

DAIKIN



DAIKIN

Marine type

Container Refrigeration Unit

Service Manual

Maintenance and Repair

Model

LXE10D
LXE10D-A

DAIKIN INDUSTRIES, LTD.

TR97-09A

This manual describes the functions, maintenance and repair of the container refrigeration unit.

Please refer also to these manuals.

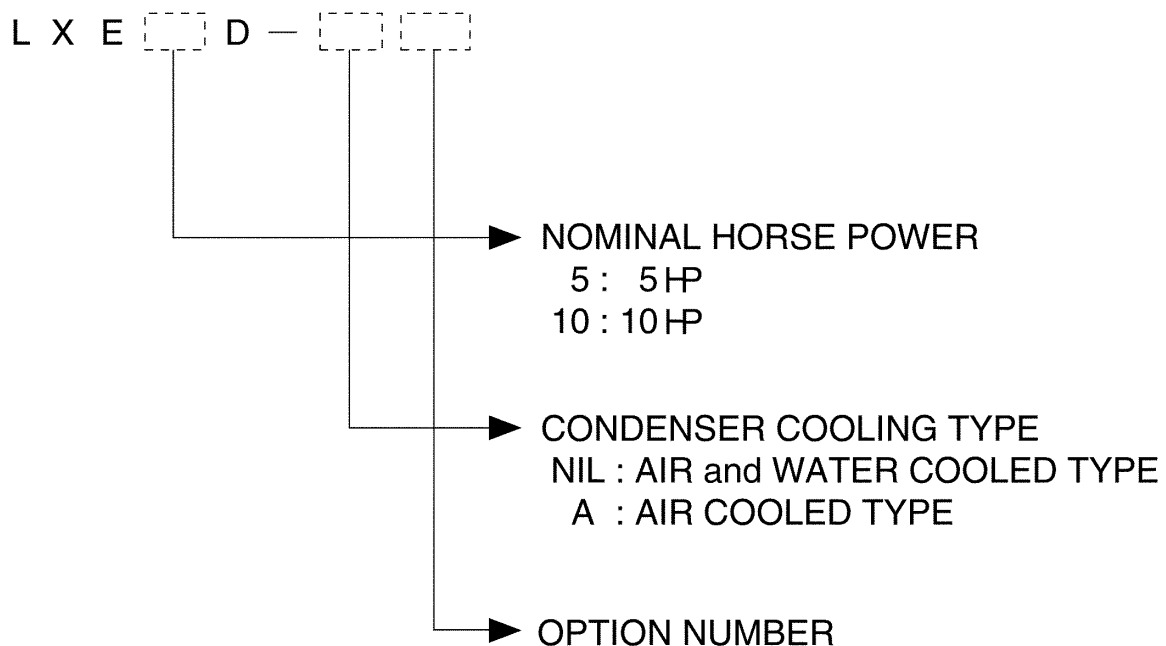
Service Manual (Operation)

Parts List

Operation Manual of Personal Computer Software

Compressor Dismantling and Assembly Manual

Denomination of Model Name

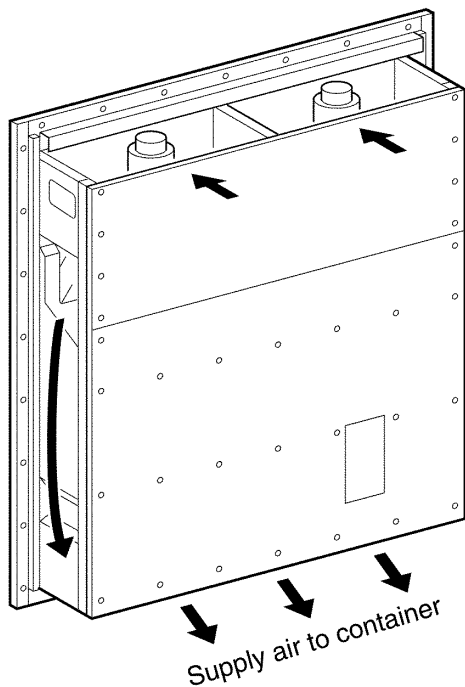
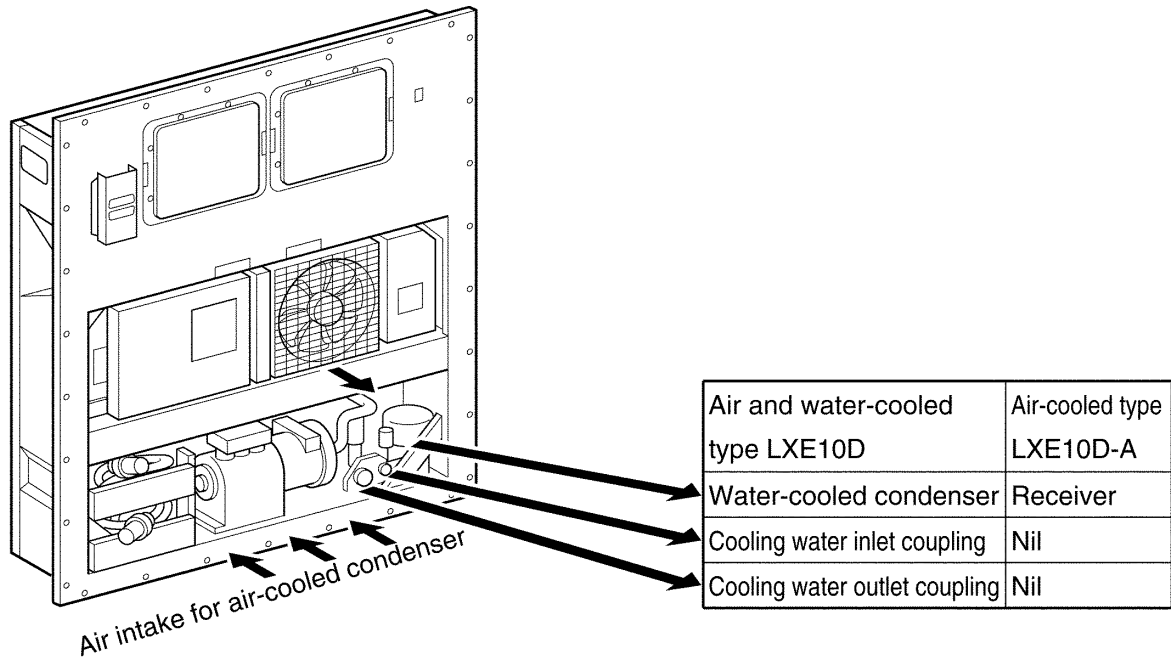


Note) "R" GIVEN AFTER OPTION NUMBER STANDS FOR "REVISION"
AND IT IS GIVEN FOR THE UNIT WHICH IS SPECIALLY
MODIFIED.

Relevant models

This service manual applies to the following models.

| Model | LXE10D | LXE10D-A |
|------------------------|---------------------------|-----------------|
| Condenser cooling type | Air and water cooled type | Air cooled type |



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SAFETY PRECAUTIONS

Always observe the following points before operating or inspecting a unit.

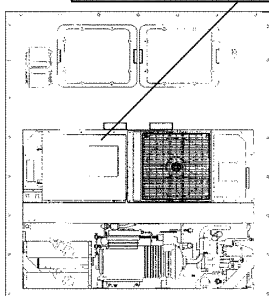
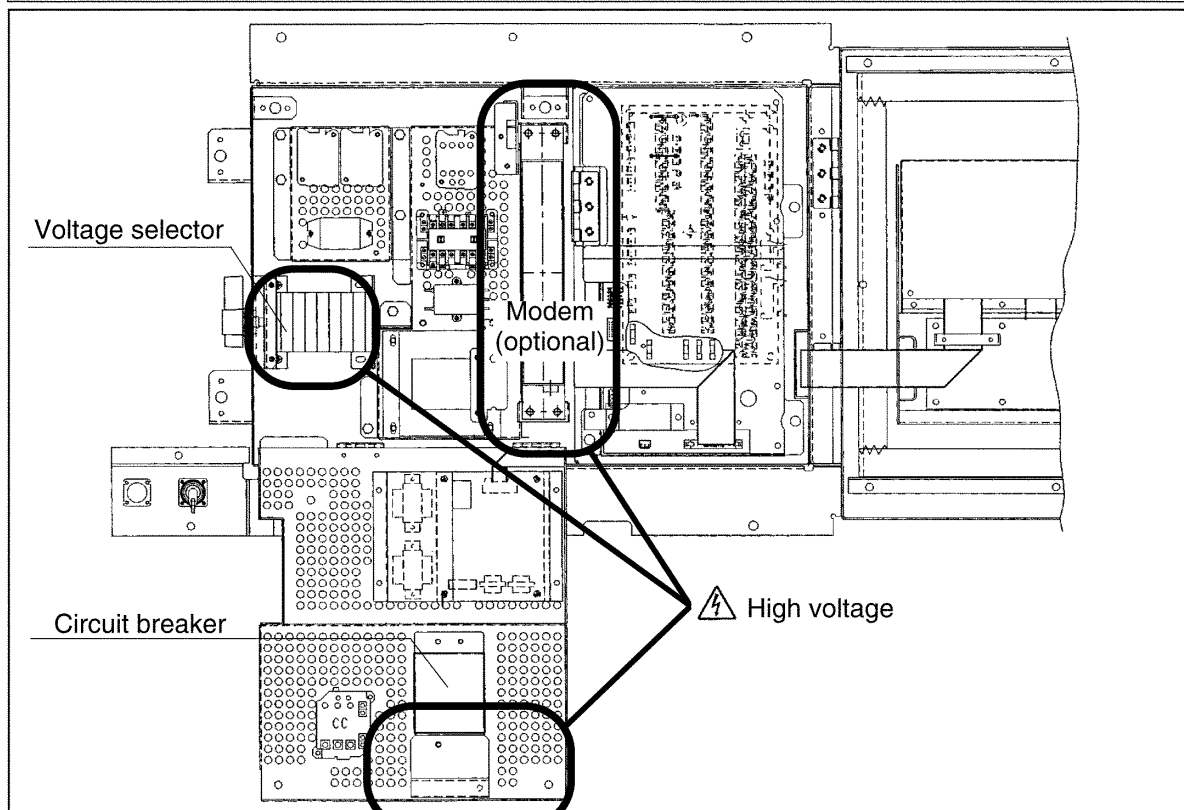
DANGER

Always turn off the main power supply of the facility before disconnecting the power plug.



Always turn off the main power supply of the facility before inspecting the inside of the control box.

* Because the high voltage remains at the voltage selector, the circuit breaker and the optionally provided modem even though the circuit breaker in the control box is turned off.



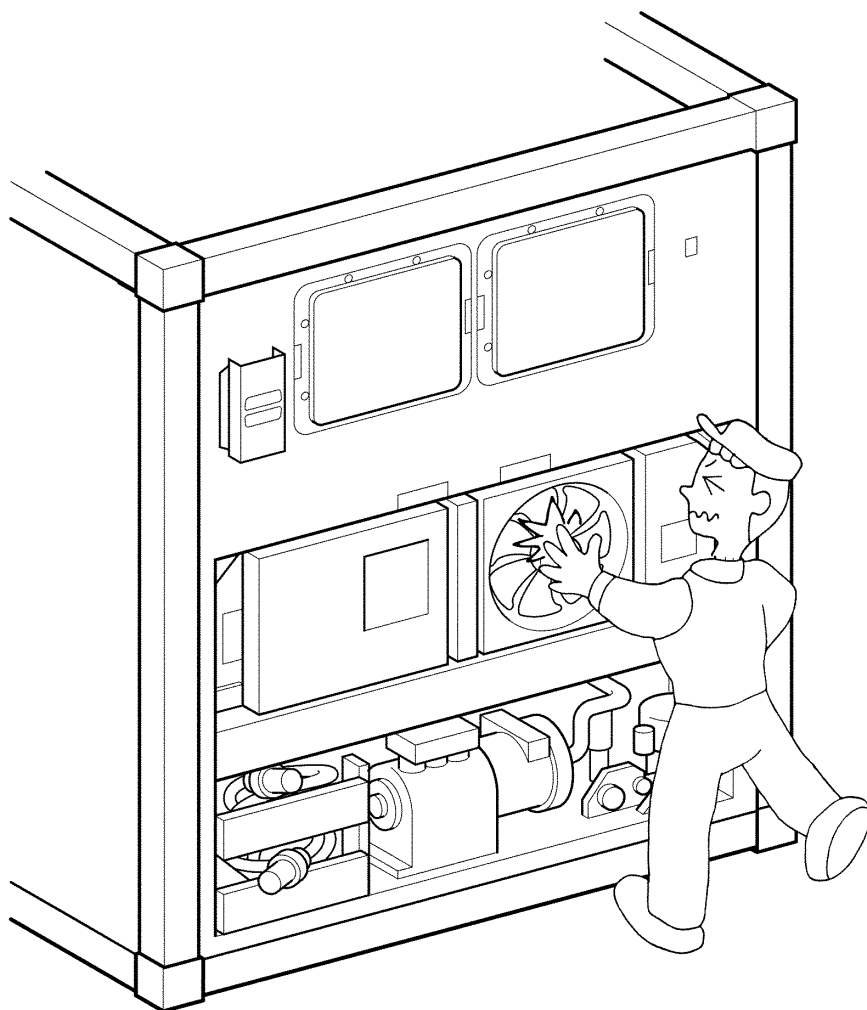
 **WARNING**

Do not touch the condenser fan during electricity being applied.

Before removing the condenser fan cover, turn off the circuit breaker and disconnect the power plug.



- At air-cooled operation : Condenser fan may start and stop automatically for the refrigerant high pressure control.
- At water-cooled operation : Condenser fan may start and stop automatically for cooling of the control box.

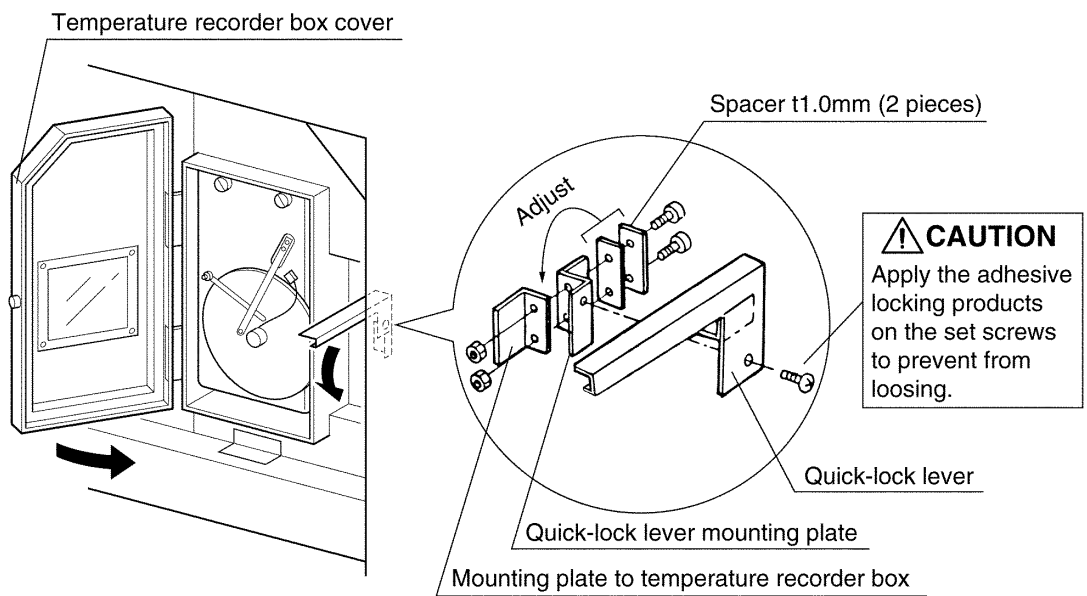


CAUTION

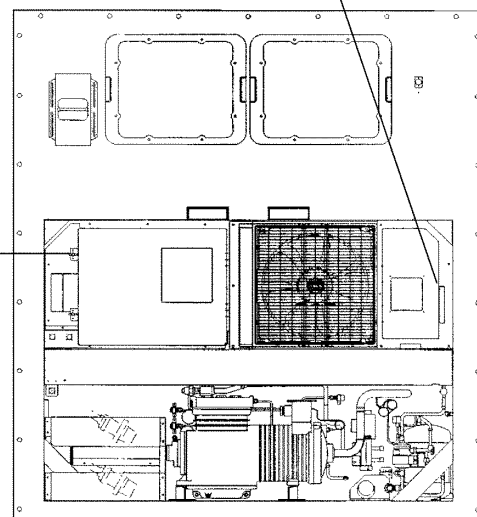
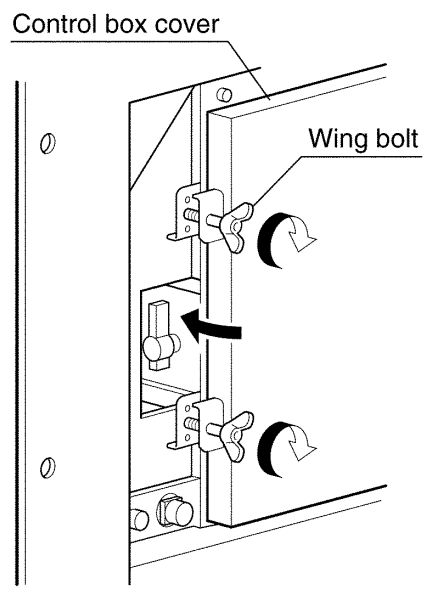
Before starting the unit, connect the power plug and run the generator.

Securely close the control box cover and the temperature recorder box cover (optional).

Otherwise, it will cause water ingress.

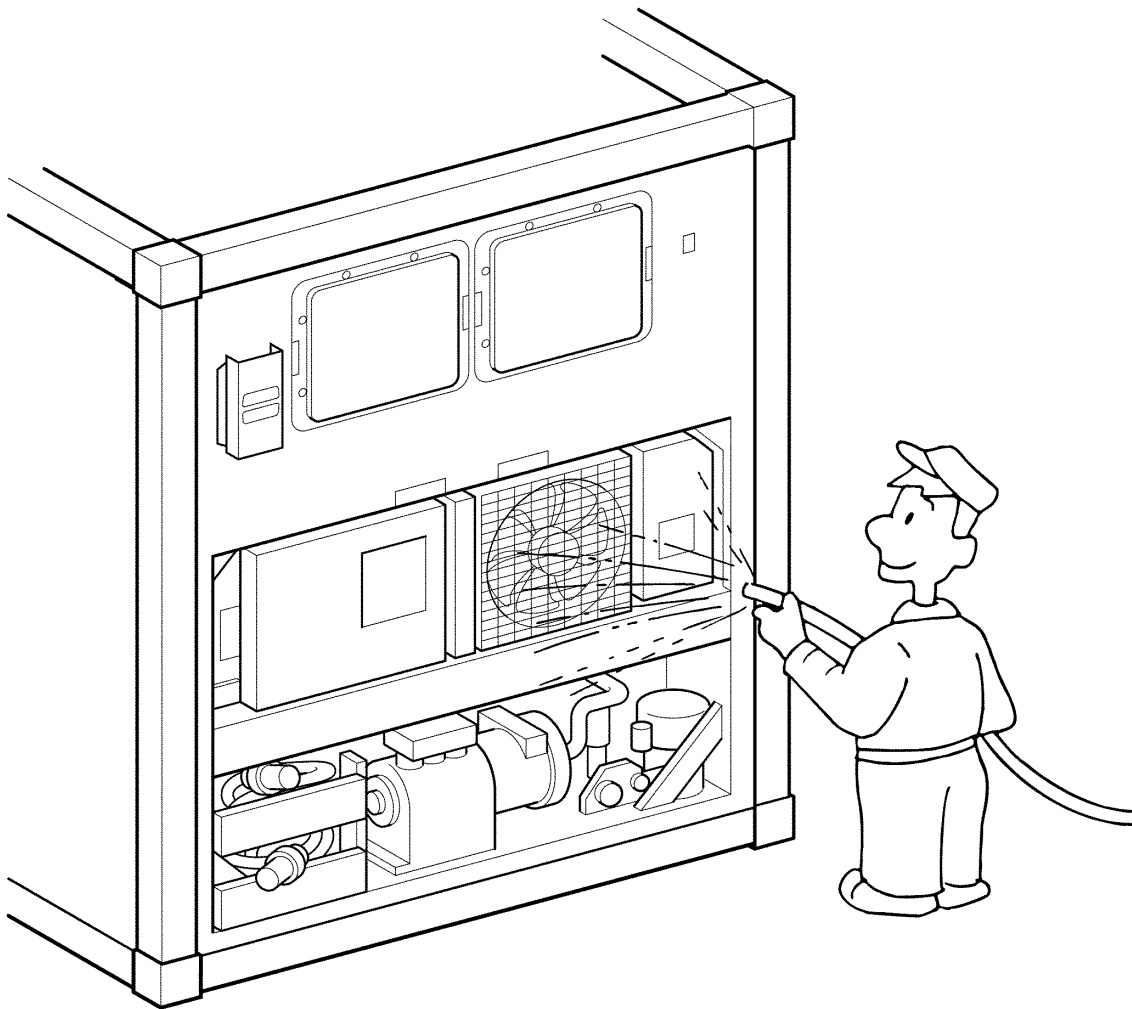


*** Quick-lock lever adjustment**
When the clearance between the cover and contact is large, adjust the quick-lock lever position.
→ Put the spacer between the quick-lock lever mounting plate and the mounting plate (temperature recorder box).



⚠ CAUTION

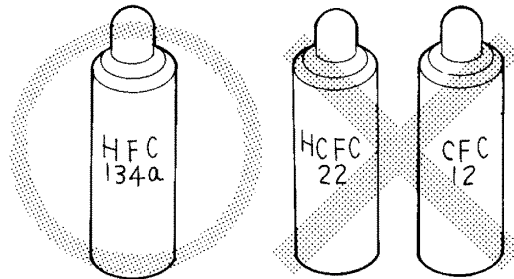
**Wash the refrigeration unit with fresh water before PTI.
Carefully flush the air-cooled condenser by fresh water since
much salt sticks to it.**



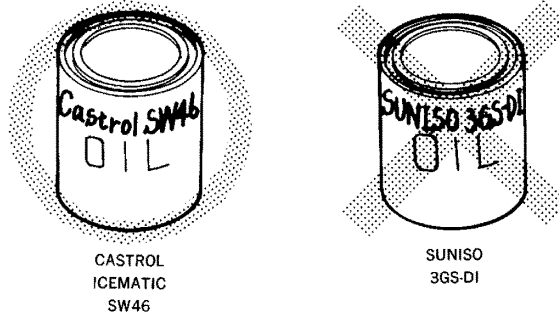
CAUTION

Refrigerant and refrigerating machine oil

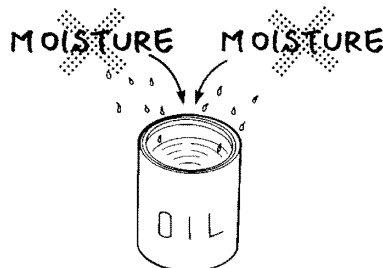
Charge only refrigerant HFC 134a to the unit.
Never attempt to use any other refrigerant (CFC12, HCFC22, etc) on the refrigeration unit.
If any other refrigerant not specified is charged, it may cause the troubles to the unit.



Use only Daikin specified oil (Castrol Icematic SW46) when replacing the refrigerating machine oil.
If any other refrigerating machine oil not specified is charged, it may cause the troubles to the unit.



Open the oil can, just before charging the oil, and use all the oil whose can is opened once.
Do not leave the opened can as it is for 5 hours or longer to avoid moisture ingress.
If any refrigerating machine oil which absorbs much moisture is used, it may cause the troubles to the unit.



Use only exclusive tools for HFC134a.(gauge manifold, charging cylinder, etc)
Do not use any tools for CFC12 or HCFC22.
Service ports with quick joints for exclusive use of HFC134a are provided in the refrigeration unit to avoid refrigerant and refrigerating machine oil of a different kind entering into the refrigeration circuit. (Refer to section 7.2)
The charging hose and service port are not interchangeable with those of previous model(s).

1. DATA OF REFRIGERATION UNIT

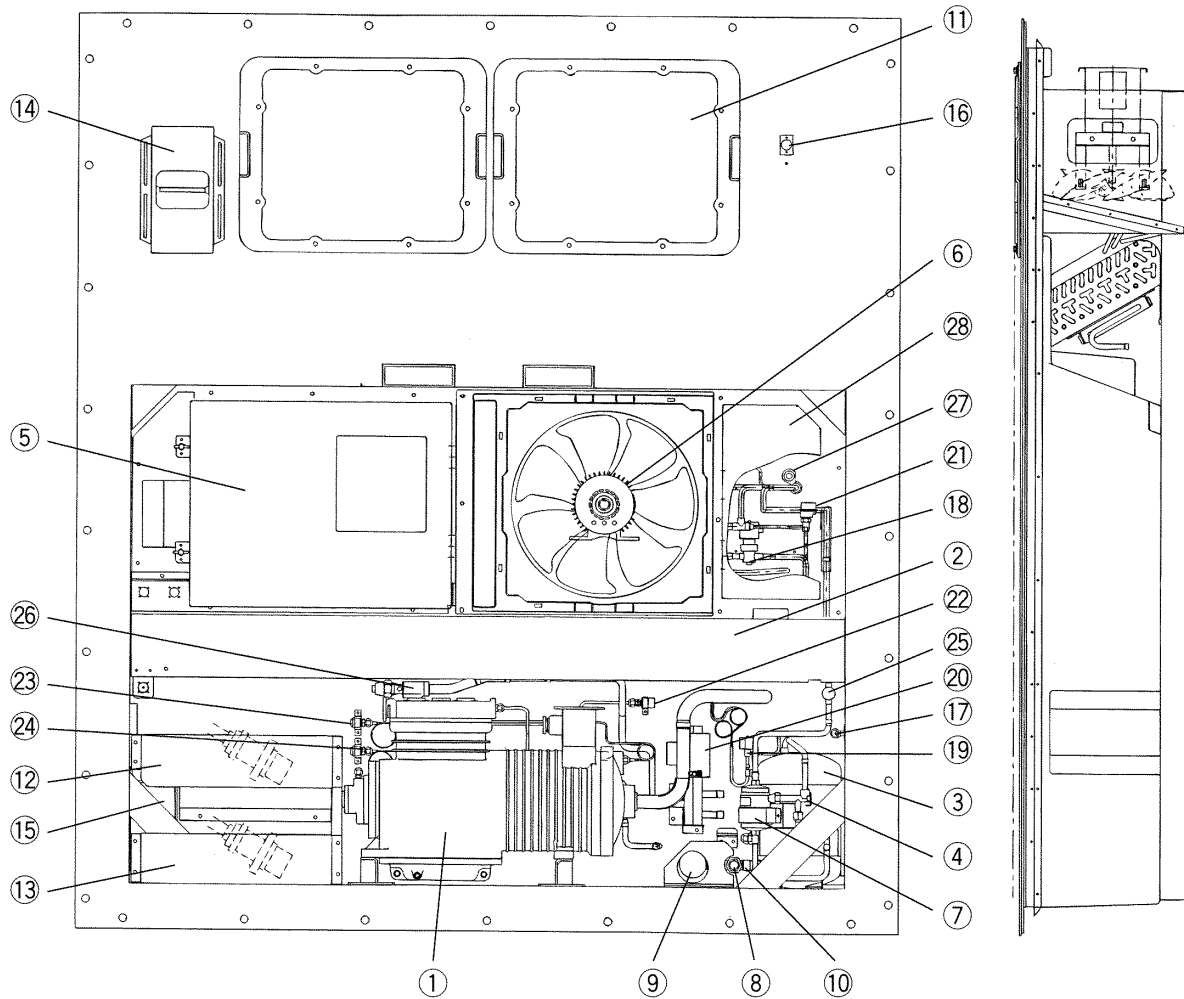
1.1 Main specifications

| Item | | Model | |
|------------------------------------|-------------|--|--|
| | | LXE10D | LXE10D-A |
| Condenser cooling system | | Air and water-cooled type | |
| Controller | | DECOS _J b | |
| Power supply | | AC 3-phase 50Hz : 380V/400V/415V 60Hz : 440V/460V (Optional) Dual voltage AC 3-phase 200V class 50Hz : 200V 60Hz : 200V/220V/230V 400V class 50Hz : 380V/400V/415V 60Hz : 440V/460V | |
| Compressor | | Semi-hermetic type (Output: 5.5kW) | |
| Evaporator | | Finned coil type | |
| Air-cooled condenser | | Finned coil type | |
| Water-cooled condenser | | Shell and coil type | Receiver |
| Fan | | Direct motor driven type propeller fan | |
| Fan motor | | Three-phase squirrel-cage induction motor | |
| Defrosting | System | Hot-gas defrosting system | |
| | Initiation | Dual timer or manual switch | |
| | Termination | Evaporator outlet pipe temperature measured by a defrosting termination detecting thermostat. | |
| Refrigerant flow control | | Electronic expansion valve | |
| Capacity control | | Hot gas bypass control with modulating control valve | |
| Protective safe devices | | Circuit breaker, PT/CT board (for over current protection). compressor thermal protector, fan-motor thermal protector, high-pressure switch, fusible safety plug, fuse (10A) × 5 | |
| Refrigerant (charged amount) | | HFC134a: 4.8 (kg)/10.6 (lbs) | HFC134a : 4.4kg/9.7 (lbs) |
| Refrigeration oil (charged amount) | | CASTROL ICEMATIC SW46: 3.6(ℓ) | |
| Refrigeration unit weight | | Approx. 650(kg)/1433(lbs) | Approx. 610(kg)/1345(lbs) (Weight is different in accordance with refrigeration units.) |

1.2 Names of components

1.2.1 Outside

●LXE10D

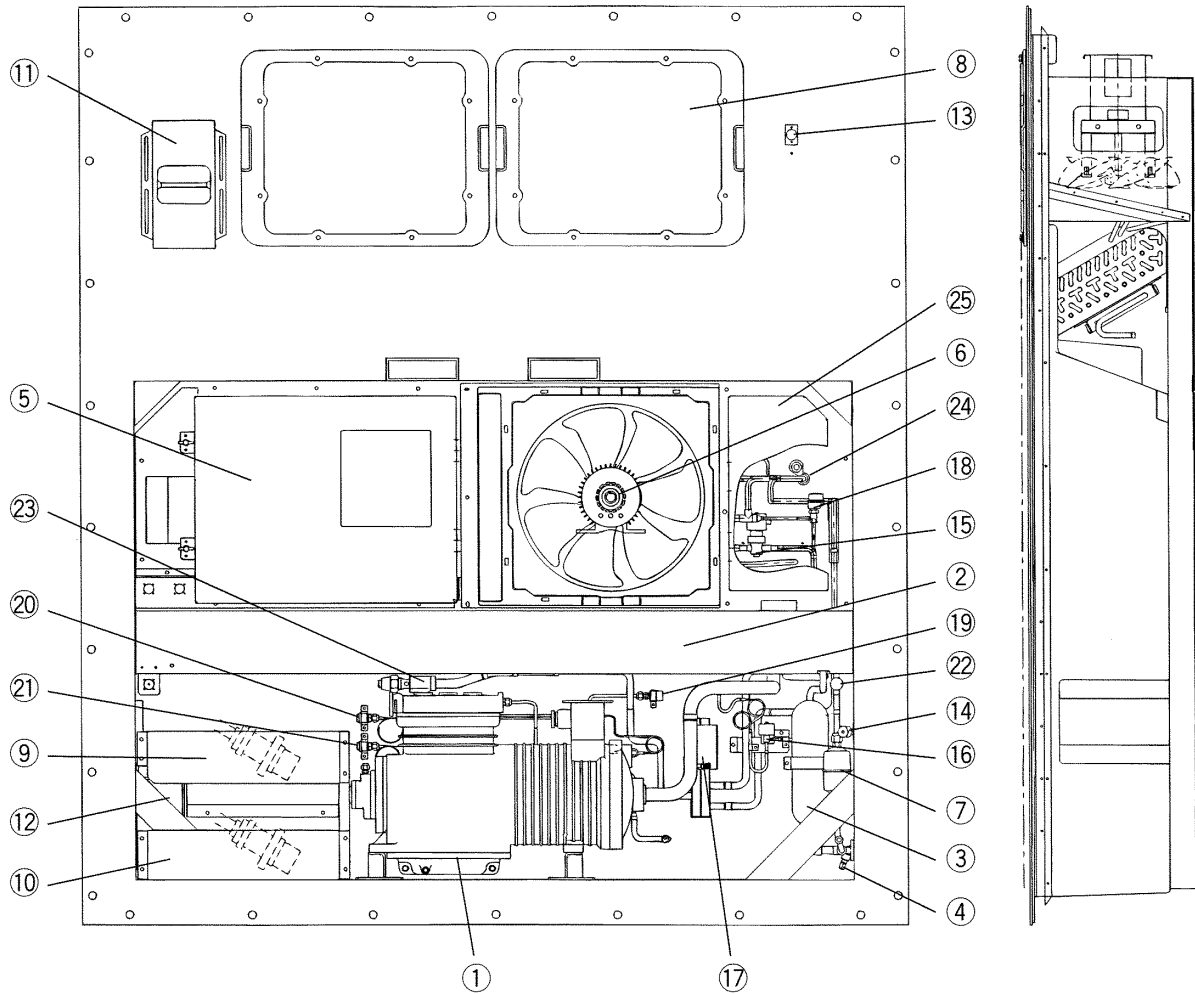


- | | |
|---|--|
| ① Compressor | ⑮ Power transformer (optional) |
| ② Air-cooled condenser | ⑯ Thermometer check port/Gas sampling port |
| ③ Water-cooled condenser | ⑰ Gas sampling port |
| ④ Outlet stop valve, water-cooled condenser | ⑱ Liquid solenoid valve (LSV) |
| ⑤ Control box | ⑲ Injection solenoid valve (ISV) |
| ⑥ Condenser fan motor | ⑳ Modulating control valve (MV) |
| ⑦ Dryer | ㉑ Electronic expansion valve (EV) |
| ⑧ Cooling water inlet coupling | ㉒ High pressure switch (HPS) |
| ⑨ Cooling water outlet coupling | ㉓ High pressure transducer (HPT) |
| ⑩ Water pressure switch | ㉔ Low pressure transducer (LPT) |
| ⑪ Access panel | ㉕ Liquid/moisture indicator |
| ⑫ Storage space for power cable (200V class) (optional) | ㉖ Discharge stop valve |
| ⑬ Storage space for power cable (400V class) | ㉗ Hot gas solenoid valve (HSV) |
| ⑭ Ventilator | ㉘ Temperature recorder box |

Note :

- The unit for single power supply is provided with a storage space for power cable (200V class ⑫ or 400V class ⑬)
- During chilled operation, the temperature checked at the gas sampling port ⑰ and the temperature displayed on the control panel may be slightly different (1.5~2.0°C) by operating conditions.

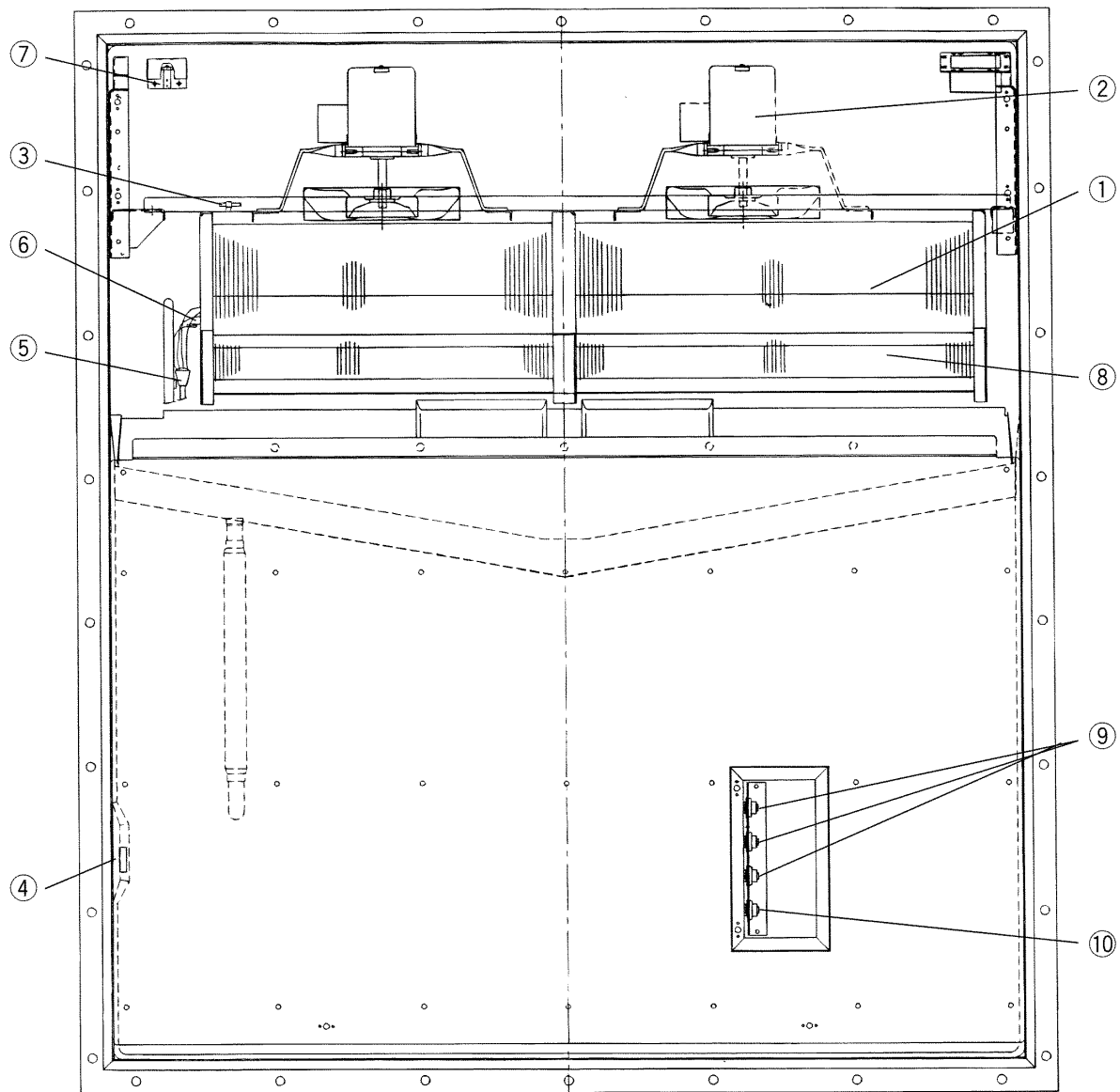
●LXE10D-A



- | | |
|---|-----------------------------------|
| ① Compressor | ⑭ Gas sampling port |
| ② Air-cooled condenser | ⑮ Liquid solenoid valve (LSV) |
| ③ Receiver | ⑯ Injection solenoid valve (ISV) |
| ④ Outlet stop valve (receiver) | ⑰ Modulating control valve (MV) |
| ⑤ Control box | ⑱ Electronic expansion valve (EV) |
| ⑥ Condenser fan motor | ⑲ High pressure switch (HPS) |
| ⑦ Dryer | ⑳ High pressure transducer (HPT) |
| ⑧ Access panel | ㉑ Low pressure transducer (LPT) |
| ⑨ Storage space for power cable (200V class) (optional) | ㉒ Liquid/moisture indicator |
| ⑩ Storage space for power cable (400V class) | ㉓ Discharge stop valve |
| ⑪ Ventilator | ㉔ Hot-gas solenoid valve (HSV) |
| ⑫ Power transformer | ㉕ Temperature recorder box |
| ⑬ Thermometer check port/Gas sampling port | |

1.2.2 Inside

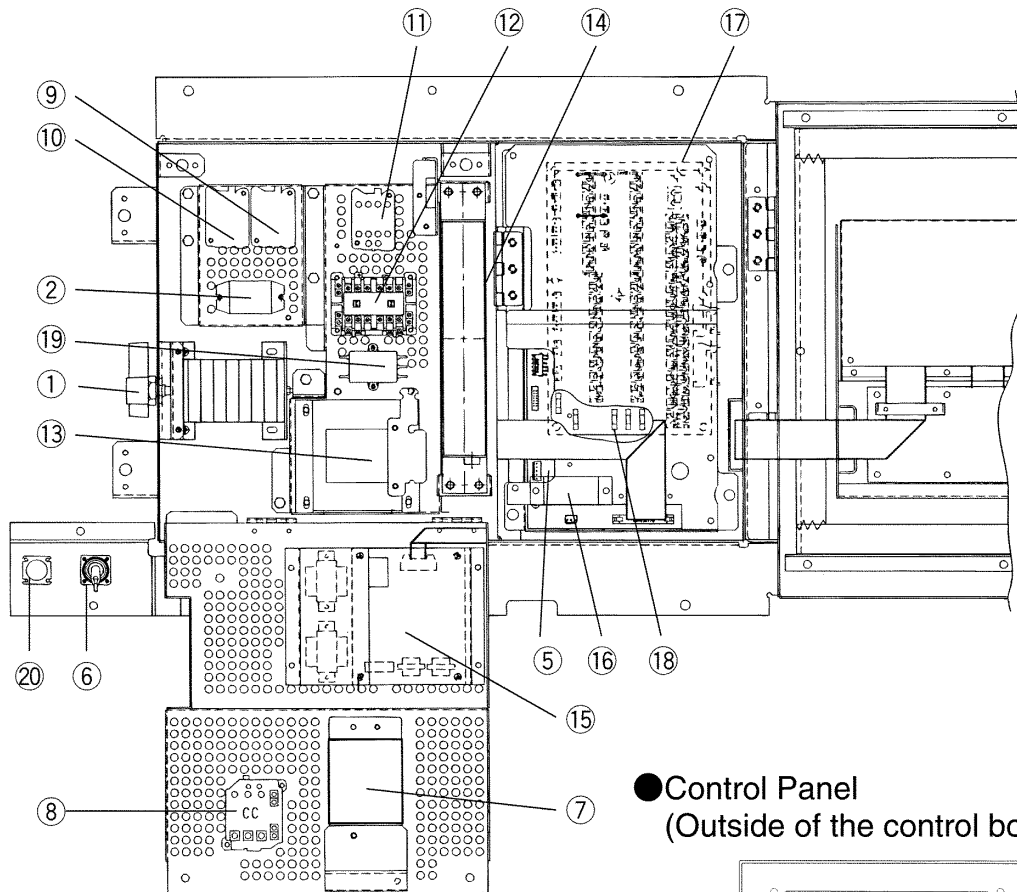
●LXE10D/ LXE10D-A



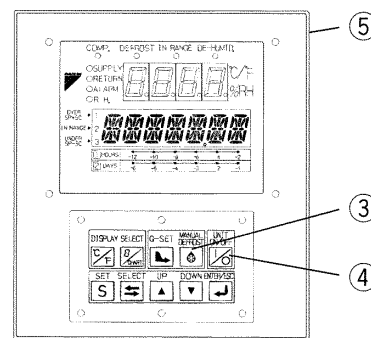
- ① Evaporator
- ② Evaporator fan motor
- ③ Unit with temperature recorder box : Return air sensor and Data recorder return air sensor (RS, DRS)
Unit without temperature recorder box : Return air sensor and Record return air sensor (RS, RRS)
- ④ Unit with temperature recorder box : Supply air sensor and Data recorder supply air sensor (SS, DSS)
Unit without temperature recorder box : Supply air sensor and Record Supply air sensor (SS, RSS)
- ⑤ Evaporator outlet sensor
- ⑥ Evaporator inlet sensor (EIS)
- ⑦ Humidity sensor (HuS) (optional)
- ⑧ Reheater (optional)
- ⑨ USDA receptacle (UR1-3) (optional)
- ⑩ Cargo temperature receptacle (CTR) (optional)

1.2.3 Control box

● Inside of the control box



● Control Panel (Outside of the control box)

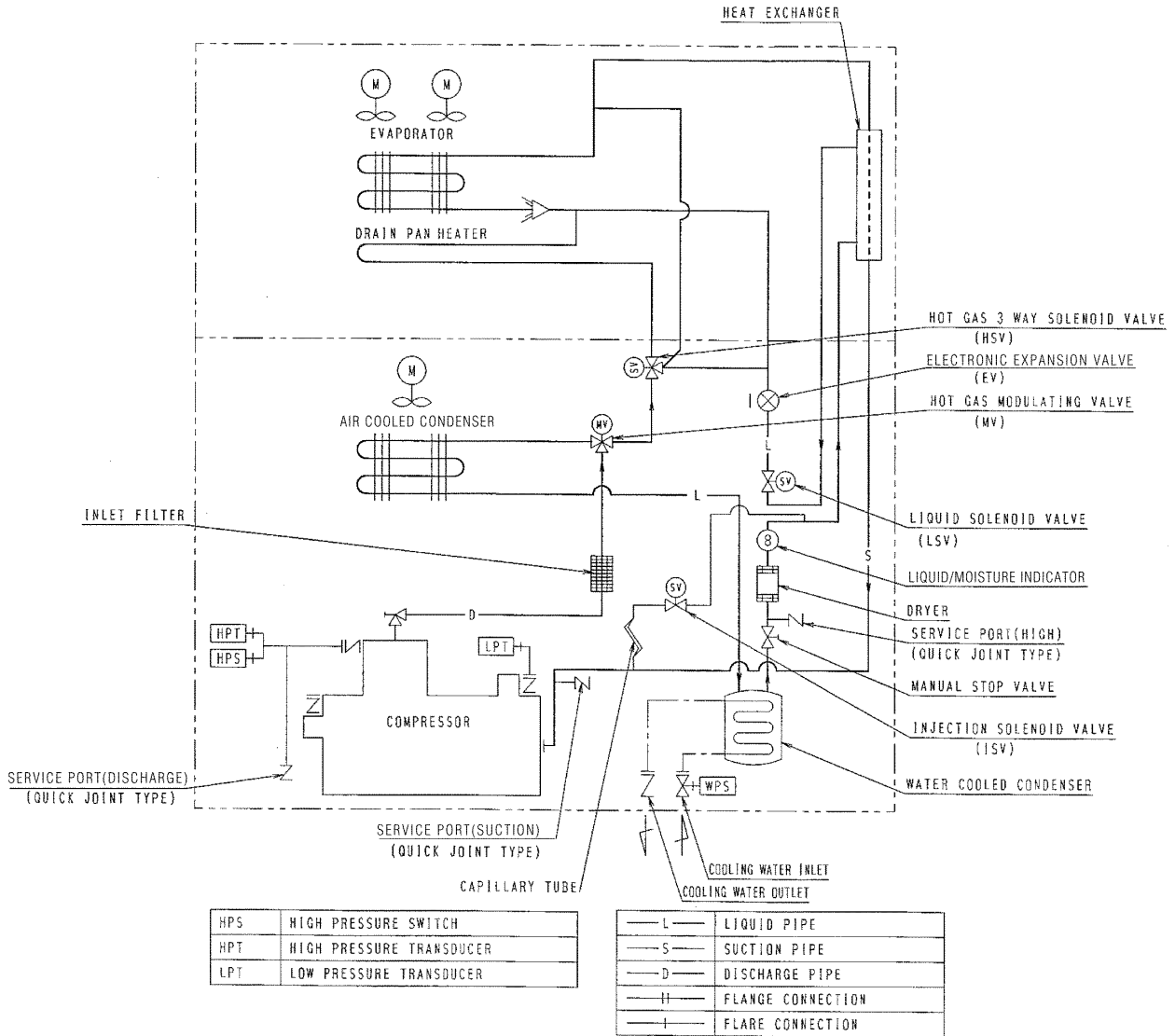


- ① Voltage selector (VS) (200/400V Dual type only)
- ② Terminal block (400V Single type only)
- ③ MANUAL DEFROST key
- ④ UNIT ON/OFF key
- ⑤ Electronic controller
- ⑥ Remote monitoring receptacle (RM)
- ⑦ Circuit breaker (CB)
- ⑧ Magnetic contactor (CC), compressor
- ⑨ Magnetic contactor for low speed (EFL), evaporator fan
- ⑩ Magnetic contactor for high speed (EFH), evaporator fan

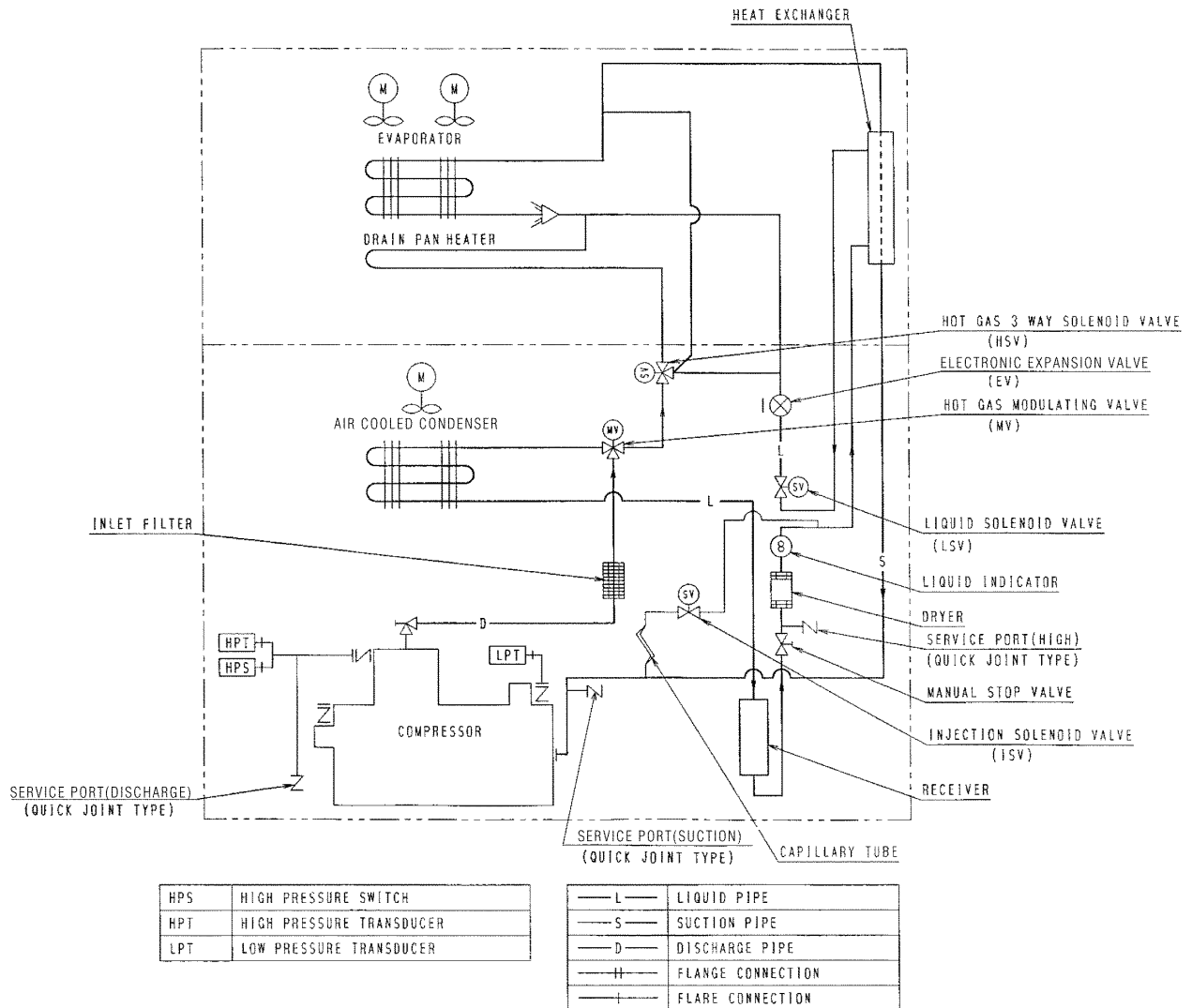
- ⑪ Magnetic contactor (CFC), condenser fan
- ⑫ Phase correction contactor (PCC1, 2)
- ⑬ Transformer (TrC), control circuit
- ⑭ Modem (RCD) (optional)
- ⑮ PT/CT board
- ⑯ Controller backup battery (BAT)
- ⑰ Terminal block board (TB1)
- ⑱ Fuse 10Ax5 (Fu)
- ⑲ Noise filter
- ⑳ Personal computer port receptacle

1.3 Piping diagram

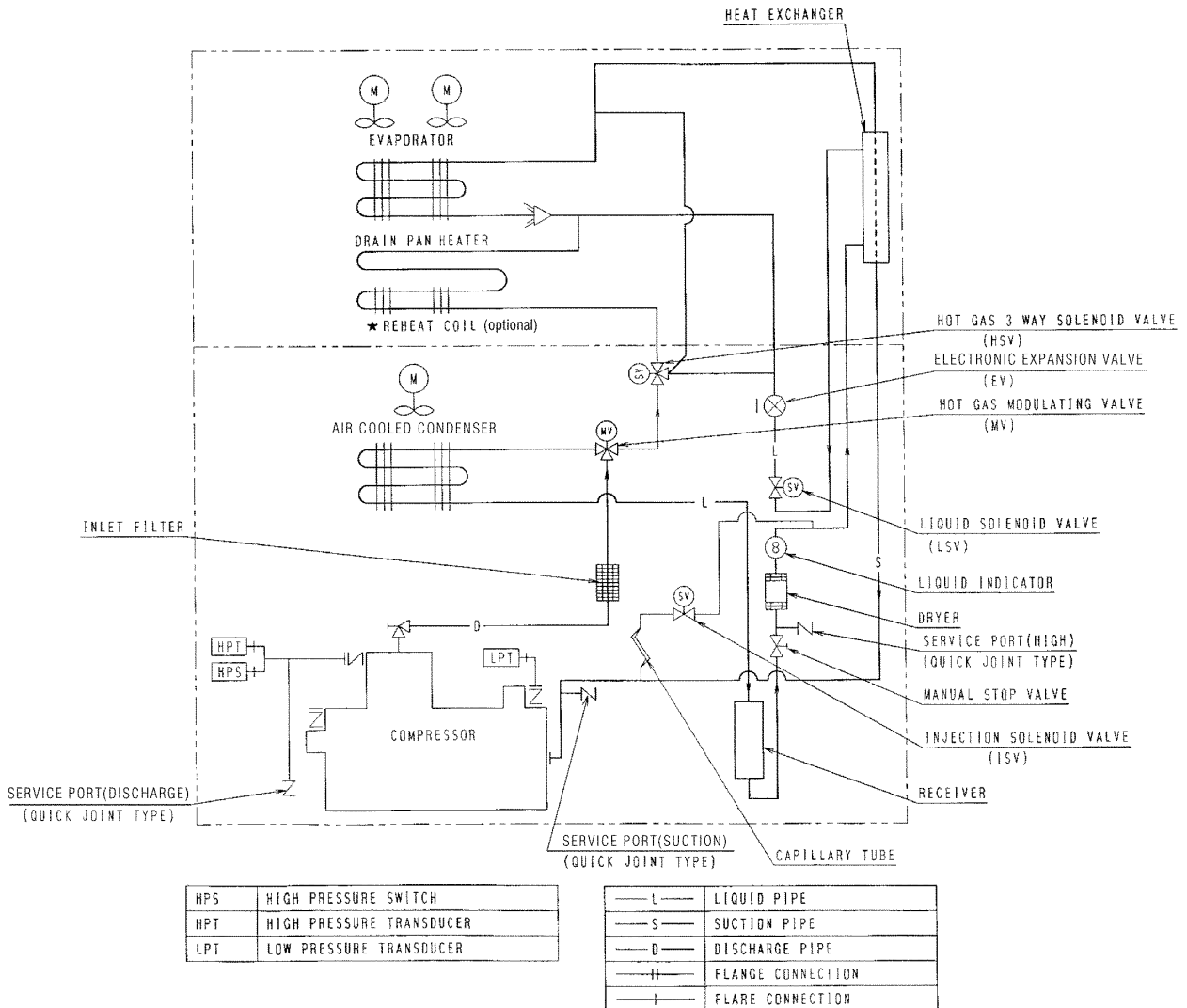
●LXE10D



●LXE10D-A



●LXE10D-A with dehumidification control (optional)



1.4 Schematic diagram

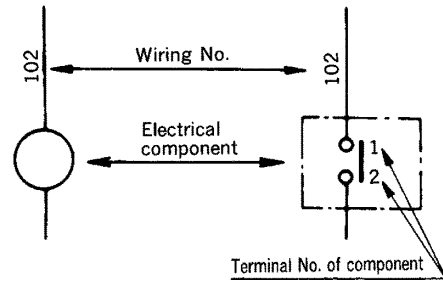
1.4.1 How to read schematic diagrams

(1) The marks and numbers in the schematic diagram have the meanings given right.

(2) Graphical Symbols for electrical chart

a. The schematic diagram indicates the unenergized or stationary state in which electricity does not flow in the circuit.

b. When a coil is energized (supplied with power), the associated contact changes its position.



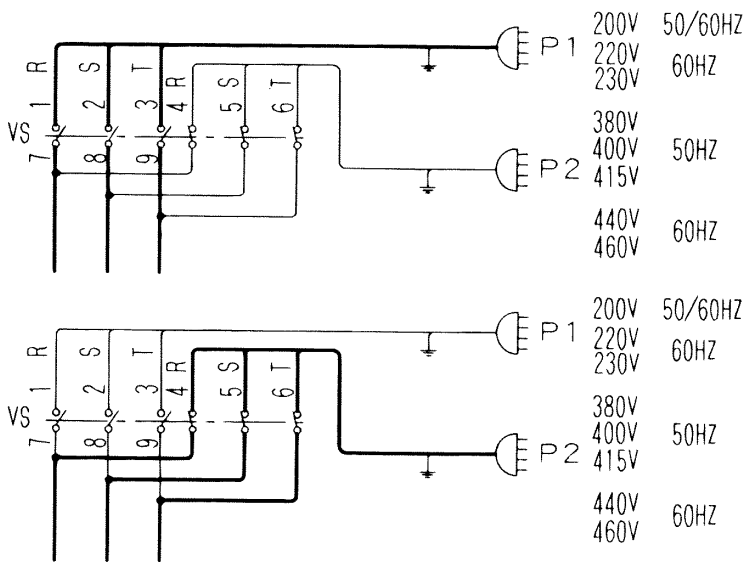
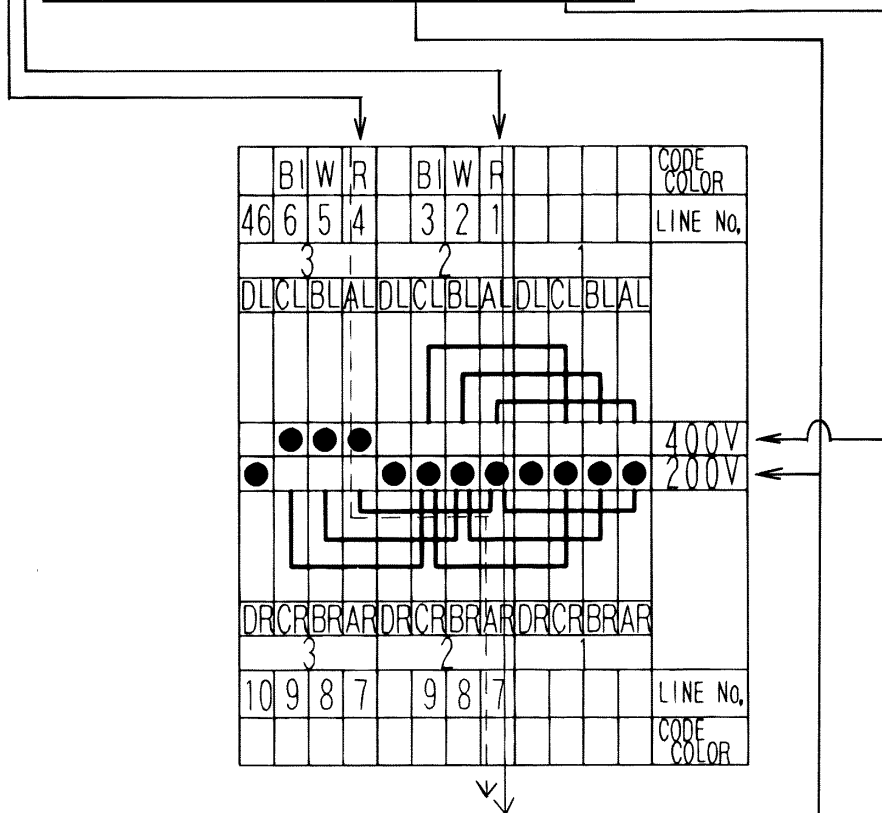
| Name of component | Brief description | DAIKIN symbol | American symbol |
|-----------------------|---------------------------------|---------------|-----------------|
| Coil | Magnetic contactor | | |
| | Solenoid valve | | |
| | Modulating valve | | |
| Contacts of contactor | N. O. : Normally open contact | | |
| | N. C. : Normally closed contact | | |
| Pressure switch | N. C. (Normal by Closed) | | |
| Thermal switch | | | |
| Voltage selector | Close on 200V class | | / |
| | Close on 400V class | | |

d. How to read the schematic diagram of the voltage selector.

In the chart "●" denotes that the contact is closed.

For example, the chart for the states between the terminal AL2 and AR2, and between AL3 and AR2 is as follows.

| | Selector lever position | |
|---------------------|-------------------------|------------|
| | 200V class | 400V class |
| Between AL2 and AR2 | Closed | Open |
| Between AL3 and AR2 | Open | Closed |

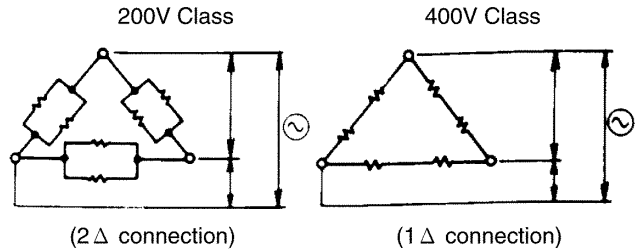


1.4.2 Voltage selection system (Change-over for 200V/400V class)

(1) Voltage selection system

Since the compressor motor is a dual voltage type and the fan motor is a transformer operated type, supply power is changed by the voltage selector lever with multi-contact cam switch which fits the wiring connections to the transformer for the control circuit and to each motor with its supply voltage. The internal wiring of the dual voltage compressor is as shown in the right.

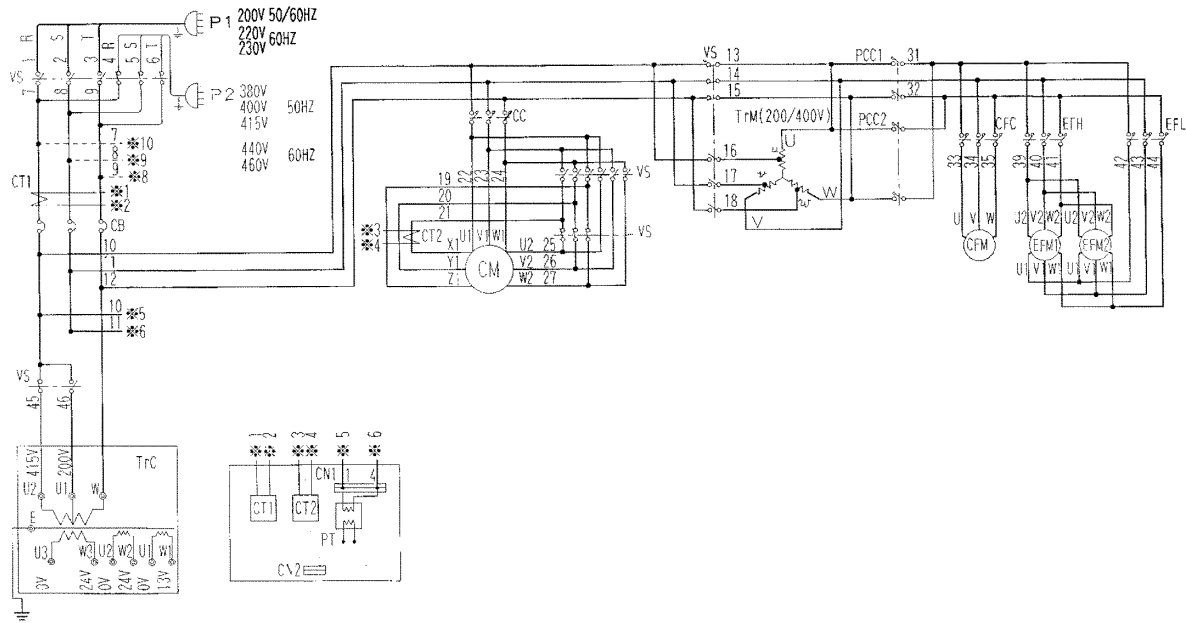
(Machine for 200V/400V dual power supply)



(2) Circuit formation

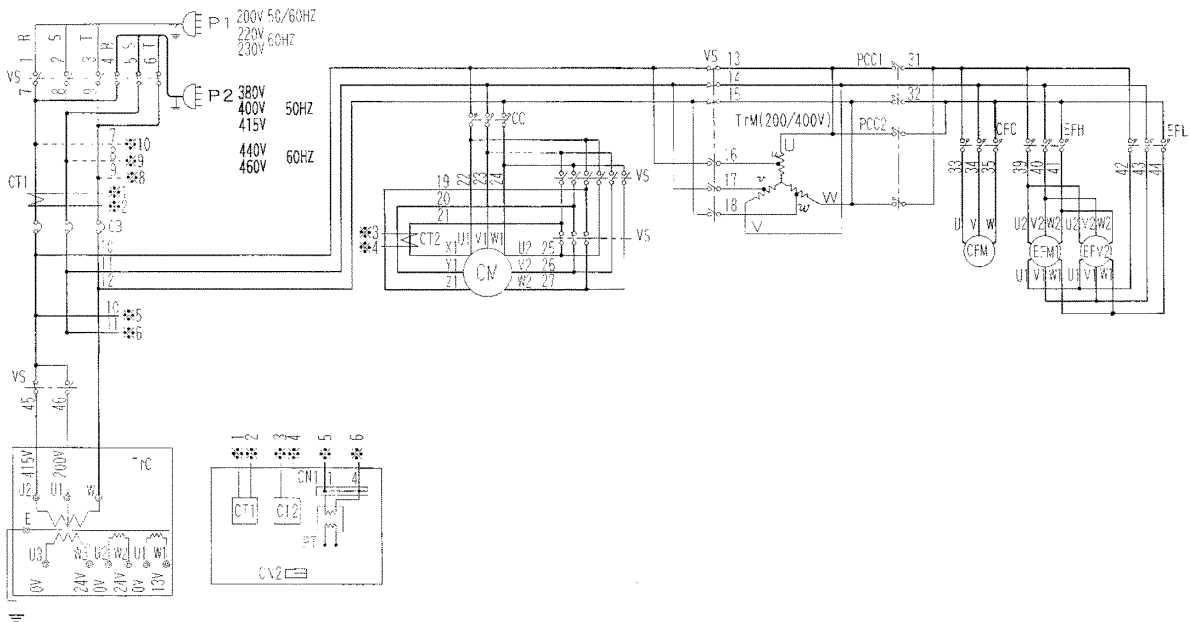
●200V class (Set the voltage selector to "200V Class".)

The contacts (except SSW) shown by become closed in the sequence circuit.



●400V class (Set the voltage selector to "400V Class".)

The contacts shown by become closed in the sequence circuit to formate the 400V class circuit.



(3) Phase selection

The reversible system is adopted to the compressor, and the positive-phase selection system is adopted to the fan motors.

Compressor

Since the oil pump is a reversible trochoid type, the specified oil pressure can be obtained regardless of the turning direction of the built-in motor.

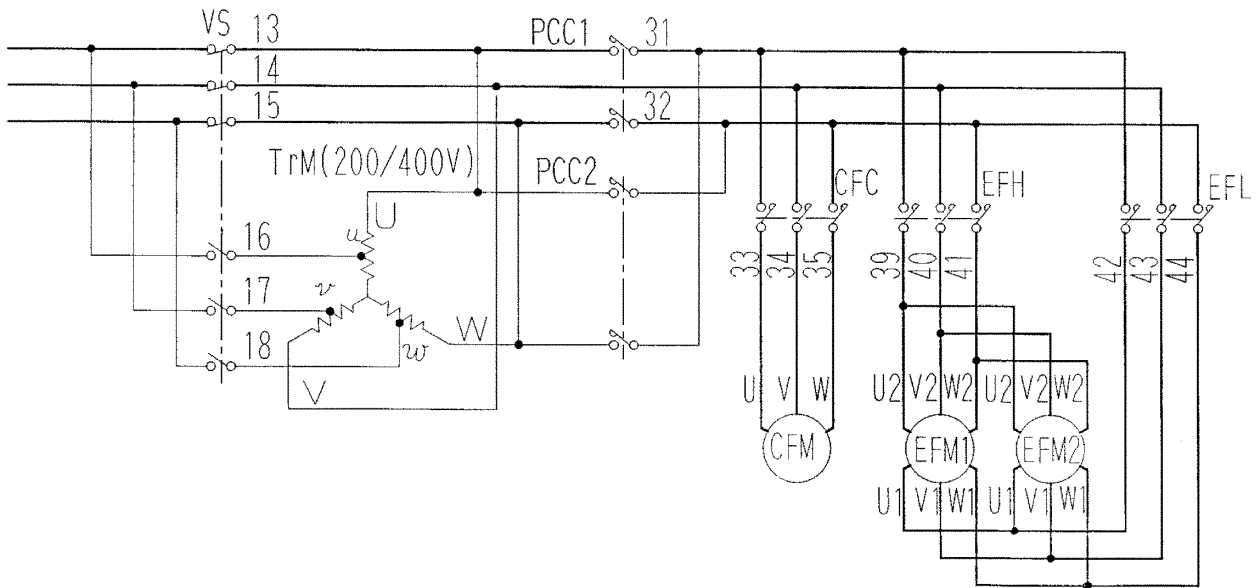
Fan motor

When the phases are reversed, R phase and T phase will be automatically interchanged by the controller according to the instruction of the phase sequence detecting function.

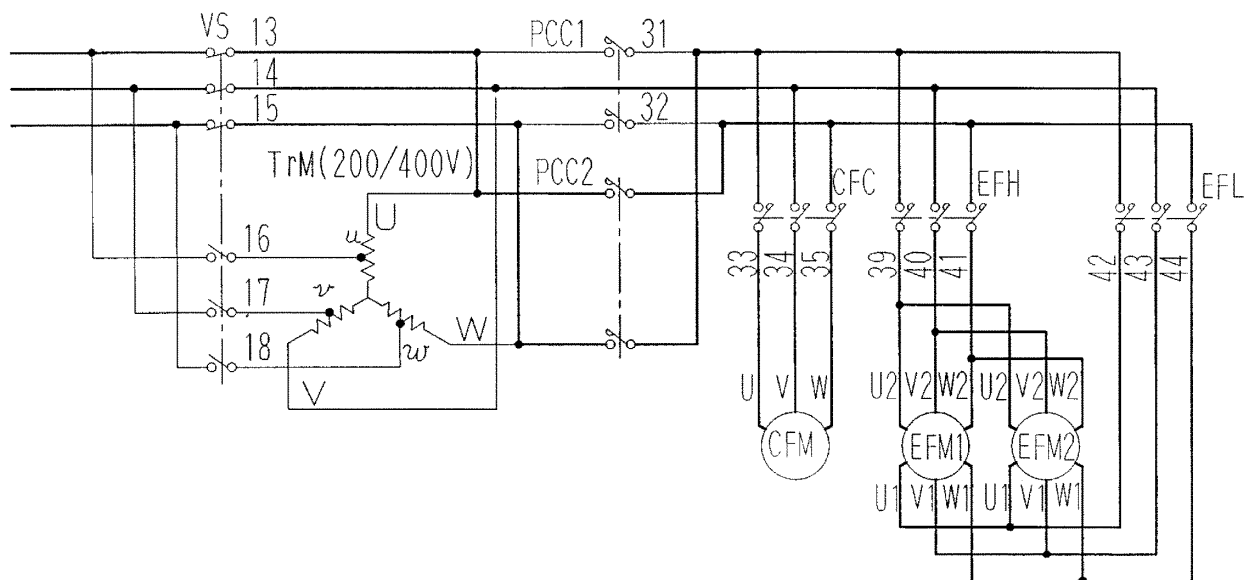
PT/CT board : Phase-sequence detecting function

PCC1, 2 : Phase correction contactor

● Positive phase



● Negative phase

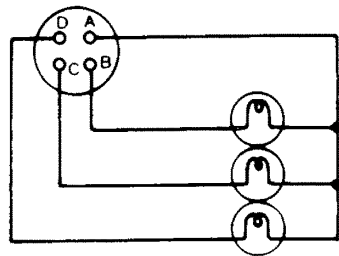


1.4.3 Pilot lamps and monitoring circuit

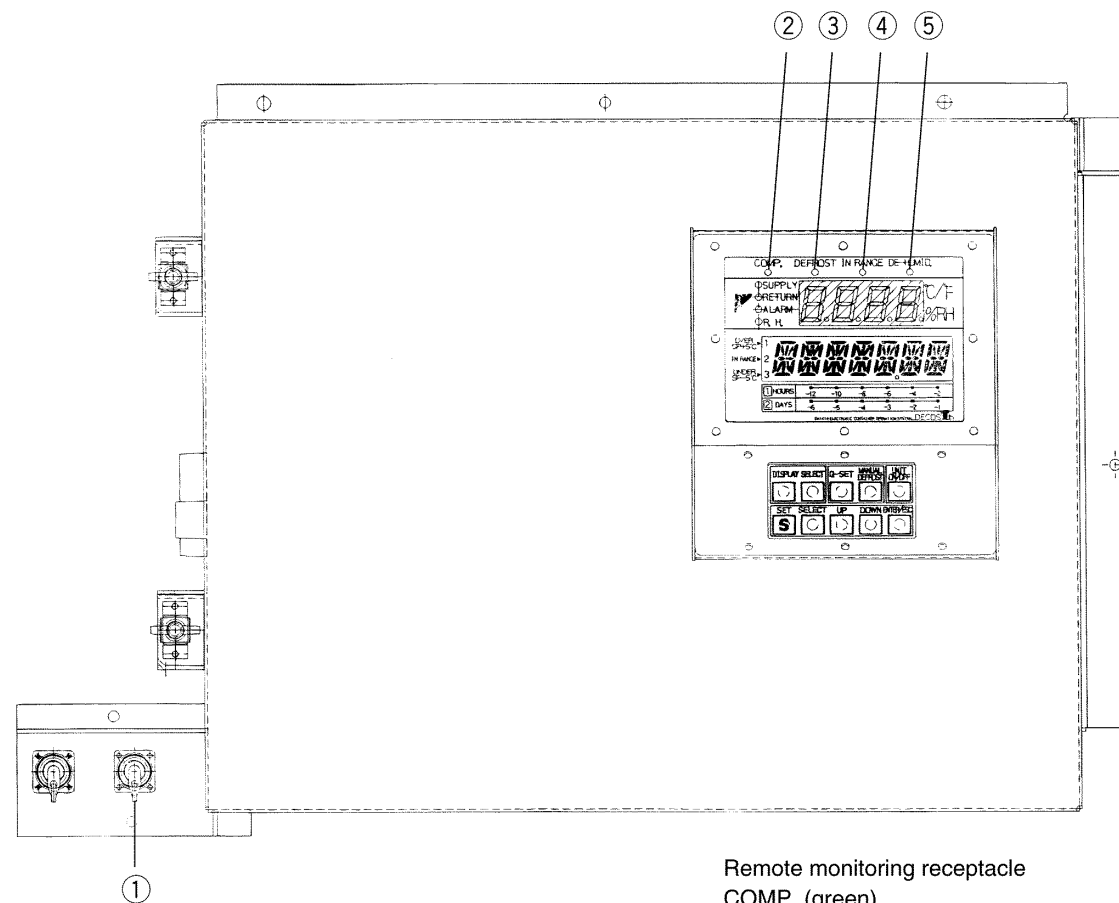
Four pilot lamps which indicate operating mode are mounted on the control panel in the control box.

| Pilot lamp to be lit on | Color | Operating condition |
|-------------------------|--------|---|
| COMP. | Green | The compressor is running. |
| DEFROST | Red | The unit is under defrosting operation. |
| IN RANGE | Orange | The inside temperature is within the range (within $\pm 2^{\circ}\text{C}$ ($\pm 3.6^{\circ}\text{F}$) of the set point temperature). |
| DE-HUMID. | Red | The controller is set to the dehumidification control operation.(optional) |

The remote monitoring receptacle for the pilot lamp is also equipped. The connections are shown below.



A : Earth
 B : Compressor (green)
 C : Defrost (red)
 D : In range (orange)

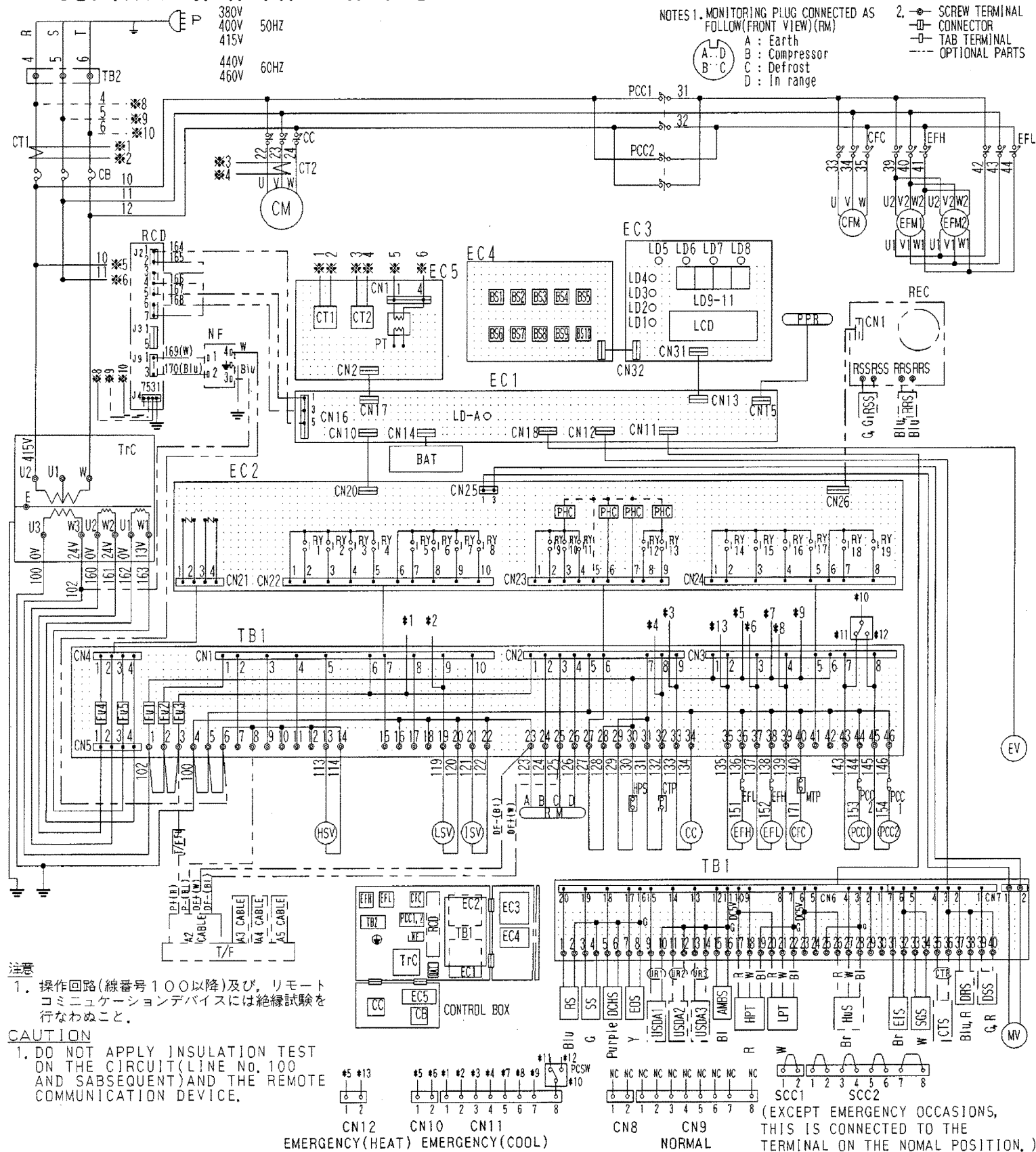


Remote monitoring receptacle
 COMP. (green)
 # DEFROST (red)
 IN RANGE (orange)
 DE-HUMID. (yellow)

1.4.4 Schematic wiring diagram

●LXE10D-A

CONTAINER REFRIGERATION UNIT WIRING DIAGRAM

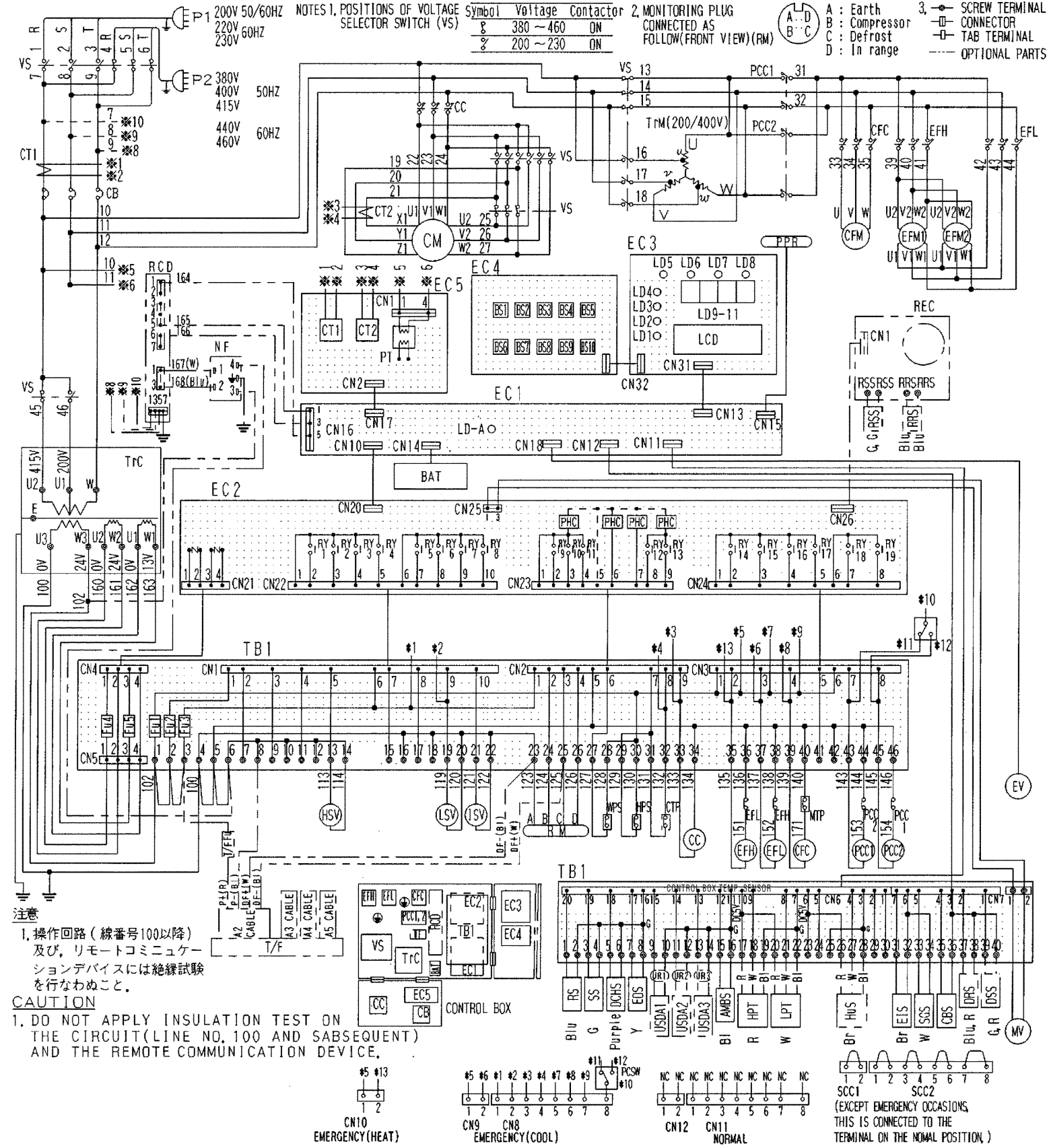


| | | | |
|---------|-------------------------------------|---------|--|
| AMBS | AMBIENT TEMP, SENSOR | LPT | LOW PRESSURE TRANSDUCER |
| BAT | BATTERY | MV | MODULATING VALVE |
| BS1-10 | PUSH BUTTON SWITCH | MTP | COND. MOTOR THERMAL PROTECTOR |
| CB | CIRCUIT BREAKER(50A) | P | POWER PLUG |
| CC | COMPRESSOR CONTACTOR | PCC1, 2 | PHASE CORRECTION CONTACTOR |
| CFC | CONDENSER FAN CONTACTOR | PCSW | PHASE CORRECTION SWITCH |
| CFM | CONDENSER FAN MOTOR | PHC | PHOTO COUPLER |
| CM | COMPRESSOR MOTOR | PT | POTENTIAL TRANSFORMER |
| CT1, 2 | CURRENT TRANSFORMER | RM | REMOTE MONITORING RECEPTACLE |
| CTP | COMPRESSOR THERMAL PROTECTOR | RS | RETURN AIR SENSOR |
| DCHS | COMPRESSOR DISCHARGE SENSOR | RY1-19 | RELAY |
| EC1 | CPU BOARD (DECOS) | SCC1 | SHORT CIRCUIT CONNECTOR |
| EC2 | I/O BOARD (DECOS) | SCC2 | SHORT CIRCUIT CONNECTOR |
| EC3 | DISPLAY BOARD (DECOS) | SGS | SUCTION GAS SENSOR |
| EC4 | SHEET KEY (DECOS) | SS | SUPPLY AIR SENSOR |
| EC5 | PRINTED CIRCUIT BOARD (PT, CT) | TB1 | TERMINAL BLOCK BOARD |
| EFH | HIGH SPEED EVAPORATOR FAN CONTACTOR | TB2 | TERMINAL BLOCK |
| EFL | LOW SPEED EVAPORATOR FAN CONTACTOR | Trc | CONTROL TRANSFORMER |
| EFM1, 2 | EVAPORATOR FAN MOTOR | | |
| EIS | EVAPORATOR INLET SENSOR | | |
| EOS | EVAPORATOR OUTLET SENSOR | | |
| | | | OPTIONAL SPECIFICATION |
| EV | ELECTRONIC EXPANSION VALVE | CTR | CARGO TEMP. RECEPTACLE |
| Fu1-5 | FUSE(250V, 10A) | CTS | CARGO TEMP. SENSOR |
| HPS | HIGH PRESSURE SWITCH | DRS | DATA RECORDER RETURN AIR SENSOR |
| HPT | HIGH PRESSURE TRANSDUCER | DSS | DATA RECORDER SUPPLY AIR SENSOR |
| HSV | HOT GAS SOLENOID VALVE | HuS | HUMIDTY SENSOR |
| PPR | PC, PORT RECEPTACLE | NF | NOISE FILTER |
| ISV | INJECTION SOLENOID VALVE | RCD | REMOTE COMMUNICATION DEVICE |
| LCD | LIQUID CRYSTAL DISPLAY | REC | RECORDER |
| LD-A | SERVICE MONITOR-GREEN | RRS | RECORDER RETURN AIR SENSOR |
| LD1 | LIGHT-EMITTING DIODE(R, H.) | RSS | RECORDER SUPPLY AIR SENSOR |
| LD2 | LIGHT-EMITTING DIODE(ALARM) | T/F A2 | Trans FRESH, A2 CABLE |
| LD3 | LIGHT-EMITTING DIODE(RETURN) | T/F Fu | Trans FRESH, FUSE ASSY IN LINE(250V, 2A) |
| LD4 | LIGHT-EMITTING DIODE(SUPPLY) | UR1-3 | USDA RECEPTACLE |
| LD5 | LIGHT-EMITTING DIODE(COMP) | USDA1-3 | USDA SENSOR |
| LD6 | LIGHT-EMITTING DIODE(DEFROST) | | |
| LD7 | LIGHT-EMITTING DIODE(IN RANGE) | | |
| LD8 | LIGHT-EMITTING DIODE(DE-HUMID) | | |
| LD9-12 | LIGHT-EMITTING DIODE | | |
| LSV | LIQUID SOLENOID VALVE | | |

LXE10D-A

●LXE10D with dual power supply (optional)

CONTAINER REFRIGERATION UNIT WIRING DIAGRAM



| | | | |
|---------|-------------------------------------|---------|--|
| AMBS | AMBIENT TEMP. SENSOR | MV | MODULATING VALVE |
| BAT | BATTERY | MTP | COND. MOTOR THERMAL PROTECTOR |
| BS1-10 | PUSH BUTTON SWITCH | PT, 2 | POWER PLUG |
| CB | CIRCUIT BREAKER(50A) | PCC1, 2 | PHASE CORRECTION CONTACTOR |
| CC | COMPRESSOR CONTACTOR | PCSW | PHASE CORRECTION SWITCH |
| CFC | CONDENSER FAN CONTACTOR | PHC | PHOTO COUPLER |
| CFM | CONDENSER FAN MOTOR | PPR | P. C PORT RECEPTACLE |
| CM | COMPRESSOR MOTOR | PT | POTENTIAL TRANSFORMER |
| CT1, 2 | CURRENT TRANSFORMER | RM | REMOTE MONITORING RECEPTACLE |
| CTP | COMPRESSOR THERMAL PROTECTOR | RS | RETURN AIR SENSOR |
| DCHS | COMPRESSOR DISCHARGE SENSOR | RY1-19 | RELAY |
| EC1 | CPU BOARD (DECOS) | SCC1 | SHORT CIRCUIT CONNECTOR |
| EC2 | I/O BOARD (DECOS) | SCC2 | SHORT CIRCUIT CONNECTOR |
| EC3 | DISPLAY BOARD (DECOS) | SGS | SUCTION GAS SENSOR |
| EC4 | SHEET KEY (DECOS) | SS | SUPPLY AIR SENSOR |
| EC5 | PRINTED CIRCUIT BOARD (PT, CT) | TB1 | TERMINAL BLOCK BOARD |
| EFH | HIGH SPEED EVAPORATOR FAN CONTACTOR | TrC | CONTROL TRANSFORMER |
| EFL | LOW SPEED EVAPORATOR FAN CONTACTOR | TrM | MAIN TRANSFORMER |
| EFM1, 2 | EVAPORATOR FAN MOTOR | VS | VOLTAGE SELECTOR |
| EIS | EVAPORATOR INLET SENSOR | WPS | WATER PRESSURE SWITCH |
| EOS | EVAPORATOR OUTLET SENSOR | | OPTIONAL SPECIFICATION |
| EV | ELECTRONIC EXPANSION VALVE | CBS | |
| Fu1-5 | FUSE(250V, 10A) | DRS | DATA RECORDER RETURN AIR SENSOR |
| HPS | HIGH PRESSURE SWITCH | DSS | DATA RECORDER SUPPLY AIR SENSOR |
| HPT | HIGH PRESSURE TRANSDUCER | HuS | HUMIDITY SENSOR |
| HSV | HOT GAS SOLENOID VALVE | NF | NOISE FILTER |
| ISV | INJECTION SOLENOID VALVE | RCD | REMOTE COMMUNICATION DEVICE |
| LCD | LIQUID CRYSTAL DISPLAY | REC | RECORDER |
| LD-A | SERVICE MONITOR-GREEN | RRS | RECORDER RETURN AIR SENSOR |
| LD1 | LIGHT-EMITTING DIODE(R, H,) | RSS | RECORDER SUPPLY AIR SENSOR |
| LD2 | LIGHT-EMITTING DIODE(ALARM) | T/F A2 | Trans FRESH, A2 CABLE |
| LD3 | LIGHT-EMITTING DIODE(RETURN) | T/F Fu | Trans FRESH, FUSE ASSY IN LINE(250V, 2A) |
| LD4 | LIGHT-EMITTING DIODE(SUPPLY) | UR1-3 | USDA RECEPTACLE |
| LD5 | LIGHT-EMITTING DIODE(COMP) | USDA1-3 | USDA SENSOR |
| LD6 | LIGHT-EMITTING DIODE(DEFROST) | | |
| LD7 | LIGHT-EMITTING DIODE(IN RANGE) | | |
| LD8 | LIGHT-EMITTING DIODE(DE-HUMID) | | |
| LD9-12 | LIGHT-EMITTING DIODE | | |
| LSV | LIQID SOLENOID VALVE | | |
| LPT | LOW PRESSURE TRANSDUCER | | |

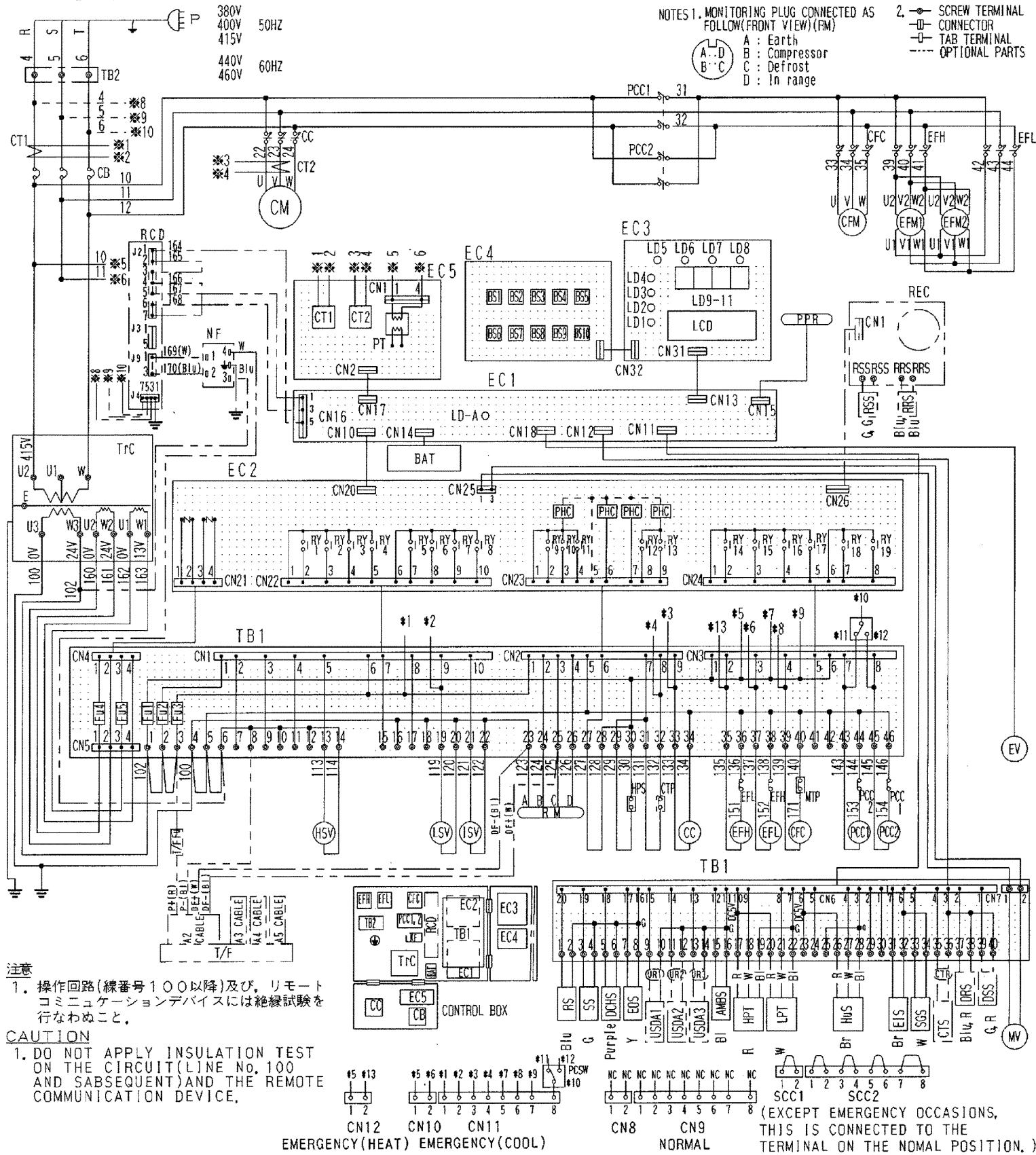
LXE10D

注意
 1. 操作回路(線番号100以降)及び、リモートコミュニケーションデバイスには絶縁試験を行なわぬこと。

CAUTION
 1. DO NOT APPLY INSULATION TEST ON THE CIRCUIT(LINE NO.100 AND SUBSEQUENT) AND THE REMOTE COMMUNICATION DEVICE.

●LXE10D-A with dehumidification control (optional)

CONTAINER REFRIGERATION UNIT WIRING DIAGRAM

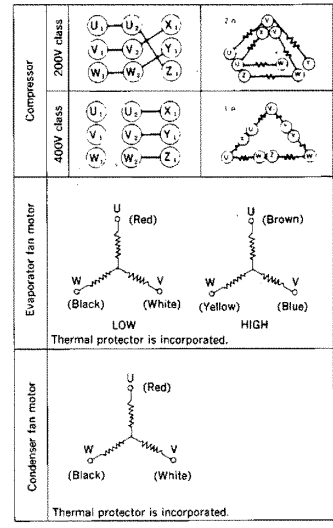
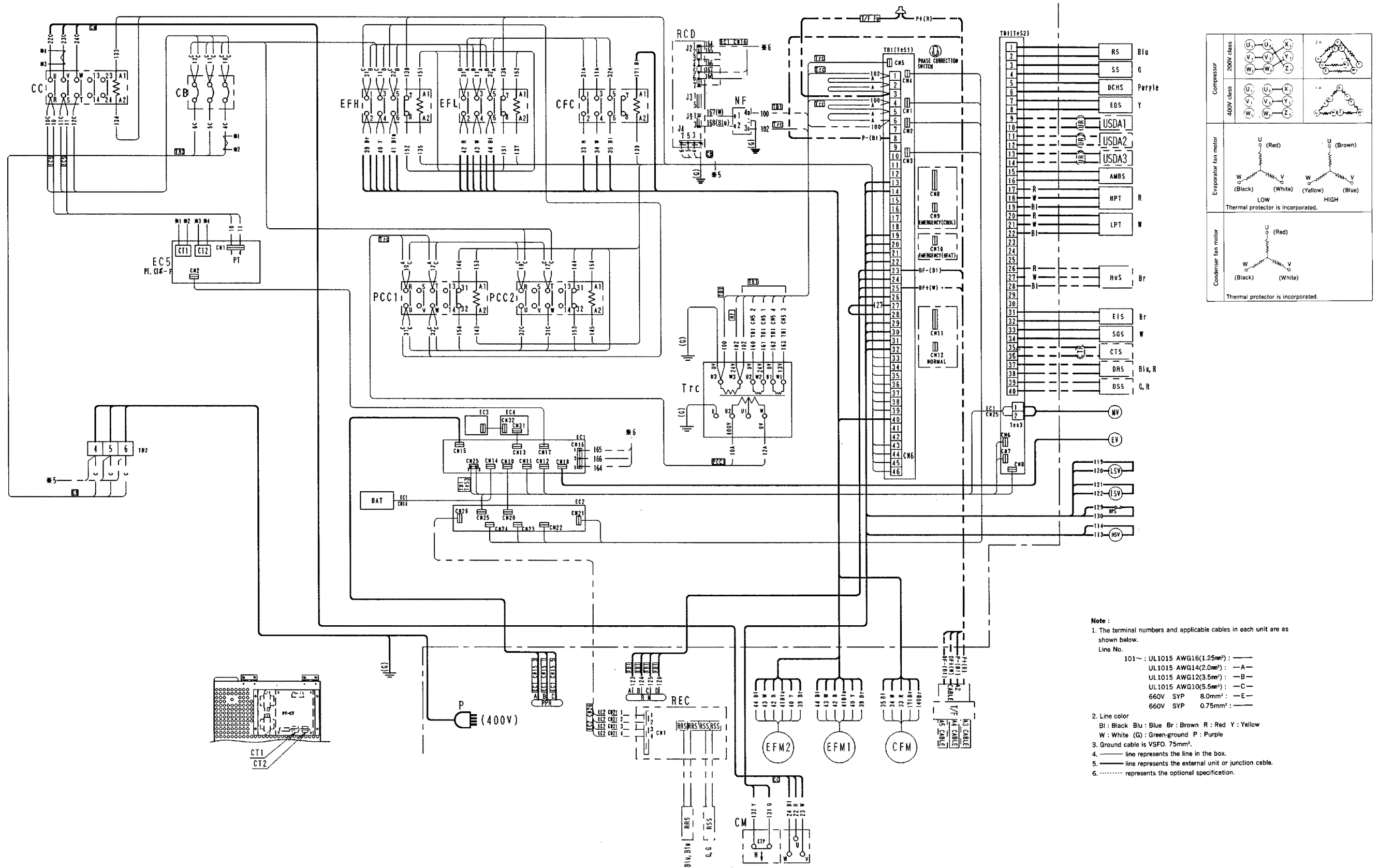


| | | | |
|---------|-------------------------------------|---------|--|
| AMBS | AMBIENT TEMP. SENSOR | LPT | LOW PRESSURE TRANSDUCER |
| BAT | BATTERY | MV | MODULATING VALVE |
| BS1-10 | PUSH BUTTON SWITCH | MTP | COND. MOTOR THERMAL PROTECTOR |
| CB | CIRCUIT BREAKER(50A) | P | POWER PLUG |
| CC | COMPRESSOR CONTACTOR | PCC1, 2 | PHASE CORRECTION CONTACTOR |
| CFC | CONDENSER FAN CONTACTOR | PCSW | PHASE CORRECTION SWITCH |
| CFM | CONDENSER FAN MOTOR | PHC | PHOTO COUPLER |
| CM | COMPRESSOR MOTOR | PHC | PHOTO COUPLER |
| CT1, 2 | CURRENT TRANSFORMER | PT | POTENTIAL TRANSFORMER |
| CTP | COMPRESSOR THERMAL PROTECTOR | RM | REMOTE MONITORING RECEPTACLE |
| DCHS | COMPRESSOR DISCHARGE SENSOR | RS | RETURN AIR SENSOR |
| EC1 | CPU BOARD (DECDS) | RY1-19 | RELAY |
| EC2 | I/O BOARD (DECDS) | SCC1 | SHORT CIRCUIT CONNECTOR |
| EC3 | DISPLAY BOARD (DECDS) | SCC2 | SHORT CIRCUIT CONNECTOR |
| EC4 | SHEET KEY (DECDS) | SGS | SUCTION GAS SENSOR |
| EC5 | PRINTED CIRCUIT BOARD (PT, CT) | SS | SUPPLY AIR SENSOR |
| EFH | HIGH SPEED EVAPORATOR FAN CONTACTOR | TB1 | TERMINAL BLOCK BOARD |
| EFL | LOW SPEED EVAPORATOR FAN CONTACTOR | TB2 | TERMINAL BLOCK |
| EFM1, 2 | EVAPORATOR FAN MOTOR | T/C | CONTROL TRANSFORMER |
| EIS | EVAPORATOR INLET SENSOR | | |
| EOS | EVAPORATOR OUTLET SENSOR | | OPTIONAL SPECIFICATION |
| EV | ELECTRONIC EXPANSION VALVE | CTR | CARGO TEMP. RECEPTACLE |
| Fu1-5 | FUSE(250V, 10A) | CTS | CARGO TEMP. SENSOR |
| HPS | HIGH PRESSURE SWITCH | DRS | DATA RECORDER RETURN AIR SENSOR |
| HPT | HIGH PRESSURE TRANSDUCER | DSS | DATA RECORDER SUPPLY AIR SENSOR |
| HSV | HOT GAS SOLENOID VALVE | HuS | HUMIDITY SENSOR |
| PPR | PC, PORT RECEPTACLE | NF | NOISE FILTER |
| ISV | INJECTION SOLENOID VALVE | RCD | REMOTE COMMUNICATION DEVICE |
| LCD | LIQUID CRYSTAL DISPLAY | REC | RECORDER |
| LD-A | SERVICE MONITOR-GREEN | RRS | RECORDER RETURN AIR SENSOR |
| LD1 | LIGHT-EMITTING DIODE(R, H.) | RSS | RECORDER SUPPLY AIR SENSOR |
| LD2 | LIGHT-EMITTING DIODE(ALARM) | T/F A2 | Trans FRESH, A2 CABLE |
| LD3 | LIGHT-EMITTING DIODE(RETURN) | T/F Fu | Trans FRESH, FUSE ASSY IN LINE(250V, 2A) |
| LD4 | LIGHT-EMITTING DIODE(SUPPLY) | URI-3 | USDA RECEPTACLE |
| LD5 | LIGHT-EMITTING DIODE(COMP) | USDA1-3 | USDA SENSOR |
| LD6 | LIGHT-EMITTING DIODE(DEFROST) | | |
| LD7 | LIGHT-EMITTING DIODE(IN RANGE) | | |
| LD8 | LIGHT-EMITTING DIODE(DE-HUMID) | | |
| LD9-12 | LIGHT-EMITTING DIODE | | |
| LSV | LIQUID SOLENOID VALVE | | |

LXE10D-A

1.4.5 Stereoscopic wiring diagram

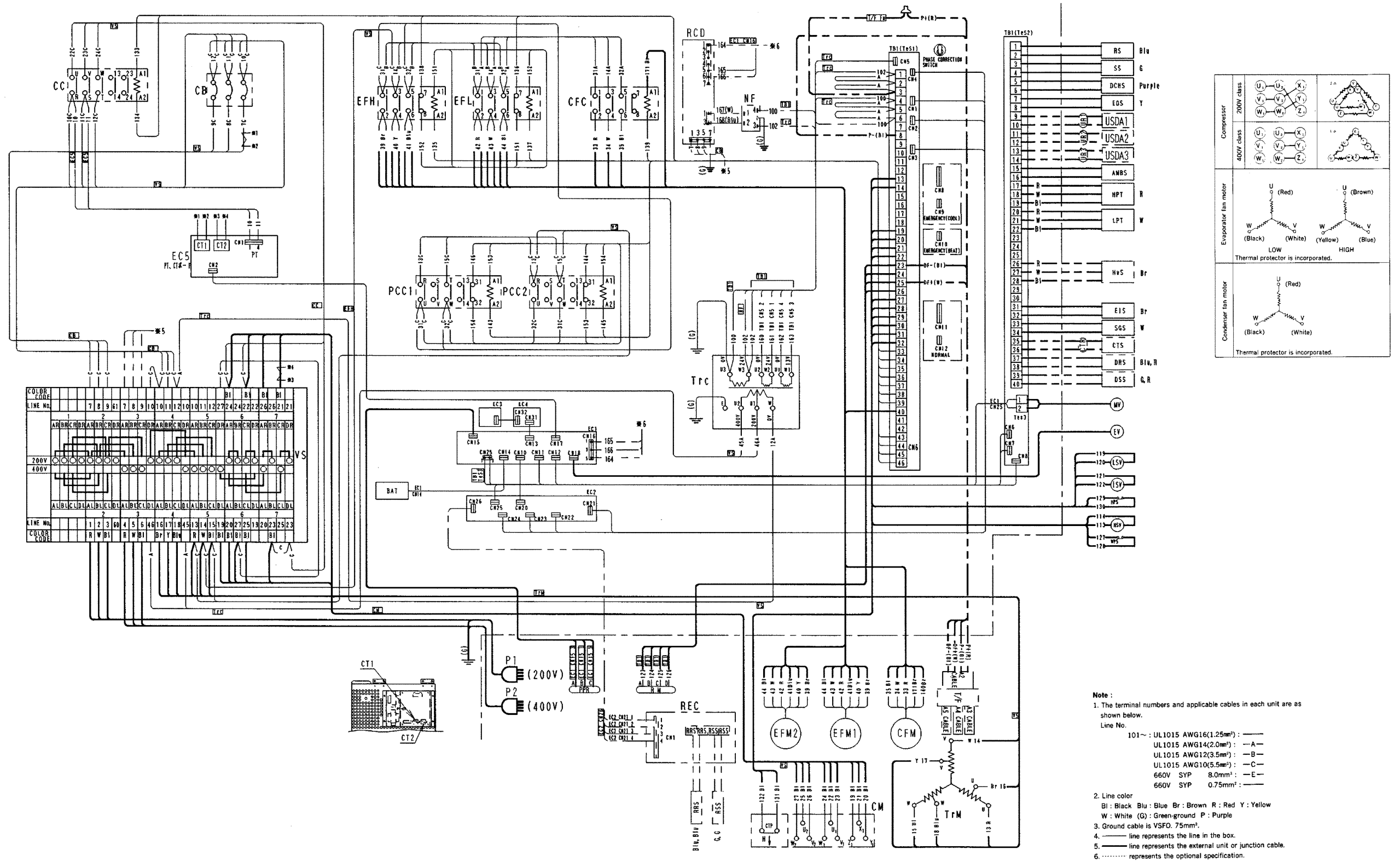
●LXE10D-A



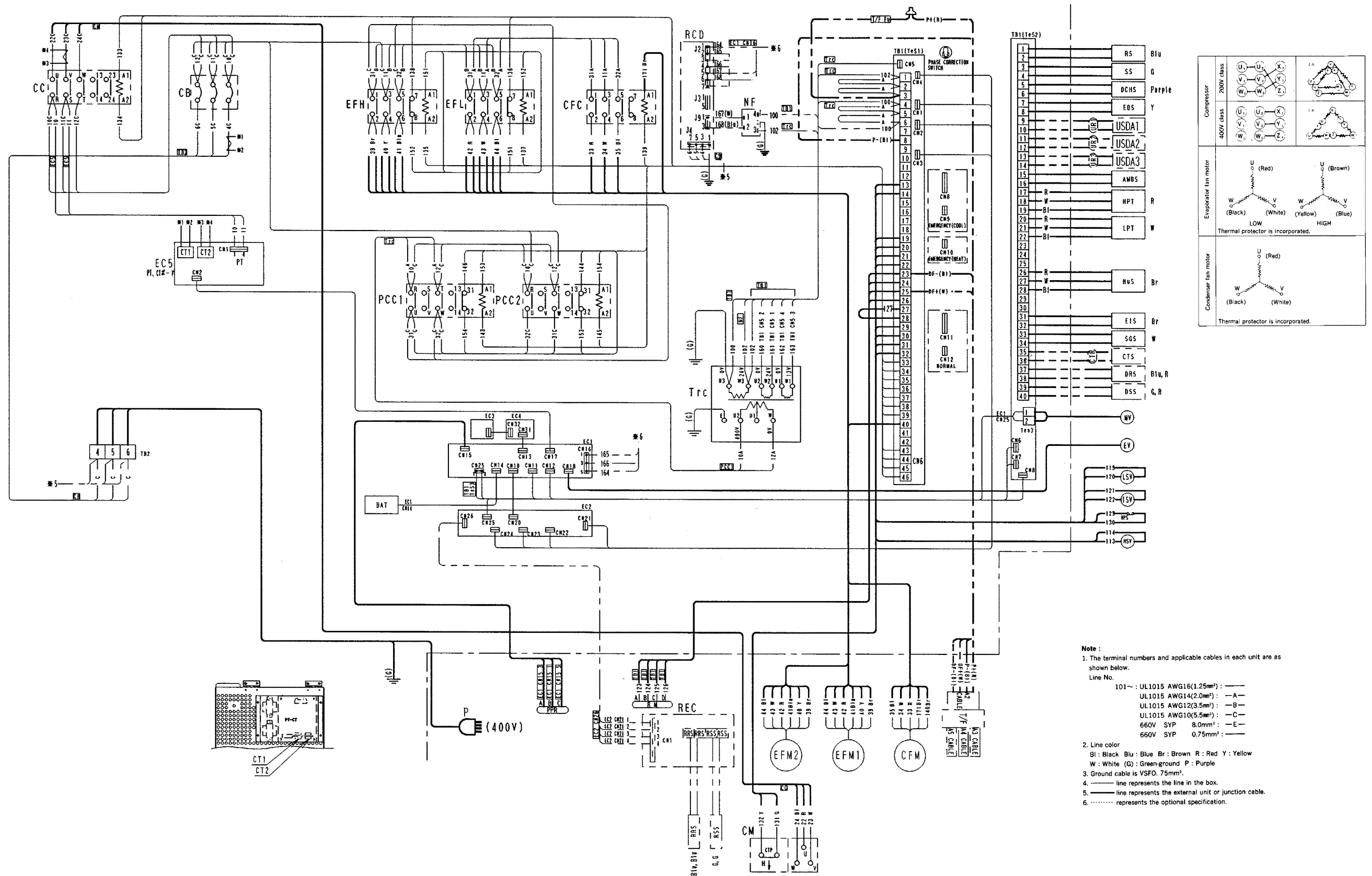
Note:

- The terminal numbers and applicable cables in each unit are as shown below.
Line No.
101~ : UL1015 AWG16(1.25mm²) : —
UL1015 AWG14(2.0mm²) : —A—
UL1015 AWG12(3.5mm²) : —B—
UL1015 AWG10(5.5mm²) : —C—
660V SYP 8.0mm² : —E—
660V SYP 0.75mm² : —F—
- Line color
Bl: Black Blu: Blue Br: Brown R: Red Y: Yellow
W: White (G) Green-ground P: Purple
- Ground cable is VSFO. 75mm².
- line represents the line in the box.
- line represents the external unit or junction cable.
- represents the optional specification.

●LXE10D with dual power supply (optional)



●LXE10D-A with dehumidification control (optional)



| | | |
|----------------------|------------|--|
| Compressor | 200V class | |
| | 400V class | |
| Evaporator fan motor | LOW | |
| | HIGH | |
| Condenser fan motor | LOW | |
| | HIGH | |

Thermal protector is incorporated.

Note:

- The terminal numbers and applicable cables in each unit are as shown below.
Line No.
101 ~ : UL1015 AWG16(1.25mm²) : —
UL1015 AWG14(2.0mm²) : —A—
UL1015 AWG12(3.5mm²) : —B—
UL1015 AWG10(5.5mm²) : —C—
660V SYP 8.0mm² : —E—
660V SYP 0.75mm² : —
- Line color
Bl : Black Blu : Blue Br : Brown R : Red Y : Yellow
W : White (G) : Green-ground P : Purple
- Ground cable is VSFO. 75mm².
- line represents the line in the box.
- line represents the external unit or junction cable.
- represents the optional specification.

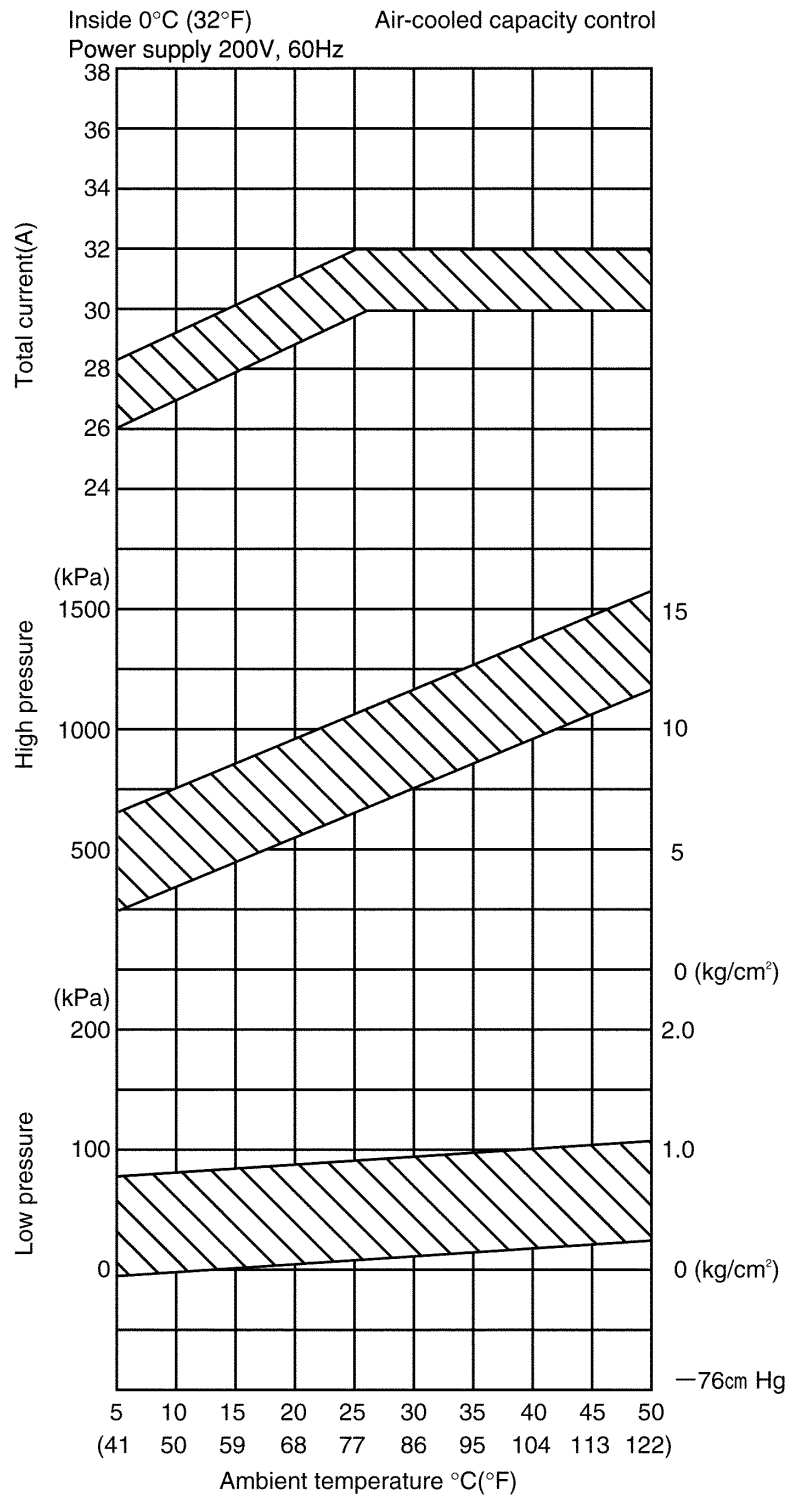
<https://daikin-p.ru>

1.5 Set point of functional and protective devices

| | | Device name | Actuation | Set point | Detection method | Symbol | | |
|--|---|---------------------|---------------------|--|---|--------------------------|------|--|
| Pressure switch | High-pressure switch | | OFF ON | 2059kPa (21kg/cm ²) 1569kPa (16kg/cm ²) | High-pressure switch | HPS | | |
| | Water pressure switch | | OFF ON | 98kPa (1.0kg/cm ²) 39kPa (0.4kg/cm ²) | Water pressure switch | WPS | | |
| Model | | | | DECOS _J b | | | | |
| Electronic controller | Mode selection | Chilled mode | | ON | +25.0°C ~ -2.9°C (+77.0°F ~ +26.8°F) | Set point temperature | EC | |
| | | Partial frozen mode | | | -3.0°C ~ -10.0°C (+26.6°F ~ +14°F) | | | |
| | | Frozen mode | | | -10.1°C ~ -30.0°C (+13.8°F ~ -22.0°F) | | | |
| | Delay timer | Fan | Change-over for H-L | | ON | 10 seconds | | |
| | | | After defrosting | | | 60 seconds | | |
| | | Compressor | At starting | | | 3 seconds | | |
| | Defrosting timer | Initiation | Short | | ON | 4 hours *1 | | |
| | | | Long | | | 3, 6, 9, 12 and 24 hours | | |
| | | Back-up | | OFF | 90 minutes | | | |
| | | In-range masking | | | 90 minutes | | | |
| | | Out-range guard | | ON | 30 minutes | | | |
| | Condenser fan motor ON/OFF set point (At water cooled operation) | | | OFF ON | 52°C (126°F) 59°C (138°F) | Control box sensor | CBS | |
| | Defrosting termination set point | | | OFF Reset | 35°C (95°F) 20°C (68°F) | Evaporator outlet sensor | EOS | |
| | High-pressure control (Condenser fan) | | | OFF ON | 500kPa (4.1kg/cm ²) 800kPa (8.2kg/cm ²) | High-pressure transducer | HPT | |
| | Compressor discharge temperature protection set point | | | Cutout Reset | 130°C (266°F) 135°C during pull down operation After 3 minutes elapse | Discharge sensor | DCHS | |
| Injection solenoid valve | | | ON OFF | 125°C (257°F) 115°C (239°F) | Discharge sensor | DCHS | | |
| Overcurrent protection | | | Cutout Reset | 400V : 26.0A 200V/400V : 15.0A After 3 minutes elapse | CT/PT board | CT2 | | |
| Current control (during modulating control) | | | Control | 50Hz 200V 31.5A 415V 16.1A 60Hz 220V 34.3A 440V 17.4A | CT/PT board | CTI | | |
| High pressure control | | | Control | 1900kPa (19.4kg/cm ²) | High-Pressure transducer | HPT | | |
| Breaker | Circuit breaker (main circuit) | | OFF | 50A | | CB | | |
| | Fuse (controller) | | OFF | 10A | | Fu | | |
| Motor | Evaporator fan motor thermal protector | | OFF | 132°C (270°F) | | | | |
| | Condenser fan motor thermal protector | | OFF | 135°C (275°F) | | | | |
| | Compressor motor thermal protector | | OFF | 105°C (221°F) | | CTP | | |

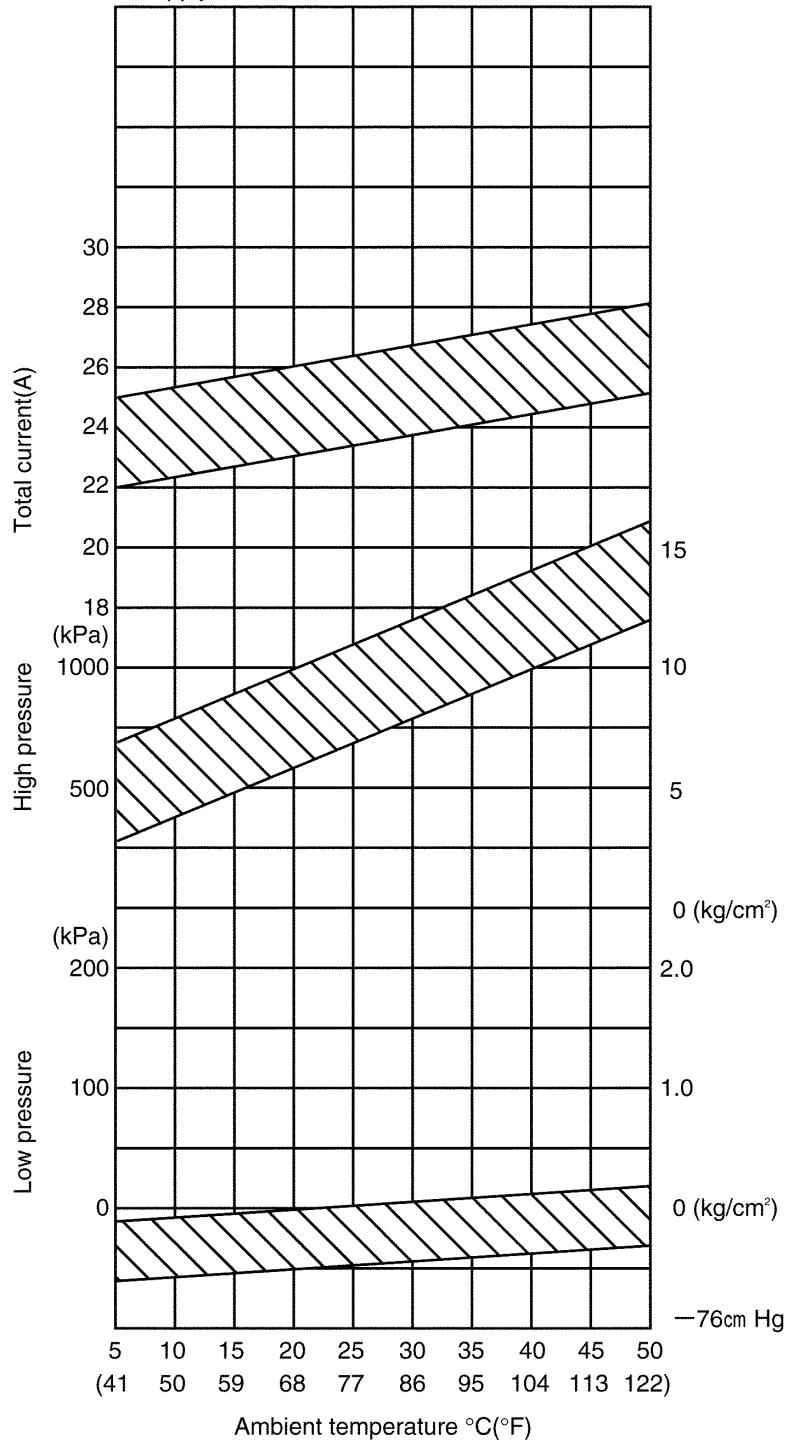
※1. 6 hours when the control temperature is -20°C or below.

1.6 Operating pressure and running current



| | Item | Unit | Amperage |
|---|---|------|-------------------------|
| 1 | Condenser fan motor running current | A | 1.4 (AC400V) |
| 2 | Evaporator fan motor running current (2 motors) | A | High speed 3.2 (AC400V) |
| | | | Low speed 0.9 (AC400V) |

Inside -18°C (-0.4°F) Air-cooled operation
 Power supply 200V, 60Hz



| | Item | Unit | Amperage |
|---|---|------|-------------------------|
| 1 | Condenser fan motor running current | A | 1.4 (AC400V) |
| 2 | Evaporator fan motor running current (2 motors) | A | High speed 3.2 (AC400V) |
| | | | Low speed 0.9 (AC400V) |

2. OPERATION MODES AND CONTROL

There are two main kinds of the operation modes: the cargo cooling control mode and the unit inspection mode.

The cargo cooling control mode is explained in this section.

※For the unit inspection mode, refer to section 4.

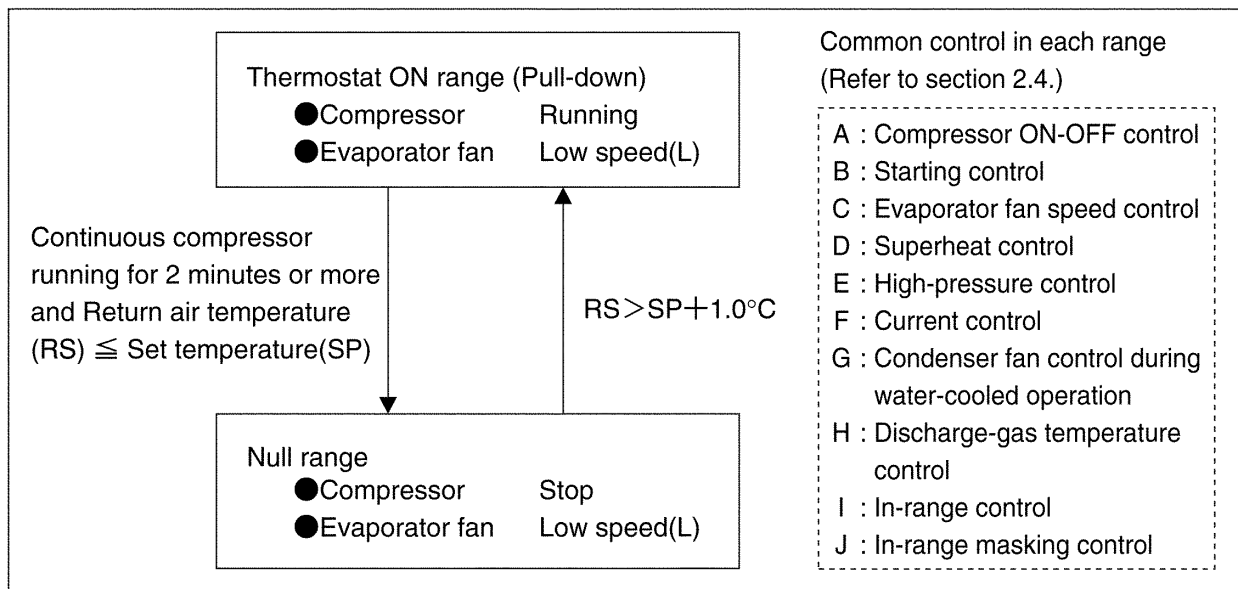
The relationship between the operation mode and set point temperature is as follows.

| Operation mode | Set point temperature | Control sensor | Operation description |
|---------------------|----------------------------------|--------------------------|--|
| Frozen mode | -10.1~-30.0°C (+13.8~-22.0°F) | Return air sensor | Compressor ON/OFF control |
| Partial frozen mode | -3.0~-10.0°C (+26.6~+14.0°F) | Return air sensor | Hot-gas bypass control with modulating valve |
| Chilled mode | +25.0~-2.9°C (+77~+26.8°F) | Supply air sensor | Hot-gas bypass control with modulating valve |
| Defrosting mode | | High pressure transducer | Hot-gas defrosting with refrigerant metering control |

※For details, refer to section 2.1 to 2.4.

2.1 Frozen operation

● Control state transition and common control



● Operation of magnetic contactor and solenoid valve

| Component name | | | Thermostat ON | Thermostat OFF | |
|----------------------------|------------------------------|-----|---------------|----------------|---------------|
| Magnetic contactor | Compressor | CC | ○ | × | |
| | Evaporator fan. High speed | EFH | × | × | |
| | Evaporator fan. Low speed | EFL | ○ | ○ | |
| | Condenser fan | CF | △ | × | |
| Solenoid valve | Liquid solenoid valve | LSV | ○ | × | |
| | Injection solenoid valve | ISV | △ | × | |
| | Hot-gas 3-way solenoid valve | HSV | × | × | |
| Opening, modulating valve | | | MV | 0% | 0% |
| Electronic expansion valve | | | EV | 300~2000 pulse | 300~2000pulse |

Note) ○ : Energized × : Deenergized △ : Depending on the control conditions

Frozen operation

(1) Set point temperature and control sensor

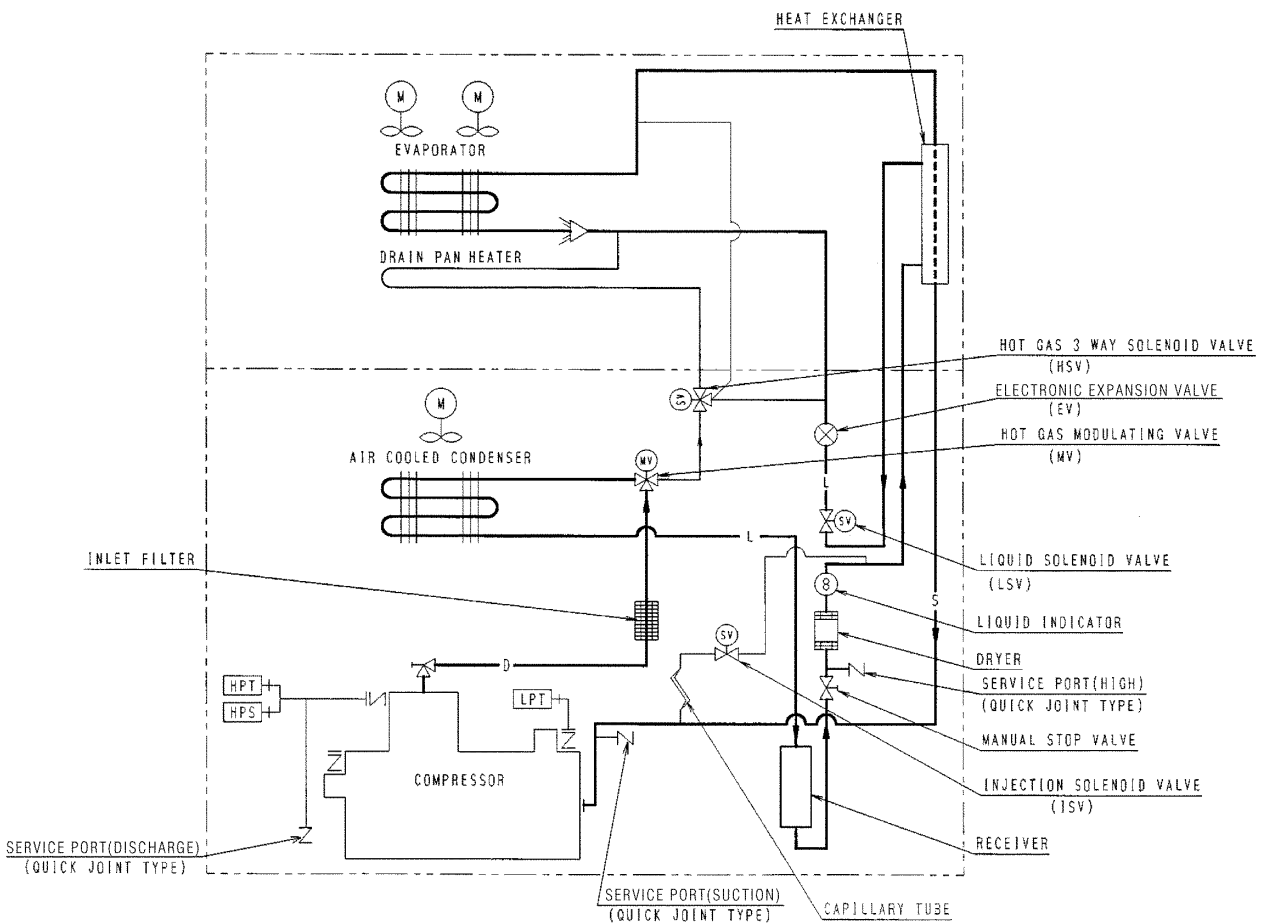
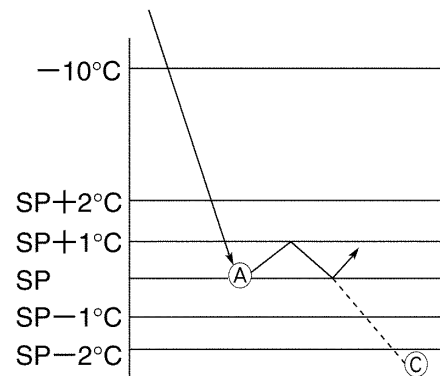
When the set point temperature (referred to as SP hereafter) is -10.1°C ($+13.8^{\circ}\text{F}$) or lower, the compressor is operated ON and OFF, in response to return air temperature.

(2) Control

When the control temperature reaches SP (point A), the compressor, condenser fan and liquid solenoid valve (LSV) are turned off.

When the control temperature exceeds $\text{SP}+1.0^{\circ}\text{C}$, the compressor, liquid solenoid valve and condenser fan are turned on.

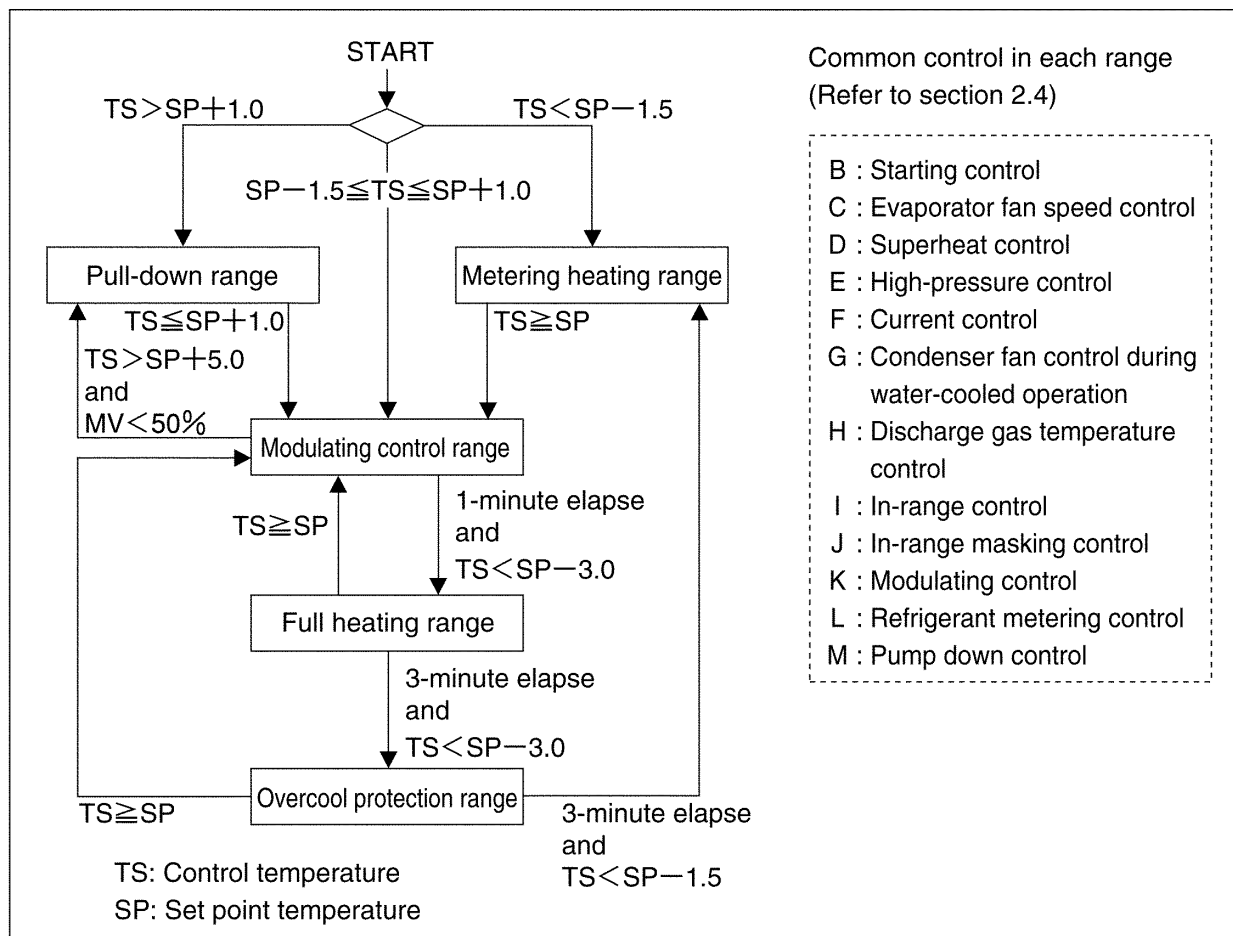
Here, the compressor runs for 2 minutes every time when it is turned on once. Even if the control temperature becomes below SP (point C) within 2 minutes after the compressor is turned on, the compressor, condenser fan and liquid solenoid valve are not turned off. (2 minutes compressor forced operation)



Note) This piping diagram is of the LXE10D-A.

2.2 Chilled and partial frozen operation

● Control state transition and common control



● Operation of magnetic contactor and electronic solenoid valve

| Component name | | | Pull-down | Modulating control | Full heating | Overcool protection | Metering heating |
|----------------------------|------------------------------|------------|-----------|--------------------|----------------|---------------------|------------------|
| Magnetic contactor | Compressor | | CC | ○ | ○ | ○ | × |
| | Evaporator fan | High speed | EFH | ○ | ○ | ○ | ○ |
| | Evaporator fan | Low speed | EFL | × | × | × | × |
| | Condenser fan | | CF | △ | △ | △ | △ |
| Solenoid valve | Liquid solenoid valve | | LSV | ○ | ○ | ○ | × |
| | Injection solenoid valve | | ISV | △ | △ | × | △ |
| | Hot-gas 3-way solenoid valve | | HSV | × | × | × | ○ |
| Opening, modulating valve | | | MV | 0% | 0.1~99.9% | 100% | 0% |
| Electronic expansion valve | | | EV | 400~2000 pulse | 350~2000 pulse | 500 pulse | 500 pulse |

Note) ○ : Energized × : Deenergized △ : Depending on the control conditions

Chilled and partial frozen operation

(1) Set point temperature and control sensor

Chilled operationWhen the set point temperature is -2.9°C ($+26.8^{\circ}\text{F}$) or higher, the modulating valve (MV) is controlled sensing the supply air temperature in order to adjust the hot gas flow rate.

Partial frozen operation ...When the set point temperature is -3.0°C to -10.0°C ($+26.6^{\circ}\text{F}$ to $+14.0^{\circ}\text{F}$), the modulating valve is controlled sensing the return air temperature in order to adjust the hot gas flow rate.

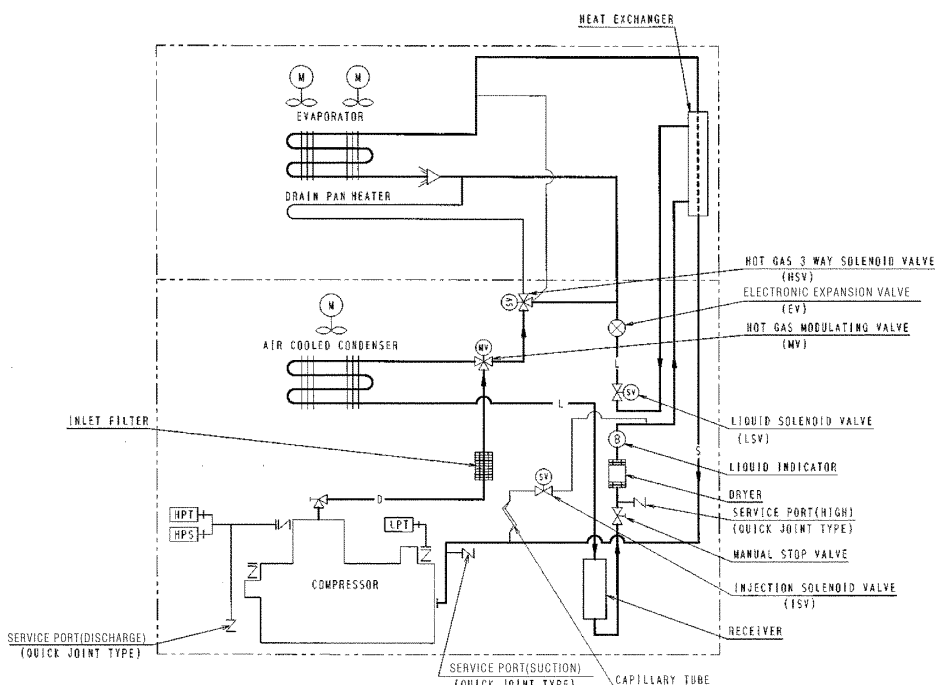
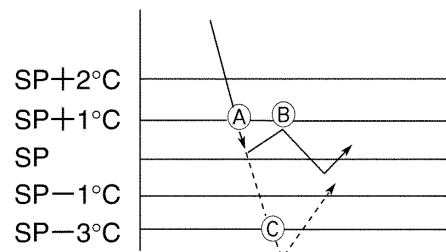
※The operation mode is automatically switched according to the set point of the electronic controller. Chilled and partial frozen operations are controlled in the same manner except the sensor for the temperature control.

(2) Description of control state

- | | |
|-------------------------------|---|
| (a) Pull-down range | Cooling operation is carried out to lower the inside temperature to the set temperature. |
| (b) Modulating control range | The hot gas flow rate is adjusted by the modulating valve in order to keep the control temperature. |
| (c) Full heating range | Rapid heating is carried out to prevent the inside temperature from over cooling. |
| (d) Metering heating range | The refrigerant is metered for heating in order to reach to the control temperature. |
| (e) Overcool protection range | The compressor is stopped but the evaporator fan is kept running. |

(3) Control

- ① In the pull-down range, the opening of the modulating valve (MV) is 0%.
- ② When the control temperature reaches the point A, the in-range lamp is turned on. At the same time, the modulating valve is opened to make the hot gas start flowing to the evaporator.
- ③ When the hot gas starts flowing, the temperature sometimes temporarily rises (point B) with the in-range lamp turned off. After this operation is repeated several times, it will come into the stable state.
- ④ The hot gas flow rate will be gradually varied by the modulating valve in order to put the control temperature into the stable state.
- ⑤ Even after the stable state is achieved the ambient temperature varies. When the control temperature falls to $\text{SP}-3^{\circ}\text{C}$ (point C), the full heating is carried out.



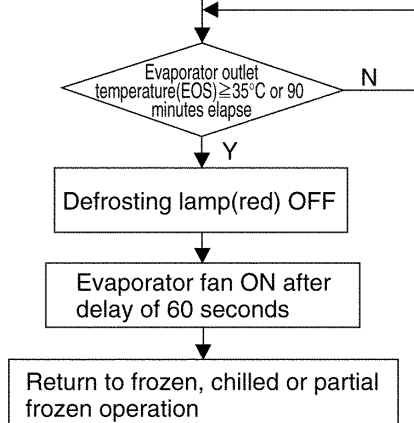
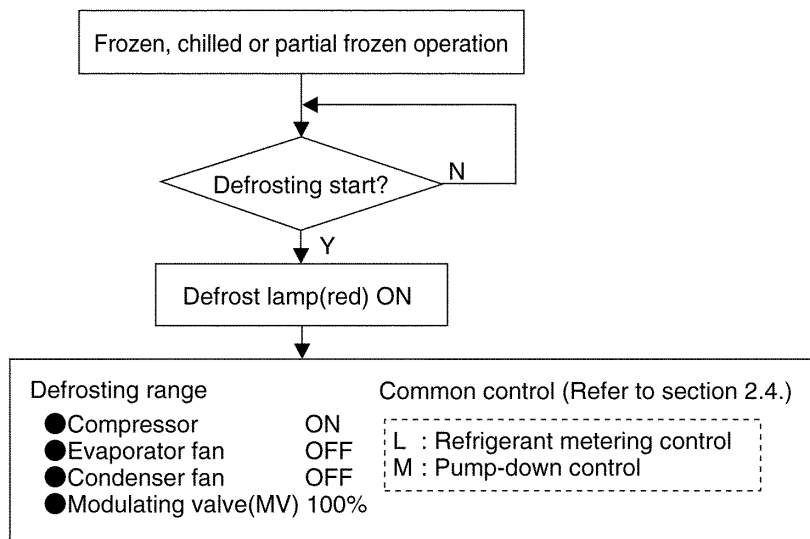
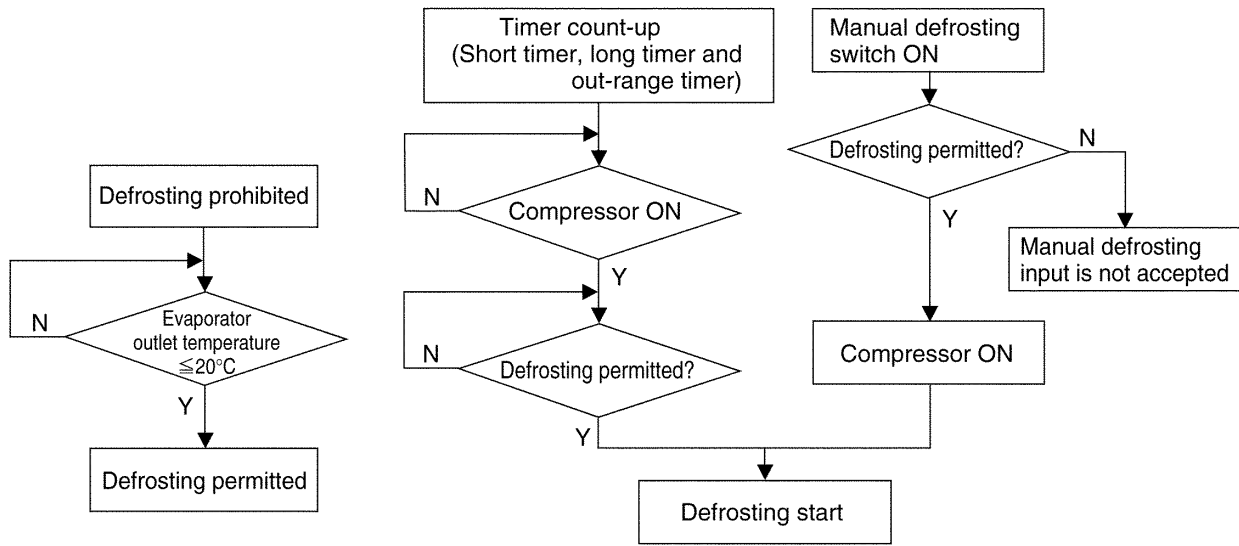
※The left figure shows the hot gas flowing state in the modulating control range.

In other range
Full heating range
...MV is 100% opened toward the evaporator.

Metering heating range
...Same as for defrosting

Note) This piping diagram is of the LXE10D-A.

2.3 Defrosting operation



Operation of magnetic contactor and solenoid valve

| Component name | | | Defrosting |
|----------------------------|------------------------------|-----|----------------|
| Magnetic contactor | Compressor | CC | ○ |
| | Evaporator fan. High speed | EFH | × |
| | Evaporator fan. Low speed | EFL | × |
| Solenoid valve | Condenser fan | CF | △ |
| | Liquid solenoid valve | LSV | × |
| | Injection solenoid valve | ISV | △ |
| | Hot-gas 3-way solenoid valve | HSV | ○ |
| Opening, modulating valve | | | MV 100% or 47% |
| Electronic expansion valve | | | EV 500 pulse |

Note) ○ : Energized × : Deenergized
 △ : Depending on the control conditions

Defrosting operation

(1) Defrosting system

The hot-gas defrost system is adopted in the units; i.e. the high temperature and high pressure refrigerant (hot gas) from the compressor is sent to the evaporator and drain pan for defrosting. Since the evaporator is heated directly by the hot refrigerant in the evaporator, defrosting can be performed effectively.

(2) Defrosting initiation

Defrosting is initiated by the timer or the manual defrost key.

However, defrosting is not initiated when the evaporator outlet temperature exceeds 20°C.

- ① Timers (Defrosting intervals are set at the electronic controller and refer to section 3.2 for its operating method.)

| Kind of timer | Defrosting interval set | Function |
|-----------------|--|---|
| Long timer | 3, 6, 9, 12 and 24 hours are selectable. | Regardless of the control temperature, defrosting is initiated according to the selected interval. |
| Short timer | 4 hours*1 | Defrosting is initiated every 4 hours until the control temperature reaches within the in-range after pull-down. |
| Out-range timer | 30 minutes | After the control temperature reaches within the in-range once, defrosting will be started 30 minutes later if the control temperature rises out of the in-range. |

*1. 6 hours when the control temperature is -20°C or below.

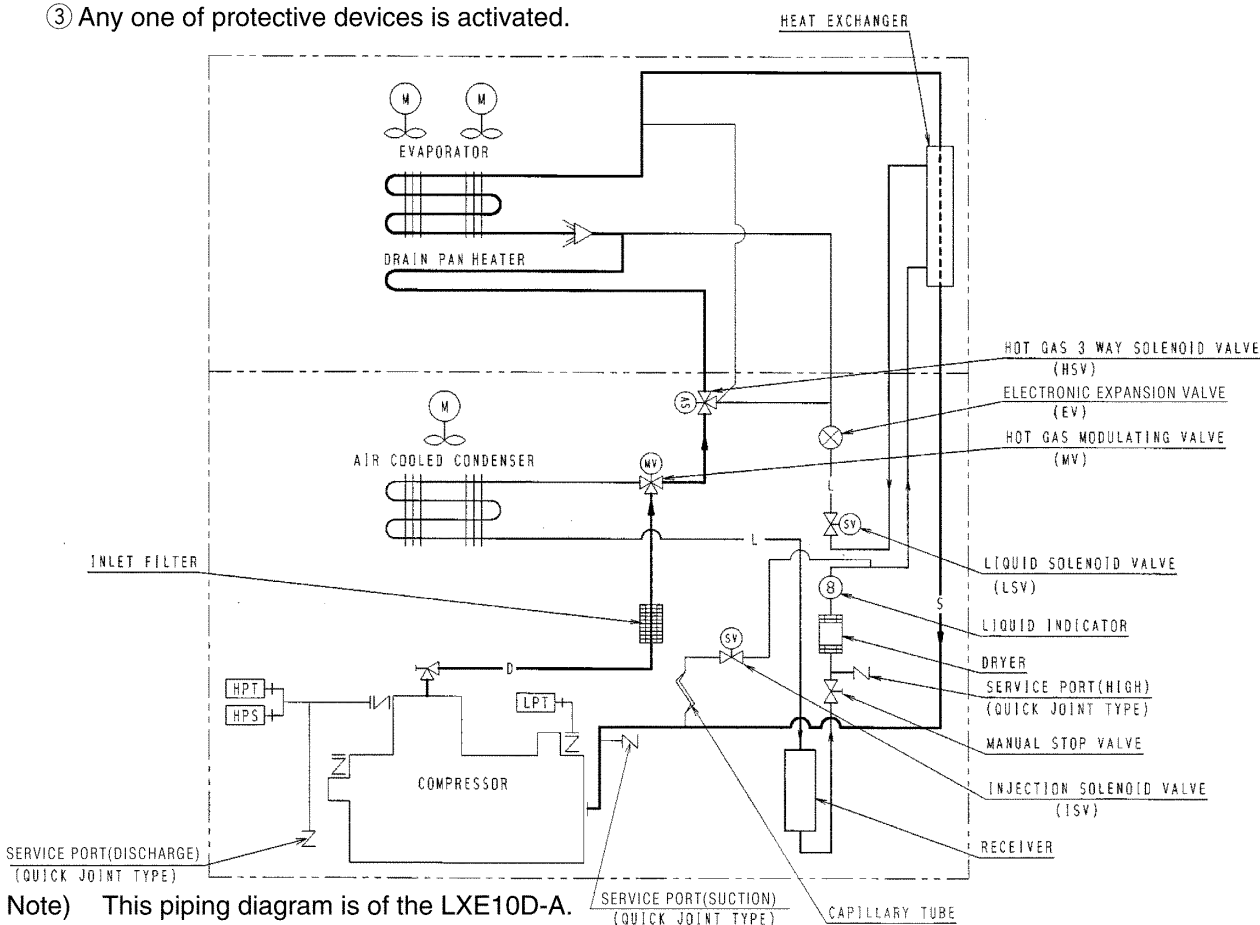
- ② MANUAL DEFROST key (on the operation panel)

Press the MANUAL DEFROST key, then press the ENTER/ESC key for confirmation. The manual defrosting operation is initiated.

(3) Defrosting termination

Defrosting will be terminated when any one of the following three conditions is satisfied.

- ① The evaporator outlet temperature becomes 35°C or higher.
- ② 90 minutes have elapsed.
- ③ Any one of protective devices is activated.



Note) This piping diagram is of the LXE10D-A.

2.4 Common control

The following are controlled in the operation modes. (For details, refer to the following pages.)

| | Control name | Control content | Operation mode | | | |
|---|---|---|----------------|---------|----------------|---------|
| | | | Frozen | Chilled | Partial frozen | Defrost |
| A | Compressor ON-OFF control | The compressor is operated on and off to adjust the inside temperature. | ○ | | | |
| B | Starting control | At starting, the compressor may repeat the process of start and stop before its normal operation. | ○ | ○ | ○ | |
| C | Evaporator fan speed control | The evaporator fan is switched to the high or low speed according to the set point temperature. | ○ | ○ | ○ | |
| D | Superheat control | In order to keep the superheat of the evaporator optimal, the opening of the electronic expansion valve is controlled. | ○ | | | |
| E | High-pressure control | In order to keep the high pressure optimum, the opening of the electronic expansion valve is controlled. | ○ | ○ | ○ | |
| F | Condenser fan control during water-cooled operation | In order to prevent the temperature of the control box from rising, the condenser fan is controlled. | ○ | ○ | ○ | |
| G | Discharge gas temperature control | In order to prevent the refrigerating machine oil from deterioration, the liquid injection solenoid valve control or electronic expansion valve control is carried out. | ○ | ○★ | ○★ | |
| H | In-range control | When the control temperature is within $SP \pm 2^{\circ}\text{C}$, the in-range lamp is turned on. | ○ | ○ | ○ | |
| I | In-range masking control | After defrosting initiation, the in-range lamp is kept on for 90 minutes. | ○ | ○ | ○ | ○ |
| J | Modulating control | The hot gas flow rate to the evaporator is proportionally controlled to keep the control temperature variation within $\pm 0.5^{\circ}\text{C}$. | | ○* | ○* | |
| K | Refrigerant metering heating control | For optimum heating, the refrigerant flow rate is controlled. | | ○☆ | ○☆ | ○ |
| L | Pump down control | The liquid refrigerant is pumped down into the water-cooled condenser (liquid receiver) | | ○ | ○ | ○ |

※ : Only in the modulating control range

☆ : Only in the metering heating range

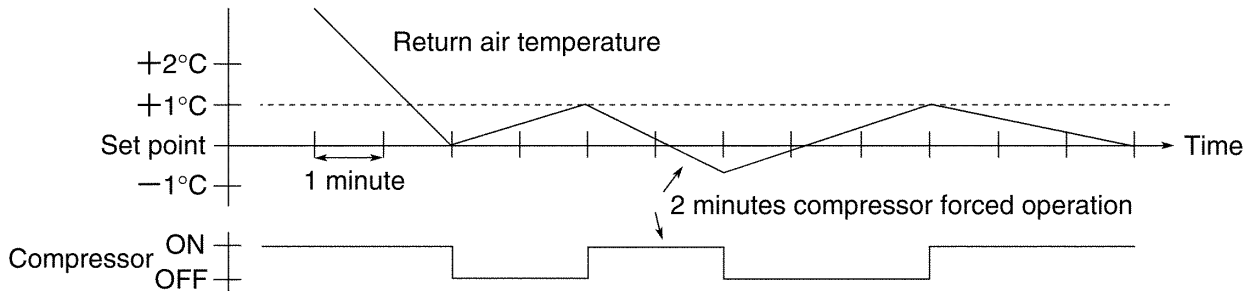
★ : Excluding the metering heating range

Common control

A: Compressor ON-OFF control

When the control temperature reaches the set point temperature or lower, the compressor is stopped. When the control temperature rises to the set point temperature +1.0°C afterward, the compressor runs again.

When the compressor starts running it is forcibly run for 2 minutes. (2 minutes compressor forced operation) in order to prevent the compressor from deterioration due to shortage of lubricant.



B: Starting control

When the high pressure rapidly rises at starting or when the starting current is overcurrent, the compressor automatically stops and starts to control high pressure and starting current.

When the unit restarts at -10 to 23°C ambient temperature after a long pause of its operation, the compressor repeats the process of stop and start for 4 times before its normal operation.

C: Evaporator fan speed control

The speed of the evaporator fan is switched in accordance with operation modes.

A delay time of 10 sec. is provided to switch the high speed to the low speed and vice versa.

Chilled mode : High speed

Partial frozen mode : High speed

Frozen mode : Low speed

D: Superheat control

The evaporator superheat is adjusted to be optimum by controlling the opening of the electronic expansion valve based on the evaporator inlet and outlet refrigerant temperature, and the compressor suction gas temperature.

E: High-pressure control

● By electronic expansion valve

When the ambient temperature is high during the air-cooled operation, the condensing pressure (high pressure) will increase, and the high pressure switch may be actuated.

In order to prevent this situation, the high pressure is controlled to be 1900kPa or lower by adjusting the opening of the electronic expansion valve.

● By condenser fan (Frozen mode and Pull down operation)

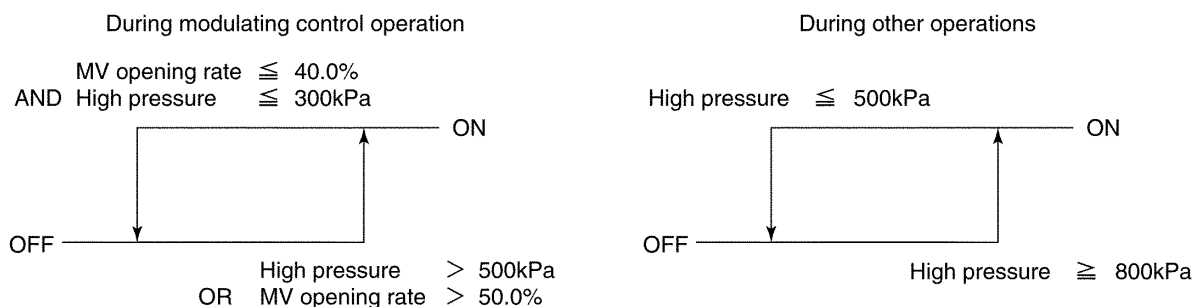
When the ambient temperature is low during the air-cooled operation, the condensing pressure (high pressure) will decrease. Then, the low pressure will decrease too.

In order to prevent this situation, when the high pressure becomes 500kPa or lower, the condenser fan stops to prevent the high pressure from excess dropping.

When the high pressure becomes 800kPa or higher afterward, the operation will be restarted.


● Condenser fan control (During the modulating control)

During the air-cooled operation, when the ambient temperature is low, the condensing pressure (high pressure) drops and then the evaporating temperature (low-pressure) drops. In order to prevent this, the condenser fan stops when the high pressure reaches 500kPa or lower. When the high pressure reaches 800kPa or higher, the condenser fan restarts. Here, during the modulating control operation, the condenser fan starts and stops in accordance with the opening rate of modulating valve (MV) and the high pressure. i.e. When the MV opening rate is 40.0% or lower and the high pressure is 300kPa or lower, the condenser fan stops, while when the MV opening rate exceeds 50.0% or the high pressure exceeds 500kPa, the condenser fan restarts.



F: Condenser fan control during water-cooled operation (optional)

The air and water-cooled type unit can be operated in any mode of air-cooled operation and water-cooled operation. Though the condenser fan is not operated in the water-cooled operation, the condenser fan is sometimes operated to cool the control box. The air-cooled operation and water-cooled operation are automatically switched with the water pressure switch. That is, cooling water is flowed into the water-cooled condenser, and when the water pressure is applied to the inlet of the condenser, the contact point of the water pressure switch will be opened to stop the condenser fan motor. Thus, the water-cooled operation will be selected. On the contrary, when water supply is stopped during water-cooled operation, the contact point of the water pressure switch will be closed to operate the condenser fan motor for the water-cooled operation.



CAUTION The condenser fan is sometimes operated even in the water-cooled operation.

G: Discharge gas temperature control

This refrigeration unit uses HFC134a as the refrigerant. In order to prevent the refrigerating machine oil used with the refrigerant from the high-temperature deterioration, the liquid refrigerant is injected to the suction pipe of the compressor.

The discharge gas temperature sensor detects the discharge gas temperature.

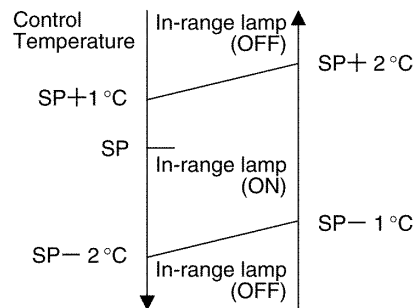
The refrigerant injection is processed by the opening of the injection solenoid valve or the electronic expansion valve in accordance with the discharge gas temperature.

| | | |
|-----------|--|---|
| RS > -5°C | Injection solenoid valve (Open) | Injection solenoid valve (Close) |
| | 125°C | 115°C |
| RS ≤ -5°C | Electronic expansion valve (Wider opening than ordinary setting) | Electronic expansion valve (Return to ordinary opening) |
| | 120°C for 10 minutes or 125°C | 115°C |

RS = Return air temperature.

H: In-range control

In order to observe at a glance whether the refrigeration unit properly controls the inside temperature or not, the orange lamp on the display panel will light on when the control temperature is near the set point temperature (SP). At the same time, AC24V will be supplied to the monitoring output (D). (The monitoring output is used for observation in the bridge on the ship.)



I: In-range masking control

If the inside temperature is within the in-range when defrosting is started, the in-range lamp will be kept turned on for 90 minutes regardless of the following inside temperature. Since the control temperature temporarily rises during defrosting, it will prevent the misunderstanding that it is regarded as a trouble when the in-range lamp goes out.

J: Modulating control

In the chilled mode operation, the opening of the modulating valve is adjusted by proportionally controlling the supply air temperature for the set point temperature (SP) in order to control the amount of the hot gas bypass flowed to the evaporator.

Thus, the supply air temperature is controlled to be in the range of set point temperature $\pm 0.5^{\circ}\text{C}$. Here, the partial frozen operation has the same control method as the chilled operation except the different control sensor.

K: Refrigerant metering control

The amount of the refrigerant in the hotgas flow is controlled to keep the high pressure in the optimum range during the metering heating range or defrosting. When the high pressure is lower than ① kPa, the injection solenoid valve will be opened (called as refrigerant charge) till it is to be ② kPa or higher. When the high pressure exceeds ③, the modulating valve will be half opened (called as refrigerant release) till it is to be ④ or lower.

Unit : kPa

| | 10HP | 5HP |
|-------------------------------|-------|-------|
| Refrigerant charge (start) | 400 | 630 |
| Refrigerant charge (stop) | 500 | 700 |
| # Refrigerant release (start) | 1,300 | 1,300 |
| Refrigerant release (stop) | 1,200 | 1,200 |

L: Pump down control

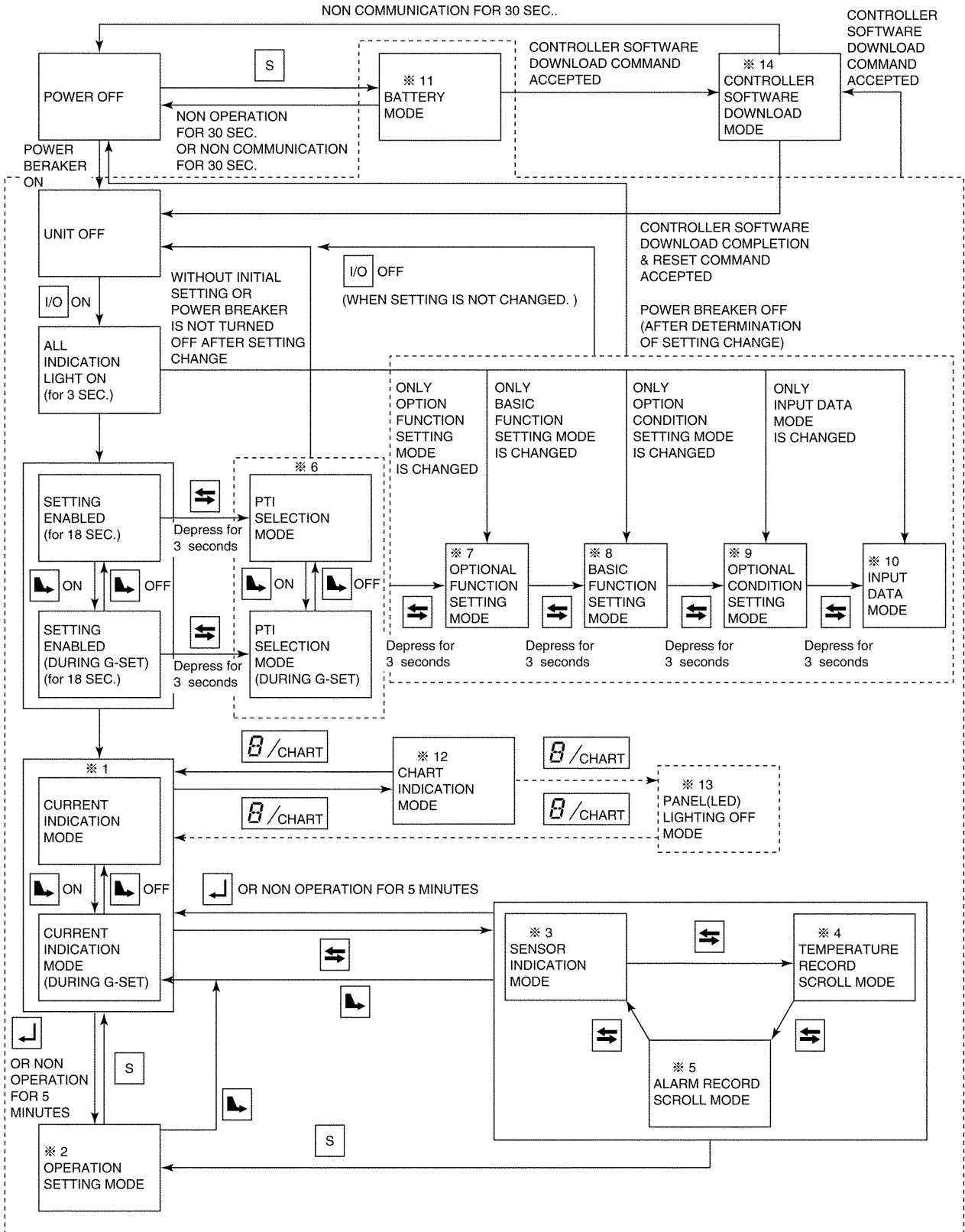
Before metering heating or defrost mode, the refrigerant in the refrigeration circuit is liquidized and pumped down in the water-cooled condenser (or receiver) by closing the liquid solenoid valve (LSV) and the modulating valve (MV). When the low pressure reaches -55kPa or lower, the pump down is terminated and it turns to the metering heating or defrost mode.

| No. | Function division | Function | DECOS IIIb |
|-----|--------------------------------------|--|----------------------|
| 5 | Self-diagnosis and Automatic back-up | <ul style="list-style-type: none"> • Open-phase running • Overcurrent running • CPU and Peripheral device (electronic controller) | |
| 6 | Manual inspection | <ul style="list-style-type: none"> • Compressor running hour indication • Evaporator fan motor operation (high speed) • Evaporator fan motor operation (low speed) • Condenser fan motor operation • Battery replacement date reset • Compressor horsepower setting indication • Elapse time since trip start/item resetting • Evaporator run-hour indication • Condenser run-hour indication • Controller software version indication • [PC]---Pulp temperature sensor/cargo temperature sensor calibration • [PC]---Header information set of data logger • [PC]---All sensor data indication • [PC]---Controller-internal relay output display/MV output (opening rate) indication/EV output (opening rate) indication • [PC]---Battery replacement date reset | Optional |
| 7 | Automatic PTI | <ul style="list-style-type: none"> • Automatic PTI (SHORT) = Operation check of components • Automatic PTI (FULL) | |
| 8 | Data logging | <ul style="list-style-type: none"> • Compressor total running hour • Evaporator fan motor total running hour • Condenser fan motor total running hour • Trip data • Pulp temperature data • Cargo temperature data • Alarm logging data • Automatic PTI data • Event data | Optional Optional |
| 9 | Data retrieving (Data output) | <ul style="list-style-type: none"> • [PC]---Alarm data • [PC]---Trip data • [PC]---Automatic PTI data • [PC]---Pulp temperature data • [PC]---Cargo temperature data • [PC]---Event data | Optional Optional |
| 10 | Communication | <ul style="list-style-type: none"> • Remote monitoring • Remote control | Optional Optional |
| 11 | Power buck-up | <p>* Even the power is off, the following works are possible.</p> <ul style="list-style-type: none"> • Setting : Temperature setting Humidity setting Defrosting interval setting [PC]---Container ID data setting • Battery back-up of the data logger record • Data retrieving and down loading | Optional |
| 12 | Chartless | <ul style="list-style-type: none"> • Alarm indication function (H code) • Operation history indication function (D code) • Pull-down time indication function (P code) • Temperature log scroll indication function • Alarm log scroll indication function | |
| 13 | G-SET mode | <p>* This is used when power supply allowance is small.</p> <ul style="list-style-type: none"> • Energy saving operation | |
| 14 | Chart indication | <ul style="list-style-type: none"> • Temperature logging data indication in graphic chart | |
| 15 | Data input | <p>* The following works are possible using the control panel.</p> <ul style="list-style-type: none"> • Container ID (No.) setting • Controller time setting | |

3.2 Operation procedure

3.2.1 Indication mode flow chart

[INDICATION FLOW CHART]



- ※1 **CURRENT INDICATION MODE**.....Supply air temp. (SS), return air temp. (RS), defrosting interval, currently existing alarms, and set point temperature/humidity are indicated.
- ※2 **OPERATION SETTING MODE**.....Control temperature, defrosting interval, and control humidity (optional) can be set.
- ※3 **SENSOR INDICATION MODE**.....The following sensor values are indicated. High pressure (HPT), low pressure (LPT), total current (CT1), compressor current (CT2), voltage (PT1), ambient temperature (AMBS), evaporator inlet temperature (EIS), evaporator outlet temperature (EOS), discharge gas temperature (DCHS), suction gas temperature (SGS), modulating valve opening, electronic expansion valve opening, supply air temperature (SS) (during PTI only), return air temperature (RS) (During PTI only), pulp temperature (USDA#1, USDA#2, USDA#3) (optional), cargo temperature (CTS) (optional), Data recorder supply sensor (DSS) (optional) and data recorder return sensor (DRS) (optional).
- ※4 **TEMPERATURE RECORD SCROLL MODE**.....Control sensor records are indicated successively (scrolled), beginning with the latest one.
- ※5 **ALARM RECORD SCROLL MODE**.....Alarm records are indicated successively (scrolled), beginning with the latest one.
- ※6 **PTI SELECTION MODE**.....Full PTI (F.PTI), Short PTI (S.PTI), manual check (M.CHECK) test modes can be selected.
- ※7 **OPTIONAL FUNCTION SETTING MODE**.....USDA sensor ON/OFF, dehumidification control ON/OFF, and cargo temperature sensor ON/OFF can be set.
- ※8 **BASIC FUNCTION SETTING MODE**.....Controller, logging interval, data recorder sensor ON/OFF, power input, horse power, panel (LED) lighting off function ON/OFF can be set.
- ※9 **OPTIONAL CONDITION SETTING MODE**.....D code, H code alarm indication, USDA sensor and conditions of alarms (H001, H002, H003, H004, H005, H006, d1--, d2--, d3--, d-1- and d-2-) can be set.
- ※10 **INPUT DATA MODE**.....Container I.D. (No.), and controller time can be input.
- ※11 **BATTERY MODE**.....This mode enables operation when power is not available.
- ※12 **CHART INDICATION MODE**.....Temperature record data can be indicated in graph on the LCD.
- ※13 **PANEL (LED) LIGHTING OFF MODE**.....Controller LED display panel can be turned the light off.
- ※14 **CONTROLLER SOFTWARE DOWNLOAD MODE**.....Data logged in a personal computer and a controller is exchangeable.

(NOTE) After changing the settings in modes *7, *8, *9, and *10, it is necessary to turn OFF the circuit breaker (CB) for the new setting to take effect.

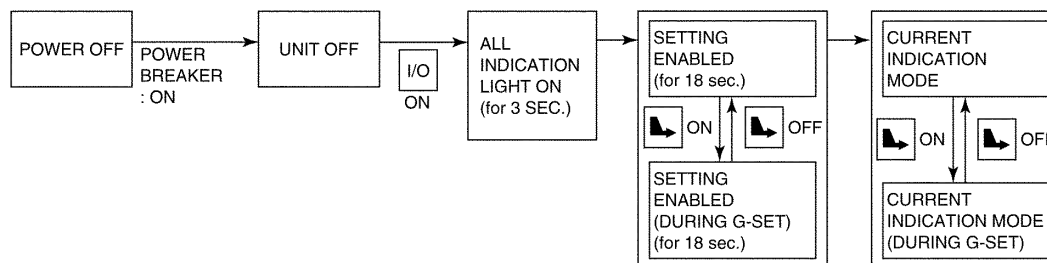
●The operation procedure for each mode is described in the following pages.

3.2.2 Mode operation procedure

1. CURRENT INDICATION MODE

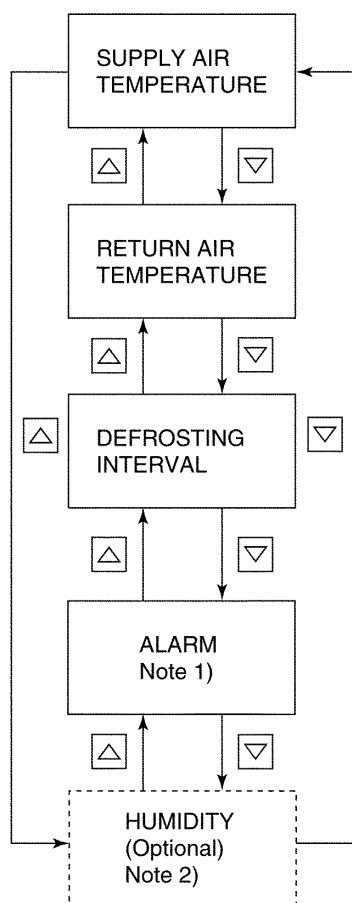
Supply air temperature (SS), Return air temperature (RS), Defrosting interval, Currently existing alarms, Set point humidity, and humidity are indicated.

<Mode selection procedure>



<Operation procedure>

Whenever the or key is pressed, the indication changes.



SUPPLY (red LED) : Light on
LED : Supply air temperature is indicated.
LCD : Set point temperature is indicated.

RETURN (red LED) : Light on
LED : Return air temperature is indicated.
LCD : Set point temperature is indicated.

In the CHILLED mode : SUPPLY (red LED) lights on.
 In the PARTIAL FROZEN, FROZEN modes :
RETURN (red LED) lights on.
LED : Supply air temperature in the Chilled mode, Return air temperature in the Partial frozen and Frozen modes are indicated.
LCD : Current defrosting interval setting is indicated.

ALARM (red LED) : Light on
LED : All the currently existing alarms are indicated in sequence.
LCD : The total number of currently existing alarms is indicated.

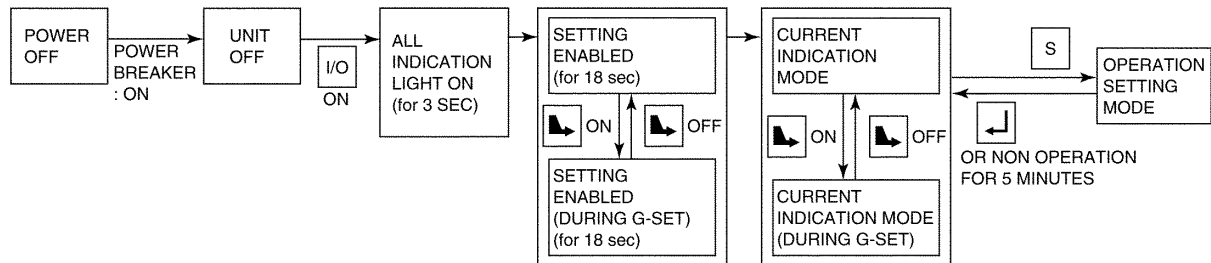
R. H. (red LED) : Light on
LED : The value of humidity sensor is indicated.
LCD : Set point humidity is indicated.

- Note 1) ① ALARM indication steps to the next item after indicating all currently existing alarm in sequence. If there are no existing alarms, "Good" is displayed on the LED.
 ② To erase the D code or H code alarm, depress the key for 3 seconds while the alarm is indicated. At this time, only the currently indicated alarm is erased on the LED, and the number of alarms on the LED is reduced.
- Note 2) The value of humidity sensor is indicated only when the "Dehumidification Control on/off Setting" is set to be "ON", according to the Optional Function Setting Operation.

2. OPERATION SETTING MODE

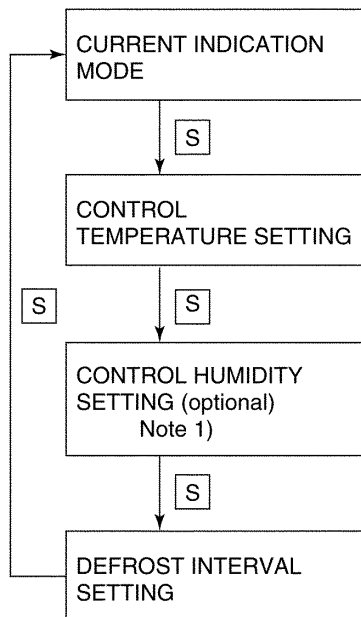
Control temperature, defrost interval, and control humidity (optional) are indicated.

<Mode selection procedure>



<Operation procedure>

Whenever the **[S]** key is pressed, the indication changes.



LED : The current set point temperature is indicated.

LCD : "SET-SPC" or "SET-SPF" is indicated.

Change the set point temperature using the **[▲]** or **[▼]** key. Press the **[↵]** key to determine the setting.

LED : The current set point humidity is indicated.

LCD : "SET-SHU" is indicated.

Change the set point temperature, using the **[▲]** or **[▼]** key. Press the **[↵]** key to determine the setting.

Note 1) Only when the humidity control is set, this indication appears.

LED : The current defrost interval is indicated.

LCD : "SET-dEF" is indicated.

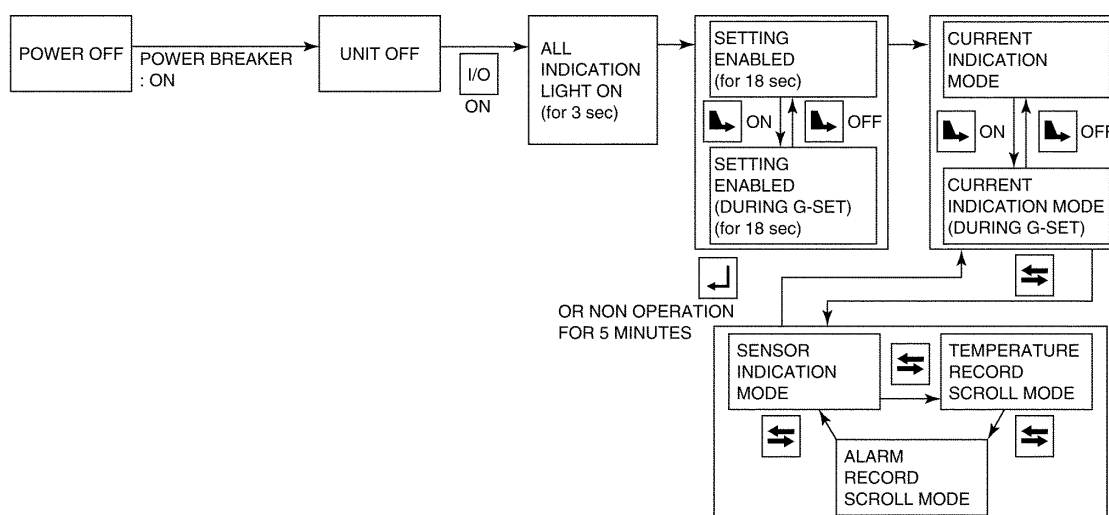
Select a defrost interval 24h, 12h, 9h, 6h or 3h using the **[▲]** or **[▼]** key. Press the **[↵]** key to determine the setting.

3. SENSOR INDICATION MODE

The following sensor values, the modulating valve (MV) opening, and the electronic evaporating valve (EV) opening can be checked.

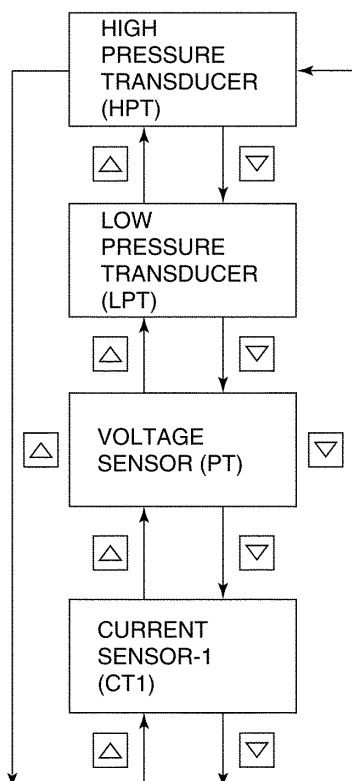
High pressure (HPT), Low pressure (LPT), Voltage (PT1), Total current (CT1), Compressor running current (CT2), Ambient temperature (AMBS), Evaporator inlet temperature (EIS), Evaporator outlet temperature (EOS), Discharge gas temperature (DCHS), Suction gas temperature (SGS), Modulating valve opening, Electronic expansion valve opening, Supply air temperature (SS) (during PTI only), Return air temperature (RS) (during PTI only), Pulp temperature (USDA#1, USDA#2, USDA#3), Cargo temperature (CTS), Supply air temperature of data recorder (dSS) (optional), Return air temperature of data recorder (dRS) (optional)

<Mode selection procedure>



<Operation procedure>

Whenever the or key is pressed, the indication changes.



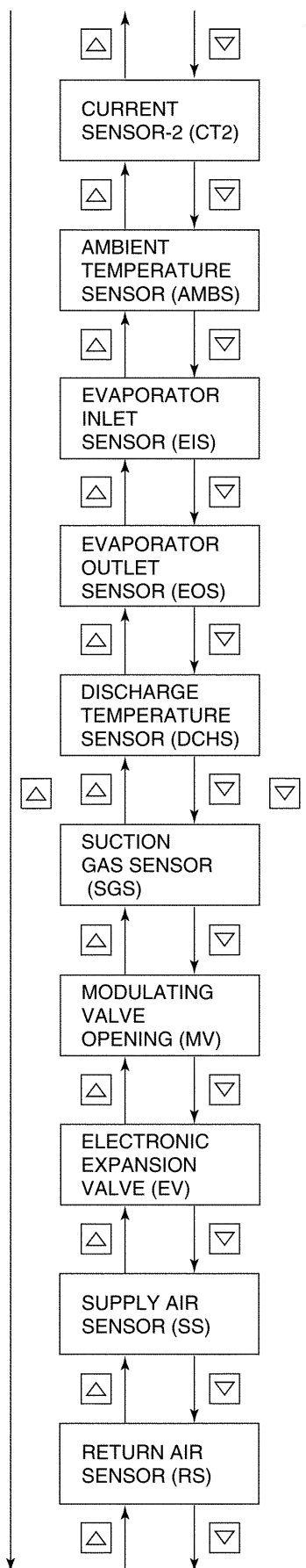
LED : The control temperature is indicated.
 LCD : The value of high pressure transducer is indicated.
 The display indicates "HPT ".
 (Unit is Kpa.)

LED : The control temperature is indicated.
 LCD : The value of low pressure transducer is indicated.
 The display indicates "LPT ".
 (Unit is Kpa.)

LED : The control temperature is indicated.
 LCD : The value of voltage is indicated.
 The display indicates "□ PT V".
 (Unit is V.)

LED : The control temperature is indicated.
 LCD : The value of total running current is indicated.
 The display indicates "□ CT A".
 (Unit is A.)

3. SENSOR INDICATION MODE continued



LED : The control temperature is indicated.
 LCD : The compressor running current is indicated.
 The display indicates "CT A".
 (Unit is A.)

LED : The control temperature is indicated.
 LCD : The ambient temperature is indicated.
 The display indicates "Ab C".
 (Unit is °C or °F.)

LED : The control temperature is indicated.
 LCD : The evaporator inlet temperature is indicated.
 The display indicates "EI C".
 (Unit is °C or °F.)

LED : The control temperature is indicated.
 LCD : The evaporator outlet temperature is indicated.
 The display indicates "EO C".
 (Unit is °C or °F.)

LED : The control temperature is indicated.
 LCD : The discharge gas temperature is indicated.
 The display indicates "dC C".
 (Unit is °C or °F.)

LED : The control temperature is indicated.
 LCD : The suction gas temperature is indicated.
 The display indicates "SG C".
 (Unit is °C or °F.)

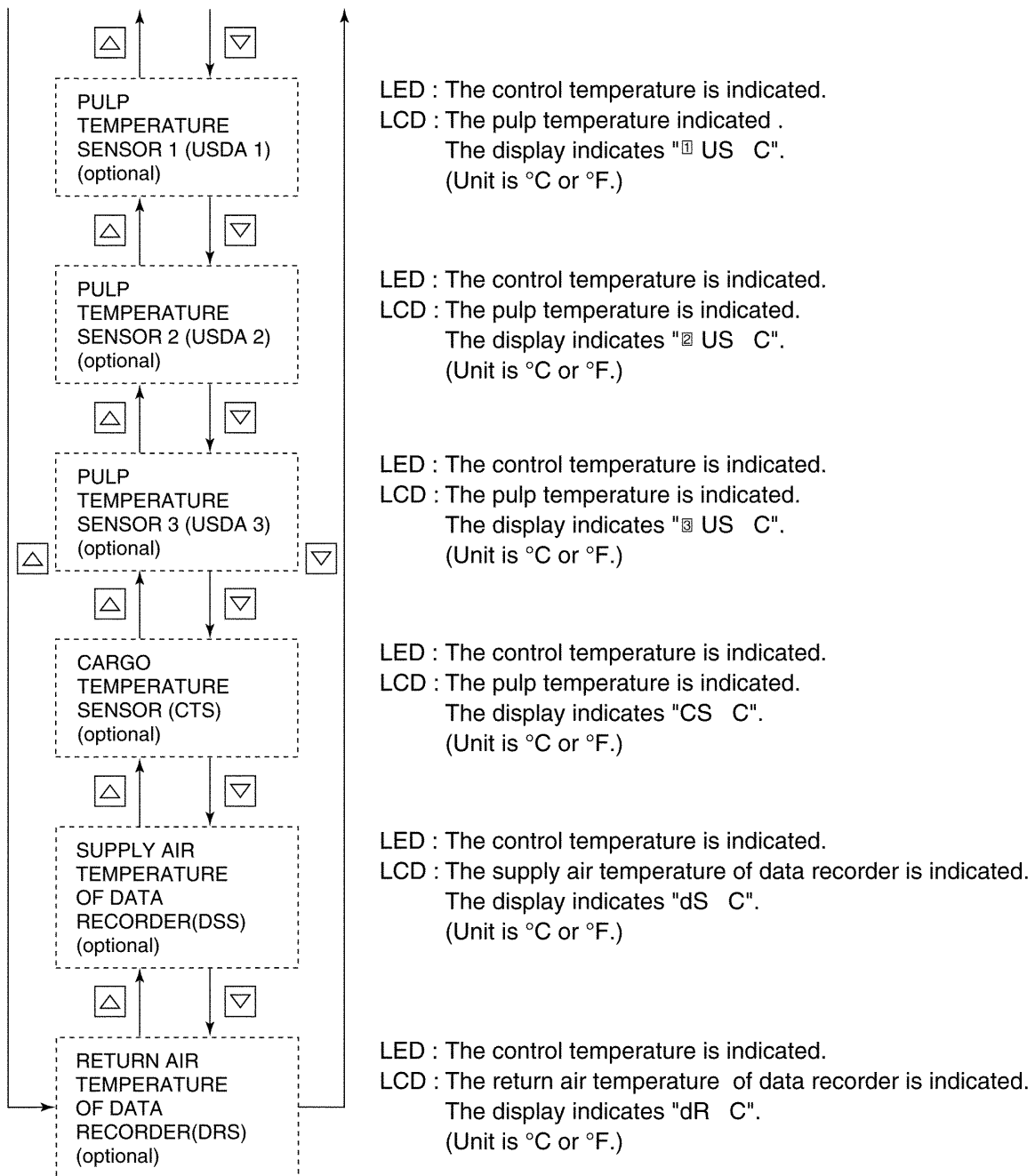
LED : The control temperature is indicated.
 LCD : The 3-way modulating valve opening is indicated.
 The display indicates "MV %".
 (Unit is % : 0%~100%)

LED : The control temperature is indicated.
 LCD : The electronic expansion valve opening is indicated.
 The display indicates "EV pulse".
 (Unit is Pulse. : 0pulse~2000pulse)

(During PTI only)
 LED : The PTI selection and the step No. are indicated.
 LCD : The supply air temperature is indicated.
 The display indicates "SS C".
 (Unit is °C or °F.)

(During PTI only)
 LED : The PTI selection and the step No. are indicated.
 LCD : The return air temperature is indicated.
 The display indicates "RS C".
 (Unit is °C or °F.)

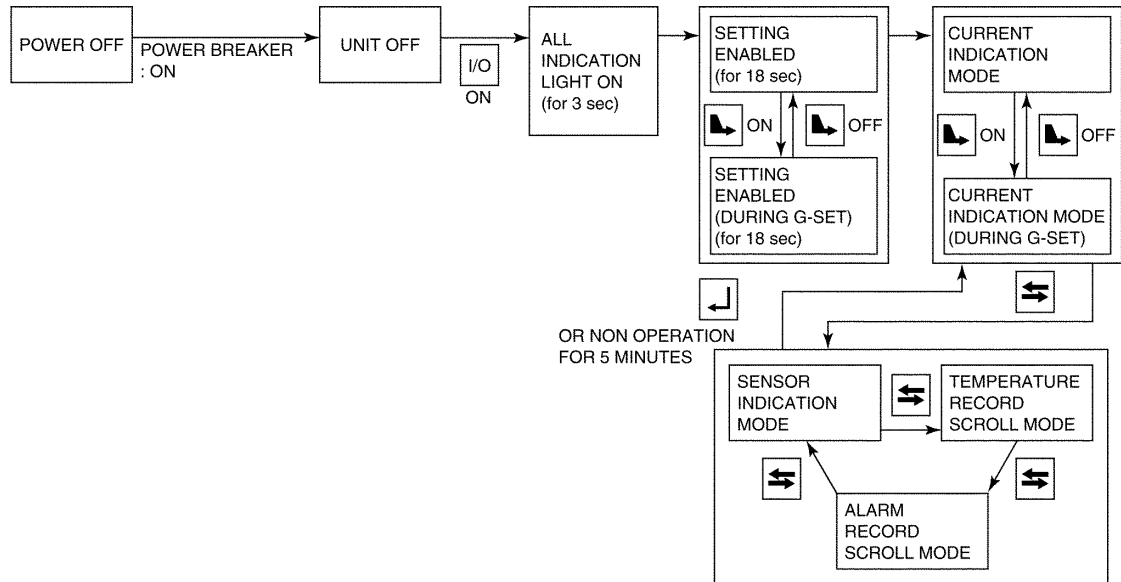
3. SENSOR INDICATION MODE continued



4. TEMPERATURE RECORD SCROLL MODE

The control sensor value record is indicated in sequence (scroll) beginning from the latest data. The latest control temperature for a maximum of 7 days is displayed.

<Mode selection procedure>



<Operation procedure>

The LED indicates the control temperature, and the LCD indicates the date/time and the non-control temperature in turn. (In the partial frozen and frozen modes, return air temperature is the controlled temperature, and in the chilled mode, supply air temperature is the controlled temperature.)

To hold the successive indication, press the or key. To advance successively the indication, press the or key during the holding of indication, or do not press any key for 10 seconds. To see data beginning with start again, depress the key for 3 seconds.

To restore the current indication mode, press the key.

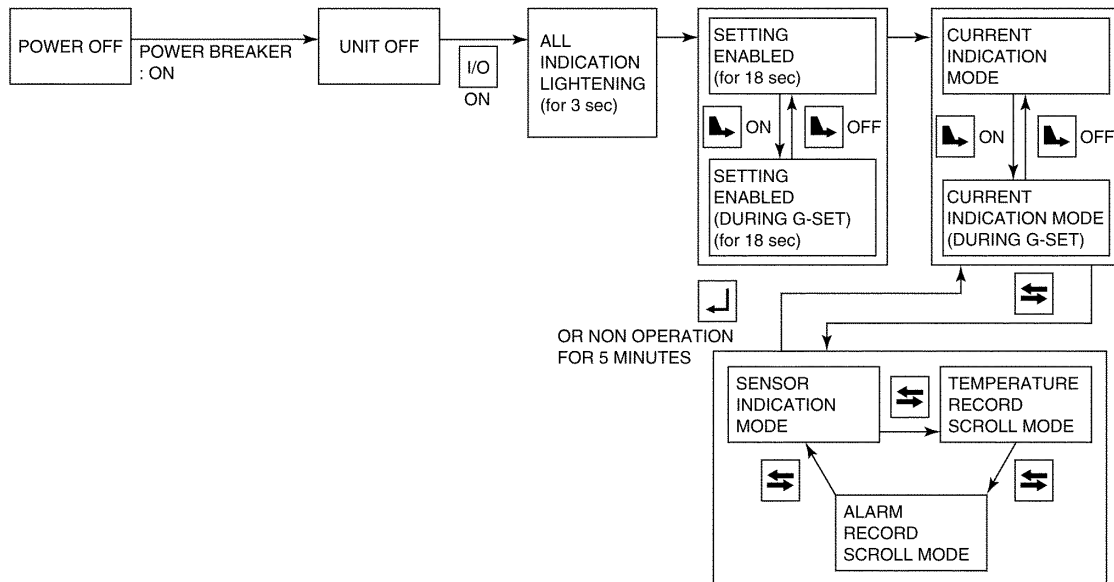
If key operation is not performed within 5 minutes, the current indication mode is resumed. If the successive (scroll) screen appears at present, the current indication mode is resumed when 5 minutes elapses after indication ends automatically.

To return to the operation setting mode, press the key.

5. ALARM RECORD SCROLL MODE

The alarm record is indicated in sequence (scroll) beginning from the latest data. The previous alarm codes for a maximum of 7 days are displayed.

<Mode selection procedure>



<Operation procedure>

The LED indicates alarm codes and the LCD indicates date and time.

To hold the successive indication, press the or key. To advance successively the indication, press the or key during the holding of indication, or do not press any key for 10 seconds. To see data beginning with start again, depress the key for 3 seconds.

To restore the current indication mode screen, press the key.

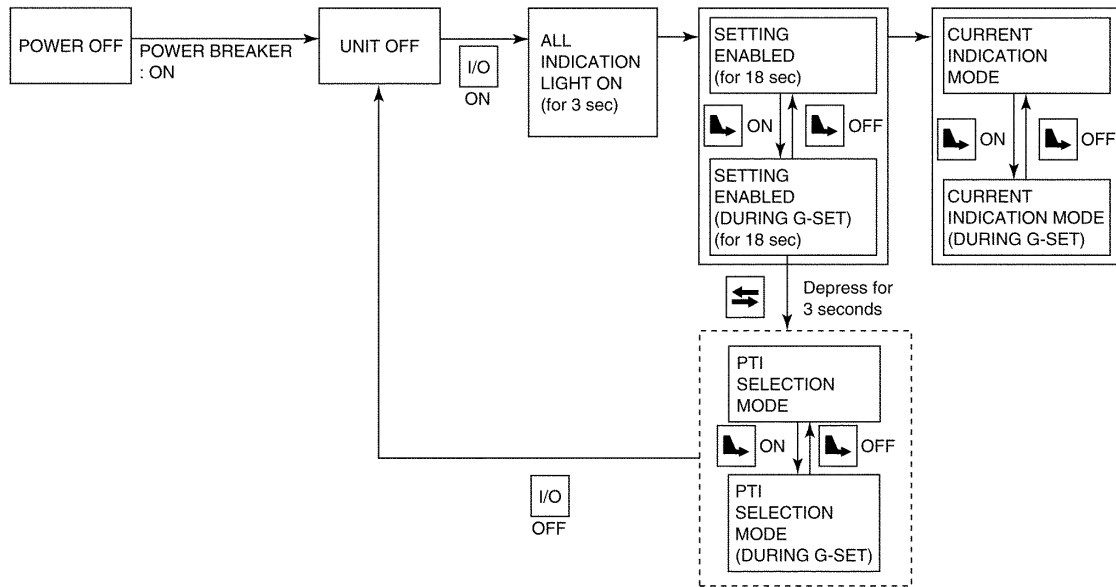
If key operation is not performed within 5 minutes, the current indication mode screen is resumed. If the successive (scroll) screen is currently indicated, the current indication mode screen is resumed automatically when 5 minutes elapses after indication ends.

To return to the operation setting mode, press the key.

6. PTI SELECTION MODE

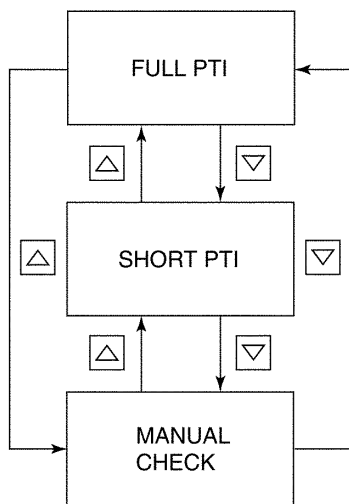
The FULL PTI (F. PTI), SHORT PTI (S. PTI), and MANUAL CHECK (M. CHECK) are selected.

<Mode selection procedure>



<Operation procedure>

Whenever the or key is pressed, the indication changes.



To start FULL PTI, press the key while "F. PTI" is displayed on the LCD.

To start SHORT PTI, press the key while "S. PTI" is displayed on the LCD.

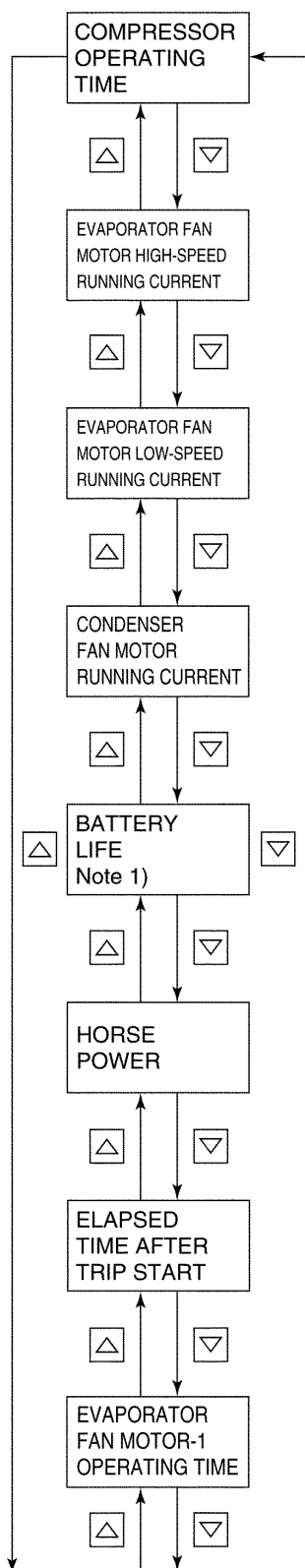
When the key is pressed while "M-CHECK" is displayed on the LCD, the manual check selection mode is set.

● The detail of the manual check selection mode is described in the following pages.

6-1. MANUAL CHECK SELECTION MODE

The LED indicates the values of following items.

Compressor operating time, Evaporator fan motor high-speed running current, Evaporator fan motor low-speed running current, Condenser fan motor running current, Battery life, Horse power, Elapsed time after trip start, Evaporator fan motor running time, Condenser fan motor running time, and Controller software version



To indicate the compressor operating time:

Press the key while the LCD indicates "CCX10H".

The operating time is the value indicated on the LEDX10 hours.

To indicate the current value of evaporator fan motor high-speed operation :

Press the key while the LCD indicates "EFH A", then the LED indicates the current value. (Unit : Ampere)

To indicate the current value of evaporator fan motor low-speed operation:

Press the key while the LCD indicates "EFL A", then the LED indicates the current value. (Unit : Ampere)

To indicate the current value of condenser fan motor running current :

Press the key while the LCD indicates "CF A", then the LED indicates the current value. (Unit : Ampere)

To indicate lithium battery service life (year and month) :

Press the key while the LCD indicates "b-CH".

When the battery life limit is reached, "E801" appears.

While the LCD indicates "E801" after the battery replacement, depress the key switch for 3 seconds, then the next battery replacement data is indicated.

Note 1) This indication is used when the lithium battery is used.

To check compressor horse power setting :

Press the key while the LCD indicates "HP".

"5HP" or "10HP" on the LED is the compressor horse power setting on the controller.

To indicate the elapsed time after trip start:

Press the key while the LCD indicates "TS H", then the LED indicates the elapsed time. (Unit : Hours).

When the key is depressed for 3 seconds while the elapsed time is indicated, the TRIP START is set, and the elapsed time display is reset to "0" (hour).

To indicate the evaporator fan motor-1 operating time:

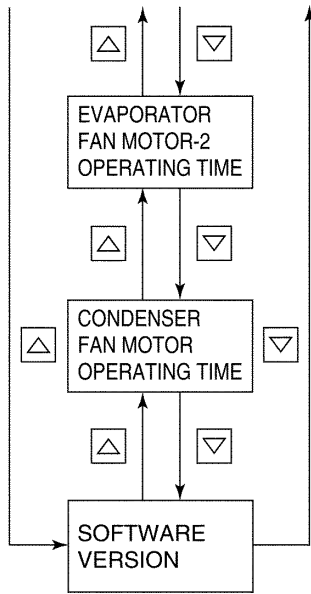
Press the key while the LCD indicates "EF1X10H".

The operating time is the value indicated on the LEDX10H hours.

When the key is depressed for 3 seconds while the evaporator fan motor-1 operation time is indicated, the evaporator fan motor-1 operation time is reset to "0" (hour)

("EF1" is the right hand side fan motor seeing from the inside of the container.)

6-1. MANUAL CHECK SELECTION MODE continued



To indicate the evaporator fan motor-2 operating time:
 Press key while the LCD indicates "EF2×10H".
 The operating time is the value indicated on the LED×10H hours.
 If the key is depressed for 3 seconds while the evaporator fan motor-2 operating time is indicated, the evaporator fan motor-2 operating time display is reset to "0" (hour).
 "EF2" is the left hand side fan motor seeing from the inside of the container.)

To indicate the condenser fan motor operating time:
 Press the key while LCD indicates "CF×10H".
 The operating time is the value indicated on the LED×10 hours.
 If the key is depressed for 3 seconds while the condenser fan motor operating time is indicated, the condenser fan motor operating time display is reset to "0" (hour).

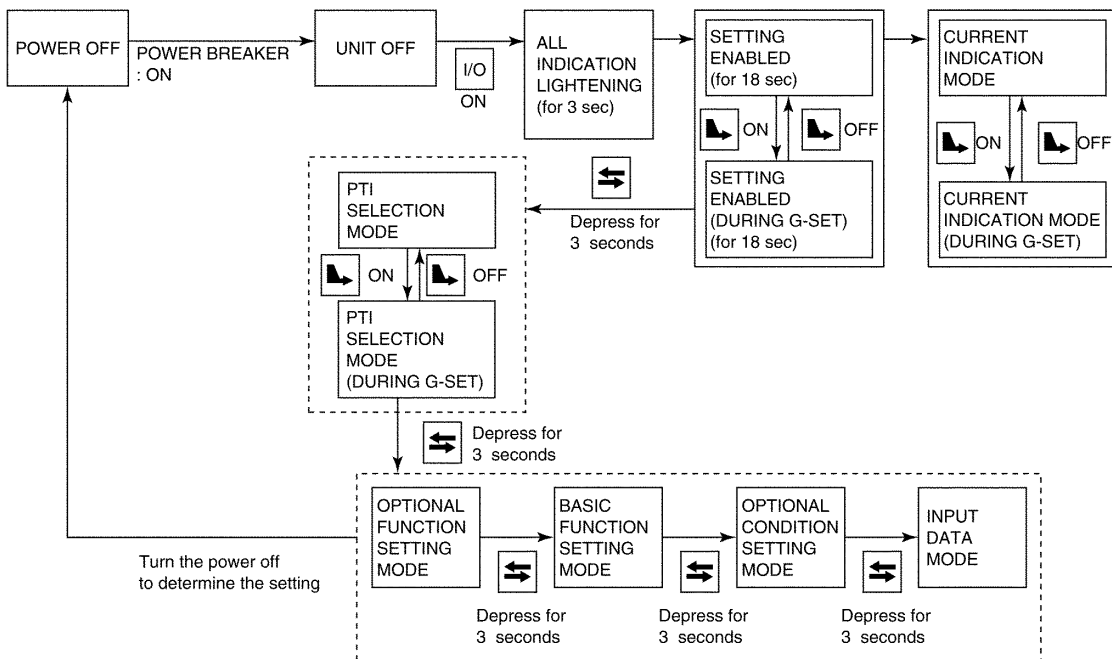
To indicate the software version:
 Press the key while the LCD indicates "SOFTVER".
 The value on the LED is the software version.

7. OPTIONAL FUNCTION SETTING MODE

The following items can be set:

USDA sensor on/off, dehumidification control on/off and cargo temperature sensor on/off.

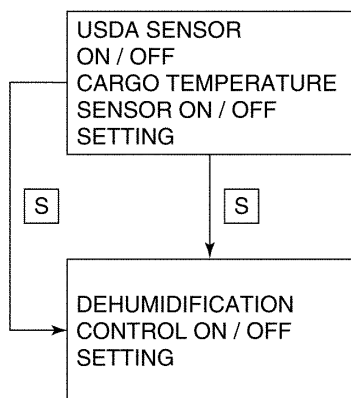
<Mode selection procedure>



<Operation procedure>

Whenever the [S] key is pressed, the indication changes.

Turn the power breaker OFF to determine the setting.



To set the USDA ON/OFF:

Select "OFF" (not in use), "3" (3 USDA probes are in use), or "4" (4 USDA probes are in use) on the LED while the LCD indicates "USdA". Whenever the [▲] or [▼] key is pressed, the indication changes. Press the [↵] key to determine the setting.

NOTE: When two USDA probes are connected, the setting will be set automatically to "3 (3 USDA probes are in use)".

To set the DEHUMIDIFICATION CONTROL ON/OFF:

Select "ON" (in use) or "OFF" (not in use) on the LED while the LCD indicates "dHU".

Whenever the [▲] or [▼] key is pressed, the indication changes. Press the [↵] key to determine the setting.

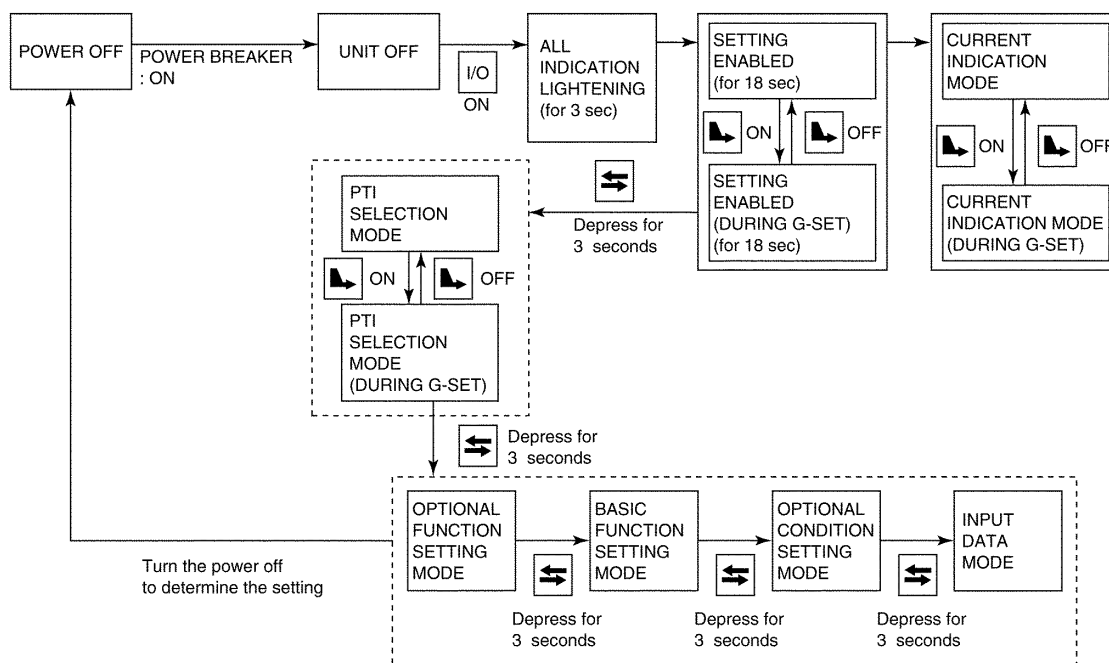
If the circuit breaker (CB) is not turned OFF, the new setting will not be recognized.

8. BASIC FUNCTION SETTING MODE


The following items can be set:

Controller setting (DECOS-] a/DECOS-] b), logging interval, data recorder sensor on/off, input power, horse power, indication (LED) light on/off

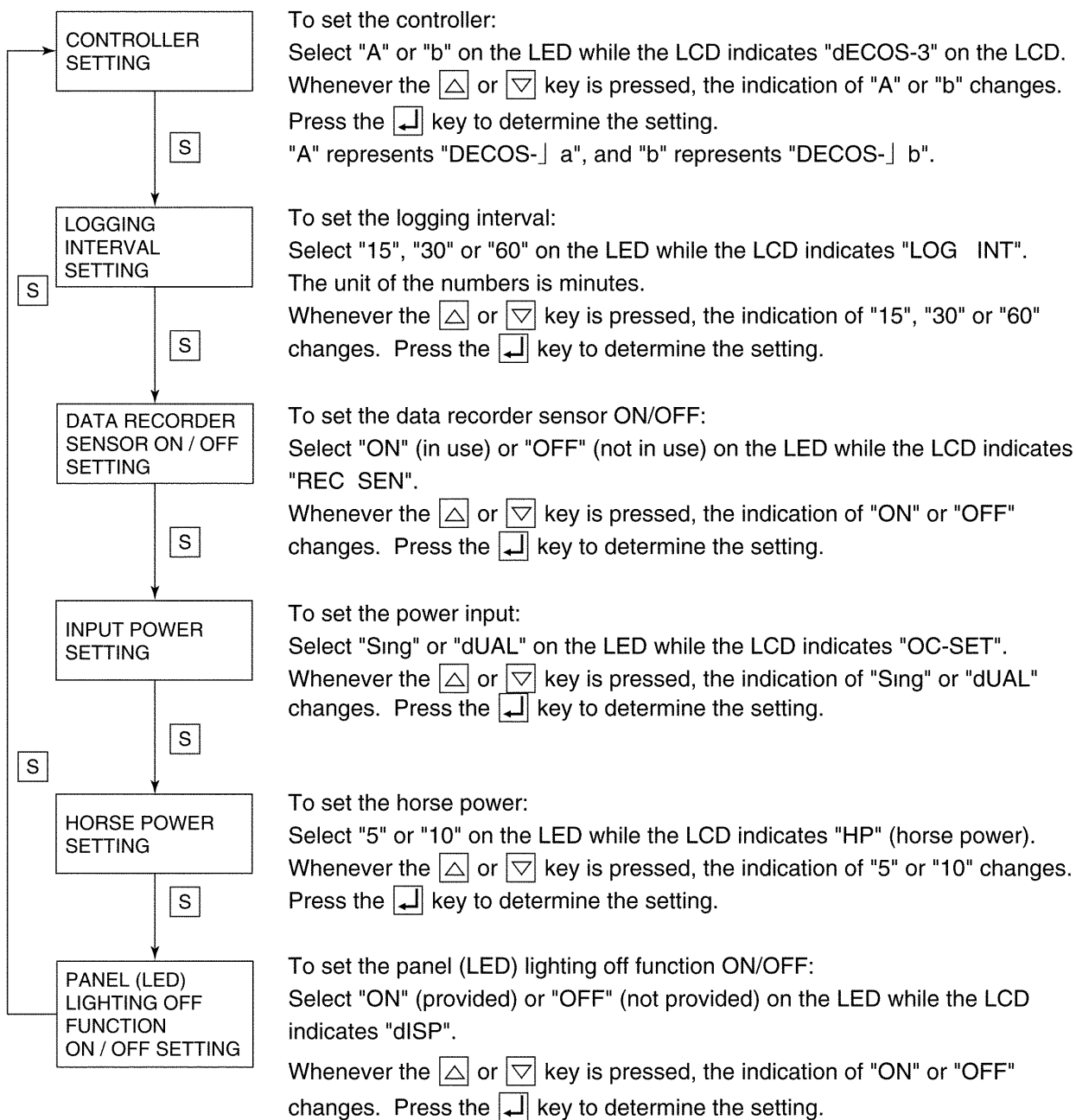
<Mode selection procedure>





<Operation procedure>

Whenever the  key is pressed, the indication changes.

Turn the power breaker OFF to determine the setting.



Note : When the  key is pressed twice while the panel (LED) lighting off function is ON, the LED panel is turned light off.

However, even if the  key is pressed twice while the panel (LED) lighting-off function is OFF, the LED panel is not lit on.

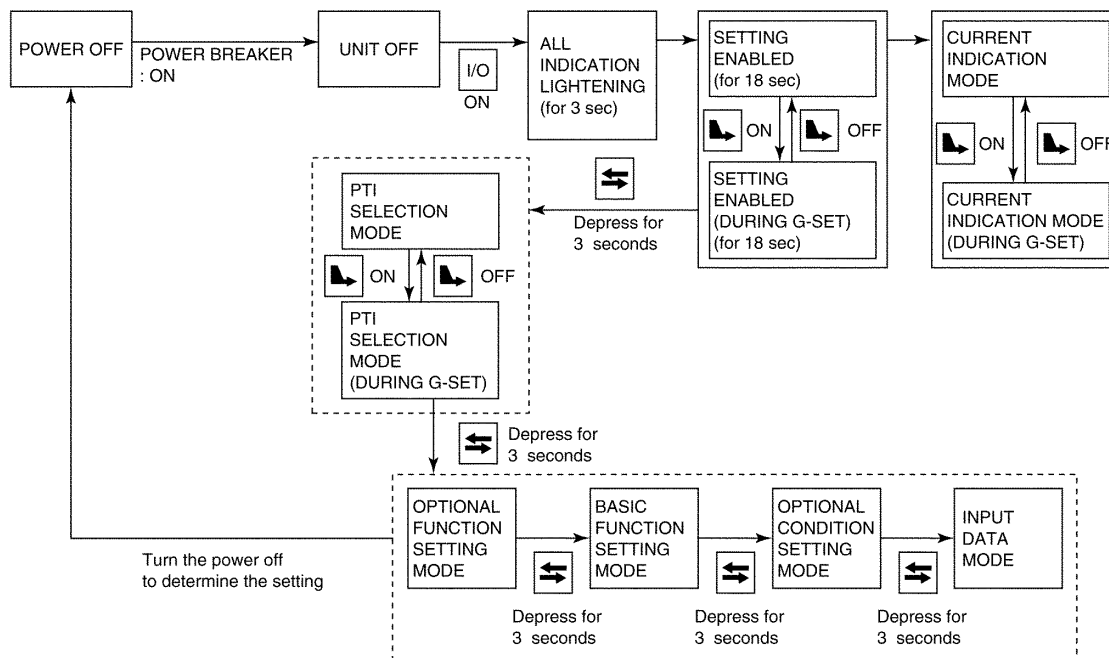
See the description of PANEL (LED) LIGHTING-OFF MODE for details. If the circuit breaker (CB) is not turned OFF, the new setting will not be recognized.

9. OPTIONAL CONDITION SETTING MODE

D code / H code alarm indication, USDA sensor, H code and D code can be set.

The numerical values on the underline are set on the factory and can be changed according to the following procedures.

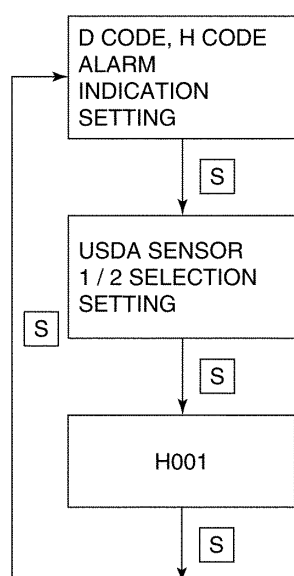
<Mode selection procedure>



<Operation procedure>

Whenever the **[S]** key is pressed, the indication changes.

Turn the power breaker OFF to determine the setting.



To set D code and H code alarms indication:

Select "ON"(indication of D/H codes) or "OFF"(no indication of D/H codes) on the LED while the LCD indicates "CHARTLS".

Whenever the **[△]** or **[▽]** key is pressed, the indication of "ON" or "OFF" changes. Press the **[↵]** key to determine the setting.

To set the USDA sensor selection:

Select "1" or "2" on the LED while the LCD indicates "USdA1/2".

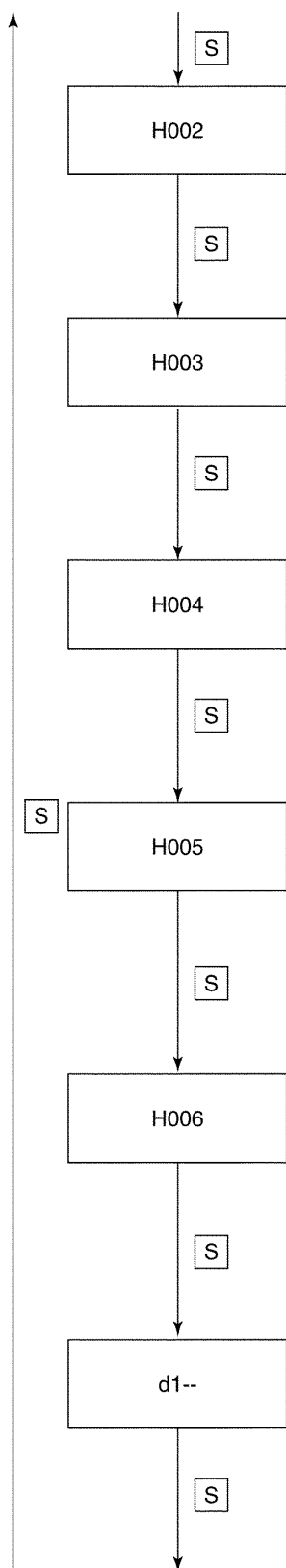
Whenever the **[△]** or **[▽]** key is pressed, the indication of "1" or "2" changes. Press the **[↵]** key to determine the setting.

H001 alarm is displayed when the control temperature does not lower by 3°C or more during pull-down operation.

Select "1"°C, "2"°C, "3"°C, "4"°C, "5"°C or "10"°C on the LED while the LCD indicates "H001".

Whenever the **[△]** or **[▽]** key is pressed, the indication of the selection from "1"°C to "10"°C changes. Press the **[↵]** key to determine the setting.

9. OPTIONAL CONDITION SETTING MODE continued



H002 alarm is displayed when the integrated time of Out-of-In-Range reaches 2 hours.

Select "1"hour, "2"hours, "3"hours, "4"hours, "5"hours or "10"hours on the LED while the LCD indicates "H002".

Whenever the \triangle or ∇ key is pressed, the indication of the selection from "1"hour to "10"hours changes. Press the \downarrow key to determine the setting.

H003 alarm is displayed when the integrated time of state "below SP - 1°C" reaches 2 hours.

Select "1"hour, "2"hours, "3"hours, "4"hours, "5"hours or "10"hours on the LED while the LCD indicates "H003".

Whenever the \triangle or ∇ key is pressed, the indication of the selection from "1"hour to "10"hours changes. Press the \downarrow key to determine the setting.

H004 alarm is displayed when the integrated time of state "below SP - 2°C" reaches one hours.

Select "1"hour, "2"hours, "3"hours, "4"hours, "5"hours or "10"hours on the LED while the LCD indicates "H004".

Whenever the \triangle or ∇ key is pressed, the indication of the selection from "1"hour to "10"hours changes. Press the \downarrow key to determine the setting.

H005 alarm is displayed when the controlled temperature is Out-of-In-Range, and defrosting was performed successively three times while the controlled temperature does not return to In-Range.

Select "1"time, "2"times, "3"times, "4"times, "5"times or "10"times on the LED while the LCD indicates "H005".

Whenever the \triangle or ∇ key is pressed, the indication of the selection from "1" time to "10" times changes. Press the \downarrow key to determine the setting.

H006 alarm is displayed when the integrated time of difference 2°C or more between control sensor data and record sensor data reaches one hour or more.

Select "1"hour, "2"hours, "3"hours, "4"hours, "5"hours or "10"hours on the LED while the LCD indicates "H006".

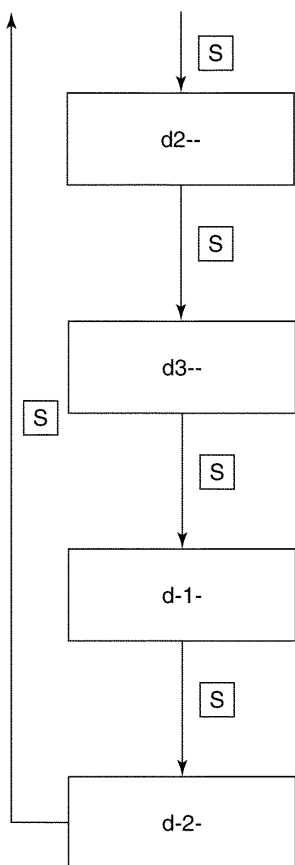
Whenever the \triangle or ∇ key is pressed, the indication of the selection from "1"hour to "10"hours changes. Press the \downarrow key to determine the setting.

d1-- message is displayed to indicate the total number of times of the state that the integrated time of state "above SP + 1°C " reaches one hour.

Select "1"hour, "2"hours, "3"hours, "4"hours, "5"hours or "10"hours on the LED while the LCD indicates "d1--".

Whenever the \triangle or ∇ key is pressed, the indication of the selection from "1"hour to "10"hours changes. Press the \downarrow key to determine the setting.

9. OPTIONAL CONDITION SETTING MODE continued



d2-- message is displayed to indicate the total number of times of the state that the integrated time of state "above SP +2°C" reaches one hour. Select "1"hour, "2"hours, "3"hours, "4"hours, "5"hours or "10"hours on the LED while the LCD indicates "d2--".

Whenever the or key is pressed, the indication of the selection from "1"hour to "10"hours changes. Press the key to determine the setting.

d3-- message is displayed to indicate the total number of times of the state that the integrated time of state "above SP + 3°C" reaches one hour. Select "1"hour, "2"hours, "3"hours, "4"hours, "5"hours or "10"hours on the LED while the LCD indicates "d3--".

Whenever the or key is pressed, the indication of the selection from "1"hour to "10"hours changes. Press the key to determine the setting.

d-1- message is displayed to indicate the total number of times of the state that the integrated time of state "below SP -1°C" reaches one hour. Select "1"hour, "2"hours, "3"hours, "4"hours, "5"hours or "10"hours on the LED while the LCD indicates "d-1-".

Whenever the or key is pressed, the indication of the selection from "1"hour to "10"hours changes. Press the key to determine the setting.

d-2- message is displayed to indicate the total number of times of the state that the integrated time of state "below SP -2°C" reaches one hour. Select "1"hour, "2"hours, "3"hours, "4"hours, "5"hours or "10"hours on the LED while the LCD indicates "d-2-".

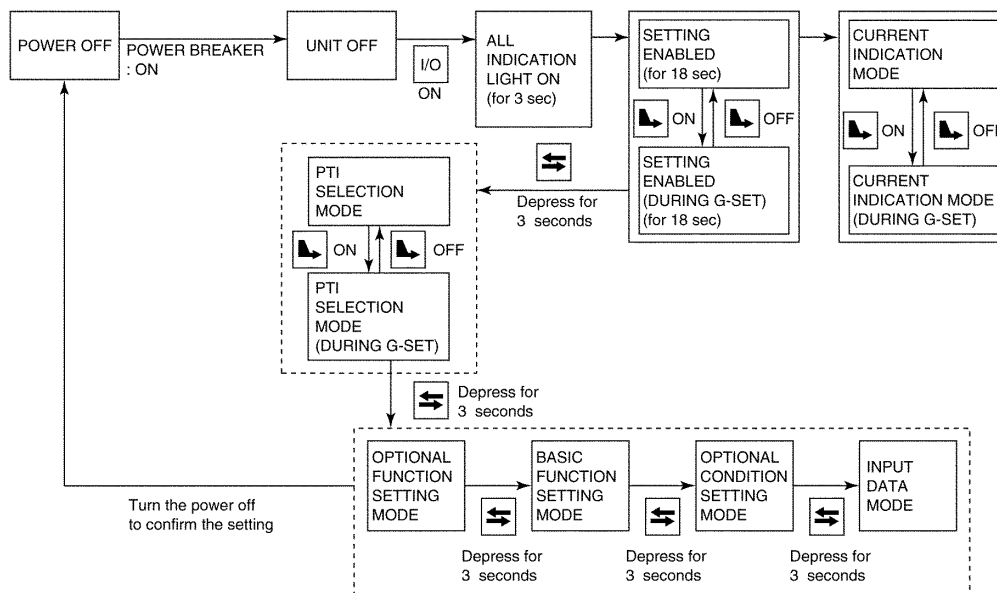
Whenever the or key is pressed, the indication of the selection from "1"hour to "10"hours changes. Press the key to determine the setting. If the circuit breaker (CB) is not turned OFF, the new setting will not be recognized.

10.INPUT DATA MODE

The following items can be set.

Container I.D.(Number) and controller time

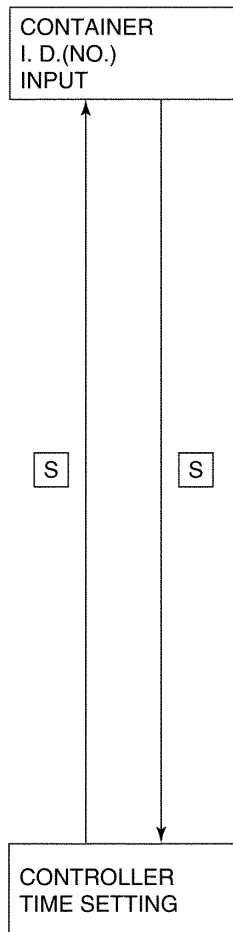
<Mode selection procedure>



<Operation procedure>

Whenever the **S** key is pressed, the indication changes.

Turn OFF the power breaker to confirm the setting.



To input the container I.D.(No.) :

Press the **↵** key while the LCD indicates "SET I.d", then the LED indicates "i.d.-C" or "i.d.-n".

Change the indication of "i.d.-C"(Shipping company name in alphabet) and "i.d.-n"(numeric numbers) using the **△** or **▽** key.

To input the shipping company name :

Press the **↵** key while the LED indicates "i.d.-C", then the leftmost LCD panel box flashes. Select the alphabet to be input using the **△** or **▽** key, and press the **↵** key, then the next panel box flashes. Carry on the same procedure until the 4 alphabets are input, then press the **↵** key to confirm the input. Once confirmed, the input alphabets are lit on from flashing.

To input the numbers (numeral) :

Press the **↵** key while the LED indicates "i.d.-n", then the leftmost LCD panel box flashes. Select the number to be input using the **△** or **▽** key, and press the **↵** key, then the next panel box flashes.

Carry on the same procedure until the 7 numbers are input, then press the **↵** key to confirm the input.

Once confirmed, the input numbers are lit on from flashing.

To set the controller time :

Press the **↵** key while the LCD indicates "SET TIME", then the LCD indicates "YEAR" and the LED indicates the year currently set. Change the setting year using the **△** or **▽** key, then press the **↵** key to confirm the setting.

Then, the LCD indicates "MONTH" and the LED indicates the month currently set. Change the setting month using the **△** or **▽** key, then press the **↵** key to confirm the setting.

Set day, time and minute by the same procedure.

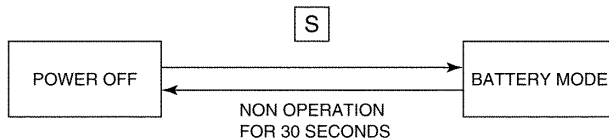
The LCD indicates "dAY", "HOuR" and "MINUTE" for the day, hour and minute setting respectively.

If the circuit breaker (CB) is not turned OFF, the new setting will not be recognized.

11. BATTERY MODE

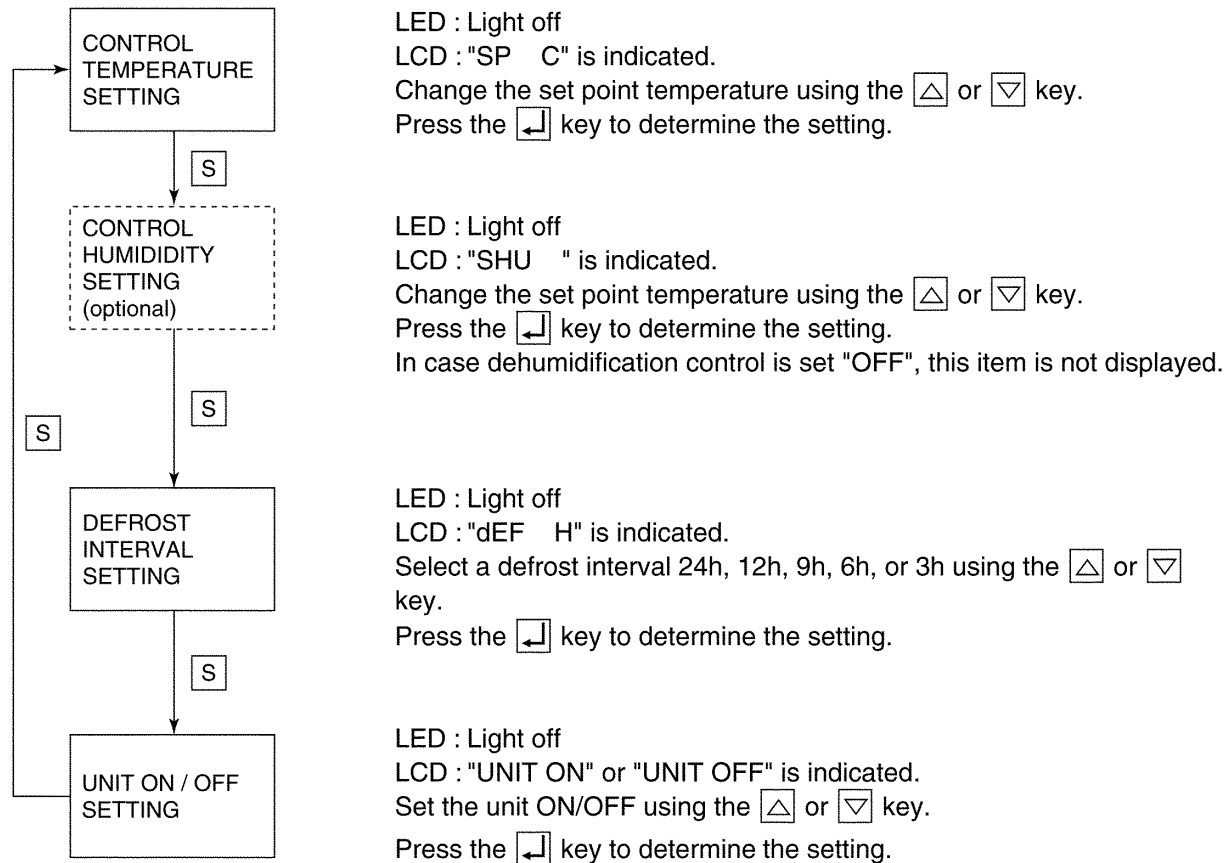
When commercial power is not available, Control temperature / Humidity and Defrosting interval, Unit ON/OFF can be controlled using the built-in wake-up battery.

<Mode selection procedure>



<Operation procedure>

Whenever the **S** key is pressed, the indication changes.

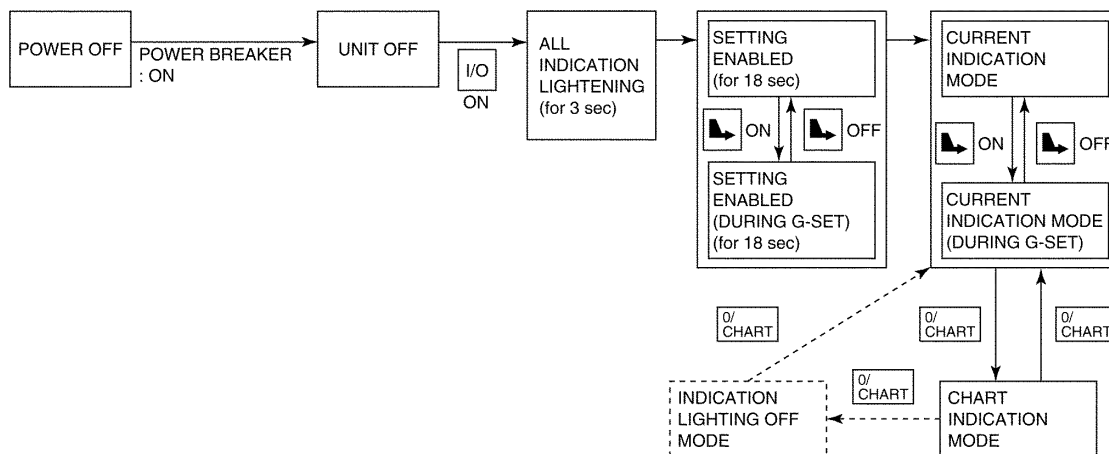


- When no key operation is performed for 30 seconds in the battery mode, the power is automatically turned off.

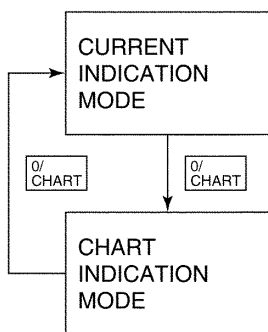
12.CHART INDICATION MODE


The temperature record data are indicated in graphic chart on the LCD.

<Mode selection procedure>



<Operation procedure>






To change to the chart indication mode, press the  key while the unit is in the current indication mode.

In the chart indication mode, the LCD indicates a graphic chart.

The axis of ordinates shows temperature base, the axis of abscissas shows time base.

The No. indicated on the left hand side of the time base is the same as the No. on the left hand side of the LCD, which indicates the graphic chart is of 12 hours log or 6 days log indication.

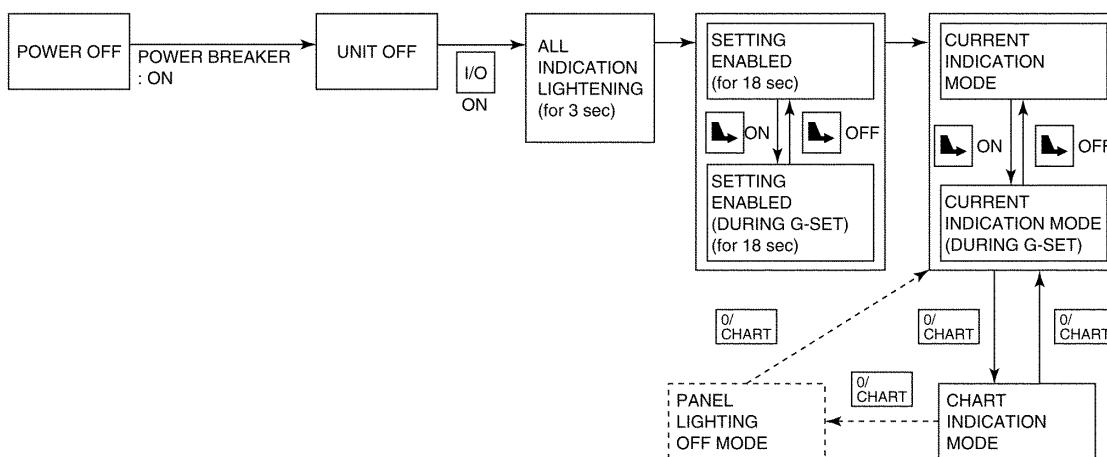
Select the base to be uses using the  or  key.

When the  key is pressed, the unit goes back to the current indication mode.

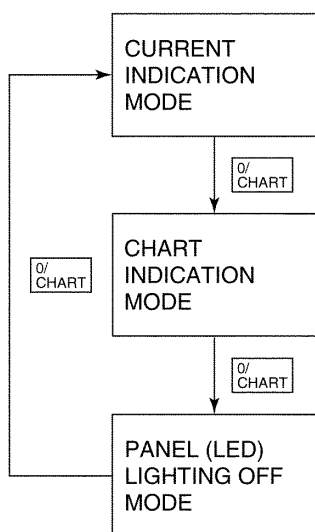
13. PANEL (LED) LIGHTING-OFF MODE

The controller LED display is turned light off in this mode.

<Mode selection procedure>



<Operation procedure>



To change to the chart indication mode, press the key while the unit is in the current indication mode.

To change to the panel lighting off mode, press the key while the unit is in the chart indication mode.

While this mode is on, the controller LED display is turned light off, and the LCD indicates "DISPOFF".

To change to the current indication mode (to light on LED display), press the key.

NOTE : If the LED display is not turned off by pressing the key twice, set "ON" the "PANEL (LED) LIGHTING OFF FUNCTION ON/OFF SETTING" in section 8, the Basic Function Setting Operation Mode.

● For setting procedure, see section 8, the Basic Function Setting Operation Mode.

14. CONTROLLER SOFTWARE DOWNLOAD MODE




The data on a personal computer and a controller are interchanged in this mode.

For details, see the Operation Manual For Personal computer software.




Downloading is possible, even in "11. BATTERY MODE".

3.2.3. Other operations


G-SET operation

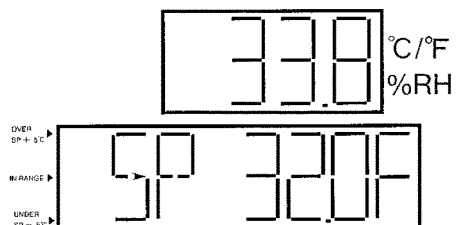
- ① Press the G-SET key.
 - ② Select "11", "12", "13", "14" or "15" (KVA) indicated on the LED by the  key or the  key, and press the  key to determine the setting, then the energy saving operation starts so that the power consumption is saved to be the selected value (KVA) or lower.
- * If "OFF" is selected during the energy saving operation, the energy saving operation is canceled.
- * If the power supply is turned off in the G-SET mode, the mode is canceled.

Manual defrosting operation

- ① Press the MANUAL DEFROST key
 - ② Select "ON" indicated on the LED by the  key or the  key, and press the  key to determine the setting, then the defrosting operation starts.
- * Once defrosting operation starts, the operation mode is not changeable until the defrosting operation completes. If this key is pressed during the defrosting operation, it is ineffective.

°C/°F conversion operation

- ① Indicate the temperature data required to be convert into "°F" on the LED or the LCD.
 - ② Press the  key, then the temperature data indicated in "°C" is converted into "°F" for one minute.
- * If any other keys is pressed during the "°F" indication, the indication is switched to "°C".



3.3 Operation pattern and operation of each equipment

● Operation pattern

| Output | Mode | Sensor | | -10 -9 -8 -7 -6 -5 -4 -3 -2 -1 SP 1 2 3 4 5 6 7 8 9 10 (°C) | | | | | | | | | | | | | | | | |
|---|---------------------------------|--------|------------------------|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|
| | | Normal | Abnormal | | | | | | | | | | | | | | | | | |
| Liquid solenoid valve (LSV), Compressor (CC) | Chilled | SS | / | OFF (dashed line) until -1°C, ON (solid line) from 1°C to 10°C | | | | | | | | | | | | | | | | |
| | | RS | / | OFF (dashed line) until -1°C, ON (solid line) from 1°C to 10°C | | | | | | | | | | | | | | | | |
| | Partial frozen | RS | / | OFF (dashed line) until -1°C, ON (solid line) from 1°C to 10°C | | | | | | | | | | | | | | | | |
| | | SS | / | OFF (dashed line) until -1°C, ON (solid line) from 1°C to 10°C | | | | | | | | | | | | | | | | |
| | Frozen | RS | / | OFF (dashed line) until -1°C, OFF (dashed line) from -1°C to 1°C, ON (solid line) from 1°C to 10°C | | | | | | | | | | | | | | | | |
| | | SS | / | OFF (dashed line) until -1°C, ON (solid line) from 1°C to 10°C | | | | | | | | | | | | | | | | |
| In-range lamp (IRS) | Chilled | SS | / | OFF (dashed line) until -1°C, ON (solid line) from 1°C to 3°C, OFF (dashed line) from 3°C to 10°C | | | | | | | | | | | | | | | | |
| | | RS | / | OFF (dashed line) until -1°C, ON (solid line) from 1°C to 3°C, OFF (dashed line) from 3°C to 10°C | | | | | | | | | | | | | | | | |
| | Partial frozen | RS | / | OFF (dashed line) until -1°C, ON (solid line) from 1°C to 3°C, OFF (dashed line) from 3°C to 10°C | | | | | | | | | | | | | | | | |
| | | SS | / | OFF (dashed line) until -1°C, ON (solid line) from 1°C to 3°C, OFF (dashed line) from 3°C to 10°C | | | | | | | | | | | | | | | | |
| | Frozen | RS | / | OFF (dashed line) until -1°C, ON (solid line) from 1°C to 3°C, OFF (dashed line) from 3°C to 10°C | | | | | | | | | | | | | | | | |
| | | SS | / | OFF (dashed line) until -1°C, ON (solid line) from 1°C to 3°C, OFF (dashed line) from 3°C to 10°C | | | | | | | | | | | | | | | | |
| Modulating valve (MV) ※Fully closed during frozen mode | Chilled | SS | / | Fully closed until -1°C, PID from -1°C to 1°C, Fully closed from 1°C to 10°C | | | | | | | | | | | | | | | | |
| | | RS | / | Fully closed until -1°C, PID from -1°C to 1°C, Fully closed from 1°C to 10°C | | | | | | | | | | | | | | | | |
| | Partial frozen | RS | / | Fully closed until -1°C, PID from -1°C to 1°C, Fully closed from 1°C to 10°C | | | | | | | | | | | | | | | | |
| | | SS | / | Fully closed until -1°C, PID from -1°C to 1°C, Fully closed from 1°C to 10°C | | | | | | | | | | | | | | | | |
| | Chilled | RS | / | Fully closed until -1°C, PID from -1°C to 1°C, Fully closed from 1°C to 10°C | | | | | | | | | | | | | | | | |
| | | SS | / | Fully closed until -1°C, PID from -1°C to 1°C, Fully closed from 1°C to 10°C | | | | | | | | | | | | | | | | |
| Defrosting enable conditions | Chilled, Partial frozen, Frozen | EOS | / | Enable (solid line) until 20°C, Inhibit (dashed line) from 20°C to 10°C | | | | | | | | | | | | | | | | |
| | | | Without back-up sensor | Fully enable (solid line) from -10°C to 10°C | | | | | | | | | | | | | | | | |
| Evaporator fan (EFH, L) | Frozen | / | / | Only EFL (solid line) from -10°C to 10°C | | | | | | | | | | | | | | | | |
| | Chilled Partial frozen | / | / | Only EFH (solid line) from -10°C to 10°C | | | | | | | | | | | | | | | | |

| Output | Mode | Sensor | | -10 -9 -8 -7 -6 -5 -4 -3 -2 -1 SP 1 2 3 4 5 6 7 8 9 10 (°C) | | | | | | | | | | | | | | | | |
|------------------------|---|--------|------------------------|---|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|
| | | Normal | Abnormal | | | | | | | | | | | | | | | | | |
| Mode switching | | | | | | | | | | | | | | | | | | | | |
| Hot gas solenoid valve | Chilled (During dehumidification control) | Hus | | OFF While the in range ramp is OFF | | | | | | | | | | | | | | | | |
| | | | Without back-up sensor | ON While the in range ramp is ON | | | | | | | | | | | | | | | | |

● Operation of each equipment

| Name of component | | | Frozen mode setting temperature temperature —10.1°C or lower | | Chilled mode setting temperature —2.9°C or higher Partial frozen mode setting temperature —3.0 to —10.0°C | | | | | | | Defrost |
|----------------------------|------------------------------|-----|---|----------------|--|--------------------|--------------|---------------------|------------------|--------------------------|-------------|---------|
| | | | Thermostat ON | Thermostat OFF | Pull-down | Modulating control | Full heat up | Overcool protection | Metering heating | Dehumidification control | | |
| Magnetic contactor | Compressor | CC | ○ | × | ○ | ○ | ○ | ○ | × | ○ | ○ | ○ |
| | Condenser fan | CF | △ | × | △ | △ | △ | △ | × | △ | △ | △ |
| | Evaporator fan (High) | EFH | × | × | ○ | ○ | ○ | ○ | ○ | ○ | ○ | × |
| | Evaporator fan (Low) | EFL | ○ | ○ | × | × | × | × | × | × | × | × |
| Solenoid valve | Liquid solenoid valve | LSV | ○ | × | ○ | ○ | ○ | ○ | × | × | ○ | × |
| | Solenoid valve for injection | ISV | △ | × | △ | △ | × | × | × | △ | △ | △ |
| | Hot-gas 3-way solenoid valve | HSV | × | × | × | × | × | × | × | ○ | △ | ○ |
| Modulating valve | | MV | 0% | 0% | 0% | 0.1~99.9% | 100% | 0% | 100% or 47% | 0.1~99.9% or 47% | 100% or 47% | |
| Electronic expansion valve | | EV | 300~2000 pulse | 300~2000 pulse | 500~2000 pulse | 500~2000 pulse | 500 pulse | 500 pulse | 500 pulse | 500~2000 pulse | 500 pulse | |

○ : Energized × : De-energized △ : Depending on the control

3.4 Alarm display and back-up function

3.4.1 Alarm list

| Alarm grouping | Alarm code | Alarm content | Action with alarm | |
|------------------------------------|------------------------------------|---|--|------------------------|
| Permanent stop | F101 | High-pressure switch cuts out within 30 seconds after operation start or protection device actuation. | Unit stops | |
| | F109 | Low-pressure cutouts within 2 seconds after operation start. | Unit stops | |
| | F301 | Temperature setting required | Unit stops | |
| | F401 | Return/supply air sensor malfunction (at chilled mode) | Unit stops | |
| | F403 | Return/supply air sensor malfunction (at partial frozen mode) | Unit stops | |
| | F603 | Modulating valve does not fully open contrary to the designation | Unit stops | |
| | F701 | Abnormal high voltage | Unit stops | |
| | F705 | S phase is single phase. | Unit stops | |
| | F803 | Any of the following alarm actuates 5 times E101, E103, E105, E107, E203, E707 | Unit stops | |
| Display alone or restartable alarm | Protector activation | E101 | High pressure switch cuts out. | Restart after 3-minute |
| | | E103 | Actuation of compressor thermal protector or electronic OC | Restart after 3-minute |
| | | E105 | Actuation of micro processor OC protector | Restart after 3-minute |
| | | E107 | High compressor discharge gas temperature exceeds over 130°C. | Restart after 3-minute |
| | | E109 | Low pressure switch cuts out (low pressure drops to -72kPa or lower for over 5 minutes.) | Restart after 3-minute |
| | Control error | E201 | Long pump down time (pump-down is not finished within 120 seconds.) | Back-up operation |
| | | E203 | Overcool protection activates in the chilled or partial frozen mode. (Control temperature drops to the set point -3°C or lower for 2 minutes.) | Restart after 3-minute |
| | | E207 | Long defrosting. (Defrosting is not finished within 90 minutes.) | Only alarm display |
| | Printed-circuit board alarm | E303 | Humidity setting required (SRAM failure/CPU board) | Only alarm display |
| | | E305 | Defrost timer setting required (SRAM failure/CPU board) | Only alarm display |
| | | E307 | Calendar setting required (SRAM failure/CPU board) | Only alarm display |
| | | E311 | Trip-start setting required (SRAM failure/CPU board) | Only alarm display |
| | | E315 | PT/CT board replace requirement (PT/CT board failure) | Restart after 3-minute |
| | Sensor alarm | E401 | Supply air temperature sensor (SS) malfunction | Back-up operation |
| | | E402 | Data recorder supply air temperature sensor (DSS) malfunction | Only alarm display |
| | | E403 | Return air temperature sensor (RS) malfunction | Back-up operation |
| | | E404 | Data recorder return air temperature sensor (DRS) malfunction | Only alarm display |
| | | E405 | Discharge air temperature sensor (DCHS) malfunction | Only alarm display |
| | | E406 | Suction gas temperature sensor (SGS) malfunction | Back-up operation |
| | | E407 | Evaporator inlet temperature sensor (EIS) malfunction | Back-up operation |
| | | E409 | Evaporator outlet sensor (EOS) malfunction | Back-up operation |
| | | E411 | Ambient sensor (AMBS) malfunction | Only alarm display |
| | | E413 | Low-pressure transducer (LPT) malfunction | Back-up operation |
| | | E415 | High-pressure transducer (HPT) malfunction | Back-up operation |
| | | E417 | Voltage transducer (PT1) malfunction | Only alarm display |
| | | E419 | Voltage transducer (PT2) malfunction | Only alarm display |
| | | E421 | Current transducer (CT1) malfunction | Only alarm display |
| | | E423 | Current transducer (CT2) malfunction | Restart after 3-minute |
| | Electrically functional part alarm | E425 | Pulp temperature sensor (USDA1) malfunction | Only alarm display |
| | | E427 | Pulp temperature sensor (USDA2) malfunction | Only alarm display |
| | | E429 | Pulp temperature sensor (USDA3) malfunction | Only alarm display |
| | | E431 | Humidity sensor (HuS) malfunction | Only alarm display |
| | | E603 | Modulating valve malfunction (wiring cut or output malfunction) | Back-up operation |
| E607 | | Manual defrosting switch contact malfunction | Only alarm display | |
| Power alarm | | E707 | Momentary power loss | Restart after 3-minute |
| Other alarms | E801 | Backup battery replace requirement | Only alarm display | |

3.4.2 Alarm code list during PTI (Pre-Trip Inspection)

The alarms during automatic PTI are concerned with PTI inspection items in addition to those during normal operation.

The alarms caused by automatic PTI are indicated in J ※ ※ ※, being discriminated from those during normal operation.

Though there are alarms which are not displayed on the controller panel, they can be checked referring to the PTI report.

| Check No. (LED display) | Check content | Alarm indication (LED display) | Alarm content | S.PTI | F.PTI | Remarks |
|----------------------------|--|-----------------------------------|--|--------|--------|---------|
| P00 | Basic data | No indication | Basic-data vanishment | ↑ ↓ | ↑ ↓ | |
| P02 | All sensor | Same as normal operation | Basic-data vanishment | | | |
| P04 | Power | No indication | Basic-data vanishment | | | |
| P05 | Starting | J051 | Compressor malfunction | | | |
| P06 | HPS | J061 | Abnormal OFF point | | | |
| | | J062 | Not return (closed) | | | |
| | | J063 | Abnormal ON point | | | |
| | | J064 | High pressure does not rise. | | | |
| | | J065 | High pressure does not drop. | | | |
| P08 | Pump-down | J081 | Long pump-down | | | |
| P10 | Liquid solenoid valve | J101 | Valve leakage | | | |
| P12 | RS, SS accuracy | J121 | Sensor deterioration | | | |
| P14 | HPT, LPT accuracy | J141 | Sensor deterioration | | | |
| P16 | Evaporator fan motor | J161 | Evaporator fan motor malfunction | | | |
| P26 | Operation | No indication | Judged with P28 | | | |
| P28 | Evaporator fan reverse-turning direction | J281 | Abnormal evaporator fan miswiring | | | |
| P29 | Electronic expansion valve | J291 | Long pump-down | | | |
| P30 | Injection solenoid valve | J301 | Injection solenoid valve malfunction | | | |
| P32 | Hot-gas 3-way solenoid valve | J321 | Hot-gas 3-way solenoid valve malfunction | | | |
| P50 | Pull-down cooling capacity | J501 | Out of ambient temperature conditions | | | |
| P50 | 0°C control | J502 | Long pull-down time | | | |
| P60 | 0°C control | No indication | | | | |
| P70 | Pull-down cooling capacity | J701 | Long pull-down time | | | |
| P80 | -18°C control | No indication | | | | |
| P90 | Defrosting | J901 | Out of starting conditions | | | |
| | Basic-data | J902 | Long defrosting time | | | |

3.4.3 Back-up function cope with sensor abnormality

C : Chilling, PF : Partial Frozen, F : Frozen, DF : Defrosting, Meter : Metering heating

| Sensor malfunctions | | Mode | Back-up content | |
|--------------------------------------|------|----------------------|--|--|
| | | | Item | Control content |
| Return air sensor | RS | PF | Normal control | Controlled at SS+2.0°C. When SS is failure, the controller shuts off all outputs. |
| | | F | Compressor running | Controlled at SS+5.0°C. |
| | | | Evaporator fan speed change over | Fixed at the low-speed operation. |
| | | | In-range lamp | Not lit. |
| | C/DF | Continuous operation | | |
| Supply air sensor | SS | C | Normal control | Controlled at RS-2.0°C. When RS is failure, the controller shuts off all output. |
| | | PF/F DF | Continuous operation | |
| Ambient temperature sensor | AMBS | All modes | Continuous operation | |
| Discharge gas temperature sensor | DCHS | All modes | Injection | Not executed. |
| | | | Malfunction protection | Not executed. |
| Evaporator outlet temperature sensor | EOS | C/PF, F | Refer to the "Back-up for sensor abnormality (EIS, EOS, EGS)" on the following page. | |
| | | DF | Permission to start defrosting | Always asking permission |
| | | | Defrosting termination | 90 minutes timer count-up or when EIS reaches to 90°C or higher. |
| High-pressure transducer | HPT | DF Meter | Refrigerant charge (Charge when injection solenoid valve open (ON).) | Charging is performed by the timer depending on the preceding defrosting time. |
| | | | Refrigerant release (Release at 47% opening of modulating valve) | Not executed. |
| Low-pressure transducer | LPT | DF | Defrosting termination | Termination by 90 minutes timer count up |
| High-pressure switch | HPS | All modes | High pressure abnormal judgment | Unit stops at HPT>2300kPa. When HPT malfunctions, unit stops. |
| Water pressure switch | WPS | All modes | Continuous operation | |
| Compressor motor thermal protector | CTP | All modes | Continuous operation | |

※Combinations of sensor alarms which cause operation stop

- ① SS & RS
- ② HPS & HPT

●Back-up for sensor abnormality (EIS, EOS, SGS) at frozen mode (super heat control)

| No. | Evaporator inlet sensor (EIS) | Evaporator outlet sensor (EOS) | Suction gas sensor (SGS) | Back-up operation |
|-----|-------------------------------|--------------------------------|--------------------------|---|
| 1 | Normal | Normal | Normal | Super heat control |
| 2 | Normal | Normal | Abnormal | Super heat control |
| 3 | Normal | Abnormal | Normal | Liquid refrigerant back prevention to compressor by EIS and SGS |
| 4 | Normal | Abnormal | Abnormal | Expansion valve fixed opening rate control |
| 5 | Abnormal | Normal | Normal | Liquid refrigerant prevention to compressor by EOS and SGS |
| 6 | Abnormal | Normal | Abnormal | Expansion valve fixed opening rate control |
| 7 | Abnormal | Abnormal | Normal | Expansion valve fixed opening rate control |
| 8 | Abnormal | Abnormal | Abnormal | Fixed expansion valve opening rate control |

3.5 Data logging

The data logging function is to store various data which occur during transportation.

There are seven kinds of logging data.

| | Data name | Logging data |
|---|-----------------------|---|
| 1 | ID data | <ul style="list-style-type: none"> • Container No. • Departure port • Set point temperature • Set point ventilation • Set point humidity • Comment • Loading date • Load • Transit place • Final destination • Navigation No. |
| 2 | Trip data | <ul style="list-style-type: none"> • Operation mode • Supply air sensor (SS) • Return air sensor (RS) • Humidity inside the container (optional) • Data recorder sensor temperature (DSS/DRS) (optional) • Ambient temperature (AMBS) ※Changeable logging intervals are 15, 30 and 60 minutes. • Set point temperature • Set point humidity (optional) |
| 3 | Alarm | <ul style="list-style-type: none"> • Alarm output date/time • Alarm code |
| 4 | PTI data | <ul style="list-style-type: none"> • SHORT PTI • FULL PTI |
| 5 | USDA (optional) | <ul style="list-style-type: none"> • Pulp temperature sensor (USDA#1~#3) • Date/time |
| 6 | Event | <ul style="list-style-type: none"> • Power switch ON/OFF • H code • D code • Unit ON/OFF • Date/time • G-SET ON/OFF |
| 7 | USDA & CTS (optional) | <ul style="list-style-type: none"> • Pulp temperature sensor (USDA#1~#3) and cargo sensor temperature • Date/time |

Logged data are retrieved with the aid of personal computer software.

Refer to the Operation Manual for Personal Computer Software for detail.

3.6 Battery

The electronic controller (DECOS III b) is designed so that set point temperature, defrosting interval and other data can be set using the built-in wake-up battery when commercial power is not available. (Refer to section 3.2, 11.)

3.6.1 Specifications of battery

Type : Alkaline battery

Model : 6LR61 or equivalent

3.6.2 Battery replacement date

At normal transportation : Replace a battery when the temperature setting is not processed at the BATTERY MODE (Refer to section 3.2.2, 11. BATTERY MODE).

The life of battery is approximately one year.

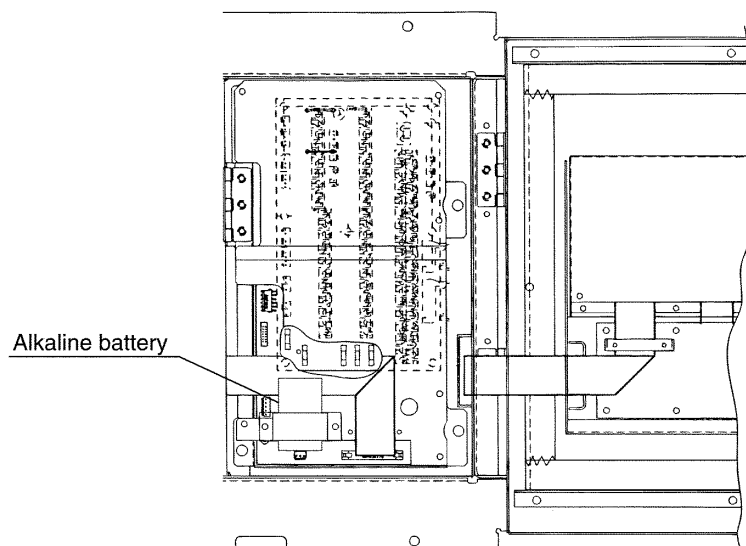
At USDA transportation : Replace a battery at the PTI

※ The life of an alkaline battery is shorten when it is used at low temperature, 0°C or lower. For a low temperature transportation, a lithium battery is available at a shipping company.

※ Do not check the battery life of an alkaline battery by the controller function of the battery life indication in section 3.2.2, 6-1.

3.6.3 Battery replacement procedure

Replace the existing battery fixed at the center of bottom side in the control box with a new battery. Then, fix the battery with binding bands.

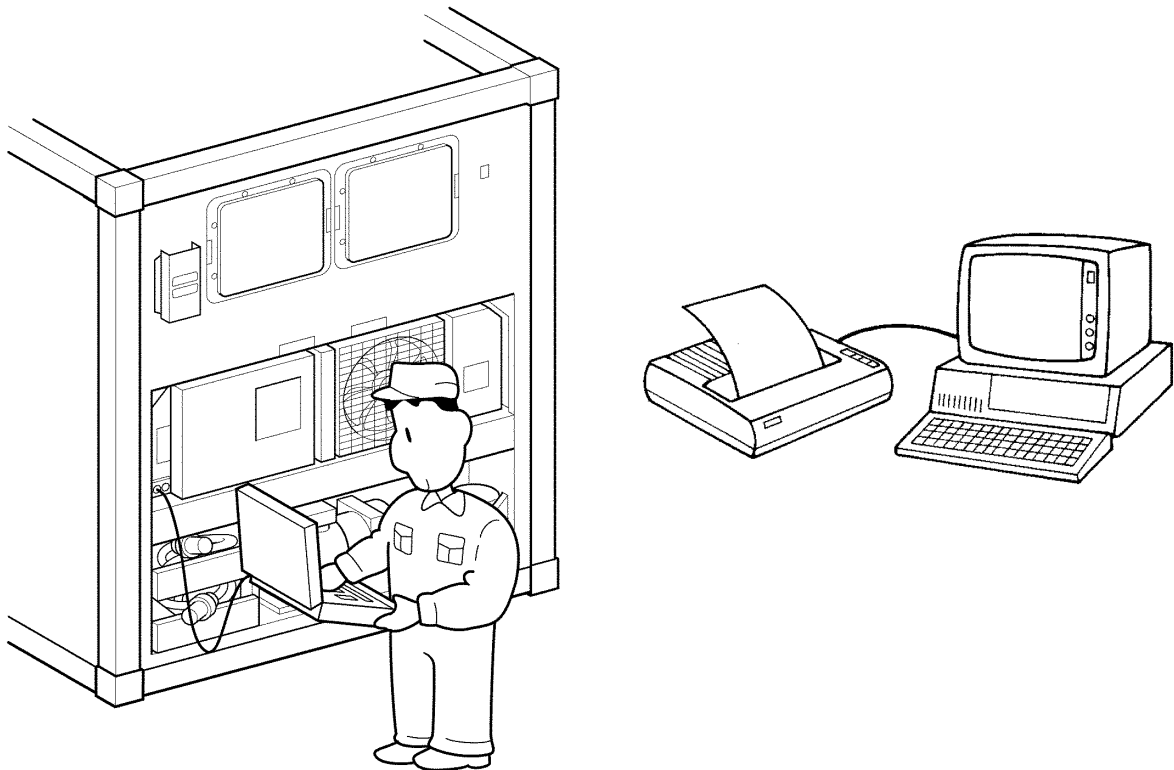


3.7 Information interchange with personal computer

The electronic controller DECOSIIIb has internally a memory function to record the set point temperature, inside temperature, operation mode, occurrence alarm and the report of automatic PTI during transportation in addition to the normal operation control.

Also users can retrieve the logging data saved in a personal computer by connecting the computer to the serial communication port (personal computer receptacle) provided on the controller front panel. The retrieved data are useful to produce the control temperature data graph and to prepare various kinds of reports for the effective analysis of troubles occurred during transportation.

Moreover, users can send the information such as the container No., cargo name, destination and other information from the personal computer to the controller for memorization.



● SOFTWARE CONFIGURATION

| | MAIN MENU | SUB MENU | Explanation of function | Remarks | |
|-----------------------------|--|---|---|--|--|
| FIELD JOB | LOGGER DATA DOWN LOAD | TRIP DATA | Data recorded in the logger is read from the controller into the personal computer (disk or hard disk). (This operation is called the down-load). | No information appears on the screen at this time. | |
| | | USDA DATA | | | |
| | | 4-PULP SENSORS DATA | | | |
| | | PTI DATA | | | |
| | CONTAINER I.D. /HEADER | ALL DATA AFTER TRIP-START | | | |
| | | SET CONTAINER I.D. /HEADER -From DISK | The logger header(set point temperature, cargo name, destination and other memorandum information) is changed. * Data previously saved in the disk is transmitted to the controller. | Disk -> Controller | |
| | | CHANGE CONTAINER I.D. -From Keyboard | The container No. (container ID) set in the controller is changed. | Input from keyboard | |
| | | CHANGE CONTAINER HEADER -From Keyboard | The logger header is changed. | Input from keyboard | |
| | MAINTENANCE & REPAIR | CHANGE CALENDAR | The internal clock of controller is changed. * The controller clock is based on GMT (Greenwich MeanTime). | Conversion from personal computer built-in clock. | |
| | | DISPLAY CURRENT OPERATING DATA | Controller sensor values, operation of internal relay and opening rates of MV and EV are displayed on the screen. | Record on disk is enabled. | |
| | | DISPLAY CURRENT ALARM | Currently existing alarms are displayed. | | |
| | | DISPLAY ALARM LOG | Information of alarm recorded in the logger is displayed. | Record on disk is enabled. | |
| | | DISPLAY TEMPERATURE CHART | Fluctuation of control temperature which has been recorded in the logger is displayed in a graphic chart. | | |
| | USDA (3-PULP SENSORS) COLD -TREATMENT | REPLACE BATTERY | The back-up battery replacement day is set. | Setting can be also made on the control panel. | |
| CALIBRATION USDA SENSORS | | The pulp sensor (USDA sensor) to be used for low temperature transportation is calibrated. | The ice bath is used. | | |
| | DISPLAY TEMPERATURE CHART | Fluctuation of the pulp sensor (USDA sensor) temperature which has been recorded in the logger is displayed in a graphic chart. Summary report of trip data is indicated. | | | |

| | MAIN MENU | SUB MENU | Explanation of function | Remarks |
|------------------|--------------------------------|--------------------------------------|---|-----------------------|
| FIELD JOB | 4-PULP SENSORS COLD -TREATMENT | CALIBRATION 4-PULP SENSORS | The pulp sensor (USDA sensor) to be used for low temperature transportation is calibrated. | The ice bath is used. |
| | | DISPLAY TEMPERATURE CHART | Fluctuation of the pulp sensor (USDA sensor) temperature which has been recorded in the logger is displayed in a graphic chart. Summary report of trip data is indicated. | |
| OFFICE JOB | MAKE REPORT | TRIP REPORT | Reports are made based on record data read from the logger. | |
| | | USDA REPORT (4-PULP SENSOR REPORT) | | |
| | | PTI REPORT | | |
| | | ALARM REPORT | | |
| | | MONITOR REPORT | | |
| | | EVENT REPORT | | |
| OFFICE JOB | MAKE CONTAINER I.D. /HEADER | SET CONTAINER I.D. /HEADER into DISK | Disk data to change LOGGER HEADER of controller is created. | |
| | CONFIG SET | CHART MARK | Various conditions are set into software. | |
| CRT MODEL | | | | |
| SET TIME ZONE | | | | |
| G.M.T-LOCAL TIME | | | | |
| SELECT JOB | | | | |
| TRIP REPORT | | | | |

3.8 Inspection procedure of the electronic controller

DECOS] b enables to make the personal computer indicate the internal data of the controller CPU (RAM data) on its display by connecting each other with a communication cable. This makes it possible to make easy inspection of the controller and diagnose the defective point of the controller.

(1) Inspection of sensors

The inspection is carried out by comparing with the sensor readings on the controller display and on the display of the personal computer. In case the sensor reading is abnormal, the sensor should be replaced to new one, but be sure to make checking for the sensor characteristics, internal wirings and its connectors before replacement. (Refer to Apendix for the sensor characteristics.)

(2) Inspection of the internal relays of the electronic controller

The inspection is carried out by checking the controller output (AC24V) utilizing the electric tester or test lamp according to the display of the personal computer. In case the controller output is abnormal, the power I/O board should be replaced to new one, but be sure to make checking for the internal wirings and its connectors before replacement.

(3) Inspection of the MV driver and its circuit

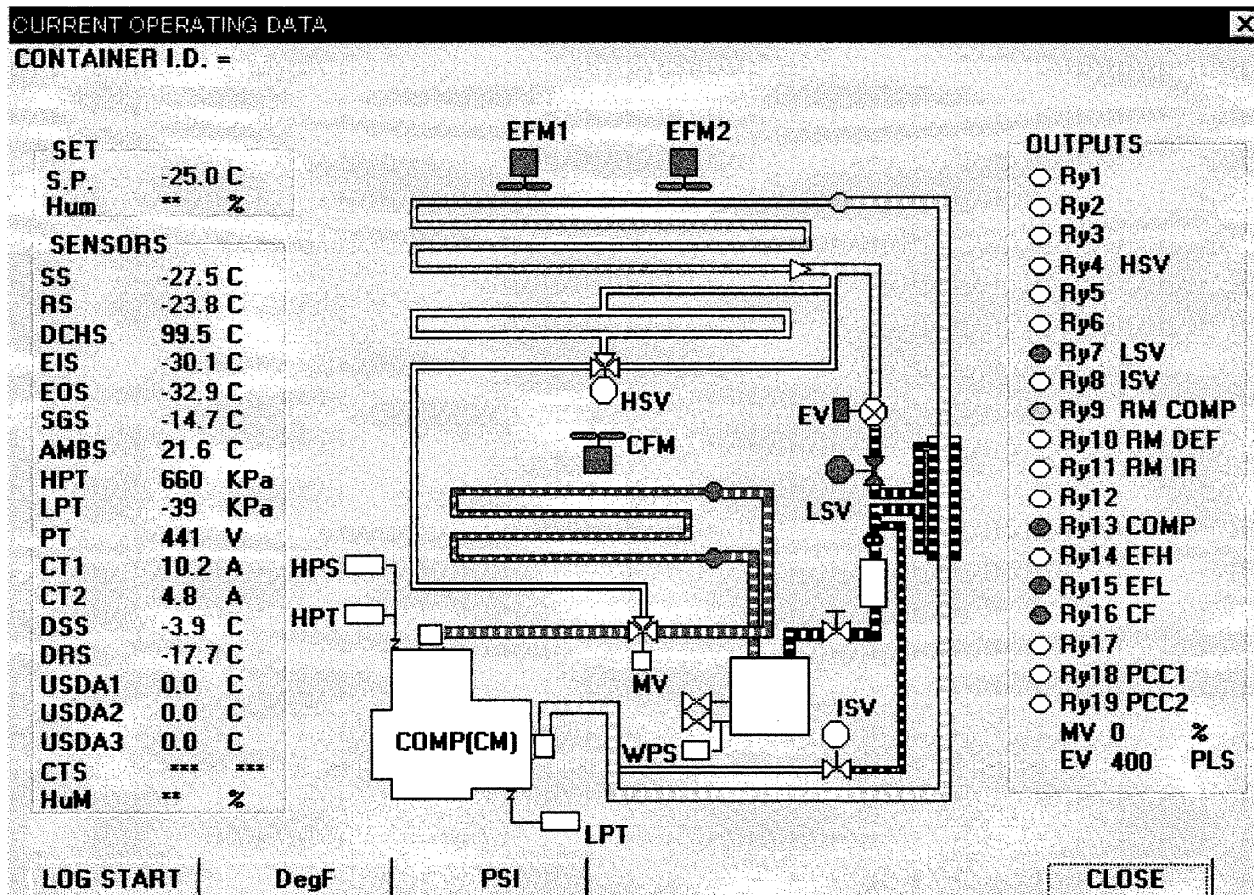
The inspection is carried out by checking of the controller output voltage according to the following table.

| MV opening (%) | Output (DCV) |
|----------------|---------------|
| 0 | 0.0 |
| 100 | 2.55V or more |

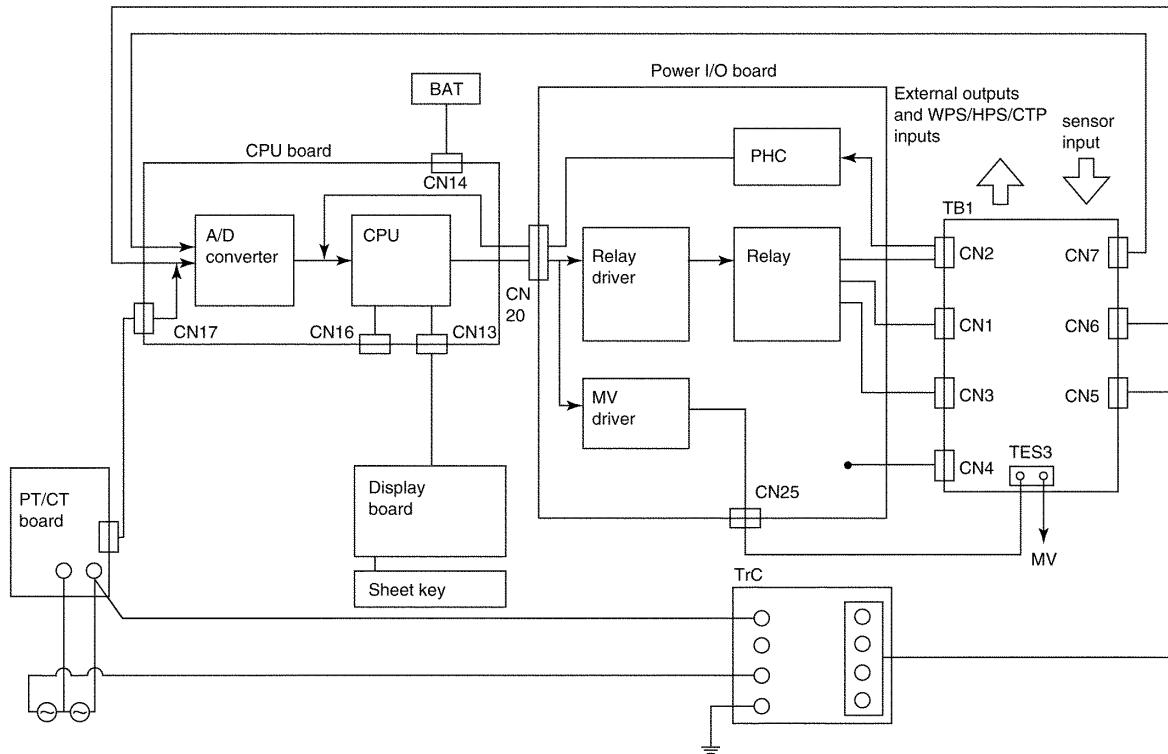
In case the controller output is abnormal, the power I/O board should be replaced to new one, but be sure to make checking for the harness and its connectors before replacement.

● The picture of the personal computer display

Menu selection: FIELD JOB — MAINTENANCE & REPAIR — DISPLAY CURRENT OPERATING DATA

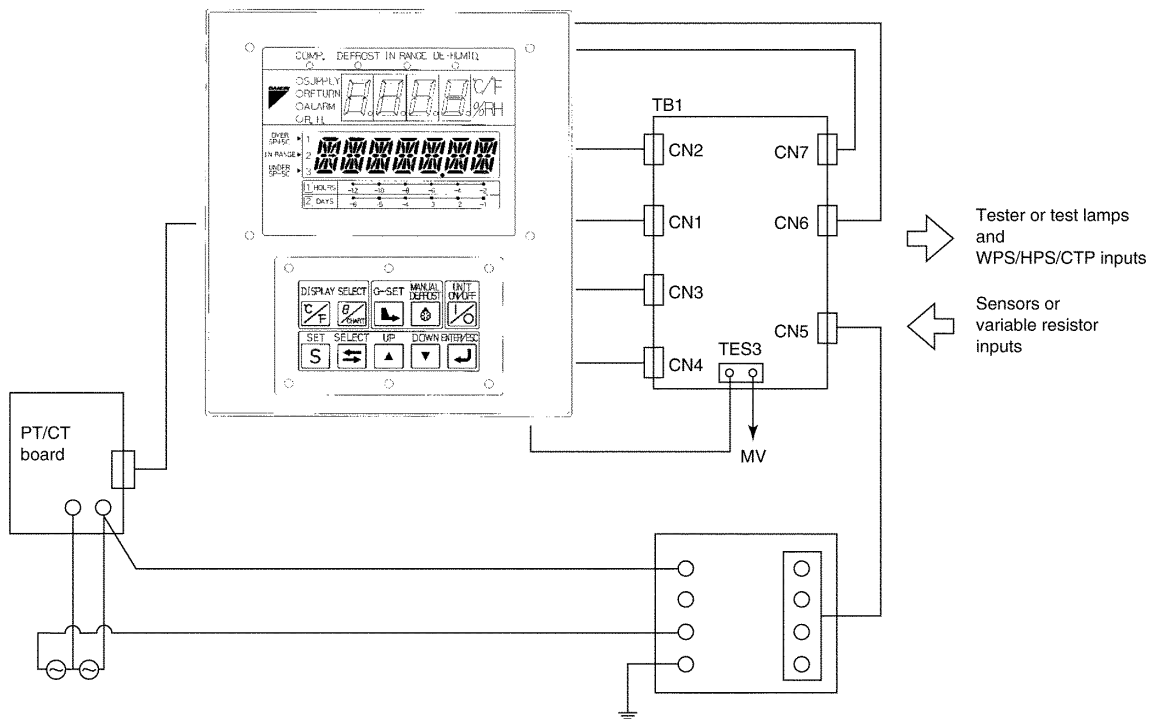


● Schematic wiring diagram of electronic controller



● Unit test of electronic controller

The controller is usually inspected with the controller unit installed in the refrigeration unit. When the controller unit is inspected with this unit removed from the refrigeration unit, the following relative components are required for the normal operation of controller.



3.9 Controller replacement and initialization

3.9.1 Controller replacement

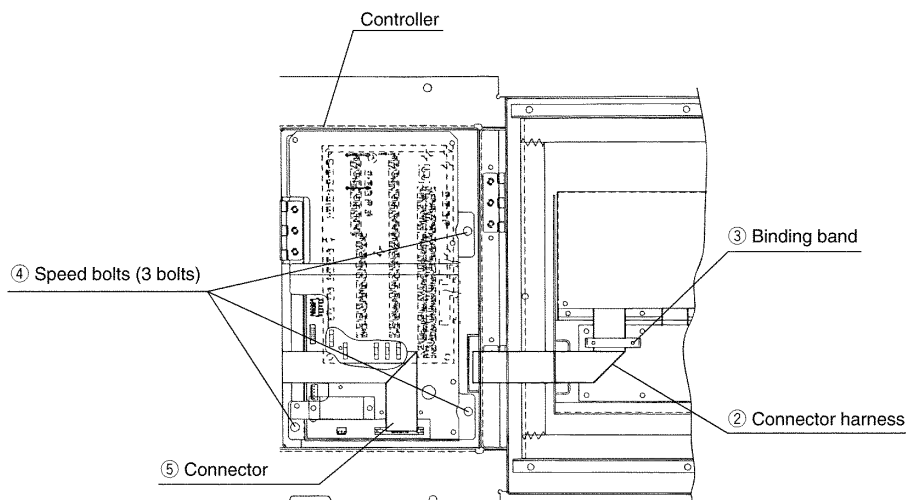
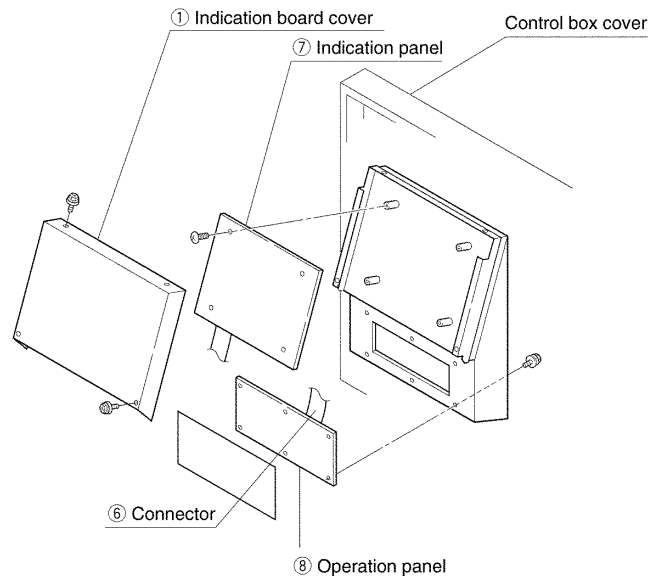
There are two different procedures for the controller replacement. Adopt the method of No.1 as much as possible.

1. To replace the controller with the LXE10D specific controller assembly
2. To replace the controller with the spare controller assembly which are interchangeable with DECOS] a

[How to replace the controller with the LXE10D specific controller assembly]

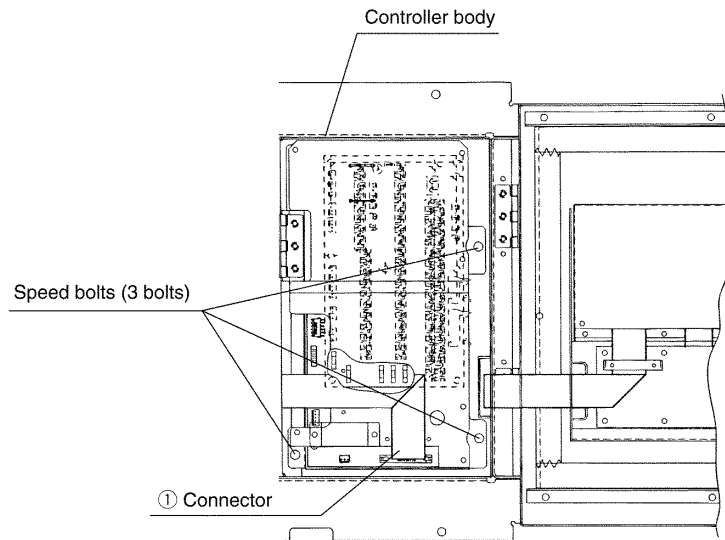
<How to replace indication and operation panel>

- (1) Remove the indication board cover ①.
- (2) Cut the binding band ③ fixing the connector harness ② using a cutting nipper.
- (3) Remove 3 speed bolts ④ from the controller body, and open the controller, then disconnect the connector ⑤.
- (4) Disconnect the connector ⑥, then remove the indication panel ⑦ and the operation panel ⑧.
- (5) Connect the new indication panel and operation panel.
- (6) In the reverse procedure, restore the controller to the original state.



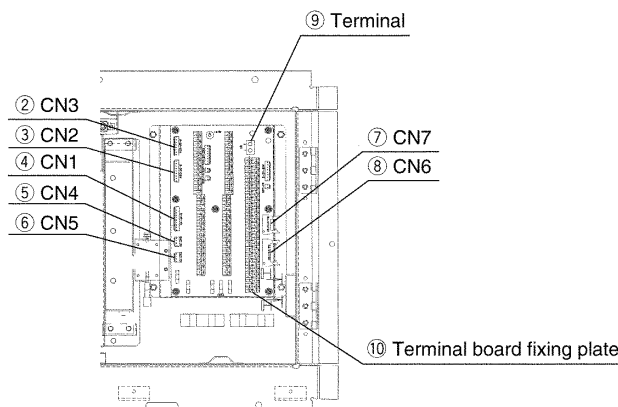
<How to replace controller>

(1) Remove 3 speed bolts on the controller body, then remove the connector ①.



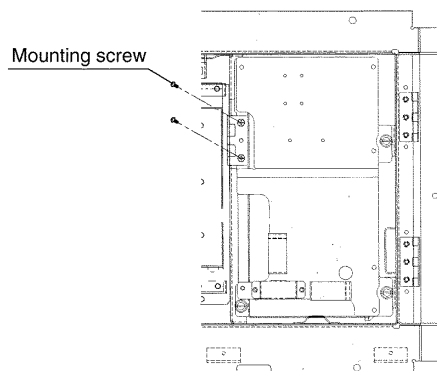
(2) Open the controller body, then disconnect the connectors ② through ⑧ on the terminal board ⑩.


(3) Remove 2 terminals ⑨.



(4) Remove 2 screws fixing the controller, and replace the controller with new one.

(5) In the reverse procedure, bring the connector, the terminal speed bolts and the mounting screws into the original states.



 **CAUTION** Make sure that the connector is firmly connected.



CAUTION Observe the following items when installing the new controller.

3.9.2 Initial setting of controller

The controller needs to be initialized referring to the operation procedures of the following modes.

Refer to section, 3.2 :

7. Optional function setting mode
8. Basic function setting mode
9. Optional condition setting mode
10. Input data mode

※Since the spare part is not initially set, it can not be operated as it is. (The alarm will be displayed.)

3.10 Optional

The following communication functions are optionally available.

The communication function enables data transmission through the ISO high-speed communication (HRCd) modem and power line. DECOS] b replies to inquiries and commands from the modem.

| | Item | Description | |
|---|----------------------------------|--|--|
| 1 | Inquiries (Remote monitoring) | <ul style="list-style-type: none">· Internal temperature and humidity· Set point temperature· Defrosting interval· Container No.· Logger header information· Alarm· Operation mode | <ul style="list-style-type: none">· Sensor data· Trip data· Alarm data |
| 2 | Commands (Remote control) | <ul style="list-style-type: none">· Set point temperature setting· Defrosting interval setting· Manual defrosting initiation | <ul style="list-style-type: none">· Container No. setting· Unit ON/OFF setting· Header information setting |

4. PTI (Pre-Trip Inspection) AND PERIODIC INSPECTION

- The controller (DECOSIII b) has the automatic PTI function, which consists of three processes of SHORT PTI (referred to as S. PTI hereafter), FULL PTI (referred to as F. PTI hereafter) and MANUAL CHECK (referred to as M. CHECK hereafter).

| Mode | Operation description |
|----------|---|
| S. PTI | The components are inspected for abnormalities. Even if any abnormal components is found, a series of inspection is all executed. |
| F. PTI | S. PTI + unit cooling capacity are inspected. The cooling capacity check is executed only if any abnormal components is not found with S. PTI. If any abnormality is found during the cooling capacity inspection, F. PTI is interrupted. |
| M. CHECK | The electric devices at the continuous operation and the operation data are inspected. |

※ Refer to section 3. 2 for details.

- The abnormalities which occur during automatic PTI will be displayed on the controller when automatic PTI is terminated.
 - Refer to section 4.2 for the alarm code checking procedure.
 - Refer to section 3.4 for the alarm code contents.
- When automatic PTI is terminated, the result of the PTI can be output as a report with the aid of personal computer. (Refer to the Operation Manual for Personal Computer Software.)

4.1 Inspection items

The periodic inspection and adjustment of components are recommended to ensure the successful operation.

The following table shows an example of the inspection plan.

| No. | Inspection item | Inspection content | PTI | 2nd year | 4th year | 8th year | |
|--------------------|---|--|---|-----------------------|-----------------------|-----------------------|-----------------------|
| General structure | 1 | Inspection for physical damage | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | |
| | 2 | Loose mounting bolts | 1) Casing frame | <input type="radio"/> | | | |
| | | | 2) Compressor | <input type="radio"/> | | | |
| | | | 3) Condenser fan motor | <input type="radio"/> | | | |
| | | | 4) Evaporator fan motor | <input type="radio"/> | | | |
| | | | 5) Control box | <input type="radio"/> | | | |
| | | | 6) Temperature recorder box | <input type="radio"/> | | | |
| | | | 7) Access panel | <input type="radio"/> | | | |
| | | | 8) Others | | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| | 3 | Conditions of panel, hinge and lock | | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | |
| | 4 | Drain pan and drain hose cleaning | <input type="radio"/> | | | | |
| | 5 | Control box inspection | 1) Cover packing inspection and replacement | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| | | | 2) Loose cable gland | | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| | | | 3) Internal cleaning | | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| | 6 | Temperature recorder box inspection | 1) Cover packing inspection and replacement | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| | | | 2) Internal cleaning | | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| | 7 | Sealing condition of casing frame through hole | 1) Air leakage and clearance | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| | 8 | Packing inspection and replacement | 1) Fresh-air intake | | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| | | | 2) Unit sealing packing | | | | <input type="radio"/> |
| 9 | Painted area recondition | 1) Compressor | | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | |
| | | 2) Water-cooled condenser /liquid receiver | | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | |
| | | 3) Solenoid valve (coil cap) | | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | |
| | | 4) Casing frame | | | <input type="radio"/> | <input type="radio"/> | |
| 10 | Repainting | 1) Compressor | | | | <input type="radio"/> | |
| | | 2) Water-cooled condenser/ liquid receiver | | | | <input type="radio"/> | |
| | | 3) Condenser fan motor | | | | <input type="radio"/> | |
| | | 4) Condenser fan | | | | <input type="radio"/> | |
| Refrigerant system | 1 | Gas leakage | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | |
| | 2 | Refrigerant/ refrigerating machine oil | 1) Inspection of moisture in the refrigerant, and refrigerant charged amount | <input type="radio"/> | | | |
| | | | 2) Inspection of refrigerating machine oil amount | <input type="radio"/> | | | |
| | | | 3) Replacement of refrigerant and refrigerating machine oil | | | <input type="radio"/> | <input type="radio"/> |
| 3 | Inspection of high pressure switch operational pressure | | <input type="radio"/> | | | | |

| | No. | Inspection item | Inspection content | PTI | 2nd year | 4th year | 8th year | |
|--------------------|--|--|---|-----|----------|----------|----------|---|
| Refrigerant system | 4 | Operation and leakage of solenoid valve | 1) Liquid solenoid valve | ○ | | | | |
| | | | 2) Injection solenoid valve | ○ | | | | |
| | | | 3) Hot gas solenoid valve | ○ | | | | |
| | 5 | Operation and leakage of modulating valve | | ○ | | | | |
| | 6 | Operation and leakage of electronic expansion valve | | ○ | | | | |
| | 7 | Compressor | 1) Water ingress to compressor terminal | | | ○ | ○ | ○ |
| | | | 2) Valve plate inspection/ replacement | | | | ○ | ○ |
| | | | 3) Oil filter cleaning | | | | ○ | ○ |
| | | | 4) Compressor disassembly and inspection | | | | | ○ |
| | 8 | Dryer replacement | | | ○ | ○ | ○ | |
| | 9 | Functional inspection and replacement of liquid moisture indicator | | ○ | | | ○ | |
| | 10 | Check of cap gasket of service valve for missing | | ○ | ○ | ○ | ○ | |
| | 11 | Conditions of fasteners on the refrigerant pipes and gauge pipes | | | ○ | ○ | ○ | |
| | 12 | Conditions of thermal insulation of refrigerant pipe | | | ○ | ○ | ○ | |
| | 13 | Evaporator coil cleaning (water-cleaning) | | | ○ | ○ | ○ | |
| 14 | Condenser coil cleaning | 1) Water-cleaning | ○ | ○ | ○ | ○ | | |
| | | 2) Steam-cleaning (after pumping down the refrigerant) | | | ○ | ○ | | |
| 15 | Water-cooled condenser inspection | 1) Water-leakage inspection | | ○ | ○ | ○ | | |
| | | 2) Operation of water pressure switch | | ○ | ○ | ○ | | |
| Electrical System | 1 | Damage of power cable and plug | | ○ | ○ | ○ | ○ | |
| | 2 | Inspection of conditions of internal wiring | | | ○ | ○ | ○ | |
| | 3 | Terminal looseness inspection and retightening | 1) Voltage selector (cam switch) | ○ | ○ | ○ | ○ | |
| | | | 2) Magnetic contactor | ○ | ○ | ○ | ○ | |
| | | | 3) Electronic controller terminal block | ○ | ○ | ○ | ○ | |
| | | | 4) Terminal block | ○ | ○ | ○ | ○ | |
| | 4 | Conditions of monitoring receptacle cap | | ○ | ○ | ○ | ○ | |
| 5 | Conditions of personal computer receptacle cap | | ○ | ○ | ○ | ○ | | |
| 6 | Fuse conditions | 1) Bruned out or not | ○ | ○ | ○ | ○ | | |

| No. | Inspection item | Inspection content | PTI | 2nd year | 4th year | 8th year | |
|---|-----------------------|---|--|----------|----------|----------|---|
| Electrical System | 7 | Magnetic contactor contact point inspection and replacement | 1) Contact point inspection | ○ | ○ | ○ | |
| | | | 2) Replace the contact of compressor contactor | | | ○ | ○ |
| | | | 3) Replace the contact of evaporator fan motor | | | | ○ |
| | | | 4) Condenser fan motor contactor replacement | | | | ○ |
| | 8 | Electric insulation check | 1) Power cable and plug | ○ | ○ | ○ | ○ |
| | | | 2) Compressor | ○ | ○ | ○ | ○ |
| | | | 3) Condenser fan motor | ○ | ○ | ○ | ○ |
| | | | 4) Evaporator fan motor | ○ | ○ | ○ | ○ |
| | 9 | Starting procedure inspection | | ○ | | | |
| | 10 | Thermosensor | 1) Installation conditions of sensor | ○ | ○ | ○ | ○ |
| | | | 2) Inspection of sensor and sensor lead for damage | | ○ | ○ | ○ |
| | | | 3) Indication error inspection and replacement | | ○ | ○ | ○ |
| | 11 | Humidity sensor | Indication of differentials compared with a calibrated humidity sensor | ○ | | | |
| | | | Replacement | | ○ | ○ | ○ |
| | 12 | PT/CT (voltage and current) indication error inspection | | | ○ | ○ | ○ |
| | 13 | Pressure sensor indication error inspection and replacement | | | ○ | ○ | ○ |
| | 14 | Temperature recorder inspection | 1) Calibration | ○ | | | |
| | | | 2) Sensor error inspection and replacement | | ○ | ○ | ○ |
| | | | 3) Chart drive inspection | ○ | | | |
| 4) Recording operation inspection | | | ○ | | | | |
| 5) Loose terminal | | | | ○ | ○ | ○ | |
| 6) Chart drive dry battery inspection, and replacement | | | ○ | | | | |
| 7) Check and replacement of pen lifting battery | | | | | | ○ | |
| 15 | Electronic controller | 1) Check and replacement of wake-up battery * | ○ | | | | |
| | | 2) LCD panel replacement | | | ○ | ○ | |
| 16 | Evaporator fan motor | 1) Speed switchover | ○ | | | | |
| | | 2) Revolution direction | ○ | | | | |
| | | 3) Motor replacement | | | | ○ | |
| 17 | Condenser fan motor | 1) Revolution direction | ○ | | | | |
| | | 2) Motor replacement | | | | ○ | |
| 18 | Evaporator fan | 1) Deformation and damage inspection | ○ | | ○ | | |
| 19 | Condenser fan | 1) Deformation and damage inspection | ○ | ○ | ○ | ○ | |

| | No. | Inspection item | Inspection content | PTI | 2nd year | 4th year | 8th year |
|--------|---------------------|---|---------------------|-----|----------|----------|----------|
| Others | 1 | Check for abnormal noise and vibration during operation | | ○ | | | |
| | 2 | Temperature control conditions | 1) 0°C operation | ○ | | | |
| | | | 2) -18°C operation | ○ | | | |
| | 3 | Defrosting function | | ○ | | | |
| 4 | Unit water-cleaning | | ○ | | | | |

※The service life of wake-up battery is approx. one year (alkali battery). For USDA transportation, replace the battery with a new alkali battery when PTI is executed.

4.2 Automatic PTI (Pre-Trip Inspection)

The automatic PTI function is provided so as to ensure the correct inspection and to shorten the inspection time.

The inspections of the following components mainly related to the unit operation are automated. (Refer to section 3.2 for detail.)

(1) Appearance inspection of unit

- ① Physical damage
- ② Casing insulation through hole area
- ③ Drain hose (dust and clogging)
- ④ Power cable and plug damage
- ⑤ Conditions of refrigerant piping fasteners
- ⑥ Conditions of each sensor installation
- ⑦ Loose installing fasteners
 - Bolts and nutsCasing frame, compressor, fan motor control box and temperature recorder box
 - Cable glandsControl box
- ⑧ Conditions of control box cover packing (water-proof) and temperature recorder box cover packing (water-proof)
- ⑨ Magnetic contactor contact point for burning out.

(2) Inspection before operation

- ① Gas leakage inspection
- ② Power voltage inspection (Automatic PTI range)

(3) Starting inspection and operation inspection of safety device and control equipment

- ① Starting
 - Inspection whether the starting procedure is proper or not
 - Inspection for abnormal noise and abnormal vibration
 - Oil level in the compressor
 - Moisture in the refrigerant.....This is reinspected at the end of PTI.
 - Revolution direction of fan motor
- ② Safety device
 - HPSMeasurement of the actuating pressure by stopping the condenser fan motor.
- ③ Control equipment
 - Solenoid valve and MV.....Inspection of operation (open and close) and leakage
 - EFMSpeed switchover and revolution direction
 - Electronic expansionInspection of operation (open and close) and leakage

(4) Operation in each mode

- ① Pull-down → 0°C
 - Pull-down time, voltage and current
- ② Chilled control 0°C
 - Electronic temperature recorder calibration
 - Return/supply air temperature differential, voltage and current
- ③ Pull-down → -18°C
 - Pull-down time, evaporator fan motor speed switchover
- ④ Frozen control -18°C
 - Electronic temperature recorder calibration
 - (Temperature differential and revolution direction)
 - ON-OFF, voltage and current
- ⑤ Defrosting
 - Defrosting time
 - Residual frost inspection

(5) PTI report printout

● Automatic PTI enable conditions

| | Water-cooled operation | Air-cooled operation | |
|----------|------------------------|--|---|
| | | Ambient temperature $\leq -10^{\circ}\text{C}$ or $> 43^{\circ}\text{C}$ | Ambient temperature $> -10^{\circ}\text{C}$ and $\leq 43^{\circ}\text{C}$ |
| S. PTI | × | ○ | |
| F. PTI | × | × | |
| M. CHECK | ○ | ○ | |

※During S. PTI at the ambient temperature of 43°C or higher, the compressor protective device may activate in accordance with the conditions of the inside temperature. This is not a malfunction of unit.

● Starting and ending operation of automatic PTI

(Refer to section 3.2)

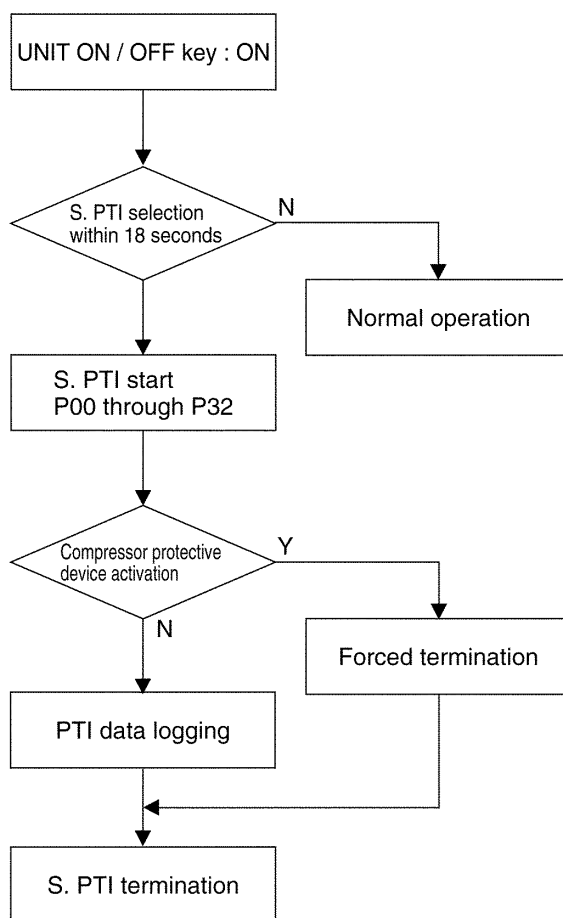
4.2.1 Short PTI (S. PTI)

Select S. PTI within 18 seconds after turning the UNIT ON/OFF key on, then Steps P00 through P32 will be carried out (displayed on LED). The items of sensor indication mode can be displayed by key operation.

● Step display and content

| Step | Content |
|------|--|
| P00 | Basic data record (container No., date, time, compressor integrated run-hour, ambient temperature) |
| P02 | Alarm check on all sensors |
| P04 | Power conditions (voltage and frequency) check |
| P05 | Compressor start running check |
| P06 | Actuating pressure check at OFF and ON of High pressure switch (HPS) |
| P08 | Pump-down check |
| P10 | Solenoid valve leakage check • Liquid solenoid valve (LSV) • Injection solenoid valve (ISV) • Modulating valve (MV) |
| P12 | Supply and return air sensor (SS and RS) accuracy check |
| P14 | Pressure sensor (HPT and LPT) accuracy check |
| P16 | Evaporator fan high and low-speed operation check |
| P26 | Standard pull-down operation |
| P28 | Negative-phase operation check • Check visually for the rotating direction of condenser fan (S) |
| P29 | Electronic expansion valve check |
| P30 | Injection solenoid valve (ISV) opening or closing check |
| P32 | Hot-gas 3-way solenoid valve (HSV) opening or closing check |

● S. PTI flow chart operation



4.2.2 Full PTI (F. PTI)

Select F. PTI within 18 seconds after turning the UNIT ON/OFF key on, then steps P00 through P90 will be started.

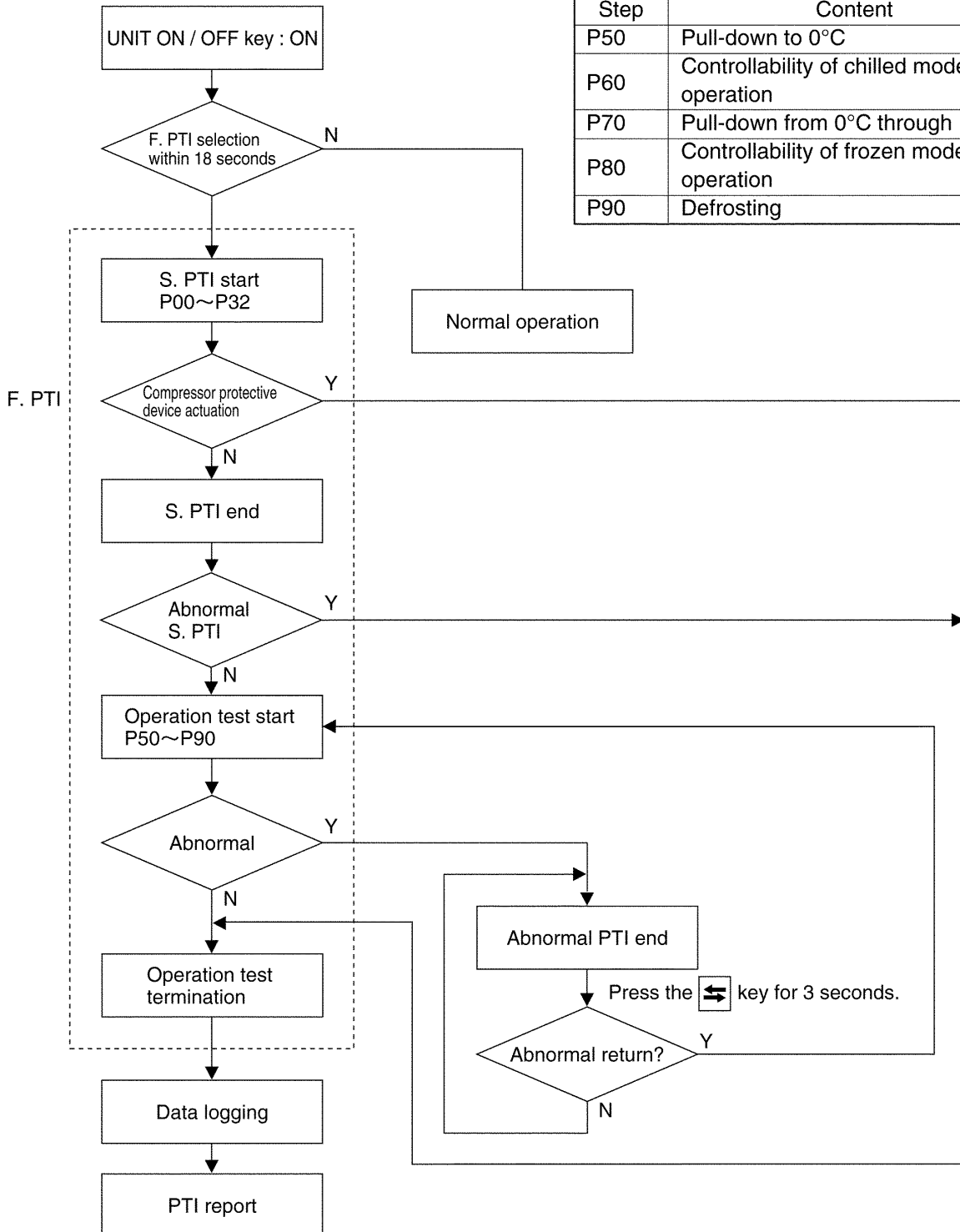
F. PTI consists of S. PTI and operation tests.

● F. PTI flow chart

● Step display and content

(Step P00~P32 are as same as S. PTI)

| Step | Content |
|------|---|
| P50 | Pull-down to 0°C |
| P60 | Controllability of chilled mode operation |
| P70 | Pull-down from 0°C through -18°C |
| P80 | Controllability of frozen mode operation |
| P90 | Defrosting |



4.2.3 Alarm list during PTI (Pre-Trip Inspection)

The alarms during automatic PTI are concerned with PTI inspection items in addition to those during normal operation.

The alarms caused by automatic PTI are indicated in J※※※, being discriminated from those during normal operation.

Though there are alarms which are not displayed on the control panel, they can be checked referring to the PTI report.

| Check No. (LED display) | Check content | Alarm indication (LED display) | Alarm content | S.PTI | F.PTI | Remarks |
|----------------------------|--|-----------------------------------|--|--|-------|---------|
| P00 | Basic data | No indication | Basic-data vanishment | ↑ | ↑ | |
| P02 | All sensor | Same as normal operation | Basic-data vanishment | | | |
| P04 | Power | No indication | Basic-data vanishment | | | |
| P05 | Starting | J051 | Compressor malfunction | | | |
| P06 | HPS | J061 | Abnormal OFF point | | | |
| | HPS | J062 | Not return (closed) | | | |
| | HPS | J063 | Abnormal ON point | | | |
| | HPS | J064 | High pressure does not rise. | | | |
| | HPS | J065 | High pressure does not drop. | | | |
| P08 | Pump-down | J081 | Long pump-down | | | |
| P10 | Liquid solenoid valve | J101 | Valve leakage | | | |
| P12 | RS, SS accuracy | J121 | Sensor deterioration | | | |
| P14 | HPT, LPT accuracy | J141 | Sensor deterioration | | | |
| P16 | Evaporator fan motor | J161 | Evaporator fan motor malfunction | | | |
| | | | J281 | | | |
| P26 | Operation | No indication | Judged with P28 | | | |
| P28 | Evaporator fan reverse-turning direction | J281 | Abnormal evaporator fan miswiring | | | |
| P29 | Electronic expansion valve | J291 | Long pump-down | | | |
| P30 | Injection solenoid valve | J301 | Injection solenoid valve malfunction | | | |
| | | | J321 | Hot-gas 3-way solenoid valve malfunction | | |
| P32 | Hot-gas 3-way solenoid valve | J321 | Hot-gas 3-way solenoid valve malfunction | ↓ | ↓ | |
| P50 | Pull-down cooling capacity | J501 | Out of ambient temperature conditions | | | |
| P50 | 0°C control | J502 | Long pull-down time | | | |
| P60 | 0°C control | No indication | | | | |
| P70 | Pull-down cooling capacity | J701 | Long pull-down time | | | |
| P80 | -18°C control | No indication | | | | |
| P90 | Defrosting | J901 | Out of starting conditions | | | |
| | Basic-data | J902 | Long defrosting time | | | |

4.2.4 Manual check (M. CHECK)

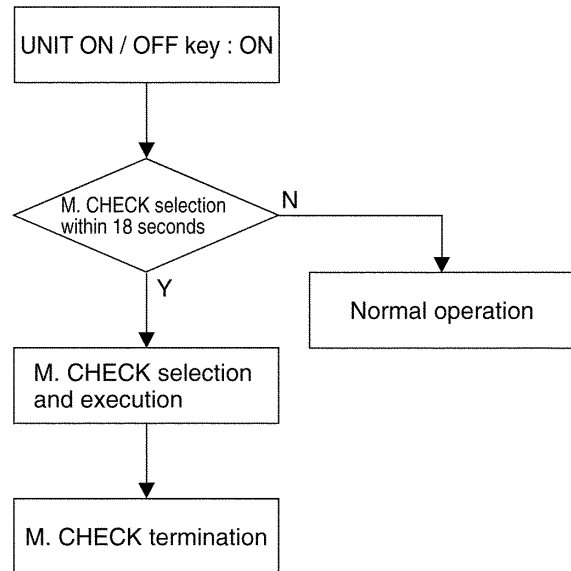
Select M. CHECK within 18 seconds after turning the UNIT ON/OFF key on, then M. CHECK will be executed.

Since the components are respectively operated differing from S. PTI and F. PTI, the steps can be respectively selected and executed. Here, any error code indication does not occur during execution. Turn the UNIT ON/OFF key OFF to terminate the M. CHECK.

●Item and content

| Indication on the LCD | Content indicated on the LED |
|-----------------------|---|
| CC X10H | Compressor integrated run-hour |
| EFH A | Running current value of evaporator fan motor high-speed running |
| EFL A | Running current value of evaporator fan motor low-speed running |
| CF A | Running current value of condenser fan motor running |
| b-CH | Battery replacement date If the battery life limit is reached, "E801" is appears. ※1 |
| HP | Compressor horse power setting (5HP or 10HP) |
| TS H | Elapsed time after trip start |
| EF1 X10H | Evaporator fan motor -1 run-hour |
| EF2 X10H | Evaporator fan motor -2 run-hour |
| CF X10H | Condenser fan motor run-hour |
| SOFTVER | Controller software version |

●M. CHECK flow chart



※1 This indication is used only when the lithium battery is used. When the alkali battery is used, keep turning the alarm code "E801" on.

5. CHARTLESS FUNCTION

The controller provides the temperature recorder function. By this function, the control temperature logging data during operation are displayed on the LCD in graphic chart. (Chart indication function)

Also, temperature and alarm records are indicated on the indication panel. (Temperature and Alarm record scroll indication function)

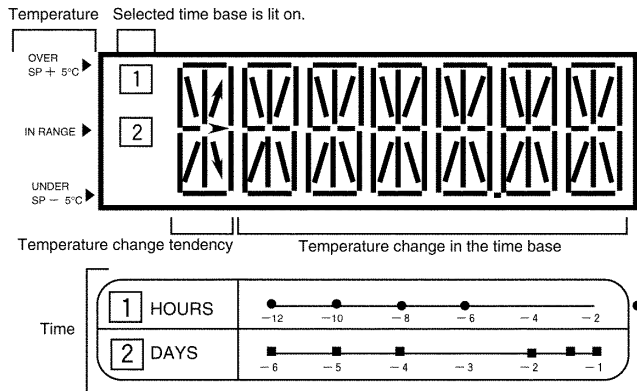
The chart indication and the temperature and alarm record scroll indication are based on the control sensor data (SS/RS). When the data recorder sensor (DSS/DRS) are optionally provided, the chart indication is based on the data recorder sensor data.

5.1 Chart indication mode

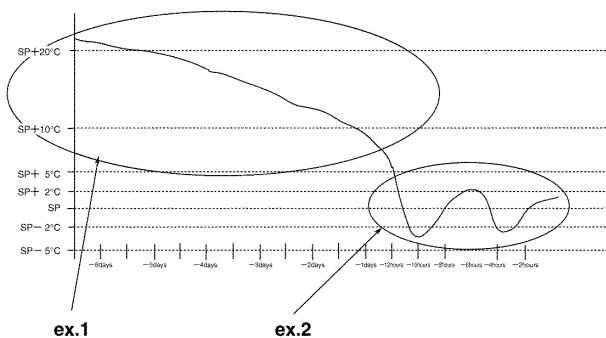
The temperature record data are indicated in graphic chart on the LCD at the chart indication mode.

- The log indication period is selectable from 12 hours ([1] HOURS on the time base) or 6 days ([2] DAYS on the time base).
- The indication intervals are 2 hours for 12 hours log ([1] HOURS) and one day for 6 days log ([2] DAYS).
- The indication of the data during the defrosting is flickered, and the indication of other data is lit on.

● LCD Display

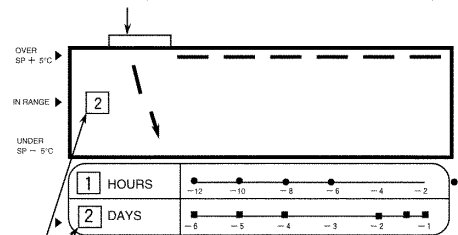


● Example of temperature change



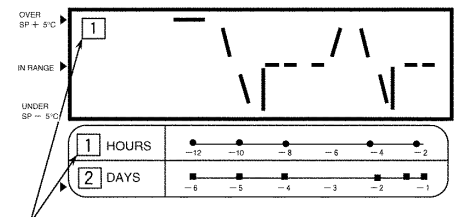
ex.1

This arrow indicates the temperature change tendency when all segments are in the same temperature range.



The graphic chart of the temperature change for 6 days log (time base : 2 (DAYS))

ex.2


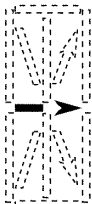



The graphic chart of the temperature change for 12 hours log (time base : 1 (HOURS))

● Indication of temperature change tendency

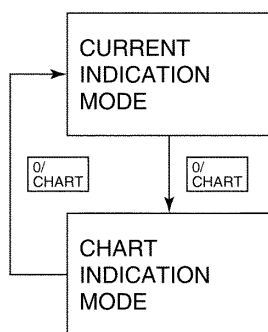
The temperature change tendency is indicated in the leftmost LCD.


Here, this indication is given only when all segments are in the same temperature range. (Refer to section 5.1 Chart, indication mode, LCD Display, ex1.)



| Indication of temperature change tendency | Condition |
|---|---|
| <p>Temperature rise tendency</p>  | <p>The subtracted value from the rightmost data to the leftmost data on the LCD is higher than the H001 setting value.</p> |
| <p>Temperature stable tendency</p>  | <p>The subtracted value from the leftmost data to the rightmost data (or from the rightmost data to the leftmost data) on the LCD display is lower than the H001 setting value.</p> |
| <p>Temperature fall tendency</p>  | <p>The subtracted value from the leftmost data to the rightmost data on the LCD is higher than the H001 setting value.</p> |


※ The setting values of the temperature change tendency can be reset. Refer to section 8, Optional condition setting mode, for the H001 setting procedure.

<Operation procedure>



To change to the chart indication mode, press the  key while the unit is in the current indication mode.

In the chart indication mode, the LCD indicates a graphic chart. The axis of ordinates shows temperature base, the axis of abscissas shows time base. The number indicated on the left hand side of the time base is the same as the number on the left hand side of the LCD, which indicates the graphic chart is of 12 hours log or 6 days log indication. Select the base to be uses using the  or  key.

When the  key is pressed, the unit goes back to the current indication mode.

5.2 Temperature and Alarm record scroll indication mode

The unit provides the following 4 functions at the TEMPERATURE RECORD SCROLL MODE or ALARM RECORD SCROLL MODE.

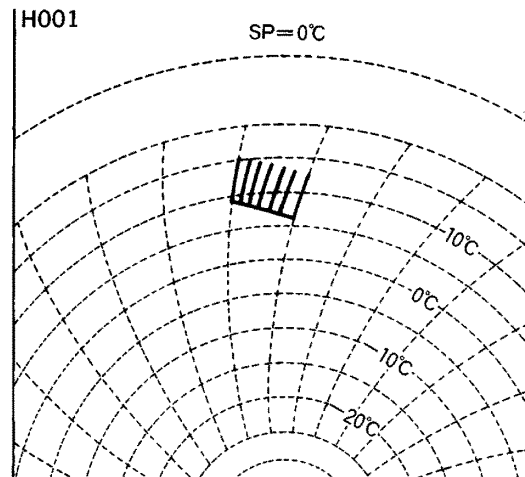
- Alarm indication function
- Operation history indication function
- Temperature record scroll function
- Alarm record scroll function

5.2.1 Alarm indication

Abnormal temperature record is indicated as an alarm code ("Hxxx") on the chart paper of temperature recorder.

An example H001 alarm

Setting : An alarm is output when the control temperature does not lower by 3°C or more for every 4 hours in pull-down state.



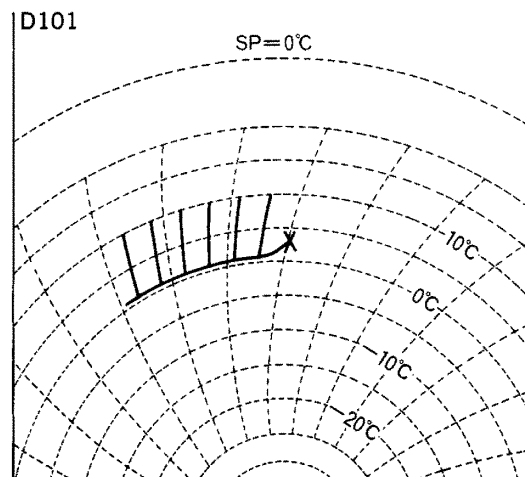
5.2.2 Operation history indication

The code indicating the current operation state of unit is displayed. It is not an alarm.

An example D101

Setting : D1XX

When the integrated time of duration of state $SP+1^{\circ}\text{C}$ or more is one hour, XX=01 is displayed.









5.2.3 Temperature record scroll indication function

The control sensor value record for a maximum of 7 days is indicated in sequence (scroll) beginning with the latest one and ending with oldest one, so that easy inspection of the previous operation data is enabled on board.

<Operation procedure>

The LED indicates the control temperature, and the LCD indicates the date or time and the non-control temperature in turn. (In the partial frozen and frozen modes, return air temperature is the controlled temperature, and in the chilled mode, supply air temperature is the controlled temperature.)

To hold the indication, press the  or  key. To advance successively the indication, press the  or  key again. If the arrow key is not pressed within 10 seconds, successive (scroll) indication appears again. To see data from the beginning, depress the  key for 3 seconds.

To restore the current indication mode screen, press the  key.

If key operation is not performed within 5 minutes, the current indication mode screen is resumed. If the successive (scroll) screen is currently displayed, the current indication mode screen is resumed when 5 minutes elapses after indication ends.

To return to the operation setting mode, press the  key.



CAUTION

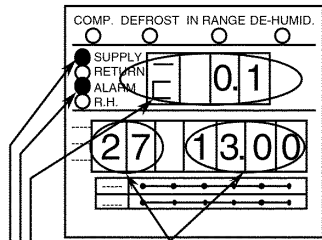
The displayed temperature is not current instantaneous value but an average taken in specific logging interval.

Thus, the printed control temperature on the trip report printed with the aid of personal computer (instaneous value) may differ from the sensor data of chartless function.

This is not an error.

● Indication example of TEMPERATURE RECORD SCROLL INDICATION MODE

It is assumed that the control temperature is SS (Supply air) and the logging interval is 1 hour, and current date and time are June 27, 1997, 14:00.

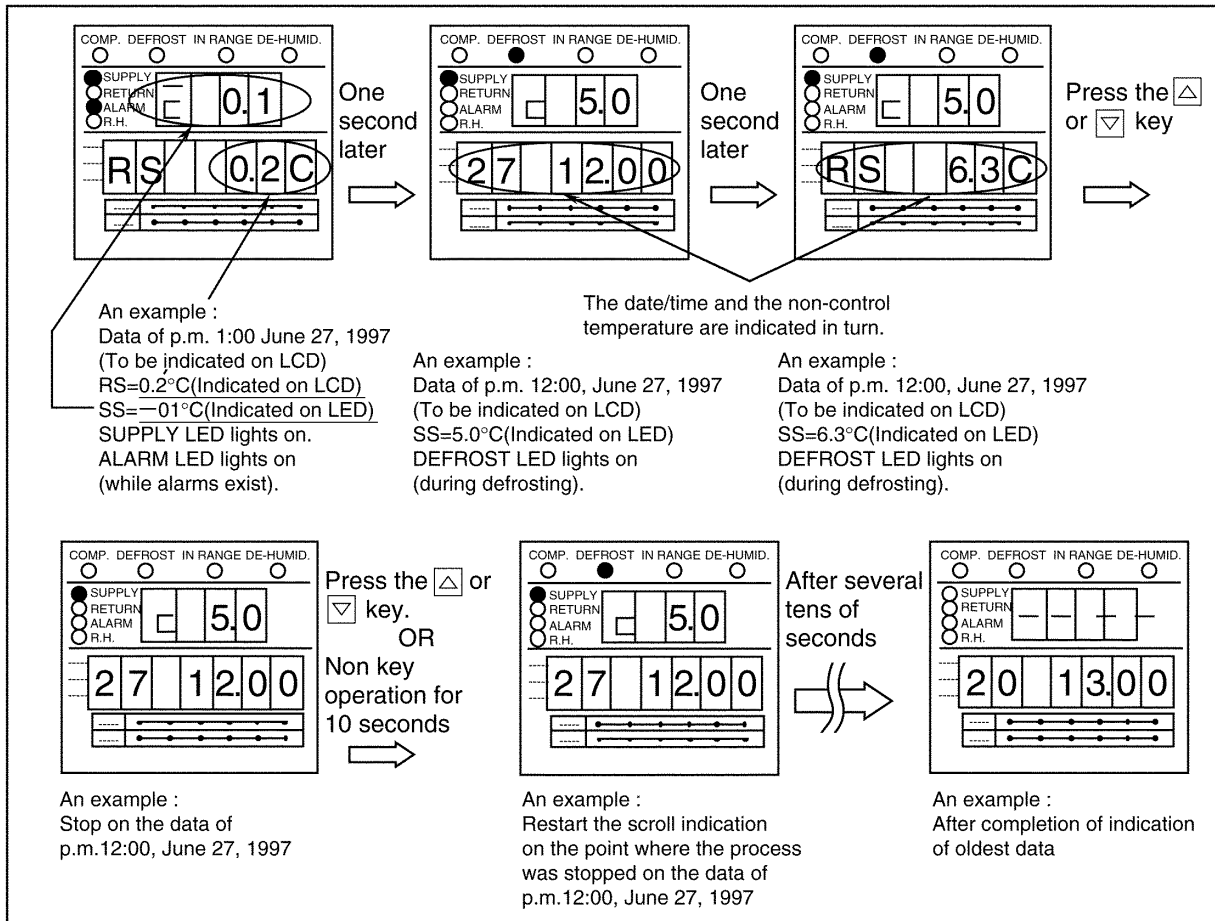


An example:
p.m. 1:00 June 27, 1997
(To be indicated on LCD)
SS=-0.1°C(Indicated on LED)
SUPPLY LED lights on.
ALARM LED lights on(while alarms exist).

One second later

※To restore the current indication mode, press the key.
If key operation is not performed within 5 minutes, the current indication mode screen is resumed.
To return to the operation setting mode, press the key.

To restart, depress the key for 3 seconds.



Note : " " on the leftmost of the LED shows that the indication is of the temperature record scroll indication mode.

5.2.4 Alarm record scroll indication function

The previous alarms are displayed on the controller at the rate of one alarm/sec. for a maximum of 7 days.

<Operation procedure>

The LED indicates alarm codes and the LCD indicates date and time.

To hold the indication, press the or key. To advance successively the indication, press the or key again. If the arrow key is not pressed within 10 seconds, successive (scroll) indication appears again. To see data from the beginning, depress the key for 3 seconds.

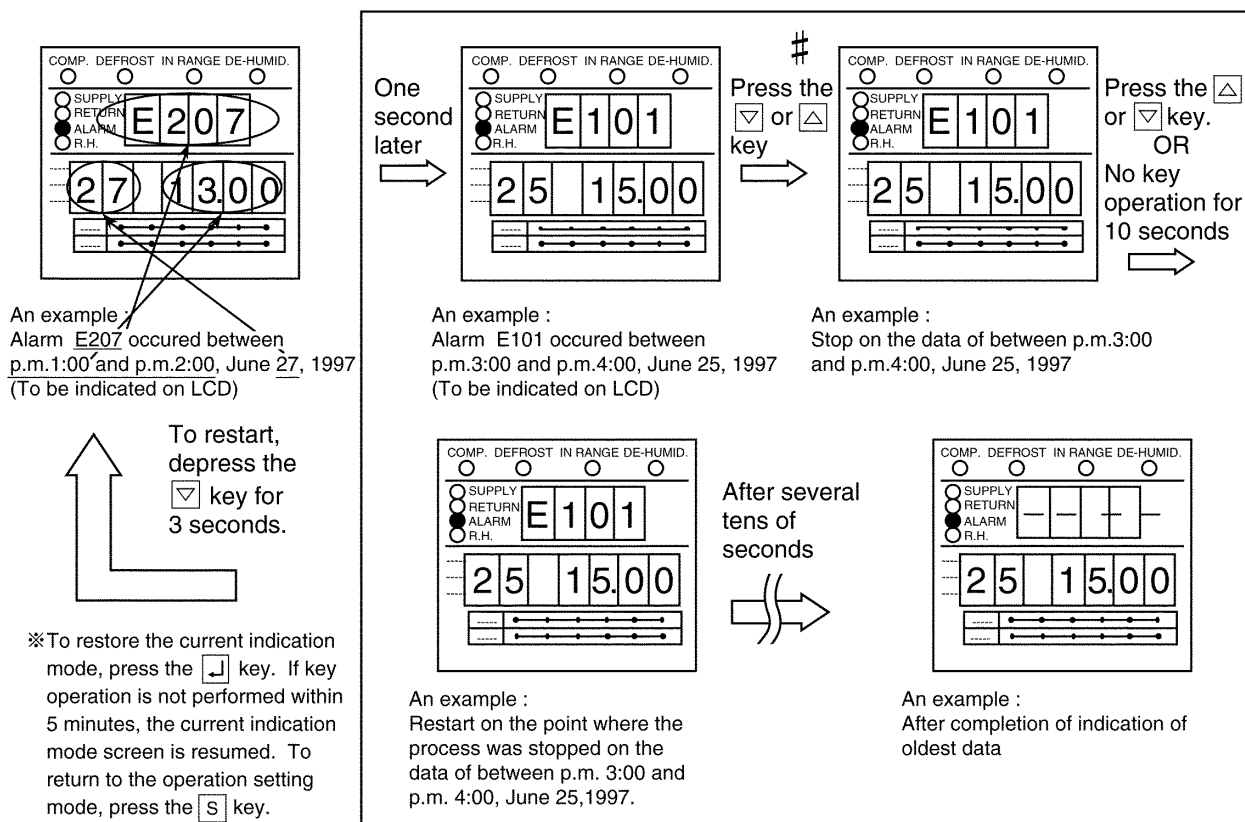
To restore the current indication mode screen, press the key.

If key operation is not performed within 5 minutes, the current indication mode screen is resumed. If the successive (scroll) screen is currently displayed, the current indication mode screen is resumed when 5 minutes elapses after indication ends.

To return to the operation setting mode, press the key.

● Indication example of ALARM RECORD SCROLL INDICATION MODE

It is assumed that the current date and time are June 27, 1997, 14:00.



5.2.5 Chartless alarm list

C : Chilled mode, F : Frozen mode, PF : Partial Frozen mode

| | Code | Description | Operation mode |
|---------------------------------------|------|---|----------------|
| Only error indication | H001 | The alarm is displayed when the control temperature does not lower by <u>3°C</u> or more for every 4 hours during pull-down operation. | C, F, PF |
| | H002 | The alarm is displayed when the integrated out-of-in-range reaches <u>2 hours</u> . (Count is not performed during defrosting.) | C, F, PF |
| | H003 | The alarm is displayed when the integrated time of state "below SP-1°C" reaches <u>2 hours</u> . | C |
| | H004 | The alarm is displayed when the integrated time of state "below SP-2°C" reaches <u>one hour</u> . | C |
| | H005 | The alarm is displayed when the control air temperature is Out-of-In-Range, and defrosting was performed successively <u>three times</u> while the control air temperature does not return to in-range. | C, F, PF |
| | H006 | The alarm is displayed when the integrated time of difference 2°C or more between control sensor data and record sensor data reaches to <u>one hour</u> or more. | C, F, PF |
| Operation history indicating function | d3XX | XX : When the total number of time of state that the integrated time of state "above SP+3°C" reaches <u>one hour</u> , an indication XX = 01 appears. | C, F, PF |
| | d2XX | XX : When the total number of time of state that the integrated time of state "above SP+2°C" reaches <u>one hour</u> , an indication XX = 01 appears. | C |
| | d1XX | XX : When the total number of time of state that the integrated time of state "above SP+1°C" reaches <u>one hour</u> , an indication XX = 01 appears. | C |
| | d-1X | XX : When the total number of time of state that the integrated time of state "below SP-1°C" reaches <u>one hour</u> , an indication 1X = 11 appears. | C |
| | d-2X | XX : When the total number of time of state that the integrated time of state "below SP-2°C" reaches <u>one hour</u> , an indication 2X = 21 appears. | C |
| | PXXX | XXX : When the integrated pull-down time reaches one hour, an indication XXX = 001 appears. | C, F, PF |

Note : The encircled setting can be changed.

The data enclosed in rectangles vary depending on the encircled setting.

6. MAIN COMPONENTS AND MAINTENANCE

6.1 Components related with refrigeration circuit

6.1.1 Compressor

The compressor is of a semi-hermetic type with the built-in motor so that there are few places where refrigerant may leak. The reversible trochoid pump is adopted to produce the required oil pressure regardless of the rotating direction of the built-in motor.

(1) Removal

Remove the compressor by the following procedure.

- ① Remove discharge stop valve, suction flange, gauge piping flare nut (compressor side), and power cable.
- ② Remove compressor set bolts (two for each of left and right leg). (Do not remove the bolts for the mounting base.)
- ③ Pull out the compressor to the front of the unit.

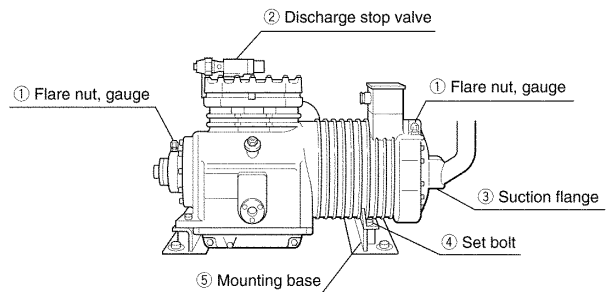


CAUTION

Seal the suction pipe opening with packing tape for prevention of moisture ingress because LXE10D and LXE10D-A are not provided with suction side stop valve.

(2) Installation

For installation, reverse the above procedure. When tightening the bolts, refer to the standard tightening-torque table.



6.1.2 Air-cooled condenser and evaporator

This finned coil is compact and has even and high thermal conductivity due to the adoption of corrugated fins.

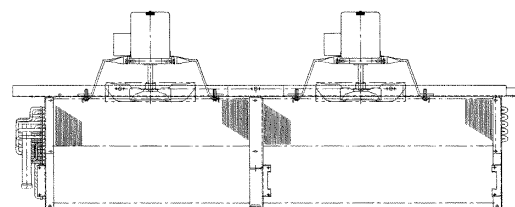
●Washing of air-cooled evaporator

Carefully flush the air-cooled condenser with fresh water after trip, although this type of condenser employs thick fins and electrodeposition coating for high corrosion resistance.

- For the maintenance of the air-cooled condenser, remove the fan cover, fan guide and temperature recorder box. For the maintenance of the evaporator, remove the rear panel of the evaporator.



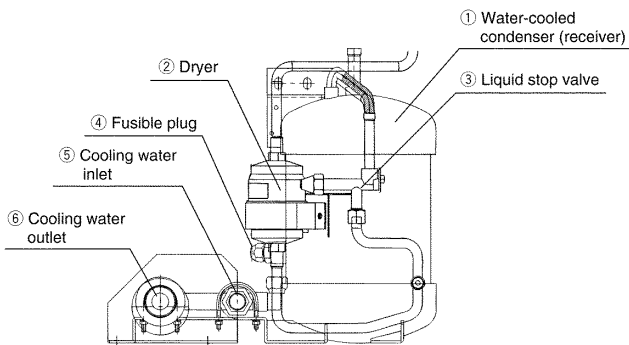
Air cooled condenser



Evaporator

6.1.3 Water-cooled condenser (Air and water-cooled type) and Receiver (Air-cooled type)

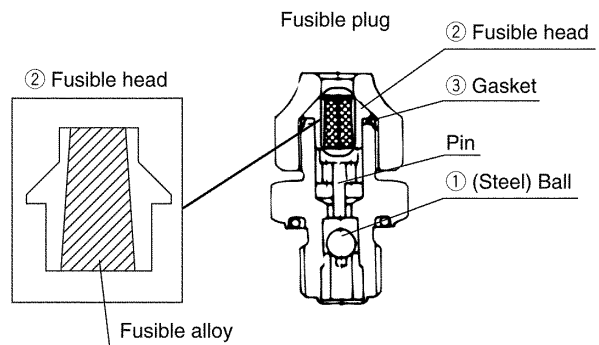
The water-cooled condenser is mounted on the air and water-cooled type, and the receiver is mounted on the air-cooled type. Since the condenser is of shell and coil type, the cooling water flows in the inner cooling tube and the refrigerant flows in the shell. The cooling tube having special fins are used to make it light and compact.



●Replacement of fusible safety plug

If pressure rises abnormally in the refrigeration circuit, the fusible plug actuates by itself. So, thoroughly check the possible causes if the fusible plug melts.

If the fusible plug actuates, the fusible alloy in the center of fusible head ② melts, from which the refrigerant jets out. When the flare nut is removed, the ball ① is apt to come out by pressure and clogs the passage of the refrigerant outlet, which prevents the refrigerant from jetting out and also the air from entering. Thus, refrigerant loss is extremely minimized.



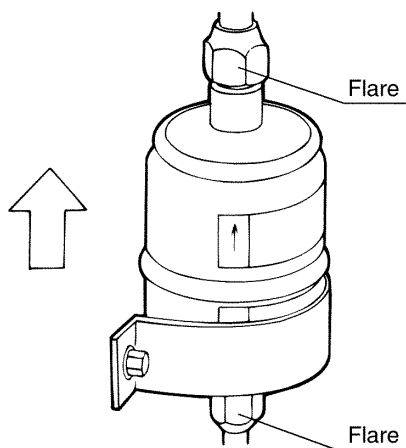
For replacement, insert a new fusible alloy with gasket ③, and tighten the flare nut.

6.1.4 Dryer

The dryer automatically absorbs moisture in the refrigerant while it is circulated. It commonly works as a filter to remove dust in the refrigerant. Replace the dryer if it does not remove moisture or is clogged. When installing the new dryer, follow the directions given on the label and do not make any mistake about the direction of the dryer.

(1) Replacement

- ① After pump-down operation, the suction pressure shall be slightly higher than the atmospheric pressure. (Refer to the section 7, Maintenance)
- ② Then, loosen the flares at the both ends of the dryer, and replace the dryer quickly.
- ③ After reattaching the dryer, evacuate with keeping the liquid stop valve at the outlet of water cooled condenser (or receiver) closed.
- ④ After completing evacuation, fully open the stop valve, and be sure to inspect the dryer fitting for refrigerant leakage. Make sure that no gas leakage is found.
- ⑤ After replacement, confirm the moisture indicator shows green.



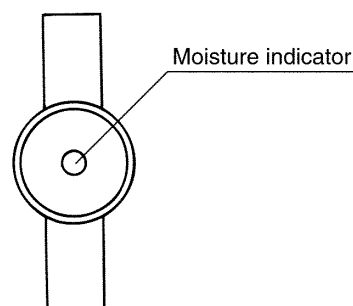
6.1.5 Moisture indicator

This indicator permits checking of flow of the refrigerant and moisture content in the refrigerant.

(1) Moisture ingress

The indicator indicates the moisture content by the color at the center of the window. Check this indicator during the unit is under operating.

| Color | Judgment |
|--------|------------------------|
| Green | Dry |
| Yellow | Wet (moisture ingress) |



- Note)
1. The indicator may appear yellow if it has been exposed to gaseous refrigerant for a long time.
 2. The indicator must be checked while the indicator is sealed by liquid refrigerant after operation of a few hours.
 3. The indication is influenced by the temperature of the liquid refrigerant. At the low temperature, a long time is required for the indicator to change.
 4. To shorten the indication changing time, raise up the temperature of the liquid refrigerant. (Block the air discharge grill of the condenser fan to increase the working pressure in order to raise up the temperature.)

(2) Flow of refrigerant

When the moisture indicator is sealed with the liquid, bubbles will disappear on the moisture indicator.

(3) Check

| Operation | Indicator state |
|------------------|--|
| Starting | Bubbles appear but liquid refrigerant is sealed in 30 minutes to an hour after starting. |
| During operation | Bubbles may sometimes appear. |

If bubbles continues violently appearing, the refrigerant may be short.

6.1.6 Electronic expansion valve

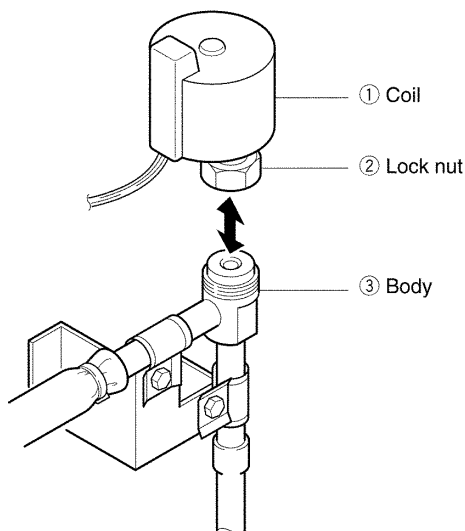
- Model Coil : EBM-MD 12DM-1
Body : EDM-B402 DM-1

This unit adopts an electronic expansion valve. The electronic expansion valve controls the optimum refrigerant flow rate automatically using the temperature sensor at the evaporator inlet and outlet pipes.

In case of the emergency occasions including controller malfunctions, refer to the chapter of troubleshooting, section 4, Emergency operation.

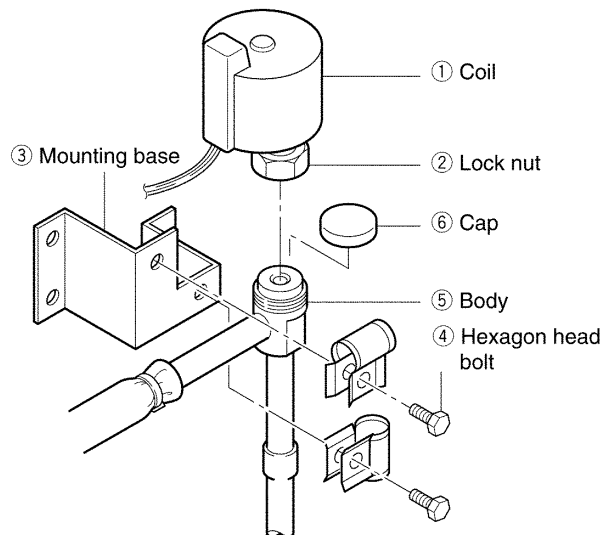
(1) Replacement of coil

- ① Disconnect the lead wire in the control box.
- ② Cut the binding bands which fasten the lead wires using cutting nippers.
- ③ Loosen the lock nut, then remove the coil from the body.
- ④ Install a new coil. The tightening torque for installation is $6.9\sim 16.7\text{ N}\cdot\text{m}$ ($70\sim 170\text{ kgf}\cdot\text{cm}$).
- ⑤ Restore the binding bands and the lead wire into the original state.
- ⑥ After replacement, carry out refrigerant leakage checking, and make sure that any refrigerant does not leak.



(2) Replacement of body

- ① Loosen the lock nut, then remove the coil.
- ② Remove the hexagon head bolts, and cut the pipe on the body, then remove remaining pipes from brazing parts.
- ③ Connect a new body to the pipes and braze the joints while cooling the body below 120°C [248°F] with the cap on.
- ④ Fix the body to the mounting base.
- ⑤ Remove the cap, and mount the coil with the tightening torque is $6.9\sim 16.7\text{ N}\cdot\text{m}$ ($70\sim 170\text{ kgf}\cdot\text{cm}$).



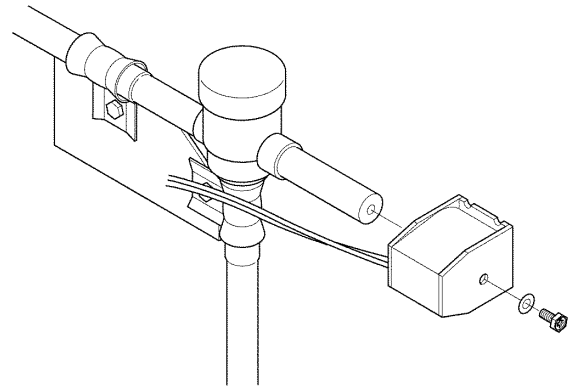
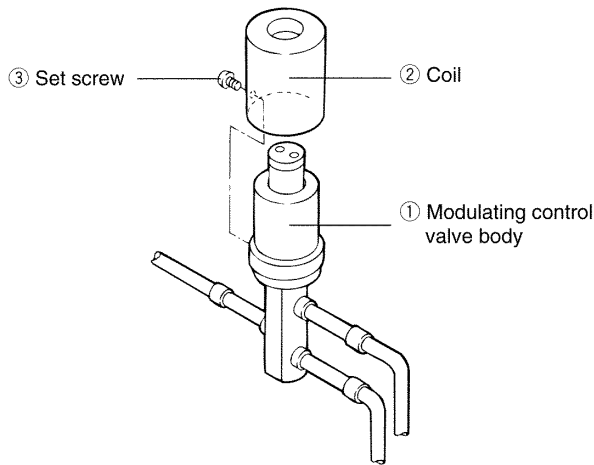
6.1.7 Modulating valve (MV)

- Model : DMR1101

The flow rate in two directions can be automatically adjusted from 0 to 100% by the magnetic valve. Modulating valve controls the hot gas by-pass operation, heating and defrosting during chilled and partial frozen operation.

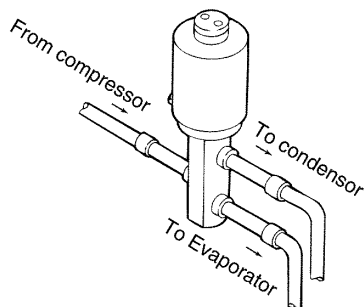
(1) Replacement of coil

- ① Disconnect the MV lead wire from the inside of control box.
- ② Remove the screw from the set side of the coil, and pull out the coil upward.
- ③ Install the new coil, tighten the set screw, then connect the lead wire at the controller.



(2) Replacement of MV body

- ① Disconnect the MV lead wire from the inside of the control box.
- ② Remove two binding bands which fasten the MV body.
- ③ Remove the MV body after cutting three pipes on the body, and remove remaining pipes from brazing parts.
- ④ For the installation of MV, first insert a pipe (inlet) at the left and next remaining two pipes (outlet), then braze the joints while cooling the lower valve body below 120°C [248°F] with wet cloth.
- ⑤ Return the binding band and lead wire into the original state.
- ⑥ After replacement, carry out refrigerant leakage checking, and make sure that any refrigerant does not leak.



(1) Replacement

- ① The internal structure of the solenoid valve is as shown below. (For checking and reassembly, refer to this illustration.)
- ② When brazing the pipe, cool down the body with wet cloth. (It is not required to disassemble the valve, but remove the coil assembly from the body.)
- ③ In case of reassembly, tighten the four hexagon socket head cap screws ⑤ with the torque of 2.9 N · m [30kg · cm] .

| No. | Parts name |
|-----|-------------------------------|
| ① | Hexagon head bolt (M5) |
| ② | Spring lock washer (M5) |
| ③ | Name plate |
| ④ | Coil assembly |
| ⑤ | Hexagon socket head cap screw |
| ⑥ | Cover assembly |
| ⑦ | Spring |
| ⑧ | Piston |
| ⑨ | Body |
| ⑩ | Gasket (teflon) |
| ⑪ | Sleeve |
| ⑫ | Inner ring |
| ⑬ | Piston ring |

6.1.8 Liquid solenoid valve(LSV)

- Model : REV1004DXF
- Power supply : AC24V, 50/60Hz

The LSV is open or closed according to the signal of the controller. When it is closed, the refrigerant flow is stopped. (It is open when it is energized)

6.1.9 Injection solenoid valve (ISV)

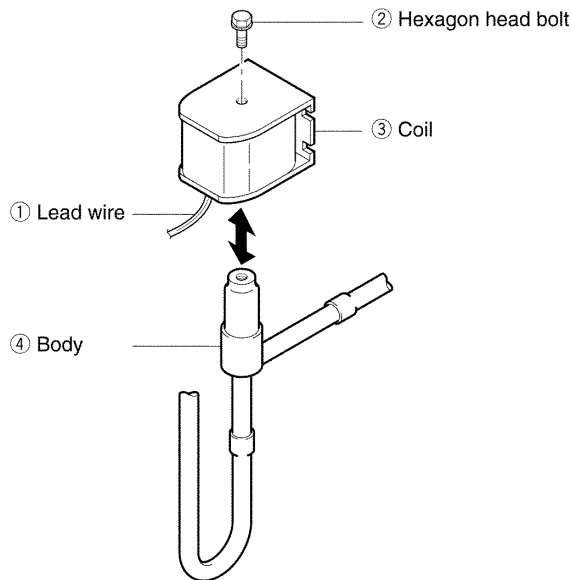
● Model : NEV-202DXF

● Power supply : AC24V, 50/60Hz

The ISV is open or closed according to the signal of the controller. When it is closed, the refrigerant flow is stopped. (It is open when it is energized.)

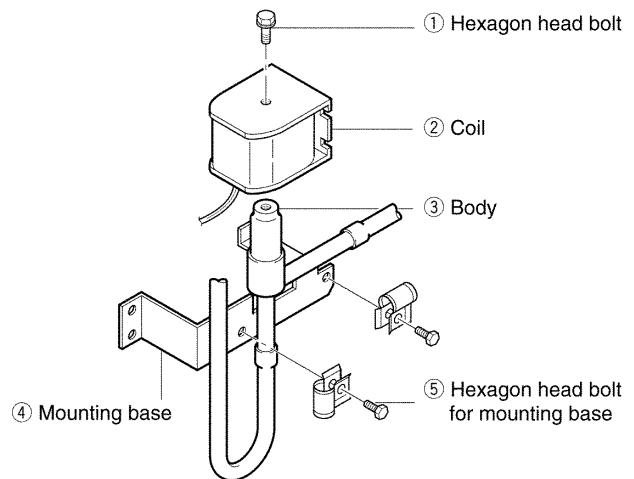
(1) Replacement of coil

- ① Disconnect the lead wire in the control box, and cut the binding bands fixing lead wires.
- ② Loosen the hexagon head bolt on the top of the coil, and pull out the bolt upward.
- ③ Replace the coil, and restore the hexagon head bolts, binding bands and connector into the original states.
Tightening torque for coil is $2.9 \text{ N} \cdot \text{m}$ ($30 \text{ kg} \cdot \text{cm}$).
- ④ After replacement, carry out the refrigerant leakage checking, and make sure that any refrigerant does not leak.



(2) Replacement of ISV body

- ① Loosen the hexagon head bolt on the top of the coil, and pull out the bolt upward.
- ② Remove the hexagon head bolt, cut two pipes on the body, then remove remaining pipes from brazing parts.
- ③ Connect a new body to the pipes, and braze the joint while cooling the body below 120°C [248°F] with wet cloth.
- ④ Install the coil, and restore the hexagon head bolt for mounting base and connector into the original state.



6.1.10 Hot-gas 3-way solenoid valve (HSV)

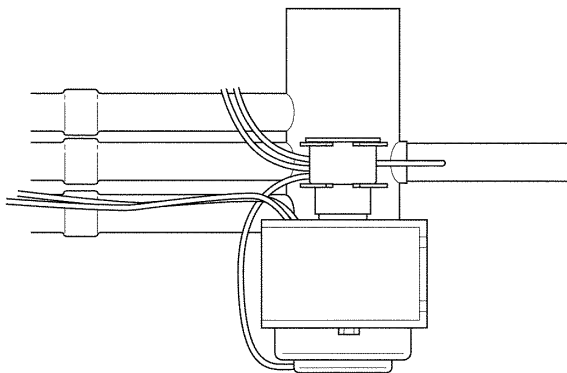
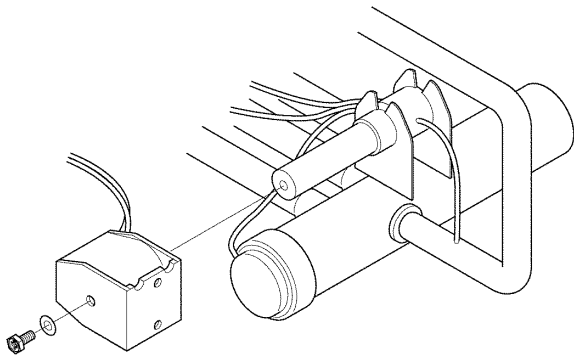
●Model : IHV804DXF

●Power supply : AC24V, 50/60Hz

The discharge gas directly flows to the evaporator in the defrosting and metering heating modes. The 3-way valve is provided to switch the discharge gas to the evaporator via the drain pan heater in the defrosting mode. Also, the dehumidification operation is controlled by the 3-way solenoid valve.

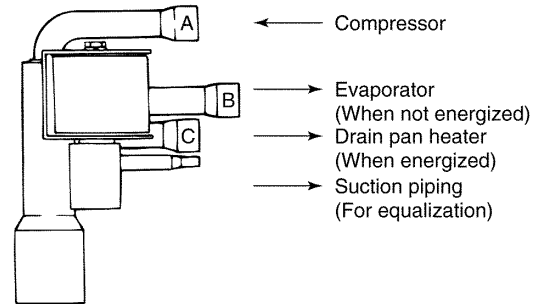
(1) Replacement of coil

| No. | Component name |
|-----|----------------------|
| ① | M4 Hexagon head bolt |
| ② | M4 Spring washer |
| ③ | Coil |
| ④ | Washer |
| ⑤ | Body |
| ⑥ | M4 Round head screw |
| ⑦ | Bracket |



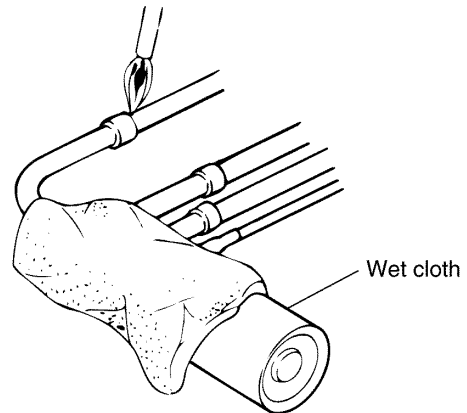
(2) Replacement of HSV body

●Piping connection



●Replacement

When brazing the valve body, remove the coil and cool the body below 120°C [248°F] with wet cloth.



6.1.11 High-pressure switch (HPS)

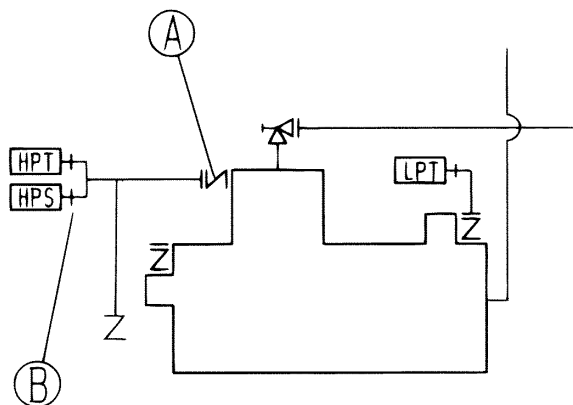
●Model 20PS780

●Set point : OFF 2059kPa (21.0kg/cm²)
ON 1569kPa (16.0kg/cm²)

When the refrigeration pressure of the unit abnormally rises, the compressor stops for safety. It will be actuated when the high pressure exceeds the set point due to the trouble of the condenser fan or the poor supply of the cooling water.

(1) Replacement

- ① Disconnect the lead wire in the control box.
- ② In order to prevent refrigerant from flowing out, disconnect the high-pressure gauge piping from the gauge joint (with check valve) (A) on the compressor side.
- ③ Remove the flare nut (B) and mounting screws of HPS on the casing at the right side of the compressor.
- ④ Replace the HPS. After tightening the flare nut (B), tighten the flare nut (A).
- ⑤ After tightening (A) slightly loosen the flare nut (B), purge air, and retighten (B).
- ⑥ After replacement, carry out the refrigerant leakage checking, and make sure that any refrigerant does not leak.



6.1.12 Water pressure switch (WPS)

LXE10D

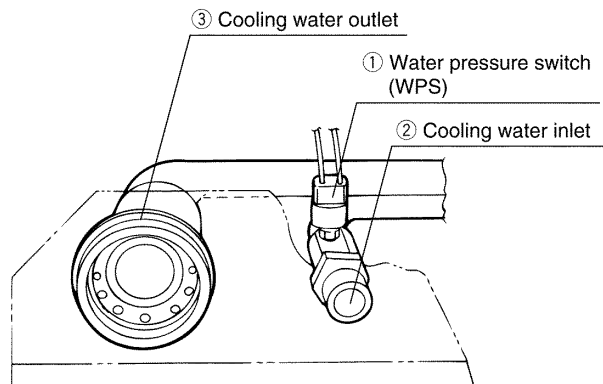
●Model : LCB-MB10

●Set point : OFF 98kPa (1.0kg/cm²)
ON 39kPa (0.4kg/cm²)

The WPS is to switch from the air-cooled operation to the water-cooled operation and visa-vis. When the cooling water pressure at the inlet exceeds the set point pressure, the contact is open to stop the condenser fan motor, and the water cooled operation will start.

(1) Replacement

- ① Disconnect the lead wire in the control box.
- ② Stop the cooling water pump, and make sure that no water pressure is charged, then remove the WPS.
- ③ After replacement of the WPS, wrap the dry seal tape on the thread, screw it in the thread.



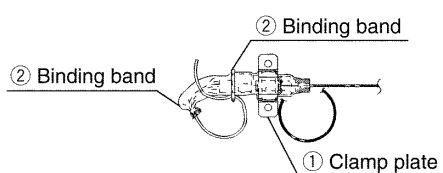
6.1.13 Low pressure transducer (LPT)

- Model : SPCL02
- Color indication : Low pressure transducer : Blue
Low pressure transducer cable : White

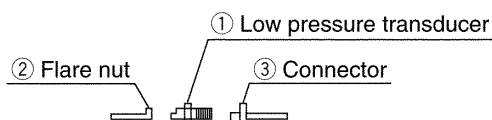
The LPT is located in the refrigerant circuit. The operating low pressure value is indicated in the controller indication panel.

(1) Replacement

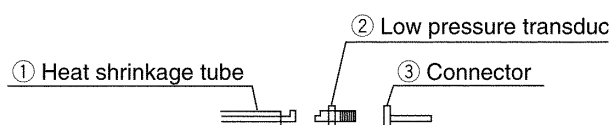
- ① Remove two screws on the clamp plate fixing low pressure transducer, and cut the binding bands.



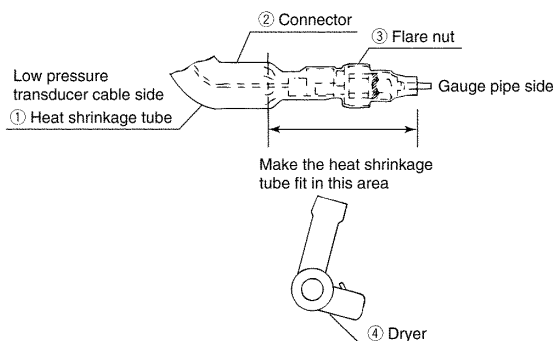
- ② Remove the heat shrinkage tube, and disconnect the connector from the low pressure transducer, then disconnect the low pressure transducer from the flare nut.



- ③ Insert the pressure transducer cable through the heat shrinkage tube, and connect the cable to the low pressure transducer. If paint on the low pressure transducer is peeled off, apply clear lacquer.



- ④ Apply the heat shrinkage tube in the following position, then shrink it with hot air of a dryer.

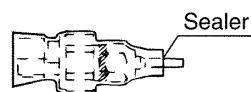


CAUTION

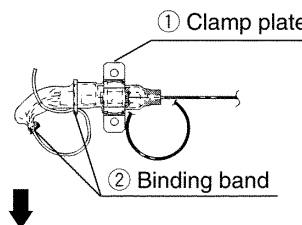
Do not expose the low pressure transducer to hot heat of a dryer for excess time.

Otherwise, the transducer may be damaged.

- ⑤ Apply sealer in between the heat shrinkage tube and the flare nut. (Sealer : KE4898)



- ⑥ Fix the low pressure transducer with the clamp plate, and fix the cable with the binding band. Fix the shrinkage tube end of the cable side downward for prevention of water ingress into the tube.



Fix the tube directing the end downward

6.1.14 High pressure transducer (HPT)

- Model : SPCH01
- Color indication : High pressure transducer : Red
High pressure transducer cable : Red

The HPT is located in the refrigerant circuit. The operating high pressure value is indicated in the controller indication panel.

(1) Replacement

The replacement procedure is the same as that for the low pressure sensor.

Make sure that the fixing position and the cable connection is correct.

6.2 Fan and fan motor

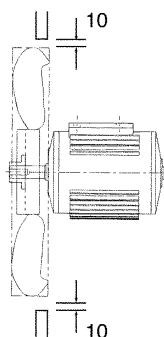
(1) Specifications

| | | Evaporator | Condenser |
|-------|-----------------------------------|---|--|
| Fan | Model | Propeller fan | |
| | Size | 440mm | 300mm |
| Motor | Model | 3-phase squirrel-cage induction motor | |
| | Output(60Hz) (Number of poles) | 700/90W (2P/4P) | 670W (4P) |
| | Bearing | Shielded ball bearing with rubber seal 6203WNC | Shielded ball bearing with rubber seal 620400NC-X |

(2) Installation structure

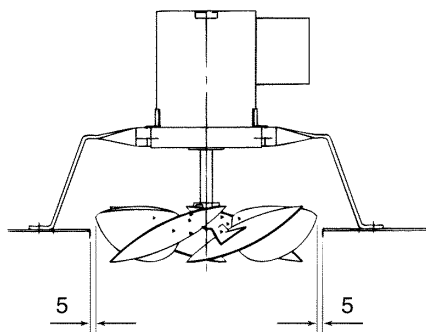
a. Condenser fan and fan motor

Condenser fan and fan motor



b. Evaporator fan and fan motor

Evaporator fan and fan motor



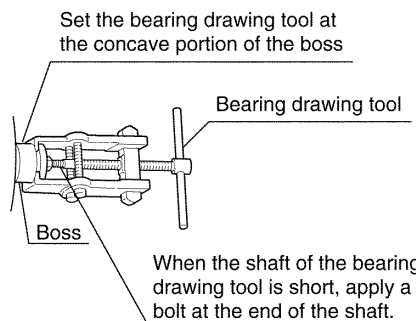
(3) Replacement

1) Condenser fan

Remove the fan grill and the fan guide, and loosen two hexagon set bolts on the boss of the fan, then pull out the fan forward.

※If the boss is stuck to the motor shaft, use the bearing drawing tool on the market.

●How to use bearing drawing tool on the market



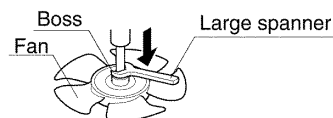
2) Condenser fan motor

- ① Remove the condenser fan.
- ② Disconnect the fan motor cable from the magnetic contactor in the control box.
- ③ Remove the fan motor mounting bolts, and replace the motor.
- ④ Install the fan motor and connect the cable.
- ⑤ After replacement, make sure that the fan is not in contact with the fan guide.

3) Evaporator fan

Loosen two set bolts on the boss portion of the fan, and pull out the fan downward.

※If the boss is stuck to the motor shaft, use a large spanner as shown below.



4) Evaporator fan motor

- ① After removing the fan at Item 3), cut the motor cable at the terminal box.
- ② Remove the motor mounting bolts. (Do not remove the motor mounting base.)
- ③ After removing the motor, connect the wiring with the cable by closed end connector.
- ④ Install the fan.
- ⑤ After replacement, make sure that the fan is not in contact with the fan guide. (For checking, rotate the fan by hand.)



CAUTION

Apply the locking products on the set bolts of the fan to prevent from loosing.

Otherwise, fan may drop from the motor.

6.3 PT and CT board (EC9756)

Two functions of the metering device and protector are integrated on this printed-circuit board. This board works as an interface between the main circuit (high voltage) and the controller.

(1) Function

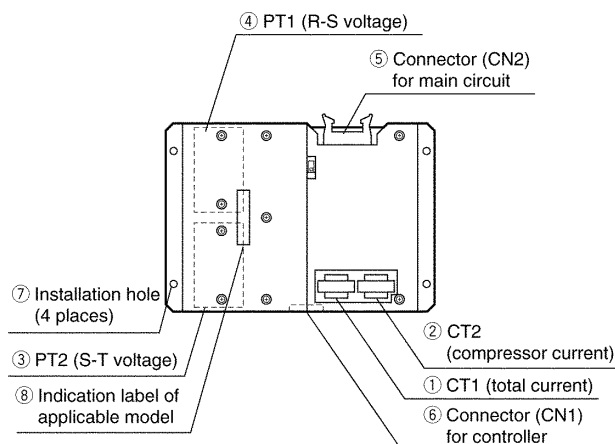
| Name | Content |
|-----------------------------------|---|
| Current measurement, (CT1, CT2) | AC 0 thru 50A (50/60Hz) |
| Voltage measurement, (PT1, PT2) | AC 150 thru 600V (50/60Hz) |
| Compressor overcurrent protection | Unit with 400V only : 26.0A Unit with 200V and 400V : 15.0A |
| Phase sequence detection | The phase sequence is detected by sending the voltage waveform to the controller. |

(2) Replacing procedure

- ① Disconnect the wire lead which passes through CT1 and CT2 at the voltage selector (cam switch).
※At this time, take care to prevent CT1 and CT2 from damaging.
- ② Disconnect the connector (CN1) for the controller and the connector (CN2) for the main circuit.
- ③ Remove four installing nuts.
- ④ After replacing the PT and CT board, connect the lead wires in reverse order of the above removal procedure.
- ⑤ After checking the wiring once, test-run the system to verify that no trouble is found.

CAUTION

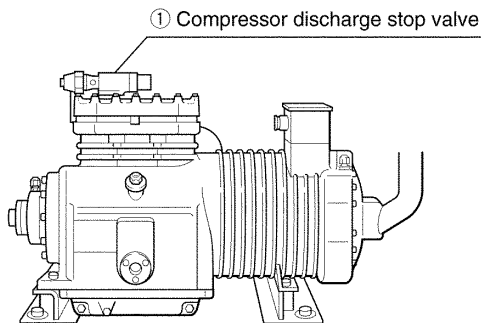
Make sure to apply the PT and CT board for 400V exclusive use and that for 200V and 400V dual use correctly when replacing.



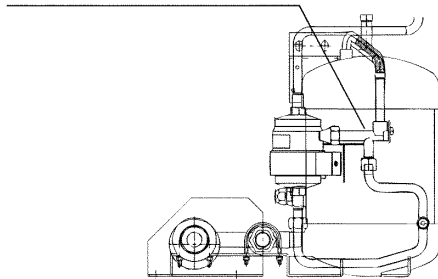
7. MAINTENANCE

7.1 How to handle stop valves

(1) Locations and kinds of stop valve

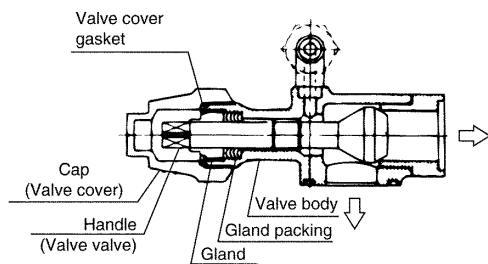


② Stop valve of water-cooled condenser (or receiver)

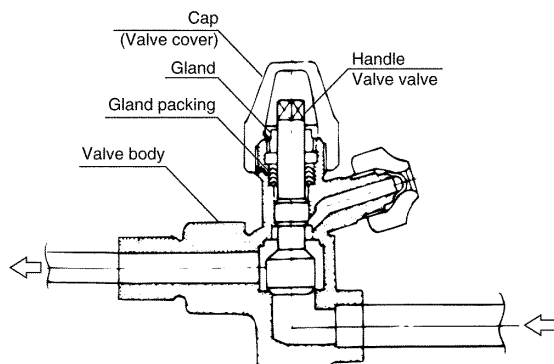


(2) Structure of stop valve

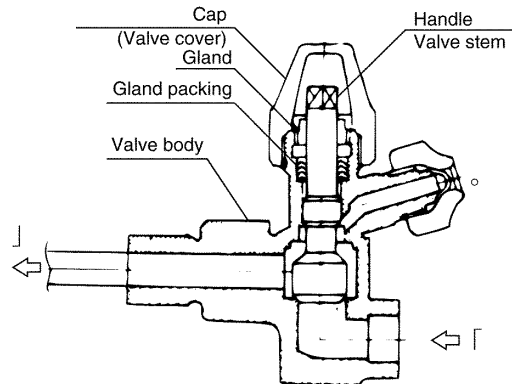
① Compressor discharge stop valve (VSH22XBP)



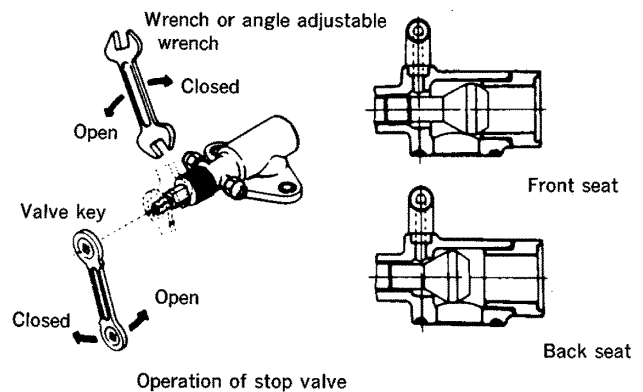
② Water-cooled condenser (or receiver) outlet stop valve (VSH10CBP-4S-4SR)



(3) Stop valve handling method



- ① Remove the cap (valve cover). At this time, take care not to miss the gasket.
- ② Loosen the grand as far as no gas is leaked.
- ③ Turn the valve stem to the following position.
 - Turn the handle to its full closing extent. →The refrigerant passage routes from ◦ to ↓ . (to front seat)
 - Turn the handle to its full open. →The refrigerant passage routes from 「 to ↓ . (to back seat)
 - Turn the handle to the neutral position. →The refrigerant passage routes from ◦ through 「 to ↓ .
- ④ After the completion of procedure ③ above, make sure to tighten the gland, and place the valve cap. At this time, don't forget to attach the gasket.

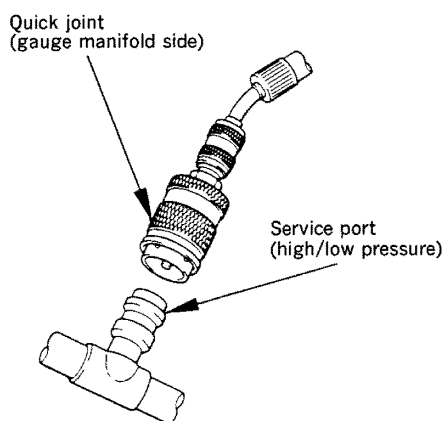


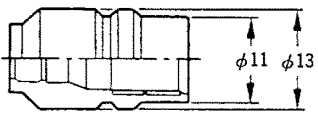
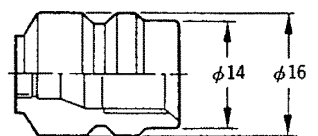
7.2 Installation and removal of gauge manifold

CAUTION

1. Use the pressure indicating function of the controller to refer the working pressure as possible instead of attaching the gauge manifold in order to prevent foreign particles or moisture from mixing into the refrigerant system.
2. Do not use any of the pressure gauge, gauge manifold, charge hose and charging cylinder which have been used for CFC12 in order to prevent refrigerant or refrigerating machine oil of a different kind from mixing. Use the exclusive tools for HFC 134a.

The service ports of quick joint type are provided to make improved handling.

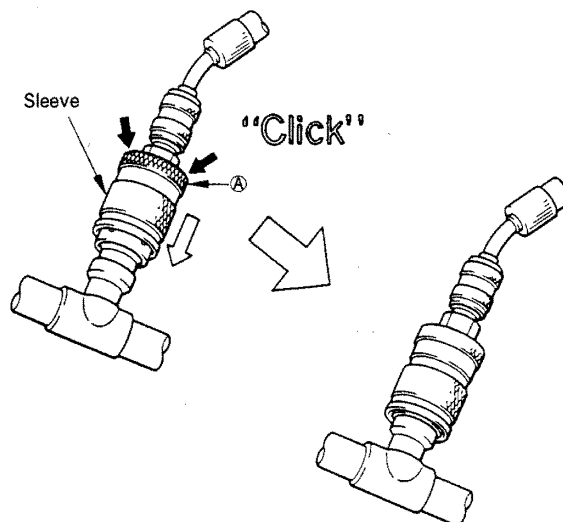


| SAE quick joints HFC134a | |
|--------------------------|---|
| Low pressure |  |
| High pressure |  |

Be sure to use the gauge manifold with the quick joints shown above.

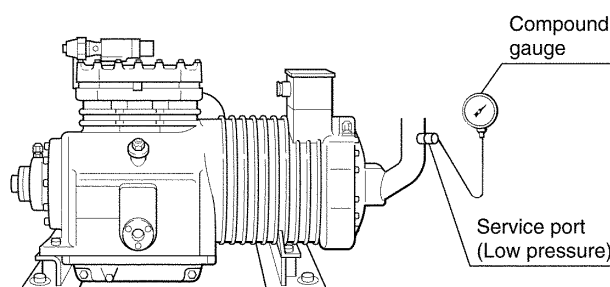
(1) Attaching the gauge manifold

Put the quick joint to the service port and push it at (A) until it clicks.



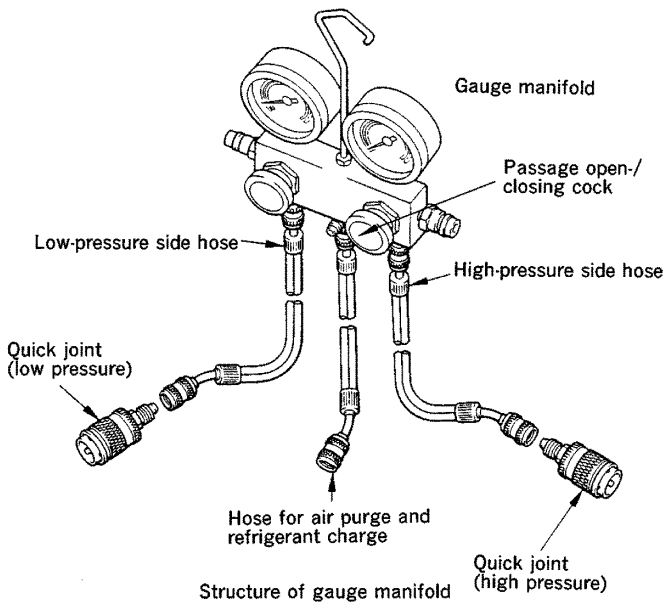
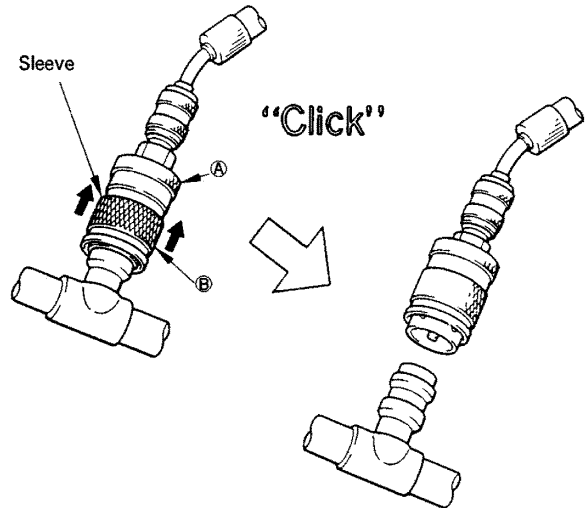
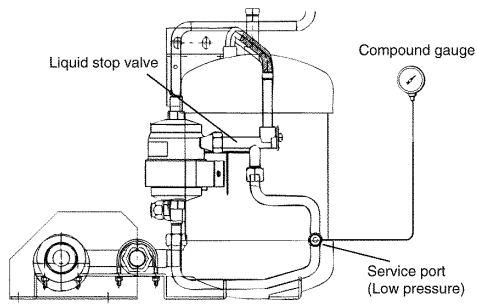
Caution

- ① Be sure not to bend the refrigerant pipe when pushing the quick joint.
- ② If the installation is failed due to movement of the sleeve, try it again after returning the sleeve at the original position.
- ③ The remaining pressure in the charge hose may cause the installation failure. In this case, try it again after removing the pressure in the hose.



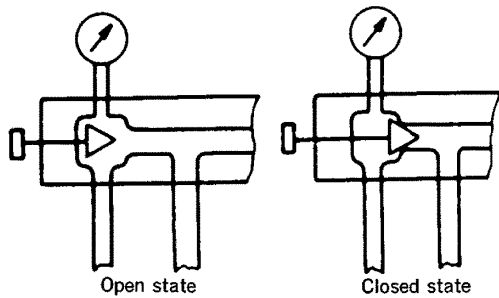
(2) Removal of pressure gauge and gauge manifold

Pushing the quick joint at (A), pull the sleeve upward and remove the quick joint from the service port.



⚠ CAUTION

Be sure to attach the cap to the service port after the removal of the manifold.



Open and closed states of gauge manifold

7.3 Pump down

Pump down is the process that the refrigerant in the refrigerant circuit is liquidized and accumulated in the water-cooled condenser (or receiver). When the refrigerant circuit is repaired, this work is required to minimize the refrigerant leakage and to avoid the risk caused by the leakage or rising pressure.

- ① Run the refrigeration unit in the cooling mode.
- ② Close the liquid stop valve at the water-cooled condenser (or receiver) outlet.
- ③ Turn off the UNIT ON/OFF key when the low pressure reaches 10kPa (0.1 kg/cm²), and close the discharge stop valve of the compressor.
- ④ After a short while, open the compressor discharge valve and repeat the same procedure.
- ⑤ Repeat the same procedure a couple of times, and the refrigerant will be accumulated in the water-cooled condenser (or receiver).

7.4 Replacement and charge of refrigerant and refrigerating machine oil



CAUTION

Carry out the operation check after the replacement or charge of refrigerant or refrigerant machine oil, then replace a dryer.

(1) Purging non-condensable gas

If air or other non-condensable gas exists in the refrigerant circuit, it is accumulated in the water-cooled condenser (or receiver), which raises pressure in the water-cooled condenser (or receiver) abnormally high and reduces heat transferring ratio of the condenser surface. It is, therefore, very important to purge non-condensable gas.

If the discharge pressure is abnormally high (even though cooling water amount is increased in the water-cooled operation) and will not return to the normal pressure, inspect if air or other non-condensable gas exists by the following procedure.

● Stop the compressor, and close the water-cooled condenser (or receiver) outlet valve, then wait until leaving and entering cooling air (or water) of the air (water) - cooled condenser become equal. If there is any difference between saturated pressure corresponding to cooling air (water) and condensing pressure, non-condensable gas exists. In this case, purge non-condensable gas as stated below.

- ① Accomplish pump down.
- ② Condense the refrigerant as much as possible, and then discharge the gas from the service port of the compressor discharge side.
- ③ Reading the pressure gauge, discharge the non-condensable gas repeatedly until condensing pressure becomes saturated pressure.

(2) Refrigerant purging

There are two methods of refrigerant purging ; i.e. one is for accumulating the refrigerant purged in a cylinder and the other is accumulating the refrigerant by using a refrigerant recovery unit.

(a) Accumulate the refrigerant in a cylinder

- ① Prepare an empty cylinder which has been dried and evacuated inside, and weigh it.
- ② Connect the cylinder to the service port of the liquid line by the charging pipe with the cylinder cock closed, and then loosen the flare nut on the cylinder side a little to purge the air from the charging pipe.
- ③ Operate the refrigeration unit to pump down the refrigerant.
- ④ After the completion of pump down, open the service port at discharge stop valve of water cooled condenser (or receiver), then open the cock of the cylinder to accumulate the liquid refrigerant in it.
- ⑤ After the accumulation of the refrigerant, close the cock, and then remove the charging pipe.
- ⑥ Be certain that the refrigerant has been accumulated in the cylinder by weighing it.
- ⑦ As for the refrigerant remaining in the refrigeration circuit, release it to the atmosphere.

Note : Use the refrigerant recovery unit to accumulated refrigerant in the refrigeration unit, and be sure not to purge it to the atmosphere except emergency case.

(3) Vacuum-dehydrating, and refrigerant/refrigerating machine oil charging

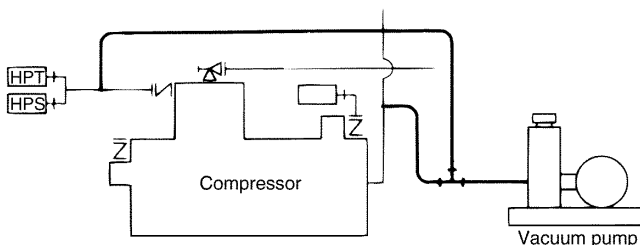
If all the refrigerant has leaked out and the air is intermixed in the refrigeration circuit, repair a cause of trouble and carry out vacuum-dehydrating. Then charge the specified amount of refrigerant. To replace the refrigerating machine oil, carry out the same procedure.

[Required tools]

1. Refrigerant cylinder (content of 20 kg) for HFC134a
2. Refrigerating machine oil (1 l or 5 l can) CASTROL ICEMATIC SW46
3. Gauge manifold with quick joints
4. Weighing scale (up to 50 kg)
5. Tools
6. Vacuum pump

(a) Charge of refrigerant alone without replacement of refrigerating machine oil

- ① Connect the vacuum pump to the service ports of the compressor suction pipe and discharge pipe, and then vacuum up to 76cmHg. Disconnect the vacuum pump, holding the refrigeration circuit in the vacuum state setting the discharge stop valve to the back seat. Here, if air enters in the refrigerant circuit, vacuum up the circuit to 76cmHg for more than 2 hours. (Vacuum-dehydrating)

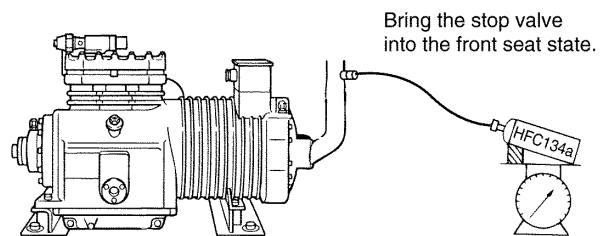


- ② Place a refrigerant cylinder on the weighing scale, and record the weight of the cylinder.
- ③ Charge the specified amount of refrigerant

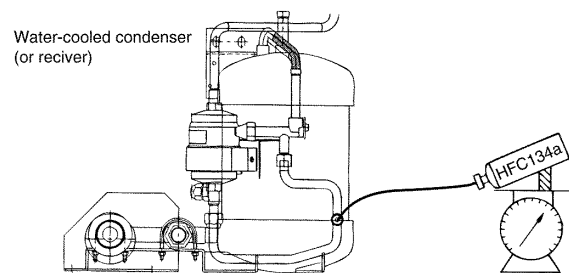
- In case of charging the liquid refrigerant

Charge the liquid refrigerant as shown in the figure (A) below. Make sure to prevent the liquid refrigerant accumulated in the water-cooled condenser (or receiver) from flowing to the low pressure side. If the refrigerant is hardly charged, charge the liquid refrigerant with the compressor running.

(A)



(B)



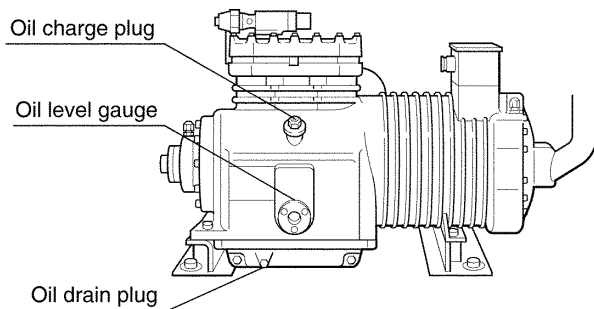
- In case of charging the gas refrigerant
- Charge the gas refrigerant as shown in the figure (B) below. If the refrigerant is hardly charged, charge the gas refrigerant with the compressor running.

- ④ After completing the refrigerant charge, return the stop valve into the original state (back seat), then confirm that if the specified amount of the refrigerant has been charged by operating the unit.

(b) Charge of refrigerant and replacement of refrigerating machine oil

① Refrigerating machine oil drainage procedure

Discharge all the gas to zero of the pressure in the refrigerant circuit. Then, loosen the oil drain plug at the bottom of the compressor to extract all the oil. At this time, first remove the oil charge plug and then the oil drain plug to prevent the oil from spouting out.



- ② Tighten up the oil drain plug.
- ③ Charge the specified amount of the oil from the compressor at the oil charge plug.
- ④ Accomplish the vacuum dehydrating and refrigerant charge stated in (a) ①.

 **CAUTION**

- Stop the compressor before the refrigerating machine oil replacement.
- Remove the oil level gauge for cleaning when discarding the refrigerating machine oil.
- Charge the CASTROL ICEMATIC SW46 only as the refrigerating machine oil.
- Never attempt to mix other kinds of refrigerating machine oil.
- Do not use any oil whose can is left opened to the atmosphere for a long time as it may have contained moisture.

(c) Replacement of refrigerating machine oil only

- 1) Pump down the refrigeration unit. (For details, refer to section 7.3 "Pump down".)
- 2) After pump down, close the compressor discharge stop valve.
- 3) Release the remaining refrigerant in the compressor from the oil charge plug. (At this time, remain the refrigerant pressure a little, and the later draining work will be done faster.)
- 4) Loosen the oil drain plug at the bottom of the compressor, and discharge all the oil.
- 5) Remove the level gauge for cleaning after draining the refrigerating machine oil.
- 6) Close the oil drain plug.
- 7) Charge the specified amount of the refrigerating machine oil from the compressor at the oil charge plug.
- 8) Vacuum-dehydrate the inside of compressor at the oil charge plug.
- 9) Return the stop valve into the original state.
- 10) Charge the following specified refrigerating machine oil only.
Manufacture CASTROL
Type ICEMATIC SW46
- 11) Take sufficient care to handle the refrigerating machine oil. (To avoid moisture mixture, different-oil mixture.)



CAUTION

Take the following care to handle the can which contains the refrigerating machine oil.

1. Open the can just before charging the oil . Once the can is opened, use all the oil in the can at once.

Replace the air in the empty space which is produced by the used oil with the dry air or dry nitrogen gas. Pour the small amount of remaining oil into a small container (with label) which can be excellently sealed.

※Since the commercially available refrigerating machine oil is filled in the can in the dry state (approx. 50ppm as the moisture contents), take the following care to handle the can.

Since ICEMATIC SW46 is hygroscopic ester oil, moisture will be absorbed to approx. 1500ppm if it is exposed to the atmosphere.

2. As possible, select a dry day for the oil replacement.
3. Never leave the can opened for 5 hours or longer.
4. Be sure not to charge the refrigerating machine oil whose can is left open for along time since it may cause the refrigerating machine oil being exposed to the moisture.

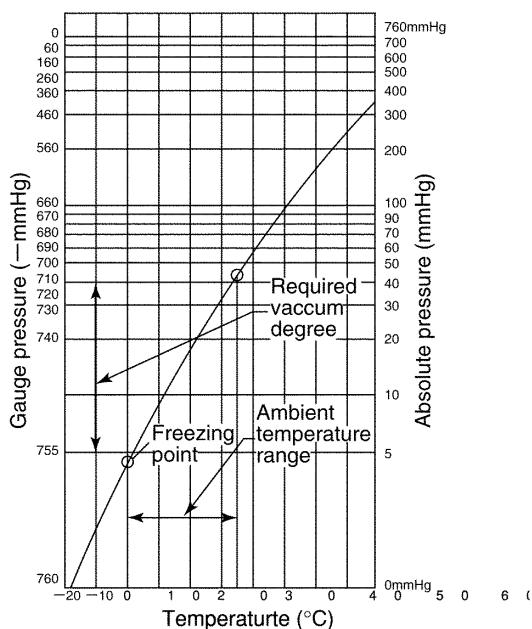
7.5 Vacuum dehydrating

After repairing the refrigerant system, vacuum-dehydrate the system before charging the refrigerant and refrigerating machine oil.

Vacuum-dehydrate is the process to make the circuit dry by purging the moisture (liquid) in the circuit to outside in state of vapor (gas) using the vacuum pump.

As the pressure is lower than normal atmosphere (760mmHg), the boiling point of water will rapidly drop. If the boiling point drops beyond the atmospheric temperature, water will be vaporized.

Example : If the atmospheric temperature is 7.2°C (45°F), vacuum-dehydrating will be impossible unless the vacuum degree is lower than -752mmHg. For vacuum-dehydrating, it is important to select and maintain the vacuum pump.



(1) Vacuum pump selection

Select a vacuum pump considering the following points.

- ① Select the vacuum pump whose vacuum achievability is excellent.
(A pressure of -755mmHg or lower is required.)
- ② The displacement must be relatively large (approx. 40 ℓ /min. or more).
Before vacuum-dehydrating operation work, be sure to use the vacuum gauge to confirm that the pump reaches the pressure of -755mmHg or lower.

| Boiling point of water (°C) | Atmospheric pressure (mmHg) | Vacuum degree (mmHg) |
|-----------------------------|-----------------------------|----------------------|
| 40 | 55 | -705 |
| 30 | 36 | -724 |
| 26.7 | 25 | -735 |
| 24.4 | 23 | -737 |
| 22.2 | 20 | -740 |
| 20.6 | 18 | -742 |
| 17.8 | 15 | -745 |
| 15.0 | 13 | -747 |
| 11.7 | 10 | -750 |
| 7.2 | 8 | -752 |
| 0 | 5 | -755 |

(Reference) Kinds of vacuum pumps and achievable vacuum

| Type | Achievable vacuum displacement | Application | |
|--|--------------------------------|--------------------|--------------|
| | | Vacuum dehydrating | Air exhaust |
| Oil rotary type (oil-necessary type) | -759.98mmHg 100 ℓ /min. | Applicable | Applicable |
| Oilless rotary type (oil-unnecessary type) | -750mmHg 50 ℓ /min. | Inapplicable | Inapplicable |
| | -759.98mmHg 40 ℓ /min. | Applicable | Applicable |

Take care that this type is often used as the handy type.

On the pump of an oil rotary type, it is important to replace oil and check the achievability every 1 to 2 months.

(2) Vacuum-dehydrating method

There are two methods of vacuum-dehydrating of normal vacuum-dehydrating and special vacuum-dehydrating. In general, the normal vacuum-dehydrating is applied. If any moisture is ingressed in the circuit, apply the special vacuum-dehydrating method.

[Normal vacuum-dehydrating]

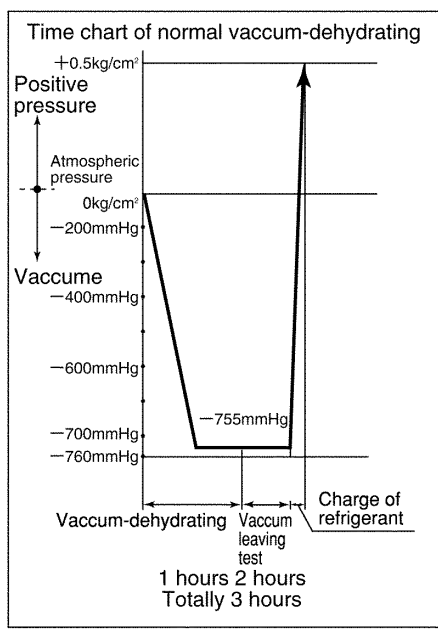
① Vacuum dehydrating (first time)

Connect the gauge manifold to the service ports of the liquid line and the suction line. Run the vacuum pump for 2 hours or longer. (The achievable vacuum must be -755mmHg or lower.)

If a pressure of -755mmHg or lower can not be achieved even after evacuation of 2 hours, moisture or leakage may exist in the system. In this case, run the pump another hour or more. If a pressure of -755mmHg or lower can not be achieved even after evacuation of 3 hours or more, check for leakage.

Note : Evacuate the system from the service ports of both liquid and suction lines.
Because the system is blocked on the way since the liquid solenoid valve is provided on the way of the system.

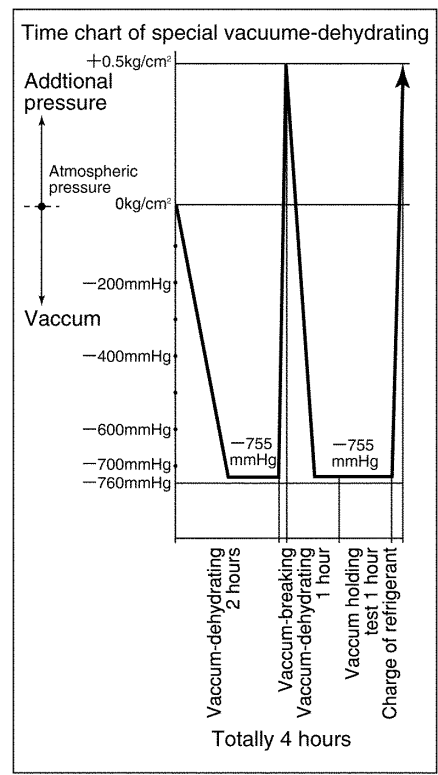
- ② Vacuum holding test
Hold the system at a pressure of -755mmHg or lower for 1 hour or longer, and confirm that the reading does not rise on the vacuum gauge. If it rises, moisture or leakage may exist in the system. Here, take care not to leak air from the gauge manifold. If air may ingress, it is recommended to use the copper tube directly instead of gauge manifold.
- ③ Charge of refrigerant
After the vacuum-holding test, evacuate the circuit again for approx.10 minutes. Then, charge the specified amount of refrigerant through the service port of the liquid line using the charging cylinder.
- ④ Fully open stop valves
Fully open the liquid stop valve and the suction stop valve.



[Special vacuum-dehydrating]
This method is that the vacuum breaking process with nitrogen gas is integrated one time or more on the way of the normal vacuum-dehydrating process.

- ① Vacuum-dehydrating (first time)
..... 2 hours
- ② Vacuum-breaking (first time)
Nitrogen gas is pressurized to 0.5kg/cm^2 . Since nitrogen gas breaks the vacuum, the effect of the vacuum-dehydrating is achieved. However, if there is much moisture, it can not be removed by this method. Therefore, do not make water ingress or produce water during the refrigerant piping work.
- ③ Vacuum-dehydrating (second time)
Run the vacuum pump one hour or longer. (The achievable vacuum must be -755mmHg or lower.)
If pressure of -755mmHg or lower can not be achieved even after evacuation of 2 hours, repeat Steps ② vacuum-breaking and ③ vacuum-dehydrating.
- ④ Vacuum holding test
.....1hour
Same as normal vacuum-dehydrating
- ⑤ Charge of refrigerant

Note : Make sure to use nitrogen gas for vacuum-breaking. (If any oxygen gas is used, it may explode.)



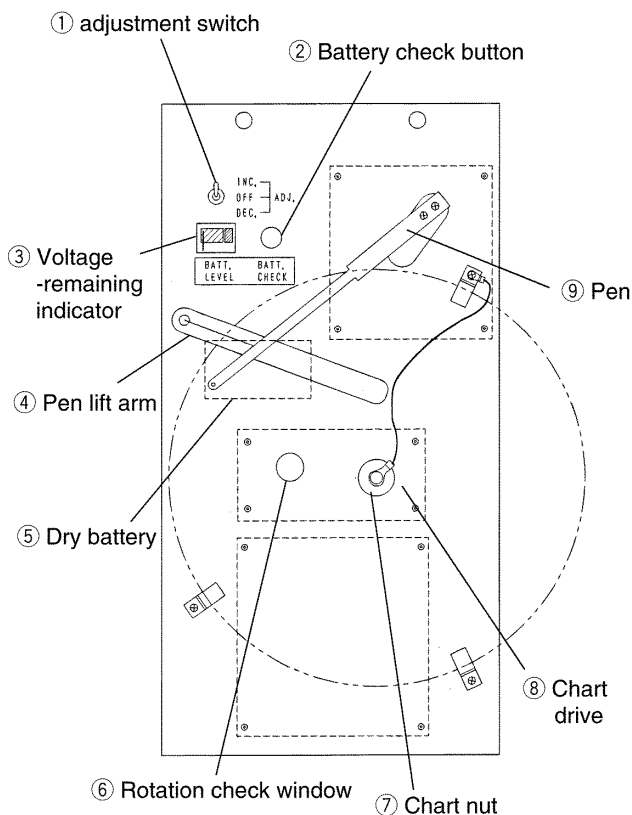
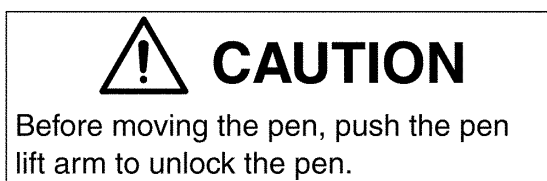
($1\text{mmHg}=0.0013\text{kg/cm}^2=0.133\text{Kpa}$)

8. OPTIONAL DEVICES

The following optional devices are available for some models.

8.1. Electronic temperature recorder

This recorder automatically records the control temperature (either return air temperature or supply air temperature) with the chilled/partial frozen and frozen switching signals. The maintenance and inspection functions including the sensor failure detecting function and calibration function are integrated.



(1) Specifications

- Model : DER9601A
- Power supply : AC13V 50/60Hz
- Recording temperature range :
-30.0~+25.0°C
(-22~+77°F)
- Chart paper : Round type 8-inch pressure-sensitive paper
[PARTLOW PSD-217C (REV.A) or equivalent]
(31days/rev.)
- Chart driving battery :
JIS C8501SUM2 } Equivalent
IECR14 } (DC1.5V)
Battery life
Approx. 1 year (Check with the voltage-remaining indicator)
- Voltage-remaining indicator (optional)
 - Green zone : Operable
 - Silver zone : Usable for 7 days
 - Red zone : Battery replacement is necessary.
- Recording pen driving system :
Pulse motor drive
- Sensor (Thermistor)

| Model | Use |
|----------|--------------------------------------|
| ST9503-4 | For RSS : Recorder Supply air Sensor |
| ST9503-2 | For RRS : Recorder Return air Sensor |

Note : Recording Accuracy

The accuracy of the recorder and the sensor are shown in the following table.

The calibration is applicable only on the recorder.

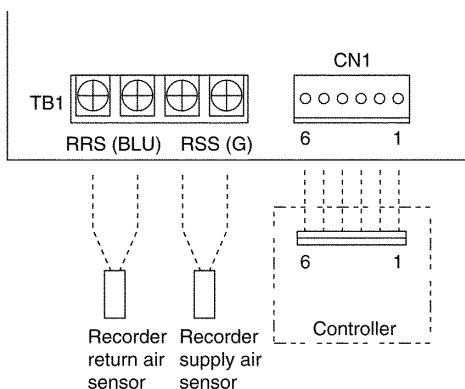
| Recording temperature range | Accuracy °C | | |
|-----------------------------|-------------|--------|-------|
| | Recorder | Sensor | Total |
| 25°C to 10°C | ±1.0 | ±1.0 | ±2.0 |
| 10°C to -15°C | ±0.5 | ±0.3 | ±0.8 |
| -15°C to -29.9°C | ±1.0 | ±1.0 | ±2.0 |

(2) Devices and schematic wiring diagram

1) Devices

| Device | Location |
|----------------------------------|---------------------------------|
| Temperature recorder board | In the temperature recorder box |
| Recorder return air sensor (RSS) | Evaporator suction area |
| Recorder supply air sensor (RSS) | Evaporator discharge area |

2) Schematic wiring diagram



(3) Checking (Calibration) of the indicated value on the recorder (optional)

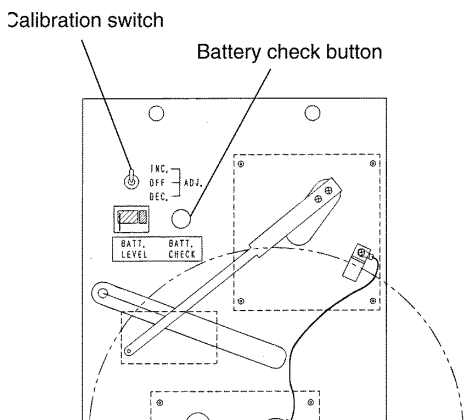
This recorder can be checked for its switching function for recording sensors and temperature indication functions regardless of inside temperature, and can be adjusted.

1) Switching function for recording sensors

The temperature recorder automatically switches the recording sensors according to the set point temperature set on the controller.

(RSS for frozen and partial frozen modes, RSS for chilled mode)

| Set point temperature (°C) | Recording sensor |
|----------------------------|-------------------|
| -30.0 to -3.0 | Return air sensor |
| -2.9 to 25.0 | Supply air sensor |

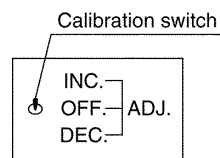


2) Pen adjusting function (optional)

Recording temperature is adjustable by changing the pen position using the calibration switch.

INC : To increase temperature figure

DEC : To decrease temperature figure

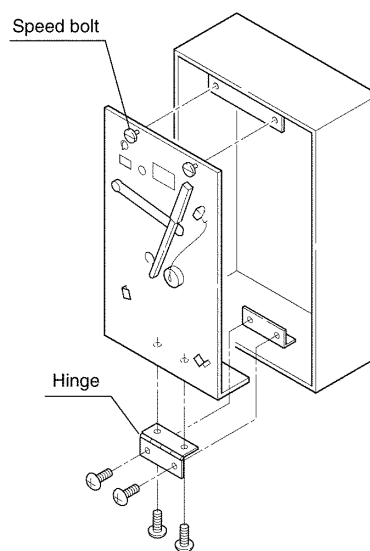


Notes :

1. The pen is adjusted to suit to the PSD-217C (REV.A) recording chart paper or its equivalent.
Do not use the recording charts other than ones mentioned above.
2. Do not change the position of pen during transportation.
3. When the power is supplied, the pen vibrates momentarily and will return to its original position due to the recording characteristics, but this is not a sign of trouble.

(4) Replacement of temperature recorder

- ① Turn off the circuit breaker.
- ② Remove the wiring connector and sensors from the back of the temperature recorder.
- ③ Remove the hinges on the bottom and the speed bolts on the top.



- ④ Replace the temperature recorder board.
- ⑤ After replacement, be sure to check the wiring.

8.2 USDA receptacle and sensor

The units with the USDA receptacles allow to install the pulp-temperature sensors for the low-temperature treatment transportation regulated by USDA (United States Department of Agriculture). Here, only the sensors specific to USDA are applicable to the receptacles.

(1) Requirements for USDA low-temperature treatment transportation

1. Precool cargo at the set point temperature.
2. Cool the container before loading cargo into it.
3. Calibrate the USDA sensors at every PTI.

(For sensor calibration, use the software (Windows version) "USDA COLD TREATMENT-CALIBRATION USDA SENSORS" supplied by Daikin. Refer to the "Operation Manual for Personal Computer Software".)

<Sensor Calibration Procedure>

- ① Connect the serial communication port (RS-232C) on the personal computer and the P.C. port receptacle on the DECOS] b controller. (or the communication ports on DECOS] /DECOS] a controller) with the communication cable.
- ② Prepare the ice bath, put the three sensors to be calibrated into the ice bath, and thoroughly stir it so as to get uniform distribution of temperature.
- ③ Select CALIBRATION SENSORS in the <SUB MENU>, then temperature of three sensors is indicated on the screen.
- ④ Press the OK button, then the message "Do you cancel former calibration?" appears. If you want to cancel the previous calibration, select YES.
- ⑤ If YES is selected, the message "Push [OK] button when the temperature of ice-bath is stabilized at 0 degC." appears. When the temperature of ice bath has stabilized at zero, press the OK button.
- ⑥ The personal computer calculates the deflection of each sensor and sends the data to the controller, and the message "Completed! Hit" appears.
- ⑦ To resume the <SUB MENU>, press the OK button.

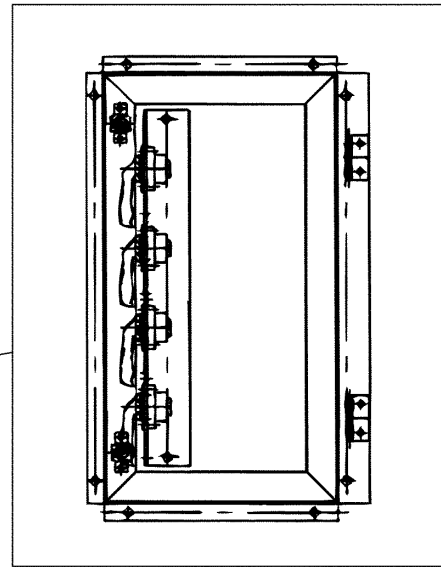
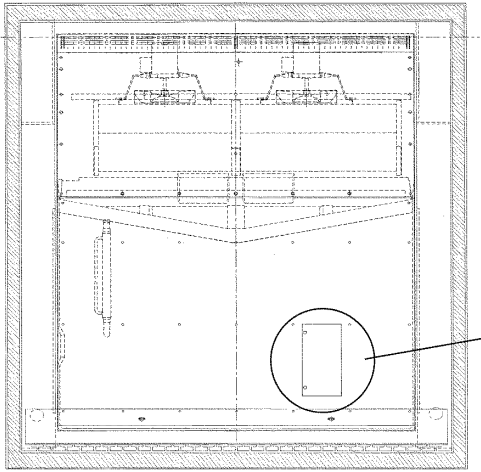
Note : If the deflection exceeds 1.0°C, the indication of pertinent sensor name is highlighted. This implies that the sensor has been degraded. Replace it with new one.

(2) USDA low-temperature treatment transport data control

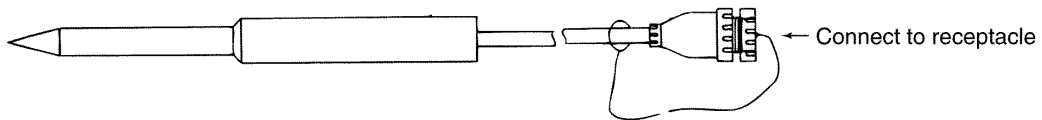
The electronic controller stores the sensor values obtained in case of USDA low-temperature treatment transportation (up to 62 days). Also, the transition of sensor values can be displayed in a graphic chart.

● An example of installation of USDA receptacle in unit

● USDA receptacle



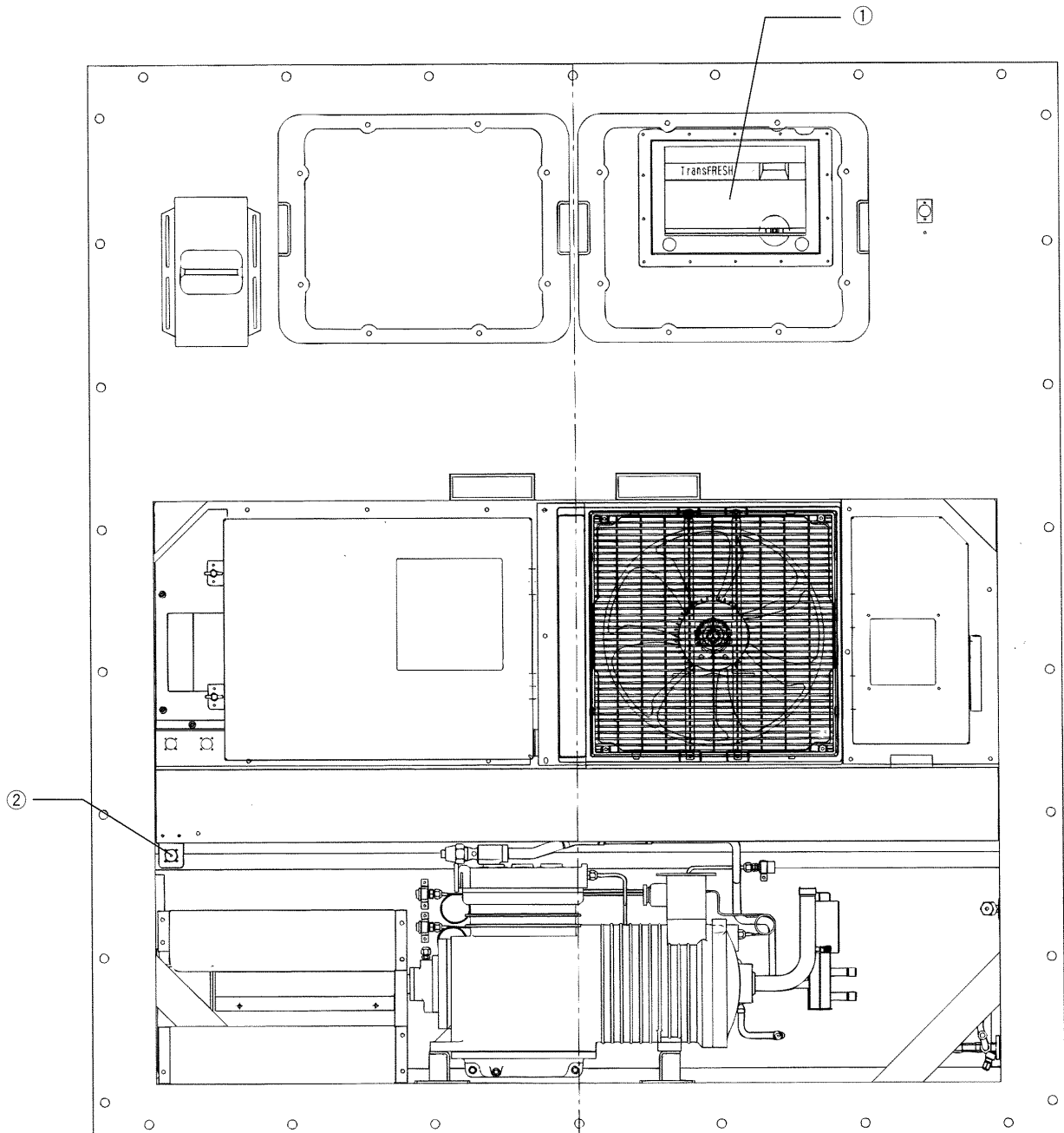
● USDA sensor



8.3 TransFRESH

The TransFRESH CA devices are provided to control the internal atmosphere (quantity of O₂ and CO₂). Use the CA devices according to the Operation Manual supplied by TransFRESH. The CA devices including the controller and the sensor are installed by the TransFRESH's agents before transportation.

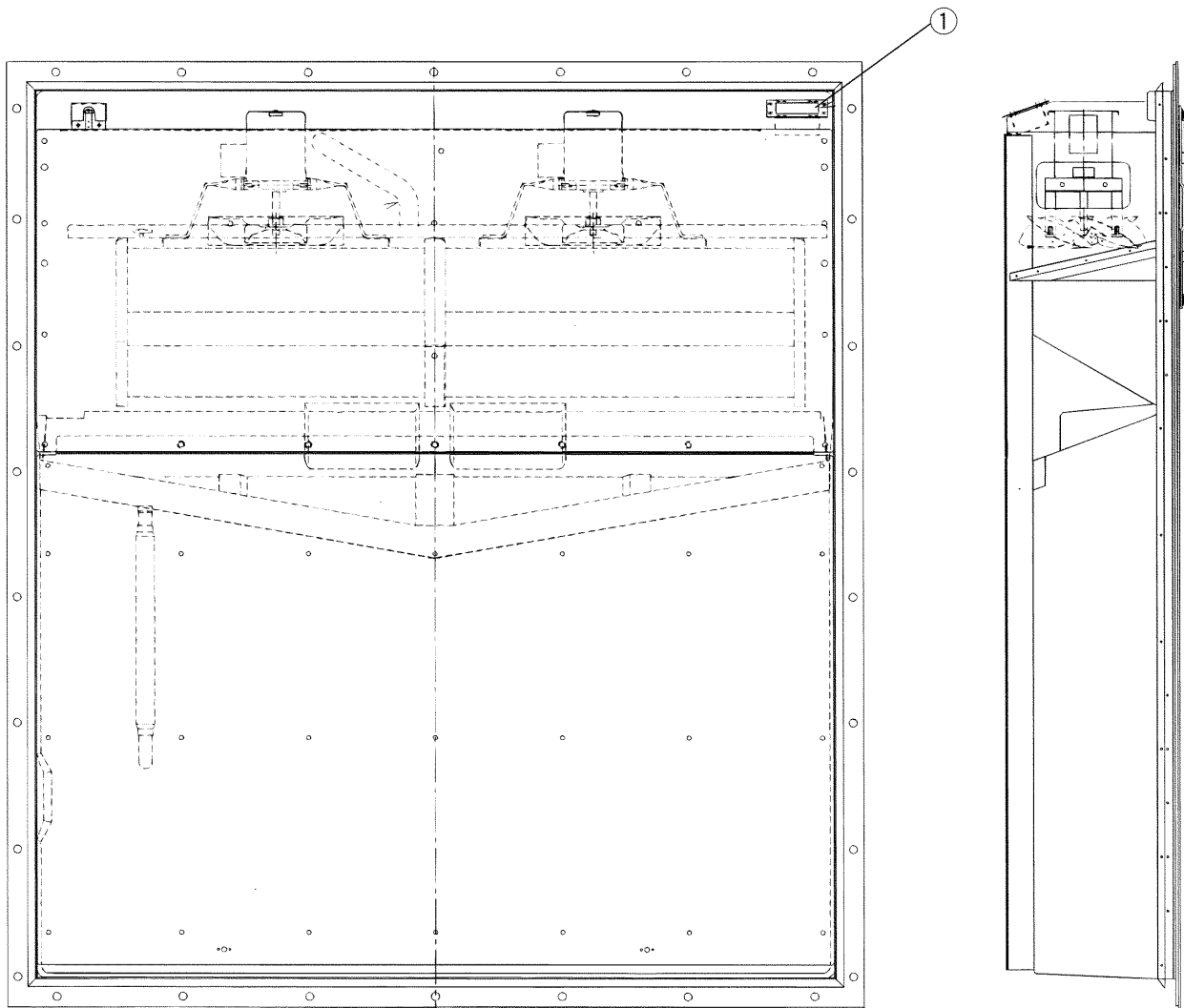
- An example of installation of CA devices, at outdoor side



① TransFRESH SECURITY ENCLOSER

② TransFRESH COMMUNICATION BRACKET

● An example of installation of CA devices at indoor side



① TransFRESH ASS'Y A4&A5 CABLES W/MOUNTING BOX

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TROUBLESHOOTING

Coil resistance of each motor and solenoid valve (Normal valve)

- Compressor motor coil : 1,780 Ω (@75°C)
- Evaporator fan motor coil : 57.2 Ω
- Condenser fan motor coil : 19.4 Ω
- Liquid solenoid valve coil (LSV) }
• Hot gas solenoid valve coil (HSV) } : 15.2 \pm 1.1 Ω (common)
• Injection solenoid valve coil (ISV) }
- Electronic expansion valve coil (EV) : 150 Ω /PHASE
- Modulating control valve coil (MV) : 10.3 Ω

※These valve are at normal temperature exclude compressor.

1. Refrigeration system and electrical system

If the unit does not work properly, refer to the following table to find causes of trouble and provide appropriate measures.

| State | Malfunction phenomenon | Abnormal point | Possible cause | | | | |
|--|---|--|--|---|--|--|--|
| Unit does not operate. | A. Neither evaporator fan, condenser fan nor compressor run | ① No trouble with unit | Power failure | | | | |
| | | | External power supply : OFF | | | | |
| | | | Disconnection of power plug | | | | |
| | | | Poor contact of power plug | | | | |
| | | ② Circuit breaker | Circuit breaker : OFF | | | | |
| | | | Solenoid valve burned out or short circuit | | | | |
| | | | Contacting coil burned out or short circuit | | | | |
| | | ③ UNIT ON/OFF Key | Short circuit of wiring | | | | |
| | | | Key : OFF or malfunction | | | | |
| | | ④ Controller | Wire breakage in the control circuit transformer | | | | |
| | Fuse (10A) burned out | | | | | | |
| | Open phase (R or T) | | | | | | |
| | Unit stops soon after operation. | B. Evaporator fan rotates, but condenser fan and compressor do not rotate. | ① No trouble with unit | Shut off due to happening of alarm | | | |
| | | | | Inside temperature is lower than SP. (at frozen mode) | | | |
| | | | | C. Condenser fan rotates, but evaporator fan and compressor do not rotate. | ① Actuation of electronic overcurrent protection device, PT/CT board | Overcurrent due to overload operation, etc | |
| D. Compressor rotates, but evaporator fan and condenser fan do not rotate. | | | | | | ① Transformer for fan motor | Wire breakage or open phase |
| | | | | | | | ② Actuation of fan motor thermal protector |
| E. Compressor buzzes, but it does not operate. | | | | | Not-closing of thermal protector contact point | | |
| | | | | | Open phase | | |
| | | | | | Lock | | |
| A. Unit start but soon stops. | | | | ① Actuation of high pressure sensor within 30 seconds after compressor starting | Low supply voltage | | |
| | | | | | Compressor fan motor burned out or short circuit | | |
| | | ② Abnormal low pressure drop within 2 seconds after compressor starting | Discharge stop valve : closed | | | | |
| | | | Liquid stop valve : closed | | | | |
| | | ③ Actuation of electronic overcurrent protection device, PT/CT board | Overcurrent due to overload operation, etc | | | | |
| ④ Actuation of compressor thermal protector | | | Overcurrent due to overload operation, etc | | | | |
| | | B. Evaporator fan rotates, but condenser fan and compressor do not rotate. | ① No trouble with unit | During ON-OFF control operation in the frozen mode | | | |

| State | Malfunction phenomenon | Abnormal place | Possible cause | | |
|--|--|-------------------------------------|--|---|---|
| ┌ Unit stops soon after operation. | C. Condenser fan rotates, but evaporator fan and compressor do not rotate. | ① Actuation of high-pressure switch | Refrigerant overcharge | | |
| | | | Air ingress in the refrigerant system | | |
| | | | Insufficient air flow rate in the air cooled condenser | | |
| | | | ○ Condenser finned coil clogged | | |
| | | | ○ Air passage blocked by foreign material | | |
| | | | ○ Broken blade of condenser fan | | |
| | | | ○ Condenser fan motor rotation failure | | |
| | | | ○ Actuation of condenser fan motor thermal protector | | |
| | | | ○ Short circuit of condenser cooling air | | |
| | | | ○ Wrong installation of condenser fan | | |
| | | | ○ Reverse rotation of condenser fan | | |
| | | | Insufficient cooling water flow rate | | |
| | | | ○ Water-cooled condenser clogged with scale | | |
| └ Inside temperature does not drop. | A. Suction pressure is high. | ① Poor compression of compressor | Damage on suction or discharge valve | | |
| | | | Abrasion of piston ring, damage on internal packing | | |
| | | ② Modulating control valve | Valve clogged with contamination | | |
| | | ③ Electronic expansion valve | Electronic expansion valve malfunction | | |
| | B. Suction valve is excessively low. | ④ Injection solenoid valve | ① Liquid solenoid valve (Not opened.) | Leakage | |
| | | | | ② Shortage of refrigerant charge | Solenoid valve coil malfunction |
| | | | | | Refrigerant leakage |
| | | | | ③ Dryer | Dryer clogged with contamination |
| | | | | | No attention to the valve |
| | | | | ⑤ Electronic expansion valve | Valve clogged with moisture |
| | | | | | Valve clogged with contamination |
| | | | | | Breakage of coil lead wire or disconnection of connector |
| | | | | | Lead wire breakage or mis-mounting of heat exchanger inlet or outlet sensor |
| ⑥ Evaporator | | | | Electronic expansion valve body malfunction | |
| | Abnormal frosting | | | | |
| | Insufficient air flow rate in the evaporator | | | | |
| | • Air passage blocked by foreign material | | | | |
| | • Evaporator fan motor malfunction | | | | |
| | • Evaporator fan damage or fall out | | | | |
| • Air short circuit of evaporator cooled air | | | | | |
| • Reverse rotation of evaporator fan motor | | | | | |
| C. Defrosting is not initiated. | ① MANUAL DEFROST Key | ① | Continuity defective | | |
| | | | ② Evaporator outlet sensor | Incorrect installation of sensor | |

| State | Malfunction phenomenon | Abnormal place | Possible cause | | | |
|---|---|----------------------------------|---|--|---|---|
| Inside temperature does not drop. | C. Defrosting is not initiated. | ③ Modulating control valve | Valve clogged with contamination Magnetic coil failure | | | |
| | D. Defrosting is operated frequently. | ① No trouble with the unit | Excessive amount of moisture in cargo | | | |
| | | ② Injection solenoid valve | Leakage | | | |
| | | ③ Defrost timer | Short setting timer | | | |
| | E. Refrigeration unit is normal. | ① Container | High cargo temperature Poor thermal insulation or air leakage | | | |
| Inside temperature does not rise (in the heating mode). | A. Discharge pressure is low. | ① Poor compression of compressor | Damages on suction or discharge valve Worn-out of piston ring or damages on internal gasket | | | |
| | | ② Modulating control valve | Hot gas leakage to condenser side | | | |
| | | ③ Injection solenoid valve | Valve clogged with contamination | | | |
| | B. Discharge pressure is high. | ① Evaporator fan | Damages on fan blade Rotation failure of fan motor Actuation of fan motor thermal protector | | | |
| | | | A. Hunting | ① Modulating control valve | Valve clogged with contamination | |
| | | | | ② Electronic expansion valve | Feeler bulb influenced by ambient temperature | |
| Control is unstable. | B. Temperature continues dropping. | ① Modulating control valve | Valve clogged with contamination Magnetic coil malfunction Wire breakage | | | |
| | C. Temperature continues rising. | ① Modulating control valve | Valve clogged with contamination | | | |
| | | ② Electronic expansion valve | Valve clogged with contamination | | | |
| | | ③ Evaporator | Insufficient evaporator air flow rate (Refer to ┘ —B—⑥.) | | | |
| | | ④ Dryer | Dryer clogged with contamination | | | |
| | ⑤ Shortage of refrigerant charging amount | Refrigerant leakage | | | | |
| | Abnormal vibration or abnormal noise. | A. Abnormal noise is generated. | ① Compressor | Worn-out of fan motor bearing Damages on suction or discharge valve Loose-tightened bolt | | |
| | | | | ② Evaporator fan | Loose fan motor set bolt Deformation of fan motor set leg or loose-tightened bolt Crooked fan motor shaft Worn-out of fan motor bearing Deformation of fan guide Contact between fan and fan guide | |
| | | | | | ③ Condenser fan | Loose-tightened fan motor set bolt Bending of fan motor shaft Worn-out of fan motor bearing Deformation of fan guide Deformation of condenser front panel |
| | | | B. Abnormal vibration generates. | | | ① Compressor |
| ② Piping | | | | | | Loose-tightened or missing of clamp bolt |
| Water-cooled operation is impossible. | | | Although water couplings are connected, condenser fan continues rotating. | | ① No actuation of water pressure switch | Insufficient cooling water flow rate Water pressure switch malfunction |
| | | | | | ② No trouble with the unit | To prevent temperature from rising in the control box, the condenser fan rotates at the ambient temperature of 30°C or higher. |

2. Alarm codes on electronic controller

If any alarm occurs, search its cause and repair it referring to the following table.

Be sure to check the connectors in the electronic controller as the poor contact of them may cause the controller alarm codes.

| Alarm code | Content | Possible cause | | | |
|---|--|--|--|--|--|
| F101 | The high-pressure switch (HPS) actuates within 30 seconds after the compressor start or the protecton devices actuation at unit start -up. | The discharge stop valve is closed. | | | |
| | | The wiring lead of the high-pressure switch is cut. | | | |
| | | The high-pressure switch is defective. | | | |
| | | The high-pressure switch contact is defective. | | | |
| | | The condenser fan motor is defective. | | | |
| Printed-circuit board failure | | | | | |
| F109 | The low pressure becomes -72kpa or lower within 2 seconds after compressor starts. | The liquid stop valve is closed. | | | |
| | | The low pressure transducer (LPT) value is abnormal. | CPU board failure The low pressure transducer failure | | |
| F111 | High-pressure switch (HPS) does not actuate at set value. | High-pressure switch is disconnected. | | | |
| | | High-pressure transducer is disconnected. | | | |
| F301 | Temperature setting request | Set point temperature is not set. | | | |
| | | Failure of SRAM (on CPU board) | | | |
| F401 F403 | In the chilled or partial frozen mode, the supply air sensor (SS) or return air sensor (RS) is defective. | Short circuit or breakage of both sensor lead wires | | | |
| | | Wrong wiring connection on both sensors | | | |
| | | Both sensors defective | | | |
| | | CPU board malfunction | | | |
| F603 | The modulating control valve does not fully open although it is set to be full-open. | Electronic expansion valve coil is broken. | | | |
| | | Electronic expansion valve body malfunction | | | |
| F701 | Abnormal power voltage Note 1 | | | | |
| F705 | S phase is open phase | The voltage selector is in poor contact. | | | |
| | | The circuit breaker is in poor contact. | | | |
| | | Power plug is in poor contact. | | | |
| | | Power cable breakage | | | |
| | | Open phase of power supply | | | |
| F803 | Any following error codes are counted 5 times E101 · E103 · E105 · E107 E109 · E203 · E707 | Refer to the possible cause of the left error code. | | | |
| E101 | The high-pressure switch (HPS) actuates during operation. | Refrigerant is overcharged. | | | |
| | | Wrong refrigerant is charged. (ie HCFC22) | | | |
| | | Air ingressed in the refrigerant system | | | |
| | | Insufficient air flow rate | Fins are clogged | | |
| | | | Air passage is blocked by some foreign material. | | |
| | | | Short circuit of condenser cooling air | | |
| | | | Wrong installation of condenser fan | | |
| | | | Condenser fan rotates reverse. | | |
| | | | Condenser fan breakage | | |
| | | Condenser fan fell out. | | | |
| | | Ambient temperature is abnormally high. | | | |
| | | Condenser fan motor running is abnormal | Motor stops due to thermal protector actuation. | Clogged finned coil. | |
| | | | | Air passage is blocked by some foreign material. | |
| | | | Motor does not run. | Wiring lead breakage | |
| | | Water-cooled condenser capacity is decreased. | Shortage of cooling-water | | |
| | | | Cooling-water temperature rise | | |
| | | | Clogged with scale | | |
| HPS malfunction | | | | | |
| Wiring lead breakage | | | | | |
| Poor connection with terminal block board | | | | | |
| Wrong wiring of high pressure switch | | | | | |
| CPU board malfunction | | | | | |
| I/O board malfunction | | | | | |

Note1 : If S phase is open, F701 may occur. When F701 and F705 are displayed together, inspect the S phase for opening.

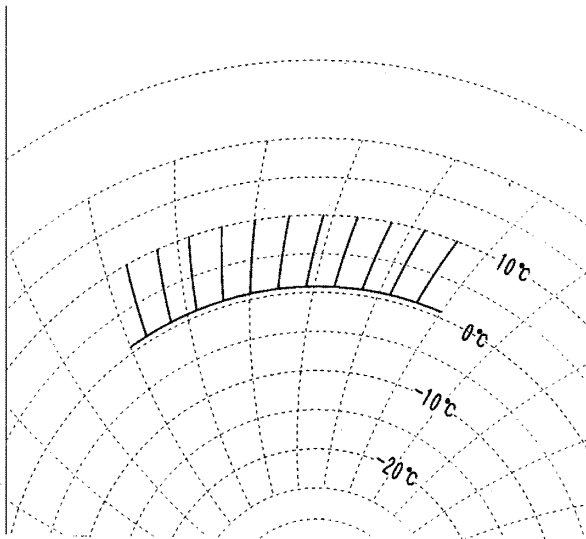
| Alarm code | Content | Possible cause | | |
|--|---|---|--|---------------------------|
| E103 | Electronic overcurrent protector (electronic overcurrent protection device) actuates. Compressor thermal protector (CTP) actuates. | Compressor lock | | |
| | | CPU board malfunction | | |
| | | I/O board malfunction | | |
| | | PT/CT board malfunction | | |
| | | Shortage of refrigerant amount | Refrigerant leakage | |
| | | | Wiring lead breakage | |
| | | | Defective wiring | |
| | | | Coil burned out | |
| | | Injection solenoid valve is not opened. | Coil fell out | |
| | | | Injection capillary is clogged. | |
| Compressor thermal protector (CTP) malfunction | | | | |
| Compressor malfunction (Compressor lock) | | | | |
| E105 | Micro-computerized overcurrent protector (micro-computerized overcurrent protection device) actuates. | Compressor malfunction (Compressor lock) | | |
| | | Excessive refrigerant supply during defrosting and metering heating | Injection solenoid valve is not closed due to foreign materials. | |
| | | The current sensor (CT2) value is abnormal. | CPU board malfunction Current sensor malfunction | |
| E107 | Discharge gas temperature sensor (DCHS) becomes 130°C or higher during operation. | Injection solenoid valve operates improperly. | Valve is clogged with contamination | |
| | | | Wire lead breakage | |
| | | | Wrong wiring | |
| | | | Coil burned out | |
| | | Coil fell out | Injection capillary is clogged. | |
| | | | High pressure is abnormally high. | Overcharge of refrigerant |
| | | Compressor valve breakage or internal gasket damage | | |
| | | Refrigerant shortage | | |
| | | Dryer is clogged | | |
| | | Excessive frost on the evaporator | | |
| | | Discharge gas temperature sensor value is abnormal. | CPU board malfunction | |
| | | | Sensor failure | |
| | | Evaporator outlet sensor failure during defrosting | | |
| E109 | Low pressure continues to be -72kpa or lower for 20 seconds. | Insufficient refrigerant flow | Shortage of refrigerant amount | |
| | | | Refrigerant leakage | |
| | | Liquid solenoid valve is not opened. | Valve clogged with contamination | |
| | | | Wiring lead breakage | |
| | | | Wrong wiring | |
| | | | Coil burned out. | |
| | | Coil fell out | Electronic expansion valve dose not actuate. (Clogging) | |
| | | | Valve clogged with moisture | |
| | | Valve clogged with foreign material | | |
| | | Coil wiring lead breakage or connector disconnection | | |
| | | Heat exchanger inlet or outlet sensor wiring breakage or wrong installation | | |
| | | Electronic expansion valve malfunction | | |
| | | Dryer is clogged. | | |
| | | Liquid stop valve is closed | | |
| Excessive frost on evaporator | Evaporator fan insufficient air circulation | Air passage is blocked by foreign material. | | |
| | | Evaporator fan breakage | | |
| Evaporator fan motor does not run. | Air-short circuit around evaporator | | | |
| | Reverse rotation of evaporator fan | | | |
| | Evaporator fan fell out | | | |
| | Wrong wiring | | | |
| Fan motor thermal protector actuates. | Wiring lead breakage | Wrong wiring | | |
| | | Air passage is blocked by foreign material. | | |

| Alarm code | Content | Possible cause | | | |
|--|--|--|---|--|--|
| E109 | Low pressure continues to be -72kpa or lower for 20 seconds. | Excessive frost on evaporator | Air leaks on the access panel. Ventilator is open. (at frozen mode) | | |
| | | Low-pressure transducer (LPT) value is abnormal. | CPU board malfunction Sensor malfunction | | |
| E201 | Pull-down does not end within 120 seconds. | Liquid solenoid valve does not close. | Valve clogged with contamination | | |
| | | | Lead wire breakage | | |
| | | | Wrong wiring | | |
| | | | Coil burned out | | |
| | | | Coil fell out | | |
| | | Compressor valve lead breakage or internal gasket damage | | | |
| | | Injection solenoid valve does not close. | Valve clogged with contamination | | |
| | | | Lead wire breakage | | |
| | | | Wrong wiring Coil burned out Coil fell out | | |
| | | Leakage of modulating valve | Valve clogged with contamination | | |
| Low pressure sensor value is abnormal. | Printed-circuit board malfunction Pressure sensor malfunction | | | | |
| E203 | Overcool protection function actuate (control sensor \leq SP-3.0) in the chilled or partial frozen mode for 2 minutes or longer. | Modulating valve does not open fully. | Lead wire breakage | | |
| | | | Wrong wiring | | |
| | | | Coil burned out | | |
| | | | Coil fell out | | |
| | | | Valve clogged with contamination | | |
| | | Insufficient evaporator fan air flow rate | Air passage is blocked by foreign material. Evaporator fan damage Air short circuit around evaporator | | |
| | | | Evaporator fan motor thermal protector activates. | Evaporator fan interferes with guide. Lead wire breakage Air passage is blocked by foreign material. | |
| | | E207 | Defrosting time is 90 minutes long. | Evaporator outlet sensor gets off from the evaporator outlet tube. | |
| | | | | Insulation pipe cover of evaporator outlet sensor is improperly installed. | |
| | | | | Evaporator outlet tube thermosensor is defective. | |
| Modulating valve does not open fully. | Lead wire breakage | | | | |
| | Coil burned out | | | | |
| | Valve clogged with contamination | | | | |
| Injection solenoid valve does not open. | Lead wire breakage | | | | |
| | Wrong wiring | | | | |
| | Coil burned out | | | | |
| | Coil fell out | | | | |
| Valve clogged with contamination | | | | | |
| High-pressure transducer or low-pressure transducer malfunction. | | | | | |
| Evaporator outlet sensor value is abnormal. | Printed-circuit board malfunction Sensor malfunction | | | | |
| E303 | Humidity setting request | CPU board (SRAM) malfunction | Resetting | | |
| E305 | Defrosting interval setting request | | | | |
| E307 | Calendar setting request | | | | |
| E311 | Trip start setting request | | | | |
| E401 | Supply air temperature sensor (SS) malfunction | Open circuit | | | |
| | | Short circuit | | | |
| | | Wrong wiring | | | |
| | | Sensor value is abnormal. | Printed-circuit board malfunction | | |
| E402 | Data recorder supply air temperature sensor (DSS) malfunction | Line breakage | | | |
| | | Short circuit | | | |
| | | Wrong wiring | | | |
| | | Sensor value is abnormal. | Printed-circuit board malfunction | | |

| Alarm code | Content | Possible cause |
|-----------------------|---|--|
| E403 | Return air temperature sensor (RS) malfunction | Line breakage |
| | | Short circuit |
| | | Wrong wiring |
| | | CPU board malfunction |
| E404 | Data recorder return air temperature sensor (DRS) malfunction | Line breakage |
| | | Short circuit |
| | | Wrong wiring |
| | | CPU board malfunction |
| E405 | Discharge temperature sensor (DCHS) malfunction | Line breakage |
| | | Short circuit |
| | | Wrong wiring |
| | | CPU board malfunction |
| E406 | Suction gas sensor (SGS) malfunction | Line breakage |
| | | Short circuit |
| | | Wrong wiring |
| | | CPU board malfunction |
| E407 | Evaporator inlet sensor (EIS) malfunction | Line breakage |
| | | Short circuit |
| | | Wrong wiring |
| | | CPU board malfunction |
| E409 | Evaporator outlet sensor (EOS) malfunction | Line breakage |
| | | Short circuit |
| | | Wrong wiring |
| | | CPU board malfunction |
| E411 | Ambient sensor (AMBS) malfunction | Line breakage |
| | | Short circuit |
| | | Wrong wiring |
| | | CPU board malfunction |
| E413 | Low pressure transducer (LPT) malfunction | Lead line breakage |
| | | Wrong wiring |
| | | Defective main body |
| | | CPU board malfunction |
| E415 | High pressure transducer (HPT) malfunction | Lead line breakage |
| | | Wrong wiring |
| | | Defective of the high pressure sensor |
| | | CPU board malfunction |
| E417 | Voltage sensor (PT1) malfunction | Sensor malfunction |
| | | CPU board malfunction |
| E419 | Voltage sensor (PT2) malfunction | Sensor malfunction |
| | | CPU board malfunction |
| E421 | Current sensor (CT1) malfunction | Sensor malfunction |
| | | CPU board malfunction |
| E423 | Current sensor (CT2) malfunction | Sensor malfunction |
| | | CPU board malfunction |
| E425 E427 E429 | Pulp temperature sensor (USD1 to 3) malfunction | Wrong wiring in the relay terminal box |
| | | Line breakage in the relay terminal box |
| | | Short circuit in the junction terminal box |
| | | Junction cable breakage |
| | | Junction cable poor contact |
| | | Wrong wiring in the control box |
| | | Short circuit in the control box |
| | | Pulp temperature sensor malfunction |
| CPU board malfunction | | |
| E431 | Humidity sensor (HuS) malfunction | Lead wire breakage |
| | | Wrong wiring |
| | | Humidity sensor malfunction |
| | | CPU board malfunction |
| E603 | Line breakage of modulating valve (MV) or drive circuit malfunction | Lead wire breakage |
| | | Wrong wiring |
| | | CPU board malfunction |

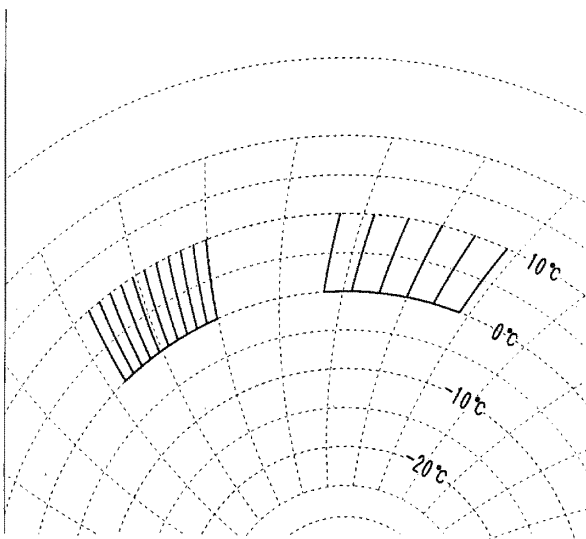
| Alarm code | Content | Possible cause |
|------------|--|---|
| E607 | Abnormal contact point of manual defrost key | Switch malfunction |
| | | Short circuit |
| | | CPU board malfunction |
| E707 | Momentally power loss | Commercial power supply stops for 40 to 300msec. |
| E801 | Battery replacement request | Service life is exceeded. |
| E805 | Dipswitch is improperly set (USDA sensor) | Sensor is connected but it is regarded as no-setting. |
| | | CPU board malfunction |
| E807 | Dipswitch is improperly set (Hu sensor). | Sensor is connected but it is regarded as no-setting. |
| | | CPU board malfunction |

3. Diagnosis based on the recording chart



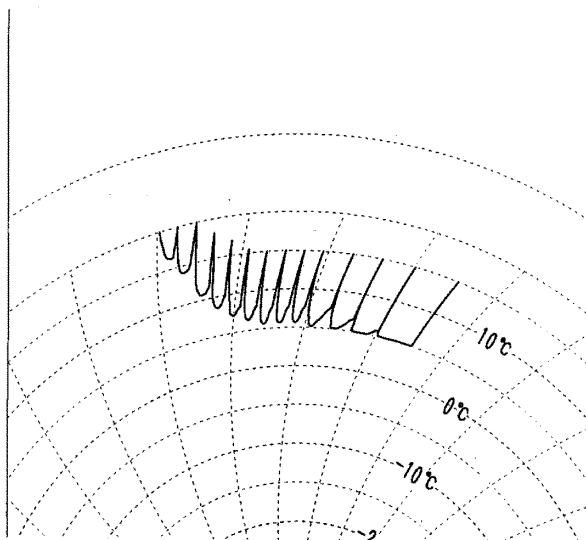
| | |
|---|------------|
| Set point temperature | 0°C |
| Phenomenon read out from the recording chart | |
| Defrosting is periodically executed by the timer. | |

| | |
|--|--|
| Abnormal content and abnormal point | |
| Normal | |



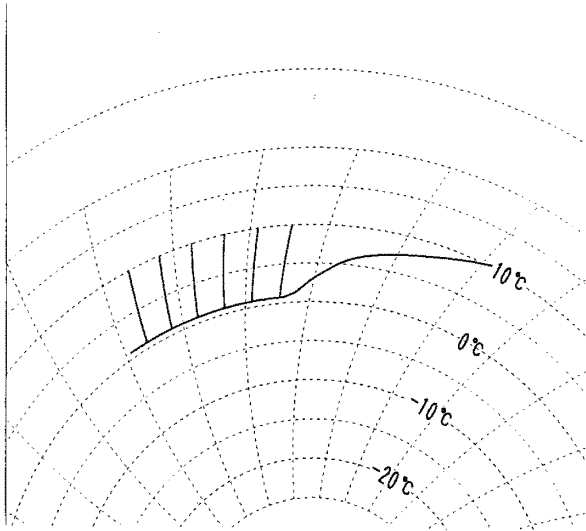
| | |
|---|------------|
| Set point temperature | 0°C |
| Phenomenon read out from the recording chart | |
| The recording paper is not properly fed since the chart nut which retains the recording chart is loose. | |
| (Left side) | |

| | |
|--|--|
| Abnormal content and abnormal point | |
| Fasten the chart nut, then it will return to normal. | |
| (Right side) | |



| | |
|--|------------|
| Set point temperature | 5°C |
| Phenomenon read out from the recording chart | |
| When moisture in the cargo is excessive or when fresh air amount is excessive, the cooling capacity becomes insufficient during pull-down operation since frosting occurs excessively. Since the temperature rises before reaching the set point temperature, defrosting is repeated at outside of the in-range temperature. | |

| | |
|--|--|
| Abnormal content and abnormal point | |
| The operation is not abnormal. Until the amount of the frost on the evaporator is to be reduced, defrosting with the short timer is repeated. In 2 to 3 days, defrosting interval will return to normal. | |



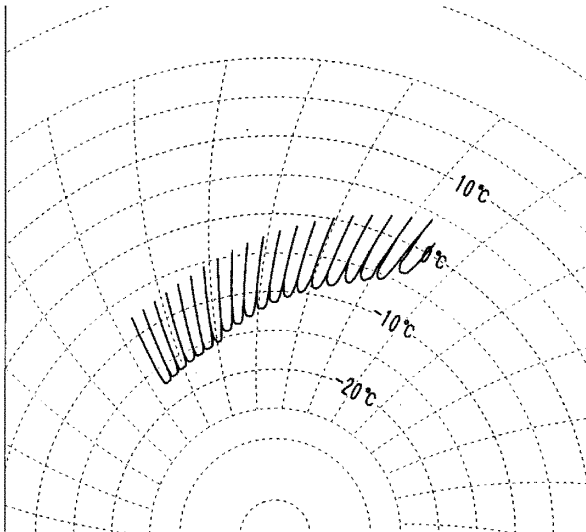
Set point temperature 0°C

Phenomenon read out from the recording chart

Though the temperature record is normal, the temperature rapidly rises.
Temperature has been recorded normally, but rised suddenly.

Abnormal content and abnormal point

Due to abnormality, the compressor stops or the fusible safety plug is molten.



Set point temperature -18°C

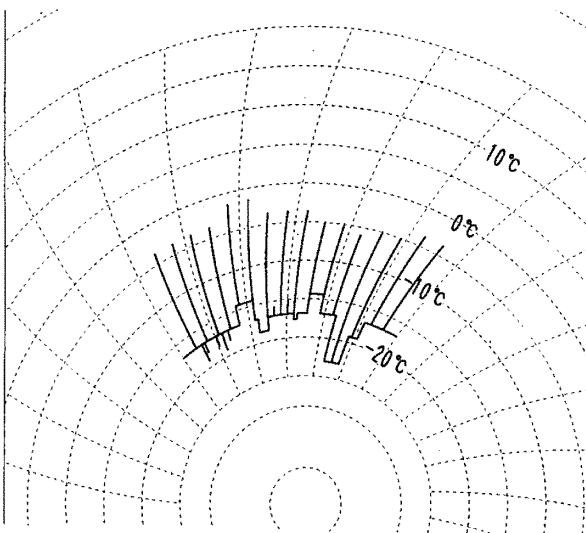
Phenomenon read out from the recording chart

Though defrosting is periodically executed, the inside temperature gradually rises.

Abnormal content and abnormal point

Due to the insufficient cooling capacity, the inside temperature rises.

- Refrigerant amount is short due to leakage.
- Compressor valve is broken.
- Hot gas bypasses due to leakage through the modulating control valve.
- Expansion valve or liquid solenoid valve are clogged.
- High pressure rises due to shortage of air blow rate of the condenser.



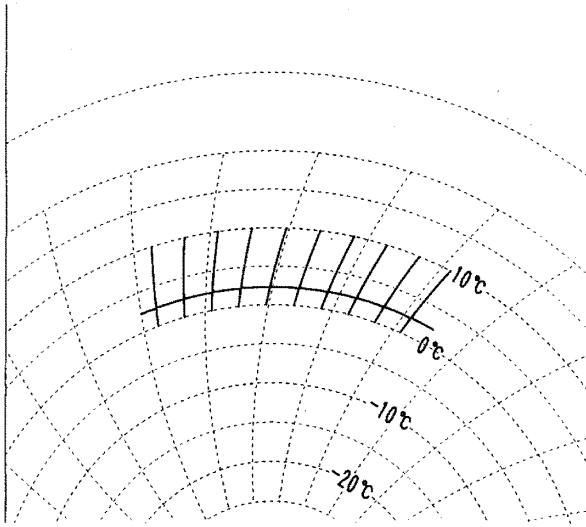
Set point temperature -18°C

Phenomenon read out from the recording chart

The recording temperature suddenly varies.

Abnormal content and abnormal point

The connector in the temperature recorder is in poor contact.

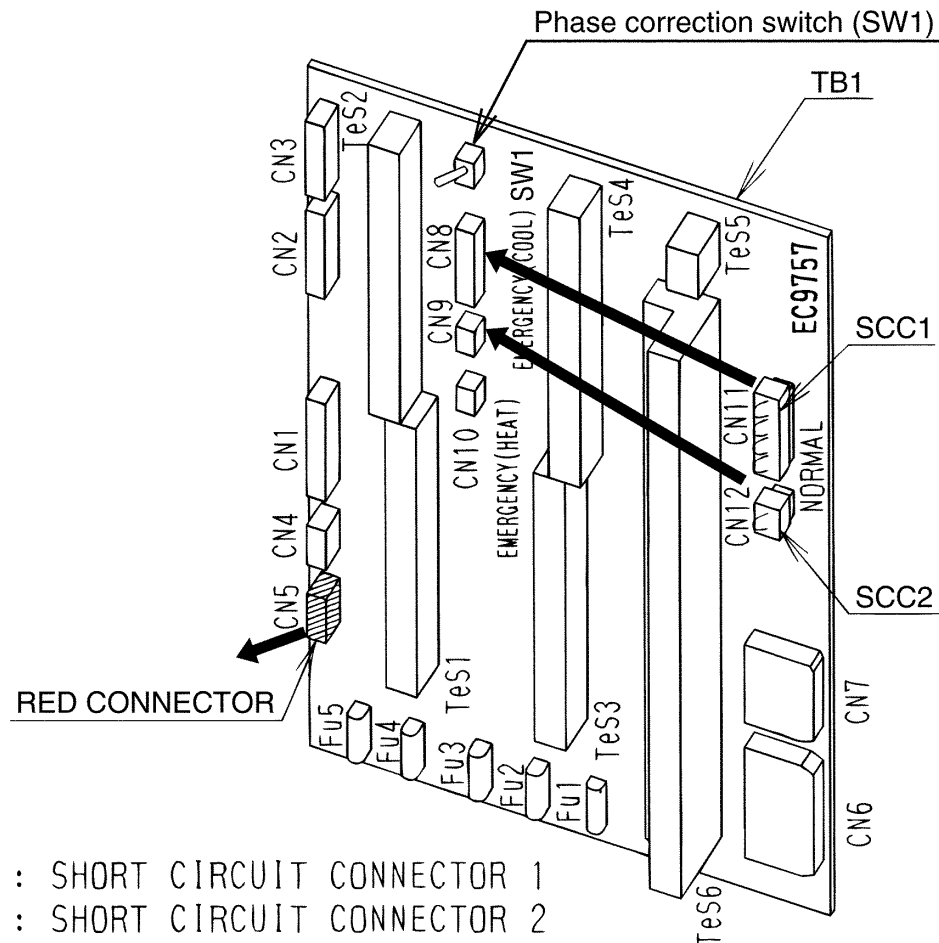


| | |
|--|------------|
| Set point temperature | 0°C |
| Phenomenon read out from the recording chart After defrosting, the inside temperature temporarily drops. | |
| Abnormal content and abnormal point Since the liquid solenoid valve is not closed, pump-down operation before defrost starts is not performed, and cooling operation continues with the evaporator fan stopped. After 2 min. of forced defrosting termination signal, the normal operation starts but the evaporater is still cold. | |

4. Emergency operation

4.1 Controller trouble

[Cooling operation]



SCC1 : SHORT CIRCUIT CONNECTOR 1
SCC2 : SHORT CIRCUIT CONNECTOR 2

(1) Procedure

1. Disconnect the power supply connector (Red connector).
2. Disconnect both 8 pin and 2 pin on the normal side, then connect them on the emergency position (Cool).
3. Open the electronic expansion valve manually.
Refer to section 4.3 for detail.

(2) Operating condition at emergency

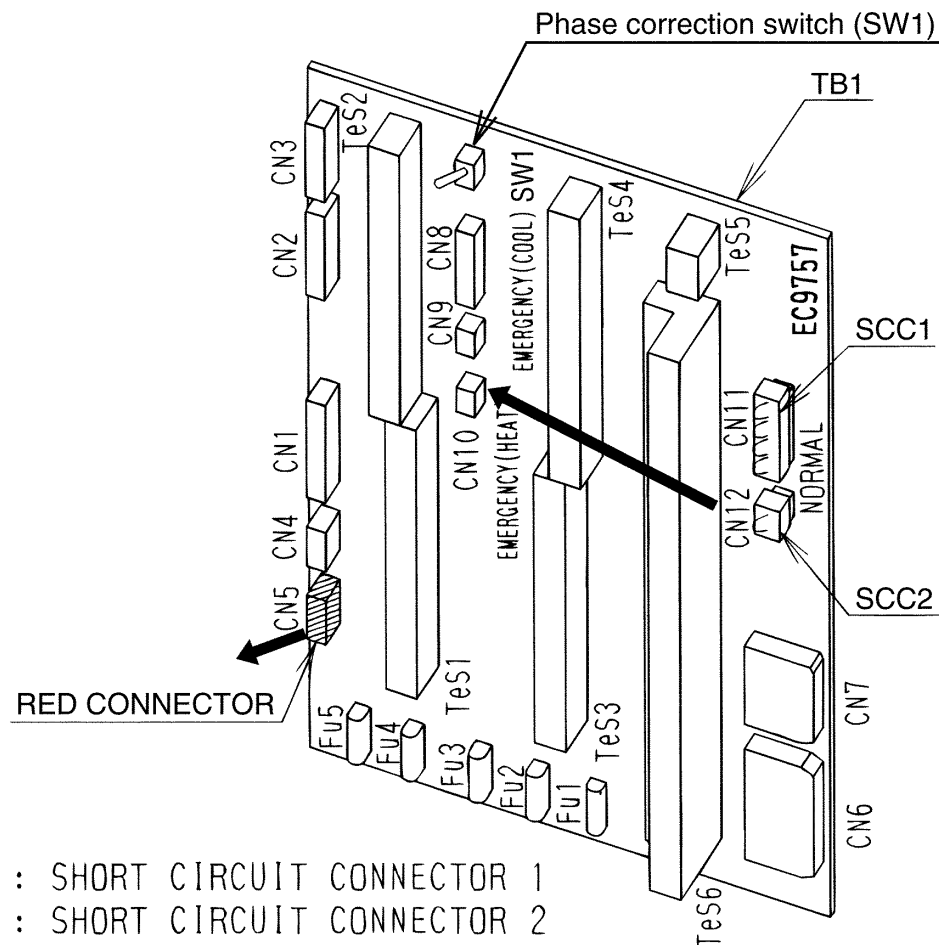
[Available functions of protection devices]

HPS (High pressure switch), CTP (Compressor thermal protection switch)

[Operation mode]

- Compressor runs. (Continuous operation)
- Evaporator fan runs at Low speed. (Continuous operation)
- Condenser fan runs. (Continuous operation)
- Opening rate of expansion valve is fixed with emergency coil cap.
- Fan direction can be changed with the phase correction switch.

[Heating operation]



SCC1 : SHORT CIRCUIT CONNECTOR 1
SCC2 : SHORT CIRCUIT CONNECTOR 2

(1) Procedure

1. Disconnect the power supply connector (Red connector).
2. Disconnect only 2 pin on the normal side, then connect it on the emergency position (Heat).
3. Open the electronic expansion valve manually.
Refer to section 4.3 for detail.

(2) Operating condition at emergency

[Operation mode]

- Evaporator fan runs at High speed. (Continuous operation)
- Compressor stops.
- Condenser fan stops.

4.2 Supply/return air temperature sensors trouble

When the unit is equipped with the data recorder sensors (optional), the following emergency operations are available.

When the DRS and the DSS are used for the emergency operation, DATA RECORDER SENSOR ON/OFF SETTING to be set OFF. (Refer to section 8, Basic function setting mode.)

RS : Return air temperature sensor

SS : Supply air temperature sensor

DRS : Data recorder return air temperature sensor

DSS : Data recorder supply air temperature sensor

RRS : Recorder return air temperature sensor

RSS : Recorder supply air temperature sensor

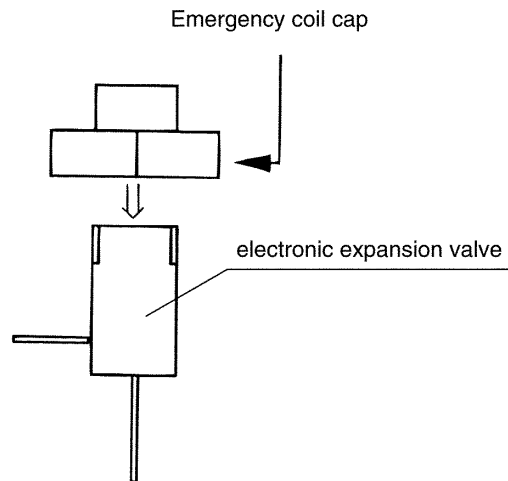
| Error code | Abnormal point | Unit Back-up operation | Check content | Measure |
|------------|--|--|--|--|
| E401 | Supply air temperature sensor (SS) malfunction | Chilled mode : Back up operation terminals starts when RS to be -2°C Frozen mode : Only error code indication | Check connectors and crimp style for tightness. | Exchange the connection of SS and DSS. |
| E402 | Data recorder supply air temperature sensor (DSS) malfunction | Only error code indication | Check connectors and crimp style terminals for tightness. | ———— |
| E403 | Return air temperature sensor (RS) malfunction | Chilled mode : Only error code indication Frozen mode : Back-up operation starts when SS to be $+5^{\circ}\text{C}$ | Check connectors and crimp style terminals for tightness. | Exchange the connection of RS and DRS. |
| E404 | Data recorder return air temperature sensor (DSS) malfunction | Only error code indication | Check connectors and crimp style terminals for tightness. | ———— |
| H006 | Chilled mode : Differential temperature is over 2°C between SS and DSS or RS and DRS for more than one hour. | Only error code indication | Specify the abnormal sensor comparing values with recorded values. | When SS malfunctions, exchange the connection of SS and DSS. |
| | Frozen mode : Differential temperature is over 2°C between SS and DSS or RS and DRS for more than one hour. | Only error code indication | Specify the abnormal sensor comparing values with recorded values. | When RS malfunctions, exchange the connection of RS and DRS. |

4.3 Electronic expansion valve trouble

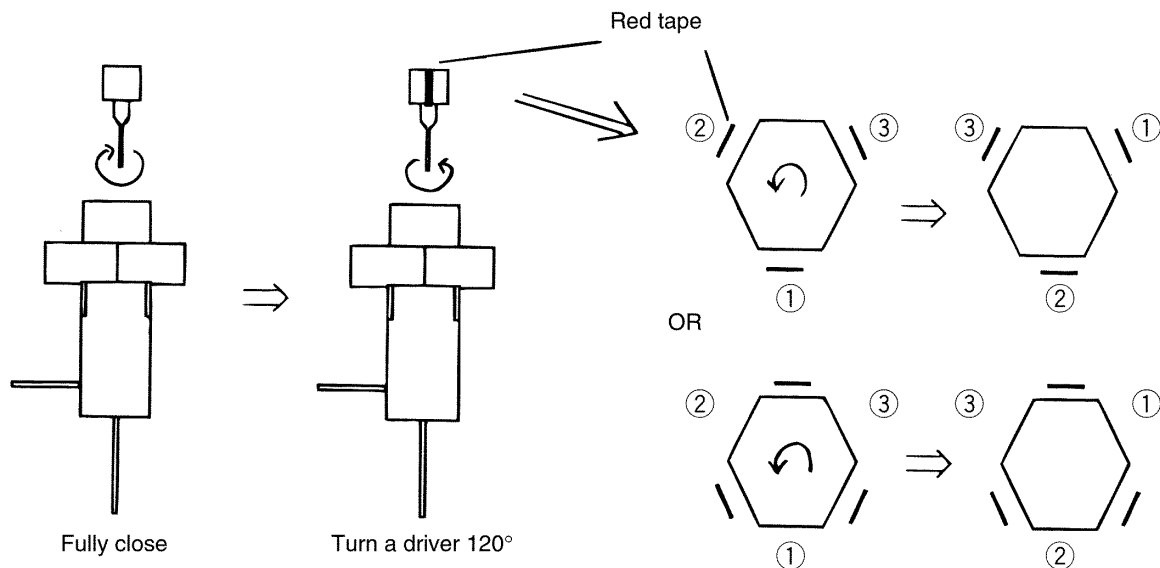
When the electric expansion valve is under malfunction, open the valve manually following the procedure below.

When the controller is also under malfunction, carry out the emergency operation for controller trouble as well (Refer to section 4.1.).

1. Set the emergency coil cap on the electronic expansion valve.



2. Fully close the expansion valve with the provided driver.
(tightening torque : approx. 1 kgf · cm : softly tighten the valve until the driver stops turning)
3. Then slightly open the expansion valve by turning a driver 120° counter clockwise.
120° turn --- from a red tape side to the next tape side or from a non-tape side to the next non-tape side.



4. Fix the screw with the provided adhesive.

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APPENDIX

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1. Standard tightening torques of bolts

| | Bolt size | Main part | Tightening torque | | |
|-----------------|-----------|---|-------------------|-------|-------|
| | | | N·m | kg·cm | lb·ft |
| Stainless steel | M4 | Small parts | 1.6 | 16 | 1.3 |
| | M5 | Solenoid valve | 2.9 | 30 | 2.5 |
| | M6 | Access panel | 4.9 | 50 | 4.3 |
| | M8 | Evaporator fan motor Flange connected dryer Control box | 12.3 | 125 | 10 |
| | | Expansion valve | | | |
| | M10 | Evaporator fan motor mounting base Condenser fan motor Suction stop valve | 25.0 | 255 | 21 |
| Compressor | | | | | |
| Steel | M8 (10T) | Discharge stop valve | 29.6 | 302 | 25 |
| | M10 (10T) | Discharge stop valve | 60.8 | 620 | 51 |

Note : Tolerance of tightening torque is within $\pm 10\%$.

2. HFC134a, temperature - vapor pressure characteristics table

| Temperature °C | Vapor pressure | | Temperature °C | Vapor pressure | |
|-------------------|----------------|-----------------------|-------------------|----------------|-----------------------|
| | kPa | kg/cm ² ·G | | kPa | kg/cm ² ·G |
| -40.0 | -49 | -0.5015 | 20.0 | 470 | 4.7977 |
| -39.0 | -46 | -0.4734 | 21.0 | 488 | 4.9795 |
| -38.0 | -44 | -0.4440 | 22.0 | 507 | 5.1656 |
| -37.0 | -41 | -0.4135 | 23.0 | 525 | 5.3560 |
| -36.0 | -37 | -0.3817 | 24.0 | 544 | 5.5508 |
| -35.0 | -34 | -0.3486 | 25.0 | 564 | 5.7500 |
| -34.0 | -31 | -0.3141 | 26.0 | 584 | 5.9538 |
| -33.0 | -27 | -0.2783 | 27.0 | 604 | 6.1621 |
| -32.0 | -24 | -0.2410 | 28.0 | 625 | 6.3751 |
| -31.0 | -20 | -0.2023 | 29.0 | 647 | 6.5929 |
| -30.0 | -16 | -0.1621 | 30.0 | 668 | 6.8154 |
| -29.0 | -12 | -0.1204 | 31.0 | 691 | 7.0428 |
| -28.0 | - 8 | -0.0771 | 32.0 | 713 | 7.2751 |
| -27.0 | - 3 | -0.0322 | 33.0 | 737 | 7.5124 |
| -26.0 | 1 | 0.0144 | 34.0 | 760 | 7.7548 |
| -25.0 | 6 | 0.0627 | 35.0 | 785 | 8.0023 |
| -24.0 | 11 | 0.1128 | 36.0 | 810 | 8.2551 |
| -23.0 | 16 | 0.1646 | 37.0 | 835 | 8.5131 |
| -22.0 | 21 | 0.2183 | 38.0 | 861 | 8.7765 |
| -21.0 | 27 | 0.2739 | 39.0 | 887 | 9.0453 |
| -20.0 | 32 | 0.3314 | 40.0 | 914 | 9.3196 |
| -19.0 | 38 | 0.3908 | 41.0 | 941 | 9.5994 |
| -18.0 | 44 | 0.4523 | 42.0 | 969 | 9.8849 |
| -17.0 | 51 | 0.5159 | 43.0 | 998 | 10.1762 |
| -16.0 | 57 | 0.5816 | 44.0 | 1027 | 10.4732 |
| -15.0 | 64 | 0.6494 | 45.0 | 1057 | 10.7761 |
| -14.0 | 71 | 0.7195 | 46.0 | 1087 | 11.0850 |
| -13.0 | 78 | 0.7918 | 47.0 | 1118 | 11.3999 |
| -12.0 | 85 | 0.8664 | 48.0 | 1149 | 11.7209 |
| -11.0 | 93 | 0.9434 | 49.0 | 1182 | 12.0481 |
| -10.0 | 100 | 1.0229 | 50.0 | 1214 | 12.3815 |
| - 9.0 | 108 | 1.1048 | 51.0 | 1248 | 12.7213 |
| - 8.0 | 117 | 1.1892 | 52.0 | 1281 | 13.0676 |
| - 7.0 | 125 | 1.2761 | 53.0 | 1316 | 13.4203 |
| - 6.0 | 134 | 1.3657 | 54.0 | 1351 | 13.7797 |
| - 5.0 | 143 | 1.4580 | 55.0 | 1387 | 14.1457 |
| - 4.0 | 152 | 1.5530 | 56.0 | 1424 | 14.5185 |
| - 3.0 | 162 | 1.6508 | 57.0 | 1461 | 14.8982 |
| - 2.0 | 172 | 1.7514 | 58.0 | 1499 | 15.2848 |
| - 1.0 | 182 | 1.8549 | 59.0 | 1538 | 15.6785 |
| - 0.0 | 192 | 1.9613 | 60.0 | 1577 | 16.0793 |
| 1.0 | 203 | 2.0708 | 61.0 | 1617 | 16.4873 |
| 2.0 | 214 | 2.1833 | 62.0 | 1658 | 16.9027 |
| 3.0 | 225 | 2.2989 | 63.0 | 1699 | 17.3254 |
| 4.0 | 237 | 2.4177 | 64.0 | 1741 | 17.7557 |
| 5.0 | 249 | 2.5398 | 65.0 | 1784 | 18.1936 |
| 6.0 | 261 | 2.6651 | 66.0 | 1828 | 18.6391 |
| 7.0 | 274 | 2.7937 | 67.0 | 1872 | 19.0925 |
| 8.0 | 287 | 2.9258 | 68.0 | 1918 | 19.5539 |
| 9.0 | 300 | 3.0613 | 69.0 | 1964 | 20.0232 |
| 10.0 | 314 | 3.2004 | 70.0 | 2010 | 20.5007 |
| 11.0 | 328 | 3.3430 | 71.0 | 2058 | 20.9864 |
| 12.0 | 342 | 3.4892 | 72.0 | 2107 | 21.4805 |
| 13.0 | 357 | 3.6392 | 73.0 | 2156 | 21.9831 |
| 14.0 | 372 | 3.7929 | 74.0 | 2206 | 22.4943 |
| 15.0 | 387 | 3.9505 | 75.0 | 2257 | 23.0142 |
| 16.0 | 403 | 4.1119 | 76.0 | 2309 | 23.5430 |
| 17.0 | 419 | 4.2773 | 77.0 | 2362 | 24.0807 |
| 18.0 | 436 | 4.4467 | 78.0 | 2415 | 24.6276 |
| 19.0 | 453 | 4.6201 | 79.0 | 2470 | 25.1837 |
| | | | 80.0 | 2525 | 25.7492 |

Conversion rate: 1kgf/cm² · G=98.0665kPa

3. Temperature conversion table and temperature sensor (SS/RS/RSS/RRS/EOS/AMBS) characteristics table

| Temperature (°C) | Temperature (°F) | Resistance (kΩ) | Temperature (°C) | Temperature (°F) | Resistance (kΩ) |
|------------------|------------------|-----------------|------------------|------------------|-----------------|
| +50 | +122 | 0.985 | + 0 | +32 | 6.860 |
| +49 | +120.2 | 1.018 | - 1 | +30.2 | 7.176 |
| +48 | +118.4 | 1.054 | - 2 | +28.4 | 7.508 |
| +47 | +116.6 | 1.090 | - 3 | +26.6 | 7.857 |
| +46 | +114.8 | 1.128 | - 4 | +24.8 | 8.226 |
| +45 | +113 | 1.167 | - 5 | +23 | 8.614 |
| +44 | +111.2 | 1.208 | - 6 | +21.2 | 9.023 |
| +43 | +109.4 | 1.251 | - 7 | +19.4 | 9.454 |
| +42 | +107.6 | 1.296 | - 8 | +17.6 | 9.909 |
| +41 | +105.8 | 1.342 | - 9 | +15.8 | 10.39 |
| +40 | +104 | 1.390 | -10 | +14 | 10.89 |
| +39 | +102.2 | 1.441 | -11 | +12.2 | 11.43 |
| +38 | +100.4 | 1.493 | -12 | +10.4 | 11.99 |
| +37 | + 98.6 | 1.548 | -13 | + 8.6 | 12.59 |
| +36 | + 97 | 1.605 | -14 | + 6.8 | 13.22 |
| +35 | + 95 | 1.665 | -15 | + 5 | 13.88 |
| +34 | + 93.2 | 1.727 | -16 | + 3.2 | 14.59 |
| +33 | + 91.4 | 1.791 | -17 | + 1.4 | 15.33 |
| +32 | + 89.6 | 1.859 | -18 | - 0.4 | 16.12 |
| +31 | + 87.8 | 1.929 | -19 | - 2.2 | 16.95 |
| +30 | + 86 | 2.003 | -20 | - 4 | 17.83 |
| +29 | + 84.2 | 2.080 | -21 | - 5.8 | 18.76 |
| +28 | + 82.4 | 2.160 | -22 | - 7.6 | 19.75 |
| +27 | + 80.6 | 2.244 | -23 | - 9.4 | 20.80 |
| +26 | + 78.8 | 2.331 | -24 | -11.2 | 21.91 |
| +25 | + 77 | 2.423 | -25 | -13 | 23.08 |
| +24 | + 75.2 | 2.519 | -26 | -14.8 | 24.33 |
| +23 | + 73.4 | 2.619 | -27 | -16.6 | 25.66 |
| +22 | + 71.6 | 2.724 | -28 | -18.4 | 27.06 |
| +21 | + 69.8 | 2.833 | -29 | -20.2 | 28.56 |
| +20 | + 68 | 2.948 | -30 | -22 | 30.15 |
| +19 | + 66.2 | 3.068 | -31 | -23.8 | 31.83 |
| +18 | + 64.4 | 3.193 | -32 | -25.6 | 33.63 |
| +17 | + 62.6 | 3.325 | -33 | -27.4 | 35.53 |
| +16 | + 60.8 | 3.463 | -34 | -29.2 | 37.56 |
| +15 | + 59 | 3.607 | -35 | -31.0 | 39.72 |
| +14 | + 57.2 | 3.758 | -36 | -32.8 | 42.02 |
| +13 | + 55.4 | 3.917 | -37 | -34.6 | 44.46 |
| +12 | + 53.6 | 4.083 | -38 | -36.4 | 47.07 |
| +11 | + 51.8 | 4.258 | -39 | -38.2 | 49.85 |
| +10 | + 50 | 4.441 | -40 | -40 | 52.81 |
| + 9 | + 48.2 | 4.633 | | | |
| + 8 | + 46.4 | 4.834 | | | |
| + 7 | + 44.6 | 5.046 | | | |
| + 6 | + 42.8 | 5.268 | | | |
| + 5 | + 41 | 5.501 | | | |
| + 4 | + 39.2 | 5.747 | | | |
| + 3 | + 37.4 | 6.004 | | | |
| + 2 | + 35.6 | 6.275 | | | |
| + 1 | + 33.8 | 6.560 | | | |

4. Temperature conversion table and temperature sensor (DCHS) characteristics table

| Temperature | | Resistance | Temperature | | Resistance |
|-------------|------|------------|-------------|------|------------|
| (°C) | (°F) | (kΩ) | (°C) | (°F) | (kΩ) |
| 72 | 162 | 32.783 | 102 | 216 | 12.566 |
| 74 | 165 | 30.629 | 104 | 219 | 11.835 |
| 76 | 169 | 28.635 | 106 | 223 | 11.153 |
| 78 | 172 | 26.787 | 108 | 226 | 10.515 |
| 80 | 176 | 25.073 | 110 | 230 | 9.919 |
| 82 | 180 | 23.482 | 112 | 234 | 9.361 |
| 84 | 183 | 22.005 | 114 | 237 | 8.840 |
| 86 | 187 | 20.633 | 116 | 241 | 8.351 |
| 88 | 190 | 19.358 | 118 | 244 | 7.894 |
| 90 | 194 | 18.171 | 120 | 248 | 7.465 |
| 92 | 198 | 17.066 | 122 | 252 | 7.063 |
| 94 | 201 | 16.037 | 124 | 255 | 6.685 |
| 96 | 205 | 15.078 | 126 | 258 | 6.331 |
| 98 | 208 | 14.184 | 128 | 262 | 5.998 |
| 100 | 212 | 13.350 | 130 | 266 | 5.686 |

5. High pressure transducer characteristics table

| Pressure (kPa·G) | Output (V) | Pressure (kPa·G) | Output (V) |
|------------------|------------|------------------|------------|
| 0 | 0.50 | 1100 | 1.62 |
| 100 | 0.60 | 1200 | 1.72 |
| 200 | 0.70 | 1300 | 1.83 |
| 300 | 0.81 | 1400 | 1.93 |
| 400 | 0.91 | 1500 | 2.03 |
| 500 | 1.01 | 1600 | 2.13 |
| 600 | 1.11 | 1700 | 2.23 |
| 700 | 1.21 | 1800 | 2.34 |
| 800 | 1.32 | 1900 | 2.44 |
| 900 | 1.42 | 2000 | 2.54 |
| 1000 | 1.52 | 2100 | 2.64 |

6. Low pressure transducer characteristics table

| Pressure (kPa·G) | Output (V) |
|------------------|------------|
| -500 | -1.03 |
| -400 | -0.72 |
| -300 | -0.42 |
| -200 | -0.11 |
| -100 | 0.19 |
| 0 | 0.50 |
| 100 | 0.81 |
| 200 | 1.11 |
| 300 | 1.42 |
| 400 | 1.72 |
| 500 | 2.03 |
| 600 | 2.34 |
| 700 | 2.64 |
| 800 | 2.95 |
| 900 | 3.25 |
| 1000 | 3.56 |

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