

SINCE 1894...



PROmetheus

Magnetic Bearing Variable Speed Centrifugal Chiller

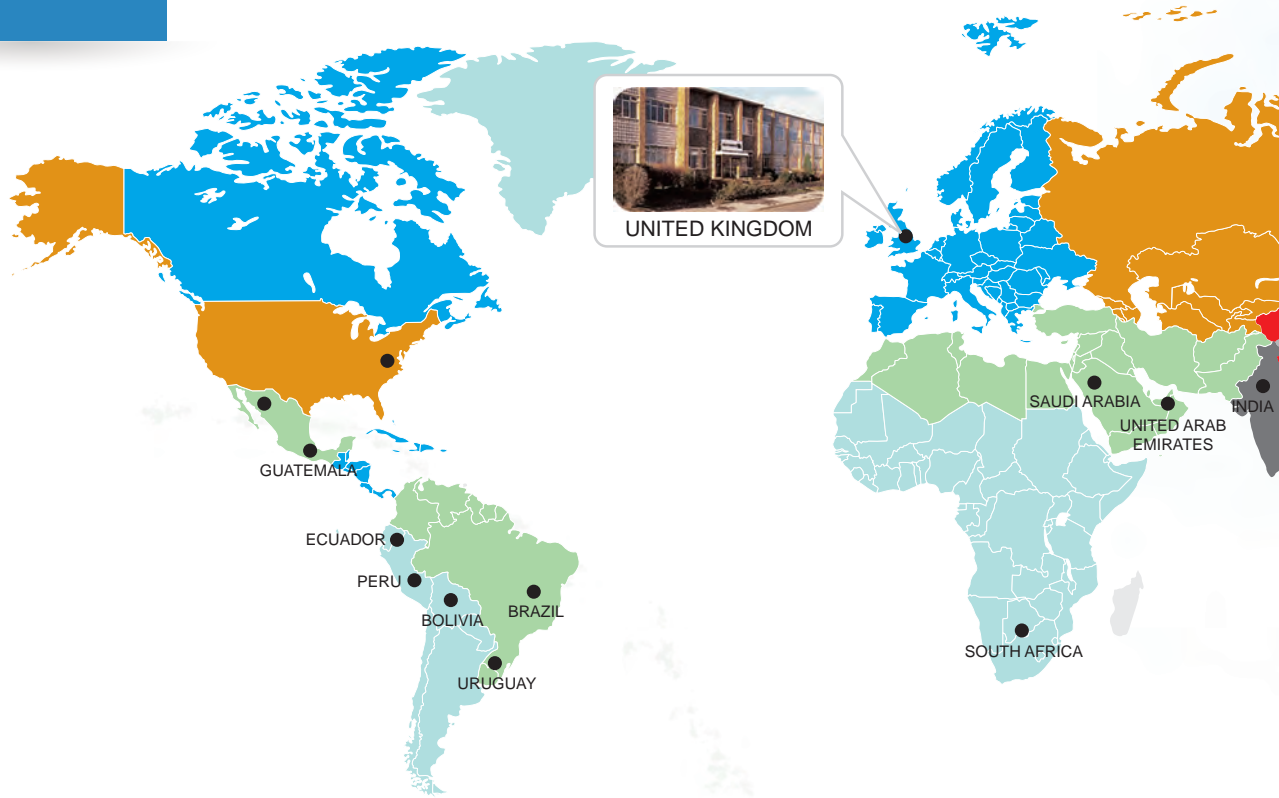
DCLC-M 50/60Hz

Cooling Capacity: 264~3095kW (75~880RT)

Dunham-Bush Air Conditioning

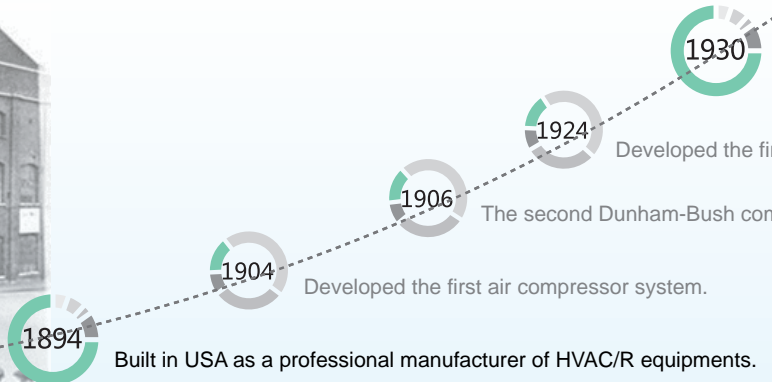


MILESTONE



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.





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 air conditioner.

First reciprocating compressor.

Company was built.



CHINA



MALAYSIA



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



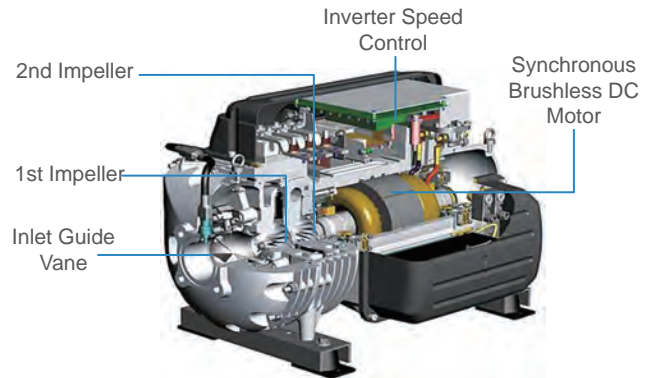
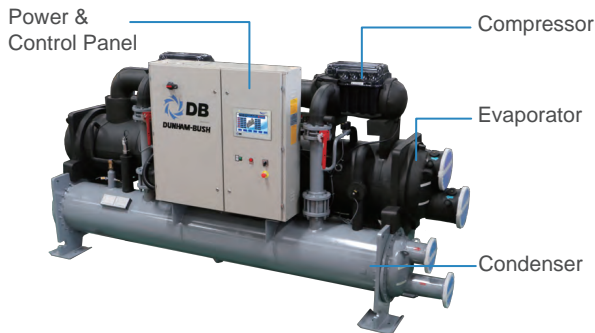
Dunham-Bush PROMetheus DCLC-M Series Introduction

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.

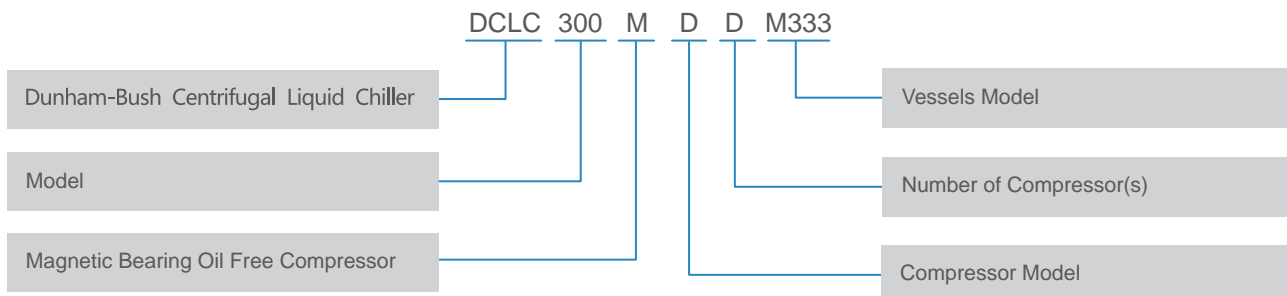


Features and Benefits

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

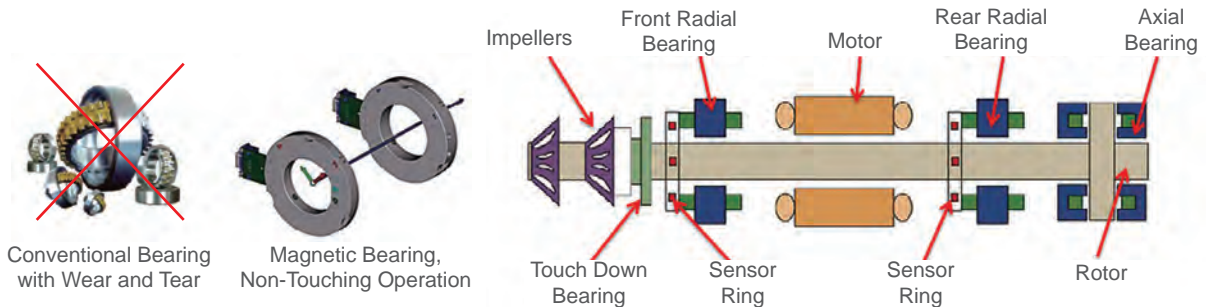


FEATURES



Advanced Technology

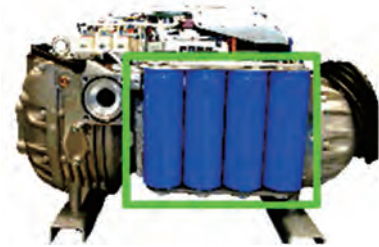
Magnetic Bearing



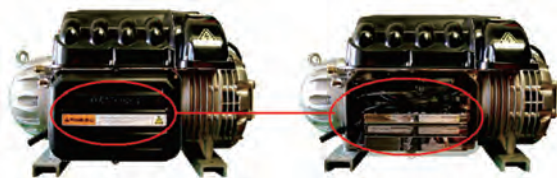
The axially and radially located magnetic bearings create electromagnetic field which levitates the shaft during rotation and float on the magnetic cushion. This has prevented contact between compressor shaft and other metallic surfaces, and thus, the oil lubrication system is no longer needed. The proximity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

Power Failure Protection

In the case of power failure, the capacitors (4 x 8000 μ F) 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

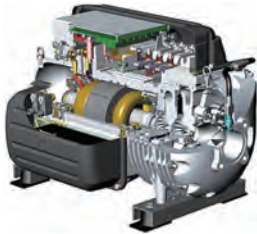
The impellers are keyed directly to the shaft and this is the only major moving compressor component. No transmission device needed and thus, eliminate the transmission losses and the compressor size can be much compact.

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





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 | |



Save 35% Energy

FEATURES



Easy Maintenance



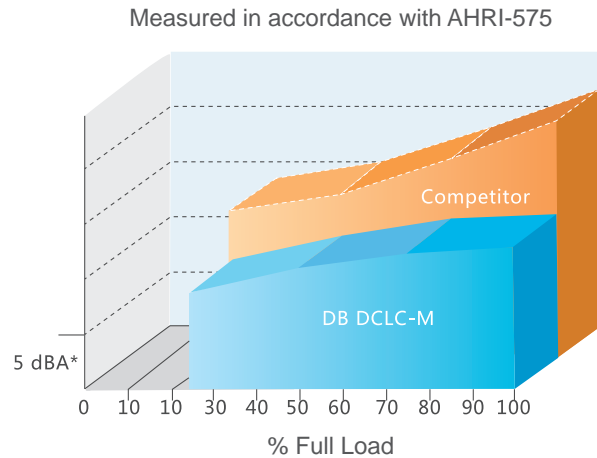
- No Oil Lubrication System-**
 Improve unit reliability. Free from lubrication oil related problems, such as low oil level, low oil pressure and etc.
- Direct Drive Impeller-**
 Only one major moving part in the compressor, less components, less failure.
- Easy Maintenance-**
 Without oil lubrication 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 |
| Contact 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 |



Environmental Protection

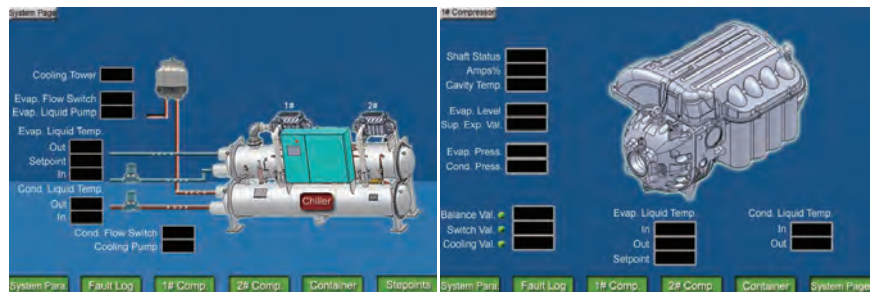
- Dunham-Bush DCLC-M chiller is operated with HFC-134a refrigerant, an environmental friendly refrigerant with no Ozone Depletion Potential (ODP) and no phasing out date as per Montreal Protocol.
- Low noise - Compressor noise level as low as 73 dB(A). Chiller Plantroom does not required acoustic treatment.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



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
- 10 inch 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



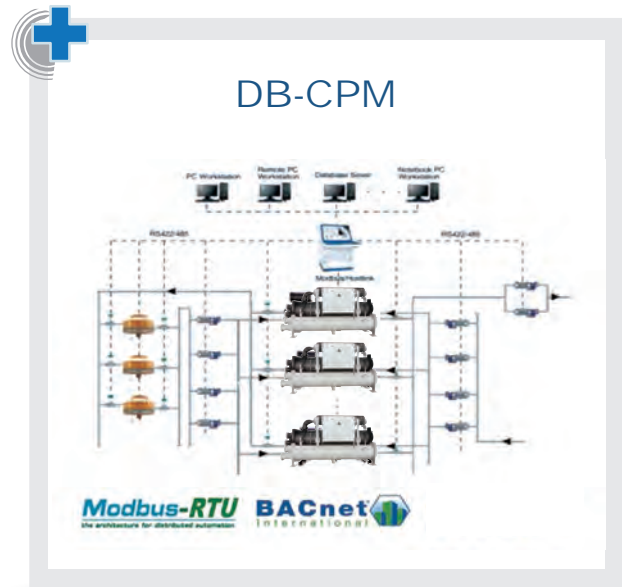
FEATURES



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.



Standard & Optional Features

| Item | Standard | Optional |
|--|--|--|
| Water Connection | Victaulic groove | Flanged; Marine Waterbox |
| Design Working Pressure (Vessel-Water Side) | 1.0MPa [150psi] | 2.1MPa [300psi] |
| 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 TCP/IP; BACnet TCP/IP | BACnet MSTP; LONworks |
| Vessel Code Compliance | — | ASME; JKKP |
| Compressor Extended Warranty | 1 Year | 2 Years; 5 Years |



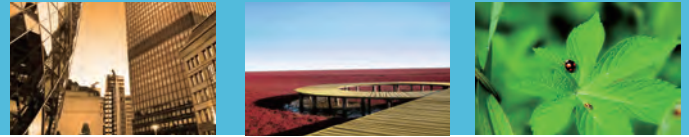
SPECIFICATIONS



DCLC-M Technical Specifications

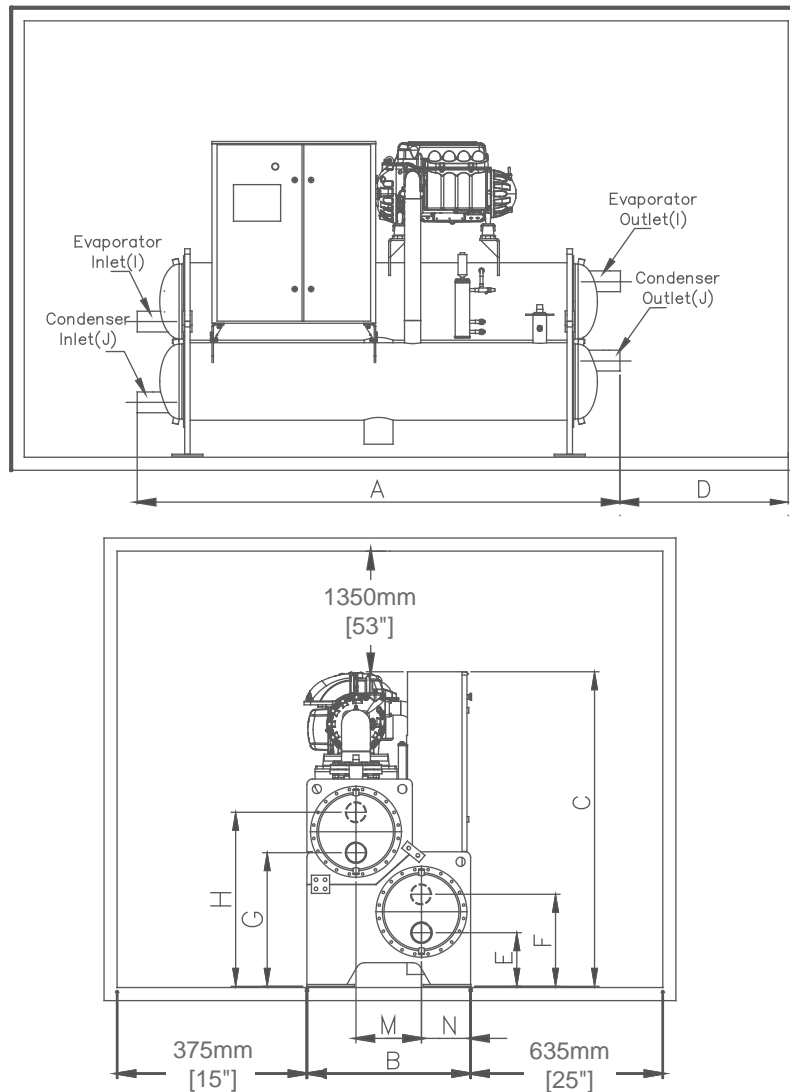
| Model | COMPRESSORS | | UNIT DIMENSIONS | | | UNIT WEIGHT | |
|------------|-------------|-----|-----------------|-------------|-------------|--------------|--------------|
| | Model | Qty | Length | Width | Height | Operating | Shipping |
| | | | mm [inch] | mm [inch] | mm [inch] | kg [lbs] | kg [lbs] |
| DCLC80MAS | TT300 | 1 | 2560 [100.9] | 1110 [43.7] | 2020 [79.4] | 1924 [4242] | 1618 [3567] |
| DCLC120MCS | TT350 | 1 | 2680 [105.4] | 1110 [43.7] | 2020 [79.4] | 2785 [6140] | 2517 [5549] |
| DCLC150MDS | TT400 | 1 | 3970 [156.3] | 1120 [44.0] | 2020 [79.4] | 2931 [6462] | 2629 [5796] |
| DCLC200MFS | TT700 | 1 | 3970 [156.3] | 1120 [44.0] | 2020 [79.4] | 2938 [6477] | 2636 [5811] |
| DCLC240MCD | TT350 | 2 | 4070 [160.0] | 1100 [43.2] | 2020 [79.4] | 3780 [8333] | 3404 [7505] |
| DCLC300MDD | TT400 | 2 | 3890 [153.0] | 1210 [47.7] | 2140 [84.3] | 4770 [10516] | 4284 [9445] |
| DCLC400MFD | TT700 | 2 | 4220 [165.9] | 1210 [47.7] | 2140 [84.3] | 4784 [10547] | 4298 [9475] |
| DCLC450MDT | TT400 | 3 | 4330 [170.5] | 1920 [75.3] | 2080 [81.8] | 6253 [13786] | 5583 [12308] |
| DCLC600MFT | TT700 | 3 | 4390 [172.6] | 2050 [80.6] | 2190 [86.2] | 7572 [16693] | 6744 [14868] |
| DCLC800MFF | TT700 | 4 | 4950 [194.7] | 2120 [83.3] | 2210 [87.0] | 9761 [21519] | 8596 [18951] |

DIMENSIONS



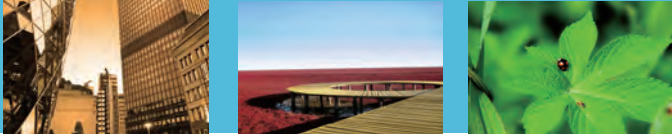
Unit Dimensions

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] | | | | | | | | | | | |
| DCLC80MAS | 2560 [100.8] | 1110 [43.7] | 2020 [79.4] | 2200 [86.6] | 278 [11.0] | 558 [22.0] | 860 [33.9] | 1164 [45.8] | 349 [13.7] | 315 [12.4] | 5" NPS | 5" NPS |
| DCLC120MCS | 2680 [105.4] | 1110 [43.7] | 2020 [79.4] | 2200 [86.6] | 307 [12.1] | 618 [24.3] | 886 [34.9] | 1229 [48.4] | 365 [14.4] | 315 [12.4] | 5" NPS | 5" NPS |
| DCLC150MDS | 3970 [156.3] | 1120 [44.0] | 2020 [79.4] | 3400 [133.9] | 296 [11.7] | 629 [24.8] | 886 [34.9] | 1229 [48.4] | 365 [14.4] | 315 [12.4] | 6" NPS | 6" NPS |
| DCLC200MFS | 3970 [156.3] | 1120 [44.0] | 2020 [79.4] | 3400 [133.9] | 296 [11.7] | 629 [24.8] | 886 [34.9] | 1229 [48.4] | 365 [14.4] | 315 [12.4] | 6" NPS | 6" NPS |

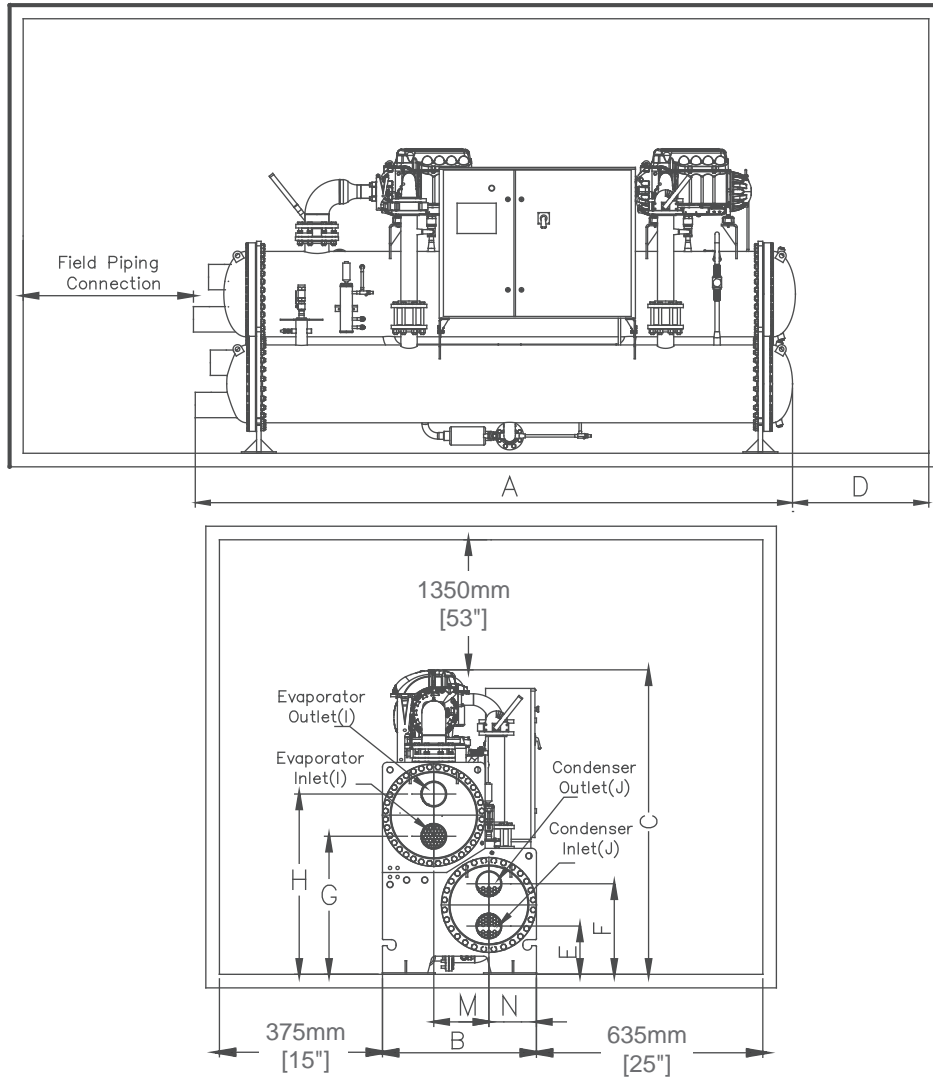
Notes: 1) Above dimensions are based on standard unit, with 3 passes evaporator and condenser, 1.0MPa [150psi] water side service pressure.
 2) Unit layout shown are for a reference. Same orientation may vary.
 3) Certified drawings are available upon request.



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] | | | | | | | | | | | |
| DCLC240MCD | 4070 [160.0] | 1100 [43.2] | 2020 [79.5] | 3400 [133.9] | 323 [12.7] | 603 [23.7] | 906 [35.7] | 1209 [47.6] | 365 [14.4] | 315 [12.4] | 6" NPS | 8" NPS |
| DCLC300MDD | 3890 [153.0] | 1210 [47.7] | 2140 [84.3] | 3400 [133.9] | 330 [13.0] | 679 [26.7] | 988 [38.9] | 1337 [52.6] | 400 [15.7] | 380 [15.0] | 8" NPS | 8" NPS |
| DCLC400MFD | 4220 [165.9] | 1210 [47.7] | 2140 [84.3] | 3400 [133.9] | 330 [13.0] | 679 [26.7] | 988 [38.9] | 1337 [52.6] | 400 [15.7] | 380 [15.0] | 8" NPS | 8" NPS |

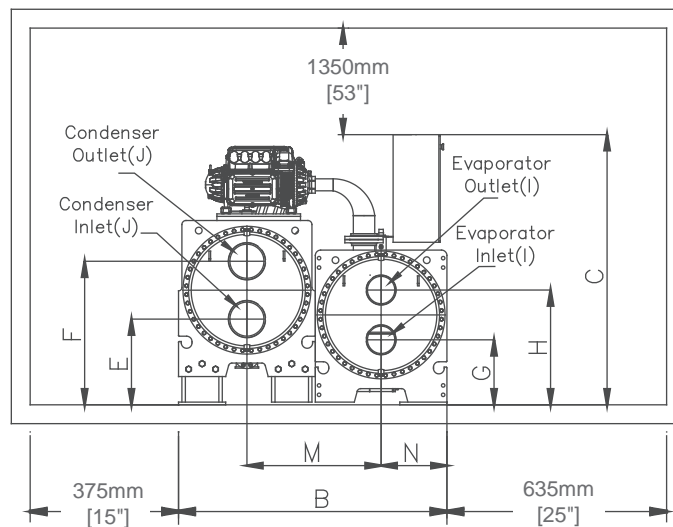
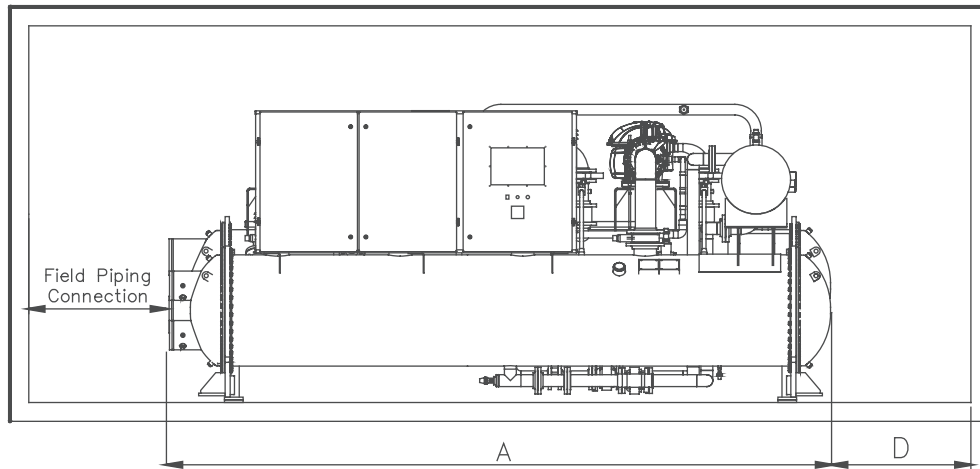
Notes: 1) Above dimensions are based on standard unit, with 2 passes evaporator and condenser, 1.0MPa [150psij] water side service pressure, left hand side water piping connection (view from control panel).
 2) Unit layout shown are for a reference. Same orientation may vary.
 3) Certified drawings are available upon request.

DIMENSIONS



Unit Dimensions

Three & Four Compressors

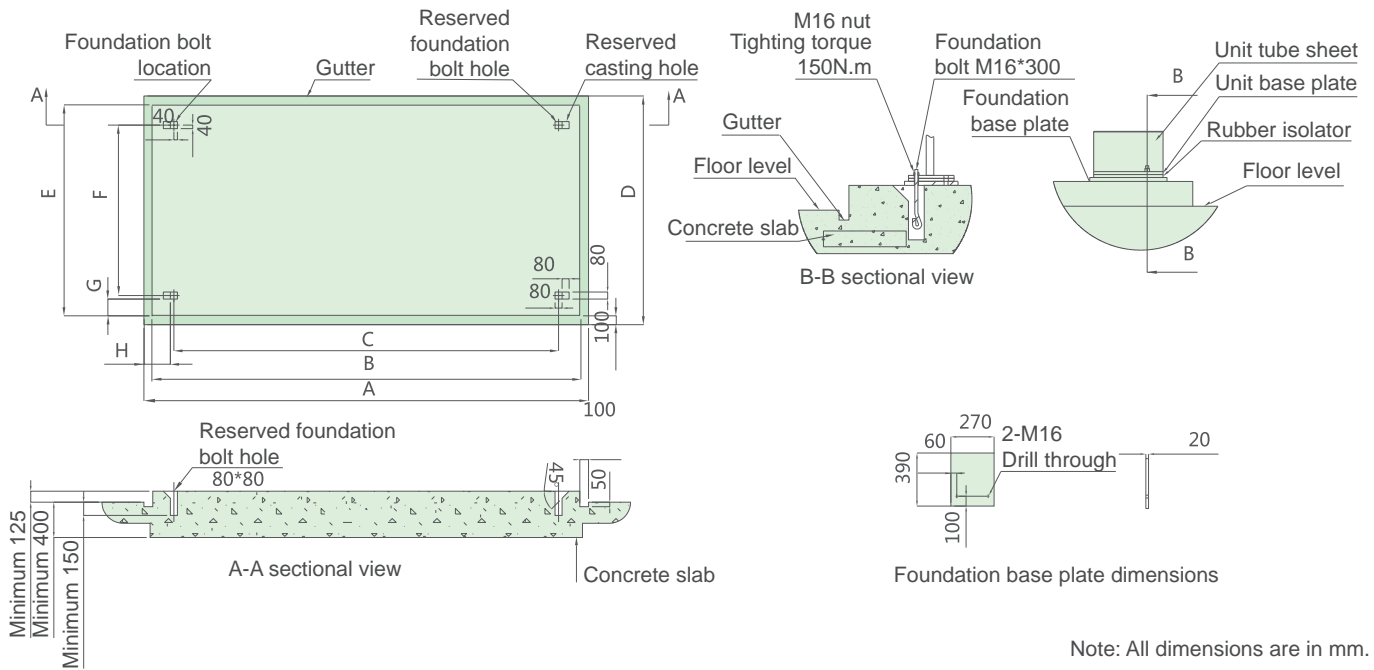


| Model | Length "A" | Width "B" | Height "C" | Clearance For Tube Cleaning "D" | E | F | G | H | M | N | Condenser Water Conn. "J" | Evaporator Water Conn. "I" |
|------------|--------------|-------------|-------------|---------------------------------|------------|-------------|------------|------------|-------------|------------|---------------------------|----------------------------|
| | mm [inch] | | | | | | | | | | | |
| DCLC450MDT | 4330 [170.5] | 1920 [75.3] | 2080 [81.8] | 3800 [149.6] | 570 [22.4] | 940 [37.0] | 435 [17.1] | 805 [31.7] | 866 [34.1] | 400 [15.7] | 8" NPS | 8" NPS |
| DCLC600MFT | 4390 [172.6] | 2050 [80.6] | 2190 [86.2] | 3800 [149.6] | 635 [25.0] | 1005 [39.6] | 535 [21.1] | 905 [35.6] | 983 [38.7] | 464 [18.3] | 8" NPS | 8" NPS |
| DCLC800MFF | 4950 [194.7] | 2120 [83.3] | 2210 [87.0] | 4300 [169.3] | 637 [25.1] | 1067 [42.0] | 483 [19.0] | 853 [33.6] | 1041 [41.0] | 489 [19.3] | 10" NPS | 8" NPS |

- Notes: 1) 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).
 2) Unit layout shown are for a reference. Same orientation may vary.
 3) Certified drawings are available upon request.

FOUNDATION

Foundation Drawing

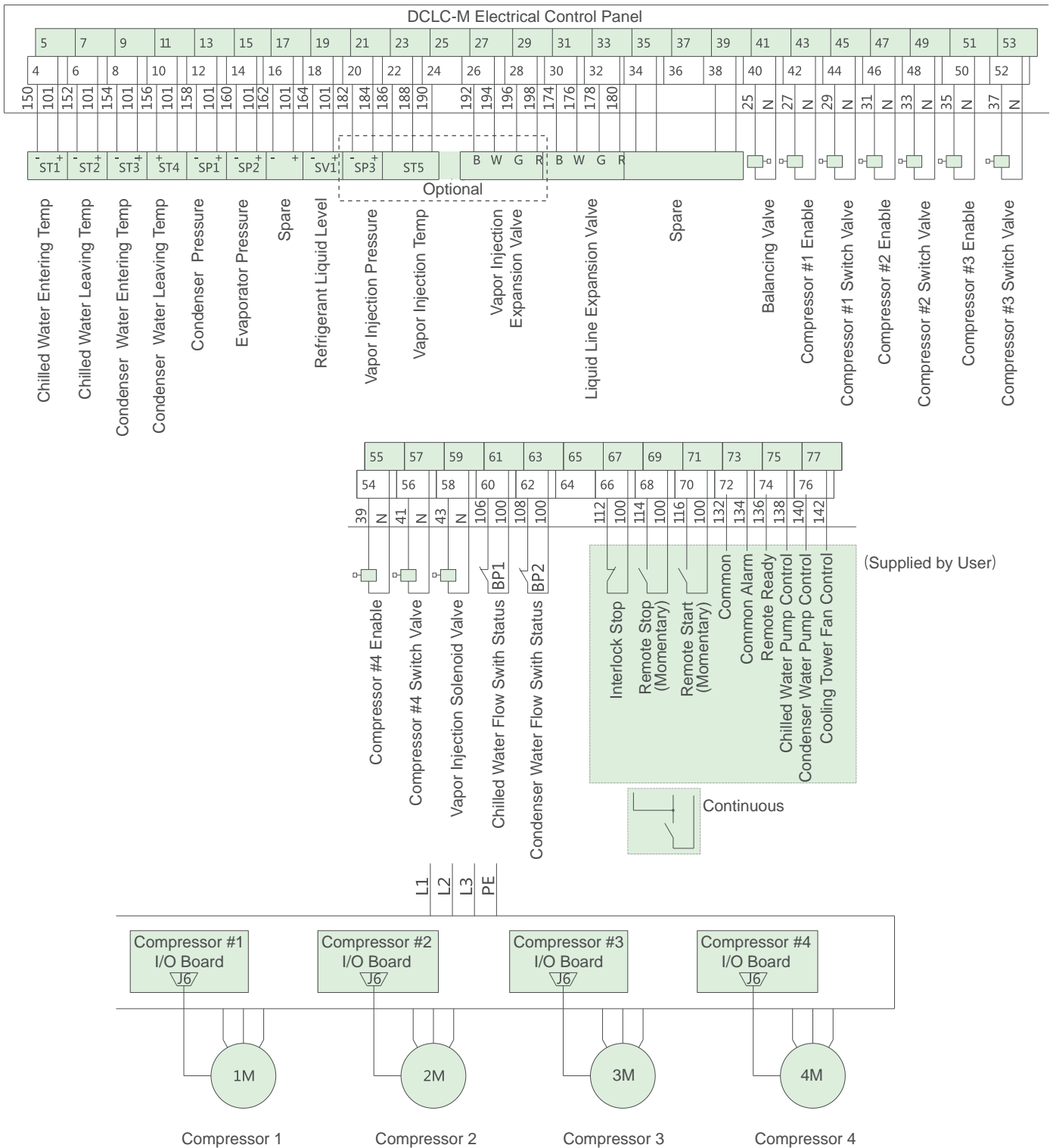


| Model | A | B | C | D | E | F | G | H |
|------------|--------------|--------------|--------------|-------------|-------------|-------------|-----------|------------|
| | mm [inch] | | | | | | | |
| DCLC80MAS | 3227 [127.0] | 3027 [119.2] | 2347 [92.4] | 1520 [59.8] | 1320 [52.0] | 860 [33.9] | 190 [7.5] | 300 [11.8] |
| DCLC120MCS | 3227 [127.0] | 3027 [119.2] | 2347 [92.4] | 1520 [59.8] | 1320 [52.0] | 860 [33.9] | 190 [7.5] | 300 [11.8] |
| DCLC150MDS | 3227 [127.0] | 3027 [119.2] | 2347 [92.4] | 1520 [59.8] | 1320 [52.0] | 860 [33.9] | 190 [7.5] | 300 [11.8] |
| DCLC200MFS | 3227 [127.0] | 3027 [119.2] | 2347 [92.4] | 1520 [59.8] | 1320 [52.0] | 860 [33.9] | 190 [7.5] | 300 [11.8] |
| DCLC240MCD | 4403 [173.3] | 4203 [165.5] | 3523 [138.7] | 1520 [59.8] | 1320 [52.0] | 860 [33.9] | 190 [7.5] | 300 [11.8] |
| DCLC300MDD | 4433 [174.5] | 4233 [166.7] | 3553 [139.9] | 1660 [65.4] | 1460 [57.5] | 1000 [39.4] | 190 [7.5] | 300 [11.8] |
| DCLC400MFD | 4433 [174.5] | 4233 [166.7] | 3553 [139.9] | 1660 [65.4] | 1460 [57.5] | 1000 [39.4] | 190 [7.5] | 300 [11.8] |
| DCLC450MDT | 4711 [185.5] | 4511 [177.6] | 3831 [150.8] | 2379 [93.7] | 2179 [85.8] | 1719 [67.7] | 190 [7.5] | 300 [11.8] |
| DCLC600MFT | 4711 [185.5] | 4511 [177.6] | 3831 [150.8] | 2439 [96.0] | 2239 [88.1] | 1779 [70.0] | 190 [7.5] | 300 [11.8] |
| DCLC800MFF | 5247 [206.6] | 5047 [198.7] | 4367 [171.9] | 2463 [97.0] | 2263 [89.1] | 1803 [71.0] | 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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