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# AIR COOLED WATER CHILLERS (COOLING ONLY AND HEAT PUMP)

## Service Manual

**RCUE40AG2-400AG2**
Cooling capacity 112 kW - 1030 kW

**RHUE40AG2-240AG2**
Cooling capacity 106 kW - 585 kW
Heating capacity 110 kW - 556 kW

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Specifications in this manual are subject to change without notice in order that HITACHI may bring the latest innovations to their customers.

Whilst every effort is made to ensure that all specifications are correct, printing errors are beyond Hitachi's control; Hitachi cannot be held responsible for these errors.

# 0. Contents

# Content

## Content (Cont.)

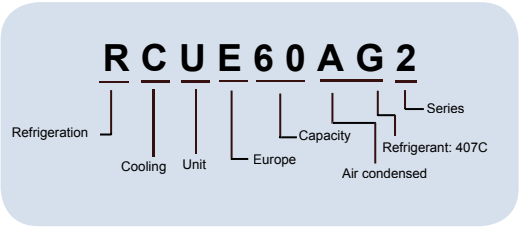
## ◆ Units Code List

*NOTE:*

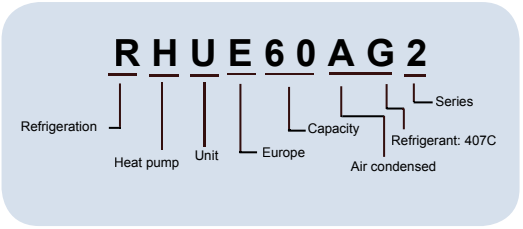
MODELS CODIFICATION

Please check, according to the model name, which is your air conditioner type and how it is abbreviated and referred to in this service manual.

| AIR COOLED WATER CHILLERS -SCREW TYPE | | | | | | | |
|---|---|---|---|---|---|---|---|
| Model | Indication code | Model | Indication code | Model | Indication code | Model | Indication code |
| RCUE40AG2 | 8E041072 | RCUE100AG2 | 8E101072 | RCUE180AG2 | 8E181072 | RCUE280AG2 | 8E281072 |
| RCUE50AG2 | 8E051072 | RCUE120AG2 | 8E121072 | RCUE210AG2 | 8E211072 | RCUE320AG2 | 8E321072 |
| RCUE60AG2 | 8E061072 | RCUE140AG2 | 8E141072 | RCUE240AG2 | 8E241072 | RCUE350AG2 | 8E351072 |
| RCUE70AG2 | 8E071072 | RCUE160AG2 | 8E161072 | | | RCUE400AG2 | 8E401072 |
| RCUE80AG2 | 8E081072 | | | | | | |



| AIR TO WATER HEAT PUMP CHILLERS -SCREW TYPE | | | | | |
|---|---|---|---|---|---|
| Model | Indication code | Model | Indication code | Model | Indication code |
| RHUE40AG2 | 9E041072 | RHUE100AG2 | 9E101072 | RHUE180AG2 | 9E181072 |
| RHUE50AG2 | 9E051072 | RHUE120AG2 | 9E121072 | RHUE210AG2 | 9E211072 |
| RHUE60AG2 | 9E061072 | RHUE140AG2 | 9E141072 | RHUE240AG2 | 9E241072 |
| RHUE70AG2 | 9E071072 | RHUE160AG2 | 9E161072 | | |
| RHUE80AG2 | 9E081072 | | | | |



| REMOTE CONTROL DEVICES LIST | | | |
|---|---|---|---|
| Name | Description | Indication Code | Figure |
| CSC-5S | Central Station | 60291050 |  |
| PSC-5T | Seven Day Timer | 60291052 |  |

| REMOTE CONTROL DEVICES ACCESSORIES LIST | | | |
|---|---|---|---|
| Name | Description | Indication Code | Figure |
| PSC-5HR | H-Link Relay | 60291105 |  |

| CENTRALISED CONTROLS LIST (Interfaces) | | | |
|---|---|---|---|
| Name | Description | Indication Code | Figure |
| HARC70-CE1 | Lonwork BMX Interface | 60559055 |  |
| HARC70-CE1 OP | | 60559056 | |
| CSNET WEB | CSNET WEB | 7E891924 |  |

| CENTRALISED CONTROLS (Interfaces) ACCESSORIES LIST | | | |
|---|---|---|---|
| Name | Description | Indication Code | Figure |
| PM001-CT200 | Current Transformer Accessory (Power Meter Option Accessory for CSNET WEB) | 7E891930 NEW |  |
| PM001-CT400 | | 7E891931 NEW | |
| PM001-CT1000 | Current Transformer Accessory 1000A (Power Meter Option Accessory for CSNET WEB) | 7E891932 NEW |  |
| PM001-GW | Communication Set (Power Meter Option Accessory for CSNET WEB) | 7E891933 NEW |  |
| PM001 | Power Meter Option (For CSNET WEB) | 7E891934 NEW |  |
| TS001 | Touch Screen Option (For CSNET WEB) | 7E891935 NEW |  |
| TS001-WS | Wall Support for Touch Screen (Touch Screen Option Accessory for CSNET WEB) | 7E891936 NEW |  |
| TS001-TS | Table Support for Touch Screen (Touch Screen Option Accessory for CSNET WEB) | 7E891937 NEW |  |

# 1. Product range and specifications

This chapter provides you with a fast review of the most important general data of the Air cooled water chillers and Air to water heat pump chillers of HITACHI.



## Content

## 1.1. General data for RCUE40~400AG2

| MODEL | | | RCUE40AG2 | RCUE50AG2 | RCUE60AG2 | RCUE70AG2 |
|---|---|---|---|---|---|---|
| Cooling Capacity | | kW | 112 | 130 | 156 | 178 |
| Total Power input | | kW | 36.4 | 42.7 | 52.3 | 59.8 |
| COP | | - | 3.08 | 3.04 | 2.98 | 2.98 |
| Outer Dimension | Height | mm | 2.430 | 2.430 | 2.430 | 2.430 |
| | Width | mm | 1.900 | 1.900 | 1.900 | 1.900 |
| | Depth | mm | 2.150 | 2.150 | 2.150 | 2.750 |
| Cabinet colour | | - | Natural Grey | | | |
| Net weight | | Kg | 1.430 | 1.470 | 1.560 | 1.760 |
| Compressor type | | - | Semi-hermetic screw type | | | |
| Models | | - | 40ASC-Z | 40ASC-Z | 50ASC-Z | 60ASC-Z |
| Quantity | | - | 1 | 1 | 1 | 1 |
| Oil heater | | W | 150 | 150 | 150 | 150 |
| Capacity control | | - | Continuous Capacity Control | | | |
| | | % | 15~100 | | | |
| Water cooler type | | - | Brazing Plate Type | | | |
| Condenser type | | - | Multi-Pass cross finned tube | | | |
| Fan Motor (pole) | | kW | 0.38 (8) | | | |
| Quantity | | - | 4 | 4 | 4 | 6 |
| Refrigerant type | | - | R407C (Factory charged) | | | |
| Flow control | | - | Electronic expansion valve | | | |
| Number of independent circuits | | - | 1 | 1 | 1 | 1 |
| Quantity of refrigerant (kg) | | - | 39 | 46 | 41 | 48 |
| Oil type | | - | JAPAN ENERGY FREOL UX300 (Ester) | | | |
| Water pipe connection | | Inch | 3” Victaulic (1xInlet/1xOutlet) | | | |
| Control system | | - | Micro-processor control | | | |
| Chilled water outlet temperature | | ºC | -10 (Option) 5~15 | | | |
| Condenser air inlet temperature | | ºC | -15~46 | | | |
| Permissible water pressure max. | | MPa | 1.0 | | | |
| Safety and protection devices | | - | Reverse Phase Protection, Fuse and Thermal Relay for Compressor, Internal Thermostat for Compressor, Compressor Oil Heater, Fuse and Internal Thermostat for Fan Motor, Control Circuit Fuse, High Pressure Switch, Low Pressure Control, High Pressure Relief Valve, Discharge Gas Temperature Control, Suction Gas Temperature Control, Freeze Protection Control and Compressor Operation Hour Meter | | | |
| Power suply | | - | 3~, N/380-415V/50Hz | | | |

*NOTE:*

The nominal cooling capacities are based on the European Standard EN12055.

- Chilled Water Inlet / Outlet Temperature : 12/7 °C
- Condenser Inlet Air Temperature : 35 °C

| MODEL | | | RCUE80AG2 | RCUE100AG2 | RCUE120AG2 | RCUE140AG2 |
|---|---|---|---|---|---|---|
| Cooling Capacity | | kW | 206 | 260 | 312 | 356 |
| Total Power input | | kW | 69.6 | 85.4 | 104.5 | 119.6 |
| COP | | - | 2.96 | 3.04 | 2.99 | 2.98 |
| Outer Dimension | Height | mm | 2.430 | 2.430 | 2.430 | 2.430 |
| | Width | mm | 1.900 | 1.900 | 1.900 | 1.900 |
| | Depth | mm | 2.750 | 4.050 | 4.050 | 5.250 |
| Cabinet colour | | - | Natural Grey | | | |
| Net weight | | Kg | 1.820 | 2.830 | 3.000 | 3.420 |
| Compressor type | | - | Semi-Hermetic screw type | | | |
| Models | | - | 60ASC-Z | 40ASC-Z | 50ASC-Z | 60ASC-Z |
| Quantity | | - | 1 | 2 | 2 | 2 |
| Oil heater | | W | 150 | 150x2 | 150x2 | 150x2 |
| Capacity control | | - | Continuous Capacity Control | | | |
| | | % | 15~100 | | | |
| Water cooler type | | - | Brazing Plate Type | | | |
| Condenser type | | - | Multi-Pass cross finned tube | | | |
| Fan Motor (pole) | | kW | 0.38 (8) | | | |
| Quantity | | - | 6 | 8 | 8 | 12 |
| Refrigerant type | | - | R407C (Factory charged) | | | |
| Flow control | | - | Electronic expansion valve | | | |
| Number of independent circuits | | - | 1 | 2 | 2 | 2 |
| Quantity of refrigerant | | - | 64 | 92 | 82 | 96 |
| Oil type | | - | JAPAN ENERGY FREOL UX300 (Ester) | | | |
| Water pipe connection | | Inch | 3" Victaulic (1xInlet/ 1xOutlet) | 3" Victaulic (2xInlet/2xOutlet) | | |
| Control system | | - | Micro-processor control | | | |
| Chilled water outlet temperature | | ºC | -10 (Option) 5~15 | | | |
| Condenser air inlet temperature | | ºC | -15~46 | | | |
| Permissible water pressure max. | | MPa | 1.0 | | | |
| Safety and protection devices | | - | Reverse Phase Protection, Fuse and Thermal Relay for Compressor, Internal Thermostat for Compressor, Compressor Oil Heater, Fuse and Internal Thermostat for Fan Motor, Control Circuit Fuse, High Pressure Switch, Low Pressure Control, High Pressure Relief Valve, Discharge Gas Temperature Control, Suction Gas Temperature Control, Freeze Protection Control and Compressor Operation Hour Meter | | | |
| Power suply | | - | 3~, N/380-415V/50Hz | | | |

*NOTE:*

The nominal cooling capacities are based on the European Standard EN12055.

- Chilled Water Inlet / Outlet Temperature : 12/7 °C
- Condenser Inlet Air Temperature : 35 °C

| MODEL | | | RCUE160AG2 | RCUE180AG2 | RCUE210AG2 | RCUE240AG2 |
|---|---|---|---|---|---|---|
| Cooling Capacity | | kW | 412 | 468 | 534 | 618 |
| Total Power input | | kW | 139.1 | 156.8 | 179.4 | 208.7 |
| COP | | - | 2.96 | 2.98 | 2.98 | 2.96 |
| Outer Dimension | Height | mm | 2.430 | 2.430 | 2.430 | 2.430 |
| | Width | mm | 1.900 | 1.900 | 1.900 | 1.900 |
| | Depth | mm | 5.250 | 5.950 | 7.750 | 7.750 |
| Cabinet colour | | - | Natural Grey | | | |
| Net weight | | Kg | 3.550 | 4.450 | 5.070 | 5.250 |
| Compressor type | | - | Semi-Hermetic screw type | | | |
| Models | | - | 60ASC-Z | 50ASC-Z | 60ASC-Z | 60ASC-Z |
| Quantity | | - | 2 | 3 | 3 | 3 |
| Oil heater | | W | 150x2 | 150x3 | 150x3 | 150x3 |
| Capacity control | | - | Continuous Capacity Control | | | |
| | | % | 15~100 | | | |
| Water cooler type | | - | Brazing Plate Type | | | |
| Condenser type | | - | Multi-Pass cross finned tube | | | |
| Fan Motor (pole) | | kW | 0.38 (8) | | | |
| Quantity | | - | 12 | 12 | 18 | 18 |
| Refrigerant type | | - | R407C (Factory charged) | | | |
| Flow control | | - | Electronic expansion valve | | | |
| Number of independent circuits | | - | 2 | 3 | 3 | 3 |
| Quantity of refrigerant | | - | 128 | 123 | 144 | 192 |
| Oil type | | - | JAPAN ENERGY FREOL UX300 (Ester) | | | |
| Water pipe connection | | Inch | 3” Victaulic (2xInlet/ 2xOutlet) | 3” Victaulic (3xInlet/3xOutlet) | | |
| Control system | | - | Micro-processor control | | | |
| Chilled water outlet temperature | | ºC | -10 (Option) 5~15 | | | |
| Condenser air inlet temperature | | ºC | -15~46 | | | |
| Permissible water pressure max. | | MPa | 1.0 | | | |
| Safety and protection devices | | - | Reverse Phase Protection, Fuse and Thermal Relay for Compressor, Internal Thermostat for Compressor, Compressor Oil Heater, Fuse and Internal Thermostat for Fan Motor, Control Circuit Fuse, High Pressure Switch, Low Pressure Control, High Pressure Relief Valve, Discharge Gas Temperature Control, Suction Gas Temperature Control, Freeze Protection Control and Compressor Operation Hour Meter | | | |
| Power suply | | - | 3~, N/380-415V/50Hz | | | |

*NOTE:*

The nominal cooling capacities are based on the European Standard EN12055.

- Chilled Water Inlet / Outlet Temperature : 12/7 °C
- Condenser Inlet Air Temperature : 35 °C

| MODEL | | | RCUE280AG2 | RCUE320AG2 | RCUE350AG2 | RCUE400AG2 |
|---|---|---|---|---|---|---|
| Cooling Capacity | | kW | 712 | 824 | 890 | 1030 |
| Total Power input | | kW | 239.2 | 278.2 | 299.0 | 347.8 |
| COP | | - | 3.0 | 3.0 | 3.0 | 3.0 |
| Outer Dimension | Height | mm | 2.430 | 2.430 | 2.430 | 2.430 |
| | Width | mm | 1.900 | 1.900 | 1.900 | 1.900 |
| | Depth | mm | 10.250 | 10.250 | 12.750 | 12.750 |
| Cabinet colour | | - | Natural Grey | | | |
| Net weight | | Kg | 6.750 | 7.000 | 8.450 | 8.750 |
| Compressor type | | - | Semi-Hermetic screw type | | | |
| Models | | - | 60ASC-Z | 50ASC-Z | 60ASC-Z | 60ASC-Z |
| Quantity | | - | 4 | 4 | 5 | 5 |
| Oil heater | | W | 150x4 | 150x4 | 150x5 | 150x5 |
| Capacity control | | - | Continuous Capacity Control | | | |
| | | % | 15~100 | | | |
| Water cooler type | | - | Brazing Plate Type | | | |
| Condenser type | | - | Multi-Pass cross finned tube | | | |
| Fan Motor (pole) | | kW | 0.38 (8) | | | |
| Quantity | | - | 24 | 24 | 30 | 30 |
| Refrigerant type | | - | R407C (Factory charged) | | | |
| Flow control | | - | Electronic expansion valve | | | |
| Number of independent circuits | | - | 4 | 4 | 5 | 5 |
| Quantity of refrigerant | | - | 192 | 256 | 240 | 320 |
| Oil type | | - | JAPAN ENERGY FREOL UX300 (Ester) | | | |
| Water pipe connection | | Inch | 3” Victaulic (4xInlet/4xOutlet) | | 3” Victaulic (5xInlet/5xOutlet) | |
| Control system | | - | Micro-processor control | | | |
| Chilled water outlet temperature | | ºC | -10 (Option) 5~15 | | | |
| Condenser air inlet temperature | | ºC | -15~46 | | | |
| Permissible water pressure max. | | MPa | 1.0 | | | |
| Safety and protection devices | | - | Reverse Phase Protection, Fuse and Thermal Relay for Compressor, Internal Thermostat for Compressor, Compressor Oil Heater, Fuse and Internal Thermostat for Fan Motor, Control Circuit Fuse, High Pressure Switch, Low Pressure Control, High Pressure Relief Valve, Discharge Gas Temperature Control, Suction Gas Temperature Control, Freeze Protection Control and Compressor Operation Hour Meter | | | |
| Power suply | | - | 3~, N/380-415V/50Hz | | | |

*NOTE:*

The nominal cooling capacities are based on the European Standard EN12055.

- Chilled Water Inlet / Outlet Temperature : 12/7 °C
- Condenser Inlet Air Temperature : 35 °C

## 1.2. General data for RHUE40~240AG2

| MODEL | | | RHUE40AG2 | RHUE50AG2 | RHUE60AG2 | RHUE70AG2 |
|---|---|---|---|---|---|---|
| Cooling Capacity | | kW | 106 | 123 | 148 | 169 |
| Heating Capacity | | kW | 110 | 127 | 152 | 185 |
| Total Power input in cooling | | kW | 36.4 | 42.7 | 52.3 | 59.8 |
| Total Power input in heating | | kW | 40.7 | 44.5 | 54.3 | 67.7 |
| Outer Dimension | Height | mm | 2.430 | 2.430 | 2.430 | 2.430 |
| | Width | mm | 1.900 | 1.900 | 1.900 | 1.900 |
| | Depth | mm | 1.900 | 1.900 | 1.900 | 2.500 |
| Cabinet colour | | - | Natural Grey | | | |
| Net weight | | Kg | 1.550 | 1.600 | 1.670 | 1.880 |
| Compressor type | | - | Semi-Hermetic screw type | | | |
| Models | | - | 40ASC-Z | 40ASC-Z | 50ASC-Z | 60ASC-Z |
| Quantity | | - | 1 | 1 | 1 | 1 |
| Oil heater | | W | 150 | | | |
| Capacity control | | - | Continuous Capacity Control | | | |
| | | % | 15~100 | | | |
| Water side heat exchanger | | - | Brazing plate type | | | |
| Air side heat exchanger | | - | Multi-Pass cross finned tube | | | |
| Fan Motor (pole) | | kW | 0.38 (8) | | | |
| Quantity | | - | 4 | 4 | 4 | 6 |
| Refrigerant type | | - | R407C (Factory charged) | | | |
| Flow control | | - | Electronic expansion valve | | | |
| Number of independent circuits | | - | 1 | 1 | 1 | 1 |
| Quantity of refrigerant | | - | 39 | 46 | 41 | 48 |
| Oil type | | - | JAPAN ENERGY FREOL UX300 (Ester) | | | |
| Water pipe connection | | Inch | 3” Victaulic (1xInlet/1xOutlet) | | | |
| Control system | | - | Micro-processor control | | | |
| Chilled water outlet temperature | | ºC | -10 (Option) 5~15 | | | |
| Heated water outlet temperature | | ºC | 35~55 | | | |
| Condenser air inlet temperature | | ºC | -15~46 for cooling operation | | | |
| Evaporator air inlet temperature | | ºC | DB: -9.5~21/ WB:-10~15.5 for heating operation | | | |
| Permissible water pressure max. | | MPa | 1.0 | | | |
| Safety and protection devices | | - | Reverse Phase Protection, Fuse and Thermal Relay for Compressor, Internal Thermostat for Compressor, Compressor Oil Heater, Fuse and Internal Thermostat for Fan Motor, Control Circuit Fuse, High Pressure Switch, Low Pressure Control, High Pressure Relief Valve, Discharge Gas Temperature Control, Suction Gas Temperature Control, Freeze Protection Control and Compressor Operation Hour Meter | | | |
| Power suply | | - | 3~, N/380-415V/50Hz | | | |

*NOTES:*

(1) The nominal cooling capacities are based on the European Standard EN12055.

- Chilled Water Inlet / Outlet Temperature : 12/7 ºC
- Condenser Inlet Air Temperature : 35 ºC

(2) The nominal heating capacities are based on the European Standard EN12055.

- Heated Water Inlet / Outlet Temperature : 40/45 ºC
- Evaporator Inlet Air Temperature : 6 ºC (WB)

| MODEL | | | RHUE80AG2 | RHUE100AG2 | RHUE120AG2 | RHUE140AG2 |
|---|---|---|---|---|---|---|
| Cooling Capacity | | kW | 195 | 246 | 296 | 338 |
| Heating Capacity | | kW | 185 | 254 | 305 | 371 |
| Total Power input in cooling | | kW | 69.6 | 85.4 | 104.5 | 119.6 |
| Total Power input in heating | | kW | 67.7 | 89.0 | 108.6 | 135.5 |
| Outer Dimension | Height | mm | 2.430 | 2.430 | 2.430 | 2.430 |
| | Width | mm | 1.900 | 1.900 | 1.900 | 1.900 |
| | Depth | mm | 2.500 | 3.800 | 3.800 | 5.500 |
| Cabinet colour | | - | Natural Grey | | | |
| Net weight | | Kg | 1.950 | 3.050 | 3.250 | 3.670 |
| Compressor type | | - | Semi-Hermetic screw type | | | |
| Models | | - | 60ASC-Z | 40ASC-Z | 50ASC-Z | 60ASC-Z |
| Quantity | | - | 1 | 2 | 2 | 2 |
| Oil heater | | W | 150 | 150x2 | | |
| Capacity control | | - | Continuous Capacity Control | | | |
| | | % | 15~100 | | | |
| Water side heat exchanger | | - | Brazing plate type | | | |
| Air side heat exchanger | | - | Multi-Pass cross finned tube | | | |
| Fan Motor (pole) | | kW | 0.38 (8) | | | |
| Quantity | | - | 6 | 8 | 8 | 12 |
| Refrigerant type | | - | R407C (Factory charged) | | | |
| Flow control | | - | Electronic expansion valve | | | |
| Number of independent circuits | | - | 1 | 2 | 2 | 2 |
| Quantity of refrigerant | | - | 64 | 92 | 82 | 96 |
| Oil type | | - | JAPAN ENERGY FREOL UX300 (Ester) | | | |
| Water pipe connection | | Inch | 3" Victaulic (1xInlet/ 1xOutlet) | 3" Victaulic (2xInlet/2xOutlet) | | |
| Control system | | - | Micro-processor control | | | |
| Chilled water outlet temperature | | ºC | -10 (Option) 5~15 | | | |
| Heated water outlet temperature | | ºC | 35~55 | | | |
| Condenser air inlet temperature | | ºC | -15~46 for cooling operation | | | |
| Evaporator air inlet temperature | | ºC | DB: -9.5~21/ WB:-10~15.5 for heating operation | | | |
| Permissible water pressure max. | | MPa | 1.0 | | | |
| Safety and protection devices | | - | Reverse Phase Protection, Fuse and Thermal Relay for Compressor, Internal Thermostat for Compressor, Compressor Oil Heater, Fuse and Internal Thermostat for Fan Motor, Control Circuit Fuse, High Pressure Switch, Low Pressure Control, High Pressure Relief Valve, Discharge Gas Temperature Control, Suction Gas Temperature Control, Freeze Protection Control and Compressor Operation Hour Meter | | | |
| Power suply | | - | 3~, N/380-415V/50Hz | | | |

*NOTES:*

(1) The nominal cooling capacities are based on the European Standard EN12055.

- Chilled Water Inlet / Outlet Temperature : 12/7 ºC
- Condenser Inlet Air Temperature : 35 ºC

(2) The nominal heating capacities are based on the European Standard EN12055.

- Heated Water Inlet / Outlet Temperature : 40/45 ºC
- Evaporator Inlet Air Temperature : 6 ºC (WB)

| MODEL | | | RHUE160AG2 | RHUE180AG2 | RHUE210AG2 | RHUE240AG2 |
|---|---|---|---|---|---|---|
| Cooling Capacity | | kW | 390 | 444 | 507 | 585 |
| Heating Capacity | | kW | 371 | 457 | 556 | 556 |
| Total Power input in cooling | | kW | 139.1 | 156.8 | 179.4 | 208.7 |
| Total Power input in heating | | kW | 135.5 | 162.9 | 203.2 | 203.2 |
| Outer Dimension | Height | mm | 2.430 | 2.430 | 2.430 | 2.430 |
| | Width | mm | 1.900 | 1.900 | 1.900 | 1.900 |
| | Depth | mm | 5.000 | 5.700 | 7.500 | 7.500 |
| Cabinet colour | | - | Natural Grey | | | |
| Net weight | | Kg | 3.780 | 4.780 | 5.440 | 5.650 |
| Compressor type | | - | Semi-Hermetic screw type | | | |
| Models | | - | 60ASC-Z | 50ASC-Z | 60ASC-Z | 60ASC-Z |
| Quantity | | - | 2 | 3 | 3 | 3 |
| Oil heater | | W | 150x2 | 150x3 | | |
| Capacity control | | - | Continuous Capacity Control | | | |
| | | % | 15~100 | | | |
| Water side heat exchanger | | - | Brazing plate type | | | |
| Air side heat exchanger | | - | Multi-Pass cross finned tube | | | |
| Fan Motor (pole) | | kW | 0.38 (8) | | | |
| Quantity | | - | 12 | 12 | 18 | 18 |
| Refrigerant type | | - | R407C (Factory charged) | | | |
| Flow control | | - | Electronic expansion valve | | | |
| Number of independent circuits | | - | 2 | 3 | 3 | 3 |
| Quantity of refrigerant | | - | 128 | 123 | 144 | 192 |
| Oil type | | - | JAPAN ENERGY FREOL UX300 (Ester) | | | |
| Water pipe connection | | Inch | 3" Victaulic (2xInlet/ 2xOutlet) | 3" Victaulic (3xInlet/3xOutlet) | | |
| Control system | | - | Micro-processor control | | | |
| Chilled water outlet temperature | | ºC | -10 (Option) 5~15 | | | |
| Heated water outlet temperature | | ºC | 35~55 | | | |
| Condenser air inlet temperature | | ºC | -15~46 for cooling operation | | | |
| Evaporator air inlet temperature | | ºC | DB: -9.5~21/ WB:-10~15.5 for heating operation | | | |
| Permissible water pressure max. | | MPa | 1.0 | | | |
| Safety and protection devices | | - | Reverse Phase Protection, Fuse and Thermal Relay for Compressor, Internal Thermostat for Compressor, Compressor Oil Heater, Fuse and Internal Thermostat for Fan Motor, Control Circuit Fuse, High Pressure Switch, Low Pressure Control, High Pressure Relief Valve, Discharge Gas Temperature Control, Suction Gas Temperature Control, Freeze Protection Control and Compressor Operation Hour Meter | | | |
| Power suply | | - | 3~, N/380-415V/50Hz | | | |

*NOTES:*

(1) The nominal cooling capacities are based on the European Standard EN12055.

- Chilled Water Inlet / Outlet Temperature : 12/7 ºC
- Condenser Inlet Air Temperature : 35 ºC

(2) The nominal heating capacities are based on the European Standard EN12055.

- Heated Water Inlet / Outlet Temperature : 40/45 ºC
- Evaporator Inlet Air Temperature : 6 ºC (WB)

# 2. Test run

This chapter describes the procedure of test run of the Air cooled water chillers and the Air to water heat pump chillers.

## Content

## 2.1. Check before test run

Confirm there is no problem regarding chiller installation space and requirements. See technical catalogue for more details.
Check the following items at the beginning of the season and before first test run.

### 2.1.1. Cabinet

| | |
|---|---|
| ◈ Exterior and interior | – Confirm there is no damage in exterior and interior caused during transportation or at installation.<br>– Remove foreign matters and dust and clean it.<br>– Confirm individually if screw and washer are fixed well using screw driver or wrench.<br>– Confirm visually if heat insulation, tape and label plates are fixed well. |
| ◈ Drain pan | – Confirm visually if there is no clogging nor rust in drain. In case of the rust, arrange it painting. |
| ◈ Air side heat exchanger | – Check visually if there is no dust between fins. In case of dust, wash the part with fin cleaner. |
| ◈ Fan part | – Confirm there is no deformation nor any trouble in fan or fan protection net.<br>– Confirm if fan spins smoothly.<br>– Confirm if screws are not loosed. (especially check if shaft and runner are fixed)<br>– Confirm if there is no strange noise during the revolution. |

*CAUTION:*

Do not use domestic detergent as a forming agent at refrigerant leakage check. The followings are recommended:

- Snove (Nupro, USA),
- Gupflex (Yokogawa, Japan)

Gas leakage detection device is not compatible with one for R22. The sensibility of the device for R22 is little, therefore, do not divert it.

### 2.1.2. Refrigerant System

| | |
|---|---|
| ◈ System in general | – Confirm individually if screws are fixed well using screwdriver or wrench.<br>– Confirm if there is no gas leakage using foaming agent or leak tester especially in flanges, screws, and flare parts. |
| ◈ Compressor | – Confirm visually if there is no oil leakage from suction and discharge flange. |
| ◈ Fuse plug | – Confirm visually if fuse plug is not inflated abnormally. |
| ◈ Stop valve for liquid refrigerant | – Confirm if the stop valve for refrigerant in outlet of air side heat exchanger is fully opened. |

### 2.1.3. Electrical System

| | |
|---|---|
| ◈ Fuse | – Confirm visually if fuse is suitable. See technical catalogue for detail regulation of fuse. |
| ◈ Electrical device | – Confirm individually if screws in installation part and wire connection part are not loosed using driver. Check it carefully since devices might be damaged if screws in wire connection part are not tightened well.<br>– Confirm if the insulation resistance is more than 1MΩ in 500V DC. In case of below 1MΩ, do not operate the unit since insulation of electrical device has failure. |
| ◈ Compressor | – Check if insulation works well. Do not operate the unit in case of below 3MΩ in 500V DC (fig.1) |
| ◈ Fan motor | – Check if insulation works well. Do not operate the unit in case of below 3MΩ in 500V DC. (fig.1) |
| ◈ Wire in the unit | – Confirm touching directly with hands if the wiring is not removed or loosed.<br>– Confirm the covered insulation part. Pay attention not to touch it by wet hand or to touch directly the edge of metal plate or high temperature part of electrical devices. (fig.2) |
| ◈ Local wiring | – Confirm if earth wire is installed correctly and not broken.<br>– Confirm if R, S, and T phase are connected correctly.<br>– Confirm the local wiring size. If the volume is not sufficient, it may cause extreme heating or fire. |
| ◈ Electrical expansion valve | – Confirm if convex part of electrical expansion valve coil is well fixed to concave part of electrical expansion valve body. |

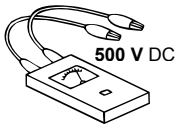



Fig.1

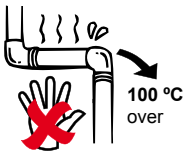



Fig.2

### 2.1.4. Water System

| | |
|---|---|
| ◈ Quality control | – Confirm if the water quality follows the guideline detailed in the technical catalogue. |
| ◈ Diameter of water pipe | – Strange noise or abnormal vibration can occur if water pump is not installed well or water pipe is too long. Confirm the piping in the following sample method (fig.3)<br>  – Open the inlet/outlet valve of water and pass the water inside the water heat exchanger and pipes.<br>  – While operating the water pump, remove the air inside the water pipe from the plug or automatic air-removing valve.<br>  – Continue operating the pump and confirm if there is no water leakage, strange noise nor abnormal vibration.<br>– Remove the air from the pump and pass the water inside all the system.<br>– Check if water is not leaked in all the system.<br>– Confirm if the valve is open.<br>– Confirm if strainer (correspondent to 20 mesh) prepared in local is installed in water inlet pipe near the unit. When checking at the beginning of the season, check also if there is any dust or foreign materials in strainer. |
| ◈ Water temperature | – In case of short periods, there is no problem if water temperature goes outside of service limits. However, chiller unit may be damaged working for more then 30 minutes out of standard specifications. Service limit of water temperature is as follows.<br>– Chilled water temperature (outlet): -10(option)~5~15°C<br>– Warm water temperature (outlet): 35~55°C |

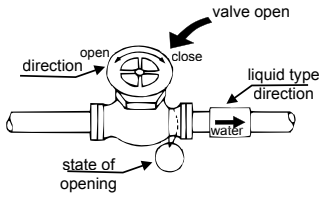



**Fig.3**

## 2.2. Test run method and check

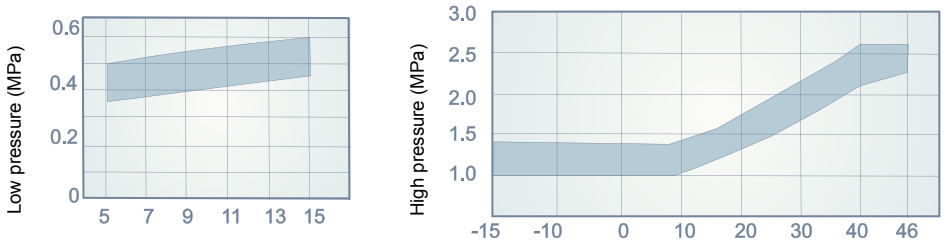
### 2.2.1. Check before Test Run

1. Need to apply electricity to oil heater. **Power ON 12 hours before the first start up.**
2. Screw compressor start-up. Confirm if there is no strange noise or abnormal vibration in 1~2 minutes after compressor operation.
3. Confirmation of standard operating pressures. Stop the operation once and re-start the unit after more than 3 minutes. Confirm if pressure is correct after 15 minutes of compressor operation referring for “Fig.6 Standard operation pressure” and “Fig.6 Water side heat exchanger washing area”.
4. Positive revolution of fan. Confirm if fan is spinning in counter clockwise rotation observing the fan from the above.
5. Check of gas leakage.Confirm if gas is not leaked after stopping the operation.

### 2.2.2. Cooling operation (low pressure, high pressure)

**Cooling operation:**

Fig.4

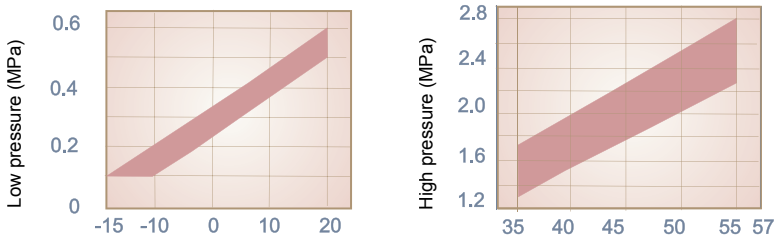





### 2.2.3. Heating operation (low pressure, high pressure)

**Heating operation:**

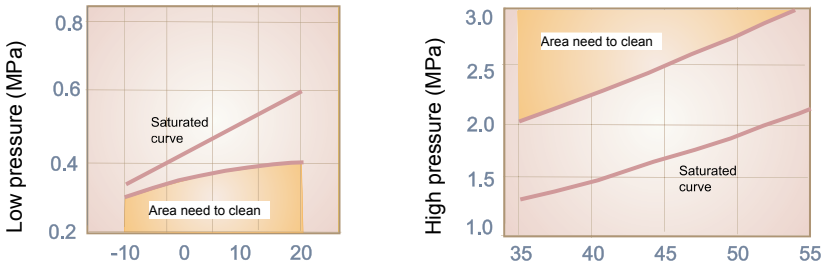
Fig.5




Low pressure and high pressure, corresponding to outlet temperature and ambient DB temperature, are within the below area (at 100% operation) normally.

Fig. Standard operation pressure (at 100% operation)

Fig.6




*CAUTION:*

For installation and test run under low ambient temperature, like at the beginning of summer, it is possible to decrease low pressure abnormally.

In such case, heating operation should be run firstly and then cooling operation. (In case of air-cooled heat pump)

*NOTE:*

Fig.6 area need to be cleaned water side heat exchanger

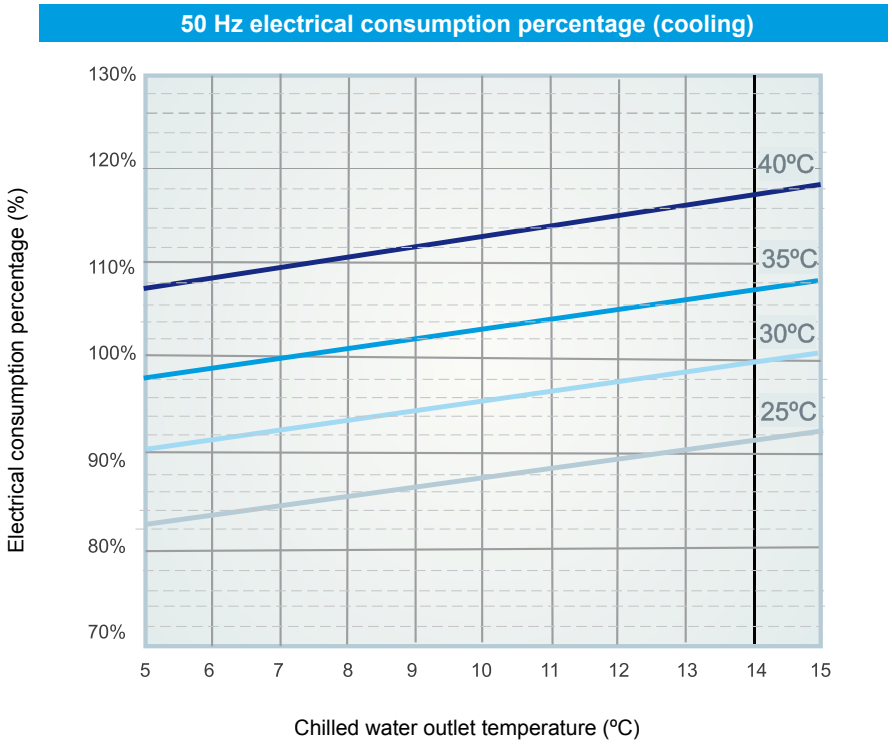
### 2.2.4. Electrical consumption percentage

Electrical consumption percentage is 100% in the following standard conditions at cooling and heating operation:

**Cooling operation:**

Air side heat exchanger inlet ambient DB 35°C,
Chilled water inlet temperature 12°C,
Chilled water outlet temperature 7°C.

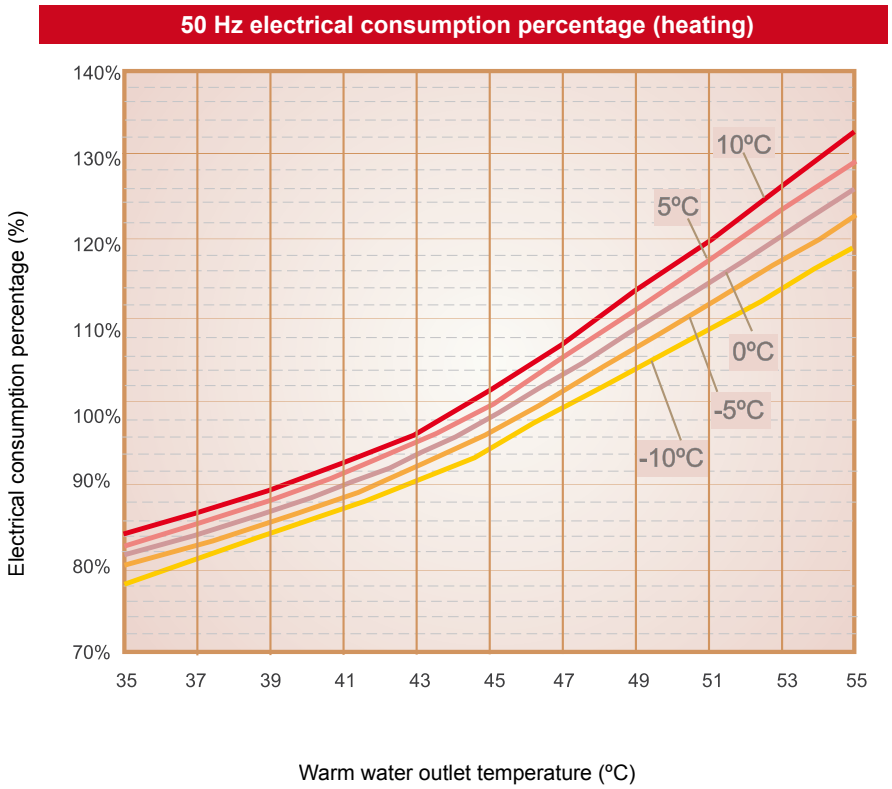
Fig.7




**Heating operation:**

Air side heat exchanger inlet ambient DB 7°C, WB temperature 6°C,
Warm water inlet temperature 40°C,
Warm water outlet temperature 45°C

Fig.8



## 2.3. Restart of Test Run

After a series of items are confirmed from the beginning to the end of test run, restart the unit and check also the following items.

| Items | Check point | Criteria and method | Remarks |
|---|---|---|---|
| Operation: operation register | Voltage | – Momentary voltage at compressor start-up is over rated voltage ±15%<br>– Operation voltage is within rated voltage: ±10%<br>– Unbalance between voltage: within 2%, in any case, within 3%. | Unbalance of voltage makes current value change significantly. |
| | High pressure<br>Low pressure | – See the diagrams in sub-chapter 2.2.2 and 2.2.3. | |
| | Ambient temperature DB, WB<br>Chilled water inlet temperature<br>Chilled water outlet temperature | – See figures 4 and 5. | |
| | Activation temperature of chilled water temperature controller<br>Activation temperature of warm water temperature controller<br>(air-cooled type) | – Confirm the activation temperature changing the setting temperature | |
| | Frequency of compressor start-up and stop | – Below 6 times in a hour and non stop operation time is over 5 minutes. | |
| Refrigerant system: cycle in general compressor | Is there no abnormal vibration and contact in pipe or capillary? | – Confirm | |
| | Frost in compressor | – Confirm if there is too much frost. | Caution in mid-term |
| Electrical system: electrical device | Is electrical device (relay etc) activated normally?<br>Is activation time of timer normal? | – Confirm if there is no strange activation like noise, spark or chattering. | |
| Water system: Pump | Is there no trouble in discharge water pressure nor in operation noise? | | If it needs to adjust it with water volume, adjust it in the discharge side of pump. |
| | Is there any clogging in strainer? | – Re-check if there is no dust nor foreign matters in strainer. | |

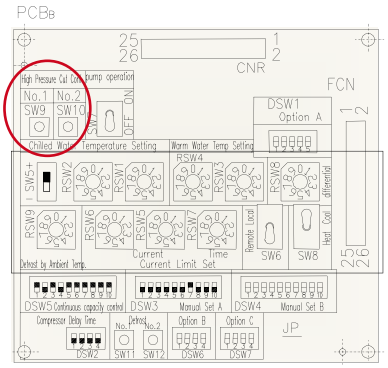
### 2.3.1. Check of high pressure switch (cooling operation)

☛ **Cooling operation:**

1. Operate the unit in local operation mode.
2. When “High pressure cut confirmation test” switch on PCB is pressed during local operation, fan is stopped forcedly and high pressure is increased. Then, high pressure switch turns ON. (Alarm stop) This confirmation switch is set in every cycle (see fig.9) (to restart the compressor, high pressure switch must be rearmed manually next to each compressor)

*NOTE:*

See “HIgh pressure confirmation” in chapter 4 “Control functions” for the details.




☛ **Fig.9**

*CAUTION:*

It is recommended that this confirmation test be performed at load-up state, operation for a few minutes after start-up.

3. After confirmation, alarm should be released by unit stop operation. When alarm is released, high pressure cut confirmation test is also released.

### 2.3.2. Check of low pressure cut control

Low pressure is decreased by closing the stop valve. Then, low pressure cut device is activated (Alarm stop).

<Activation conditions for low pressure cut control>

Activated in 3 seconds at low pressure sensor detection pressure of below 0.049MPa

### 2.3.3. Temperature controller

It is difficult to check the temperature controller accurately in an installation place, however, the following method helps to grasp the setting state roughly.

1. Temperature controller is set in high temperature side for chilled water, and in low temperature side for warm water.
2. Measure the set temperature at compressor stop, and compare it with actual inlet water temperature.

### 2.3.4. Check of refrigerant leakage

It is possible for screws to be loosened at delivery. Take 10~15 seconds at least in one position to check the leakage.

## 2.4. Instruction at delivery

When delivering the unit after test run, give an appropriate explanation to customers about operation method and periodical maintenance method etc as well as the following items.

1. Apply the electricity to oil heater

   Do not turn off the power source of unit during normal use in order that electricity is applied to oil heater. In case of re-starting the unit after a long time, turn on the power 12 hours before operation start. Oil heater avoids the damage of shaft and rotor, preventing the foaming of lubrication oil in compressor at start-up. (Heats oil to approx. 40ºC)

2. If chiller unit is not used for a long time, drain the water out of pipes using water-drawing or air-drawing plug.

3. Anti-freeze in winter

- To avoid freezing, which might damage devices or pipes, it is needed to be installed some insulation in pump and water pipes.
- This chiller has a function to operate chilled (warm) water circulation pump automatically in case of decreasing outside temperature during unit stop, therefore, do not turn off the power source during season. In case of turning off, draw the water out of chiller unit.

4. In case of fire,

   Turn all power OFF

5. The unit will not display failure in spite of the following cases.

- During operation and after unit stop, if there is water flowing noise. However, this is a refrigerant flowing noise, and it is not a failure.
- Compressor is not operated (fuses are out) although operation switch is ON while temperature controller is being activated. This is not a failure, but operation is started when temperature control (Thermostat) turns ON.
- In screw type chiller unit, there is a noise in the compressor rotors when it is stopped. Refrigerant is flowed back temporally, and this is not a failure.

6. The refrigerant used in this unit is incombustible, non-toxic and odourless safe. However, toxic gas is produced when leaked refrigerant is exposed to fire and oxygen will be lacked due to that refrigerants gravity is higher than air. Therefore, in case that refrigerant is leaked or eye or throat are irritated, stop the use of fire, and ventilate well, then contact a distributor.

7. About operation method

   Standard method of use is described in the operation manual attached with the product. Operation method would be changed if special modification were realized by request of the customers. Give a clear explanation to the customers that it is necessary to contact a distributor or Customer Service Centre of manufactures in case that operation, not described in the manual, must be performed.

8. For customers' continued safety

   For customers' safety, give plain and sufficient explanation and instruction to them about the contents of "Please observe safety precautions fully" described in Installation Manual and "For safety use" described the Operation Manual, and tell them to read them very carefully.

   Cautions are divided into "Alarm" and "Caution":

   "Alarm" includes cases where it is possible to lead to a dangerous result like death or severe injury.

   Cases described in "Caution" may also lead a grave result depending on the situations. Therefore, please read them carefully and follow the instruction.

   Operation Manual should be kept where any user can reach.

## 2.5.Warning & Cautions

### 2.5.1. During product and electrical installation

*WARNING*

- Installation must be performed by distributors or specialists. Inadequate installation may cause water leakage, electrical shock or fire.
- Electrical work must be performed by person with qualification. Inadequate electrical work may cause electrical shock.
- Confirm if earth wire is connected. Earth wire is determined according to the technical criteria of electrical installation.
- Do not use wire or copper wire in stead of a fuse inside the unit or in the switch for power source. It may cause heat or fire in case of abnormal current.
- Confirm if fuse is correct and adequate. In case of setting inadequate fuse, like high volume fuse, fuse would not melt in spite of abnormal current, and cause fire. See installation check manual attached with the unit for correct fuse volume.
- Confirm the open/close state of valves according to label or operation manual. Especially, confirm if inlet valve is open in those products that have inlet valve of condenser. Operation with the valve close may cause explosion due to the abnormal increase of high pressure.
- Use only specified refrigerant. Nitrogen gas should be used in air tight test. The use of combustible gas like oxygen and acethylene may cause fire or explosion.

### 2.5.2. During operation

*WARNING*

- Do not touch the switch with wet hand. It may cause electrical shock (fig.10).
- Do not use any sprays such as insecticide, lacquer, hair spray or other flammable gases near the unit. It may cause fire. (fig.11)
- Do not operate with cover of electrical box open. To touch the electrical part may cause electrical shock.
- Turn OFF all power source immediately in case that unit is not stopped in spite of the stop operation or that refrigerant is leaked or chilled water is discharged. It may cause electrical shock, fire and explosion. Contact a distributor of Customer Service Centre of manufacturer in such case. (fig.12)
- Do not press repeatedly the operation switch. It avoids a normal activation of protection device and may result in failure, electrical shock and fire.
- Turn OFF main power in case of safety devise is activated frequently or operation switch is not activated steadily. There is a possibility of ground leakage or overcurrent and may result in electrical shock or fire. Contact a distributor of Customer Service Centre of manufacturer in such case. (fig.12)
- Safe refrigerant (Fluorocarbon), incombustible, non-toxic and odourless, is used. In case that Fluorocarbon is leaked and touched with fire, it would be a cause of toxic gas production and of lack of oxygen. Contact a distributor of Customer Service Centre of manufacturer in such case. (fig.13)
- Do not put fingers or sticks etc into the air inlet and outlet. These units have high speed rotating fans and it is dangerous that any object touches them.
- Do not remove the protection net air inlet and outlet. These units have high speed rotating fans and it is dangerous that any object touches them.
- Do not touch hot temperature parts. It may cause burn. (fig.14)

Fig.10

Fig.11

Fig.12

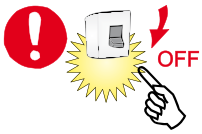


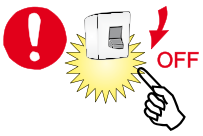

Fig.13


Fig.14

### 2.5.3. During repair and relocation

**WARNING**

Fig.12




- Turn OFF all powers when checking electrical parts, otherwise, it may result in electrical shock.
- Do not touch protection device. It may result in failure, electrical shock, fire and explosion if these devices are touched, the setting value can be changed or short-circuited.
- In case of troubles (smell something burning etc), stop the operation and turn OFF main power immediately. Operation with abnormal state may cause failure, electrical shock and fire. Contact a distributor of Customer Service Centre of manufacturer in such case (fig.12)
- Consult to a distributor of Customer Service Centre of manufacturer in case of repair and relocation. Inadequate installation may cause electrical shock

### 2.5.4. Other cautions

**CAUTION:**

- Do not pour water inside the unit.
- Do not modify the units. Modification or the use of unspecified parts may cause failure, electrical shock and fire.
- Maintain the units on firm ground.
- In case of fire turn OFF the main power. Use oil or distinguish for electrical fire in fire control.
- Do not touch hot temperature parts. It may cause burn.
- Consult with a distributor or qualified service person in case of disposal of unit since refrigerant should be pull out correctly. The law prohibits indecent discharge of refrigerant in air.

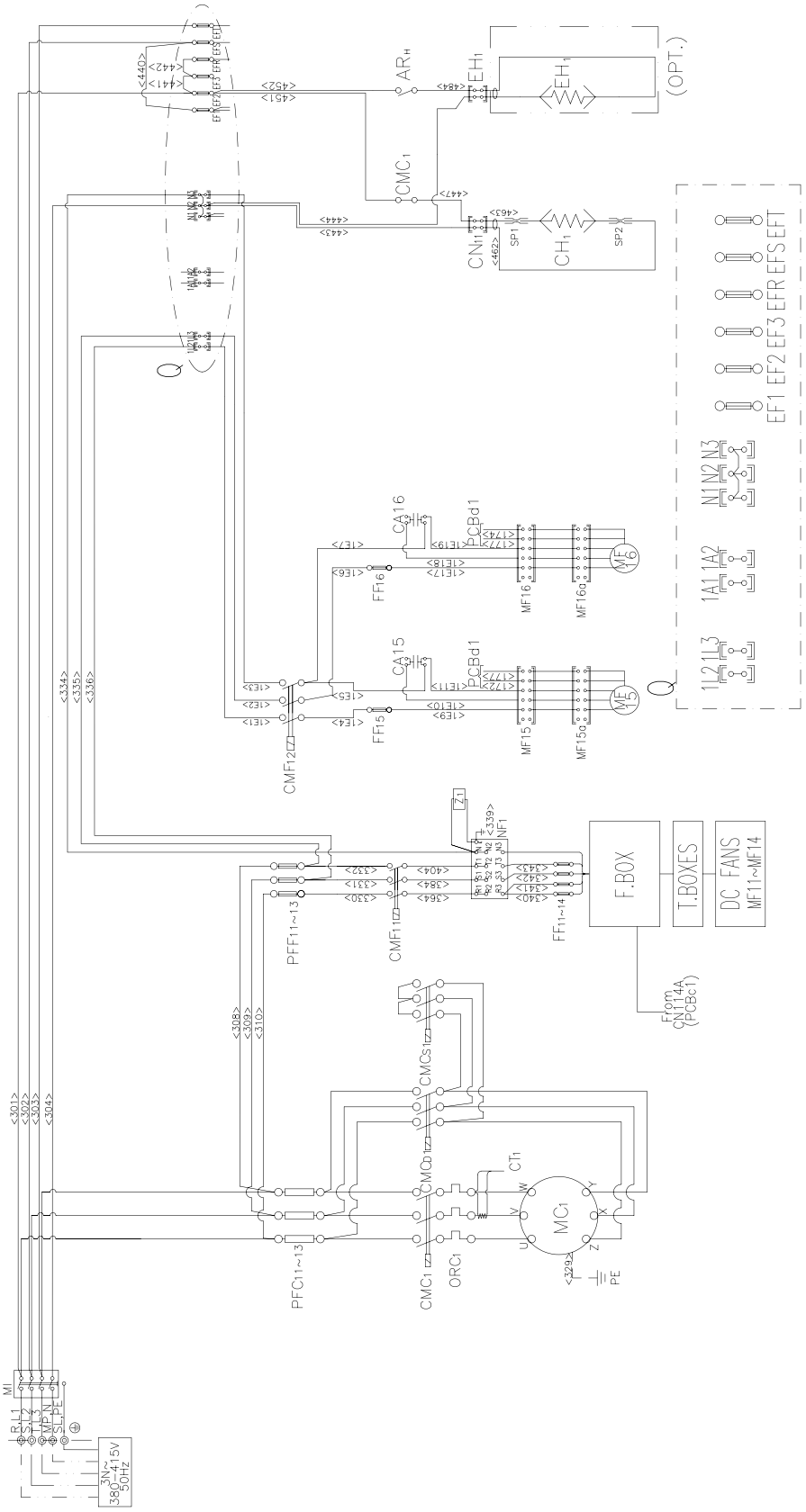
# 3. Electrical Wiring Diagrams

This chapter shows the electrical wiring diagrams for Chiller AG2 of Hitachi.

## Content

## 3.1. Power Wiring Diagram

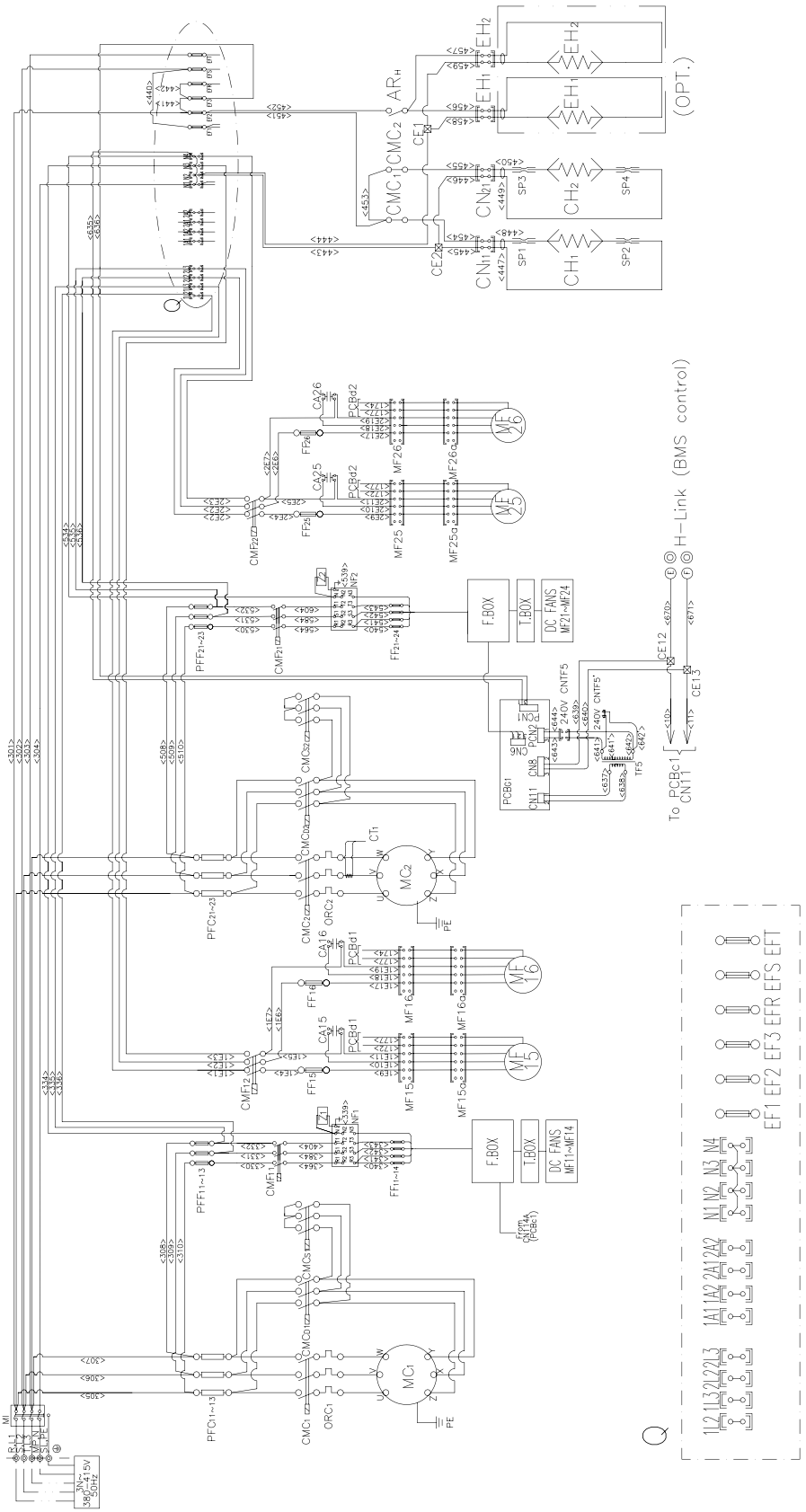
### 3.1.1. Model: R(C/H)UE 40~80AG2




Drawing Code:
XEKS1037_r1

*NOTE:*
*All the field wiring equipment must comply with local codes.*
*For more information about DWS configuration, please refer to chapter 4 of this catalogue.*
*See the diagram abbreviations description at the end of this chapter.*

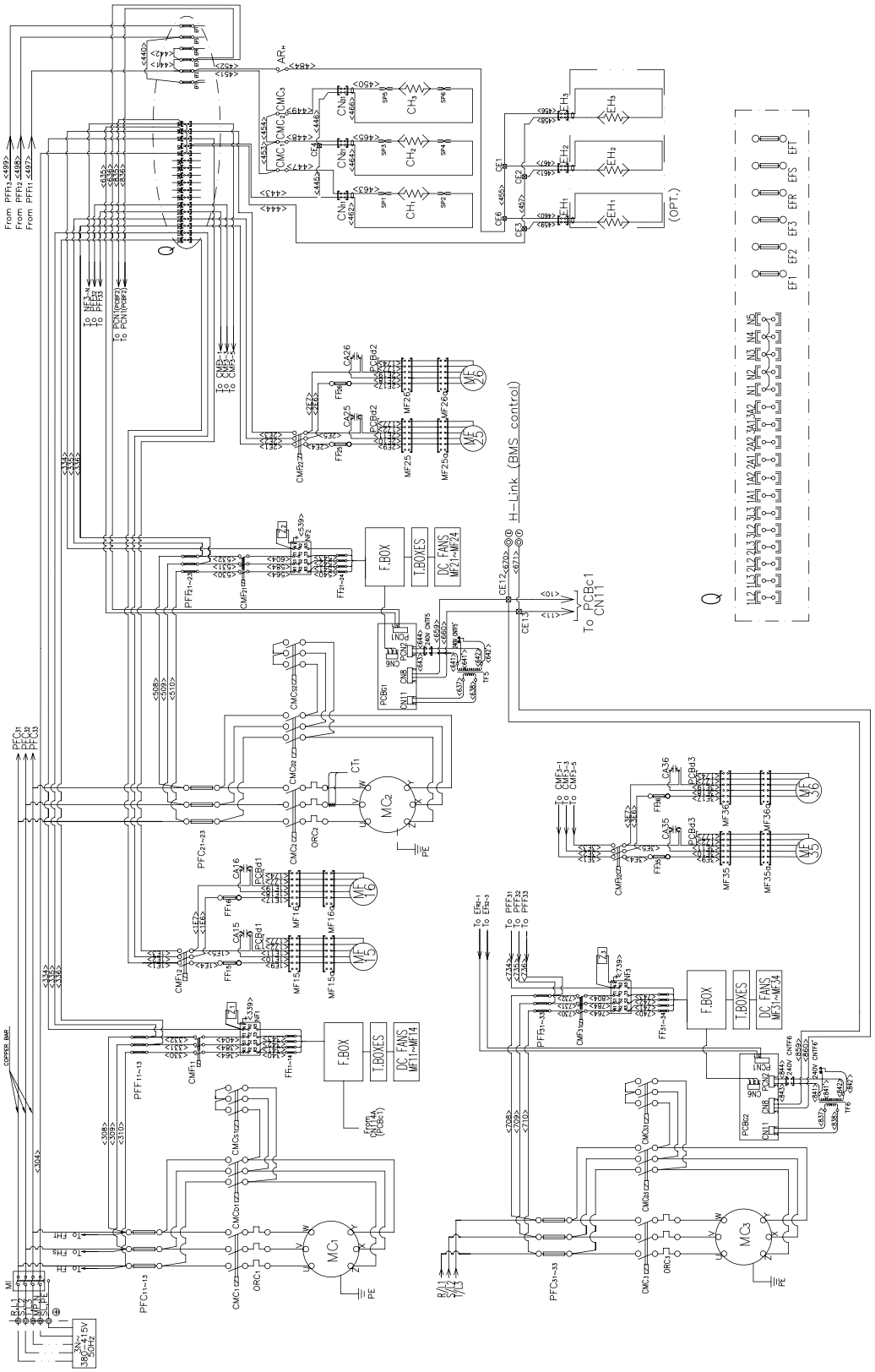
### 3.1.2. Model: R(C/H)UE 100~160AG2




Drawing Code:
XEKS1038_r1

*NOTE:*
*All the field wiring equipment must comply with local codes.*
*For more information about DWS configuration, please refer to chapter 4 of this catalogue.*
*See the diagram abbreviations description at the end of this chapter.*

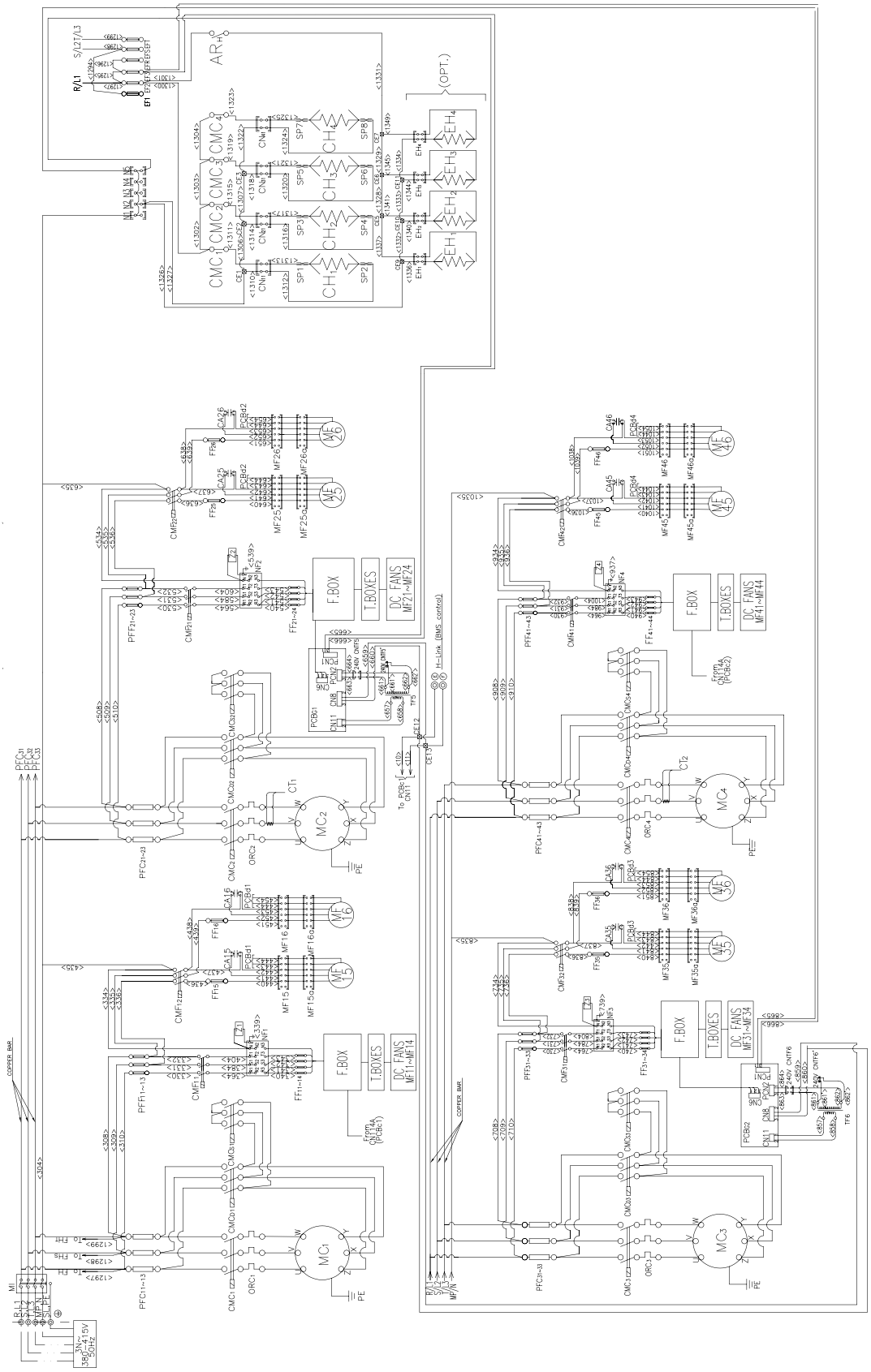
### 3.1.3. Model: R(C/H)UE 180~240AG2




Drawing Code:
XEKS1036_r1

*NOTE:*
*All the field wiring equipment must comply with local codes.*
*For more information about DWS configuration, please refer to chapter 4 of this catalogue.*
*See the diagram abbreviations description at the end of this chapter.*

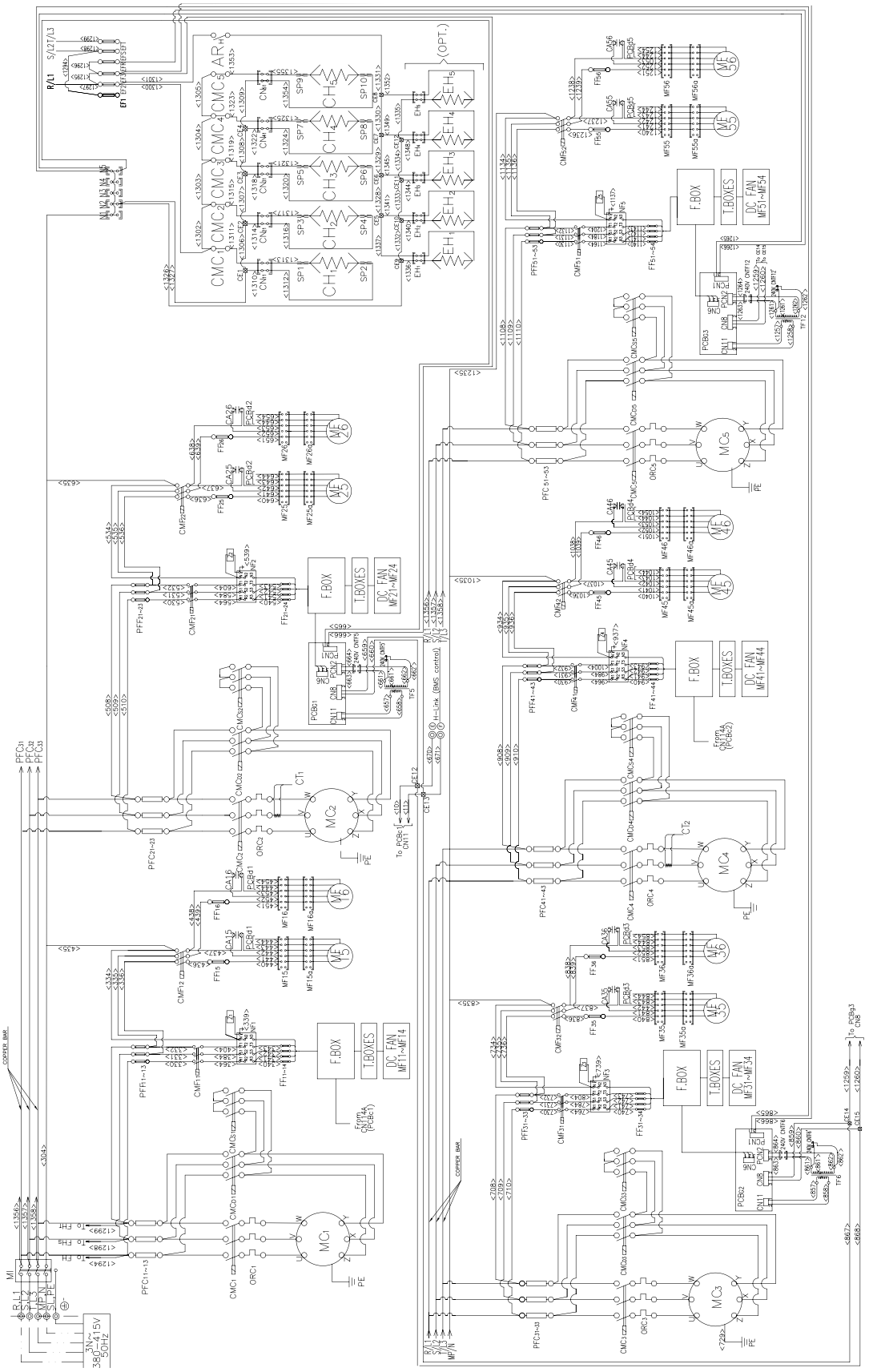
### 3.1.4. Model: R(C/H)UE 280~320AG2




Drawing Code:
XEKS1040_r1

*NOTE:*
*All the field wiring equipment must comply with local codes.*
*For more information about DWS configuration, please refer to chapter 4 of this catalogue.*
*See the diagram abbreviations description at the end of this chapter.*

### 3.1.5. Model: R(C/H)UE 350~400AG2

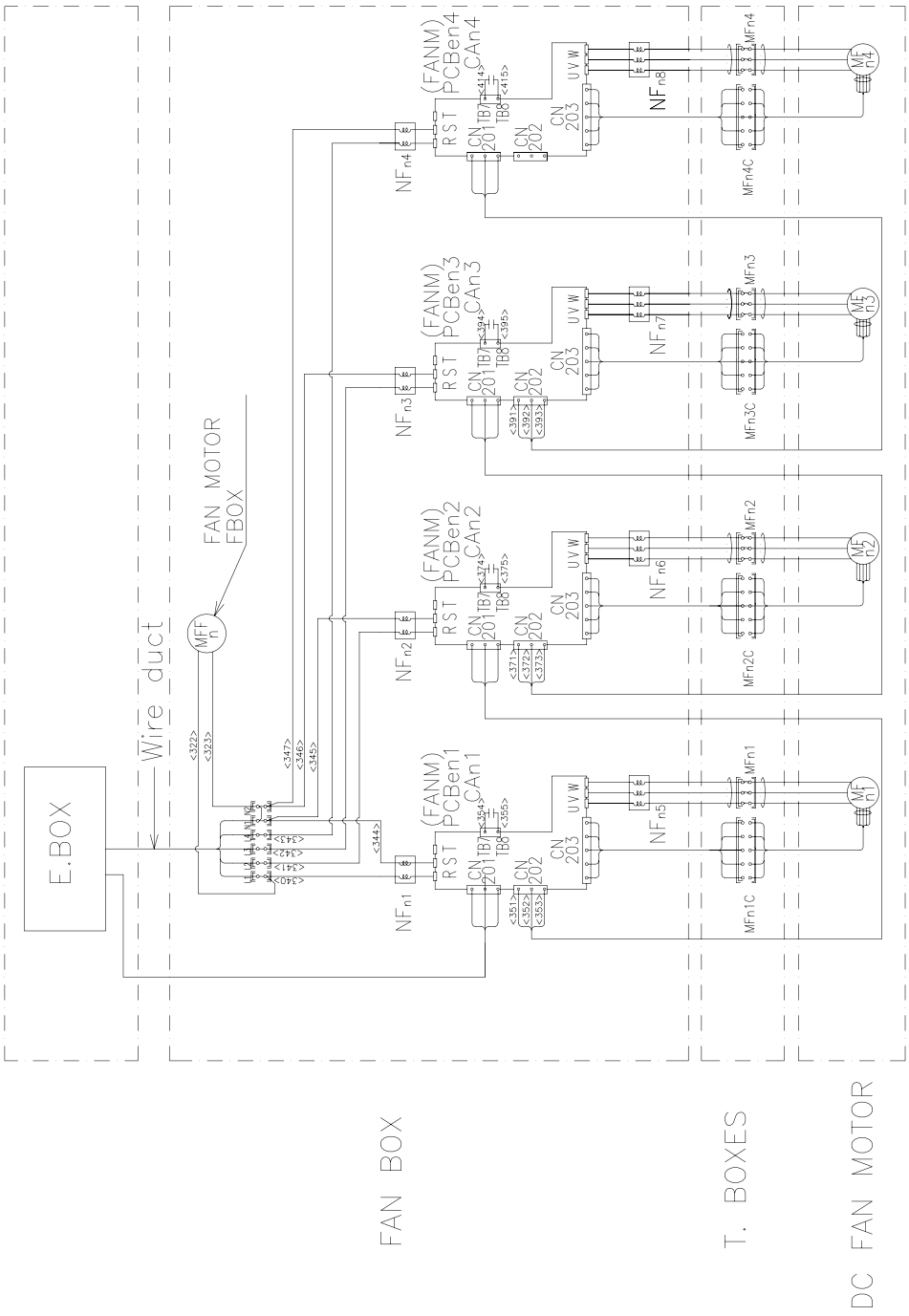


Drawing Code:
XEKS1041_r1

*NOTE:*
*All the field wiring equipment must comply with local codes.*
*For more information about DWS configuration, please refer to chapter 4 of this catalogue.*
*See the diagram abbreviations description at the end of this chapter.*

## 3.2. Power Wiring Diagram (FAN)

### 3.2.1. Model: R(C/H)UE 40~400AG2

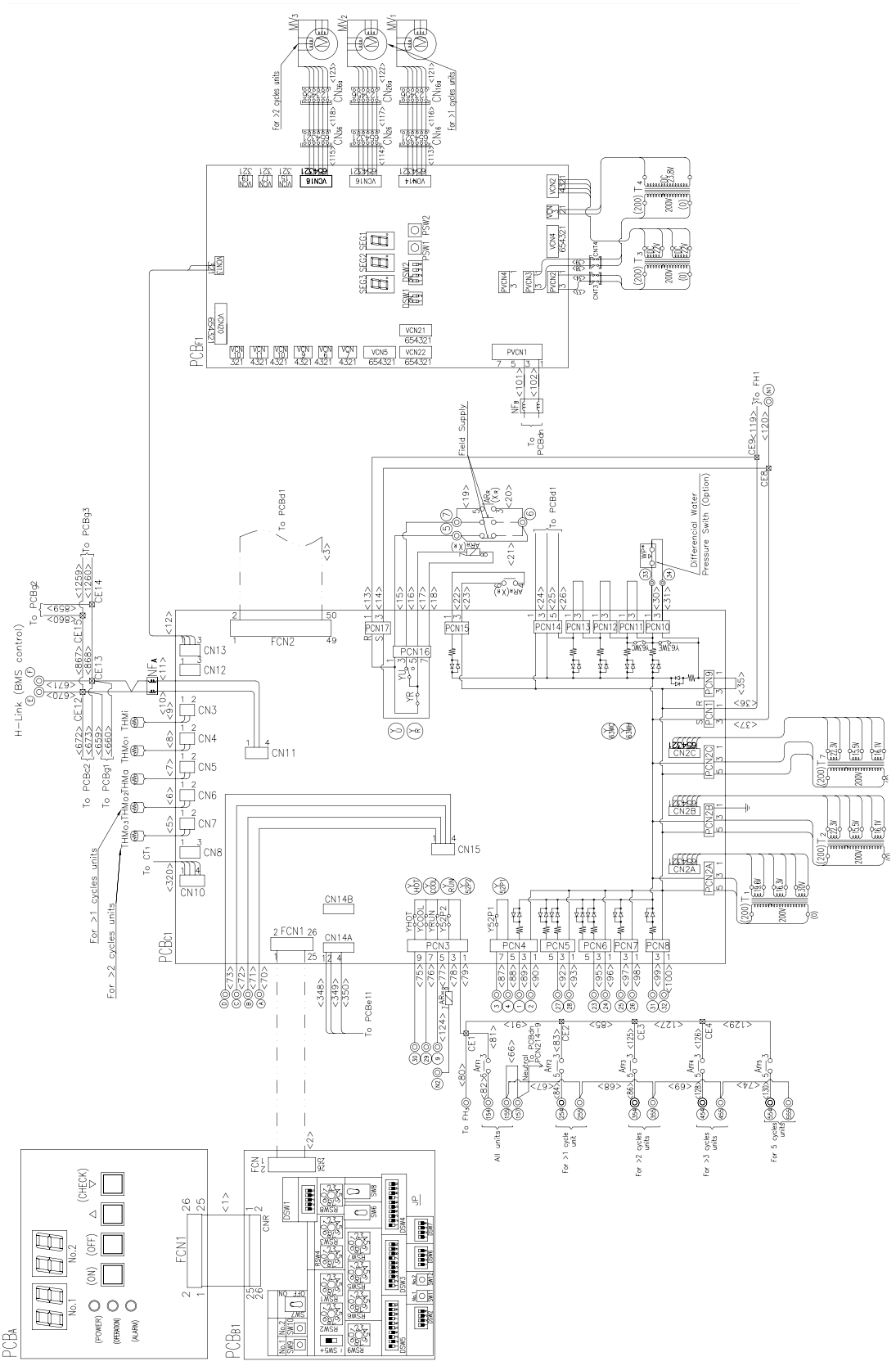



Drawing Code:
XEKS1042_r0

*NOTE:*
*All the field wiring equipment must comply with local codes.*
*For more information about DWS configuration, please refer to chapter 4 of this catalogue.*
*See the diagram abbreviations description at the end of this chapter.*

## 3.3. Control PCB (PCBc)

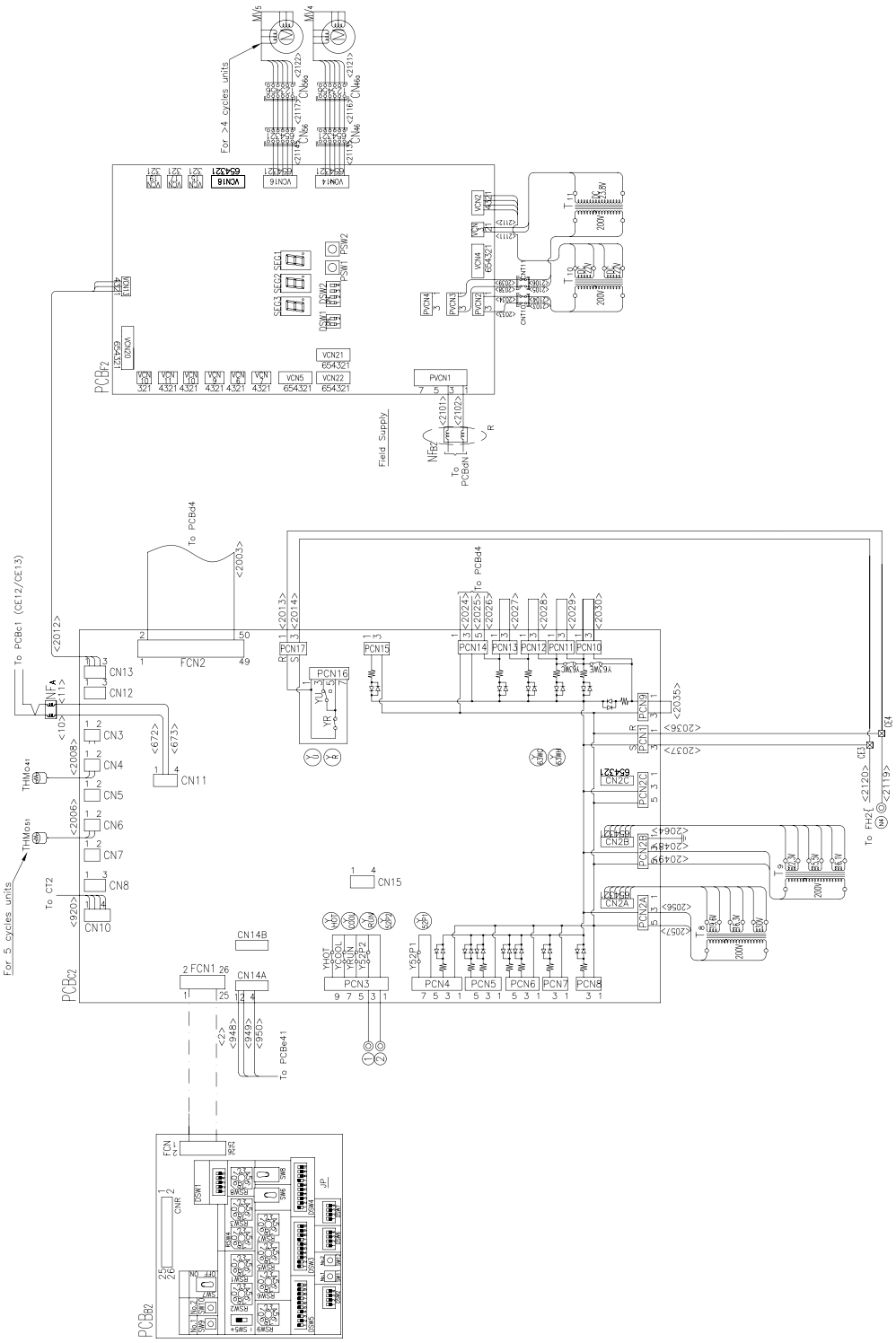
### 3.3.1. Model: R(C/H)UE 40~400AG2




Drawing Code:
XEKS1043_r1

*NOTE:*
*All the field wiring equipment must comply with local codes.*
*For more information about DWS configuration, please refer to chapter 4 of this catalogue.*
*See the diagram abbreviations description at the end of this chapter.*

### 3.3.2. Model: R(C/H)UE 280~400AG2 (Secondary PCBc)

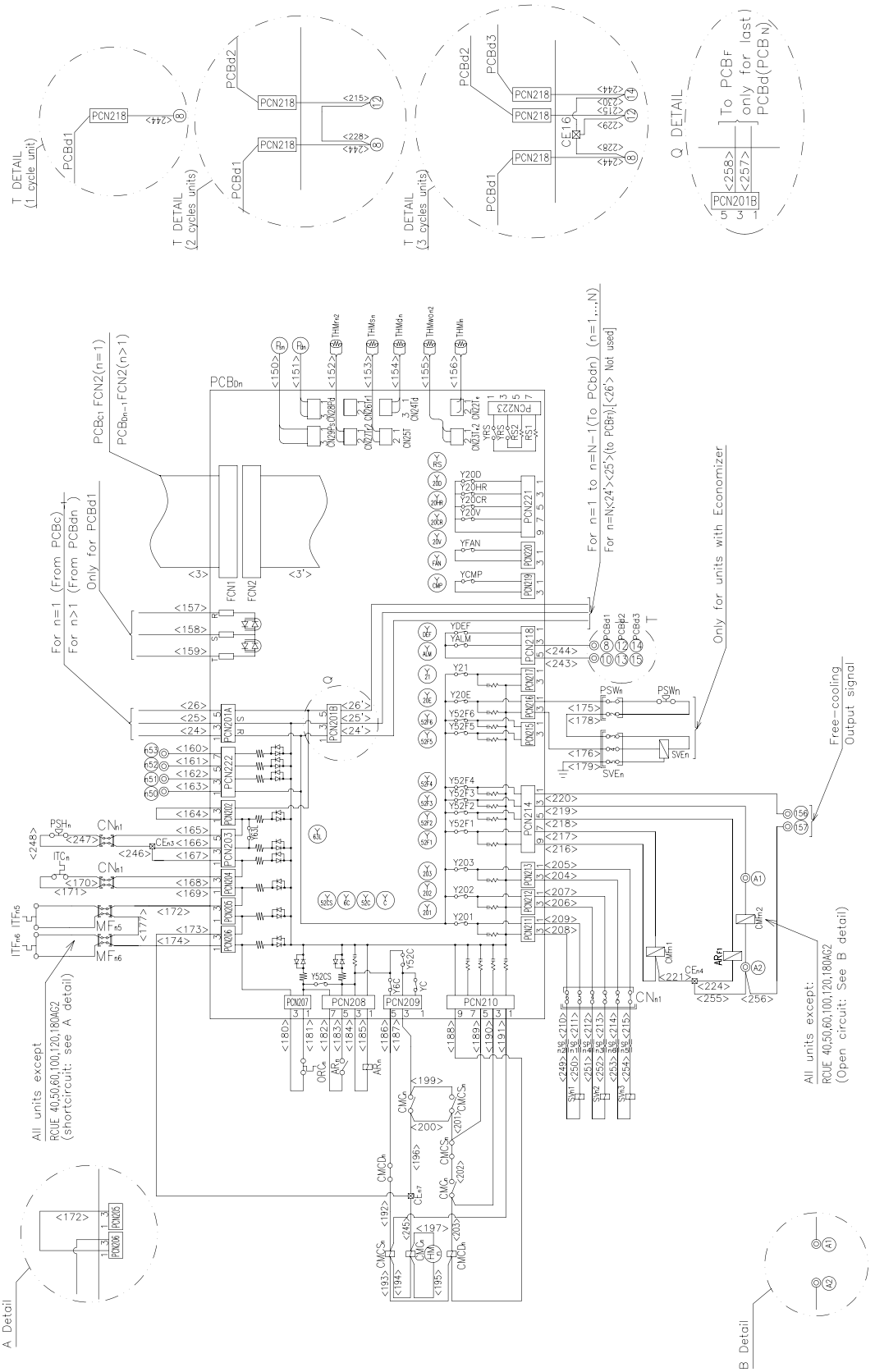


Drawing Code:
XEKS1045_r1

*NOTE:*
*All the field wiring equipment must comply with local codes.*
*For more information about DWS configuration, please refer to chapter 4 of this catalogue.*
*See the diagram abbreviations description at the end of this chapter.*

## 3.4. Input / Output PCB (PCBd)

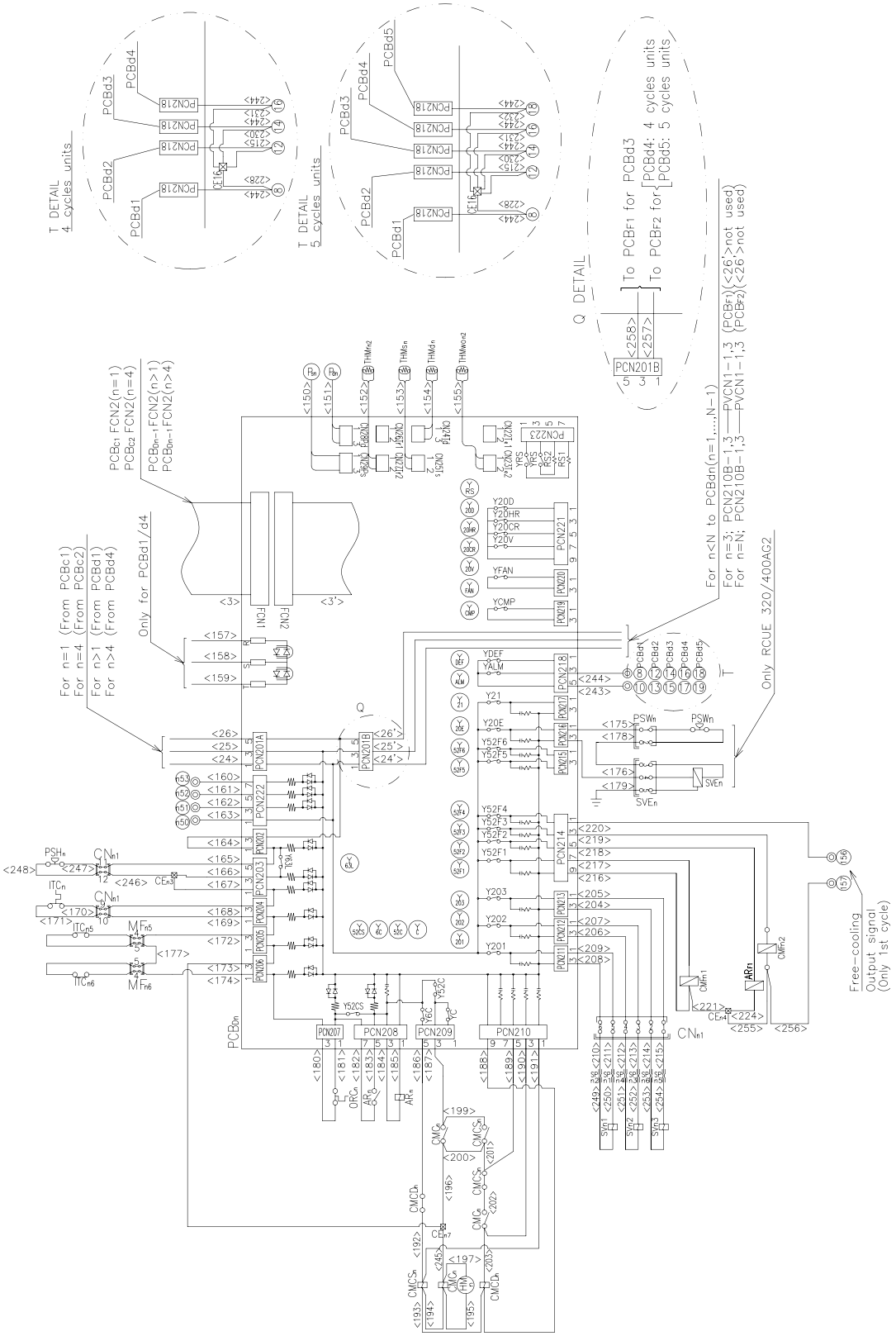
### 3.4.1. Model: RCUE 40~240AG2




Drawing Code:
XEKS1044_r1

*NOTE:*
*All the field wiring equipment must comply with local codes.*
*For more information about DWS configuration, please refer to chapter 4 of this catalogue.*
*See the diagram abbreviations description at the end of this chapter.*

## 3.4.2. Model: RCUE 280~400AG2

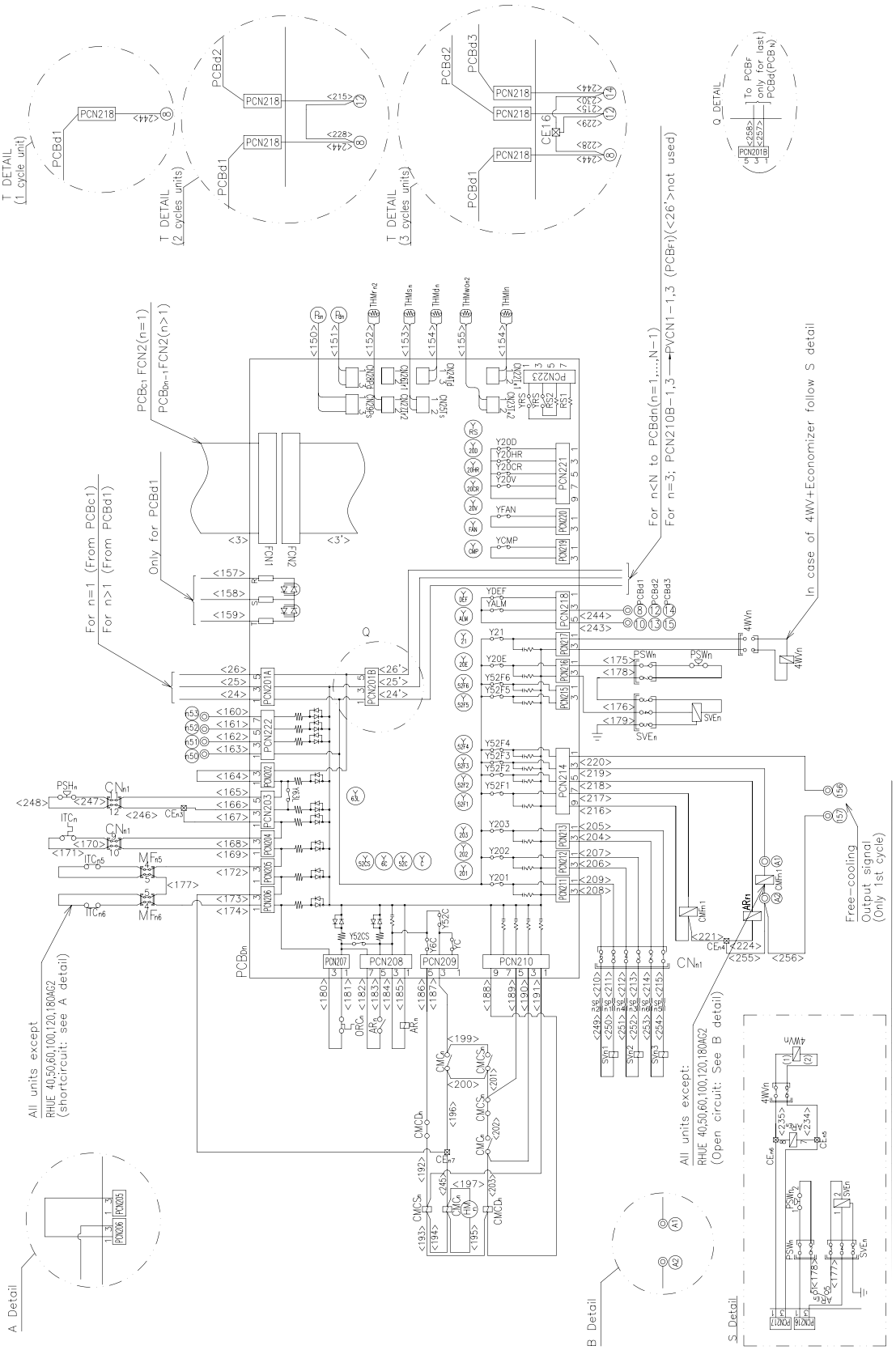



3

Drawing Code:
XEKS1046_r1

*NOTE:*
*All the field wiring equipment must comply with local codes.*
*For more information about DWS configuration, please refer to chapter 4 of this catalogue.*
*See the diagram abbreviations description at the end of this chapter.*

### 3.4.3. Model: RHUE 40~240AG2

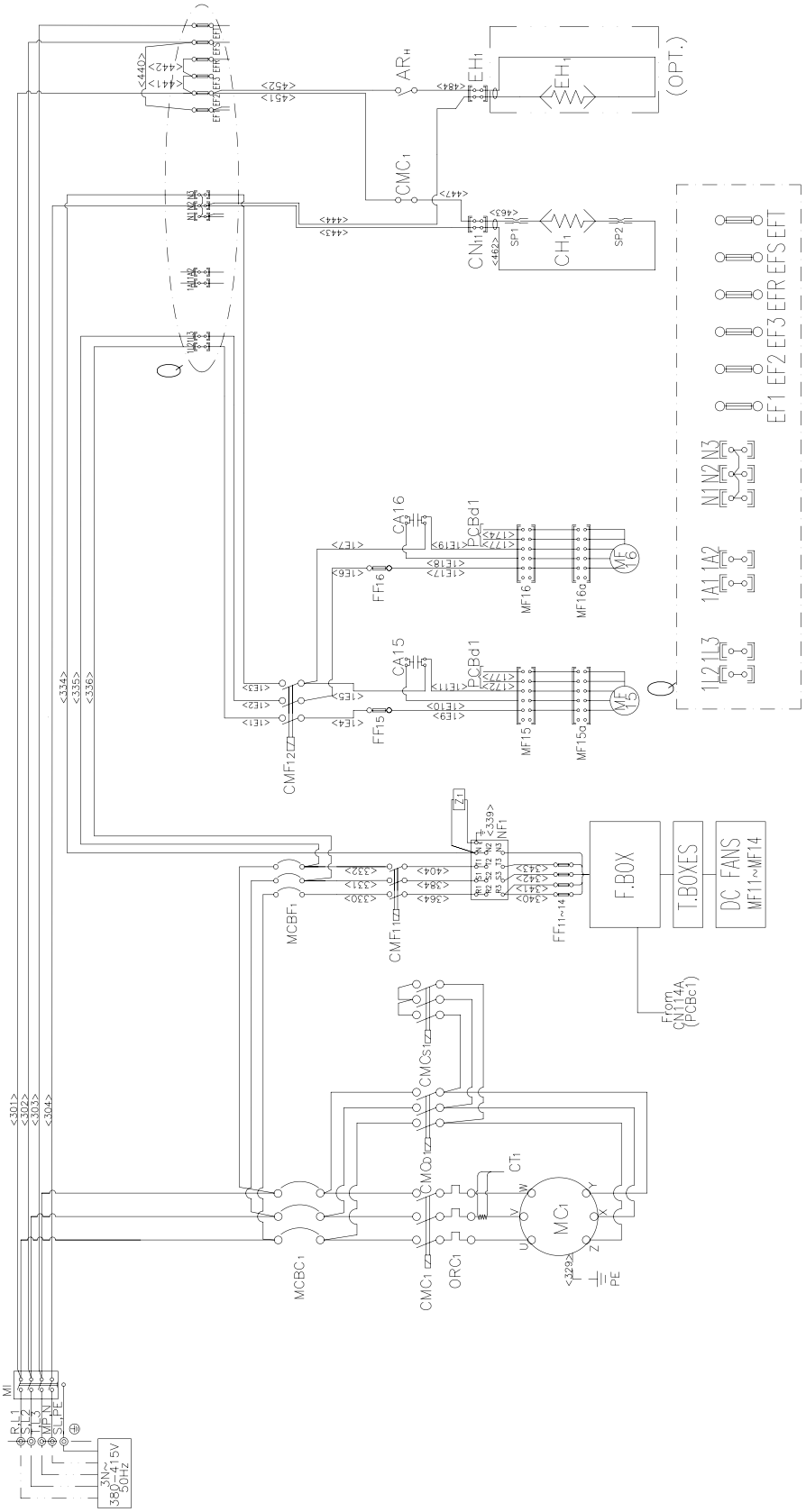



Drawing Code:
XEKS1047_r1

*NOTE:*
*All the field wiring equipment must comply with local codes.*
*For more information about DWS configuration, please refer to chapter 4 of this catalogue.*
*See the diagram abbreviations description at the end of this chapter.*

## 3.5. Power Wiring Diagram (MCB Option)

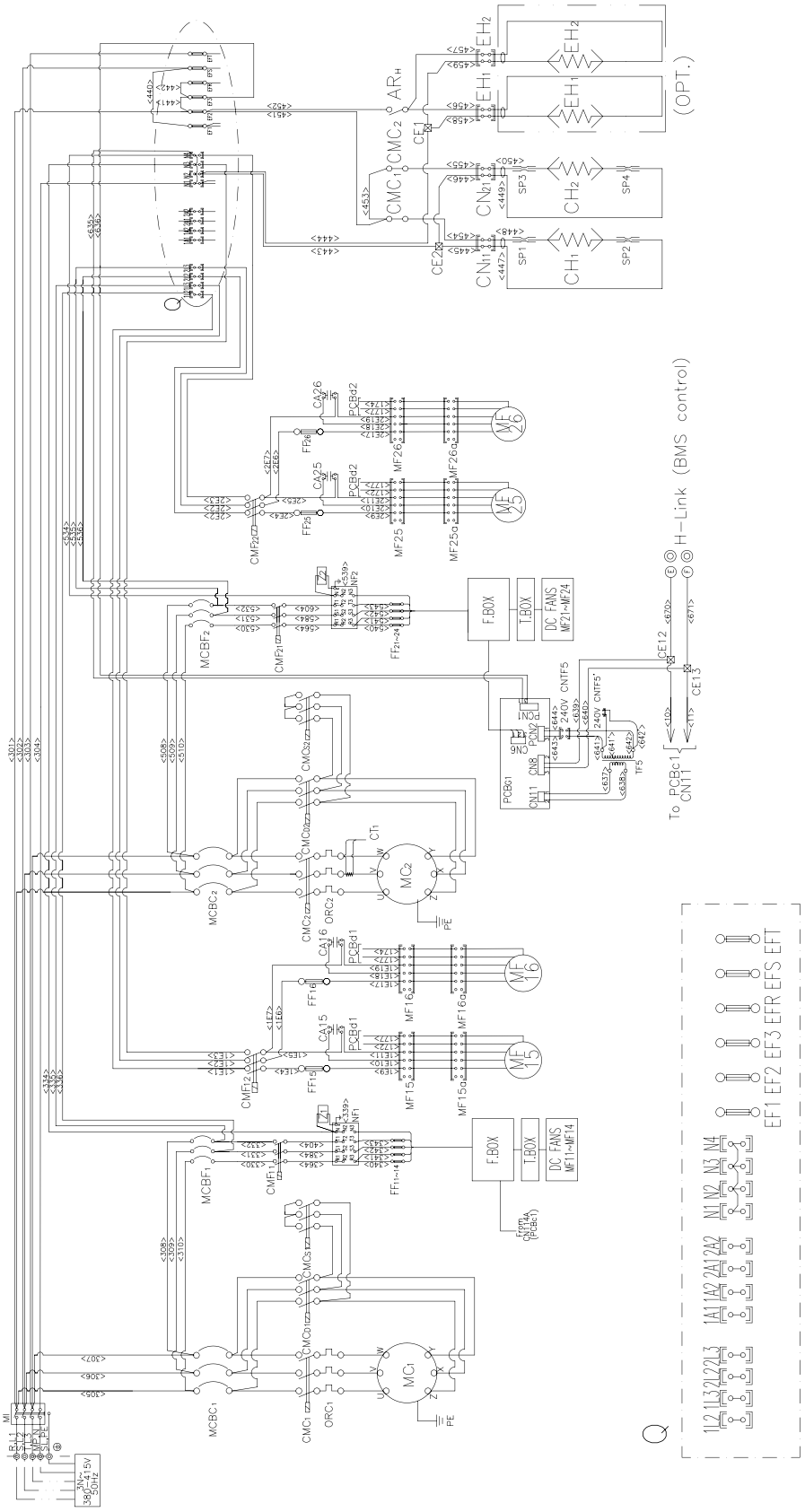
### 3.5.1. Model: R(C/H)UE 40~80AG2




Drawing Code:
XEKS1048_r1

*NOTE:*
*All the field wiring equipment must comply with local codes.*
*For more information about DWS configuration, please refer to chapter 4 of this catalogue.*
*See the diagram abbreviations description at the end of this chapter.*

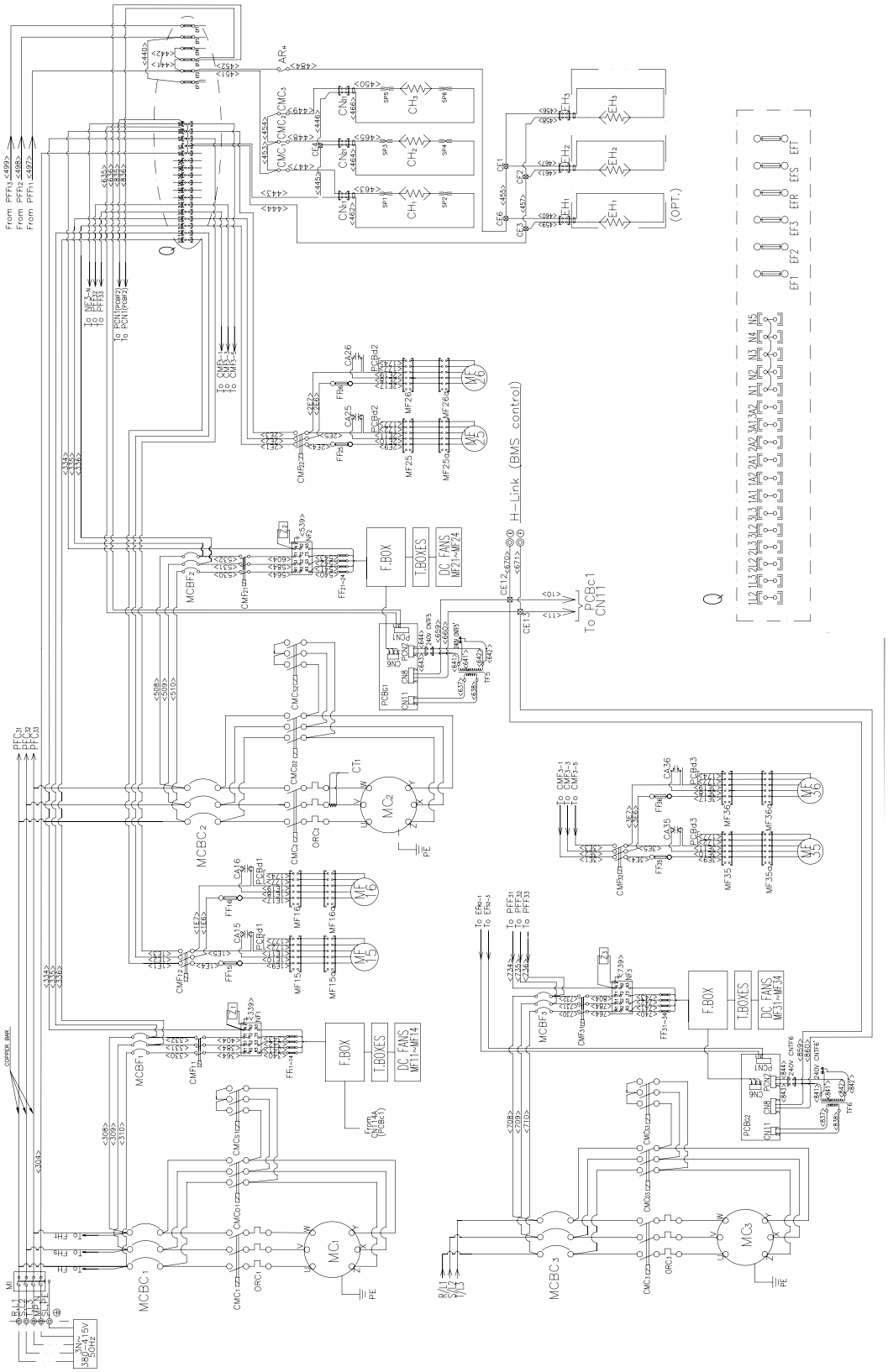
### 3.5.2. Model: R(C/H)UE 100~160AG2




Drawing Code:
XEKS1046_r1

*NOTE:*
*All the field wiring equipment must comply with local codes.*
*For more information about DWS configuration, please refer to chapter 4 of this catalogue.*
*See the diagram abbreviations description at the end of this chapter.*

### 3.5.3. Model: R(C/H)UE 180~240AG2

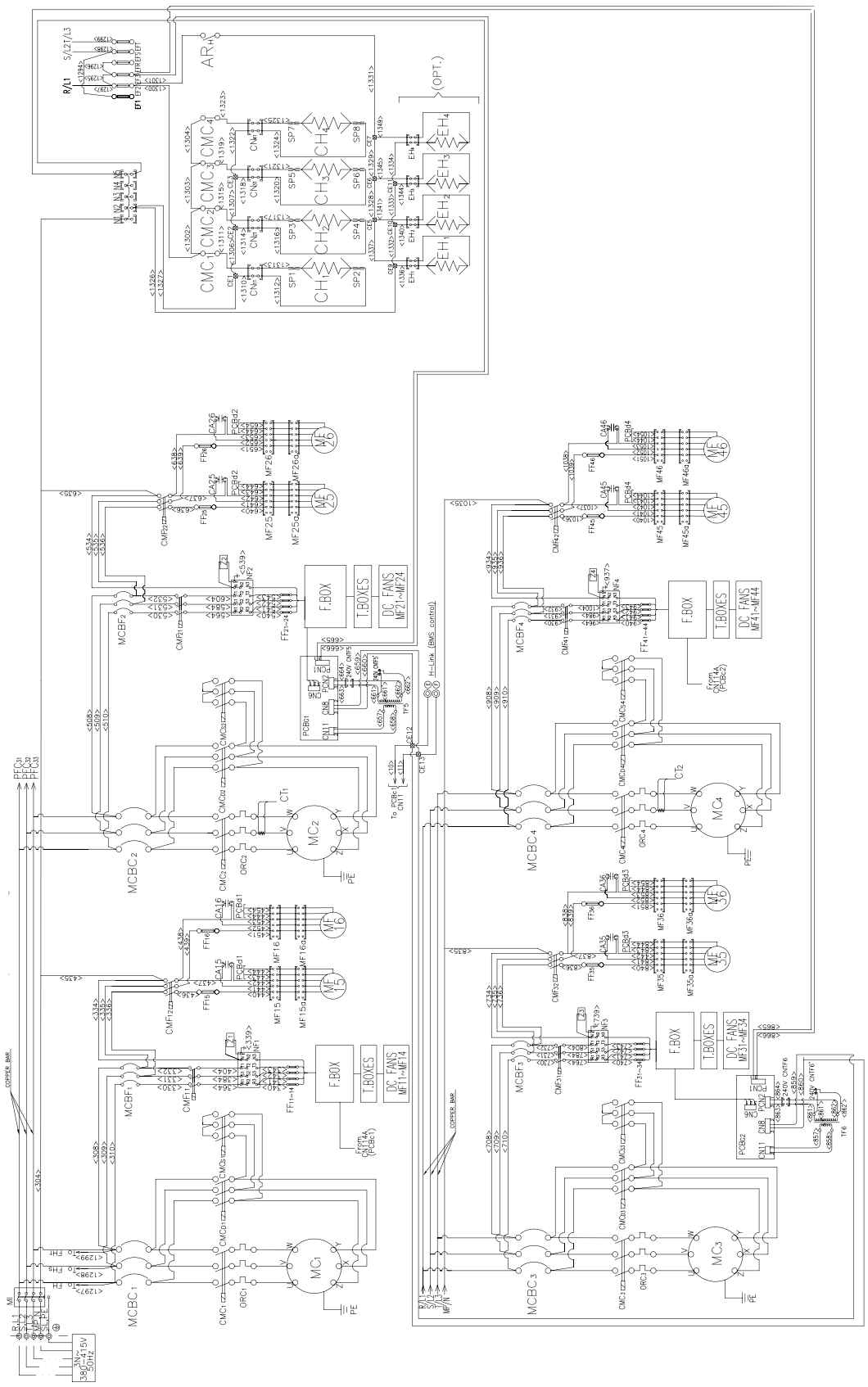





Drawing Code:
XEKS1050_r1

*NOTE:*
*All the field wiring equipment must comply with local codes.*
*For more information about DWS configuration, please refer to chapter 4 of this catalogue.*
*See the diagram abbreviations description at the end of this chapter.*

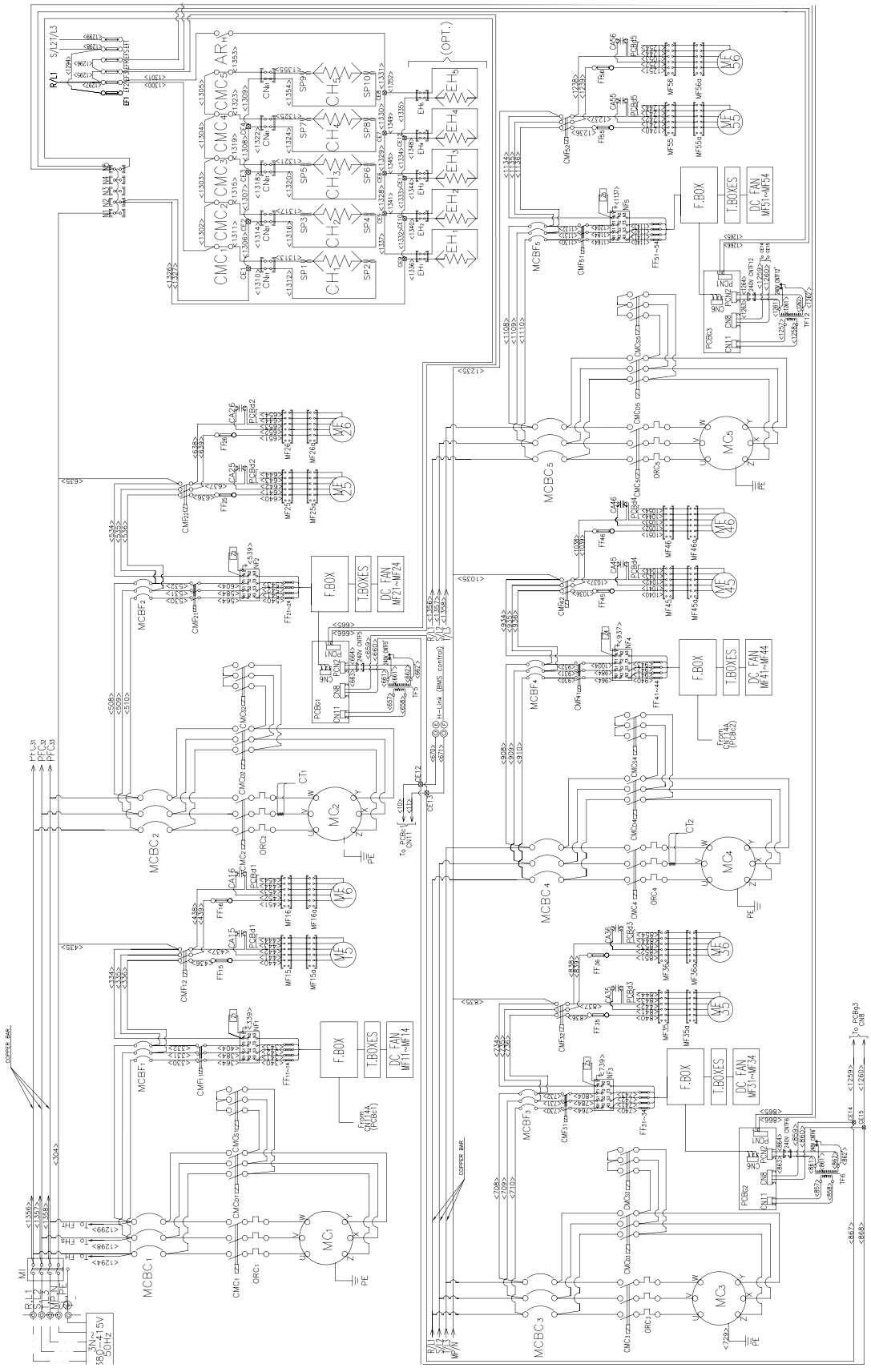
### 3.5.4. Model: R(C/H)UE 280~320AG2




Drawing Code:
XEKS1051_r1

*NOTE:*
*All the field wiring equipment must comply with local codes.*
*For more information about DWS configuration, please refer to chapter 4 of this catalogue.*
*See the diagram abbreviations description at the end of this chapter.*

### 3.5.5. Model: R(C/H)UE 350~400AG2



Drawing Code:
XEKS1037_r1

*NOTE:*
*All the field wiring equipment must comply with local codes.*
*For more information about DWS configuration, please refer to chapter 4 of this catalogue.*
*See the diagram abbreviations description at the end of this chapter.*

## 3.6. Diagram abbreviations descriptions

| Mark | Name | Remark |
|---|---|---|
| MCn | Compressor Motor | |
| MF11-N6 | Condenser Fan Motor | |
| MI | Main Isolator | |
| CMC1 | Contactor for Compressor Motor | |
| CMCsn | Contactor for Compressor Motor (Start Operation) | |
| CMCDn | Contactor for Compressor Motor (Delta Operation) | |
| CMF11-N2 | Contactor for Condenser Fan Motor | |
| EFCn | Fuse for Compressor Motor | or optional Circuit Breaker |
| ORCn | Overcurrent Relay for Compressor Motor | |
| EFF11-N4 | Fuse for Condenser Fan Motor | or optional Circuit Breaker |
| ITC1-n | Internal Thermostat for Compressor | |
| ITFn5,n6 | Internal Thermostat for Fan Motor | |
| CHn | Crankcase Heater | |
| ARn,H,R | Auxiliary Relay | |
| PSHn | High Pressure Switch | OFF: 2.74Mpa<br>ON: Manual Reset |
| Pdn | High Pressure Sensor | |
| Psn | Low Pressure Sensor | |
| THMi | Inlet Water Temperature Thermistor | |
| THMW01n | Outlet Water Temperature Thermistor | |
| THMr2 n | Cooler Inlet Refrigerant Thermistor | |
| THMn | Suction Gas Temperature Thermistor | |
| THMIwon2 | Water Temperature cooler backside | |
| THMd n | Discharge Gas Thermistor | |
| PFCn | Fuse holder for Compresor Motor | Or optional Circuit Breaker |
| PFFn | Fuse holder for Compresor Fan Motor | Or optional Circuit Breaker |
| THMa | Ambient Temperature Thermistor | |
| NFn | Noise Filter (PCB) | |
| NFA,B,11~9N | Noise Filter (PCB) | |
| MVn | Electronic Expansion Valve (Exp.v) | |
| CT1,2 | Current sensor | |
| FF11~N4 | Fan five protection | 12A |
| MFFn | Fan motor inside Electrical Box | |
| CA11~N6 | Capacitors for Fan | |
| EF1~3, R,S,T | Fuse | 6A |
| SV11-N1 | Solenoid Valve for Starting | |
| SV12-N2 | Solenoid Valve for Load-down | |
| SV13-N3 | Solenoid Valve for Load-up | |
| TMn | Hour Meter | |
| PCBA | Printed Circuit Board for Display | |

| Mark | Name | Remark |
|---|---|---|
| PCBB1,B2 | Printed Circuit Board for Operation | |
| PCBC1,C2 | Printed Circuit Board for CPU | |
| PCBD1 | Printed Circuit Board for Relay | |
| PCBE11~ | Printed Circuit Board for Fan Control | |
| PCBF1,F2 | PCB for Electronic Expansion Valve | |
| PCBG1,G2,G3 | PCB for DC Fan control | |
| WP | Water Pressure Switch,<br>Water Flow Switch | Option |
| SVEn | Solenoid Valve for Economizer | |
| PSWn | Pressure Switch for Economizer | |
| EHn | Cooler Heater | |
| TF1,2,3,4,5,6,7 | Transformers | |
| 4WNn | 4-way valve | |
| SW2~8 | External Swich | Field Supplied |
| CL | Pilot Lamp for caution signal (from Fans) | |
| PBSR1 | Push Button Switch for Starting (REMOTE) | |
| PBSR2 | Push Button Switch for Stoppage (REMOTE) | |
| RLn | Pilot Lamp for Remote Indication (Unit Operation) | |
| OLn | Pilot Lamp for Remote Indication (Alarm) | |
| CMP | Contactor for Pump | |
| TRP | Thermal Relay for Pump | |
| N:1~n | | |

| Symbol | Description |
|---|---|
| ◎ | Terminals |
| —⊠— | Closed-end Connector |
| ※ | Field-supplied |
| – ·· – ·· – | Field Wiring |
| – – – – – | Earth Wiring |
| ———— | Factory wiring |

| N | Model |
|---|---|
| 1 | R(C/H)UE 40, 50, 60, 70, 80AG2 |
| 2 | RC/H)UE 100, 120,140, 160AG2 |
| 3 | R(C/H)UE 180, 210, 240AG2 |
| 4 | RCUE 280, 320AG2 |
| 5 | RCUE 350,400AG2 |

# 4.Control system

## Content

## 4.1. List of Main Control Function

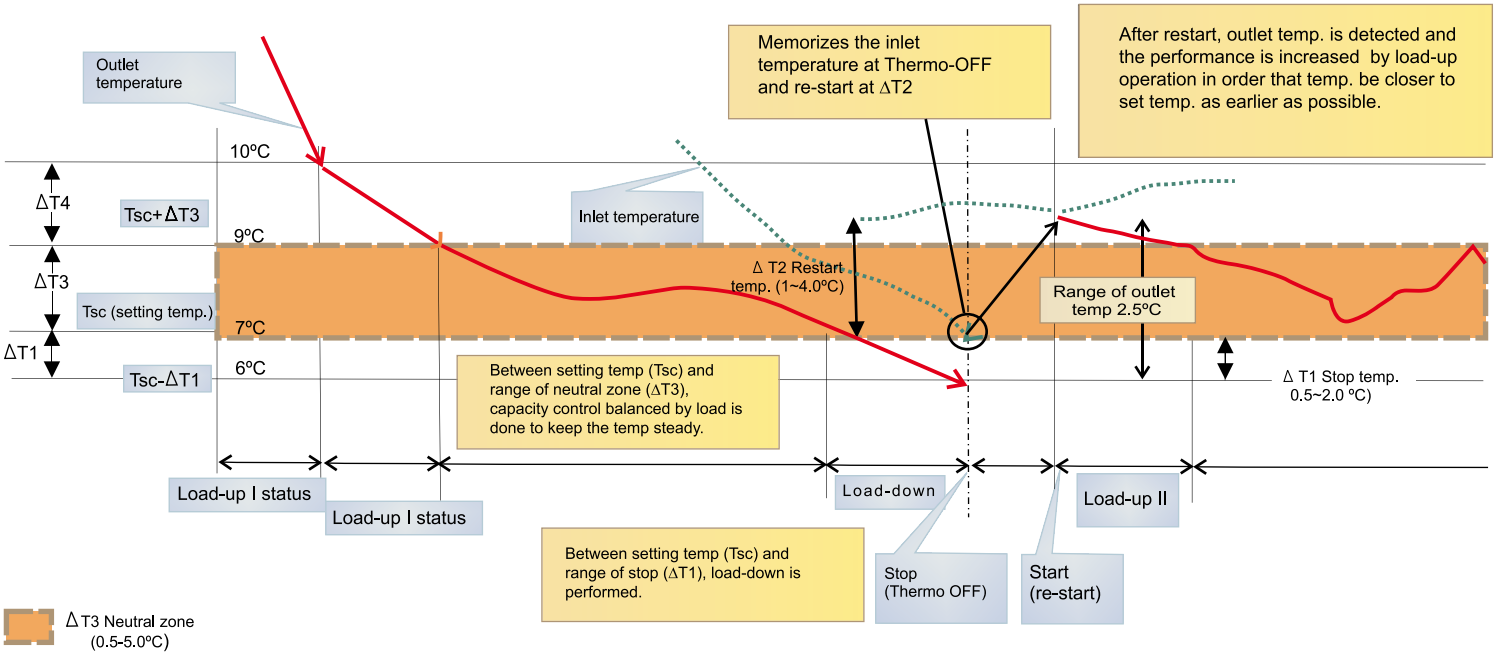
| Item | | Contents |
|---|---|---|
| Water temp. control | Automatic water temperature control | – Outlet water temperature of water side heat exchanger is detected by thermistor and the position of compressor slide valve is controlled continuously.<br>– The range of capacity control: 100~15%, Stop (all models) |
| Compressor | 1. Starting control | – 人 Δ control (5 seconds), Starting unload control (30 sec before capacity control). |
| | 2. Time Guard | – Prevention of excessive compressor re-starts (3 minutes) |
| | 3. Sequential starting control | – Prevention of compressors' simultaneous start (1 minute delay) (Unit with more than 1 cycle) |
| | 4. Rotation control | – Balance of each compressor running hours (more than 1 cycle) |
| Current limit control | | – When unit current reaches to the setting value, power supply capacity load is reduced. Therefore, unload operation is performed forcedly for some minutes. |
| Reverse protection control | | – 3 phase status is detected to avoid the operation in reverse phase or open phase (before starting and during running of unit). |
| Restart function from momentary power failure | | – In case of momentary power failure (13mm seconds ≤ time ≤ 2 seconds, and under –20% of power voltage), unit is stopped, and then is restarted when the voltage is back. |
| Automatic restart function from power failure <option> | | – In case of power failure of over 2 seconds, the units are restarted after power supply is back.<br>– In case of long-term power failure, the units are restarted when oil heater has electricity for a certain period after the power supply is back.<br>– The units are not started automatically if power failure happens during stop.<br>– It is an optional setting by Dip Switch (DSW1 pin2). |
| Operation error/ wrong setting prevention control | | – Alarm is output for such operation errors that changeover from remote to local or from cooling to heating and wrong setting.<br>– In case that operation order is input by remote controller when local operation is selected, alarm is output as safety. |
| Forced load control | | – Forced capacity operation (forced Thermo OFF, forced capacity control) is performed by external signal attending to special needs of load.<br>– Control is performed externally by a no-voltage contact for each compressor. |
| Second water temperature setting | | – It is possible to adjust 2 setting temperatures.<br>– 1st temperature is set by rotary switch, and 2nd temperature is set by key operation on the 7 segment.<br>– According to the usage state of loading side, setting temperature can be switched by external signal (no-voltage contact input). |

| Item | Contents |
|---|---|
| Ice/Heat storage operation by external order | – Full load operation is performed by external order (no-voltage contact input).<br>– Chiller unit stops when the water temperature reaches the setting value (no capacity control).<br>– Dip Switch setting is necessary. |
| Fan forced operation function | – It is possible to operate only fans by an external order as a countermeasure against snow while units are stopped.<br>– Run or Stop operation is performed by a no-voltage contact . |
| High pressure cut confirmation test (only cooling) | – While the actuation of high pressure interrupt device is confirmed, unit is operated with fan forcedly stopped.<br>– Push button is set on PCB for every cycle number. |
| Pump automatic operation function in winter | – Operation order to pump is output automatically by chiller in order to avoid freezing due to the decrease of chilled water temperature during unit stop in winter. |
| “Saving energy” priority mode <option> (only cooling) | – It is to keep high pressure at low values when ambient temperature below 30 ºC.<br>– Since fan speed is increased, it is a saving energy operation more than a silence operation.<br>– It is an optional setting by Dip Switch. |
| “Silence priority” mode <option> (only cooling) | – It is focused on a silent operation of the unit reducing the fan speed.<br>– Since the revolution number is reduced during night or mid-term period, efficiency is changed hardly in all around the year.<br>– Silence is given priority over saving energy.<br>– It is an optional setting by Dip Switch. It is possible to switch from the remote controller by the external signal (no-voltage contact ). |
| Night shift mode <option> (only cooling) | – When fan full speed operation is not needed, fan revolution number is reduced, and low noise operation is performed.<br>– Ambient temperature target: function is valid under 30 °C (noise value 1-~-2dB) (changeover by no-voltage a contact input) |
| Thermo OFF selection function | – There are two methods to judge Thermo OFF, possible to select.<br>1. Immediate Thermo OFF by Thermo OFF temperature<br>2. No immediate Thermo OFF if Thermo OFF temperature continues for 3 minutes. (however, if outlet water temperature is out of the range, it will be immediate Thermo OFF) |

## 4.2. Water control

### 4.2.1. Automatic temperature adjustment

- Outlet water temperature of Chiller Unit is detected by Thermistor, and based on this value, compressor ON/ OFF and the most suitable capacity is determined.
- Possible range of water temperature setting (°C):
  Cooling –10(option)~15, Heating: 35~55 (outlet water temperature control)
- Capacity control : 100~15%, stop
- The minimum range of temperature adjustment (°C): 0,5
- Restarting of unit after thermo-OFF is done depending on inlet water temperature.




Method of outlet temp detection

In case of standard setting: outlet setting temp 7°C, neutral zone (ΔT3) 2°C (change of outlet water temp 7~9°C). Range of stop temp (ΔT1) 1°C (stop temp 6°C), range of restart temp 2°C.

1. Load-up I control at over 10°C (The capacity is changed a lot in order to approximate the target temp. quickly)
2. Load-up II control at 9~10 °C (The capacity is changed moderately)
3. In neutral zone (9~7°C), load is balanced and performance is not changed.
4. Under neutral zone (below 7°C) load-down control is performed and performance is decreased.
5. Stop temp: Compressor is stopped at 6 °C. The inlet temp of that time is saved.
6. When inlet temp becomes 2°C higher than that of at stop, re-start signal is output and unit is re-started after at least 3 min guard.
7. Control mode after re-start is the same as listed before.

## 4.3. Compressor control

Compressor Control:

1. Starting control
2. Time Guard
3. Sequential starting control
4. Rotation control

☛ Compressor control

### 4.3.1. Starting control

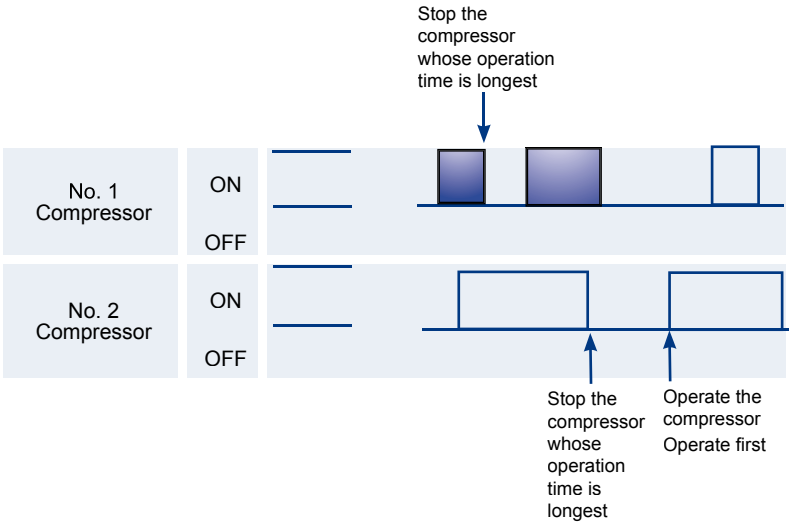
Starting control, Time Guard and Sequential starting control.

These three controls are performed in the control circuit on PCB.

- Y Δ starting control of screw compressor (Y operation lasts 5 seconds), at minimum load. (for 30 seconds)
- Time guard function which limits the frequency of Run/Stop when cooling/ heating load is small (at minimum 3 minutes of stop time to avoid more than 6 ON/OFF in one hour)
- Sequential starting control which reduces the starting current of the unit. (Cycles start sequentially with a 1 minute delay between each one. Finally all work together for 30 seconds before capacity control starts.).

### 4.3.2. Rotation control

Run/Stop order of compressor is modified in each Run/Stop in order to balance the compressors operation time and unit life is prolonged.



## 4.4. Current limit control

Unit has a function to perform automatically forced unload when the power consumption is over a certain set point.

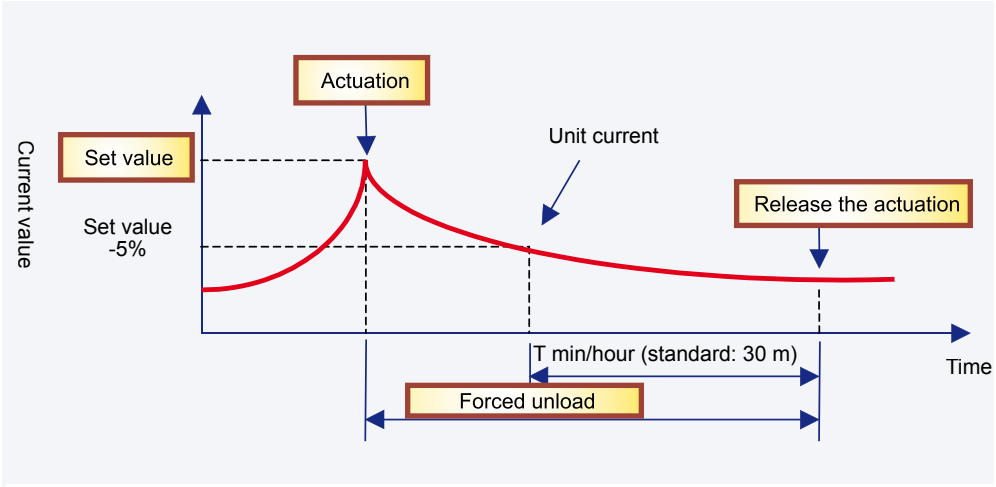
### 4.4.1. Actuation of current limiter

When unit current detected by CT reaches to the setting value, forced unload operation is performed for some minutes to reduce the power capacity load. (See the figure below)

Load is down until actual current value is 95% of setting value, and then load down signal is output for 12 seconds to keep the load.

Current value and forced unload operation time are set on PCBa (current limit setting).

☛ Current limit setting

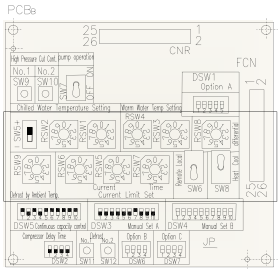


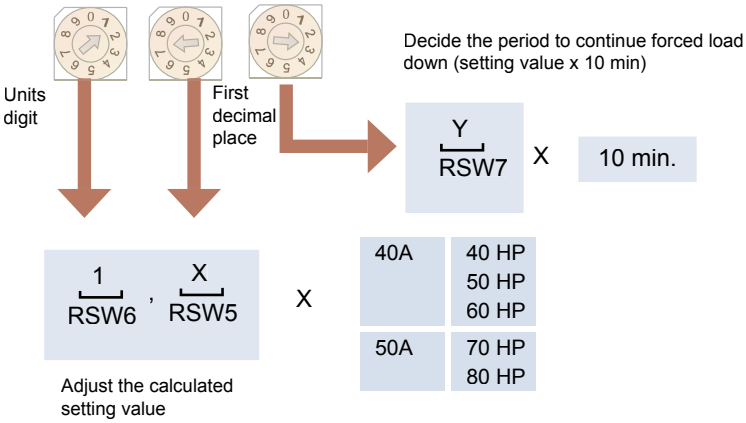

Segment indication
Cooling : [Cn←→CE]
Heating : [Cn←→CE]

### 4.4.2. Standard setting value of unload time

- Current standard setting value of each model is shown in the below figure:

☛ Current limit control




Ejemplo RCUE80AG2

1 RSW6 , 6 RSW5 X 50 = 80 A

Ejemplo RCUE40AG2

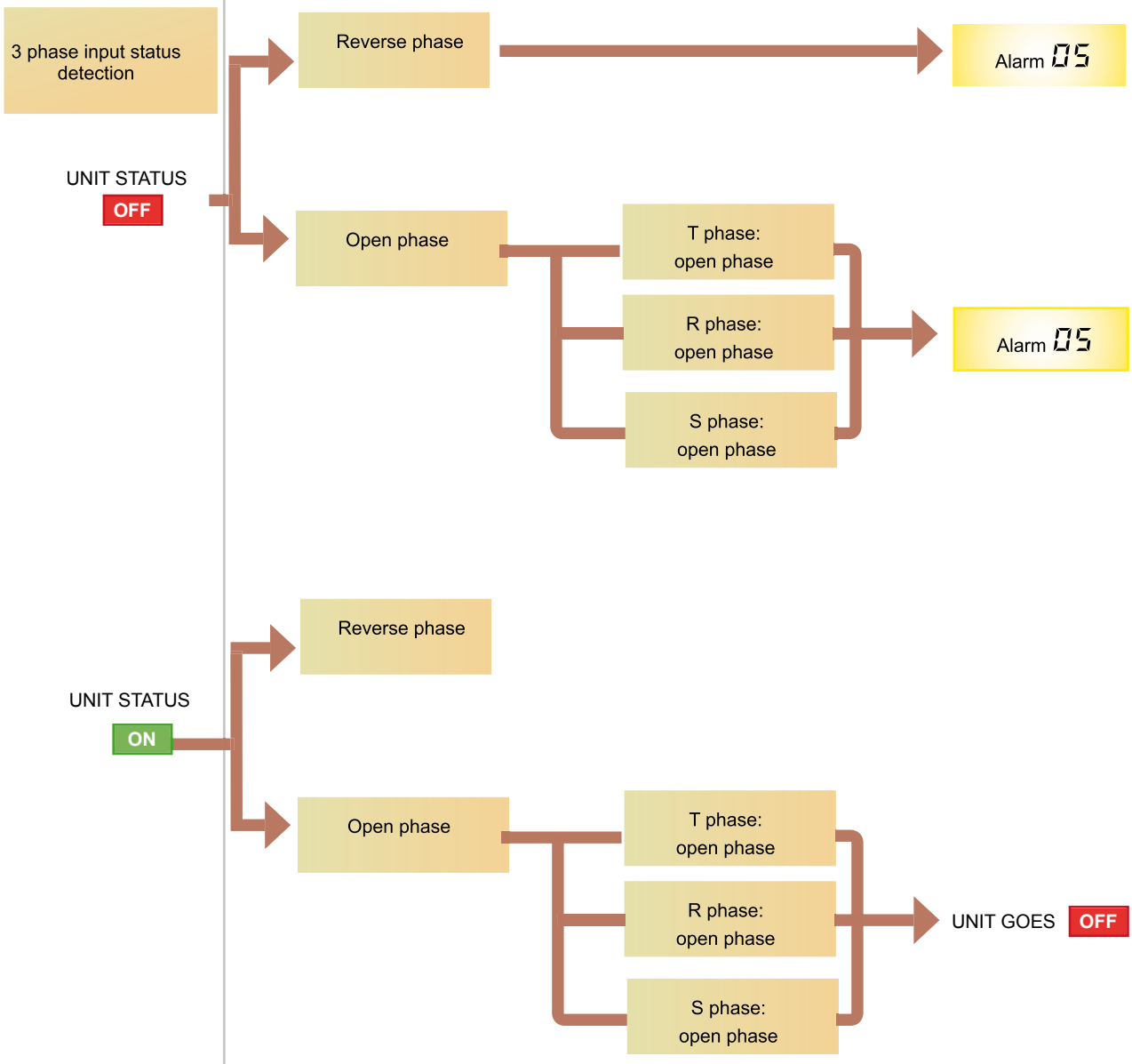
1 RSW6 , 2 RSW5 X 40 = 48 A

☛ Reverse protection control:

## 4.5. Reverse protection control

Screw compressor compresses the refrigerant to a determined pressure by decreasing the space formed by male/female rotor and slide valve. If the rotor revolution direction is reversed, the suction side and discharge side are reversed and the functioning of the compressor will not be correct.

Therefore, 3 phase input status is detected and operation is not performed in case of reverse phase or open phase.



☛ Restart control after power failure:

# 4.6. Restart control after power failure

## 4.6.1. Restart control after momentary power failure (<2 sec)

In momentary power failure, all settings are saved, so after 3 minutes time guard, unit is run automatically with the same operation mode as before the power failure.

*NOTE:*

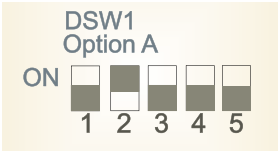
Momentary power failure: Power failure of 13m seconds~2 seconds, below 160V.

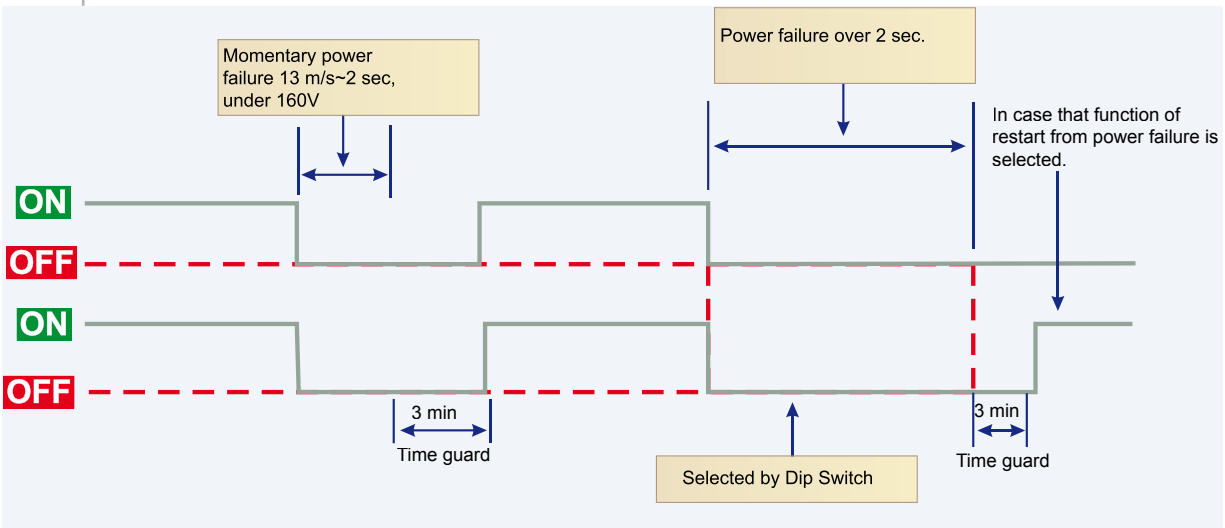
In case of a power failure of over 2 seconds, it is possible to re-start the unit by optional function. If restart function after power failure is not selected, the units are not re-started in spite of ending the power failure. In that case, the units should be started according to the operation start process.

## 4.6.2. Restart function after power failure <Option> (>2 sec)

When this function is valid, even in spite of over 2 seconds power failure, units are run automatically with the same operation mode as before the power failure (after delay time guard).

To be valid this function, DSW1- pin 2 on PCBb shall be ON.




*NOTE:*

In case that power failure occurs during unit stop, the units shall be stopped when power supply returns.

## 4.7. Operation error/wrong setting prevention control [40 – 40]

☛ Operation error/wrong setting prevention control [40-40]:

Alarm is output in the following cases.

1. Operation error
   - While the unit is stopped, there is a input (including external Thermo signal) from the remote controller in spite of local operation mode.
   - However, alarm is not indicated if there is a local input (operation switch of unit body) while the unit is stopped in remote operation mode.
2. Local /Remote operation error
   - To switch local → remote or remote → local while the unit is running, unit is stopped and alarm is output. [40-40]
3. Cooling/Heating operation error
   - To operate heating during cooling or to operation in cooling during heating, unit is stopped and alarm is output. [40-40]
4. Wrong setting of Dip Switch
   - Dip Switch is set wrongly, alarm is indicated at power ON.



☛ Forced capacity control:

## 4.8. Forced capacity control

This is a control to do Thermo OFF forcedly or to be shifted to the desired capacity by a external control.

Since it is possible to change the operation capacity forcedly according to the load, it is very useful if it is needed to control the temperature by a external signal.

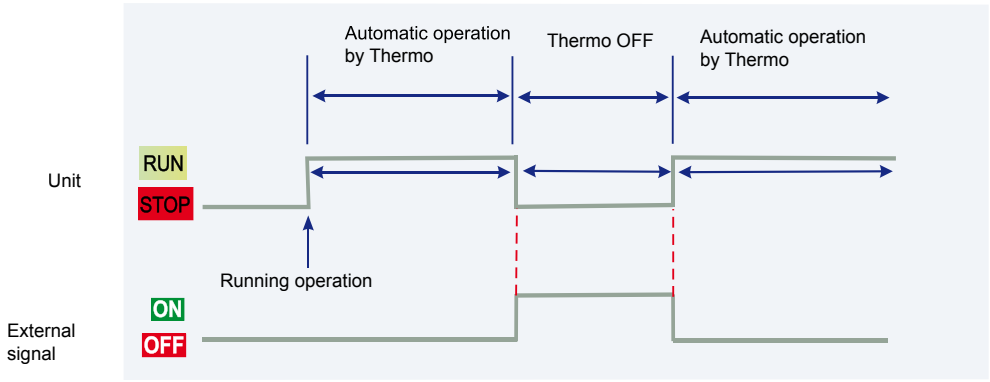
1. Forced Thermo OFF function

a) Contents

In case that it is required to stop a compressor temporally, the order can be given forcedly through the customer wiring terminals. After receiving this signal, compressor shall be Thermo OFF forcedly. When this order is released, normal operation is performed.

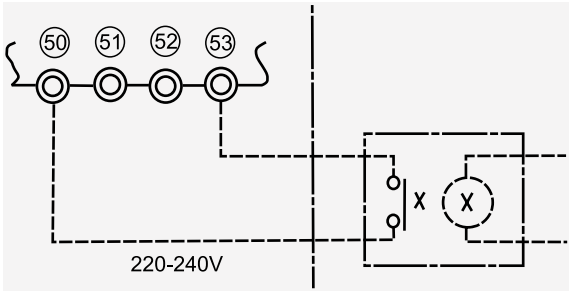
*NOTE:*

This control is individual for each compressor.




b) Wiring method (custormer wiring terminal)

Wire as follows (n: n° of compressor).



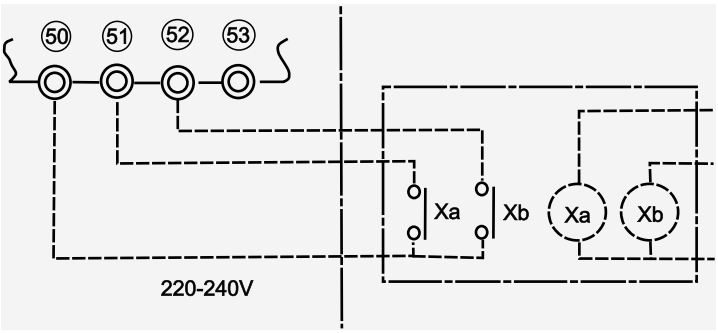
2. Forced capacity control

a) Contents

Compressor operation capacity is set forcedly through customer wiring terminals. Order signal pattern and compressor operation capacity are shown as below.

| | Compressor forced operation capacity | | | Normal operation |
|---|---|---|---|---|
| | HOLD | LOAD DOWN | LOAD UP | |
| Xa | ON | ON | OFF | OFF |
| Xb | ON | OFF | ON | OFF |

b) Wiring method (customer wiring terminal)




----: Customer wiring

☛ Second water temperature setting:

## 4.9. Second water temperature setting

According to the day run / night run or classification of load application, temperature setting can be changed remotely.

Thanks to the two setting temperatures and the two control procedures for water temperature (capacity control and full load or energy storage) these can be combined to have the following possibilities.

1) Air-conditioning (capacity control ) + Air-conditioning (capacity control)

2) Air-conditioning (capacity control) + Heat storage operation (100-0%)

3) Heat storage operation (100-0%) + Heat storage operation (100-0%)

Air-conditioning temperature is set by rotary switch on operation PCB and heat storage temperature is set by using "▲or▼" switch on indication PCB (7 segment).

◆ **Operation mode and setting**

| Operation mode | | Water temp control | Dip Switch setting | Switch: Air-conditioning/ heat storage | Setting water temp | Operation signal |
|---|---|---|---|---|---|---|
| 1) | Air-conditioning | Capacity control | - | Air-conditioning | Rotary Switch | Local / remote |
| | Air-conditioning | Capacity control | - | heat storage | Segment | Local / remote |
| 2) | Air-conditioning | Capacity control | External Thermo | Air-conditioning | Rotary Switch | Local / remote |
| | Heat storage | 100-0% | External Thermo | heat storage | Segment | External Thermo |
| 3) | Heat storage | 100-0% | External Thermo | Air-conditioning | Rotary Switch | External Thermo |
| | Heat storage | 100-0% | External Thermo | heat storage | Segment | External Thermo |

1. Air-conditioning operation 1 (capacity control) + Air-conditioning operation 2 (capacity control)

   The below example: chilled water outlet temperature 7°C and chilled water outlet temperature 10°C in cooling.

   ◈ Running operation:

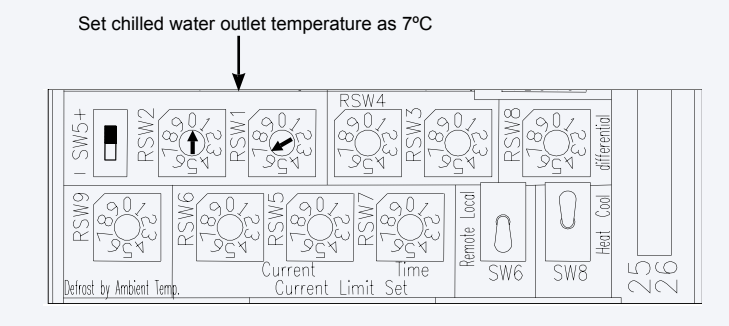
   – Run/Stop signal is received from local or remote.

   a) Dip Switch Setting

      It is not necessary. Set it as factory default.

   b) Setting of air-conditioning temperature 1

      Set chilled water outlet temperature as 7°C.

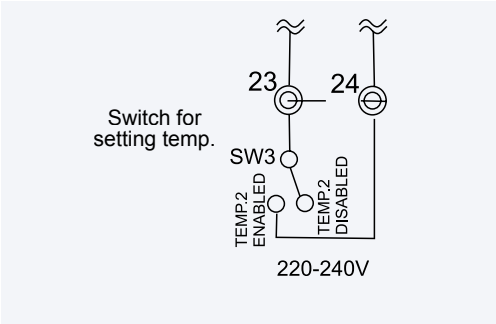



   c) Setting of air-conditioning temperature 2

      Set chilled water outlet temperature as 10°C using "▲or▼" switch on indication PCB. (see item (4) for the setting method)

   d) Wiring for switch

      Wire as the below figure. Terminal No.23-24 wiring makes 2nd setting temperature valid.




2. Air-conditioning operation (capacity control) + heat storage operation (100-0%)

   The below example: chilled water outlet temperature 7°C (capacity control) in cooling and chilled water outlet temperature 10°C in heat storage.

   ◈ Running operation:

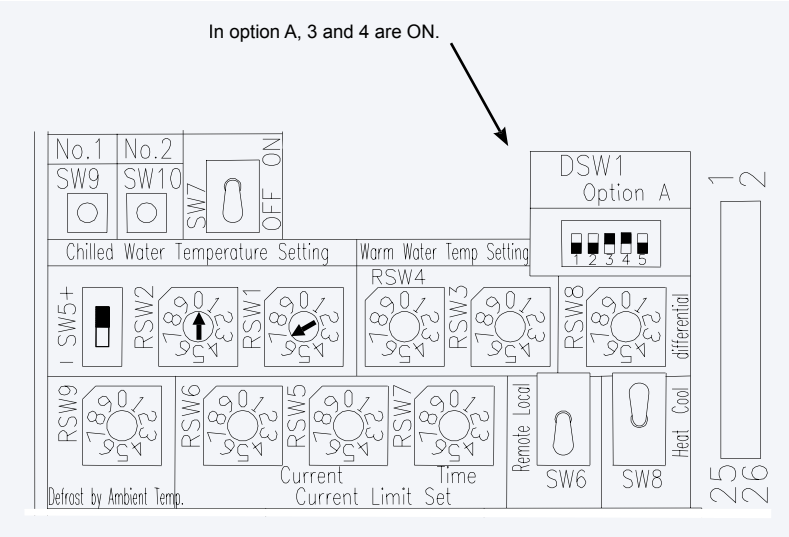
   – Run/Stop signal: Local or remote (cooling), external Thermo (heat storage)

   – Water temperature is set by air-conditioning / heat storage switch. Air-conditioning / heat storage = Air-conditioning setting water temperature / heat storage setting water temperature.

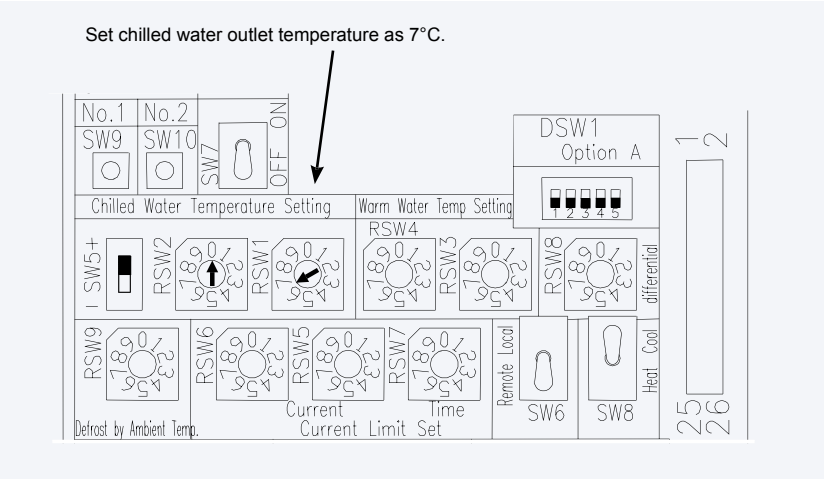
- In case that operation signal is input in local at heat storage operation, capacity control operation is performed.

a) Dip Switch Setting

In option A, 3 and 4 are ON.




b) Setting of operation PCB of unit body (setting of air-conditioning temperature)

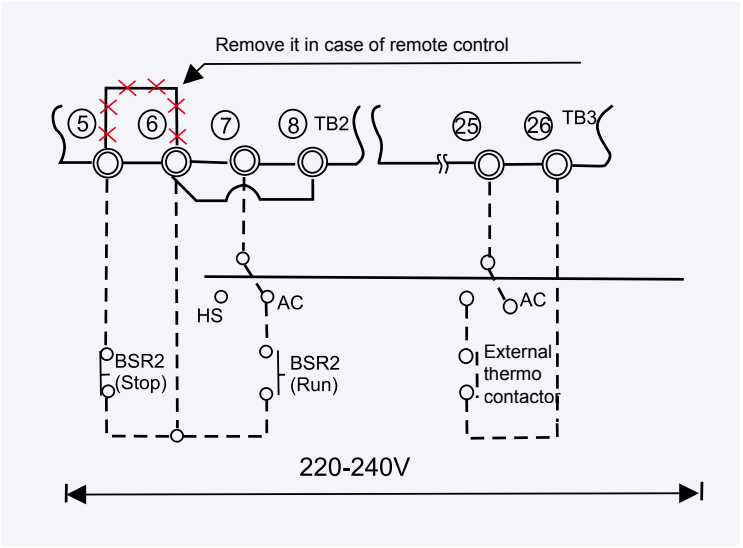



c) Temperature setting by indication PCB

Set chilled water outlet temperature as 10°C using "▲or▼" switch on indication PCB.

d) Wiring for the switch and external Thermo contact input

Wire as follows.




NOTE:

AC: Air-conditioning
HS: Heat Storage

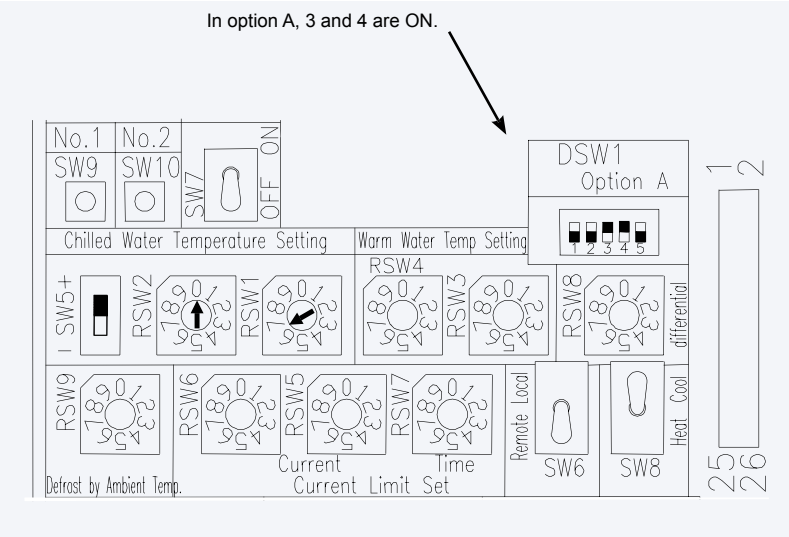
3. Heat storage operation 1 (100-0%)+ heat storage operation 2 (100-0%)

   The below example: chilled water outlet temperature 7°C and chilled water outlet temperature 10°C in cooling.

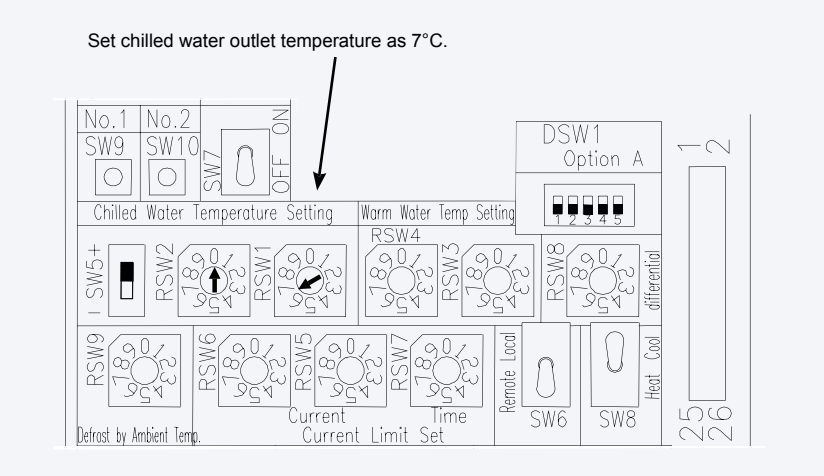
   ◈ Running operation

   - Run/Stop signal is received from external Thermo contact.
   - Water temperature is set by the switch to set the temperature.
   - If operation signal is input in local, capacity control operation is performed. Do not connect the wiring for remote operation.

   a) Dip Switch Setting




   b) Setting of operation PCB of unit body (setting of air-conditioning temperature)

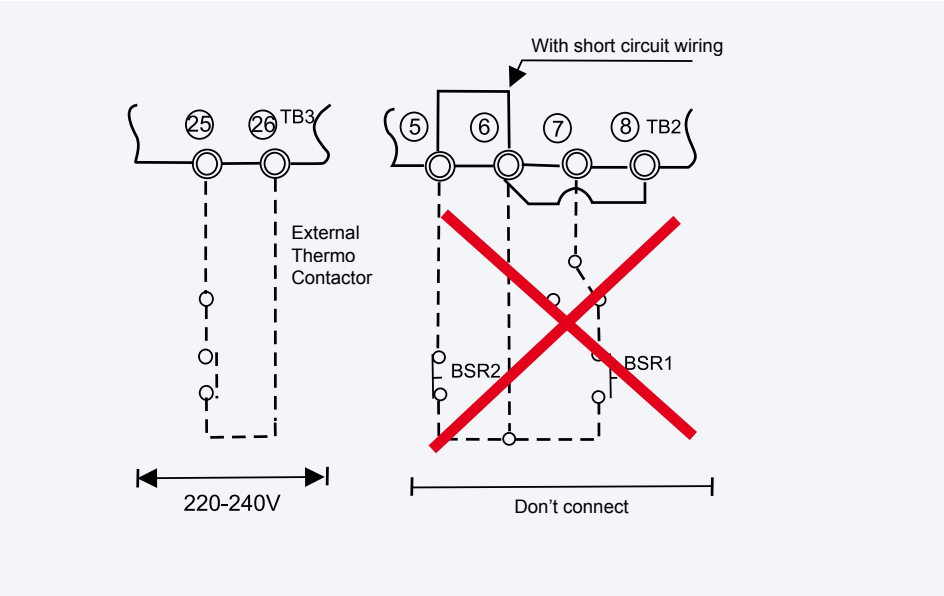



   c) Temperature setting by indication PCB

      Set chilled water outlet temperature as 10°C using "▲or▼" switch on indication PCB.

d) Wiring for the switch and external Thermo contact input

Wire as follows.




*NOTE:*

AC: Air-conditioning
HS: Heat Storage

4. Setting method of second temperature

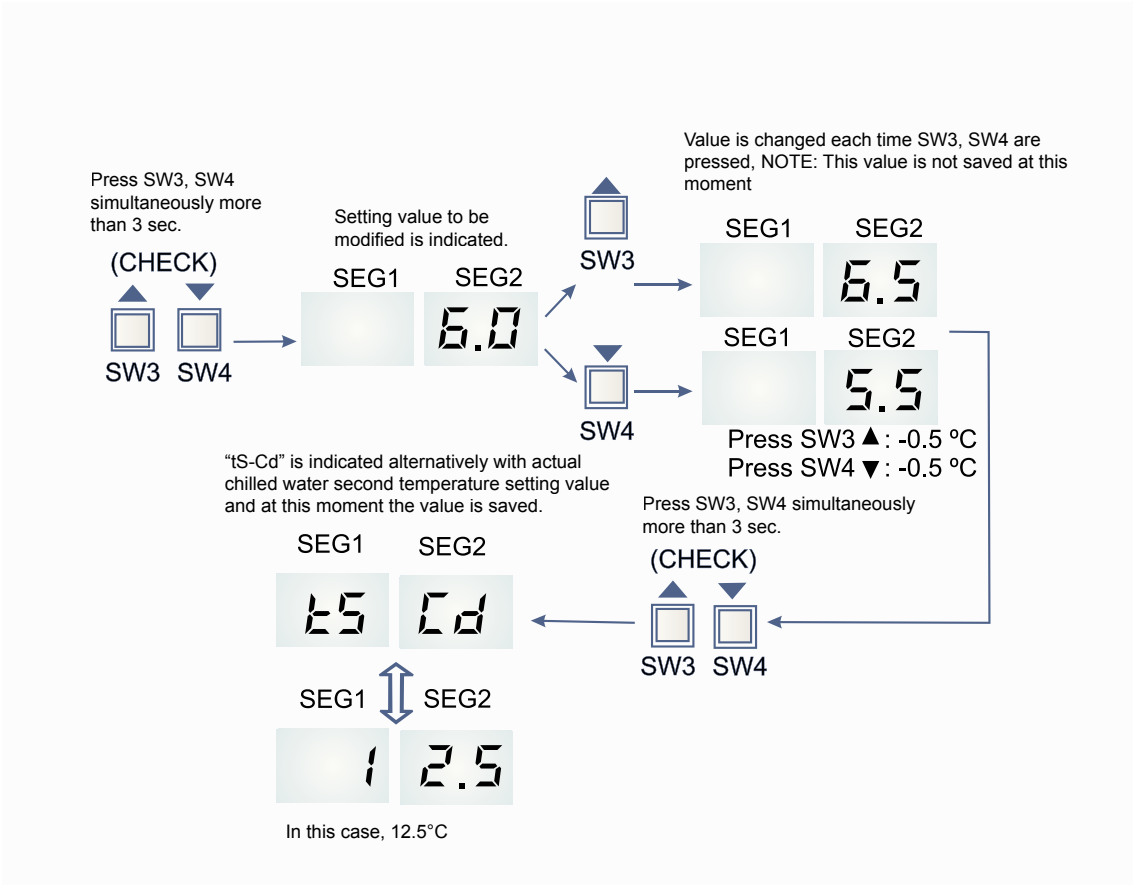
Second temperature setting mode is set by pressing "▼" switch for more then 3 sec. on indication PCB with Unit power ON. By pressing "▲or▼" switch during this mode, each second temperature of chilled water temperature and warm water temperature is set.

◈ Second temperature set mode

- Press "▼" switch on normal display on 7 segment more than 3 seconds with Unit power ON. Indication of the segment is changed to "tS-Cd" and it is indicated alternatively with actual chilled water second temperature setting value.
- With this status, by pressing "▲or▼" switch, indication of the segment is changed to "tS-Hd" and it is indicated alternatively with actual warm water second temperature setting value (heat pump units).
- And, by pressing "▼" switch on indication PCB more than 3 seconds, we return to normal indication display.

◈ Temperature setting method

The following operation is performed from the status of chilled water second temperature setting value or warm water second temperature setting value. Here, the example of chilled water second temperature setting is shown.



## 4.10. Heat storage operation by external order

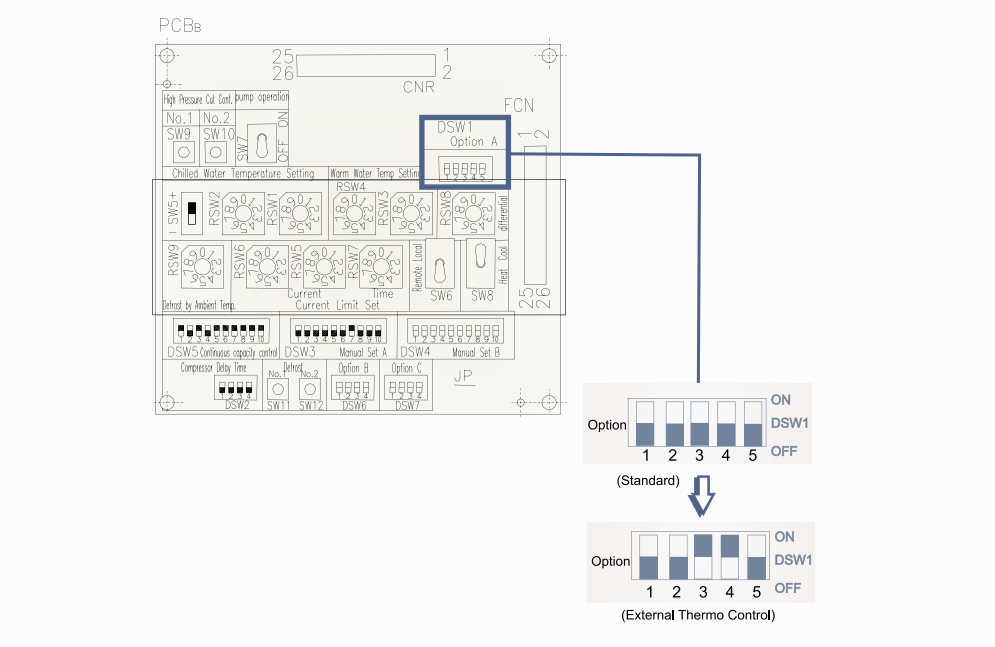
☛ Heat storage operation by external order:

1. Operation control

   It is a control that runs unit by External Thermostat order. It forces unit to work at full load with no capacity control. (It is valid only at remote setting)

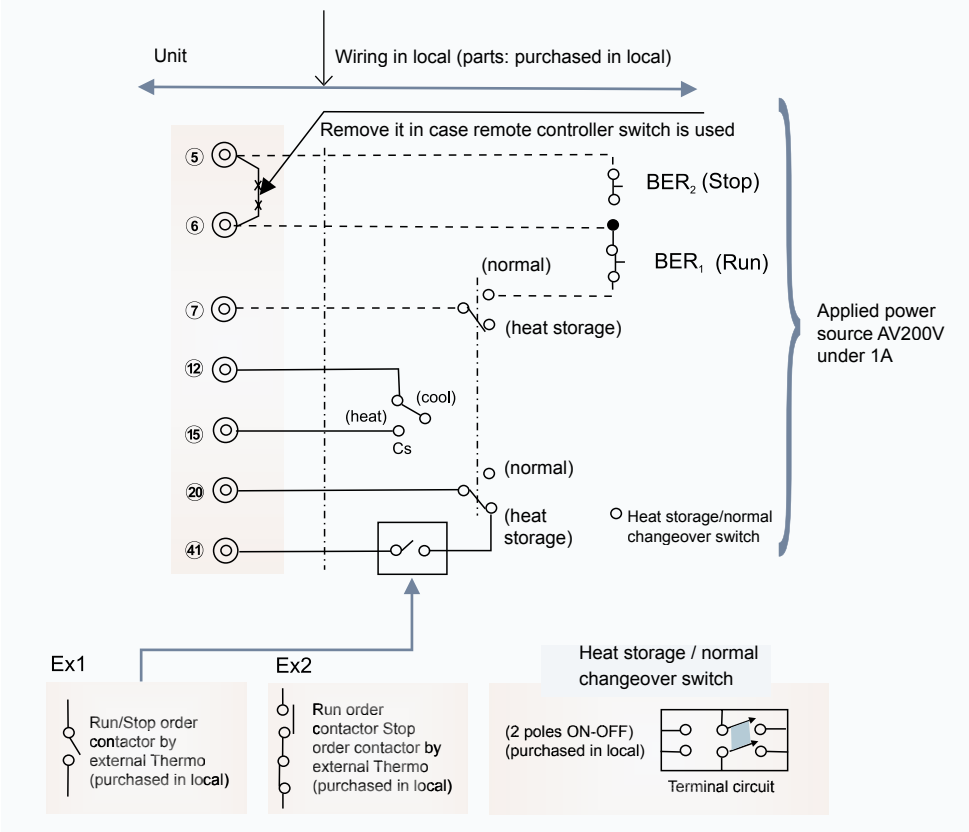
2. Setting method

   a) Dip Switch (DSW1) on the $PCB_B$ is set as follows before power ON.




   b) Connection to external Thermo

   - Connection to Chiller unit is as follows.
   - Connect with terminal No. 40, 41 of TB3 within the electrical box.




(*) In case of only heat storage operation, wiring of (– – –) part is not necessary

*ATTENTION:*

- Dip Switch for this control should be set before power ON.
- Local external Thermo does not run/stop by pulse signal order.
- Normal operation order and heat storage operation order shall be input to Chiller unit separately.
- Local external Thermo order shall have at minimum 5 minutes interval of continuous operation order (5 min in case of stop).
- Additional wiring shall be put into a metal pipe independently, or shield line shall be used.
- During control by external Thermo, Chiller unit stops when water temperature reaches to the setting value of Chiller unit, and automatically starts again. Therefore, set the temperature in external Thermo higher than that of chiller unit.
- If Thermo setting value of body side is set “higher” at cooling and “lower” at heating, unit is stopped earlier than the stop order from external Thermo.
- Switch normal / heat storage operation during unit stop.



## 4.11. Operation by DC24V input (Remote Control)

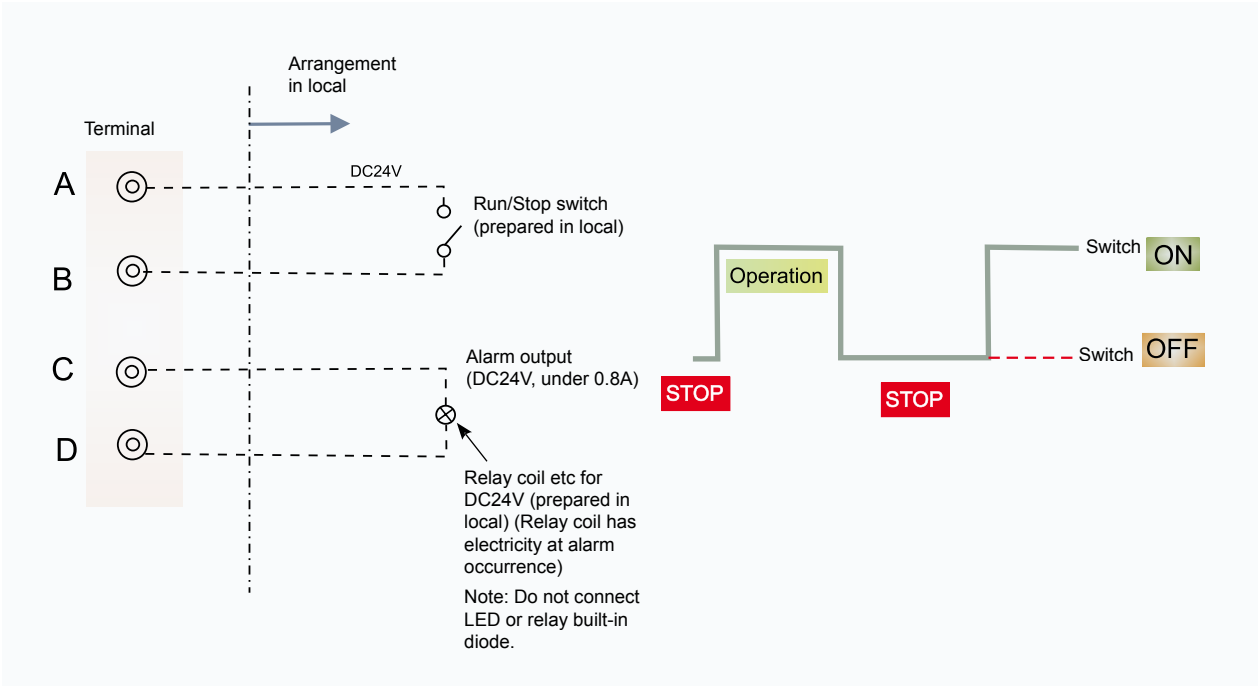
1. Outline

Operation control by DC24V is explained here.

- Operation signal pattern: 1. Level input, 2. 1 pulse input, 3. 2 pulse input.
- Set as follows and perform additional wiring in each 3 cases.
- This control is not compatible with other remote Run/Stop order.

2. Level input

a) Signal and basic sequence



b) Setting method

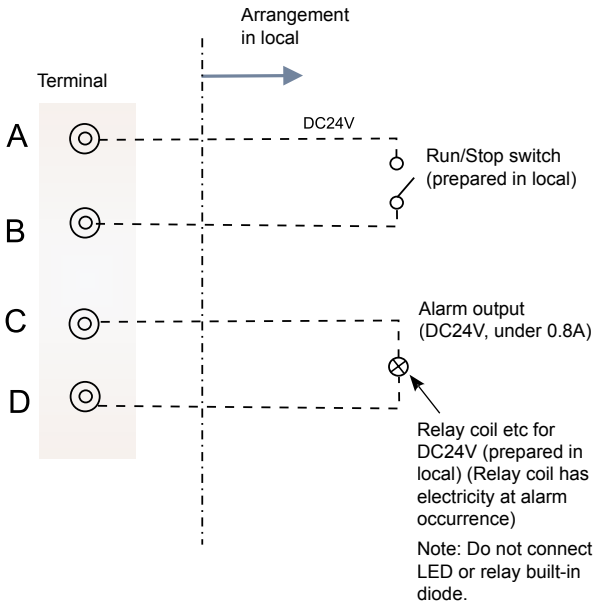
Dip Switch for optional function setting on $PCB_B$ is set as follows before power ON.

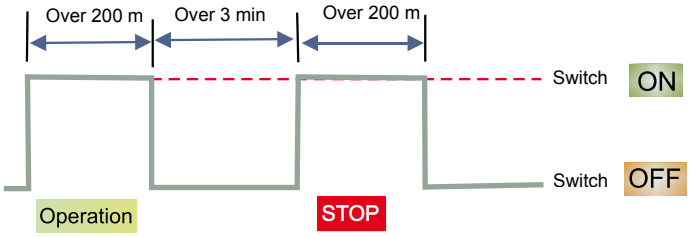

*ATTENTION:*

- Additional wiring should not be connected to other operation circuit, especially wiring for 220-240V.
- Additional wiring shall be put into a metal pipe independently or shield line shall be used.

3. Pulse input (I)

a) Signal and basic sequence




b) Setting method

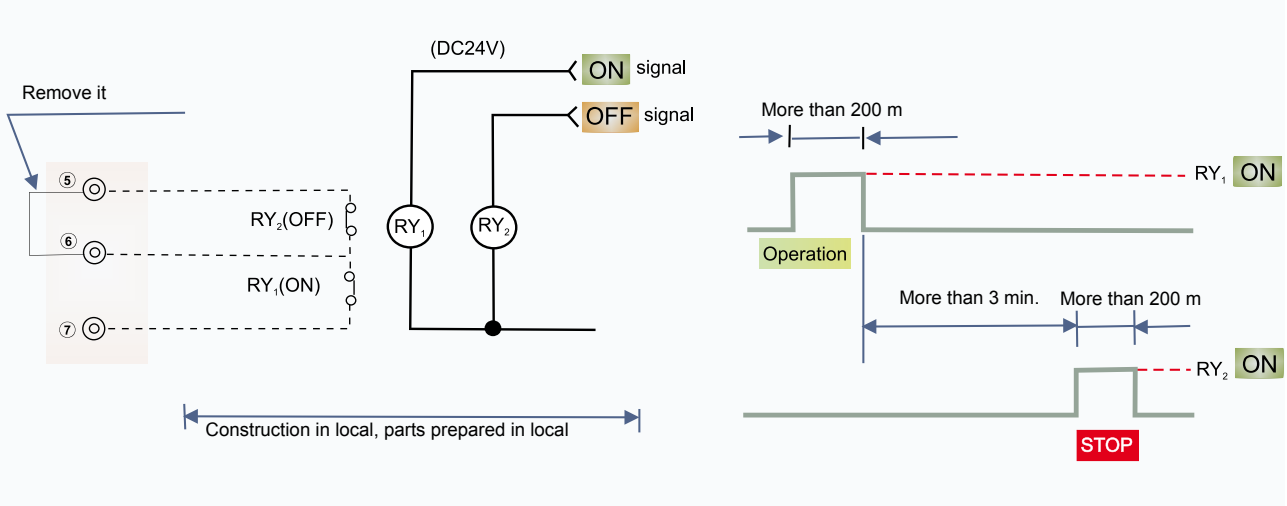
Dip Switch for optional function setting on PCBB is set as follows before power ON.


*ATTENTION:*

- Additional wiring should not be connected to other operation circuit, especially wiring for 220-240V.
- Additional wiring shall be put into a metal pipe independently or shield line shall be used.

4. Pulse input (II)

a) Signal and basic sequence




b) Setting method

It is an application of remote control and it is unnecessary to modify the setting of PCB.

*ATTENTION:*

- Additional wiring should not be connected to other operation circuit, especially wiring for 220-240V.
- Additional wiring shall be put into a metal pipe independently or shield line shall be used.

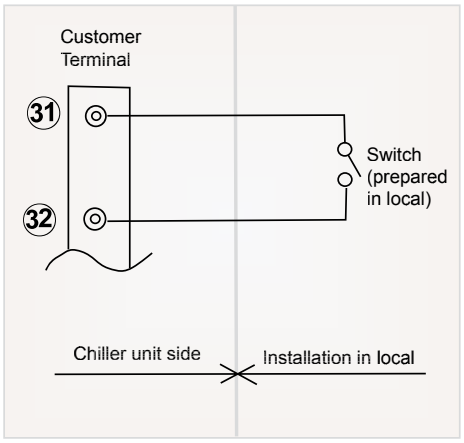
## 4.12. Installation of switch for snow measure (Fan manual operation)

☛ Installation of switch for snow measureHeat storage operation by external order:

If a switch for snow measure is installed, it is connected to terminal #31 and #32 in customer wiring terminals. When the switch is ON, fan is operated during unit stop or Thermo OFF.

However, the fan is not operated in the following cases:

- When local is set
- During alarm occurrence
- When the switch has been ON before power ON (including power failure)
- Fan manual operation is stopped by the stop switch of unit body




⚠ *ATTENTION:*

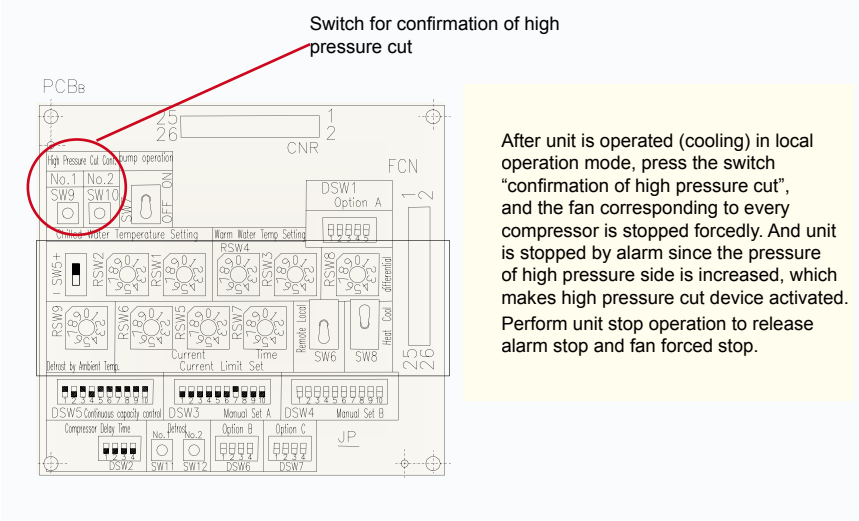
- It is possible to insert a automatic contactor like a snow relay in this switch part.
- This switch can be used only at remote control. Pay attention to it at Unit check.
- Once the fan is started-up by this switch, fan continues running at least for 10 minutes if it is not stopped by the switch during this period. (In case of emergency, stop the fan by the stop switch of unit)
- This switch is locally purchased.

## 4.13. Switch for confirmation of high pressure cut

☛ Switch for confirmation of high pressure cut

Switching to this test mode makes easy to confirm if the device for cutting high pressure is activated.

◈ Operation method




After unit is operated (cooling) in local operation mode, press the switch "confirmation of high pressure cut", and the fan corresponding to every compressor is stopped forcedly. And unit is stopped by alarm since the pressure of high pressure side is increased, which makes high pressure cut device activated.
Perform unit stop operation to release alarm stop and fan forced stop.

– To Stop/Start all fans of each cycle follow the below table:

☛ PCBa1

| PCBa1 | SW9 | SW10 |
|---|---|---|
| Cycle 1 | ● | |
| Cycle 2 | | ● |
| Cycle 3 | ● | ● |

☛ PCBa2

| PCBa2 | SW9 | SW10 |
|---|---|---|
| Cycle 4 | ● | |
| Cycle 5 | | ● |

## 4.14 Antifreeze control in winter

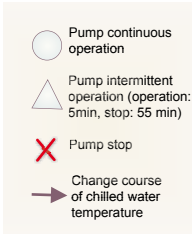
It happens sometimes that chilled water temperature is decreased so much that heat exchanger of water side or piping system are frozen during operation stop in winter. This control prevents Chiller unit from freezing by operating chilled and warm water circulation pump automatically after detecting ambient and chilled water temperature.

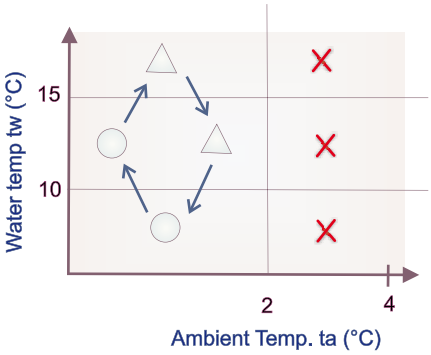
1. Ambient temperature is below 2°C

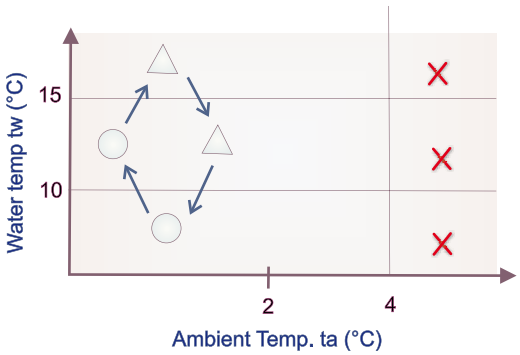
   When ambient temperature is below 2°C, operation order is sent to pump and continuos operation of chilled water circulation pump is started automatically. When chilled water is over 15°C, intermittent operation (5 min of operation and 55 min of stop) is performed.

2. Automatic release of antifreeze control

   This operation is released only when ambient temperature is over 4°C.




*ATTENTION:*

In case that ambient temperature of chilled/warm water circulation system is lower than that of the Unit installation place, Thermostat for ambient temperature shall be introduced in the place with the lowest temperature and shall be connected to pump operation order circuit in parallel.

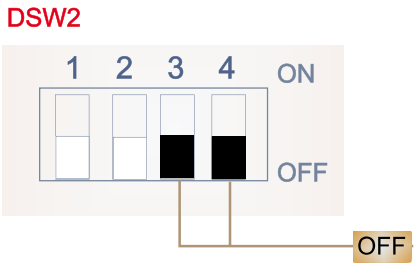
## 4.15. Saving energy priority mode, silence priority mode (night shift), only cooling

Saving energy priority mode, silence priority mode (night shift), only cooling.

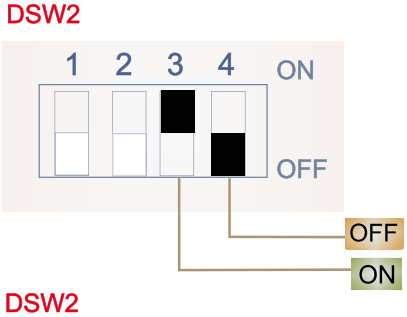
It is possible to select 3 types of fan control depending on the installation place or use applications

**PCBb**

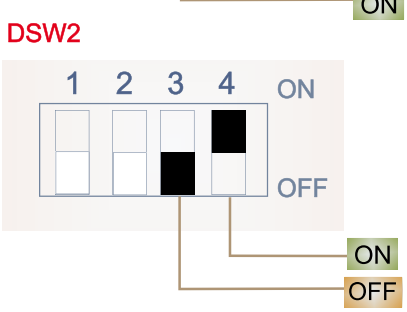
1. Standard mode
   - Fan control (revolution number control) suitable to ambient temperature.
   - Good balance from the view of saving energy and silence.



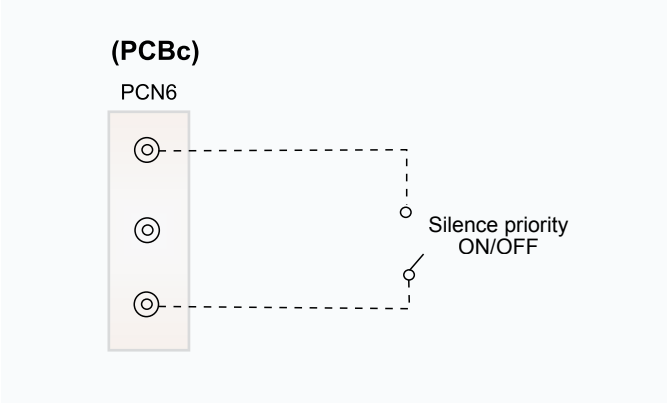

2. Saving energy priority mode
   - Fan control (revolution number control) tries to keep discharge pressure as low as possible at night or during midterm period.
   - Saving energy has the priority to silence.



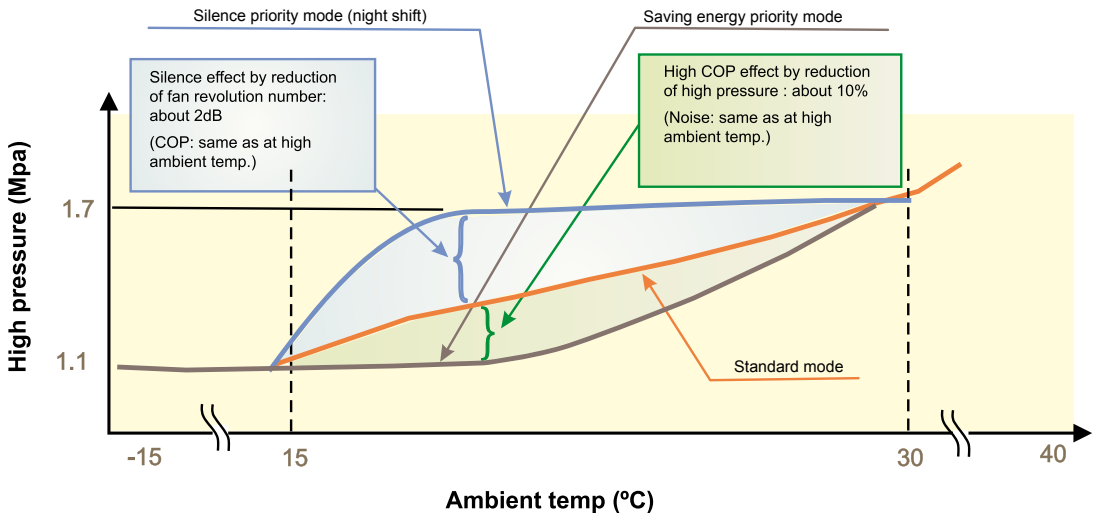

3. Silence priority mode (night shift)
   - Smaller revolution number for silence purpose at night or during midterm period.
   - Little fan noise mode.



Silence priority mode is valid by a no-voltage contactor input in Dip Switch setting of Standard mode or Saving energy priority mode, therefore, such changeover as saving energy mode in daytime and silence priority mode at night can be performed from remote controller.






*NOTE:*

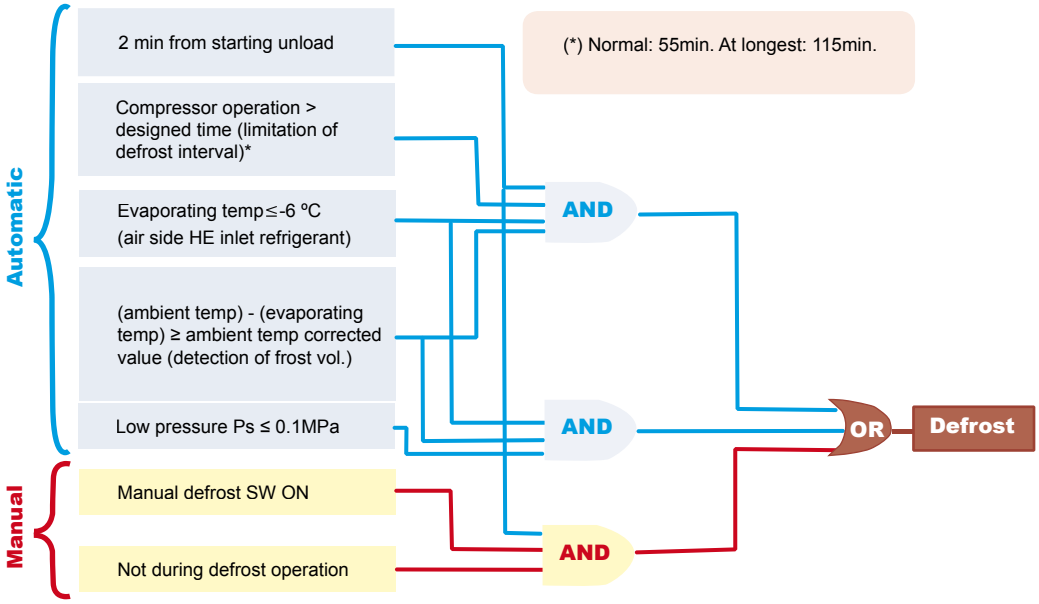
The above figure is an image, and the real effect differs from temperature condition.

☛ Defrost (only air-cooled heat pump type)

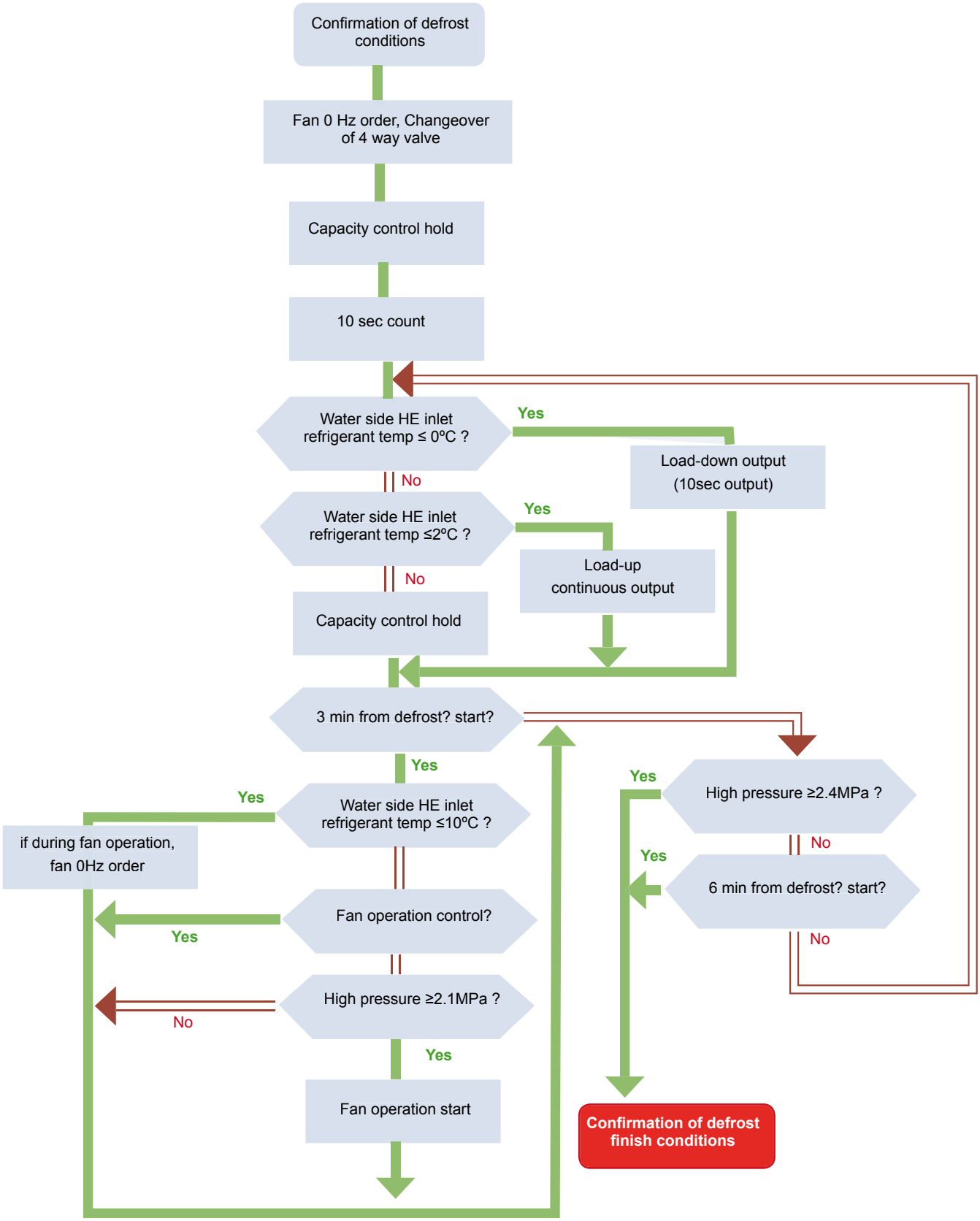
## 4.16. Defrost (only air-cooled heat pump type)

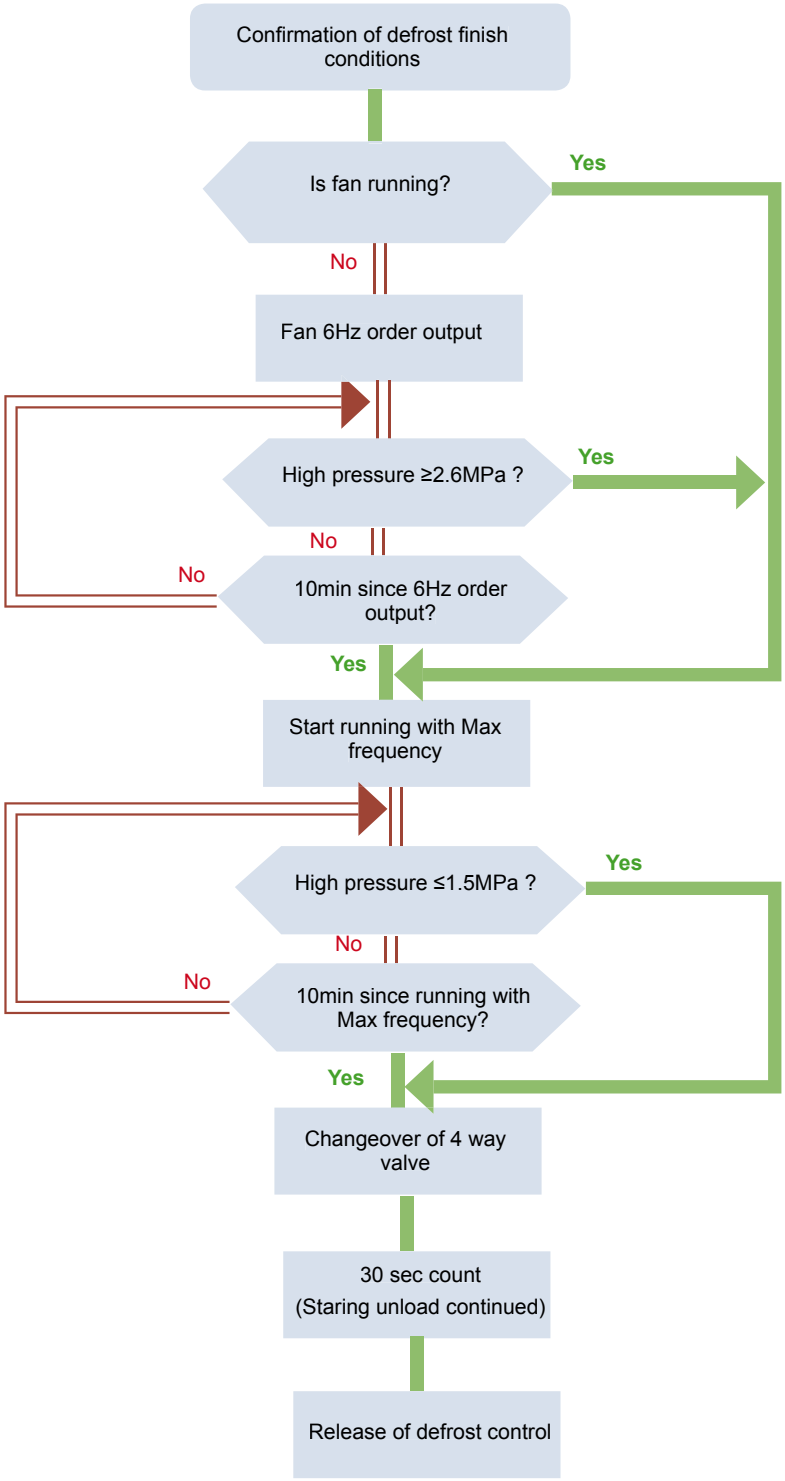
Ambient temperature, evaporating temperature and evaporating pressure are detected during heat operation to detect the frost volume. By the changeover of 4 way valve, reverse-cycle defrosting is performed.

◈ Defrosting start conditions




- Defrosting is performed for 6 minutes at longest. (automatic stop when all frost is taken out).
- In case that all frost is taken out very quickly, the period till next frost is extended automatically in order to avoid too much defrost.
- Warm water outlet temperature is lower than inlet temperature due to the reverse cycle defrost.


Confirmation of defrost conditions
Fan 0 Hz order, Changeover of 4 way valve
Capacity control hold
10 sec count
Water side HE inlet refrigerant temp ≤ 0°C ?
Yes
Load-down output (10sec output)
No
Water side HE inlet refrigerant temp ≤2°C ?
Yes
Load-up continuous output
No
Capacity control hold
3 min from defrost? start?
Yes
Water side HE inlet refrigerant temp ≤10°C ?
Yes
if during fan operation, fan 0Hz order
Fan operation control?
Yes
High pressure ≥2.1MPa ?
No
Yes
Fan operation start
High pressure ≥2.4MPa ?
Yes
No
6 min from defrost? start?
Yes
No
Confirmation of defrost finish conditions


Confirmation of defrost finish conditions
Is fan running?
Yes
No
Fan 6Hz order output
High pressure ≥2.6MPa ?
Yes
No
No
10min since 6Hz order output?
Yes
Start running with Max frequency
High pressure ≤1.5MPa ?
Yes
No
No
10min since running with Max frequency?
Yes
Changeover of 4 way valve
30 sec count
(Staring unload continued)
Release of defrost control

☛ Thermo off selection function

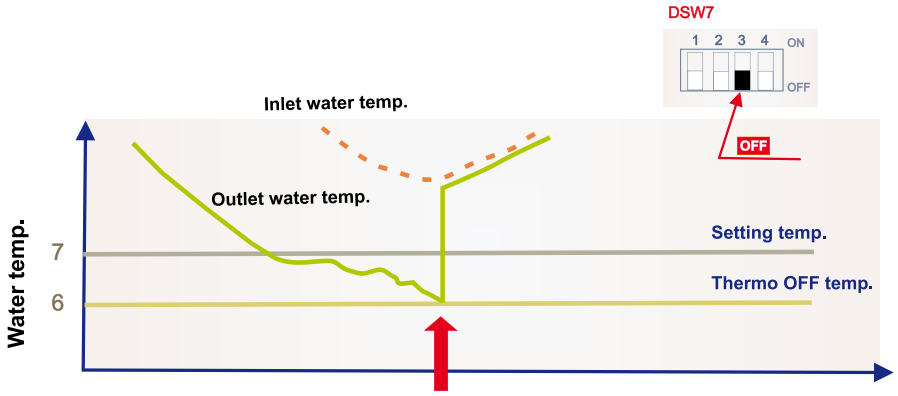
## 4.17. Thermo off selection function

It is a function to prevent the Chiller unit from going Thermo OFF due to a sudden change of temperature or flow volume (inverter water pumps). It is possible to select it by DSW7-pin 3 on operation PCB. Standard is set at delivery.

1. Standard setting

**PCBc**

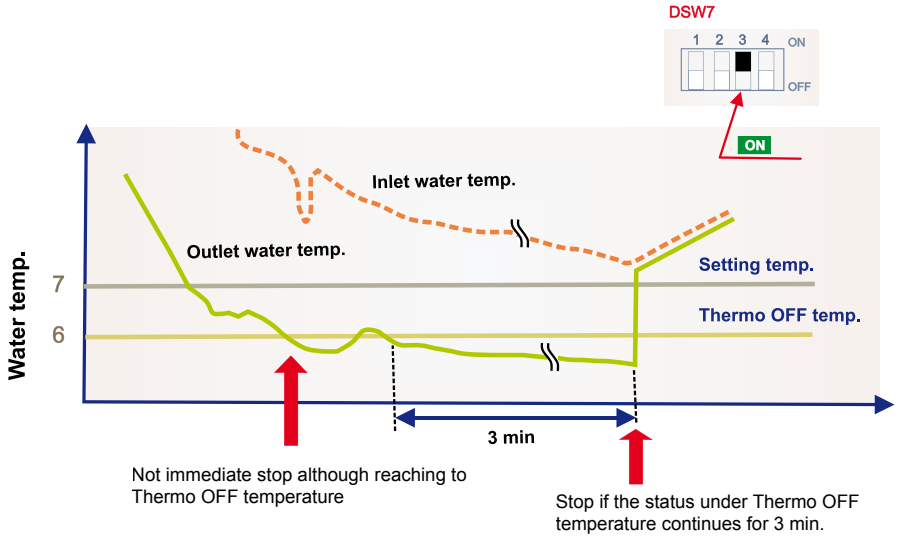
☛ Standard setting




Immediate stop when reaching to Themo OFF temp

2. Setting to continue Thermo OFF temperature for a certain period

☛ Setting to continue Thermo OFF temperature




Not immediate stop although reaching to Thermo OFF temperature

Stop if the status under Thermo OFF temperature continues for 3 min.

*NOTE:*

However, it becomes Thermo OFF immediately once outlet water temperature is decreased until protection values

4

### 4.17.1 Fan Control

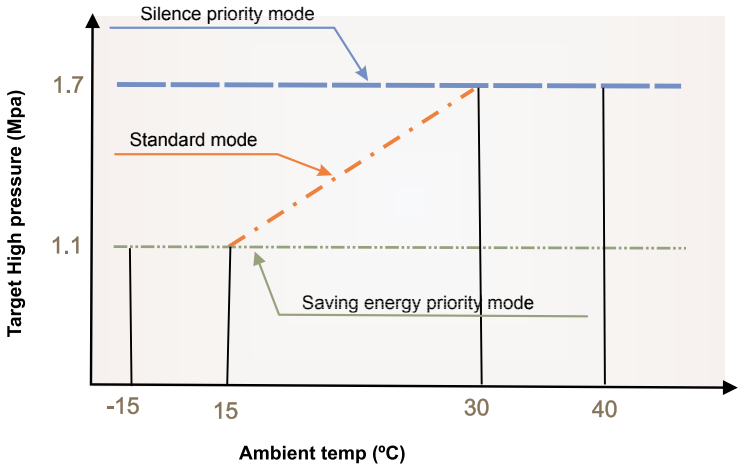
1. Cooling operation

In this series, fan speed is controlled by inverters and adjusts depending on discharge pressure. Target high pressure is set based on the ambient temperature, and revolution number is increased / decreased by PID control. The unit number is not changed.

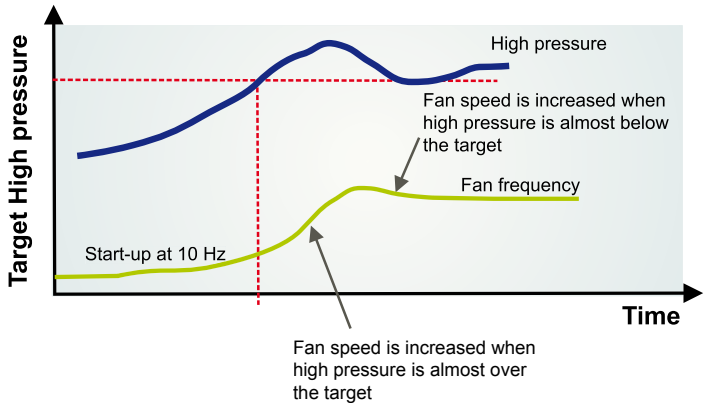
Inverter output Max Frequency

Max Frequency: 66

Min Frequency: 10




☛ Fan control imaged figure




- Recalculation of fan speed is done every 10 sec.
- Calculation is not performed when high pressure target value is within ±0.1MPa.
- The following control is performed in case of sudden change.

| Prevention of high pressure excess increase |
|---|
| ➤ Discharge pressure ≥ 2.2MPa ⟶ out put +10Hz<br>➤ Discharge pressure ≥ 2.5 MPa ⟶ out put max. frequency |

| Prevention of high pressure excess decrease |
|---|
| ➤ Discharge pressure ≤ 0.9 MPa ⟶ out put -10Hz<br>➤ Discharge pressure ≤ 0.8 MPa ⟶ out put min. frequency |

2. Heating operation

Basically unit is operated with Max frequency, but under the following conditions revolution number control is performed.

| Prevention of low pressure excess increase |
|---|
| Fan speed control is activated if “suction pressure ≥ 0.6 MPa” and “ambient temperature ≥ 25ºC”<br>*Released at ambient temperature ≤ 20 °C |

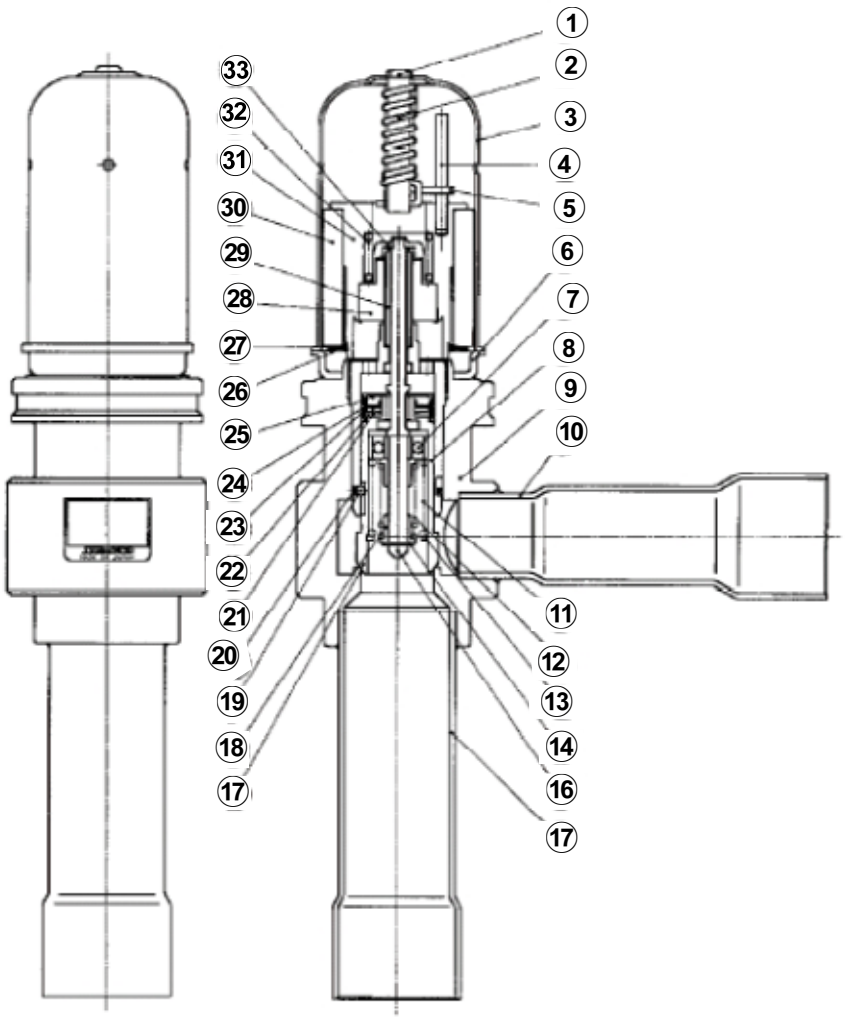
### 4.17.2 Electronic expansion valve

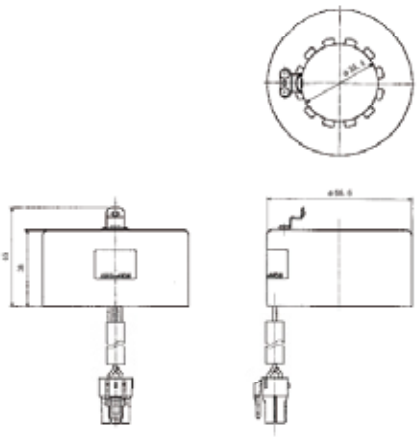
Model of expansion valve

Model: MKV-1610D-Q5

Refrigerant: R407C

Parts No.: C4340



| Nº | Name | Qty. | Material |
|---|---|---|---|
| 1 | Stem | 1 | SUS303 |
| 2 | Guide | 1 | SUS304 |
| 3 | Case | 1 | SUS305 |
| 4 | Spring Pin | 1 | SUS420 |
| 5 | Slider | 1 | SUS304 |
| 6 | Under cover | 1 | SUS304 |
| 7 | Bear ring | 1 | SUS440C |
| 8 | Guide | 1 | C3771 |
| 9 | Body | 1 | C3771 |
| 10 | Copper union (side) | 1 | C1220 |
| 11 | Coil spring A | 1 | SUS304 |
| 12 | Coil spring B | 1 | SUS304 |
| 13 | Snap ring B | 1 | S65CM |
| 14 | Snap Ring C | 1 | SUS304 |
| 15 | Connection lot | 1 | SUS303 |
| 16 | Copper union (under) | 1 | C1220 |
| 17 | Needle | 1 | SUS303 |
| 18 | Collar | 2 | C3604 |
| 19 | Ball | 1 | SUS440C |
| 20 | Ring spring | 1 | SUS304 |
| 21 | Disk spring | 1 | SUS304 |
| 22 | Leaf spring tray | 1 | C3604 |
| 23 | Leaf spring | 2 | SUS304 |
| 24 | Piston | 2 | PTFE |
| 25 | Piston cylinder | 1 | SUS303 |
| 26 | Snap Ring A | 1 | SK-5M |
| 27 | Wave spring washer | 2 | S65M |
| 28 | Female | 1 | Cu alloy |
| 29 | Male | 1 | SUS303 |
| 30 | Magnet | 1 | Ferrite |
| 31 | Connection fitting | 1 | A6D61 |
| 32 | Coil spring C | 1 | SUS304 |
| 33 | Fixing bracket | 1 | SUS303 |

In this series, electronic expansion valve is used. Electronic expansion valve is consisted in the body (figure), Coil, and PCB for expansion valve running ($PCB_G$ (VD PCB)).

1. The range of opening of expansion valve

   The opening of expansion valve is managed by pulse number. The range is 116~656 pulse. During stop, it is stand-by with 10 pulse.

2. PCB for expansion valve running

   $PCB_G$ (VD PCB) is used. The pulse number of the opening of expansion valve is indicated in the segment on VD PCB.

3. Zero point adjustment

   Zero point is adjusted by initialization at power ON. The order of opening of expansion valve is closed fully (less than 0 pulse) and both control pulse number recognized in micro computer and real pulse number are adjusted to zero. During this adjustment, “Cn-Eo” is indicated in the segment. (n= Unit No.)

   Zero point adjustment is also performed “ at the first compressor stop after 24 hours since the last zero point adjustment”., to modify the error between control pulse number and real pulse number. If compressore has not stopped for over 200 hours, compressor is to be stopped forcedly (forced Thermo OFF) and zero point is adjusted. Then, unit is re-started after 3 minutes guards. It is possible to cancel this forced zero point adjustment by Dip Switch selection on expansión valve PCB.

4. During normal operation

   Temperature of compressor suction gas superheat is calculated from the temperature detected by Thermistor of compressor suction refrigerant gas and the pressure detected by the sensor for suction pressure, and the opening is determined by calculation value to reach target superheat. (Control cycle: 28 seconds)

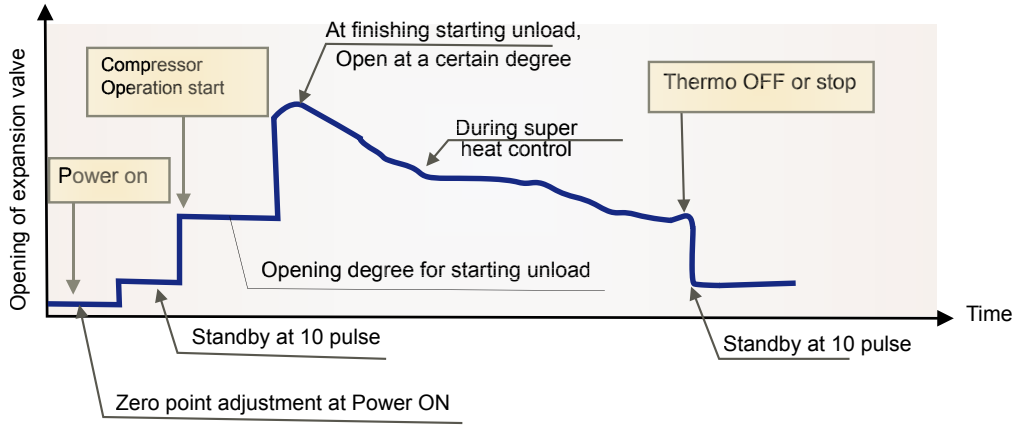
5. Prevention control for discharge refrigerant gas overheat

   When discharge gas refrigerant temperature is over 100°C, expansion valve is opened forcedly and excess increase of discharge gas refrigerant temperature is prevented. (Td control).

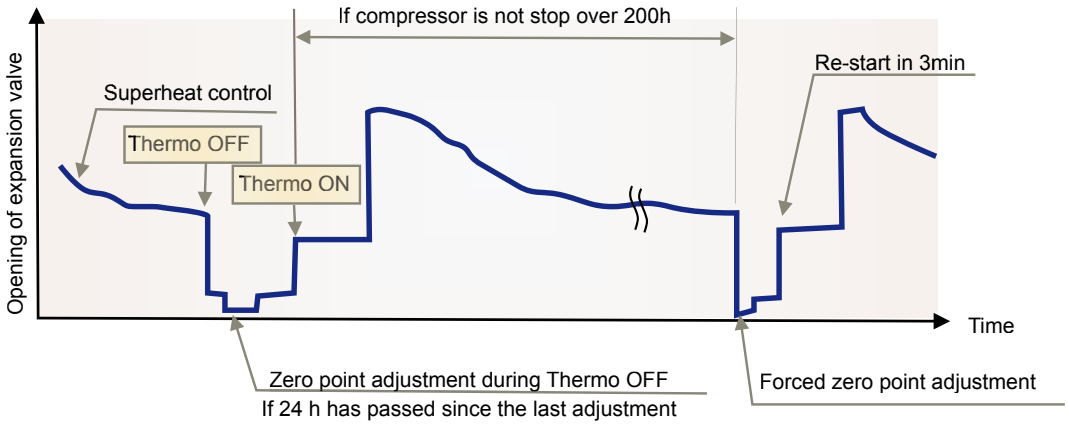
6. Prevention control for freezing

If it is detected that refrigerant inlet temperature of water side heat exchanger is decreased, expansion valve shall be open so that decrease of refrigerant temperature is prevented, which leads to anti-freeze in the water side heat exchanger.

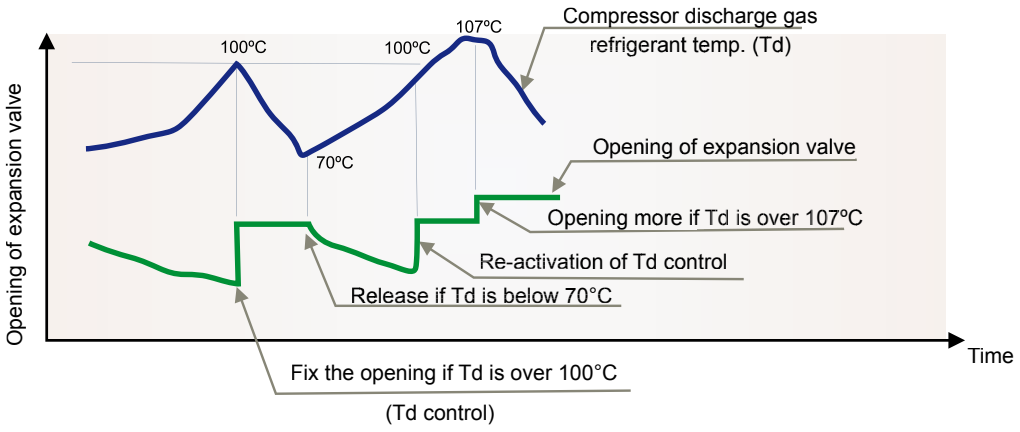
a) Normal Control




b) Zero Point Adjustment (imaged figure)




c) Prevention Control for Discharge Refrigerant Gas Overheat (imaged figure)



### 4.17.3. Protection Controls

This series has a protection control to resolve abnormal status before reaching to the alarm status, occurrence.

| Control Name | Conditions | Contents | Release conditions |
|---|---|---|---|
| High pressure protection | High pressure ≧2.6MPa | Hold after load-down 10 second output | 30 min and High pressure < 2.5MPa |
| Low presssure protection (1) <COOLING> | Cooling only:<br>Low pressure ≦0.333MPa<br>Heating:<br>Low pressure ≦0.314MPa | When it is continued for 1 min, hold after load-down 10 second output | 10 min and --Cooling only:<br>Low pressure≧0.363MPa |
| Low presssure protection (2) <COOLING> | Cooling only:<br>Low pressure ≦0.333MPa<br>Heating:<br>Low pressure ≦0.314MPa<br>90 sec | -Compressor stop: retry code [Cn-P6]<br>-Re-start in 3 min<br>(alarm: 3 times in 30min) | - |
| Protection of overheat of discharge gas temperature | Discharge gas refrigerant temp≧130°C<br>1min | -Compressor stop: retry code [Cn-P5]<br>-Re-start in 3 min<br>(alarm: 3 times in 90min) | - |
| Prevention of overheat of compressor | Actuation of internal Thermo of motor for compressor | -Compressor stop: retry code [Cn-P5]<br>-Re-start at internal Thermo restart<br>(alarm: 3 times in 60min) | - |
| Prevention of decrease of evaporating temperature (1) <COOLING> | Inlet refrigerant temperature of water side heat exchanger ≦–4.5°C<br>3 sec | -output of fan inverter frequency 6Hz<br>-Fan inverter frequency is 20Hz at high pressure≧1.8MPa | 30 min or high pressure≧2.0MPa during fan is fixed at 20Hz |
| Prevention of decrease of evaporating temperature (2) <COOLING> | Inlet refrigerant temperature of water side heat exchanger ≦–5.5°C<br>10 sec | Hold after output of load-up 10 second | 30 min |
| Prevention of decrease of evaporating temperature (3) <COOLING> | Inlet refrigerant temperature of water side heat exchanger ≦–6.5°C<br>3 sec | -Compressor stop: retry code [Cn-P6]<br>-Re-start in 3 min<br>(alarm: 3 times in 30min) | |
| Anti-freezing (1) <COOLING> | Suction refrigerant gas temperature ≦–2°C<br>10 sec | -Compressor stop: retry code [Cn-P6]<br>-Re-start in 3 min<br>(alarm: 3 times in 30min) | - |
| Anti-freezing (2) <COOLING> | Chilled water outlet temperature ≦2.5°C | Hold after output of load-down 10 second | 30 min |
| Protection of pressure difference | High pressure – low pressure≦0.3MPa | Hold after output of load-up 12 second | High pressure – low pressure > 0.3MPa<br>1min |
| Prevention of excess increase of warm water temperature <Compressor Stop> | Warm water temperature ≧65°C | -Pump stop<br>-Alarm output<br>-[PU-PU] is flickering in the segment | Warm water temperature < 60°C<br>(Automatic release of alarm) |

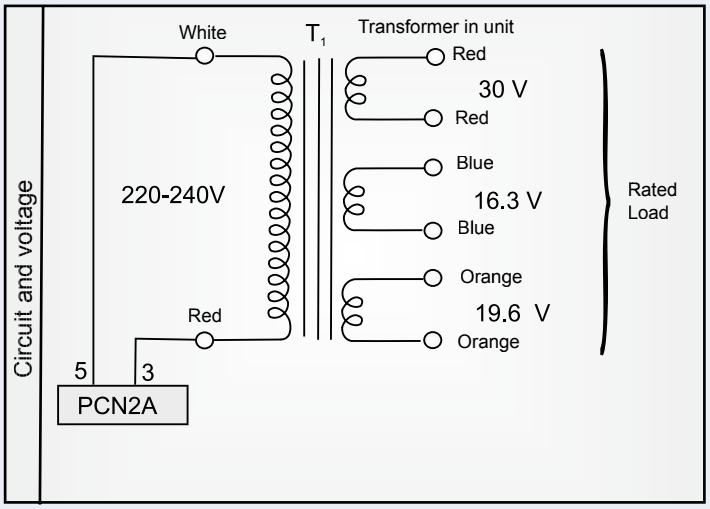
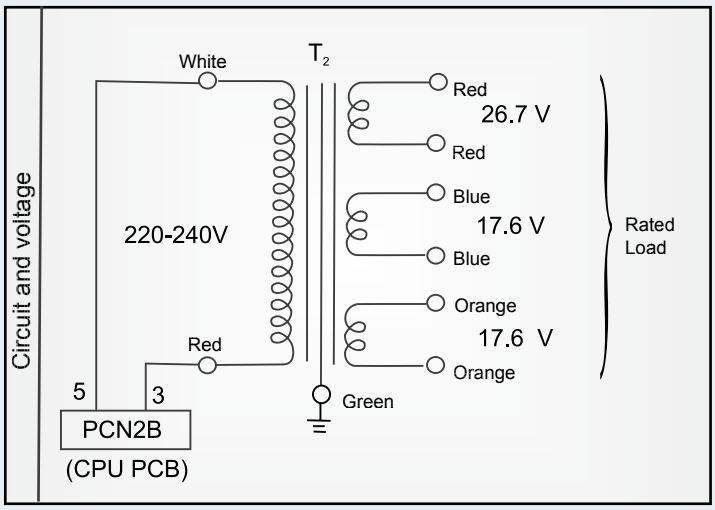
# 5. Troubleshooting

## Content

# 5.1. Initial check

### 5.1.1. Check of power supply and connection

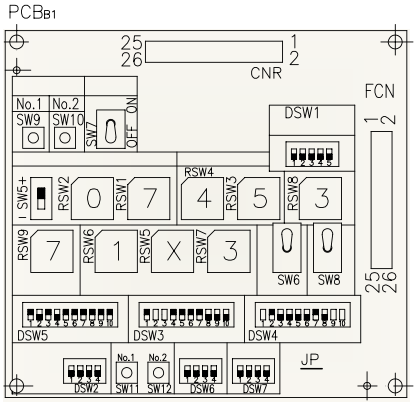
In case of abnormality in Chiller unit, check the following items firstly.

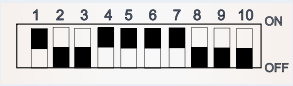
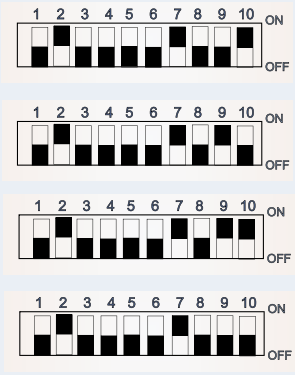
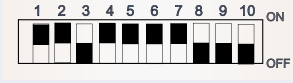
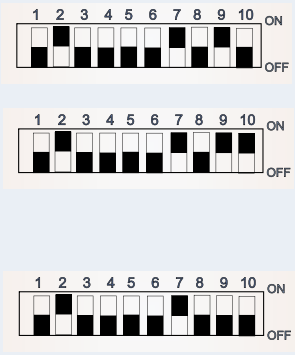
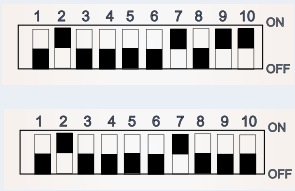
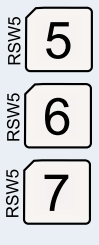
| Nº | Check Item | Check Method |
|---|---|---|
| 1 | Is power supply or fuse broken? | Measure secondary voltage of breaker and current carrying of fuse by tester. |
| 2 | Does secondary power of transformer supply correctly? | Pull out the connection of secondary side in Transformer and measure the voltage by tester. Confirm if the voltage corresponds to the indication in Transformer.<br>  <br>  |
| 3 | Wiring loose?<br>Wrong wiring? | Confirm if wiring is not loose nor wiring is wrong referring to the electricity circuit.<br>– Insertion of connector of Thermistor or Compressor Sensor<br>– Insertion of connector of Flat Cable<br>– Insertion of connector of Transformer Connector<br>– Insertion of each connector in 200V circuit. |

### 5.1.2. Check on PCB

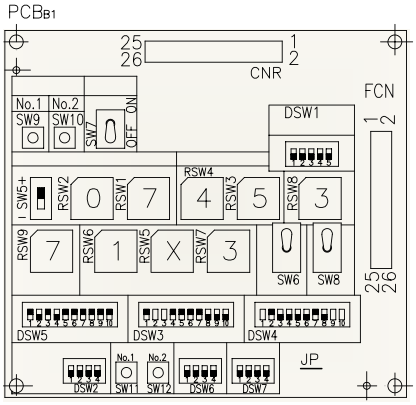
Configuration for standard version. Standard values are the ones shown on PCB drawing and table below.

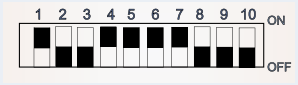
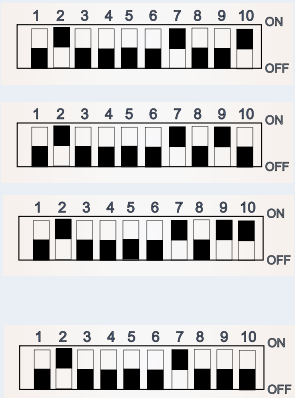
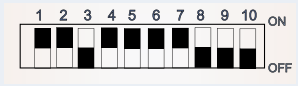
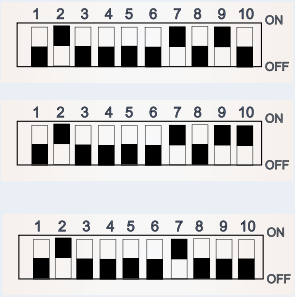
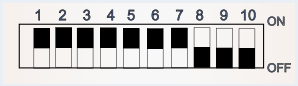
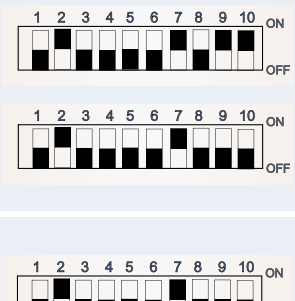
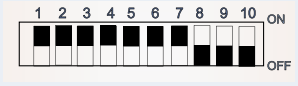
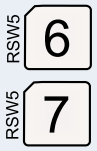
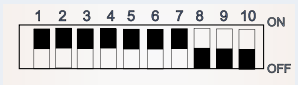
#### ◆ $PCB_{B1}$ (RHUE40~400 AG2)



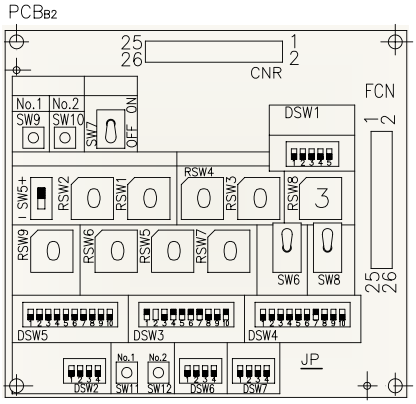

| MODEL | DSW3 | DSW4 | RSW5 |
|---|---|---|---|
| RHUE40AG2 |  |  |  |
| RHUE50AG2 | | | |
| RHUE60AG2 | | | |
| RHUE70AG2 | | | |
| RHUE80AG2 | | | |
| RHUE100AG2 |  |  |  |
| RHUE120AG2 | | | |
| RHUE140AG2 | | | |
| RHUE160AG2 | | | |
| RHUE180AG2 |  |  |  |
| RHUE210AG2 | | | |
| RHUE240AG2 | | | |

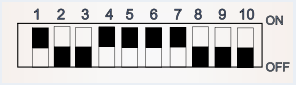
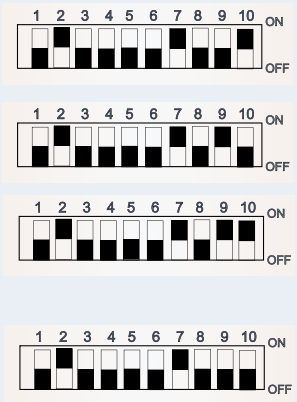
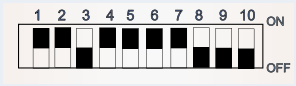
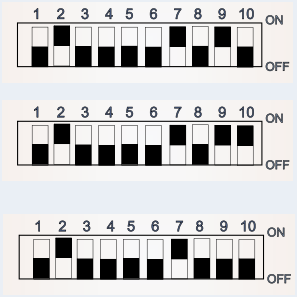
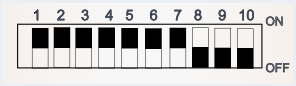
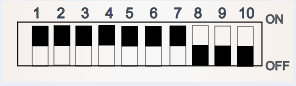
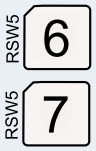
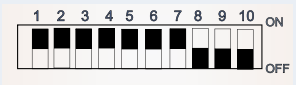
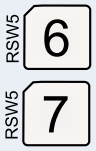
## ◆ $PCB_{B1}$ (RCUE40~400 AG2)




| MODEL | DSW3 | DSW4 | RSW5 |
|---|---|---|---|
| RCUE40AG2 |  |  |  |
| RCUE50AG2 | | | |
| RCUE60AG2 | | | |
| RCUE70AG2 | | | |
| RCUE80AG2 | | | |
| RCUE100AG2 |  |  |  |
| RCUE120AG2 | | | |
| RCUE140AG2 | | | |
| RCUE160AG2 | | | |
| RCUE180AG2 |  |  |  |
| RCUE210AG2 | | | |
| RCUE240AG2 | | | |
| RCUE280AG2 |  |  |  |
| RCUE320AG2 | | | |
| RCUE350AG2 |  |  |  |
| RCUE400AG2 | | | |

## ◆ $PCB_{B2}$ (RCUE280~400 AG2)

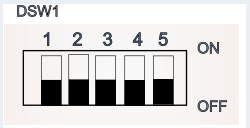
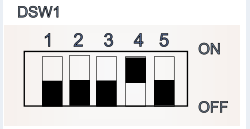
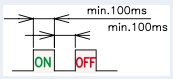
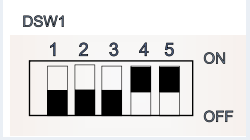



| MODEL | DSW3 | DSW4 | RSW5 |
|---|---|---|---|
| RCUE40AG2 |  |  |  |
| RCUE50AG2 | | | |
| RCUE60AG2 | | | |
| RCUE70AG2 | | | |
| RCUE80AG2 | | | |
| RCUE100AG2 |  |  |  |
| RCUE120AG2 | | | |
| RCUE140AG2 | | | |
| RCUE160AG2 | | | |
| RCUE180AG2 |  |  |  |
| RCUE210AG2 | | | |
| RCUE240AG2 | | | |
| RCUE280AG2 |  |  |  |
| RCUE320AG2 | | | |
| RCUE350AG2 |  |  |  |
| RCUE400AG2 | | | |

5

◈ DESCRIPTION:

– **$PCB_{B1}$ DSW1: Setting of Low Voltage for Remote Control**
($PCB_{B2}$ DSW1: No function)

| MODE | Dip Switch Setting (DSW1 of Main PCB) |
|---|---|
| NORMAL MODE (Now low voltage control) |   |
| MODE 1 (Hi/Lo)   |   |
| MODE 2 (Pulse)   |   |

– **$PCB_{B1}$ DSW2: Starting Delay**
($PCB_{B2}$ DSW2: No function)
DSW2-1,2: Setting for Starting Delay of Compressor [min]

| Figure | 1 | 2 | 1 | 2 | 1 | 2 | | |
|---|---|---|---|---|---|---|---|---|
| Location | ON | ON | ON | OFF | OFF | ON | OFF | OFF |
| Time (minute) | 0.5 | | 6 | | 10 | | 3 | |

DSW2-3: ON; Low noise and night shift Opt.
DSW2-4: ON: High Efficiency Opt.

– **$PCB_{B1,B2}$ DSW3: Mode Switch A**

DSW3-1,2,3: Enable of compressor No.1,2,3 ($PCB_{B1}$)
DSW3-1,2: Enable of compressor No.4,5 ($PCB_{B2}$)
DSW3-4,5,6,7: Enable of DC Fan Motor No.11,12,13,14 – Cycle Nº1 ($PCB_{B1}$)
DSW3-4,5,6,7: Enable of DC Fan Motor No.41,42,43,44 – Cycle Nº4 ($PCB_{B2}$)
DSW3-8,9,10: H-LINK ADDRESS [000 by deffault on $PCB_{B1}$];
Use same address in $PCB_{G1,G2}$ (DSW4-1,2,3)
DSW3-8,9,10: H-LINK ADDRESS [001 by deffault $PCB_{B2}$ ];
Use same address in $PCB_{G3}$ (DSW4-1,2,3)

- **$PCB_{B1}$ DSW4: Optional Function A**
  **($PCB_{B2}$ DSW4: No function except DSW4-7 in ON: HAPE CHILLER)**
  DSW4-1: OFF for RCUEXXXAG2 models
  ON for RHUEXXXAG2 models

  DSW4-2,7: ON / DSW4-3,4,5,6,8: OFF ; Configuration for HAPE Chillers
  DSW4-3: ON: Not Available Option
  DSW4-4: ON; Enable of Brine Option

  DSW4-9,10: Compressor Model

| Figure | 9 | 10 | 9 | 10 | 9 | 10 | 9 | 10 |
|---|---|---|---|---|---|---|---|---|
| Location | OFF | ON | ON | OFF | ON | ON | OFF | OFF |
| Compressor | 40 HP | | 40 HP | | 50 HP | | 60 HP | |
| Time (minute) | 40 HP | | 50 HP | | 60 HP | | 70,80 HP | |

- $PCB_{B1}$ DSW5: Continuous Capacity Control
  **($PCB_{B2}$: No function)**

  DSW5-1,2: Temperature band for Thermo OFF

| Figure | 1 | 2 | 1 | 2 | 1 | 2 | 1 | 2 |
|---|---|---|---|---|---|---|---|---|
| Location | ON | ON | ON | OFF | OFF | ON | OFF | OFF |
| Band (degree) | 0.5 | | 1.0 | | 1.5 | | 2.0 | |

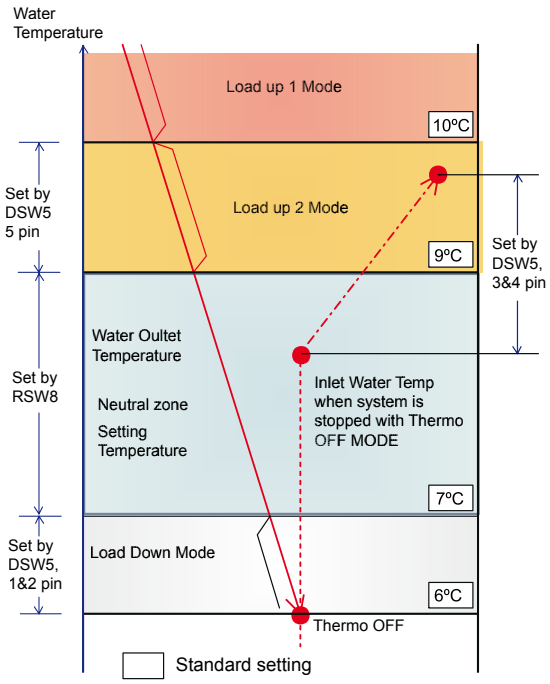
  DSW5-3,4: Temperature band for Compressor re-start

| Figure | 3 | 4 | 3 | 4 | 3 | 4 | 3 | 4 |
|---|---|---|---|---|---|---|---|---|
| Location | ON | ON | ON | OFF | OFF | ON | OFF | OFF |
| Band (degree) | 1.0 | | 2.0 | | 3.0 | | 4.0 | |

  DSW5-5: Temperature band for LOAD UP2

| Figure | 5 | 5 |
|---|---|---|
| Location | ON | OFF |
| Band (degree) | 1.0 | 3.0 |

This chart is based on a Temp. Setting of 7°C




5

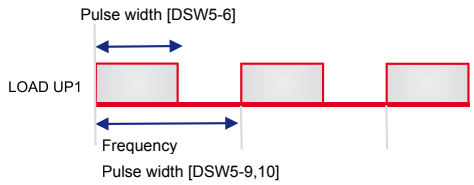
- **DSW5-6: Pulse width in Seconds for Load Up Slide Valve in compressor in LOAD UP1 Mode.**
  (SVn-UP: Coil energizing)

| | | |
|---|---|---|
| Figure | 6 | 6 |
| Location | ON | OFF |
| Time (minute) | 12 | 24 |

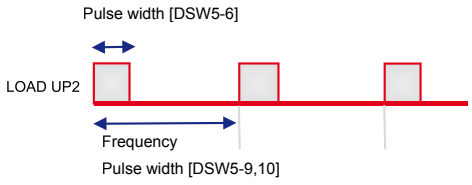
- **DSW5-7,8: Pulse width in Seconds for Load Up Slide Valve in compressor in LOAD UP2 Mode**.
  (SVn-UP: Coil energizing)

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Figure | 7 | 8 | 7 | 8 | 7 | 8 | 7 | 8 |
| Location | ON | ON | ON | OFF | OFF | ON | OFF | OFF |
| Time (minute) | 2 | | 4 | | 6 | | 8 | |

- **DSW5-9,10: Frequency of Load Up Slide Valve in compressor.**
  (SVn-UP: Coil energizing)




- **$PCB_{B1}$ DSW6: Optional Function B**
  **($PCB_{B2}$ DSW6: No function. Keep DSW6-4 in OFF)**
  DSW6-2: ON: Pump freeze protection activated ($T_{ambient}$ = 2ºC)
  OFF: Pump freeze protection disabled
  [DSW6-1,3,4: OFF; Not available]




- **$PCB_{B1}$ DSW7: Optional Function C**
  ($PCB_{B2}$ DSW7: No function)
  DSW7-1,2: Temperature Range for Brine Opt.
  [DSW7-1,2: Both in ON; this function is not available)

| | | | | | | |
|---|---|---|---|---|---|---|
| Figure | 1 | 2 | 1 | 2 | 1 | 2 |
| Location | OFF | OFF | ON | OFF | OFF | ON |
| Time Range | Standard | | -5~5 ºC | | -10~6 ºC | |

DSW7-3: ON; Thermo OFF is delayed after Outlet Temperature is below Thermo OFF setting for 3 min.
DSW7-4: ON: Used only in case of remote control through H-LINK (e.g.:CSC-5S, HARC)

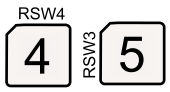
- **$PCB_{B1}$ RSW1,2 (SW5): Setting Temperature in Cooling Mode with to digits and the sign indicated in SW5**

  **($PCB_{B2}$ RSW1,2 & SW5: No function)**

  In case of Brine 2 Option can be set negative temperatures.


- **$PCB_{B1}$ RSW3,4: Setting Temperature in Heating Mode with to digits (Only available in Heat Pump Models- RHUEXXXAG2)**

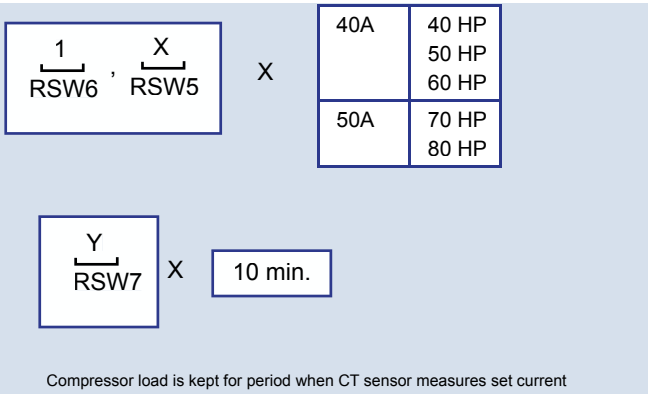
  **($PCB_{B2}$ RSW3,4: No function)**




- **$PCB_{B1}$ RSW5,6,7: CT Sensor function (Supplied as standard)**


**($PCB_{B2}$ RSW5,6,7: No function)**

| Num. "X" | Model (HP) |
|---|---|
| 2 | 40 |
| 3 | 50/100 |
| 5 | 60/120/180 |
| 6 | 70/140/210/280/350 |
| 7 | 80/160/240/320/400 |




e.g.:

RCUE40AG2: Compressor load is "down" and "hold" for 30min (Y=3; 3*10min) when compressor current is higher than 48 A (X=2; 1.2*40A).

- **$PCB_{B1}$ RSW8: Temperature band for Neutral Zone (See also DSW5)**


($PCB_{B2}$ RSW8: No function)

| Figure | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
|---|---|---|---|---|---|---|---|---|---|---|
| Band (degree) | 0.5 | 1.0 | 1.5 | 2.0 | 2.5 | 3.0 | 3.5 | 4.0 | 4.5 | 5.0 |

- **$PCB_{B1}$ RSW9: Temperature setting for one Defrost condition [Evaporator. Temp.- Ambient Temp.: 2~20ºC]**


**($PCB_{B2}$ RSW9: No function)**

1→ 2x1=2ºC

2→ 2x2=4ºC

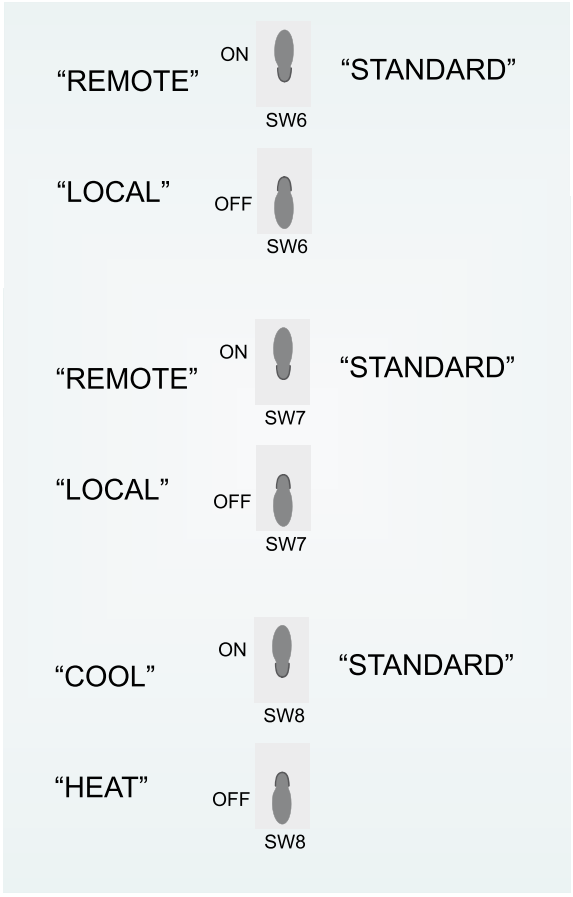
…

9→9x2=18ºC

0→10x2=20ºC]

- **$PCB_{B1}$ SW5:** See explanation for $PCB_{B1}$ RSW1,2
($PCB_{B2}$ SW5: No function)

- **$PCB_{B1}$ SW6: Remote unit control. Standard is**
($PCB_{B2}$ SW6: No function)




**$PCB_{B1}$ SW7:** Pump operation
($PCB_{B2}$ SW7: No function)

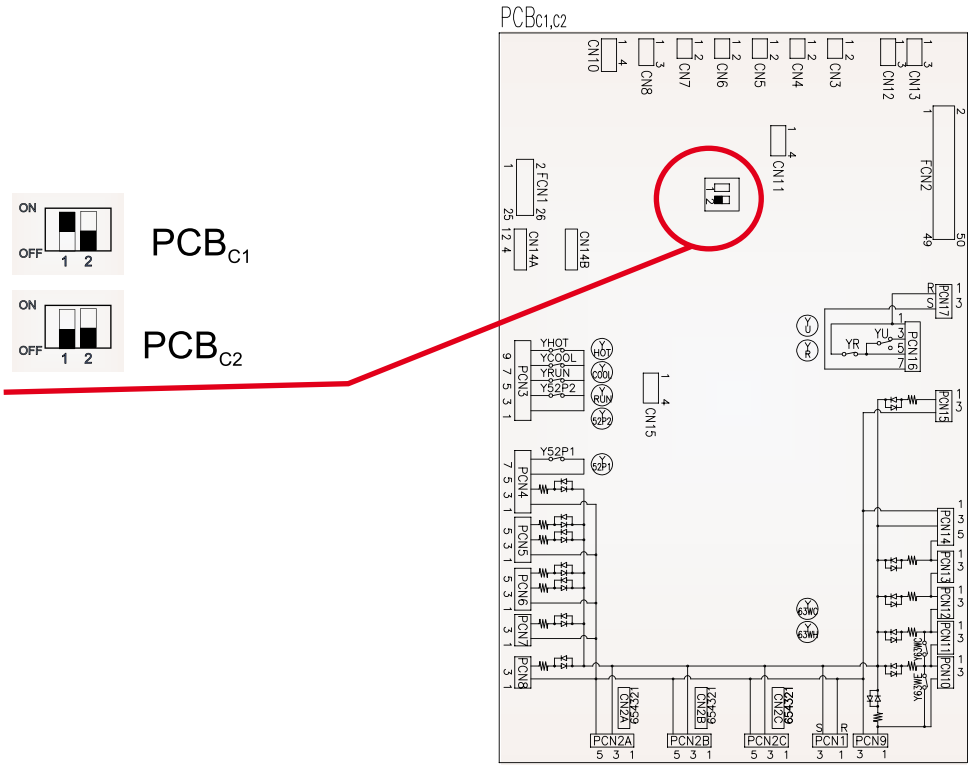
- **$PCB_{B1}$ SW8:** Operation Mode.
($PCB_{B2}$ SW8: No function)

- $PCB_{B1,B2}$ SW9, SW10: High Cut check (Fan Stop for Check)
  SW9 ($PCB_{B1}$): ON → Checking Cycle 1
  SW10 ($PCB_{B1}$): ON → Checking Cycle 2
  SW9 + SW10 ($PCB_{B1}$): ON → Checking Cycle 3
  SW9 ($PCB_{B2}$): ON → Checking Cycle 4
  SW10 ($PCB_{B2}$): ON → Checking Cycle 5

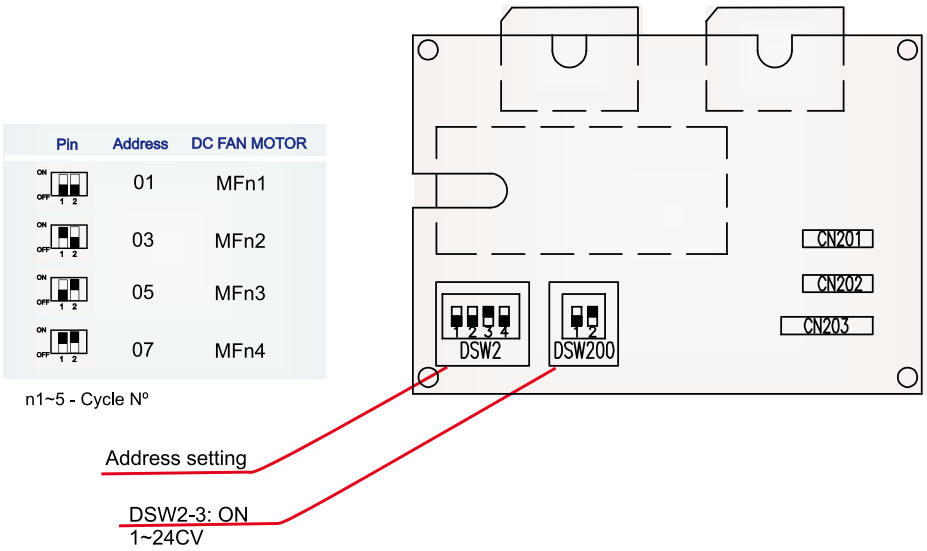

- $PCB_{B1}$ SW11, SW12: Manual Defrost (Only Heat Pump models)
  ($PCB_{B2}$ : Not available function)
  SW11 ($PCB_{B1}$): ON → Checking Cycle 1
  SW12 ($PCB_{B1}$): ON → Checking Cycle 2
  SW11 + SW12 ($PCB_{B1}$): ON → Checking Cycle 3


5

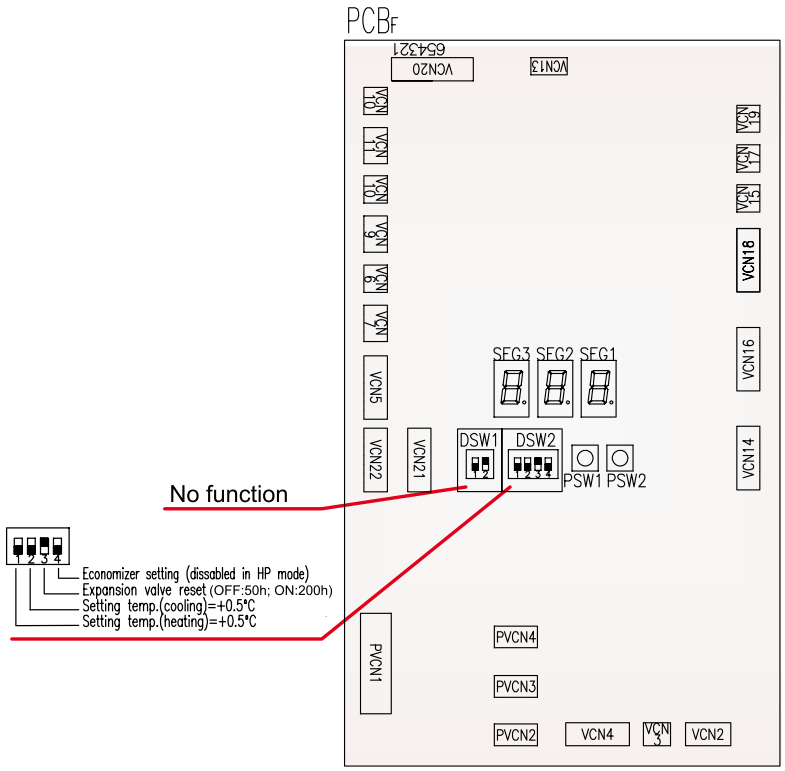
◆ **DIP SWITCH SETTING PCBC1,C2 (MAIN CONTROL PCB; Master & Subsidiary)**
DSW-1: H-LINK end resistance (ON only PCB C1)
DSW-2: Fuse protection



## ◆ DIP SWITCH SETTING PCB$_{e1\sim e5}$ (FAN MODULE FOR DC FAN MOTORS)



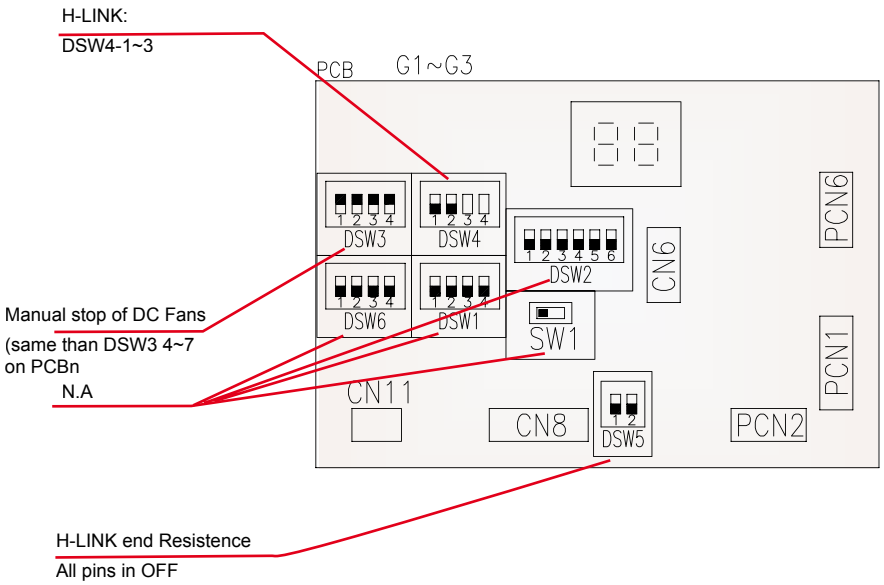

## ◆ DIP SWITCH SETTING PCB$_{F1\sim F2}$. (EXP. VALVE CONTROL PCB)



## ◆ DIP SWITCH SETTING PCB$_{G1,G2,G3}$ (FAN CONTROL PCB)

Standard Setting

| Setting PCB DSW4 | H LINK DSW4 1 2 3 | PCB Nº DSW4 4 |
|---|---|---|
| PCB $_{G1}$ | 000 | 0 |
| PCB $_{G2}$ | 000 | 1 |
| PCB $_{G3}$ | 001 | 0 |




5

### 5.1.3. Confirmation of activation value of protection device an Automatic operation device

◆ **Protection device**

Activation value of protection device is as follows:

| | Name | Activation value |
|---|---|---|
| Cooling | High pressure block device | 2.74 MPa (re-start manually) |
| | Prevention control for low pressure decrease | 0.314 MPa (Electron control) |
| | Low pressure block device | 0.049 MPa (Electron control) |
| Heating | High pressure block device | 2.74 MPa (re-start manually) |
| | Prevention control for low pressure decrease | 0.049 MPa (Electron control) |
| Excess current in relay for compressor | 40 HP | 55 A |
| | 50 HP | 60 A |
| | 60 HP | 70 A |
| | 70 HP | 85 A |
| | 80 HP | 90 A |
| Prevention control for freezing | | 2°C (Electron control) |
| Prevention control for suction gas decrease | | -2°C |
| Internal Thermostat for Compressor | | 115°C |
| Prevention control for overheating of discharge gas | | 140°C |
| Fusible plug | | 72°C |
| Safety valve | | 3.0 MPa |
| Fuse for operation circuit | | 10, 5, 3A |

*NOTE:*

Safety valve is installed in all models

◆ **Automatic operation device**

The value of automatic operation device is set as follows:

| Item (unit) | | | Setting value | Remarks |
|---|---|---|---|---|
| Relay for only starting control | Time guard | Min | Variable: 30 sec ~ 10 min (standard value: 3 min) (Note 1) | Electron control |
| | -Δ switch | Sec | 5 | |
| | Staring unload | Sec | 30 | |
| | Sequential starting (Note 2) | Min | 1 | |

*NOTES:*

1. It should be normally over 3 min.
2. In all chiller units there is a timer which prevents compressors starting at the same time.

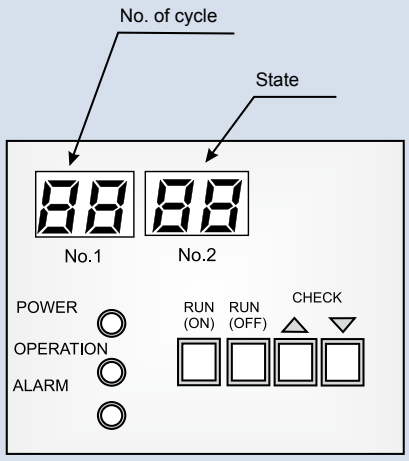
### 5.1.4. Individual indication for activation of protection device

◆ **Indication in the segment**

Status of unit and activation of the different protection devices are indicated on the display. This indication helps to make a diagnosis about the unit, indicating if it is running well, and it can help to solve different inconvenients on the system.

Indication on the segment at normal operation (standard menu display) is as follows:

| Segment indication abnormal code | Contents |
|---|---|
| C1 ~ C5 88 | Power ON |
| Pu Pu | Wait for pump feed back |
| C1 ~ C5 E0 | Procedure of ex. valve zero reset |
| C1 ~ C5 oF | After pump feed back |
| C1 ~ C5 Co | At cooling operation |
| C1 ~ C5 HE | At heating operation |
| C1 ~ C5 Ct | At activation of current limit |
| At Alarm | |
| C1 ~ C5 oF | At thermo OFF |
| C1 ~ C5 88 | At stop operation |



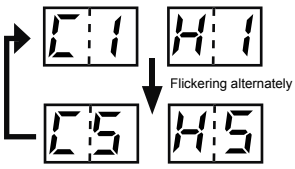

*NOTES:*

- C1~C5 means No of cycle. (C1: Cycle 1)
- Number of cycle whose manual set switch is ON is indicated alternately.
- It is a state from the output of pump operation signal to the confirmation of pump interlock. In case that pump interlock is confirmed immediately, it is possible that the indication is not checked visually since the indication time is too short.

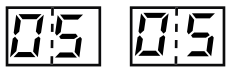
### ◆ Abnormal code of segment indication part

In this section “abnormal code” is explained. See subchapter 5.2.3 “Method of failure diagnosis” for the concrete treatment.

Ex. High pressure interrupt device for unit 1 is activated
(Cooling operation in unit 2)




Ex. Phase detection abnormality (common abnormality)




| | Segment Indication abnormal code | | Contents |
|---|---|---|---|
| Individual Alarm (stop only the corresponding cycle) | E1-E5 | H1-H5 | Activation of High Pressure Block Devise(63H) |
| | E1-E5 | L1-L5 | Activation of Suction Pressure Block Device |
| | E1-E5 | L1-L5 | Activation of Prevention Control for Suction Pressure Block Decrease |
| | E1-E5 | 51-55 | Activation of Thermal Relay for Compressor (51C) |
| | E1-E5 | 61-65 | Activation of Discharge Gas Thermistor (Td) |
| | E1-E5 | 71-75 | Activation of Compressor Thermostat (49C) |
| | E1-E5 | 91-95 | Activation of Evaporating Temperature Thermistor (Tr) |
| | E1-E5 | t1-t5 | Activation of Suction Gas Thermistor (Ts) |
| | E1-E5 | 05 | Phase Abnormality (Reverse Phase / Phase Failure) [Individual power source spec: Option] |
| | E1-E5 | 12 | Outlet Chilled Water Thermistor Abnormality in some cycles |
| | E1-E5 | 13 | Activation of Freeze Protection Control Abnormality in some cycles |
| | E1-E5 | 14 | Activation of Water Overheating Protection Control Abnormality in some cycles |
| | E1-E5 | 21 | Evaporating Temperature Thermistor Abnormality |
| | E1-E5 | 23 | Abnormality of discharge gas temperature Thermistor |
| | E1-E5 | 24 | Liquid Temperature Thermistor Abnormality |
| | E1-E5 | 25 | Abnormality of Outlet Water Temperature Thermistor for Protection |
| | E1-E5 | 26 | Suction Gas Temperature Thermistor Abnormality |
| | E1-E5 | 27 | Discharge Pressure Sensor Abnormality |
| | E1-E5 | 28 | Suction Pressure Sensor Abnormality |
| | E1-E5 | F0 | Abnormality of Setting Fan Number |
| Common Alarm (Stops unit) | 05 | 05 | Phase Abnormality (Reverse Phase / Phase Failure) |
| | 11 | 11 | Inlet Chilled Water Thermistor Abnormality |
| | 12 | 12 | Outlet Chilled Water Thermistor Abnormality in 1 cycle |
| | 13 | 13 | Activation of Freeze Protection Control Abnormality in 1 cycle |
| | 14 | 14 | Activation of Water Overheating Protection Control Abnormality in 1 cycle |
| | 22 | 22 | Ambient Temperature Thermistor Abnormality |
| | 5P | 5P | 52P Pump Interlock Signal Abnormality |
| | 40 | 40 | Operation Error / Setting Error |
| | EU | EU | Error Communication between Ctrl. PCB and Ex. Valve PCB |
| | FC | FC | Error Communication between Ctrl. PCB and Fan Speed control PCB |
| | F1-F5 | 11-14 | Inverter Speed Control Abnormality |
| | F1-F5 | 21-24 | Inverter Excess Current Protection Abnormality |
| | F1-F5 | 31-34 | Inverter Position Detection Abnormality |
| | F1-F5 | 41-44 | Transmission Abnormality between Inverter and CPU PCB or between Fan Speed Control PCB |
| | F1-F5 | 51-54 | Voltage Shortage or Excess Voltage in Inverter |
| | PU | PU | During Activation of Pump Stop Control by Excess Increase of Water Temperature |
| | (flicker) | | |
| | 6E | 6E | Water Shortage Protection Switch Activation (at 63W use; Option) |
| | 03 | 03 | System Controller Connection Abnormality (at CSC-5S connection: Option) |

◆ **Indication of inverter (fan module) for control of fan revolution number**

Fan module has protection control and indicates abnormal code on the segment.

– List of inverter abnormal code

| Segment Indication abnormal code | | Contents |
|---|---|---|
| F1-F5 | 11-14 | Inverter Speed Control Abnormality |
| F1-F5 | 21-24 | Inverter Excess Current Protection Abnormality |
| F1-F5 | 31-34 | Inverter Position Detection Abnormality |
| F1-F5 | 41-44 | Transmission Abnormality between Inverter and CPU PCB or between Fan Speed Control PCB |
| F1-F5 | 51-54 | Voltage Shortage or Excess Voltage in Inverter |

– List of state at inverter retry

| Segment Indication abnormal code | | Contents |
|---|---|---|
| F1-F5 | P7 | During retry control at simultaneous abnormal in some (majority) fans (Fan single retry) |
| F1-F5 | P8 | Abnormal code during retry control in Fn-4m, Fn-5m |

*NOTES:*

"n": Cycle Nº (n=1-5)

"m": Fan Nº (m=1-4)

In case of fan abnormal operation, retry is performed in every case and in case that the same abnormal operation occurs in specified times within specified period, unit is stopped by alarm.

Retry:

1. Retry in fan by itself (compressor keeps operating. Re-start in 10 seconds)
2. Retry in cycle by itself (compressor also stops. Re-start in 3 minutes).

In case of retry in cycle by itself, retry is indicated like above "list of state at inverter retry". In case of retry in fan by itself, it is possible to confirm which fan is being retried in check mode.

### 5.1.5. Modification of $PCB_C$ configuration

Every Chiller is delivered with the correct priority configuration (Master PCB and slave PCB). In case of a Control PCB delivered as a spare part, it will be necessary to set the correct priority configuration because it is not known where it will be applied (Chiller model).

In case that this priority configuration is not correct, the Chiller cannot operate. See next point.

◆ **Problem detection**

When the priority configuration is not correct, on the 7 segment it is displayed:

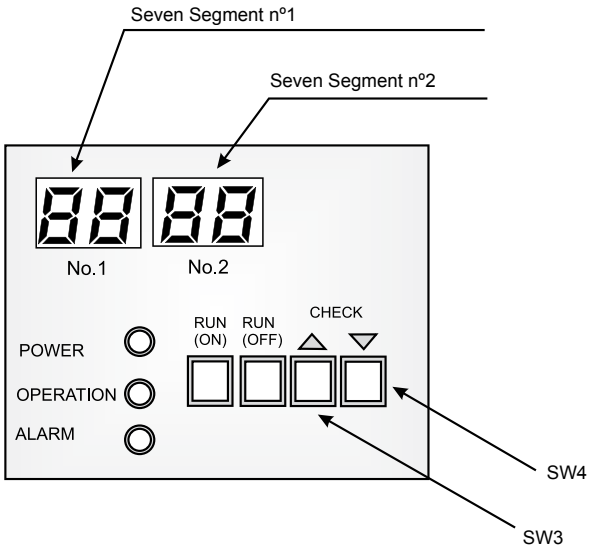

7 segments on $PCB_A$ shows the above message and no alarm message is shown.

◆ **Configuration**

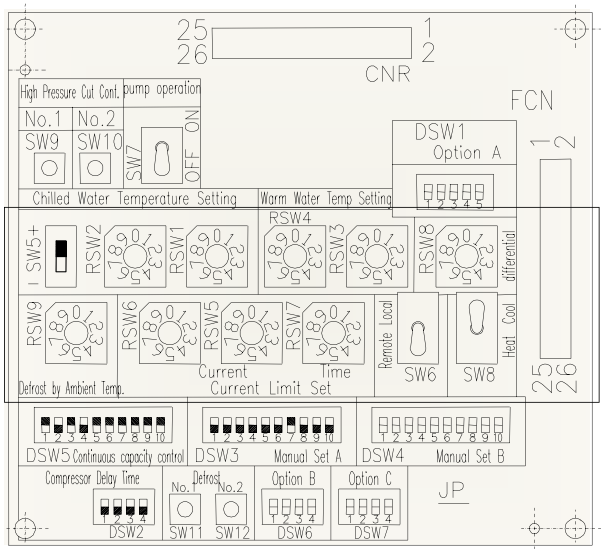
To establish the right priority configuration in each $PCB_C$ it is necessary to connect an operation PCB ($PCB_A$ and $PCB_B$) to the corresponding Control $PCB_C$. It means that in case of a CHILLER Electric Box with 5 cycles, it is necessary to connect an additional operation PCB ($PCB_A$ and $PCB_B$) to establish the right priority configuration in this subsidiary control PCB ($PCB_{C2}$)

Next drawings shows the controls required for this procedure.

$PCB_A$



## $PCB_B$

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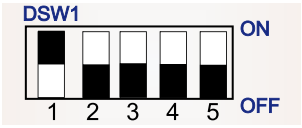
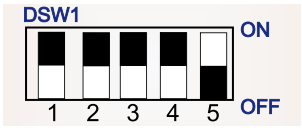
### ◆ Checking of current priority configuration

1. Power supply OFF (Main Switch turned-off)
2. Put DSW1-1 from Operation PCB in ON ($PCB_B$)




3. Electric Box Power supply ON (M.I. switch ON)
4. Put DSW1-2,3,4 from Operation PCB in ON ($PCB_B$)




5. Rotate RSW8 from Operation PCB at position nº2: **RSW8**

6. See that in the 7 segments on Operation (PCBA) shows:


("X": 0, 1 or 2)

7. The right priority configuration follows the next table criteria.

| 7 segments | |
|---|---|
| U 1:00 | Setting for main control PCB ($PCB_C$) in all CHILLERS up to 240 HP |
| U 1:01 | Setting for main control PCB ($PCB_C$1) in Cooling Only CHILLERS with 4 or 5 cycles. |
| U 1:02 | Setting for subsidiary control PCB ($PCB_C$2) in Cooling Only CHILLERS with 4 or 5 cycles |

◆ **Modification of priority configuration**

Check previous table for the correct configuration

1. Modification of the priority number: "00", "01", "02"

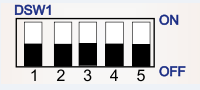
| 7 segments | |
|---|---|
| U 1:0X | "X" is the priority number of the PCB (0, 1 or 2), according to the above table |

2. Priority number is changeable only in "U2" position, it means that first it is necessary to set U2 in 7 segments pushing the SW3 and SW4 at the same time in Operation PCB ($PCB_A$) during 3 seconds.

| 7 segments | |
|---|---|
| U2:0X | "X" is the priority number (0, 1 or 2) that you can select following the next point. |

3. For modifying "X" value is necessary to push during 1 second SW3 or SW4 of Operation PCB ($PCB_A$) depending if you want to increase (DSW3) or decrease (DSW4) the priority number
4. Push at the same time DSW3 and DSW4 for 3 seconds for fixing at "U1" the corresponding priority number established before in "U2".
5. Switch OFF the power supply in the Electrical Box (M.I. switch OFF)
6. Switch ON the power supply in the Electrical Box (M.I. switch ON)
7. See on the Operation PCB, in the 7 segments, the right configuration number according to the table on point 7. On the contrary repeat again all steps and select the right configuration number.
8. Restore the initial setting: DWS1, RSW8-3

Confirm the initial setting for these switches with the Technical Catalogue considering the options included in the model. The standard setting values are the next:

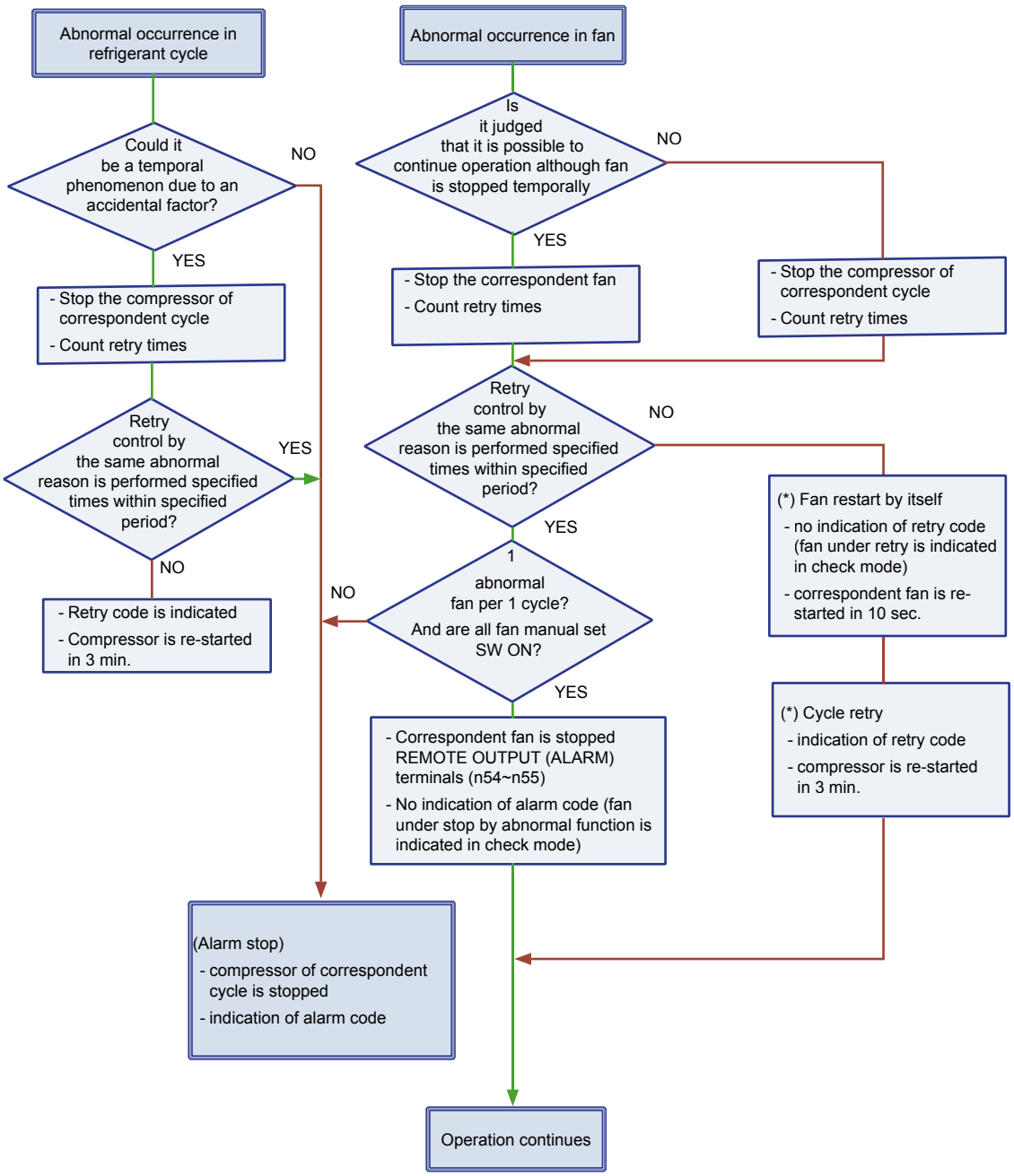
| DSW1 | RSW8 |
|---|---|
|  |  |



*NOTE:*

In case of additional option DSW1 and RSW8 can be different

– Flowchart at abnormal occurrence




◆ **Abnormal indication of Option / Remote Controller Switch**

Indication lamp of remote controller side distinguishes “Run”, “Alarm”, and ”Stop”:

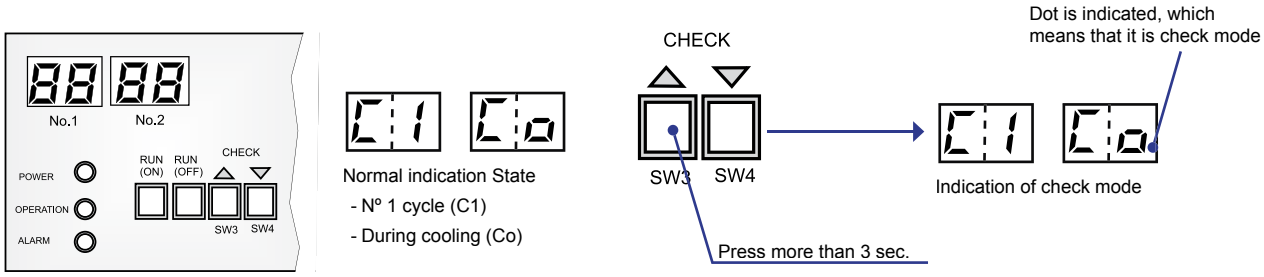
-“Run”: Red light indication lamp on.
-“Alarm”: Light red indication lamp on. Light orange indication lamp on: in case of option switch use
-“Stop”: Light red indication lamp off.

### 5.1.6. Check function

◆ **Check mode**

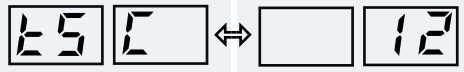
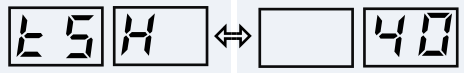
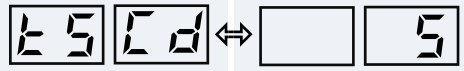
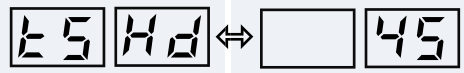
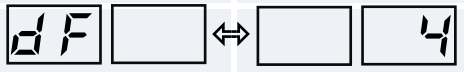
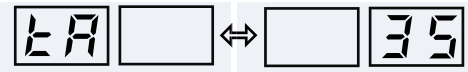
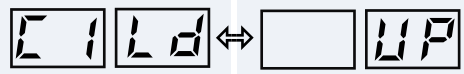
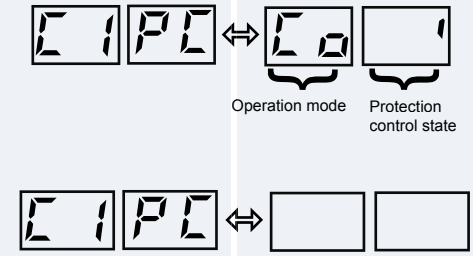
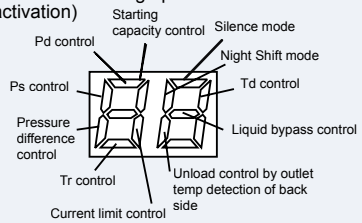
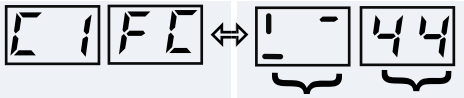
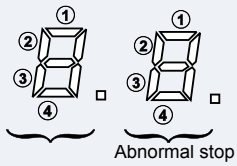
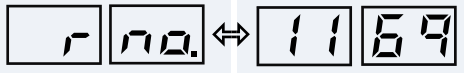
By pressing [▲] (SW3) on PCB more than 3 seconds, control state of chilled water temperature, each refrigerant cycle pressure/ temperature etc are indicated. (it is possible both during stopping and during running), (*mode shall not be shifted in case of alarm).

Pressing again [▲] (SW3) on PCB more than 3 seconds enables you to see the different values but with decimals




By pressing [▲][▼], indication is changed. The followings are the contents.

| Item | Example of code indication (alternately flicker) | Contents |
|---|---|---|
| Latest protection device state (alarm code) | C1 H1 | In case of latest alarm = activation of No. 1 high pressure block device<br>(if alarm code is not saved, it is “00-00”. |
| Refrigerant cycle state | C1 Pd ⇔ 1.42 | 1. Pd (high pressure) indication [MPa]<br>-Example of Pd of No.1 = 1.42MPa<br>-Example of Pd of No. 2 = 1.43MPa<br>Indication of unit of 2 cycles<br>(Indication of only the unit whose manual set SW is ON) |
| | C2 Pd ⇔ 1.43 | |
| | C1 PS ⇔ 0.41 | 2. Ps (low pressure) indication [MPa]<br>-in case of Ps of No. 1 = 0.41MPa<br>-In case of unit of 2 cycles, [C2-PS]. |
| | C1 td ⇔ 81 | 3. Td (discharge gas temp) indication [ºC]<br>-in case of Td of No. 1 = 81ºC<br>-In case of unit of 2 cycles, [C2-td]. |
| | C1 tS ⇔ -2 | 4. Ts (suction gas temp) indication [ºC]<br>-in case of Ts of No. 1 = -2ºC<br>-In case of unit of 2 cycles, [C2-tS]. |
| | C1 tr ⇔ 5 | 5. Tr (Plate heat exchanger inlet refrigerant temp) indication [ºC]<br>-in case of Td of No. 1 = 5ºC<br>-In case of unit of 2 cycles, [C2-tr]. |
| | C1 tE ⇔ 35 | 6. Te (Refrigerant liquid temp) indication [ºC]<br>-in case of Te of No. 1 = 35ºC<br>-In case of unit of 2 cycles, [C2-tE]. |
| | CEL ⇔ 12 | 7. Inlet water temperature indication [ºC]<br>-in case of inlet water temperature = 12ºC |
| | CoL ⇔ 7 | 8-1. Outlet water temperature indication [ºC]<br>-in case of outlet water temperature = 7ºC<br>(For units with more than one cycle, this is the average value) |
| | CoL1 ⇔ 7 | 8-2. Individual outlet water temperature indication [ºC]<br>In 2 cycles, chilled water outlet temp every cycle is indicated. (no indication in case of 1 cycle)<br>-in case of outlet water temp of No.1 = 7ºC<br>-in case of outlet water temp of No.2 = 7ºC<br>*Unit whose manual set SW is OFF is indicated. |
| | CoL2 ⇔ 7 | |

| | Item | Example of code indication (alternately flicker) | Contents |
|---|---|---|---|
| SW3 SW4 | Setting state indication |  | 1. Chilled water setting temperature indication [ºC]<br>-in case of setting temperature = 12ºC<br>-integer round up is indicated in case of +0.5ºC setting |
| SW3 SW4 | |  | 2. Warm water setting temperature indication [ºC] (only heat pump type)<br>-in case of setting temperature = 40ºC<br>-integer round up is indicated in case of +0.5ºC setting |
| SW3 SW4 | |  | 3. Chilled water second temperature setting indication [ºC]<br>-in case of setting temperature = 5ºC<br>*only at alarm selection |
| SW3 SW4 | |  | 4. Warm water second temperature setting indication [ºC] (only heat pump type)<br>-in case of setting temperature = 45ºC<br>*It is indicated only if heat storage is selected. |
| SW3 SW4 | |  | 5. Neutral zone range indication [ºC] |
| SW3 SW4 | Ambient temperature indication |  | Ambient temperature indication [ºC]<br>-In case of 35ºC |
| SW3 SW4 | Capacity control state indication |  | Capacity control state in every cycle<br>Continuous control spec:<br>*Load-up [UP] / Neutral Zone [nU] / Load down [d0]<br>Thermo OFF [- - ].<br>*In case of 2 cycles, [C2-Ld] |
| SW3 SW4 | Protection control activation state indication |  | Protection control state is indicated in every cycle.<br>*Protection control is assigned in 7 segment. Control under activation is lighted. (example in the left side: No. 1 cooling operation and Td control under activation)<br>  <br>In case of 2 cycles, [C2-FC] |
| SW3 SW4 | Fan control state indication |  | Fan control state and order frequency are indicated in every cycle.<br>(example in the left side: Fan No. 2 and No. 4 of No. 1 cycle are under retry, Fan No. 1 is under stop by abnormality, other fans are under operation with 44 Hz)<br>Fan control state<br>  <br>*①~④: Fan number<br>Light the position correspondent to the fan<br>In case of 2 cycles, [C2-FC] |
| SW3 SW4 | Control software ROM Nº indication |  | Indication of ROM NO. (ex: 239) |

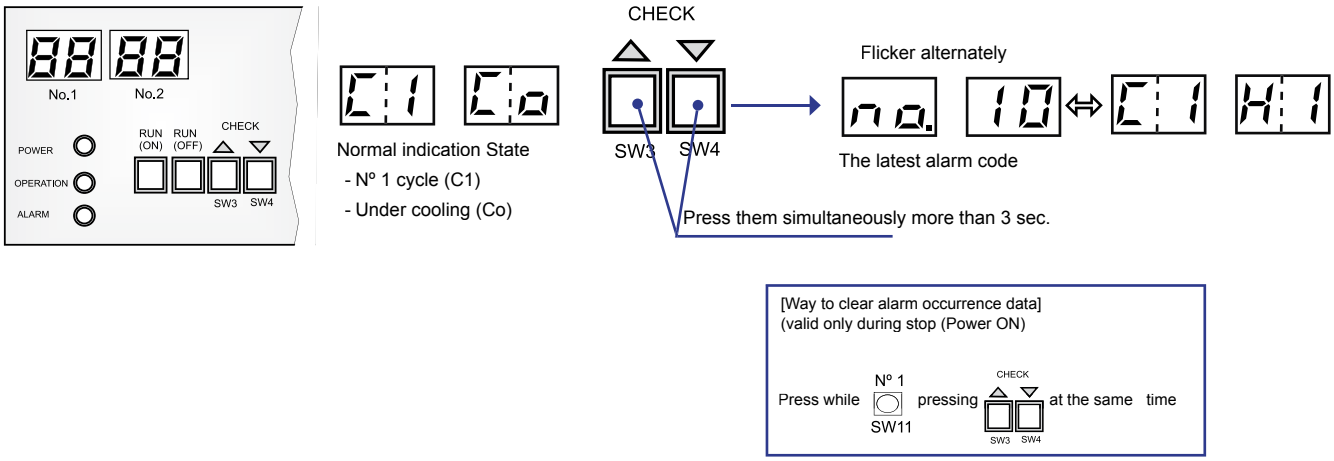
5

The following operation makes change from check mode back to normal mode.

1. Press [▲] (SW3) more than 3 sec.
2. In case that un-input state continues 1 hour.

### ◆ Alarm occurrence data

Alarm occurrence data is indicated by pressing [▲] (SW3) [▼] (SW4) on PCB. (It is possible to do during stop / operation). (*Mode should not be shifted during alarm occurrence)




By pressing [▲][▼], indication is changed. The followings are the contents.

| Item | Example of code indication (alternately flicker) | Contents |
|---|---|---|
| Latest activation of protection device (alarm code) | no. 10 ⇔ C1 H1 | The latest alarm is indicated firstly. (Max 10).<br>In case of 5 alarm is saved, no.5 is indicated firstly.<br>In case of the latest alarm = No.1 high pressure block device activation<br>If there is no saved alarm code, [00-00] |
| 5th oldest Activation of protection device (alarm code) | no. 5 ⇔ SP SP | The 5th oldest alarm [pump interlock abnormality]. |
| | no. 1 ⇔ 40 40 | The 10th alarm [Error operation]<br>*Alarm of more than10th oldest is renewed |

The following operation makes change from alarm occurrence indication mode back to normal mode.

1. Press [▲] (SW3) [▼] (SW4) more than 3 sec.

2. In case that un-input state continues 30 seconds.

3 Alarm Data Indication Function (The Last Saved Data before Alarm Occurrence)

Regarding the latest alarm, the last sensor data before stop can be indicated, while alarm occurrence is indicated. (Data is indicated by the following operation during the latest alarm occurrence indication)

-Alarm data of the latest alarm occurrence is only saved.

-Alarm data is cleared by Power OFF

-In case that data is not saved, alarm occurrence data mode after flickering [- - -] twice.

4 To switch indication items, Press [▲] (SW3) [▼] (SW4).

5 Indication data is the same as the one of check mode. However, the next items are indicated as an additional.

| Item | Example of code indication (alternately flicker) | Contents |
|---|---|---|
| Refrigerant liquid | | |
| Outlet water temp (backside of heat exchanger of water side) | C1 Co ⇔ 7<br>C2 Co ⇔ 7 | Outlet water temp (backside of heat exchanger of water side) [ºC]<br>-In case of No. 1 outlet water temp is 7ºC<br>-In case of No. 2 outlet water temp is 7ºC |
| Fan control state | | |
| | C1 Eo ⇔ 242<br>C2 Eo ⇔ 240 | Indication of electron expansion valve opening<br>-In case of No. 1 opening is 242 pulse.<br>-In case of No. 2 opening is 240 pulse. |

The following operation makes change from alarm data indication mode to normal mode.

1. Press [▲] (SW3) [▼] (SW4) more than 3 sec.
2. In case that un-input state continues 30 seconds.

The following operation makes change from alarm data indication mode to alarm occurrence data mode.

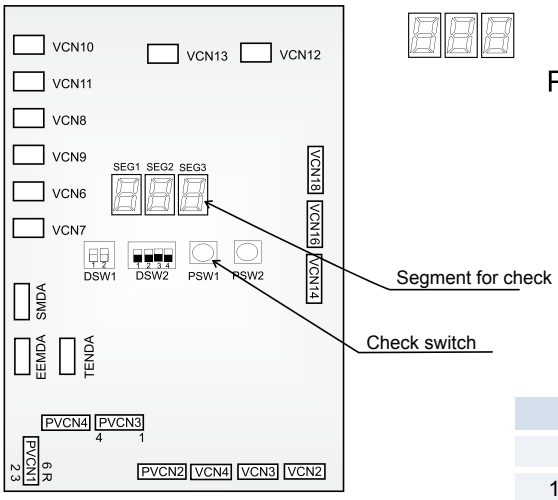
1. Press [▼] (SW4) more than 3 sec.

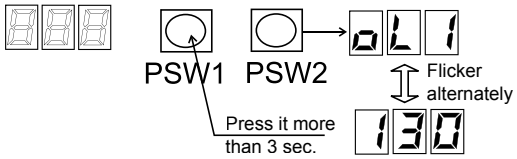
### ◆ Electron expansion valve opening indication

By pressing [O] (PSW1) on PCB for electron expansion valve more than 3 seconds, actual expansion valve order opening (pulse) is indicated on the segment. (it is possible during stop / operation)

Once pulses are displayed, pushing again PSW1 enables you to check each cycles expansion valve position.

$PWB_G$ (VD PCB)



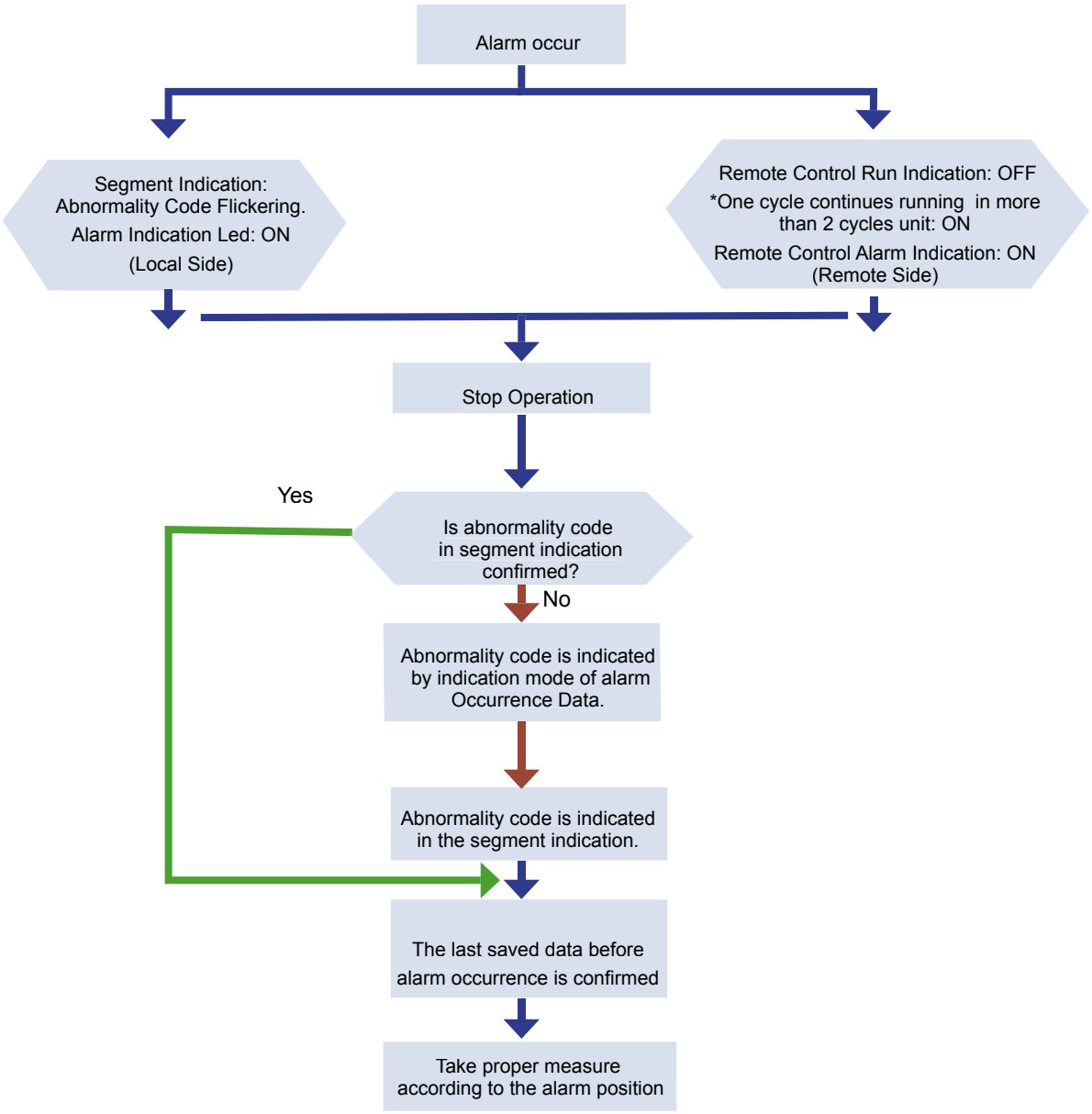

* Light off by pressing [O] more than 3 seconds.

| PULSES | OPENING % |
|---|---|
| 10 (Thermo OFF) | 1,5 % |
| 112 (Min. running value) | 17% |
| 656 (Max. running value) | 100% |

# 5.2. Troubleshooting

## 5.2.1. Outline of failure diagnosis

In the case of abnormality, alarm LED on the control panel of unit and of remote control is ON and segment indication on the control panel is flickering. To stop the unit, put it into stop operation without power OFF(Main switch).

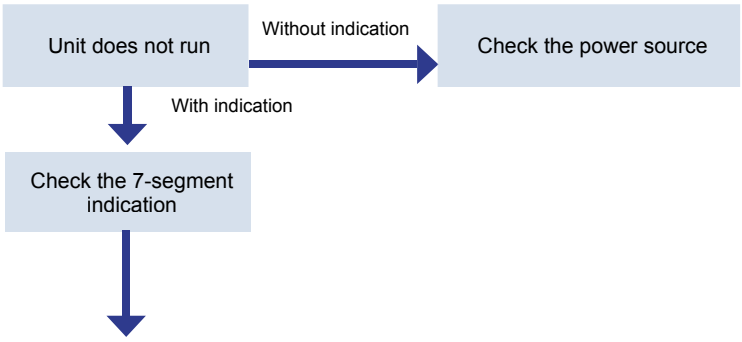



*NOTES:*

- After the stop operation, alarm indication is turned off and initial status 88 is displayed. Abnormality code, which was activated before can be seen by entering “Indication Mode of Alarm Occurrence Data”.
- When the power turns off and turns on, the indication on the display is initial status. Abnormal code, which was activated before can be seen by entering “Indication Mode of Alarm Occurrence Data”
- When the power turns off (Main switch), “The Last Saved Data before Alarm Occurrence” is cleared.
- "The Last Saved Data before Alarm Occurrence” has only the last data before last alarm. In case of before that, only alarm code is saved.

### 5.2.2. Alarm indication

7-Segment indication shows the following abnormalities:




| Alarm Code<br>No.1~6 cycles | Description of abnormality |
|---|---|
| [E1-H1]~[ES-HS] | Activation of High Pressure Switch |
| [E1-L1]~[ES-LS] | Excessively Low Pressure |
| [E1-L1]~[ES-LS] | Activation of Low Pressure Protection Control |
| [E1-41]~[ES-45] | Activation of Fan Motor Internal Thermostat (Only for 70,80,140,160,210,240,280,320,350 and 400HP) |
| [E1-51]~[ES-55] | Activation of Thermal Relay for Compressor or Chattering alarm or Malfunction of Auxiliary Relay Arn |
| [E1-61]~[ES-65] | Activation of Discharge Gas Thermostat |
| [E1-71]~[ES-75] | Activation of Compressor Internal Thermostat |
| [E1-91]~[ES-95] | Excess Low Temperature of Cooler Inlet Refrigerant |
| [E1-E1]~[ES-ES] | Low Pressure Protection by Suction Gas Thermistor |
| [E1-05]~[ES-05] | Phase Abnormally (Only for 4 and 5 cycle unit) |
| [E1-12]~[ES-12] | Failure of Water Outlet Thermistor (Only for 2 – 5 cycle unit) |
| [E1-13]~[ES-13] | Activation of Freeze Protection Control (Only for 2 – 5 cycle unit) |
| [E1-14]~[ES-14] | Activation of Water Overheating Protection Control |
| [E1-21]~[ES-21] | Failure of Cooler Inlet Refrigerant Thermistor (Open/Short) |
| [E1-23]~[ES-23] | Failure of Discharge Gas Thermistor (Open/Short) |
| [E1-24]~[ES-24] | Failure of Thermistor set before Expansion Valve (Open / Short) |
| [E1-25]~[ES-25] | Failure of Water Outlet Thremistor at Rear Side of Water Cooler (Open / Short) |
| [E1-26]~[ES-26] | Failure of Suction Gas Thermistor (Open / Short) |
| [E1-27]~[ES-27] | Failure of Discharge Gas Pressure Sensor (Open / Short) |
| [E1-28]~[ES-28] | Failure of Suction Gas Pressure Sensor (Open / Short) |
| [E1-F0]~[ES-F0] | Incorrect Setting of Fan Number |
| [E1-SP]~[ES-SP] | No Feedback Signal from Water Pump |
| [F1-11]~[FS-14] | Fan Inverter Rotation Abnormality *1 |
| [F1-21]~[FS-24] | Activation of Fan Inverter Over Current Protection Control *1 |
| [F1-31]~[FS-34] | Fan Inverter Phase Abnormality *1 |
| [F1-41]~[FS-44] | Error Communication between Inverter PCB and Control or Fan Control PCB *1 |
| [F1-51]~[FS-54] | Inverter Power Supply Abnormality *1 |
| [05-05] | Phase Abnormality (Only for 1 – 3 cycle unit) |
| [11-11] | Failure of Water Inlet Thermistor (Open / Short) |
| [12-12] | Failure of Water Outlet Thermistor (Open / Short) (Only for 1 cycle unit) |
| [13-13] | Activation of Freezing Protection Control (Only for 1 cycle unit) |
| [14-14] | Activation of Water Overheating Protection Control |
| [22-22] | Failure of Ambient Temperature Thermistor (Open / Short) |
| [SP-SP] | Pump interlock Signal abnormality |

*1 : [21] Right side Segment shows Fan No.

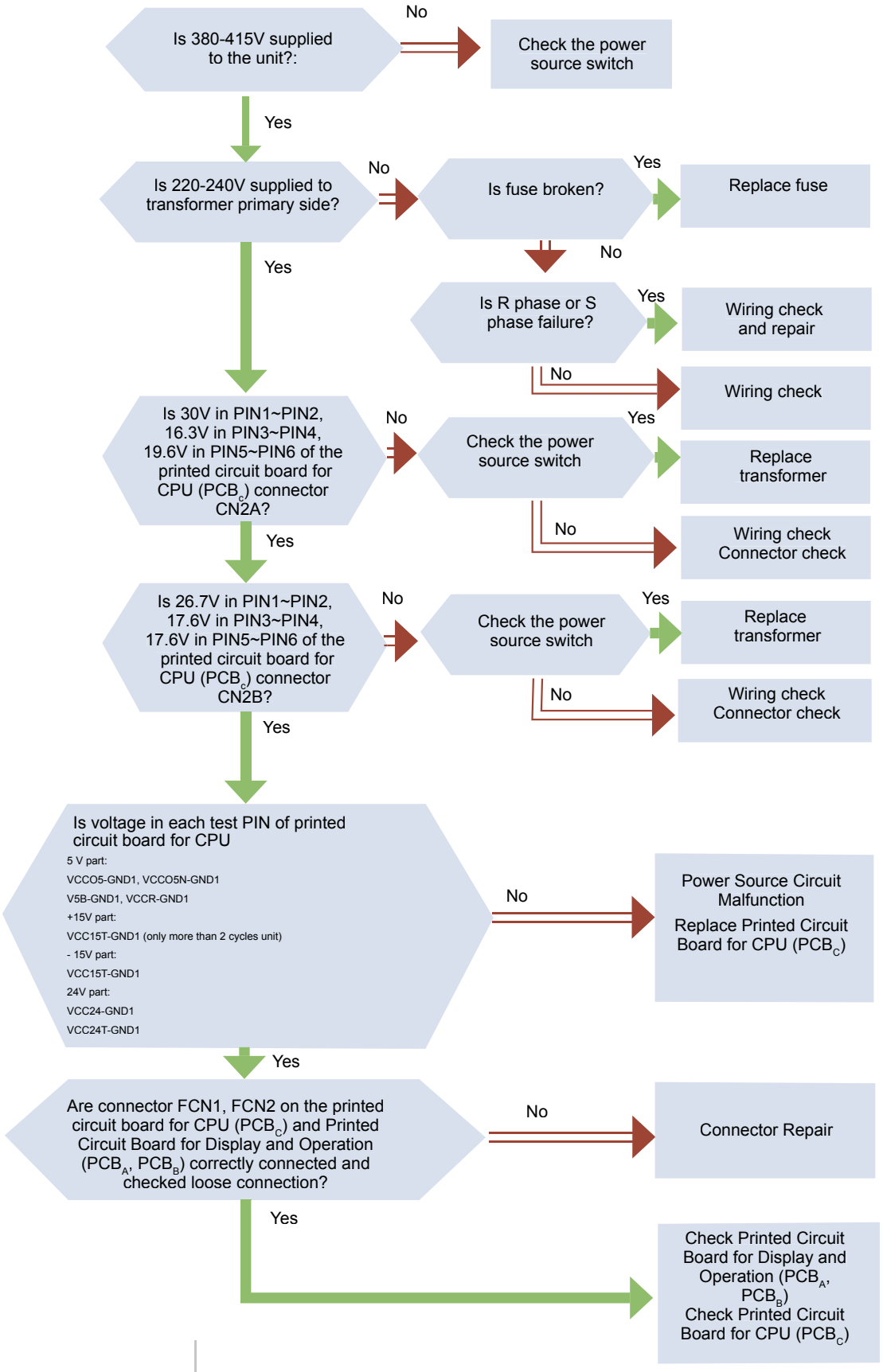
| Alarm Code<br>No.1~5 cycles | Description of abnormality |
|---|---|
| [40-40] | Incorrect Operation |
| [CP-CP] | Error communication between Ctrl. PCB ($PCB_{C1}$, $PCB_{C2}$) |
| [EU-EU] | Error communication between Expansion Valve PCB and Cntrol PCB |
| [$F_C$-$F_C$] | Error communication between Fan Contol PCB and Cntrol PCB |
| " [PU-PU] " | Alarm of Excessively High Water -Temperature |
| [bE-bE] | Alarm of Water Failure (Differential Water Pressure Switch Option) |
| [AP-AP] | Activation of Additional Protection Device (Option) |
| [03-03] | Error communication between Chiller and Remote Controller (If CSC-5S is connected.) |
| [F1-P7]~[F5-P7] | Retry Operation (More Than 3 Fans Retry at The Same Time) |
| [F1-P8]~[F5-P8] | Retry Operation (by Alarm Fx-41 or Fx-51, x: Cycle No.) |
| [C1-P5]~[C5-P5] | Retry Operation (by Alarm Cx-6x or Cx-7X, x: Cycle No.) |
| [C1-P6]~[C5-P6] | Retry Operation (by Alarm Cx-9x or Cx-LX, x: Cycle No.) |

" - " : Flickering

### 5.2.3. Failure diagnosis method

◆ **General check of failure diagnosis.**

In the case of no segment indication, unit can not operate.



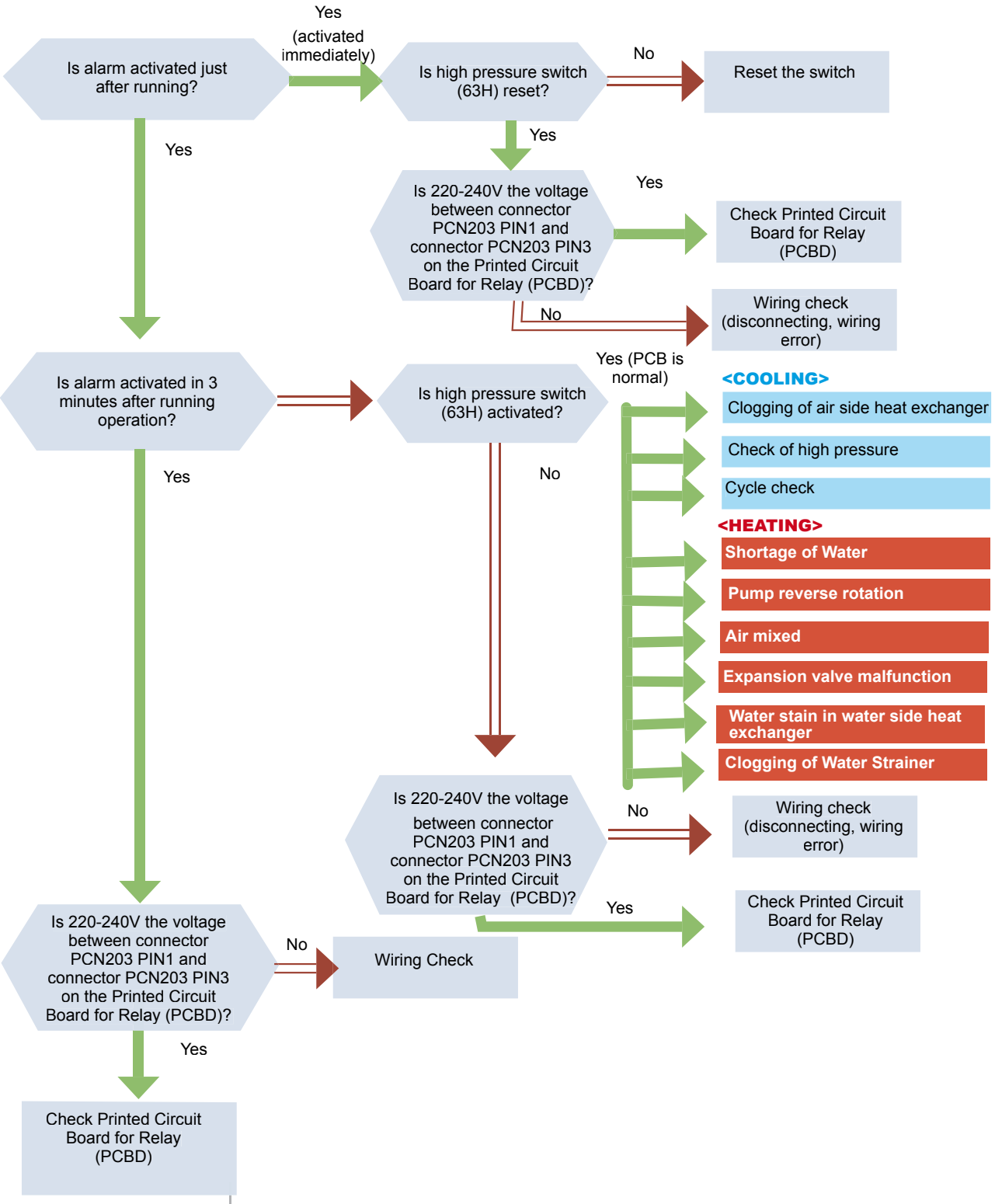
## Alarm code C1-H1 C5-H5 — Activation of High Pressure Switch (63H)

**[Alarm Stop Reason]**

High pressure (Pd) is increased to more than 2.74MPa, and high pressure switch (63H) is activated.

**[PCB Monitoring Position]**

No. 1 Cycle: $PCB_{D1}$ (I/O PCB )PCN203
No. 2 Cycle: $PCB_{D2}$ (I/O PCB )PCN203
No. 3 Cycle: $PCB_{D3}$ (I/O PCB )PCN203
No. 4 Cycle: $PCB_{D4}$ (I/O PCB )PCN203
No. 5 Cycle: $PCB_{D5}$ (I/O PCB )PCN203



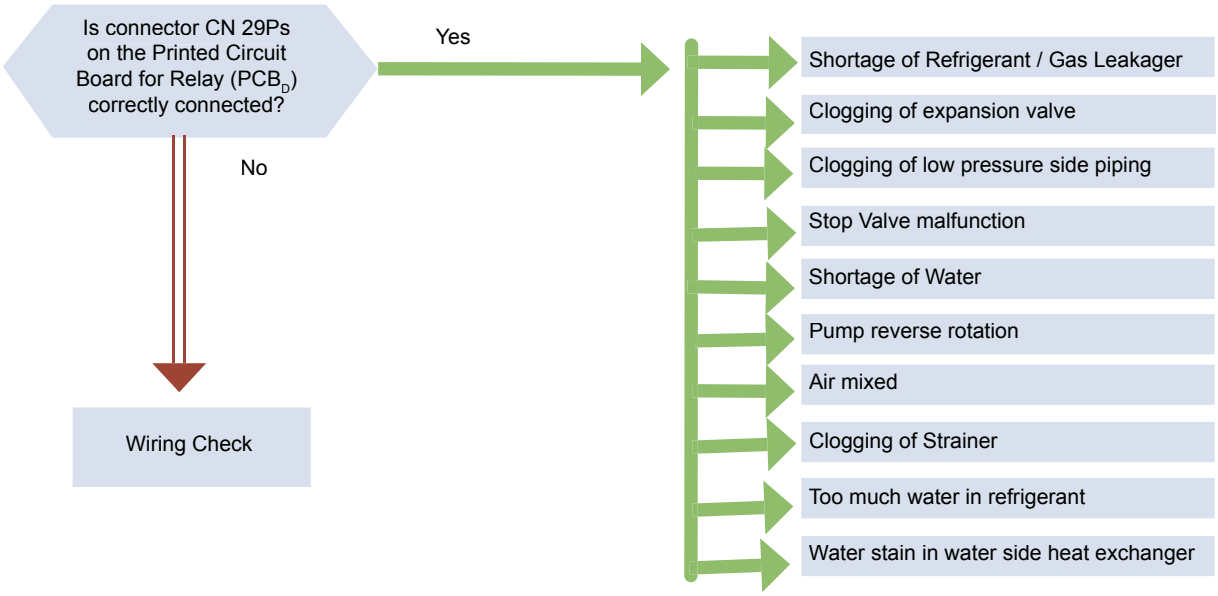
## Alarm code E1-L1 E5-L5 — Excessively low suction pressure

**[Alarm Stop Reason]**

Suction pressure (Ps) is less than 0.049MPa during 3 seconds. (electron control, cooling and heating)

**[PCB Monitoring Position]**

No. 1 Cycle: $PCB_{D1}$ (I/O PCB) CN29Ps
No. 2 Cycle: $PCB_{D2}$ (I/O PCB) CN29Ps
No. 3 Cycle: $PCB_{D3}$ (I/O PCB) CN29Ps
No. 4 Cycle: $PCB_{D4}$ (I/O PCB) CN29Ps
No. 5 Cycle: $PCB_{D5}$ (I/O PCB) CN29Ps



## Alarm code C1-L1 C2-L5 — Activation of suction pressure protection control

**[Alarm Stop Reason]**

-Suction pressure (Ps) is less than 0.333MPa during 90 seconds. (Electronic control, air-cooled type)

-Suction pressure (Ps) is less than 0.314MPa during 90 seconds. (Electronic control, air-cooled heat pump type

(only cooling operation))

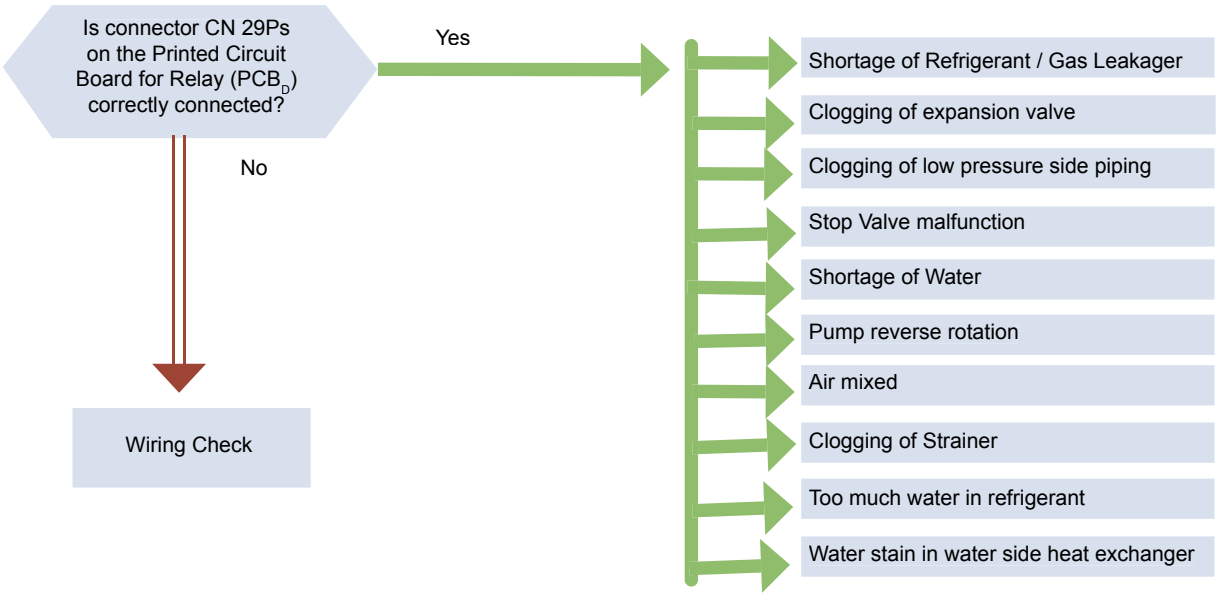
*Alarm stop: 3 retries during 30 minutes. (Compressor stop, automatic restart in 3 minutes)

**[Retry Code]**

No. 1 Cycle: C1-P6
No. 2 Cycle: C2-P6
No. 3 Cycle: C3-P6
No. 4 Cycle: C4-P6
No. 5 Cycle: C5-P6

**[PCB Monitoring Position]**

No. 1 Cycle: $PCB_{D1}$ (I/O PCB) CN29Ps
No. 2 Cycle: $PCB_{D2}$ (I/O PCB) CN29Ps
No. 3 Cycle: $PCB_{D3}$ (I/O PCB) CN29Ps
No. 4 Cycle: $PCB_{D4}$ (I/O PCB) CN29Ps
No. 5 Cycle: $PCB_{D5}$ (I/O PCB) CN29Ps



## Alarm code C1-51 / C5-55 — Activation of Thermal Relay for Compressor (51C)

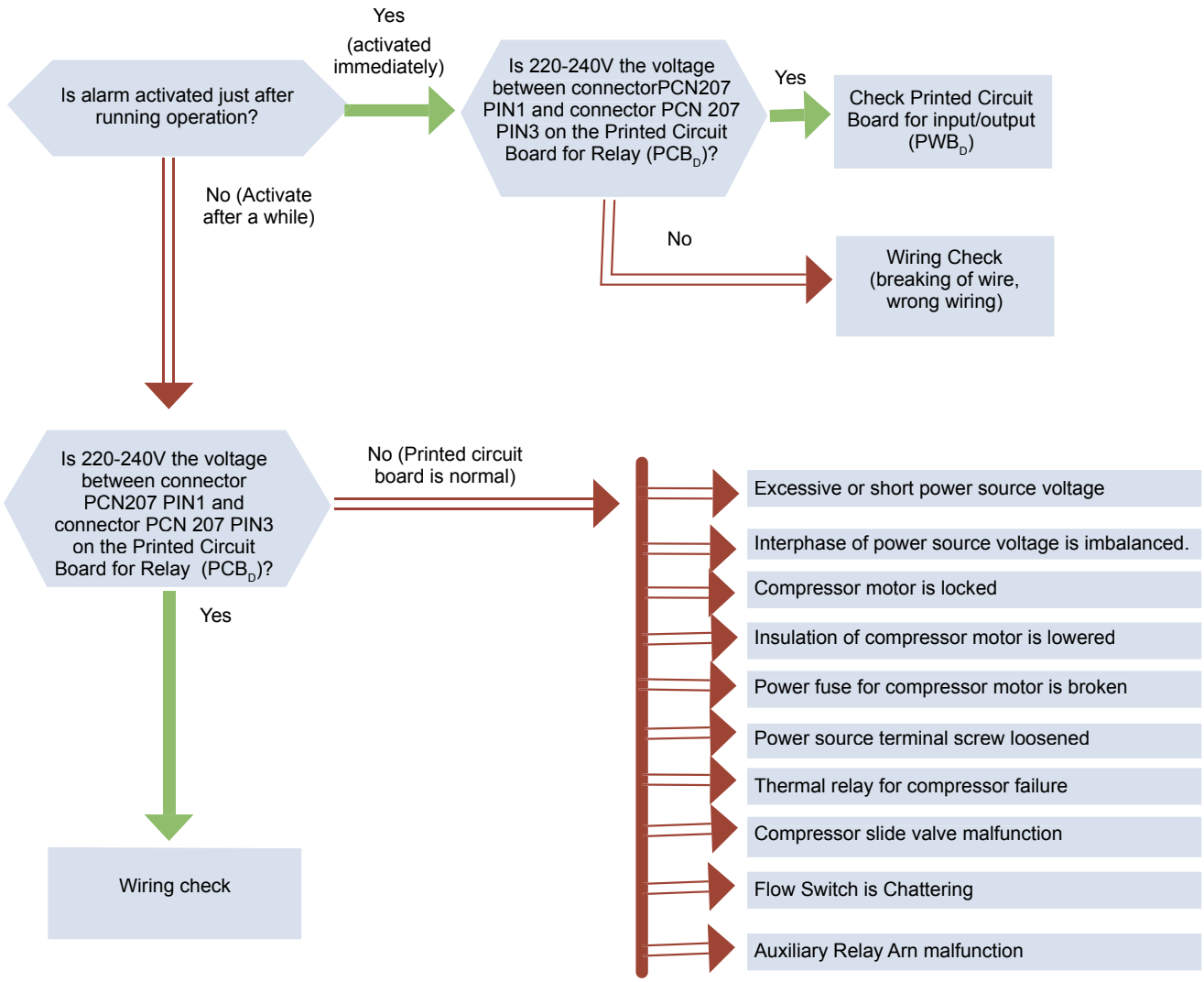
**[Alarm Stop Reason]**

-Operation current for any compressor is increased too much and activates the Thermal Relay.

-Chattering of external protection device connected to the chiller (eg: flow switch)

**[PCB Monitoring Position]**

No. 1 Cycle: $PCB_{D1}$ (I/O PCB) PCN207
No. 2 Cycle: $PCB_{D2}$ (I/O PCB) PCN207
No. 3 Cycle: $PCB_{D3}$ (I/O PCB) PCN207
No. 4 Cycle: $PCB_{D4}$ (I/O PCB) PCN207
No. 5 Cycle: $PCB_{D5}$ (I/O PCB) PCN207



## Alarm code C1-61 C5-65 — Activation of Discharge Gas Thermistor (Td)

**[Alarm Stop Reason]**

1.- Discharge gas temperature from the compressor is increased to 130°C and continues for 1 minute.

2.- During the time counting in 1 minute, temperature is increased over 140°C during more than 3 seconds.

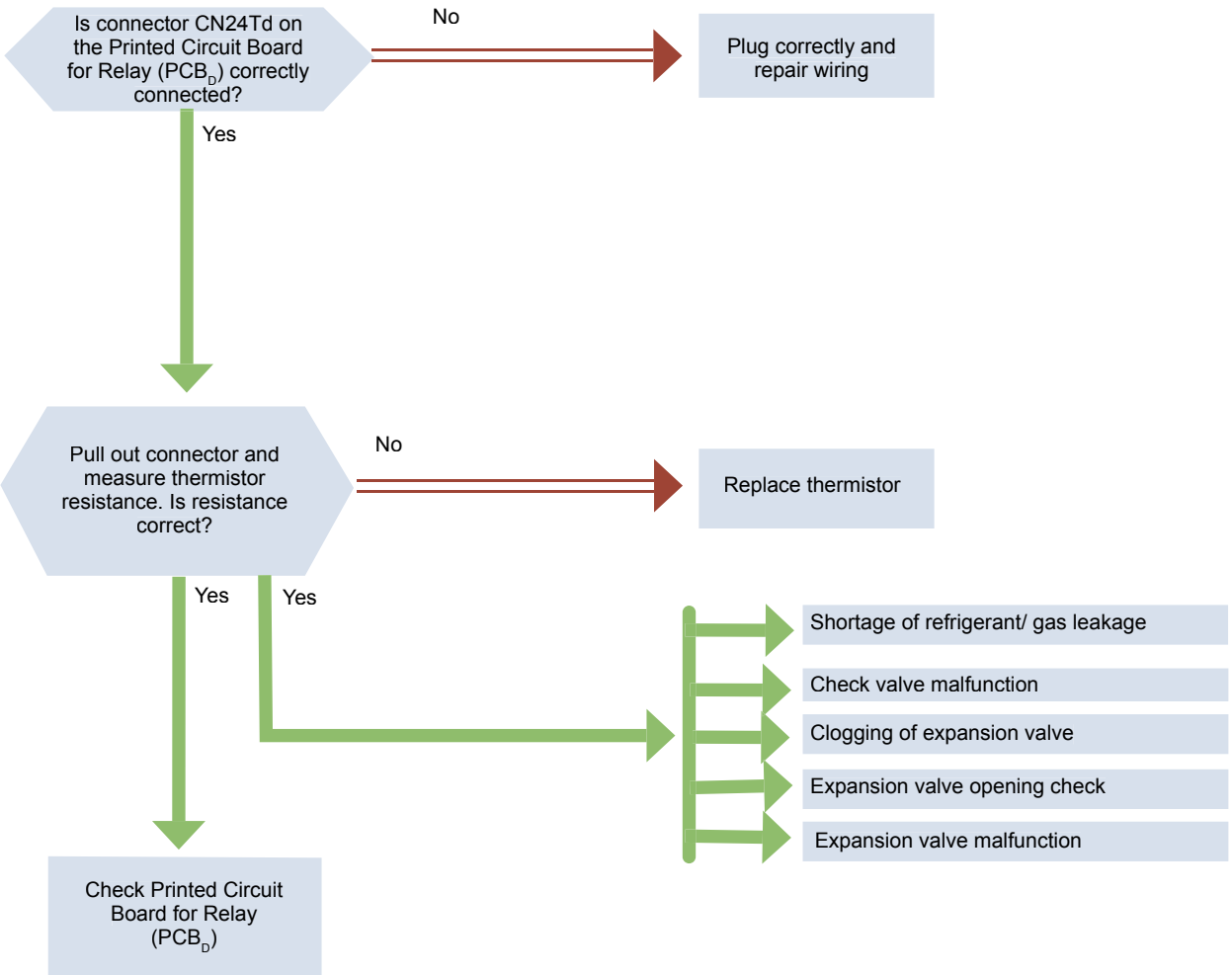
*In case of nº 2, alarm stop: 3 retries during 90 minutes. (Compressor stop, automatic restart in 3 minutes)

**[Retry Code]**

No. 1 Cycle: C1-P5
No. 2 Cycle: C2-P5
No. 3 Cycle: C3-P5
No. 4 Cycle: C4-P5
No. 5 Cycle: C5-P5

**[PCB Monitoring Position]**

No. 1 Cycle: $PCB_{D1}$ (I/O PCB) CN24Td
No. 2 Cycle: $PCB_{D2}$ (I/O PCB) CN24Td
No. 3 Cycle: $PCB_{D3}$ (I/O PCB) CN24Td
No. 4 Cycle: $PCB_{D4}$ (I/O PCB) CN24Td
No. 5 Cycle: $PCB_{D5}$ (I/O PCB) CN24Td



## Alarm code C1-71 C5-75 — Activation of Internal Thermostat for Compressor

**[Alarm Stop Reason]**

The electrical motor of the compressor is overheated and internal Thermostat is activated.

*Alarm stop: 3 retries during 60 minutes. (Automatic restart after compressor stop and Thermostat recover)

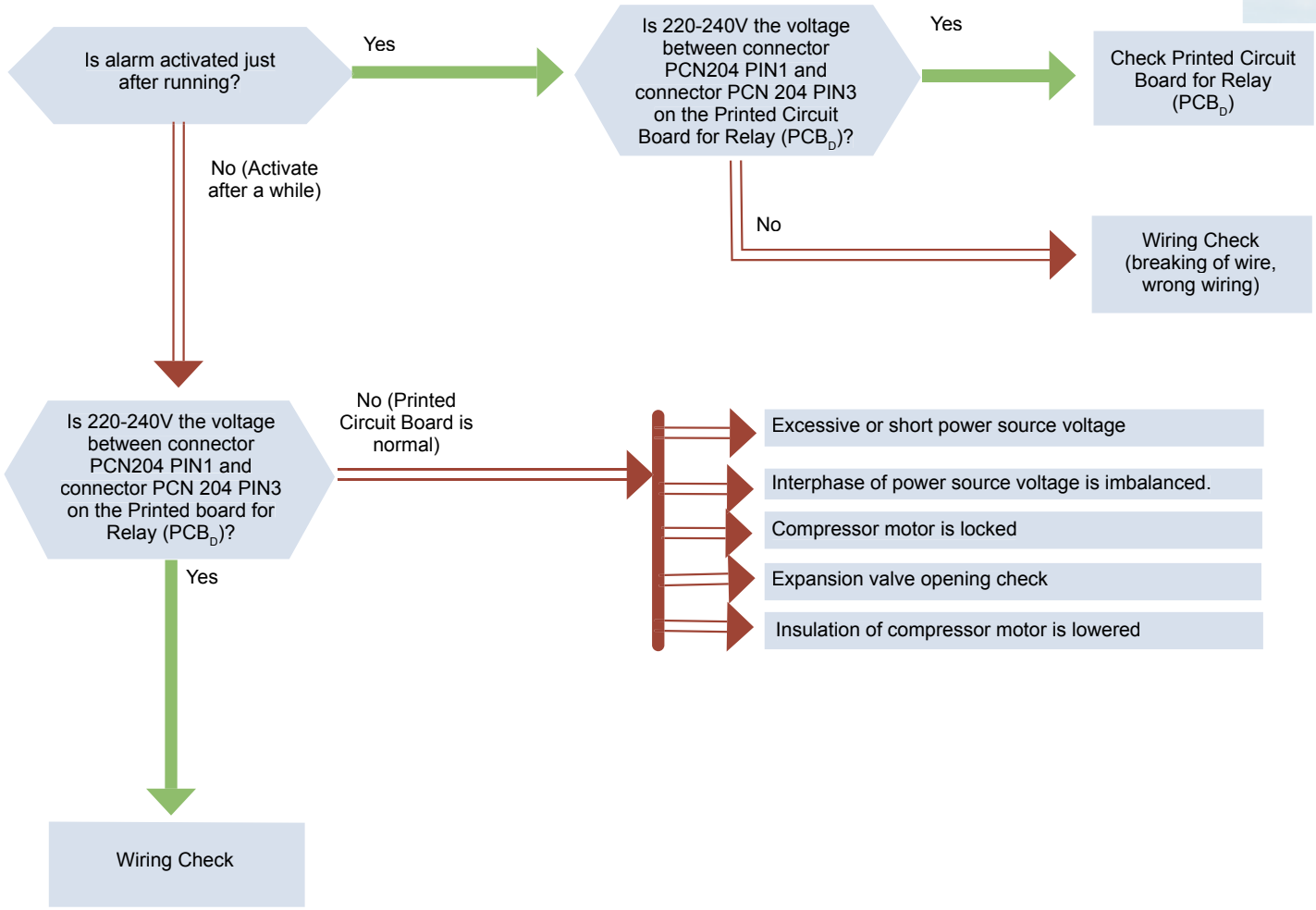
**[PCB Monitoring Position]**

No. 1 Cycle: $PCB_{D1}$ (I/O PCB) PCN204
No. 2 Cycle: $PCB_{D2}$ (I/O PCB) PCN204
No. 3 Cycle: $PCB_{D3}$ (I/O PCB) PCN204
No. 4 Cycle: $PCB_{D4}$ (I/O PCB) PCN204
No. 5 Cycle: $PCB_{D5}$ (I/O PCB) PCN204

**[Retry Code]**

No. 1 Cycle: C1-P5
No. 2 Cycle: C2-P5
No. 3 Cycle: C3-P5
No. 4 Cycle: C4-P5
No. 5 Cycle: C5-P5

5



## Alarm code C1-91 C5-95 — Excess Low Temperature of Cooler Inlet Refrigerant (Tr)

**[Alarm Stop Reason]**

- Refrigerant temperature in water side heat exchanger inlet (Tr) is less than –6.5°C during 3 seconds. (only for cooling operation)

*Alarm stop: 3 retries during 30 minutes. (Compressor stop, automatic restart in 3 minutes)

- Refrigerant temperature in water side heat exchanger inlet (Tr) is less than -35°C during 10 seconds. (only for defrosting operation)
- If the time between the end of a defrost, and the confirmation of the conditions to start again a defrost in the same cycle is less then 13 minutes.

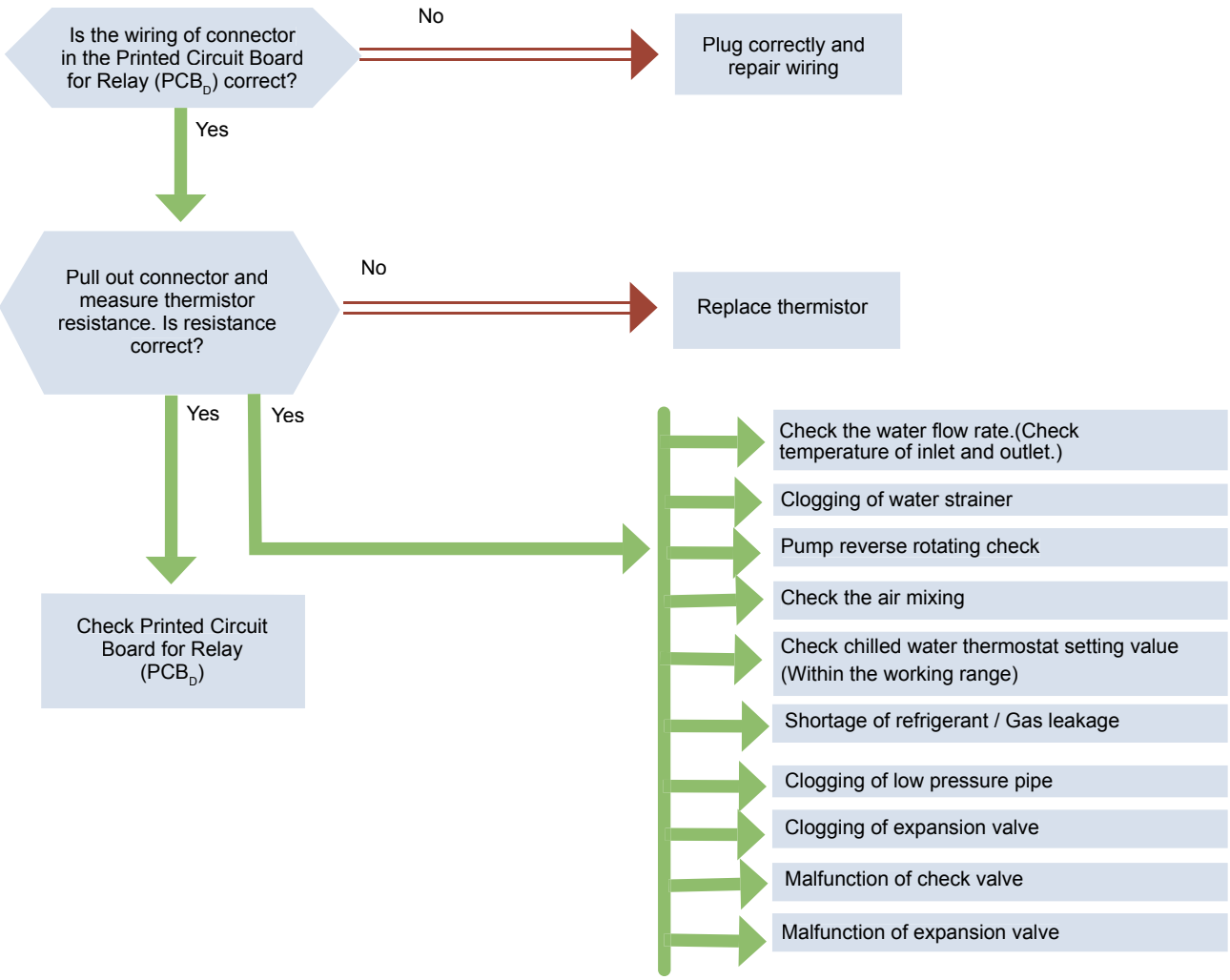
*No retry during defrosting operation. Alarm stop immediately.

**[PCB Monitoring Position]**

No. 1 Cycle: $PCB_{D1}$ (I/O PCB) CN27Tr2
No. 2 Cycle: $PCB_{D2}$ (I/O PCB) CN27Tr2
No. 3 Cycle: $PCB_{D3}$ (I/O PCB) CN27Tr2
No. 4 Cycle: $PCB_{D4}$ (I/O PCB) CN27Tr2
No. 5 Cycle: $PCB_{D5}$ (I/O PCB) CN27Tr2

**[Retry Code]**

No. 1 Cycle: C1-P6
No. 2 Cycle: C2-P6
No. 3 Cycle: C3-P6
No. 4 Cycle: C4-P6
No. 5 Cycle: C5-P6



## Alarm code C1-t1 / C5-t5 — Low Pressure Protection by Suction Gas Thermistor (Ts)

**[Alarm Stop Reason]**

- Suction Gas Temperature (Ts) is lower than –2°C during 10 seconds. (only cooling operation)

*Alarm stop: 3 retries during 30 minutes. (Compressor stop, automatic restart in 3 minutes)

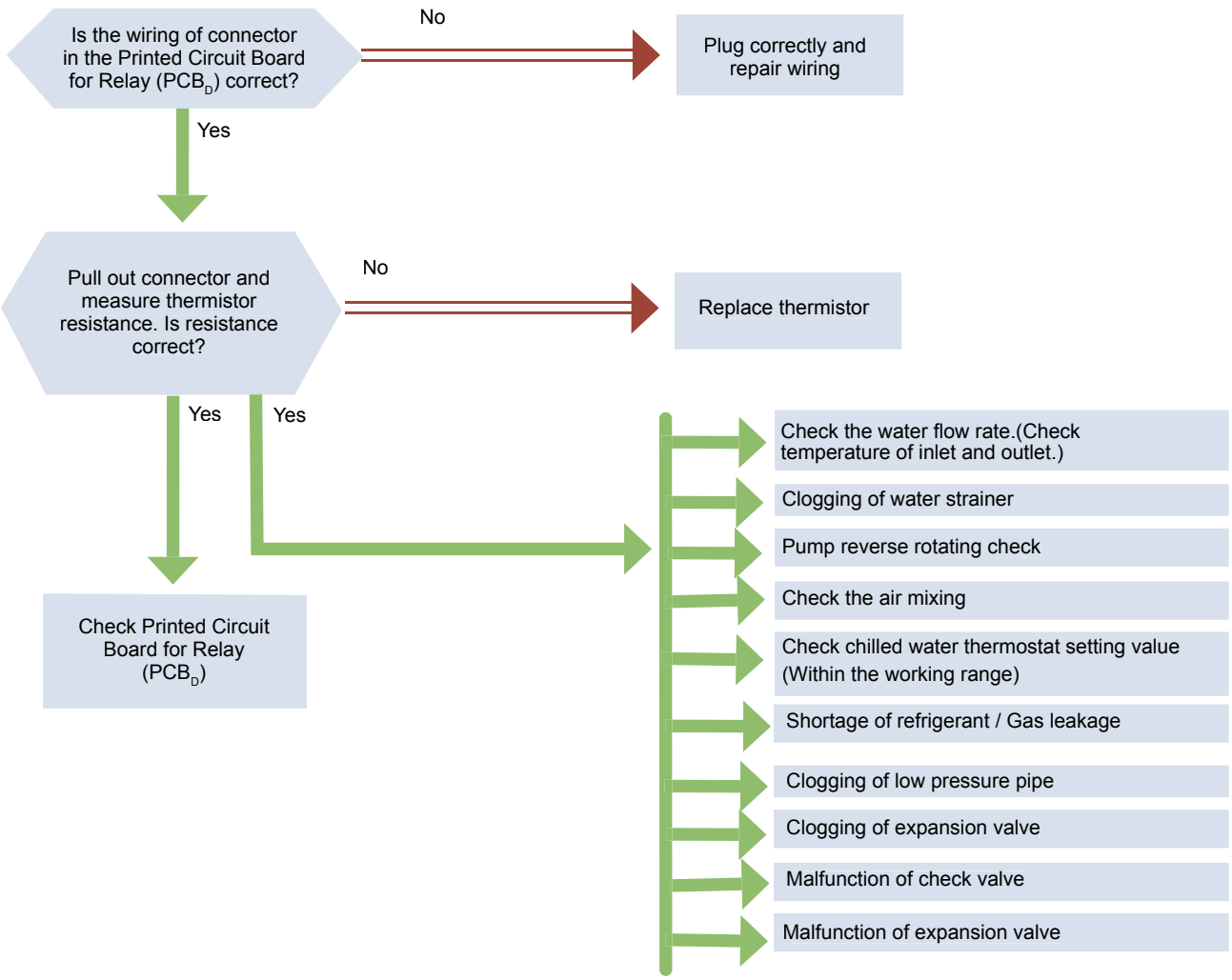
**[Retry Code]**

No. 1 Cycle: C1-P6
No. 2 Cycle: C2-P6
No. 3 Cycle: C3-P6
No. 4 Cycle: C4-P6
No. 5 Cycle: C5-P6

**[PCB Monitoring Position]**

No. 1 Cycle: $PCB_{D1}$ (I/O PCB) CN25Ts
No. 2 Cycle: $PCB_{D2}$ (I/O PCB) CN25Ts
No. 3 Cycle: $PCB_{D3}$ (I/O PCB) CN25Ts
No. 4 Cycle: $PCB_{D4}$ (I/O PCB) CN25Ts
No. 5 Cycle: $PCB_{D5}$ (I/O PCB) CN25Ts





## Alarm code 5P-5P — No Feedback Signal from Water Pump

**[Alarm Stop Reason]**

Pump operation feedback signal (terminals 1-2) is OFF during pump Interlock (CMP) ON (terminals 3-4)

*It is available once feedback signal confirmed.

**[PCB Monitoring Position]**

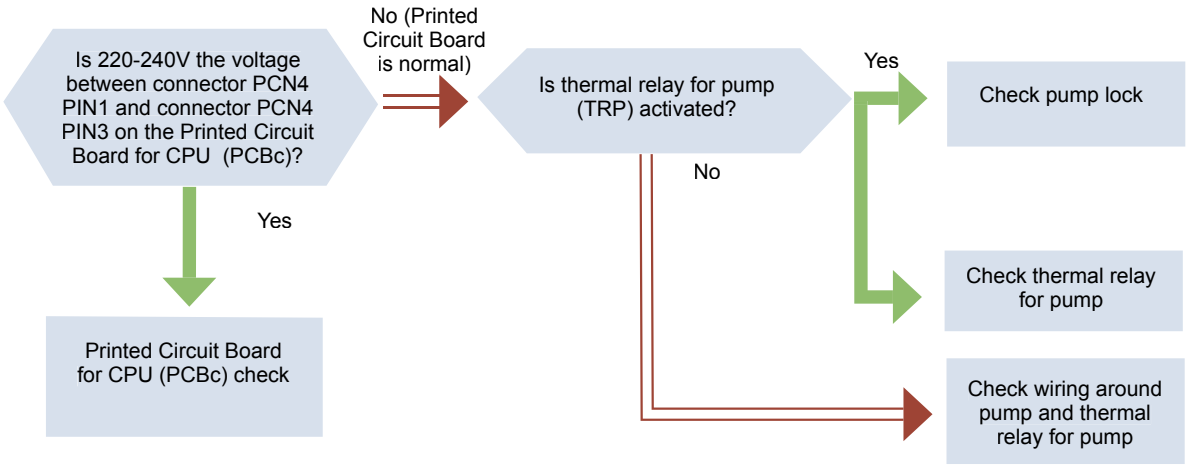
$PCB_c$ (CPU PCB) PCN24

*ATTENTION:*

During pump operation (during unit stop), Alarm is reset by

1. Feedback signal reconfirm
2. Pump stop
3. Unit operation

It is not reset by stop operation.



## Alarm code 05-05 / C1-05 / C5-05 — Phase Abnormality (Reverse Phase / Phase Failure)

**[Alarm Stop Reason]**

Power source connected to unit is reversed phase or open phase.

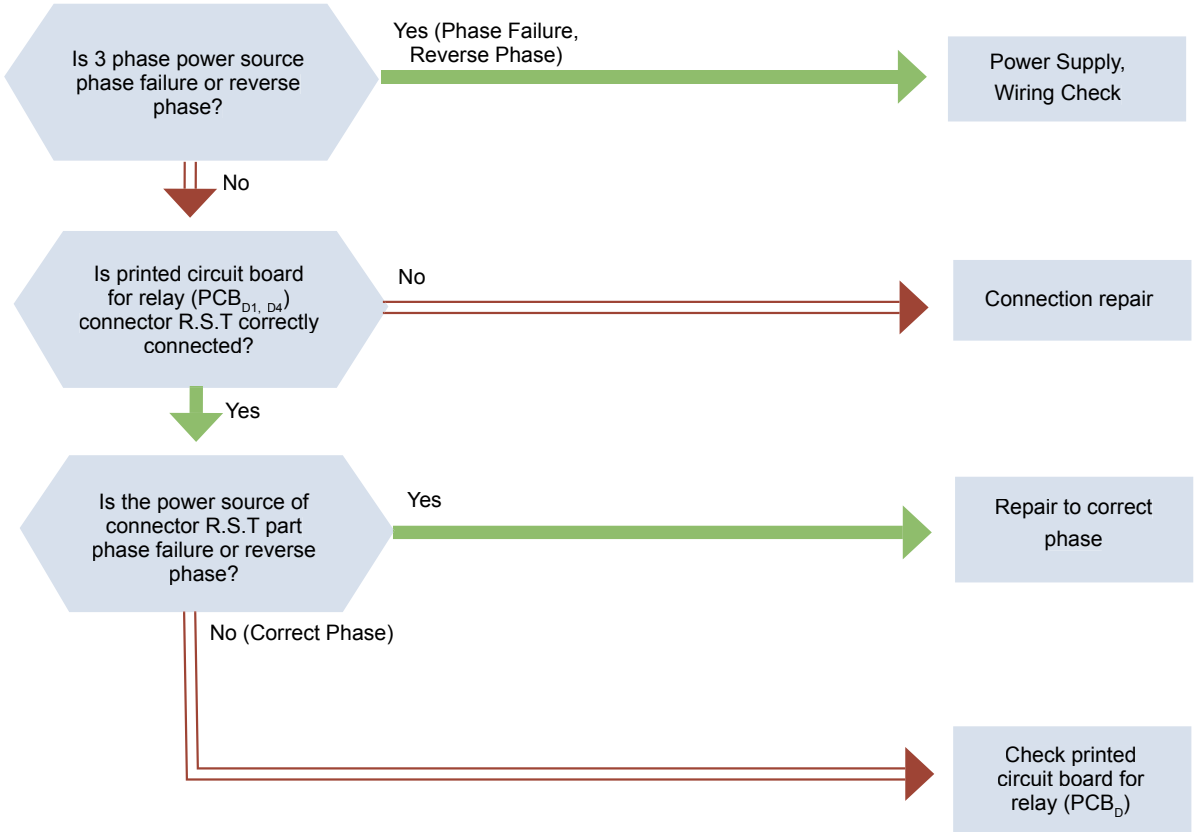
*In case of 1~3 cycle unit, “05-05”

In case 4, 5 cycle unit, “C1-05 ~ C5-05”.

**[PCB Monitoring Position]**

No. 1 ~ No. 3 Cycle: $PCB_{D1}$ (I/O PCB) R, S, T

No. 4 and No. 5 Cycle: $PCB_{D4}$ (I/O PCB) R, S, T




5

## Alarm code 13-13 / C1-13 / C5-13 — Activation of Freeze Protection Control

**[Alarm Stop Reason]**

- Chilled water temperature is lower than 2°C.(standard unit) (only cooling operation)
- $PCB_C$ PCN13 wiring is broken.

*"13-13" : for 1 cycle unit or if alarm is detected in inlet water temperature Thermistor or PCN13 wiring is broken.

"C1-13 ~ C5-13": It is detected in outlet water temperature in more than 2 cycle units.

**[PCB Monitoring Position]**

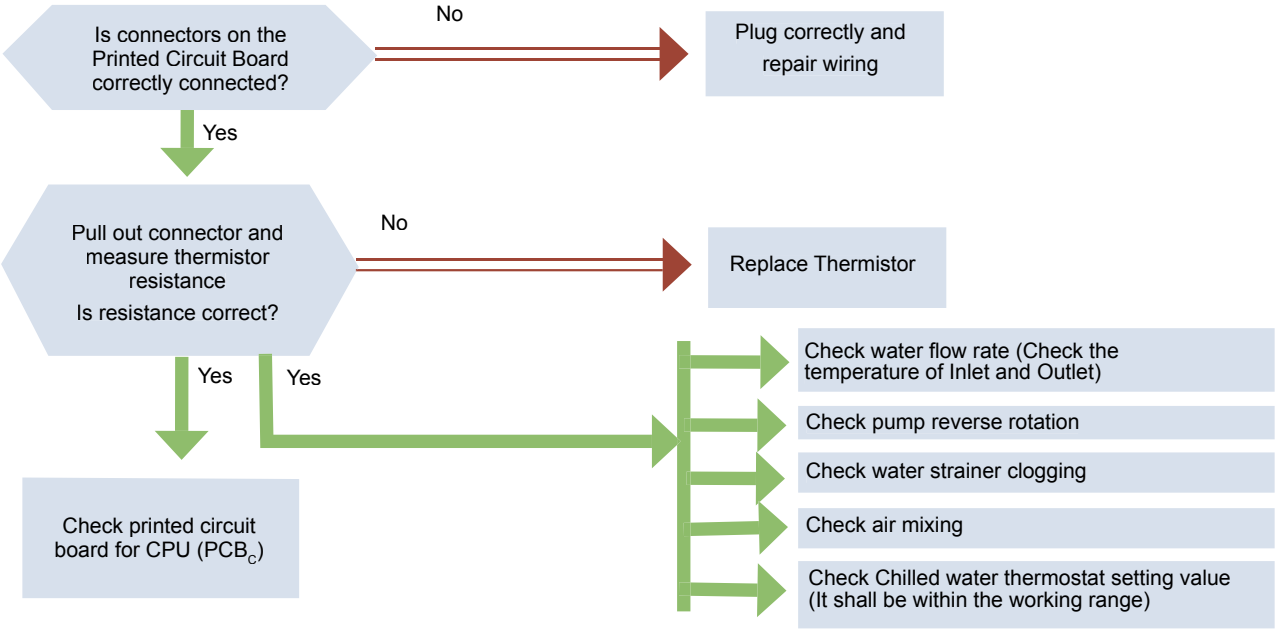
$PCB_C$ (CPU PCB) CN3 (for inlet), CN4 (for No. 1 cycle outlet), CN6 (for No. 2 cycle outlet), CN7 (for No. 3 cycle outlet)

$PCB_{D1}$ (I/O PCB) CN23Te2 (for No. 1 cycle protection)

$PCB_{D2}$ (I/O PCB) CN23Te2 (for No. 2 cycle protection)

$PCB_{D3}$ (I/O PCB) CN23Te2 (for No. 3 cycle protection)

$PCB_C$ (CPU PCB) PCN13




*NOTE:*

- One inlet temperature Themistor is installed in each unit.
- Two outlet temperature Thermistors are installed in every heat exchanger in water side.
- The below table shows the relation between Thermistor and alarm indication as well as connecting Printed Circuit Board (PCB).

| Product Model | Abnormal Code | Thermistor | PCB | Connector |
|---|---|---|---|---|
| RCUE 40 ~ 80 AG2<br>RHUE 40 ~ 80AG2 | 13-13 | Chilled water outlet temperature Thermistor 1 | $PCB_C$ | CN4 |
| | | Chilled water outlet temperature Thermistor 2 (backside cooler) | $PCB_{D1}$ | CN23 |
| RCUE 80 ~ 400 AG2<br>RHUE 80 ~ 240 AG2 | C1-13 | Chilled water outlet temperature Thermistor 1 | $PCB_{C1}$ | CN4 |
| | | Chilled water outlet temperature Thermistor 2 (backside cooler) | $PCB_{D1}$ | CN23 |
| | C2-13 | Chilled water outlet temperature Thermistor 1 | $PCB_{C1}$ | CN6 |
| | | Chilled water outlet temperature Thermistor 2 (backside cooler) | $PCB_{D2}$ | CN23 |
| | C3-13 | Chilled water outlet temperature Thermistor 1 | $PCB_{C1}$ | CN7 |
| | | Chilled water outlet temperature Thermistor 2 (backside cooler) | $PCB_{D3}$ | CN23 |
| | C4-13 | Chilled water outlet temperature Thermistor 1 | $PCB_{C2}$ | CN4 |
| | | Chilled water outlet temperature Thermistor 2 (backside cooler) | $PCB_{D4}$ | CN23 |
| | C5-13 | Chilled water outlet temperature Thermistor 1 | $PCB_{C2}$ | CN6 |
| | | Chilled water outlet temperature Thermistor 2 (backside cooler) | $PCB_{D5}$ | CN23 |
| RCUE 40 ~ 400 AG2<br>RHUE 40 ~ 240 AG2 | 13-13 | Chilled water inlet temperature Thermistor | $PCB_C$ | CN3 |

## Alarm code 14-14 / C1-14 / C5-14 — Activation of Water Overheating Protection Control

**[Alarm Stop Reason]**

- Water outlet temperature is above 59°C during compressor operation. (only heating operation)
- $PCB_C$PCN12 wiring is broken.

*"14-14" : 1 cycle unit

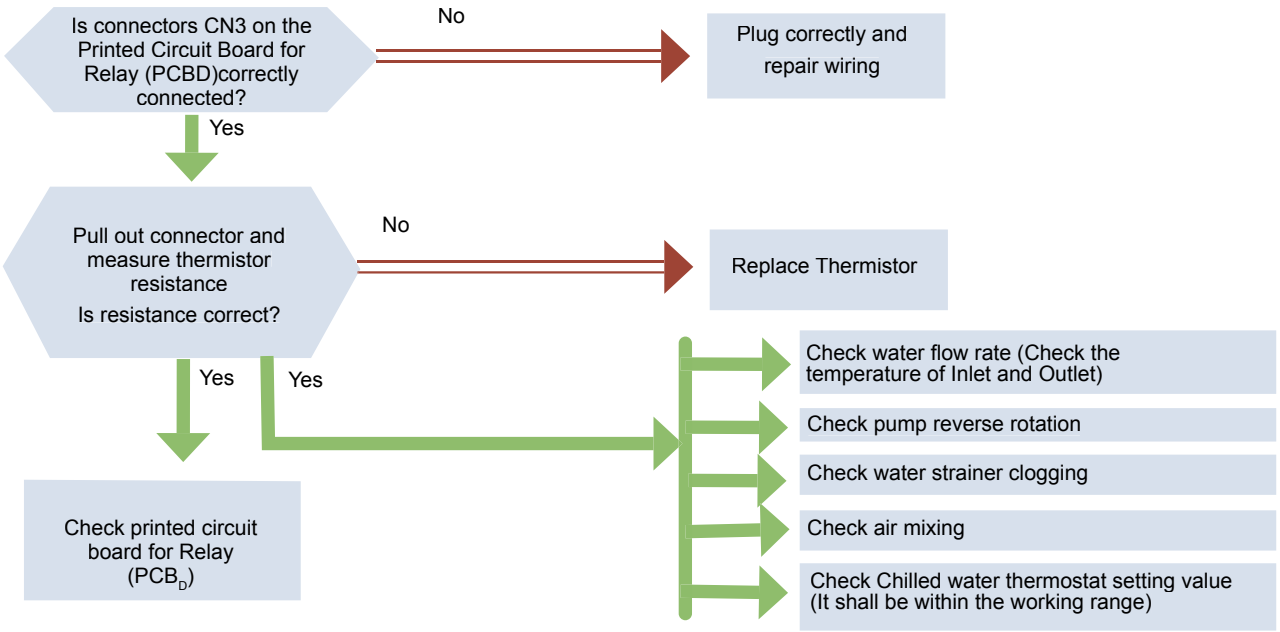
"C1-14 ~ C5-14 ": more than 2 cycle units

**[PCB Monitoring Position]**

$PCB_C$ (CPU PCB):

- CN4 (for No.1 cycle outlet control)
- CN6 (for No. 2cycle outlet control)

$PCB_C$ (CPU PCB) PCN12




*NOTE:*

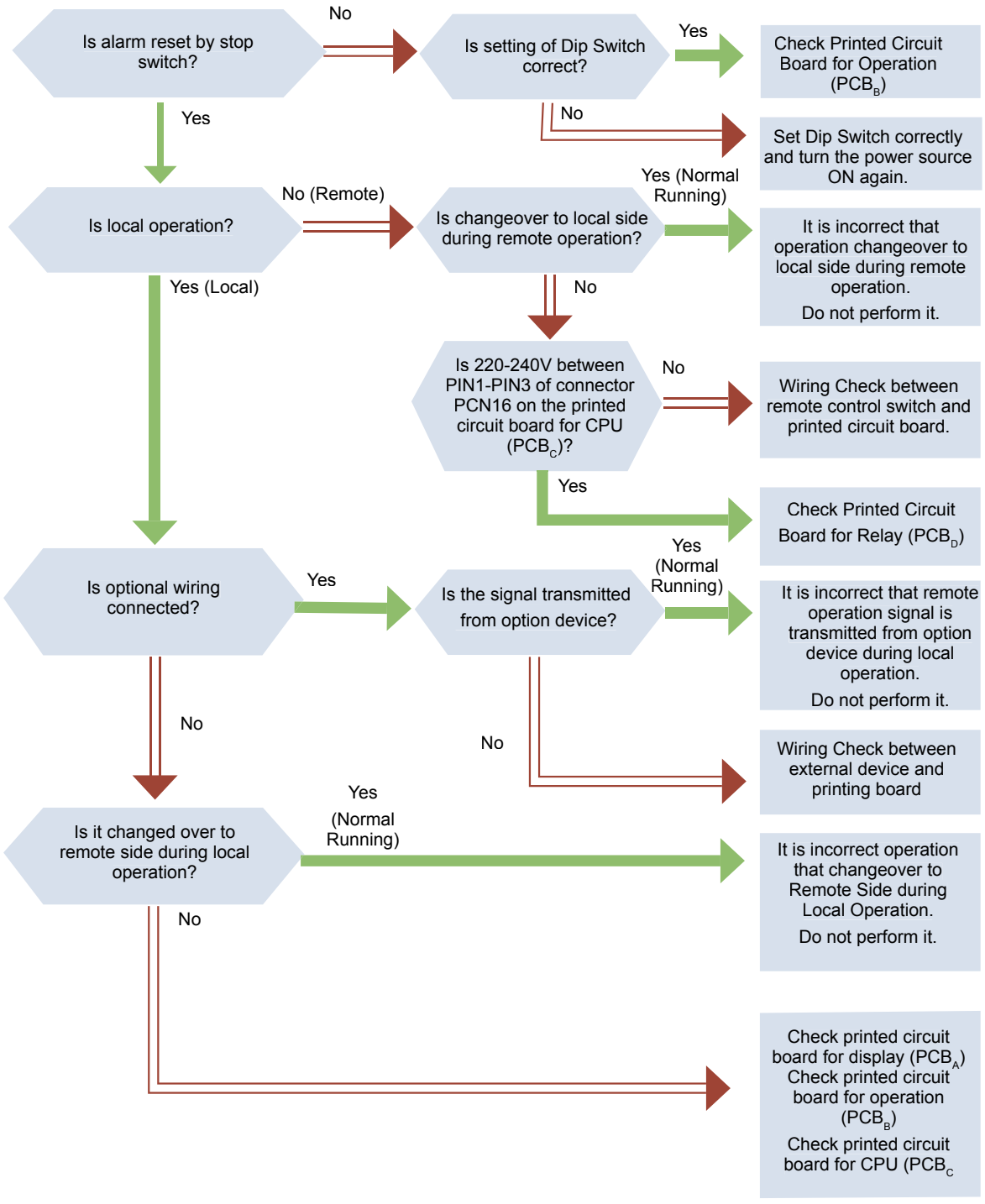
The below table shows the relation between Thermistor and alarm indication as well as connecting Printed Circuit Board (PCB).

| Product Model | Abnormal Code | Thermistor | PCB | Connector |
|---|---|---|---|---|
| RCUE 40 ~ 80 AG2<br>RHUE 40 ~ 80AG2 | 14-14 | Outlet water outlet temperature Thermistor 1 | $PCB_{C1}$ | CN4 |
| RCUE 80 ~ 400 AG2<br>RHUE 80 ~ 240 AG2 | C1-14 | Outlet water outlet temperature Thermistor 1 | $PCB_{C1}$ | CN4 |
| | C2-14 | Outlet water outlet temperature Thermistor 1 | $PCB_{C1}$ | CN6 |
| | C3-14 | Outlet water outlet temperature Thermistor 1 | $PCB_{C1}$ | CN7 |
| | C4-14 | Outlet water outlet temperature Thermistor 1 | $PCB_{C2}$ | CN4 |
| | C5-14 | Outlet water outlet temperature Thermistor 1 | $PCB_{C2}$ | CN6 |

## Alarm code 40-40 — Operation Error / Setting Error

**[Alarm Stop Reason]**

Wrong setting is performed in Dip Switch on Printed Circuit Board, or prohibited operation is performed.



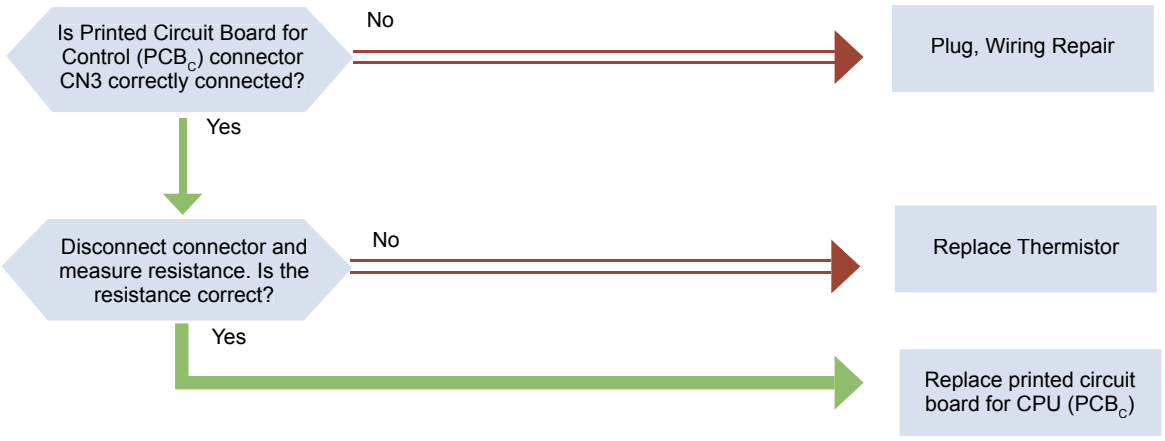
## Alarm code 11-11 — Inlet Chilled Water Thermistor Abnormality

**[Alarm Stop Reason]**

Thermistor for inlet water temperature indicates abnormal value.

**[PCB Monitoring Position]**

$PCB_{C1}$ (CPU PCB) CN3




## Alarm code 12-12 / C1-12 / C5-12 — Outlet Chilled Water Thermistor Abnormality

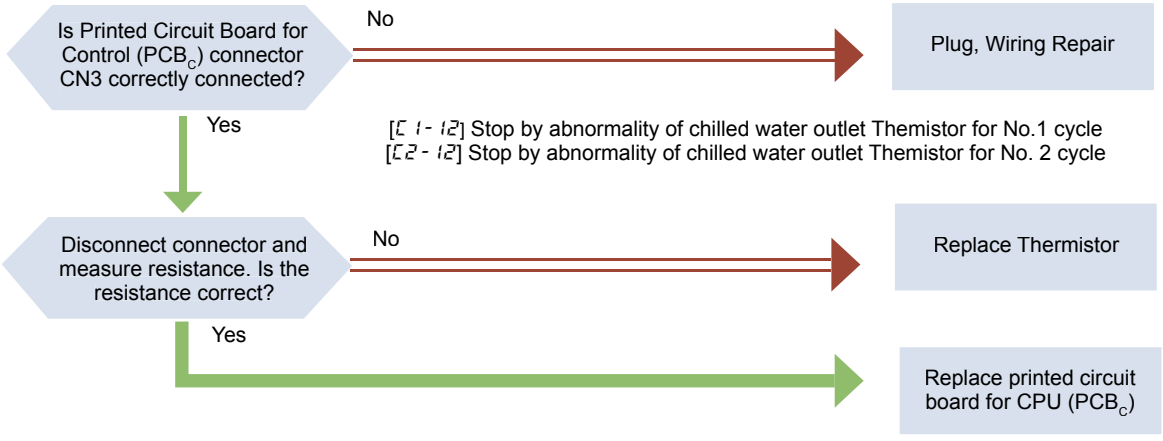
**[Alarm Stop Reason]**

Thermistor for outlet water temperature indicates abnormal value.

*"12-12": 1 cycle, "C1-12 ~ C5-12 ": more than 2 cycle units

**[PCB Monitoring Position]**

$PCB_C$ (CPU PCB) CN4 (for inlet), CN6(for No. 2 cycle)




*NOTE:*

The connector position differs from product model.

| Product Model | Abnormal Code | Thermistor | PCB | Connector |
|---|---|---|---|---|
| RCUE 40 ~ 80 AG2<br>RHUE 40 ~ 80AG2 | 12 - 12 | Outlet water temperature Thermistor 1 | $PCB_{C1}$ | CN4 |
| RCUE 80 ~ 400 AG2<br>RHUE 80 ~ 240 AG2 | C1 - 12 | Outlet water temperature Thermistor 1 | $PCB_{C1}$ | CN4 |
| | C2 - 12 | Outlet water temperature Thermistor 1 | $PCB_{C1}$ | CN6 |
| | C3 - 12 | Outlet water temperature Thermistor 1 | $PCB_{C1}$ | CN7 |
| | C4 - 12 | Outlet water temperature Thermistor 1 | $PCB_{C2}$ | CN4 |
| | C5 - 12 | Outlet water temperature Thermistor 1 | $PCB_{C2}$ | CN6 |

## Alarm code C1-21 C5-21 — Evaporating Temperature Thermistor Abnormality

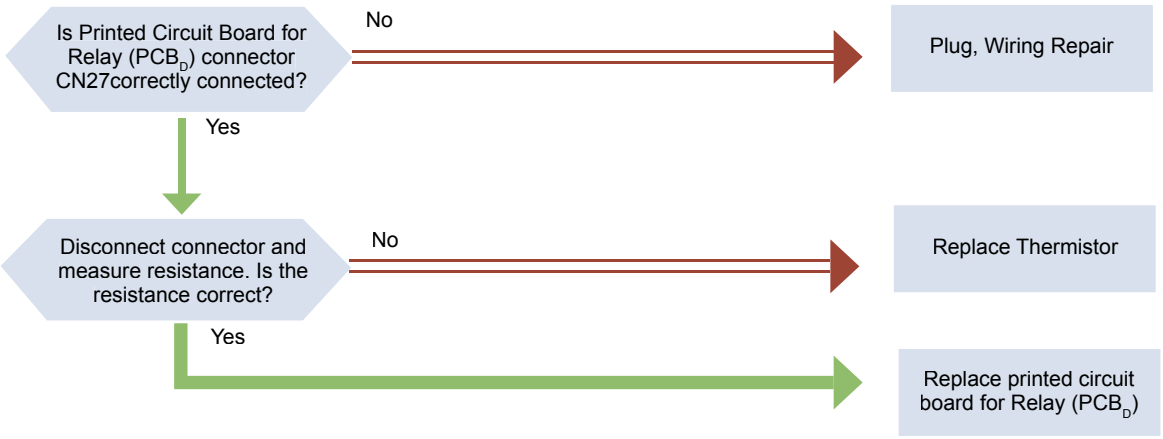
5

**[Alarm Stop Reason]**

Thermistor for inlet refrigerant temperature at water side heat exchanger indicates abnormal value.

**[PCB Monitoring Position]**

No. 1 Cycle: $PCB_{D1}$ (I/O PCB) CN27Tr2
No. 2 Cycle: $PCB_{D2}$ (I/O PCB) CN27Tr2
No. 3 Cycle: $PCB_{D3}$ (I/O PCB) CN27Tr2
No. 4 Cycle: $PCB_{D4}$ (I/O PCB) CN27Tr2
No. 5 Cycle: $PCB_{D5}$ (I/O PCB) CN27Tr2



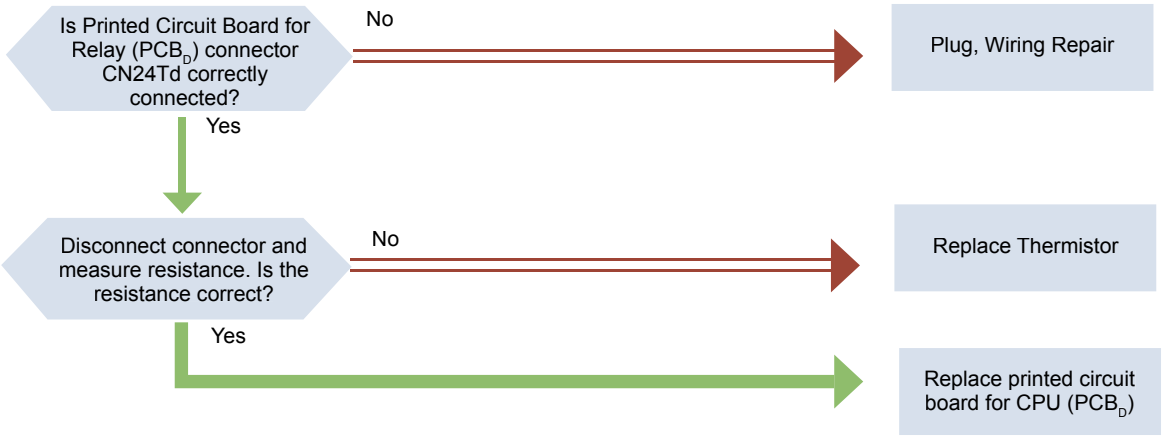
## Alarm code C1-23 C5-23 — Discharge Gas Temperature Thermistor Abnormality

**[Alarm Stop Reason]**

Thermistor for discharge gas temperature indicates abnormal value.

**[PCB Monitoring Position]**

No. 1 Cycle: $PCB_{D1}$ (I/O PCB) CN24Td
No. 2 Cycle: $PCB_{D2}$ (I/O PCB) CN24Td
No. 3 Cycle: $PCB_{D3}$ (I/O PCB) CN24Td
No. 4 Cycle: $PCB_{D4}$ (I/O PCB) CN24Td
No. 5 Cycle: $PCB_{D5}$ (I/O PCB) CN24Td



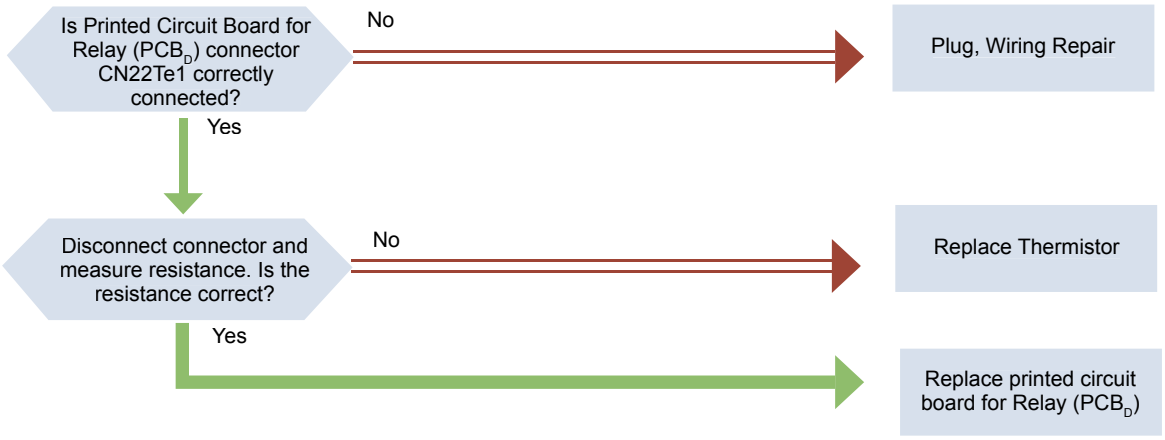

## Alarm code C1-24 C5-24 — Liquid Temperature Thermistor Abnormality

**[Alarm Stop Reason]**

Thermistor for detection of air side heat exchanger outlet (subcooled liquid) temperature indicates abnormal value.

**[PCB Monitoring Position]**

No. 1 Cycle: $PCB_{D1}$ (I/O PCB) CN22Te1
No. 2 Cycle: $PCB_{D2}$ (I/O PCB) CN22Te1
No. 3 Cycle: $PCB_{D3}$ (I/O PCB) CN22Te1
No. 4 Cycle: $PCB_{D4}$ (I/O PCB) CN22Te1
No. 5 Cycle: $PCB_{D5}$ (I/O PCB) CN22Te1



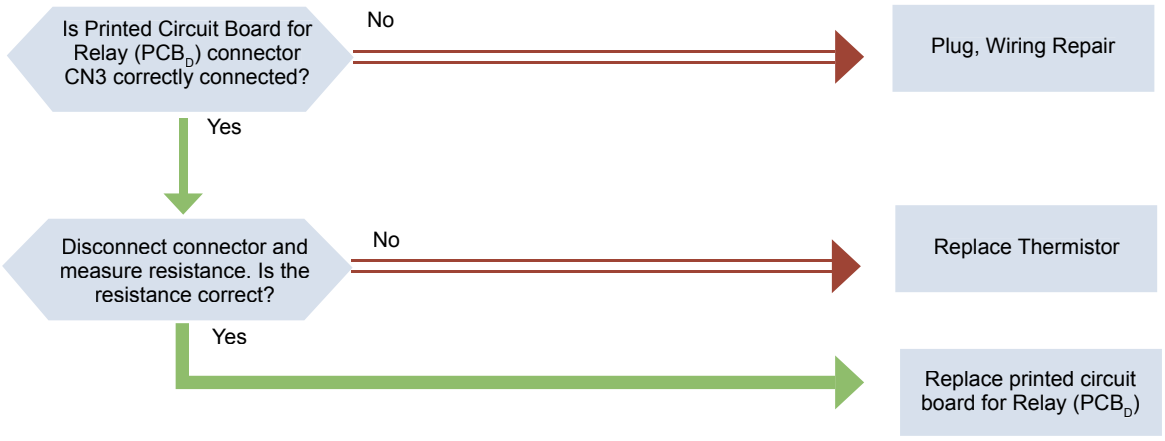
## Alarm code C1-25 C5-25 — Abnormality of Outlet Water Temperature Thermistor for Protection

**[Alarm Stop Reason]**

Thermistor for detection of water side heat exchanger outlet (backside=inside of heat exchanger) temperature indicates abnormal value.

**[PCB Monitoring Position]**

No. 1 Cycle: PCBD1 (I/O PCB) CN23Te2
No. 2 Cycle: PCBD2 (I/O PCB) CN23Te2
No. 3 Cycle: PCBD3 (I/O PCB) CN23Te2
No. 4 Cycle: PCBD4 (I/O PCB) CN23Te2
No. 5 Cycle: PCBD5 (I/O PCB) CN23Te2




*NOTE:*

The connector position differs from product model.

| Product Model | Abnormal Code | Thermistor | PCB | Connector |
|---|---|---|---|---|
| RCUE 40 ~ 80 AG2<br>RHUE 40 ~ 80AG2 | 25-25 | Outlet water temperature Thermistor (backside of cooler) | PCB$_{D1}$ | CN23 |
| RCUE 80 ~ 400 AG2<br>RHUE 80 ~ 240 AG2 | C1-25 | Outlet water temperature Thermistor (backside of cooler) | PCB$_{D1}$ | |
| | C2-25 | Outlet water temperature Thermistor (backside of cooler) | PCB$_{D2}$ | |
| | C3-25 | Outlet water temperature Thermistor (backside of cooler) | PCB$_{D3}$ | |
| | C4-25 | Outlet water temperature Thermistor (backside of cooler) | PCB$_{D4}$ | |
| | C5-25 | Outlet water temperature Thermistor (backside of cooler) | PCB$_{D5}$ | |

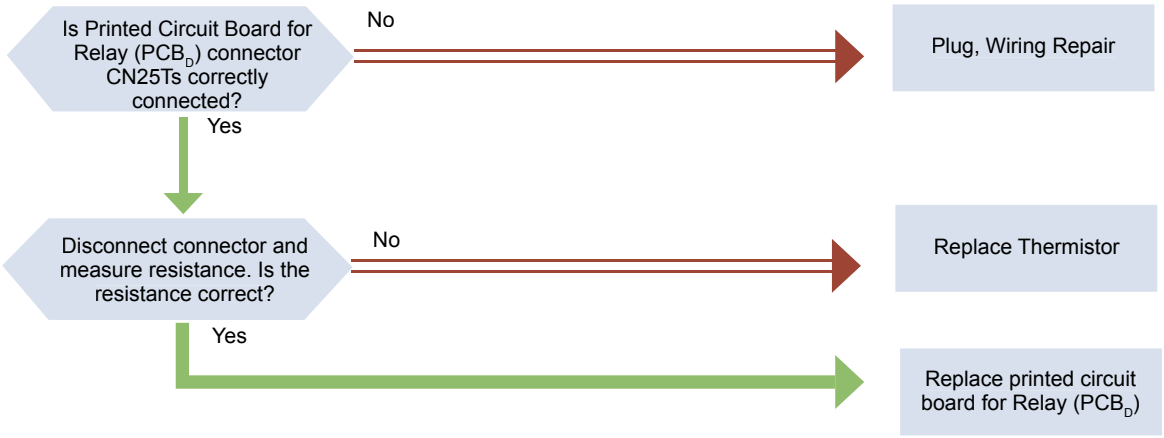
## Alarm code E1-26 E5-26 — Suction Gas Temperature Thermistor Abnormality

**[Alarm Stop Reason]**

Thermistor for detection of compressor suction gas refrigerant temperature indicates abnormal value.

**[PCB Monitoring Position]**

No. 1 Cycle: $PCB_{D1}$ (I/O PCB) CN25Ts
No. 2 Cycle: $PCB_{D2}$ (I/O PCB) CN25Ts
No. 3 Cycle: $PCB_{D3}$ (I/O PCB) CN25Ts
No. 4 Cycle: $PCB_{D4}$ (I/O PCB) CN25Ts
No. 5 Cycle: $PCB_{D5}$ (I/O PCB) CN25Ts



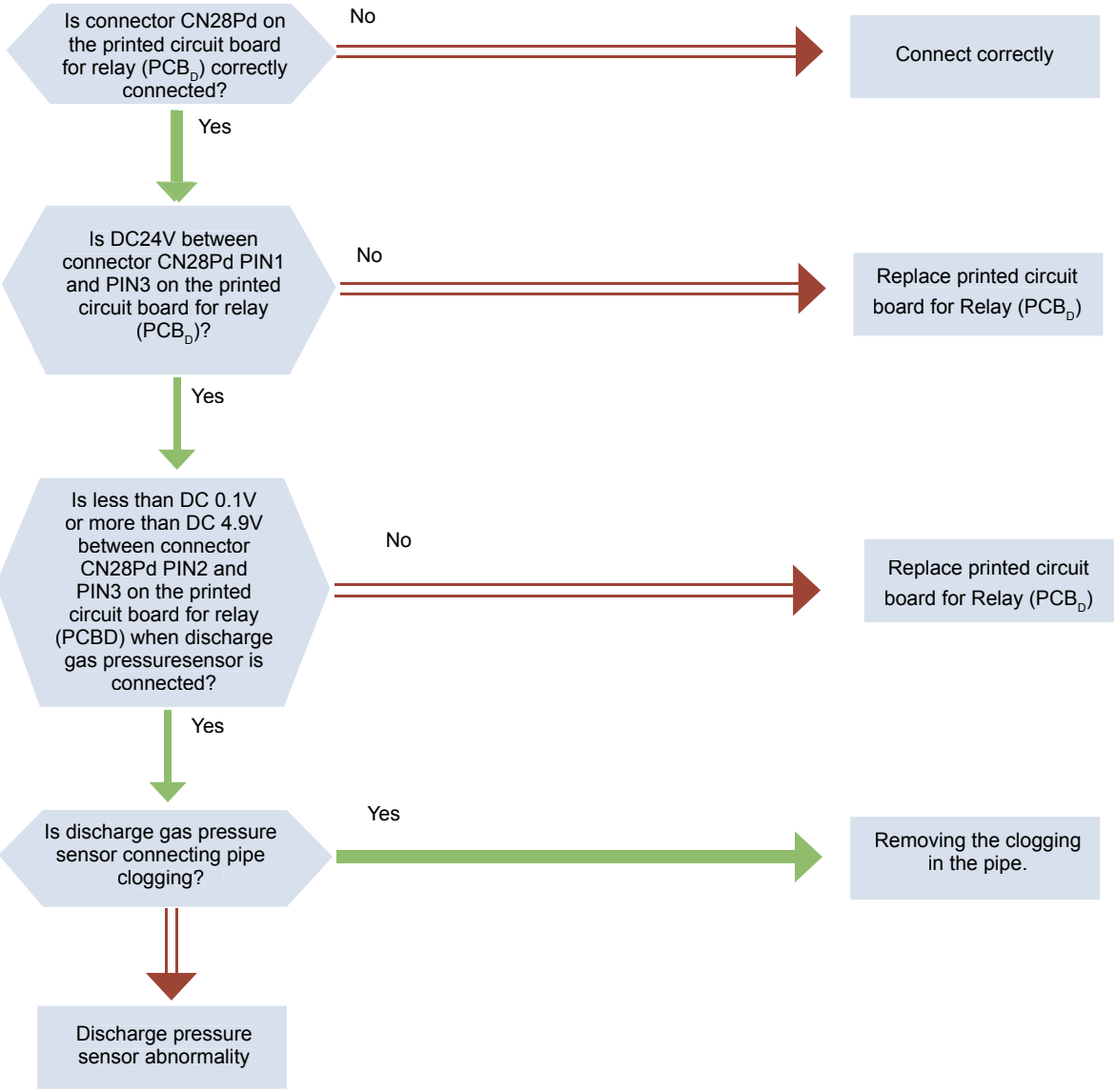
## Alarm code E1-27 E5-27 — Discharge Pressure Sensor Abnormality

**[Alarm Stop Reason]**

Discharge pressure sensor of compressor indicates abnormal value.

**[PCB Monitoring Position]**

No. 1 Cycle: $PCB_{D1}$ (I/O PCB) CN28Pd
No. 2 Cycle: $PCB_{D2}$ (I/O PCB) CN28Pd
No. 3 Cycle: $PCB_{D3}$ (I/O PCB) CN28Pd
No. 4 Cycle: $PCB_{D4}$ (I/O PCB) CN28Pd
No. 5 Cycle: $PCB_{D5}$ (I/O PCB) CN28Pd

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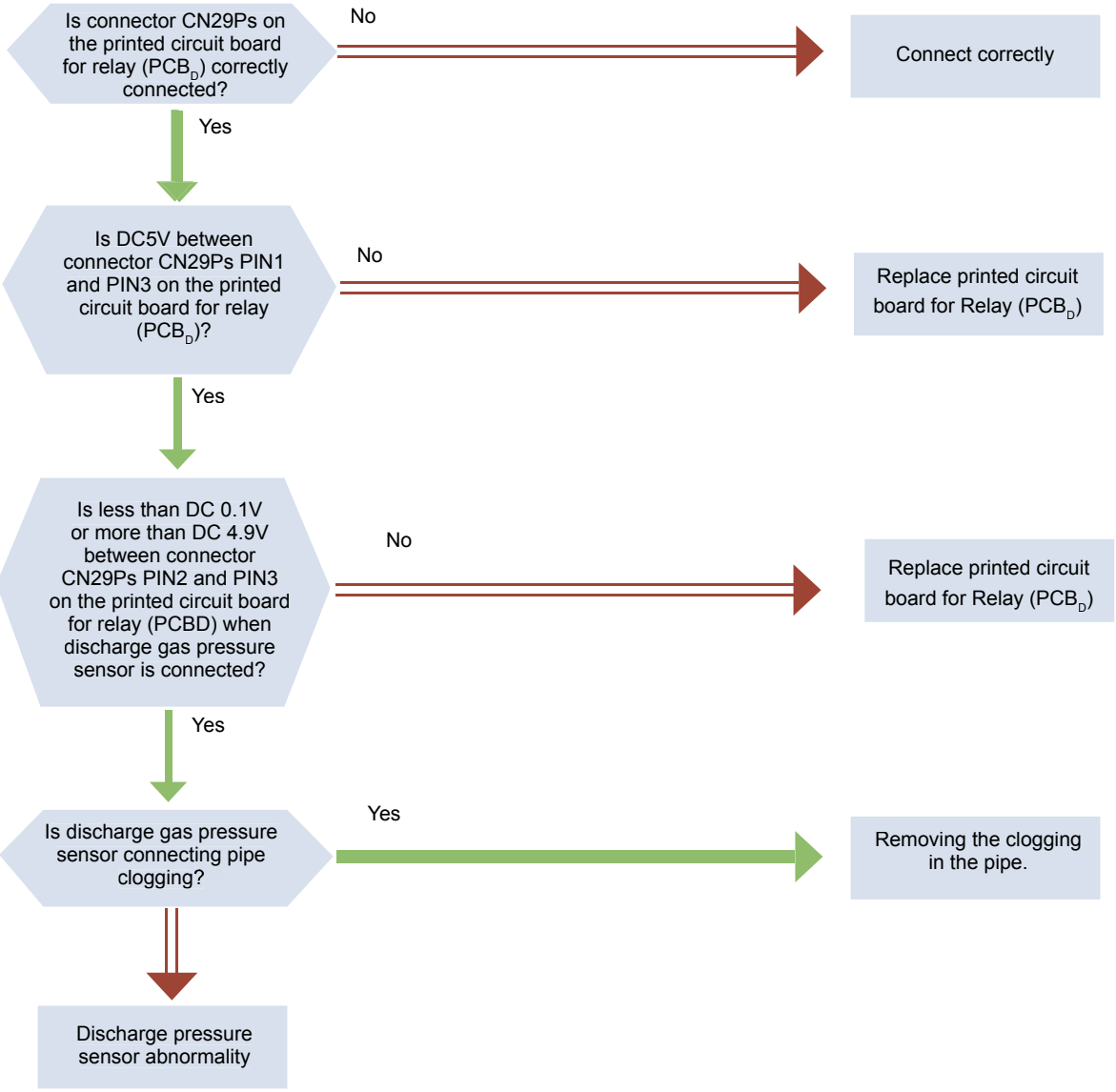
## Alarm code E1-28 E5-28 — Suction Pressure Sensor Abnormality

**[Alarm Stop Reason]**

Suction pressure sensor of compressor indicates abnormal value..

**[PCB Monitoring Position]**

No. 1 Cycle: PCBD1 (I/O PCB) CN29Ps
No. 2 Cycle: PCBD2 (I/O PCB) CN29Ps
No. 3 Cycle: PCBD3 (I/O PCB) CN29Ps
No. 4 Cycle: PCBD4 (I/O PCB) CN29Ps
No. 5 Cycle: PCBD5 (I/O PCB) CN29Ps



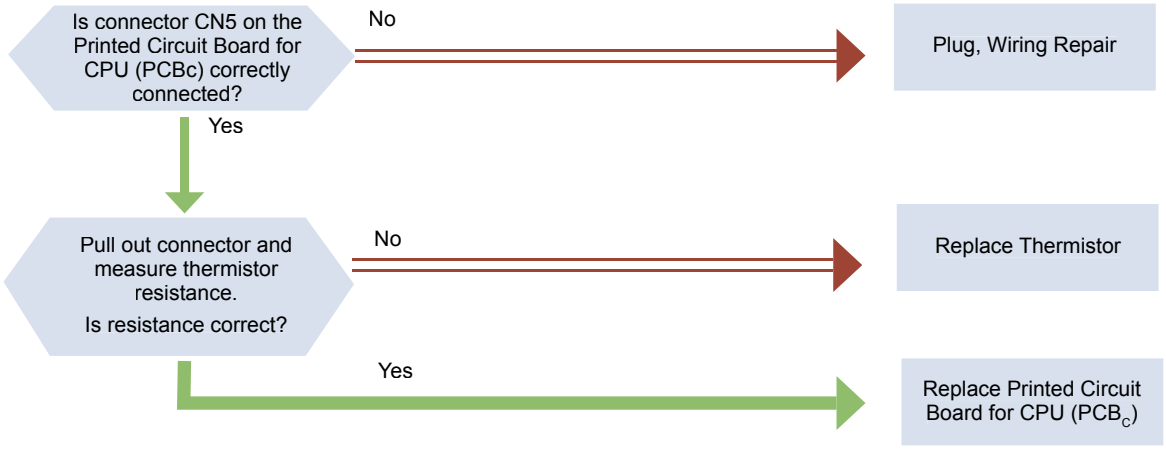
## Alarm code 22-22 — Ambient Temperature Thermistor Abnormality

**[Alarm Stop Reason]**

Thermistor for ambient temperature indicates abnormal value.

**[PCB Monitoring Position]**

$PCB_C$ (CPU PCB) CN5

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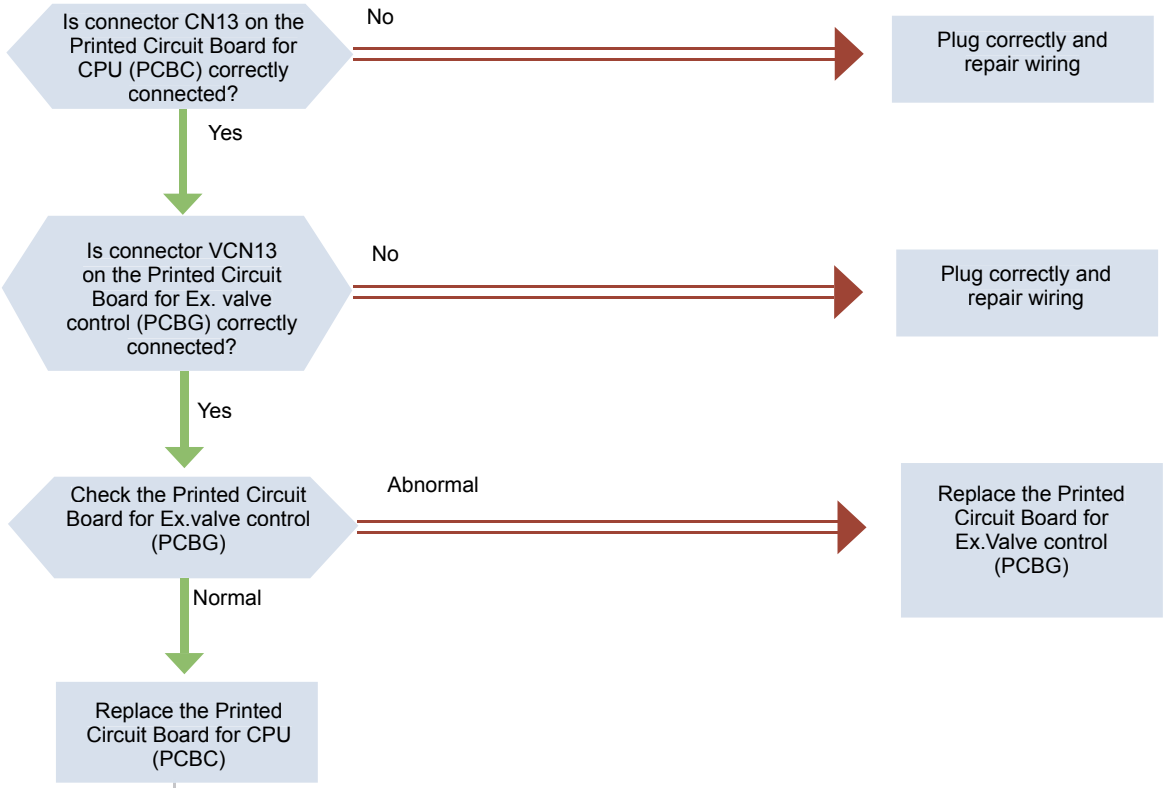
## Alarm code EU-EU — Error Communication between Ctrl. PCB and Ex. Valve PCB

**[Alarm Stop Reason]**

Communication between Ctrl PCB and Ex.Valve PCB is not performed correctly during 30 seconds.

**[PCB Monitoring Position]**

$PCB_C$ (CPU PCB) ~$PCB_G$ (VD board) VCN13



## Alarm code FC-FC

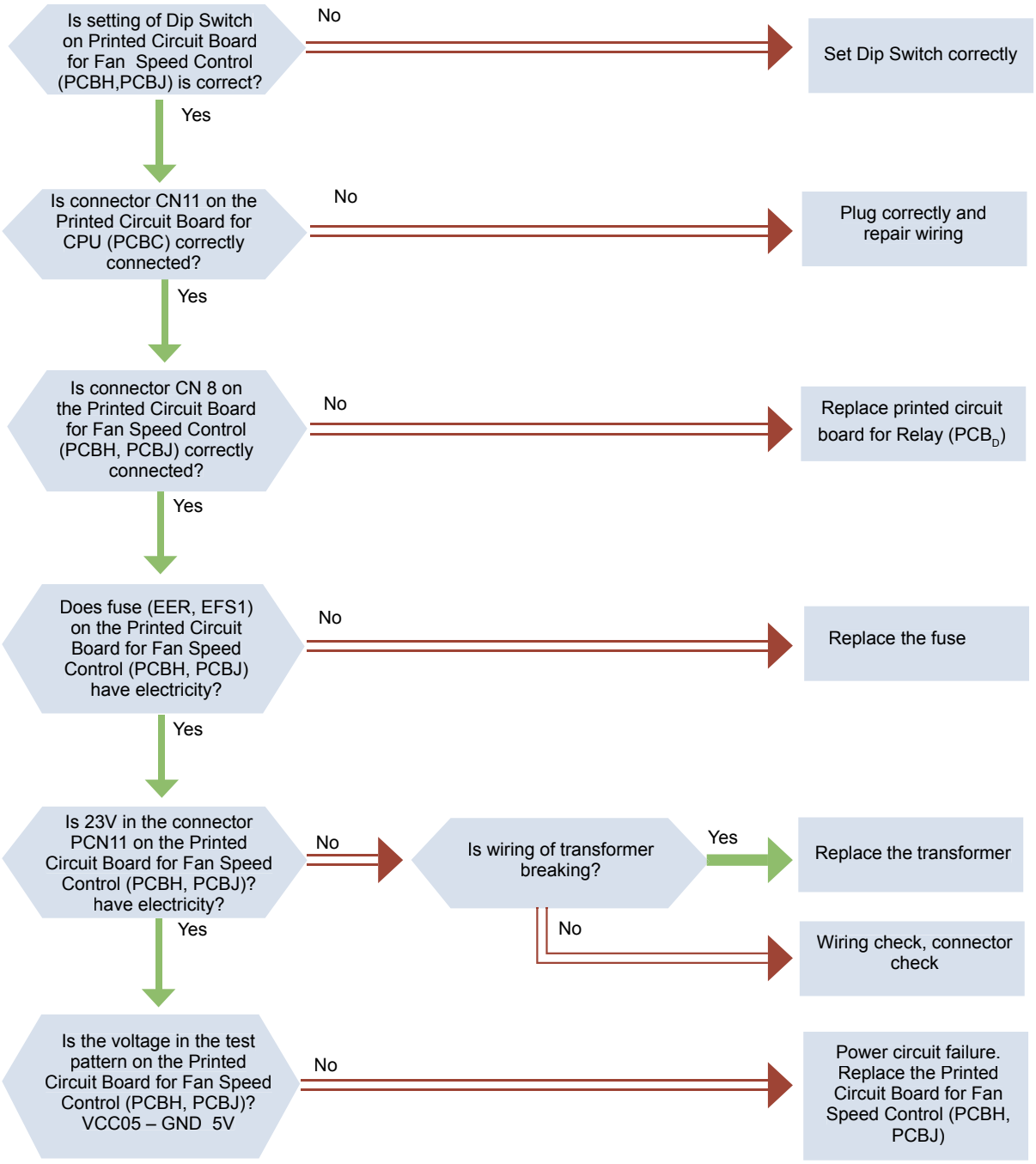
**Error Communication between Ctrl. PCB and Fan Speed control PCB**

**[Alarm Stop Reason]**

Communication between Ctrl PCB (PCBc) and fan speed PCB is not performed correctly during 30 seconds.

**[PCB Monitoring Position]**

$PCB_C$ (CPU PCB) CN11~ $PCB_H$ (Fan control PCB) CN8 ~ $PCB_J$ (Fan control PCB) CN8



## Alarm code PU-PU (Flicker)

## During Activation of Pump Stop Control by Excess Increase of Water Temperature

**[Alarm Stop Reason]**

Water temperature is increased to 65°C by heat generation in pump during only pump running (during compressor stop: during heat operation Thermo OFF or during pump automatic operation in winter).

*If water temperature is decreased under 65°C due to pump stop, it becomes normal status automatically.

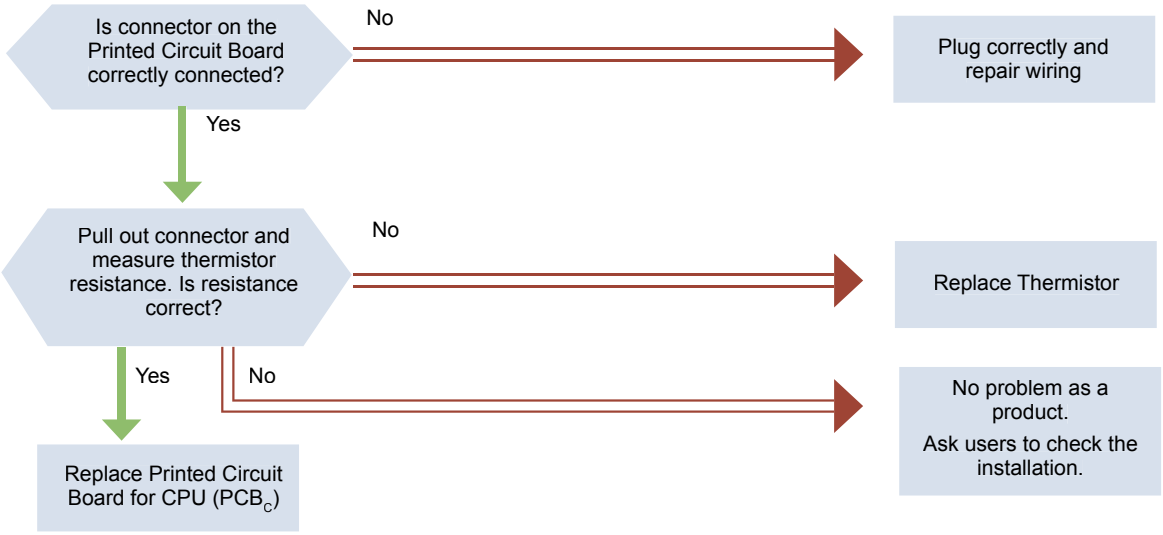
Since this is not an abnormality of chiller unit, it is not saved in alarm occurrence data.

**[PCB Monitoring Position]**

$PCB_C$ (CPU PCB) CN3(for inlet), CN4(for outlet control in Unit 1), CN6 (for outlet control in Unit 2)

$PCB_D$ (I/O PCB) CN23Te2 (for protection of Unit 1)

$PCB_E$ (I/O PCB) CN23Te2 (for protection of Unit 2)

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## Alarm code C1-F0 C5-F0

## Abnormality of Fan Number Setting

**[Alarm Stop Reason]**

Thermistor for detection of compressor suction gas refrigerant temperature indicates abnormal value.

**[PCB Monitoring Position]**

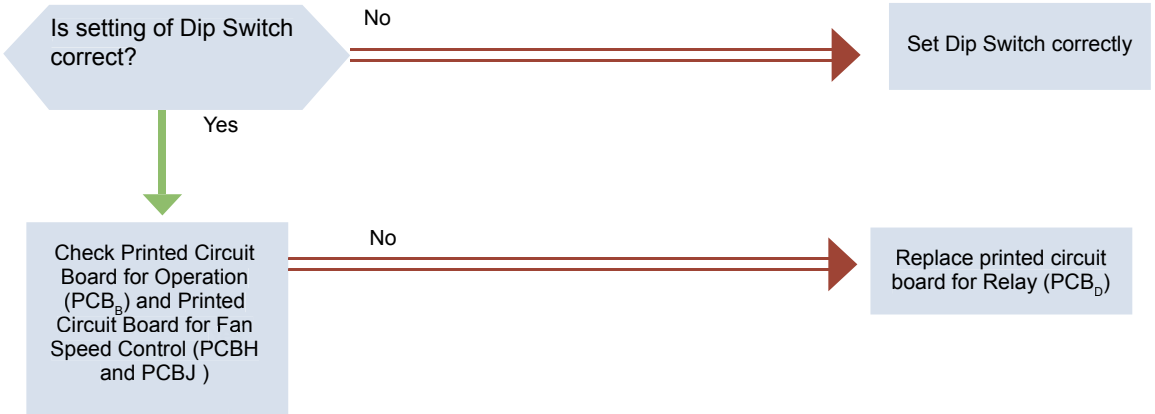
No. 1 Cycle: $PCB_{D1}$ (I/O PCB) CN25Ts

No. 2 Cycle: $PCB_{D2}$ (I/O PCB) CN25Ts

No. 3 Cycle: $PCB_{D3}$ (I/O PCB) CN25Ts

No. 4 Cycle: $PCB_{D4}$ (I/O PCB) CN25Ts

No. 5 Cycle: $PCB_{D5}$ (I/O PCB) CN25Ts



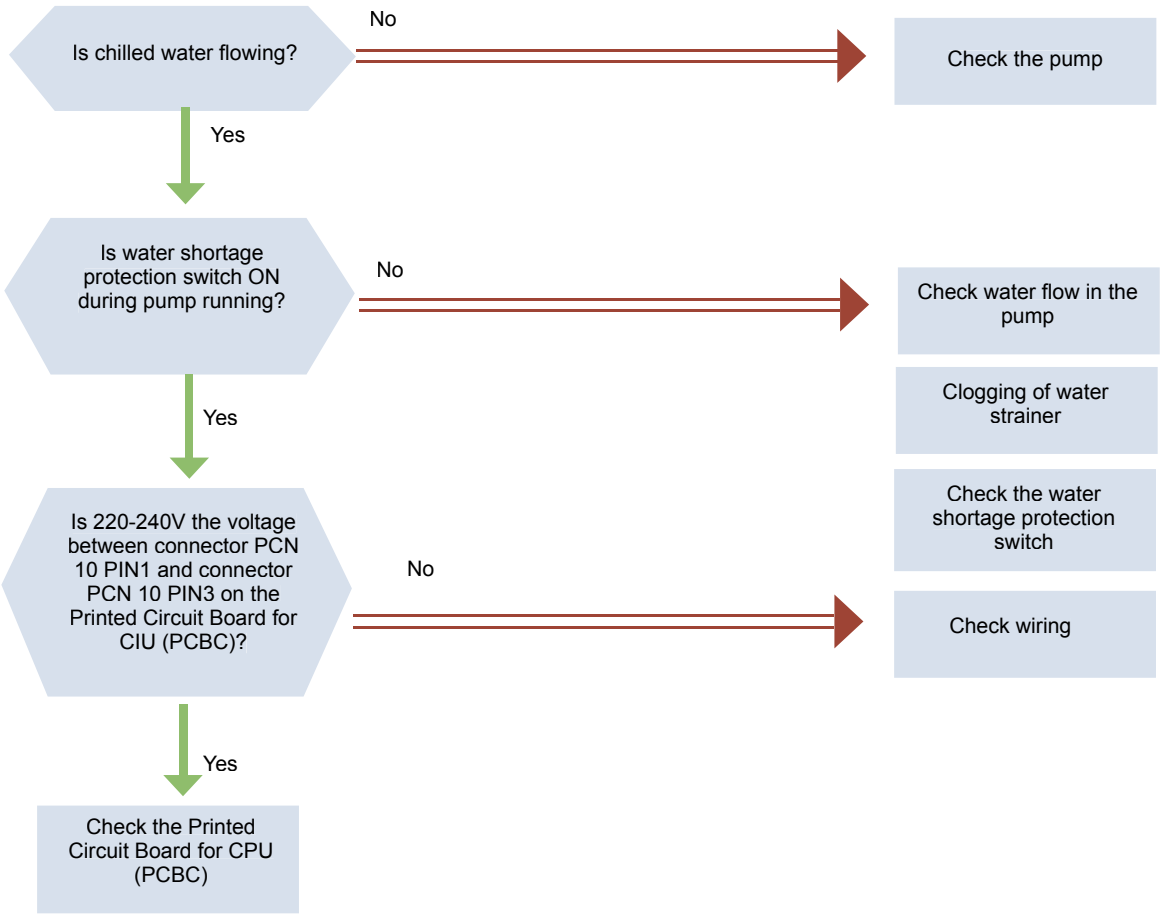
## Alarm code 6E-6E — Water flow Protection Switch Activation (at 63W use; Option)

**[Alarm Stop Reason]**

Water flow protection switch is activated

**[PCB Monitoring Position]**

$PCB_C$ (CPU PCB) PCN10




## Alarm code 03-03 — System Controller Connection Abnormality (at CSC-5S connection:

**[Alarm Stop Reason]**

At remote setting by remote controller, transmission is not performed for 3 minutes once it is started.

**[PCB Monitoring Position]**

$PCB_C$ (CPU PCB) CN11

## Alarm code F1- 11-14 / F5- 1m: m=Fan No. — Inverter Speed Control Abnormality

**[Alarm Stop Reason]**

The actual frequency is over the admissible value of inverter order frequency.

*Alarm stop: 5 retries during 30 minutes.(only corresponding fan is stopped, automatic restart in 10 seconds)

**[PCB Monitoring Position]**

FANM (Fan Module)

**[Retry Code]**

No code indication (indicated within the check mode)

*NOTE:*

See "Inverter position detection abnormality" in the next page for flowchart

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## Alarm code F1- 21-24 / F5- 1m: m=Fan No. — Inverter Excess Current Protection Abnormality

**[Alarm Stop Reason]**

1. DC electricity value of inverter is over the admissible value.
2. Inverter temperature is increased over the limit.
3. Error signal is detected.

*Alarm stop: 5 retries during 30 minutes. (only corresponding fan is stopped, automatic restart in 10 seconds)

**[PCB Monitoring Position]**

FANM (Fan Module)

**[Retry Code]**

No code indication (indicated within the check mode)

*NOTE:*

See "Inverter position detection abnormality" in the next page for flowchart

## Alarm code F1- / F5- 31-34 (1m: m=Fan No.) — Inverter Position Detection Abnormality

**[Alarm Stop Reason]**

The actual cycle is over the admissible value calculated by inverter order frequency.

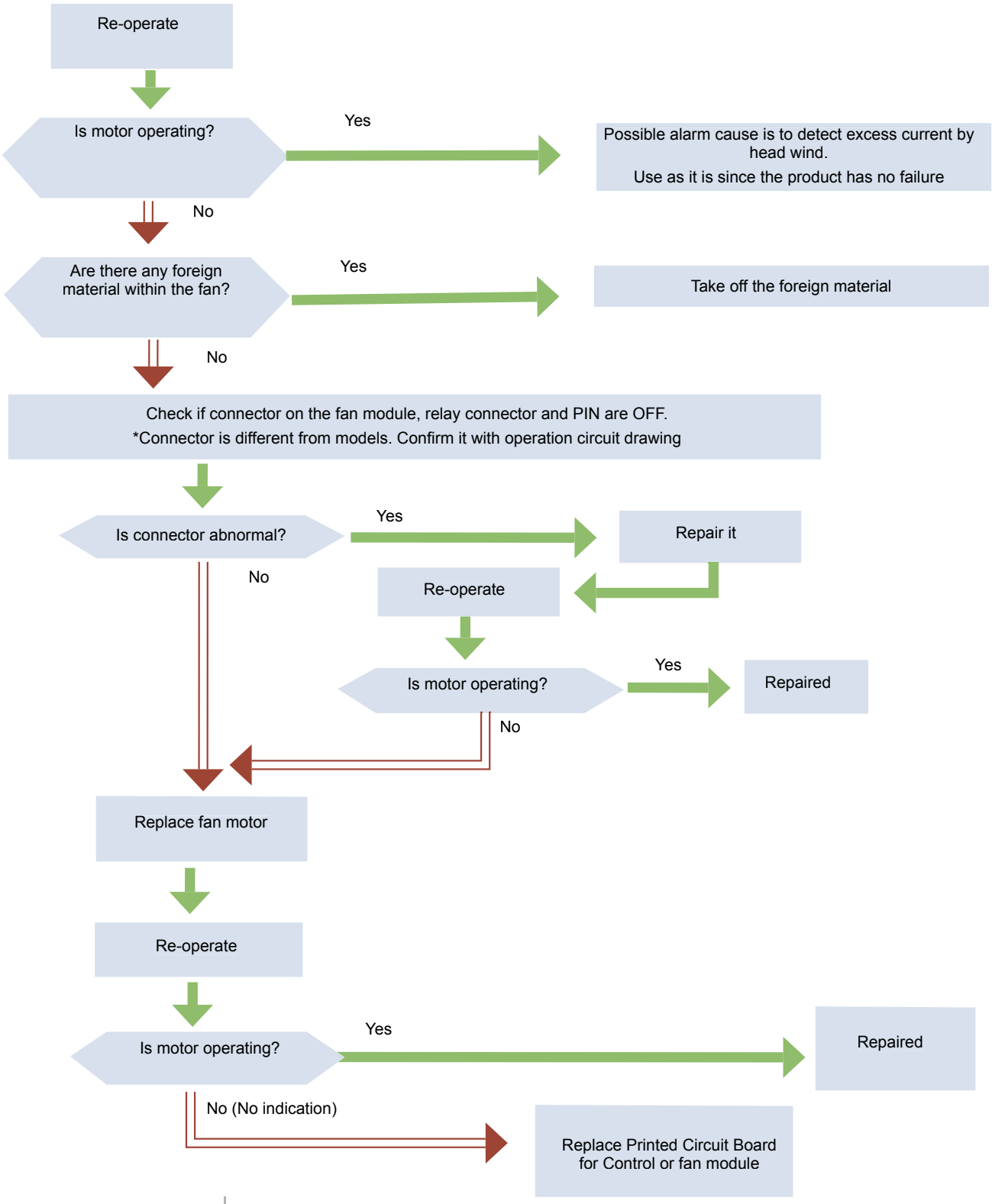
*Alarm stop: 5 retries during 30 minutes.(only corresponding fan is stopped, automatic restart in 10 seconds))

**[PCB Monitoring Position]**

FANM (Fan Module)

**[Retry Code]**

No code indication (indicated within the check mode)



## Alarm code F1-41-44 / F5- 1m: m=Fan No. — Transmission Abnormality between Inverter and CPU PCB or between Fan Speed Control PCB

**[Alarm Stop Reason]**

Communication is not performed during a certain period.

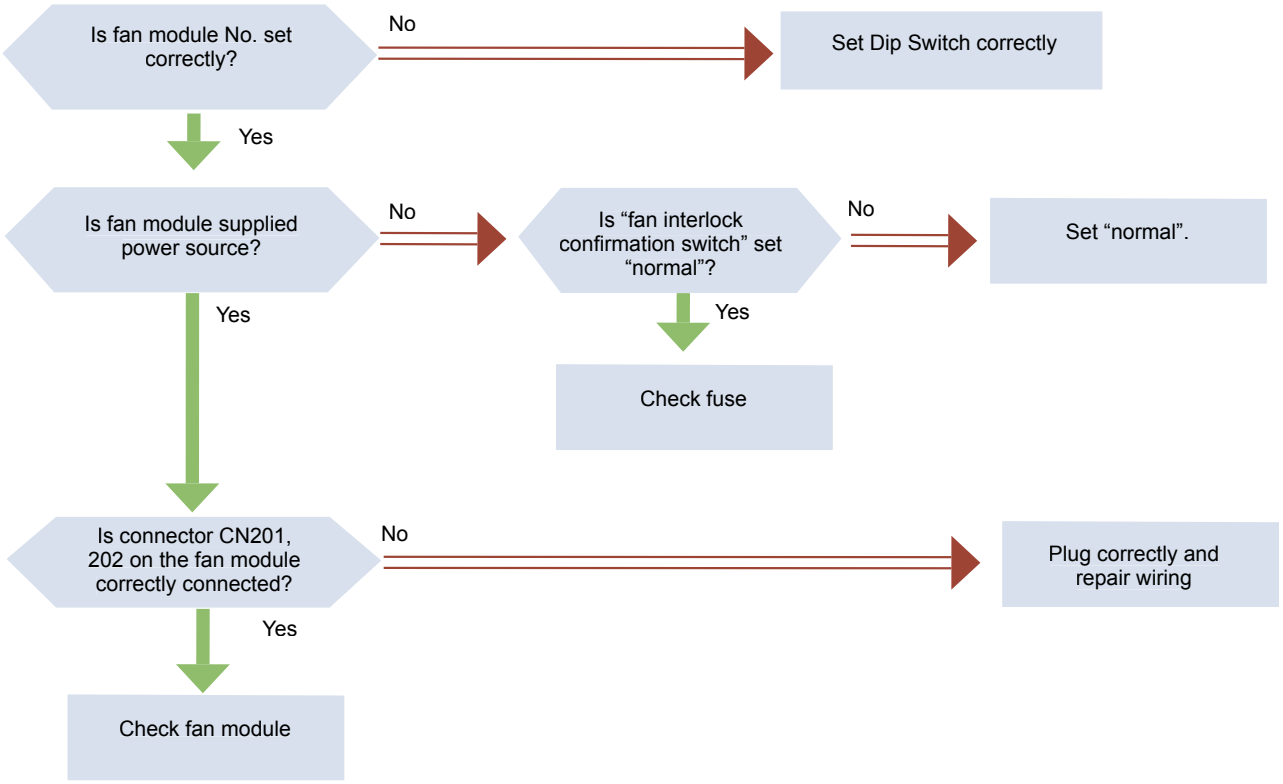
*Alarm stop: 3 retries during 30 minutes. (compressor stop, automatic restart in 3minutes)

**[PCB Monitoring Position]**

FANM (Fan Module)

**[Retry Code]**

No. 1 Cycle : F1-P8
No. 2 Cycle : F2-P8
No. 3 Cycle : F3-P8
No. 4 Cycle : F4-P8
No. 5 Cycle : F5-P8




5

## Alarm code F1-F5- 51-54 (1m: m=Fan No.) Voltage Shortage or Excess Voltage in Inverter

**[Alarm Stop Reason]**

Inverter DC voltage is under or over the setting voltage level.

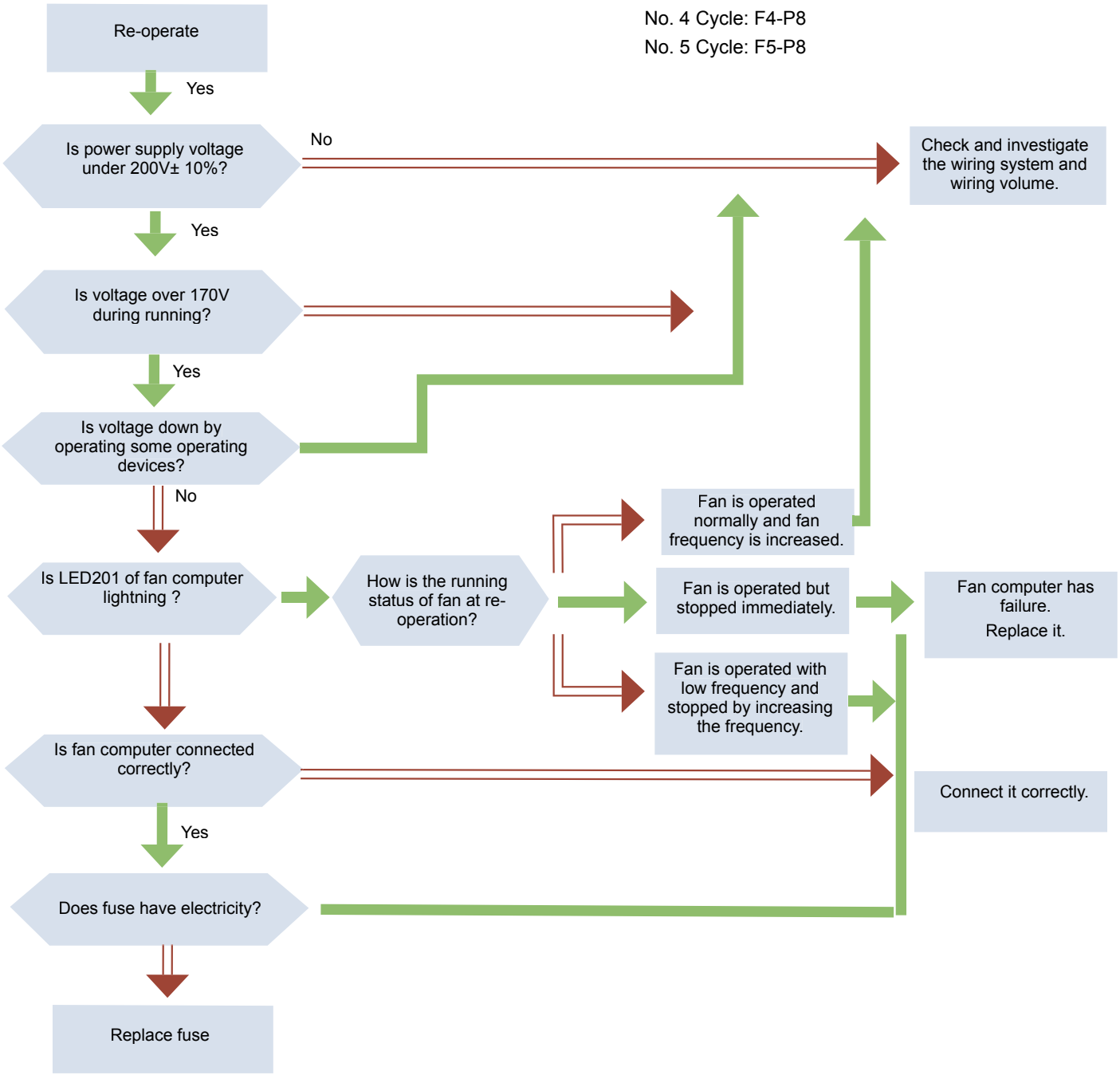
*Alarm stop: 3 retries during 30 minutes.(compressor stop, automatic restart in 3minutes)

**[PCB Monitoring Position]**

FANM (Fan Module)

**[Retry Code]**

No. 1 Cycle: F1-P8
No. 2 Cycle: F2-P8
No. 3 Cycle: F3-P8
No. 4 Cycle: F4-P8
No. 5 Cycle: F5-P8

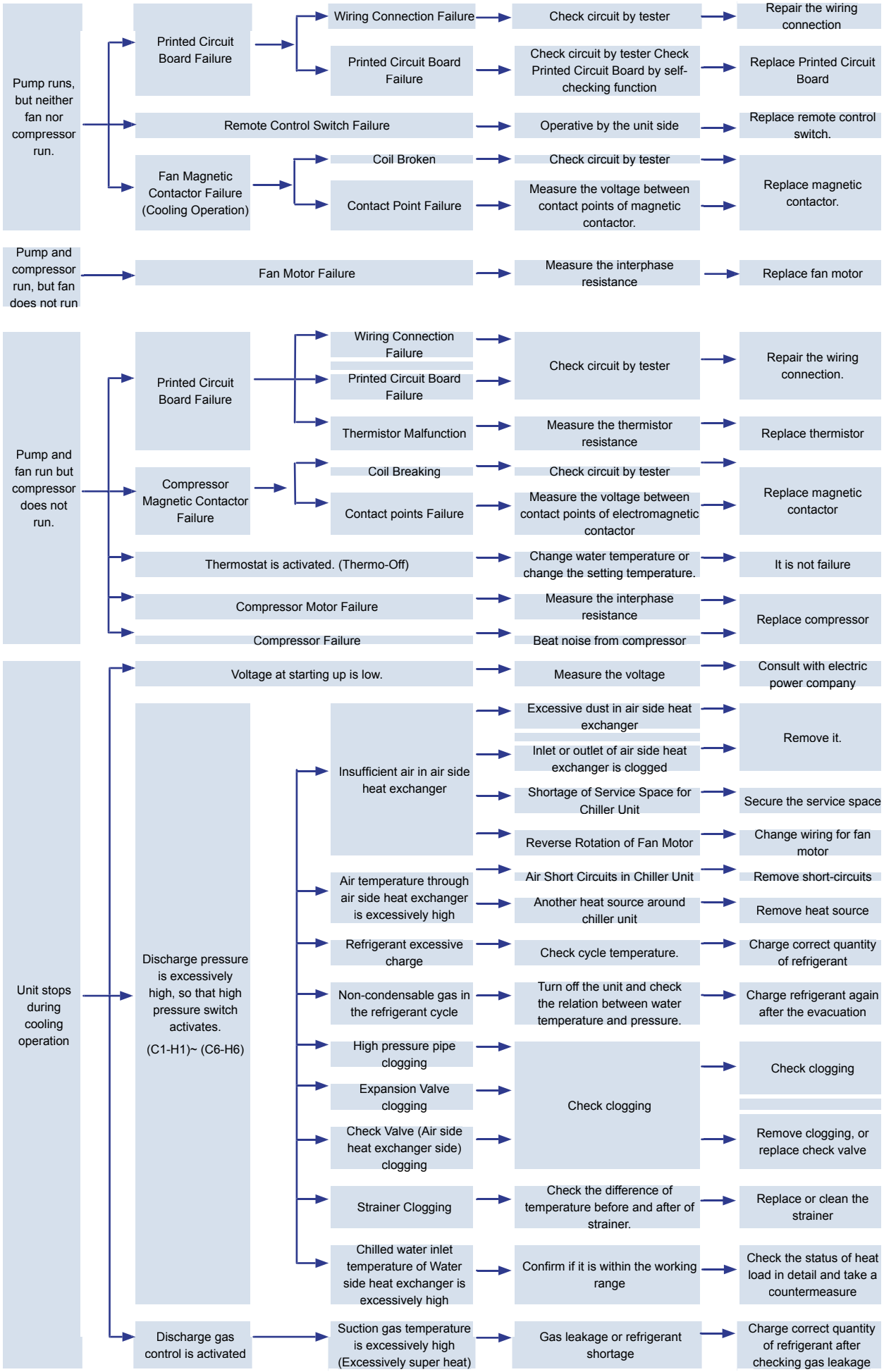


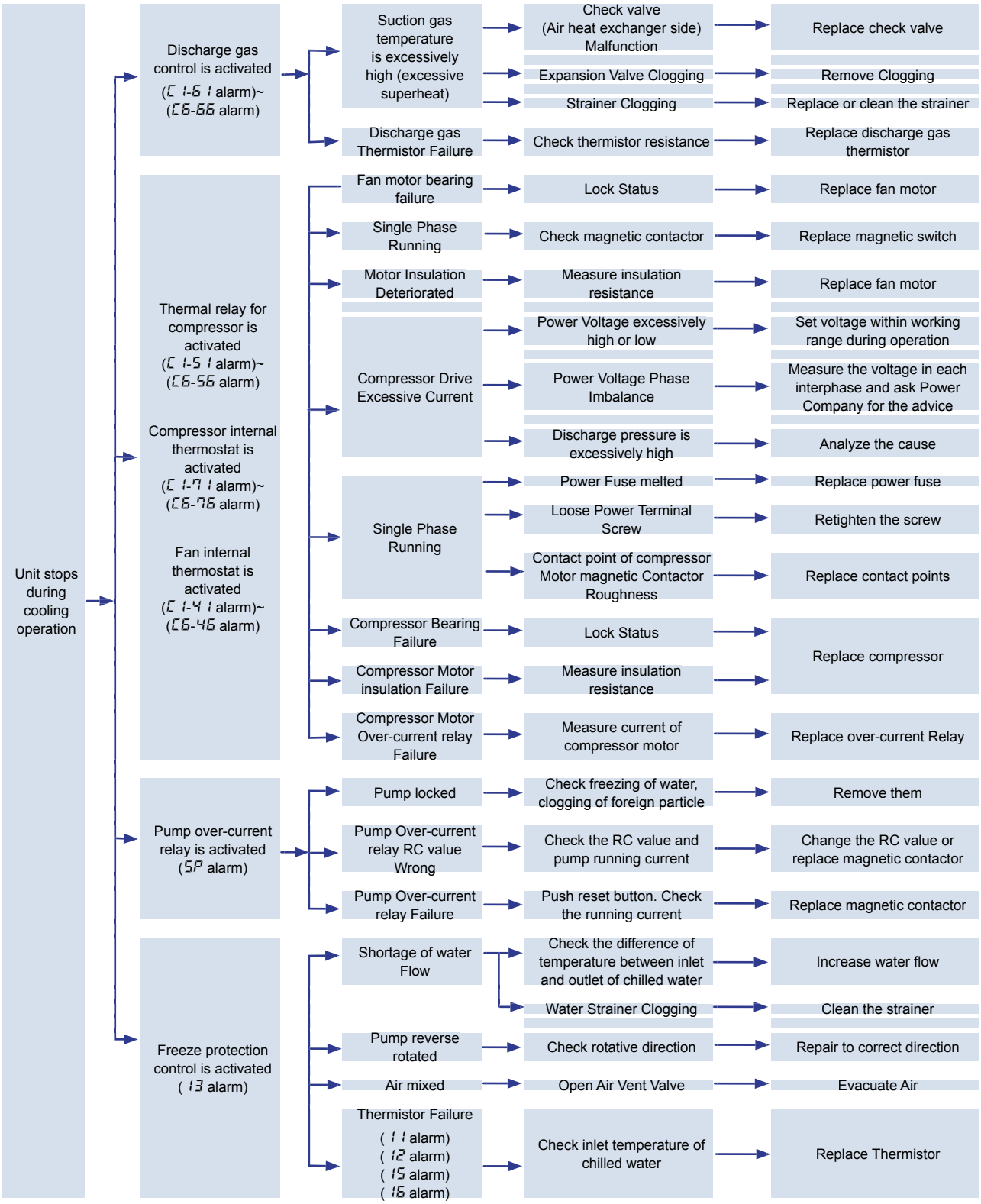
## 5.3. Analysis and countermeasure of abnormal running

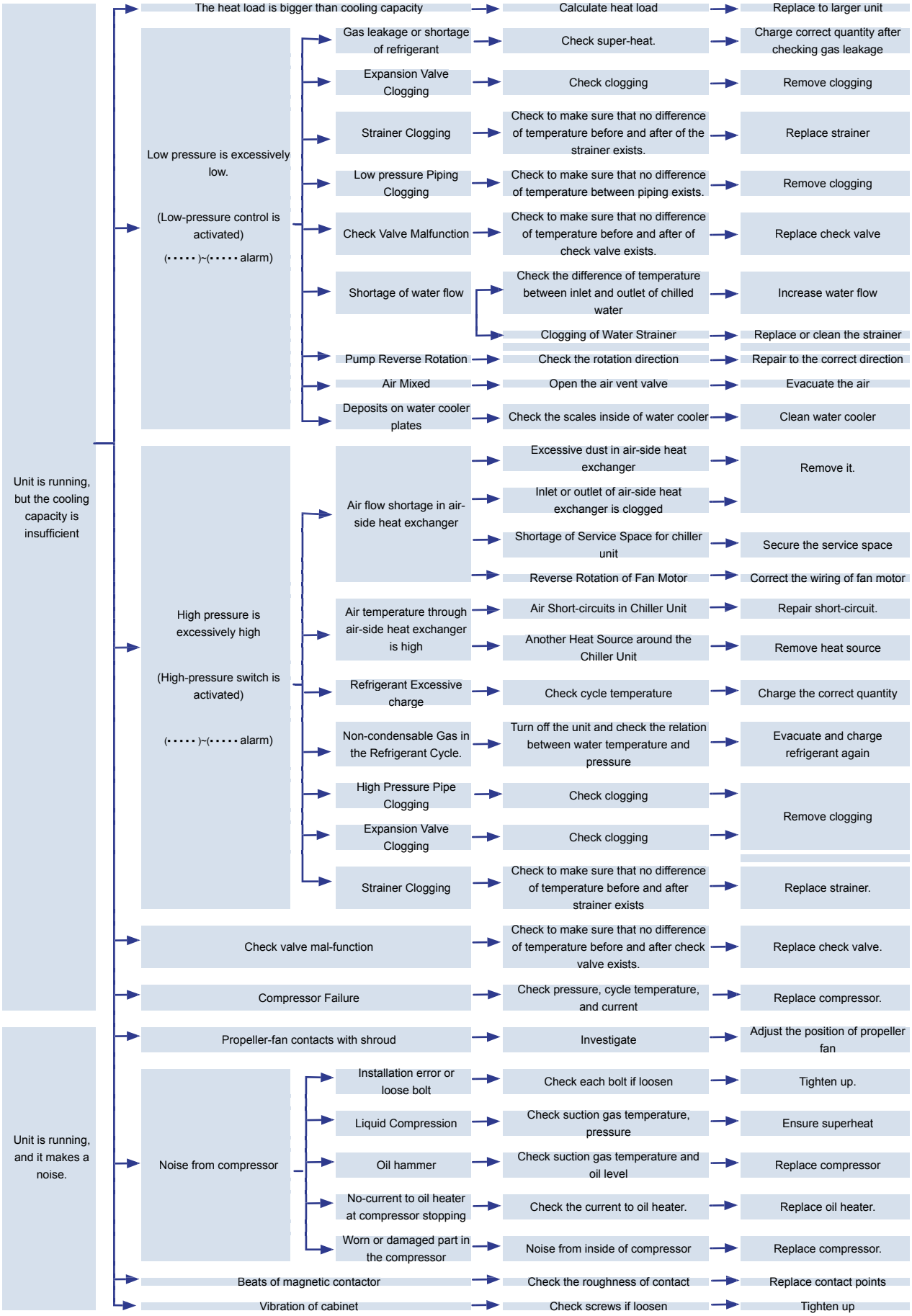
Chiller unit has various kinds of protection devices. When the operation status is not correct due to the activation of some protection device, refer to the table below and find out the main reason to apply a countermeasure.

One failure can affect other different conditions. Thus, do not check only 1 point but analyze it from overall viewpoint in detail.

| Phenomenon | Cause | | Check Point | Countermeasure |
|---|---|---|---|---|
| It does not run when operate | Power Failure | | Measure voltage by tester. | Wait the recovery of power source |
| | Power is OFF | | Check power switch. | Power Switch ON |
| | Fuse for power source is melted | Wiring Short Circuit | Check falling of wiring coating. | Eliminate short-circuit and replace fuse. |
| | | Wiring Earth Fault | Measure insulation resistance. | Eliminate the earth fault and replace fuse. |
| | | Compressor Motor Failure | Measure the interphase resistance, insulation resistance. | Replace compressor and fuse. |
| | | Fan Motor Failure | | Replace fan motor and fuse |
| | Fuse for operation circuit is melted | Wiring Short-circuit | Check falling of wiring device. | Eliminate short-circuit and replace fuse.. |
| | | Earth Fault in Operation Circuit | Measure insulation resistance. | Eliminate earth fault and replace fuse |
| | | Magnetic Contactor for Compressor Motor Failure | Measure the coil resistance. | Replace magnetic contactor and fuse. |
| | | Magnetic Contactor for Fan Motor Failure | | |
| | | Magnetic Contactor for pump motor Failure | | |
| | | Auxiliary Relay Coil Failure | | Replace auxiliary relay and fuse. |
| | | Solenoid Valve Coil Failure | | Replace solenoid coil and fuse. |
| | | Printed Circuit Board Short-Circuit | Conductive Foreign Particle. | Remove the particle and replace fuse |
| | | Crankcase Heater Failure | Measure resistance. | Replace oil heater and fuse. |
| | Trans Coil Failure | | Measure the transformer secondary voltage. | Replace transformer. |
| | Remote Control Wiring Incorrect | | Wiring | Change wiring. |
| | R, S, T phase of power source is phase failure or reverse phase. (05 alarm) | | Check the connection of R, S, and T phase | Change to the correct phase. |
| | Remote Control Switch Failure. Change-over switch of Printed Circuit Board is “Local” (40 alarm) | | Check changeover switch. | Replace remote control switch. Turn changeover switch on “Remote |
| | Printed Circuit Board Failure | Wiring Connection Failure | Check the current by tester. | Repair the wiring connection |
| | | Printed Circuit Board Failure | | Replace the Printed Circuit Board |
| | Pump Magnetic Contactor for Pump Failure (52P) | Breaking of Coil | Measure the voltage of contact point of magnetic contactor | Replace magnetic contactor for pump |
| | | Loose Connection | | |
| Pump stops before compressor running | Pump Over-current Relay Activated (TRP) (5P Alarm) | Pump locked | Check water freeze, clogging of foreign particle. | Remove it. |
| | | Pump Over-current relay RC Value Wrong | Check the RC value and pump running current. | Change the RC value or replace magnetic contactor. |
| | | Pump over-current relay failure | Push reset button and check running current. | Replace magnetic contactor. |


Pump runs, but neither fan nor compressor run.
Printed Circuit Board Failure
Wiring Connection Failure
Check circuit by tester
Repair the wiring connection
Printed Circuit Board Failure
Check circuit by tester Check Printed Circuit Board by self-checking function
Replace Printed Circuit Board
Remote Control Switch Failure
Operative by the unit side
Replace remote control switch.
Fan Magnetic Contactor Failure (Cooling Operation)
Coil Broken
Check circuit by tester
Contact Point Failure
Measure the voltage between contact points of magnetic contactor.
Replace magnetic contactor.
Pump and compressor run, but fan does not run
Fan Motor Failure
Measure the interphase resistance
Replace fan motor
Pump and fan run but compressor does not run.
Printed Circuit Board Failure
Wiring Connection Failure
Printed Circuit Board Failure
Check circuit by tester
Repair the wiring connection.
Thermistor Malfunction
Measure the thermistor resistance
Replace thermistor
Compressor Magnetic Contactor Failure
Coil Breaking
Check circuit by tester
Contact points Failure
Measure the voltage between contact points of electromagnetic contactor
Replace magnetic contactor
Thermostat is activated. (Thermo-Off)
Change water temperature or change the setting temperature.
It is not failure
Compressor Motor Failure
Measure the interphase resistance
Replace compressor
Compressor Failure
Beat noise from compressor
Unit stops during cooling operation
Voltage at starting up is low.
Measure the voltage
Consult with electric power company
Discharge pressure is excessively high, so that high pressure switch activates.
(C1-H1)~ (C6-H6)
Insufficient air in air side heat exchanger
Excessive dust in air side heat exchanger
Inlet or outlet of air side heat exchanger is clogged
Remove it.
Shortage of Service Space for Chiller Unit
Secure the service space
Reverse Rotation of Fan Motor
Change wiring for fan motor
Air temperature through air side heat exchanger is excessively high
Air Short Circuits in Chiller Unit
Remove short-circuits
Another heat source around chiller unit
Remove heat source
Refrigerant excessive charge
Check cycle temperature.
Charge correct quantity of refrigerant
Non-condensable gas in the refrigerant cycle
Turn off the unit and check the relation between water temperature and pressure.
Charge refrigerant again after the evacuation
High pressure pipe clogging
Expansion Valve clogging
Check Valve (Air side heat exchanger side) clogging
Check clogging
Check clogging
Remove clogging, or replace check valve
Strainer Clogging
Check the difference of temperature before and after of strainer.
Replace or clean the strainer
Chilled water inlet temperature of Water side heat exchanger is excessively high
Confirm if it is within the working range
Check the status of heat load in detail and take a countermeasure
Discharge gas control is activated
Suction gas temperature is excessively high (Excessively super heat)
Gas leakage or refrigerant shortage
Charge correct quantity of refrigerant after checking gas leakage


Unit stops during cooling operation
Discharge gas control is activated (E 1-6 1 alarm)~ (E6-66 alarm)
Suction gas temperature is excessively high (excessive superheat)
Check valve (Air heat exchanger side) Malfunction
Replace check valve
Expansion Valve Clogging
Remove Clogging
Strainer Clogging
Replace or clean the strainer
Discharge gas Thermistor Failure
Check thermistor resistance
Replace discharge gas thermistor
Thermal relay for compressor is activated (E 1-5 1 alarm)~ (E6-56 alarm)
Compressor internal thermostat is activated (E 1-7 1 alarm)~ (E6-76 alarm)
Fan internal thermostat is activated (E 1-4 1 alarm)~ (E6-46 alarm)
Fan motor bearing failure
Lock Status
Replace fan motor
Single Phase Running
Check magnetic contactor
Replace magnetic switch
Motor Insulation Deteriorated
Measure insulation resistance
Replace fan motor
Compressor Drive Excessive Current
Power Voltage excessively high or low
Set voltage within working range during operation
Power Voltage Phase Imbalance
Measure the voltage in each interphase and ask Power Company for the advice
Discharge pressure is excessively high
Analyze the cause
Single Phase Running
Power Fuse melted
Replace power fuse
Loose Power Terminal Screw
Retighten the screw
Contact point of compressor Motor magnetic Contactor Roughness
Replace contact points
Compressor Bearing Failure
Lock Status
Replace compressor
Compressor Motor insulation Failure
Measure insulation resistance
Compressor Motor Over-current relay Failure
Measure current of compressor motor
Replace over-current Relay
Pump over-current relay is activated (SP alarm)
Pump locked
Check freezing of water, clogging of foreign particle
Remove them
Pump Over-current relay RC value Wrong
Check the RC value and pump running current
Change the RC value or replace magnetic contactor
Pump Over-current relay Failure
Push reset button. Check the running current
Replace magnetic contactor
Freeze protection control is activated ( 13 alarm)
Shortage of water Flow
Check the difference of temperature between inlet and outlet of chilled water
Increase water flow
Water Strainer Clogging
Clean the strainer
Pump reverse rotated
Check rotative direction
Repair to correct direction
Air mixed
Open Air Vent Valve
Evacuate Air
Thermistor Failure ( 11 alarm) ( 12 alarm) ( 15 alarm) ( 16 alarm)
Check inlet temperature of chilled water
Replace Thermistor

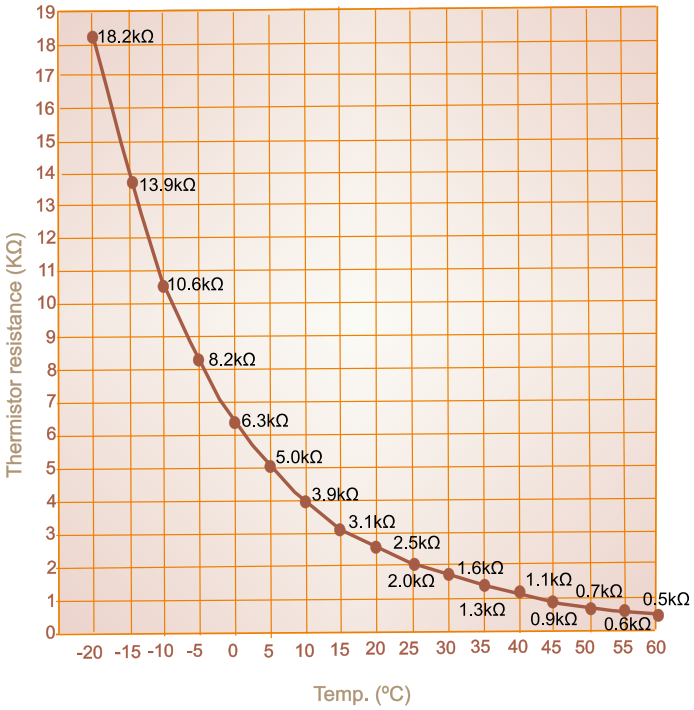

Unit is running, but the cooling capacity is insufficient
The heat load is bigger than cooling capacity
Calculate heat load
Replace to larger unit
Low pressure is excessively low.
(Low-pressure control is activated)
(•••••)~(•••••alarm)
Gas leakage or shortage of refrigerant
Check super-heat.
Charge correct quantity after checking gas leakage
Expansion Valve Clogging
Check clogging
Remove clogging
Strainer Clogging
Check to make sure that no difference of temperature before and after of the strainer exists.
Replace strainer
Low pressure Piping Clogging
Check to make sure that no difference of temperature between piping exists.
Remove clogging
Check Valve Malfunction
Check to make sure that no difference of temperature before and after of check valve exists.
Replace check valve
Shortage of water flow
Check the difference of temperature between inlet and outlet of chilled water
Increase water flow
Clogging of Water Strainer
Replace or clean the strainer
Pump Reverse Rotation
Check the rotation direction
Repair to the correct direction
Air Mixed
Open the air vent valve
Evacuate the air
Deposits on water cooler plates
Check the scales inside of water cooler
Clean water cooler
High pressure is excessively high
(High-pressure switch is activated)
(•••••)~(•••••alarm)
Air flow shortage in air-side heat exchanger
Excessive dust in air-side heat exchanger
Inlet or outlet of air-side heat exchanger is clogged
Remove it.
Shortage of Service Space for chiller unit
Secure the service space
Reverse Rotation of Fan Motor
Correct the wiring of fan motor
Air temperature through air-side heat exchanger is high
Air Short-circuits in Chiller Unit
Repair short-circuit.
Another Heat Source around the Chiller Unit
Remove heat source
Refrigerant Excessive charge
Check cycle temperature
Charge the correct quantity
Non-condensable Gas in the Refrigerant Cycle.
Turn off the unit and check the relation between water temperature and pressure
Evacuate and charge refrigerant again
High Pressure Pipe Clogging
Check clogging
Remove clogging
Expansion Valve Clogging
Check clogging
Strainer Clogging
Check to make sure that no difference of temperature before and after strainer exists
Replace strainer.
Check valve mal-function
Check to make sure that no difference of temperature before and after check valve exists.
Replace check valve.
Compressor Failure
Check pressure, cycle temperature, and current
Replace compressor.
Unit is running, and it makes a noise.
Propeller-fan contacts with shroud
Investigate
Adjust the position of propeller fan
Noise from compressor
Installation error or loose bolt
Check each bolt if loosen
Tighten up.
Liquid Compression
Check suction gas temperature, pressure
Ensure superheat
Oil hammer
Check suction gas temperature and oil level
Replace compressor
No-current to oil heater at compressor stopping
Check the current to oil heater.
Replace oil heater.
Worn or damaged part in the compressor
Noise from inside of compressor
Replace compressor.
Beats of magnetic contactor
Check the roughness of contact
Replace contact points
Vibration of cabinet
Check screws if loosen
Tighten up

## 5.4. Thermistor characteristics

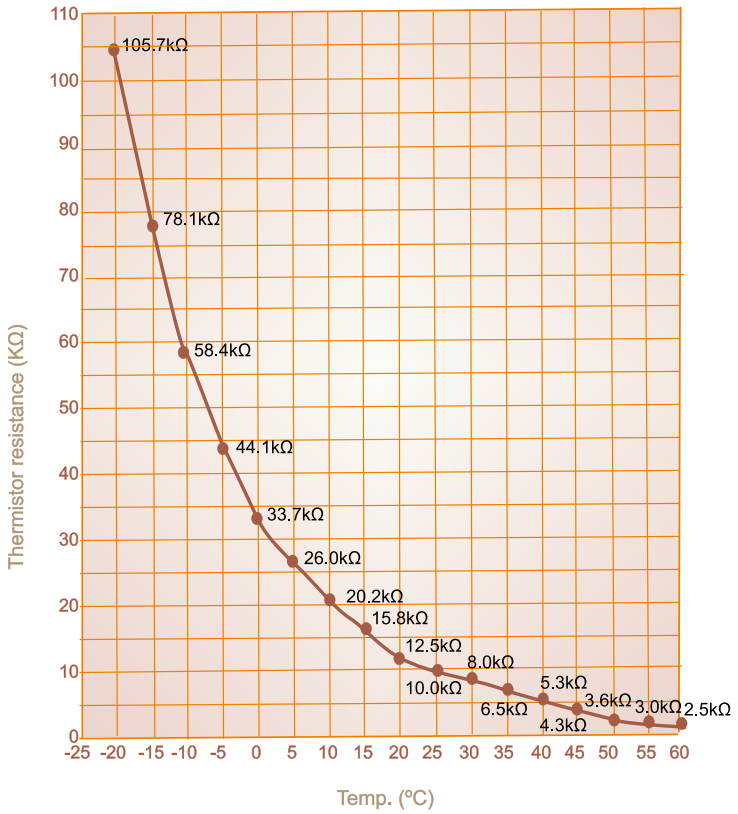
The thermistor is installed in this product to detect the cycle temperature such as water temperature (inlet-outlet of water side heat exchanger). Ambient temperature and outlet liquid refrigerant temperature air side heat exchanger.

The temperature characteristics are shown in the below figures:

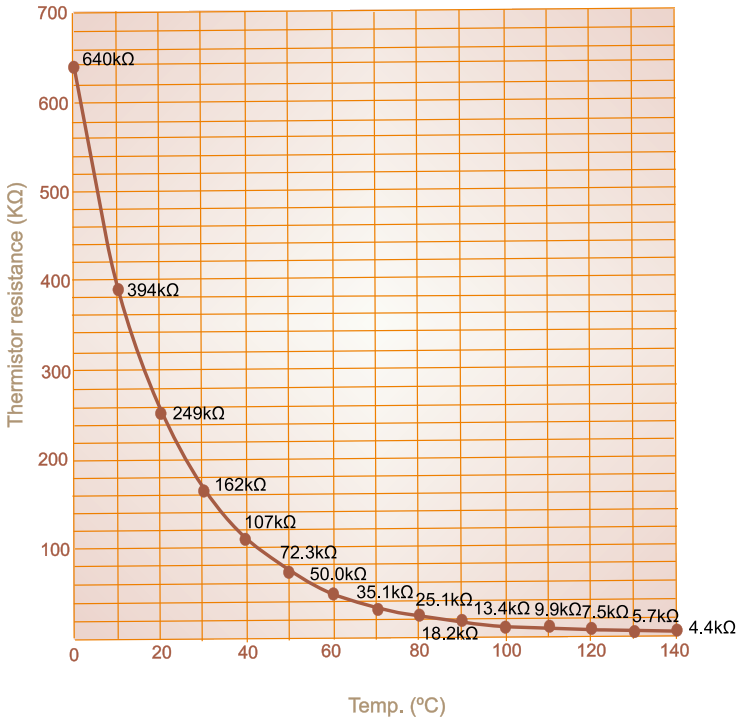
### 5.4.1. Thermistor temperature characteristics (All temperature except discharge gas)



### 5.4.2. Thermistor temperature characteristics (Ambient)



### 5.4.3. Thermistor temperature characteristics (Discharge gas temperature)



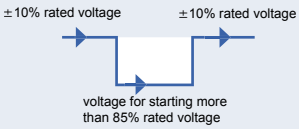
# 6. Maintenance

This chapter describe the procedure of the maintenance of the Air cooled water chillers.

## Content

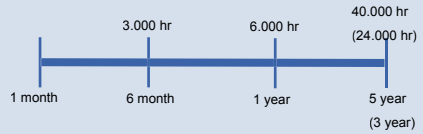
## 6.1. Maintenance criteria

| Check Item | | Check Frequency | Criteria (procedure) | Remarks |
|---|---|---|---|---|
| 1. General | | | | |
| Noise | | A/N | Confirm if there is no abnormal noise. | Judge from aprox. 1m from the control panel surface. |
| Vibration | | A/N | Confirm visually if there is no abnormal vibration | |
| 2. Cabinet | | | | |
| Outside board and inner | Dirt | A/N | Clean with cloths | |
| | Rust | A/N | Perform repair painting with Anticorrosion paint | |
| | Vibration | A/N | Re-tighten screws | |
| 3. Refrigerant Circuit | | | | |
| General | Refrigerant leakage | once/ season | Confirm if there is no refrigerant leakage by using detecting device in each component and pipe connection parts. As for checking for leakage in water cooler and condenser, confirm it with the air discharged to water inlet and outlet, and in this, case water should be drained. | |
| | Capillary pipes | once/ season | Perform visual check if there is no contact or resonance. | |
| Compressor | Noise | A/N | Confirm if there is no abnormal noise at starting, operating and stop. | |
| | Oil leakage bleed | A/N | Confirm if there is no oil leakage or bleed from the compressor. | |
| | Oil level | A/N | Perform visual check by sight glass. | |
| | Insulation Resistance | once/ season | More than 3MΩ at 500V DC | |
| | Oil Heater | once/ season | Apply current during compressor stop. | |
| | Ageing of Vibration Insulation rubber | once/ season | Touch and confirm if they have rubber elasticity. | |
| | Intermediate check (1) | once/ 3,000 hr | Pay special attention to noise, vibration and oil leakage etc. | See following ”maintenance criteria of Screw compressor” for details |
| | Intermediate check (2) | once/ 6,000 hr | Confirm if safety device and protection device function well. | |
| | Overhauling | once/ 24,000 hr (water-cooled) 40,000 hr (Air-cooled) | Overhaul the compressor and check it according to the specialist’ advice. | |
| Condenser (air-cooled) | Fin clogging | once / season | Clean it spraying warm water (less than 40ºC). | |
| Condenser (water-cooled) | Water flow, water temp. | A/N | Confirm if they are within the criteria | See technical catalogue for details. |
| | Water quality | once/ month | Confirm if it is within the criteria. | See technical catalogue for details. |
| | Cleaning | A/N | Confirm if high pressure is within the criteria. Perform the predetermined cleaning. | Frequency of cleaning differs depending on result of water quality or operation time. |
| | Drain water | once/ season | If condenser is not used for intermediate or long period, drain water. At this time, open also plug for draining water and for removing air. | |

| Check Item | | Check Frequency | Criteria (procedure) | Remarks |
|---|---|---|---|---|
| 3. Refrigerant Circuit (Cont.) | | | | |
| Water Cooler | Cleaning | once/ season | Perform the predetermined cleaning. | Frequency of cleaning differs depending on result of water quality or operation time. |
| | Water flow, water temp. | A/N | Adjust them so that standard operation pressure is kept. | See technical catalogue for details. |
| | Drain water | once/ season | If the water cooler is not used for intermediate or long period, drain water in the heat exchanger of water side. | Drain also water in pipes. |
| | Water quality | once/ month | Confirm if it is within the criteria. | See technical catalogue for details. |
| 4 way valve | Operation | once/ season | Confirm if switching coolingheating is performed smoothly. | Only for air-cooled heat pump type |
| Expansion valve (Mechanical) | Operation | once/ month | Confirm if low-pressure changes smoothly by turning adjustable screw. | See technical catalogue for details. |
| Expansion valve (Electronic) | Operation | once/ season | Touch it to confirm if it functions correctly when zero reset is performed automatically just after power ON. | |
| Strainer | Clogging | once/ month | Confirm if there is no pressure difference inlet and outlet of strainer | |
| Solenoid valve | Operation | once/ month | Confirm if valve opens or closes smoothly. | |
| Stop valve | Operation | once/ month | Confirm if valve functions smoothly. | |
| High pressure switch | Operation | Once / month | Confirm if it is activated correctly with the value of safety and control device setting in technical catalogue. | Pay attention to fluttering of contact parts at operation. |
| 4. Electrical system | | | | |
| Electricity in general | Supply voltage | A/N | Supply voltage is as follows:<br>  <br> | |
| | Insulation resistance | once/ season | More than 1MΩ at 500 V Mega in every electrical devices. | |
| | Connection of electrical wire | once/ season | Confirm if the terminal does not loose or coat of wire is not removed. | |
| | Earth wire | once/ season | Confirm if they are installed correctly. | |
| | Fuse | once/ season | Confirm if the capacity of fuses is correct. | |
| Electrical component | Magnetic contactor | once/ season | Confirm if there is no abnormal noise or sparks by switching ON→ OFF.<br>Confirm if it is correct apparently. | The interval of switching ON⇔OFF is more than 3min. |
| | Auxiliary relay | once/ season | Confirm if they are operated smoothly. | |
| | PCB | once/ season | Confirm if they are operated correctly. | |
| | Operation SW | once/ season | Confirm if they are operated smoothly. | |
| | Transformer | once/ season | Confirm if there is no abnormality apparently. | |

## 6.2. Maintenance criteria of Screw Compressor

| Classification | Time and year | Model | Performance items |
|---|---|---|---|
| Daily check | Every day | | – Save of operation situation<br>– (pressure, temperature, voltage, current value, remarks etc.) |
| Periodically check | Every 6,000 hrs<br>Every one year | | – Operation check of safety device, protection device |
| | 24,000 hrs<br>Every 5 years | air-cooled | – Overhaul check of compressor and parts check<br>– Lubricant oil |
| | 40,000 hrs<br>Every 5 years | water-cooled | |
| Remarks | Take the shorter period | | – According to purpose or conditions of use, work items shall be added individually. |

| Item \ Time | | Year/month to change or check (min) | Remark |
|---|---|---|---|
| | |  | ( ) is for air-cooled. |
| Operation test of safety device and protection device | | | |
| 1 | High pressure switch | ○ | |
| Check of lubricant oil and change it | | | |
| 2 | Refrigerant oil | ● | |
| 3 | Suction gas strainer, oil strainer. | ○ | |
| Decomposition of compressor | | | |
| 4 | Bearing | ● | |
| 5 | Rotor | ○ | |
| 6 | thrust liner | ● | |
| 7 | Set of tooth lock washer (tighten the nuts) | ● | Change them at the same time as bearing |
| 8 | Set of P.K.O ring | ● | |
| 9 | Set of Teflon ring | ● | |

*NOTE:*

- ● : part change ○ : part change if abnormality is detected in the check
- This table is applied in case that operation condition is good and operation record is fully equipped.
- Perform compressor check according to the compressor service manual and technical notice.

## 6.3. Maintenance of Water Quality

This air-conditioning device uses water as a heat source (for cooling) or as a media (chilled water, heat water) for use of heat. Therefore, it is necessary to select suitable water and control it to maintain the quality and performance and avoid possible problems.
Serious failure of plate heat exchanger may stop the units function and cause high expenses for its repair. Therefore, it is indispensable to promote the maintenance and selection of water for the chiller installation.
Read the below criteria of water quality very carefully to avoid any troubles.
In case of using some chemical products for water treatment, it is recommended to consult with manufacturers specialised in water treatment, since characteristics of chemical agents may differ with product specifiactions.

### 6.3.1. Water to be used

Water to be supplied to the chiller should be running water (clean water), industrial water or groundwater. Other special water like pure water cannot be used in the standard product.

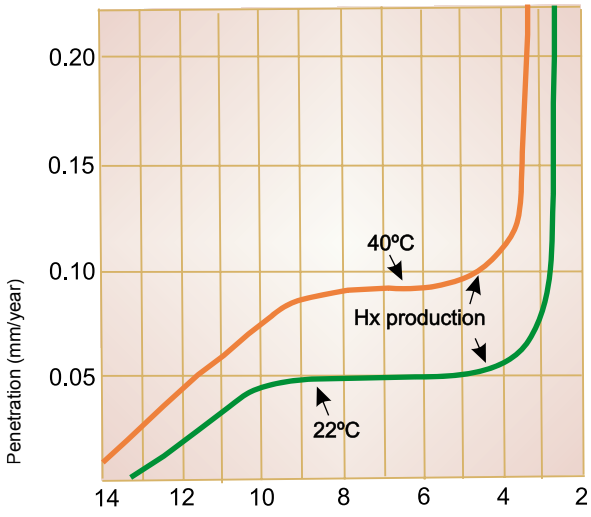
### 6.3.2. Criteria of Water

The later table shows the guideline of water quality regulated by JRAIA. Each criteria is set for water for cooling and for heating. The compliance of this criteria is premised on the product guarantee.

◆ **Explanation of Main Items in Water Quality Maintenance>**

- pH (hydrogen-ion concentration)

  pH is used as a measure to judge acidity, neutral and alkalinity of water. It is a big factor in taste, corrosion, purification effect in water treatment, disinfection effect in chloride treatment, water stain formation, and other fields like analytic chemistry, biochemistry etc. The below figure shows an example of relation between pH value and corrosion.




Relation between pH and corrosion of soft steel

- Electrical conductivity

  To know the outline of water quality, it is effective to measure electrical conductivity. This value is determined by quality and quantity of dissolved chlorine, and generally water with a greater value of electrical conductivity is not suitable since it has a lot of substance causing corrosion and lime.

- Chloride ion

  Chloride ion has a important property regarding corrosion and corrosion is higher in water with big amount of chloride ion although pH value is free of corrosion. Chloride ion does not have oxidise property, however precious metal is penetrated if chloride ion combines with oxidant or dissolved oxygen.

- Sulfate ion

  Sulfate ion is a cause of corrosion, but it gives an indication for line formation. If running water has a great amount of sulfate ion, it will become rusty water.

- Acid consumption (pH4.8) = M alkali level

  It shows the volume of hydroxide, carbonate and bicarbonate in water. It is a base of saturation index calculation or prevention of corrosion, rusty water and line formation.

- All hardness, calcium hardness

  The volume of calcium ion and magnesium ion in water is indicated with mg/l corresponding to the calcium carbonate . Hardness by calcium ion is called calcium hardness. This is a cause of line trouble related with temperature, pH, and electrical conductivity.

- Ionic silica

  When metallic corrosion products (FE, Zn etc) increase in water, silica produces compound products reacting with metallic corrosion products, which helps that line is found easily.

- Iron

  Iron exists in water as a bicarbonate, a chloride, a hydrosulfate,a hydroxide, iron bacterium and an organoiron salt, and is a cause of rusty water or line trouble.

- Copper

  Copper is often melt from copper pipes. Copper is a promoting factor of corrosion against iron pipes or galvanized steel pipe.

- Sulfide ion

  It is a sulfide dissolved in water. When pH is decreased, sulfide is dissolved to produce $H_2S$, which causes a heavy corrosion on many metal materials.

- Ammonium ion

  When ammonium exist in water, copper and ammonium react together to produce complex salt, which leads to copper evolution and finally to the corrosion. The volume of ammonium, producing copper and complex salt, is equivalent in $NH_3 + H_2O \leftrightarrow NH_4^+ + OH^-$. When water pH value increases, the volume of ammonium also increases, and the danger to corrosive becomes higher.

- Chlorine residual

  It is chlorine remained in the water which has been chlorinated, and is a cause of corrosion of copper etc.

- Free carbon dioxide

  It is carbon dioxide gas dissolved in water, and is a cause of iron corrosion or action on concrete.

- Ryzner Stability Index (RSI))

  It is a measure of the grade of water corrosion and line production. It is calculated by the following formula.

  RSI = (9.3+A+B-C-D) x 2 –E

  A: Dissolved matter index=0.1 (electrical conductivity≒5~50mS/m)., 0.2 (electrical conductivity≒50~150mS/m)

  B: Temperature index <Chilled water>=2.4, <Warm water>=1.6

  C: Calcium hardness index = log (calcium hardness) – 0.4

  D: Oxygen consumption (pH4.8) index = log[Oxygen consumption (pH4.8)]

  E: pH value

  RSI < 6: Possibility of line production

  6≦RSI < 7: Stable area

  RSI≧7: Possibility of corrosion

*CAUTION*

In the beside data, only chilled circulation water is defined, however, stable index of 6~7 should be kept in other cases.

- Dissolved oxygen

  It is an oxygen gas dissolved in water and is a great factor to promote the corrosion. Regarding copper corrosion, possibility of corrosion is increased in dissolved oxygen volume of 5~15 (ml/l), and is decreased in greater or less value than that.

  Remarks: Oxygen consumption, all hardness and calcium hardness

  If these values are greater, line is likely to be produced, and if they are fewer, corrosion is likely to be caused. In the guideline presented in the table, only the upper value is limited, which is based on an idea of prevention of line trouble and of that the corrosion can be judged by other method. Therefore, if there is no worry about line trouble, it is better to keep these values high to prevent the possibility of corrosion.

  Concretely, in chilled and warm water, if RSI is 6~7.5 (there is no worry about line problem), it is convenient to maintain the below value to prevent the corrosion.

  - Oxygen consumption (pH4.8) ($mgCaCO_3/l$) =50~100
  - All hardness ($mgCaCO_3/l$) =50~200
  - Calcium hardness ($mgCaCO_3/l$) =below 150

### 6.3.3. Maintenance method of Water Quality

#### ◆ Quality inspection of circulation water

1. Before test run, all criteria items in the table should be checked.
2. The first week after test run pH and electrical conductivity should be measured. In case of any trouble, all items should be checked.
3. One month after test run, all items should be checked.
4. After that, water quality tendency should be captured in these 3 tests and afterward schedule should be decided by these results. Even in the case of no trouble, pH and electrical conductivity should be checked every month and all criteria items of water quality should be checked every half year.



#### ◆ Action in case of water quality trouble

When the result of periodical inspection recognises some troubles in water quality, those actions as similar to the following should be taken according to the situation.

1. Replace old water to new one or perform forced blow. (once a week ~ once a month)
2. Water should be treated with anti-corrosion agent or line inhibitor.

◆ **Other maintenance item**

To maintain good water quality, it is necessary to consider the installation place. See the below for your reference.

– Before installation

| Maintenance item | Measures |
|---|---|
| 1. Installation place<br>a). Study if installation place is suitable.<br>(*).Abnormal wastewater from boiler or refrigerating machine is not mixed with the chilled water. | – Analysis of water quality should be asked to a specialised company in water treatment. If it is a negative result, water source should be changed or treatment system should be changed after consulting with the company. |
| 2. System<br>a). Study if materials of heat exchanger, pipe, tank, valve etc are suitable.<br>b). Prohibition of open the pipe connected with tank to ambient air.<br>c). Study of temperature, flow, pressure and minimum holding water volume of chilled and heating water. | – Corrosion may concentrate to only one part due to the difference of material in chilled and heating water system.<br>– Open the pipe to ambient air may promote the corrosion. Pipe should be put inside the water.<br>– Control that these values be within the usage range. |
| 3. Water for use<br>a). Study of specification in case of brine.<br>b). Study of specification in case of special water like pure water. | – Suitable brine for Hitachi's product should be selected. Its specification is accorded with Hitachi technical handbook "caution in use of brine".<br>– There is a case that special water like pure water may not use in standard Chiller unit. Especially, in case of pure water, material should be made in SUS or certain water treatment should be performed. |

– After working

| Maintenance item | Measures |
|---|---|
| 1. Confirm if there is no leakage in pump, valve, pipe etc. | – Suitable measurement should be taken in case of the leakage |
| 2. Study of temperature, flow, pressure and minimum holding water volume of chilled and heating water | – Control that these values be within the usage range. (once a day) |

## 6.4. Cleaning of water side heat exchanger

Plate heat exchanger is used in water side heat exchanger in this series .

Water passes through the clearance between plates in the plate heat exchanger, therefore, dust or foreign materials should not exist there. (See the below structure figure for your reference)

Strainer (correspondent to 20 mesh) should be installed in the inlet pipe of chilled water (Strainer should be prepared in each case).

Line is produced based on the water quality, and it is possible to decrease the performance or to break the plate due to the partial freezing caused by local clogging, which leads to the refrigerant leakage. Cleaning of strainer as well as water side heat exchanger should be performed periodically.

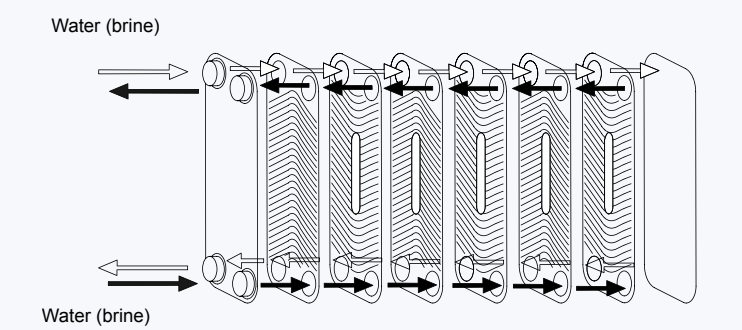
See the below cautions and normal cleaning method for your reference. Contact the below detergent companies to the details.

Showa HQ (Gifu): +81-58-232-1131

Tokyo branch: +81-3-3580-6121

Osaka sales office: +81-6-6391-2051

Futuro +81-3-92-434-4143





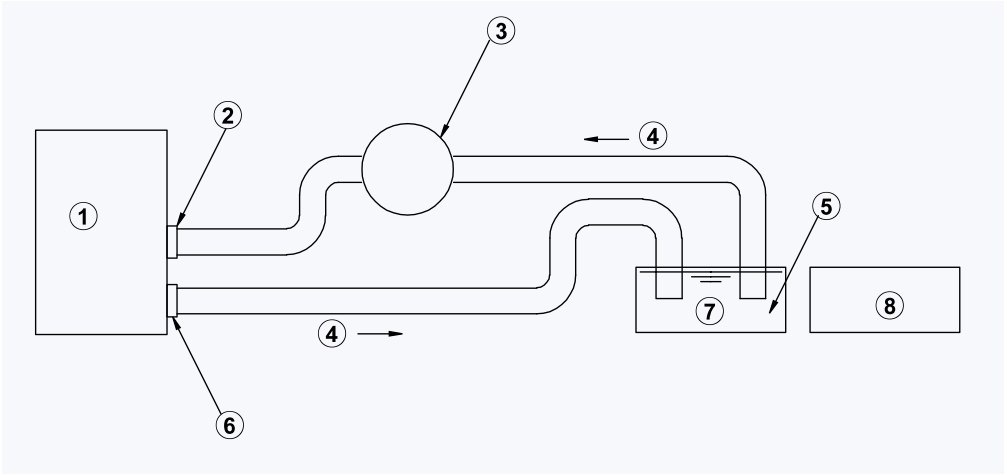

*CAUTION*

1. Suitable cleaning agent for line should be selected. (According to the dirty, cleaning agent differs)
2. Plate heat exchanger is made by stainless. (Copper material is used in the connection of plate). Therefore, do not use a cleaning agent with “chlorine and fluoride”. If it were used, heat exchanger should be damaged, which may cause the refrigerant leakage.
3. After water discharge, wash the inside with water and then water treatment should be performed in order to prevent the corrosion, rusty water or re-production of line.
4. Density of cleaning agent, cleaning time or temperature should be adjusted according to the line.
5. After oxygen cleaning, neutralization treatment should be performed. Disposal of waste water in neutralization treatment should be asked to the specialised company.
6. Cleaning agent or neutralization agent is corrosive or irritating to the body (skin, eye etc). Therefore, when cleaning, put the protection materials (protection glasses, protection grove, protection boots etc) on.

### 6.4.1. Cleaning method>

Cleaning whole system using the existing pump and cleaning only water circuit of chiller unit (single body cleaning) are the popular cleaning methods. Here, it is explained how to do concretely in simple body cleaning.

| N° | Name |
|---|---|
| ① | Chiller unit |
| ② | Water inlet |
| ③ | acid-proof pump |
| ④ | hose |
| ⑤ | Cleaning solution |
| ⑥ | Water outlet |
| ⑦ | Circulation tank (tank for cleaning) |
| ⑧ | Tank for waste water collection |




☛ **Step 1:** Cleaning circuit installation

- Chiller unit operation is stopped.
- Circulation pump operation is stopped.
- Water inlet/outlet connection is removed from the water circuit of unit, and another circulation circuit used the acid-proof pump is installed separately from the water circuit.

☛ **Step 2:** Confirmation of circulation circuit
An acid-proof pump is run while water is put in the tank for cleaning, and confirm

- if water is not leaked from the cleaning circuit.
- If cleaning hose is fixed.
- if devices installed around the unit is not contaminated by cleaning liquid, possible to overflow from the tank
- if air is not clogged.
- if there is no strange noise.

☛ **Step 3:** Cleaning

- Drain off the water in cleaning circuit.
- Adequate quantity of cleaning agent is put in the tank for cleaning and while diluting it, operate the acid-proof pump so that the diluted cleaning liquid circulates in the circuit.
- Perform the circulation cleaning during prescribed time (it is determined in each cleaning agent, although it differs from liquid type or density). It is necessary to change the cleaning time according to the dirtiness.

☛ **Step 4:** Wastewater treatment

- Acid-proof pump operation is stopped.
- Wastewater is put to the tank for wastewater collection.
- Water is put in the tank for cleaning and the tank is washed with pump.
- Water used before is also put to the tank for wastewater collection.
- While confirming with pH test paper, neutralization agent is added gradually to neutralise the tank.
- Neutralised wastewater should be treated by industrial waste disposal contractor. In case that wastewater is diluted by much abundant of water and drained to public sewer, consult with a cleaning agent company in advance.

☛ **Step 5:** Neutrization treatment

- Water is put in the tank for cleaning.
- Acid-proof pump is operated while air is pulled out.
- While confirming with pH test paper, neutralization agent is added gradually so that pH value be 7~9.
- After pump is operated for prescribed time, neutrization treatment is finished.
- After finishing neutrization treatment, neutrization liquid is drained to public sewer.
- Circulation pump is operated and circulation system is washed sufficiently until dirty liquid is totally out.



☛ **Step 6:** Re-start operation

- Water pipe is installed as before the cleaning.
- After cleaning, water treatment is performed to prevent the corrosion occurred at operation start.

## 6.5. Check items in daily operation

| | Check items | | Check contents | Result (write the value or *X* ) |
|---|---|---|---|---|
| 1 | Check of around of chiller unit | | Remove the obstacle | Good / NG |
| 2 | Pressure, quantity and quality of chilled (heating) water | | Check them while pouring water | Good / NG |
| 3 | Pipe of chilled (heating) water | | | Good / NG |
| 4 | Check of screws and bolts etc | | Re-tighten those which are loosed | Tightened / No tightened |
| 5 | Re-tightening of electrical wiring terminal | | Re-tighten all by driver | Tightened / No tightened |
| 6 | Leakage of water pipe | | Confirm it while pouring water | Yes / No |
| 7 | Dirtiness of air side heat exchanger | | Clean it by pouring hot (40°C) water. | Done / No done |
| 8 | Clogging of drain pump | | Confirm it while pouring water | Yes / No |
| 9 | Cleaning of inside/outside of machine room | | | Done / No done |
| 10 | | Compressor | Check valves, flare parts, welding parts etc. | Good / NG |
| 11 | | Air side heat exchanger | | Good / NG |
| 12 | | Water side heat exchanger | | Good / NG |
| 13 | | Expansion valve | | Good / NG |
| 14 | | 4 way valve (only cooled heat pump) | | Good / NG |
| 15 | | Solenoid valve | | Good / NG |
| 16 | | Stop valve | | Good / NG |
| 17 | | Strainer | | Good / NG |
| 18 | | Pipe, capillary tube | | Good / NG |
| 19 | | High pressure block switch | | Good / NG |
| 20 | Cleaning of inside/outside of unit | | | Done / no done |
| 21 | Interphase voltage of compressor | | More than 180V | Good / NG |
| 22 | Vibration and noise | | Check compressor, fan, pipe etc. | Abnormal / Normal |
| 23 | Operation adjustment and automatic operation mechanism | | Check the activation of ON, OFF, temperature adjustment | Good / NG |
| 24 | High pressure block switch | | Check the activation value and setting value. | Good / NG |
| 25 | Indication light | | | Good / NG |
| 26 | 4 way valve (only cooled heat pump) | | Check the state of switch from cooling to heating and vice versa. | Good / NG |
| 27 | Solenoid valve | | | Good / NG |
| 28 | Instruction on operation method | | | Done / No done |
| 29 | Inlet temperature of chilled (heating) water | | | °C |
| 30 | Outlet temperature of chilled (heating) water | | | °C |
| 31 | Inlet DB(WB) temperature of air side heat exchanger | | | °C ( °C) |
| 32 | Water flow of water side heat exchanger | | | m3/h |
| 33 | High pressure | | | MPa |
| 34 | Low pressure | | | MPa |
| 35 | Operation voltage | | | V |
| 36 | Operation current | | | A |

## 6.6. Caution on handling of R407C

### 6.6.1. Refrigerant

The refrigerant is HFC type refrigerant whose ozone destruction coefficient is ZERO. If other refrigerant is mixed, the property of refrigerant is changed and may cause a problem. The following points should be taken into account on its handling.

- Refrigerant should be added in liquid state not in gas state. R407C is nonazeotropic refrigerant mixture, and compositions of boiling point are different. Therefore, if it is added in gas state, refrigerant, easy to evaporate, is added and refrigerant, hard to evaporate, remains in a refrigerant tank.
- Confirm if the tanks specialised for R407C.
- The tank should be set so that refrigerant can be added in gas state.
- The valves or hose for charge should be specialised for R407C.

### 6.6.2. Refrigerant oil

Freol UX300 of Japan Energy is used as a refrigerant oil due to its high compatibility with R407C. Other refrigerant oil cannot be used, therefore, pay attention not to be mixed with others at maintenance. The hygroscopicity is the same as a conventional Icematic SW220HT of Castrol, therefore, moisture maintenance is not changed. (Icematic SW220HT as well as Ferreol UX300 are ester series refrigerant oil, therefore, open to the ambient air as short as possible)

| Type | Ester series synthetic oil |
|---|---|
| Name | Ferreol UX300 of Japan Energy |
| Fluid point | Below -20°C |
| kinematic viscosity (40 °C) | 250~310mm2/s |
| water saturation | Aprox. 1600 ppm |

| Model | Reference | Refrig. Qty. (kg) |
|---|---|---|
| RCUE40AG2 | 8E041072 | 39 |
| RCUE50AG2 | 8E051072 | 46 |
| RCUE60AG2 | 8E061072 | 41 |
| RCUE70AG2 | 8E071072 | 48 |
| RCUE80AG2 | 8E081072 | 64 |
| RCUE100AG2 | 8E101072 | 92 |
| RCUE120AG2 | 8E121072 | 82 |
| RCUE140AG2 | 8E141072 | 96 |
| RCUE160AG2 | 8E161072 | 128 |
| RCUE180AG2 | 8E181072 | 123 |
| RCUE210AG2 | 8E211072 | 144 |
| RCUE240AG2 | 8E241072 | 192 |
| RCUE280AG2 | 8E281072 | 192 |
| RCUE320AG2 | 8E321072 | 256 |
| RCUE350AG2 | 8E351072 | 240 |
| RCUE400AG2 | 8E401072 | 320 |
| RHUE40AG2 | 9E041072 | 39 |
| RHUE50AG2 | 9E051072 | 46 |
| RHUE60AG2 | 9E061072 | 41 |
| RHUE70AG2 | 9E071072 | 48 |
| RHUE80AG2 | 9E081072 | 64 |
| RHUE100AG2 | 9E101072 | 92 |
| RHUE120AG2 | 9E121072 | 82 |
| RHUE140AG2 | 9E141072 | 96 |
| RHUE160AG2 | 9E161072 | 128 |
| RHUE180AG2 | 9E181072 | 123 |
| RHUE210AG2 | 9E211072 | 144 |
| RHUE240AG2 | 9E241072 | 192 |

### 6.6.3. Refrigeration cycle complete parts

Organic materials (rubber, teflon) used in compressor and control device use compatible parts with Freol UX300 and R407C.

The pressure of R407C is higher than that of R22, and pressure strength of devices is increased. Therefore, devices for R407C are not compatible with that for R22. Use specified devices when replacing the compressor and refrigeration cycle parts at maintenance.

Do not put R407C to the units for R22 .

### 6.6.4. Reference materials

The following materials are published as a reference for R407C handling. Please see for them.

- Implementation, service and maintenance of Package Air conditionings with R407C. (material No.: HR-325)
- Implantation and service technique of devices used HFC series (JRAIA)

## 6.7. Manual at compressor overall check and parts check

The refrigerant (R407C) used in this unit is HFC refrigerant and does not cause the destruction of ozone layer in contrast with CFC or HCFC refrigerant.

However, its global heating coefficient is the same level as HCFC refrigerant, therefore it is important to control the discharge. Also, it is necessary to collect refrigerant at disposal of device or at arrangement of devices.

Collection of refrigerant, vacuuming and additional insertion of refrigerant at compressor overall check and parts check are shown in the following.

Handling of R407C alternative refrigerant is described in “Implantation / Service Technical of Devices used HFC Refrigerant”.

### 6.7.1. Collection of refrigerant

Refrigerant at airside heat exchanger should be collected in case of compressor overall check and parts check. However, at replacement or arrangement of airside heat exchanger itself, valve and fusible plug of airside heat exchanger, refrigerant of airside heat exchanger and other high pressure parts cannot be collected, and refrigerant inside the refrigeration cycle is needed to be collected using refrigerant collection device.

1. Liquid outlet valve (A) of airside heat exchanger is fully closed.
2. Chiller unit is operated with chilled water fully flowing. (In case of air-cooled heat pump type it is operated in cooling mode)
3. Chiller unit is stopped when pressure of low pressure side is decreased to aprox. 0.05MPa. Do NOT operate Chiller unit under 0.05MPa. Such operation may cause a compressor failure.
4. After a few minutes later when pressure of low pressure side is increased to 0.45~0.5MPa, chiller unit is re-operated and (2) and (3) are repeated 4~5 times.
5. This above operation enables the major part of refrigeration cycle to be collected in airside heat exchanger and high pressure pipe (between (B) and (A)).
6. Refrigerant, remained in low pressure side pipe and water cooling device, should be collected from stop valve (D) using refrigerant collection device.

### 6.7.2. Structure and Start-up method of Compressor

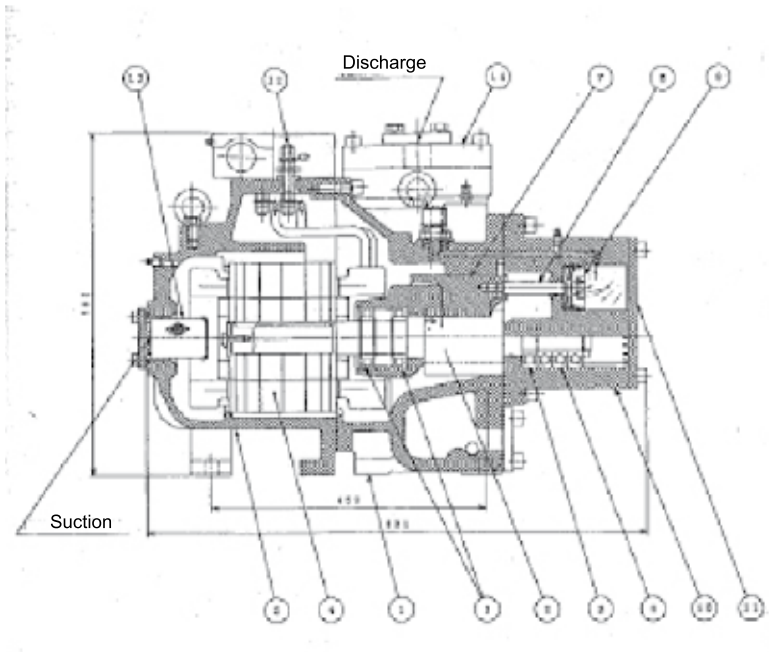
◆ **Structure of Compressor**

The structure of compressor used in this series is shown below figures:

1. A screw of half-sealed compressor is composed with male rotors and female rotors which have 5~6 dies.
2. Capacity is controlled by bypassing the refrigerant moving the slide valve(#7), a part of casing, to a shaft direction by a hydraulic piston(#9).

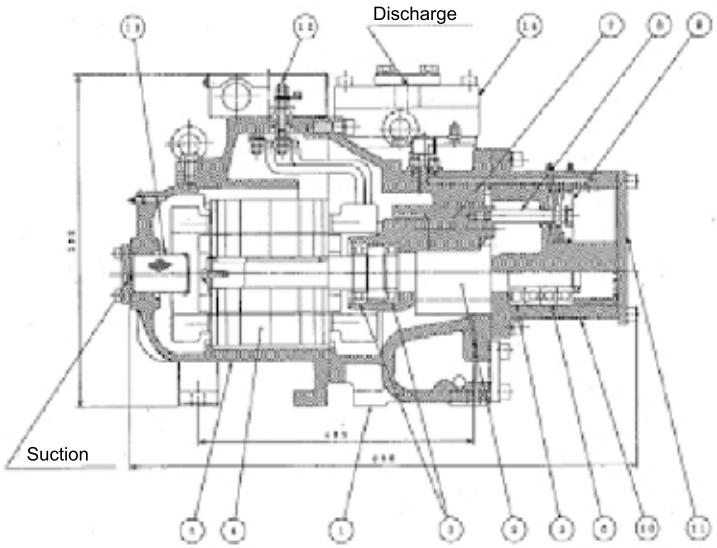
The standard specification of motor(#4), built-in the casing, is 200W Y △ and start-up.

☛ **Structure drawing of 40ASP-H, 40ASP-Z:**



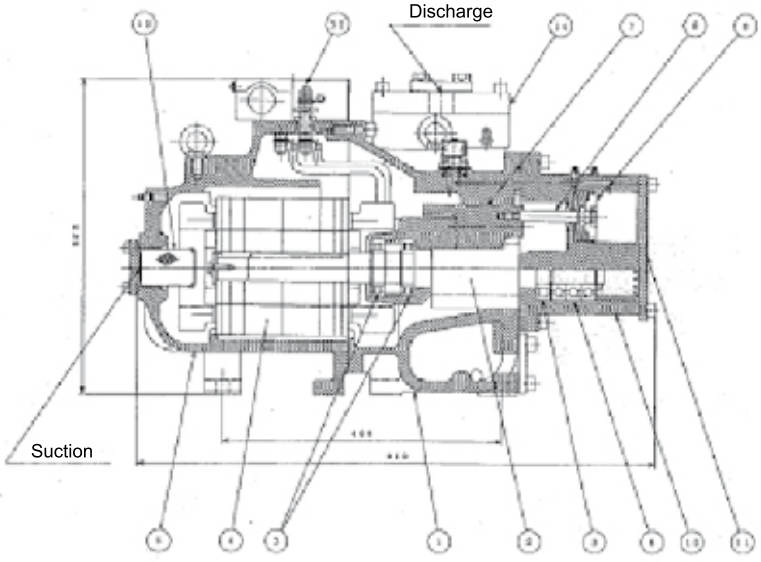

| Nº | Name | Material |
|---|---|---|
| ① | Main casing | FC250 |
| ② | Screw rotor | |
| ③ | Roller bearing | |
| ④ | Motor | |
| ⑤ | Motor casing | FC250 |
| ⑥ | Ball bearing | |
| ⑦ | Slide valve | |
| ⑧ | Rod | |
| ⑨ | Piston | |
| ⑩ | D casing | FC250 |
| ⑪ | E cover | SM400B |
| ⑫ | Terminal | |
| ⑬ | Gas strainer | |
| ⑭ | C cover | SM400B |

## ☛ Structure drawing of 50ASP-H, 50ASP-Z:




| Nº | Name | Material |
|---|---|---|
| ① | Main casing | FC250 |
| ② | Screw rotor | |
| ③ | Roller bearing | |
| ④ | Motor | |
| ⑤ | Motor casing | FC250 |
| ⑥ | Ball bearing | |
| ⑦ | Slide valve | |
| ⑧ | Rod | |
| ⑨ | Piston | |
| ⑩ | D casing | FC250 |
| ⑪ | E cover | SM400B |
| ⑫ | Terminal | |
| ⑬ | Gas strainer | |
| ⑭ | C cover | SM400B |

## ☛ Structure drawing of 60ASP-H, 60ASP-Z:




| Nº | Name | Material |
|---|---|---|
| ① | Main casing | FC250 |
| ② | Screw rotor | |
| ③ | Roller bearing | |
| ④ | Motor | |
| ⑤ | Motor casing | FC250 |
| ⑥ | Ball bearing | |
| ⑦ | Slide valve | |
| ⑧ | Rod | |
| ⑨ | Piston | |
| ⑩ | D casing | FC250 |
| ⑪ | E cover | SM400B |
| ⑫ | Terminal | |
| ⑬ | Gas strainer | |
| ⑭ | C cover | SM400B |

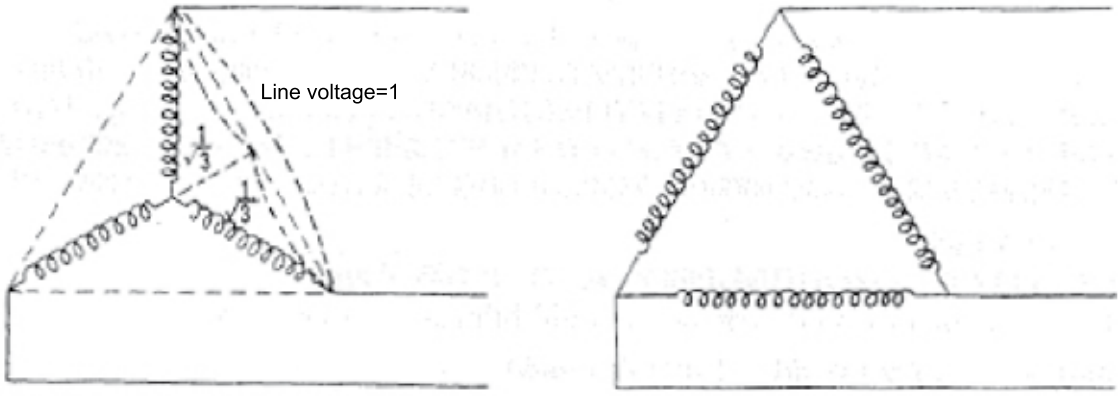
◆ **Start-up method**

Normally more than 22kW compressor has Y △ start-up, partly waiting start-up as well as normal start-up due to its high start-up current.

All Hitachi self-sealed screw compressors of rated output more than 22kW adapt -Y △ start-up system due to its high performance from the view of start-up current.

Like shown in the figure 9/18, at start-up, coil of the stator is connected as a star (Y), and 1/root3 of power voltage is added to each phase. When motor is accelerated and compressor starts to run normally, the connection is changed to a delta (△) to add the power voltage to all phase fully.

☛ **Start-up method:**




At start-up ( Y connection)

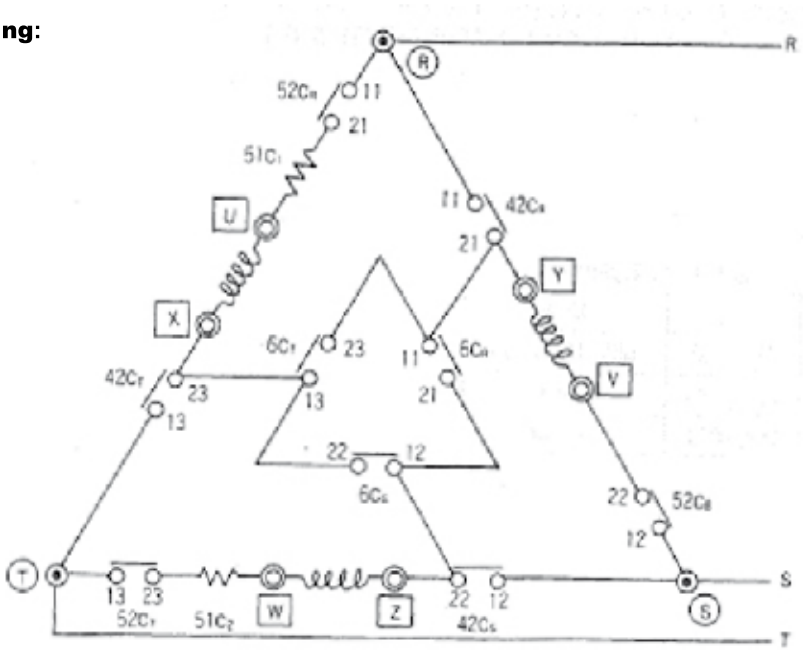
At operation ( △ connection)



The real wiring is shown in the below figure

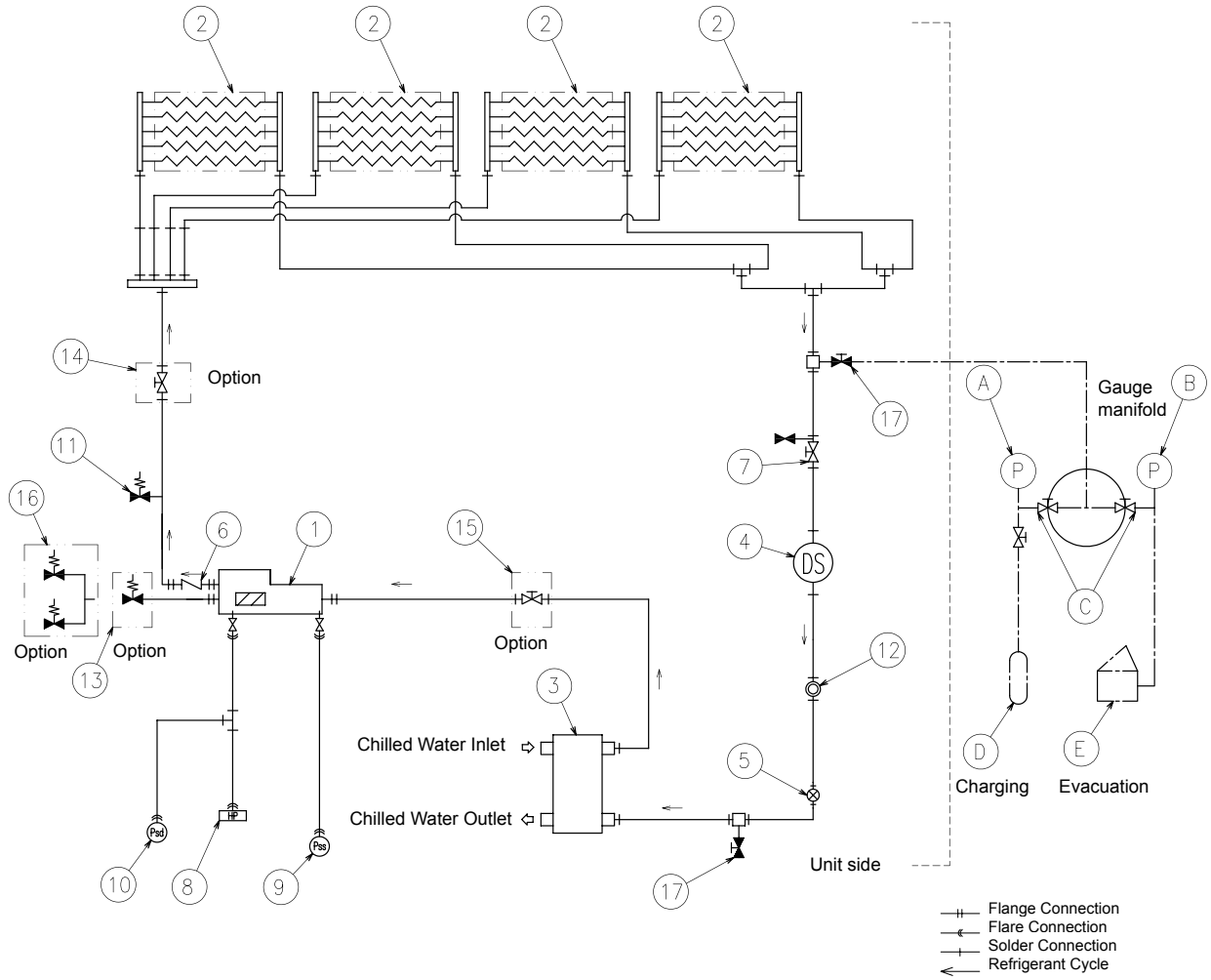
1. The connection of U~X, V~Y and W~Z is a motor, which is inside of screw compressor.
2. At start (Y) connection 52C, 6C:ON 42C:OFF
3. At operation (△) connection 52C, 42C:ON 6C:OFF

☛ **Real Wiring:**



## 6.8. Refrigerant cycle diagrams

### 6.8.1. Refrigerant cycle diagram of Hitachi Air-Cooled Water Chiller (RCUE 40, 50, 60, 70, 100, 120, 140, 180, 210, 280, 350 AG2)

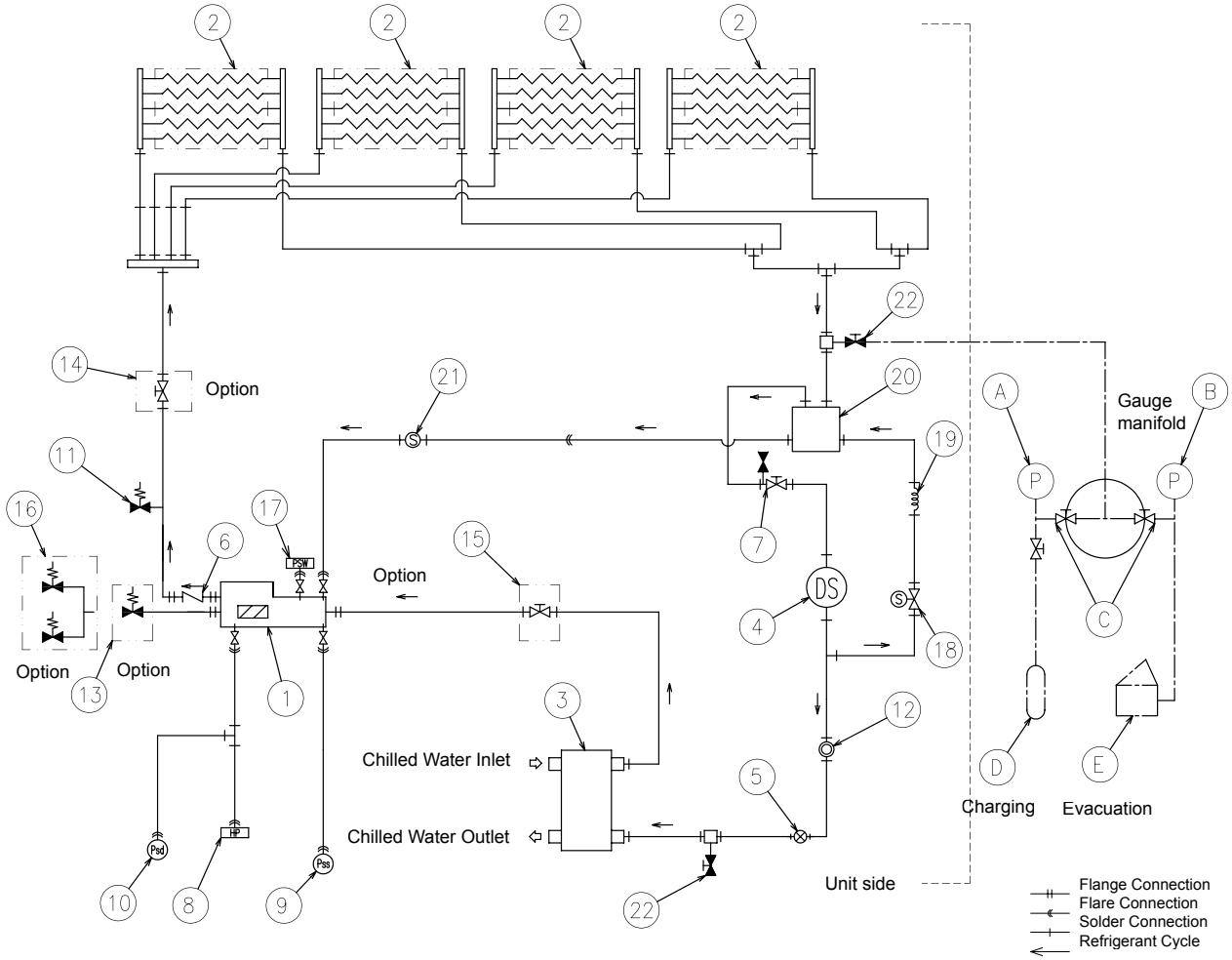



| No. | Name | No. | Name |
|---|---|---|---|
| 1 | Compressor | 12 | Sight Glass |
| 2 | Air-Cooled Condenser | 13 | Compressor Safety Valve (Option) |
| 3 | Water Cooler | 14 | Stop Valve (Option) |
| 4 | Filter Drier | 15 | Stop Valve (Option) |
| 5 | Electronic Expansion Valve | 16 | Compressor Dual Safety Valve (Option) |
| 6 | Check Valve | 17 | Stop Valve |
| 7 | Stop Valve (with check Joint) | A | High Pressure Gauge |
| 8 | High Pressure Switch | B | Low Pressure Gauge |
| 9 | Pressure Sensor (Low) | C | Stop Valve |
| 10 | Pressure Sensor (High) | D | Charging Cylinder |
| 11 | Pressure Relief Valve | E | Vacuum Pump |

*NOTE:*

R407C shall be charged by LIQUID.

### 6.8.2. Refrigerant Cycle Diagram of Hitachi Air-Cooled Water Chiller (RCUE 80, 160, 240, 320, 400 AG2) with economizer.

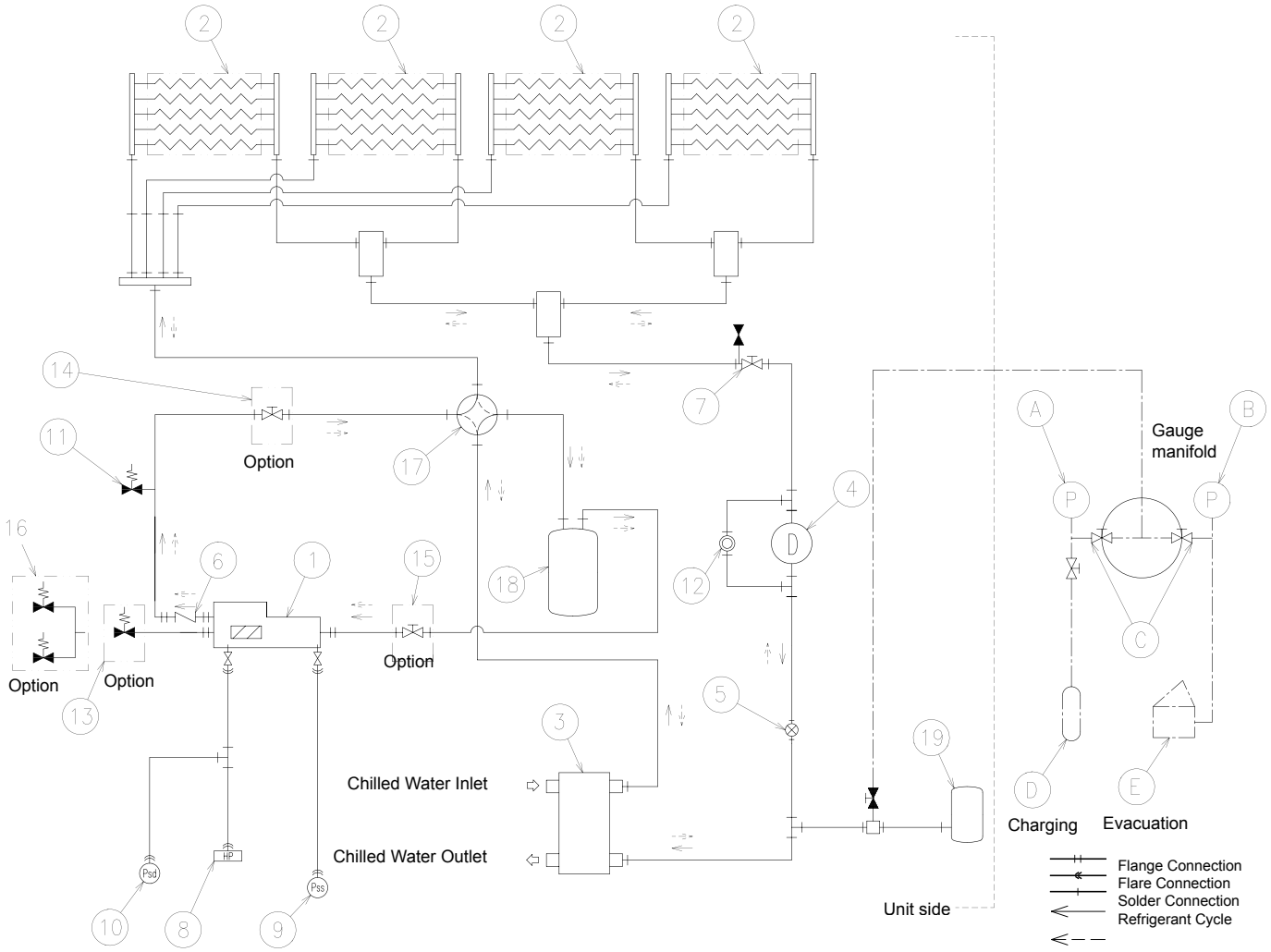



| No. | Name | No. | Name |
|---|---|---|---|
| 1 | Compressor | 15 | Stop Valve (Option) |
| 2 | Air Cooled Condenser | 16 | Compressor Dual Safety Valve (Option) |
| 3 | Water Cooler | 17 | Pressure Switch |
| 4 | Filter Drier | 18 | Solenoid Valve |
| 5 | Electronic Expansion Valve | 19 | Capillary Tube |
| 6 | Check Valve | 20 | Economizer |
| 7 | Stop Valve (with check Joint) | 21 | Strainer |
| 8 | High Pressure Switch | 22 | Stop Valve |
| 9 | Pressure Sensor (Low) | A | High Pressure Gauge |
| 10 | Pressure Sensor (High) | B | Low Pressure Gauge |
| 11 | Pressure Relief Valve | C | Stop Valve |
| 12 | Sight Glass | D | Charging Cylinder |
| 13 | Compressor Safety Valve (Option) | E | Vacuum Pump |
| 14 | Stop Valve (Option) | | |

*NOTE:*

R407C shall be charged by LIQUID.

### 6.8.3. Refrigerant Cycle diagram of Hitachi Air-to-water Heat Pump Chiller (RHUE 40, 50, 60, 70, 100, 120, 140, 180, 210AG2)

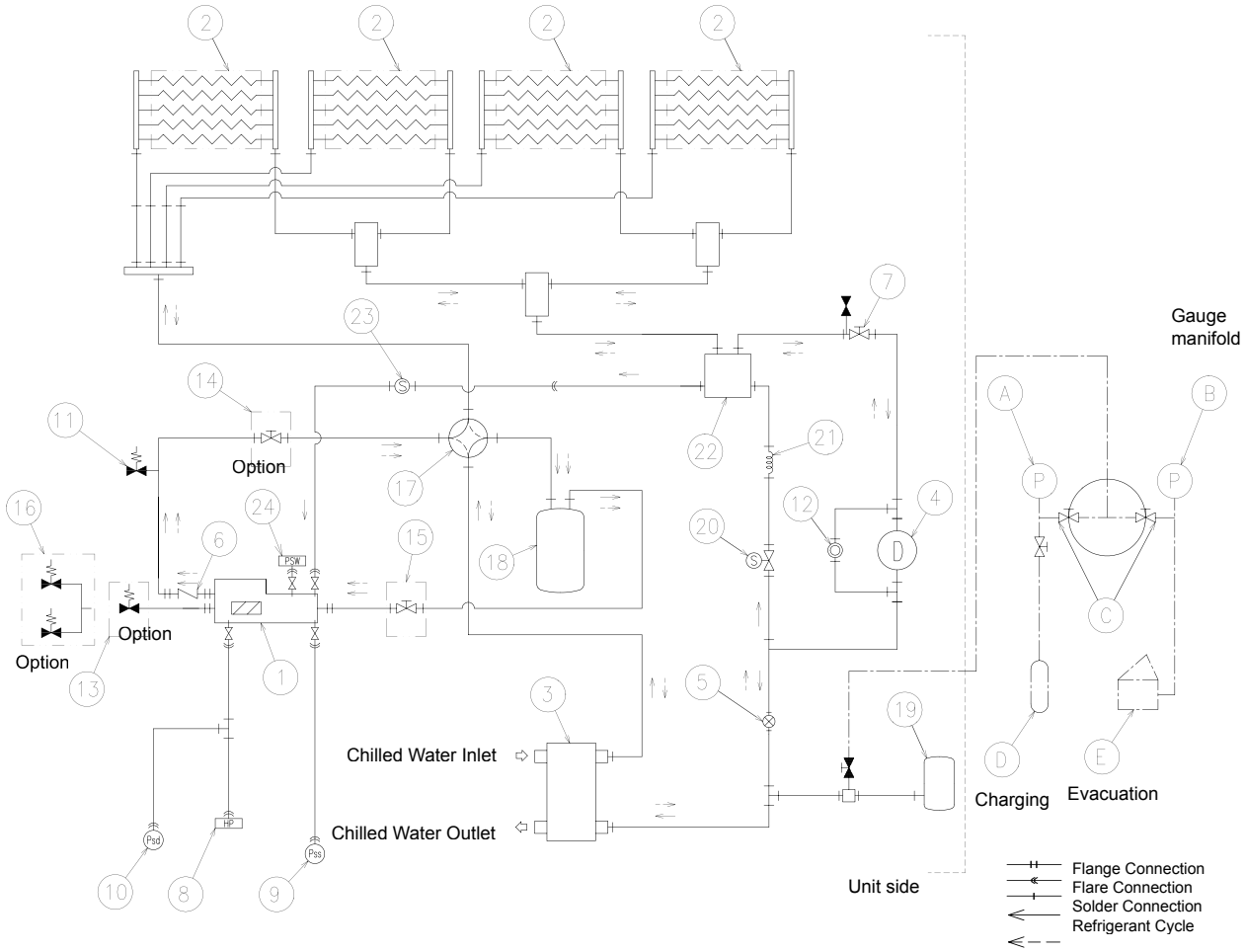



| No. | Name | No. | Name |
|---|---|---|---|
| 1 | Compressor | 12 | Sight Glass |
| 2 | Air-Side Heat Exchanger | 13 | Compressor Safety Valve (Option) |
| 3 | Water Side Heat Exchanger | 14 | Stop Valve (Option) |
| 4 | Biflow drier | 15 | Stop Valve (Option) |
| 5 | Electronic Expansion Valve | 16 | Compressor Dual Safety Valve (Option) |
| 6 | Check Valve | 17 | Stop Valve |
| 7 | Stop Valve (with check Joint) | A | High Pressure Gauge |
| 8 | High Pressure Switch | B | Low Pressure Gauge |
| 9 | Pressure Sensor (Low) | C | Stop Valve |
| 10 | Pressure Sensor (High) | D | Charging Cylinder |
| 11 | Pressure Relief Valve | E | Vacuum Pump |

*NOTE:*

R407C shall be charged by LIQUID

### 6.8.4. Refrigerant Cycle diagram of Hitachi Air-to-water Heat Pump Chiller (RHUE 80, 160, 240 AG2) With economizer.)




| No. | Name | No. | Name |
|---|---|---|---|
| 1 | Compressor | 16 | Compressor Dual Safety Valve (Option) |
| 2 | Air Side Heat Exchanger | 17 | 4-Way Valve |
| 3 | Water Side Heat Exchanger | 18 | Accumulator |
| 4 | Biflow drier | 19 | Liquid Tank |
| 5 | Electronic Expansion Valve | 20 | Solenoid Valve |
| 6 | Check Valve | 21 | Capillary Tube |
| 7 | Stop Valve (with check Joint) | 22 | Economizer |
| 8 | High Pressure Switch | 23 | Strainer |
| 9 | Pressure Sensor (Low) | 24 | Pressure Switch |
| 10 | Pressure Sensor (High) | A | High Pressure Gauge |
| 11 | Pressure Relief Valve | B | Low Pressure Gauge |
| 12 | Sight Glass | C | Stop Valve |
| 13 | Compressor Safety Valve (Option) | D | Charging Cylinder |
| 14 | Stop Valve (Option) | E | Vacuum Pump |
| 15 | Stop Valve (Option) | | |

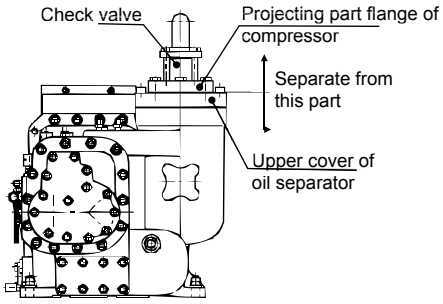
*NOTE:*

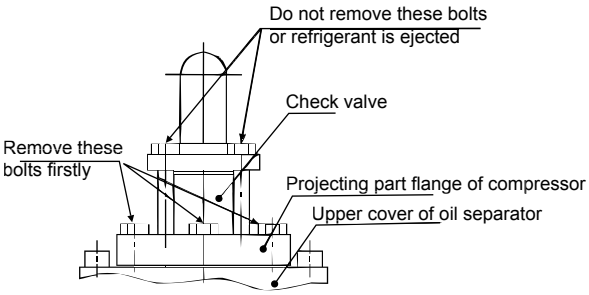
R407C shall be charged by LIQUID

## 6.9. Overhaul work

Perform the work according to “Dissolution and Composition Manual of Hitachi Half Sealed Screw Compressor”.

When compressor is removed from refrigeration cycle, high pressure part should be separated between projecting part flange of compressor and upper cover of oil separator. Do not be separated between check valve and projecting part flange of compressor, or collected refrigerant is ejected.




## 6.10. Vacuuming Procedure

Although refrigerant is collected to airside heat exchanger by the above collection operation, it is necessary to be vacuumed due to that refrigerant cycle of low pressure side pipe and of water side heat exchanger are open.

Vacuum should be performed in the following 2 positions.

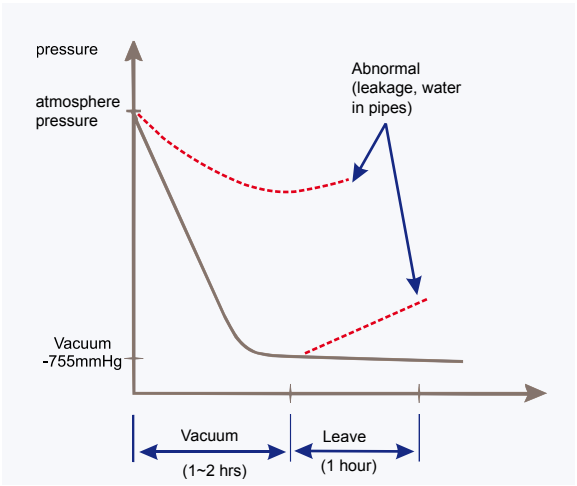
- Stop valve for refrigerant insertion ((D) part)
- Check joint of compressor suction side ((E) part)

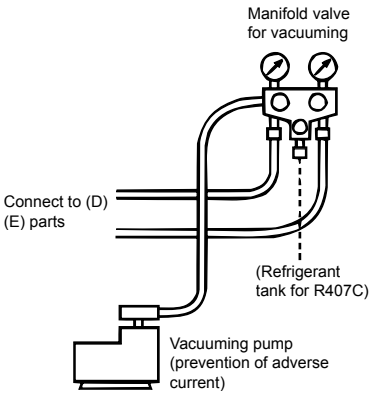
  *Capillary for compound gauge in low pressure side is installed in check joint. This capillary should be removed from check joint.

Vacuuming procedure is shown in the following.

### 6.10.1. Vacuuming

- Manifold valve, vacuuming pump and vacuuming gauge for R407C are connected.
- Operate vacuuming pump for at least 1~2 hours until vacuum grade be below –755mmHg (5Torr).




**CAUTION**

If vacuum grade is not decreased to –755mmHg in 1 hour, confirm if there is no leakage or if water is not in the pipes, and then keep vacuuming other 1 hour.

- Confirmation of vacuum
  Vacuum gauge should be used to measure a target vacuum, however, it is impossible to read the vacuum gauge installed in the manifold very accurately. It is recommended to use a digital vacuum measure device, available in the market.

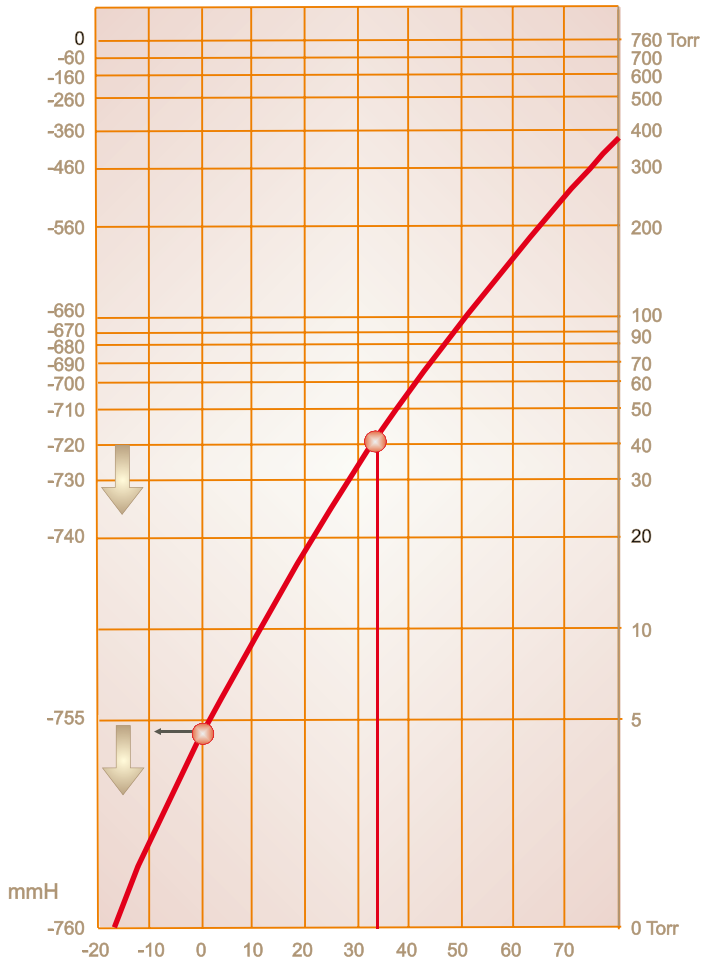
- Water evaporation>

  In atmosphere pressure, water boils at 100°C, however, each time a pressure in pipes reaches to a vacuum state, water boils at lower temperature than 100°C.

  The lower this temperature is, the more water evaporates and vacuum drying is kept.

**CAUTION**

If there is a possibility of dew condensation, vacuum (vacuuming time) should be controlled more strictly since water does not evaporate easily and it is difficult to know the degree of dew condensation. It is desirable to control the vacuum grade as a –755~758 mmHg (5~2 Torr).




### 6.10.2. Leave

After finishing vacuuming, manifold valve is closed and vacuum pump is stopped, and then leave it for 1 hour to confirm if a pressure measured by vacuum gauge is not increased.

**CAUTION**

1. This process should be performed since air can be leaked due to the negative pressure although air leakage is not confirmed in air tight test.
2. In case of increasing pressure, it is possible that there is a slight leakage in some positions. Perform air tight test again, and perform vacuum drying again after repaired.

## 6.11. Additional refrigerant insertion

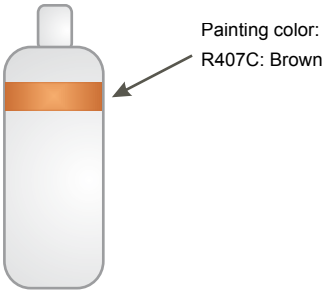
According to the refrigerant characteristics, the followings should be taken into account.

CAUTION

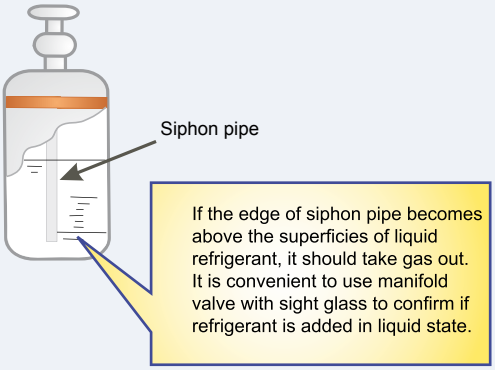
- Refrigerant should be added in liquid state not in gas state.
- Confirm if the tanks are specialised for R407C.
- The tank should be set so that refrigerant can be added in gas state.
- The valves or hose for charge should be specialised for R407C.

### 6.11.1. Confirmation of tank

1. Paining color is different from types of refrigerant. And a mark stamped in inspection also serves for the confirmation of refrigerant .




2. The refrigerant tank has two specifications as shown in the below. In any case, liquid refrigerant should be added.

| The same structure as conventional tank. <no siphon pipe> | Tank specialized for R407C <with siphon pipe···Label attached> |
|---|---|
|  |   |
| Do not add refrigerant while being stand | It is possible to add refrigerant while being stand |

### 6.11.2. Measurement device used for refrigerant insertion

Measurement device for R407C is not compatible with that for R22 due to the following reasons, therefore, do not divert them. These devices should be controlled separately to avoid being mixed.

| Measurement device | Reasons | Remarks |
|---|---|---|
| Manifold valve | – Pressure-proof criteria is different<br>– Material spec. of packing is different (question of deterioration)<br>– If R22 is mixed, sludge is occurred due to the flow of mineral oil to devices, which may cause a clogging of cycle or accident in compressor. | |
| Hose for charge | | Pay special attention not to use a hose for charge for R22. |
| Charging cylinder | | It is possible to change the composition when putting from refrigerant tank to charging cylinder.<br>Under studying the handling. |
| Detector of gas leakage | – Detection method is different<br>– Sensor of conventional detector of gas leakage is very low, and practically it is impossible to use. | |

6

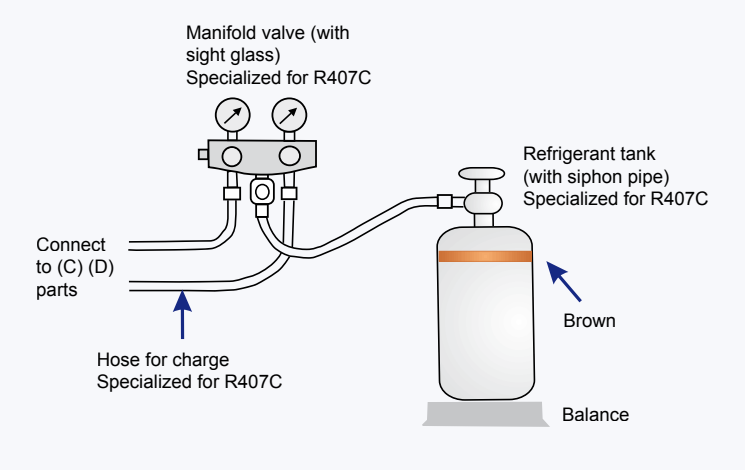
*NOTE:*

The specification of connection screw is different from measurement device for R410A.

- R407C, R404A UNF7/16
- R410A UNF1/2

### 6.11.3. Procedure for refrigerant insertion

R407C should be added in liquid state.

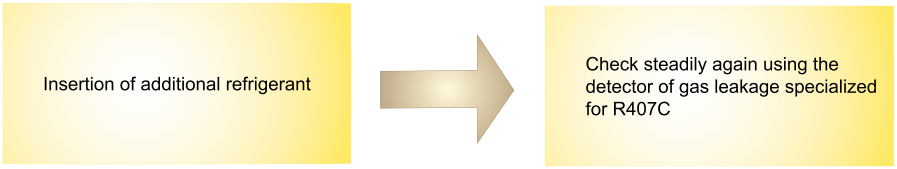


1. After vacuuming, additional refrigerant should be inserted in liquid state with stop valve of liquid side and gas side close. (Confirm the volume by the balance)
   In principal, collected refrigerant from water side heat exchanger to outside of refrigeration cycle by collection device is measured to determine the volume. If it is impossible to measure it, use the following figure to determine the volume, confirming the balance pressure after collection operation.
2. If it is impossible to add regulated volume due to the lower ambient temperature, compressor is operated in cooling mode and liquid refrigerant should be added from stop valve for refrigerant insertion (C). Then, regulated volume is added with the liquid side stop valve (high pressure side) open a little bit.

**CAUTION**

Do NOT add refrigerant in gas state from suction side of compressor (gas side stop valve).

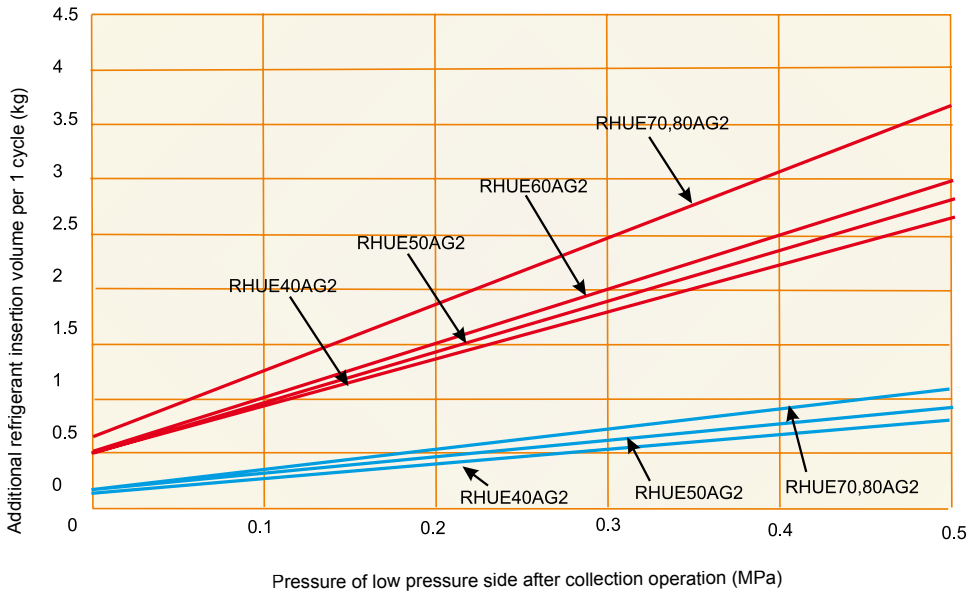
### 6.11.4. Check of leakage position




Alarm:
Check for refrigerant leakage should be performed steadily. The refrigerant used in this unit is incombustible, non-toxic and odourless safe one. However, toxic gas is produced when leaked refrigerant is exposed to fire. And oxygen will be lacked due to that refrigerant, its gravity is higher than air, is spread in the floor.

**CAUTION**

Refrigerant should be added in a suitable volume since excess or less insertion cause alarm or accident of compressor.



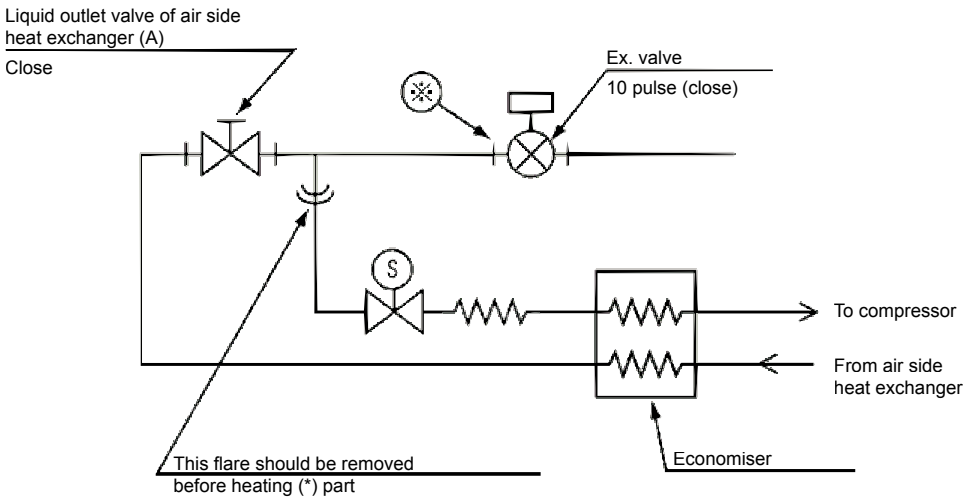
### 6.11.5. Caution at Replacement of Expansion Valve

The replacement of expansion valve can be performed by collecting the refrigerant to air side heat exchanger in the method shown in the “1 Collection of Refrigerant”. And pay attention to the following points.

Electrical expansion valve is used in this product, and its opening is almost closed (10 pulse) at compressor stop. Therefore, when removing the welding of expansion valve, it is important not to remain the refrigerant between liquid outlet valve of air side heat exchange (A) and expansion valve.

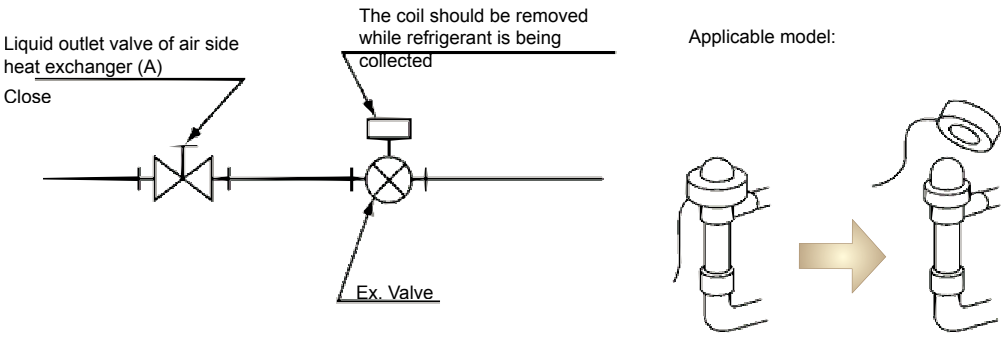
1. In case of the model with economiser

☛ With economizer:




2. In case of the model without economiser

☛ Without economizer:




**CAUTION**

There will be a clearance between control value and actual value of expansion valve opening, therefore, zero point adjustment (re-input of power source) should be realized.

This operation makes expansion valve open in spite of compressor stop by low pressure setting.

Operate chiller unit → Compressor is started up and when starting unload is finished → Remove the coil of ex. valve → Close outlet valve of air side heat exchanger

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