

DC MODULAR CHILLER MUENR-H7

Service manual

MUENR-H7T & MUENR-H7T(K)



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Part 1

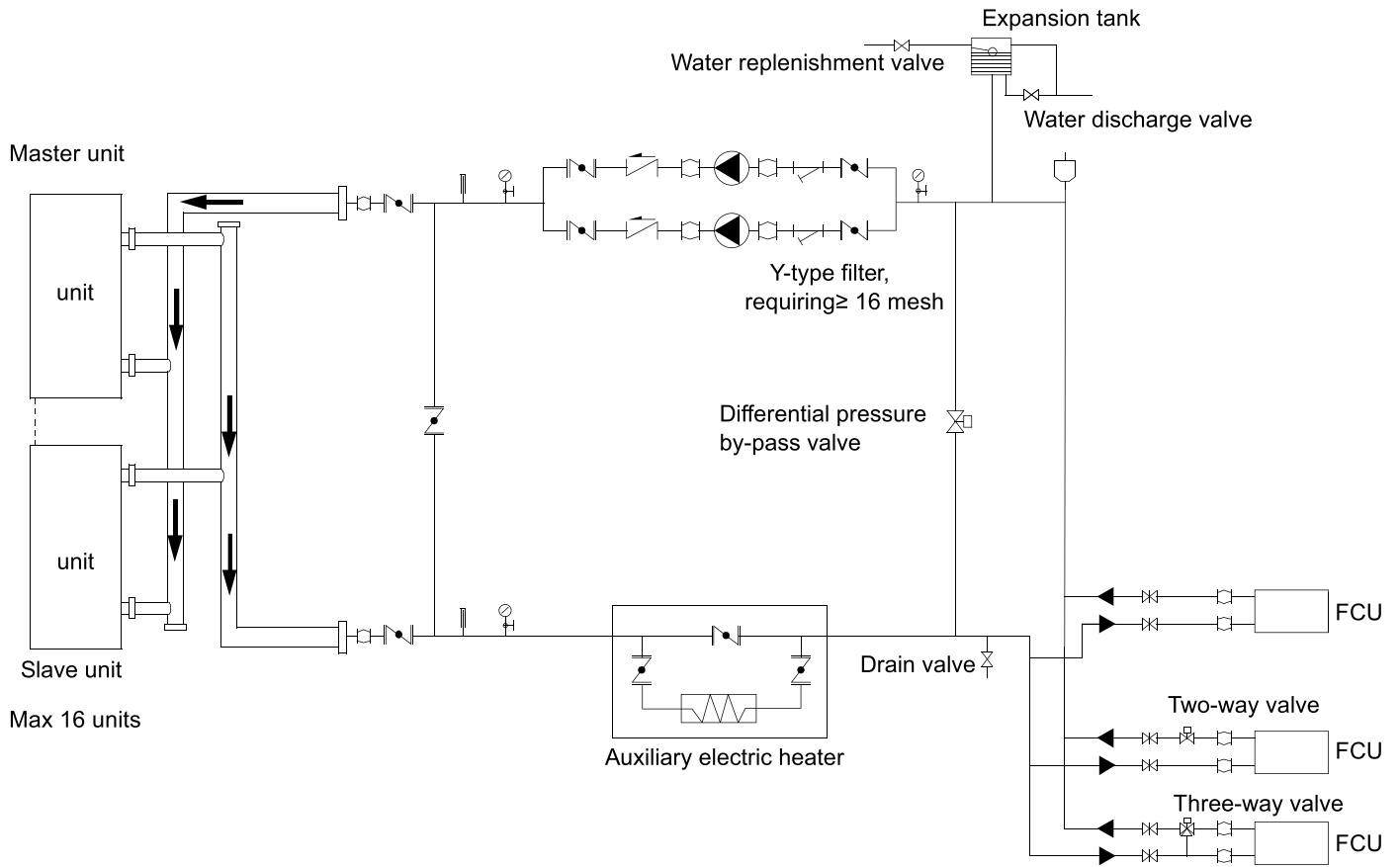
General Information










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1 DC Modular Chiller System

1.1 System Schematic

Figure 1-1.1: System schematic





| Legend | | | | |
|---|--|--|---|---|
|  Stop valve |  Pressure gauge |  Flexible joint |  Gate valve |  Automatic discharge valve |
|  Y-shaped filter |  Thermometer |  Circulating pump |  Check valve | |

DC Modular Chiller is an integrated air-to-water space heating and space cooling heat pump system. The outdoor heat pump system extracts heat from the outdoor air and transfers this heat through refrigerant piping to the plate heat exchanger in the hydronic system. The heated water in the hydronic system circulates to low temperature heat emitters (floor heating loops or low temperature radiators) to provide space heating. The 4-way valve in the outdoor unit can reverse the refrigerant cycle so that the hydronic system can provide chilled water for cooling using fan coil units.

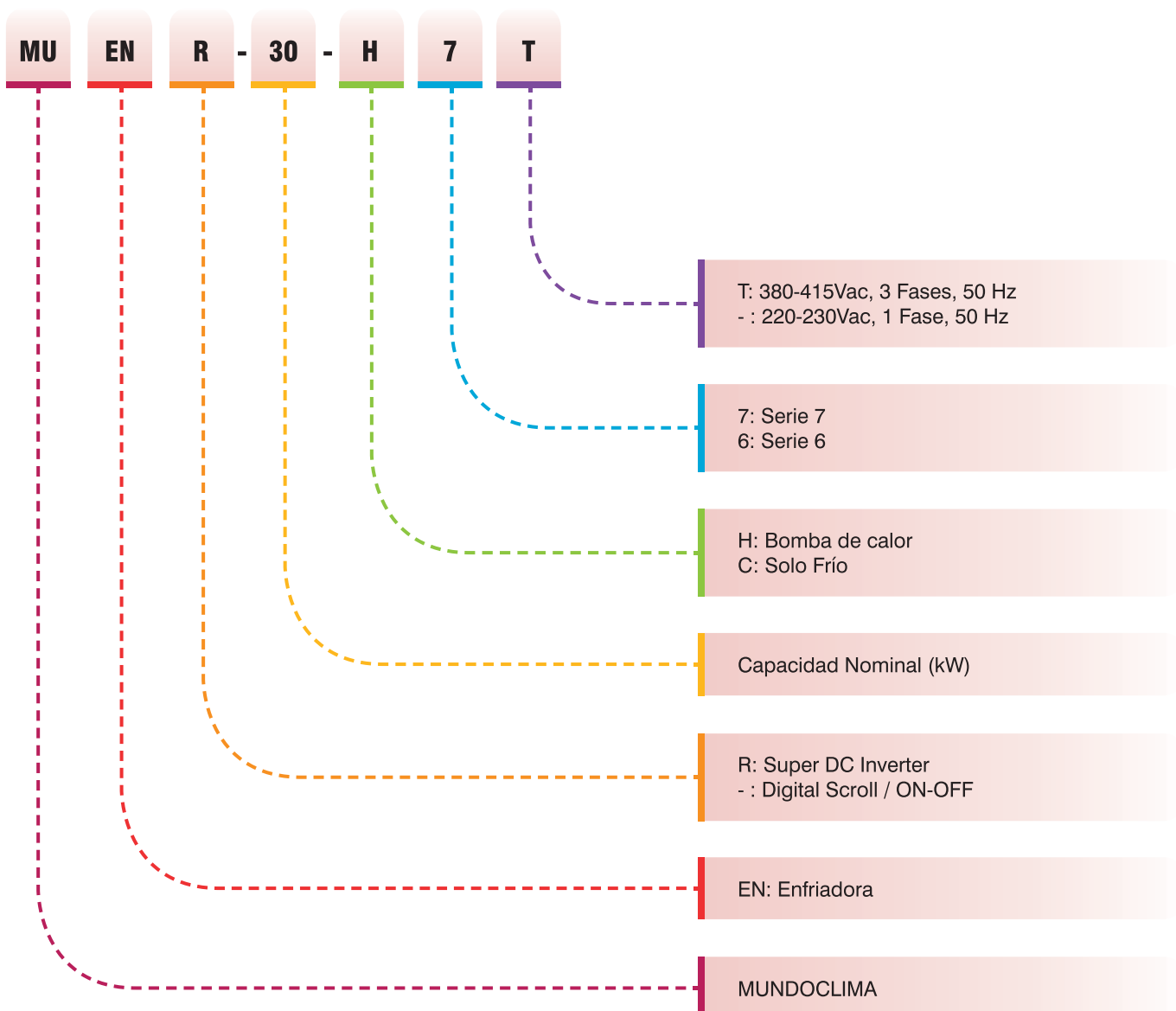
The heating capacity of heat pumps decreases with ambient temperature. DC Modular Chiller is reserved a auxiliary electric heater control port to provide additional heating capacity for use during extremely cold weather when the heat pump capacity is insufficient. The auxiliary electric heater also serves as a backup in case of heat pump malfunction and for anti-freeze protection of the outside water piping in winter.

2 Unit Capacities

Table 1-2.1: unit capacity range and unit appearances

| Capacity | 30kW | 60kW |
|--------------|---|--|
| Model | MUENR-30-H7T / MUENR-30-H7T(K) / MUENR-30-H7T(K2) | MUENR-60-H7T / MUENR-60-H7T(K) |
| Appearance |  |  |
| Power supply | 380-415V/3Ph/50Hz | |

3 Nomenclature



4 System and Design Unit Selection

4.1 Selection Procedure

Step 1: Total heat load calculation

Calculate conditioned surface area
Select the heat emitters (type, quantity, water temperature and heat load)

Step 2: System configuration

Decide whether to enable or disable auxiliary electric heater

Step 3: Selection of outdoor units

Determine required total heat load on outdoor units
Set capacity safety factor
Select power supply

Provisionally select DC Modular Chiller unit capacity¹ based on nominal capacity

Correct capacity of the outdoor units for the following items:
Outdoor air temperature / Outdoor humidity / Water outlet temperature² /
Altitude / Anti-freeze type

Is corrected DC Modular Chiller unit capacity \geq Required total heat load on outdoor units³

Yes

No

DC Modular Chiller
system selection is
complete

Select a larger model or enable
auxiliary electric heater operation

Notes:

- Up to 16 units can be connected together, giving a system cooling/heating capacity range of 30kW to 960kW.
- If the required water temperatures of the heat emitters are not all the same, the Chiller's outlet water temperature setting should be set at the highest of the heat emitter required water temperatures. If the water outlet design temperature falls between two temperatures listed in the outdoor unit's capacity table, calculate the corrected capacity by interpolation.
- If the outdoor unit selection is to be based on total heating load and total cooling load, select DC Modular Chiller units which satisfy not only the total heating load requirements but also the total cooling load requirements.

4.2 DC Modular Chiller Leaving Water Temperature (LWT) Selection

The recommended design LTW ranges for different types of heat emitter are:

- For floor heating: 30 to 35°C
- For fan coil units: 30 to 45°C
- For low temperature radiators: 40 to 50°C

4.3 Optimizing System Design

To get the most comfort with the lowest energy consumption with DC Modular Chiller, it is important to take account of the following considerations:

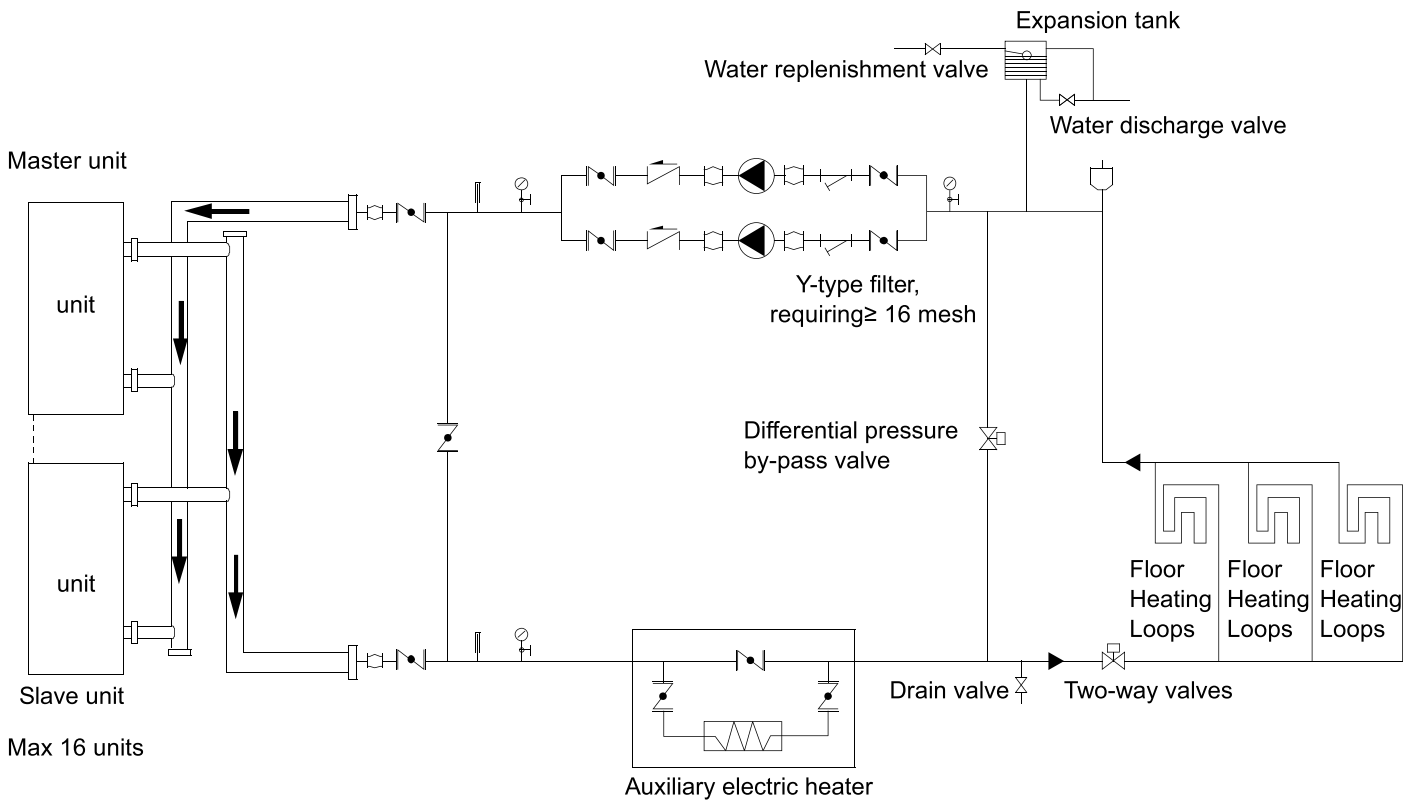
- Choose heat emitters that allow the heat pump system to operate at as low a hot water temperature as possible whilst still providing sufficient heating.

5 Typical Applications

5.1 Space Heating Through Floor Heating Loops

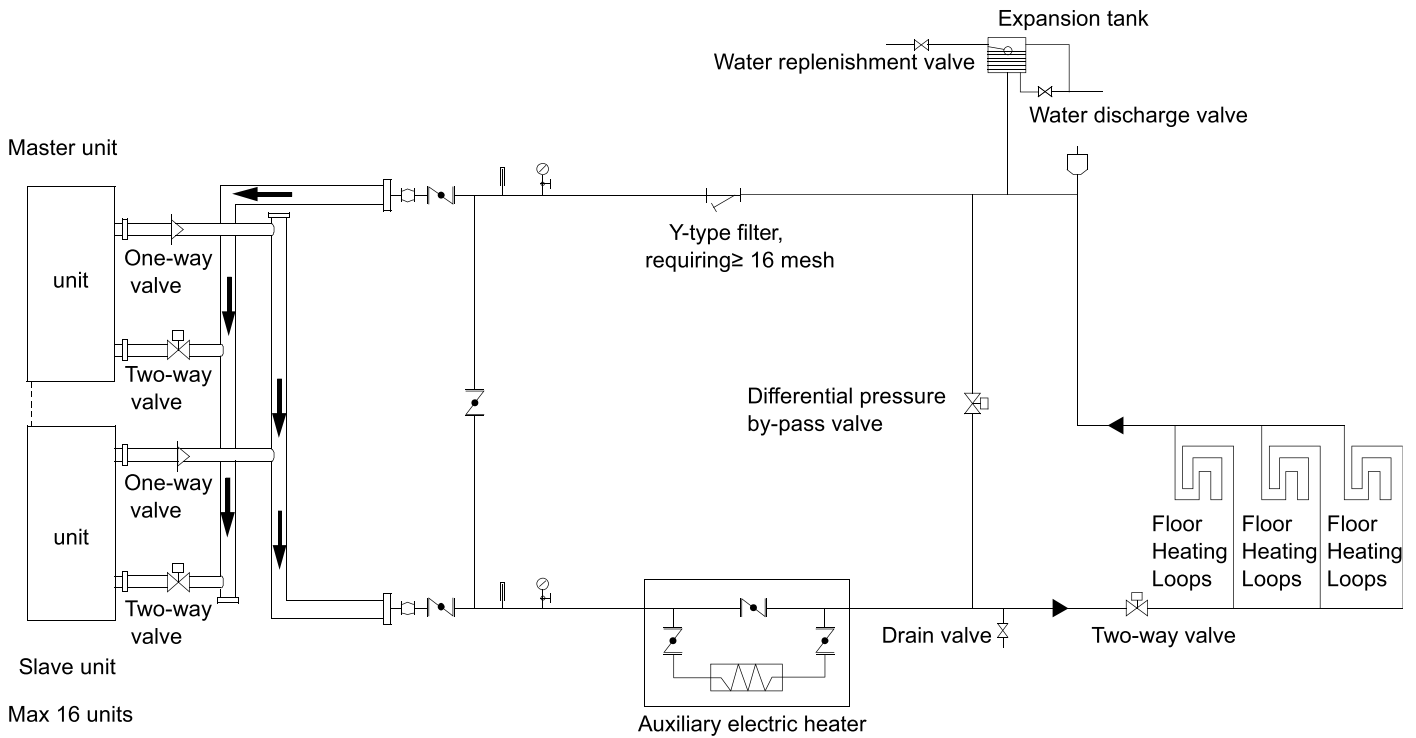
Floor heating Loops are used for spaces heating.

Figure 1-5.1: Space heating through floor heating loops (standard unit without hydronic module)



| Legend | | | | |
|-----------------|----------------|------------------|-------------|---------------------------|
| Stop valve | Pressure gauge | Flexible joint | Gate valve | Automatic discharge valve |
| Y-shaped filter | Thermometer | Circulating pump | Check valve | |

Figure 1-5.2: Space heating through floor heating loops (customized unit with built-in hydronic module)

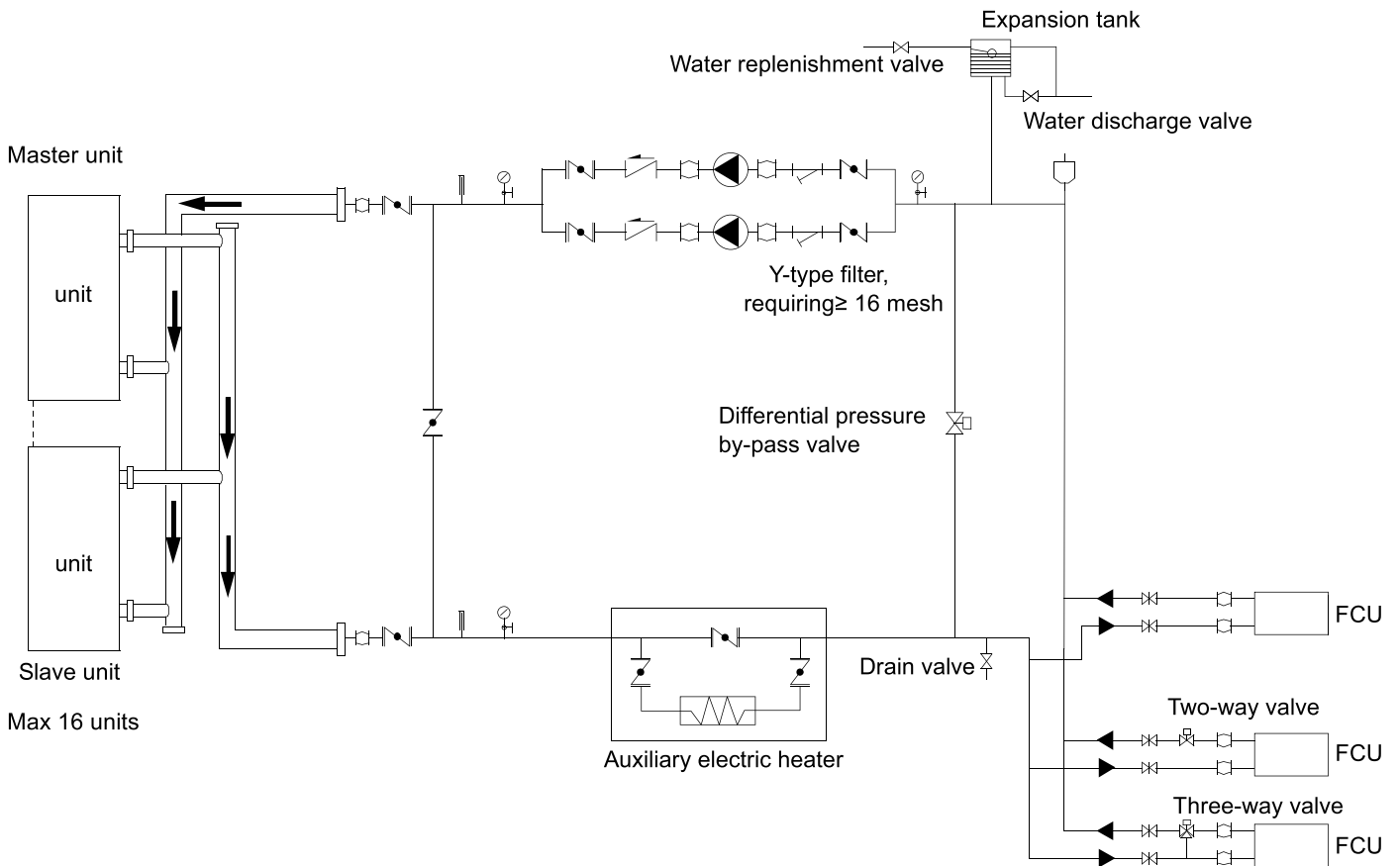


| Legend | | | | |
|-----------------|----------------|------------------|-------------|---------------------------|
| Stop valve | Pressure gauge | Flexible joint | Gate valve | Automatic discharge valve |
| Y-shaped filter | Thermometer | Circulating pump | Check valve | |

5.2 Space Heating and Space Cooling Through Fan Coil Unit

Fan coil units are used for space heating and cooling.

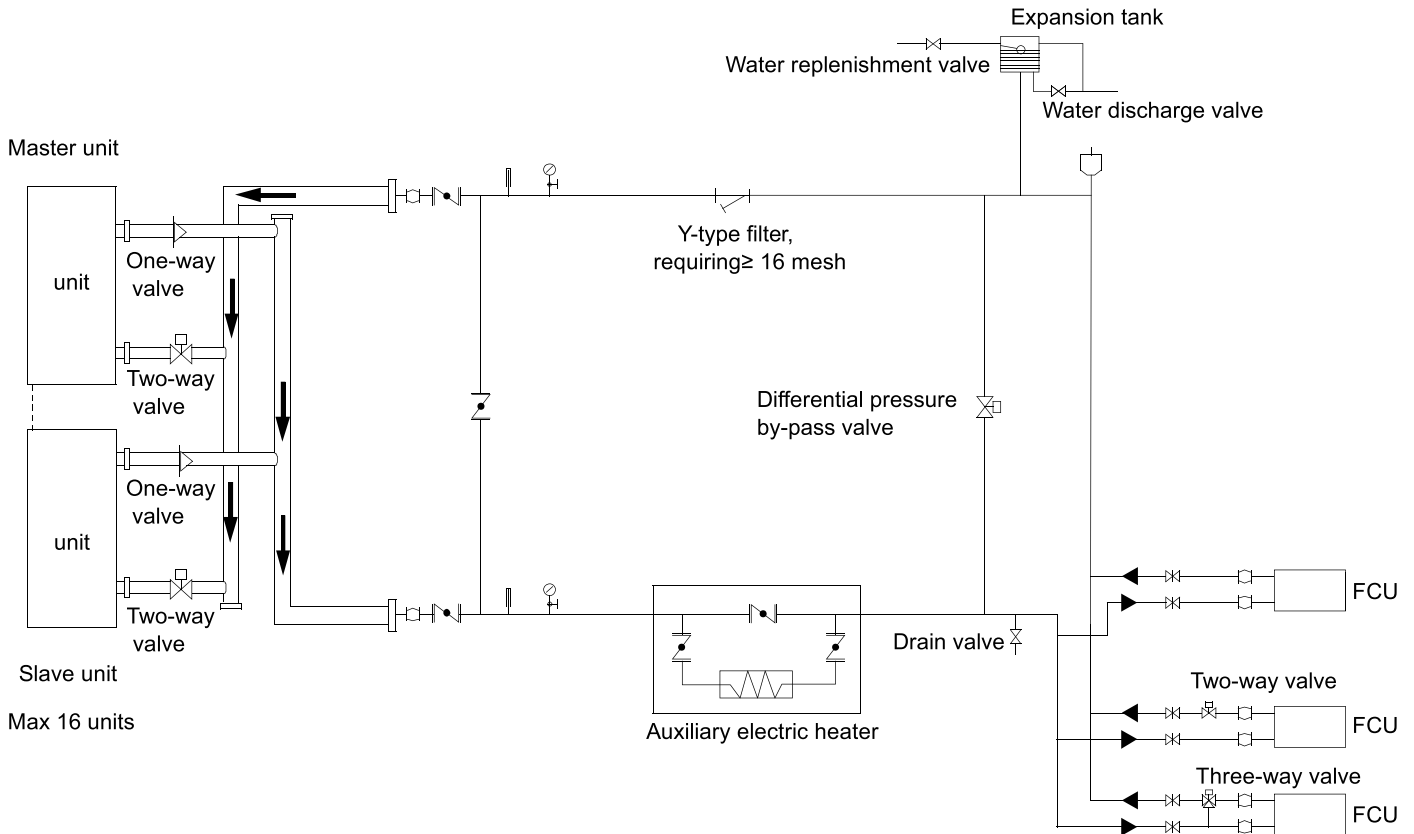
Figure 1-5.3: Space heating and space cooling through fan coil unit (standard unit without hydronic module)












Legend

| | | | | |
|-----------------|----------------|------------------|-------------|---------------------------|
| Stop valve | Pressure gauge | Flexible joint | Gate valve | Automatic discharge valve |
| Y-shaped filter | Thermometer | Circulating pump | Check valve | |

Figure 1-5.4: Space heating and space cooling through fan coil unit (customized unit with built-in hydronic module)

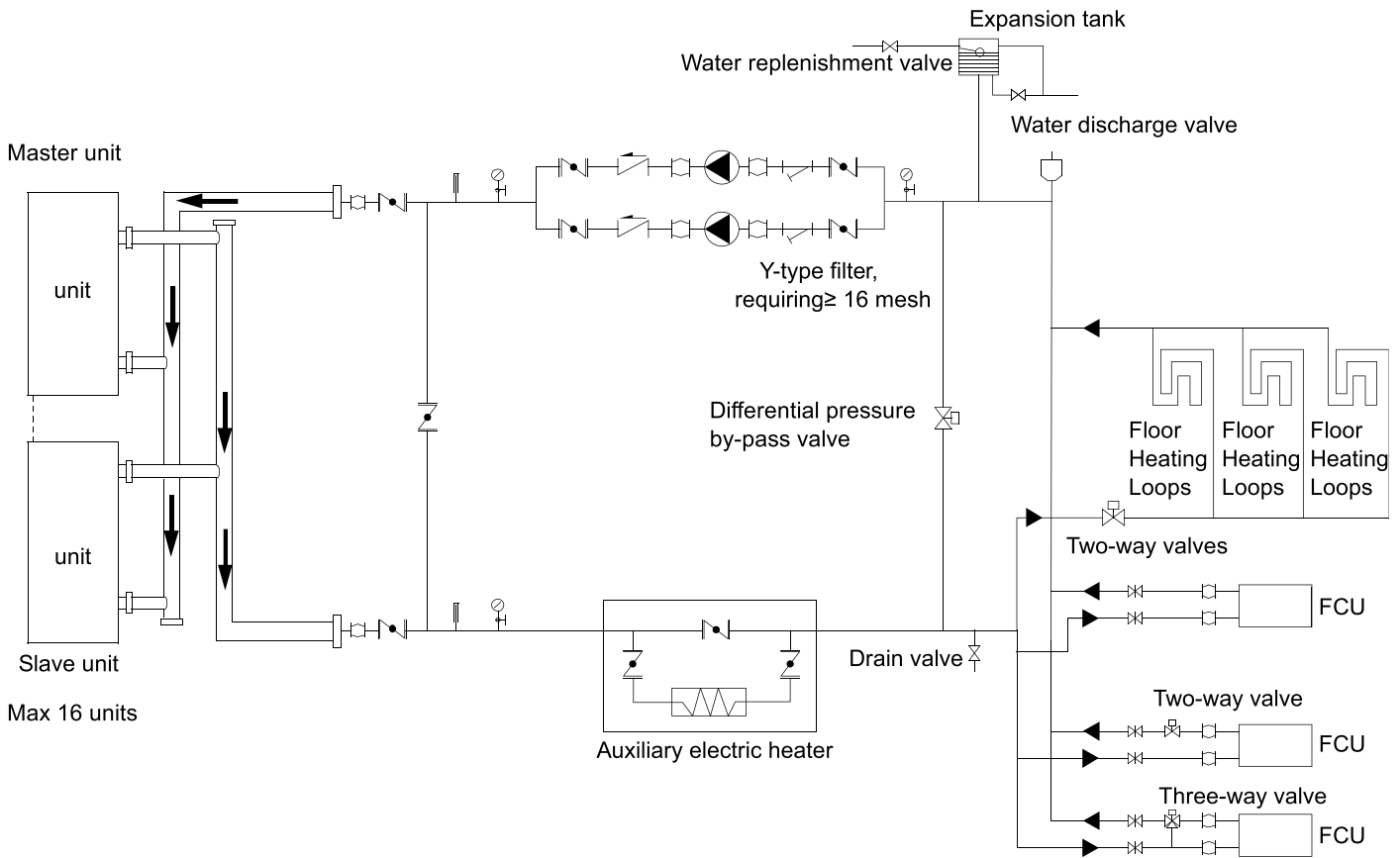


| Legend | | | | |
|---|--|--|---|---|
|  Stop valve |  Pressure gauge |  Flexible joint |  Gate valve |  Automatic discharge valve |
|  Y-shaped filter |  Thermometer |  Circulating pump |  Check valve | |

5.3 Space Heating Through Floor Heating Loops And Space Cooling Through Fan Coil Unit

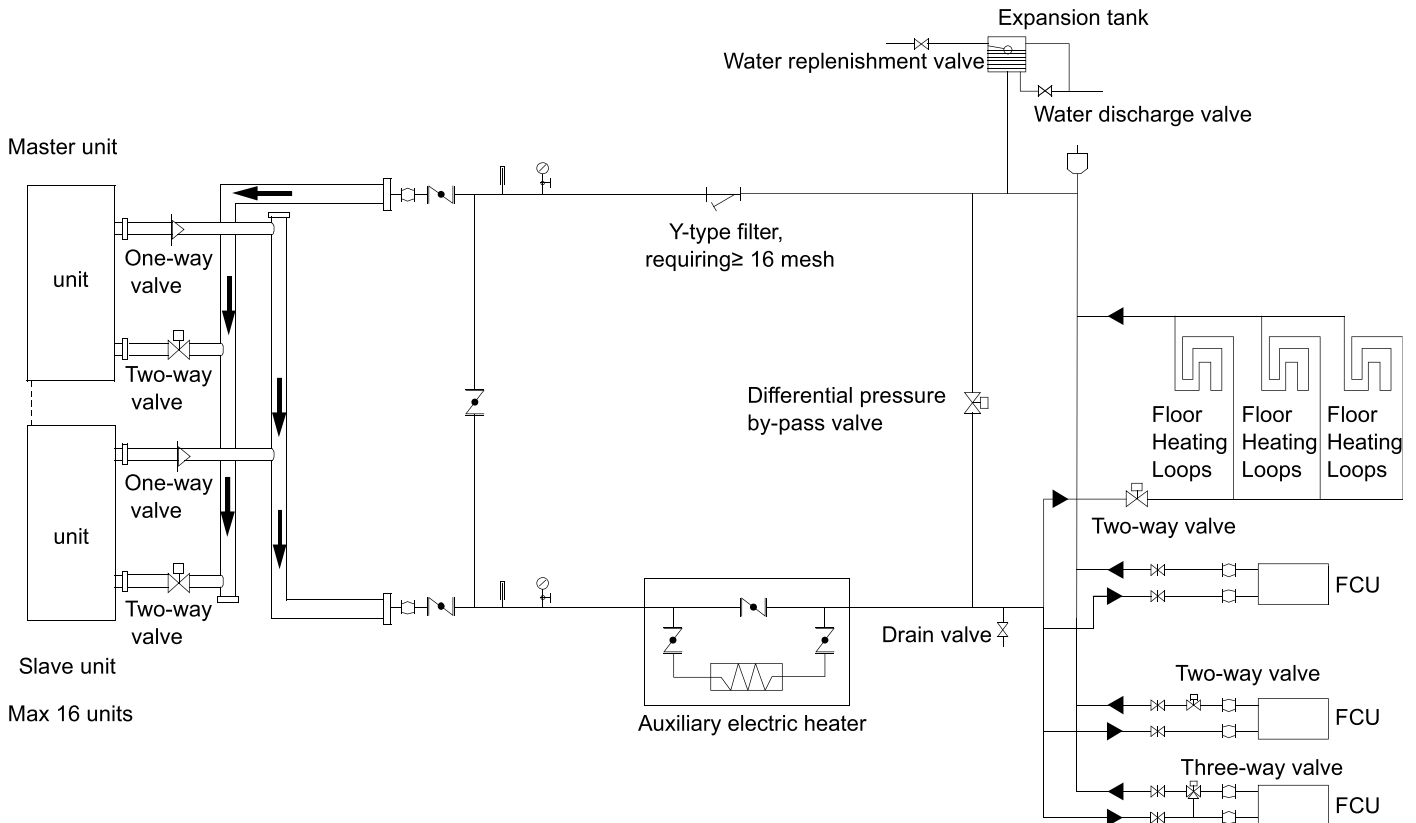
Floor heating loops and fan coil units are used for space heating and fan coil units are used for space cooling. In space cooling mode, the 2-way valve is closed to prevent cold water entering the floor heating loops.

Figure 1-5.5: Space heating through floor heating loops and space cooling through fan coil unit (standard unit without hydronic module)



| Legend | | | | |
|-----------------|----------------|------------------|-------------|---------------------------|
| Stop valve | Pressure gauge | Flexible joint | Gate valve | Automatic discharge valve |
| Y-shaped filter | Thermometer | Circulating pump | Check valve | |

Figure 1-5.6: Space heating through floor heating loops and space cooling through fan coil unit (customized unit with built-in hydronic module)

**Legend**

| | | | | |
|-----------------|----------------|------------------|-------------|---------------------------|
| Stop valve | Pressure gauge | Flexible joint | Gate valve | Automatic discharge valve |
| Y-shaped filter | Thermometer | Circulating pump | Check valve | |

Part 2

Engineering Data

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1 Specifications

Table 2-1.1: specifications

| Model | | | MUENR-30-H7T | MUENR-30-H7T(K2) | MUENR-60-H7T | MUENR-60-H7T(K) |
|----------------------------------|-------------------------------------|-------------------------|---------------------------------|------------------|----------------------------|------------------|
| Code | | | CL 25 630 | CL 25 634 | CL 25 632 | CL 25 633 |
| Cooling ⁽¹⁾ | Capacity | kW | 27 | 27.6 | 55 | |
| | Power consumption | kW | 10.8 | 11.4 | 22 | 23.2 |
| | Current | A | 16.7 | 18.7 | 33.9 | 36.9 |
| | EER | W/W | 2.50 | 2.42 | 2.50 | 2.37 |
| | SEER ⁽⁷⁾ | W/W | 4.41 | 3.93 | 4.20 | 3.73 |
| Heating ⁽²⁾ | Capacity | kW | 31 | | 61 | |
| | Power consumption | kW | 10.5 | 11.2 | 20.3 | 21.5 |
| | Current | A | 16.2 | 18.4 | 31.3 | 34.3 |
| | COP | W/W | 2.95 | 2.77 | 3.00 | 2.84 |
| | SCOP ⁽⁸⁾ | W/W | 4.01 | 3.27 | 3.85 | 3.45 |
| | Energy labeling ⁽⁸⁾ | | A + + | A + | A + + | A + |
| Max. current | | A | 18 | 20 | 36.8 | 39.8 |
| Sound pressure ⁽³⁾ | | dB(A) | 65.8 | 65.8 | 72.1 | 72.1 |
| Sound power ⁽³⁾ | | dB(A) | 78 | 78 | 84 | 86 |
| Power supply | | Ph, V, Hz | 3N-, 400, 50 | | | |
| Compressor | Brand | | Mitsubishi Electric | | | |
| | Model | | LNB65FAEMC | | | |
| | Type | | Inverter DC Twin Rotary | | | |
| | Amount | | 1 | | 2 | |
| Fan | Type | | DC | | | |
| | Amount | | 1 | | 2 | |
| | Air flow rate | m³/h | 12,500 | | 24,000 | |
| Water exchanger | Type | | Plates | | | |
| | Water pressure drop | kPa | 60 | | 80 | |
| | Volume | L | 2.44 | | 5.17 | |
| | Nominal consumption (Min. - Max.) | m³/h | 5.0 (3.8 ~ 6.4) | | 9.8 (8.0 ~ 13.0) | |
| | Max. design pressure | Mpa | 1 | | | |
| | Hydraulic connections | mm (inches) | DN40 (1 1/2") (Internal thread) | | DN50 (2") (Type Victaulic) | |
| Water pump | Model | | – | Grundfos CM5-3A | – | Grundfos CM10-2A |
| | Nominal flow | m³/h | – | 4.7 | – | 10 |
| | Nominal pressure | kPa (mca) | – | 210 (21.45) | – | 280 (28.6) |
| | Nominal height | m | – | 22.8 | – | 27.1 |
| Expansion tank | | L | – | 5 | – | 12 |
| Dimensions (W x H x D) | | mm | 1870 x 1175 x 1000 | | 2220 x 1325 x 1055 | |
| Weight | | kg | 300 | 315 | 480 | 515 |
| Refrigerant | Type/GWP | | R410A/2088 | | | |
| | Amount | kg/TCO ₂ eq. | 10.5/21.92 | | 17/35.5 | |
| Electrical connections | Power wiring ⁽⁴⁾ / ICP | mm²/A | 4 x 10 + T / 36 | | 4 x 25 + T / 70 | |
| | Communication wiring ⁽⁵⁾ | mm² | 3 x 0.75 (shielded) | | | |
| Outdoor temperature in operation | Cooling | °C | -15 a 43 | | | |
| | Heating | °C | -15 a 24 | | | |
| Outlet Water Temperature | Cooling ⁽⁶⁾ | °C | 0 ~ 20 | | | |
| | Heating | °C | 25 ~ 55 | | | |

⁽¹⁾Nominal conditions cooling: Water temperature 12 °C (Inlet), 7 °C (Outlet), outdoor temperature 35 °C DB. Water flow 0.172 m³ / (h-KW).

⁽²⁾Nominal conditions heating: Water temperature 40 °C (Inlet), 45 °C (Outlet), outdoor temperature 7 °C DB and 6 °C WB. Water flow 0.172 m³ / (h-KW).

⁽³⁾Noise level measured in semi-anechoic chamber at 1 m front distance and 1.1 m height.

⁽⁴⁾Power wiring recommended for L < 20 m, for longer distances it should be calculated.

⁽⁵⁾Remote control wiring and interconnection of several modules.

⁽⁶⁾Below 5 °C, antifreeze must be added to the hydraulic circuit and set to ON the S5-1 (on all modules).

⁽⁷⁾According to (EU) N° 2016/2281.

⁽⁸⁾According to (EU) N° 811/2013.

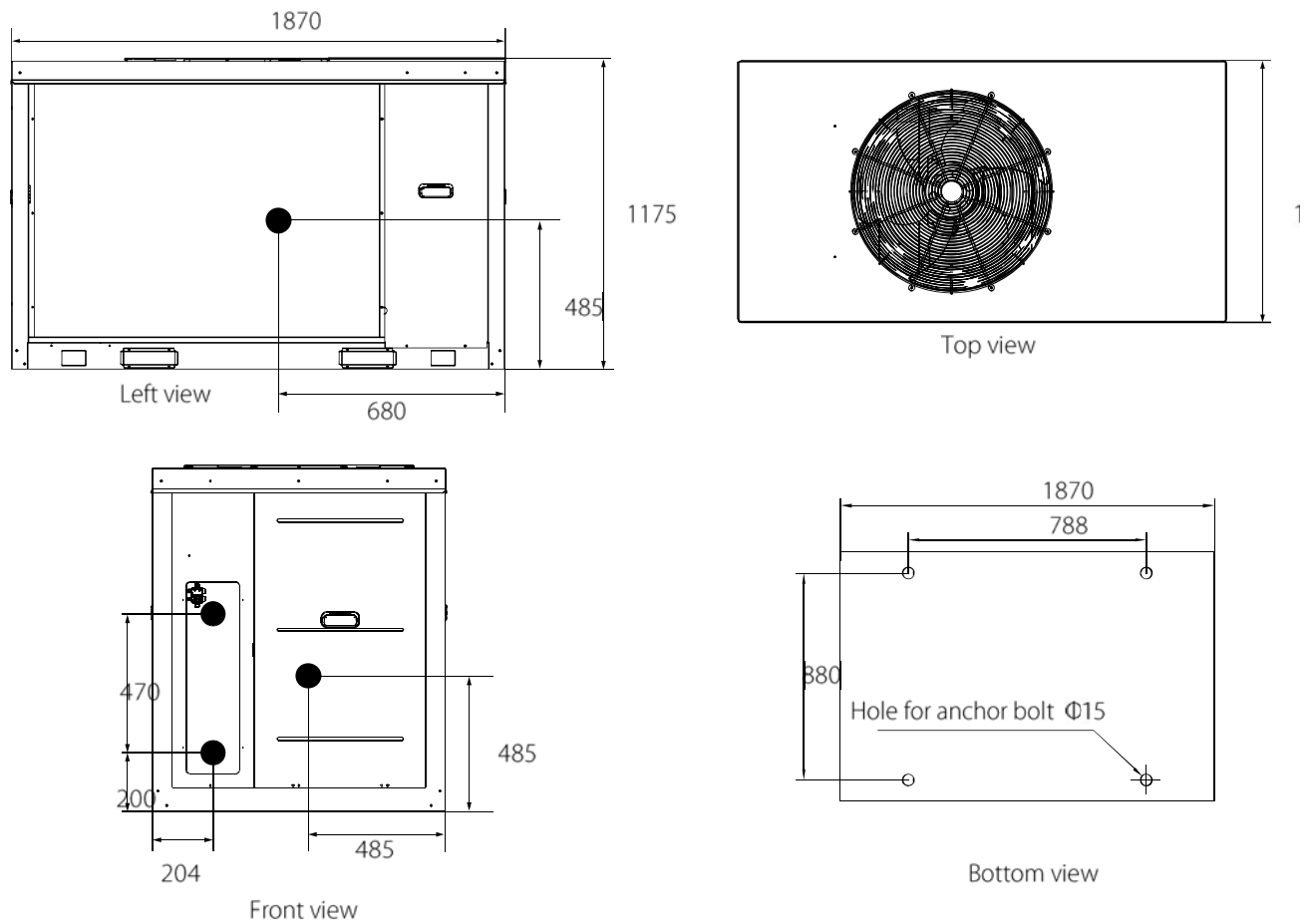
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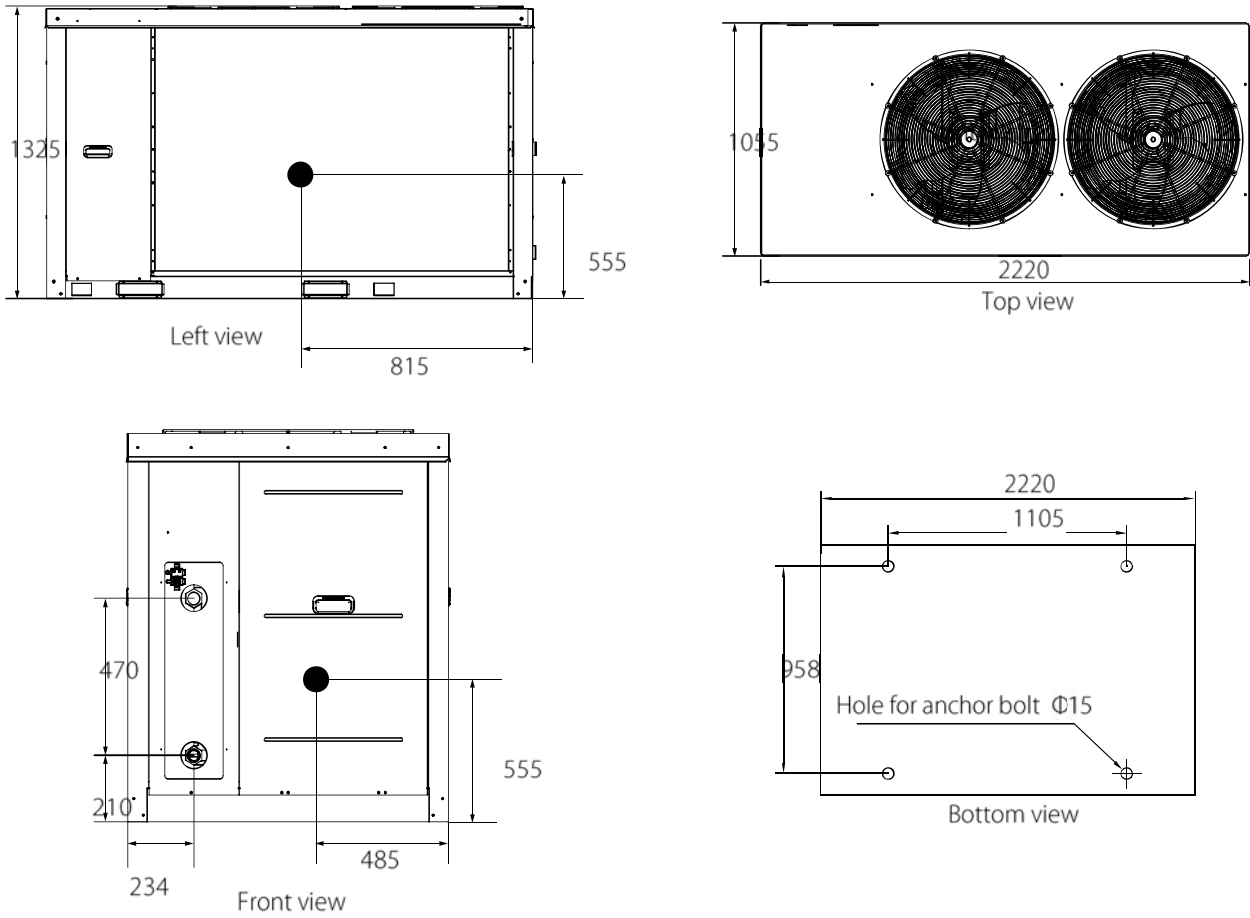
- Do not use groundwater or well water directly.
- The hydraulic circuit must be closed.
- Data and specifications are subject to changes without previous notice.

2 Dimensions and Center of Gravity

MUENR-30-H7T / MUENR-30-H7T(K) / MUENR-30-H7T(K2)

Figure 2-2.1: dimensions and center of gravity (unit: mm)

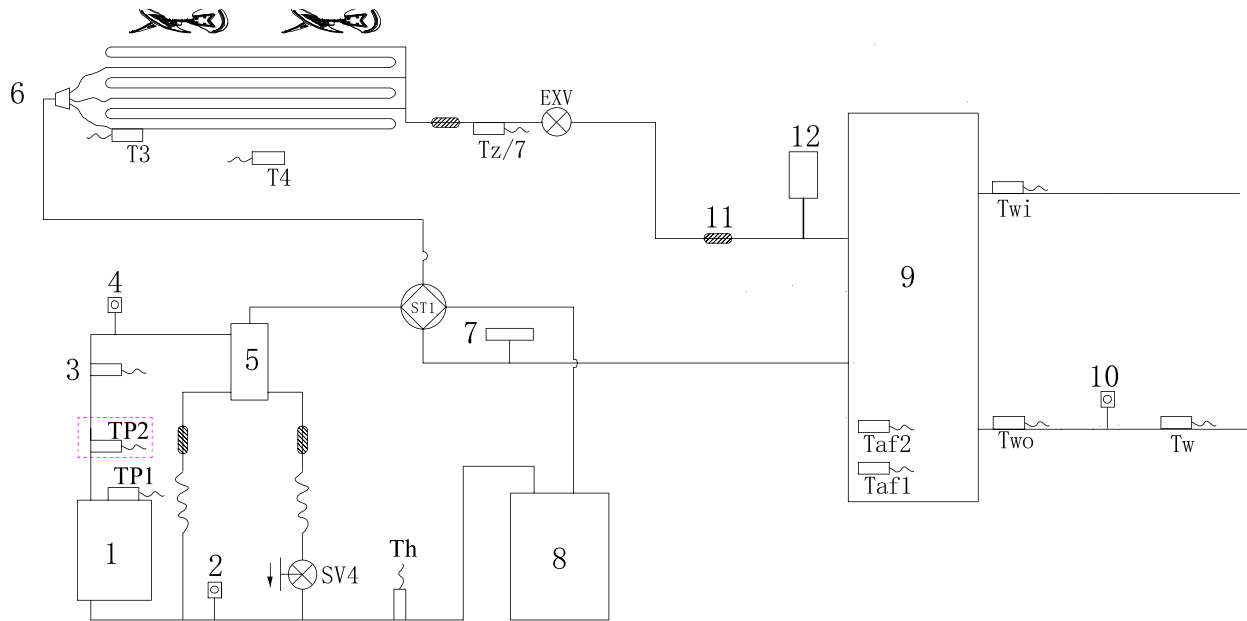


MUENR-60-H7T / MUENR-60-H7T(K)*Figure 2-2.2: dimensions and center of gravity (unit: mm)*

3 Piping Diagrams

MUENR-30-H7T / MUENR-30-H7T(K) / MUENR-30-H7T(K2)

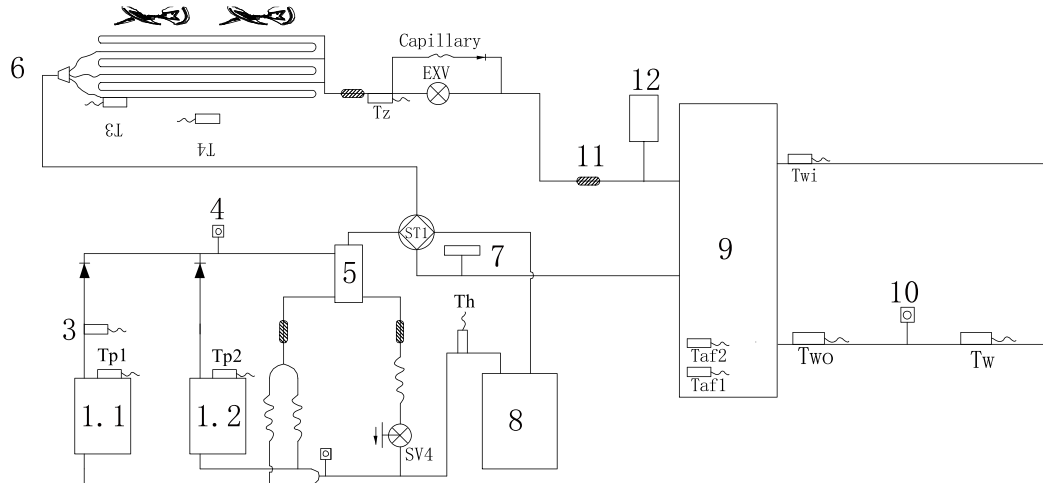
Figure 2-3.1: piping diagram



| Legend | | | |
|--------|--------------------------------------|------|--|
| 1 | Compressor | ST1 | 4-way valve |
| 2 | Low pressure switch | TP1 | Discharge pipe temperature sensor |
| 3 | Discharge temperature control switch | TP2 | Compressor top temperature sensor |
| 4 | High pressure switch | T3 | Air side heat exchanger temperature sensor |
| 5 | Oil separator | T4 | Outdoor ambient temperature sensor |
| 6 | Air side heat exchanger | TZ/7 | Total cooling outlet temperature sensor |
| 7 | Pressure sensor | Taf1 | Water side heat exchanger anti-freezing temperature sensor 1 |
| 8 | Vapor liquid separator | Taf2 | Water side heat exchanger anti-freezing temperature sensor 2 |
| 9 | Water side heat exchanger | Twi | Water inlet temperature sensor |
| 10 | Water flow switch | Two | Water outlet temperature sensor |
| 11 | Filter | Tw | Total water outlet temperature sensor |
| 12 | Accumulator | Th | Air suction temperature sensor |
| EXV | Electronic expansion valve | SV4 | Oil return solenoid valve |

MUENR-60-H7T / MUENR-60-H7T(K)

Figure 2-3.2: piping diagram

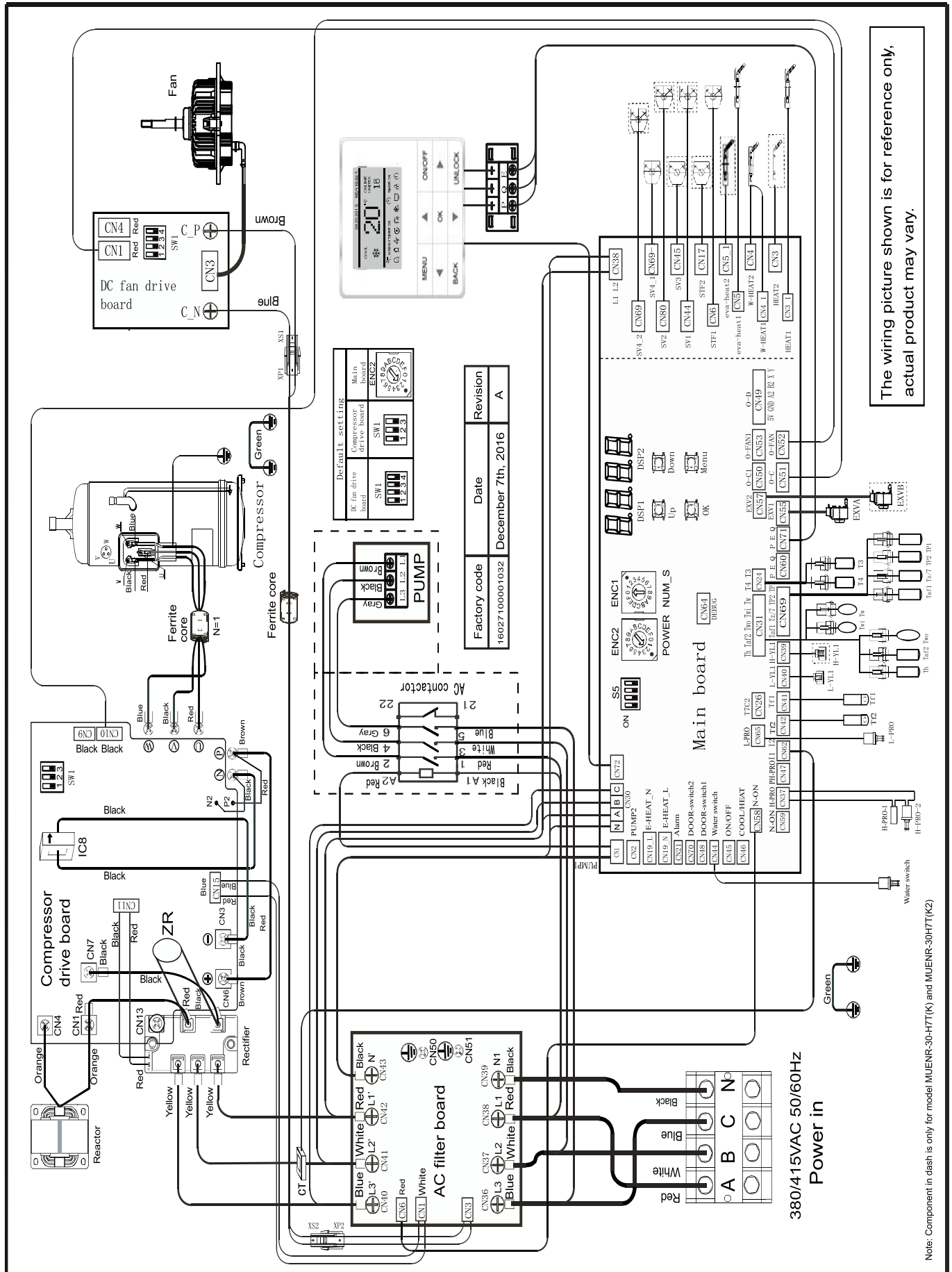


| Legend | | | |
|--------|--------------------------------------|------|--|
| 1 | Compressor | ST1 | 4-way valve |
| 2 | Low pressure switch | Tp1 | Discharge pipe temperature sensor |
| 3 | Discharge temperature control switch | Tp2 | Compressor top temperature sensor |
| 4 | High pressure switch | T3 | Air side heat exchanger temperature sensor |
| 5 | Oil separator | T4 | Outdoor ambient temperature sensor |
| 6 | Air side heat exchanger | TZ/7 | Total cooling outlet temperature sensor |
| 7 | Pressure sensor | Taf1 | Water side heat exchanger anti-freezing temperature sensor 1 |
| 8 | Vapor liquid separator | Taf2 | Water side heat exchanger anti-freezing temperature sensor 2 |
| 9 | Water side heat exchanger | Twi | Water inlet temperature sensor |
| 10 | Water flow switch | Two | Water outlet temperature sensor |
| 11 | Filter | Tw | Total water outlet temperature sensor |
| 12 | Accumulator | Th | Air suction temperature sensor |
| EXV | Electronic expansion valve | SV4 | Oil return solenoid valve |

4 Wiring Diagrams

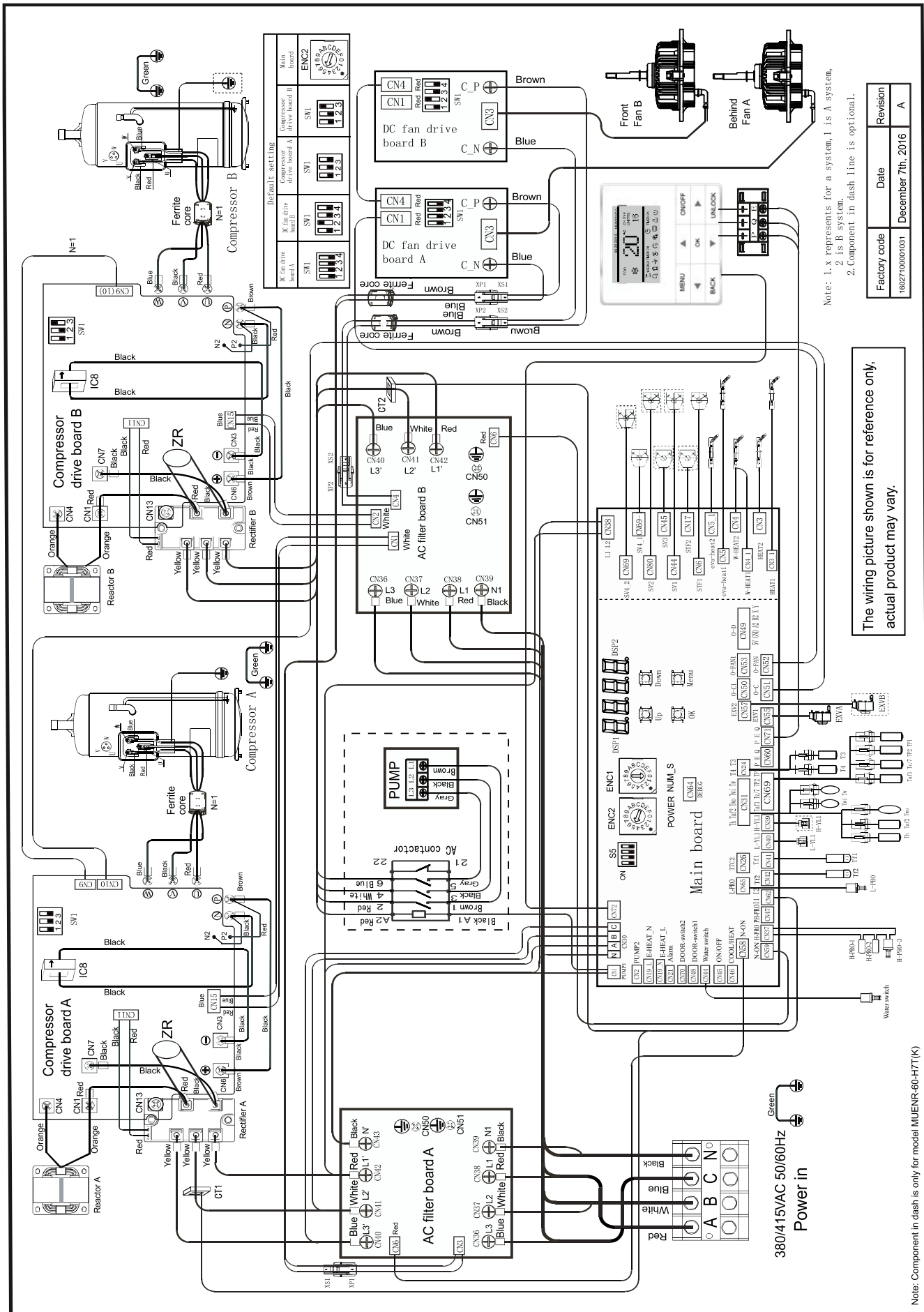
MUENR-30-H7T / MUENR-30-H7T(K) / MUENR-30-H7T(K2)

Figure 2 4.1: wiring diagram



MUENR-60-H7T / MUENR-60-H7T(K)

Figure 2-4.2: wiring diagram



Note: Component in dash is only for model MUENR-60-H7T(K)

| Legend | | | |
|--------------|------------------------------------|------------|---|
| H-PRO | High pressure switch | Eva-heat 1 | Plate heat exchanger heater 1 |
| L-PRO | Low pressure switch | Eva-heat 2 | Plate heat exchanger heater 2 |
| Water switch | Water flow switch | Tf1 | Inverter module temperature sensor 1 |
| L-YL1 | Pressure sensor | Tf2 | Inverter module temperature sensor 2 |
| T4 | Outdoor ambient temperature sensor | TW | Total water outlet temperature sensor |
| T3 | Condenser tube temperature sensor | TWi | Water inlet temperature sensor |
| CT1 | AC current detector 1 | TWO | Water outlet temperature sensor |
| CT2 | AC current detector 2 | Taf1 | Evaporator anti-freezing temperature sensor 1 |
| STF1 | 4-way valve 1 | Taf2 | Evaporator anti-freezing temperature sensor 2 |
| STF2 | 4-way valve 2 | Tp1 | Discharge temperature sensor 1 |
| SV4 | Oil return solenoid valve | Tp2 | Discharge temperature sensor 2 |
| HEAT1 | Compressor crankcase heater 1 | Tz/7 | Total cooling outlet temperature sensor |
| HEAT2 | Compressor crankcase heater 2 | W-HEAT1 | Water flow heater 1 |
| Th | Air suction temperature sensor | W-HEAT2 | Water flow heater 2 |

5 Capacity Tables

5.1 Heating Capacity Tables

Table 2-5.1: Model 30 heating capacity

| Ambient temp. (°C) | Chilled water outlet temperature (°C) | | | | | | | | | | | |
|--------------------------|---------------------------------------|------|-------|------|-------|------|-------|-------|-------|-------|-------|------|
| | 30.00 | | 35.00 | | 40.00 | | 45.00 | | 50.00 | | 55.00 | |
| | TC | PI | TC | PI | TC | PI | TC | PI | TC | PI | TC | PI |
| | kW | kW | kW | kW | kW | kW | kW | kW | kW | kW | kW | kW |
| -15.00 | 17.38 | 8.03 | 16.06 | 8.22 | 16.80 | 8.60 | 15.35 | 9.65 | - | - | - | - |
| -7.00 | 25.44 | 8.85 | 24.41 | 9.46 | 24.32 | 9.90 | 23.33 | 11.11 | 20.23 | 11.21 | - | - |
| 2.00 | 25.67 | 8.04 | 25.05 | 8.51 | 24.23 | 8.90 | 23.94 | 9.99 | 20.76 | 10.08 | - | - |
| 7.00 | 31.84 | 8.17 | 33.80 | 8.95 | 32.95 | 9.36 | 32.31 | 10.51 | 28.01 | 10.60 | 22.19 | 9.20 |
| 15.00 | 34.27 | 5.35 | 32.23 | 5.77 | 27.58 | 5.86 | 24.21 | 6.64 | 23.54 | 7.93 | 21.97 | 8.70 |
| 20.00 | 33.69 | 4.51 | 30.77 | 4.67 | 25.45 | 4.63 | 21.57 | 5.10 | 20.87 | 6.08 | 19.43 | 6.73 |
| 25.00 | 33.75 | 4.18 | 31.22 | 4.34 | 26.34 | 4.31 | 22.82 | 4.78 | 22.62 | 5.77 | 21.61 | 6.38 |

Abbreviations:

TC: Total capacity (kW)

PI: Power input (kW)

Notes:

1. Performance specifications measured with water pump operating at rated water flow rate.

Table 2-5.1: Model 60 heating capacity

| Ambient temp. (°C) | Chilled water outlet temperature (°C) | | | | | | | | | | | |
|--------------------------|---------------------------------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| | 30.00 | | 35.00 | | 40.00 | | 45.00 | | 50.00 | | 55.00 | |
| | TC | PI | TC | PI | TC | PI | TC | PI | TC | PI | TC | PI |
| | kW | kW | kW | kW | kW | kW | kW | kW | kW | kW | kW | kW |
| -15.00 | 28.07 | 12.66 | 25.94 | 12.96 | 27.23 | 13.35 | 24.87 | 15.51 | - | - | - | - |
| -7.00 | 51.23 | 16.95 | 49.16 | 18.12 | 49.13 | 18.66 | 47.13 | 21.67 | 40.86 | 21.87 | - | - |
| 2.00 | 45.39 | 14.12 | 44.28 | 14.96 | 42.96 | 15.40 | 42.45 | 17.89 | 36.81 | 18.05 | - | - |
| 7.00 | 61.57 | 16.10 | 65.37 | 17.64 | 63.91 | 18.16 | 62.67 | 21.09 | 54.34 | 21.28 | 43.04 | 18.47 |
| 15.00 | 66.27 | 10.54 | 62.32 | 11.37 | 53.50 | 11.38 | 46.97 | 13.33 | 45.67 | 15.93 | 42.61 | 17.46 |
| 20.00 | 65.14 | 8.90 | 59.50 | 9.21 | 49.37 | 8.97 | 41.84 | 10.24 | 40.49 | 12.21 | 37.69 | 13.52 |
| 25.00 | 65.26 | 8.23 | 60.37 | 8.54 | 51.09 | 8.36 | 44.26 | 9.60 | 43.87 | 11.59 | 41.91 | 12.81 |

Abbreviations:

TC: Total capacity (kW)

PI: Power input (kW)

Notes:

1. Performance specifications measured with water pump operating at rated water flow rate.

5.2 Cooling Capacity Tables

Table 2-5.3: Model 30 cooling capacity

| Ambient temp. (°C) | Chilled water outlet temperature (°C) | | | | | | | | | | | |
|--------------------------|---------------------------------------|-------|----------|-------|----------|-------|----------|-------|----------|-------|----------|-------|
| | 3.00 | | 7.00 | | 10.00 | | 13.00 | | 15.00 | | 20 . 00 | |
| | Capacity | Power | Capacity | Power | Capacity | Power | Capacity | Power | Capacity | Power | Capacity | Power |
| | TC | PI | TC | PI | TC | PI | TC | PI | TC | PI | TC | PI |
| -15.00 | 22.98 | 6.08 | 26.20 | 5.93 | 28.64 | 6.54 | 29.25 | 6.70 | 29.65 | 6.80 | 32.12 | 7.11 |
| -5.00 | 21.99 | 6.18 | 24.79 | 6.75 | 27.01 | 6.80 | 28.90 | 7.11 | 30.16 | 7.32 | 31.90 | 7.28 |
| 5.00 | 21.75 | 6.14 | 24.88 | 6.91 | 26.87 | 6.89 | 28.75 | 7.19 | 30.01 | 7.39 | 31.13 | 7.31 |
| 10.00 | 20.78 | 5.92 | 24.57 | 6.98 | 26.54 | 6.89 | 28.54 | 7.23 | 29.87 | 7.45 | 30.14 | 7.32 |
| 17.00 | 40.18 | 11.41 | 42.86 | 11.91 | 46.28 | 12.61 | 49.29 | 13.09 | 51.28 | 13.75 | 56.25 | 13.75 |
| 25.00 | 35.87 | 10.68 | 38.49 | 11.39 | 40.89 | 11.78 | 43.53 | 12.08 | 45.29 | 12.69 | 50.19 | 12.90 |
| 30.00 | 31.98 | 10.09 | 33.58 | 10.36 | 35.24 | 10.55 | 37.79 | 11.56 | 39.49 | 11.55 | 46.56 | 13.30 |
| 35.00 | 30.54 | 12.31 | 31.11 | 11.96 | 32.18 | 10.12 | 32.50 | 11.80 | 34.17 | 10.95 | 40.77 | 12.17 |
| 40.00 | 18.68 | 9.47 | 22.32 | 10.24 | 25.05 | 10.82 | 26.87 | 11.40 | 28.69 | 11.79 | 33.24 | 12.76 |
| 45.00 | 17.1 | 8.85 | 19.78 | 9.57 | 21.79 | 10.11 | 23.81 | 10.65 | 25.15 | 11.01 | 28.5 | 11.91 |

Abbreviations:

TC: Total capacity (kW)

PI: Power input (kW)

Notes:

1. Performance specifications measured with water pump operating at rated water flow rate.

Table 2-5.4: Model 60 cooling capacity

| Ambient temp. (°C) | Chilled water outlet temperature (°C) | | | | | | | | | | | |
|--------------------------|---------------------------------------|-------|----------|-------|----------|-------|----------|-------|----------|-------|----------|-------|
| | 3.00 | | 7.00 | | 10.00 | | 13.00 | | 15.00 | | 20.00 | |
| | Capacity | Power | Capacity | Power | Capacity | Power | Capacity | Power | Capacity | Power | Capacity | Power |
| | TC | PI | TC | PI | TC | PI | TC | PI | TC | PI | TC | PI |
| -15.00 | 44.77 | 12.30 | 51.01 | 11.99 | 55.76 | 13.23 | 55.15 | 13.31 | 57.71 | 13.76 | 62.51 | 14.37 |
| -5.00 | 42.84 | 12.50 | 48.27 | 13.66 | 52.60 | 13.76 | 56.08 | 14.31 | 58.69 | 14.80 | 62.08 | 14.73 |
| 5.00 | 42.39 | 12.44 | 48.46 | 13.98 | 52.32 | 13.94 | 55.81 | 14.46 | 58.41 | 14.95 | 60.58 | 14.78 |
| 10.00 | 40.50 | 11.98 | 47.86 | 14.12 | 51.68 | 13.94 | 55.56 | 14.56 | 58.14 | 15.06 | 58.66 | 14.79 |
| 17.00 | 78.14 | 23.06 | 83.34 | 24.04 | 89.97 | 25.47 | 96.42 | 26.84 | 99.67 | 27.76 | 109.32 | 27.77 |
| 25.00 | 69.78 | 21.57 | 74.86 | 23.00 | 79.52 | 23.80 | 85.18 | 24.70 | 88.05 | 25.62 | 97.56 | 26.05 |
| 30.00 | 62.23 | 20.38 | 65.34 | 20.94 | 68.56 | 21.31 | 67.52 | 22.48 | 76.79 | 23.32 | 90.50 | 26.85 |
| 35.00 | 59.44 | 24.86 | 60.54 | 24.16 | 62.62 | 20.45 | 64.30 | 21.38 | 66.47 | 22.12 | 79.27 | 24.57 |
| 40.00 | 40.31 | 20.32 | 45.45 | 21.06 | 49.30 | 21.61 | 53.16 | 23.28 | 55.73 | 23.65 | 62.15 | 24.57 |
| 45.00 | 35.72 | 19.3 | 40.28 | 19.68 | 43.70 | 20.72 | 47.12 | 21.75 | 49.40 | 22.44 | 55.10 | 24.17 |

Abbreviations:

TC: Total capacity (kW)

PI: Power input (kW)

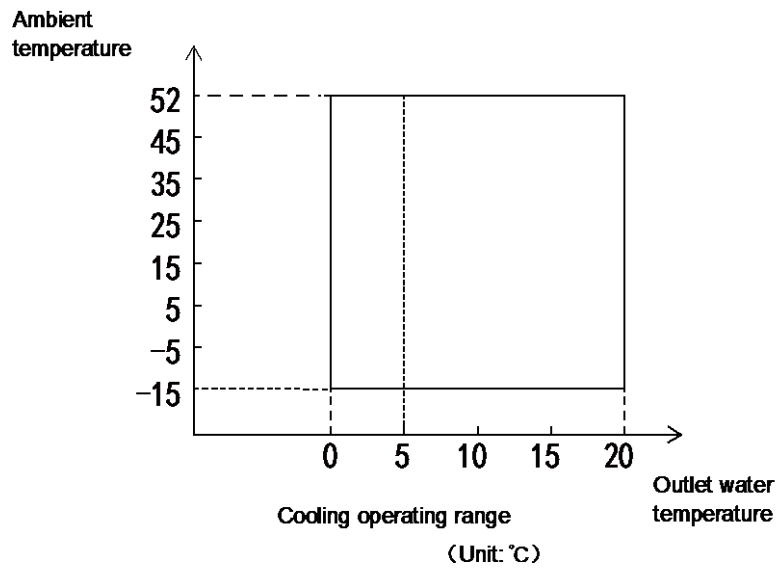
Notes:

- Performance specifications measured with water pump operating at rated water flow rate.

6 Operating Limits

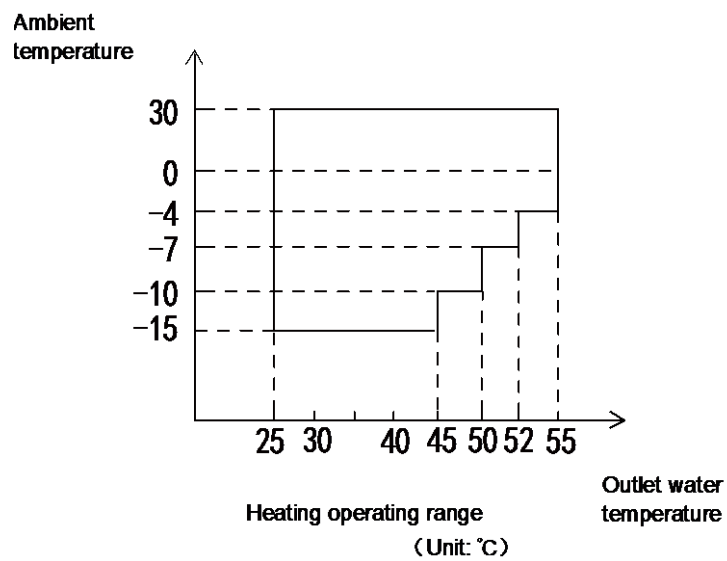
6.1 Cooling operating range

Figure 2-6.1: Cooling operating range



6.2 Heating operating range

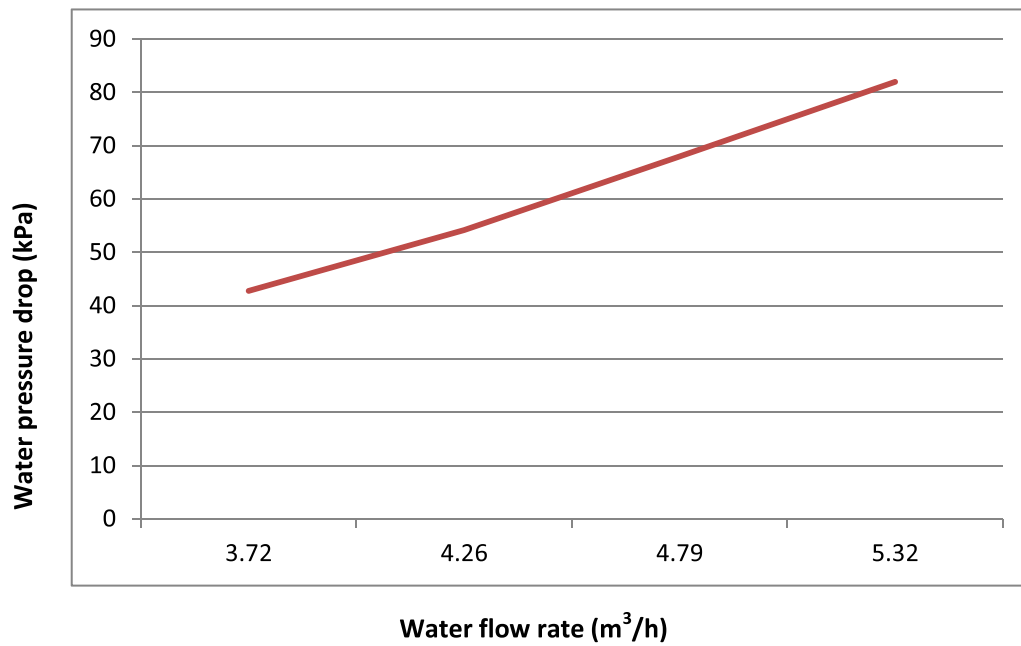
Figure 2-6.2: Heating operating range



7 Hydronic Performance

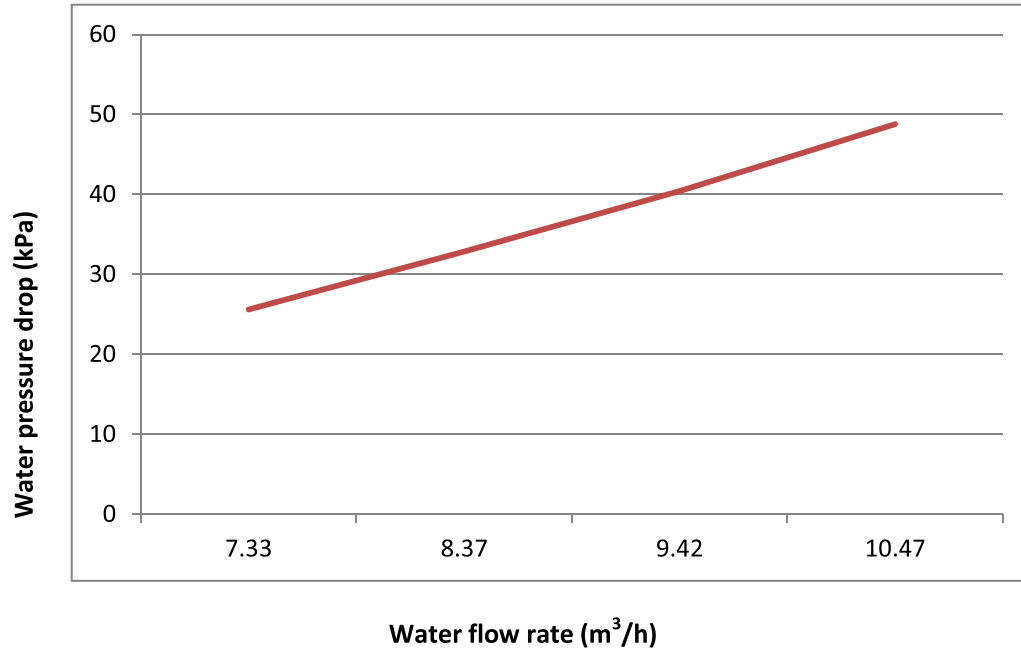
MUENR-30-H7T / MUENR-30-H7T(K) / MUENR-30-H7T(K2)

Figure 2-7.1: Hydronic performance



MUENR-60-H7T / MUENR-60-H7T(K)

Figure 2-7.2: Hydronic performance



8 Sound Levels

8.1 Overall

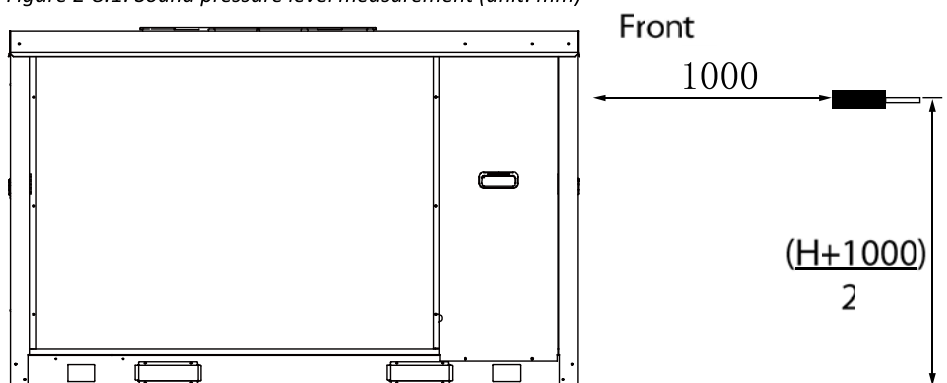
Table 2-8.1: Sound pressure levels

| Model name | dB(A) |
|------------|-------|
| 30 | 75.9 |
| 60 | 85.3 |

Notes:

1. Sound pressure level is measured at a position 1m in front of the unit and $(1+H)/2$ m (where H is the height of the unit) above the floor in a semi-anechoic chamber. During in-situ operation, sound pressure levels may be higher as a result of ambient noise.

Figure 2-8.1: Sound pressure level measurement (unit: mm)



8.2 Octave Band Levels

Figure 2-8.2: Model 30 octave band level (in cooling mode at rated compressor frequency)

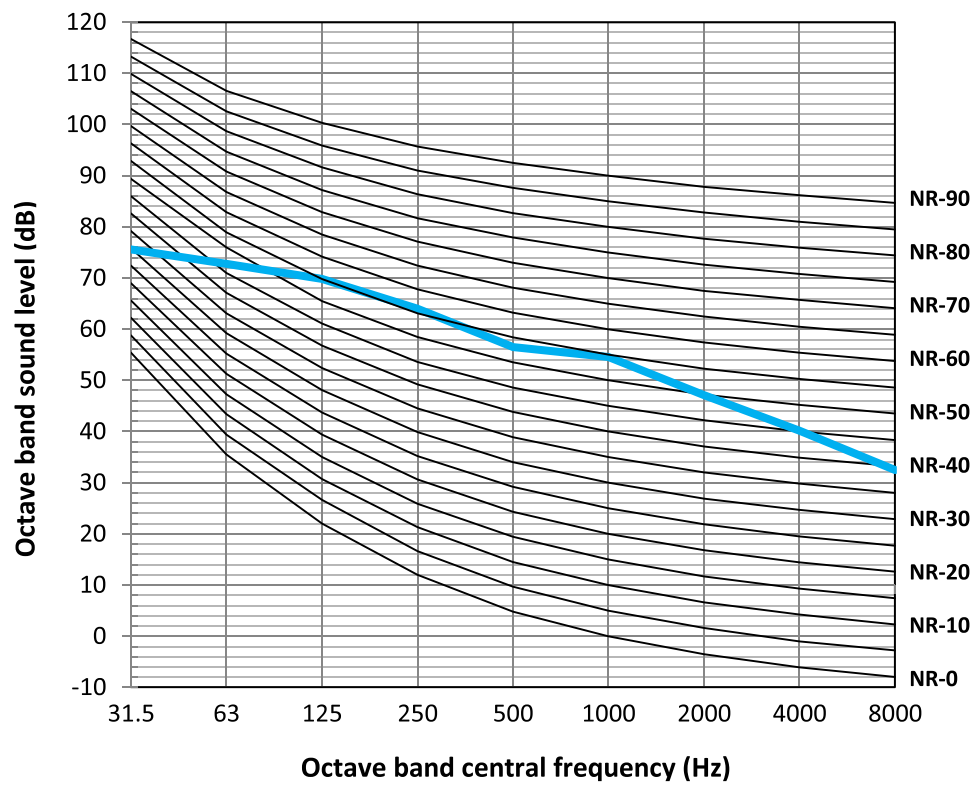


Figure 2-8.3: Model 60 octave band level (in cooling mode at rated compressor frequency)

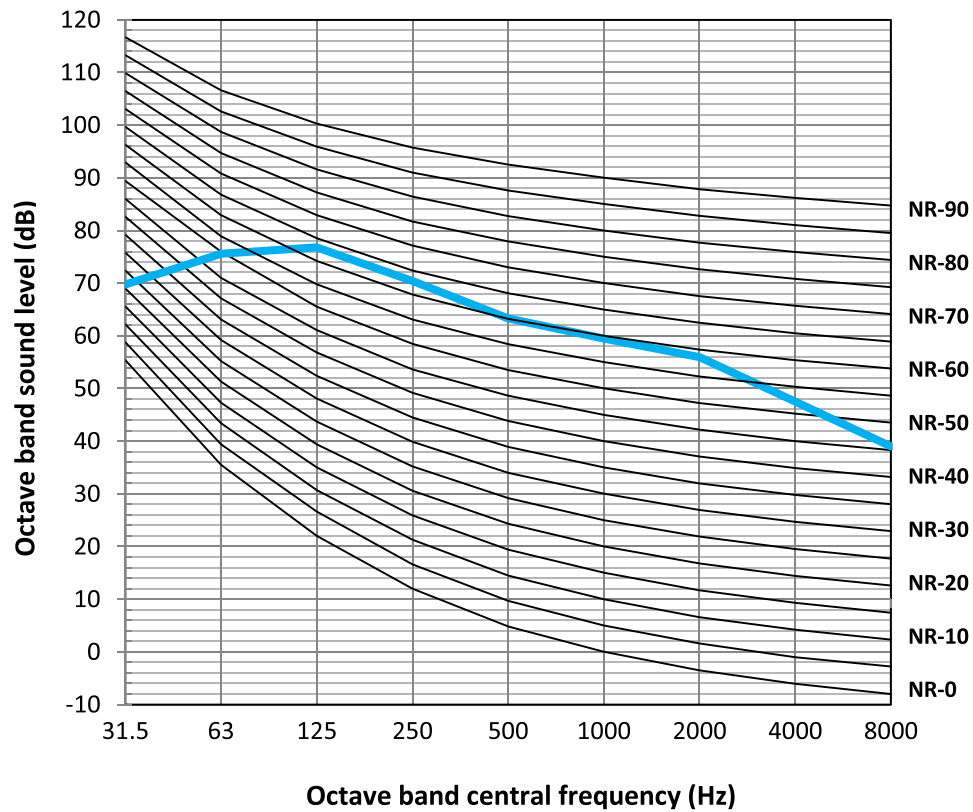


Figure 2-8.4: Model 30 octave band level (in heating mode at rated compressor frequency)

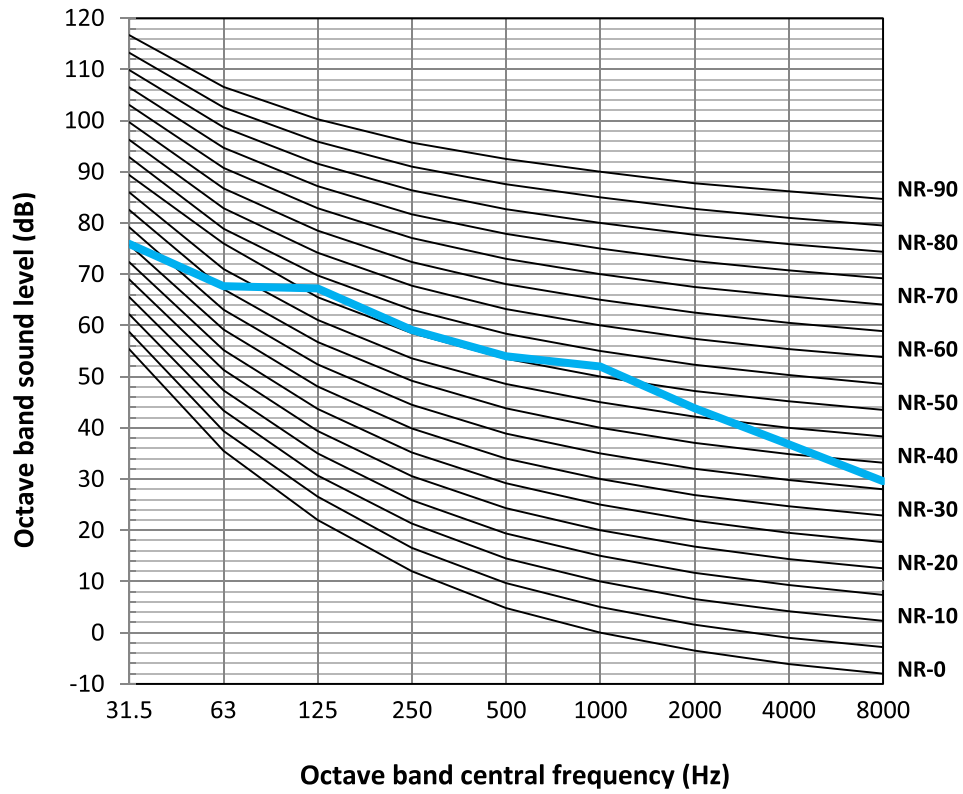
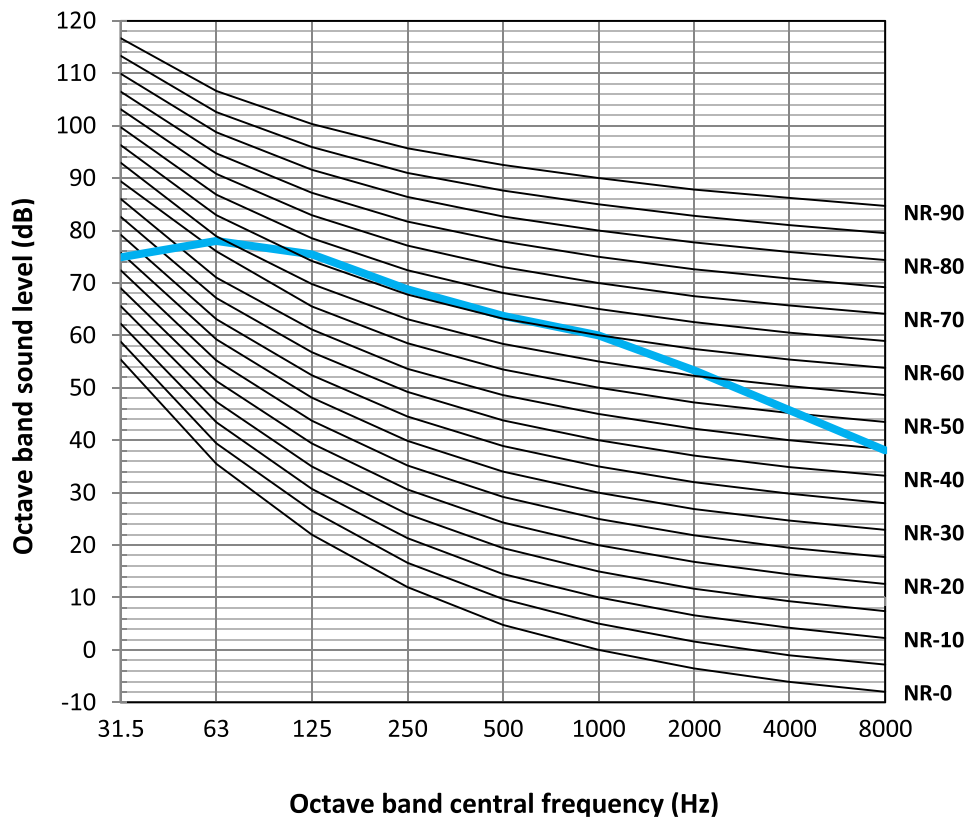






Figure 2-8.5: Model 60 octave band level (in heating mode at rated compressor frequency)



9 Accessories

9.1 Standard accessories

Table 2-9.1: Standard accessories

| Name | Shape | Quantity |
|---|---|----------|
| Installation & Operation Manual |  | 1 |
| Temperature testing components for total water outlet |  | 1 |
| Wired controller power adapter |  | 1 |
| Wired controller installation manual |  | 1 |

Part 3

Installation and Field Settings

| | | |
|---|---|----|
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| 3 | Water System Design and Installation..... | 39 |
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1 Preface to Part 3

1.1 Notes for Installers Boxes

The information contained in this Engineering Data Book may primarily be of use during the system design stage of a DC Modular Chiller project. Additional important information which may primarily be of use during field installation has been placed in boxes, such as the example below, titled “Notes for installers”.

Notes for installers



- Notes for installers boxes contain important information which may primarily be of use during field installation, rather than during desk-based system design.

1.2 Definitions

In this Engineering Data Book, the term “applicable legislation” refers to all national, local and other laws, standards, codes, rules, regulations and other legislation that apply in a given situation.

1.3 Precautions

All system installation including installation of water piping and electrical works must only be carried out by competent and suitably qualified, certified and accredited professionals and in accordance with all applicable legislation.

2 Unit Placement and Installation

2.1 Acceptance and Unpacking

Notes for installers



- When units are delivered check whether any damage occurred during shipment. If there is damage to the surface or outside of a unit, submit a written report to the shipping company.
- Check that the model, specifications and quantity of the units delivered are as ordered.
- Check that all accessories ordered have been included. Retain the Owner's Manual for future reference.

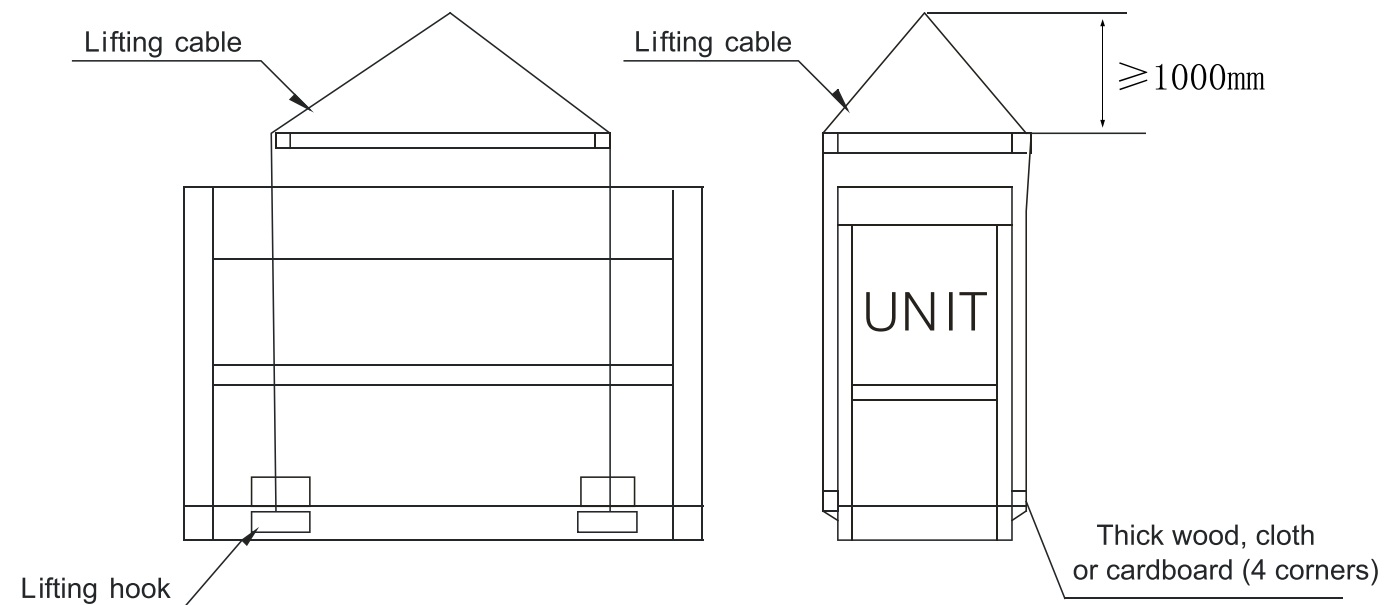
2.2 Hoisting

Notes for installers



- Do not remove any packaging before hoisting. If units are not packaged or if the packaging is damaged, use suitable boards or packing material to protect the units.
- Hoist one unit at a time, using two ropes to ensure stability.
- Keep units upright during hoisting, ensuring that the angle to the vertical does not exceed 30°.

Figure 3-2.1: Hoisting the unit



2.3 Placement Considerations

Placement of outdoor units should take account of the following considerations:

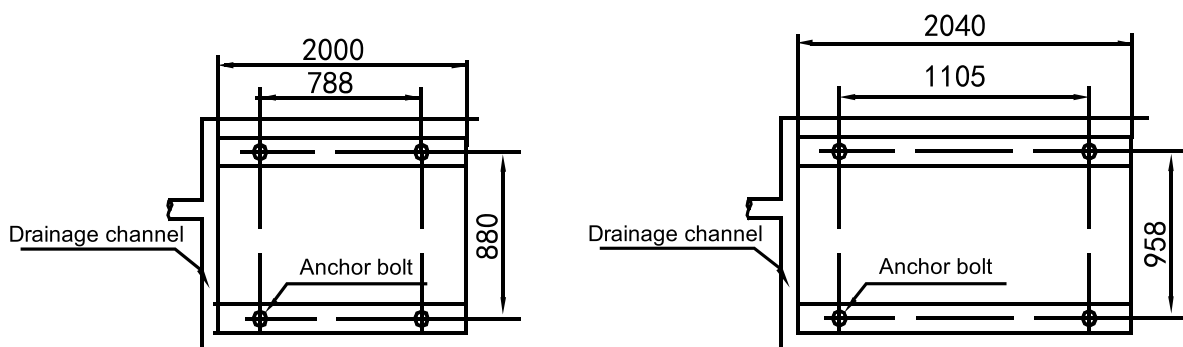
- Air conditioners should not be exposed to direct radiation from a high-temperature heat source.
- Air conditioners should not be installed in positions where dust or dirt may affect heat exchangers.
- Air conditioners should not be installed in locations where exposure to oil or to corrosive or harmful gases, such as acidic or alkaline gases, may occur.
- Air conditioners should not be installed in locations where exposure to salinity may occur.
- Outdoor units should be installed in well-drained, well-ventilated positions that are as close as possible to the indoor units.
- Outdoor units can be installed on the ground or on a roof structure that is strong enough to bear the unit's weight. When installed in a position that is not easily accessible, a method of safe access for installation/maintenance should be provided.
- Outdoor units should not be installed in locations which have stringent low-noise or low-vibration requirements.
- Outdoor units should not be installed adjacent to boiler flues and should be sheltered from direct sunlight as much as possible.
- For the safety of persons which may be in the vicinity of an outdoor unit and to protect the unit from accidental damage, guard rails/meshes should be installed to prevent unauthorized persons from opening unit casings.

2.4 Base Structure

Outdoor unit base structure design should take account of the following considerations:

- A solid base prevents excess vibration and noise. Outdoor unit bases should be constructed on solid ground or on structures of sufficient strength to support the units' weight and that of installation/maintenance personnel.
- Bases should be at least 300mm high to provide sufficient access for installation of piping.
- Either steel or concrete bases may be suitable.
- To ensure that all contact points are equally secure, bases should be completely level. Base design should ensure that the points on the units' bases designed for weight-bearing support are fully supported.
- A drainage ditch should be provided to allow drainage of condensate that may form on the heat exchangers when the units are running in heating mode. The drainage should ensure that condensate is directed away from roadways and footpaths, especially in locations where the climate is such that condensate may freeze.
- The unit casing should not be embedded into a concrete foundation.
- When installed on the ground, the unit's foundations should be a separate structure from the building foundations, to prevent transfer of noise and vibrations.
- When installed on a roof, if a steel frame is used, the steel should be sufficiently wide that the dampers can be installed.
- In areas of high snowfall, the height of the base structures should be increased so as to raise the units further off the ground.

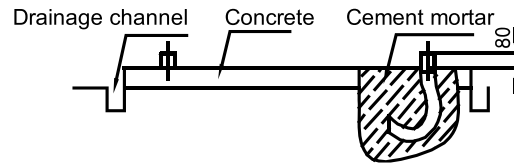
Figure 3-2.2: Outdoor unit typical concrete base structure design (unit: mm)



2.5 Drainage

Drainage ditch should be provided to allow drainage of condensate that may form on the air side heat exchanger when the unit is running in heating mode. The drainage should ensure that condensate is directed away from roadways and footpaths, especially in locations where the climate is such that condensate may freeze.

Figure 3-2.3: Drainage hole



2.6 Spacing

Outdoor units must be spaced such that sufficient air may flow through each unit. Sufficient airflow across heat exchangers is essential for outdoor units to function properly. The influence of adjacent structures on the airflow around the unit should also be taken into consideration. For units installed in locations that may experience high wind speeds, measures such as installing fences should be taken to protect the units from turbulent flows that may disturb the air entering/leaving the units. When fencing or other forms of wind protection are installed, the minimum spacing requirements detailed in Figure 3-2.4 should still be observed.

Figure 3-2.4: Installation with obstacles

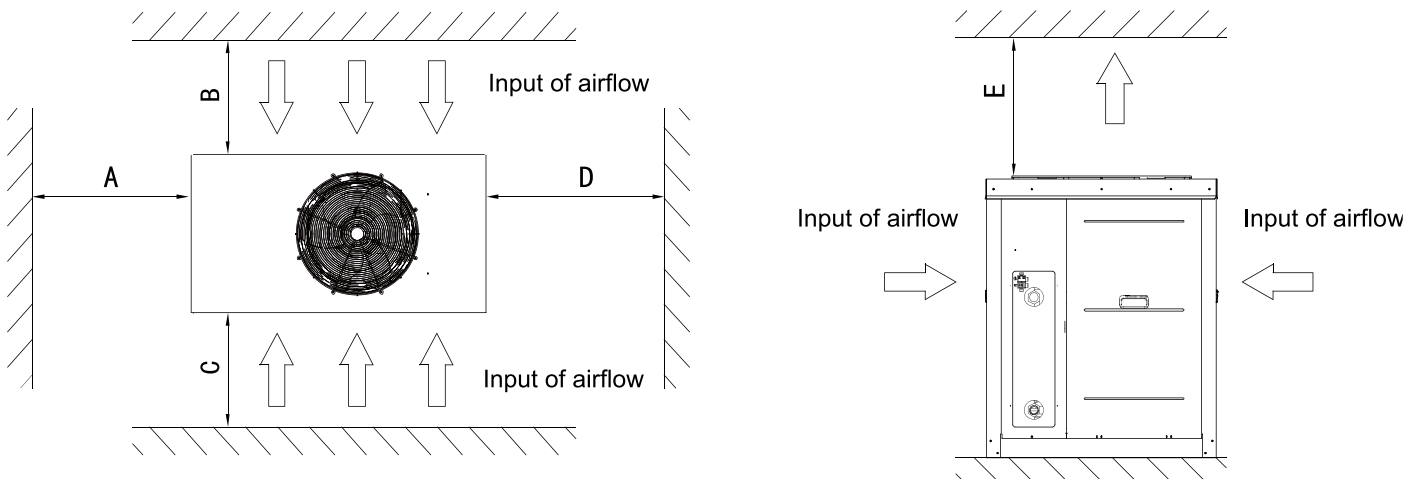
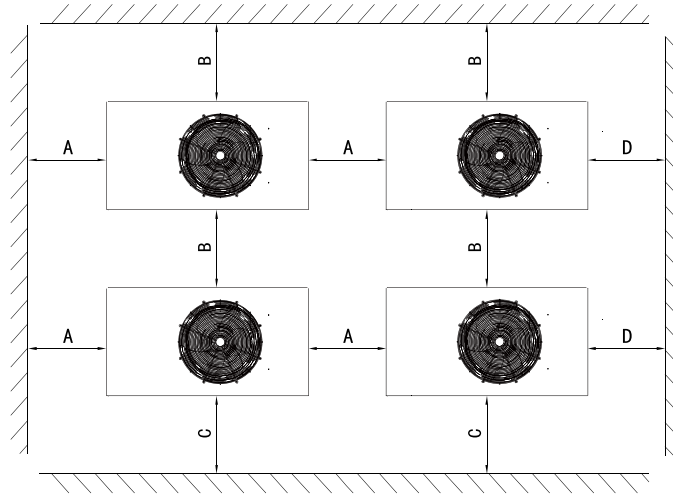


Table 3-2.1: Recommend minimum spacings

| Module | Installation space (mm) | | | | |
|--------|-------------------------|-------|-------|------|-------|
| | A | B | C | D | E |
| 30 | ≥800 | ≥2000 | ≥2000 | ≥800 | ≥6000 |
| 60 | | | | | |

Figure 3-2.5: Parallel installation with obstacles



2.7 Installation of Damping Devices

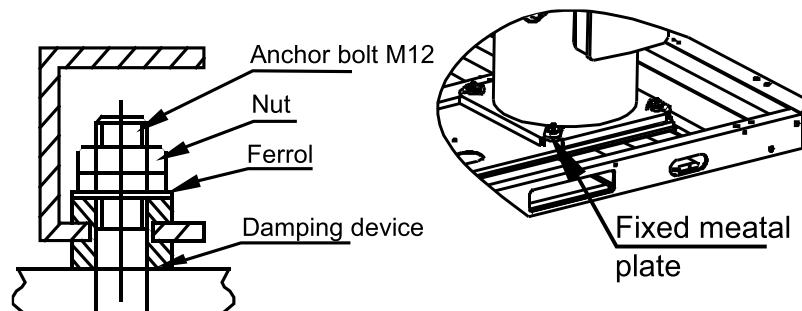
2.7.1 Damping devices must be provided between the unit and its foundation

By means of the $\Phi 15\text{mm}$ diameter installation holes on the steel frame of the unit base, the unit can be fastened on the foundation through the spring damper. See figure above (Figure 3-2.2) for details about center distance of the installation holes. The damper does not go with the unit, and the user can select the damper according to the relevant requirements. When the unit is installed on the high roof or the area sensitive to vibration, please consult the technical engineers before selecting the damper.

2.7.2 Installation steps of the damper

- Step 1. Make sure that the flatness of the concrete foundation is within $\pm 3\text{mm}$, and then place the unit on the cushion block.
- Step 2. Raise the unit to the height suitable for installation of the damping device. Remove the clamp nuts of the damper.
- Step 3. Place the unit on the damper, and align the fixing bolt holes of the damper with the fixing holes on the unit base.
- Step 4. Return the clamp nuts of the damper to the fixing holes on the unit base, and tighten them into the damper.
- Step 5. Adjust the operational height of the damper base, and screw down the leveling bolts. Tighten the bolts by one circle to ensure equal height adjustment variance of the damper.
- Step 6. The lock bolts can be tightened after the correct operational height is reached.

Figure 3-2.6: Installation of the damper



3 Water System Design and Installation

3.1 Water Circuit Checks

DC Modular Chillers units are equipped with a water inlet and outlet for connection to a water circuit. DC Modular Chillers II units should only be connected to closed water circuits. Connection to an open water circuit would lead to excessive corrosion of the water piping. Only materials complying with all applicable legislation should be used.

Before continuing installation of the unit, check the following:

- All chilled water pipelines should be thoroughly flushed, to be free of any impurity, before the unit is operated. Any impurity should not be flushed to or into the heat exchanger.
- Water must enter the heat exchanger through the inlet; otherwise the performance of the unit will decline.
- The pump installed in the water pipeline system should be equipped with starter. The pump will directly press water into the heat exchanger of the water system.
- The pipes and their ports must be independently supported but should not be supported on the unit.
- The pipes and their ports of the heat exchanger should be easy to disassemble for operation and cleaning, as well as inspection of port pipes of the evaporator.
- The evaporator should be provided with a filter with more than 40 meshes per inch at site. The filter should be installed near to the inlet port as much as possible, and be under heat preservation.
- The by-pass pipes and by-pass valves as shown in Figure 1-1.1: System schematic must be mounted for the heat exchanger, to facilitate cleaning of the outside system of water passage before the unit is adjusted. During maintenance, the water passage of the heat exchanger can be cut off without disturbing other heat exchangers.
- The flexible ports should be adopted between the interface of the heat exchanger and on-site pipeline, to reduce transfer of vibration to the building.
- To facilitate maintenance, the inlet and outlet pipes should be provided with thermometer or manometer. The unit is not equipped with pressure and temperature instruments, so they need to be purchased by the user.
- All low positions of the water system should be provided with drainage ports, to drain water in the evaporator and the system completely; and all high positions should be supplied with discharge valves, to facilitate expelling air from the pipeline. The discharge valves and drainage ports should not be under heat preservation, to facilitate maintenance.
- All possible water pipes in the system to be chilled should be under heat preservation, including inlet pipes and flanges of the heat exchanger.
- The outdoor chilled water pipelines should be wrapped with an auxiliary heating belt for heat preservation, and the material of the auxiliary heat belt should be PE, EDPM, etc., with thickness of 20mm, to prevent the pipelines from freezing and thus cracking under low temperature. The power supply of the heating belt should be equipped with an independent fuse.
- When the ambient temperature is lower than 2°C, and the unit will be not used for a long time, water inside the unit should be drained. If the unit is not drained in winter, its power supply should not be cut off, and the fan coils in the water system must be provided with three-way valves, to ensure smooth circulation of the water system when the anti-freezing pump is started up in winter.
- The common outlet pipelines of combined units should be provided with mixing water temperature sensor.

3.2 Water Quality Control

When industrial water is used as chilled water, little furring may occur; however, well water or river water, used as chilled water, may cause much sediment, such as furring, sand, and so on. Therefore, well water or river water must be filtered and softened in softening water equipment before flowing into chilled water system. If sand and clay settle in the evaporator, circulation of chilled water may be blocked, and thus leading to freezing accidents; if hardness of chilled water is too high, furring may occur easily, and the devices may be corroded. Therefore, the quality of chilled water should be analyzed before being used, such as PH value, conductivity, concentration of chloride ion, concentration of sulfide ion, and so on.

Table 3-3.1: Applicable standard of water quality for the unit

| pH value | Total hardness | Conductivity | Sulfide ions | Chloride ions | Ammonia ions | Sulfate ions | Silicon | Iron | Sodium ions | Calcium ions |
|----------|----------------|------------------------|----------------|---------------|----------------|--------------|---------|----------|----------------|--------------|
| 7-8.5 | < 50ppm | < 20 μ V/cm (25°C) | No requirement | < 50ppm | No requirement | < 50ppm | < 30ppm | < 0.3ppm | No requirement | < 50ppm |

3.2.1 Performance adjustment factors

The antifreeze must be required according to anyone condition as following:

- The outlet water temperature is below 5°C;
- The ambient temperature is below 0 °C;
- Don't start up the unit for a long time.
- The power supply was cut off and needn't change the water in system.

3.2.2 Ethylene and Propylene Glycol factors

A glycol solution is required when the unit with condition as mentioned. The use of glycol will reduce the performance of the unit depending on concentration.

Table 3-3.2: Ethylene glycol

| Concentration of ethylene glycol (%) | Modification coefficient | | | | Freezing point (°C) |
|--------------------------------------|--------------------------|-------------|------------------|------------|---------------------|
| | Cooling capacity | Power input | Water resistance | Water flow | |
| 0 | 1.000 | 1.000 | 1.000 | 1.000 | 0 |
| 10 | 0.984 | 0.998 | 1.118 | 1.019 | -4 |
| 20 | 0.973 | 0.995 | 1.268 | 1.051 | -9 |
| 30 | 0.965 | 0.992 | 1.482 | 1.092 | -16 |
| 40 | 0.960 | 0.989 | 1.791 | 1.145 | -23 |
| 50 | 0.950 | 0.983 | 2.100 | 1.200 | -37 |

Table 3-3.3: Propylene glycol

| Concentration of propylene glycol (%) | Modification coefficient | | | | Freezing point (°C) |
|---------------------------------------|--------------------------|-------------|------------------|------------|---------------------|
| | Cooling capacity | Power input | Water resistance | Water flow | |
| 0 | 1.000 | 1.000 | 1.000 | 1.000 | 0 |
| 10 | 0.976 | 0.996 | 1.071 | 1.00 | -3 |
| 20 | 0.961 | 0.992 | 1.189 | 1.016 | -7 |
| 30 | 0.948 | 0.988 | 1.380 | 1.034 | -13 |
| 40 | 0.938 | 0.984 | 1.728 | 1.078 | -22 |
| 50 | 0.925 | 0.975 | 2.150 | 1.125 | -35 |

3.2.3 Altitude correction factors

Performance tables are based at sea level. Elevations other than sea level affect the performance of the unit. The decreased air density will reduce condenser capacity and reduce the unit's performance. For performance at elevations other than sea level refer to Table 3-3.4. Maximum allowable altitude is 1800meters.

3.2.4 Evaporator temperature drop factors

Performance tables are based on a 5°C temperature drop through the evaporator. Adjustment factors for applications with temperature ranges from 3°C to 6°C in follow table. Temperature drops outside this range can affect the control system's capability to maintain acceptable control and are not recommended.

3.2.5 Fouling factor

Fouling refers to the accumulation of unwanted material on solid surfaces, most often in an aquatic environment. The fouling material can consist of either living organisms (biofouling) or a non-living substance (inorganic or organic). Fouling is usually distinguished from other surface-growth phenomena in that it occurs on a surface of a component, system or plant performing a defined and useful function, and that the fouling process impedes or interferes with this function.

Other terms used in the literature to describe fouling include: deposit formation, encrustation, crudding, deposition, scaling, scale formation, slagging, and sludge formation. The last six terms have a more narrow meaning than fouling within the scope of the fouling science and technology, and they also have meanings outside of this scope; therefore, they should be used with caution.

Fouling phenomena are common and diverse, ranging from fouling of ship hulls, natural surfaces in the marine environment (marine fouling), fouling of heat-transfer components through ingredients contained in the cooling water or gases, and even the development of plaque or calculus on teeth, or deposits on solar panels on Mars, among other examples.

Foreign matter in the chilled water system will adversely affect the heat transfer capability of the evaporator, and could increase the pressure drop and reduce the water flow. To provide optimum unit operation, proper water treatment must be maintained. Refer to the table as following.

Table 3-3.4: Fouling factor

| ALTITUDE (m) | Difference of water inlet and outlet temp. (°C) | Fouling Factor | | | | | | | |
|-----------------|---|-------------------------------|-------|-------------------------------|-------|-------------------------------|-------|-------------------------------|-------|
| | | 0.018 m ² . °C /kW | | 0.044 m ² . °C /kW | | 0.086 m ² . °C /kW | | 0.172 m ² . °C /kW | |
| | | C | P | C | P | C | P | C | P |
| Sea level | 3 | 1.036 | 1.077 | 1.019 | 1.076 | 0.991 | 0.975 | 0.963 | 0.983 |
| | 4 | 1.039 | 1.101 | 1.022 | 1.080 | 0.994 | 0.996 | 0.971 | 0.984 |
| | 5 | 1.045 | 1.105 | 1.028 | 1.086 | 1.000 | 1.000 | 0.977 | 0.989 |
| | 6 | 1.051 | 1.109 | 1.034 | 1.093 | 1.006 | 1.004 | 0.983 | 0.994 |
| 600 | 3 | 1.024 | 1.087 | 1.008 | 1.064 | 0.980 | 0.984 | 0.951 | 0.991 |
| | 4 | 1.027 | 1.111 | 1.011 | 1.068 | 0.983 | 1.005 | 0.959 | 0.992 |
| | 5 | 1.034 | 1.115 | 1.017 | 1.074 | 0.989 | 1.009 | 0.965 | 0.997 |
| | 6 | 1.043 | 1.115 | 1.026 | 1.084 | 0.998 | 1.009 | 0.973 | 0.999 |
| 1200 | 3 | 1.013 | 1.117 | 0.996 | 1.052 | 0.969 | 1.011 | 0.942 | 1.002 |
| | 4 | 1.015 | 1.118 | 0.998 | 1.055 | 0.971 | 1.012 | 0.948 | 1.003 |
| | 5 | 1.023 | 1.122 | 1.006 | 1.063 | 0.979 | 1.015 | 0.955 | 1.005 |
| | 6 | 1.031 | 1.125 | 1.015 | 1.072 | 0.987 | 1.018 | 0.962 | 1.007 |
| 1800 | 3 | 1.002 | 1.128 | 0.986 | 1.042 | 0.959 | 1.021 | 0.935 | 1.007 |
| | 4 | 1.005 | 1.129 | 0.989 | 1.045 | 0.962 | 1.022 | 0.941 | 1.010 |
| | 5 | 1.012 | 1.132 | 0.995 | 1.051 | 0.968 | 1.024 | 0.945 | 1.012 |
| | 6 | 1.018 | 1.134 | 1.001 | 1.058 | 0.974 | 1.026 | 0.949 | 1.014 |

Abbreviations:

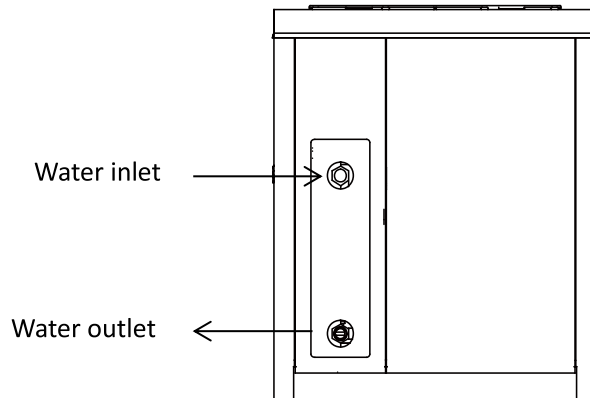
C: Cooling capacity

P: Power input

3.3 Installation of Water System Pipeline

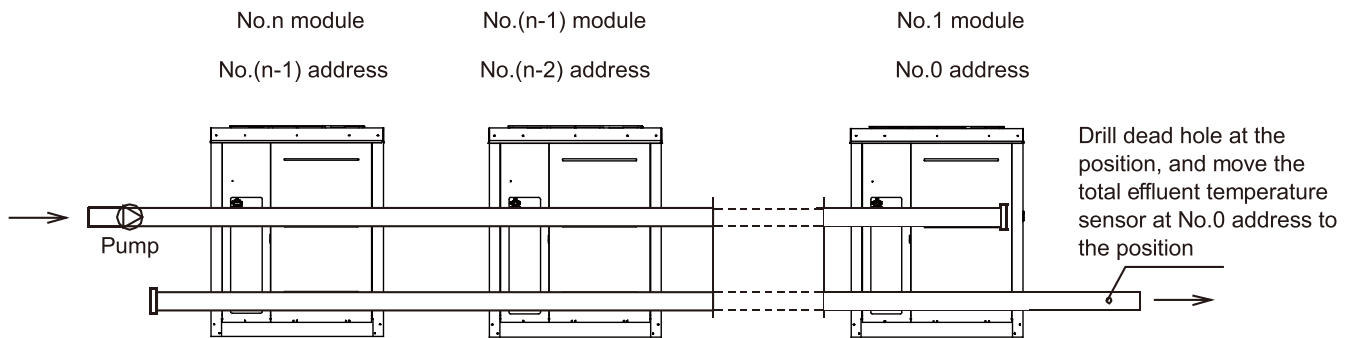
3.3.1 Installation of single-module water system pipeline

Figure 3-3.1: Installation of single-module water system pipeline



3.3.2 Installation of multi-module water system pipeline

Figure 3-3.2: Installation of multi-module water system pipeline



Note: n: the module quantity, max 16

3.3.3 Diameter parameters of main inlet and outlet pipes

Table 3-3.5: Fouling factor

| Cooling capacity | Total inlet and outlet water pipe inside nominal diameter |
|---------------------|--|
| $25 \leq Q \leq 50$ | DN40 |
| $50 < Q \leq 80$ | DN50 |
| $80 < Q \leq 130$ | DN65 |
| $135 < Q \leq 210$ | DN80 |
| $210 < Q \leq 325$ | DN100 |
| $325 < Q \leq 510$ | DN125 |
| $510 < Q \leq 740$ | DN150 |
| $740 < Q \leq 960$ | DN200 |

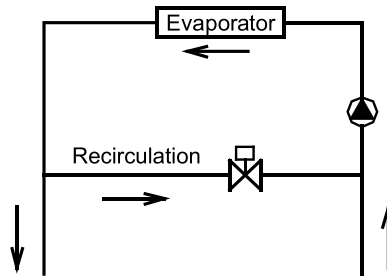
Please pay attention to the following items when installing multiple modules:

- Each module corresponds to an address code which cannot be repeated.
- Main water outlet temperature sensing bulb and auxiliary electric heater are under control of the main module.
- The unit can be started up through the wired controller only after all addresses are set and the aforementioned items are determined. The wired controller is $\leq 500\text{m}$ away from the outdoor unit.

3.3.4 Chiller water flow

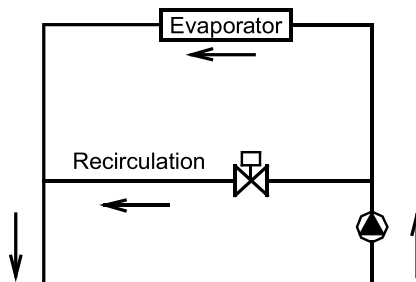
Minimum chilled water flow: if the system flow is less than the minimum unit flow rate, the evaporator flow can be recalculated, as shown in the diagram below.

Figure 3-3.3: Diagram for minimum chilled water flow



Maximum chilled water flow: the maximum chilled water flow is limited by the permitted pressure drop in the evaporator. If the system flow is more than the maximum unit flow rate, bypass the the evaporator as shown in the diagram to obtain a lower evaporator flow rate.

Figure 3-3.4: Diagram for maximum chilled water flow



Minimum and Maximum water flow rates:

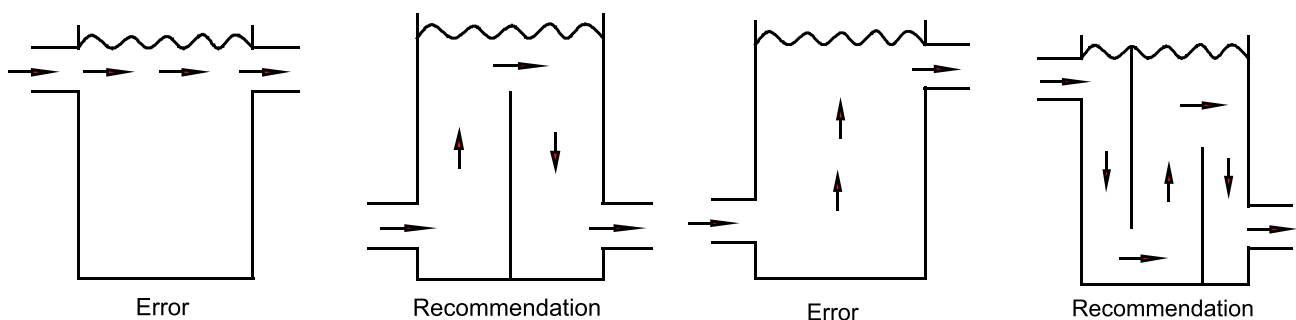
Table 3-3.6: Minimum and Maximum water flow rates

| Model | Water flow rate(m3/h) | |
|-------|-----------------------|---------|
| | Minimum | Maximum |
| 30 | 3.8 | 6.4 |
| 60 | 8.0 | 13.0 |

3.3.5 Design of the store tank in the system

In certain occasion (especially in manufacture cooling process), for conforming the system water content requirement, it's necessary to mount a tank equipping with a cut-off baffle at the system to avoid water short-circuit, Please see the following schemes:

Figure 3-3.5: Design of the store tank



Chilled water system minimum water volume

Chilled water system water volume can be calculated as:

$$\begin{aligned}
 \text{Chilled water system water volume} &= \text{Water pipework volume} \\
 &+ \text{Chiller heat exchanger volume} \\
 &+ \text{Water tank volume} \\
 &+ \text{FCU heat exchanger volume}
 \end{aligned}
 \tag{Equation 1}$$

From the above it can be seen that the system water volume can be adjusted by adjusting the water pipe and/or water tank dimensions. For replacement projects (where the pipework is already installed) the water system water volume can only be adjusted by adjusting the water tank dimensions. If the minimum water volume requirements (as per the calculations below) indicate that the water requirement is met by the pipework and heat exchanger volumes, a water tank is not required.

From equation 1:

$$\begin{aligned}
 \text{Water tank design volume} &= \text{Chilled water system minimum water volume} \\
 &- \text{Water pipework volume} \\
 &- \text{Chiller heat exchanger volume} \\
 &- \text{FCU heat exchanger volume}
 \end{aligned}$$

Two factors place lower limits on the chilled water system required water volume:

1. Cooling mode limit: To ensure reliable system operation, the chilled water system water volume should be sufficient to prevent frequent system start/shutdown when operating in cooling mode under relatively low ambient temperatures. Typically systems should be designed such that the system runs for a minimum of 5 minutes following each system start up in cooling mode.
2. Heating mode limit: To ensure occupant comfort during the defrosting operation, the water system water volume should be sufficient to ensure that the leaving water temperature at the end of the defrosting operation has not fallen so low that occupants could experience cold drafts.

Cooling mode limit on chilled water system water volume

The cooling mode lower limit for the chilled water system water volume is given by:

$$W_c = Q_{c5} / (\Delta T_s - (Q_{cmin} / (G \times 1000))) \tag{Equation 2}$$

Where:

- W_c is the required water volume (in liters)
- Q_{c5} is the unit's cumulative cooling output (in kcal) when running at the unit's lowest operating speed for 5 minutes less the cumulative cooling output required to maintain the conditioned spaces at their set temperatures during that time, which can be obtained from:

$$Q_{c5} = Q_c \times 860 \times (C_{min} - R_{min}) \times (5/60) \tag{Equation 3}$$

Where:

- Q_c is the unit's cooling capacity (in kW) corrected for ambient temperature (using the lowest expected cooling mode ambient temperature) and leaving water temperature
- C_{min} is the ratio of unit output at its lowest operating speed to its output at maximum operating speed
- R_{min} is the cooling output required to maintain the conditioned spaces at their set temperatures, as a proportion of Q_c
- ΔT_s is the unit's deadband temperature range (in °C)
- Q_{cmin} is the unit's output (in kcal/h) when operating at its lowest speed and corrected for ambient temperature and leaving water temperature, which can be obtained from:

- $Q_{cmin} = Q_c \times 860 \times C_{min}$
- G is the unit's minimum chilled water flow rate (in m³/h)

Example - 30kW unit:

From Table 2-1.1, G is 5m³/h and Cmin a typical value of 12.8% may be used. With lowest expected cooling mode ambient temperature of 25°C (as per EN14511) and with leaving water temperature set at 10 °C, from Table 2-5.3 the unit's corrected cooling capacity, Qc, is 40.9kW. For Rmin, a typical value of 5% may be used. The factory default for ΔTs is 4°C.

Wc can then be obtained using Equations 2 to 4:

$$Q_{c5} = 40.9 \times 860 \times (0.128 - 0.05) \times (5/60) = 229\text{kcal}$$

$$Q_{cmin} = 40.9 \times 860 \times 0.128 = 4502\text{kcal/h}$$

$$W_c = 229 / (4 - (4502 / (5 \times 1000))) = 74\text{L}$$

Heating mode limit on chilled water system water volume

To prevent occupants experiencing cold drafts during defrosting, system design should ensure that the leaving water temperature at the end of the defrosting operation does not fall below 15°C (when the ambient temperature is 1°C and the leaving water temperature before starting defrosting is 30°C) or does not fall below 20°C (when the ambient temperature is -7°C and the leaving water temperature before starting defrosting is 35°C).

Defining Q_h as the unit heating capacity (in kW) adjusted for ambient temperature and leaving water temperature, the required minimum water volume is given by:

$$W_{ct} = (Q_d + Q_s) / \Delta T_t \quad \text{Equation 5}$$

Where:

- W_{ct} is the required water volume in liters
- Q_d is the heat energy (in kcal) required for defrosting, which may be taken to be 12% of hourly unit output, such that:
 - $Q_d = Q_h \times 860 \times 0.12$ Equation 6
- Q_s is the heat energy (in kcal) required for room heating during the defrosting operation, which may be obtained from:
 - $Q_s = Q_h \times 860 \times (t_f/60)$ Equation 7
 - Where:
 - t_f is the duration of defrosting operation (in mins)
- ΔT_t is the permitted water system temperature drop during defrosting operation (in °C)

Example - 30kW unit:

With ambient temperature of 2°CWB and with leaving water temperature set at 30°C, from Table 2-5.1 the unit's corrected heating capacity, Q_{h2°C}, is 25.7kW. With ambient temperature of -7°CWB and with leaving water temperature set at 35°C, from Table 2-5.1 the unit's corrected heating capacity, Q_{h-7°C}, is 24.4kW. t_f may be taken to be 4mins. Using equations 5 to 7:

$$Q_{d2°C} = 25.7 \times 860 \times 0.12 = 2652\text{kcal}$$

$$Q_{d-7°C} = 24.4 \times 860 \times 0.12 = 2518\text{kcal}$$

$$Q_{s2°C} = 25.7 \times 860 \times (4/60) = 1473\text{kcal}$$

$$Q_{s-7°C} = 24.4 \times 860 \times (4/60) = 1399\text{kcal}$$

The heating mode limit is the larger of W_{ct2°C} and W_{ct-7°C}, hence 275L.

$$\Delta T_{t2°C} = 30 - 15 = 15°C$$

$$\Delta T_{t-7°C} = 35 - 20 = 15°C$$

$$W_{ct2°C} = (2652 + 1473) / 15 = 275\text{L}$$

$$W_{ct-7°C} = (2518 + 1399) / 15 = 261\text{L}$$

Minimum water volume of combination chilled water system

In cooling mode, the minimum water volume of combination chilled water system W_{cc} is:

$$W_{cc} = W_c \times N$$

Where: W_c is the minimum water volume of single chilled water system in cooling mode

N is the quantity of combination units of the chilled water system

In heating mode, the minimum water volume of combination chilled water system W_{ch} is:

$$W_{ch} = W_{ct} * N$$

Where: W_{ct} is the minimum water volume of single chilled water system in heating mode

N is the quantity of units running in defrosting of chilled water system

The minimum water volume of combination chilled water system is the larger of the W_{cc} and W_{ch} .

3.3.6 Design of the store tank in the system

If a closed expansion tank with its filled volume of air is too small, the system pressure will easily exceed the maximum allowable pressure and cause water to discharge from the pressure relief valve, thus wasting water. If the closed tank is too large, when the water temperature drops, the system pressure may decrease to a level below the minimum allowable value and cause trouble in the air vent. Therefore, accurate sizing of a closed expansion tank is essential.

For diaphragm expansion tanks, the minimum volume of the water tank, V_t , gal(m^3), can be calculated by the following formula, recommended by ASHRAE Handbook 1996, HVAC Systems and Equipment:

$$V_t = V_s \left(\frac{\frac{V_2}{V_1} - 1 - 3\alpha(T_2 - T_1)}{1 - \frac{P_1}{P_2}} \right)$$

T_1 =lower temperature, °F (°C)

T_2 =higher temperature, °F (°C)

V_s =volume of water in system, gal(m^3)

P_1 =absolute pressure at lower temperature, psia(kPa abs.)

P_2 =absolute pressure at higher temperature, psia (kPa abs.)

V_1, V_2 =specific volume of water at lower and higher temperature, respectively, ft³/lb(m^3 /kg)

α =linear coefficient of thermal expansion: for steel, $\alpha=6.5 \times 10^{-6}$ in./in. • °F (1.2×10^{-5} per °C);

for copper, $\alpha=9.5 \times 10^{-6}$ in./in. • °F (1.7×10^{-5} per °C)

In a chilled water system, the higher temperature T_2 is the highest anticipated ambient temperature when the chilled water system shuts down during summer. The lower temperature in a heating system is often the ambient temperature at fill conditions (for example, 50 °F or 10°C).

3.3.7 Selection and installation of the pump

Select the lift of the pump:

$$H = H_1 + H_2 + H_3 + H_4$$

H : The lift of the pump.

H_1 : Main unit water resistance.

H_2 : Pump water resistance.

H_3 : Water resistance of the longest water-loop distance, includes: pipe resistance, different valve's resistance, flexible pipe resistance, pipe elbow and three-way resistance, two-way resistance or three-way resistance, as well as filter resistance.

H_4 : the longest terminal resistance.

Install the pump:

- The pump should be installed at the water inlet pipe, both of which sides must mount the soft connectors for vibration-proof.
- The backup pump for the system (recommended).
- The control signal is provided by the units.

3.3.8 Water circuit connection

Water connections must be made correctly in accordance with the labels on the outdoor unit, with respect to the water inlet and water outlet. If air, moisture or dust gets in the water circuit, problems may occur. Therefore, always take into account the following when connecting the water circuit:

- Use clean pipes only.

- Hold the pipe end downwards when removing burrs
- Cover the pipe end when inserting it through a wall to prevent dust and dirt entering.
- Use a good thread sealant for sealing the connections. The sealing must be able to withstand the pressures and temperatures of the system.
- When using non-copper metallic piping, be sure to insulate the two kind of materials from each other to prevent galvanic corrosion.
- For copper is a soft material, use appropriate tools for connecting the water circuit. Inappropriate tools will cause damage to the pipes

3.3.9 Water piping insulation

The complete water circuit including all piping, water piping must be insulated to prevent condensation during cooling mode operation and reduction of the heating and cooling capacity as well as to prevent of freezing of the outside water piping during winter. The insulation material should be of least of B1 fire resistance rating and should comply with all applicable legislation. The thickness of the sealing materials must be at least 13mm with thermal conductivity 0.039W/mK in order to prevent freezing on the outside water piping. If the outdoor ambient temperature is higher than 30°C and the humidity is higher than RH 80%, the thickness of the sealing materials should be at least 20mm in order to avoid condensation on the surface of the seal.

4 Electrical Wiring

4.1 General

Notes for installers



Caution

- All installation and wiring must be carried out by competent and suitably qualified, certified and accredited professionals and in accordance with all applicable legislation.
- Electrical systems should be grounded in accordance with all applicable legislation.
- Overcurrent circuit breakers and residual-current circuit breakers (ground fault circuit interrupters) should be used in accordance with all applicable legislation.
- Wiring patterns shown in this data book are general connection guides only and are not intended for, or to include all details for, any specific installation.
- The water piping, power wiring and communication wiring are typically run in parallel. However the communication wiring should not be bound together with power wiring. To prevent signal interference, the power wiring and communication wiring should not be run in the same conduit. If the power supply is less than 10A, a separation of at least 300mm between power wiring and communication wiring conduits should be maintained; if the power supply is in the range 10A to 50A then a separation of at least 500mm should be maintained.

4.2 Precautions

- The chiller should apply special power supply, whose voltage should conform to rated voltage.
- Wiring construction must be conducted by the professional technicians according to the labeling on the circuit diagram.
- Only use the electric components specified by our company, and require installation and technical services from the manufacturer or authorized dealer. If wiring connection fails to conform to electric installation norm, failure of the controller, electronic shock, and so on may be caused.
- The connected fixed wires must be equipped with full switching-off devices with at least 3mm contact separation.
- Set leakage protective devices according to the requirements of national technical standard about electric equipment.
- After completing all wiring construction, conduct careful check before connecting the power supply.
- Please carefully read the labels on the electric cabinet.
- The user's attempt to repair the controller is prohibited, since improper repair may cause electric shock, damages to the controller, and so on. If the user has any requirement of repair, please contact the maintenance center.

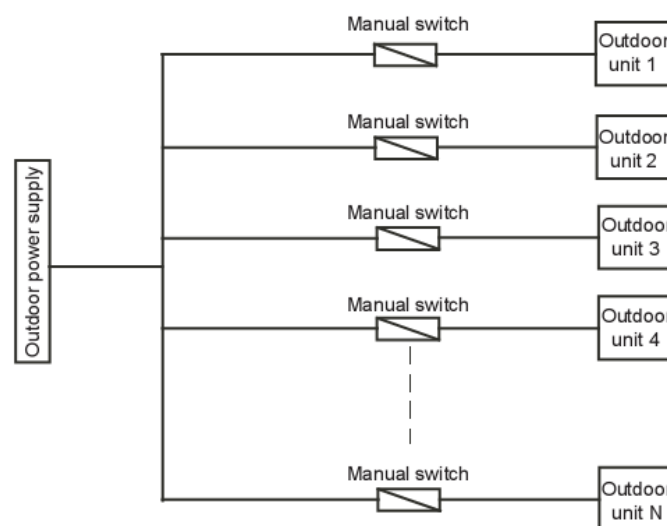
4.3 Requirements of Wiring Connection

No additional control components are required in the electric cabinet (such as relay, and so on), and the power supply and control wires not connected with the electric cabinet are not allowed to go through the electric box. Otherwise, electromagnetic interference may cause failure of the unit and control components and even damages to them, which thus lead to protective failure.

- All cables led to the electric box should be supported independently but by the electric box.
- The strong current wires generally pass the electric box, and 220V alternating current may also pass the control board, so wiring connection should conform to the principle of separation of strong current and weak current, and the wires of power supply should be kept more than 100 mm away from the control wires.
- Only use 380-415V 3Ph~ 50Hz rated power supply for the unit, and the maximum allowable range of voltage is 342V-418V.

- All electric wires must conform to local wiring connection norm. The suitable cables should be connected to power supply terminal through wiring connection holes at the bottom of the electric cabinet. According to Chinese standard, the user is responsible for providing voltage and current protection for the input power supply of the unit.
- All power supplies connected to the unit must pass one manual switch, to ensure that the voltages on all nodes of electric circuit of the unit are released when the switch is cut off. Please refer to the Figure
- The cables of correct specification must be used to supply power for the unit. The unit should use independent power supply, and the unit is not allowed to use the same power supply together with other electric devices, to avoid over-load danger. The fuse or manual switch of the power supply should be compatible with working voltage and current of the unit. In case of parallel connection of multiple modules, the requirements of wiring connection mode and configuration parameters for the unit are shown in the following Table 3-2.7.
- Some connection ports in the electric box are switch signals, for which the user needs to provide power, and the rate voltage of the power should be 220-230V AC. The user must be aware that all power supplies they provided should be obtained through power circuit breakers (provided by the user), to ensure that all voltages on the nodes of the provided power supply circuit are released when the circuit breakers are cut off.
- All inductive components provided by the user (such as coils of contactor, relay, and so on) must be suppressed with standard resistance-capacitance suppressors, to avoid electromagnetic interference, thus leading to failure of the unit and its controller and even damages to them.
- All weak current wires led to the electric box must apply shielded wires, which must be provided with grounding wires. The shield wires and power supply wires should be laid separately, to avoid electromagnetic interference.
- The unit must be provided with grounding wires, which are not allowed to be connected with the grounding wires of gas fuel pipelines, water pipelines, lightning conductors or telephones. Improper earth connection may cause electric shock, so please check whether earth connection of the unit is firm or not frequently.

Figure 3-4.1: Diagram of manual switch for the system



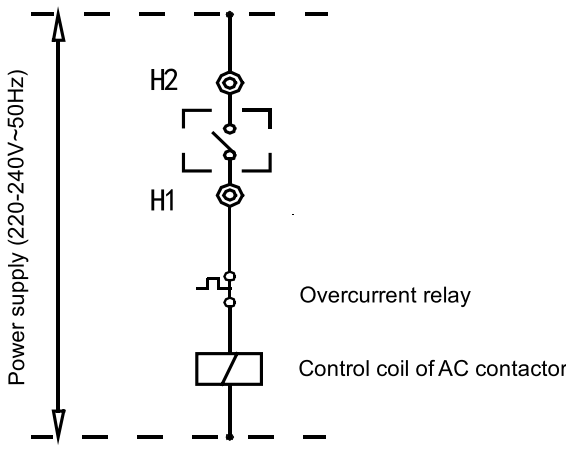
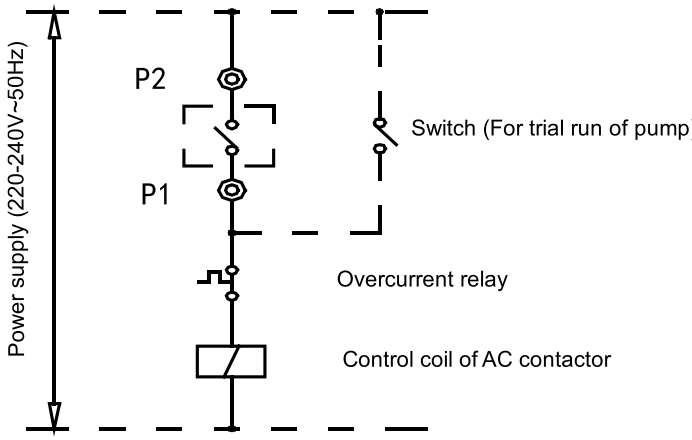
Note: up to 16 units can be combined at most.

Table 3-4.1: Power supply specifications

| Model | Outdoor power supply | | | Wiring |
|-------|----------------------|---------------|------|-----------------------------|
| | Power supply | Manual switch | Fuse | |
| 30 | 380-415V 3Ph~50Hz | 50A | 36A | 16mm ² (<20m) |
| 60 | 380-415V 3Ph~50Hz | 100A | 70A | 25mm ² (<20m) |

4.4 Wiring Steps

Table 3-4.2: Wiring steps

| Step | Content |
|------|--|
| 1 | Check the unit and ensure that it is connected with grounding wires correctly, to avoid leakage, and the grounding devices should be mounted in strict accordance with the requirements of electrical engineering rules. The grounding wires can prevent electric shock. |
| 2 | The control box of the main power switch must be mounted in a proper position. |
| 3 | Wiring connection holes of the main power should be provided with glue cushion. |
| 4 | The main power and neutral wires and grounding wires of power supply are led into the electric box of the unit. |
| 5 | The wires of the main power must pass the bonding clamp. |
| 6 | Wires should be connected firmly to the connection terminals A,B,C, N. |
| 7 | Phase sequences must be consistent when the wires of the main power. |
| 8 | The main power should be located out of easy reach of non-professional maintenance personnel, to avoid mal-operation and improve safety. |
| 9 | Connection of control wires of ON/OFF, HEAT/COOL and ALARM to the main control board terminal. The ON/OFF and HEAT/COOL are signal input ports, while the ALARM is signal output port. Both of them are weak electric ports. |
| 10 | <p>Connection of control wires of auxiliary electric heaters: the control wires of AC contactor of the auxiliary electric heater must pass the connection terminals H1 and H2 of the main unit, as shown.</p>  <p>The diagram shows a vertical power line from a 220-240V~50Hz supply. It passes through terminal H2, then a switch, then terminal H1, followed by an overcurrent relay and the control coil of an AC contactor.</p> |
| 11 | <p>Connection of control wires of pump: the control wires of AC contactor of the pump must pass the connection terminals P1 and P2 of the main unit, as shown.</p>  <p>The diagram shows a vertical power line from a 220-240V~50Hz supply. It passes through terminal P2, then a switch labeled 'Switch (For trial run of pump)', then terminal P1, followed by an overcurrent relay and the control coil of an AC contactor.</p> |
| 12 | Connection of the wired controller to P, Q, E terminal in the electric control box. The wired controller is built-in the electric control box as standard. |

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Figure 3-4.1: Diagram combination system

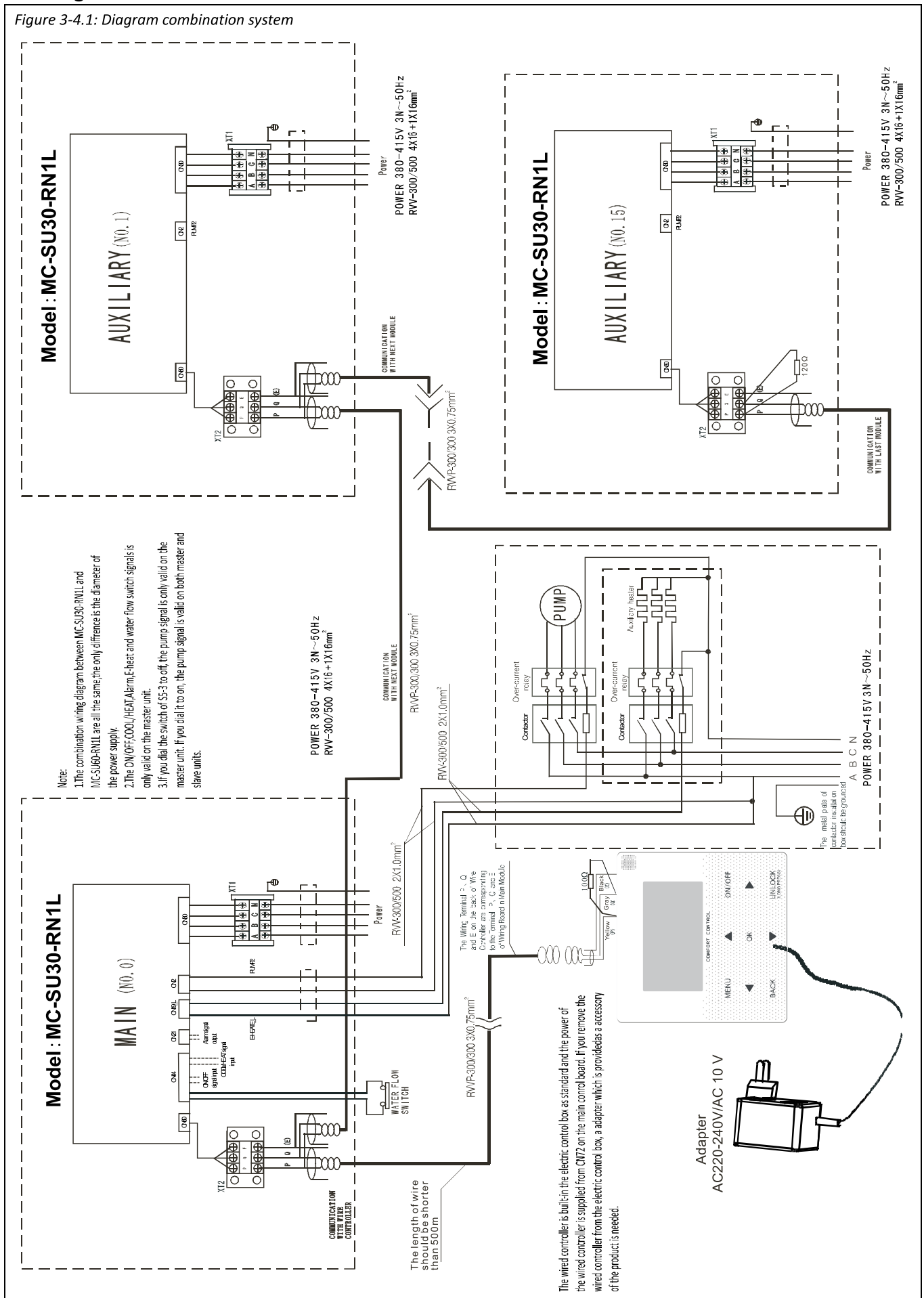


Table 3-4.2: Wiring requirements

| Item | Description | Current | Required number of conductors | Maximum running current | Minimum wiring size |
|------|----------------------------------|---------|-------------------------------|-------------------------|--------------------------|
| 1 | User interface wire ¹ | AC | 5 | 200mA | 0.75-1.25mm ² |
| 2 | Auxiliary heater control wire | AC | 2 | 200mA | 0.75mm ² |
| 3 | Pump control wire | AC | 2 | 200mA | 0.75mm ² |
| 4 | ON/OFF signal wire | DC | 2 | - | 0.75mm ² |
| 5 | Cool/Heat signal wire | DC | 2 | - | 0.75mm ² |
| 6 | Alarm signal wire | AC | 2 | 200mA | 0.75mm ² |

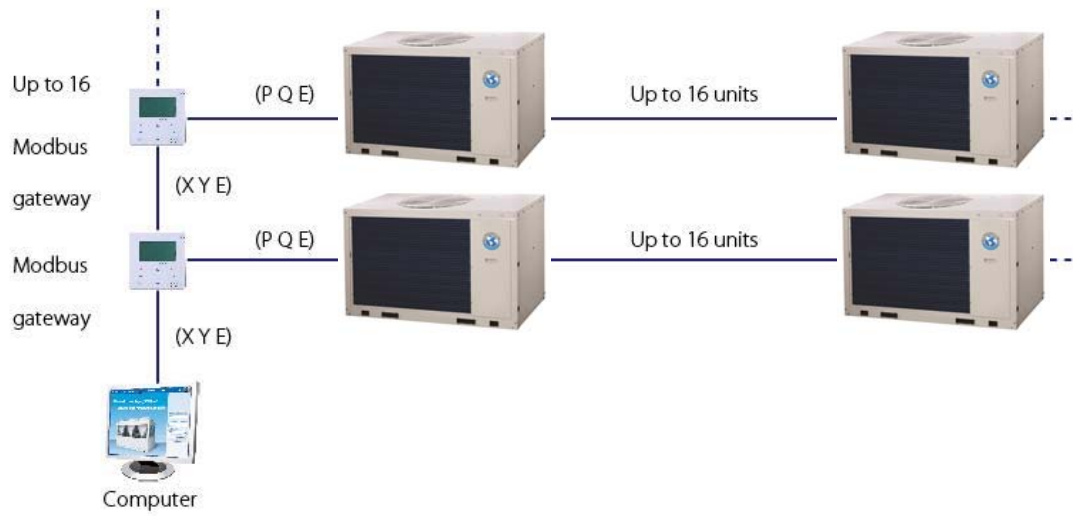
Notes:

1. 5-core shielded wire is required; the standard maximum wire length is 50m.

4.6 Modbus Gateway (customization option)


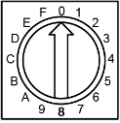
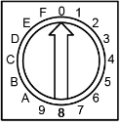
Modbus Gateway functionality can be added by adding X, Y, E ports to the wired controller. Up to 16 wired controllers can be connected together, with each controller controlling up to 16 units.

Figure 3-4.2: Modbus Gateway wiring connection



5 Field Settings

Table 3-5.1: Main PCB switch settings

| Switch | | Description | ON | OFF | Default factory setting |
|--|------|--|-------------------------|--|-------------------------|
| S5  | S5-1 | Water outlet temperature ¹ | Low | Normal | OFF |
| | S5-2 | Reserved | - | - | OFF |
| | S5-3 | Water pump | One small pump per unit | One large pump controlled by master unit | OFF |
| | S5-4 | ON/OFF function | Activated | Deactivated | OFF |
| ENC2  | ENC2 | 0: Model 30 | - | - | 0 |
| | | 5: Model 60 | - | - | 5 |
| ENC1  | ENC1 | 0: master unit 1,2,3...F: slave units | - | - | 0 |
| | | | - | - | |

Notes:

1. Low water outlet temperature range: 0°C to 20°C; normal water outlet temperature range: 5°C to 20°C.

6 Commissioning and Maintenance

6.1 Commissioning

6.1.1 Preparation

- After the water system pipeline is flushed several times, please make sure that the purity of water meets the requirements; the system is re-filled with water and drained, and the pump is started up, then make sure that water flow and the pressure at the outlet meet the requirements.
- The unit is connected to the main power 12 hours before being started up, to supply power to the heating belt and pre-heat the compressor. Inadequate pre-heating may cause damages to the compressor.
- Setting of the wired controller. See details of the manual concerning setting contents of the controller, including such basic settings as refrigerating and heating mode, manual adjustment and automatic adjustment mode and pump mode. Under normal circumstances, the parameters are set around standard operating conditions for trial run, and extreme working conditions should be prevented as much as possible.
- Carefully adjust the inlet stop valve of the unit, to make the water flow of the system accord with the water flow in specification table.

6.1.2 Test run

- Start up the controller and check whether the unit displays a fault code. If a fault occurs, remove the fault first, and start the unit according to the operating method in the “unit control instruction”, after determining that there is no fault existing in the unit.
- Conduct trial run for 30 min. When the influent and effluent temperature becomes stabilized, adjust the water flow to nominal value, to ensure normal operation of the unit.
- After the unit is shut down, it should be put into operation 10 min later, to avoid frequent start-up of the unit. In the end, check whether the unit meets the requirements in specification table.

6.1.3 Notices

- The unit can control start-up and shut-down of the unit, so when the water system is flushed, the operation of the pump should not be controlled by the unit.
- Do not start up the unit before draining the water system completely.
- Do not re-start the unit within 10 min after the unit is shut down during trial run.
- When the unit is used frequently, do not cut off the power supply after the unit is shut down; otherwise the compressor cannot be heated, thus leading to its damages.
- If the unit is not in service for a long time, and the power supply needs to be cut off, the unit should be connected to the power supply 12 hours prior to re-starting of the unit, to pre-heat the compressor.

6.2 Maintenance

6.2.1 Maintenance for main components

- Close attention should be paid to the discharge and suction pressure during the running process. Find out reasons and eliminate the failure if abnormality is found.
- Control and protect the equipment. See to it that no random adjustment be made on the set points on site.
- Regularly check whether the electric connection is loose, and whether there is bad contact at the contact point caused by oxidation and debris etc., and take timely measures if necessary. Frequently check the work voltage, current and phase balance.
- Check the reliability of the electric elements in time. Ineffective and unreliable elements should be replaced in time.

6.2.2 Removing scale

After long-time operation, calcium oxide or other minerals will be settled in the heat transfer surface of the water-side

heat exchanger. These substances will affect the heat transfer performance when there is too much scale in the heat transfer surface and sequentially cause that electricity consumption increases and the discharge pressure is too high (or suction pressure too low). Organic acids such as formic acid, citric acid and acetic acid may be used to clean the scale. But in no way should cleaning agent containing chlorine acid or fluoride should be used as the water-side heat exchange is made from stainless steel and is easy to be eroded to cause refrigerant leakage. Pay attention to the following aspects during the cleaning and scale-removing process:

- Water-side heat exchanger should be done by professionals.
- Clean the pipe and heat exchanger with clean water after cleaning agent is used. Conduct water treatment to prevent water system from being eroded or re-absorption of scale.
- In case of using cleaning agent, adjust the density of the agent, cleaning time and temperature according to the scale settlement condition.
- After pickling is completed, neutralization treatment needs to be done on the waste liquid. Contact relevant company for treating the treated waste liquid.
- Protection equipment (such as goggles, gloves, mask and shoes) must be used during the cleaning process to avoid breathing in or contacting the agent as the cleaning agent and neutralization agent is corrosive to eyes, skins and nasal mucosa.

6.2.3 Winter shutdown

- For shutdown in winter, the surface of the unit outside and inside should be cleaned and dried. Cover the unit to prevent dust. Open discharge water valve to discharge the stored water in the clean water system to prevent freezing accident (it is preferable to inject antifreeze in the pipe).

6.2.4 Replacing parts

Parts to be replaced should be the ones provided by our company. Never replace any part with different part.

6.2.5 First startup after shutdown

The following preparations should be made for re-startup of unit after long-time shutdown:

- Thoroughly check and clean the unit.
- Clean water pipe system.
- Check pump, control valve and other equipment of water pipe system.
- Fix connections of all wires.
- It is a must to electrify the machine before startup.

6.2.6 Refrigeration system

Determine whether refrigerant is needed by checking the value of suction and discharge pressure and check whether there is a leakage. Air tight test must be made if there is a leakage or part of refrigerant system is to be replaced. Take different measures in the following two different conditions from refrigerant injection.

Total leakage of refrigerant. In case of such situation, leakage detection must be made on the pressurized nitrogen used for the system. If repair welding is needed, welding cannot be made until all the gas in the system is discharged. Before injecting refrigerant, the whole refrigeration system must be completely dry and of vacuum pumping.

- Connect vacuum pumping pipe at the fluoride nozzle at low-pressure side.
- Remove air from the system pipe with vacuum pump. The vacuum pumping lasts for above 3 hours. Confirm that the indication pressure in dial gauge is within the specified scope.
- When the degree of vacuum is reached, inject refrigerant into the refrigeration system with refrigerant bottle. Appropriate amount of refrigerant for injection has been indicated on the nameplate and the table of main technical parameters. Refrigerant must be injected from the low pressure side of system.
- The injection amount of refrigerant will be affected by the ambient temperature. If the required amount has not

been reached but no more injection can be done, make the chilled water circulate and start up the unit for injection. Make the low pressure switch temporarily short circuit if necessary.

Refrigerant supplement:

- Connect refrigerant injection bottle on the fluoride nozzle at low-pressure side and connect pressure gauge at low pressure side.
- Make chilled water circulate and start up unit, and make the low pressure control switch short circuit if necessary.
- Slowly inject refrigerant into the system and check suction and discharge pressure.

6.2.7 Disassembling compressor

Follow the following procedures if compressor needs to be disassembled:

- Cut off the power supply of unit.
- Remove power source connection wire of compressor.
- Remove suction and discharge pipes of compressor.
- Remove fastening screw of compressor.
- Move the compressor.

6.2.8 Auxiliary electric heater

When the ambient temperature is lower than 2°C, the heating efficiency decreases with the decline of the outdoor temperature. In order to make the unit stably run in a relatively cold region and supplement some heat lost due to de-frosting. When the lowest ambient temperature in the user's region in winter is within 0°C -10°C, the user may consider to use auxiliary electric heater. Please refer to relevant professionals for the power of auxiliary electric heater.

6.2.9 System anti-freezing

- In case of freezing at the water-side heat exchanger interval channel, severe damage may be caused, i.e. heat exchange may be broken and appears leakage. This damage of frost crack is not within the warranty scope, so attention must be paid to anti-freezing.
- If the unit that is shut down for standby is placed in an environment where the outdoor temperature is lower than 0°C, the water in the water system should be drained.
- Frost crack may happen to water-side heat exchanger at maintenance when refrigerant is injected to the unit or is discharged for repair. Pipe freezing is likely to happen any time when the pressure of refrigerant is below 0.4Mpa. Therefore, the water in the heat exchanger must be kept flowing or be thoroughly discharged.

7 User Interface Field Settings

7.1 Introduction

The wired controller is built-in the electric control box which operating ambient range is from -15°C to 70°C. During installation, the unit's settings and parameters should be configured by the installer to suit the installation configuration, climate conditions and end-user preferences. The relevant settings are accessible and programmable through the PROJECT menu on the wired controller's user interface. The user interface menus and settings can be navigated using the user interface's touch-sensitive keys, as detailed in Table 3-7.1.

Figure 3-7.1: User interface

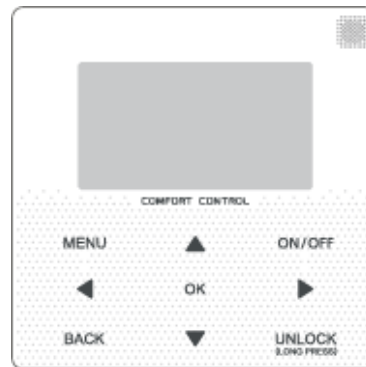


Table 3-7.1: User interface keys

| Keys | Function |
|---------------|--|
| MENU | Display the main menu |
| ◀ ▶ ▼ ▲ | <ul style="list-style-type: none"> ▪ Navigate the menu structure ▪ Adjust setting values |
| ON/OFF | <ul style="list-style-type: none"> ▪ Turn space heating/cooling on/off |
| BACK | Exit a sub-menu (move up one level in the menu structure) |
| UNLOCK | Press for 3 seconds to unlock/lock the user interface |
| OK | <ul style="list-style-type: none"> ▪ Enter a sub-menu ▪ Confirm entered values |

7.2 General Operation

7.2.1 Unlocking/Locking operation

When the wired controller is locked, press and hold the "UNLOCK" button for 2s to unlock it; when "🔒" is not displayed in the locked status, press and hold the "UNLOCK" button for 2s to lock it. When "🔒" is displayed the wired controller cannot be operated. When there is no operation for 60 continuous seconds on any page, the wired controller returns to the home page and is locked automatically, and the lock icon is displayed.

7.2.2 Power-on/off

When the wired controller is unlocked and the unit is on, "ON/OFF" can be pressed to power off the unit under the home page only; when the unit is off, press "ON/OFF" to power on the unit. The mode can be switched under the power-off mode only.

7.2.3 Setting wired controller address

Press the "MENU", "▶", "▲" and "▼" buttons for 3s at the same time to access wired controller address selection, and press the "▲" and "▼" buttons to select the desired values. The set address range is 0 to 15.

7.2.4 Auto restart function

The power supply to the system fails unexpectedly during operation. When the system is powered on again, the wired controller continues to operate according to the status before the last power failure, including the power-on/off status, mode, set temperature, failure, protection, wired controller address, timer, hysteresis, etc. However, the memorized content must be the content set at least 7s before the power failure.

7.2.5 Combination function of wired controller

- A maximum of 16 wired controllers can be connected in parallel, and the address can be set in the range of 0 to 15.
- After wired controllers are connected in parallel, wired controllers with the same address are not allowed on the bus; otherwise a communication failure will occur.
- After multiple wired controllers are connected in parallel, data is shared among them, e.g., the power-on/off function, data settings (such as the water temperature and hysteresis) and other parameters will be kept consistent (note: The mode, temperature, and hysteresis settings can be shared only when the system is powered on).
- Start point of data sharing: After the power-on/off button is pressed, data can be shared during parameter adjustment. The "OK" button must be pressed after parameters are adjusted, and the finally adjusted values will be shared.
- Since the bus is processed in the polling mode, the data of the wired controller with the minimum number is valid if multiple wired controllers are operated at the same time in the same bus cycle (4s). Avoid the above situation during operation.
- After any of parallel wired controllers has been reset, the address of this wired controller is 0 by default.

7.2.6 Upper computer communication function

- The home page displays the content below during communication with the upper computer: Communication between the wired controller and the upper computer.
- If the outdoor main control board is in the remote ON/OFF control mode and the wired controller sends an alarm, the current alarm page displays: Remote ON/OFF Control Mode. In this case, the network control of upper computer is invalid, and the wired controller can query the system status only and cannot send out control information.

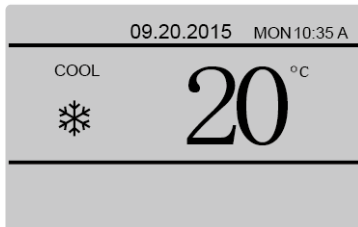
7.2.7 Setting mode

In unlock mode, press the "MENU" button to enter the menu setting interface, press the "▼" and "▲" buttons to select "MODE" and set a mode, and press the "OK" button as shown in the above figure to access the submenu (mode setting).

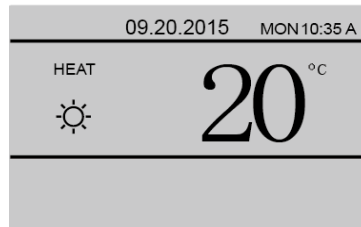
As shown below: three modes available.

Figure 3-7.1: Different mode interfaces

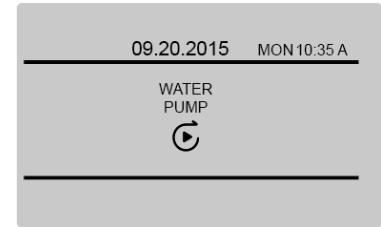
Cooling mode



Heating mode



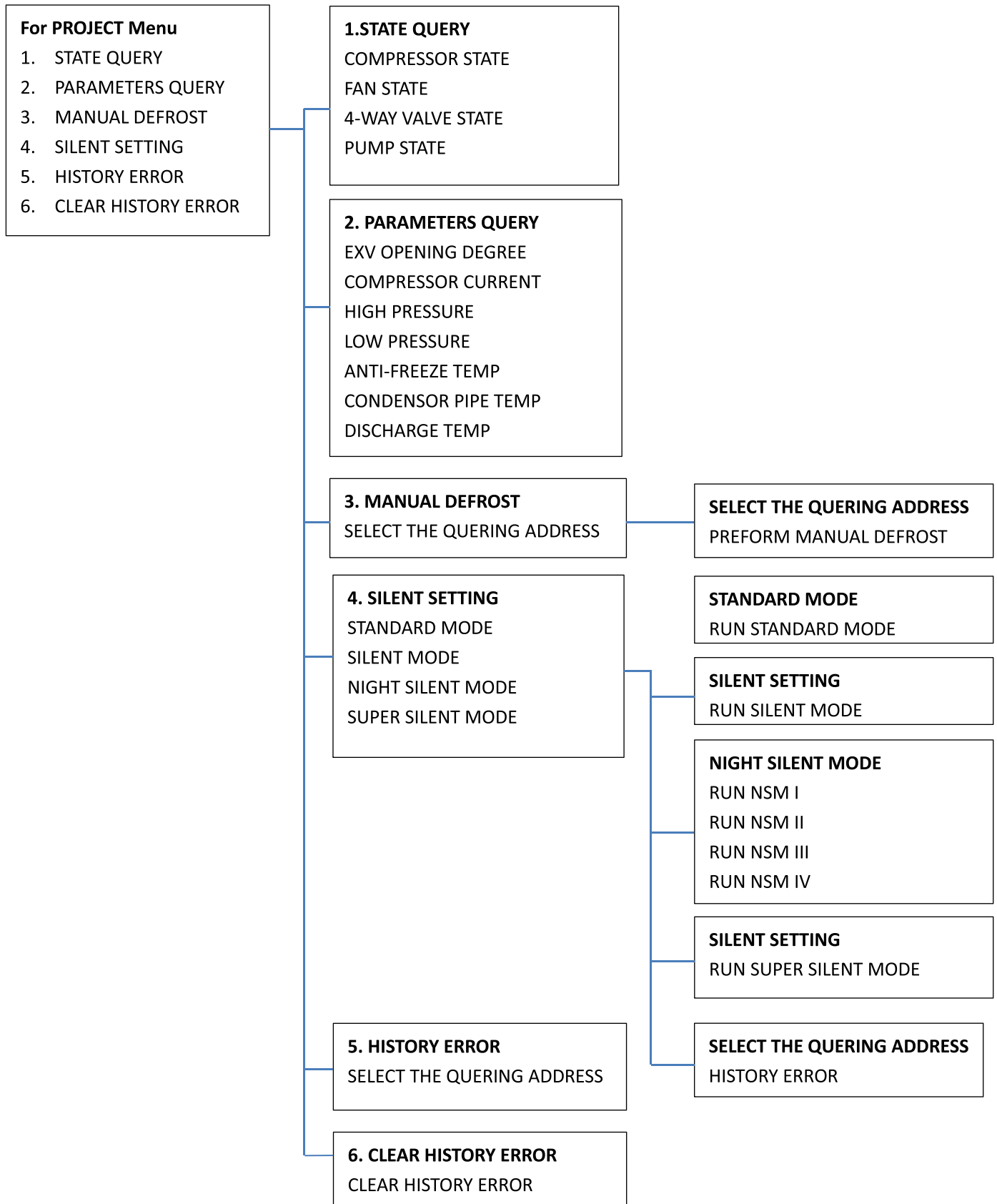
Water pump mode



When the current mode button is selected (blinking), press "◀" and "▶" to set a mode or temperature, and then press "▼" and "▲" to adjust the mode and set temperature value. After setting, press the "OK" button to save the setting and go back to the home page; or press the "BACK" button to go back to the home page; if there is no subsequent operation in 60s, the setting is saved automatically, and the system returns to the home page.

7.3 PROJECT Menu

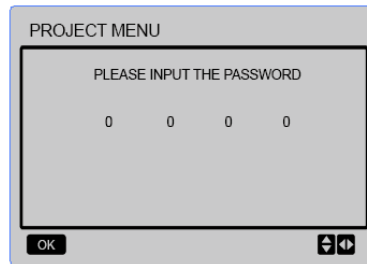
7.3.1 PROJECT menu structure



7.3.2 Enter the PROJECT

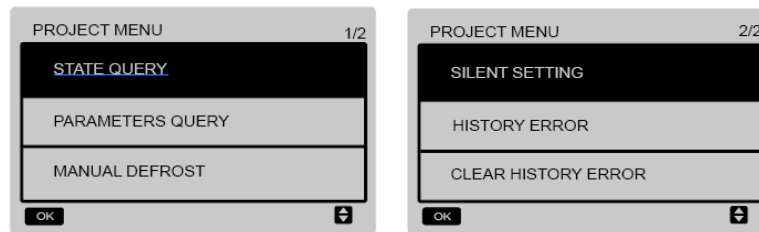
PROJECT allows installers to input the system configuration and set the system parameters. To enter PROJECT, go to MENU > PROJECT.

Figure 3-7.2: PROJCT password screen



Enter the password, using ◀ ▶ to navigate between digits and using ▼ ▲ to adjust the numerical values, and then press OK. The password is 6666. Then it will display the below interface:

Figure 3-7.3: PROJECT menu

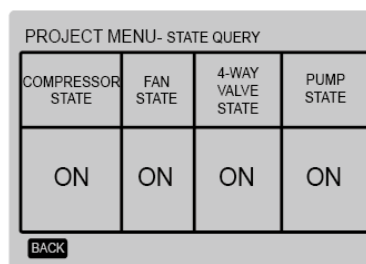


7.3.3 Detail operation

Press the "▼" and "▲" buttons to select the desired option, and press the "OK" button to access the interface.

- a. State query: compressor state, fan state, 4-way valve state, pump state

Figure 3-7.4: State query interface



- b. Parameters query: EXV opening degree, compressor current, high pressure, low pressure, anti-freeze temperature, condenser pipe temperature, discharge temperature

Figure 3-7.5: State query interface

The figure shows three screenshots of the 'PARAMETERS QUERY' interface. Each screen has a 'BACK' button at the bottom left.

| PARAMETERS QUERY | | |
|--------------------|--------------------|---------------|
| EXV OPENING DEGREE | COMPRESSOR CURRENT | HIGH PRESSURE |
| 60 | 95 | 95 |

| PARAMETERS QUERY | |
|------------------|------------------|
| LOW PRESSURE | ANTI-FREEZE TEMP |
| 95 | 95 |

| PARAMETERS QUERY | |
|---------------------|----------------|
| CONDENSOR PIPE TEMP | DISCHARGE TEMP |
| 95 | 60 |

- c. Manual defrost

Figure 3-7.6: Manual defrost interface

The screenshot shows the 'MANUAL DEFROST' interface. It asks 'PERFORM MANUAL DEFROST?' with a 'YES' option and a right arrow. There is an 'OK' button at the bottom left and a right arrow at the bottom right.

- d. Silent setting: standard mode, silent mode, night silent mode (factory default setting), super silent mode.

Figure 3-7.7: Silent setting interface

The screenshot shows the 'SILENT SETTING' interface. It lists four modes: STANDARD MODE, SILENT MODE, NIGHT SILENT MODE, and SUPER SILENT MODE. The 'STANDARD MODE' is currently selected. At the bottom, there are 'OK' and 'ENTER' buttons, and a right arrow.

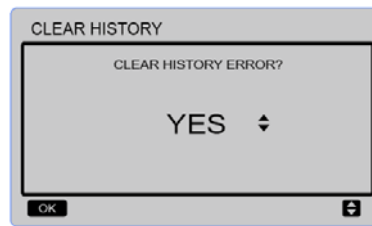
- e. Querying history error: A maximum of 4 history errors can be displayed.

Figure 3-7.8: Querying history error interface

The screenshot shows the 'ERROR QUERY-HISTORY' interface. It displays a table with 4 rows of error history. At the bottom, there is a 'BACK' button.

| ERROR QUERY-HISTORY | | | |
|---------------------|----|------------|-------|
| 1 | E5 | 19/03/2015 | 6:30A |
| 2 | E5 | 19/03/2015 | 6:30A |
| 3 | E5 | 19/03/2015 | 6:30A |
| 4 | E5 | 19/03/2015 | 6:30A |

f. Clearing history error

Figure 3-7.9: Clearing history error interface

7.3.4 Parameters setting

Table 3-7.1: Parameters setting

| parameters | Setting range | Default value | Adjustment range |
|--|-------------------|---------------|------------------|
| Defrosting cycle | 20 min to 120 min | 35 min | 5min |
| Defrost enter temperature | -5°C to 5°C | 0°C | 1°C |
| Defrost exit temperature | -10°C to +10°C | 0°C | 1°C |
| Manual defrost enter temperature ¹ | -5°C to 5°C | 0°C | 1°C |
| Capacity adjustment period | 60s to 360s | 180s | 30S |
| Hysteresis temperature setting | 1°C to 5°C | 2°C | 1°C |
| Normal water outlet antifreezing temperature | 2°C to 4°C | 4°C | 1°C |
| Low water outlet antifreezing temperature | -2°C to 0°C | 0°C | 1°C |
| Delay closing time of water pump | 2min to 4min | 2min | 1min |
| Auxiliary electric heater opens water temperature | 0°C to 50°C | 25°C | 1°C |
| Auxiliary electric heater close water temperature | 0°C to 50°C | 45°C | 1°C |
| Water inlet and outlet temperature difference protection | 8°C to 15°C | 12°C | 1°C |
| Initial cooling ratio | 0 to 100% | 50% | 5% |
| Initial heating ratio | 0 to 100% | 50% | 5% |

Notes:

1. Add the adjustment value to the original exit value.

8 Appendix

8.1 Error Code Table

Table 3-8.1: Error code table

| Error code | Content |
|------------|--|
| 1E0 | Main PCB EEPROM mismatch |
| 2E0 | Inverter module A EEPROM mismatch |
| 3E0 | Inverter module B EEPROM mismatch |
| E1 | Power phase sequence error |
| E2 | Communication error between main PCB and wired controller |
| E3 | Total water outlet temperature sensor (Tw) error (displayed on master unit only) |
| E4 | Outlet water temperature sensor (Two) error |
| E5 | Air-side heat exchanger temperature sensor (T3) error |
| E7 | Outdoor ambient temperature sensor (T4) error |
| E9 | Water flow failure |
| 1Eb | Water-side heat exchanger anti-freezing temperature sensor1 (Taf1) error |
| 1Eb | Water-side heat exchanger anti-freezing temperature sensor2 (Taf2) error |
| EC | Number of units detected by wired controller has decreased |
| 1Ed | Compressor discharge temperature sensor1 (Tp1) error |
| 2Ed | Compressor discharge temperature sensor2 (Tp2) error |
| EF | Inlet water temperature sensor (Twi) error |
| EH | System self-check error |
| EP | Compressor discharge temperature sensor error |
| EU | Total cooling outlet temperature sensor (Tz/7) error |
| P0 | High pressure or compressor discharge temperature protection |
| P1 | Low pressure protection |
| P4 | System A Current protection |
| P5 | System B Current protection |
| 1P6 | System A inverter module protection |
| 2P6 | System A inverter module protection |
| P7 | Condenser tube and Total cooling outlet high temperature protection |
| P9 | Water-side heat exchanger inlet/outlet temperature difference protection |
| PA | Inlet water high temperature in cooling mode |
| Pb | System anti-freezing protection |
| PC | Evaporator pressure low in cooling mode |
| PE | Low-temperature protection of evaporator (manual recovery) |
| PH | Ambient temperature(T4)high temperature protection in heating mode |
| PL | Module high temperature protection |
| 1PU | DC fan 1 module protection |
| 2PU | DC fan 2 module protection |
| 1H0 | System A IPM module Communication error |
| 2H0 | System B IPM module Communication error |
| H1 | Under/Over voltage protection |
| 1H6 | System 1 DC bus voltage error |
| 2H6 | System 2 DC bus voltage error |
| Fb | Pressure sensor error |

| | |
|-----|--|
| Fd | Air suction temperature(Th) protection error |
| 1FF | DC fan 1 error |
| 2FF | DC fan 2 error |
| FP | DIP inconsistency of multiple water pumps(Power failure recovery required) |
| L0 | Inverter module protection |
| L1 | DC bus low voltage protection |
| L2 | DC bus high voltage protection |
| L4 | MCE error |
| L5 | Zero speed protection |
| L7 | Phase sequence error |
| L8 | Compressor frequency variation greater than 15Hz within one second protection |
| L9 | Actual compressor frequency differs from target frequency by more than 15Hz protection |
| dF | Defrosting indicator |

8.2 System Check Table

Press buttons SW3 and SW4 simultaneously to activate the system check function. The parameters listed in Table 3-8.2 will be displayed in sequence.

Table 3-8.2: System check table

| No. | Parameters displayed on DSP2 |
|-----|---|
| 0 | Standby: ODU address (DSP1 display) + number of on-line units (DSP1 display) On: display frequency Defrosting: dF and operating frequency flash alternately at 1s intervals frequency In case of Pb protection, Pb and operating frequency flash alternately at 1s intervals |
| 1 | Outdoor unit address |
| 2 | Outdoor unit capacity |
| 3 | Number of outdoor units (main unit display) |
| 4 | Unit capacity corrected for ambient temperature |
| 5 | Operating mode (8: Off; 0: Standby; 1: Cooling; 2: Heating) |
| 6 | Fan 1 speed index |
| 7 | Fan 2 speed index |
| 8 | Air side heat exchanger temperature (sensor T3) |
| 9 | Outdoor ambient temperature (sensor T4) |
| 10 | Reserved |
| 11 | Water side heat exchanger anti-freezing temperature (sensor Taf1) |
| 12 | Water side heat exchanger anti-freezing temperature (sensor Taf2) |
| 13 | Total water outlet temperature(Tw) |
| 14 | Inlet water temperature(Twi, displays to decimal places) |
| 15 | Outlet water temperature(Two) |
| 16 | Total cooling outlet temperature(Tz/7) |
| 17 | Reserved |
| 18 | Compressor discharge temperature 1 (sensor Tp1) |
| 19 | Compressor discharge temperature 2 (sensor Tp2) |
| 20 | Compressor module temperature(Tf1) |
| 21 | Compressor module temperature(Tf2) |
| 22 | Air discharge superheat degree |
| 23 | Compressor 1 current |
| 24 | Compressor 2 current |
| 25 | Pump current |
| 26 | EXV 1 position(step=value displayed *4) |
| 27 | EXV 2 position(step=value displayed *4) |

| | |
|----|--|
| 28 | Compressor discharge pressure |
| 29 | Compressor suction pressure |
| 30 | Air suction superheat degree |
| 31 | Air suction temperature(Th) |
| 32 | Silent selection |
| 33 | Static pressure selection |
| 34 | DC bus low voltage 1 (reserved) |
| 35 | DC bus low voltage 2(reserved) |
| 36 | Most recent error or protection code |
| 37 | Limit frequency No. (0: no limits; 1: ambient temperature(T4) limit frequency; 2: voltage limit frequency; 3: air discharge limit frequency; 4: low voltage ratio; 5: instant limit frequency; 6: current limit frequency; 7: voltage limit frequency; 8: pressure ratio and capacity demand adjusting; 9: cooling low pressure limit frequency) |
| 38 | Defrosting process status (the first digit: T4 selection solution; the second digit: scheme's range; the third and fourth digits as a whole indicates the defrosting time) |
| 39 | EEPROM mismatch indicator: 1 indicates failure, and 0 indicates no failure |
| 40 | Defrosting scheme |
| 41 | Initial frequency |
| 42 | Saturation temperature (Tc, reserved) |
| 43 | Software version |
| 44 | ---- |

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