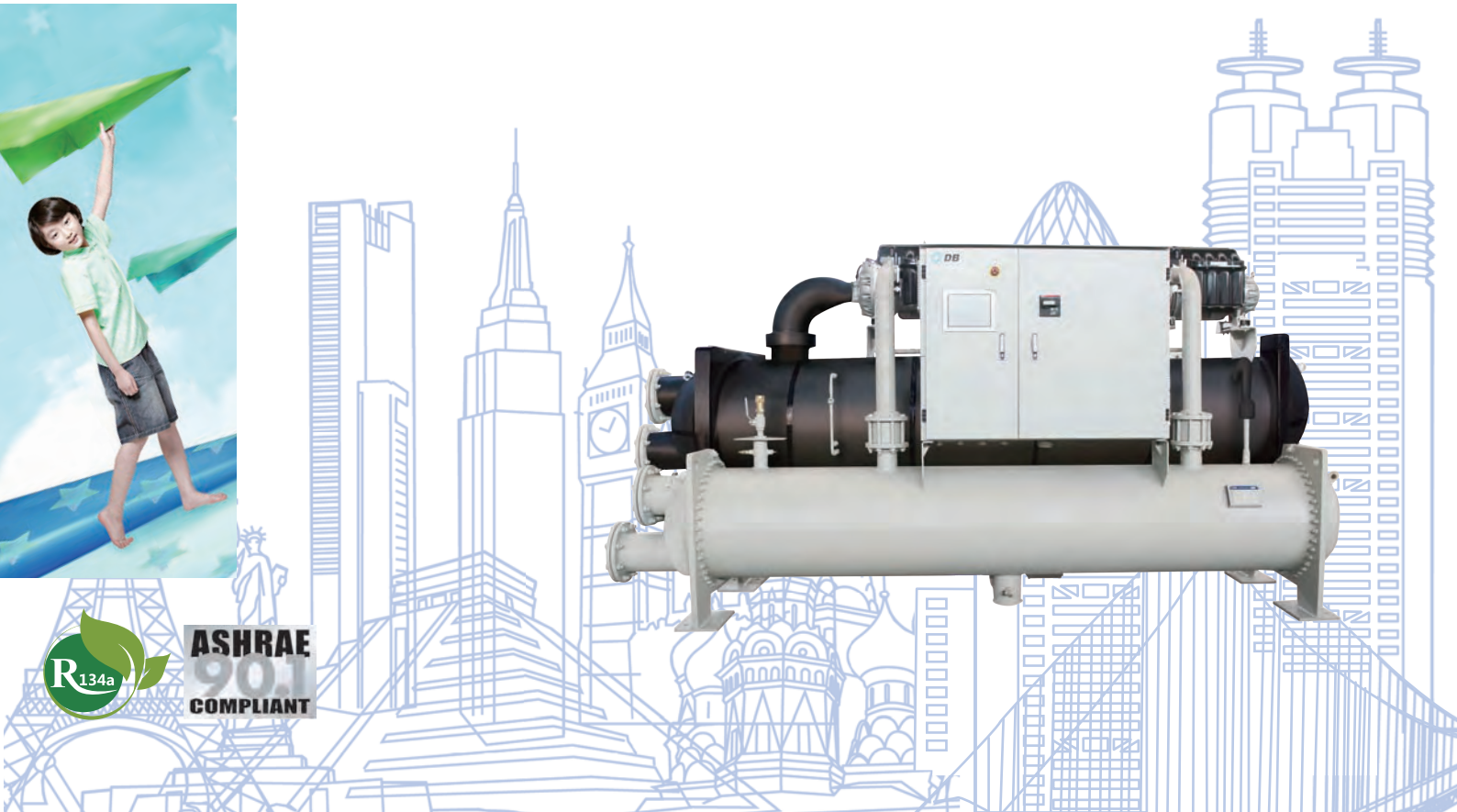
PROmetheus

Magnetic Bearing Variable Speed Centrifugal Chiller

DCLC-M 50/60Hz

Cooling Capacity: 316~2391kW (90~680RT)

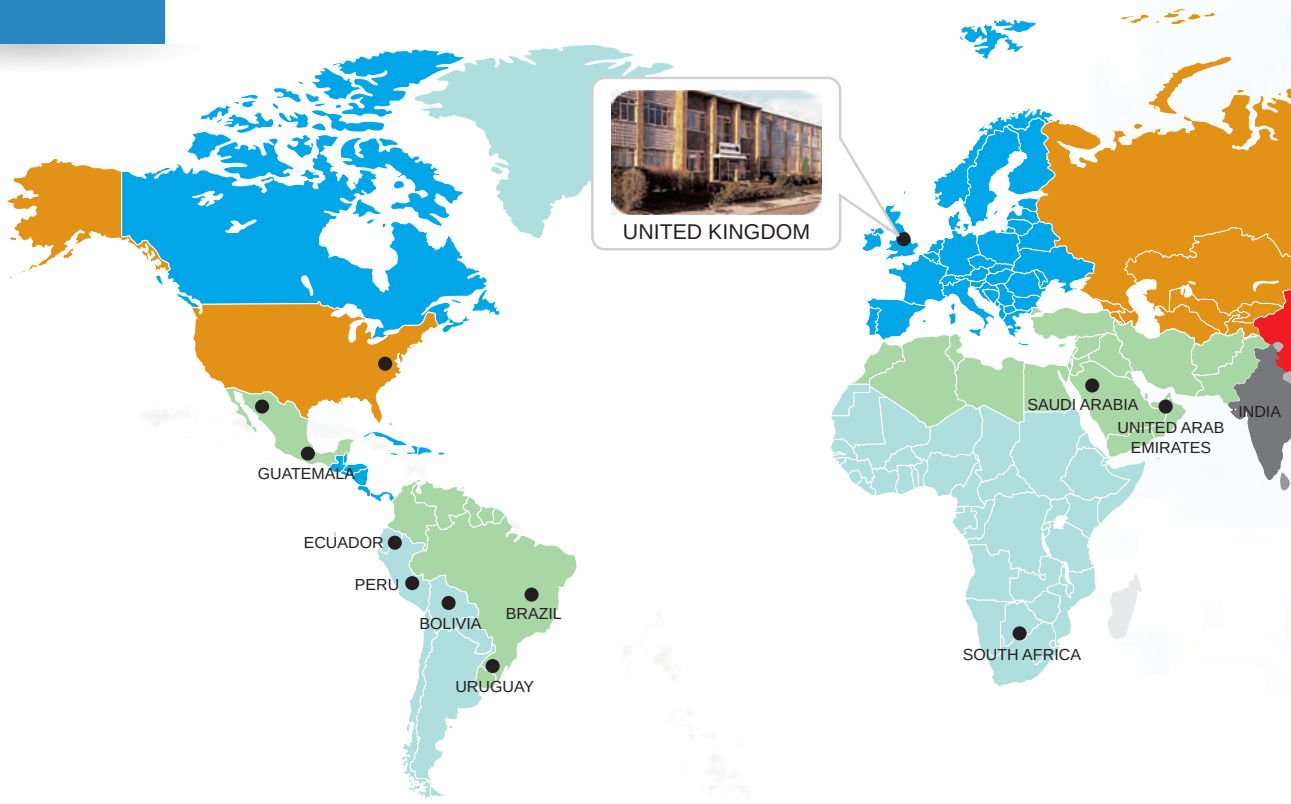
Dunham-Bush Air Conditioning



R134a

ASHRAE 90.1 COMPLIANT

MILESTONE



Dunham-Bush Profile

Dunham-Bush, one of the world's top commercial air conditioning manufacturers, has long been committed to offering creative solutions for the customer's requirements over its 120 years history in the HVAC/R. Dunham-Bush offers a complete range of HVAC/R products such as large chillers, unitary, airside system and thermal energy storages for residences, commercial buildings and industrial facilities. Dunham-Bush is striving to be the leader in the commercialization of green technologies. Today, by utilizing our global network of sales and service offices, Dunham-Bush is offering our value-added products and solutions to all corners of the world.

1894 Built in USA as a professional manufacturer of HVAC/R equipments.

1904 Developed the first air compressor system.

1906 The second Dunham-Bush comp

1924 Developed the firs

1930

Today and Beyond — Innovations... never ends

2013 — New compressor R&D center was founded in UK to engage in high tier compressor technology.

2008 — Dunham-Bush launched its new logo to match its new global brand & business strategy.

1998 — Dunham-Bush built the factory in Kajang, Malaysia. Later built Global Headquarters there in 2000.

1996 — Hartford Compressors Incorporated was built in USA.

1995 — Dunham-Bush Yantai Co. Ltd. was jointly built by Dunham-Bush Group and Yantai Moon Group.

1967 — Patented the technology to use a screw compressor for refrigeration / cooling.

1965 — Developed the first centrifugal chiller.

1956 — Engaged in the research, development and production of high standard products.

1948 — The factory in West Hartford, Connecticut, USA was built.

1935 — Factory in Morden, Great Britain was built to produce heating products.

Manufactured the first air cooled
ir conditioner.

t reciprocating compressor.

pany was built.

DUNHAM-BUSH MALAYSIA

Dunham-Bush Malaysia; founded in 1987, adhered to the innovation system of focusing on customers' demands to drive global research & design, and superior quality manufacturing. Nowadays Dunham-Bush Malaysia are creating innovative cooling solutions appropriate to the individual requirements of commercial building, schools, hospitals, airports, factories and residences. No matter where you are, what we deliver is the same: high performing, highly engineered cooling solutions developed to take on the challenges of the 21st century.



PROmetheus

Magnetic Bearing Variable Speed Centrifugal Chiller

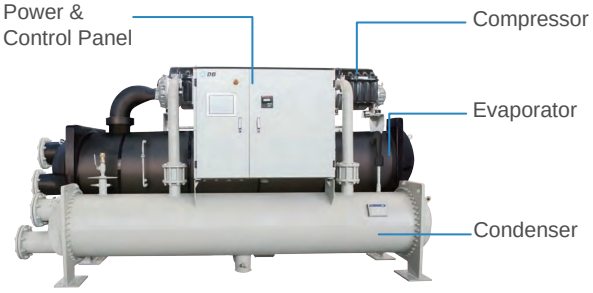
DCLC-M

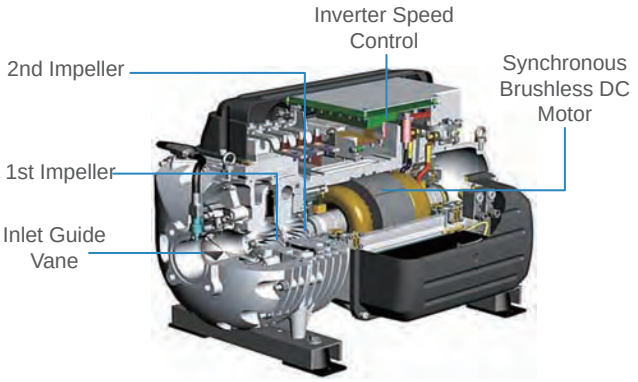
Dunham-Bush PROmetheus DCLC-M Series Introduction

Dunham-bush DCLC-M Centrifugal chillers with State-Of-The-Art magnetic bearing oil-free compressor offers owner packaged chiller with supreme efficiency, reliability and sustainability.

Features and Benefits

DCLC-M Centrifugal Chillers are designed to exceed ASHRAE Standard 90.1 requirements. The cutting edge magnetic bearing oil-free compressor, superior evaporator and condenser, Electronic Expansion Valve (EEV) and the intelligent chiller controller ensures the DCLC-M performance and stability when operates at both full load and part load conditions.





Nomenclature

DCLC 300 M D AU

- DCLC: Dunham-Bush Centrifugal Liquid Chiller
- 300: Model
- M: Magnetic Bearing Oil Free Compressor
- D: Number of Compressor(s)
  - S - Single Compressor
  - D - Twin Compressors
  - T - Three Compressors
  - F - Four Compressors
- AU: Power Supply
  - AU: 400V/3Ph/50Hz
  - CS: 400V/3Ph/60Hz
  - AR: 460V/3Ph/60Hz

FEATURES

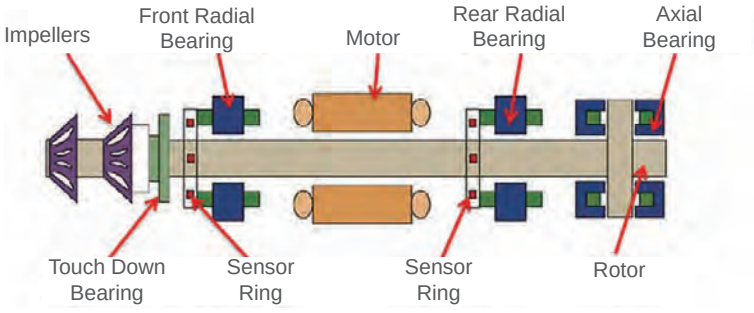


Advanced Technology

Magnetic Bearing

Conventional Bearing with Wear and Tear

Magnetic Bearing, Non-Touching Operation

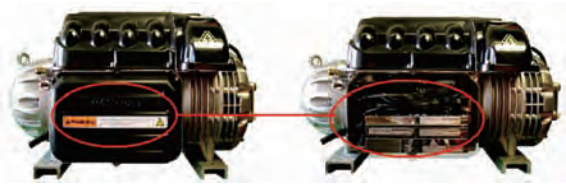


The axially and radially located magnetic bearings create electromagnetic field which levitates the shaft during rotation and float on the magnetic cushion. This has prevented contact between compressor shaft and other metallic surfaces, and thus, the oil lubrication system is no longer needed. The proximity sensors at bearings sense rotor movements and adjustment are made accordingly in the rate of 6,000,000 times per minute. This ensures presicion of rotor position in the magnetic field.

Power Failure Protection

In the case of power failure, the capacitors (4 x 8000μF) provide backup power to bearings to keep the rotor levitated. The rotor will continue to rotate with its rotational inertia, and this will turn the motor into a generator which will then power itself down to a stop.

Inverter Speed Control & Soft-starter



The Magnetic Bearing compressor is furnished with built-in inverter speed control and soft-starter, with below advantages:

- No surge current
- Wide operating range, can work at 10% minimum load
- High efficiency throughout the working range
- Auto-tuning on rotation speed to eliminate compressor surging

Direct Drive Rotor & Impeller

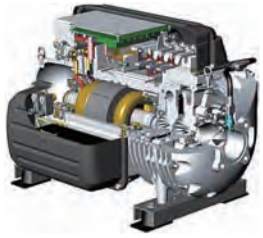
The impellers are keyed directly to the shaft and this is the only major moving compressor component. No transmission device needed and thus, eliminate the transmission losses and the compressor size can be much compact.

As no mechanical contact during the rotation, the unit noise level is greatly reduced.



FEATURES

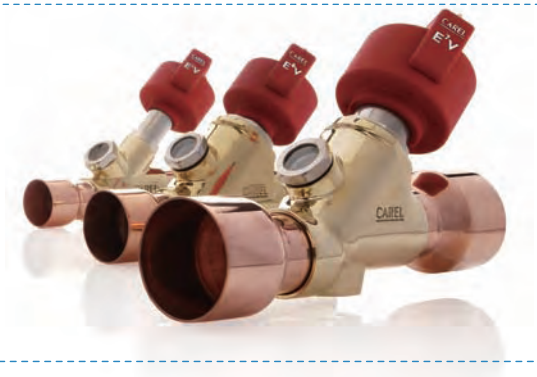
Dual-Stage Compression



DCLC-M compressors are with dual-stage compression design. Compressors with dual-stage compression technology can be operated at higher lift and wider operating range. With the built-in inverter speed control, DCLC-M can be operated stably and efficiently at a wider operating range.

Refrigerant Liquid Level Control

By using Electronic Expansion Valve (EEV), the refrigerant flow into evaporator can be control precisely. In such, the refrigerant liquid level in evaporator can be controlled at the optimum level to maximized heat transfer in the flooded type, shell-and-tube heat exchanger.



Rapid Recovery

Conventional centrifugal chiller needs to ensured oil lubrication at right pressure and temperature before starting the compressor motor. Even with essential power supply to the oil lubrication system, it will easily take more than a minute to restart the compressor motor. Thanks to the oil-free technology, DCLC-M chillers can rapidly recover from a power failure with much shorter restart time. This is a great feature especially for data center and process cooling applications.

Energy Saving

- No Friction Loss – Compressor shaft has no physical contact with other mechanical components
- No Transmission Loss – With direct drive design at compressor shaft, conventional gear transmission is eliminated
- No Lubrication Oil – DCLC-M is Oil-Free. Heat exchanger's de-rating performance due to lubricating oil is prevented.
- High COP – DCLC-M full load COP is up to 6.54 [0.538kW/ton]; IPLV is up to 11.8 [0.298kW/ton], far more efficient than conventional centrifugal chillers.

Below table shows an example to compare annual energy consumed by a 300RT DCLC-M (DCLC-300MD) versus a conventional 300RT centrifugal chiller, with 3000 hours operating time annually.

Model	DCLC300MD	Conventional 300RT
Cooling Capacity (KW)	1055KW	1055KW
IPLV	11.8	6.52
Annual Electricity Consumption (KW.h)	182,482	279,278
Electricity Saving (KW.h)	96,796	

FEATURES



Easy Maintenance

- No Oil Lubrication System-
  Improve unit reliability. Free from lubrication oil related problems, such as low oil level, low oil pressure and etc.

- Direct Drive Impeller-
  Only one major moving part in the compressor, less components, less failure.

- Easy Maintenance-
  Without oil lubrication system, routine maintenance becomes very simple. The compressor is virtually maintenance free.

- No Overhauling-
  Periodic overhauling is not required by DCLC-M chillers.

Maintenance work	Standard Chiller R123	Standard Chiller R134a	PROmetheus DCLCM
Change the lubrication oil	Once a year	Each three year	No need
Change oil filter core	Once a year	Once a year	No need
Check oil pump pressure	Once a quarter	Once a quarter	No need
Check oil quality	Once a week	Once a week	No need
Check the pressure differential through oil filter	Once a month	Once a month	No need
Compressor Vibration test	Once a year	Once a year	No need
Oil pump insulation inspection	Each three year	Each three year	No need
Oil heater inspection	Each three year	Each three year	No need
Motor winding inspection	Once a year	Once a year	No need
Contactor and overload set inspection	Once a year	Once a year	No need
Refrigerant inspection	Once a week	No need	No need
Change refrigerant filter core	Once a quarter	No need	No need

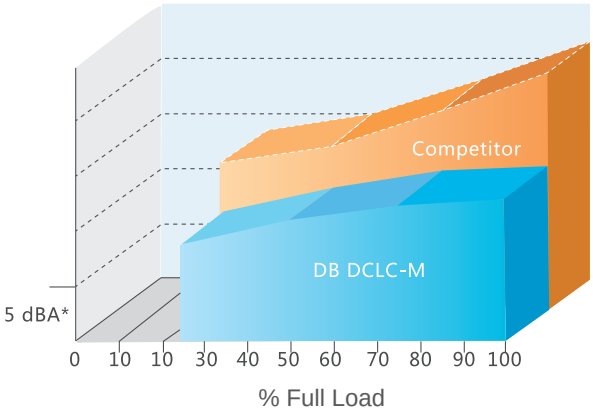


FEATURES

Environmental Protection

- Dunham-Bush DCLC-M chiller is operated with HFC-134a refrigerant, an environmental friendly refrigerant with no Ozone Depletion Potential (ODP) and no phasing out date as per Montreal Protocol.
- Low noise - Compressor noise level as low as 73 dB(A). Chiller Plantroom does not required acoustic treatment.
- Low vibration
- LEED points - Helps to earn points in Energy and Atmosphere category for LEED certification

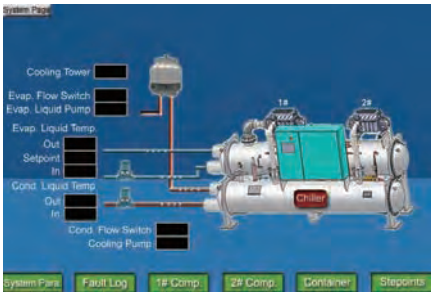
Measured in accordance with AHRI-575

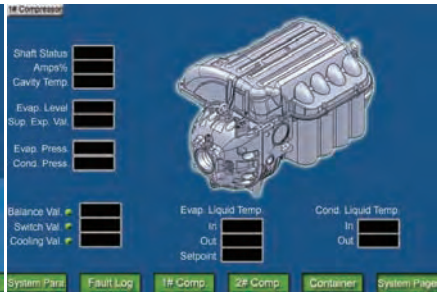


The rotating impeller and shaft is levitated at the magnetic field cushion, and have no physical contact with other components during the operation. Therefore, the unit structural vibration is virtually zero. With the permanent magnet DC brushless motor, the noise level is further reduced. Dunham-Bush DCLC-M centrifugal chillers will be best solution for installation at sound level sensitive area.

Intelligent Control System

- Low starting current thanks for inverter speed control and softstarter
- Dunham-Bush DB Director control the system efficiently and effectively
- 15.4” Color Touch Screen Panel
- Display unit operating parameters
- Programmable Unit Operating Schedule
- Self diagnosis on alarm. Last 10 alarms are recorded
- Single power point connection
- BMS communication protocol- Modbus, BACnet, Profibus





FEATURES

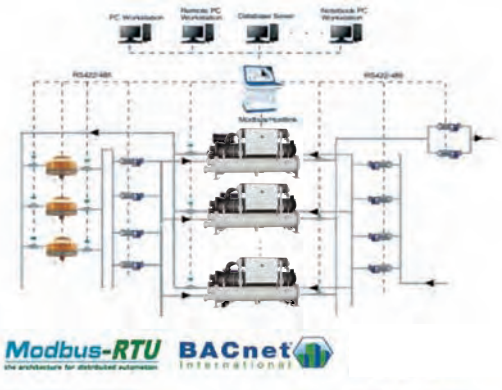


BMS Connectivity, Chiller Plantroom Control

- Built-in ModBus RTU RS485 port for direct interfacing of Building Management System (BMS). Profibus RS485 communication protocol is available as option
- DB Chiller Plant Manager, DB-CPM, a trustworthy and headache-free solution for building owners and users on chiller plant control and automation system
- DB-CPM's advanced controllers supervise equipments in chiller plant such as chillers, pumps, cooling towers and variable frequency drives (VFD); and monitor field devices such as, flow meters, energy meters, digital power meters, sensors & transducers.
- NetVisorPRO – Monitoring software of DB-CPM system provides graphical animations on system operation, temperature and energy trend graphs, historical data and alarm history logs.

Chiller plantroom control and automation by Dunham-Bush DB-CPM provides owners a chiller system with stable and optimized performance in its operation.

DB-CPM



Standard & Optional Features

Item	Standard	Option
Water Connection	Victaulic groove	Flanged; Marine Waterbox
Design Working Pressure (Vessel-Water Side)	1.0MPa [150psi]	1.6MPa [250psi]
Evaporator Insulation Thickness	25mm [1"]	50mm [2"]
Compressor Service Valve	Suction & Discharge	–
Spring Isolator	–	Neoprene Pad; Spring Isolator
Compressor Main Power Isolation	Compressor Circuit Breaker	Main Incoming Isolator
Main Incoming Options	–	Ground Fault Protection (GFI); Digital Power Meter (DPM); EMI Filter
Communication Protocol	Modbus RS485; ModBus TCPIP; BACnet TCPIP	BACnet MSTP; LONworks



SPECIFICATIONS

DCLC-M Technical Specifications

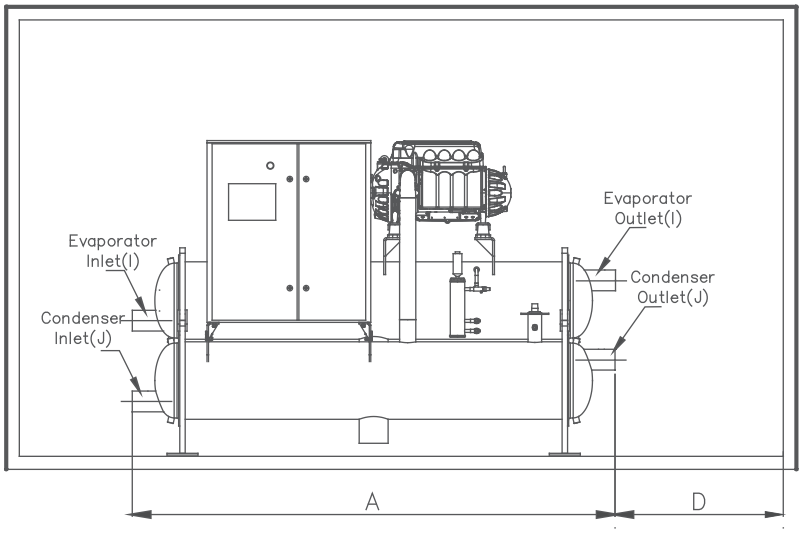
Model	COMPRESSORS		UNIT DIMENSIONS			UNIT WEIGHT	
	Model	Qty	Length	Width	Height	Operating	Shipping
			mm [inch]	mm [inch]	mm [inch]	kg [lbs]	kg [lbs]
DCLC120MS	TT350	1	2750 [108.3]	1020 [40.2]	2040 [80.3]	2691 [5933]	2421 [5337]
DCLC150MS	TT400	1	2750 [108.3]	1020 [40.2]	2040 [80.3]	2863 [6312]	2553 [5628]
DCLC190MS	TT500	1	2750 [108.3]	1020 [40.2]	2040 [80.3]	2932 [6464]	2622 [5780]
DCLC210MD	TT350	2	4027 [158.5]	1020 [40.2]	2040 [80.3]	3531 [7784]	3171 [6991]
DCLC240MD	TT350	2	4027 [158.5]	1020 [40.2]	2040 [80.3]	3730 [8223]	3310 [7297]
DCLC270MD	TT350 TT400	1 1	4063 [160.0]	1160 [45.7]	2117 [83.3]	4287 [9451]	3827 [8437]
DCLC300MD	TT400	2	4063 [160.0]	1160 [45.7]	2117 [83.3]	4328 [9542]	3868 [8527]
DCLC330MD	TT400 TT500	1 1	4063 [160.0]	1160 [45.7]	2117 [83.3]	4742 [10454]	4202 [9264]
DCLC370MD	TT500	2	4063 [160.0]	1160 [45.7]	2117 [83.3]	4808 [10600]	4268 [9409]
DCLC390MT	TT350 TT400	2 1	4360 [171.7]	1880 [74.0]	2080 [81.9]	5673 [12507]	5217 [11501]
DCLC420MT	TT350 TT400	1 2	4360 [171.7]	1880 [74.0]	2080 [81.9]	5822 [12835]	5285 [11651]
DCLC450MT	TT400	3	4360 [171.7]	1880 [74.0]	2110 [83.1]	5969 [13159]	5432 [11975]
DCLC480MT	TT400 TT500	2 1	4360 [171.7]	1880 [74.0]	2110 [83.1]	6135 [13525]	5518 [12165]
DCLC500MT	TT400 TT500	2 1	4405 [173.4]	1994 [78.5]	2110 [83.1]	6650 [14661]	5974 [13170]
DCLC540MT	TT400 TT500	1 2	4405 [173.4]	1994 [78.5]	2110 [83.1]	6708 [14788]	6032 [13298]
DCLC570MT	TT500	3	4405 [173.4]	1994 [78.5]	2110 [83.1]	6753 [14888]	6077 [13397]
DCLC600MF	TT400	4	4936 [194.3]	2096 [82.5]	2150 [84.6]	8359 [18428]	7406 [16327]
DCLC680MF	TT400 TT500	2 2	4936 [194.3]	2096 [82.5]	2150 [84.6]	8468 [18669]	7515 [16568]

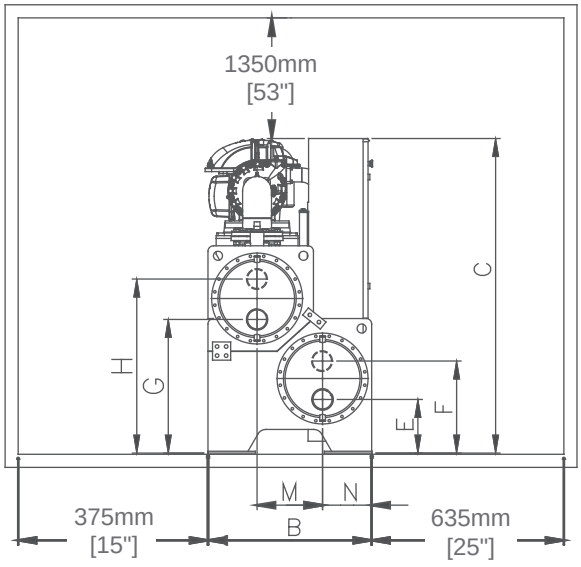
DIMENSIONS



Unit Dimensions

Single Compressor





Model	Length "A"	Width "B"	Height "C"	Clearance For Tube Cleaning "D"	E	F	G	H	M	N	Condenser Water Conn. "J"	Evaporator Water Conn. "I"
	mm [inch]											
DCLC120MS	2750 [108.3]	1020 [40.2]	2040 [80.3]	2200 [86.6]	320 [12.6]	625 [24.6]	884 [34.8]	1226 [48.3]	365 [14.4]	315 [12.4]	6" NPS	6" NPS
DCLC150MS	2750 [108.3]	1020 [40.2]	2040 [80.3]	2200 [86.6]	320 [12.6]	625 [24.6]	884 [34.8]	1226 [48.3]	365 [14.4]	315 [12.4]	6" NPS	6" NPS
DCLC190MS	2750 [108.3]	1020 [40.2]	2040 [80.3]	2200 [86.6]	320 [12.6]	625 [24.6]	884 [34.8]	1226 [48.3]	365 [14.4]	315 [12.4]	6" NPS	6" NPS

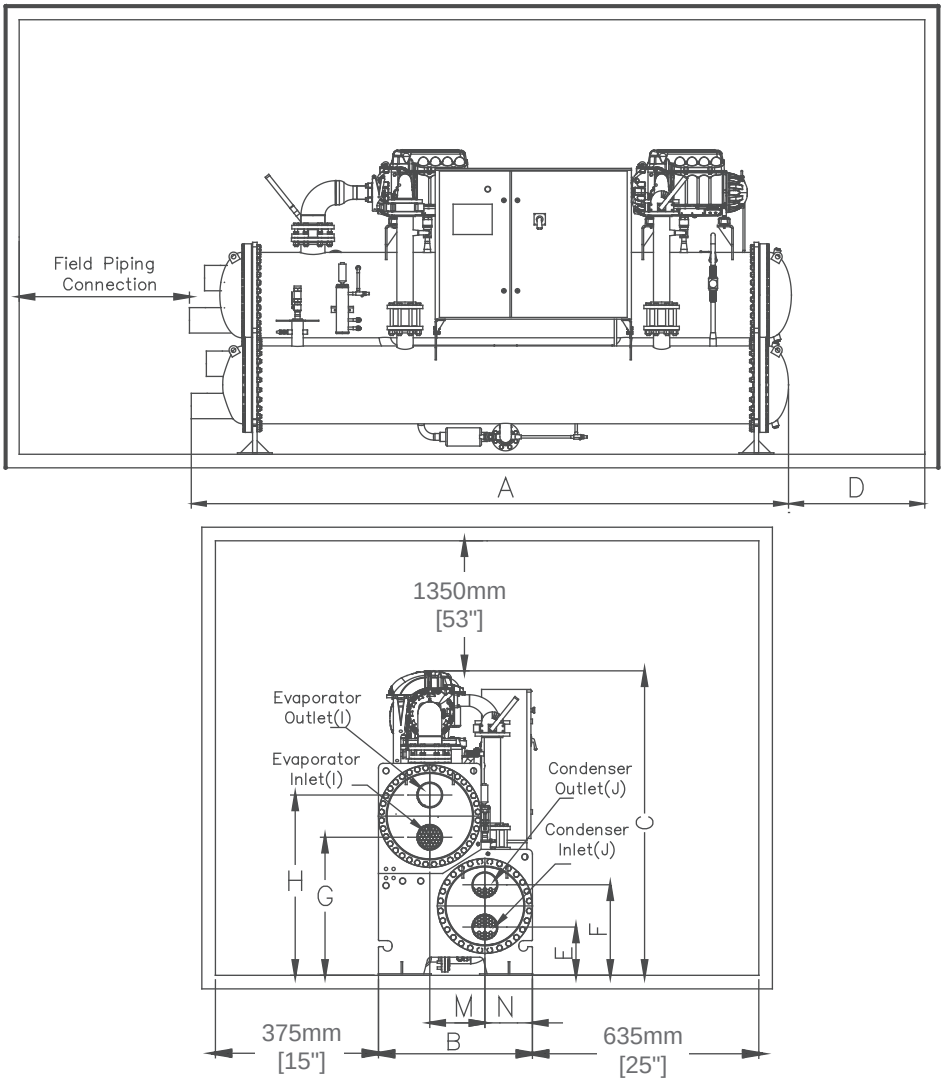
Note: Above dimensions are based on standard unit, with 3 passes evaporator and condenser, 1.0MPa [150psi] water side service pressure.



DIMENSIONS

Unit Dimensions

Twin Compressors



Model	Length "A"	Width "B"	Height "C"	Clearance For Tube Cleaning "D"	E	F	G	H	M	N	Condenser Water Conn. "J"	Evaporator Water Conn. "I"
	mm [inch]											
DCLC210MD	4027 [158.5]	1020 [40.2]	2040 [80.3]	3400 [133.9]	305 [12.0]	614 [24.2]	880 [34.6]	1230 [48.4]	365 [14.4]	315 [12.4]	8" NPS	8" NPS
DCLC240MD	4027 [158.5]	1020 [40.2]	2040 [80.3]	3400 [133.9]	305 [12.0]	614 [24.2]	880 [34.6]	1230 [48.4]	365 [14.4]	315 [12.4]	8" NPS	8" NPS
DCLC270MD	4063 [160.0]	1160 [45.7]	2117 [83.3]	3400 [133.9]	330 [13.0]	680 [26.8]	950 [37.4]	1300 [51.2]	400 [15.7]	380 [15.0]	8" NPS	8" NPS
DCLC300MD	4063 [160.0]	1160 [45.7]	2117 [83.3]	3400 [133.9]	330 [13.0]	680 [26.8]	950 [37.4]	1300 [51.2]	400 [15.7]	380 [15.0]	8" NPS	8" NPS
DCLC330MD	4063 [160.0]	1160 [45.7]	2117 [83.3]	3400 [133.9]	330 [13.0]	680 [26.8]	950 [37.4]	1300 [51.2]	400 [15.7]	380 [15.0]	8" NPS	8" NPS
DCLC370MD	4063 [160.0]	1160 [45.7]	2117 [83.3]	3400 [133.9]	330 [13.0]	680 [26.8]	950 [37.4]	1300 [51.2]	400 [15.7]	380 [15.0]	8" NPS	8" NPS

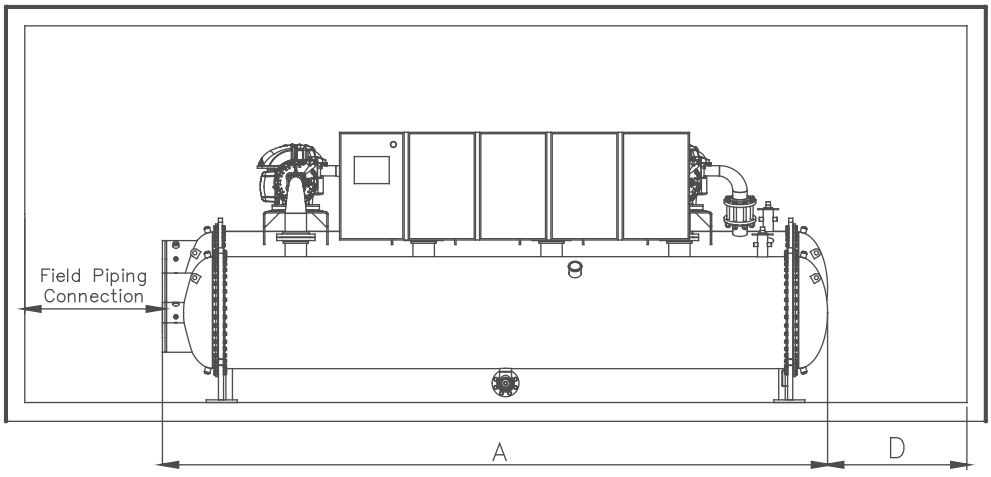
Note: Above dimensions are based on standard unit, with 2 passes evaporator and condenser, 1.0MPa [150psi] water side service pressure, left hand side water piping connection (view from control panel)

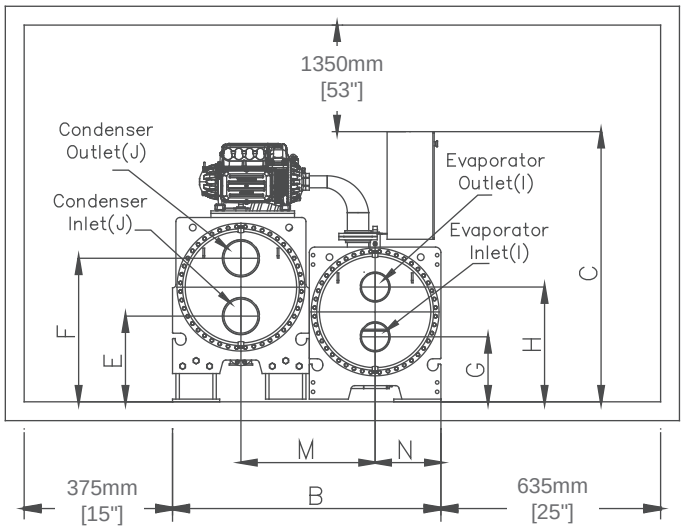
DIMENSIONS



Unit Dimensions

Three & Four Compressors





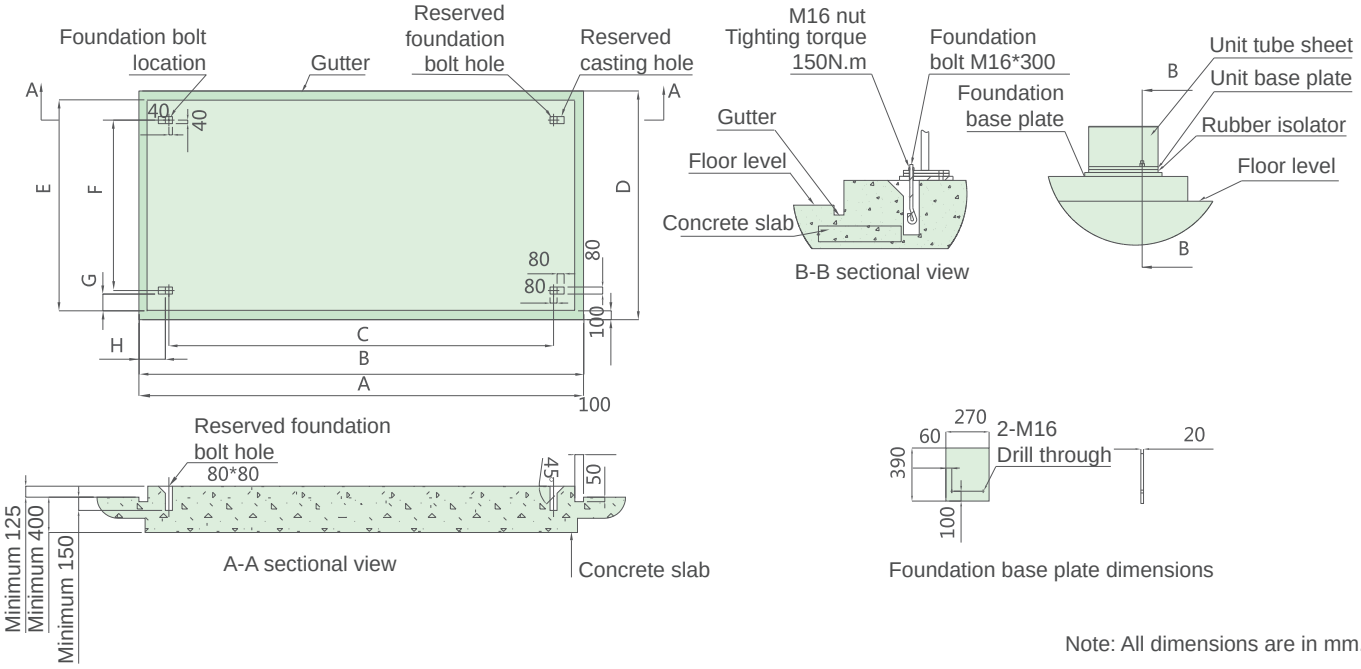
Model	Length "A"	Width "B"	Height "C"	Clearance For Tube Cleaning "D"	E	F	G	H	M	N	Condenser Water Conn. "J"	Evaporator Water Conn. "I"
	mm [inch]											
DCLC390MT	4360 [171.7]	1880 [74.0]	2080 [81.9]	3800 [149.6]	614 [24.2]	1027 [40.4]	480 [18.9]	855 [33.7]	940 [37.0]	464 [18.3]	8" NPS	8" NPS
DCLC420MT	4360 [171.7]	1880 [74.0]	2080 [81.9]	3800 [149.6]	614 [24.2]	1027 [40.4]	480 [18.9]	855 [33.7]	940 [37.0]	464 [18.3]	8" NPS	8" NPS
DCLC450MT	4360 [171.7]	1880 [74.0]	2110 [83.1]	3800 [149.6]	614 [24.2]	1027 [40.4]	480 [18.9]	855 [33.7]	940 [37.0]	464 [18.3]	8" NPS	8" NPS
DCLC480MT	4360 [171.7]	1880 [74.0]	2110 [83.1]	3800 [149.6]	614 [24.2]	1027 [40.4]	480 [18.9]	855 [33.7]	940 [37.0]	464 [18.3]	8" NPS	8" NPS
DCLC500MT	4405 [173.4]	1994 [78.5]	2110 [83.1]	3800 [149.6]	614 [24.2]	1027 [40.4]	461 [18.1]	874 [34.4]	997 [39.3]	489 [19.3]	8" NPS	10" NPS
DCLC540MT	4405 [173.4]	1994 [78.5]	2110 [83.1]	3800 [149.6]	614 [24.2]	1027 [40.4]	461 [18.1]	874 [34.4]	997 [39.3]	489 [19.3]	8" NPS	10" NPS
DCLC570MT	4405 [173.4]	1994 [78.5]	2110 [83.1]	3800 [149.6]	614 [24.2]	1027 [40.4]	461 [18.1]	874 [34.4]	997 [39.3]	489 [19.3]	8" NPS	10" NPS
DCLC600MF	4436 [174.6]	2096 [82.5]	2150 [84.6]	4300 [169.3]	678 [26.7]	1129 [40.4]	461 [18.1]	874 [34.4]	1048 [41.3]	489 [19.3]	10" NPS	10" NPS
DCLC680MF	4436 [174.6]	2096 [82.5]	2150 [84.6]	4300 [169.3]	678 [26.7]	1129 [40.4]	461 [18.1]	874 [34.4]	1048 [41.3]	489 [19.3]	10" NPS	10" NPS

Note: Above dimensions are based on standard unit, with 2 passes evaporator and condenser, 1.0MPa [150psi] water side service pressure, left hand side water piping connection (view from control panel)



FOUNDATION

Foundation Drawing



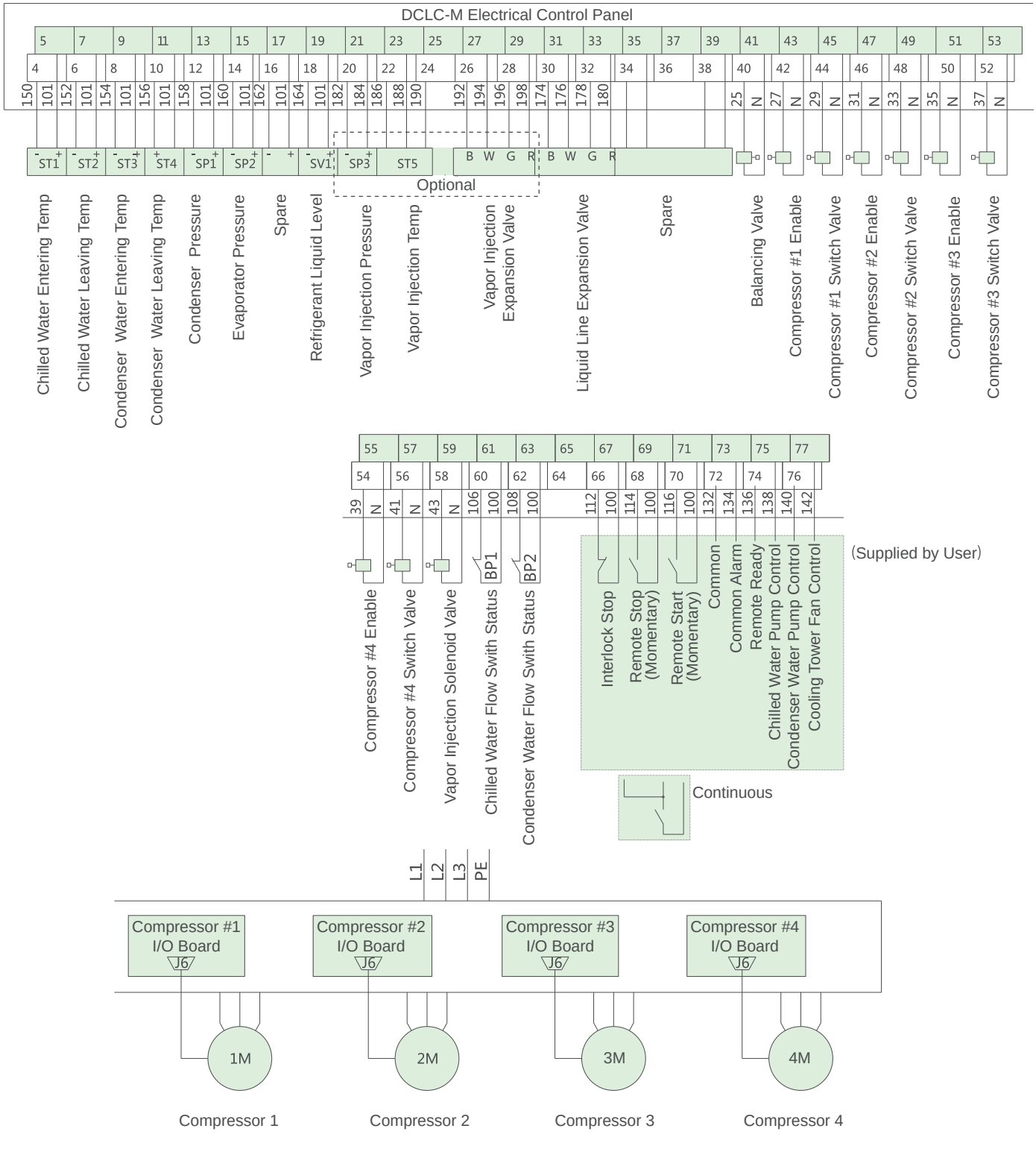
Note: All dimensions are in mm.

Model	A	B	C	D	E	F	G	H
	mm [inch]							
DCLC120MS	3132 [123.3]	2932 [115.4]	2252 [88.7]	1520 [59.8]	1320 [52.0]	860 [33.9]	190 [7.5]	300 [11.8]
DCLC150MS	3132 [123.3]	2932 [115.4]	2252 [88.7]	1520 [59.8]	1320 [52.0]	860 [33.9]	190 [7.5]	300 [11.8]
DCLC190MS	3132 [123.3]	2932 [115.4]	2252 [88.7]	1520 [59.8]	1320 [52.0]	860 [33.9]	190 [7.5]	300 [11.8]
DCLC210MD	4353 [171.4]	4153 [163.5]	3473 [136.7]	1520 [59.8]	1320 [52.0]	860 [33.9]	190 [7.5]	300 [11.8]
DCLC240MD	4353 [171.4]	4153 [163.5]	3473 [136.7]	1520 [59.8]	1320 [52.0]	860 [33.9]	190 [7.5]	300 [11.8]
DCLC270MD	4353 [171.4]	4153 [163.5]	3473 [136.7]	1660 [65.4]	1460 [57.5]	1000 [39.4]	190 [7.5]	300 [11.8]
DCLC300MD	4353 [171.4]	4153 [163.5]	3473 [136.7]	1660 [65.4]	1460 [57.5]	1000 [39.4]	190 [7.5]	300 [11.8]
DCLC330MD	4353 [171.4]	4153 [163.5]	3473 [136.7]	1660 [65.4]	1460 [57.5]	1000 [39.4]	190 [7.5]	300 [11.8]
DCLC370MD	4353 [171.4]	4153 [163.5]	3473 [136.7]	1660 [65.4]	1460 [57.5]	1000 [39.4]	190 [7.5]	300 [11.8]
DCLC390MT	4726 [186.1]	4526 [178.2]	3846 [151.4]	2252 [88.7]	2052 [80.8]	1592 [62.7]	190 [7.5]	300 [11.8]
DCLC420MT	4726 [186.1]	4526 [178.2]	3846 [151.4]	2252 [88.7]	2052 [80.8]	1592 [62.7]	190 [7.5]	300 [11.8]
DCLC450MT	4726 [186.1]	4526 [178.2]	3846 [151.4]	2379 [93.7]	2179 [85.8]	1719 [67.7]	190 [7.5]	300 [11.8]
DCLC480MT	4726 [186.1]	4526 [178.2]	3846 [151.4]	2379 [93.7]	2179 [85.8]	1719 [67.7]	190 [7.5]	300 [11.8]
DCLC500MT	4726 [186.1]	4526 [178.2]	3846 [151.4]	2379 [93.7]	2179 [85.8]	1719 [67.7]	190 [7.5]	300 [11.8]
DCLC540MT	4726 [186.1]	4526 [178.2]	3846 [151.4]	2379 [93.7]	2179 [85.8]	1719 [67.7]	190 [7.5]	300 [11.8]
DCLC570MT	4726 [186.1]	4526 [178.2]	3846 [151.4]	2379 [93.7]	2179 [85.8]	1719 [67.7]	190 [7.5]	300 [11.8]
DCLC600MF	5247 [206.6]	5047 [198.7]	4367 [171.9]	2443 [96.2]	2243 [88.3]	1783 [70.2]	190 [7.5]	300 [11.8]
DCLC680MF	5247 [206.6]	5047 [198.7]	4367 [171.9]	2443 [96.2]	2243 [88.3]	1783 [70.2]	190 [7.5]	300 [11.8]

Notes:
1. Unit vibration is very low; generally foundation bolts are not required, unit can be installed directly on the foundation.
2. When installation on foundation bolts is required, customer to supplies 4 nos of M16*300 foundation bolts and foundation base plates.

FIELD WIRING DIAGRAM





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