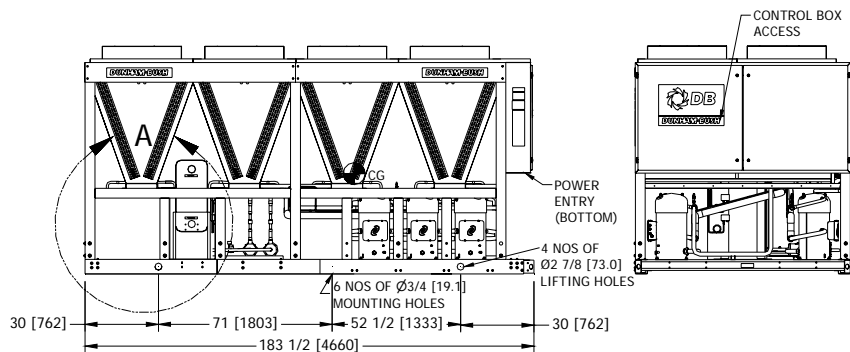
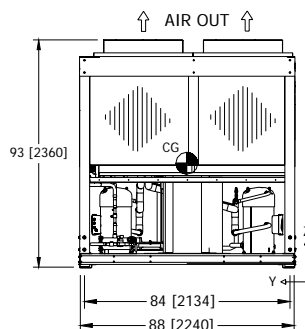
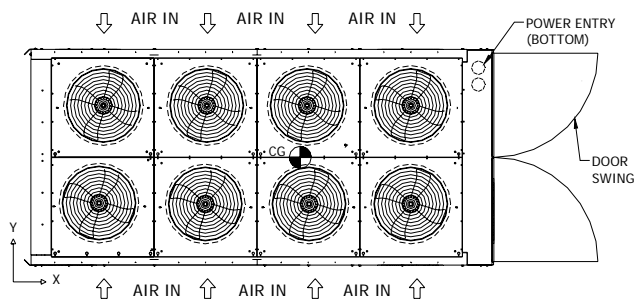
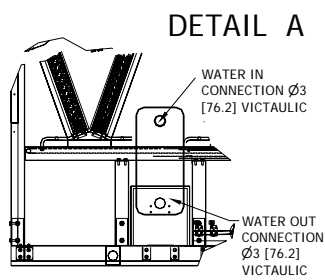
1. ALLOW 60in [1524mm] CLEARANCE AT CONTROL PANEL END OF UNIT FOR SERVICE.
2. WATER PIPING TO BE SUPPORTED TO MINIMIZE LOAD ON UNIT.



ACDS 115

NOTES:

1. ALLOW 60in [1524mm] CLEARANCE AT CONTROL PANEL END OF UNIT FOR SERVICE.
2. WATER PIPING TO BE SUPPORTED TO MINIMIZE LOAD ON UNIT.



Note: All dimensions are in inches [mm].

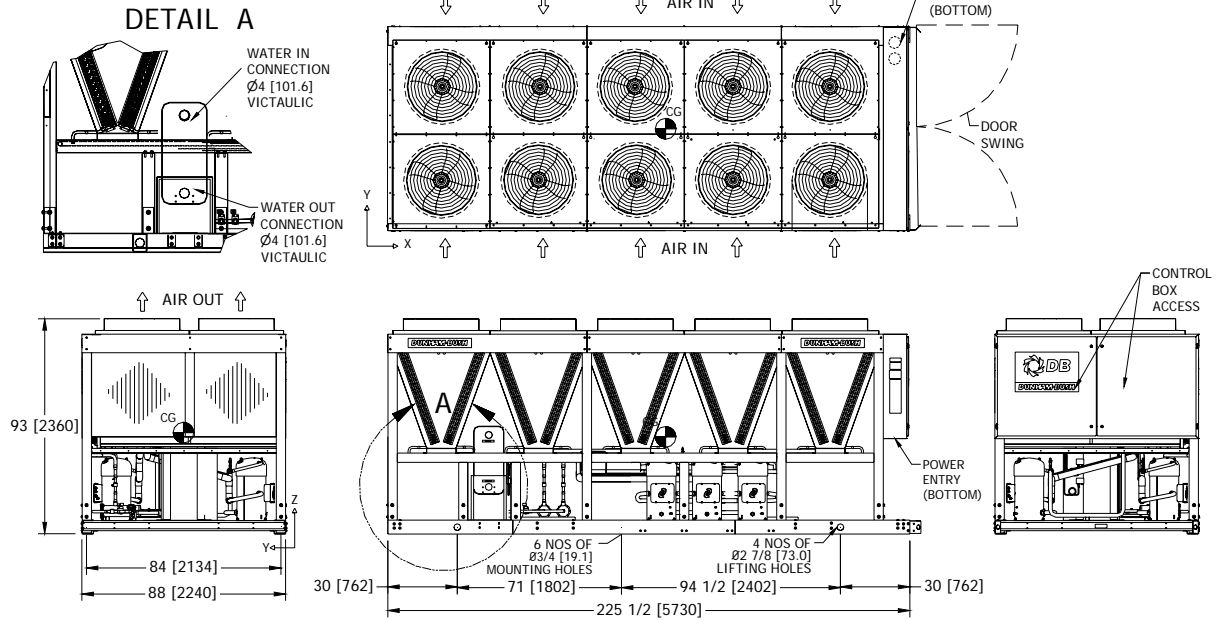
DIMENSIONAL DATA

50 Hz

ACDS 125

NOTES:

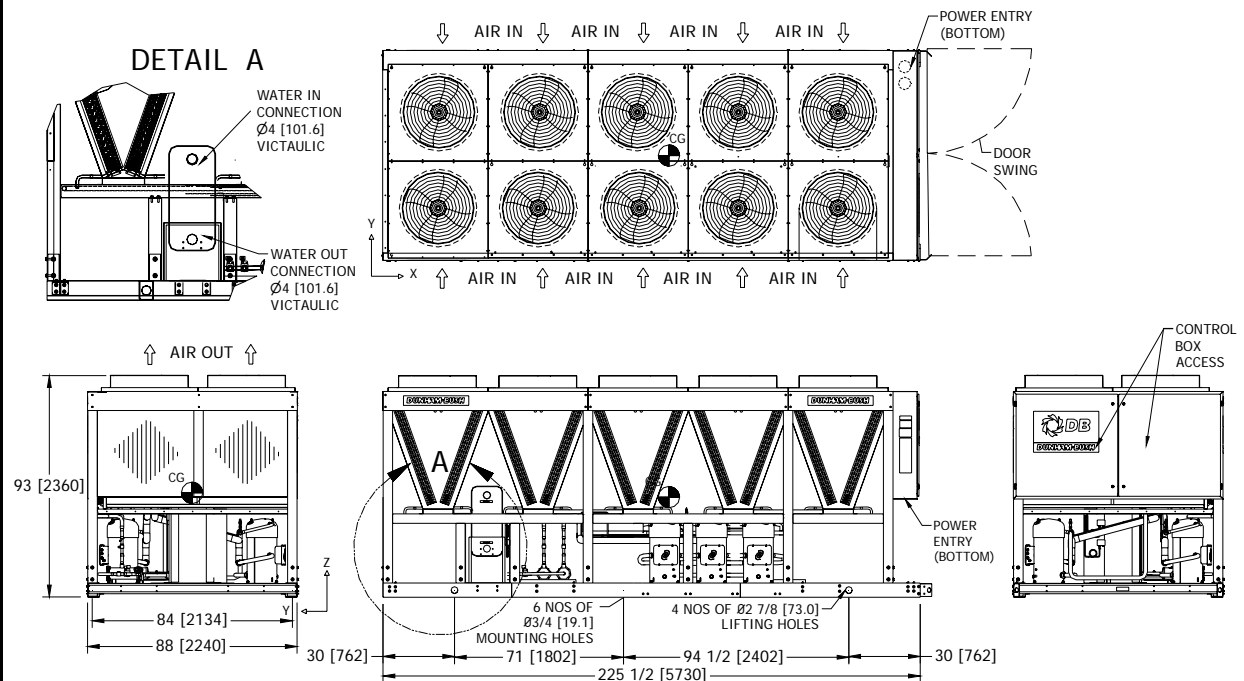
1. ALLOW 60in [1524mm] CLEARANCE AT CONTROL PANEL END OF UNIT FOR SERVICE.
2. WATER PIPING TO BE SUPPORTED TO MINIMIZE LOAD ON UNIT.



ACDS 135

NOTES:

1. ALLOW 60in [1524mm] CLEARANCE AT CONTROL PANEL END OF UNIT FOR SERVICE.
2. WATER PIPING TO BE SUPPORTED TO MINIMIZE LOAD ON UNIT.



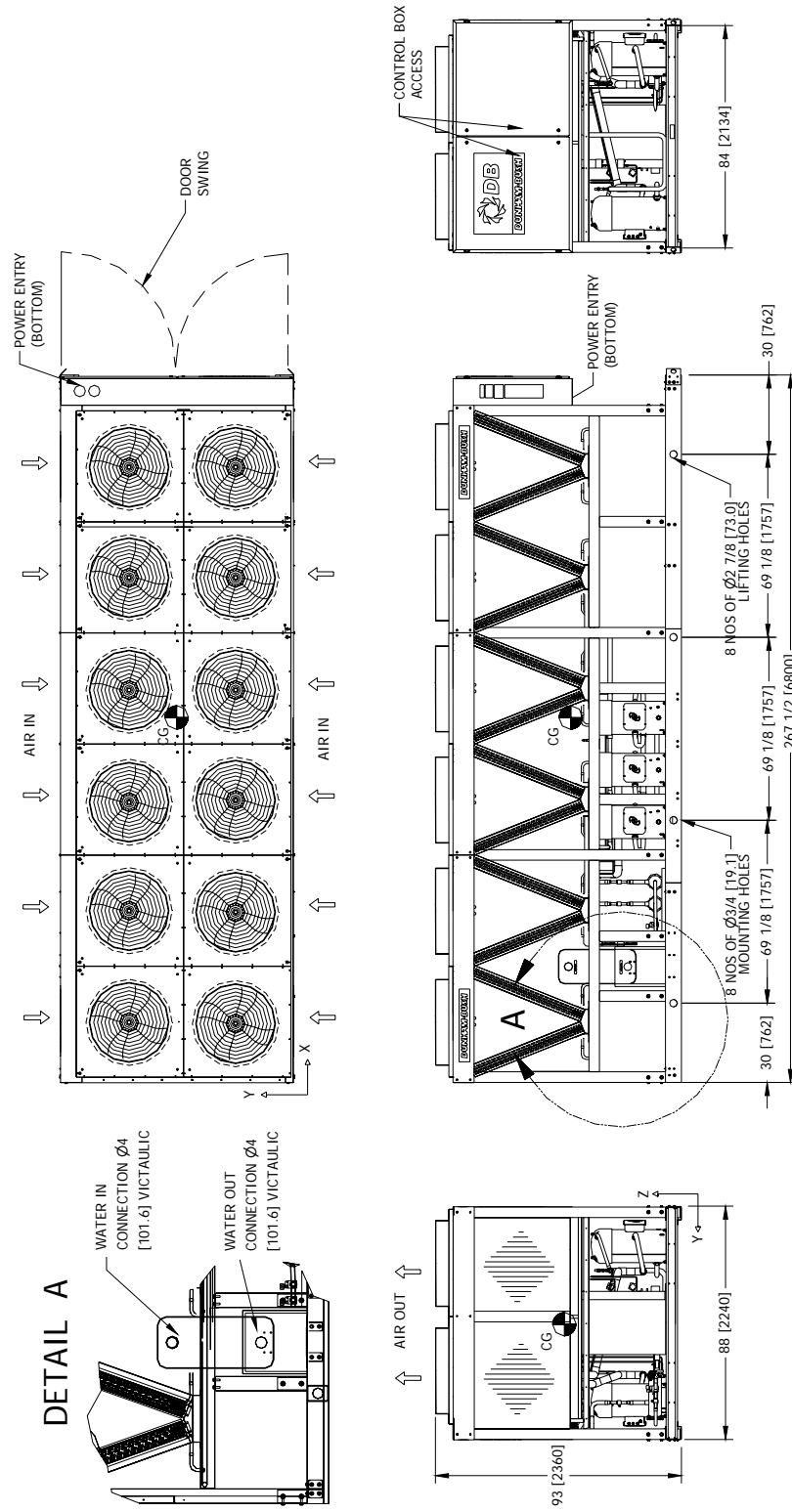
Note: All dimensions are in inches [mm].

DIMENSIONAL DATA

50 Hz

ACDS 175

- NOTES:**
1. ALLOW 60in [1524mm] CLEARANCE AT CONTROL PANEL END OF UNIT FOR SERVICE.
 2. WATER PIPING TO BE SUPPORTED TO MINIMIZE LOAD ON UNIT.



Note: All dimensions are in inches [mm].

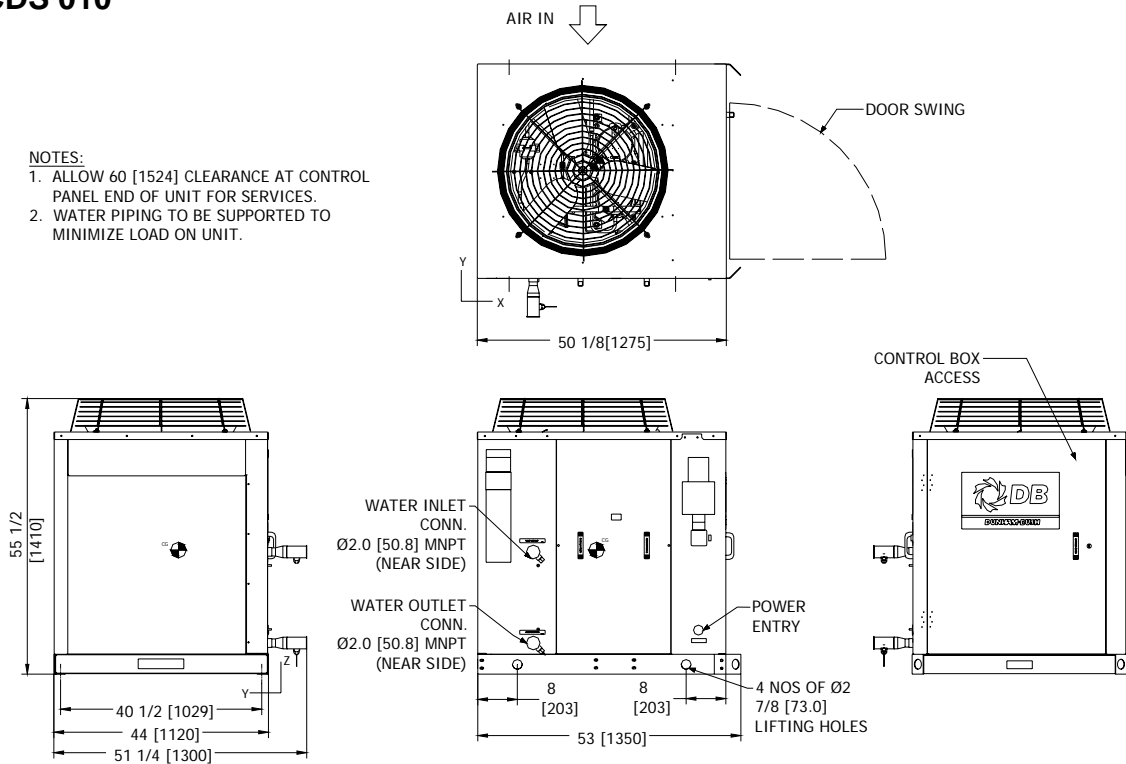
DIMENSIONAL DATA

60 Hz

ACDS 010

NOTES:

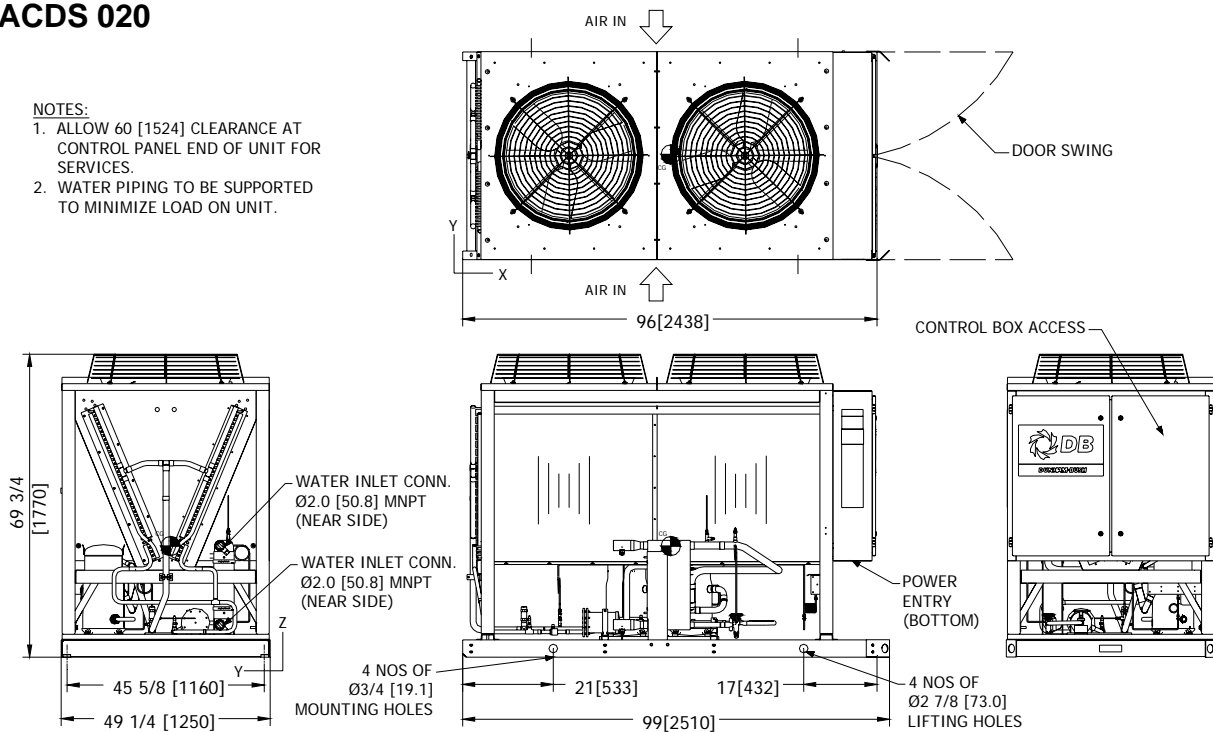
1. ALLOW 60 [1524] CLEARANCE AT CONTROL PANEL END OF UNIT FOR SERVICES.
2. WATER PIPING TO BE SUPPORTED TO MINIMIZE LOAD ON UNIT.



ACDS 020

NOTES:

1. ALLOW 60 [1524] CLEARANCE AT CONTROL PANEL END OF UNIT FOR SERVICES.
2. WATER PIPING TO BE SUPPORTED TO MINIMIZE LOAD ON UNIT.



Note: All dimensions are in inches [mm].

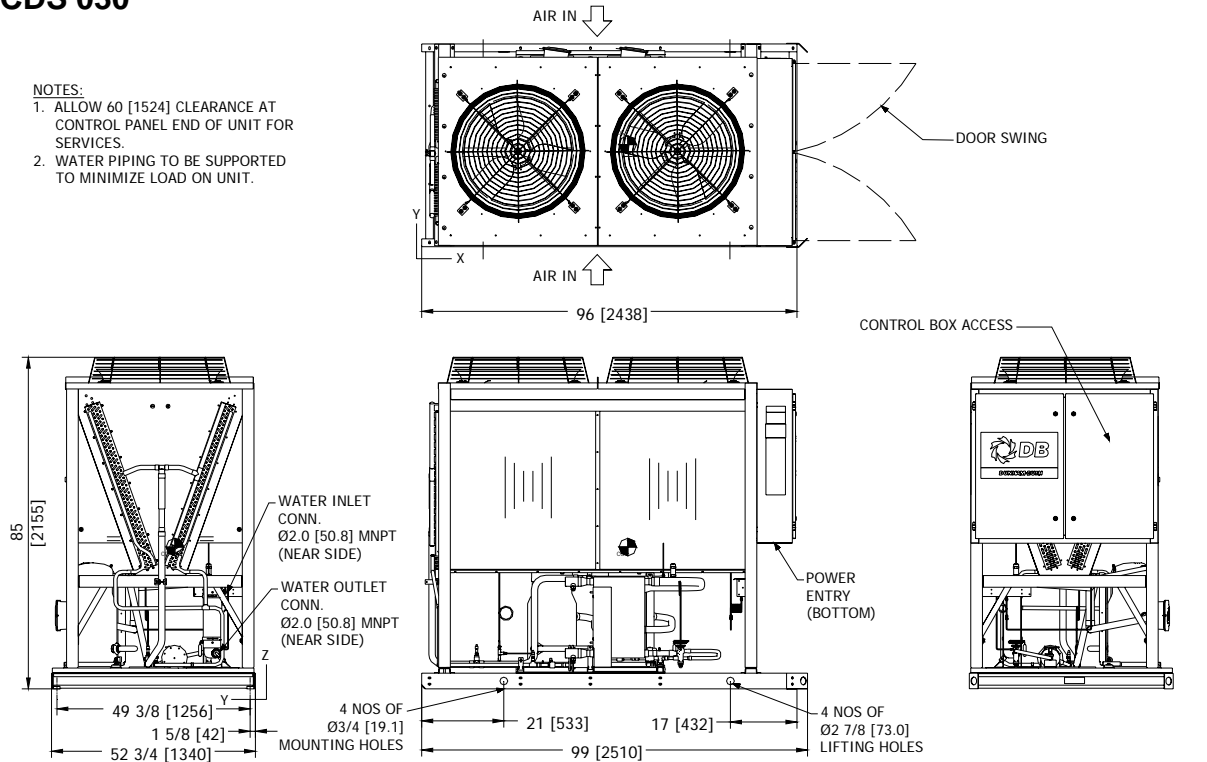
DIMENSIONAL DATA

60 Hz

ACDS 030

NOTES:

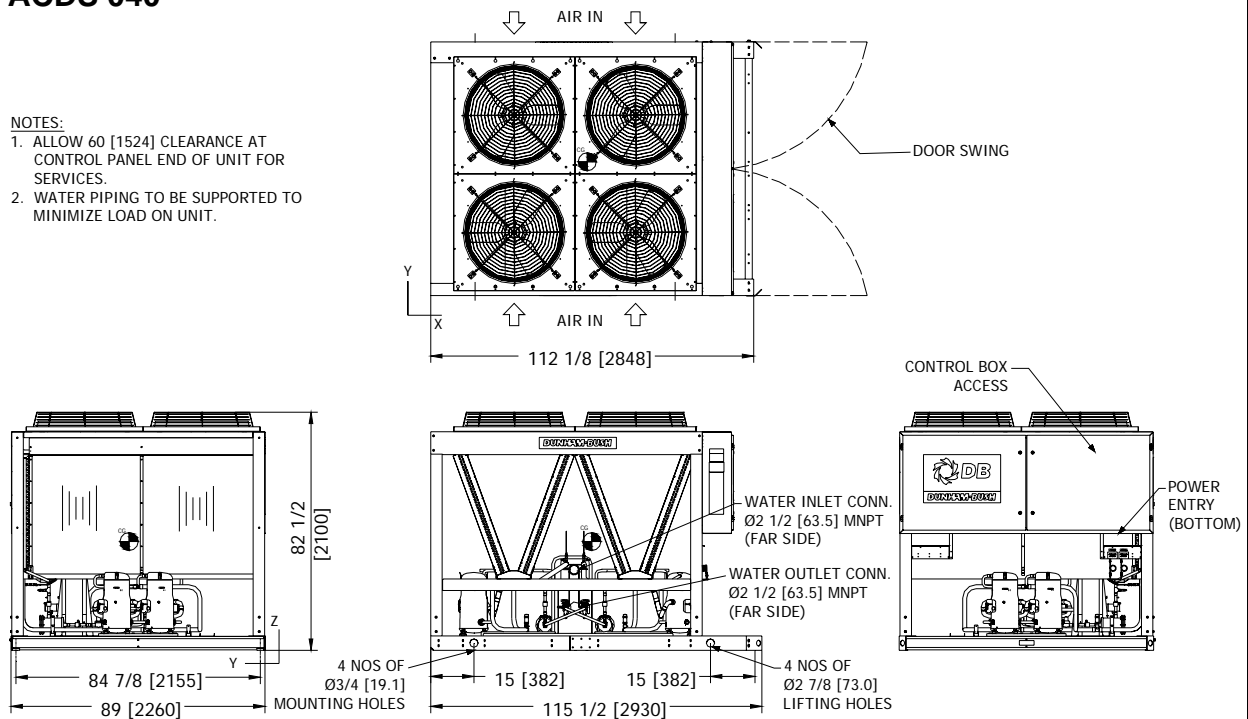
1. ALLOW 60 [1524] CLEARANCE AT CONTROL PANEL END OF UNIT FOR SERVICES.
2. WATER PIPING TO BE SUPPORTED TO MINIMIZE LOAD ON UNIT.



ACDS 040

NOTES:

1. ALLOW 60 [1524] CLEARANCE AT CONTROL PANEL END OF UNIT FOR SERVICES.
2. WATER PIPING TO BE SUPPORTED TO MINIMIZE LOAD ON UNIT.



Note: All dimensions are in inches [mm].

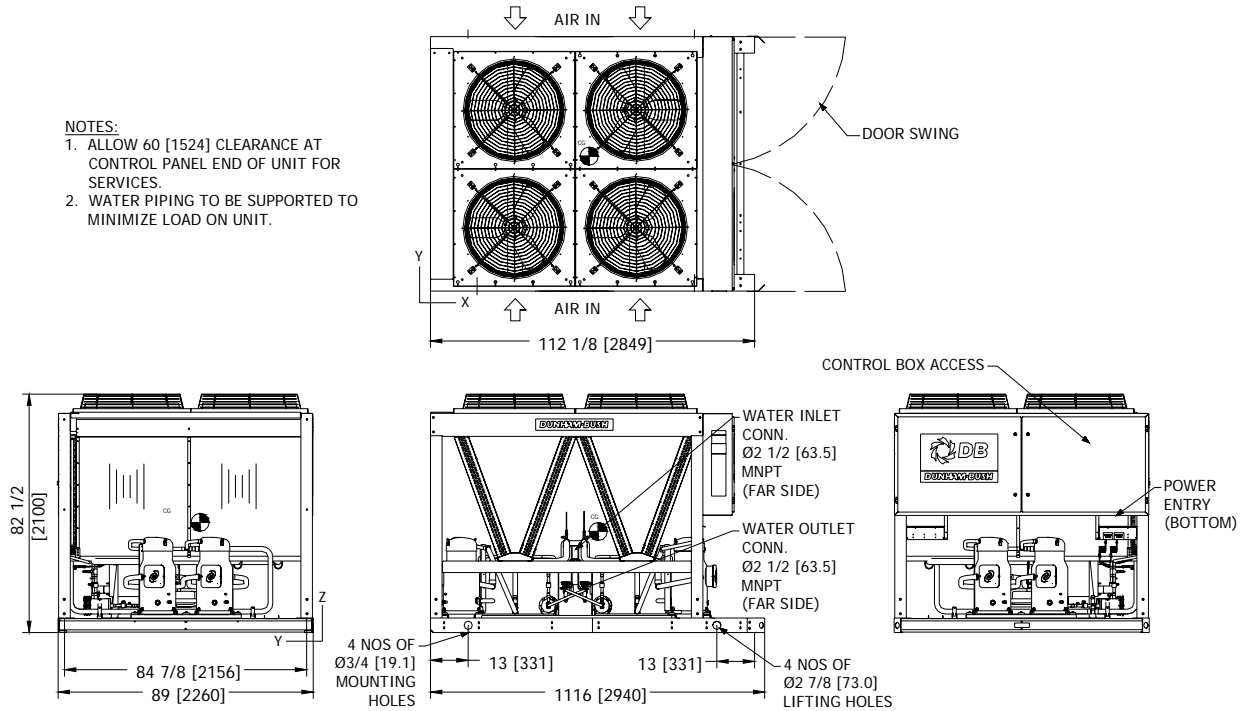
DIMENSIONAL DATA

60 Hz

ACDS 050, 060, 070

NOTES:

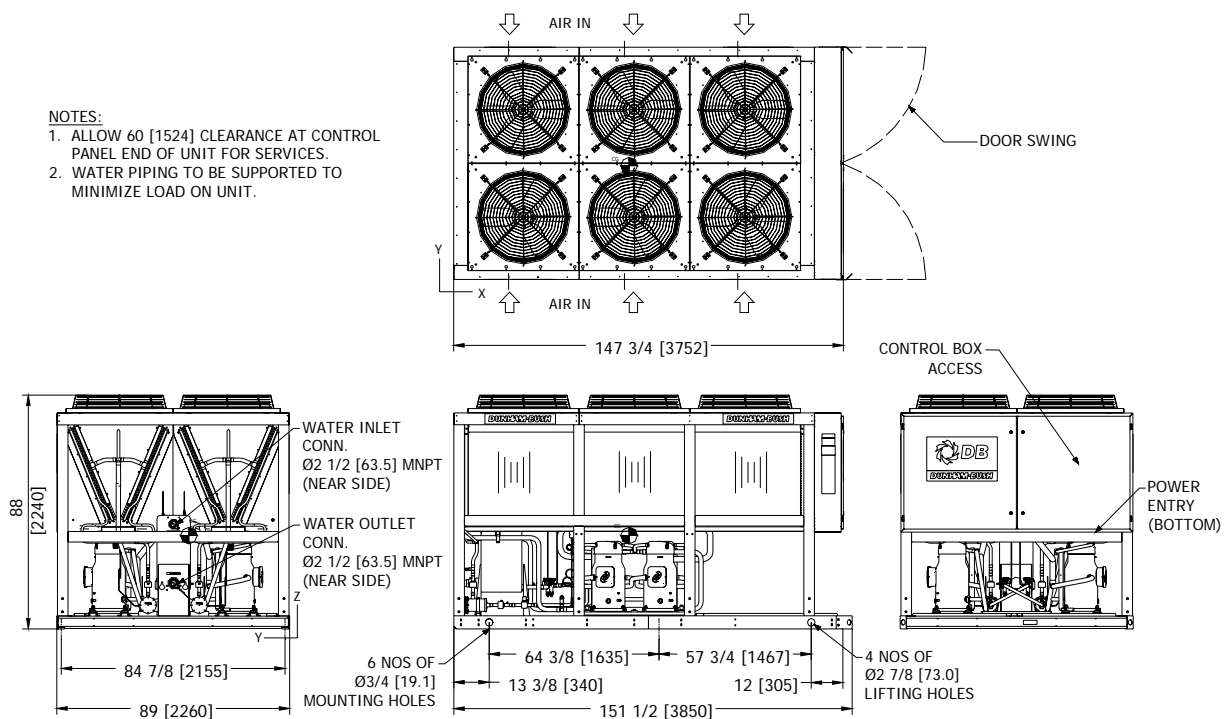
1. ALLOW 60 [1524] CLEARANCE AT CONTROL PANEL END OF UNIT FOR SERVICES.
2. WATER PIPING TO BE SUPPORTED TO MINIMIZE LOAD ON UNIT.



ACDS 080, 090

NOTES:

1. ALLOW 60 [1524] CLEARANCE AT CONTROL PANEL END OF UNIT FOR SERVICES.
2. WATER PIPING TO BE SUPPORTED TO MINIMIZE LOAD ON UNIT.



Note: All dimensions are in inches [mm].

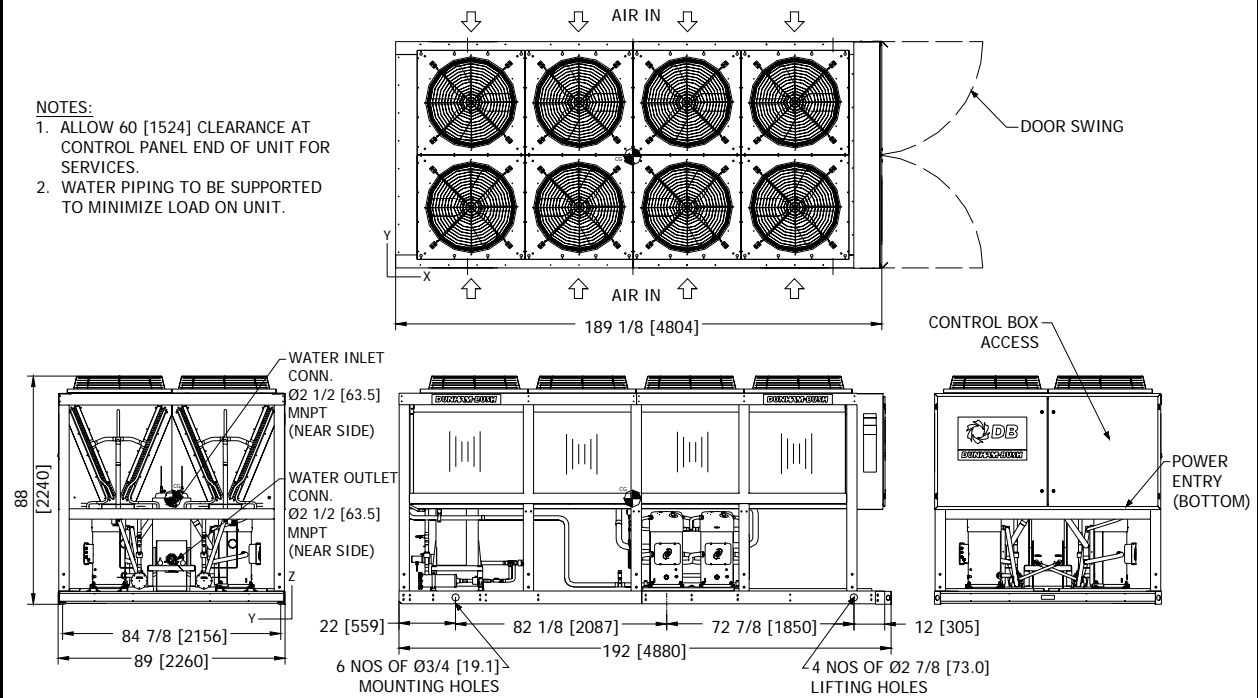
DIMENSIONAL DATA

60 Hz

ACDS 100, 120

NOTES:

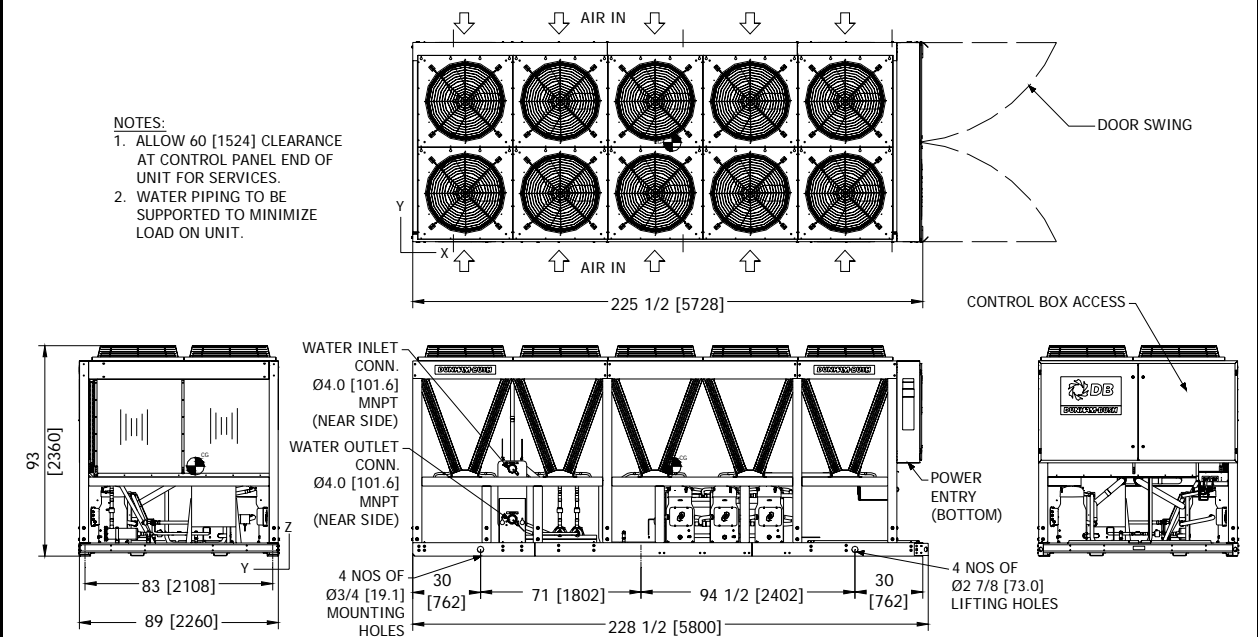
1. ALLOW 60 [1524] CLEARANCE AT CONTROL PANEL END OF UNIT FOR SERVICES.
2. WATER PIPING TO BE SUPPORTED TO MINIMIZE LOAD ON UNIT.



ACDS 135, 150

NOTES:

1. ALLOW 60 [1524] CLEARANCE AT CONTROL PANEL END OF UNIT FOR SERVICES.
2. WATER PIPING TO BE SUPPORTED TO MINIMIZE LOAD ON UNIT.

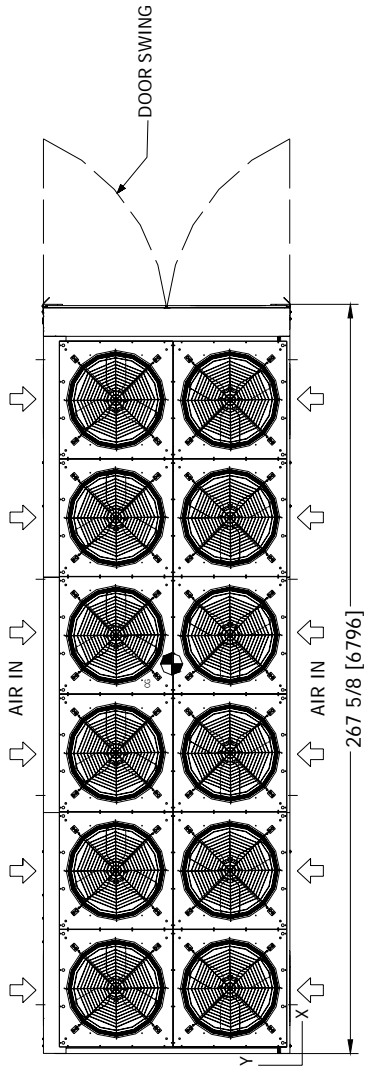


Note: All dimensions are in inches [mm].

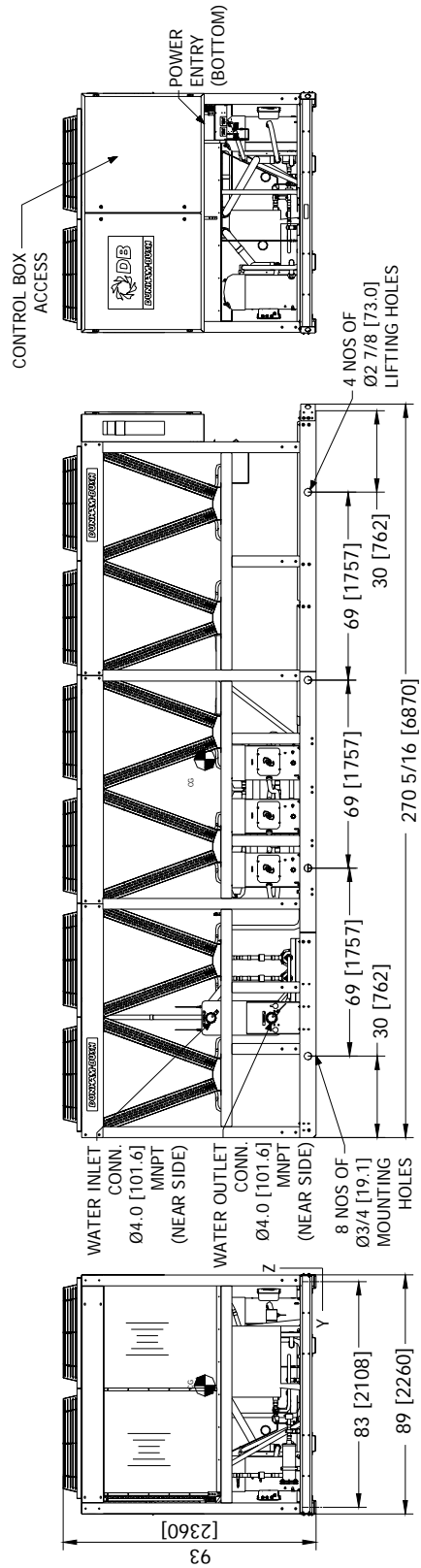
DIMENSIONAL DATA

60 Hz

ACDS 165, 180

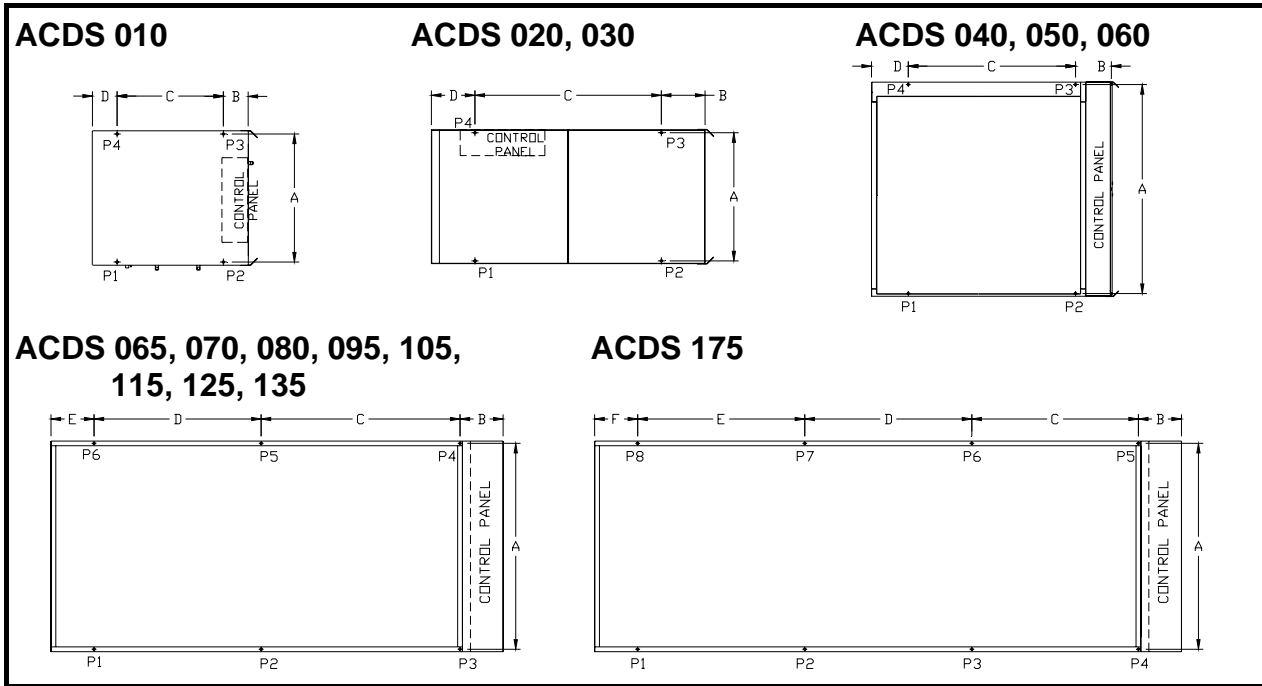


- NOTES:
1. ALLOW 60 [1524] CLEARANCE AT CONTROL PANEL END OF UNIT FOR SERVICES.
 2. WATER PIPING TO BE SUPPORTED TO MINIMIZE LOAD ON UNIT.



FLOOR LOADING DIAGRAM

50 Hz



POINT LOAD LOCATION

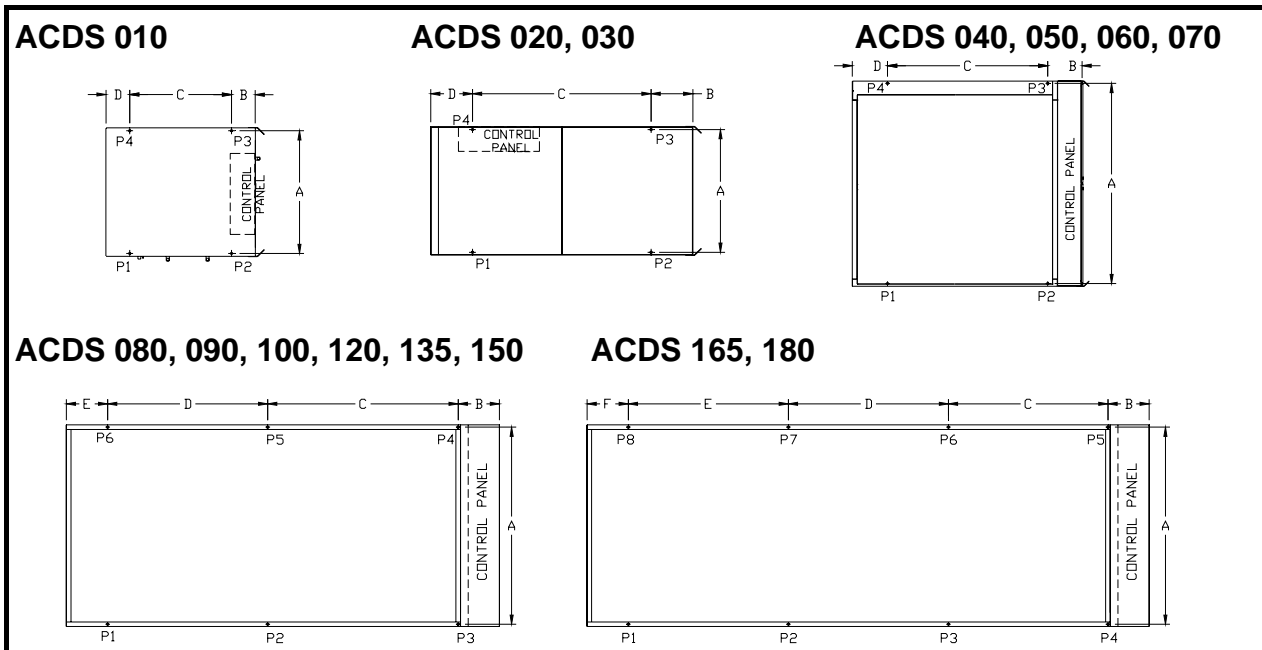
Model ACDS	Dimensions – inches [mm]					
	A	B	C	D	E	F
010	40 1/2 [1029]	8 [203]	34 1/4 [869]	8 [203]	-	-
020	45 5/8 [1160]	17 [432]	58 [1473]	21 [533]	-	-
030	49 3/8 [1256]	17 [432]	58 [1473]	21 [533]	-	-
040	84 7/8 [2155]	15 [382]	82 1/4 [2084]	15 [382]	-	-
050	84 7/8 [2156]	13 [331]	86 1/8 [2187]	13 [331]	-	-
060	84 7/8 [2156]	13 [331]	86 1/8 [2187]	13 [331]	-	-
065	84 7/8 [2155]	12 [305]	57 3/4 [1467]	64 3/8 [1635]	13 3/8 [340]	-
070	84 7/8 [2155]	12 [305]	57 3/4 [1467]	64 3/8 [1635]	13 3/8 [340]	-
080	84 7/8 [2155]	12 [305]	57 3/4 [1467]	64 3/8 [1635]	13 3/8 [340]	-
095	84 7/8 [2156]	12 [305]	72 7/8 [1850]	82 1/8 [2087]	22 [559]	-
105	83 [2108]	16 [406]	52 1/2 [1334]	71 [1802]	16 [406]	-
115	84 [2134]	16 [406]	52 1/2 [1334]	71 [1802]	16 [406]	-
125	84 [2134]	30 [762]	95 [2402]	71 [1802]	30 [762]	-
135	84 [2134]	30 [762]	95 [2402]	71 [1802]	30 [762]	-
175	84 [2134]	30 [762]	69 [1757]	69 [1757]	69 [1757]	30 [762]

POINT LOAD DATA

Model ACDS	Loads - lbs [kg]								Total Operating Weight lbs [kg]
	P1	P2	P3	P4	P5	P6	P7	P8	
010	211 [96]	282 [128]	296 [134]	247 [112]	-	-	-	-	1036 [470]
020	371 [168]	394 [179]	452 [205]	435 [197]	-	-	-	-	1652 [749]
030	477 [216]	447 [203]	514 [233]	626 [284]	-	-	-	-	2064 [936]
040	827 [375]	806 [366]	835 [379]	861 [391]	-	-	-	-	3329 [1511]
050	1005 [456]	939 [426]	988 [448]	1065 [483]	-	-	-	-	3997 [1813]
060	1046 [475]	970 [440]	1019 [462]	1107 [502]	-	-	-	-	4142 [1879]
065	931 [422]	891 [404]	855 [388]	848 [385]	883 [400]	921 [418]	-	-	5329 [2417]
070	935 [424]	893 [405]	855 [388]	849 [385]	885 [401]	925 [420]	-	-	5342 [2423]
080	1001 [454]	937 [425]	879 [399]	872 [395]	928 [421]	991 [449]	-	-	5608 [2543]
095	1246 [565]	1194 [542]	1149 [521]	1126 [511]	1173 [532]	1225 [556]	-	-	7113 [3227]
105	1033 [468]	1339 [607]	1565 [710]	1565 [710]	1339 [607]	1033 [468]	-	-	7873 [3571]
115	1060 [480]	1396 [633]	1644 [750]	1644 [750]	1396 [633]	1060 [480]	-	-	8201 [3720]
125	1457 [661]	1555 [706]	1687 [765]	1687 [765]	1555 [706]	1457 [661]	-	-	9399 [4263]
135	1487 [675]	1518 [689]	1559 [707]	1644 [746]	1554 [655]	1296 [588]	-	-	8948 [4059]
175	1320 [599]	1342 [609]	1364 [619]	1366 [629]	1366 [629]	1364 [619]	1342 [609]	1320 [599]	10824 [4910]

FLOOR LOADING DIAGRAM

60 Hz



POINT LOAD LOCATION

MODEL ACDS	Dimensions – inches [mm]					
	A	B	C	D	E	F
010	40 1/2 [1029]	8 [203]	34 1/4 [869]	8 [203]	-	-
020	45 5/8 [1160]	17 [432]	58 [1473]	21 [533]	-	-
030	49 3/8 [1256]	17 [432]	58 [1473]	21 [533]	-	-
040	84 7/8 [2155]	15 [382]	82 1/2 [2084]	15 [382]	-	-
050	84 7/8 [2156]	13 [331]	86 [2187]	13 [331]	-	-
060	84 7/8 [2156]	13 [331]	86 [2187]	13 [331]	-	-
070	84 7/8 [2156]	13 [331]	86 [2187]	13 [331]	-	-
080	84 7/8 [2155]	12 [305]	57 3/4 [1467]	64 3/8 [1635]	13 3/8 [340]	-
090	84 7/8 [2155]	12 [305]	57 3/4 [1467]	64 3/8 [1635]	13 3/8 [340]	-
100	84 7/8 [2156]	12 [305]	72 7/8 [1850]	82 1/8 [2087]	22 [559]	-
120	84 7/8 [2156]	12 [305]	72 7/8 [1850]	82 1/8 [2087]	22 [559]	-
135	83 [2108]	30 [762]	94 1/2 [2402]	71 [1802]	30 [762]	-
150	83 [2108]	30 [762]	94 1/2 [2402]	71 [1802]	30 [762]	-
165	83 [2108]	30 [762]	69 [1757]	69 [1757]	69 [1757]	30 [762]
180	83 [2108]	30 [762]	69 [1757]	69 [1757]	69 [1757]	30 [762]

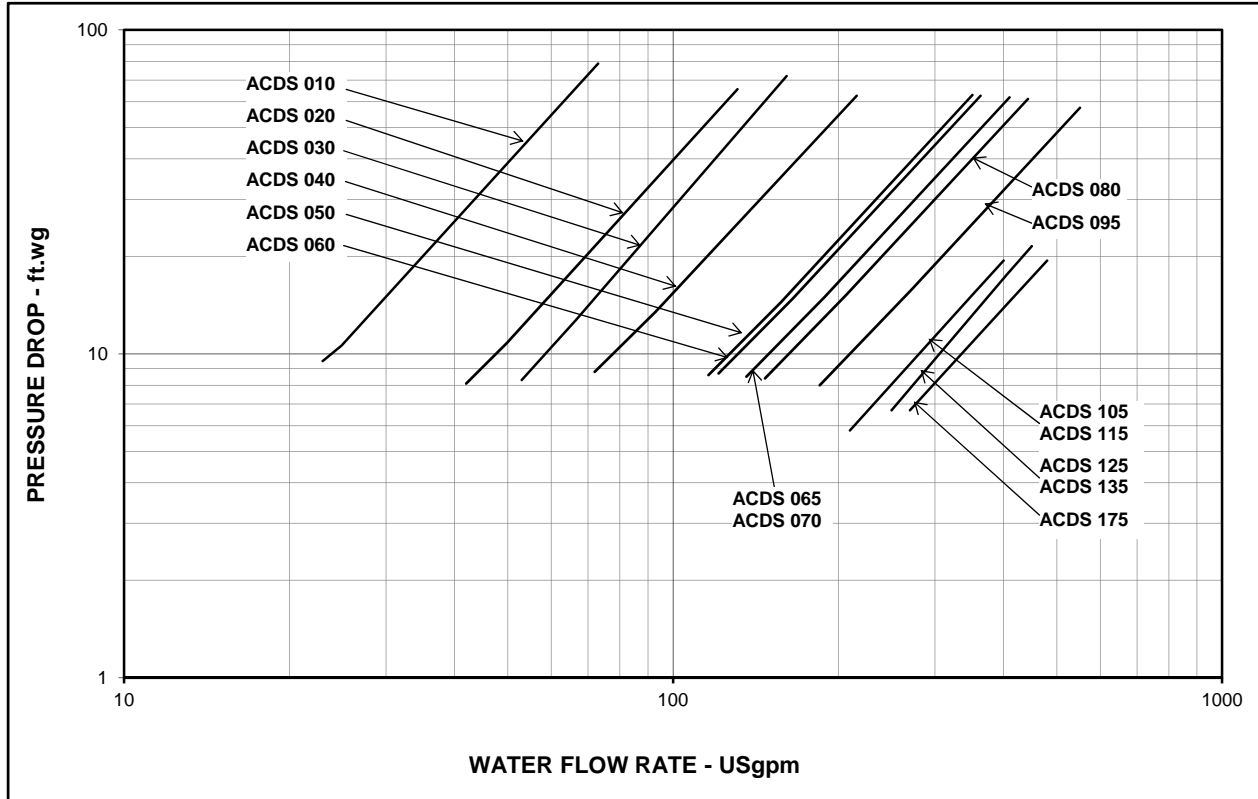
POINT LOAD DATA

MODEL ACDS	Loads - lbs [kg]								Total Operating Weight lbs [kg]
	P1	P2	P3	P4	P5	P6	P7	P8	
010	184 [84]	254 [115]	276 [125]	219 [99]	-	-	-	-	934 [424]
020	362 [164]	414 [188]	470 [213]	423 [192]	-	-	-	-	1669 [757]
030	570 [258]	559 [253]	696 [316]	597 [271]	-	-	-	-	2422 [1099]
040	776 [352]	726 [329]	748 [339]	806 [366]	-	-	-	-	3056 [1386]
050	908 [412]	830 [376]	855 [388]	942 [428]	-	-	-	-	3535 [1603]
060	955 [433]	861 [390]	890 [404]	995 [451]	-	-	-	-	3700 [1678]
070	986 [447]	879 [399]	915 [415]	1034 [469]	-	-	-	-	3813 [1730]
080	854 [388]	824 [374]	797 [362]	788 [357]	813 [369]	842 [382]	-	-	4918 [2231]
090	919 [417]	887 [402]	858 [389]	847 [384]	875 [397]	905 [411]	-	-	5290 [2400]
100	1102 [500]	1049 [476]	1002 [455]	989 [449]	1035 [470]	1086 [493]	-	-	6264 [2841]
120	1126 [511]	1069 [485]	1018 [462]	1005 [456]	1054 [478]	1111 [504]	-	-	6383 [2895]
135	1200 [545]	1254 [569]	1325 [601]	1378 [625]	1211 [549]	1086 [492]	-	-	7454 [3381]
150	1291 [586]	1370 [622]	1476 [670]	1447 [657]	1275 [578]	1145 [520]	-	-	8005 [3631]
165	1318 [598]	1236 [560]	1153 [523]	1071 [486]	1050 [476]	1096 [497]	1141 [518]	1187 [539]	9251 [4196]
180	1445 [655]	1345 [610]	1246 [565]	1147 [520]	1122 [509]	1178 [535]	1234 [560]	1289 [585]	10007 [4539]

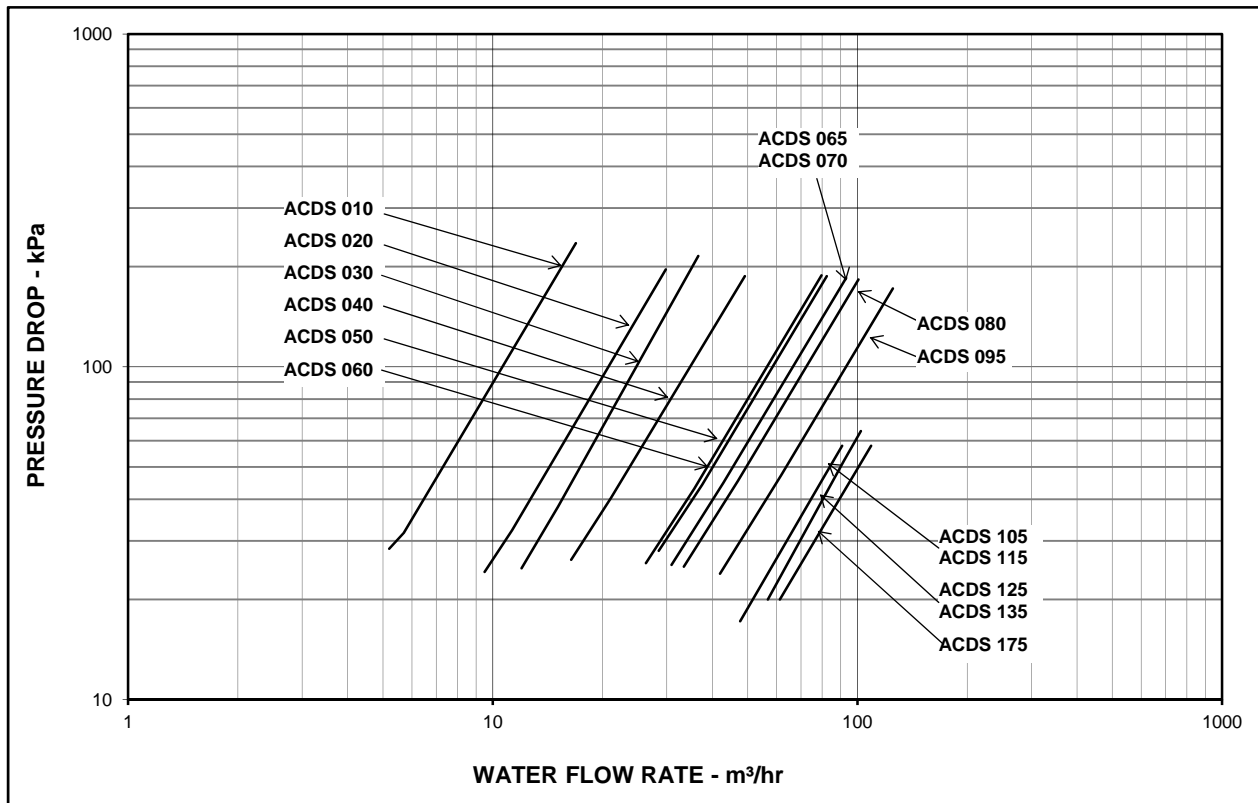
EVAPORATOR WATER PRESSURE DROP

50 Hz

1a.) Imperial Units



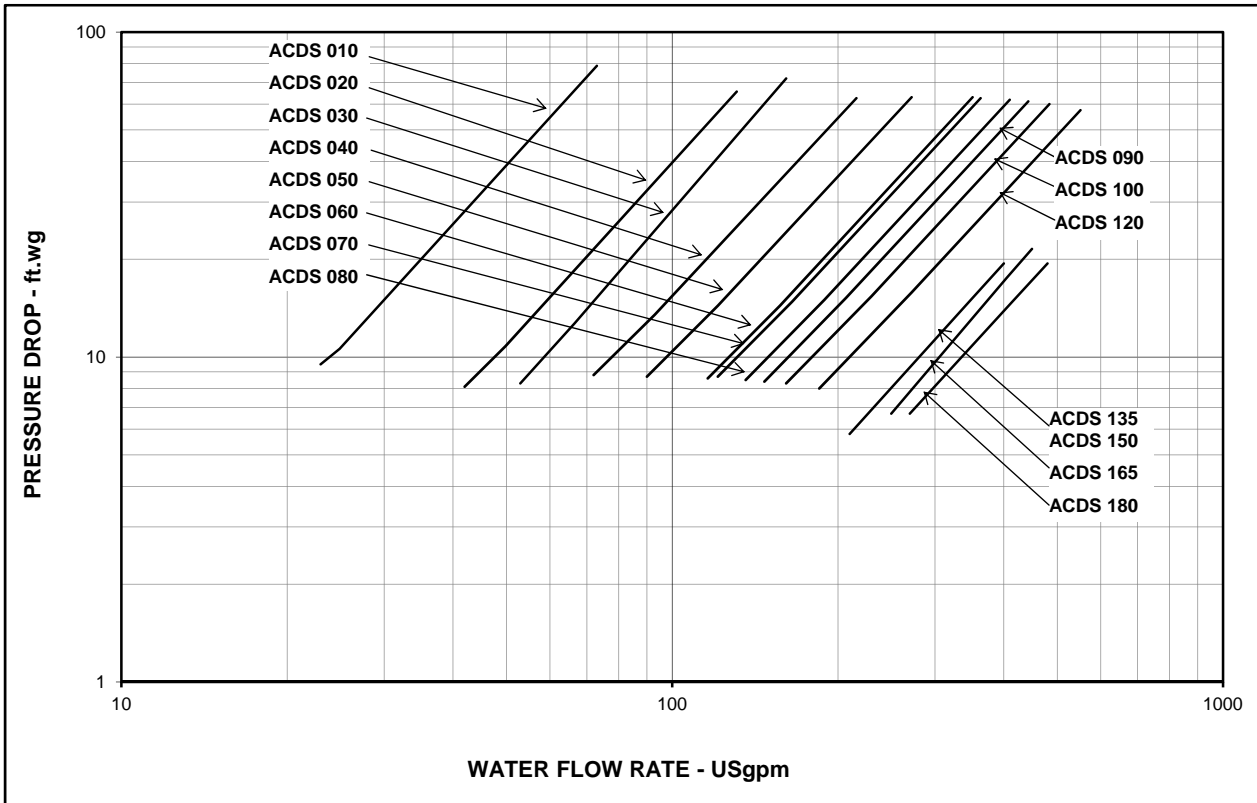
1b.) SI Units



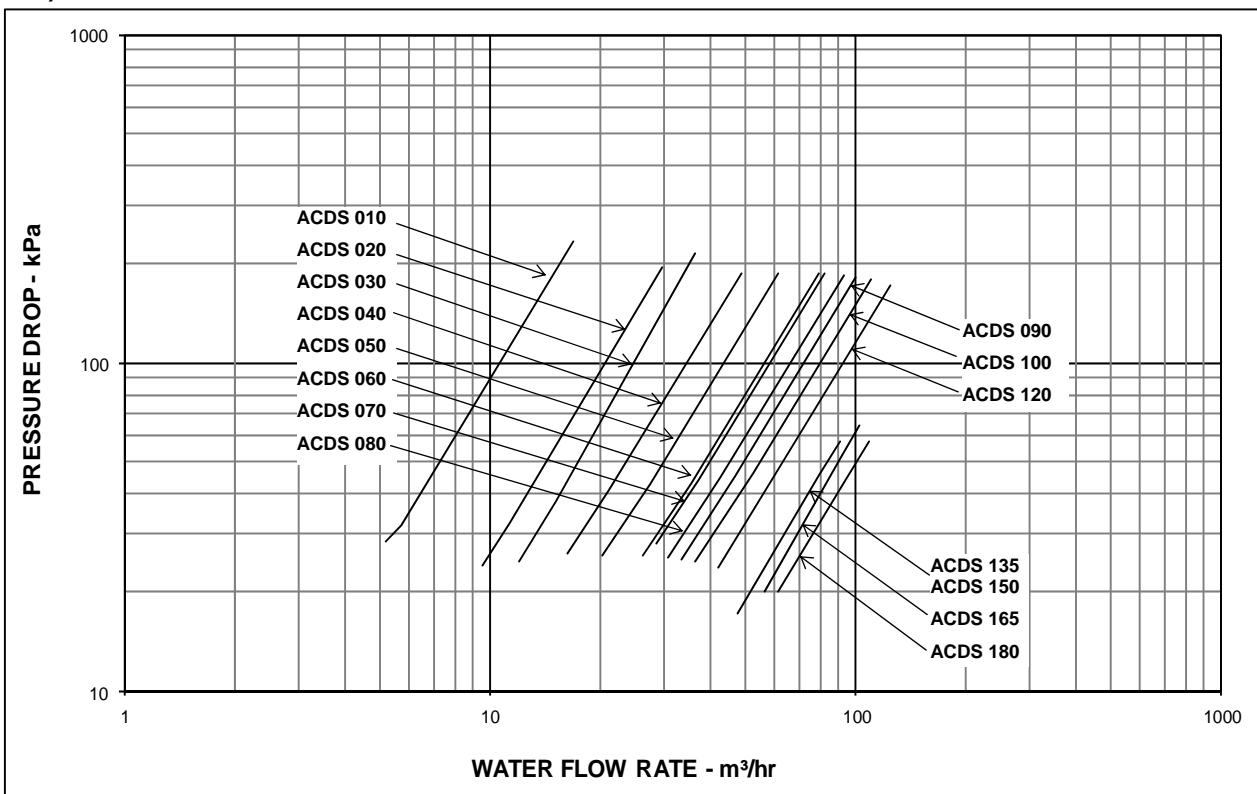
EVAPORATOR WATER PRESSURE DROP

60 Hz

1a.) Imperial Units

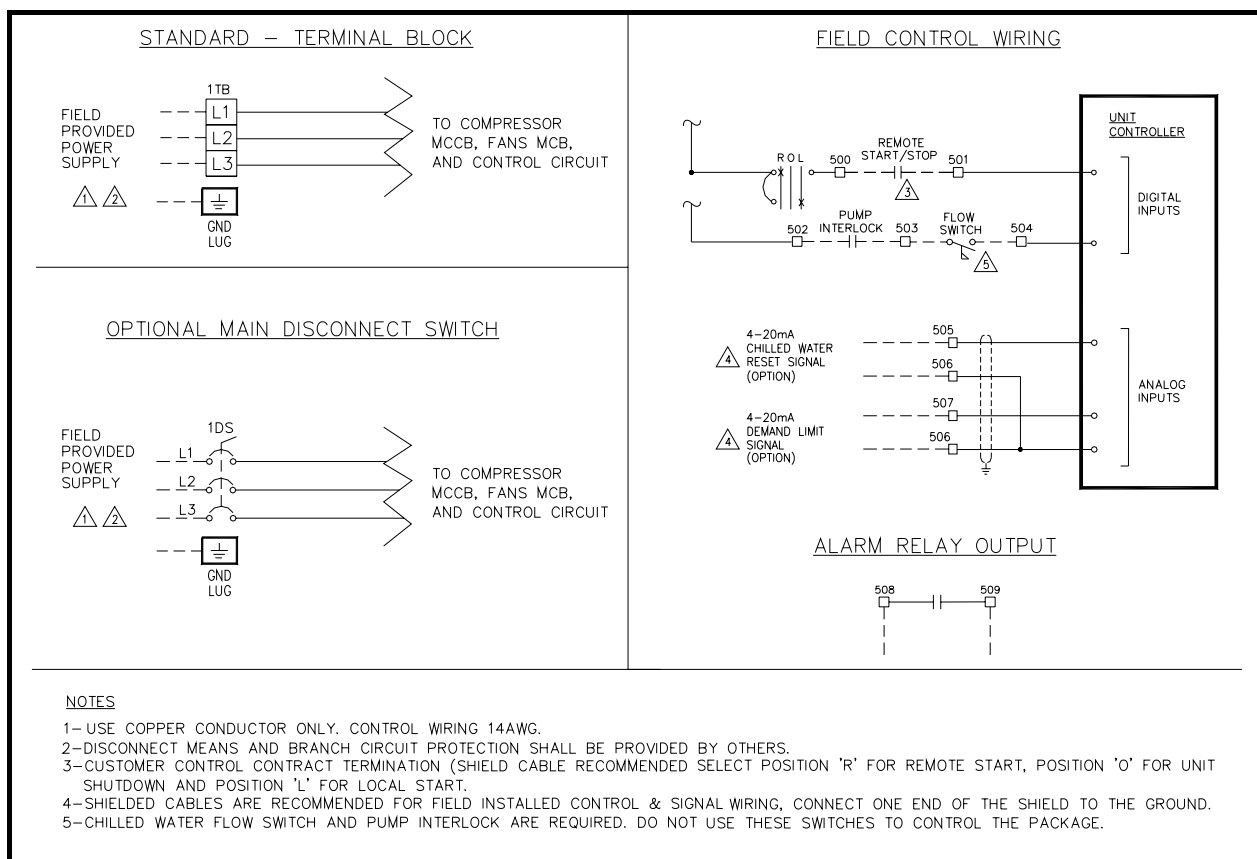


1b.) SI Units



FIELD POWER & CONTROL WIRING SCHEMATIC

TYPICAL FIELD WIRING DIAGRAM



APPLICATION DATA

UNIT DESIGNED OPERATING RANGE

Unit Operating Range – Ambient Temperature

The units are designed to operate at ambient temperature, 45~115°F [7~46°C]. If the unit requires to be operated at lower ambient temperature, the optional **Low Ambient Operation (LA 1)**, or **Extra Low Ambient Operation (LA 2)** shall be incorporated for stable operation.

Operating Limits – Ambient Temperature

Operating Ambient Temperature	SR, standard series	
	Minimum	Maximum
Standard	45°F [7°C]	115°F [46°C]
With LA 1	14°F [-10°C]	115°F [46°C]
With LA 2	-20°F [-29°C]	115°F [46°C]

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

Unit Operating Range – Evaporator Temperature

The unit is designed to deliver chilled fluid temperature within 40~60 °F [4.5~18 °C]. The unit can start and pull down with up to 80°F [27°C] entering-fluid temperature. For sustained operation, it is recommended that the entering fluid temperature not exceed 70°F [21°C].

For unit installation with minimum ambient temperature at 32°F [0°C] or below, **Evaporator Heater (EVH)** 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	40 °F [4.5 °C]	60 °F [18 °C]
Dual Mode / Low Temp. Operation	20 °F [-6.6 °C]	60 °F [18 °C]

APPLICATION DATA

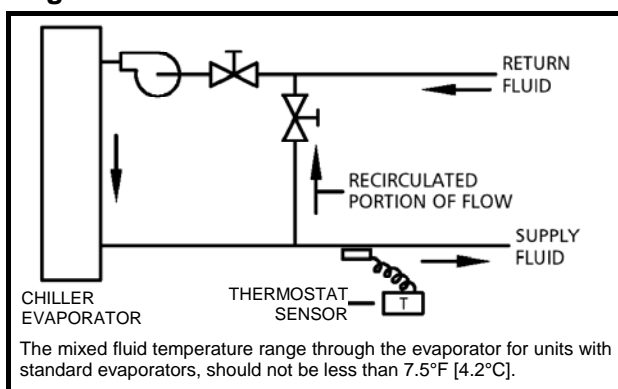
EVAPORATOR FLUID CIRCUIT

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

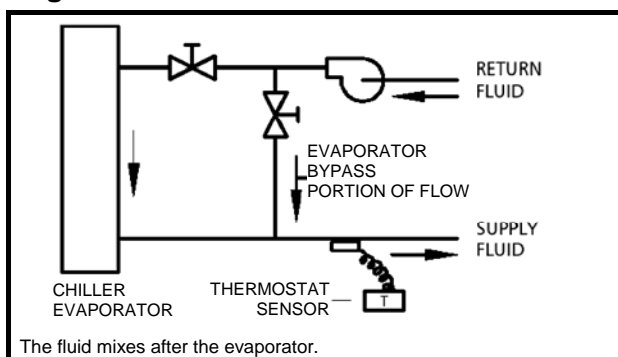


Narrow Range ΔT - High Flow Applications

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

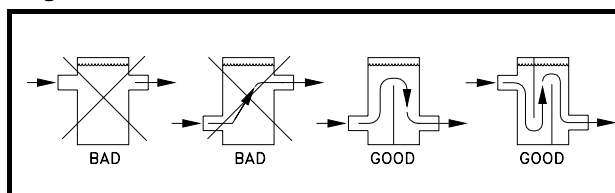


Figure 2B Single Loop System with Storage Tank to Increase Loop Volume

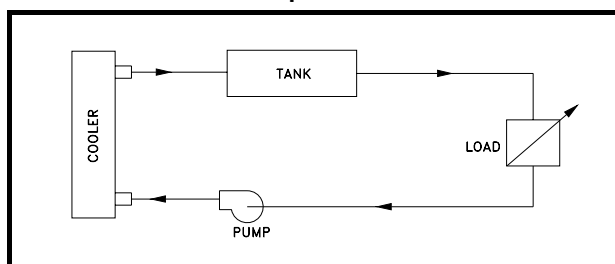
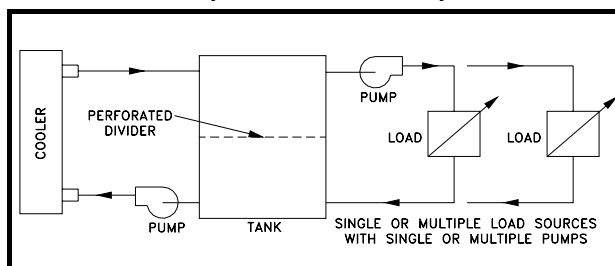


Figure 2C Primary and Secondary Loop Systems are normally used where the secondary system has variable flow and/or multiple loads. See example below.



Multiple Chillers In A Chilled Water System

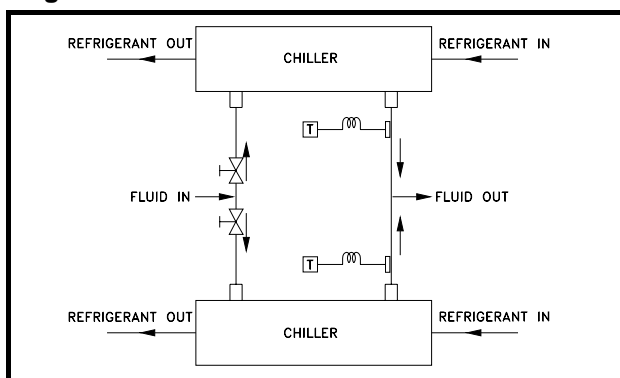
Where the load is greater than available from one ZEUS ACDS, where standby capacity is required or the load profile dictates, multiple chillers may be piped in parallel. Units of equal size help to ensure fluid flow balance, but balancing valves ensure balanced flows even with dissimilar sized chillers.

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)

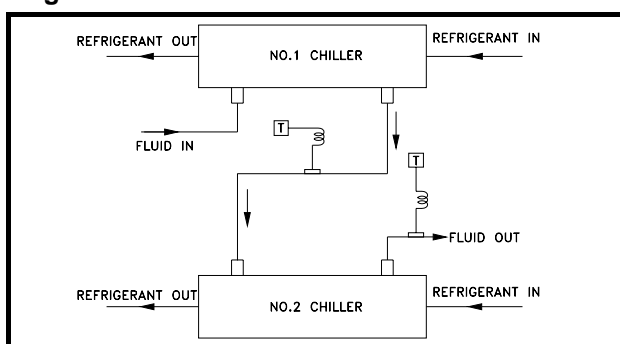
APPLICATION DATA

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.

Water (Fluid) Strainers

It is recommended that 40-mesh strainers be installed in the fluid piping as close to unit evaporator as possible.

Oversizing Chillers

Oversizing of chillers more than 5-10% is not recommended. Oversizing causes energy inefficiency and shortened compressor life due to excessive compressor cycling. Future load requirements may result in temporary oversizing of equipment which will

require careful unit selection. It may be better to properly size for the initial load and add another unit later for future increase. The use of multiple units is recommended where operation at minimum load for prolong period is expected and goal control required. Fully loaded equipment operates better and more efficiently than large equipment running at or near minimum capacity.

Hot gas bypass should not be a means to allow oversizing of chillers. Hot gas bypass should only be used where the equipment is sized properly for full load but the minimum load expected is lower than can be achieved by mechanical unloading is less than the minimum unloading step available.

Sound and Vibration

The compressors in ACDS units are resiliently, mounted to reduce the transmission of any noise and vibration to the frame.

The compressors are not mounted on springs because extra movement may cause line breakage and refrigerant leaks. Unit isolation helps prevent any remaining sound or vibration from entering the building structure, piping or electrical service.

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.

If the equipment is being used to supply chilled fluid 38°F [3.3°C] or below, glycol should be used to prevent freeze damage. The freeze protection level should be 15°F [8.3°C] lower than the leaving brine temperature.

The use of glycol causes a performance derate as shown below which needs to be included in the unit selection procedure.

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
35	0.0	-17.8	0.977	0.992	1.097	1.275
40	-10.0	-23.3	0.973	0.991	1.116	1.331
45	-17.5	-27.5	0.968	0.990	1.138	1.398
50	-28.9	-33.8	0.964	0.989	1.161	1.466

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

APPLICATION DATA

Table 3 : 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 4 : 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

Design Requirements

The following design requirements must be known in order to select a packaged chiller.

- *1) Required cooling capacity in TR [kW].
- 2) Evaporator outlet fluid temperature °F [°C].
- *3) USgpm of chilled fluid to be circulated.
- *4) Chilled fluid cooling range (fluid in °F[°C]- fluid outlet °F[°C])
- 5) Design ambient temperature °F[°C].
- 6) Electrical power characteristics.
- 7) Special codes (local, state or national codes) with which unit must comply

*Any 2 out of 3 must be known

EXAMPLE

Select an air cooled packaged chiller for the following conditions:

Cooling Capacity :	60 TR [211kW]
Chilled Water In/Out Temperature :	54/44°F [12.2/6.7°C]
Design ambient temperature :	95°F [35°C]
Minimum operating ambient :	+20°F [-6.7°C].
Altitude :	2000 feet [609.6m]
Evaporator fouling factor :	0.0005 Hr.ft ² .°F/Btu
Electrical characteristics :	460V/3/60Hz with single power connection.

Step 1- Unit Selection

For 2000 feet [609.6m] elevation divide the specified tonnage by the capacity correction factor from Table 3.

$$\frac{100 \text{ TR}}{0.99} = 101 \text{ TR}$$

For 0.0005 Hr.ft².°F/Btu fouling factor divide the required tonnage at 2000 feet [609.6m] by the fouling correction factor from Table 4.

$$\frac{101 \text{ TR}}{0.978} = 103.3 \text{ TR}$$

Entering the capacity data and we see that an **ZEUS** ACDS 120 unit for water at sea level has a capacity of 108.4 TR, drawing 118.66 compressor kW. The kW correction factors from Table 3 and 4 will be applied to the compressor kW below. For the conditions specified, the unit will do:

$$\begin{aligned} \text{Capacity} &= 108.4 \times 0.99 \times 0.978 = 105 \text{ TR} \\ \text{Compressor kW} &= 118.66 \times 1.01 \times 0.99 \\ &= 118.65 \text{ kW} \end{aligned}$$

Step 2- Evaporator USgpm and Pressure Drop

$$\begin{aligned} \text{USgpm} &= \frac{\text{Specified TR} \times 24}{\text{Cooling Range}} = \frac{100 \times 24}{10} \\ &= 240 \text{ USgpm [54.50m}^3\text{/hr]} \end{aligned}$$

Step 3- Chilled Fluid Pump Selection

To the pressure drop calculated in Step 2, add the pressure drop through the chilled fluid loop piping, valves and equipment. This will be the foundation of your pump selection criteria.

ICE THERMAL STORAGE SYSTEM (*ITES*)

The globe is progressively marching towards a serious electric energy crisis. The HVAC/R industry is shifting to operate with more efficient machines, as well as alternate system designs and solutions. Dunham-Bush, as a leader of HVAC/R solutions provider, we provide packaged solution for *ITES*, which include, equipments selections, chillers, Ice Cels and *CPM* for *ITES* system controls.

Dunham-Bush Chillers, with positive displacement rotary scroll compressor can easily cool low temperature glycol down to 20°F [-6.7 °C] to charge the ice storage tanks. The same chiller can also produce warmer supply fluid temperature, 40 to 45 °F [4.4 to 7.2 °C], for those building systems designed for only peak shaving.

Dunham-Bush is the only HVAC/R manufacturer who can provide complete *ITES* packaged solution, with own products for chillers, ice storage tanks and plant room control system, with following benefits.

Demand Charge: *ITES* allows some of the peak demand to be shifted to low-demand nighttime periods, thus reducing demand charges for the entire year.

Energy Cost: *ITES*, by operating chillers at night, will fully utilize incentive on electricity night tariff, which is much lower compare to day tariff

Rebates: *ITES* usually qualifies for rebates offered by electric utilities or governments for equipment that shift peak loads to off-peak hours

Colder Air Temperature: *ITES* can produce chilled liquid at supply temperature of 38°F [3.3°C] or even lower without scarifying system's efficiencies. This realizes energy saving on chilled water pumping system, AHUs and FCUs. Colder supply air distribution lowers room humidity, and thus, comfort cooling can be achieved with higher room temperature. This reduce air conditioning load required, and therefore, reduces the installation cost and system operating cost.

Standby Cooling Capacity: Energy stored in *ITES* can be utilized to cater peak or unexpected loads which exceeded total cooling capacity available from the installed chillers. This is savior to the regions which having difficulties on power generation plants expansion, where with *ITES*, will significantly reduced total demand of the buildings.

GUIDE SPECIFICATIONS

1.0 GENERAL

1.1 Work Included

Provide complete electrically or microcomputer controlled air cooled chiller utilizing tandem or trio scroll compressor sets suitable for outdoor installation. Contractor shall furnish and install chillers as shown and scheduled on the drawings. Units shall be installed in accordance with this specification.

1.2 Quality Assurance

- A. Unit shall be rated in accordance with AHRI Standard 550/590-2011.
- B. Unit construction shall be designed to conform to ANSI/ASHRAE 15 latest version safety standards, NEC (USA), and ASME Section VIII (USA) applicable codes.
- C. Unit efficiency shall meet or exceed ASHRAE Standard 90.1 (1989).
- D. Unit shall have cETL (USA) and (Canadian) approval (60Hz models).
- E. The unit shall be fully tested at the factory.

1.3 Design Base

The construction drawings indicate a system based on a selected manufacturer of equipment and the design data available to the Engineer during construction document preparation. Electrical services, size, configuration and space allocations are consistent with that manufacturer's recommendations and requirements.

Other listed or approved manufacturers are encouraged to provide equipment on this project; however, it shall be the Contractor and/or Supplier's responsibility to assure the equipment is consistent with the design base. No compensation shall be approved for revisions required by the design base or other manufacturers for any different services, space, clearances, etc.

1.4 Delivery And Handling

The unit shall be delivered to the job site completely assembled and charged with R410A refrigerant and oil by the manufacturer.

Comply with the manufacturer's instruction for rigging and handling.

1.5 Maintenance

Maintenance of the chillers shall be the responsibility of the owner and performed in accordance with the manufacturer's instructions.

2.0 PRODUCTS

2.1 Tandem or Trio Scroll Compressor Air Cooled Water Chillers

2.2 Acceptable Manufacturers

- A. Dunham-Bush
- B. (Approved equal)

2.3 General

Furnish and install as shown on the plans, air cooled tandem or trio scroll compressor liquid chillers. Units shall be Dunham-Bush Model ACDS or equal.

Environment friendly refrigerant with Zero ODP (Ozone Depletion Potential) shall be used. Refrigerant with non-Zero ODP shall not be accepted.

The units are to be completely factory assembled and wired in a single package complete with tandem or trio scroll compressors, evaporator, condenser, starting control with safety and operating controls. The unit shall be given a complete factory operating and control sequence test under load conditions and shall be shipped with full operating charge of R410A and full oil charge.

2.4 Performance

The units shall be furnished as shown on capacity schedules and drawings. Unit performance shall be rated in accordance with AHRI Standard 550/590-2011.

The unit shall be designed to operated safety and stably to provide chilled fluid temperature 40~60 °F [4.5~18°C], ambient temperature 45~115°F [7~46°C].

Optional Dual mode operation or low temperature operation shall be available to allow unit operation down to 20°F[-6.6°C] for leaving chilled fluid temperature.

Optional low ambient kit shall be available to allow unit operation with ambient temperature down to -20°F [-29 °C].

2.5 Construction

The unit shall be designed for maximum corrosion protection being of heavy gauge, galvanized steel construction with baked on powder coating.

2.6 Evaporator

Evaporator shall be brazed plate heat exchanger for compact foot print. Fluid side design working pressure shall be minimum 400psig [28bar] and refrigerant side design working pressure shall be minimum 450psig [31bar]. Evaporator shall be insulated with 1 inches [25mm] closed-cell insulation.

2.7 Condenser

The condenser coil shall be constructed of copper tubes and die-formed aluminum fins having self-spacing collars. Fins shall be mechanically bonded to the tubes. Integral sub-cooling circuits shall be incorporated into the coil. Condenser divider baffles shall fully separate each condenser fan section to control the airflow to maintain proper head pressure control.

2.8 Fans

The fans shall be heavy duty, aluminum blade, direct drive propeller type. Motors shall be three phase type with internal overloads. Fan blades shall be statically and dynamically balanced. Fan motor shall be rated minimum IP54 for outdoor application.

GUIDE SPECIFICATIONS

2.9 Compressor

The compressors shall be Tandem or Trio Scroll with suction and discharge manifold, with oil and gas equalization provided. All compressors shall be direct drive with an integral two-pole hermetic squirrel cage motor. A dust-proof terminal box, located in an accessible location on the compressor, shall contain all connection terminals.

The compressors shall be fitted with a crankcase heater, and oil sight glass.

2.10 Capacity Control

Compressor cycling shall be utilized to match the demand requirement of the system. The factory supplied temperature controller shall cycle compressors in response to leaving fluid temperature and maintain fluid temperature within 3.0°F [1.7°C] of setpoint. This system is to provide precise and stable control of supply fluid temperature over the complete range of operating conditions. It shall be capable of maintaining a system capacity range from 100% to _____% at specified conditions without hot gas bypass.

2.11 Refrigerant Circuit

(Two compressors) (Four compressors) (Six compressors) shall be used with a direct expansion evaporator.

Insulate evaporator and other cold surfaces as required to prevent condensation at ambient conditions of 75% rH of 90°F [32°C] dry bulb with no air movement.

Each refrigerant circuit shall include expansion valve, sight glass, moisture indicator, solenoid valve, replaceable core filter-drier, liquid line shut off valves, and charging port.

2.12 Control Center

Control Center shall be fully enclosed in a steel, baked powder coated control panel with hinged access doors. Dual compartments, separating safety and operating controls from the power controls, are to be provided.

A. Controls shall include:

1. Compressor protection, solid state, thermal sensing overloads, with manual reset.
2. High refrigerant discharge pressure, manual reset.
3. Low refrigerant suction pressure protection
4. Freeze protection, manual reset.
5. Chilled fluid flow switch interlock.
6. Separate power terminal blocks for main power and 115V AC chiller heater power.
7. Compressor starter including current sensing overload protection.
8. Factory installed controller including integral anti-recycle protection.
9. Complete labeling of all control components.
10. Numbered terminal strips and labeled components for easier wire tracing.
11. Condenser fan cycling control.

Electromechanical temperature controller can be offered for the ease of operation. Intelligent controller shall be offered as option for complete unit monitoring and control. For any type of controller is offered, items listed at 2.12.A shall be complied.

The electromechanical temperature controller shall be capable to perform up to four stages of temperature control, based on the leaving fluid temperature.

Intelligent microprocessor controller shall be provided for complete monitoring and control of the unit. The unit algorithm program and operating parameters shall be stored in FLASH-MEMORY that does not require a back-up battery. Microprocessor controller which requires back up battery shall not be accepted.

The controller shall be equipped with a user friendly semi-graphical display panel. All description shall be spelled out in English; unit of measurement shall be selectable between Imperial and Metric. The display panel shall have dedicated keys for access to each individual menu/function, such as input status, compressor status, alarm history, real time clock, login and etc. The controller shall provide minimum three levels of access to prevent unauthorized access to control setpoints and parameters.

The microprocessor controller shall provide as a minimum the following features and options.

1. Control Functions:
 - a. Staging of compressors to achieve precise control of leaving water.
 - b. Switching of fans on the air cooled condenser to control head pressure.
 - c. Anti-recycle timer
 - d. 7 day weekly schedules for machine control.
 - e. Automatic pump-down before unit shut down; and pump-out during unit start-up
 - f. Proactive control of compressor cycling to help prevent high pressure or low pressure trips.
 - g. Proactive control providing safeties for high pressure, low pressure and freeze protection, to eliminate nuisance trips.
 - h. Proactive compressor staging to eliminate overloading during start-up to reduce compressor cycling.
 - i. Hotgas bypass control [option]
2. Unit Protection:
 - a. Low pressure cutout with Proactive safety.
 - b. High pressure cutout with Proactive safety.
 - c. Automatic re-start from power outage with event posting.
 - d. Evaporator freeze protection.
 - e. Sensor error.
 - f. Pump down -pump out failure.
 - g. Compressor starter error lockoff.
3. Readouts:
 - a. Leaving liquid temperature.
 - b. Evaporator suction pressure
 - c. Condenser discharge pressure
 - d. Unit control Status.
 - e. Water flow switch status.

GUIDE SPECIFICATIONS

- f. Compressor status.
 - g. Liquid line solenoid control status.
 - h. Condenser fan control status.
 - i. Unit alarm status.
4. Setpoints with proper authorization:
- a. Leaving chilled water temperature setpoint
 - b. Leaving chilled water temperature control zone
 - c. Evaporator freeze protection alarm setpoint
 - d. Evaporator leaving chilled water high and low temperature alarm setpoint
 - e. Fan staging control setpoints
 - f. Pumpdown control setpoints
 - g. Low suction pressure safety setpoints
 - h. High discharge pressure safety setpoints
5. Alarm history
- a. 99 of most recent alarms shall be retained in Alarm History with below information:
 - i. Date and time the alarm was triggered with description on the alarm triggered
 - ii. Suction pressure
 - iii. Discharge pressure
 - iv. Evaporator leaving chilled water temperature
6. Group Control and Remote monitoring capabilities
- a. Unit Master Slave Control
 - b. Building Management System (BMS) Interface
Controller shall be equipped with factory supplied and installed communication card [option] for interfacing with Building Management System (BMS).
 - c. Various communication protocols as below shall be offered.
 - i. Modbus RTU RS485
 - ii. Modbus TCP/IP
 - iii. BACnet TCP/IP
 - iv. BACnet MS/TP
 - v. BACnet PTP
 - vi. LonTalk

2.13 Options and Accessories

Shell-And-Tube Evaporator (ST) – Shell-And-Tube vessel shall be supplied as evaporator in lieu of brazed plate heat exchanger. Shell-And-Tube evaporator shall be constructed in accordance with ASME CODES Sections VIII Division I for unfired pressure vessels. ASME approval shall be available on request.

Double Thick Insulation – Evaporator shall be insulated with double thick 2" [50mm] closed cell insulation for extra resistance to condensation

Dual Mode Operation – The unit shall be capable to operate in dual mode operation, and able to deliver chilled fluid temperature down to 20 °F [-6.6 °C] during ice making mode.

Low Temp. Operation – The unit shall be capable to deliver chilled fluid temperature down to 20 °F [-6.6 °C].

Low Noise Fan (LNF) – Low noise fans are incorporated to reduce unit sound level

Compressor Acoustic Jacket (LN2) – Compressor acoustic jackets shall be added to further reduce unit sound level.

Low Ambient Operation (LA 1) – To allow unit operation down to 14 °F [-10 °C] ambient temperature

Extra Low Ambient Operation (LA 2) – To allow unit operation down to -20°F [-29°C] ambient temperature

Heat Recovery (DES) – To recover heat from compressor to produce hot water up to 55°C.

Condenser Corrosion Protection – Options on condenser materials and costing to improve corrosion resistance.

- a. Copper (CU) fins coil
- b. Hydrophilic coated fins coil
- c. DB-COAT, the post-coated solution for condenser coil to provide extensive corrosion protection which withstand not less than 5000 hours salt spray testing as per ASTM B-117

Protective Grille for Condenser Coil – Grille to protect condenser coil from unauthorized access

Hot Gas Bypass (HGBP) – To maintain unit operation below minimum unloaded capacity.

Pressure Gauges (GAG) – Pressure gauges shall be installed on the unit to display suction and discharge pressure readings

Evaporator Heater (EVH) – Strip heater shall be wrapped around the evaporator to provide anti-freeze protection down to -20°F[-28.9°C] ambient temperature

Hydronic Pump Package (HPP) – Circulating pumps and fittings, completed with insulated expansion tank shall be provided with up to 50ft.wg pump head for the ease of installation. Dual pumps package shall be available for the ease of duty-standby operation

Electrical And Controls

Unit Mounted Main Disconnect Switch – Non-fused disconnect switch with external lockable handle shall be furnished to isolate unit main incoming power supply for servicing.

Softstarter For Compressor Motors – Solid State starter comes with bypass contactor shall be furnished to reduced mechanical stress and inrush current at compressor start-up

IP55 Control Panel – Control panel with IP55 rating shall be supplied for harsh working environment

Voltmeter (VM3) / Ammeter (AM3) – Analog ammeter or voltmeter with 3 phase selector switch shall be supplied for voltage / current indication, located inside the control panel

Ground Fault Interrupt (GFI) – Provides equipment with ground fault protection

Convenience Outlet (CON) – 115Vac GFCI convenience outlet with female receptacle shall be supplied for 60Hz units. For 50Hz units, 230Vac convenience outlet shall be supplied

Weather Proof Alarm Bell (WPA) – Weatherproof audible alarm shall be supplied for common alarm fault alert

GUIDE SPECIFICATIONS

Micro Vision (V2C) – Intelligent microprocessor controller shall be supplied in lieu of electromechanical controller

Below options shall be available for units with intelligent controller.

Low Ambient Monitoring & Lock-Out (LAL) – Ambient temperature sensor shall be supplied and ambient temperature readout shall be used to lock-out unit to prevent unit operation at low ambient condition.

Entering Chilled Water Temperature Sensor – Temperature sensor shall be installed to monitors fluid temperature returns to unit evaporator

Chilled Water Pump Control – Primary chilled water pump shall be controlled by chiller's Micro Vision controller for enhanced safety operation

System Voltage Measurement (SVM) – Voltage of power supply shall be displayed on the unit display panel

Chilled Water Reset (RFTR) – To allowed controlled temperature setpoint to be reset by a 4-20mA signal from BAS

Demand Limiting (AMPL) – To limit maximum running compressors by 4-20mA signal from BAS

BMS Communication – Below communication protocol shall be provided with add-on communication card:

- a. Modbus RTU RS485 / TCPIP
- b. BACnet over IP / MSTP / PTP
- c. LonTalk

Factory Supplied, Field Installed By Customer

Evaporator Water Flow Switch (WFS) – Flow switch shall be shipped loose and installed at evaporator outlet piping at field as safety interlock to evaporator water flow status. Three options shall be available: Weather tight flow switch with CE mark; NEMA 3R, and NEMA 4 rated flow switch

Rubber-in-shear Isolators (RIS)

Spring Isolators (SPG) – Spring isolator with 1" [25.4mm] deflection.

3.0 EXECUTION

3.1 Installation Work By Mechanical Contractor

- A. Install on a flat surface level within 1/16 inches [1.6mm] and of sufficient strength to support concentrated loading. Place vibration isolators under the unit.
- B. Assemble and install all components furnished loose by manufacturer as recommended by the manufacturer's literature.
- C. Complete all fluid and electrical connections to unit, fluid circuits and electrical circuits are serviceable.
- D. Provide and install valves in fluid piping upstream and downstream of the evaporator to provide means of isolating shells for maintenance and to balance and trim system.
- E. Provide soft sound and vibration eliminator connections to the evaporator fluid inlet and outlet as well as electrical connections to the unit.
- F. Interlock chillers through a flow switch in the chilled fluid line to the chilled fluid pump to ensure the unit can operate only when fluid flow is established.
- G. Furnish and install taps for thermometers and pressure gauges in fluid piping adjacent to inlet and outlet connections of the evaporator.
- H. Provide and install drain valves with capped hose ends to each fluid box.
- I. Install vent cocks to each fluid box.

3.2 Work By Temperature Control Contractor

- A. Furnish interlock wiring per manufacturer's recommendations and install loose control components furnished by chiller manufacturer.

3.3 Work By Electrical Contractor

- A. Furnish power wiring to chiller control panel and obtain required code approval.
- B. Furnish and install approved disconnect switch and short circuit protection and short circuit protection.





Malaysia

Lot 5755-6,
Kidamai Industrial Park,
Bukit Angkat,
43000 Kajang,
Selangor, Malaysia

Tel: +603-8924 9000
Fax: +603-8739 5020

China

No. 1 Dunham-Bush Road,
Laishan District,
Yantai,
Shandong Province,
China 264003

Tel: +86-535-739 7888
Fax: +86-535-739 7999

United Kingdom

8 Downley Road,
Havant,
Hampshire,
England PO9 2JD

Tel : +44-23-9247 7700
Fax: +44-23-9245 0396

United States of America

2125 NW 86th Ave
Doral, Florida 33122
United States of America

Tel: +305-883-0655
Fax: +786-527-3539

United Arab Emirates

Office # 2606,
Fortune Executive Towers,
Cluster T1, Jumeirah Lake Tower
Dubai, UAE

Tel: +971-4-443 9207
Fax: +971-4-443 9208

South Africa

No. 57 Sovereign Drive
Route 21 Corporate Park
Irene, Pretoria
South Africa

Tel: +27-12-345 4202
Fax: +27-12-345 4203

Singapore

2 Kallang Pudding Road
#07-07 Mactech Building
Singapore 349307

Tel: +65-6842 2012
Fax: +65-6842 2013

Indonesia

The Vida Building 7th Floor
Jl. Raya Perjuangan
No. 8 Kebon Jeruk
Jakarta 11530, Indonesia

Tel: +62-21-2977 8100
Fax: +62-21-2977 8001

Thailand

1 QHouse Lumpini,
27th Floor, South Sathorn Road,
Tungmahamek, Sathorn,
Bangkok Thailand 10120

Tel: +66-0-2610 3749
Fax: +66-0-2610 3601

Vietnam

10th Floor, Nam A Bank Tower,
201-203 Cach Mang Thang 8 Street,
District 3, Ho Chi Minh City,
Vietnam

Tel: +84-8-6290 3108
Fax: +84-8-6290 3109

DUNHAM-BUSH®

info@dunham-bush.com
www.dunham-bush.com



Products that perform...By people who care

Manufacturer reserves the right to change specifications without prior notice.

MS-0495D-1016