SERVICE MANUAL

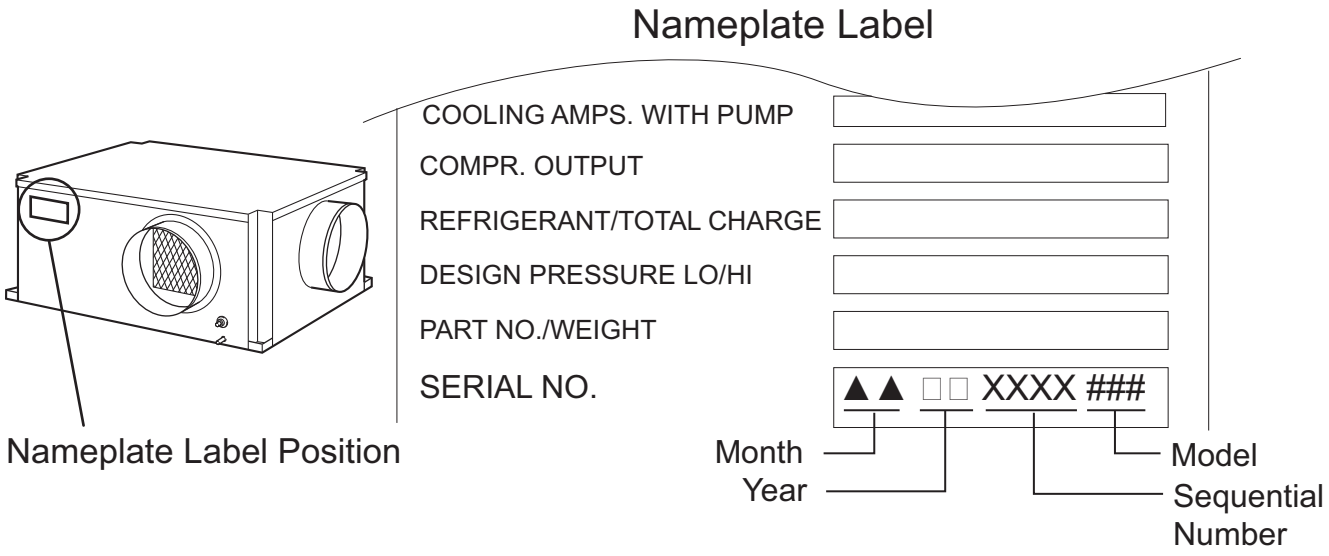
CM 25

Unit Serial Number Range: 1009XXXXC25 to Present
(From October 2009 to Present)

MOVINCOOL®
THE #1 SPOT COOLING SOLUTION

DocID: 00G00045EA

SERIAL NUMBER LOCATION AND IDENTIFICATION



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Operation Section

Repair Section

1. PRECAUTIONS FOR SAFETY

1.1 Foreword

- This manual has been published to service the MovinCool CM 25. Use this manual only when servicing the CM 25.

1.2 Definition of Terms

⚠ **WARNING**	Describes precautions that should be observed in order to prevent injury to the user during installation or unit operation.
⚠ **CAUTION**	Describes precautions that should be observed in order to prevent damage to the unit or its components, which may occur during installation or unit operation if sufficient care is not taken.
NOTE	Provides additional information that facilitates installation or unit operation.

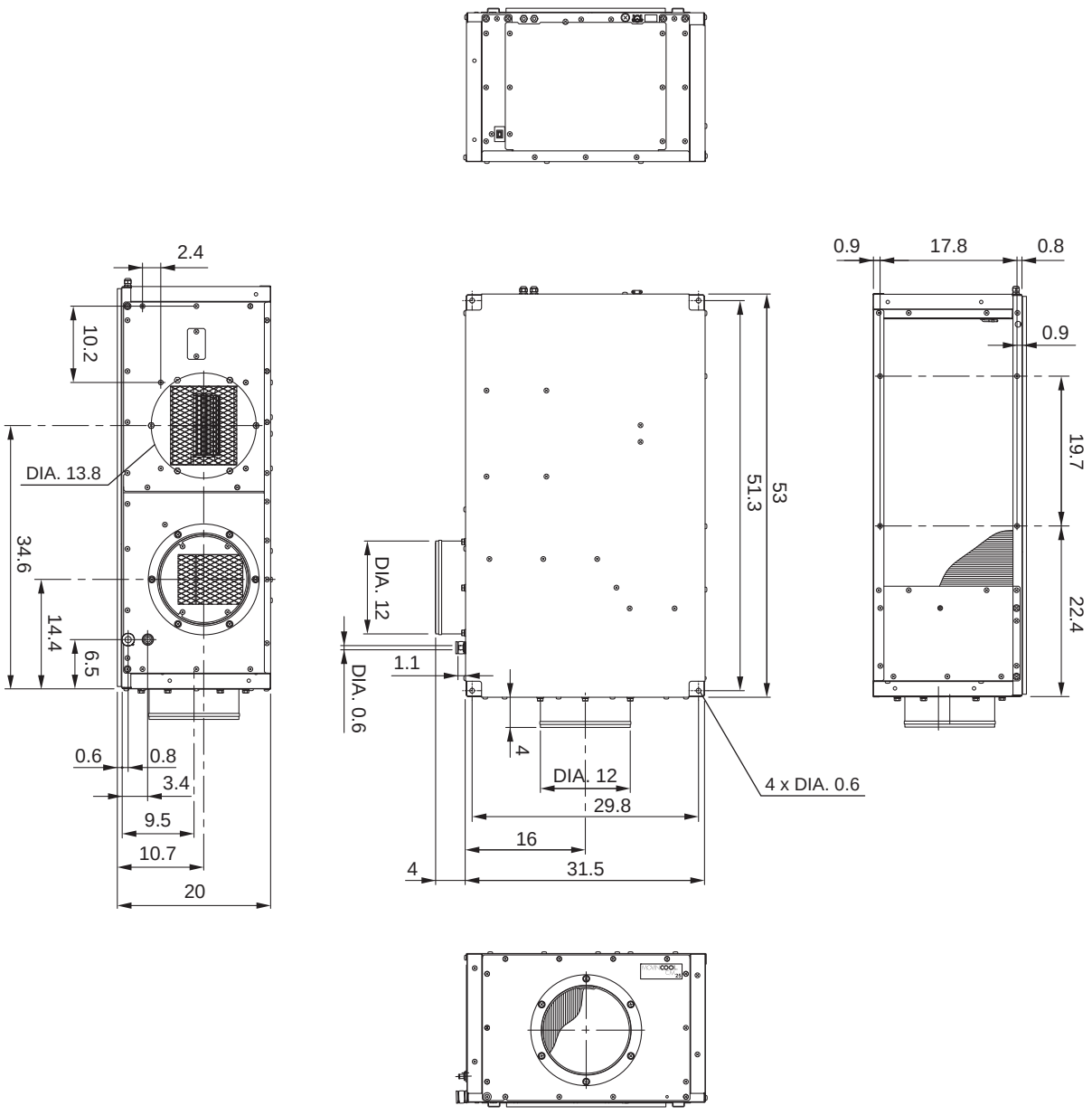
1.3 General Precautions

⚠ WARNING

- **All electrical work should only be performed by qualified electrical technician. Repair to electrical components by non-certified technicians may result in personal injury and/or damage to the unit. All electrical components replaced must be genuine MovinCool parts, purchased from an authorized reseller.**
- **Disconnect power supply from the unit before performing any service.**
- **Before replacing any refrigeration components, recover the refrigerant using standard recovery procedures and equipment.**
- **When handling refrigerant, always wear proper eye protection and do not allow the refrigerant to come in contact with your skin.**
- **Do not expose refrigerant to an open flame.**
- **The power supply for this unit should be a dedicated single outlet circuit with a UL recognized short-circuit and ground-fault protective breaker to prevent electrical shock from the unit.**
- **When brazing any tubing, always wear eye protection, and work only in a well ventilated area.**
- **Be careful of any sharp edges when working on this unit.**

2. SPECIFICATIONS

2.1 Exterior Dimension Diagram



UNIT: inch

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2.2 Technical Specifications

Electronic Features	Operation		Wall Mounted Controller (WMC) with LCD display
	Control		Electronic with Inverter Circuit
Electronic Characteristics	Voltage Requirement		Single-Phase 208/230 V 60 Hz
	Min.- Max. Voltage		Min. 198 V, Max. 253 V
	Recommended Fuse Size		20 A
Cooling Capacity and Power Consumption			
Evaporator: 80°F (27°C), 50% RH/ Condenser: 95°F (35°C), 50% RH	Total Cooling Capacity*1		25000/25000 Btu/h (7320/7320 W)
	Sensible Cooling Capacity*1		18000/18000 Btu/h (5280/5280 W)
	Power Consumption*1		2.90/2.90 kW
	Current Consumption*1		13.6/12.6 A
	Power Factor		98/99%
Evaporator: 72°F (22°C), 50% RH/ Condenser: 95°F (35°C), 50% RH	Total Cooling Capacity*1		25000/25000 Btu/h (7320/7320 W)
	Sensible Cooling Capacity*1		18900/18900 Btu/h (5580/5580 W)
	Power Consumption*1		3.20/3.20 kW
	Current Consumption*1		15.0/15.0 A
	Power Factor		98/98%
SEER*1			14/14
Refrigerant Circuit	Compressor	Compression Type	Hermetic Swing Inverter
	Evaporator		Plate Fin
	Condenser		Plate Fin
	Refrigerant Control		Electronic Expansion Valve
Evaporator	Type of Fan		Centrifugal Fan
	Air Flow	High	850/950 CFM (1445/1615 m^3/h)
		Low	700/800 CFM (1190/1360 m^3/h)
	Max. External Static Pressure		0.6 IWG (150 Pa)
	Motor Output		0.21 kW
Condenser	Type of Fan		Centrifugal Fan
	Air Flow	High	1490/1600 CFM (2530/2720 m^3/h)
		Low	1190/1300 CFM (2020/2210 m^3/h)
	Max. External Static Pressure		0.5 IWG (125 Pa)
	Motor Output		0.35 kW
Refrigerant	Type		R-410A
	Amount		2.31 lb (1.05 kg)

Signal Connection	Fire Alarm Input		• Dry contact type (recommended) • No-voltage contact input/Contact resistance less than 100 ohm
	Warning Signal Output		2 A at 30 V DC/AC max. with resistive load
Dimension	W x D x H (without flange)		53 x 32 x 20 in (1346 x 813 x 508 mm)
	W x D x H (with flange)		57 x 36 x 20 in (1448 x 914 x 508 mm)
Weight	Net/Shipping		310/353 lb (140/160 kg)
Internal Drain Pump Capacity	Pump Rate		5.0 gal/h (19 L/h)
	Head		4 ft (1.2 m)
Operating Condition Range	Evaporator	Max. Inlet Air	95°F (35°C), 50% RH
		Min. Inlet Air	60°F (15.5°C), 50% RH
	Condenser	Max. Inlet Air	113°F (45°C)
		Min. Inlet Air	50°F (10°C)
Maximum Duct Length	Cold Duct*2		120 ft (36.6 m)
	Hot Duct*2		90 ft (27.4 m)
Maximum Sound Level	Measured at 1 m under the ceiling with evaporator duct and ceiling tile.		55/55 dB (A)

• Specifications are subject to change without notice.

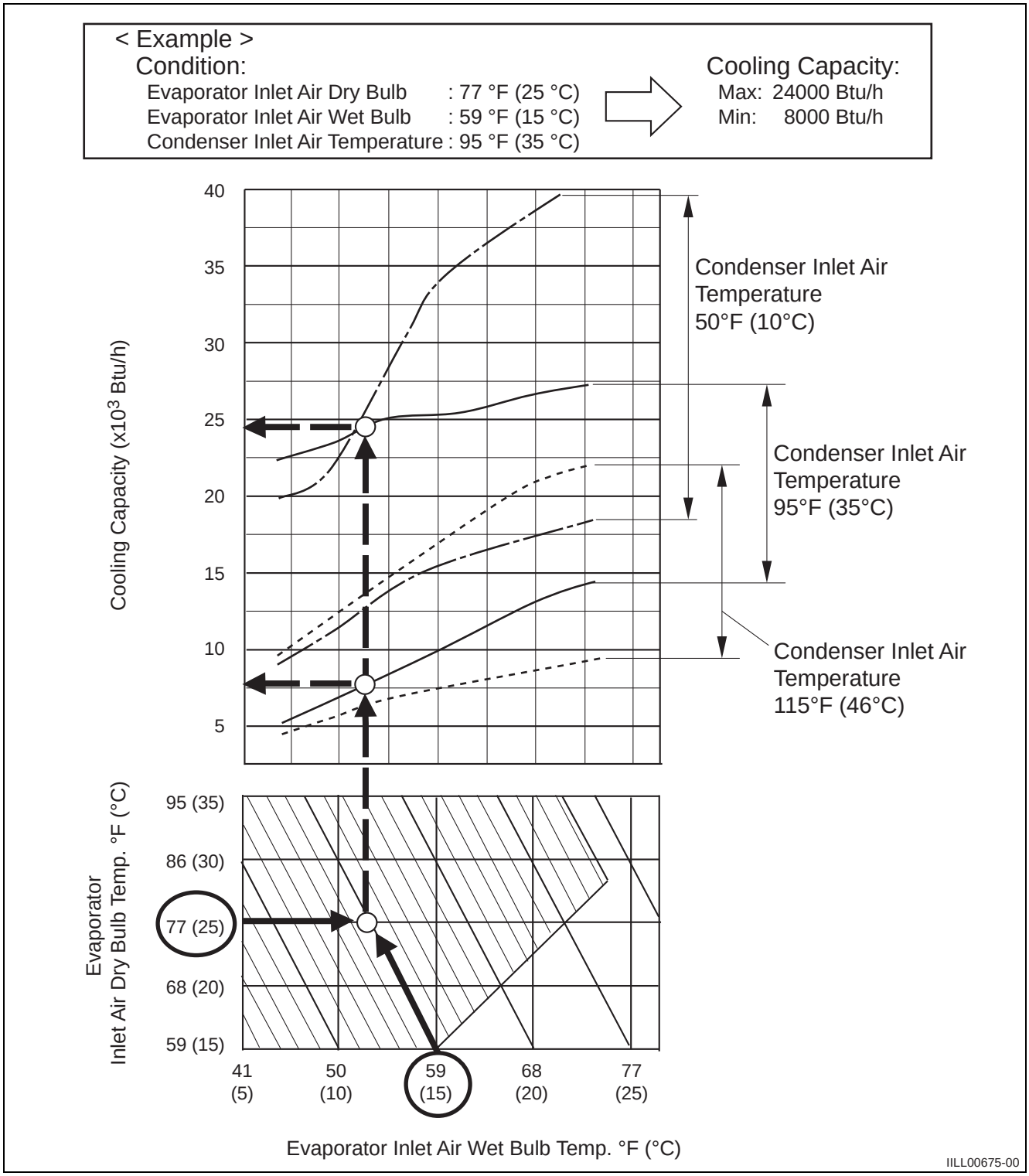
< NOTE >

*1 : With two 20-foot (6.1 m) ducts containing one 90° bend each, supply grill and return grill with filter {0.30 IWG (75 Pa) external static pressure} on high fan speed.
*2 : Confirm pressure drop of duct, grills, and filter with manufactures specifications.

2.3 Characteristics

- Value range for each outdoor temperature shown in the graphs is based on the compressor speed.

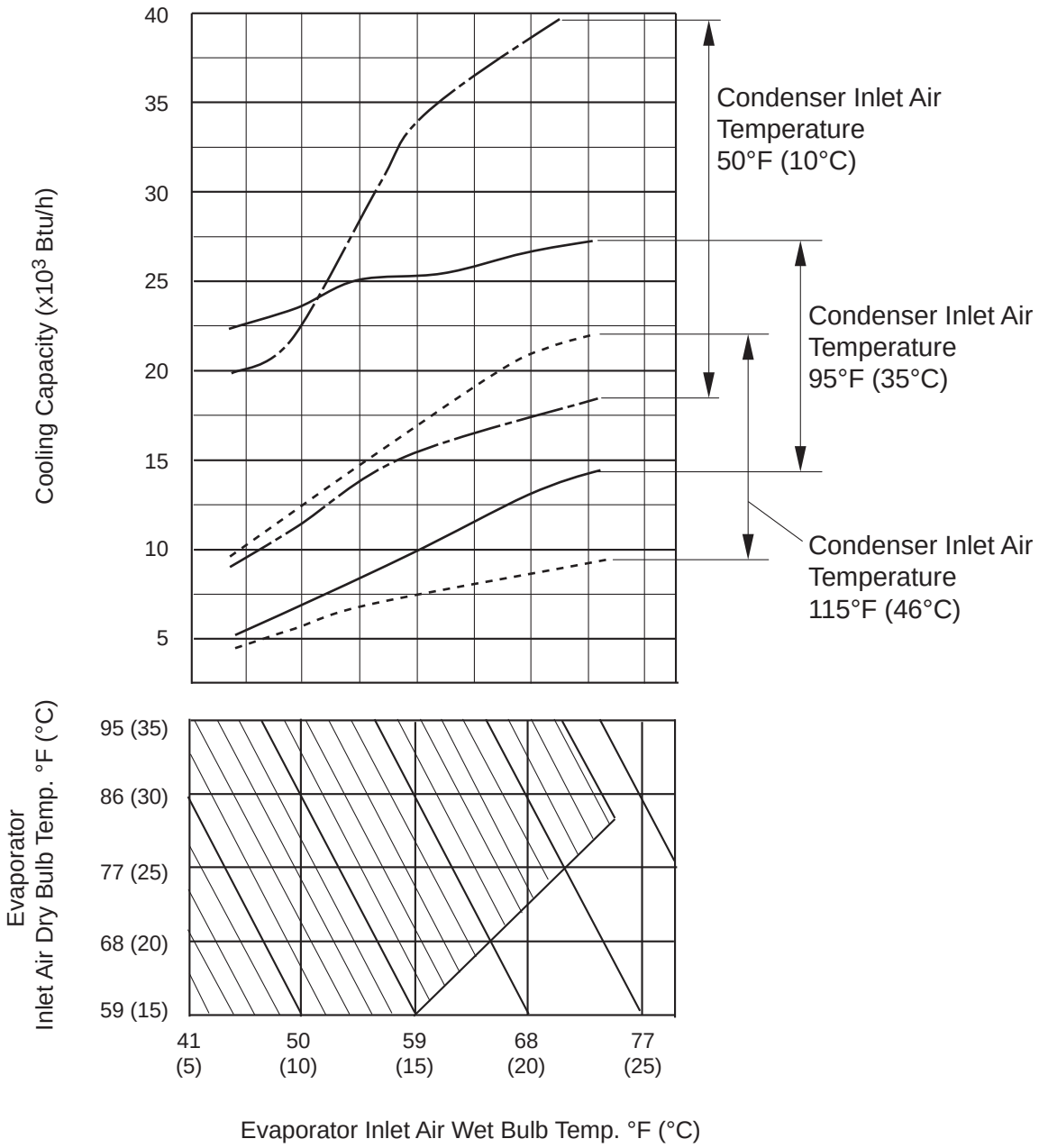
(1) How to read the characteristics



< NOTE >

Condenser inlet air temperatures are at 50% relative humidity.

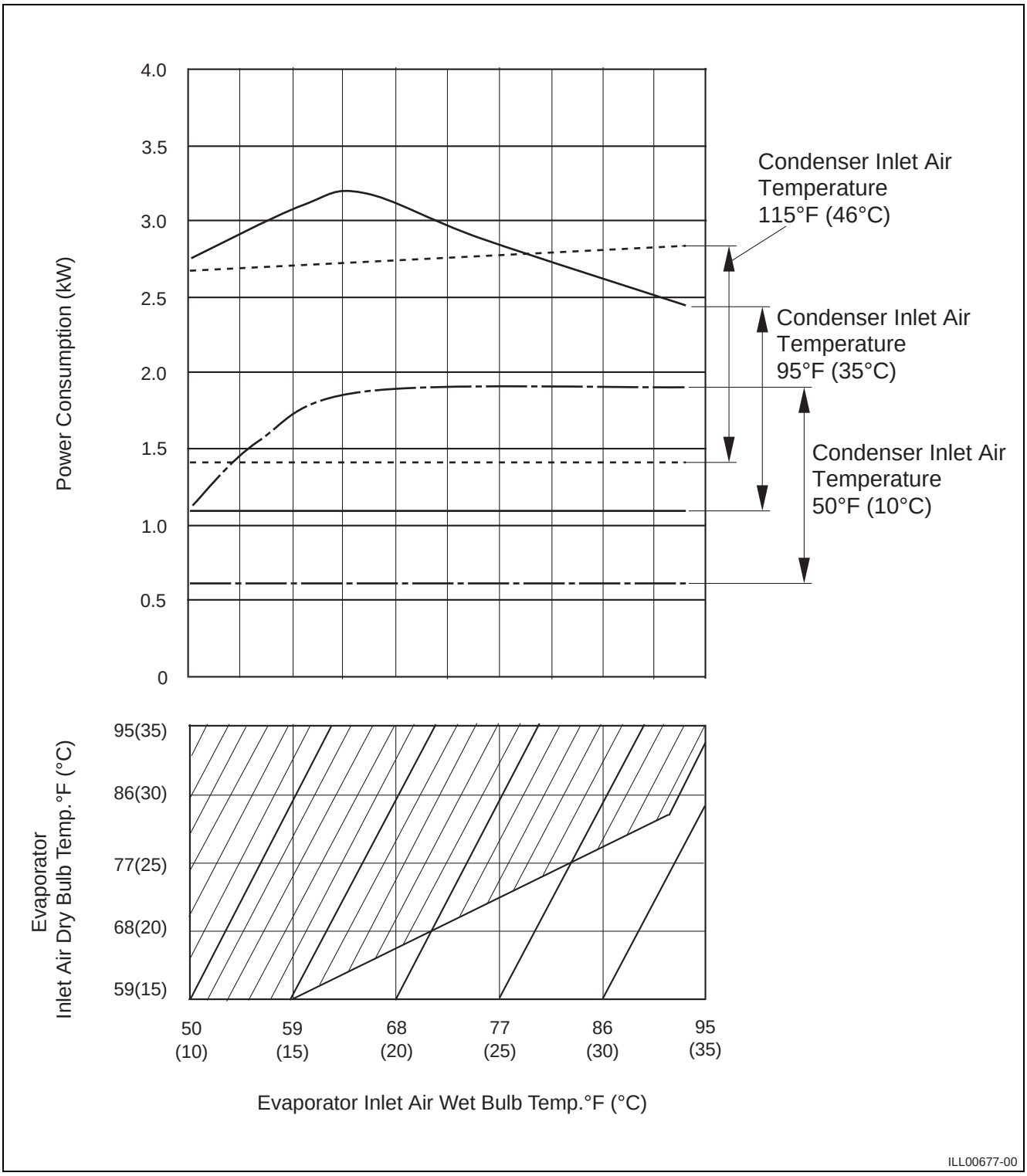
(2) Cooling capacity curve



< NOTE >

Condenser inlet air temperatures are at 50% relative humidity.

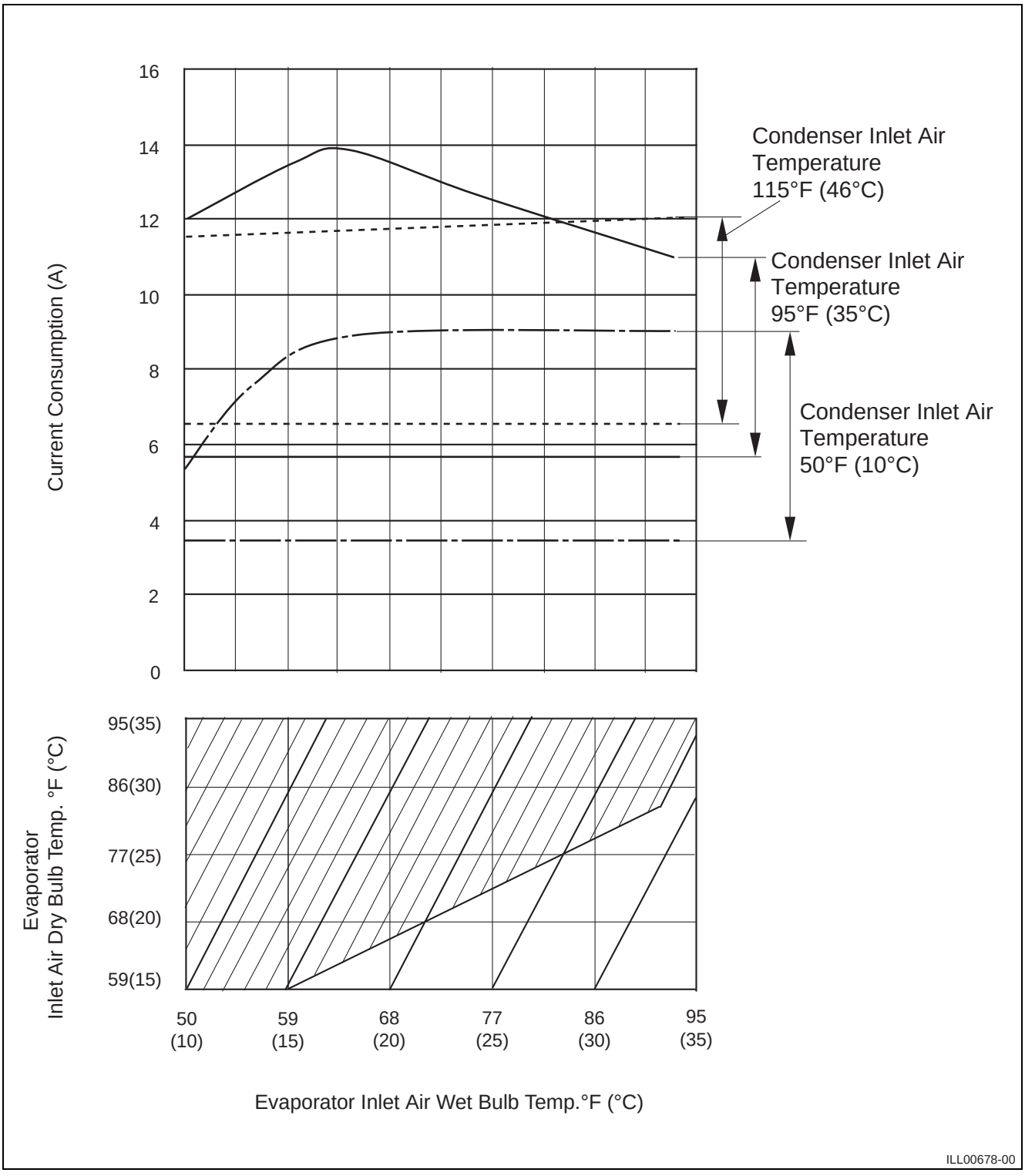
(3) Power consumption curve



< NOTE >

Condenser inlet air temperatures are at 50% relative humidity.

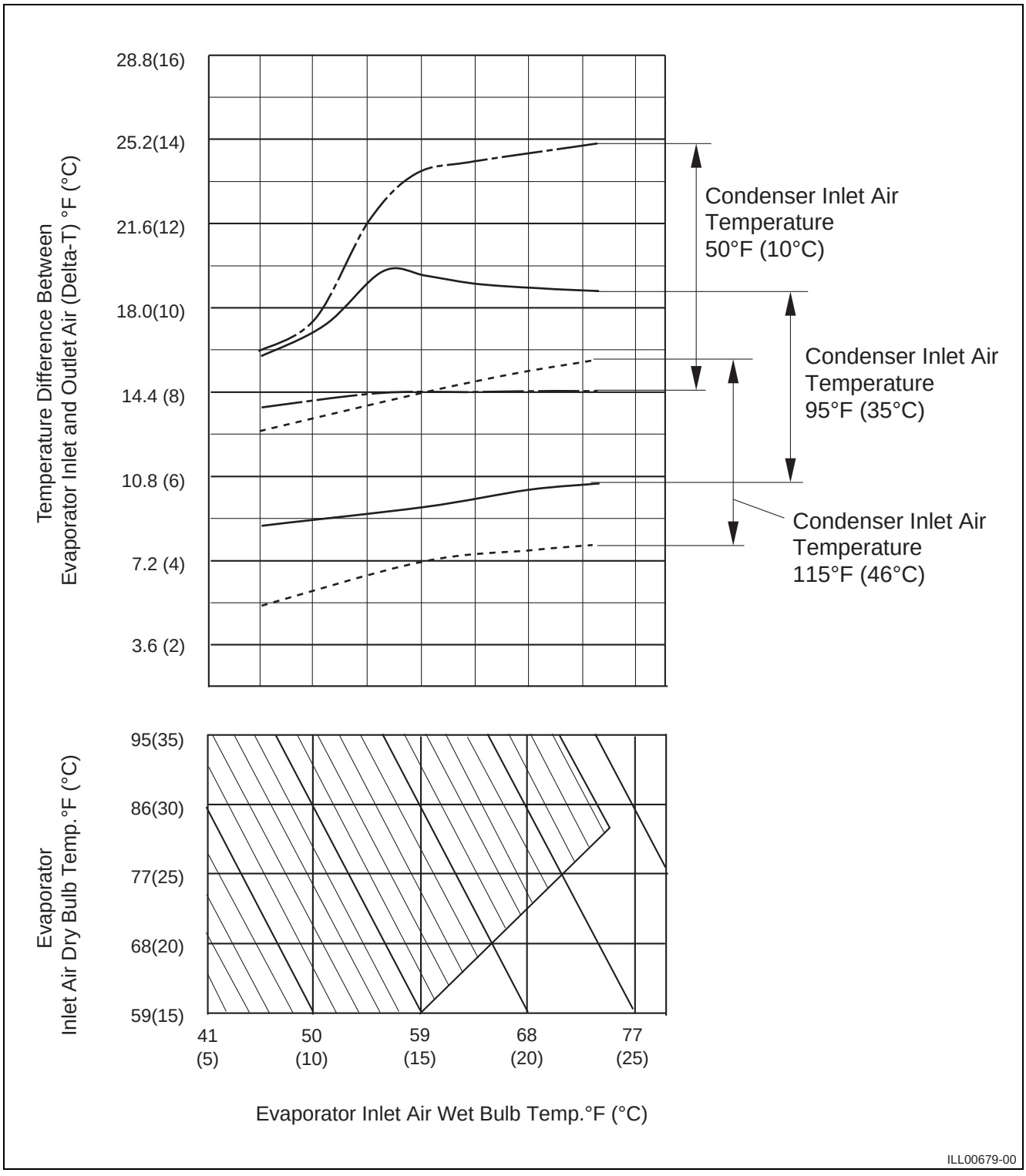
(4) Current consumption curve



< NOTE >

Condenser inlet air temperatures are at 50% relative humidity.

(5) Cool air temperature difference curve

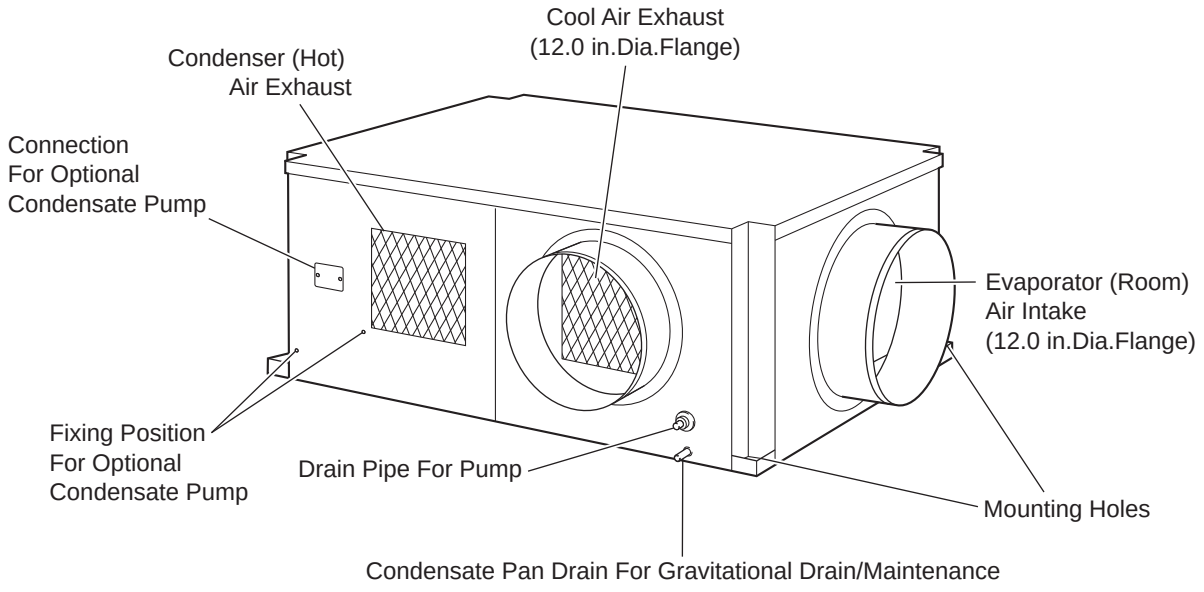


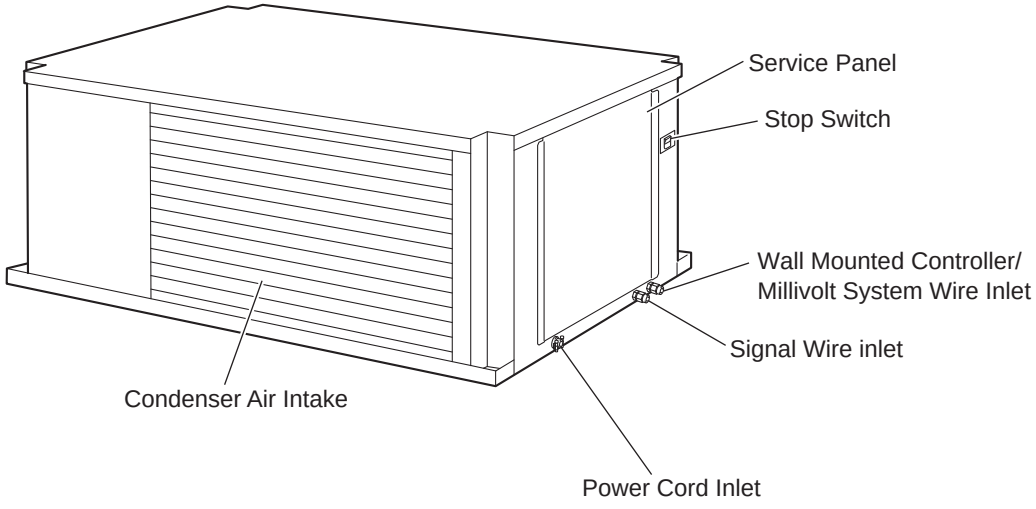
< NOTE >

Condenser inlet air temperatures are at 50% relative humidity.

3. CONSTRUCTION

3.1 Exterior Components





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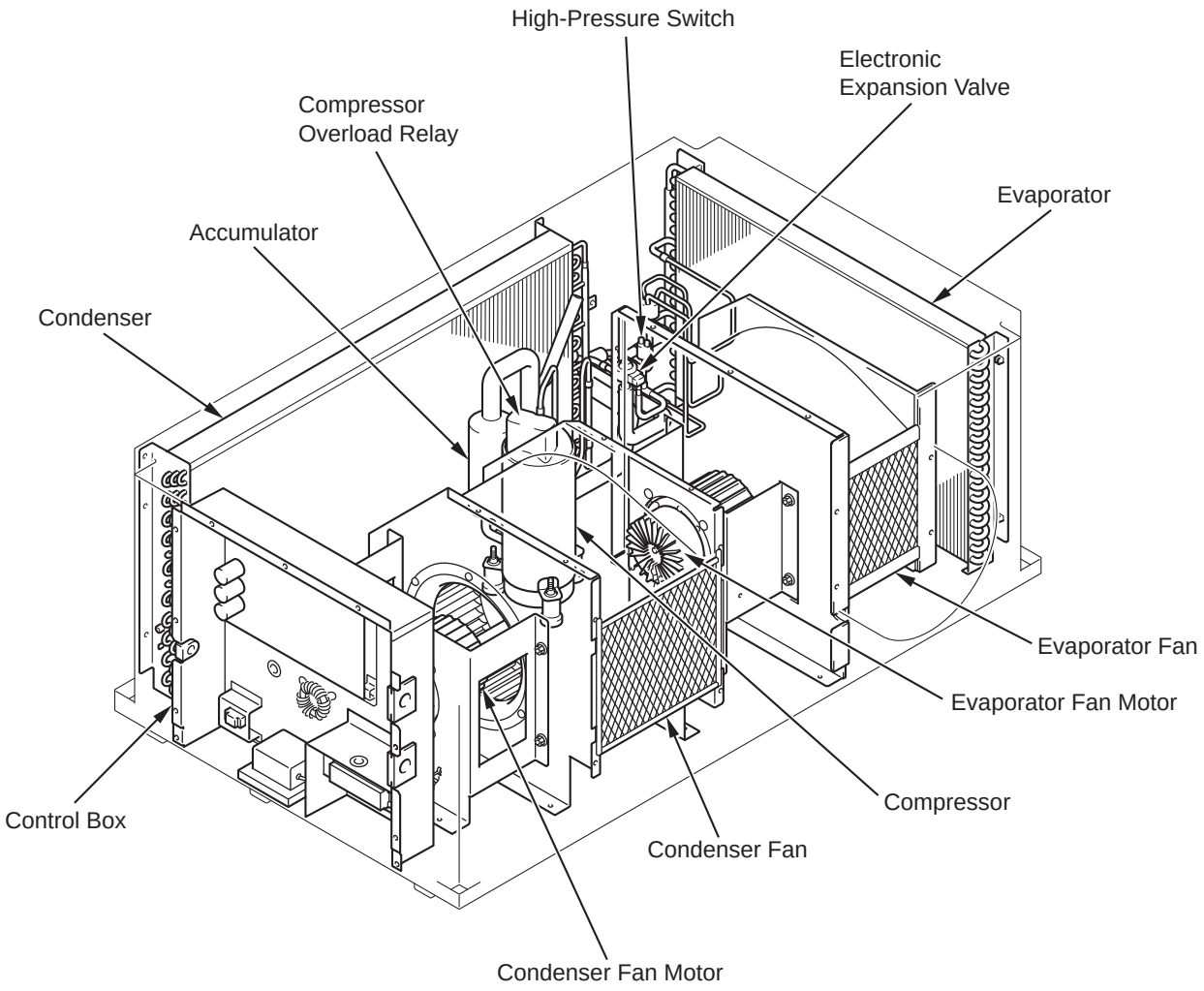
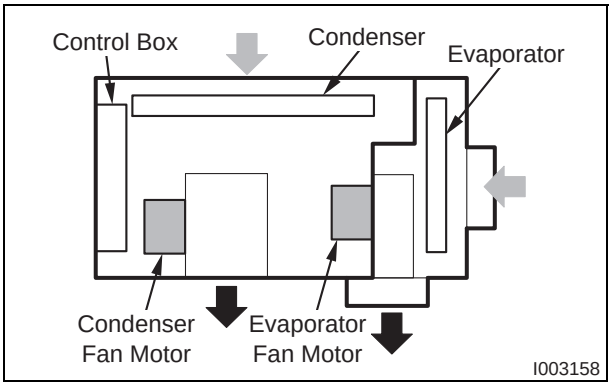
3.2 Internal Structure



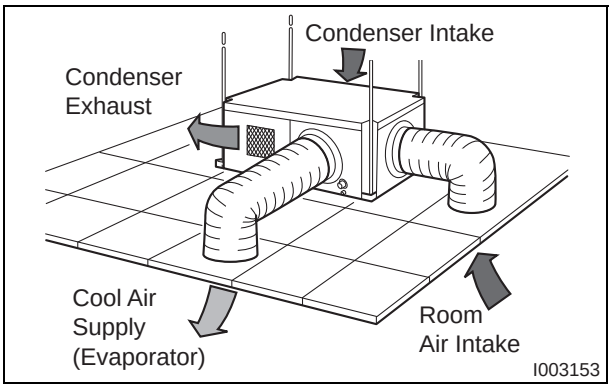
3.3 Basic Construction

- The MovinCool CM 25 is compact in construction due to the condenser and evaporator being enclosed in one unit. The interior of the unit is divided into two sections. One section contains the evaporator which cools room interior air. The other section is comprised of the condenser, compressor and control box.



3.4 Air Flow

- Air drawn from the condenser intake passes over the condenser, extracting heat from the refrigerant. The hot air is blown out through the condenser exhaust air vent. Air taken in from the room air intake is cooled by the evaporator and then blown through the cool air supply.



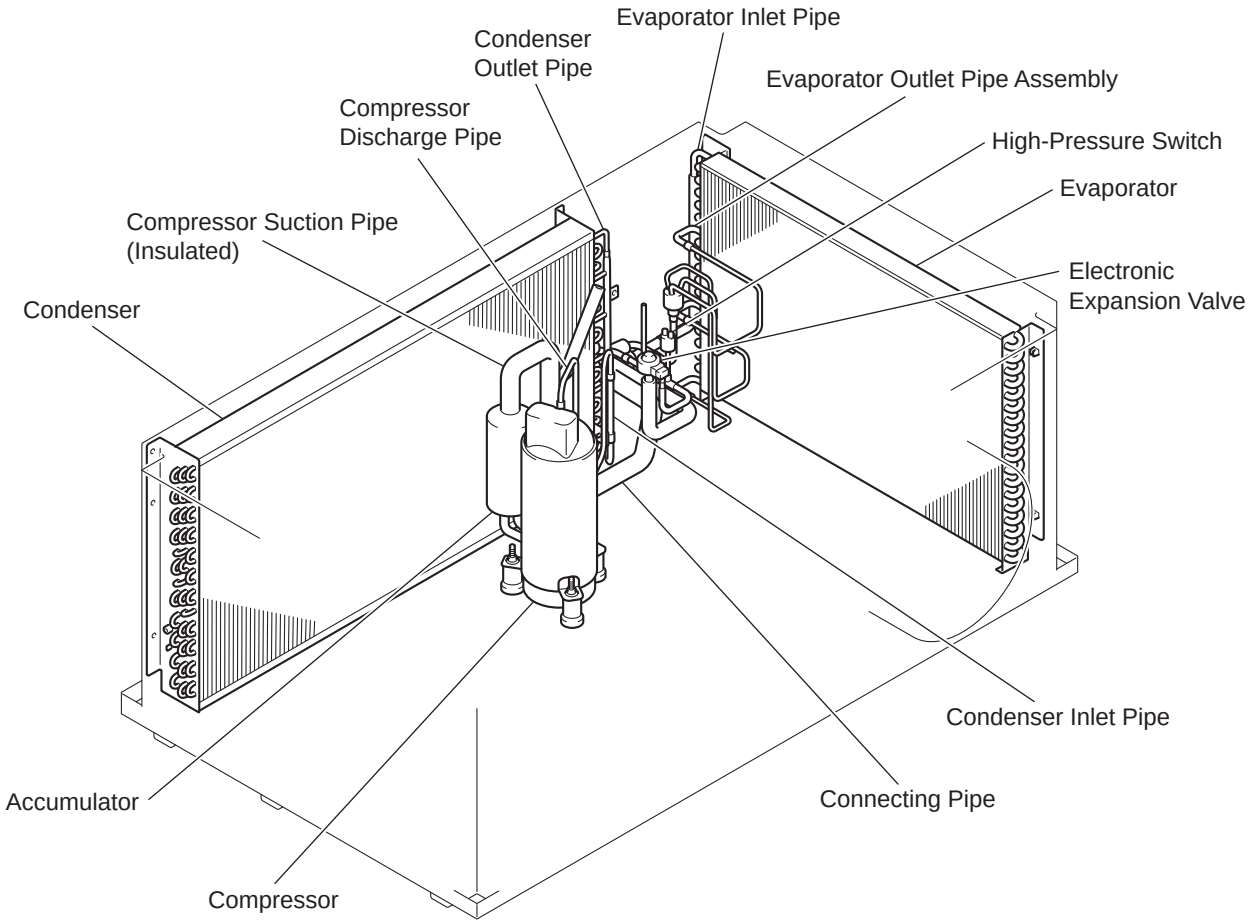
4. REFRIGERATION SYSTEM

4.1 Refrigeration System Construction

The component parts of the refrigeration system include the following:

- Compressor, Evaporator, Condenser, Accumulator, Electronic expansion valve

These parts are all connected by copper tubing. All the connections are brazed.



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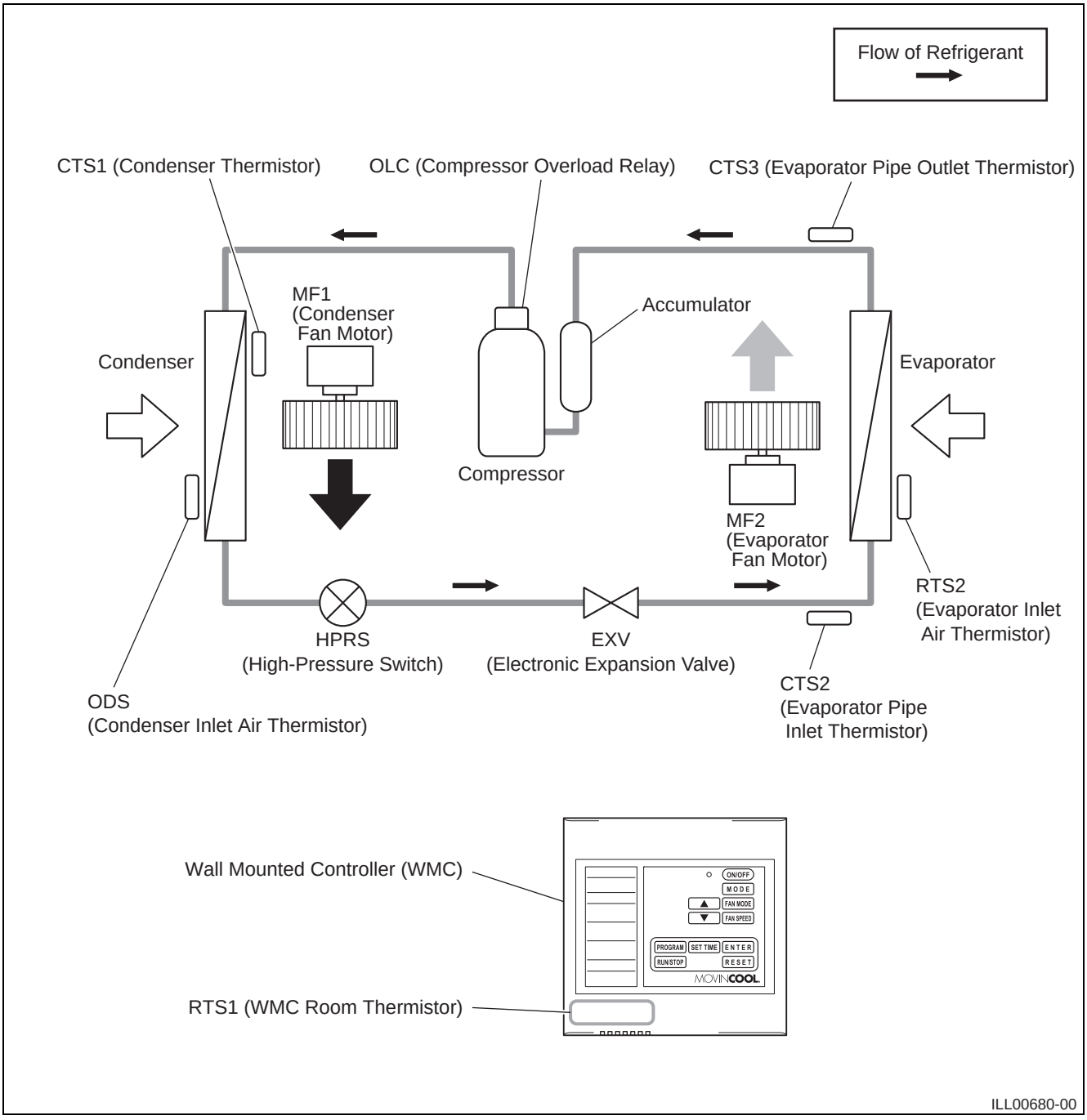
Flow of Refrigerant
CTS1 (Condenser Thermistor)
OLC (Compressor Overload Relay)
CTS3 (Evaporator Pipe Outlet Thermistor)
MF1
(Condenser
Fan Motor)
Accumulator
Condenser
Evaporator
Compressor
MF2
(Evaporator
Fan Motor)
RTS2
(Evaporator Inlet
Air Thermistor)
HPRS
(High-Pressure Switch)
EXV
(Electronic Expansion Valve)
ODS
(Condenser Inlet Air Thermistor)
CTS2
(Evaporator Pipe
Inlet Thermistor)
Wall Mounted Controller (WMC)
RTS1 (WMC Room Thermistor)
ON/OFF
MODE
FAN MODE
FAN SPEED
PROGRAM
SET TIME
ENTER
RUN/STOP
RESET
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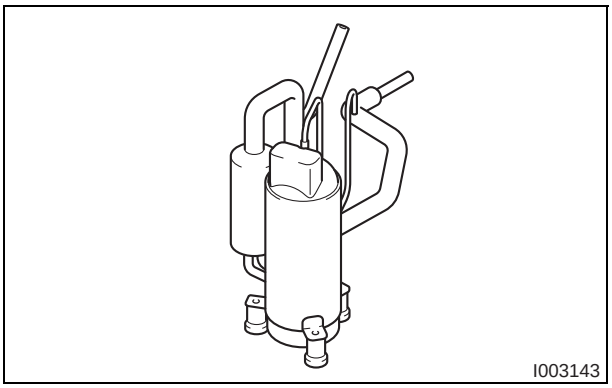
4.2 Compressor

- The CM 25 is equipped with a variable speed compressor, which is driven by state of the art inverter technology.
- A variable speed compressor automatically adjusts its speed as the heat load in the room changes. With its soft start up, a variable speed compressor reduces start up wear on the compressor and eliminates in-rush current resulting in no dip in the power supply.
- As an AC power signal is supplied to the inverter circuit, it is then rectified and converted into a DC power signal with modulated frequency. This modulated frequency controls the speed of the compressor.
- As the compressor speed decreases, the amount of refrigerant entering the evaporator also decreases. This results in a more comfortable environment as the unit provides the appropriate amount of desired cooling. As a result, the room is controlled with a much smaller temperature swing than traditional control methods.

(1) Compressor construction

- The construction of a swing type compressor is divided into two mechanisms; the drive mechanism (compressor motor), and the compression mechanism (compressor). When the rotor shaft of the motor (drive mechanism) turns, the piston (compression mechanism) rotates to compress the refrigerant.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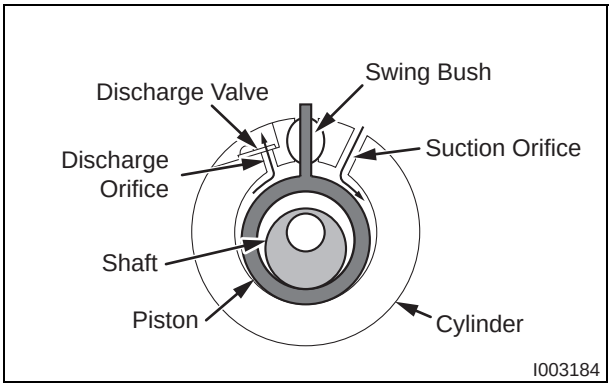
(2) Basic compressor operation

- The piston (compression mechanism) is set eccentrically with a certain distance given from the axis of the center of the cylinder. The piston turns to compress the refrigerant in the space between the cylinder and eccentrically mounted piston. A swing bush absorbs the lateral blade movement under piston action. The blade partitions the space between the suction side and the discharge side to keep compressed refrigerant from returning to the suction side. There is no suction valve. The discharge valve is designed not to open until the pressure of the refrigerant within the cylinder reaches or exceeds discharge side pressure. As a result, the discharge valve prevents the backward flow of refrigerant gas.



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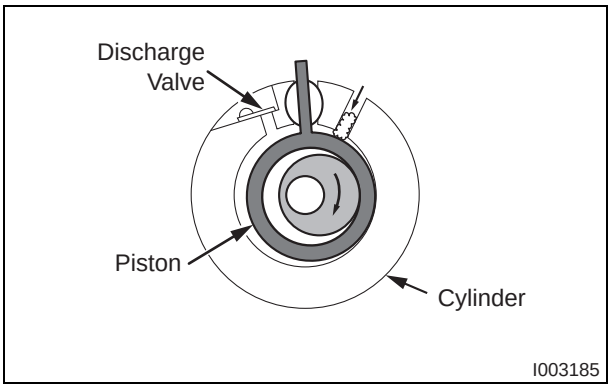
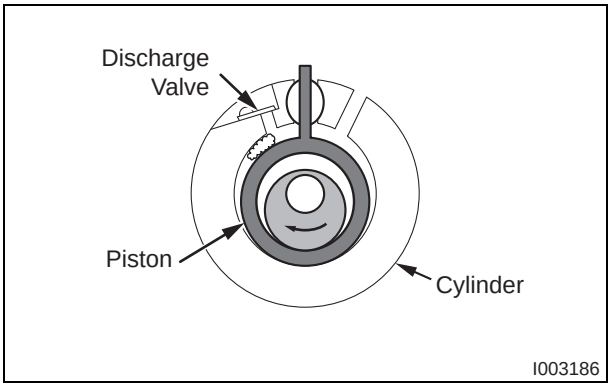
(3) Operation



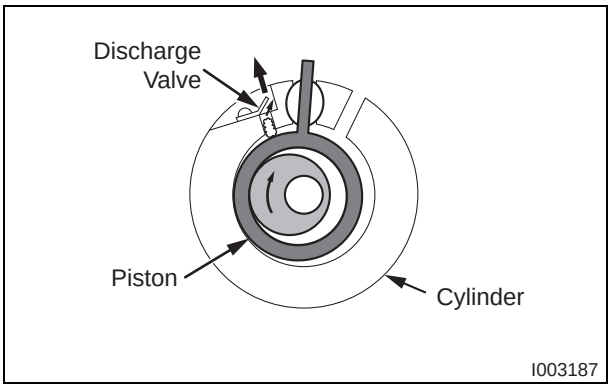
1) Start of compression

1) The cylinder is filled with low pressure gas.
2) Since pressure in the discharge chamber is higher than in the cylinder, the discharge valve is kept closed.



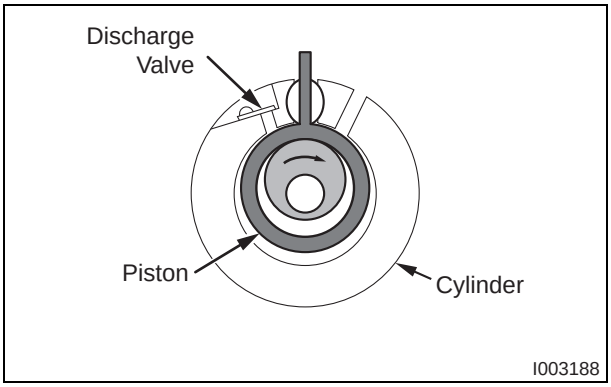
2) Suction and compression

1) The pressure in the cylinder increases gradually.
2) Refrigerant suction begins on the suction side of the cylinder.
3) The discharge valve remains closed.



3) Discharge

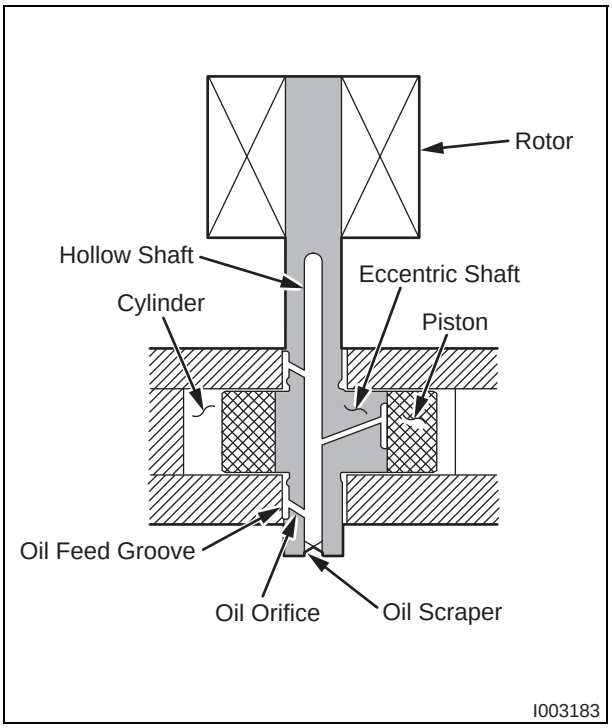
1) The pressure in the cylinder exceeds that in the discharge chamber, and the discharge valve opens.
2) On the suction side, refrigerant suction continues.



4) Completion of compression

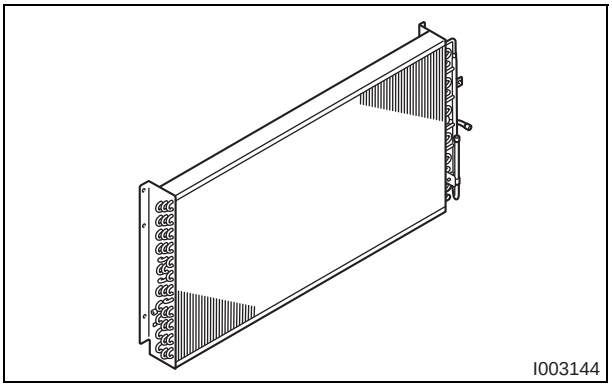
1) When compression is completed, all of the refrigerant has been drawn from the suction chamber.
2) Operation then returns to step 1) (Start of compression) and the above process of suction and compression continues repeatedly in succession.

(4) Compressor lubrication



- The lubrication system is comprised of a hollow shaft, an oil scraper mounted at the bottom end of a shaft journal (shaft bearing), and the lubrication groove for the shaft journal. The lubrication groove is wider than the oil orifice. When the shaft turns, oil is scraped upward by the oil scraper along the inside diameter of the hollow shaft. The oil is fed through the oil orifice by centrifugal force, then supplied to the lubrication groove for each shaft journal, lubricating the bearing. In this lubrication system, oil enters into each bearing separately and returns to the oil reservoir. This system effectively prevents bearing temperature increases, and offers high reliability. In addition, the specially treated shaft journal keeps the bearing from being damaged during high temperature operation.

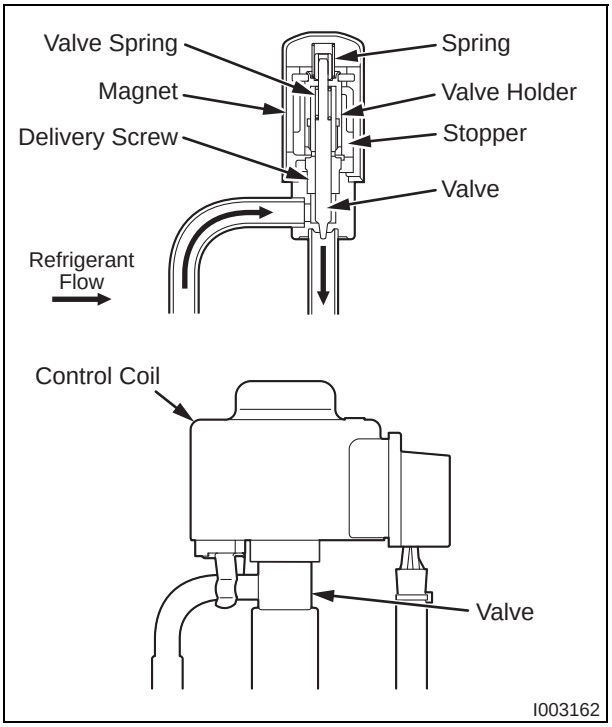
4.3 Condenser



- The condenser is a heat exchanger with copper tubes that are covered with thin aluminum projections called plate fins.
- Heat is given off and absorbed by air being pulled across the condenser fins by the centrifugal fan, and then expelled through the exhaust air duct.

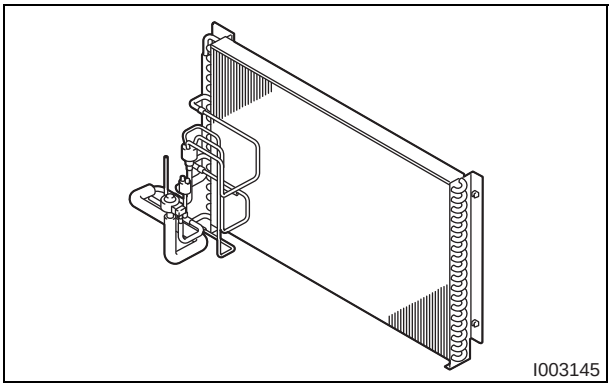
4.4 Electronic Expansion Valve

- The electronic expansion valve causes rapid refrigerant expansion by injecting "high-temperature, high-pressure liquid refrigerant" from the condenser through a small orifice. The resultant "low-temperature, low-pressure mist refrigerant" is then sent to the evaporator. A solenoid valve adjusts the refrigerant quantity according to the evaporator inlet air and outlet air thermistors such that the mist refrigerant can undergo heat exchange in the evaporator under optimal conditions.

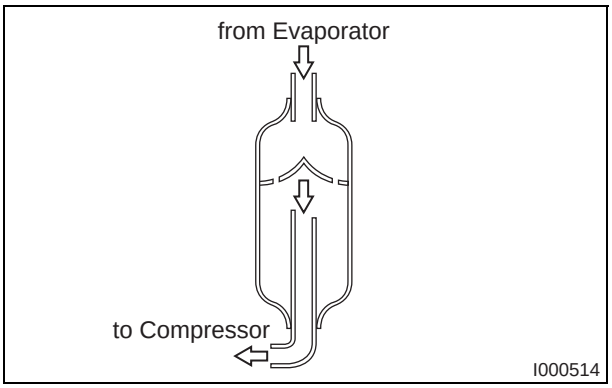


4.5 Evaporator

- The evaporator is a heat exchanger covered with plate fins. Heat is removed from the air being pulled across the evaporator by the centrifugal fan. The resulting cool air is expelled through the cool air vent.

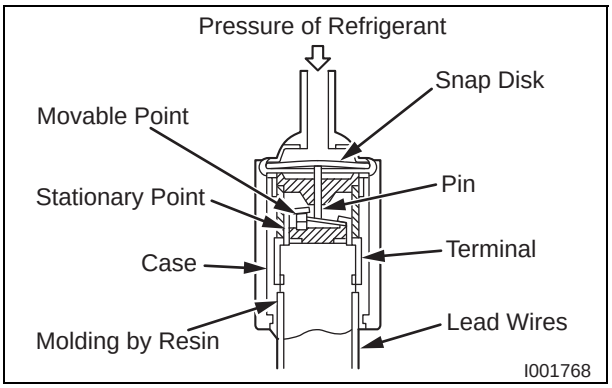


4.6 Accumulator



- The accumulator is mounted on the suction gas piping between the evaporator and the compressor. The accumulator separates the liquid refrigerant from the gas refrigerant, allowing only the gas refrigerant to enter the compressor. In the accumulator, suction gas is led into a cylindrical vessel where the speed of the gas is decreased. This process separates the refrigerant contained in the gas by the force of gravity, causing the refrigerant to accumulate at the bottom of the vessel. As a result, the compressor is protected from possible damage caused by liquid refrigerant intake.

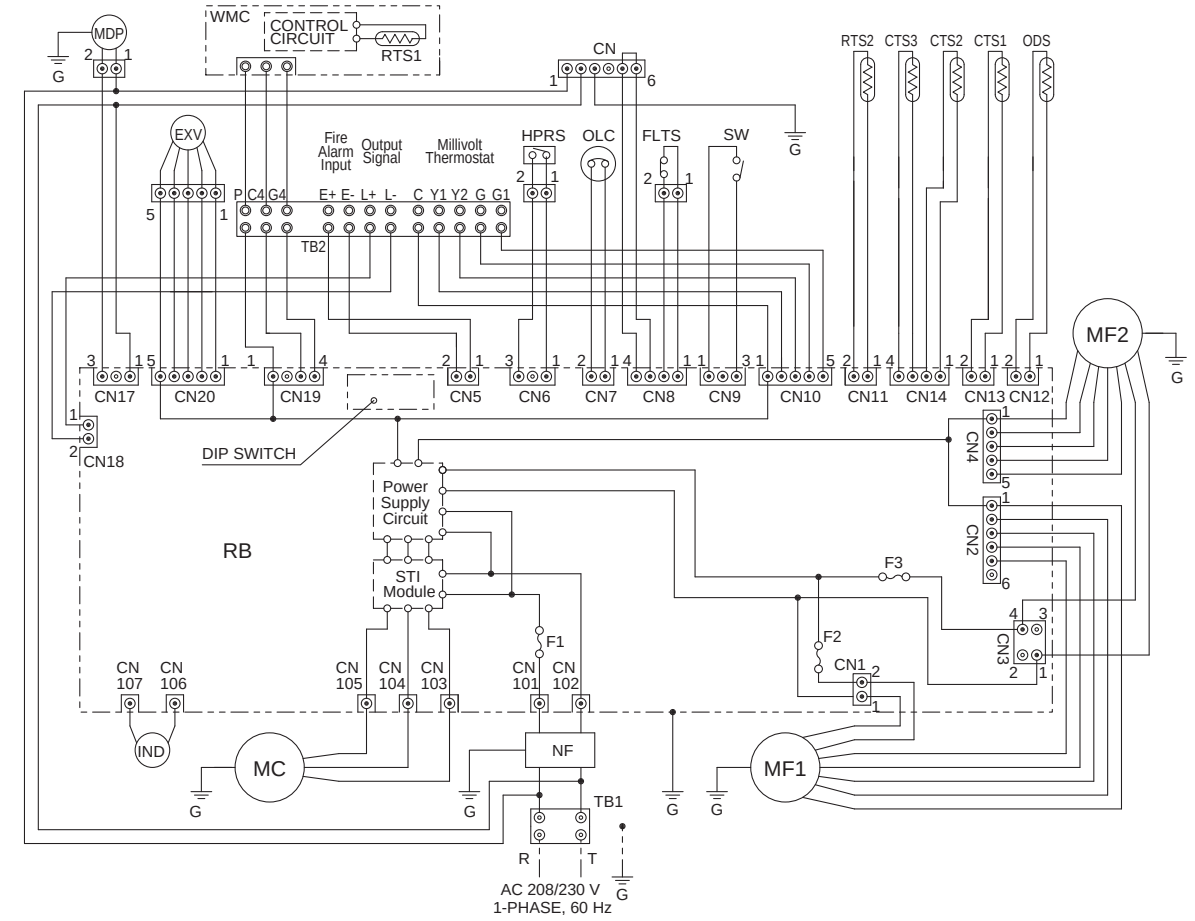
4.7 High-Pressure Switch

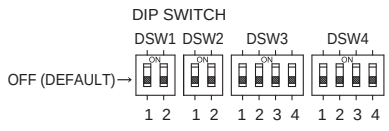


- The high-pressure switch prevents the condenser and compressor from being damaged by excessively high pressure in the high-pressure line of the refrigeration cycle. The switch is normally closed. The snap disk responds to the variations in pressure and, if pressure is abnormally high, the snap disk moves down to push the pin down, causing the internal contacts to open. This interrupts the ground signal at the relay board which turns the compressor off.
- Possible causes of this trouble include:
  - The condenser air filter is dirty, and restricting air flow.
  - The condenser fan motor is defective.

5. ELECTRICAL SYSTEM

5.1 Circuit Diagram





DSW1
#1 ON : ENABLES MILLIVOLT WALL THERMOSTAT (MWT)
OFF : ENABLES WALL MOUNTED CONTROLLER (WMC)
#2 : N/A

DSW2
#1 : ON : INITIALIZES FAN MOTORS
#2 : N/A

DSW3
#1 : ON : TEST MODE
#2 : ON : DISABLES INTERNAL DRAIN PUMP
OFF : ENABLES INTERNAL DRAIN PUMP
#3, #4 : N/A

DSW4 : N/A

TB1	Terminal Block 1	FLTS	Float Switch
TB2	Terminal Block 2	WMC	Wall Mounted Controller
MC	Compressor Motor	RB	Relay Board
OLC	Compressor Overload Relay	F1	Fuse 1
MF1	Condenser Fan Motor	F2	Fuse 2 For Condenser Fan Motor
MF2	Evaporator Fan Motor	F3	Fuse 3 For Evaporator Fan Motor
MDP	Internal Drain Pump Motor	RTS1	WMC Room Thermistor
EXV	Electronic Expansion Valve	RTS2	Evaporator Inlet Air Thermistor
NF	Noise Filter	ODS	Outdoor Thermistor (Condenser Inlet Air Thermistor)
IND	Inductor Coil	CTS1	Condenser Thermistor
SW	Stop Switch	CTS2	Evaporator Pipe Inlet Thermistor
CN	Connector For Optional Condensate Pump	CTS3	Evaporator Pipe Outlet Thermistor
HPRS	High-Pressure Switch	G	Ground

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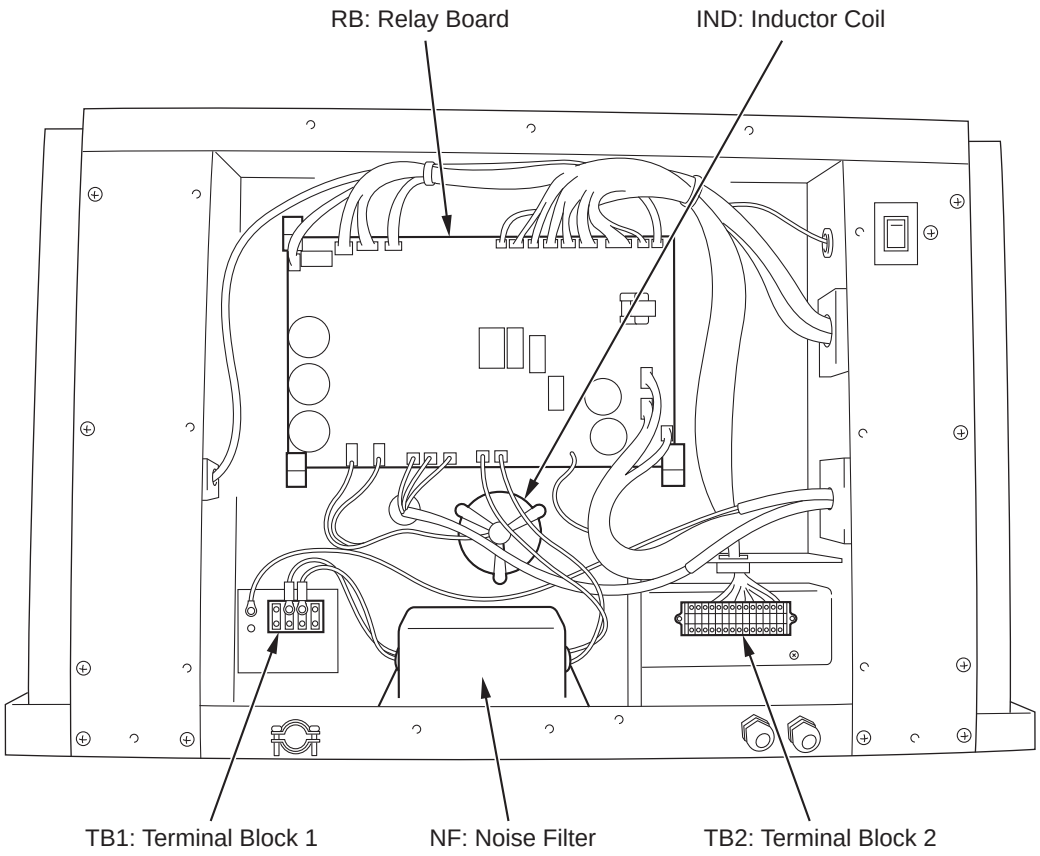
5.2 Control Box



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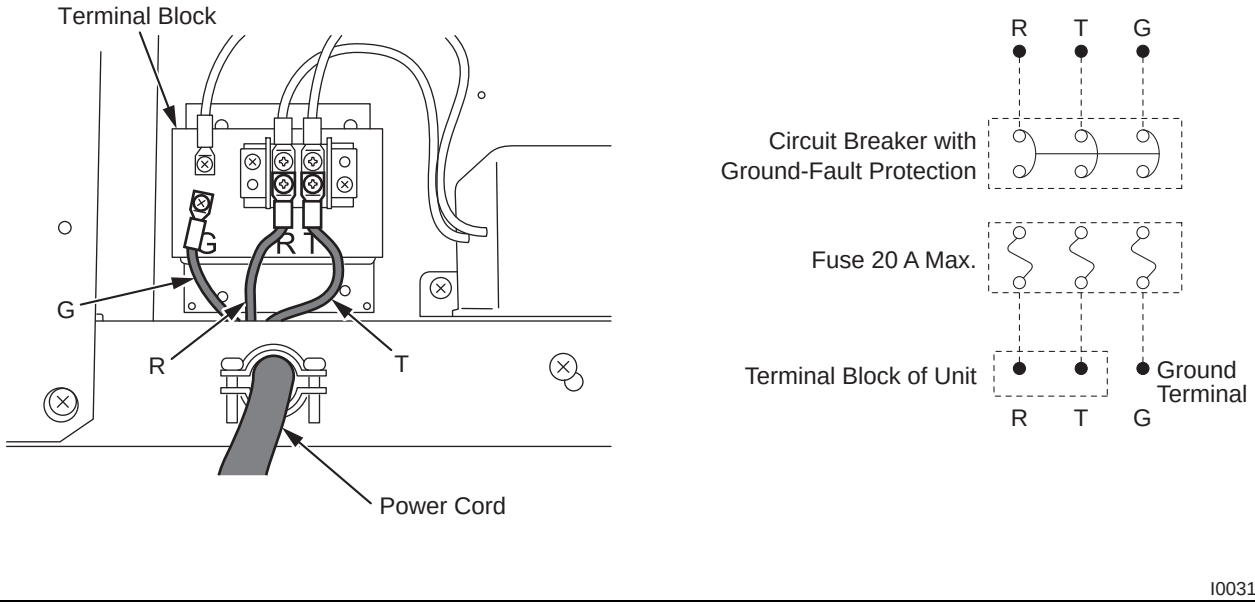
5.3 Power Supply Requirements

- The unit requires a single-phase 208/230 V, 60 Hz power supply to operate.
- The power supply should be a dedicated single outlet circuit with a UL approved short-circuit and ground fault protective breaker with a fuse size of 20 A maximum.
- Securely tighten each terminal.
- The following wire sizes and electrical ratings are recommended:
  - Cord Type: SJT (3 wires) or equivalent
  - Wire Gauge: 12 AWG
  - Voltage Rating: 300 V minimum
  - Heat Resistance: 221°F (105°C)

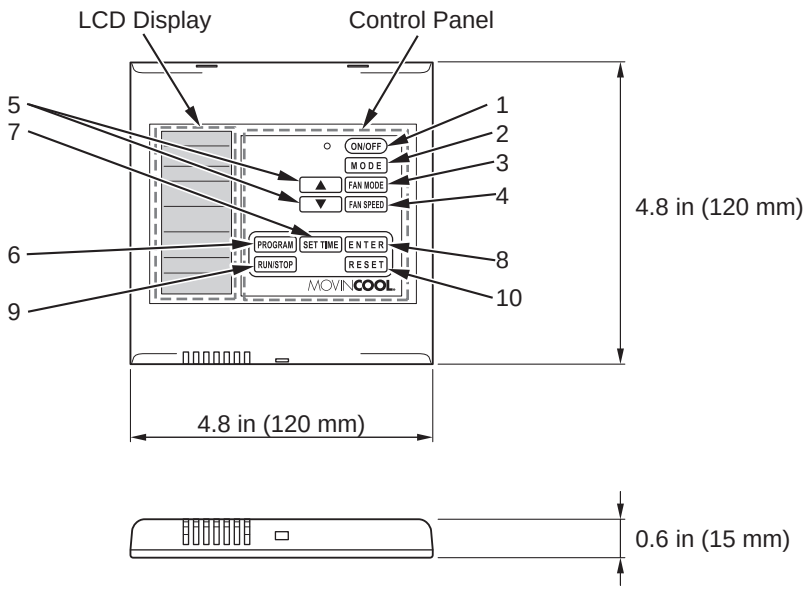


⚠ CAUTION

Use a specified 20 A fuse. Do not use wiring, copper wire or soldering instead of the fuse. The use of non-specified fuses can cause machine failure or fire.

5.4 Wall Mounted Controller (WMC)

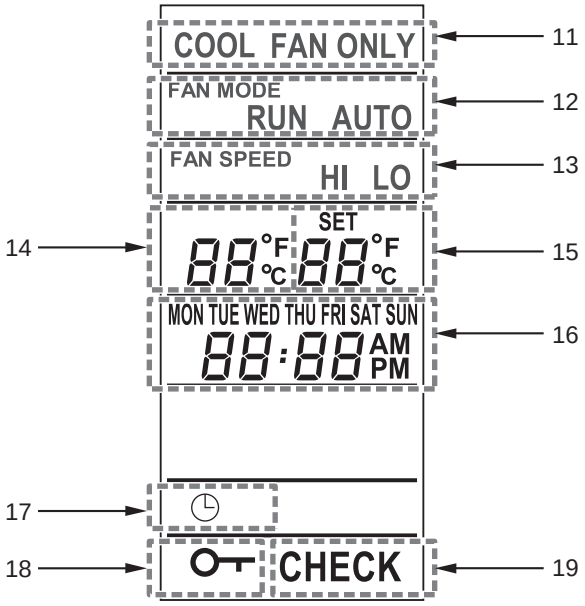
- The WMC for this unit should be mounted within the room close to the return air grill to provide convenient system control.



I003163

1	ON/OFF button	Activates (LED illuminates green) or deactivates unit operation.
2	MODE button	Activates COOL or FAN ONLY operation.
3	FAN MODE button	Activates fan mode RUN or AUTO. RUN: Fan operates continuously during COOL mode even after the room temperature reaches the set point temperature. RUN mode is automatically selected when FAN ONLY mode is selected. AUTO: Fan automatically stops during COOL mode after the room temperature reaches the set point temperature. Fan automatically operates when the room temperature is above the set point temperature.
4	FAN SPEED button	Activates fan speed High or Low.
5	UP (△) and DOWN (▽) button	Increases or decreases the temperature set point during COOL mode. Selects each item when setting the clock or program.
6	PROGRAM button	Sets or displays program.
7	SET TIME button	Sets clock (day and time).
8	ENTER button	Accepts selection and goes to the next step.
9	RUN/STOP button	Activates or deactivates program(s).
10	RESET button	• Clears self-diagnostic codes. • Returns to “Day of the week” for “ON” (start) program setting during program editing mode. • Clears all program memory during program editing mode by pressing and holding the RESET button for 3 seconds.

LCD Display



I003164

11	COOL or FAN ONLY	Illuminates to indicate COOL on or FAN ONLY on.
12	RUN or AUTO	Illuminates to indicate fan mode set to RUN or AUTO.
13	HI or LO	Illuminates to indicate fan speed set to High or Low.
14	Room temperature	Illuminates temperature in either Fahrenheit (°F) or Celsius (°C) (See Note).
15	Set temperature	Illuminates temperature in either Fahrenheit (°F) or Celsius (°C) in COOL mode (See Note).
16	Day of the week and time	Illuminates to indicate day of the week and time.
17	Clock symbol	Illuminates to indicate program is running.
18	Key symbol	Illuminates to indicate keypad locked.
19	CHECK	Illuminates with self-diagnostic codes.

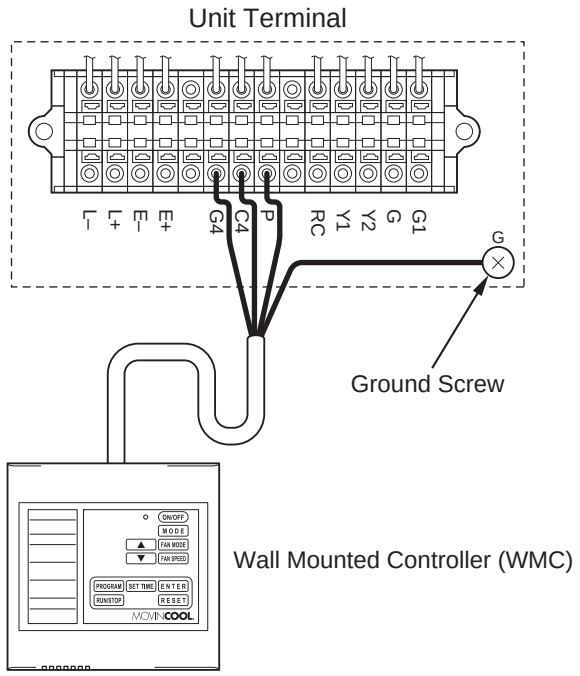
< NOTE >

The room temperature display range is from 16°F (-9°C) to 140°F (60°C). When the display value is greater than 99°F, it displays values of 00F (for 100°F), 01F (for 101°F), and 09F (for 109°F).

• WMC connection

Connection Table

Wall Mounted Controller Wire No. (Color)	Unit Terminal No.
P (Red)	P
C4 (White)	C4
G4 (Black)	G4
Shield Conductor (Green)	G (Ground Screw)



< NOTE >

If the wiring needs to be extended, a maximum extension wire can be extended up to 316 feet.

Shield wire 16-22 AWG is recommended for use as an extension wire to reduce noise interference.

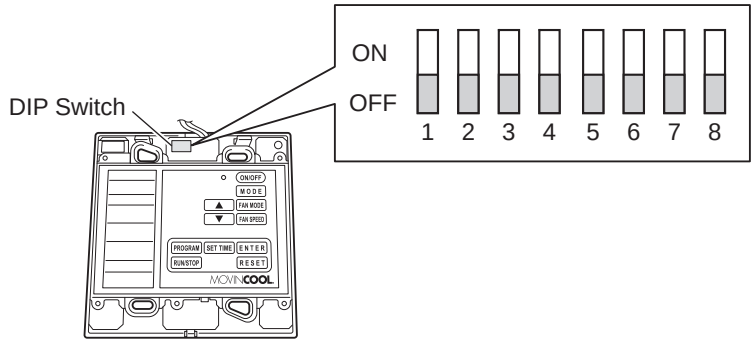
Recommended extension cord: Shield wire 16-22 AWG, length 316 feet maximum

For WMC supplied with the CM 25 serial number from 0113XXXXC25 to present

- If the reading of the room temperature value is not accurate, adjustment can be done by setting the DIP switch located inside the WMC using the table shown below as reference.
- Label of model name is located on the back cover of WMC.

⚠ CAUTION

To avoid static electricity, do not touch the solder joints or the non-insulated parts on the controller board.



DIP Switch Position				Temperature
1	2	3	4 ~ 8	Values
OFF	OFF	OFF	OFF	DEFAULT
OFF	ON	OFF	OFF	+1
OFF	OFF	ON	OFF	+2
OFF	ON	ON	OFF	+3
ON	ON	OFF	OFF	-1
ON	OFF	ON	OFF	-2
ON	ON	ON	OFF	-3

ILL00683-00

< NOTE >

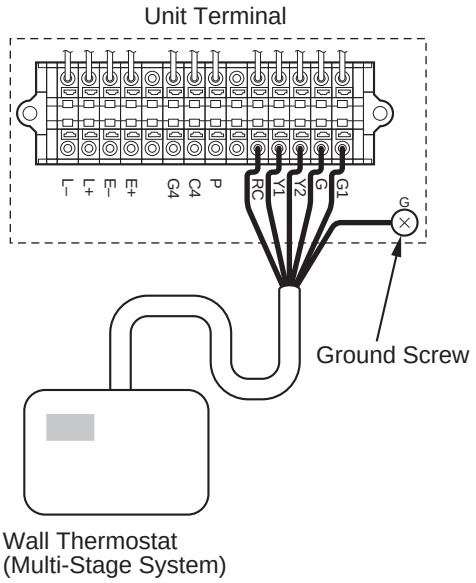
Set the DIP switch 4 to 8 to OFF positions.

5.5 Field-Supplied Millivolt Wall Thermostat (MWT) Connection

- The CM 25 is equipped with terminals for connection to the MWT. The MWT can be installed for convenient access in any room.
  - Use with a single- and multi-stage system wall thermostat.
    Thermostat type: Millivolt system
  - Most wall thermostats provide these basic functions:
    Fan Mode: On/Auto (Selects the desired fan mode.)
    System: Cool/Heater (Selects Cool only.)
  - Unit receives signals from the MWT to perform the following operations.

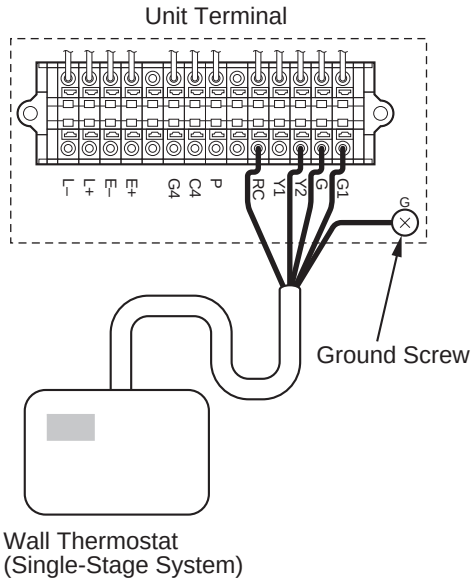
Multi-Stage System

Terminal No.	Function
RC	Common
Y1	Cool MIN
Y2	Cool MAX
G	Fan HI
G1	Fan LO



Single-Stage System

Terminal No.	Function
RC	Common
Y (Y2)	Cool
G	Fan HI
G1	Fan LO



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< NOTE >

Terminal No. G1 is used only with the MWT that has Fan Hi-Lo speed control.

Use the recommended extension cord size from 16 AWG to 26 AWG for a solid wire.

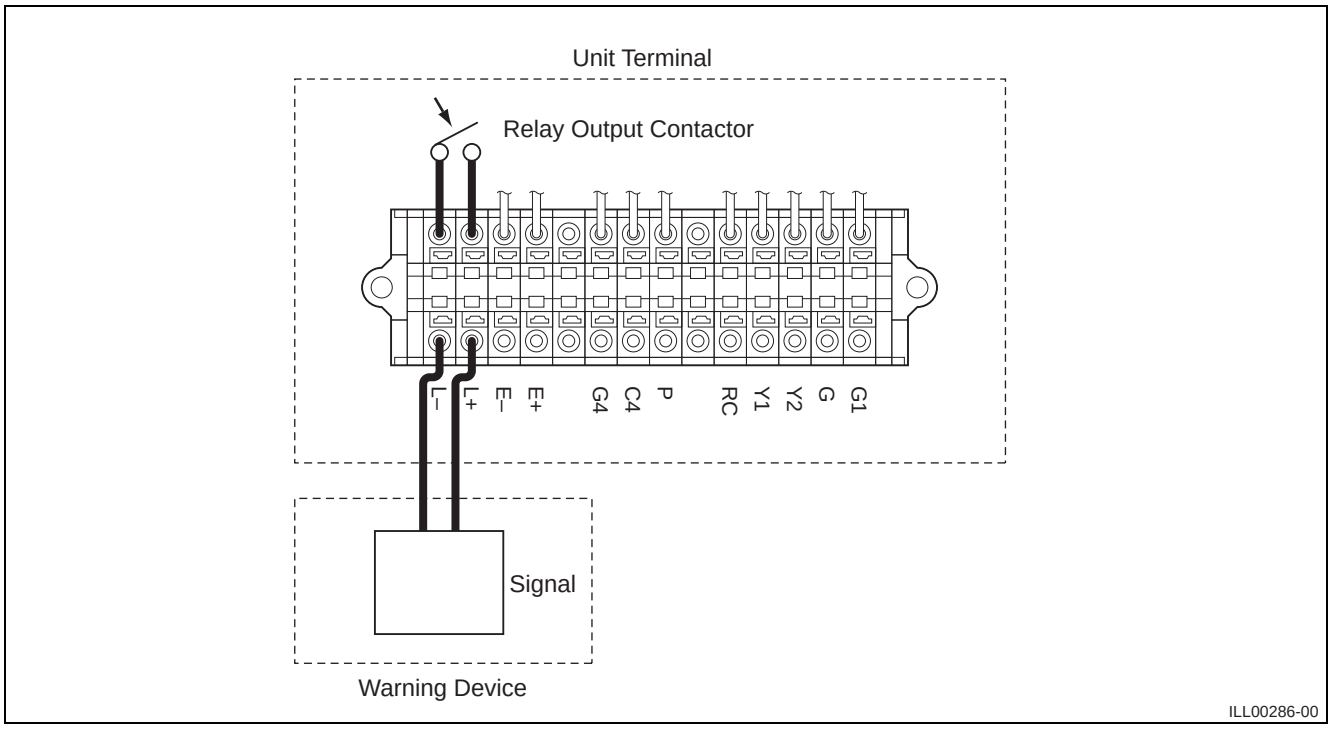
5.6 Warning Signal Connection (Output Signal Terminal L+ and L-)

- The unit is equipped with a warning signal output relay type (Form-C, normal open dry contact) that can be used to monitor the failure condition.
- The relay contactor is closed when the following conditions have occurred:
  - Condensation overflows
  - Temperature sensor fails
  - Cooling function fails
- The relay output contactor is rated 2 A at 30 VDC or 2 A at 30 VAC maximum with resistive load, and is compatible with various warning devices such as alarm speakers, light indicators, etc.

< NOTE >

Use the recommended warning signal wire size from 16 AWG to 26 AWG for a solid wire, or 16 AWG to 22 AWG for a stranded wire.

- Connect the warning signal wires to terminal L+ and L- in the unit control box according to the labels shown below.



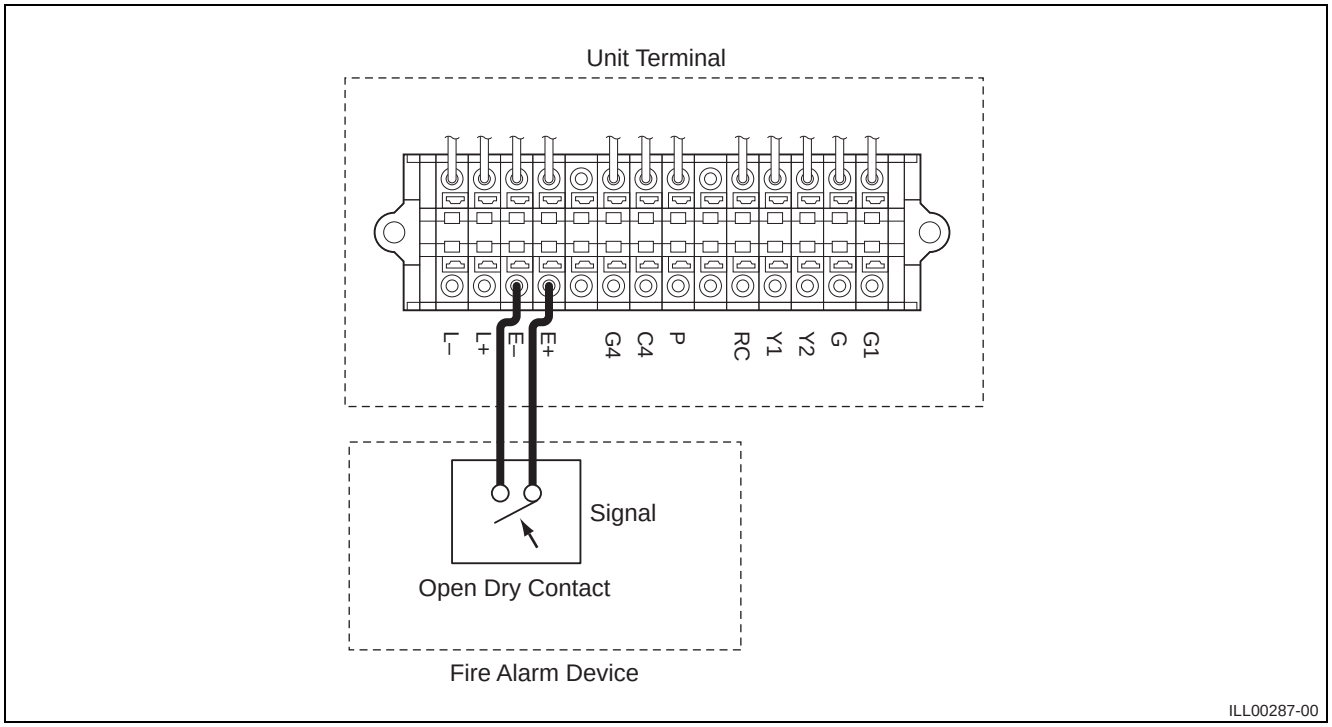
5.7 Fire Alarm Control Panel Connection (Input Signal Terminal E+ and E-)

- The unit is equipped with a normal open input signal that can be connected directly from the fire alarm control panel. When receiving the signal from the fire alarm control panel, the unit turns off and does not turn back on until the power source is reset, or the MWT turns off and on.

< NOTE >

Use the recommended fire alarm signal wire size from 16 AWG to 26 AWG for a solid wire, or 16 AWG to 22 AWG for a stranded wire.

- Connect the fire alarm signal wires to terminal E+ and E- in the unit control box according to labels shown below.



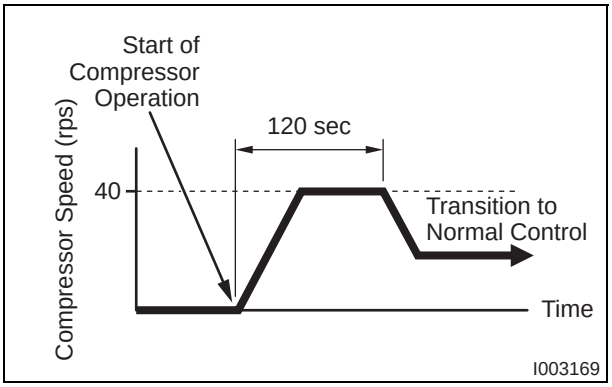
5.8 Basic Operation

- The following components are controlled based on settings and signals from the WMC or MWT in accordance with signals from various sensors: compressor, evaporator fan motor, condenser fan motor, electronic expansion valve, internal drain pump.

5.9 Compressor Operation

(1) Startup speed control

- The compressor operates at 40 rps for 120 seconds after cooling operation begins. Once the refrigeration cycle stabilizes, the inverter controls compressor speed.



< NOTE >

While under startup speed control, the unit continues to operate to protect the refrigerant system, even if cooling operations are suspended by the WMC or MWT.
When startup speed control is completed and cooling operation is suspended within 120 seconds, the "COOL" display flashes for the WMC.

(2) Delay control

- After the power supply is turned on, or after the compressor is stopped, compressor startup is delayed for a fixed time period to prevent overloading the compressor.

Specifications:
- Time Delay: 120 sec.

5.10 Electronic Expansion Valve Operation

- The electronic expansion valve automatically controls its valve position to optimize the refrigerant cycle.

5.11 Evaporator Fan Motor Operation

• The evaporator fan motor is controlled by signals from the WMC or MWT.

(1) When the WMC is connected

• ON/OFF control and fan speed are determined by the WMC settings.

Fan motor settings

- AUTO: The fan motor turns ON when the compressor is ON, and OFF when the compressor is OFF.
- RUN: The fan motor continuously operates, regardless of whether the compressor is ON or OFF.

Fan speed settings

- HI: Fan speed = 880 rpm
- LO: Fan speed = 780 rpm

(2) When the MWT is connected

• ON/OFF control and fan speed are determined by the MWT settings.

Terminal No.		Function	Signal Input			
	G	Fan HI	OFF	OFF	ON	ON
	G1	Fan LO	OFF	ON	OFF	ON
Evaporator fan motor speed			OFF		HI: 880 rpm	LO: 780 rpm

5.12 Condenser Fan Motor Operation

• The condenser fan motor turns ON when the compressor is ON, and OFF when the compressor is OFF.

In addition, fan motor speed is determined by the condenser inlet air thermistor (ODS), and compressor speed.

When ODS ≥ 30°C

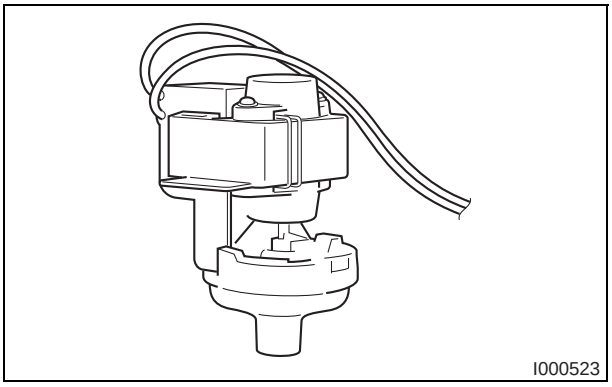
- Compressor 30-40 rps: Fan speed = LO 710 rpm
- Compressor 40-90 rps: Fan speed = HI 865 rpm

ODS < 30°C

- Fan speed = HI 865 rpm

5.13 Internal Drain Pump Operation

- The internal drain pump evacuates evaporator condensation accumulated in the drain pan. This pump turns on only when the compressor is turned on.
- After the compressor turns OFF, the internal drain pump continues to operate for 2.5 minutes before it turns OFF.



5.14 Anti-Frost Control

- Anti-frost controls activate in accordance with the evaporator pipe inlet thermistor (CTS2) temperature in order to turn the compressor on and off, and prevent a decrease in cooling performance resulting from a buildup of frost on the evaporator.
- Compressor off conditions: Evaporator pipe inlet thermistor (CTS2) temperature ≤ 27°F (-3°C)
- Compressor on (recovery) conditions: CTS2 temperature ≥ 43°F (6°C)

5.15 Fan Motor Reverse Rotation Protection

- When the motor rotates in reverse due to an external force, electricity is generated inside the motor. If the fan motor is operated while electricity is being generated, the relay board built into the fan motor will be damaged.

  To prevent damage to the relay board, the unit turns OFF when either the evaporator fan motor, or condenser fan motor rotates in reverse.

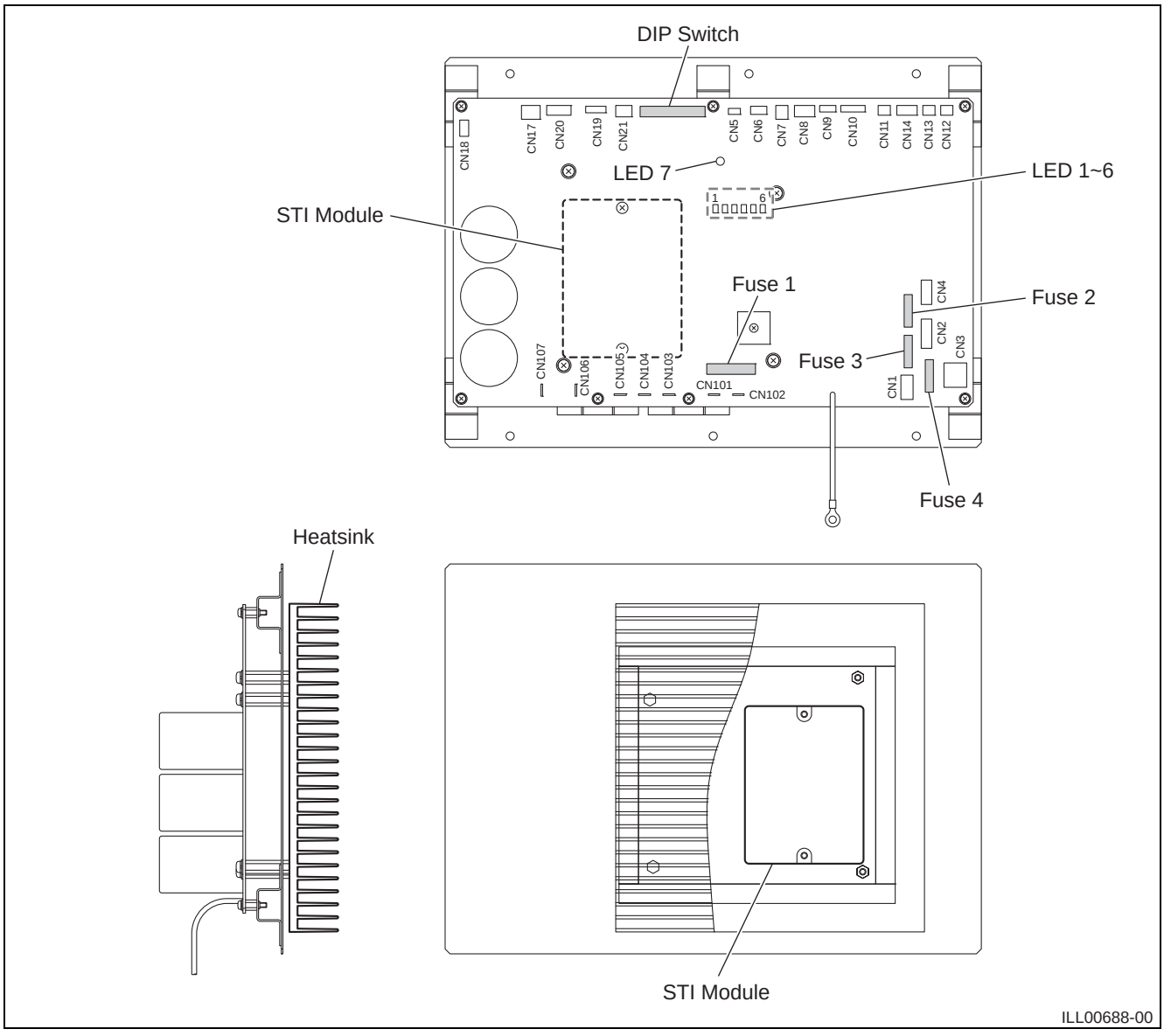
  - Unit OFF conditions: Reverse rotation speed is at or above 760 rpm
  - Unit ON conditions: Automatic recovery when reverse rotation speed is below 760 rpm

5.16 Automatic Restart After Power Interruption (Automatic Recovery Function)

- The program within the CM 25 microprocessor contains a feature that will automatically restart the unit after power is lost and then regained. The unit also has memory in order to return itself back to the operating mode (either manual or preset program) it was in prior to the loss of power. Any “preset” program will also be retained in the memory in the event power loss occurs.

5.17 Relay Board

- The relay board controls components such as the compressor and fan motor based on both signals received from the WMC or MWT, as well as signals from various sensors.
  The relay board is equipped with a compressor control device called the “STI module”.
  The relay board also contains fuses and a DIP switch.

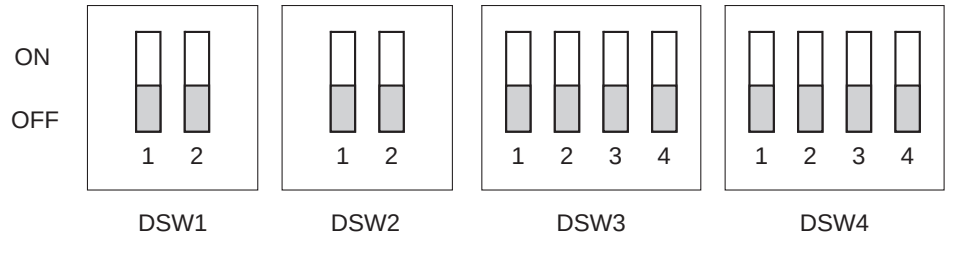


(1) Fuse

Fuse	Function	Specification
F1	Main fuse	20 A, 250 VAC
F2	Fuse for control circuit	1 A, 250 VAC
F3	Fuse for condenser fan motor	3.15 A, 250 VAC
F4	Fuse for evaporator fan motor	3.15 A, 250 VAC

(2) DIP switch configuration and setting

- The controller of the unit is equipped with DIP switches that default in the OFF position. The DIP switch can be set to configure the following functions.



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Switch Name	Switch Number	Function	
DSW1	1	ON	Enables the MWT.
		OFF	Enables the WMC.
	2	ON	No function.
		OFF	
DSW2	1	ON	Initializes setting of the condenser and evaporator fan motors after replacing the fan motors.
		OFF	Set to OFF when the motor replacement is completed.
	2	ON	No function.
		OFF	
DSW3	1	ON	Enters the test mode.
		OFF	Exits the test mode.
	2	ON	Disables the internal condensation removal pump.
		OFF	Enables the internal condensation removal pump.
	3	ON	No function.
		OFF	
	4	ON	No function.
		OFF	
DSW4	1	ON	No function.
		OFF	
	2	ON	
		OFF	
	3	ON	
		OFF	
	4	ON	
		OFF	

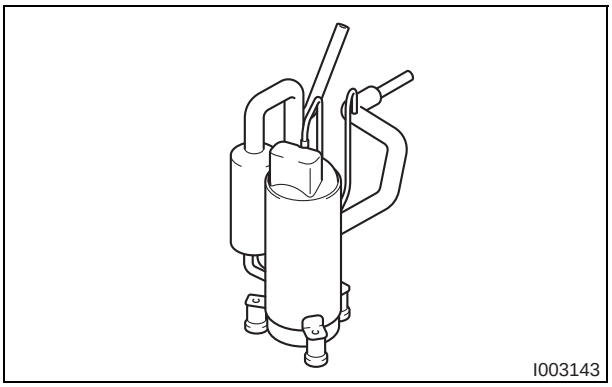
5.18 Compressor

(1) Compressor motor

- The CM 25 uses an inverter-controlled DC compressor. The compressor motor is operated by three-phase voltage outputted from the STI module on the relay board.

Specifications:

- Rated Voltage: DC 220 V
- Rated Output: 1380 W

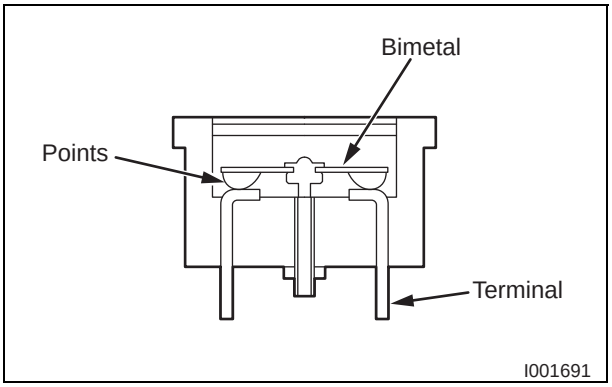


(2) Compressor overload relay

- An external compressor overload relay is used to protect the compressor motor. This relay is mounted within the connector housing that attaches to the top of the compressor. The relay interrupts high temperature build-up in the compressor.

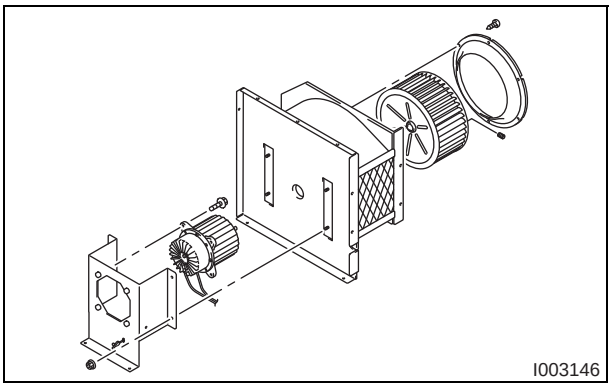
Specifications:

	Temperature
Contact Open	248°F (120°C)
Contact Close	203°F (95°C)



5.19 Fan Motor

(1) Evaporator fan motor

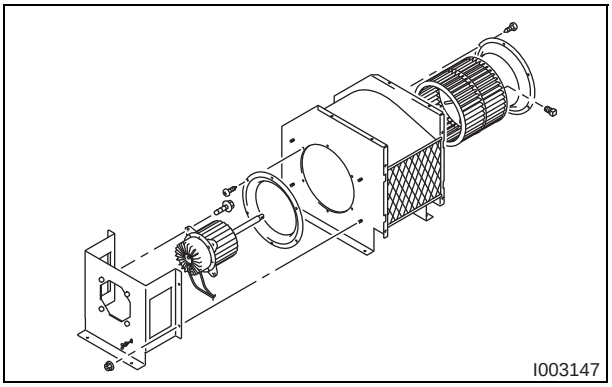


- The CM 25 uses an inverter-controlled DC evaporator fan motor.
- The evaporator fan motor is operated by DC motor actuation voltage outputted by the relay board. Evaporator fan motor speed is controlled by a relay board built into the fan motor.

Specifications:

- Rated Voltage: DC 325 V
- Rated Output: High - 192 W, Low - 136 W
- Rotational Speed: High - 880 rpm, Low - 780 rpm

(2) Condenser fan motor



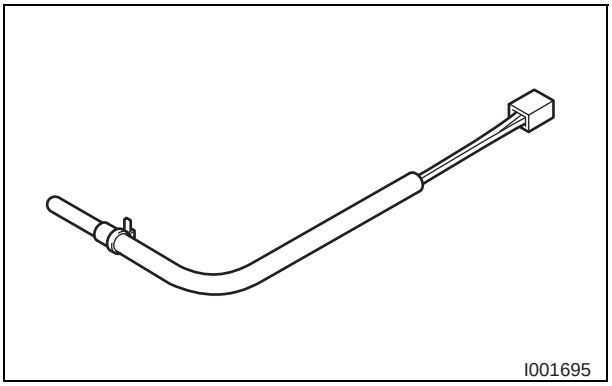
- The CM 25 uses an inverter-controlled DC condenser fan motor.
- The condenser fan motor is operated by DC motor actuation voltage outputted from the relay board. Condenser fan motor speed is controlled by a relay board built into the fan motor.

Specifications:

- Rated Voltage: DC 325 V
- Rated Output: High - 322 W, Low - 187 W
- Rotational Speed: High - 865 rpm, Low - 710 rpm

5.20 Temperature Thermistor

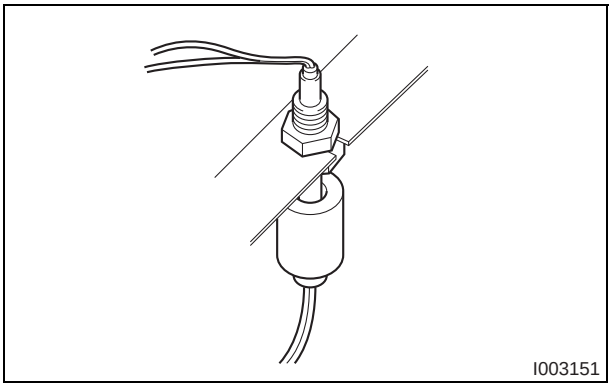
• The temperature thermistor detects temperature as a resistance value.



Symbol	Denomination	Specification		
		Characteristic	Detect “SHORT”	Detect “OPEN”
RTS1	WMC room thermistor	8 k ohm at 77°F (25°C)	181°F (83°C) or higher	-29°F (-34°C) or less
RTS2	Evaporator inlet air thermistor	5 k ohm at 77°F (25°C)	181°F (83°C) or higher	-29°F (-34°C) or less
CTS1	Condenser thermistor	5 k ohm at 77°F (25°C)	181°F (83°C) or higher	-29°F (-34°C) or less
CTS2	Evaporator inlet pipe thermistor	5 k ohm at 77°F (25°C)	181°F (83°C) or higher	-29°F (-34°C) or less
CTS3	Evaporator outlet pipe thermistor	5 k ohm at 77°F (25°C)	181°F (83°C) or higher	-29°F (-34°C) or less
ODS	Condenser inlet air thermistor	5 k ohm at 77°F (25°C)	181°F (83°C) or higher	-29°F (-34°C) or less

5.21 Float Switch

• A normally closed float switch is installed in the drain pan to prevent the drain pan from overflowing and alerts the user of an abnormal condition. When condensation in the drain pan becomes full, the float rises and turning the switch OFF. After the float switch is OFF for 60 seconds, the unit turns off, error code "PU" and buzzer turn on.



6. TROUBLESHOOTING

⚠ WARNING

- **Disconnect power supply from the unit before performing any service. Beware that some residual voltages may remain in the unit immediately after the power is disconnected.**

6.1 Troubleshooting

- Before troubleshooting the system, the following inspection should be performed.

(1) Inspection of power source voltage

- Check the voltage of the power source.
  - Single-phase 208/230 V (60 Hz)
- Check the operation and condition of the fuse or circuit breaker in the power source.

(2) Inspection of air filters

- Remove the air filters and check the element. If the element is dirty, wash it as described in the OPERATION MANUAL supplied with the unit.

6.2 Self-Diagnostic Codes

- Self-diagnostic codes are displayed on the WMC and indicate by LED on the relay board under the following conditions.
- LED on the relay board indicates self-diagnostic codes for the MWT under the following conditions.

Self-Diagnostic Code		Cause	Alarm Pattern	Relay Board LED (Red)						Warning Signal Output	Detection Contents
User Mode	Service Mode			1	2	3	4	5	6		
AL	AL	Fire alarm input	1	●	●		●	●		ON	When receiving fire alarm signal input.
PU	PU	Condensation overflow (Internal drain pump)	3		●		●	●			When drain pan float switch is OFF continuously for 60 seconds.
E07	E07	Condensation overflow (Optional condensate pump)	3	●			●	●			When optional drain pan float switch is OFF continuously for 60 seconds.
HP	HP	High-pressure signal detected	-							OFF	When high-pressure switch is activated 2 times in 24 hours from first detection.
										ON	When high-pressure switch is activated 3-7 times in 24 hours from first detection.
		High-pressure protection activated	4				●	●			When high-pressure switch is OFF eight times.
E01	E01	WMC room thermistor (RTS1) failure	2	●	●	●		●			When an abnormality is detected.
E02	E02	Evaporator inlet air thermistor (RTS2) failure			●	●		●			
E03	E03	Condenser inlet air thermistor (ODS) failure		●		●		●			
E04	E04	Condenser thermistor (CTS1) failure				●		●			
E05	E05	Evaporator pipe inlet thermistor (CTS2) failure		●	●			●			
E06	E06	Evaporator pipe outlet thermistor (CTS3) failure			●			●			
E08	E08	WMC communication error	4	●				●			When a communication error between the relay board and WMC continues for at least 10 seconds.

Self-Diagnostic Code		Cause	Alarm Pattern	Relay Board LED (Red)						Warning Signal Output	Detection Contents
User Mode	Service Mode			1	2	3	4	5	6		
E09	E09	Evaporator fan motor locked	4					●		ON	When a fan motor speed of 50 rpm or less is detected four times within 10 seconds after the fan motor is started.
E10	E10	Condenser fan motor locked		●	●	●	●				
OL	OL	Compressor overload			●	●	●				When compressor overload relay is activated.
E11	E11	STI module communication error		●		●	●				When a communication failure between the STI module and microcomputer on the relay board is detected for at least 40 seconds.
E12	E14	Compressor over current				●	●				When compressor current is detected at or above 35.9 A.
	E15	Compressor lock failure		●	●		●				During the operational check when the compressor is stopped, no change in position is detected.
	E16	Compressor phase interruption abnormality			●		●				When one phase is detected as 0 A.
	E17	Motor position detection abnormality		●			●				When an abnormality in the compressor motor position is detected.
E13	E18	Input overcurrent					●				When STI module input current that exceeds the specified value is detected.
	E19	Power device temperature abnormality		●	●	●					When STI module temperature that exceeds the specified value is detected.
	E20	DC voltage abnormality			●	●					When a DC voltage or current that is at or below the specified value, or at or above the specified value is detected.
	E21	Power device damage abnormality		●		●					When a compressor startup current/voltage that is at or below the specified value is detected.
	E22	Circuit malfunction				●					When a short or open in the STI internal current/voltage detection circuit is detected.

Self-Diagnostic Code	Cause	Alarm Pattern	Relay Board LED (Red)						Warning Signal Output	Detection Contents
			1	2	3	4	5	6		
DF*1	Freezing abnormality	-	●	●					OFF	When an evaporator inlet air thermistor temperature at or below 26.5°F (-3°C) is detected during compressor operation. However, detection is not possible for 5 minutes after the compressor starts.
IR*1	Evaporator fan motor reverse rotation abnormality	-		●						When a fan motor reverse rotation signal (-760 rpm) is detected.
OR*1	Condenser fan motor reverse rotation abnormality	-	●							

●: LED turn on

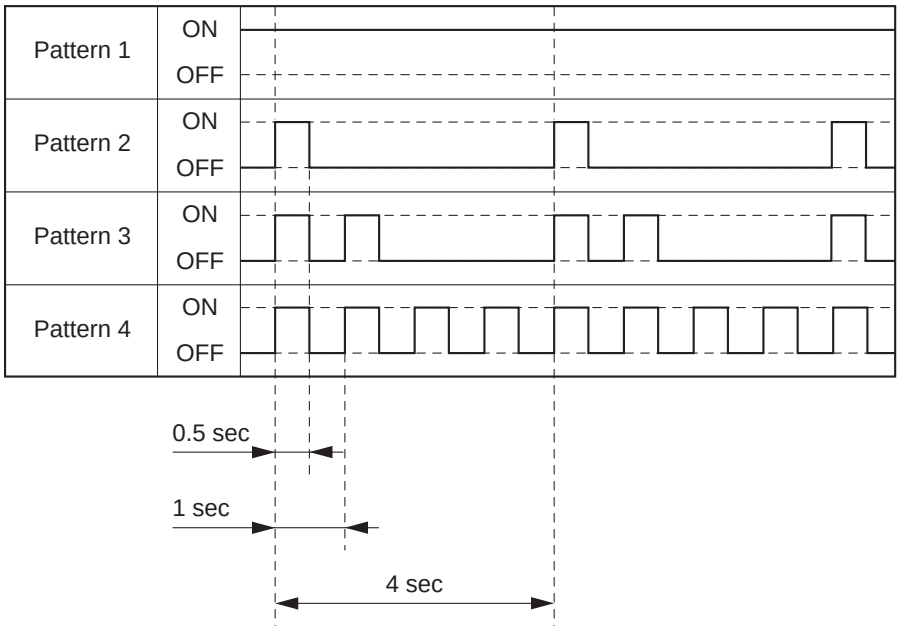
< NOTE >

*1 Shown with the operational status display mode.

When the fan is under the initial settings or in test mode, either the WMC or MWT will be inoperative, and no self-diagnostic codes will be displayed.

- Verify self-diagnostic codes using the LED on the relay board.
- To erase self-diagnostic codes, (including either the WMC or MWT), open and close the circuit breaker.

Alarm (buzzer) patterns



Alarm clear method

- Self-diagnostic codes are not displayed for the MWT. To identify the cause, check the LED on the relay board and refer to the charts on page 44 to 46.

Self-Diagnostic Code		Cause	Alarm Clear Method	
User Mode	Service Mode		Wall Mounted Controller (WMC)	Millivolt Wall Thermostat (MWT)
AL	AL	Fire alarm input	Press RESET button.	Reset the power from the circuit breaker.
PU	PU	Condensation overflow (Internal drain pump)		
E07	E07	Condensation overflow (Optional condensate pump)		
HP	HP	High-pressure signal detected	Alarm clears automatically.	Alarm clears automatically.
		High-pressure protection activated	Press RESET button.	Reset the power from the circuit breaker.
E01	E01	WMC room thermistor (RTS1) failure		
E02	E02	Evaporator inlet air thermistor (RTS2) failure		
E03	E03	Condenser inlet air thermistor (ODS) failure		
E04	E04	Condenser thermistor (CTS1) failure		
E05	E05	Evaporator pipe inlet thermistor (CTS2) failure		
E06	E06	Evaporator pipe outlet thermistor (CTS3) failure		
E08	E08	WMC communication error		
E09	E09	Evaporator fan motor locked		
E10	E10	Condenser fan motor locked		
OL	OL	Compressor overload		
E11	E11	STI module communication error		
E12	E14	Compressor over current		
	E15	Compressor lock failure		
	E16	Compressor phase interruption abnormality		
	E17	Motor position detection abnormality		

Self-Diagnostic Code		Cause	Alarm Clear Method	
User Mode	Service Mode		Wall Mounted Controller (WMC)	Millivolt Wall Thermostat (MWT)
E13	E18	Input overcurrent	Press RESET button.	Reset the power from the circuit breaker.
	E19	Power device temperature abnormality		
	E20	DC voltage abnormality		
	E21	Power device damage abnormality		
	E22	Circuit malfunction		

Self-Diagnostic Code	Cause	Alarm Clear Method	
		Wall Mounted Controller (WMC)	Millivolt Wall Thermostat (MWT)
DF*1	Freezing abnormality	Alarm clears automatically.	Alarm clears automatically.
IR*1	Evaporator fan motor reverse rotation abnormality		
OR*1	Condenser fan motor reverse rotation abnormality		

< NOTE >

*1 Shown with the operational status display mode.

When the fan is under the initial settings or in test mode, either the WMC or MWT will be inoperative, and no self-diagnostic codes will be displayed.

- Verify self-diagnostic codes using the LED on the relay board.
- To erase self-diagnostic codes, (including either the WMC or MWT), open and close the circuit breaker.

6.3 Troubleshooting Chart

- To accurately troubleshoot the problem, it is important to carefully confirm the nature of the problem.

Condition Unit does not operate.	Check Area	Possible Cause	Remedy
LCD display turns off.	1. Voltage	Power failure.	Repair power supply.
			Turn the circuit breaker on.
	2. Ground fault breaker trip	Ground fault or defective ground fault.	Repair ground fault section.
			Reset or repair circuit breaker.
	3. Fuse	Fuse is blown.	Replace fuse on the relay board.
	4. WMC/MWT	Incorrect connection.	Connect the wires correctly.
		DIP switch setting is incorrect.	Correct DIP switch setting.
	5. Stop switch	Stop switch is in the STOP position.	Turn the stop switch to OPERATE.

- If conditions persist after the above actions have been taken, turn the unit off, disconnect the power and contact your MovinCool reseller or a qualified technician.
- Self-diagnostic codes are not displayed for the MWT. To identify the cause, check the LED on the relay board and refer to the charts on page 44 to 46.

Condition	Check Area			Possible Cause	Remedy
Unit does not operate.	Self-Diagnostic Codes (WMC)		Buzzer Pattern		
	User Mode	Service Mode			
LCD displays self-diagnostic codes.	AL	AL	1	Signal is input from the fire alarm.	Check the fire alarm system and confirm there is no signal input to the unit, then RESET the controller*1.
	PU	PU	3	Drain hose clogged (for internal drain pump).	Remove any blockage or excessive kinks preventing water flow.
				Drain hose trap position is too high to pump up condensation water (for internal drain pump).	Improve hose installation. (Refer to the operation manual of this unit.) Drain water through the gravitational drain pipe. RESET the controller*1.
				Internal drain pump is not working.	Reconnect the internal drain pump and check connection. Drain water through the gravitational drain pipe. RESET the controller*1. If the internal drain pump still does not work, replace it.
	E07	E07	3	Drain hose is clogged (for optional condensate pump).	Remove any blockage or excessive kinks preventing air flow. RESET the controller*1.
				Drain hose trap position is too high to pump up condensation water (for optional condensate pump).	Improve hose installation. (Refer to the installation manual of the optional condensate pump.) RESET the controller*1.
				Optional condensate pump is not working.	Reconnect the drain pump and check the connection. RESET the controller*1. If the optional condensate pump still does not work, replace it.

*1 : To RESET the controller, press RESET button, then press ON/OFF button.

Condition	Check Area			Possible Cause	Remedy
Unit does not operate.	Self-Diagnostic Codes (WMC)		Buzzer Pattern		
	User Mode	Service Mode			
LCD displays self-diagnostic codes.	HP	HP	4	Operating outside of the operating temperature range.	Check environmental condition. Do not operate the unit outside the operating condition range. (See page 9.) RESET the controller*1.
				Insufficient air volume.	Clean air filter. RESET the controller*1.
					Check ducting of intake and exhaust air, and make sure there are no objects preventing air flow. RESET the controller*1.
				Loose high-pressure switch connection.	Reconnect the high-pressure switch and check the connection. RESET the controller*1.
				Defective high-pressure switch (short or open).	Replace high-pressure switch. RESET the controller*1.
				Refrigerant is over charged.	Charge correct amount of refrigerant. (See page 86.) RESET the controller*1.
	E01	E01	2	Defective RTS1 thermistor (short or open).	Replace the WMC.
	E02	E02	2	Loose RTS2 thermistor connection.	Reconnect the RTS2 thermistor and check the connection. RESET the controller*1.
				Defective RTS2 thermistor (short or open).	Replace RTS2 thermistor. RESET the controller*1.
	E03	E03	2	Loose ODS thermistor connection.	Reconnect the ODS thermistor and check the connection. RESET the controller*1.
				Defective ODS thermistor (short or open).	Replace ODS thermistor. RESET the controller*1.
	E04	E04	2	Loose CTS1 thermistor connection.	Reconnect the CTS1 thermistor and check the connection. RESET the controller*1.
				Defective CTS1 thermistor (short or open).	Replace CTS1 thermistor. RESET the controller*1.

*1 : To RESET the controller, press RESET button, then press ON/OFF button.

Condition	Check Area			Possible Cause	Remedy
Unit does not operate.	Self-Diagnostic Codes (WMC)		Buzzer Pattern		
	User Mode	Service Mode			
LCD displays self-diagnostic codes.	E05	E05	2	Loose CTS2 thermistor connection.	Reconnect the CTS2 thermistor and check the connection. RESET the controller*1.
				Defective CTS2 thermistor (short or open).	Replace CTS2 thermistor. RESET the controller*1.
	E06	E06	2	Loose CTS3 thermistor connection.	Reconnect the CTS3 thermistor and check the connection. RESET the controller*1.
				Defective CTS3 thermistor (short or open).	Replace CTS3 thermistor. RESET the controller*1.
	E08	E08	4	WMC lost communication with the unit for more than 10 seconds.	Check for connection or interference. RESET the controller*1.
	E09	E09	4	Evaporator fan motor is locked.	Remove any foreign object causing fan lock. RESET the controller*1.
	E10	E10	4	Condenser fan motor is locked.	Remove any foreign object causing fan lock. RESET the controller*1.
	OL	OL	4	Compressor overload protection is activated by refrigerant leakage.	Repair the leaking section and recharge the correct amount of refrigerant. RESET the controller*1.
	E11	E11	4	Relay board communication error occurs for 40 seconds.	Check all wire connections on the relay board. RESET the controller*1.
					If the error still occurs, replace the relay board. RESET the controller*1.

*1 : To RESET the controller, press RESET button, then press ON/OFF button.

Condition	Check Area			Possible Cause	Remedy
Unit does not operate.	Self-Diagnostic Codes (WMC)		Buzzer Pattern		
	User Mode	Service Mode			
LCD displays self-diagnostic codes.	E12	E14	4	Excessive current from the STI module to the compressor.	RESET the controller*1 twice or three times. If the error still occurs, replace the compressor.
		E15	4	Compressor lock.	RESET the controller*1 twice or three times. If the error still occurs, replace the compressor.
		E16	4	Compressor wires are disconnected.	• Reconnect and check the compressor wires. • Reconnect and check the relay board wires. RESET the controller*1.
		E17	4	Excessive compressor load.	RESET the controller*1 twice or three times. If the error still occurs, replace the compressor.
				Excessive compressor startup differential pressure.	
	E13	E18	4	Excessive current from the power source to the STI module.	RESET the controller*1 twice or three times. If the error still occurs, replace the compressor.
		E19	4	Degraded heat sink performance.	Replace the relay board. Then initialize the fan motor. (See page 61.)
		E20	4	Recovery from momentary power loss or momentary voltage drop.	Check if the supplied voltage to the unit is unstable due to the external influence or not. RESET the controller*1. If the error still occurs, replace the relay board. Then initialize the fan motor. (See page 61.)
				Momentary power loss, or momentary voltage drop.	
		E21	4	Sensor on the relay board is short or open.	Replace the relay board. Then initialize the fan motor. (See page 61.)
		E22	4	Compressor actuating circuit on the relay board is short or open.	Replace the relay board. Then initialize the fan motor. (See page 61.)

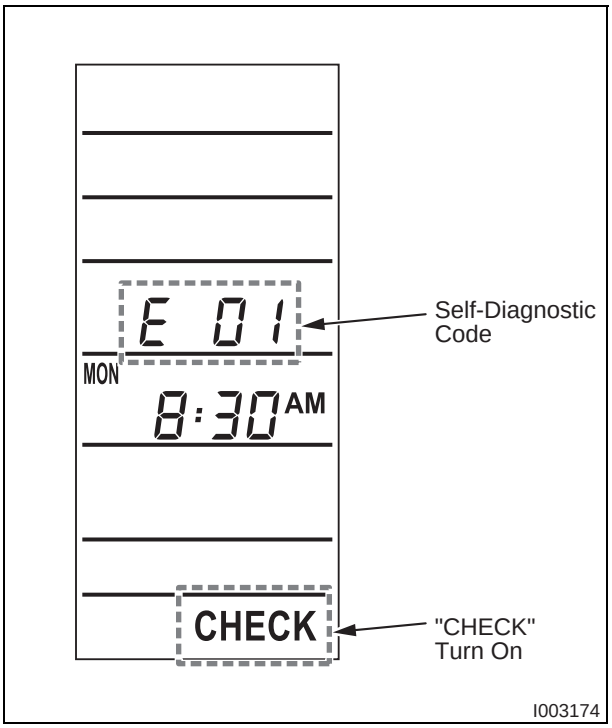
*1 : To RESET the controller, press RESET button, then press ON/OFF button.

Condition		Check Area	Possible Cause	Remedy
Insufficient Cooling				
Unit operates.	LCD displays normally.	Air is not cool.	Compressor start delay (120 seconds) is activated.	Compressor starts after 120 seconds automatically.
			Freeze protection is activated.	Compressor starts automatically when evaporator outlet pipe temperature (CTS3) rises more than 43°F (6°C) while compressor stops.
			Evaporator fan reverse rotation protection is activated.	Fan rotates in reverse direction by abnormal air flow. Check duct condition. When reverse rotation is stopped, compressor and fan start automatically.
			Condenser fan reverse rotation protection is activated.	Fan rotates in reverse direction by abnormal air flow (Ex. strong wind from out side). When reverse rotation is stopped, compressor and fan start automatically.
	Insufficient air volume	Insufficient air volume	Air filter is clogged.	Clean or replace air filter.
			Leak or clogged on the duct connection.	Repair duct connection.
			Using longer duct length or smaller duct diameter than recommended.	Change the duct to proper size.
			Fan is locked.	Check for any foreign object causing fan lock.

6.4 Self-Diagnostic Code Display Operation and Control

(1) WMC

- When an abnormality occurs in a unit, a self-diagnostic code and “CHECK” will display on the WMC.



Switching the self-diagnostic code display mode

- The self-diagnostic code display can be switched between user mode and service mode.
  - Press and hold the “△” and “▽” buttons simultaneously for 3 seconds.
  - When in the service mode, self-diagnostic codes flash.

Self-diagnostic code reset

- While the self-diagnostic code is displayed, press the “RESET” button.

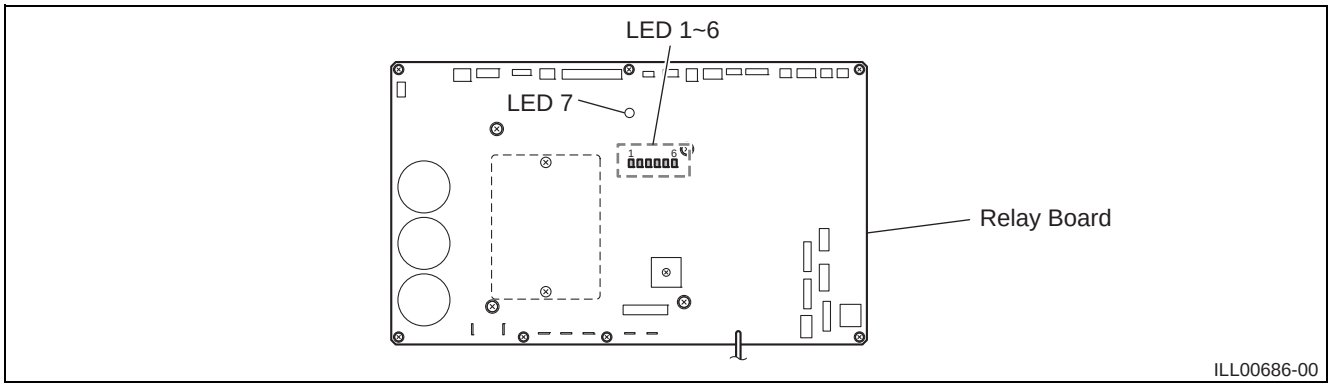
  The self-diagnostic code and “CHECK” displays will turn off, and the system will switch to standby mode.

  The LEDs on the WMC and relay board will illuminate.

(2) When the MWT is connected

- When an abnormality occurs in a unit, self-diagnostic codes are displayed via illuminated LEDs on the relay board.

  Self-diagnostic codes are reset by opening and then closing the circuit breaker.

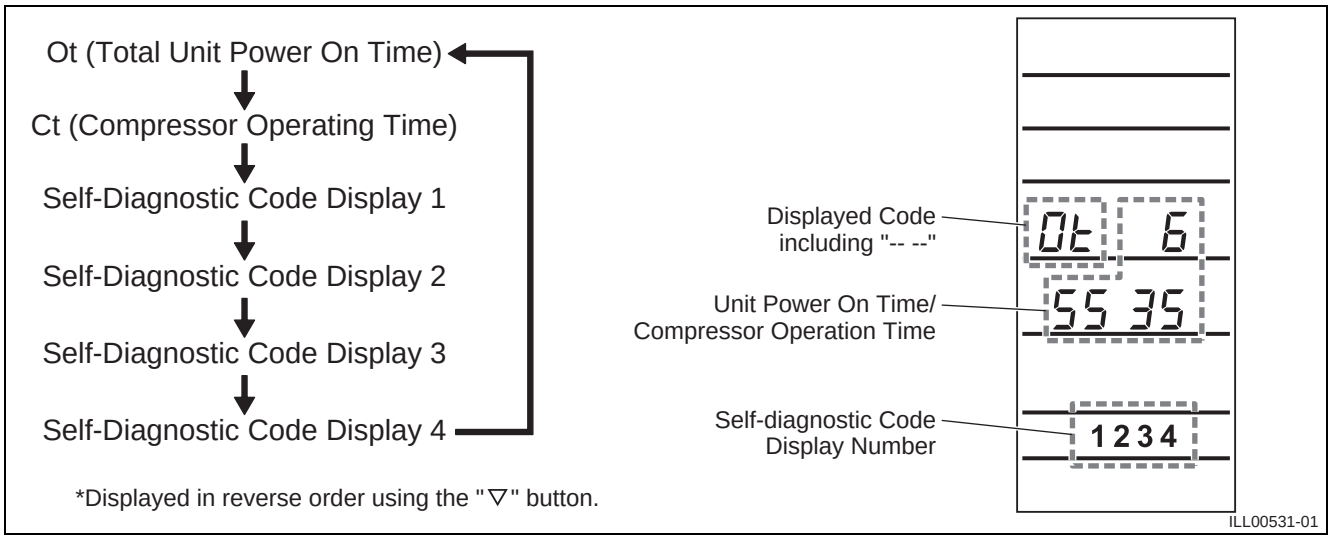


6.5 Self-Diagnostic Code Records Display Operation (Only When Connected With WMC)

- The unit power on time, compressor operation time, and self-diagnostic codes can be displayed on the WMC when it is connected to CM 25. The unit power on time and compressor operating time can be stored up to 65535 hours (automatically cleared to 0 hour and start counting). The self-diagnostic codes can be stored up to 4 different codes.

(1) Display method

- To display the unit power on time, compressor operation time and self-diagnostic codes, set the unit to standby mode, then press and hold the “RESET” button for 3 seconds.
- Unit power on time (Ot) is a default view. Press “△” button to view the compressor operating time (Ct) or press “▽” button to view the self-diagnostic code number 4. The view sequences are shown in the figure below.



(2) Exiting the self-diagnostic code records display

- To exit the self-diagnostic code records display, press the "RESET" button, or do not operate the system for 1 minute.

Display No.	Display code	Function
-	Ot	Total unit power on time (unit: h)
-	Ct	Compressor operating time (unit: h)
1	Self-diagnostic code display	Self-diagnostic code record 1
2	Self-diagnostic code display	Self-diagnostic code record 2
3	Self-diagnostic code display	Self-diagnostic code record 3
4	Self-diagnostic code display	Self-diagnostic code record 4

< NOTE >

If there are no self-diagnostic codes, “-- --” will be displayed.

6.6 Operational Status Display Control (Only When Connected With WMC)

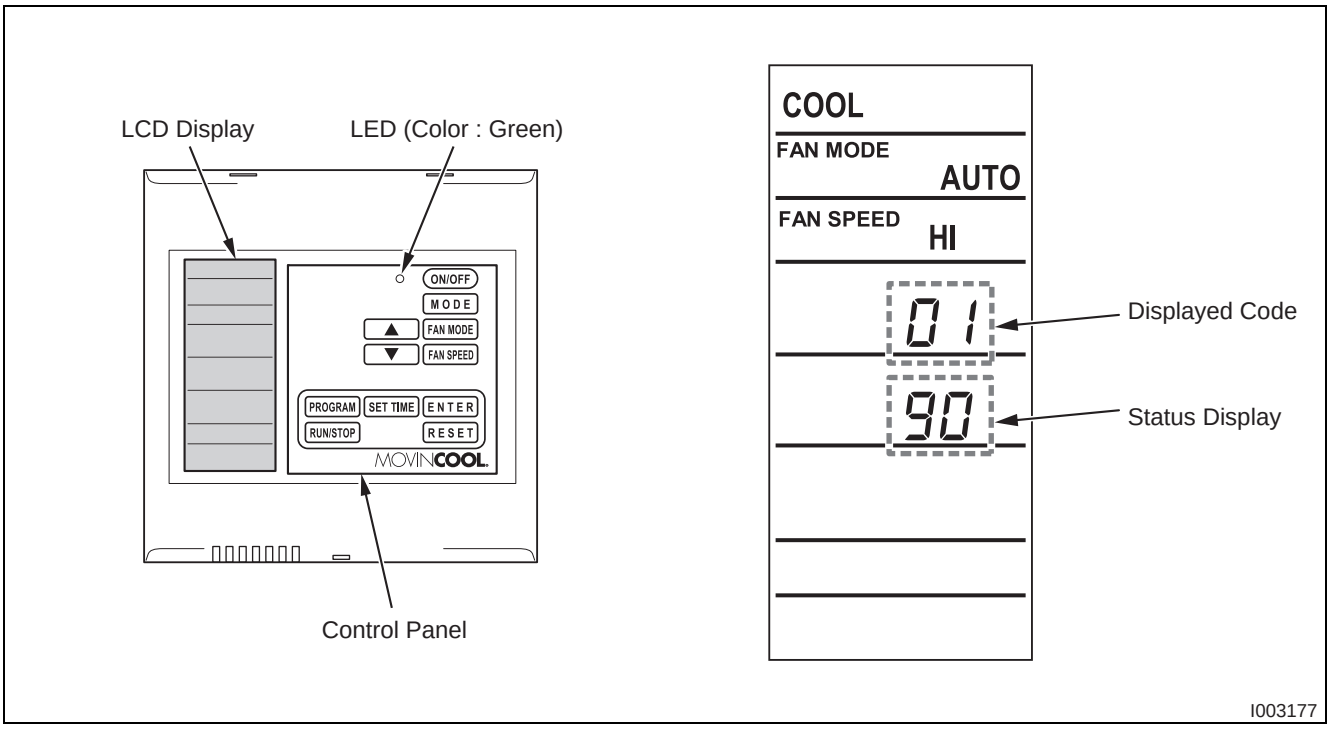
- The operational status of each functional part can be displayed while the CM 25 is running.

(1) Display method

- Press and hold the “△”, “▽”, and “FAN MODE” buttons simultaneously for 3 seconds.
- The display items can be switched using the “△” or “▽” buttons.

(2) Exiting operational status display

- To exit the operational status display, press the “RESET” button, or do not operate the system for 1 hour.



Displayed Code	Display Item	Display Units	Display Example
01	Compressor speed	rps	90 (90 rps)
02	Electronic expansion valve position	pulse	3 50 (350 pulse)
03	Evaporator fan motor speed	rpm	8 80 (880 rpm)
04	Condenser fan motor speed	rpm	8 65 (865 rpm)
05	Compressor operating current	A	15 (15 A)
06	Evaporator inlet air thermistor (RTS2)*1	°F/°C	80 (80°F)
07	Condenser inlet air thermistor (ODS)*1	°F/°C	95 (95°F)
08	Condenser thermistor (CTS1)*1	°F/°C	120 (120°F)
09	Evaporator pipe inlet thermistor (CTS2)*1	°F/°C	104 (104°F)
10	Evaporator pipe outlet thermistor (CTS3)*1	°F/°C	40 (40°F)
11	Self-diagnostic code	-	DF, IR, OR

< NOTE >

*1 Displayed in accordance with the WMC temperature unit setting.

6.7 Initialize Fan Motor

- Initialize the motor to correct the motor speed when any of the following components are replaced: evaporator fan motor, condenser fan motor, relay board.

(1) Operation method

1) With the power supply OFF, turn DIP switch 2-1 ON.
2) Turn the power supply ON.
3) Turn DIP switch 3-1 ON.
   The evaporator fan motor and condenser fan motor will stop after operating for approximately one minute.
   The LEDs on the relay board will illuminate in order while the fan motors are operating.
   After the settings are complete, the fan motors will automatically stop, and all the LEDs on the relay board will illuminate.

(2) Quit

4) Turn DIP switch 2-1 OFF.
5) Turn DIP switch 3-1 OFF.
6) The system will switch to standby mode.

< NOTE >

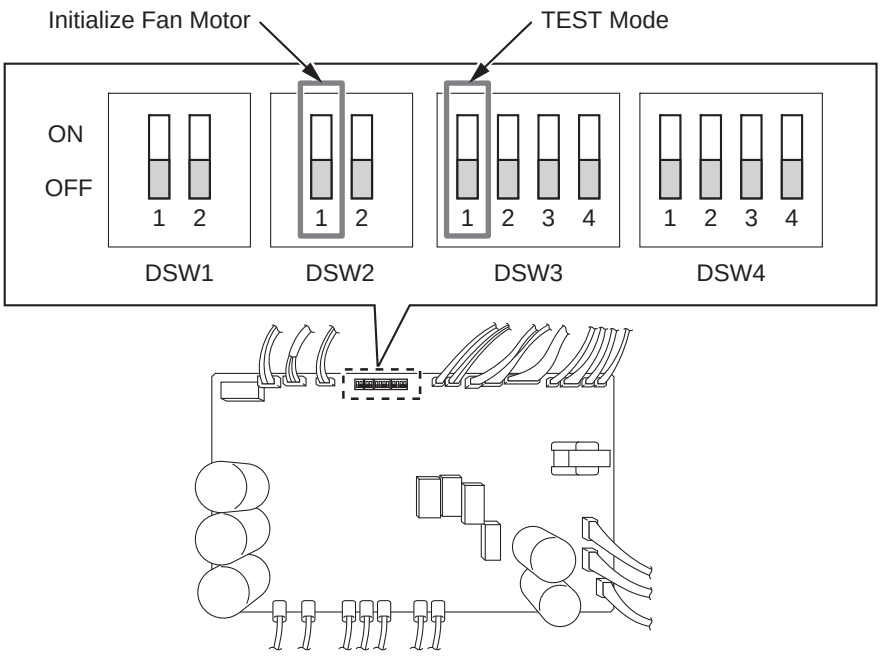
The WMC (or MWT) will be rendered inoperative.

- The initial settings are automatically determined to be satisfactory (OK) or unsatisfactory (NG). When unsatisfactory, perform initialization again. If the settings are unsatisfactory after initializing a second time, check the fan motors or relay board.

Judgment Value		Target speed ± 50 rpm
Display	OK	All relay board LEDs are illuminated.
	NG	All relay board LEDs flash.

⚠ CAUTION

Perform initial settings after removing the evaporator inlet/outlet, and condenser inlet/outlet ducts (unit-external static pressure = 0 Pa.)
Performing the initial settings with the ducts in place may result in an unsatisfactory (NG) determination.


Initialize Fan Motor
TEST Mode
ON
OFF
1 2
1 2
1 2 3 4
1 2 3 4
DSW1
DSW2
DSW3
DSW4

I003178

6.8 TEST Mode

- Test operation can be performed using the test mode.

(1) Operation method

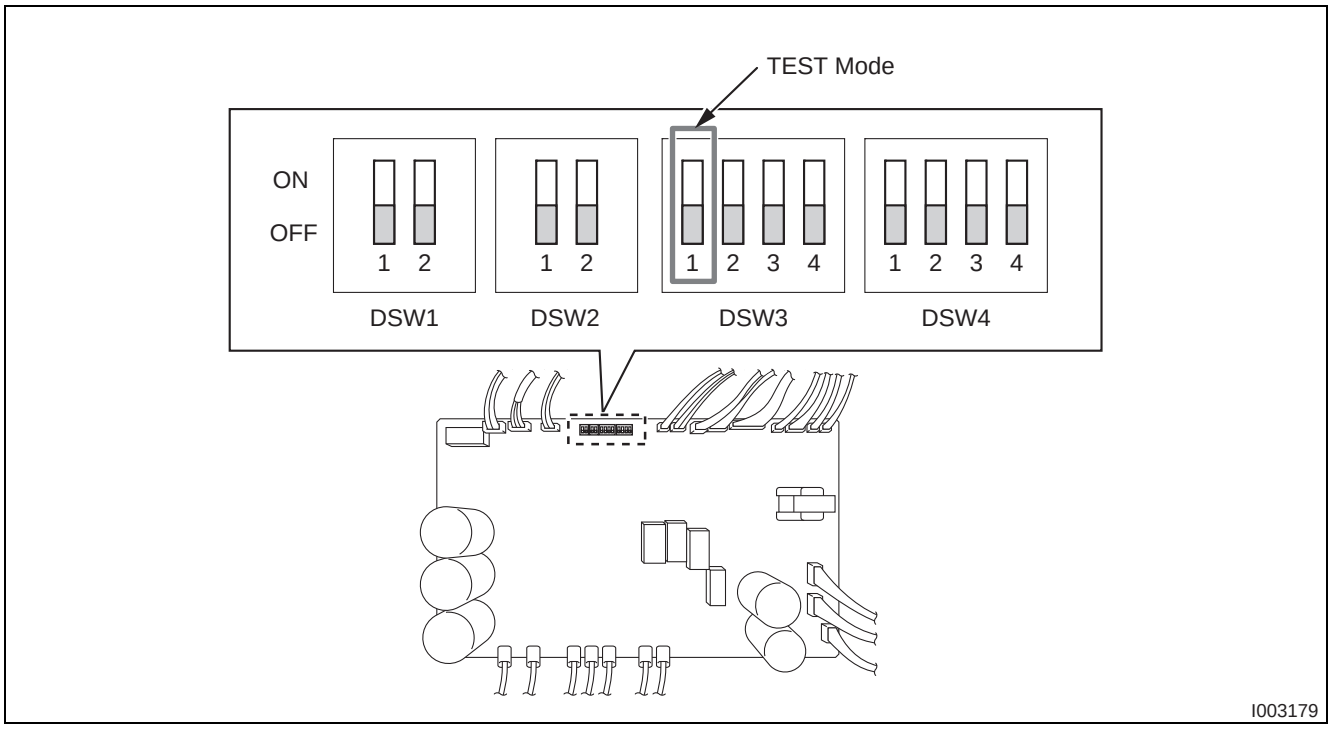
- Set the CM 25 to standby mode, turn DIP switch 3-1 ON, then turn on the unit. The unit will automatically operate at the following conditions.
  - Compressor speed: 90 rps
  - Cool mode
  - Fan mode: RUN
  - Fan speed: HI

< NOTE >

The WMC (or MWT) will be rendered inoperative.

(2) Quit

- Turn DIP switch 3-1 OFF.
  CM 25 operation will stop, and the system will shift to standby status.

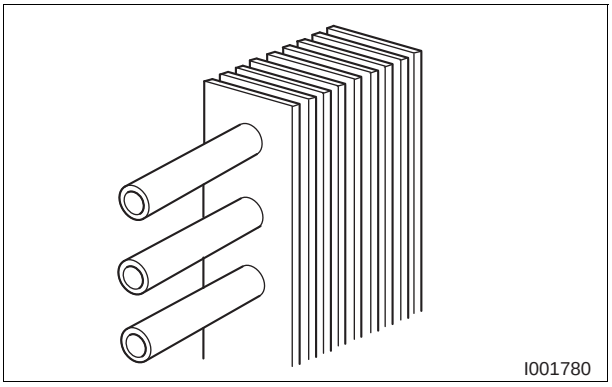


6.9 Basic Inspection

- Perform the following inspection before disassembly.

(1) Inspection of plate fins

- To inspect the plate fins of either the evaporator or condenser, the air filter must be removed. After removal of the air filters, inspect the plate fins for any dirt, dust, lint, or debris that may have caused insufficient cooling performance of the unit. If cleaning of the fins is necessary, it is recommended that this service be performed by a qualified service technician.

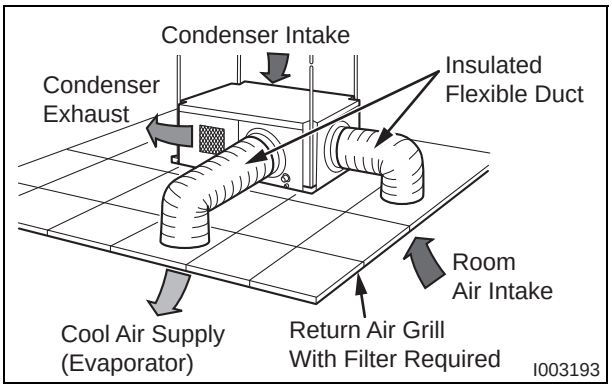


(2) Examination of operating environment

- Operating environments can vary depending on location, climate and surrounding conditions. Installation location also can cause operational problems. Consult your reseller concerning operational environment requirements.

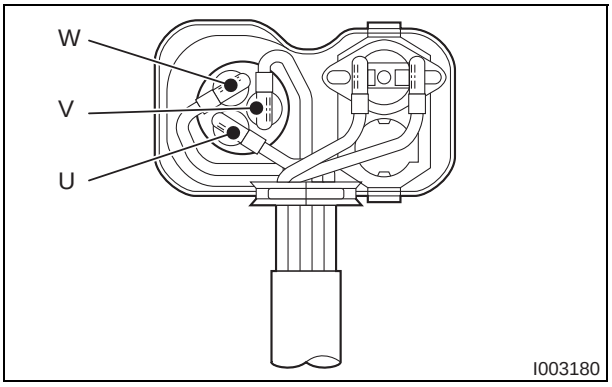
(3) Inspection of cooling capacity performance

- Measure the difference in temperature between the inlet of the evaporator and the cool air vent. If the difference is out of the range given in the graphs on page 10, proceed with the remedy suggested in the troubleshooting chart on page 50 to 55.



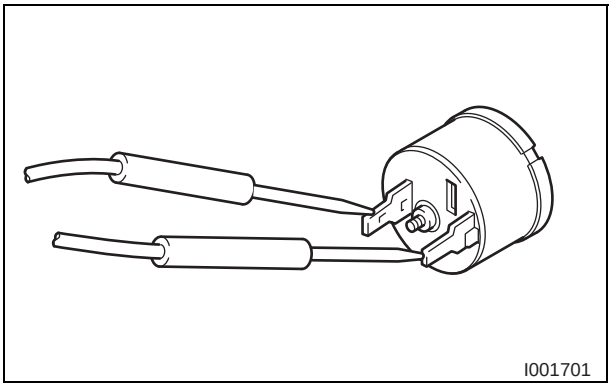
6.10 Inspection of Compressor

(1) Compressor motor



- Measure resistance across the terminals of the compressor motor. (All terminals must be disconnected from the unit.)
- Between terminals {at 68°F (20°C)}
  - U-V Approx. 0.64 ohm
  - V-W Approx. 0.64 ohm
  - W-U Approx. 0.64 ohm
- If the measured resistance is not equal to these standard values, replace the compressor.

(2) Overload relay



- Check for continuity across two terminals of the overload relay. At normal temperature, there should be continuity across the terminals.

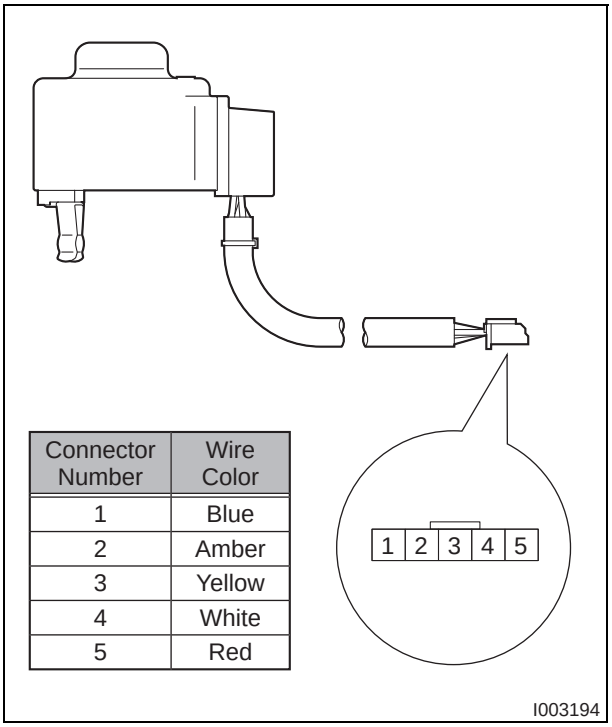
Specifications:

- OFF (Open contact): 248°F (120°C)
- ON (Closed circuit): 203°F (95°C)

- If there is no continuity across the terminals, replace the overload relay.

6.11 Inspection of Electronic Expansion Valve Control Coil

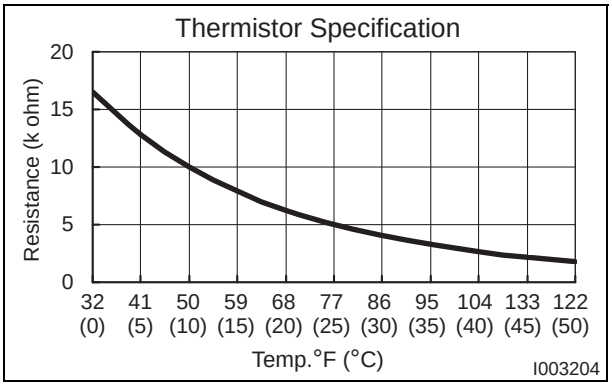
- Measure resistance across the connector pins of the electronic expansion valve control coil.
- Between connector pins {at 68 °F (20 °C)}
  - Blue-Red Approx. 46 ohm
  - Amber-Red Approx. 46 ohm
  - Yellow-Red Approx. 46 ohm
  - White-Red Approx. 46 ohm
- If the measured resistance is not equal to these standard values, replace the electronic expansion valve control coil.



Connector Number	Wire Color
1	Blue
2	Amber
3	Yellow
4	White
5	Red

6.12 Inspection of Thermistor

- Using an ohmmeter, check the resistance value across the 2-pin connector.
- Thermistors:
  - Evaporator inlet air thermistor (RTS2).
  - Condenser inlet air thermistor (ODS).
  - Condenser thermistor (CTS1).
  - Evaporator pipe inlet thermistor (CTS2).
  - Evaporator pipe outlet thermistor (CTS3).



6.13 Inspection of Wiring Connection

- Refer to the wiring diagrams on page 25, and check the connection of each wire.

⚠ CAUTION

Secure the wires using clamps to prevent contact with the edges of the structure, etc. Secure the wires in the same position as prior to removal.

6.14 Inspection of Refrigeration System

- In most cases, the probable cause for insufficient cooling is a clog in the system, leakage or an incorrect amount of refrigerant. In such cases, inspect the system according to the following procedure.

(1) Clogged refrigeration system

- Check the component parts of the refrigeration system, including piping that could be clogged with refrigerant. If clogged with refrigerant, only the clogged part is partially frosted. If this occurs, replace the part in question.

(2) Refrigerant leak

- Carefully check all connections, and each component for leaks whenever the refrigeration system is installed or repaired. Use an electronic gas leak tester to inspect the system. (See page 78 to 87.)

(3) Insufficient refrigerant

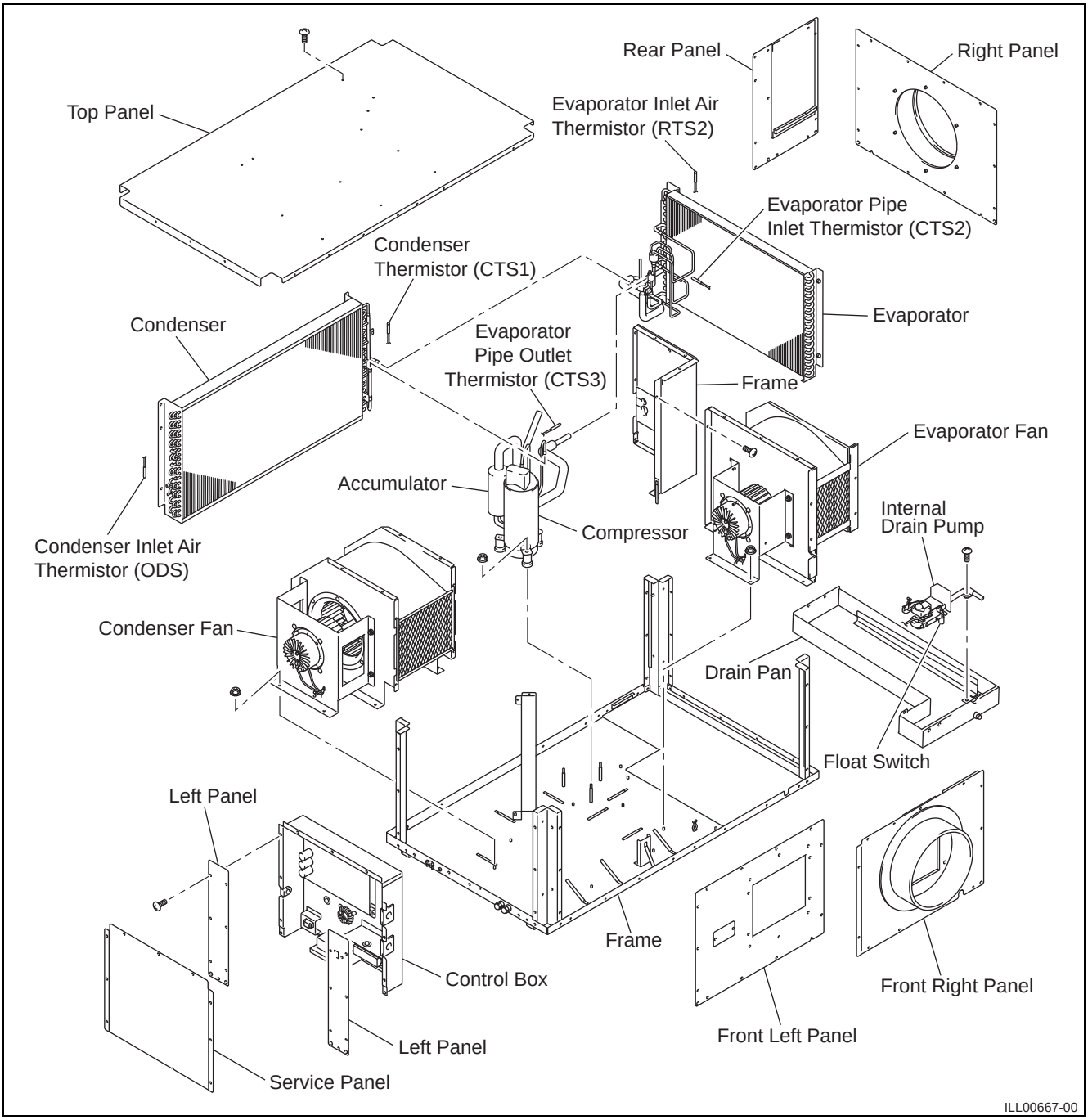
- When the unit is not producing sufficient cooling, follow the troubleshooting chart on page 55 to confirm the cause of the problem. Then, charge the system with the refrigerant to the specified amount as indicated on page 86.

7. DISASSEMBLY

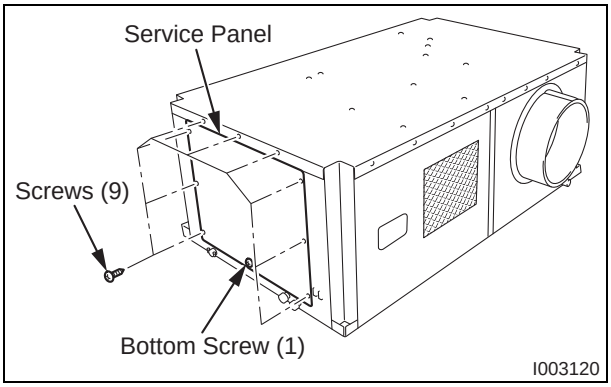
⚠ WARNING

- **Disconnect power supply from the unit before performing any service. Beware that some residual voltage may remain in the unit immediately after the power is disconnected.**

7.1 Parts Construction

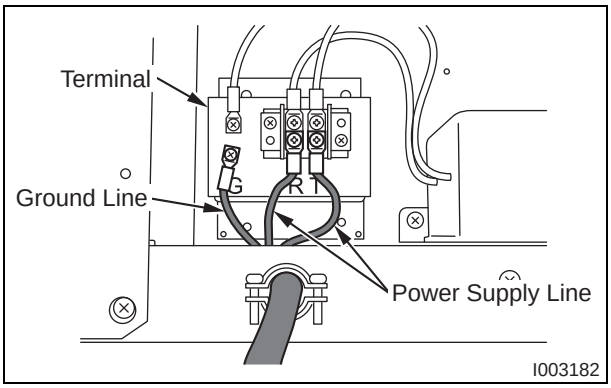


7.2 Disassembly



1) Loosen the bottom screw.

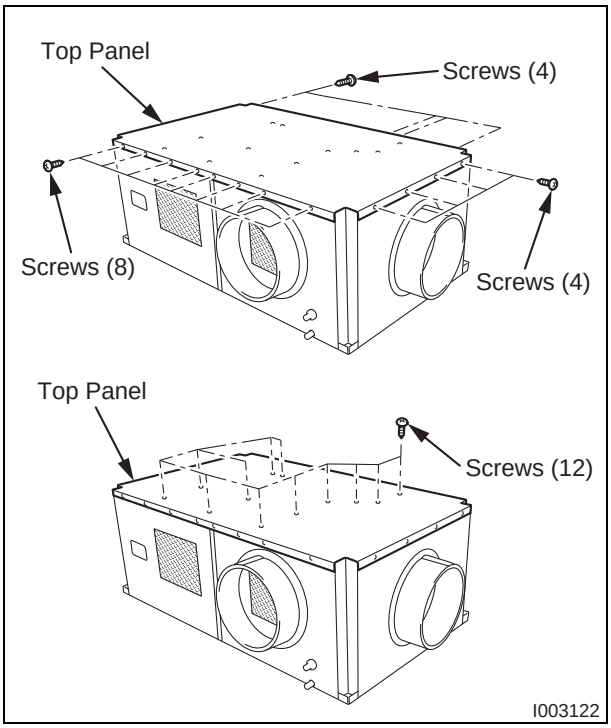
2) Take out the nine (9) screws, and then remove the service panel.



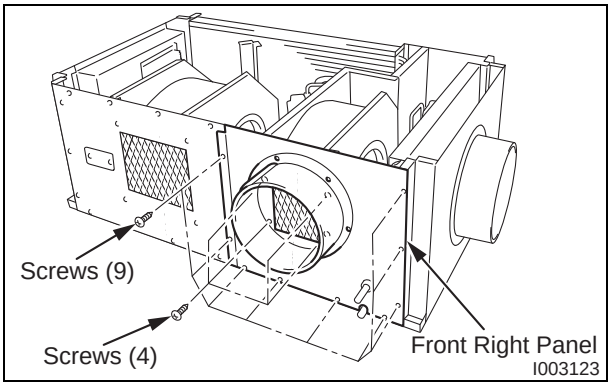
3) Disconnect the two (2) power supply lines from the terminal, and disconnect the ground line.

⚠ CAUTION

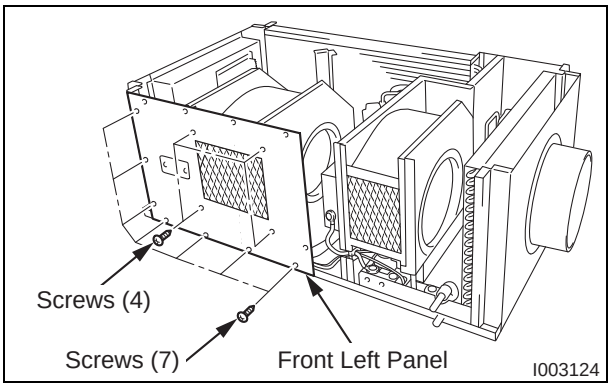
- Ground tightening torque:
  - 1.0 ± 0.15 ft•lbf (1.3 ± 0.2 N•m)



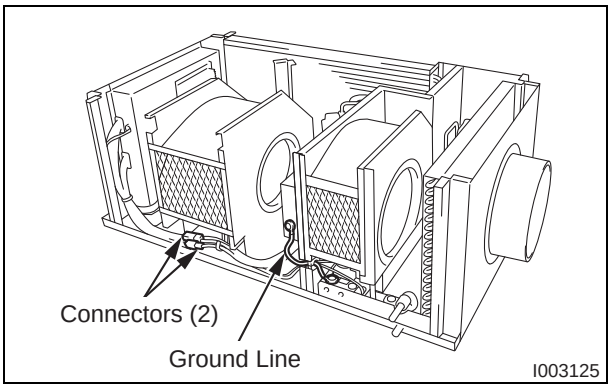
4) Take out the twenty-eight (28) screws, and then remove the top panel.



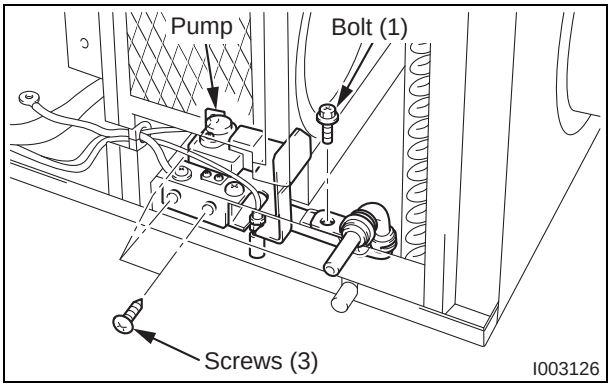
5) Take out the thirteen (13) screws, and then remove the front right panel.



6) Take out the eleven (11) screws, and then remove the front left panel.

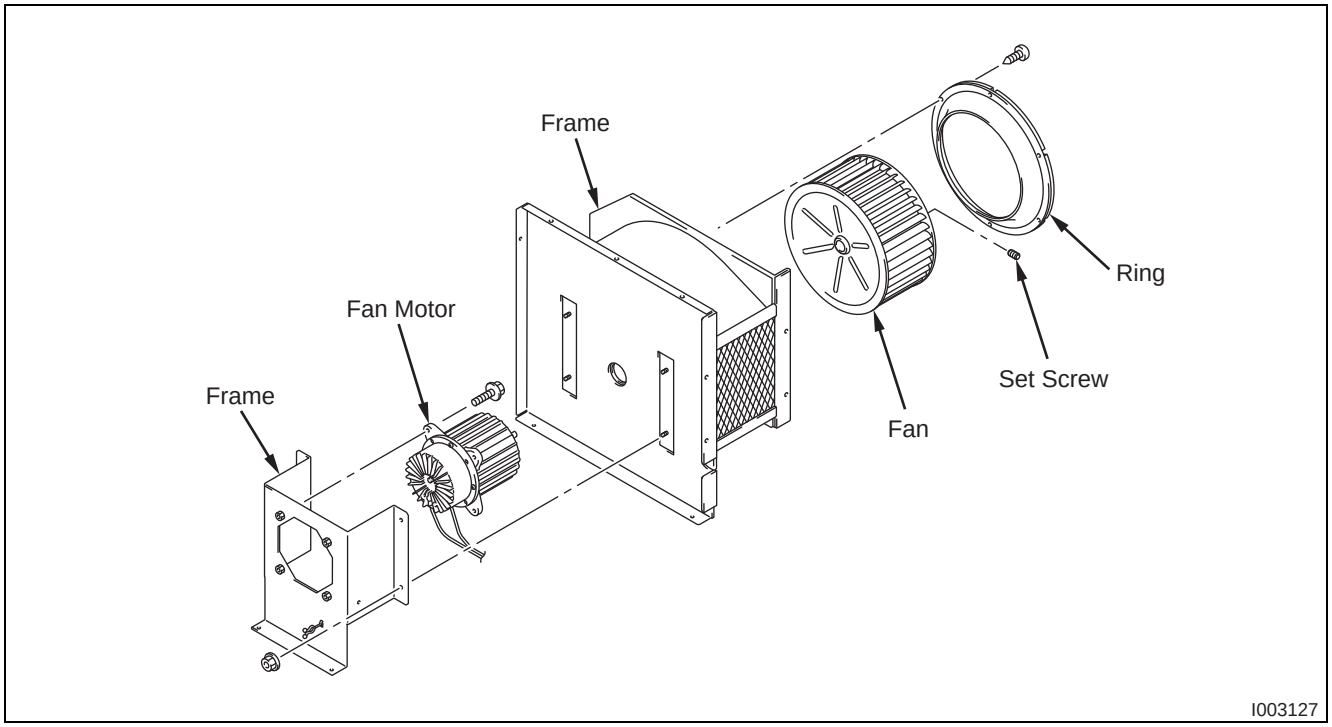


7) Disconnect the two (2) connectors, and disconnect the ground line.



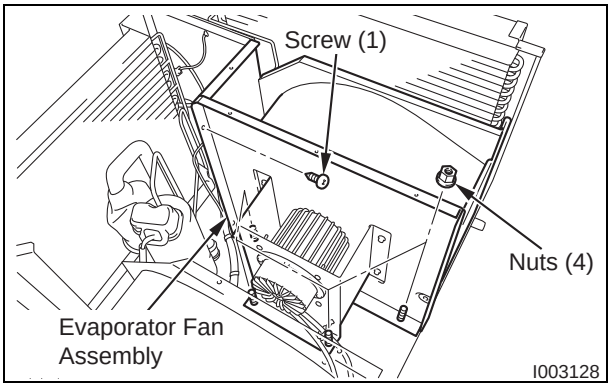
8) Take off the three (3) screws and bolt, and remove the internal drain pump assembly.

7.3 Removal of Evaporator Fan Assembly

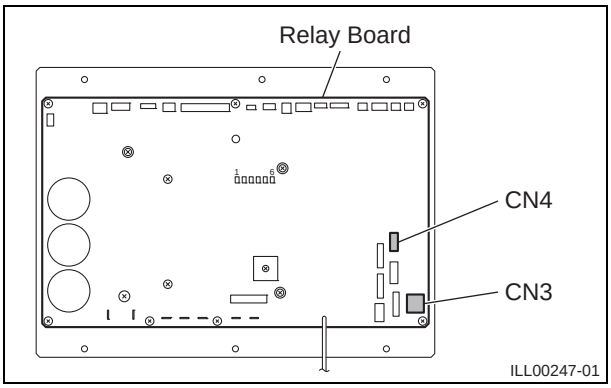


< NOTE >

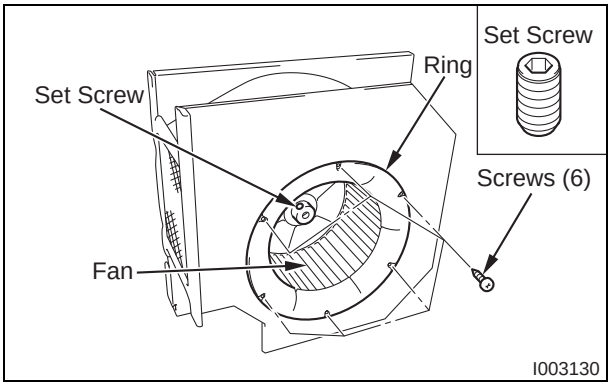
Initialization is required after replacing the evaporator fan motor. (See page 61)



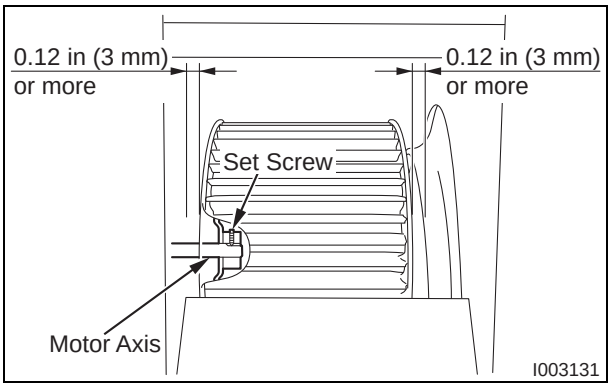
1) Take out the screw, and the four (4) nuts.



2) Disconnect the motor connectors (white, 5-pin and white, 4-pin) from relay board CN3, CN4, and remove the evaporator fan assembly.



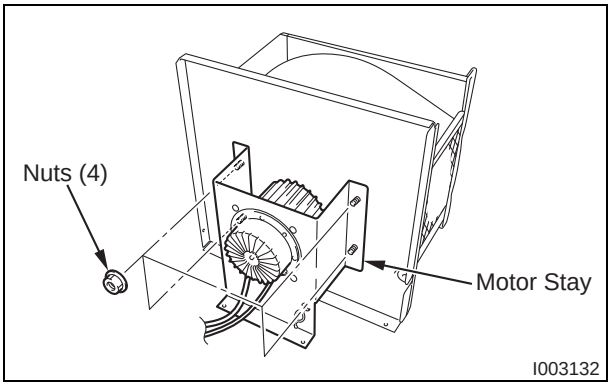
3) Take out the six (6) screws, and then remove the ring. Loosen the set screw with an Allen wrench and remove the fan.



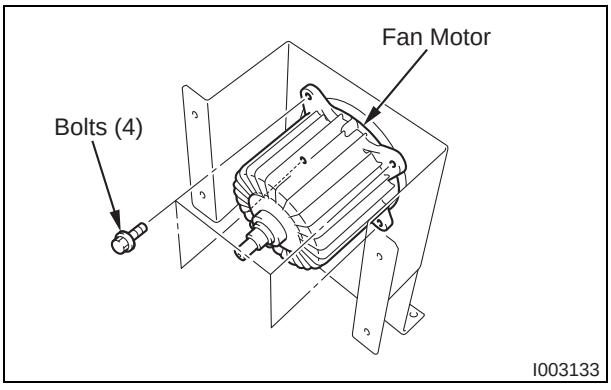
4) When assembling the fan, ensure that the screws align with the motor axis positioning holes.

⚠ CAUTION

- Tightening torque:
  - 10.0 ± 1.0 ft•lbf (14.0 ± 1.4 N•m)
- Verify the clearance between the fan and case ring. After installing the fan and fan motor, ensure that the clearance between the fan and case ring is at least 0.12 inch (3 mm).



5) Take out the four (4) nuts, and then remove the motor stay.

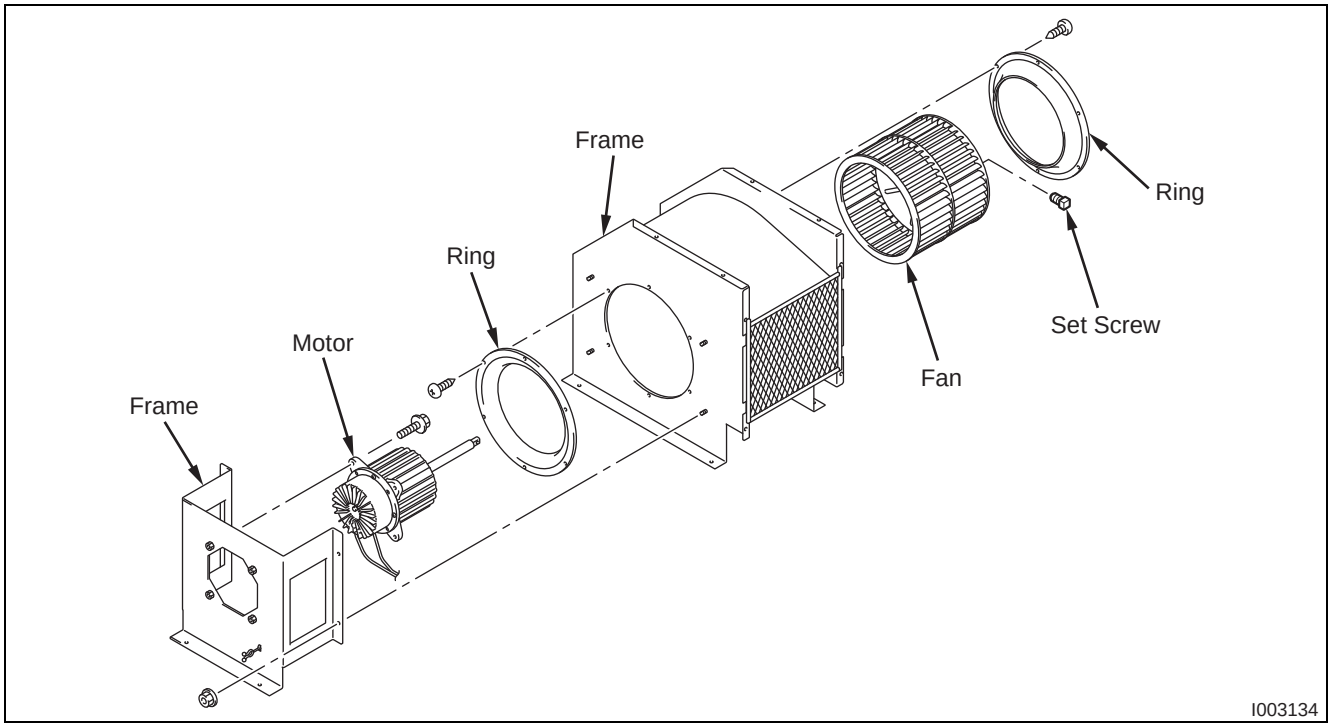


6) Take out the four (4) bolts, and then remove the fan motor.

⚠ CAUTION

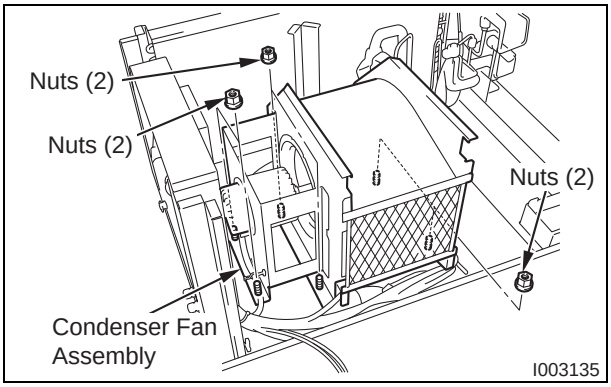
When assembling the motor, ensure that the wire connection ends are facing down.

7.4 Removal of Condenser Fan Assembly

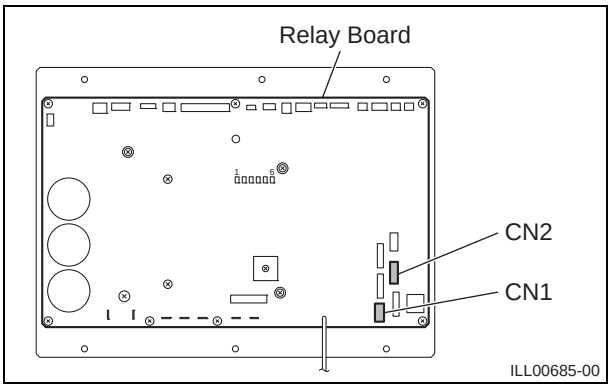


< NOTE >

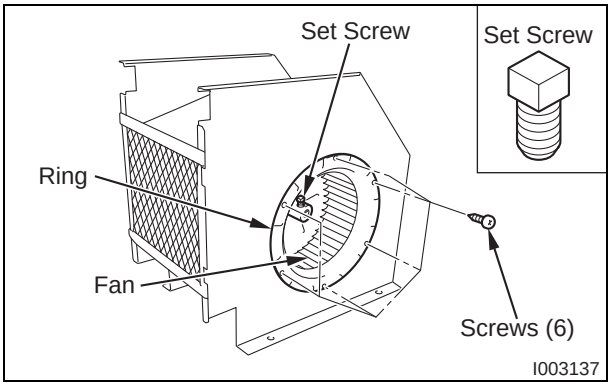
Initialization is required after replacing the condenser fan motor. (See page 61)



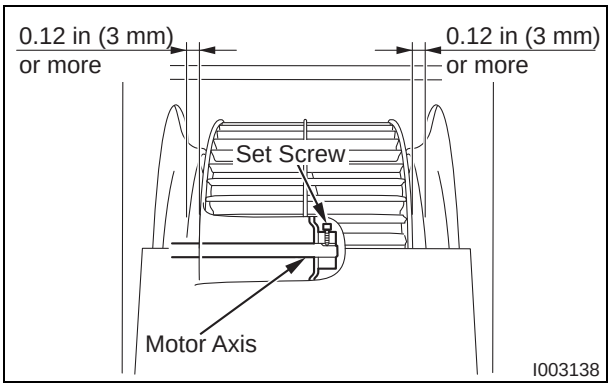
1) Take off the six (6) nuts.



2) Disconnect the motor connectors (white, 4-pin and white, 6-pin) from relay board CN1, CN2, and remove the condenser fan assembly.



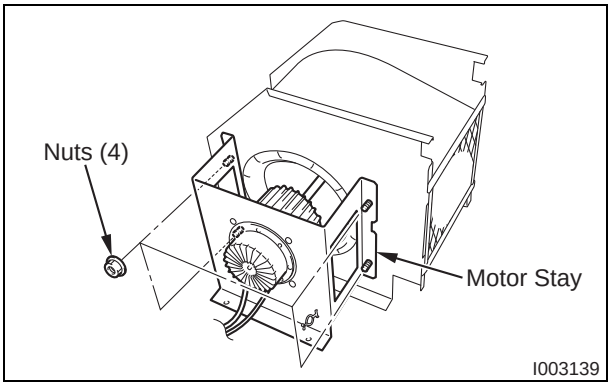
3) Take out the six (6) screws, and then remove the ring. Loosen the set screw with an Allen wrench and remove the fan.



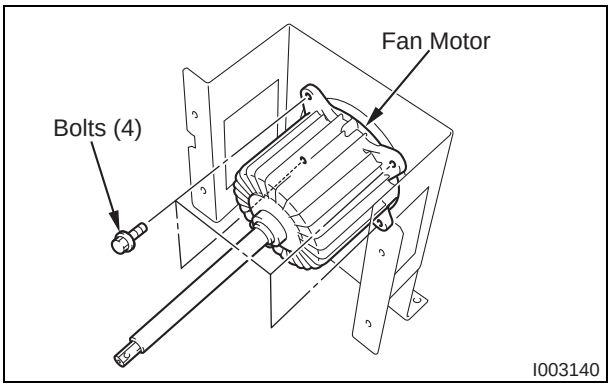
4) When assembling the fan, ensure that the screws align with the motor axis positioning holes.

⚠ CAUTION

- Tightening torque:
  - 10.0 ± 1.0 ft•lbf (14.0 ± 1.4 N•m)
- Verify the clearance between the fan and case ring. After installing the fan and fan motor, ensure that the clearance between the fan and case ring is at least 0.12 inch (3 mm).



5) Take out the four (4) nuts, and then remove the motor stay.

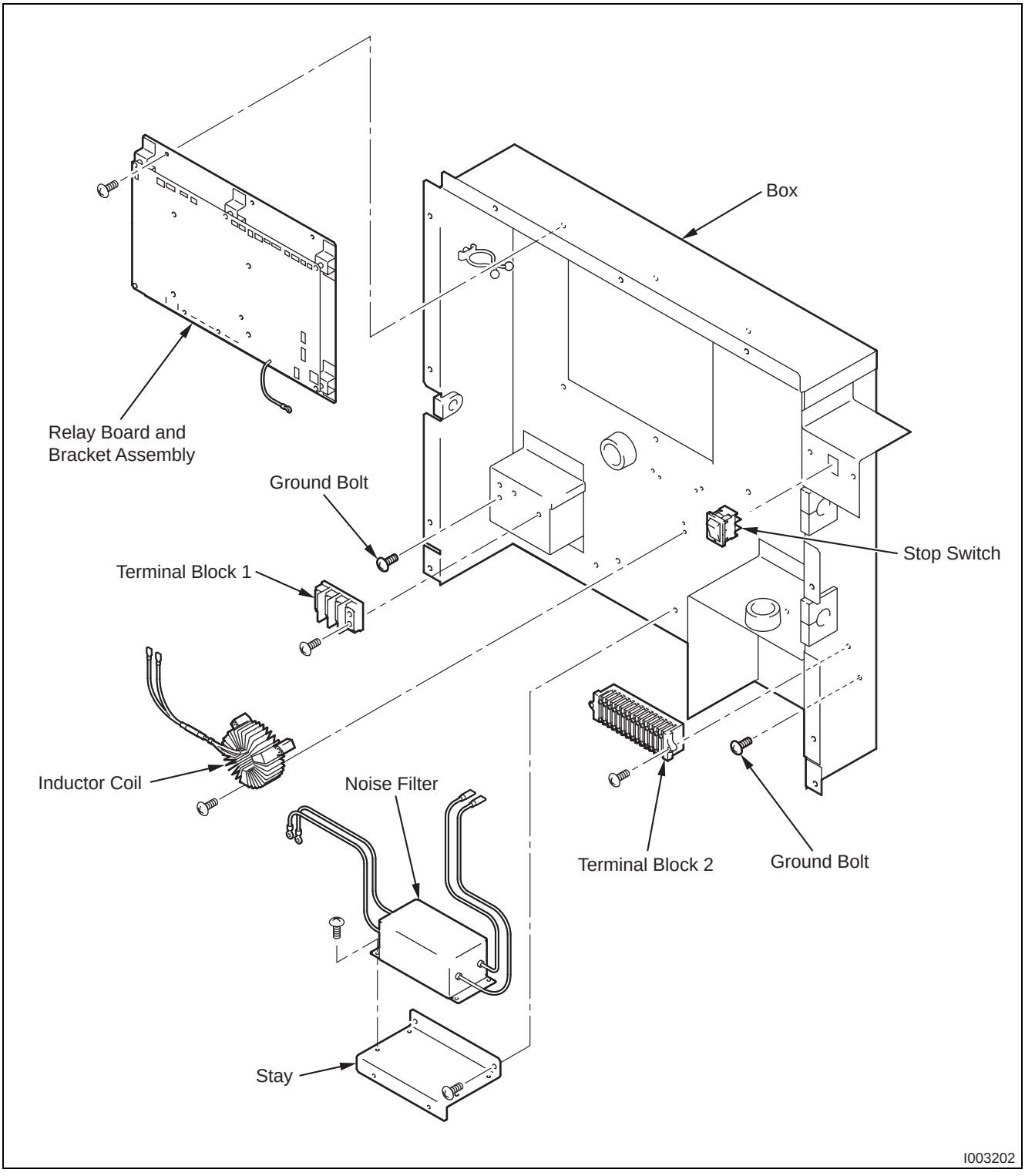


6) Take out the four (4) bolts, and then remove the fan motor.

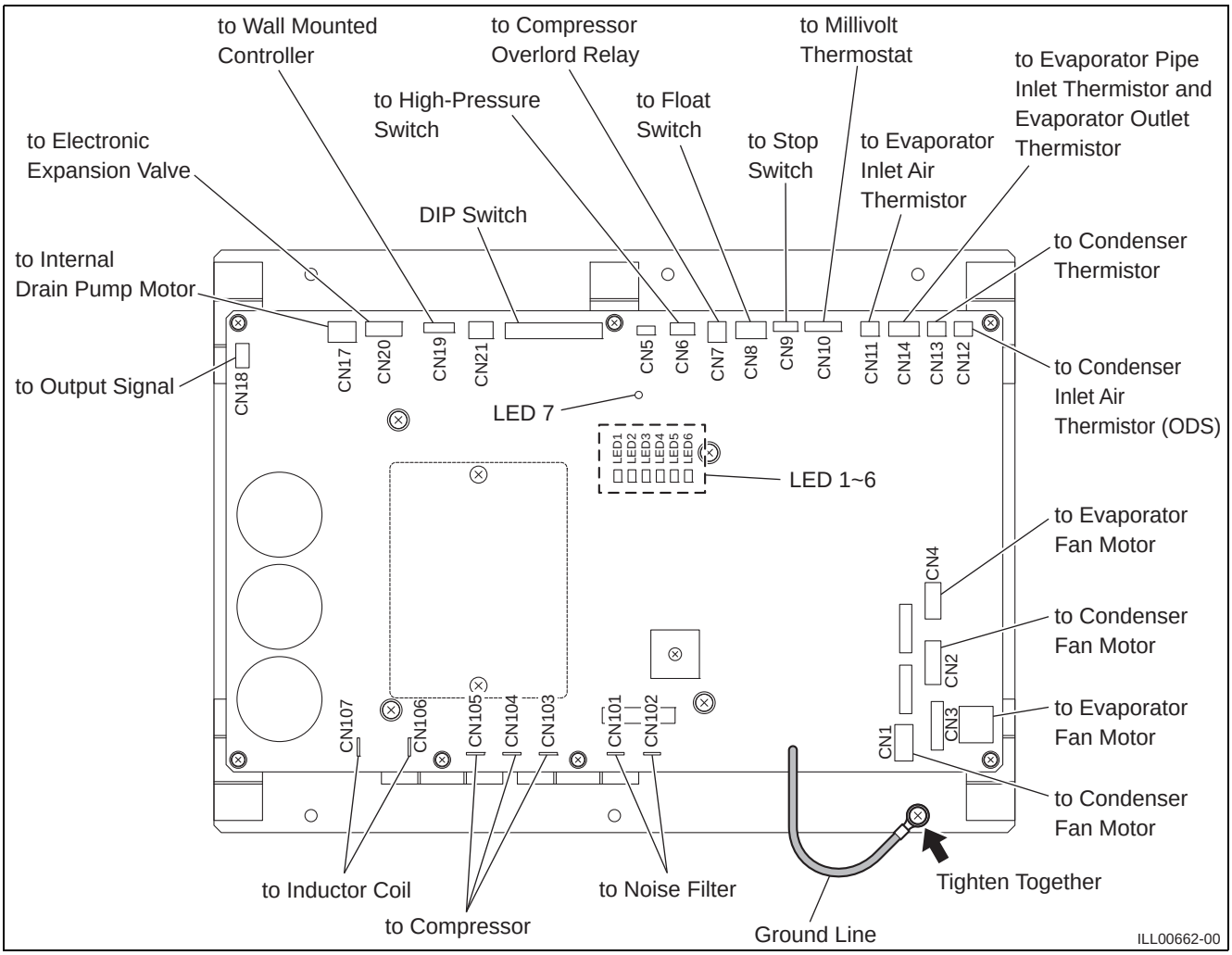
⚠ CAUTION

When assembling the motor, ensure that the wire connection ends are facing down.

7.5 Removal of Electrical Components



(1) Relay board



⚠ WARNING

- **Do not touch the relay board until the green LED7 is turned off. Failure to follow this warning may lead to electrical shock.**

Removal of Relay Board

1) Disconnect the power at the source.
2) Loosen the bottom screw. (See page 69.)
3) Take out the nine (9) screws, and then remove the service panel. (See page 69.)
4) Disconnect all connectors from the relay board (18 connectors, 7 connections on the relay). Refer to the figure “Relay board” to identify the relay connections and the connectors marked as CN##. (To ensure easy reinstallation, be sure to label each connector wire as you remove them)
5) Take out the six (6) screws, and remove the relay board. The ground line for the relay board is tightened together with the bottom right screw. (As shown in the illustration above, the relay board and bracket assembly are replaced as a set.)

Replacement of Relay Board

1) Attach the relay board with the six (6) screws. Always tighten the ground line for the relay board together with the bottom right screw. Make sure that the DIP switches on the new relay board are all set to the off position.
2) Reconnect all 25 connectors to the new relay board. Refer to the figure “Relay Board” to identify the connectors that need to be connected.
3) Reconnect the power at the source and turn on the unit to verify the function and operation of the unit. Turn off the unit.
   - The initial setting for motor speed must be done if the relay board is replaced.
   - When using the MWT, its settings are also required.
4) Initialize the fan motor. (See page 61).
5) Close the service panel and secure with the nine (9) screws.
6) Tighten the bottom screw.

8. REFRIGERATION SYSTEM REPAIR

⚠ WARNING

- **Disconnect power supply from the unit before performing any service. Beware that some residual voltages may remain in the unit immediately after the power is disconnected.**

8.1 Repair of Refrigeration System

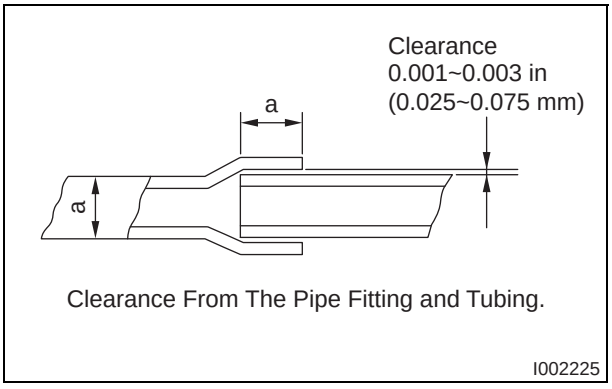
- In case there is a leak, obstruction, or trouble in the refrigeration system, replace or repair the part in question. After replacing any component all connections must be brazed.

(1) Proper brazing techniques

- It is desirable to use a slightly reduced flame. Oxyacetylene is commonly used since it is easy to judge and adjust the condition of the flame. Unlike gas welding, a secondary flame is used for brazing. It is necessary to preheat the base metal properly depending on the shape, size or thermal conductivity of the brazed fitting.
- The most important point in flame brazing is to bring the whole brazed fitting to a proper brazing temperature. Care should be taken to not cause overflow of brazing filler metal, oxidation of brazing filler metal, or deterioration due to the overheating of flux.

(2) Brazed fittings and fitting clearance

- In general, the strength of brazing filler metal is lower than that of the base metal. So, the shape and clearance of the brazed fitting are quite important. As for the shape of the brazed fitting, it is necessary to maximize its adhesive area. The clearance of the brazed fitting must be minimized to facilitate brazing filler metal to flow into it by capillary action.



Clearance From The Pipe Fitting and Tubing.

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(3) Cleaning brazing filler metal and pipe

- When the refrigeration system has been opened up, exposure to heat may have caused brazing filler metal to stick to the inside and outside of the pipe. Brazing filler metal may also be compounded with oxygen in the air to form oxide film. Fats and oils may stick to the pipe from handling. All these factors can reduce the effectiveness of brazing. It is necessary to eliminate excess brazing filler metal using sand paper, and by cleaning thoroughly with a solvent such as Trichlene.

⚠ CAUTION

Do not use chlorine cleaner.

(4) Use of dry nitrogen gas

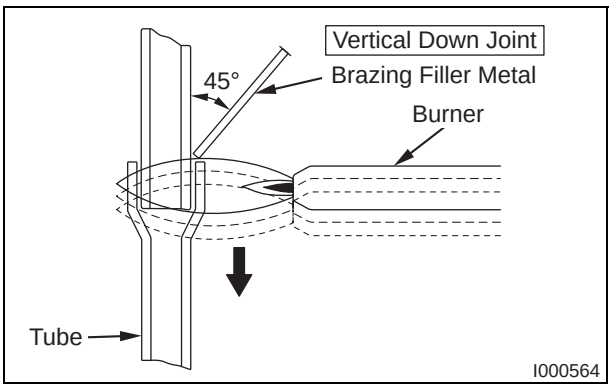
- During brazing, the inside of the pipe undergoes an oxidative reaction due to the brazing flame. Introduce dry nitrogen gas {0.3 gal/min (1 L/min)}; adjust with the flow regulator} through the pinch-off tube of the refrigerant.

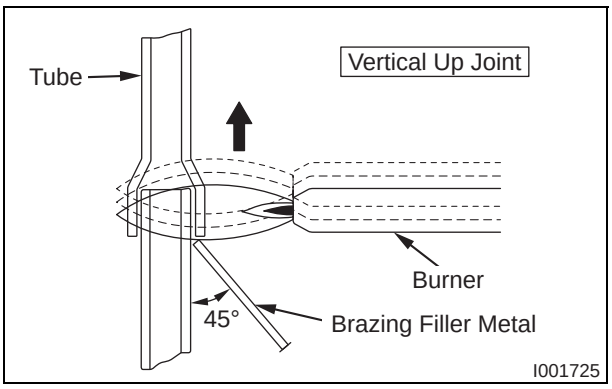
< NOTE >

Take care not to allow dirt, water, oil, etc. to enter into the pipe.

(5) Vertical joints

- Heat the whole brazed fitting to a proper brazing temperature. Bring the brazing filler metal into contact with the fitting so that the brazing filler metal starts flowing by itself.
- Stop heating the fitting as soon as the brazing filler metal has flown into the clearance. Since the brazing filler metal flows easily into portions heated to the proper temperature, it is essential to keep the whole fitting at the proper brazing temperature.





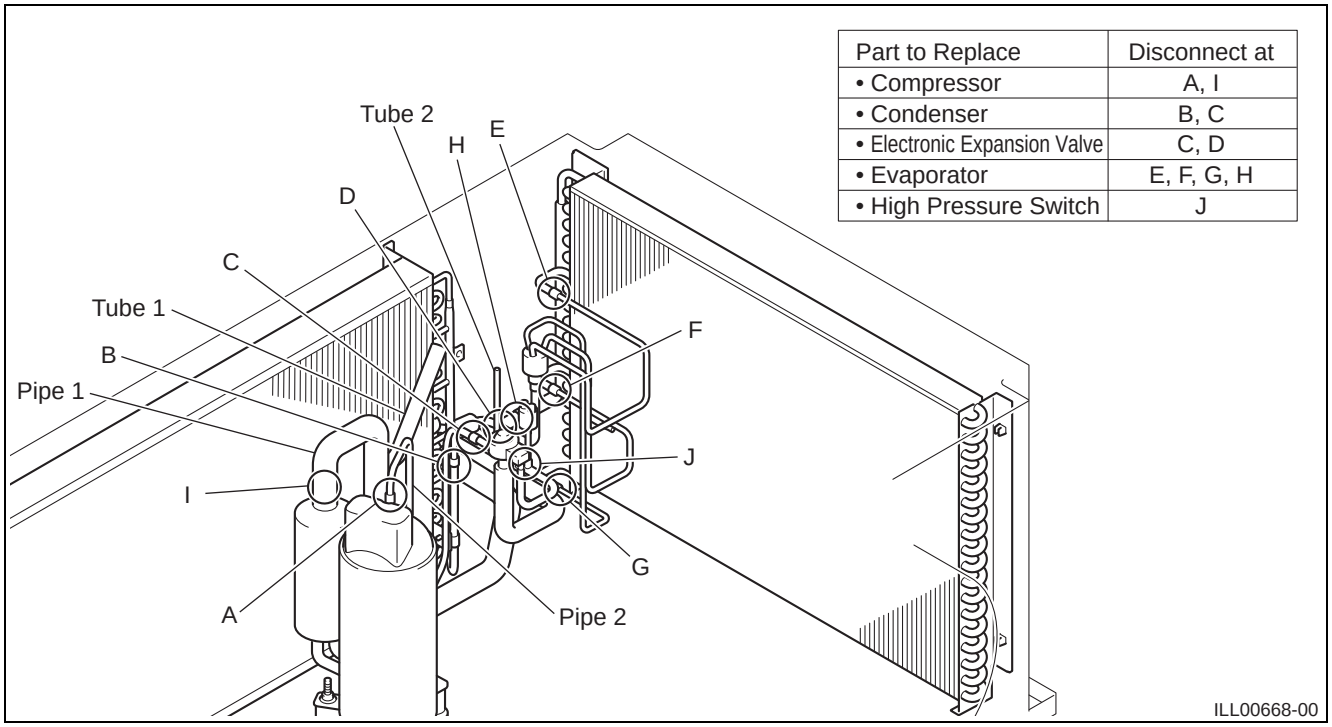
8.2 Removal of Refrigeration System Components

⚠ WARNING

- **Before replacing any refrigeration cycle component, recover the refrigerant using standard recovery procedures and equipment.**
- **When recovering the refrigerant, use the pinch-off tubes at the low pressure side (tube 1) and high pressure side (tube 2) as shown in the figure below.**

⚠ CAUTION

- To prevent oxidation, dry nitrogen should be conducted {flow rate 0.27 gal/min (1 L/min)} through the pinch-off tube during any brazing operation.
- During any component replacement involving brazing, shield nearby parts with a steel plate, etc., to protect them from the flame.



< NOTE >

When replacing the compressor, attach the pipe 1 and the pipe 2 packaged in the compressor assembly.

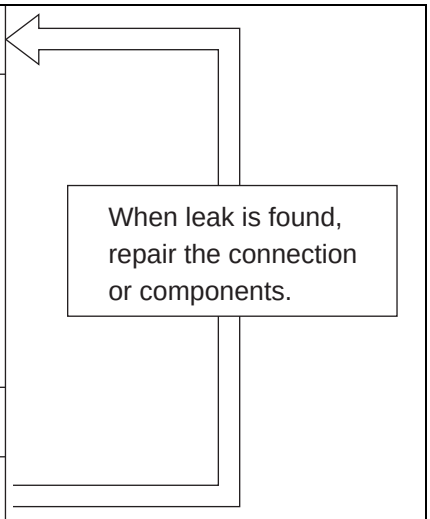
8.3 Charging the System with R-410A Refrigerant

- Always ensure that the refrigeration system has been properly evacuated before charging with the specified amount of R-410A.
- Equipment is only for R-410A.
- Liquid charge (no gas charge).
- Make sure not to use more than 90% of the initial weight of R-410A in the cylinder.

⚠ WARNING

- **When handling refrigerant (R-410A), the following precautions should always be observed:**
  - **Always wear proper eye protection while handling refrigerant.**
  - **Maintain the temperature of the refrigerant container below 104°F (40°C).**
  - **Perform repairs in a properly ventilated area. (Never in an enclosed environment.)**
  - **Do not expose refrigerant to an open flame.**
  - **Never smoke while performing repairs, especially when handling refrigerant.**
  - **Be careful the liquid refrigerant does not come in contact with the skin.**
- **If liquid refrigerant strikes eye or skin:**
  - **Do not rub the eye or the skin.**
  - **Splash large quantities of cool water on the eye or the skin.**
  - **Apply clean petroleum jelly to the skin.**
  - **Go immediately to a physician or to a hospital for professional treatment.**

Step 1	Connect manifold gauge.
Step 2	1) Evacuate the system. • 15 minutes or more. • 30 inHg (100 kPa) or more of vacuum. 2) Stop evacuating the system. • Leave for 5 minutes. 3) Check the vacuum.
Step 3	Connect to refrigerant source.
Step 4	Test the system for leaks.
Step 5	Charge the system with R-410A. • See “Technical Specifications” for the specified amount.
Step 6	Remove manifold gauge.



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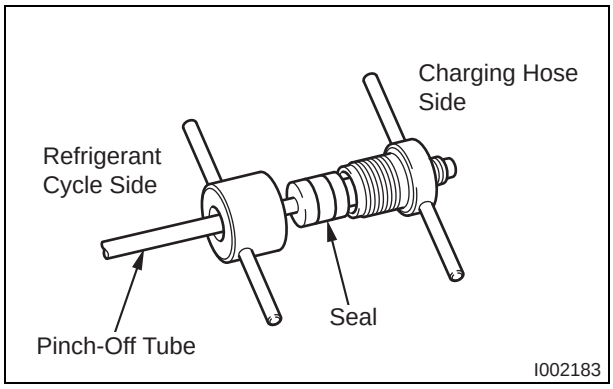
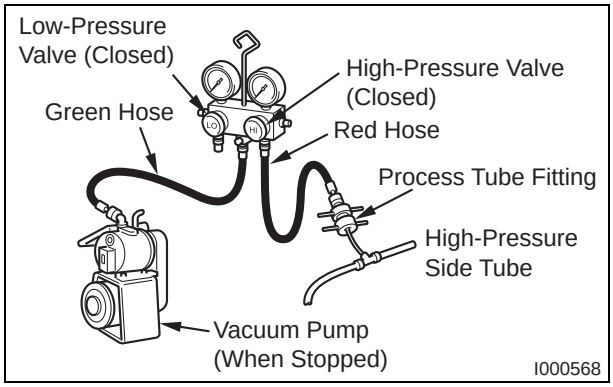
(1) Connection of gauge manifold



1) Properly remove the crushed end of the pinch-off tube at the high-pressure side and the low pressure side of the refrigerant cycle with a pipe cutter.

2) Fit the process tube fitting to the pinch-off tube on both sides.



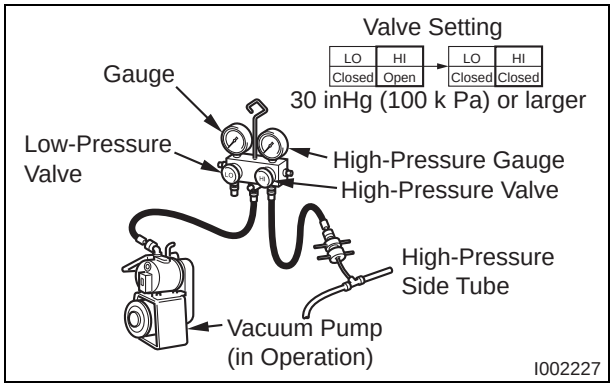
3) Connect the charging hoses (red high-pressure side) for the gauge manifold to the process tube fitting.

< NOTE >

Connect the hoses using care not to mistake the high-pressure side for the low-pressure side and vice versa.

4) Connect the charging hose (green) at the center of the gauge manifold to the vacuum pump.

(2) Evacuation

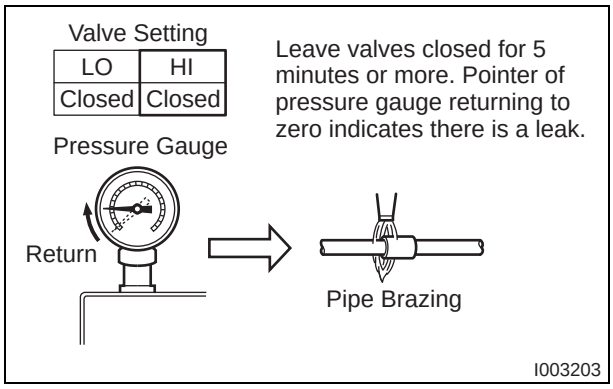


1) Open the high-pressure valve (Hl) of the gauge manifold.

2) Turn on the vacuum pump to start evacuation. (Evacuate the system for approximately 15 minutes.)

3) When the high-pressure gauge indicates 30 inHg (100 kPa) or higher, turn off the vacuum pump and close the high-pressure valve of the gauge manifold.

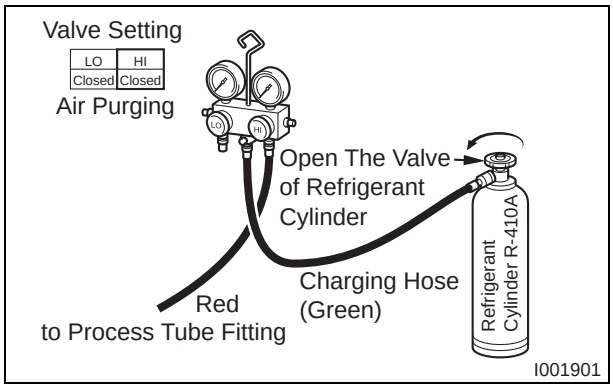
(3) Checking vacuum

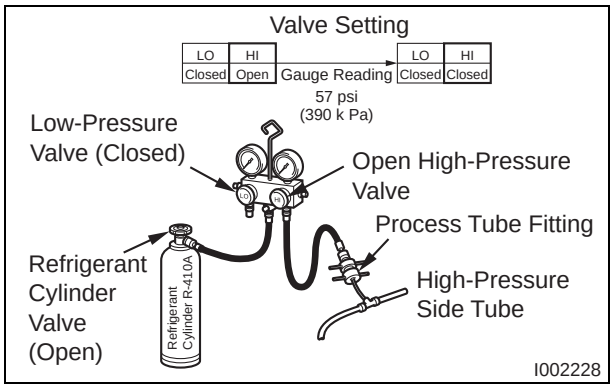


1) Leave the high-pressure valve and the low-pressure valve of the gauge manifold closed for 5 minutes or more, and confirm that the gauge pointer does not return to zero.

2) If the gauge pointer returns gradually to zero there is a leak somewhere in the system (this could also include gauge manifold). Perform a leak check according to the procedure indicated in the next step. Once the leak has been found and repaired, evacuate the system once more to confirm that the system holds vacuum.

(4) Checking for gas leaks





1) Remove the charging hose (green) from the vacuum pump, and connect the hose to the refrigerant cylinder (R-410A).

2) Loosen the nut on the gauge manifold side of the charging hose (green).

3) Open the valve of the refrigerant cylinder and perform air purging in the charging hose (green). Then tighten the nut.

4) Open the high-pressure valve of the gauge manifold. Charge the system with refrigerant until the high-pressure gauge indicates 57 psi (390 kPa). After charging is complete, close the high-pressure valve.

5) Open the valve of the refrigerant cylinder and perform air purging in the charging hose (green). Then tighten the nut.

6) Check carefully for gas leaks inside the refrigerant system using the gas leak tester.

7) Repair any leak.

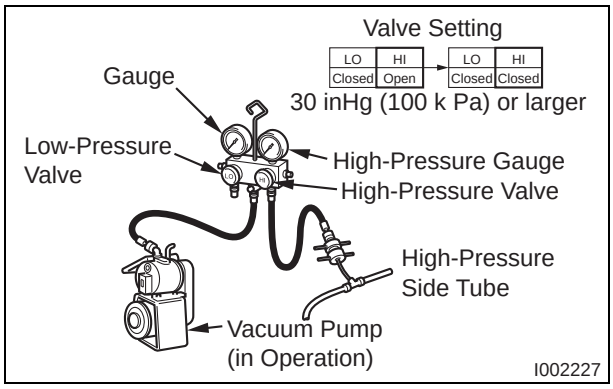
⚠ WARNING

Any repair on a charged system should be performed by a licensed professional only.

⚠ WARNING

Before checking for gas leaks, fully confirm that there is nothing flammable in the area to cause an explosion or fire. Contact of refrigerant with an open fire generates toxic gas.

(5) Evacuation (repeat)



1) Close the valve of the refrigerant cylinder. Then remove the charging hose (green) from the refrigerant cylinder, and connect it to the refrigerant recovery machine.

< NOTE >

Keep the high-pressure valve and the low-pressure valve of the gauge manifold closed.

2) Using the procedure under “Evacuation”, evacuate the system until the high-pressure gauge indicates 30 inHg (100 kPa) or larger. (For 15 minutes or more.)

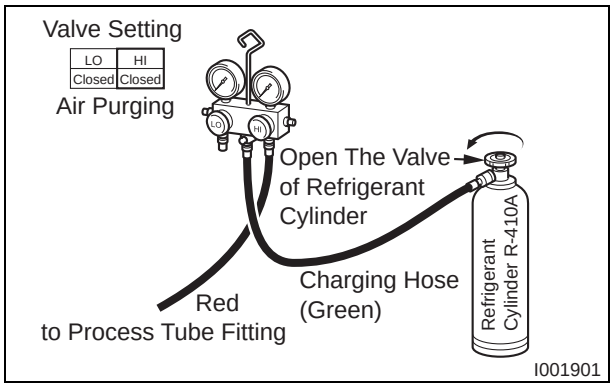
3) After evacuation is complete, close the high and the low pressure valves of the gauge manifold.

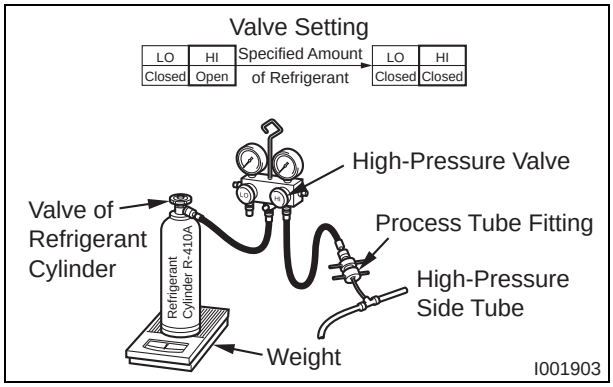
⚠ CAUTION

Make sure to evacuate the system twice or more using the repetitive vacuum method. Evacuate the system an additional time on rainy or humid days.

8.4 Refrigerant Charging Work

(1) Refrigerant charging





1) Remove the charging hose (green) from the vacuum pump, and connect it to the refrigerant cylinder (R-410A).

2) Loosen the nut on the gauge manifold side of the charging hose (green). Open the valve of the charging hose (green). Open the valve of the refrigerant cylinder. After air purging, tighten the nut and close the valve of the refrigerant cylinder.

3) Securely place the refrigerant cylinder on a scale with a weighing capacity of 70 lb (30 kg) that is graduated in 0.2 oz (5 g) increments.

4) Open the high-pressure valve of the gauge manifold and the valve of the refrigerant cylinder. Charge the system with refrigerant to the specified amount.

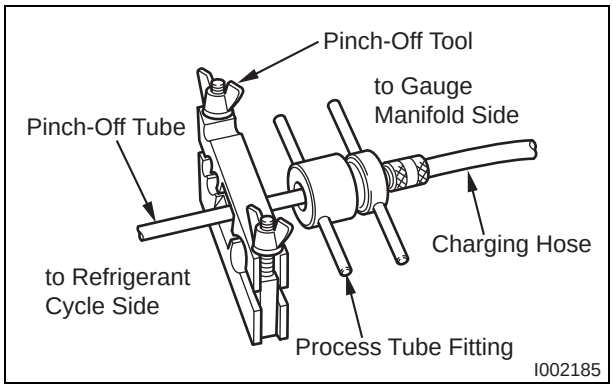
Standard Amount of Refrigerant: 2.31 lb (1.05 kg)

⚠ CAUTION

The amount of refrigerant charged has a great effect on the cooling capacity of the unit. Charge to the specified amount, always observing the scale graduations while charging.

5) Close the high-pressure valve of the gauge manifold and the valve of the refrigerant cylinder.

(2) Removal of gauge manifold



1) Crimp the pinch-off tube with a pinch-off tool.

2) Remove the gauge manifold and the process tube fitting. Crush the end of the pinch-off tube.

3) Braze the end of the pinch-off tube.

4) Ensure that a gas leak is not present at the pinched off portion and the brazed end.

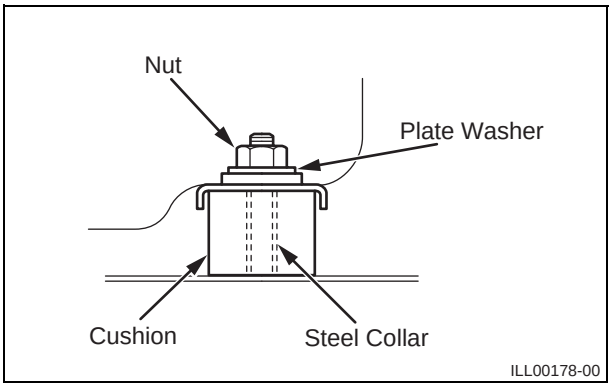
9. REASSEMBLY

9.1 Reassembly of Unit

- Reassemble the unit in the reverse order of removal. Described below are the parts that require special care in reassembling the unit. Perform all wiring or rewiring as referenced in the wiring diagram.

9.2 Compressor Mounting

- Mount the compressor on the frame, using cushions, steel collars, plate washers, and nuts.



9.3 Evaporator Fan Assembly

- Install the evaporator fan. Allow a clearance of 0.12 inch (3.0 mm) or more on each side of the evaporator fan. (See page 72.)

< NOTE >

Initialize the fan motor after replacement. (See page 61.)

9.4 Condenser Fan Assembly

- Install the condenser fan. Allow a clearance of 0.12 inch (3.0 mm) or more on each side of the condenser fan. (See page 74.)

< NOTE >

Initialize the fan motor after replacement. (See page 61.)

9.5 Wiring Notice

- Secure the wires using clamps so that they do not come into contact with the edges of the structure. Secure the wires using clamps in the same position they were before removal.

9.6 Perform an Inspection

- Perform an inspection of cooling performance and check for abnormal noise or vibration.

DENSO

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