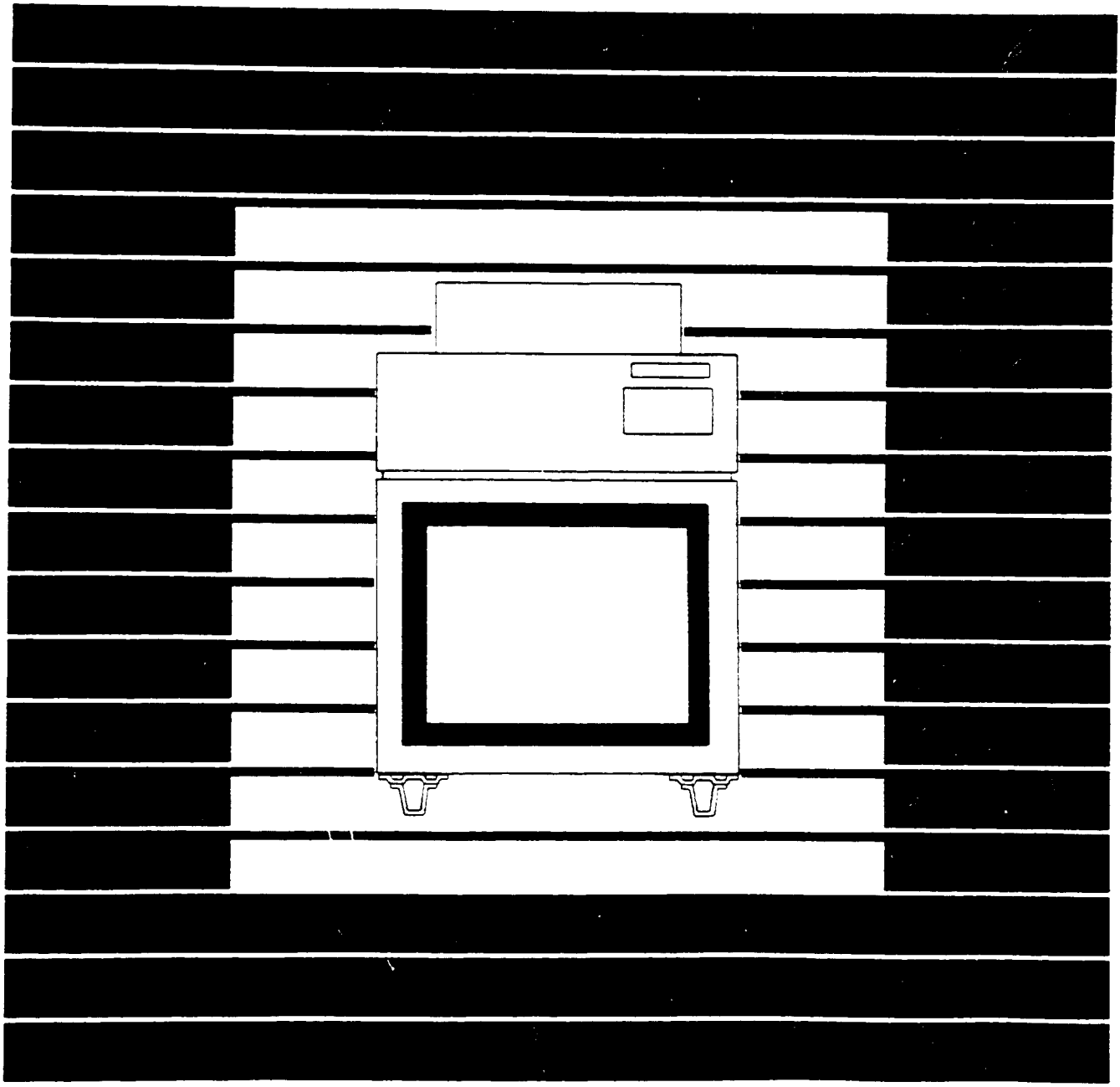
MovinCool®
SPOT COOLING SYSTEMS

SERVICE MANUAL
50HU



GMZR—08

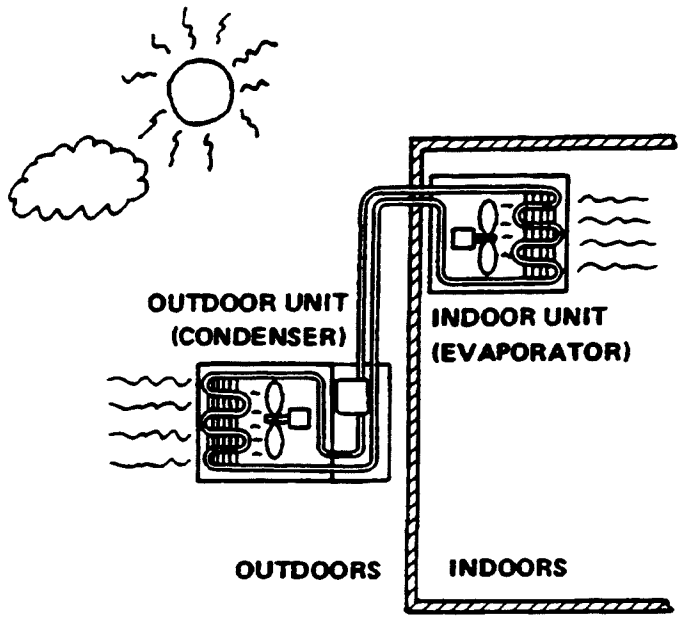
Construction and Operation

1. GENERAL DESCRIPTION

Generally speaking conventional air conditioners cool the entire enclosed environment. They act as "heat exchangers", requiring an indoor unit (evaporator) to supply cool air to the indoor, and an outdoor unit (condenser) to exhaust exchanged heat to the outdoor.

Unlike conventional air conditioners, the SPOT COOL is a cooling system which directs cool air to specific areas or objects.

SPOT COOL has the following features;



CONVENTIONAL
AIR CONDITIONER

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1) Compact Design

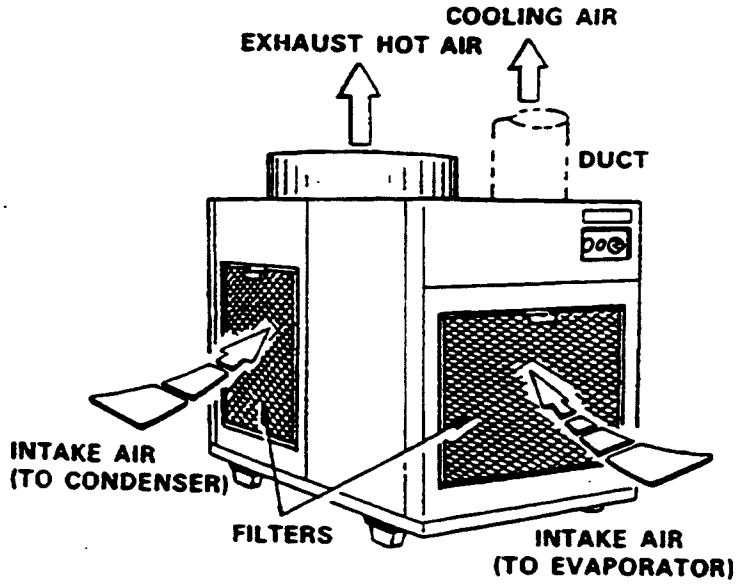
The innovative design of SPOT COOL has resulted in a single compact unit, replacing the need for two separate units.

2) Easy Installation

With the whole cooling system built into one compact unit, SPOT COOL requires no pipe work for refrigerant and can be easily installed, although in this case, cooling air duct work is required.

3) Energy Conservation

SPOT COOL is economical as it cools only the area or objects which need to be cooled, and not the entire room.



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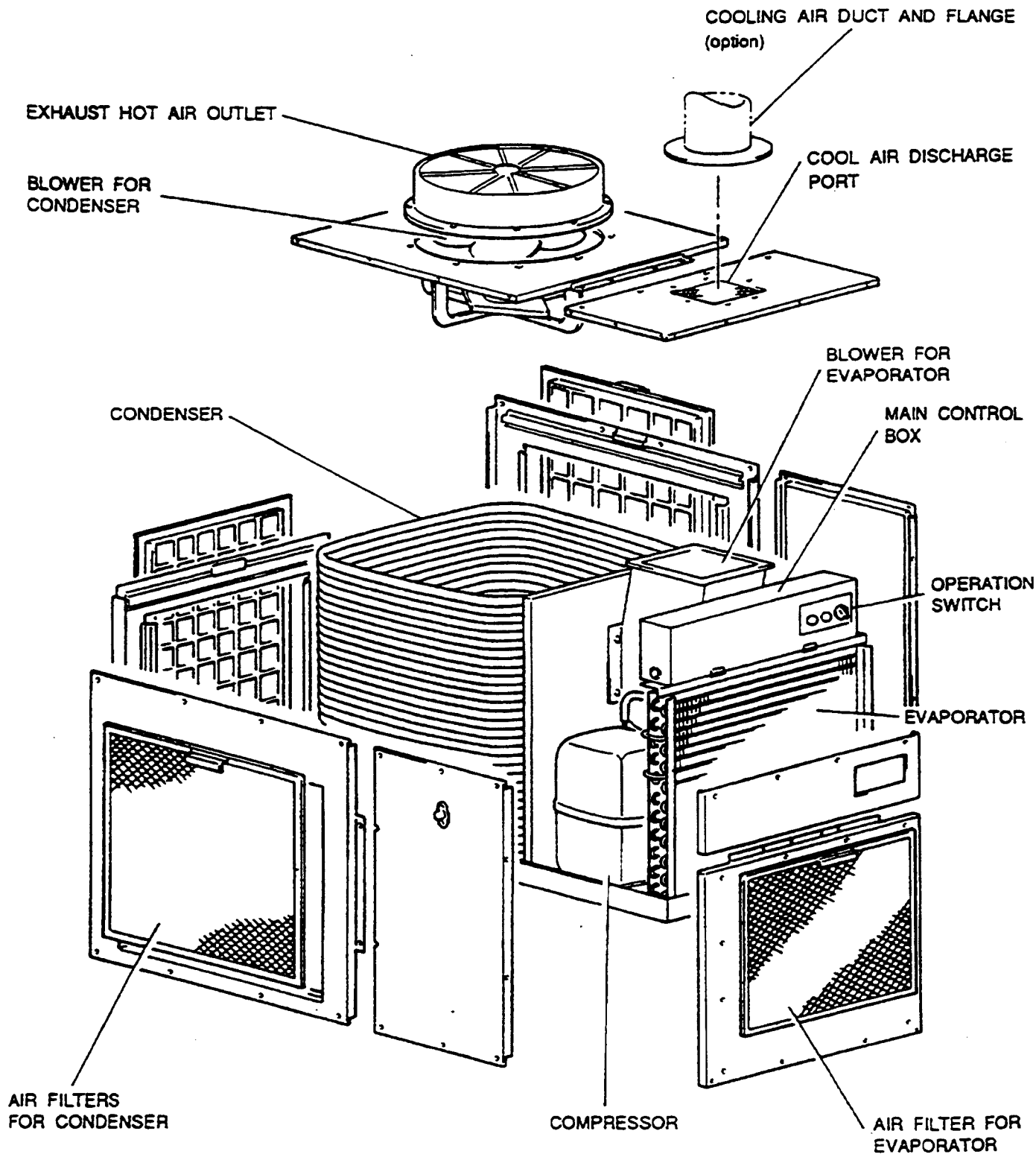
Air flow of SPOT COOL

2. CONSTRUCTION AND SPECIFICATION

2-1. Construction

<Shown after removing all panels>



1) Basic Construction

The interior of SPOT COOL is divided into two sections. The front section houses the evaporator and control box, and the rear section the condenser and the compressor.

2) Air Flow

1. Air flow for the condenser

Condenser cooling air is drawn through the sides and rear of the unit, and discharged through the exhaust hot air outlet located on the top of the unit.

2. Air flow for the evaporator

Air is taken from the front face of the unit, cooled via the evaporator, and discharged through the aperture in the unit top.

Using a cooling air duct (option, to be installed on the field), blow cool air against the object to be cooled.

All air inlets are provided with air filters.

CAUTION:

The SPOT COOL 50HU should always be placed on the floor. It should never be hung from the ceiling.

2-2. Specifications

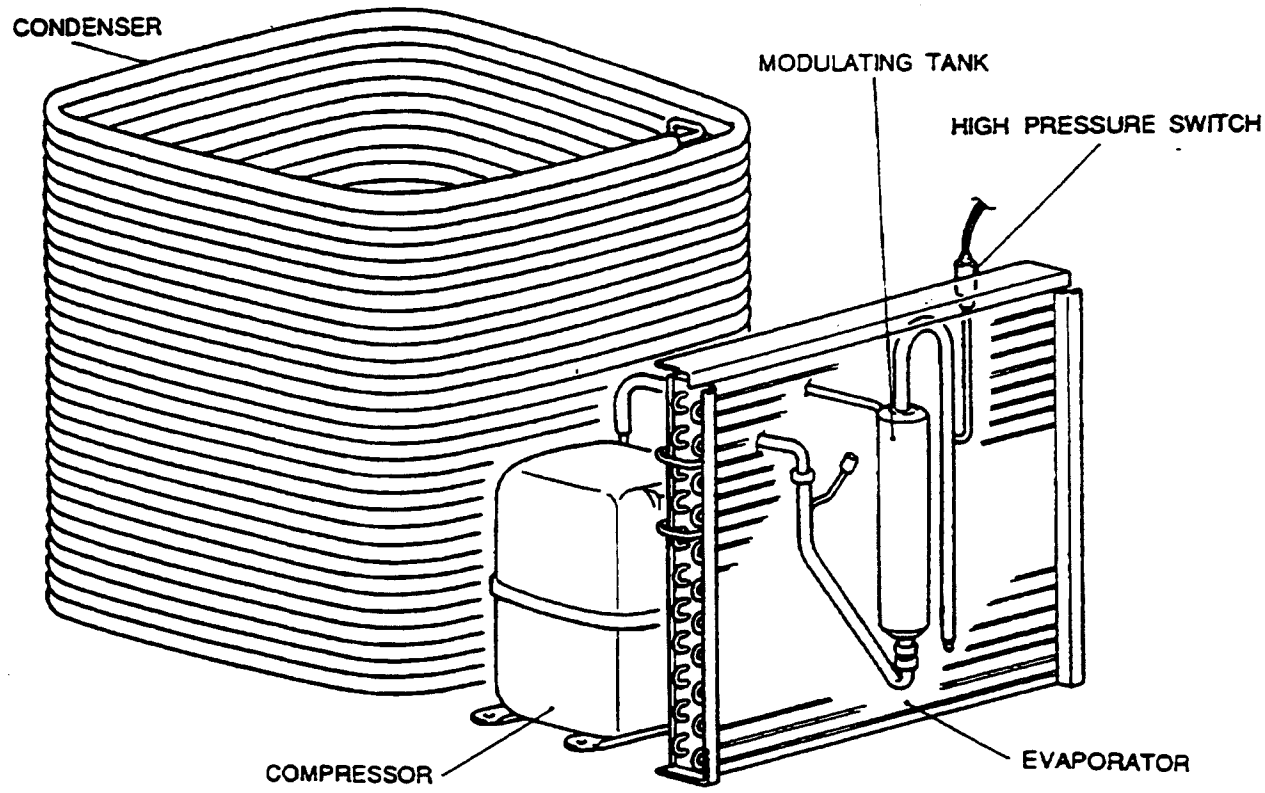
Item \ model		50HU
[Rating Condition]		
(Inlet air)		35°C (95°F), 60%RH (WB 28.2°C (83°F))
[Features]		
Power frequency	(Hz)	60
Line Voltage	(Volt)	Three phase 460
Power consumption	(Kw)	7.2
Current consumption	(Amp)	10.5
Power factor	(%)	86
Starting current	(Amp)	65
Power wiring	(AWG)	12(4-core)
[Cooling Unit]		
Cooling capability	(Kcal/h)	15000
	(Btu/h)	60000
Cooling system		Direct expansion
[Blower]		
Type of fan		Centrifugal fan
Air volume	(m^3/h)	2700
	(ft^3/min)	1580
Motor output	(W)	750
[Compressor]		
Type		Hermetically sealed reciprocating type
Output	(W)	3750
Refrigerant		R-22
Packed amount of refrigerant	(kg)	2.7
	(lbs)	5.9
[Safety Device]		
Overcurrent relays (for compressor, evaporator fan motor and condenser fan motor)		With
Compressor overload relay		With
Fan motor protectors (for evaporator and condenser)		With
High pressure switch		With
Anti-freezing thermostat		With
[Dimensions and Weight]		
W x D x H	(mm)	800 x 1250 x 1075
	(inch)	31.5 x 49.2 x 42.3
Weight	(kg)	210
	(lbs)	463
[Operating Conditions]		
(Inlet air)	MAX.	45°C (113°F), 50% RH
	MIN.	25°C (77°F), 50% RH

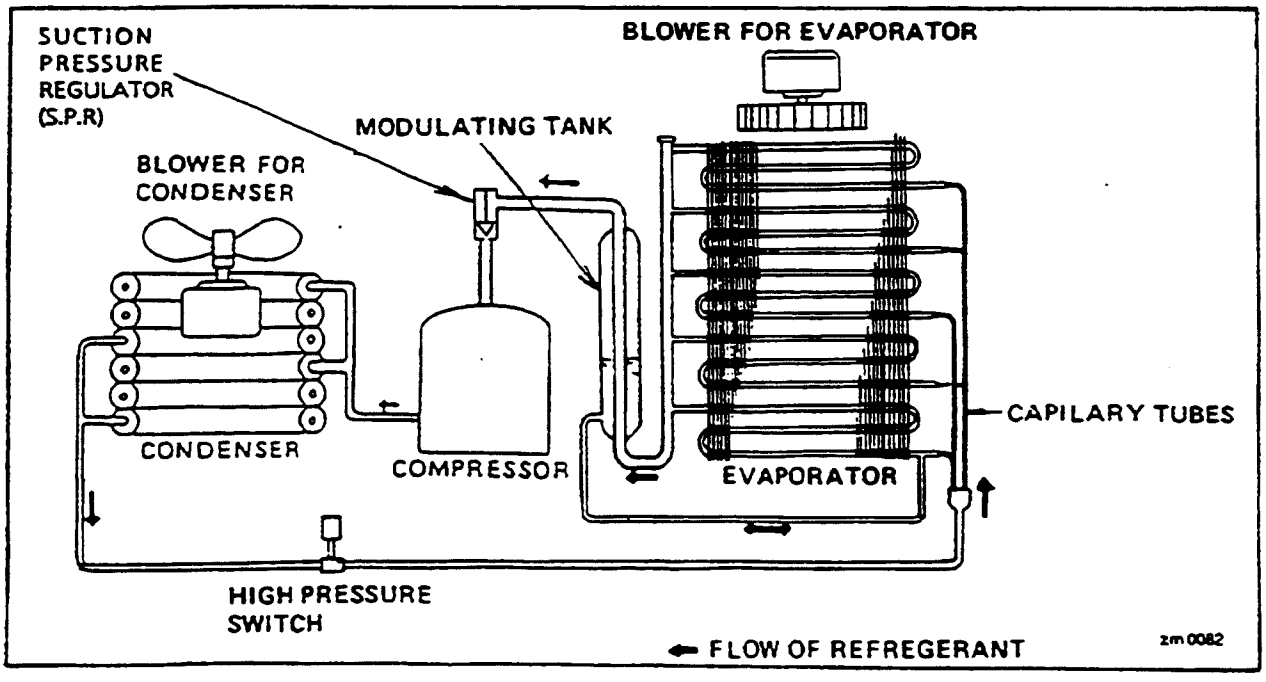
3. REFRIGERANT SYSTEM

The component parts of the refrigerant system include the following;

- Compressor
- Condenser
- Capilary tube
- Evaporator
- Modulating tank
- High pressure switch

These parts are all connected by copper piping, with brazed connections.





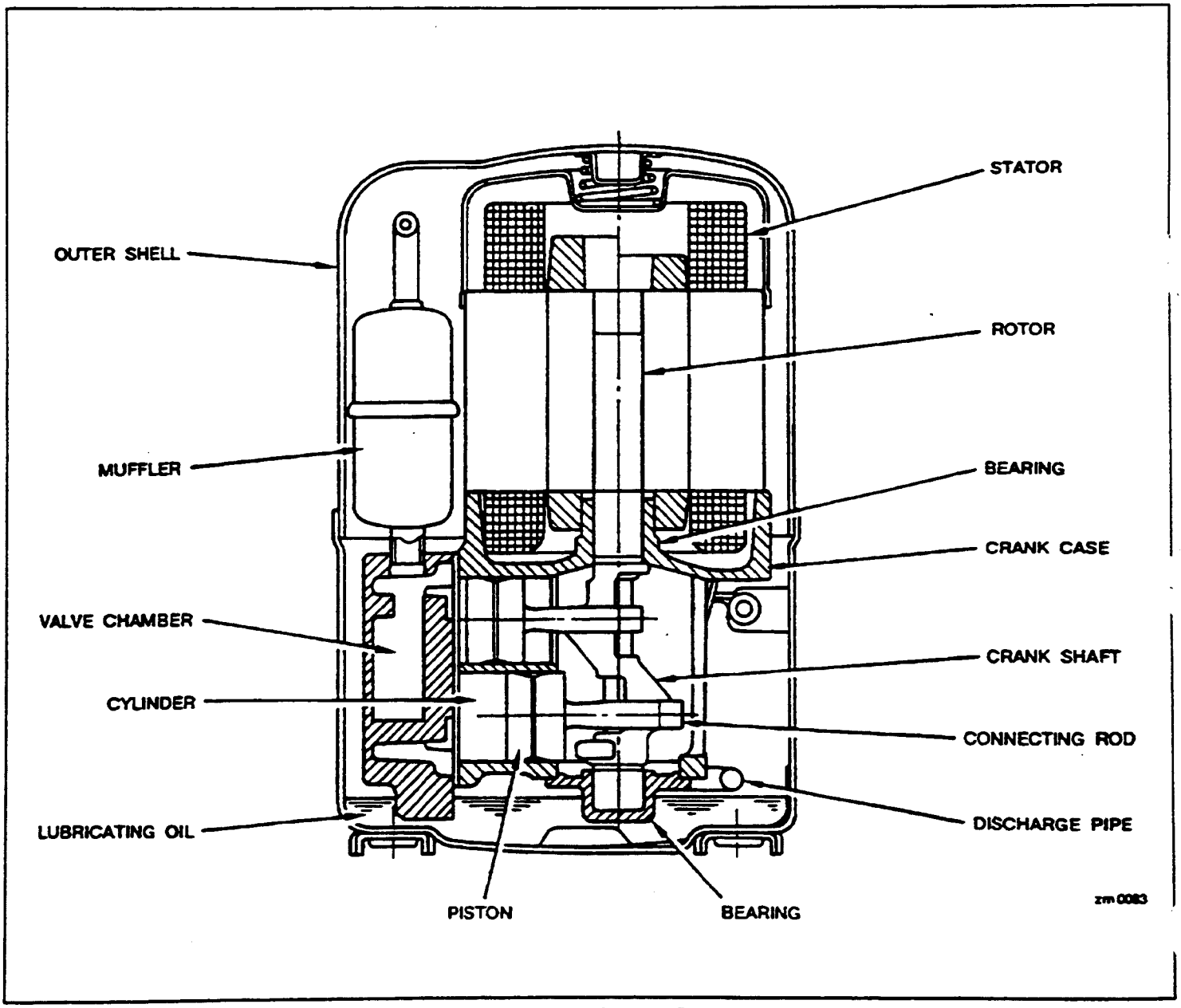
Refrigerant System

3-1. Compressor

The compressor used in the SPOT COOL is of a reliprocating hermetic type, incorporating a drive motor and compression mechanism in an enclosed vessel.

3-1-1. Construction

The reciprocating type compressor consists of a drive section (motor), and a compression mechanism as shown below. When the rotor shaft of the motor rotates, the crank shaft causes the piston to reciprocate in the cylinder and absorb and compress the refrigerant. Main components are the motor, crank case, bearing, crank shaft, cylinder, piston, etc. The motor and compression mechanism are supported by a spring inside the outer shell so that vibration of the compressor does not transmit directrly to the outside. The outer shell is on the low pressure side, in which gas flows from the evaporator. This gas cools the motor and compression mechanism.

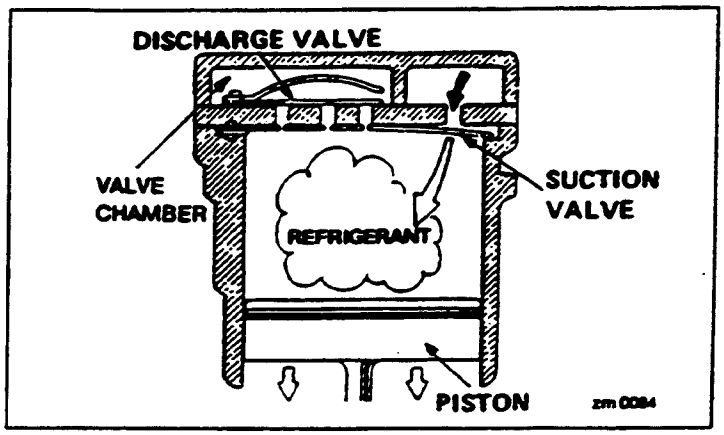


Construction of Hermetric Rotary Type Compressor

3-1-2. Operation

1) Suction

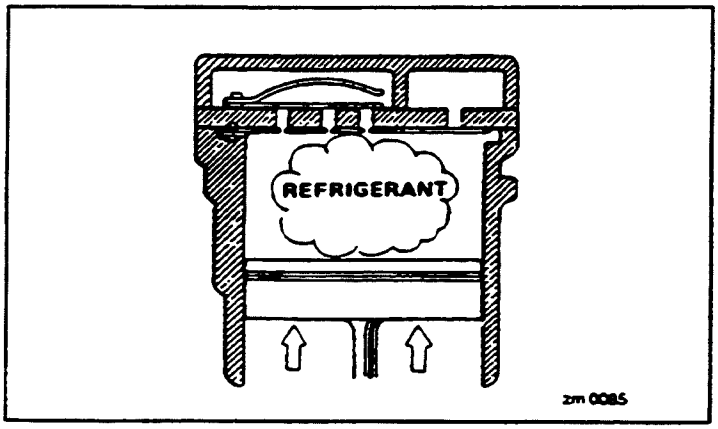
When the piston is on a downward stroke, pressure inside the cylinder is reduced. When this pressure becomes lower than the sunction side (low pressure side) pressure, the suction valve at the top of the cylinder opens and the refrigerant enters the cylinder.



Suction

2) Compression

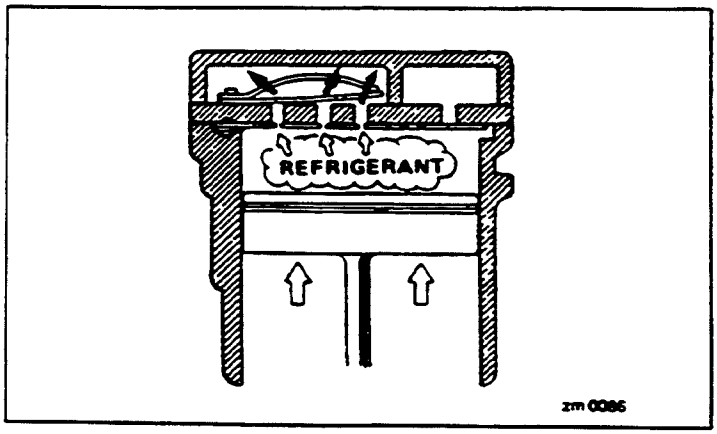
As the piston commences its upward stroke the refrigerant is compressed, causing a gradual increace in pressure, within the cylinder.



Compression

3) Discharge

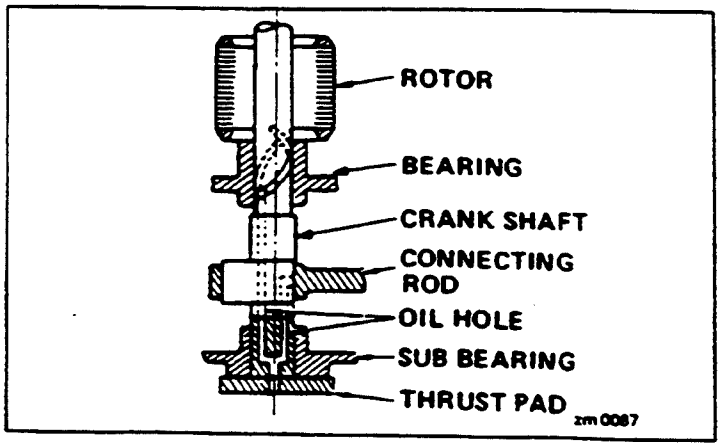
When the refrigerant pressure in the cylinder becomes higher than the pressure on the delivery side (high pressure side) of the compressor, the discharge valve opens to deliver the compressed refrigerant to the discharge side.



Discharge

3-1-3. Lubrication of Compressor

Lubricant from the thrust pad hole enters an eccentric hole in the crankshaft, and modes upwards, by centrifugal force, until it enters a spiral groove in the shaft. Here it continues to rise, lubricating the bearing and subsequent areas.



Lubrication of Compressor

3-2. Condenser

The condenser, which serves as a heat exchanger, has thin aluminum projections, called spine fins, fastened to a copper tube. Heat is exchanged by forcing cooling air across the condenser fins.

3.3. Capillary Tube

The following table shows the specifications of the capillary tube.

Model	Qty	Purpose of Use	I. D. (mm)	Length (mm)
50HU	2	For cooling	ϕ 1.8±0.02	1000
	3		ϕ 1.6±0.02	525

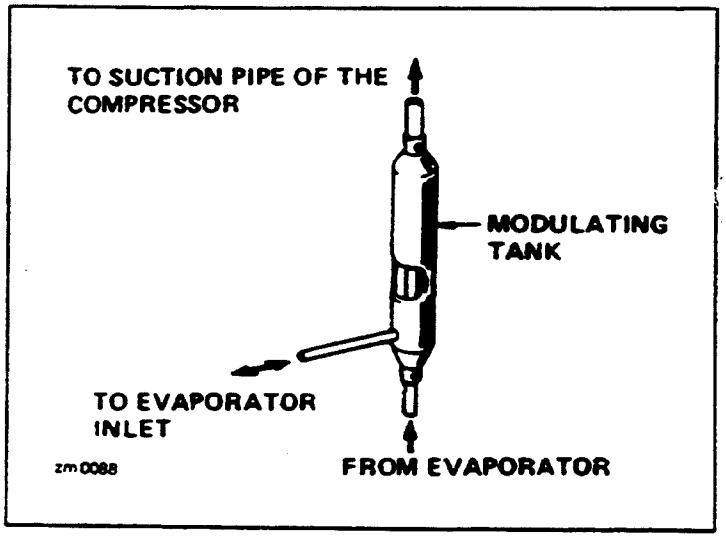
3-4. Evaporator

The evaporator is a heat exchanger using plate-fins and tubes. It is mounted at the front face of the unit, located on the suction side of the blower.

3-5. Modulating Tank

The modulating tank consists of a copper pipe and tank sections, each being separated from the other. The pipe connects to the evaporator outlet at one end and to the suction pipe of the compressor at the other; the tank connects to the evaporator inlet.

The modulating tank is covered with a heat insulator that eliminates themal effects from ambient temperature. It modulates the quantity of refrigerant in the refrigerating cycle for optimum operating condition: it stores part of the refrigerant under light load and delivers additional refrigerant to the cycle under heavy load.

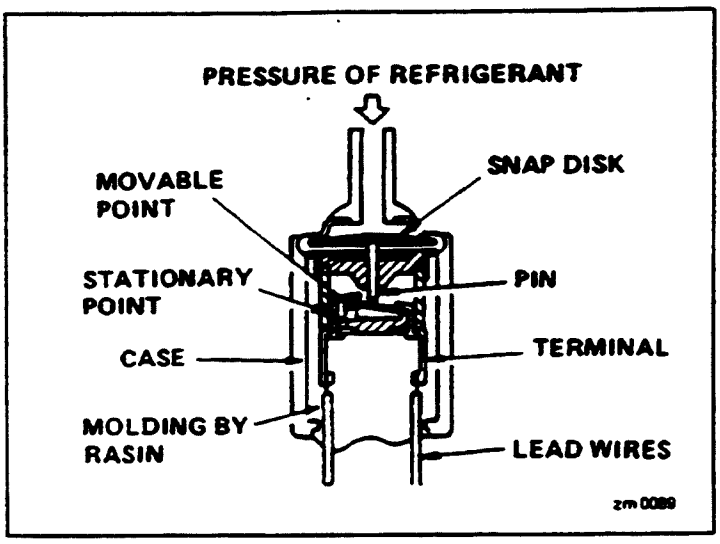


Modulating Tank

3-6. High Pressure Switch

The high pressure switch prevents the condenser and compressor from being damaged by an excessively high pressure in the high pressure end of the refrigerating cycle, i.e., the refrigerant condensing pressure.

The switch is normally closed. The diaphragm detects variations in pressure and, as the pressure increases, the snap disk snaps back to push the pin down, causing the internal contacts to open. This generates a signal to open the auxiliary relay. (Refer to P.12)



High Pressure Switch

Possible causes of this trouble include:

(1) The condenser air filter is seriously contaminated and clogged.

(2) Defective condenser blower.

3-7. Piping

All parts of the cooling system are connected by copper pipe with brazed joints (Refer P.5).

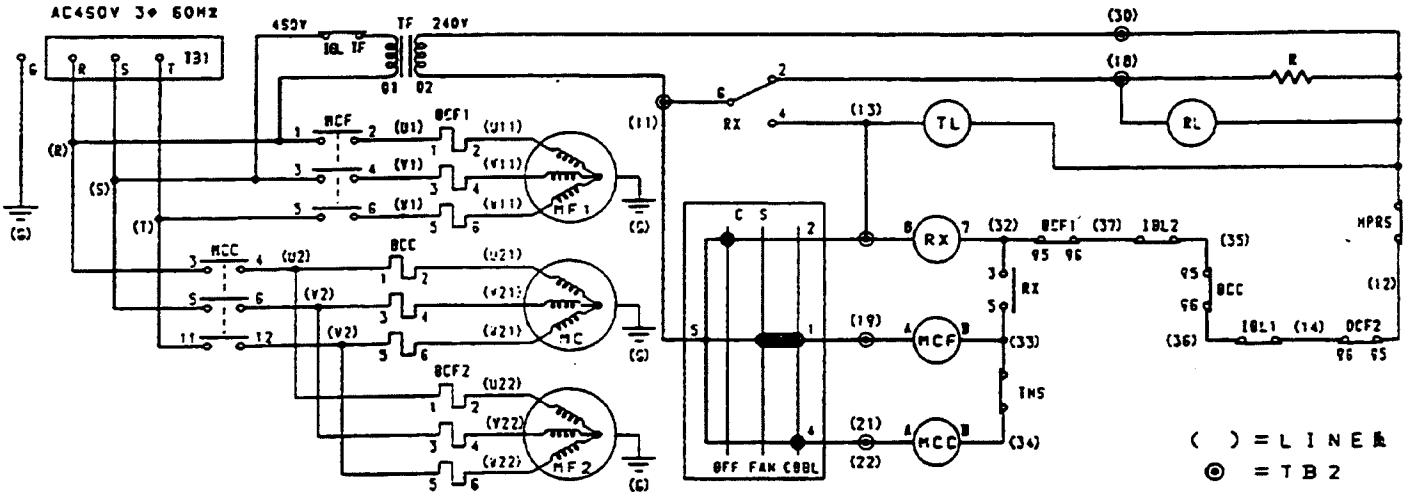
4. ELECTRICAL SYSTEM

The component parts of the electrical system include the following;

- Control box
- Control switch
- Fan motor
- Compressor motor
- Overcurrent relays
- Relays
- Lamps etc.

TB1 : Terminal block for power
TB2 : Terminal block for control
MF1 : Fan motor for evaporator
MF2 : Fan motor for condenser
MC : Motor for compressor
MCF : Relay for fan motor
MCC : Relay for compressor motor
RX : Auxiliary relay
OCC : Overcurrent relay for MC
OCF1 : Overcurrent relay for MF1
TF : Transformer

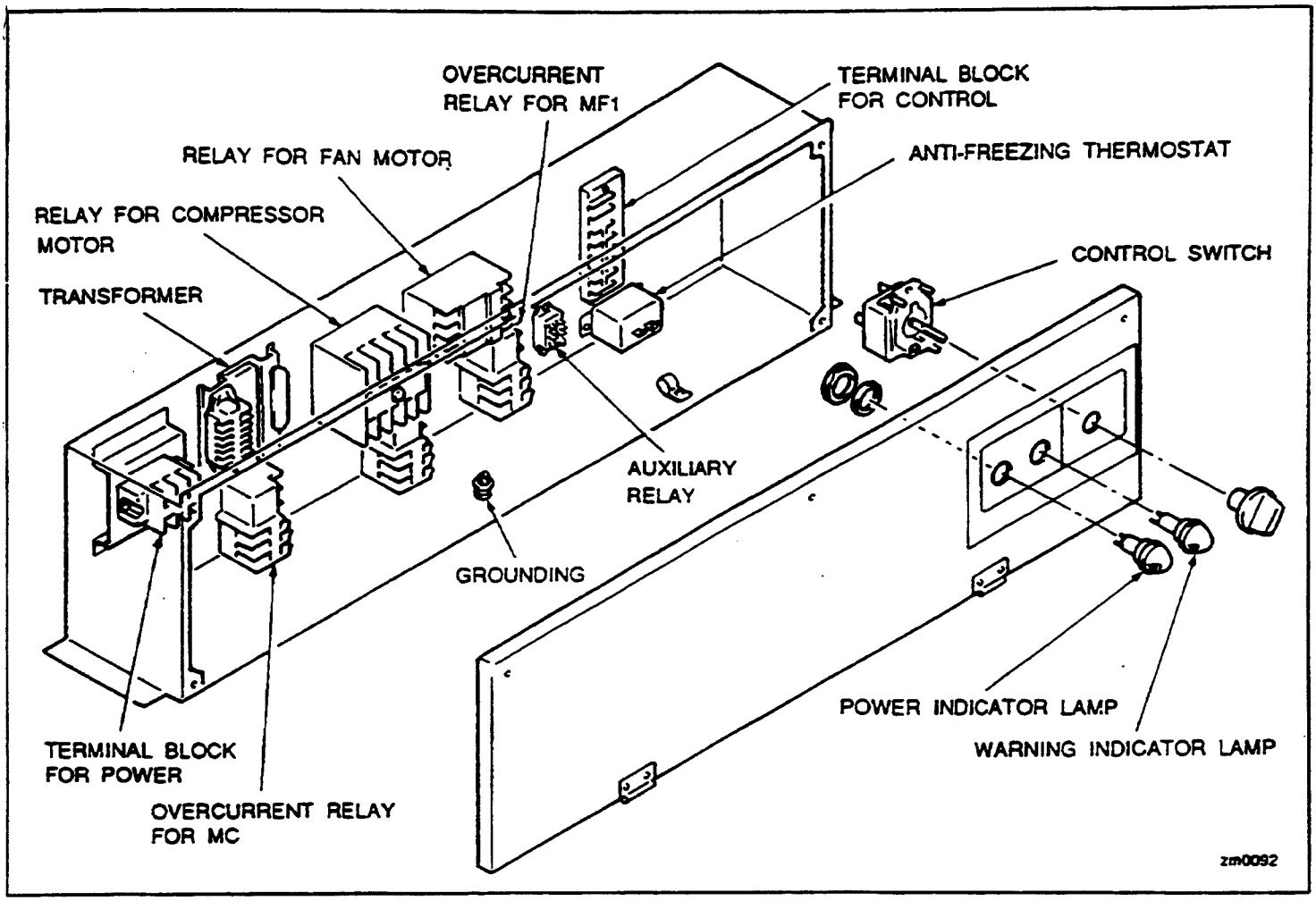
OCF2 : Overcurrent relay for MF2
TL : Power indicator lamp
RL : Warning indicator lamp
HPRS : High pressure switch
IOL1 : Internal protector for MF1
IOL2 : Internal protector for MF2
IOLTF : Internal protector for TF
THS : Anti-freezing Thermostat
CS : Control switch
R : Resistance for lamp
G : Grounding



Electrical System

4-1. Control Box

The interior of the control box is shown in the figure below.

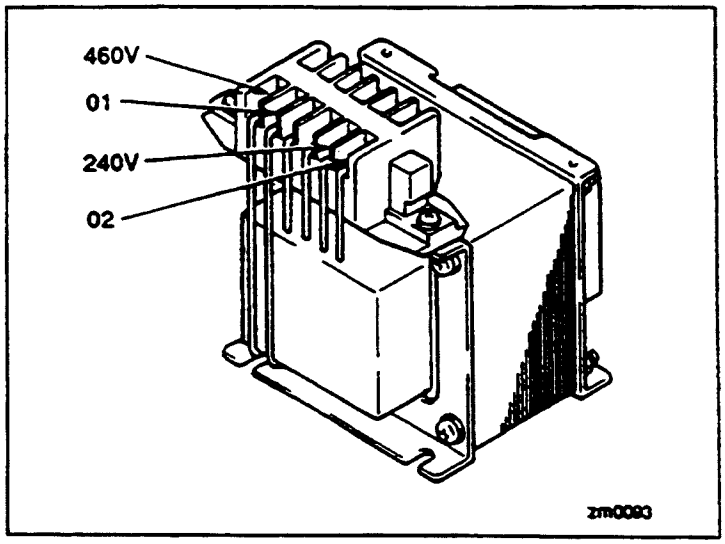


Control Box

4-1-1. Transformer

This transformer is designed to convert 460V to 240V and supply power to the control circuit.

An internal protector which cuts in at 120°C is installed on the primary coil of the transformer, and will isolate the power supply when unusual temperature rises occur to prevent the coil from burning.



Transformer

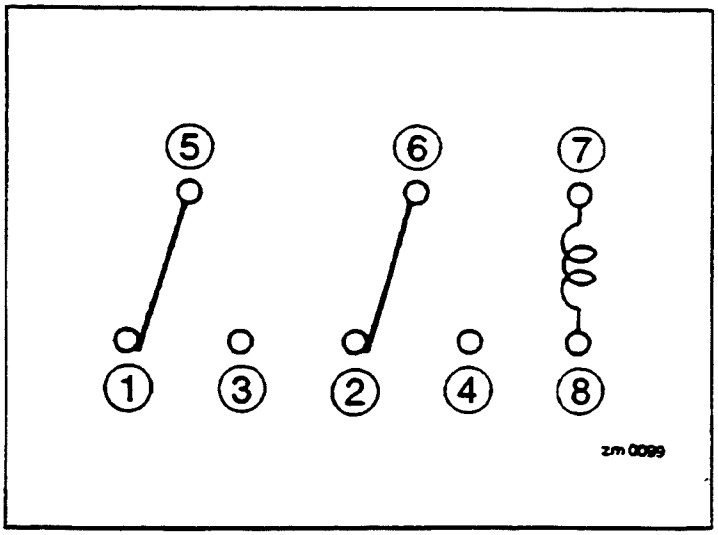
Specifications

Primary Rated Voltage	: AC460 Volts
Secondary Rated Voltage	: AC240 Volts
Secondary Rated Current	: 0.5 amp

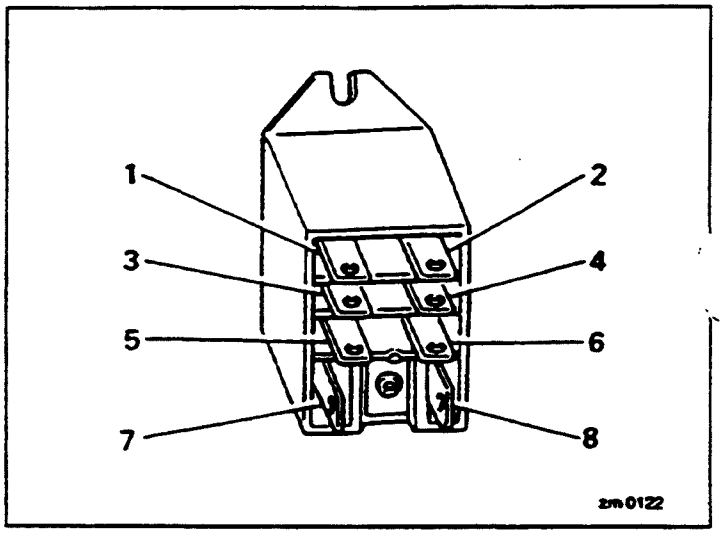
4-1-2. Auxiliary Relay

When the power is supplied to the unit, this relay is energized across terminals 7 and 8 and closed across terminals 5 and 3 and across 6 and 4. These conditions remain unchanged in all operation modes (FAN or COOL). If one of the errors mentioned below occurs, the auxiliary relay is deenergized across terminals 7 and 8, and opened across terminals 5 and 3 and across 6 and 4. This shuts off power to the fan motor relay and compressor motor relay bringing the unit to a stop. When, the relay is closed across terminals 6 and 2 the warning indicator lamp, will come on.

1. Abnormally large current in the evaporator fan motor.
2. Abnormally large current in the condenser fan motor.
3. Abnormally large current in the compressor motor.
4. Compressor motor temperature has risen abnormally.
5. Condenser or evaporator fan motor temperature has risen abnormally.
6. High pressure has risen abnormally.



Circuit of Auxiliary Relay



Auxiliary Relay

Specifications

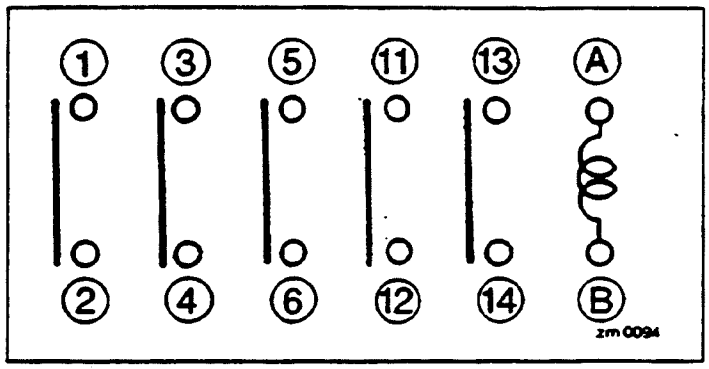
Rated Voltage : AC240 Volts

Rated Current : 10 amps

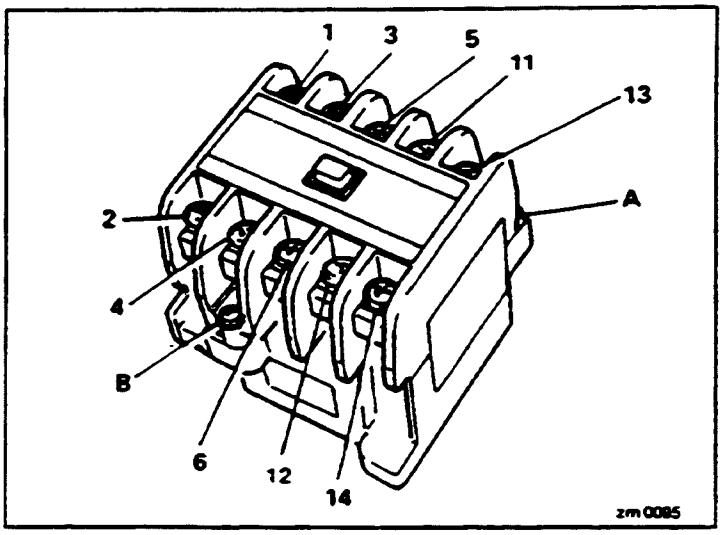
4-1-3. Compressor Relay

This compressor relay is closed when the unit is operating in COOL mode, with power supplied to the compressor. In the following cases, the relay opens to cut off power to the compressor.

*When the auxiliary relay is opened by the high pressure switch OFF, overcurrent relay OFF compressor overload relay OFF, or internal overload protector of fan motor OFF.
*When the evaporator is frozen. (Anti-freezing thermostat OFF)



Circuit of Compressor Relay



Compressor Relay

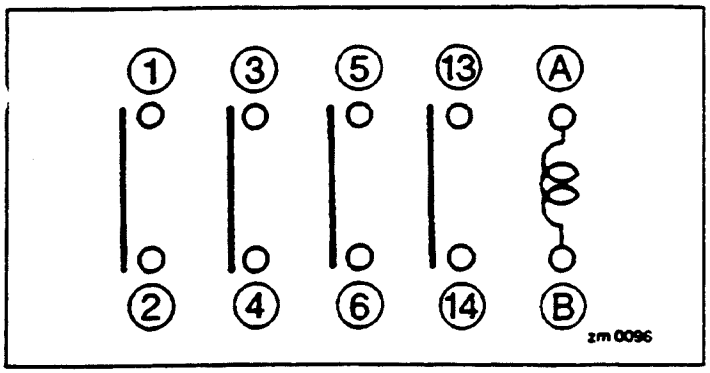
Specifications

Rated Voltage : AC240 Volts
Rated Current : 30 amps

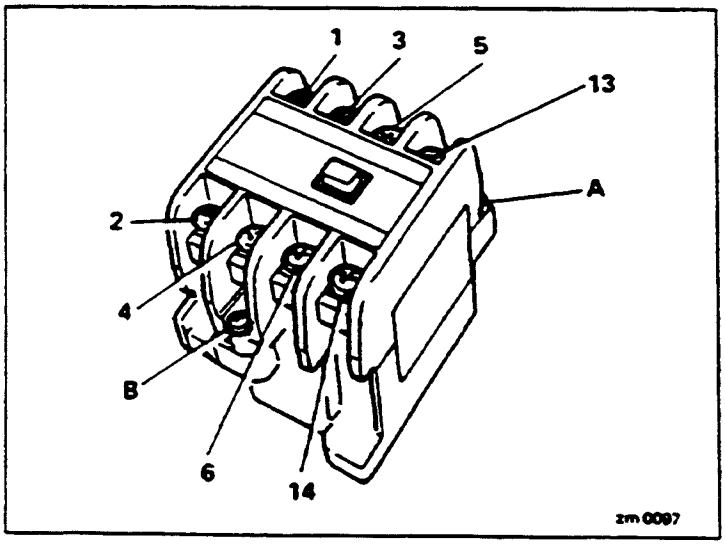
4-1-4. Fan Motor Relay

This fan motor relay is closed when the unit is operating, with power supplied to the evaporator fan motor. In the following cases, the relay opens to cut off power to the evaporator fan motor.

*When the auxiliary relay is opened by the high pressure switch OFF, overcurrent relay OFF compressor overload relay OFF, or internal overload protector of fan motor OFF.



Circuit of Fan Motor Relay



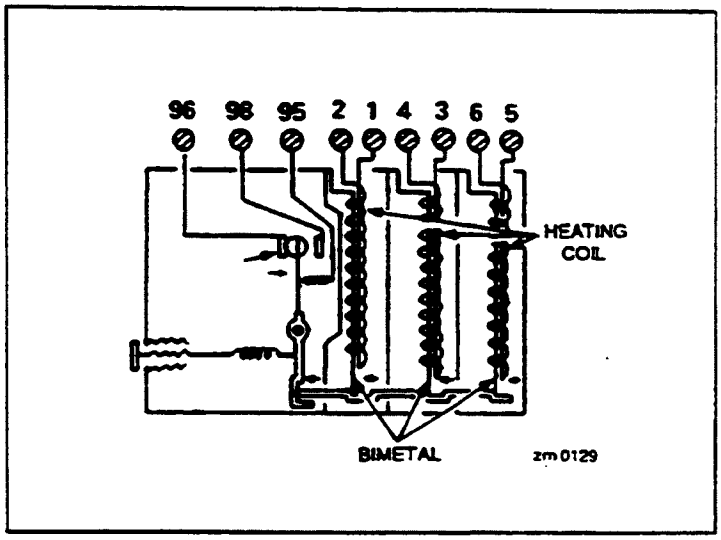
Fan Motor Relay

Specifications

Rated Voltage : AC240 Volts
Rated Current : 13 amps

4-1-5. Overcurrent Relay

For the three-phase blower motor and compressor motor, an overcurrent relay is usually used as a safety device. This prevents the motor coil from burning if an overcurrent situation has occured due to abnormal load on the blower motor, compressor motor, extraordinary change in supply voltage, o loss of current in one phase. If overcurrent flows into the heating coil wound around the bimetalic strip, the bimetalic strip curls, thereby opening the output contact (across terminals 95 and 96). This output contact shuts off the auxiliary relay circuit and brings the unit to a stop.



Internal Construction of Over Current Relay

Dial Setting

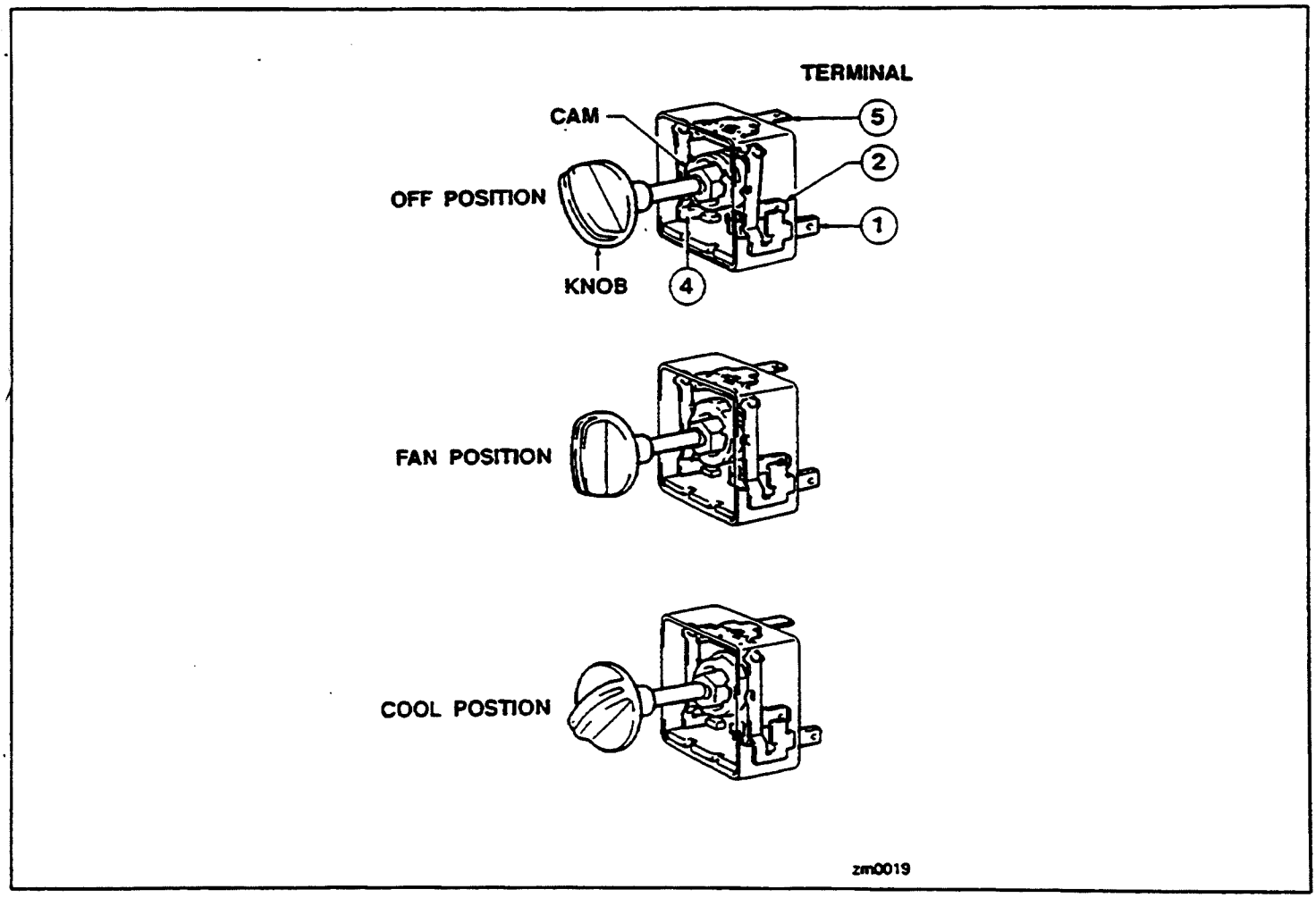
For compressor motor	11.5A
For evaporator fan motor	1.4A
For condenser fan motor	1A

4-2. Control Switch

The control switch is employed to start or stop operation. This switch is of a 250V, 20A rating rotary type (3-positions).

The switching positions are OFF-FAN-COOL. Each contact is switched by a cam mechanism.

Switch position	Switch terminals		
	1-5	2-5	4-5
OFF	Open	Closed	Open
FAN	Closed	Open	Open
COOL	Closed	Open	Closed



Control Switch

4-3. Fan Motor

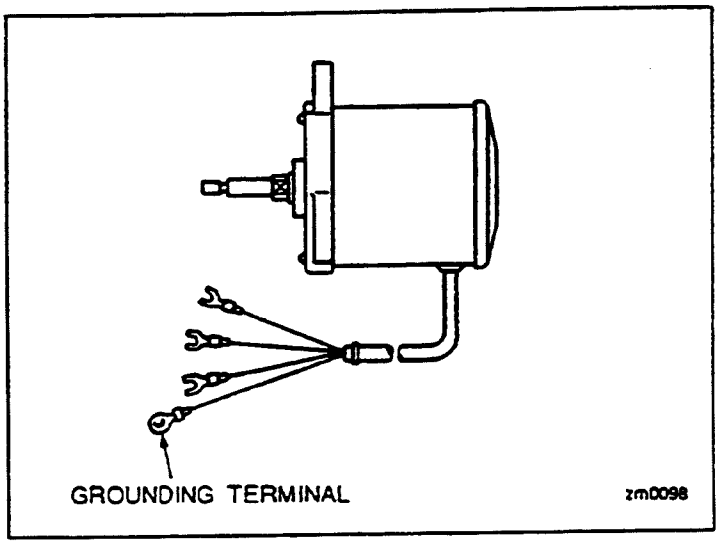
The fan motors are three phase, induction type.

The following table shows the specifications of the fan motors.

When the control switch is set to FAN, the evaporator fan motor rotates. When it is set to COOL, both the evaporator and condenser fan motors rotate.

The fan motor is equipped with an internal protector which cuts in at 120°C. If an unusual temperature rise occurs in the motor coil, the protector isolates the power supply via an auxiliary relay to prevent the motor coil from burning.

Spec. / Model	Rated Voltage (Volt)	Rated Output (Watt)
For Evaporator	460	750
For Condenser	460	400



Fan Motor

4-4. Compressor Motor

The compressor motor is a three phase induction motor. This motor is built in the shell of the compressor. (Refer to 3-1.)

Specifications

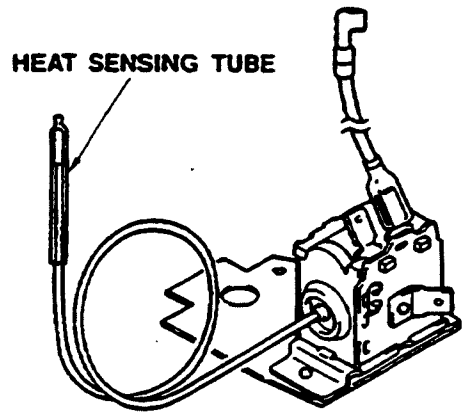
Rated Voltage : 460 Volts

Rated Output : 3750 W

4-5. Anti-Freezing Thermostat

When the evaporator has frozen, the contact of the thermostat opens to stop the compressor, and the ventilating operation is automatically activated. When the evaporator has defrosted, the contact closes to restart the compressor.

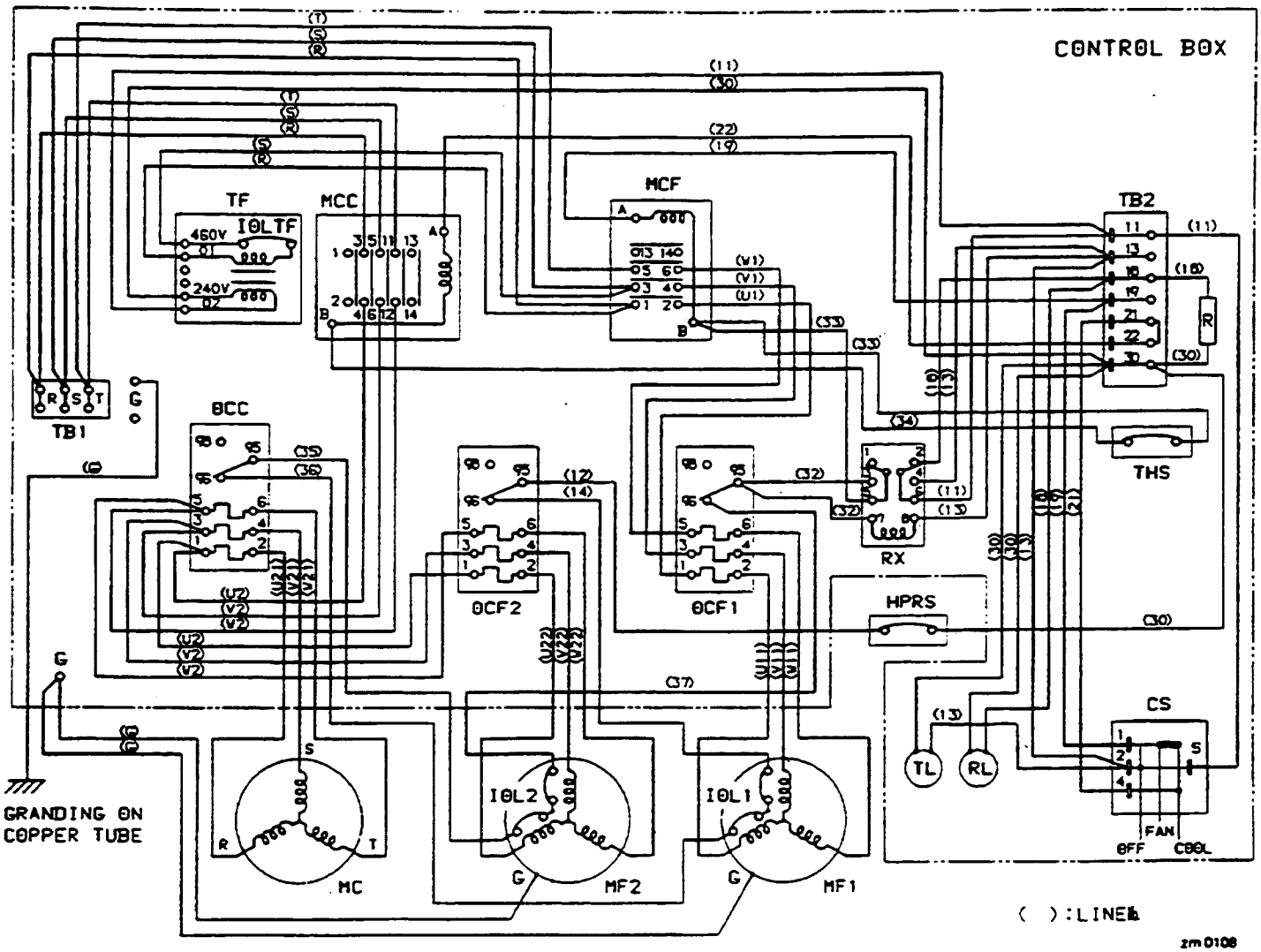
The heat sensing tube of the thermostat is mounted at the evaporator outlet tube and is insulated from surrounding air by heat insulating material. The setting of thermostat is fixed at 0°C when the contacts are open, and at +16°C when the contacts are closed.



Anti-freezing Themostat

4-6. Wiring

Proper connections are indicated at all the wire ends.

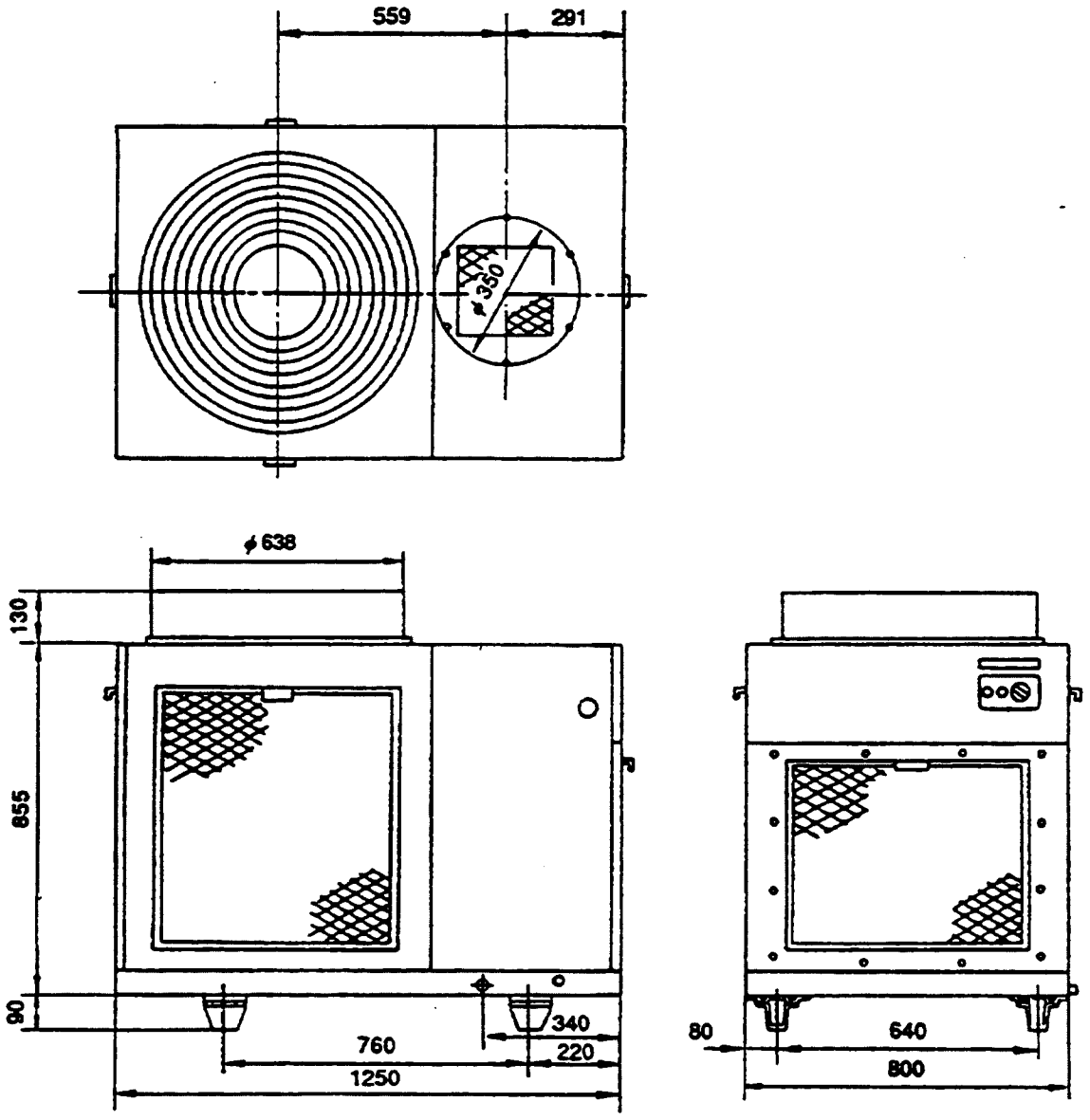


TB1	: Terminal block for power	OCF2	: Overcurrent relay for MF2
TB2	: Terminal block for control	TL	: Power indicator lamp
MF1	: Fan motor for evaporator	RL	: Warning indicator lamp
MF2	: Fan motor for condenser	HPRS	: High pressure switch
MC	: Motor for compressor	IOL1	: Internal protector for MF1
MCF	: Relay for fan motor	IOL2	: Internal protector for MF2
MCC	: Relay for compressor motor	IOLTF	: Internal protector for TF
RX	: Auxiliary relay	THS	: Anti-freezing Thermostat
OCC	: Overcurrent relay for MC	CS	: Control switch
OCF1	: Overcurrent relay for MF1	R	: Resistance for lamp
TF	: Transformer	G	: Grounding

Wiring Diagram

5. DATA

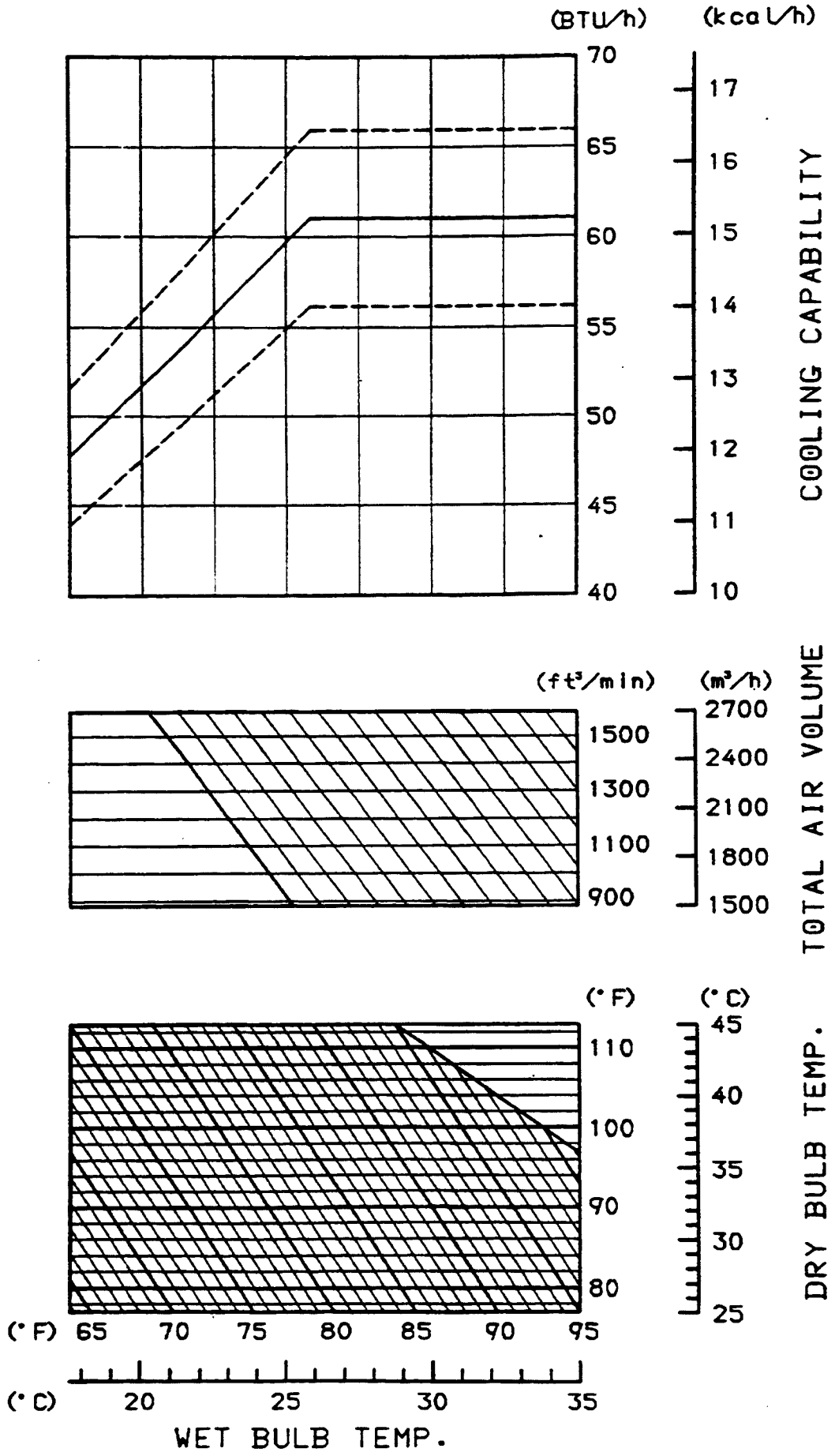
5-1. Exterior Dimensions



Exterior Dimensions

5-2. Cooling Capability Characteristics

1) Cooling Capability Curve



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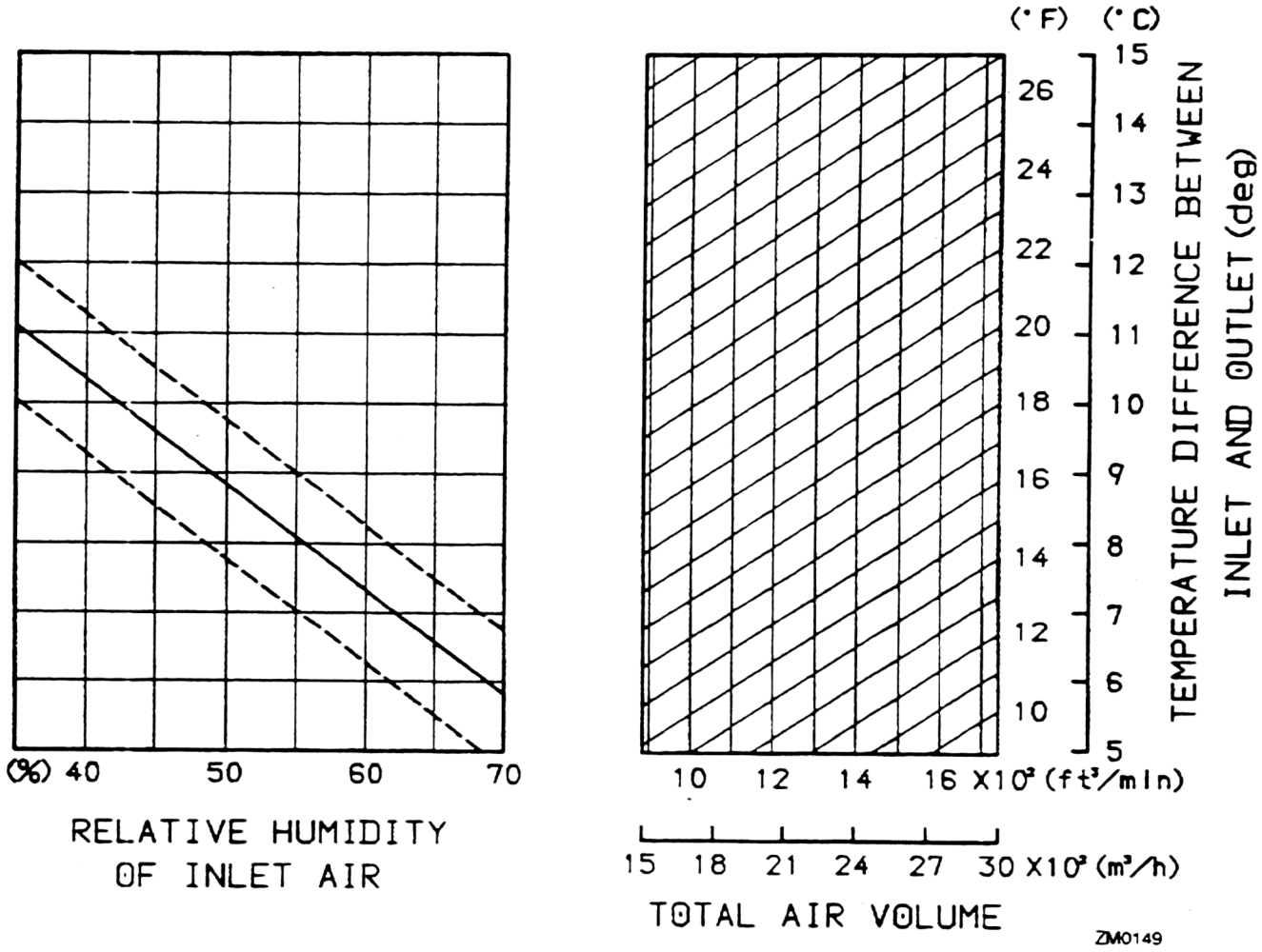
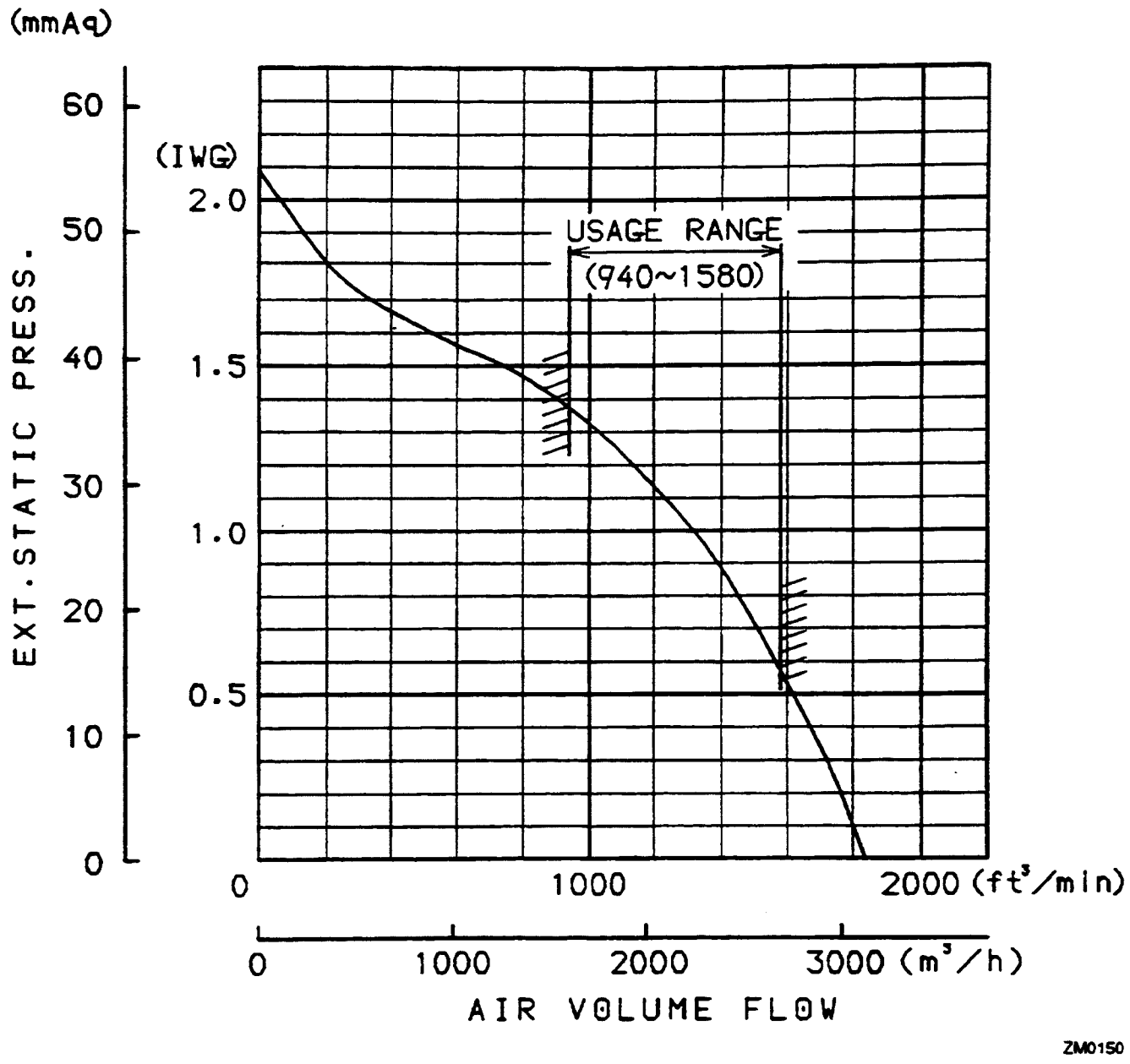
2) Cool Air Temperature Difference Curve



If the air of 104°F or higher is drawn, the temperature of outlet air increase by about 3°F.

3) Extension static pressure and air volume curve of cool air.



Repair

1. TROUBLE SHOOTING

Before trouble shooting this system the following inspection should be performed.

a) Inspection of power source voltage and phase sequence.

Check the voltage of the power source.

Model 50HU : Three phase, 460 volts, 60 Hz.

Check the condition of the fuse or circuit breaker in the power source.

Check the rotating direction of blower. If the blower rotates in the opposite direction, phase sequence of the power soruce is reverse.

Therefore, exchange two of the power cables Connected to the power terminals R, S, and T.

b) Inspection of air filters

Remove the air filters and check the element. If it is dirty, wash it as described in the INSTRUCTION MANUAL.

The following charts are provided as a guide for categorized problem remedies. Detailed information is contained in the following pages.

TROUBLE	SYMPTOM	POSSIBLE CAUSE	REMEDY
Unit does not operate correctly	Unit does not start	1) Defective transformer 2) Defective auxiliary relay 3) Defective control switch 4) Defective overcurrent relays 5) Defective high pressure switch	Refer to 4-1 Refer to 4-11 Refer to 4-2 Refer to 4-9
	Unit starts, but stops immediately	1) Defective evaporator fan motor 2) Defective condenser fan motor 3) Defective compressor motor	Refer to 4-4 Refer to 4-4 Refer to 4-7
	Unit operates, but stops after a while	1) Defective compressor motor 2) Defective condenser motor 3) Refrigerant leakage 4) Reverse rotation of the condenser fan motor 5) High environment condition	Refer to 4-7 Refer to 4-4 Refer to 5-1 Exchange two of the power wires Refer to 2-2
Evaporator is covered with frost		1) Low environment condition 2) Clogged evaporator 3) Defective evaporator motor 4) Defective thermostat 5) Loose-fitting of the anti-freezing thermostat tip	Refer to 2-2 Refer to 2-1 Refer to 4-4 Refer to 4-5 Tighten

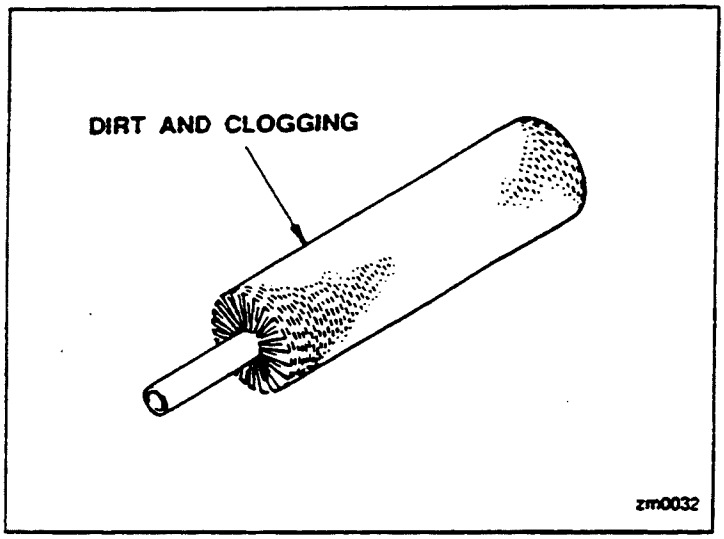
TROUBLE	SYMPTOM	POSSIBLE CAUSE	REMEDY
Water leakage from the unit		1) Defective drain pan (Crack or hole) 2) Defective drain hose (Clogged or loose connection)	Repair Repair or replace
Abnormal noise or shaking		1) Loose compressor mounting nut 2) Loose or deformed condenser fan or evaporator fan 3) Interference of fan and scroll 4) Interference with other materials to the fan	Tighten Tighten or replace Readjust Remove and inspect
Insufficient velocity of cooled air		1) Defective evaporator fan motor 2) Defective evaporator fan motor relay 3) Frozen evaporator 4) Reverse rotation of the evaporator fan motor 5) Clogged evaporator	Refer to 4-4 Refer to 4-10 Operate in FAN mode to defrost Exchange two of the power wires Refer to 2-1
Insufficient cooling	Compressor and fan motors do not rotate properly	1) Abnormal environment condition 2) Clogged evaporator 3) Refrigerant leakage 4) Clogged refrigerant system 5) Defective compression mechanism of the compressor	Refer to 2-2 Refer to 2-1 Refer to 5-1 Refer to 5-1 Replace
	Compressor motor does not rotate	1) Defective compressor motor 2) Defective compressor relay 3) Defective overcurrent relay 4) Defective control switch 5) Defective thermostat 6) Low environment condition	Refer to 4-7 Refer to 4-8 Refer to 4-9 Refer to 4-2 Refer to 4-5 <Normality>
Cooled air does not come out	Evaporator fan motor does not rotate	1) Defective evaporator fan motor 2) Defective evaporator fan motor relay 3) Defective overcurrent relay 4) Defective auxiliary relay 5) Defective control switch	Refer to 4-4 Refer to 4-10 Refer to 4-9 Refer to 4-11 Refer to 4-2

2. INSPECTION OF UNIT

In case of trouble, perform the following inspection before disassembly.

2-1. Inspection of Clogging at Heat Exchanger of Evaporator and Condenser.

Check the heat exchanger of the evaporator and condenser for dirt and clogging. If they are dirty or clogged, remove and wash each part.



Spine Fins of the Condenser

2-2. Examination of Operating Environment Check the Environment Around the Unit.

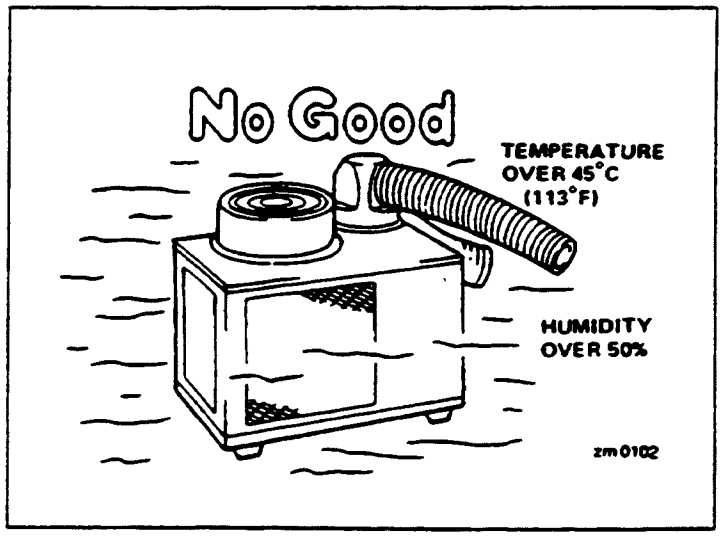
Inlet Air :

45°C (113°F), 50% or lower

25°C (77°F), 50% or higher

If the unit is operated at a higher temperature and/or higher humidity than above, change the location of installation.

If the unit is operated in an environment below this range, the evaporator will freeze.

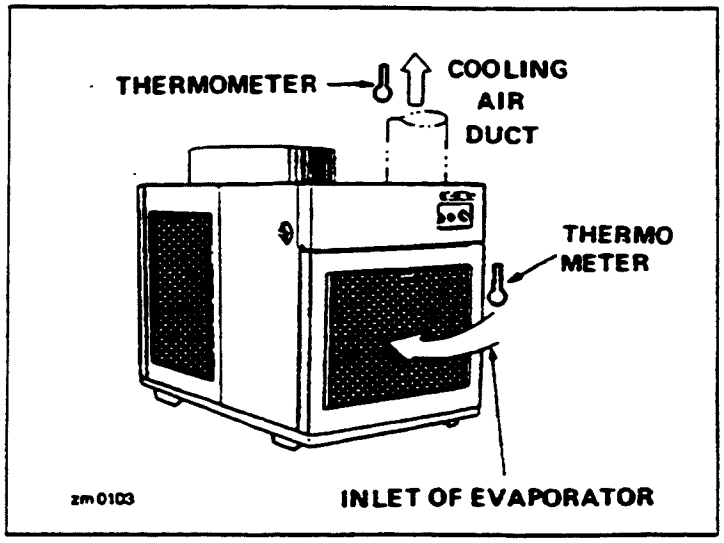


Operating Environment

2-3. Inspection of Cooling Capacity

Measure the difference in temperature between the inlet of evaporator and the cooling air duct.

If the difference is out of the range given in the graph (Refer to 5-2), perform inspection.



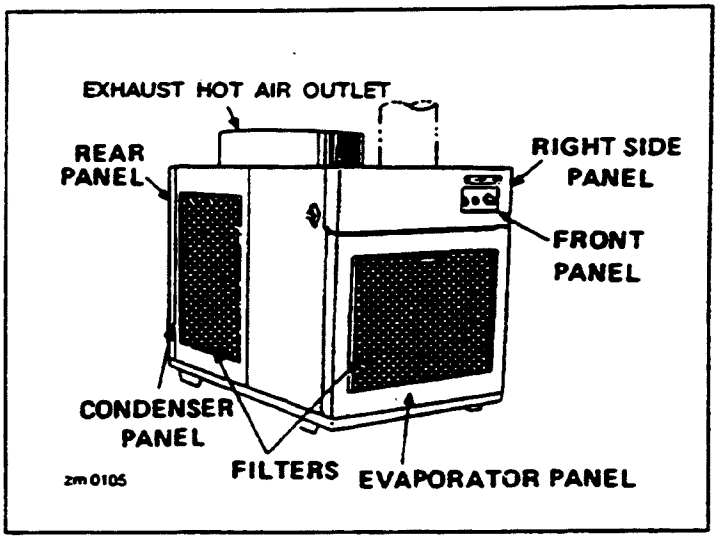
Inspection of Cooling Capacity

3. DISASSEMBLY

(Refer to P.2)

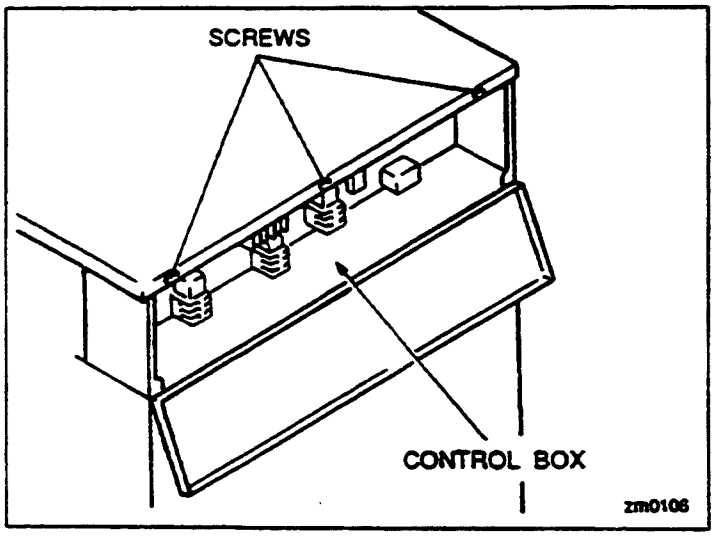
3-1. Removal of Outer Panels

1) Remove the following parts
   1. Filters
   2. Exhaust hot air outlet
   3. Front panel
   4. Evaporator panel
   5. Condenser panel
   6. Right side panel
   7. Rear panel



Removal of Outer Panels

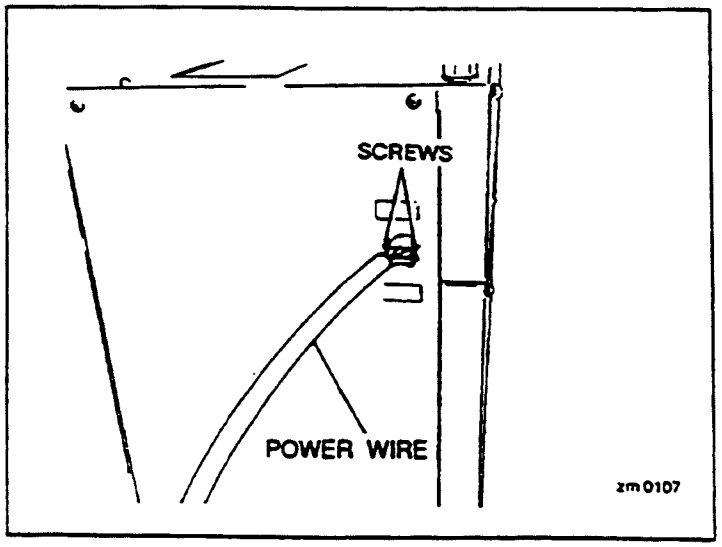
2) Remove the three screws from the control box and open the control box cover.



Removal of Control Box Cover

3) Remove the four lead wires of the power wire from the terminal block. Loosen the two screws fixing the conduit and disconnect the power wire. (Power wire is not provided.)

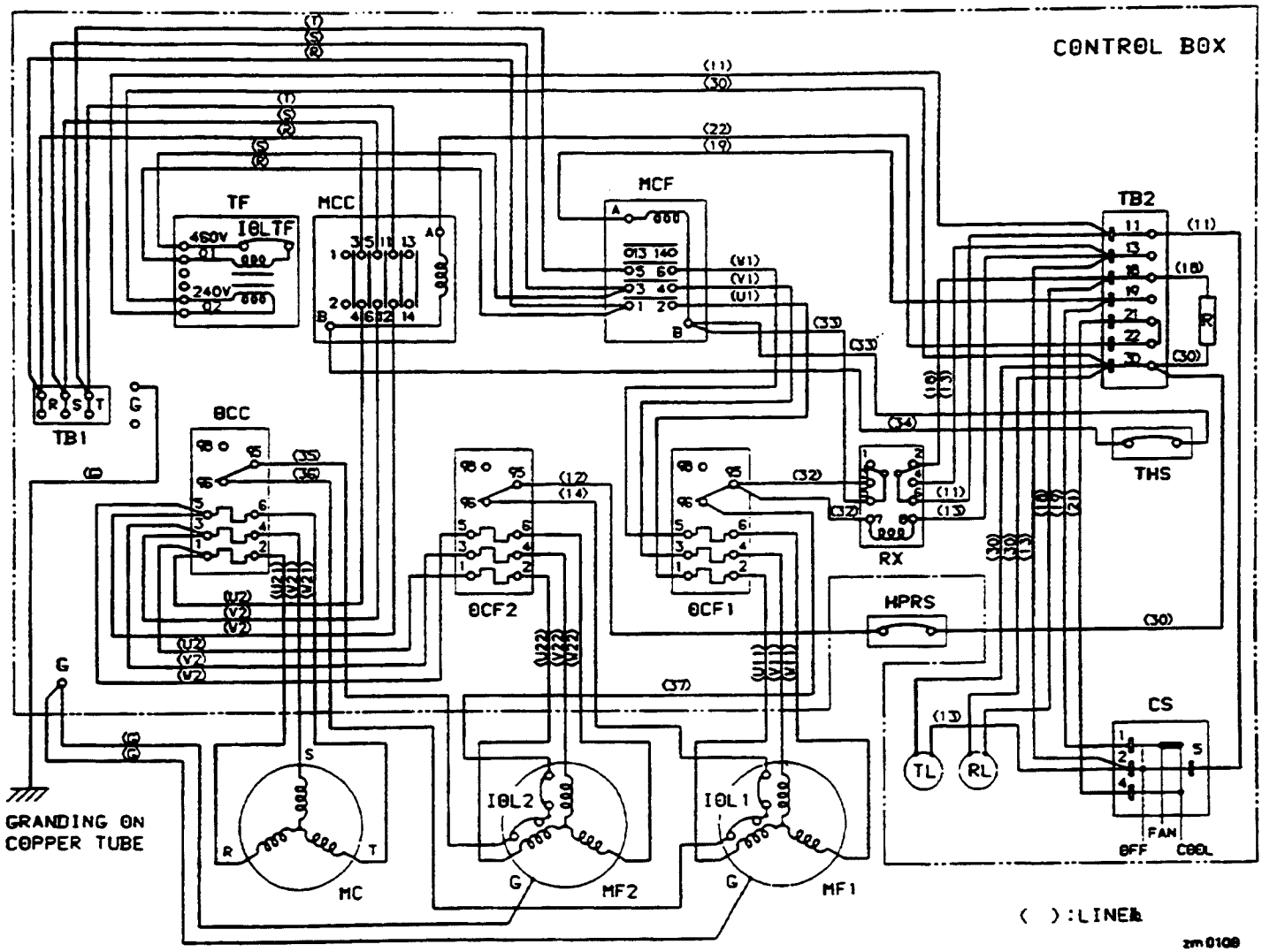
4) Remove left side panel.



Removal of Power Wire

3-2. Removal of Electrical Parts

1) Remove the electrical wiring according to the wiring diagram as shown below.

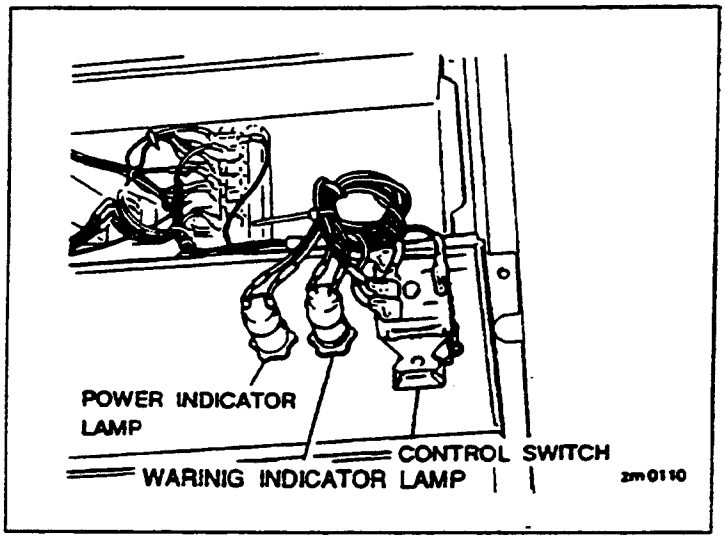


TB1	: Terminal block for power	OCF2	: Overcurrent relay for MF2
TB2	: Terminal block for control	TL	: Power indicator lamp
MF1	: Fan motor for evaporator	RL	: Warning indicator lamp
MF2	: Fan motor for condenser	HPRS	: High pressure switch
MC	: Motor for compressor	IOL1	: Internal protector for MF1
MCF	: Relay for fan motor	IOL2	: Internal protector for MF2
MCC	: Relay for compressor motor	IOLTF	: Internal protector for TF
RX	: Auxiliary relay	THS	: Anti-freezing Thermostat
OCC	: Overcurrent relay for MC	CS	: Control switch
OCF1	: Overcurrent relay for MF1	R	: Resistance for lamp
TF	: Transformer	G	: Grounding

Wiring diagram

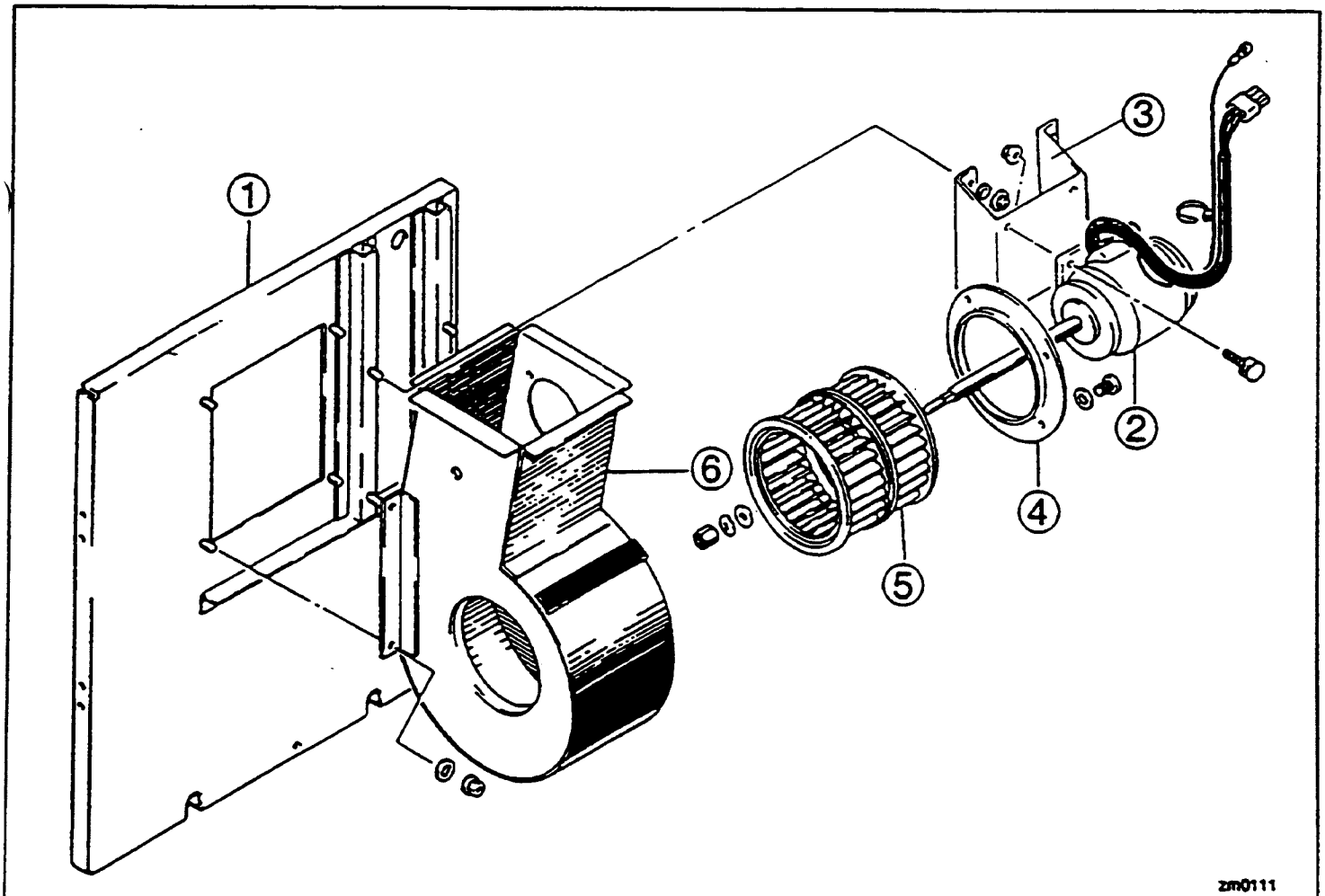
2) Remove the electrical parts, in the control box. (Refer to P.11)

3) Remove the control switch, power indicator lamp and warning indicator lamp as shown.



Removal of Control Switch

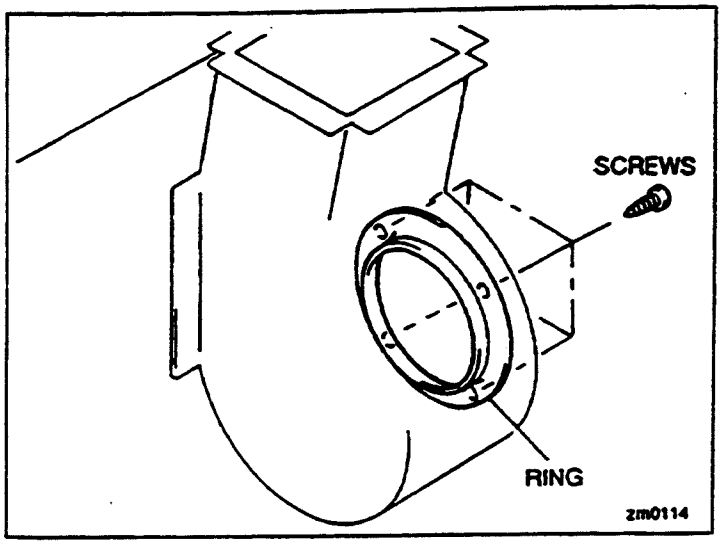
3-3. Removal of Blower Assembly (for evaporator)



1. Frame
2. Fan motor
3. Motor mounting bracket
4. Ring
5. Fan
6. Fan casing

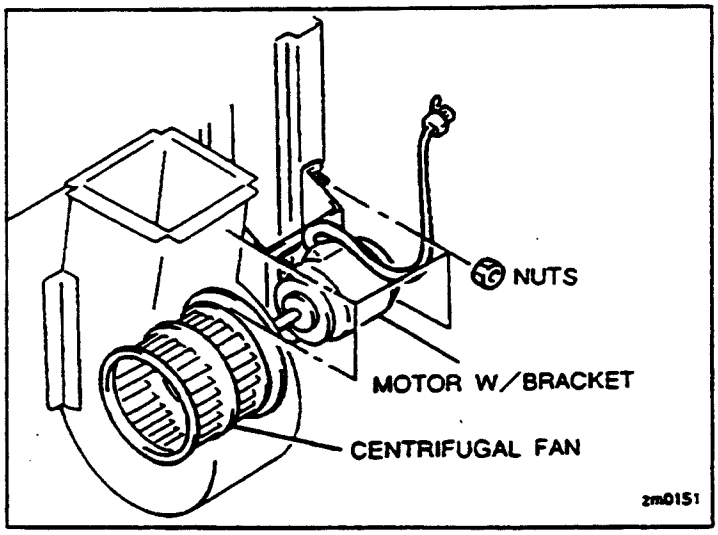
Blower Assembly

1) Remove the ring by loosening the four screws.



Removal of Ring

2) Remove the fan motor with bracket by loosening the four nuts.



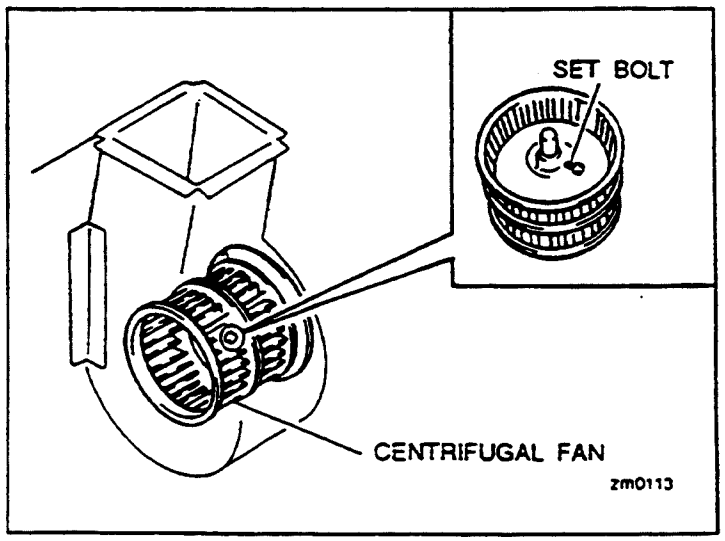
Removal of Motor with Bracket

3) Remove the centrifugal fan by loosening the set bolt and nut (left handed screw) using a hexagonal key wrench and wrench.

NOTE : Tightening torque

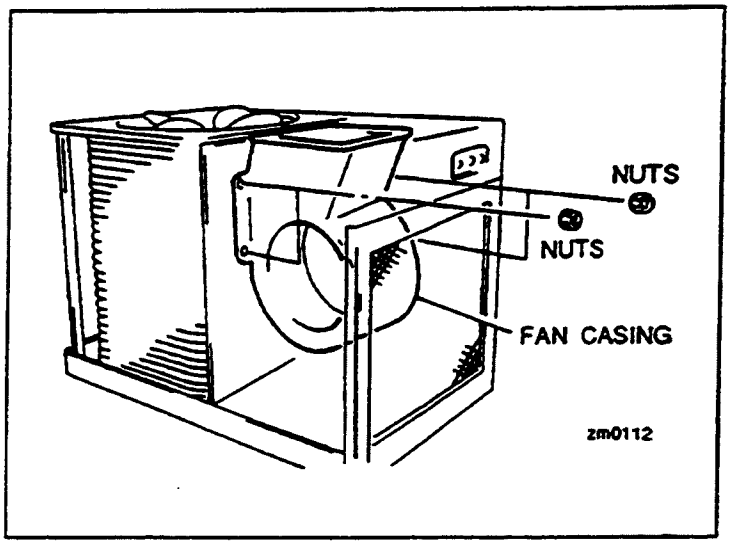
Set bolt : 120~180kg·cm (9.0~13.0 lb-ft)

Nut : 400~500kg·cm (30~35 lb-ft), Left handed screw



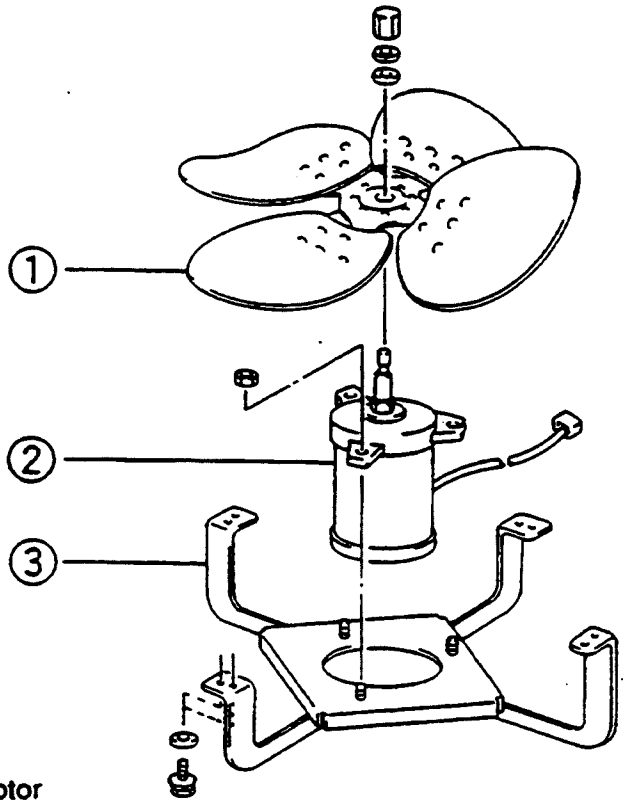
Removal of Centrifugal Fan

4) Remove the fan casing by loosening the four nuts.



Removal of Fan Casing

3-4. Removal of Blower Assembly (for condenser)



1. Fan
2. Motor
3. Bracket, motor

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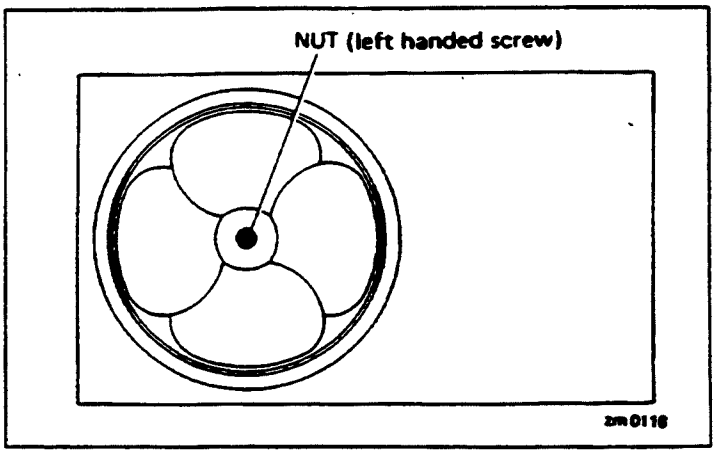
Blower Assembly

1) Remove the fan by loosening the nut (left handed screw).

Note:

Tightening torque for nut.

400～500 kg-cm (30～35 lb-ft)



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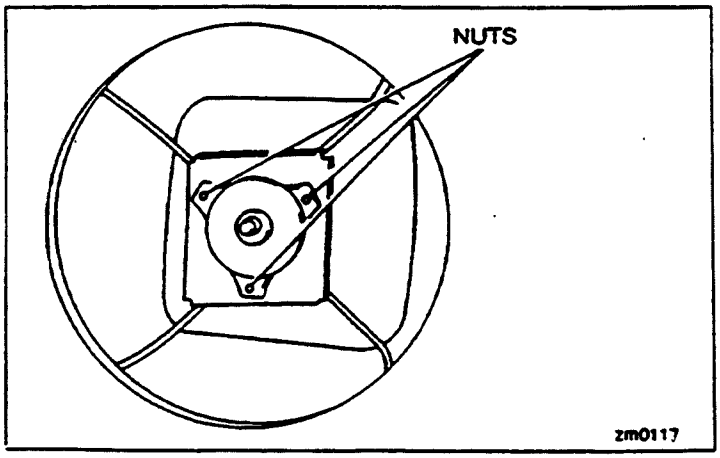
Removal of Fan

2) Remove the blower motor from bracket by loosening the three nuts.



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Removal of Blower Motor

4. INSPECTION AND REPAIR OF ELECTRICAL SYSTEM

4-1. Inspection of Transformer

Measure resistance between the terminals (460V-01, 240V-02) of the transformer.

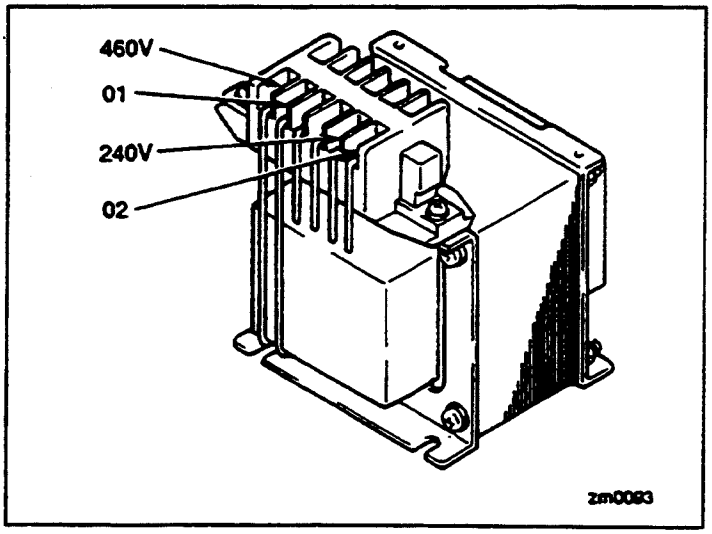
Resistance : 460V-01 (Primary coil) : 75Ω (at 20°C)

240V-02 (Secondary coil) : 24Ω (at 20°C)

Note:

Primary rated voltage AC 460 volts

Secondary rated voltage AC 240 volts



Inspection of Transformer

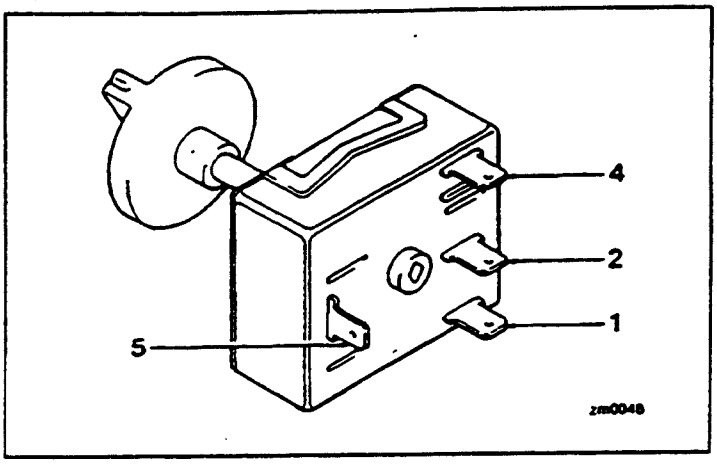
If the resistance is not comparable to the above standard values, replace the transformer.

4-2. Inspection of Control Switch

At each position of the control switch, there should be continuity across the following terminals.

Switch Position	Conducting Terminals
OFF	2 - 5
FAN	1 - 5
COOL	1 - 5, 4 - 5

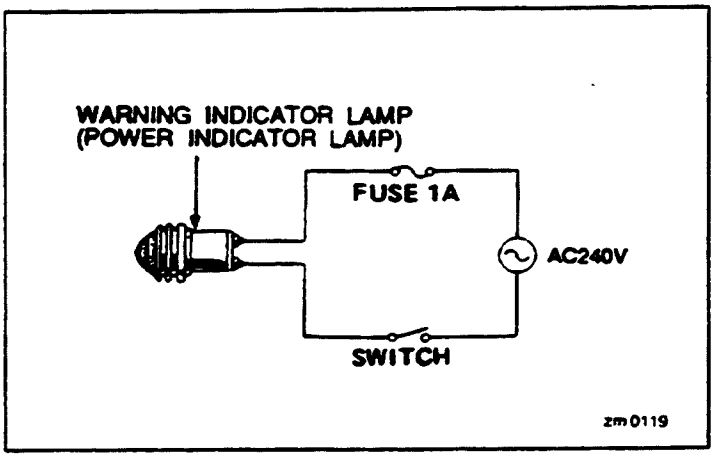
If there is no switch continuity, replace the control switch.



Inspection of Control Switch

4-3. Inspection of Warning Indicator Lamp and Power Indicator Lamp.

Make a test circuit as shown in the figure. If the lamp fails to light up, replace it.



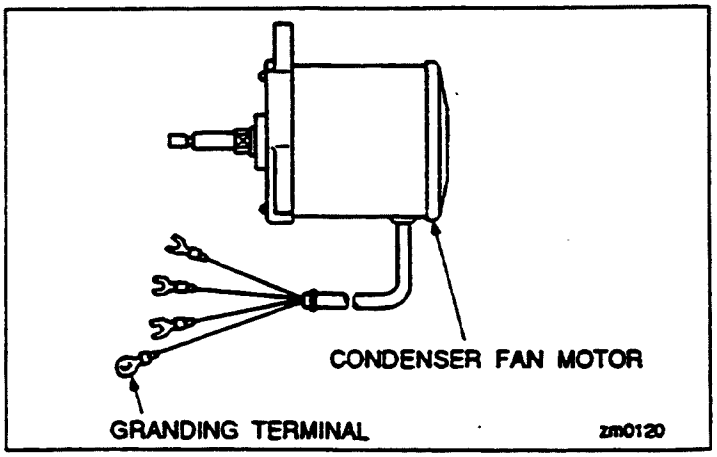
Inspection of Lamps

4-4. Inspection of Fan Motor

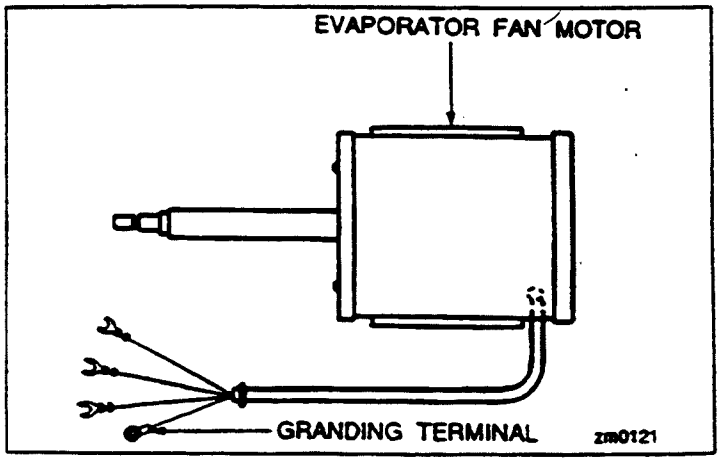
Measure the resistance between each terminal of the fan motor. (Except the earth terminal)

Condenser fan motor : 45.7Ω (at 20°C)
Evaporator fan motor : 24.8Ω (at 20°C)

If the resistance is not comparable to the above standard values, replace the fan motor.



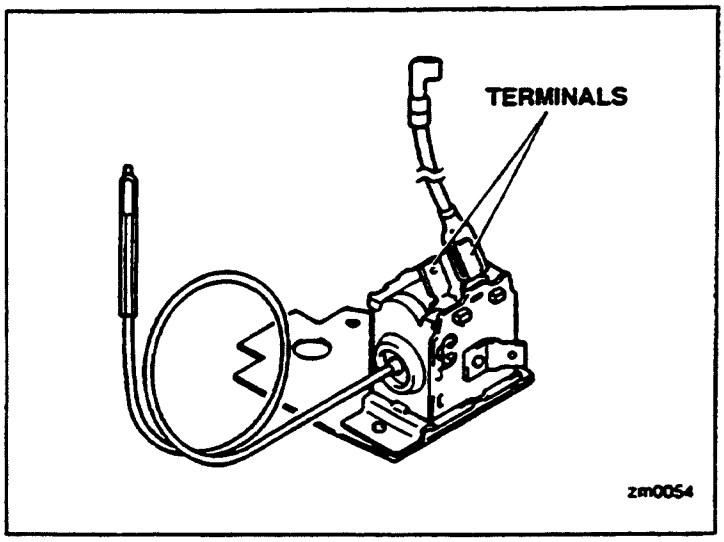
Inspection of Condenser Fan Motor



Inspection of Evaporator Fan Motor

4-5. Inspection of Anti-freezing Thermostat

At normal temperature, (18°C or higher) there should be continuity across the two terminals. If not, replace the thermostat.



Inspection of Anti-freezing Thermostat

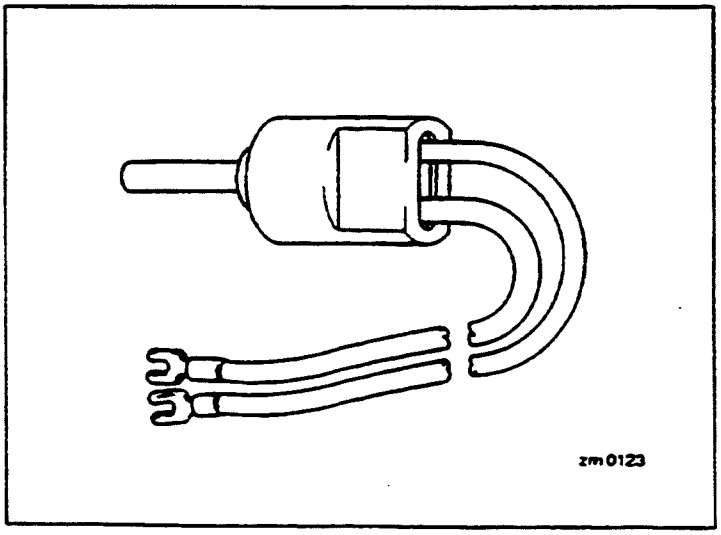
4-6. Inspection of High Pressure Switch

At normal pressure when the unit is off, there should be continuity across the two terminals. If not, replace the high pressure switch.

Note:

Cut off pressure 27.5 kg/cm²G (391 PSIG)

Reset pressure 20.5 kg/cm²G (291 PSIG)



Inspection of High Pressure Switch

4-7. Inspection of Compressor Motor

Measure resistance across the terminals (R, S, T) of the compressor motor.

Resistance : 2.30~2.64Ω (at 25°C)

If the resistance is not comparable to the above standard values, replace the compressor.

4-8. Inspection of Compressor Relay & Fan Motor Relay

Check for continuity across the terminals when the test button is depressed and/ again when released.

Depressed:

All terminal pairs are conducting.

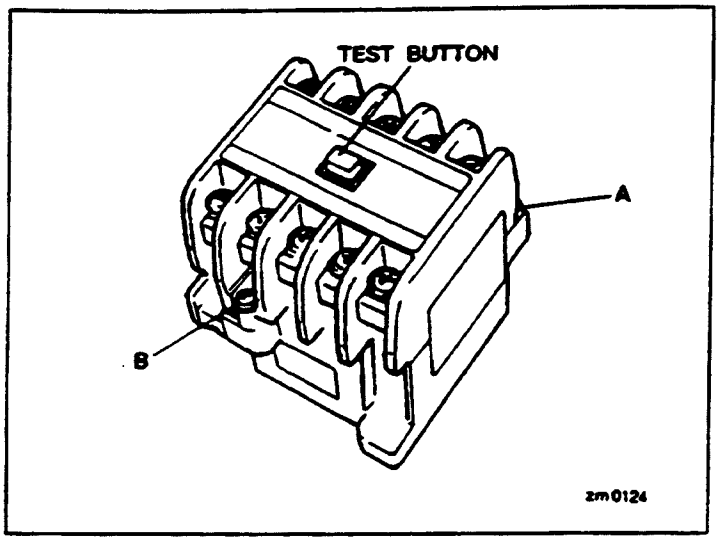
Released:

All terminal pairs are not conducting.

Measure the resistance across terminals A and B.

Standard resistance: 650~800Ω

If the resistance is out of this range, replace the relay.



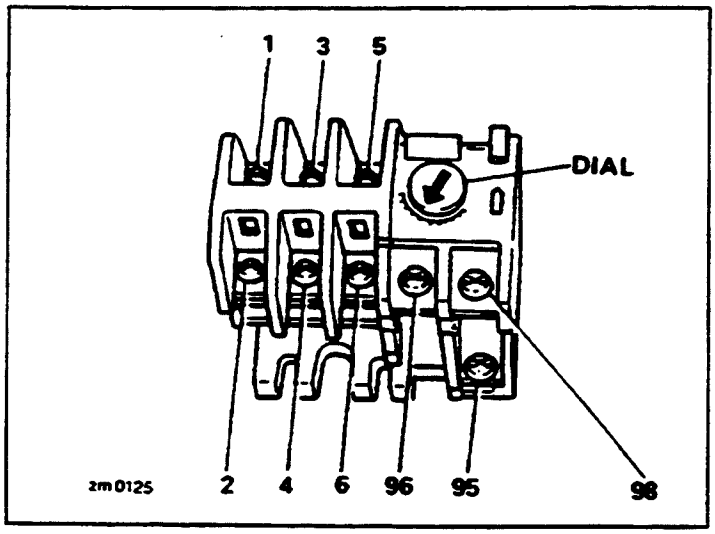
Inspection of Compressor & Fan Motor Relay

4-9. Inspection of Over Current Relays

Check for continuity across the terminals 1-2, 3-4 and 5-6. These terminal pairs are conected by a low resistance coil.

At normal condition (power source disconnected), these should be continuity across terminals 96 and 95.

If there is no continuity between any of the terminal pairs, replace the overcurrent relay.



Inspection of Over Current Relays

Note:

1. Do not turn the dials of over current relays. These dials have been factory-adjusted.
2. These over current relays are automatic resetting type.

	For Compressor	For Evaporator fan motor	For Condenser fan motor
Dial Settings	11.5A	1.4A	1A

4-10. Inspection of Auxiliary Relay

Check for continuity between the relevant terminals as follows.

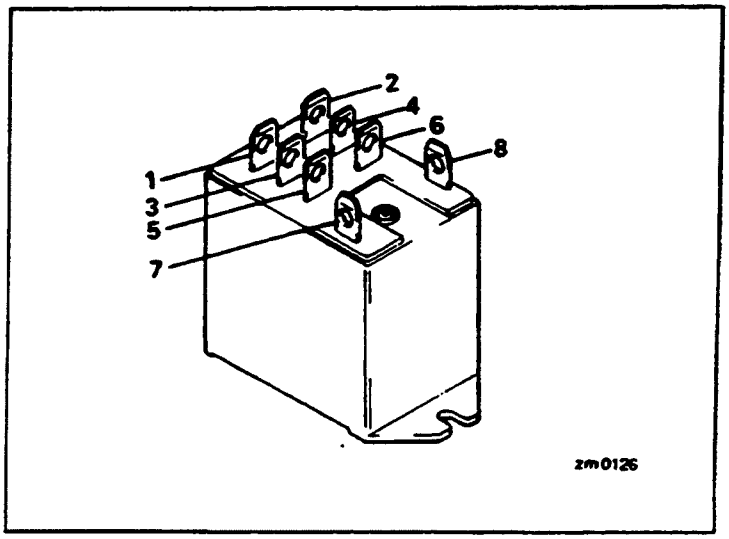
Terminals							
7	8	1	2	3	4	5	6
Appling no voltage		○				○	
			○				○
Appling voltage 240V (AC)				○		○	
					○		○

* ○——○ : CONTINUITY

Measure the resistance across terminals 7 and 8.

Standard resistance: 14~16kΩ.

If the resistance is out of this range, and/or continuity is not as per the above table, replace the auxiliary relay.



Inspection of Auxiliary Relay

4-11. Inspection of Wiring Connection

Refering to 3-2, check for correct connection of each wire.

5. INSPECTION AND REPAIR OF REFRIGERANT SYSTEM

5-1. Inspection

When something is wrong with the refrigerant system, it fails to cool effectively. Possible causes are clogging, leakage or insufficient refrigerant. In such a case, carry out the following inspection procedure.

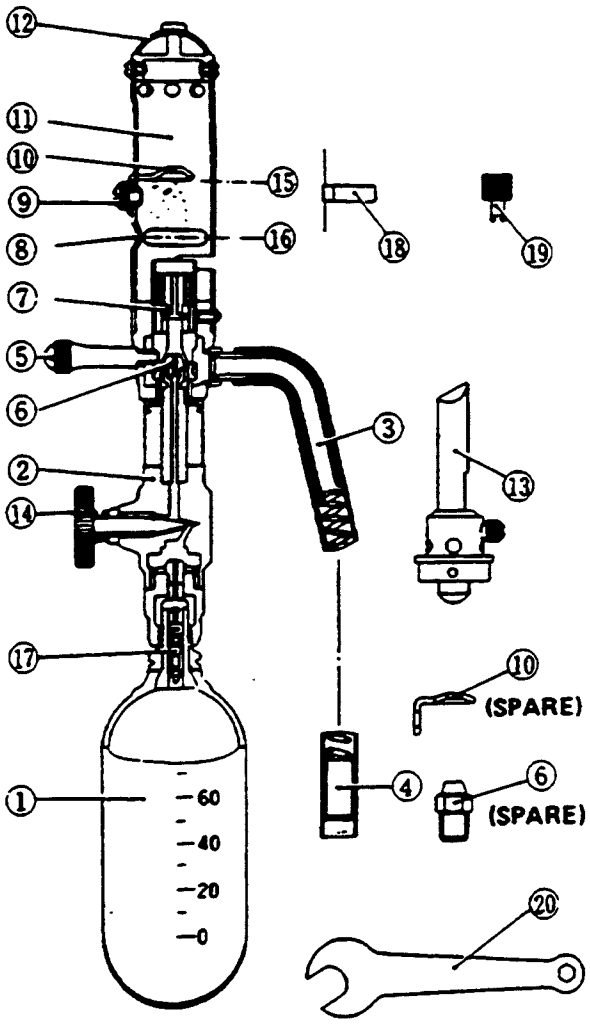
5-1-1. Inspection of Refrigerant Clogging

Check for clogging in the component parts of the refrigerant system and the pipes connecting them. The clogged area of the regrigerant cycle can be detected by the appearance of frost in the affected region. In such a case, change the part in question.

5-1-2. Inspection of Refrigerant Leak

Carefully check all connections, and each component for leaks whenever the refrigerant system is installed or repaired.

Use the gas detector to inspect the system.



1. GAS LEAK TESTER BULB
2. GAS LEAK TESTER BODY
3. INTAKE TUBE
4. FILTER
5. COMBUSTION CYLINDER HOLDER
6. NOZZLE
7. FLAME DIVIDER
8. IGNITING HOLE
9. REACTOR PLATE SCREW
10. REACTOR PLATE
11. COMBUSTION CYLINDER
12. COMBUSTION CYLINDER CAP
13. CAP (for using leak detector as soldering iron)
14. ADJUSTING HANDLE
15. FLAME LENGTH (UPPER LIMIT)
16. FLAME LENGTH (LOWER LIMIT)
17. PROPANE CONTAINER NOZZLE
18. NOZZLE CLEANER
19. WRENCH
20. WRENCH

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Gas Leak Tester

The gas detector should be used in the following way:

1) Check the amount of propane liquid in the container.
2) Install the propane container to the gas detector body by turning it fully clockwise.
3) When lighting the detector, insert the match into the igniting hole and turn the adjusting handle slowly counterclockwise.
   This will ignite the gas detector.
4) The reactor (copper ring) must be red hot, but the flame must be kept as small as possible. The smaller the flame, the more sensitive the detector.
5) Hold the tip of the sensing tube at all possible leakage points.
6) Watch for a change in the flame colour.
   If there is no leak, the flame will be almost colourless.
   The slightest leak will be indicated by a brightly coloured flame.
   Colour of flame:
   When leak is very small·····Colour of flame is light green.
   When leak is large·····Colour of flame is bright blue.
   When leak is very large·····Colour of flame is purple.

Note: a) Always hold the tester vertically when detecting a leak.
b) Use adequate ventilation, burned R-22 is poisonous and should not be inhaled.
c) Never make a gas leak check near flammable materials.

5-1-3. Insufficient Refrigerant

Should test 2, 3 confirms poor cooling performance, then carry out inspections 5-1-1 and 5-1-2 and rectify any trouble found. The system should then be charged with refrigerant in accordance with 5-3.

5-2. Repair of Refrigerant System

In case there is a leaks, clogging or trouble in the refrigerant system of the Spot Cool replace or repair the part in question. All the connections of the refrigerant system have been brazed. When removing or reassembling these connections, they must be brazed.

5-2-1. Correct Brazing Work

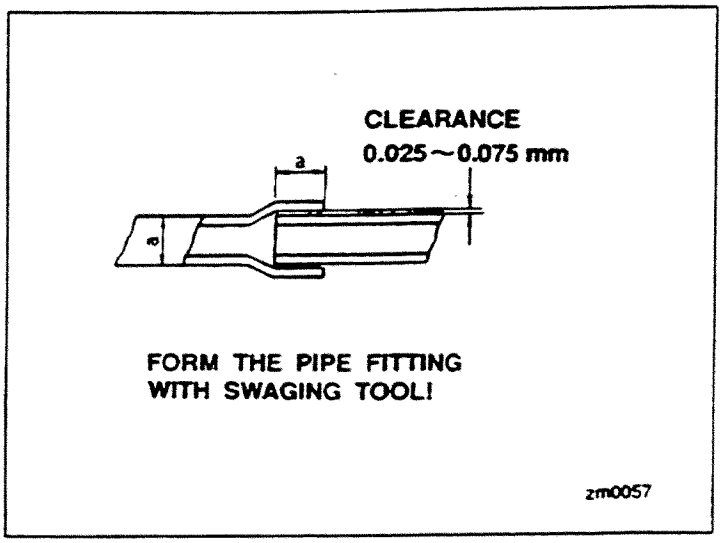
It is desirable to use a slightly reduced flame. Oxy-acetylene is often used, as it is easy to judge and adjust the condition of the flame. Unlike gas welding, a secondary flame is used for brazing.
It is necessary to preheat the base metal properly depending on the shape, size or thermal conductivity of the brazed fitting.

The most important point in flame brazing is to bring the whole brazed fitting to a proper brazing temperature. It is also important to take care not to cause overflow of brazing filler metal, oxidization of brazing filler metal, or deterioration due to the overheating of flux.

1) Correct Fitting, Correct 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 is very important.

As for the shape of the brazed fitting, it is necessary to maximize its bonding area. The clearance of the brazed fitting must be minimized in order to draw in the brazing filler metal by capillary action.



Brazed Fitting and Its Clearance

2) Cleaning of Blazing Filler Metal and Pipe

Whe removing pipework and/or connections, it is most important to ensure that all surfaces to be re-brazed are clean and free from old brazing filler metal, oil, dust and dirt. This should be done with sandpaper or a solvent such as trichlene.

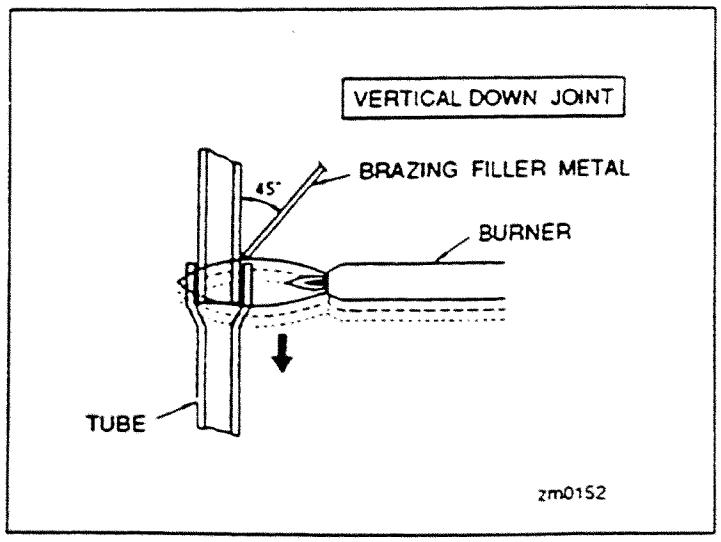
3) Use of Dry Nitrogen Gas

During brazing, the inside surface of the pipe undergose an oxidative process due to the high temperatures. To prevent oxidization conduct dry nitrogen gas (1 l/min ; adjust with the flow regulator) through the pinch-off tube of the refrigerant cycle.

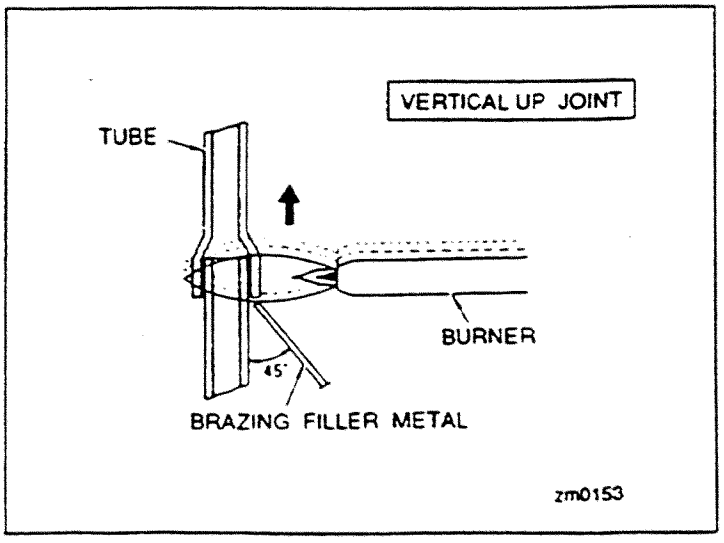
4) Take care not to allow dirt, water, oil, etc. to enter into the pipe.

5) Vertical Joint

Heat the entire brazed fitting to the correct temperature. Hold the brazing filler metal in contact with the fitting so that it starts to flow by itself. Stop heating the fitting as soon as the brazing filler metal flows into the clearance.



Vertical Down Joint



Vertical Up Joint

5-2-2. Removal of Refrigerant Cycle Relatives

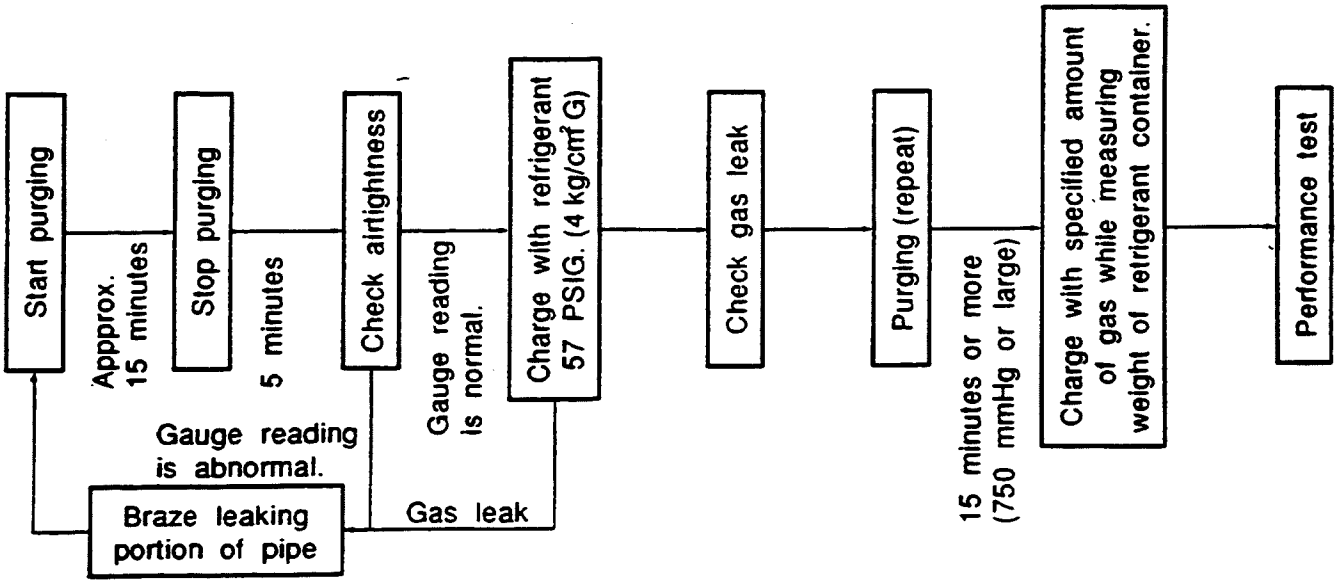
1. When removing a brazed portion, protect the other parts from the flame with a steel plate, asbestos, etc.
2. Before removing the brazed portion from the refrigerant cycle, be sure to cut off the end of the pinch-off tube and bleed the cycle of gas.
3. In this case, also bleed the refrigerant cycle of N_2 gas through the open pinch-off tube in order to prevent oxydization.

5-3. Charging the System with R-22

Be sure to purge and charge the system with refrigerant to the specified amount in the following way:

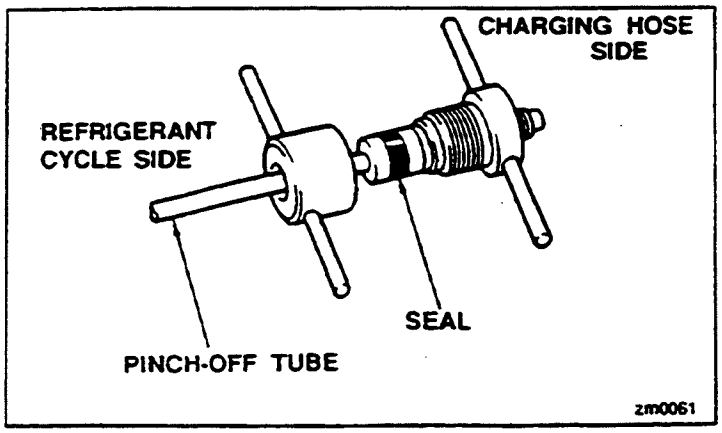
CAUTION:

1) When handling refrigerant (R-22), the following precautions should be observed.
   A) Always wear eye protection while handling refrigerant.
   B) Keep the refrigerant container below 40°C (104°F).
   C) Do not handle refrigerant in an enclosed room.
   D) Do not handle refrigerant near an open flame (especially while smoking a cigarette).
   E) Discharge refrigerant slowly, when purging a system.
   F) Be careful that the liquid refrigerant does not contact skin.
2) If liquid refrigerant comes into contact with skin or eyes:
   A) Do not rub the eye or skin.
   B) Splash large quantities of cool water on the eye or skin.
   C) Apply clean petroleum jelly to the skin.
   D) Rush to doctor or hospital for immediate professional treatment.
   E) Do not attempt to treat it yourself.



5-3-1. Connection of Gauge Manifold

1) Cut off 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.



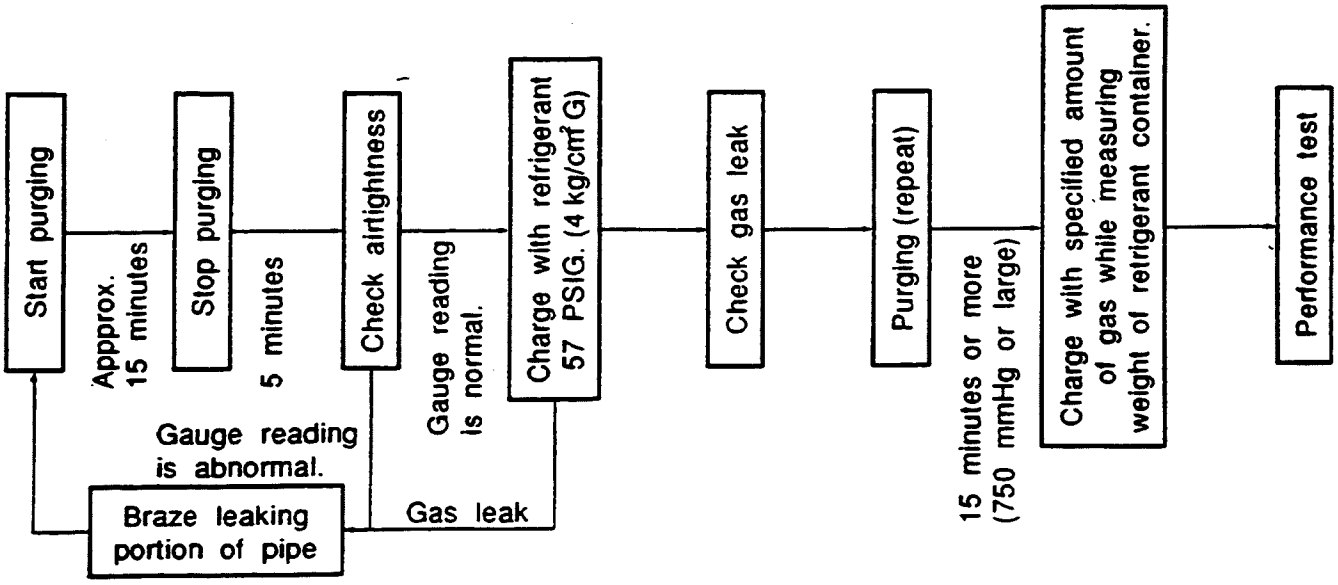
Mounting of Precess Tube Fitting

5-3. Charging the System with R-22

Be sure to purge and charge the system with refrigerant to the specified amount in the following way:

CAUTION:

1) When handling refrigerant (R-22), the following precautions should be observed.
   A) Always wear eye protection while handling refrigerant.
   B) Keep the refrigerant container below 40°C (104°F).
   C) Do not handle refrigerant in an enclosed room.
   D) Do not handle refrigerant near an open flame (especially while smoking a cigarette).
   E) Discharge refrigerant slowly, when purging a system.
   F) Be careful that the liquid refrigerant does not contact skin.
2) If liquid refrigerant comes into contact with skin or eyes:
   A) Do not rub the eye or skin.
   B) Splash large quantities of cool water on the eye or skin.
   C) Apply clean petroleum jelly to the skin.
   D) Rush to doctor or hospital for immediate professional treatment.
   E) Do not attempt to treat it yourself.



5-3-1. Connection of Gauge Manifold

1) Cut off 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.
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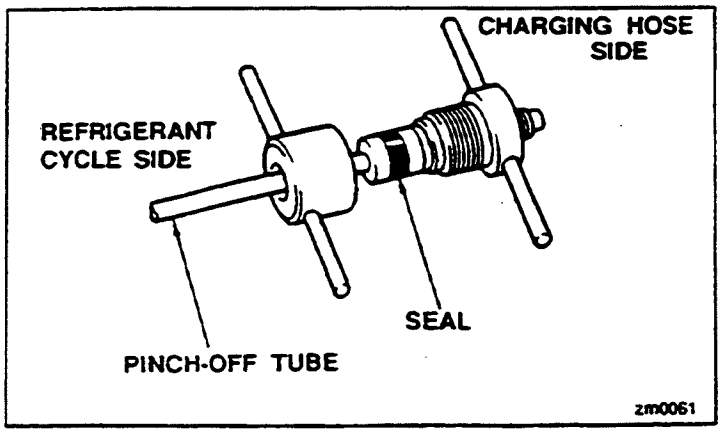
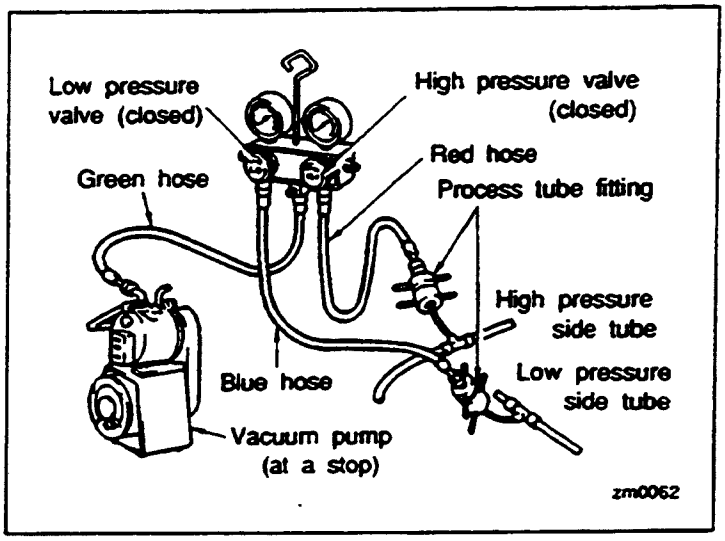


Mounting of Precess Tube Fitting

3) Connect the charging hoses (red one on high pressure side, and blue one on low pressure side) of the gauge manifold to the process tube fittings.

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

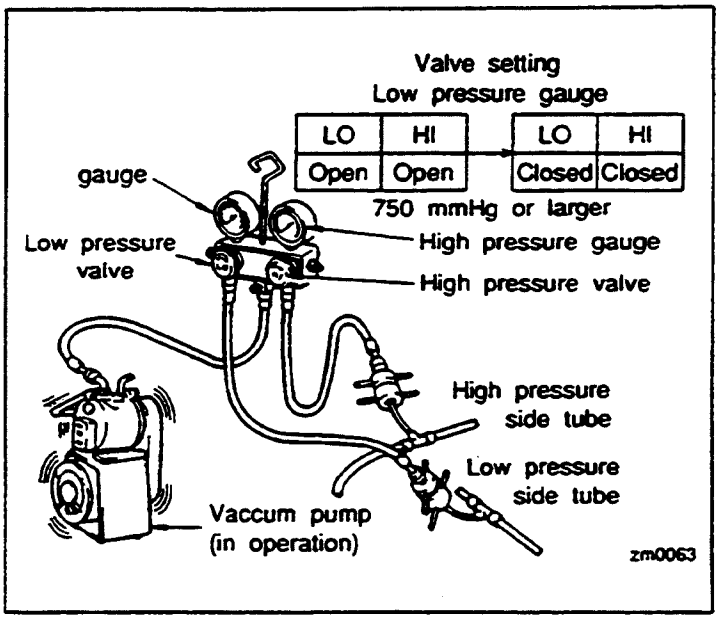
4) Connect the charging hose (green) at the center of the gauge manifold to the vacuum pump.



Connection of Gauge Manifold

5-3-2. Purging

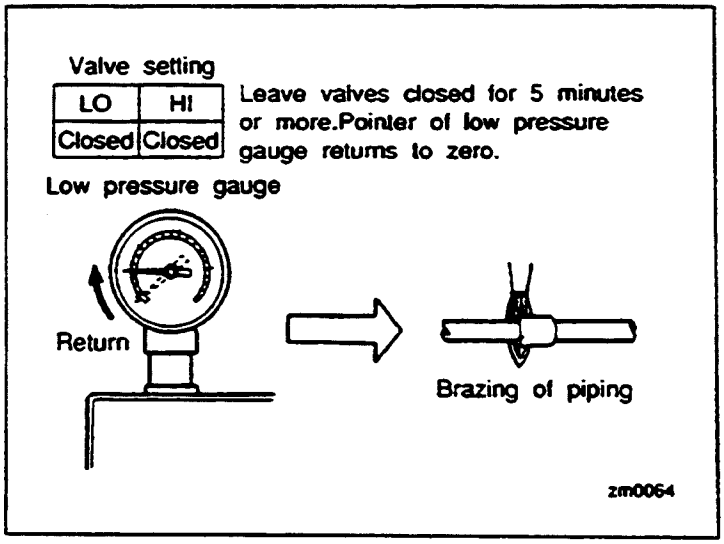
1) Open the high pressure valve (HI) and the low pressure valve (LO) of the gauge manifold.
2) Turn on the vacuum pump to start purging. (purge the system for approx. 15 minutes.)
3) When the negative pressure gauge reading (degree of vacuum) reaches *750 mmHg or more*, close the high pressure valve and the low pressure valve of the gauge manifold and turn off the vacuum pump.



Purging

5-3-3. Checking Airtightness

1) Leave the high pressure valve and the low pressure valve of the gauge manifold closed for five 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 such a case, locate the detecting point and re-braze. Purge the system once more, and confirm there is no leak.

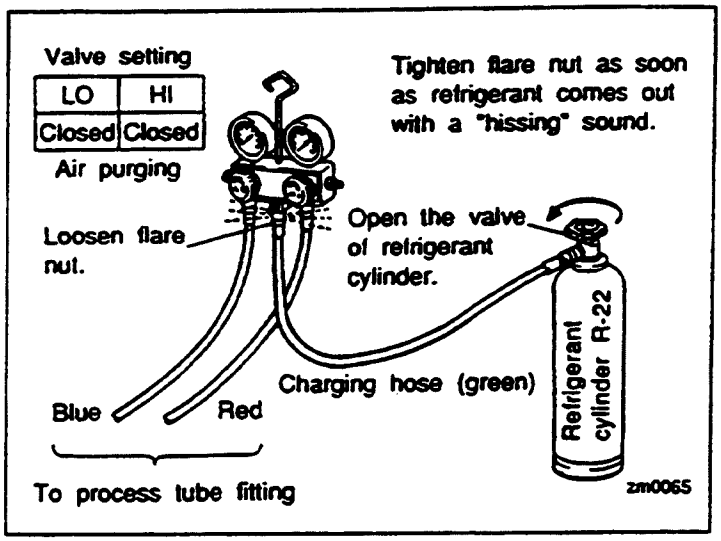


Checking Airtightness

5-3-4. Checking Gas Leak

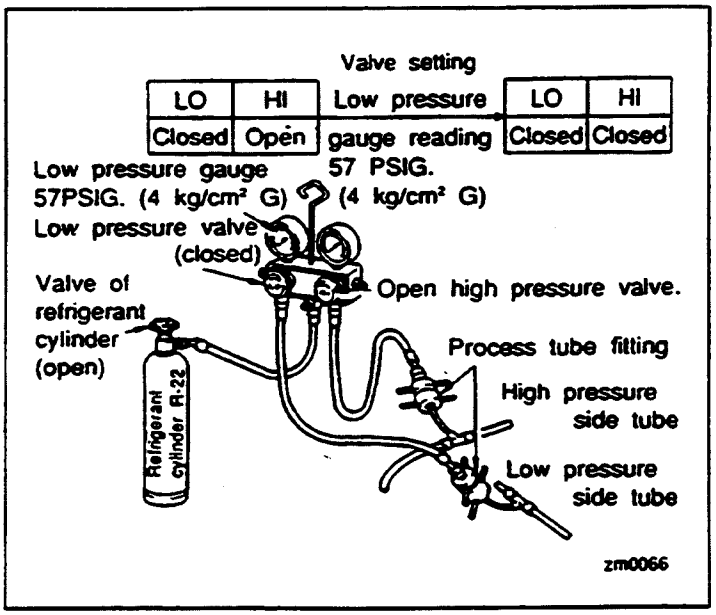
1) Remove the charging hose (green) from the vacuum pump, and connect the hose to the refrigerant cylinder (R22).

Note: Before this step, fit *the mouthpiece for refrigerant cylinder (service tool : No. 945502050)*, to the outlet of the refrigerant cylinder.



Purging Air Inside Charging Hose

2) Loosen the nut on the gauge manifold side of the charging hose (green). Open the valve of the refrigerant cylinder to purge air from inside the charging hose. (As soon as a "hissing" sound is heard, tighten the nut as it was before.)
3) Open the high pressure valve of the gauge manifold. Charge the system with refrigerant until the low pressure gauge indicates *75 PSIG. (4 kg/ cm²G)*.
   After charging is complete, close the high pressure valve.
4) Check carefully for gas leak inside the refrigerant cycle using the gas leak tester.
5) Correct (braze) leaking portions, if any.



Charging with Refrigerant for Gas Leak Check

CAUTION:

Before checking for gas leak, fully confirm that there is nothing flammable in the area to cause an explosion or fire. Since contact of refrigerant with an open fire generates toxic gas (phosgene), take care not to breathe it.

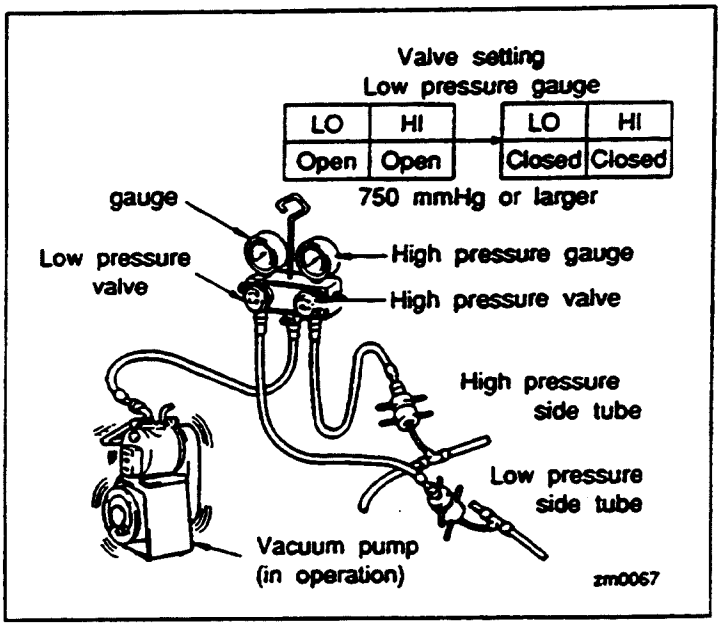
5-3-5. Purging (Repeat)

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

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

2) In the procedure of above "5-3-2.", purge the system until the low pressure gauge indicates *750mmHg or more.* (For 15 minutes or more)

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



Purging (Repeat)

CAUTION:

Be sure to purge the system twice or more using the repetitive vacuum method.
Purge the system an additional time on rainy or humid days.

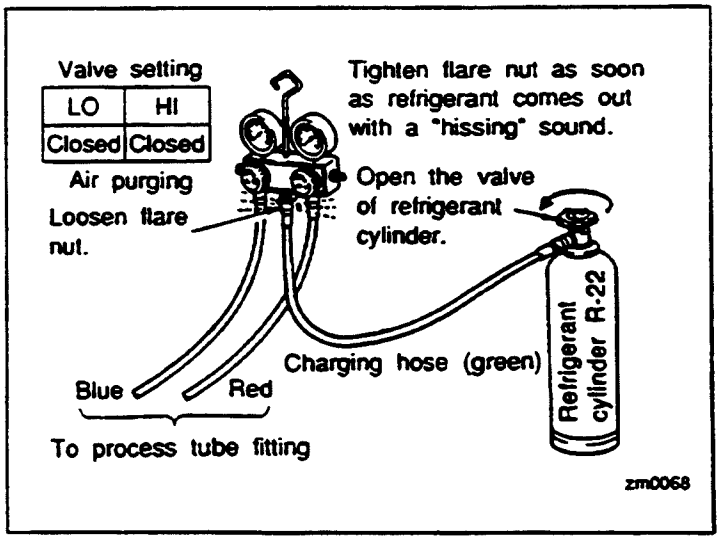
5-4. Refrigerant Charging Work

5-4-1. Refrigerant charging

1) Remove the charging hose (green) from the vacuum pump, and connect it to the refrigerant cylinder (R-22).

2) Loosen the nut on the gauge manifold side of the charging hose (green). Open the valve of the refrigerant cylinder, and purge the air from inside the charging hose.

   Note: At this time, tighten the nut as soon as the air comes out with a "hissing" sound.



Purging Air Inside Charging Hose

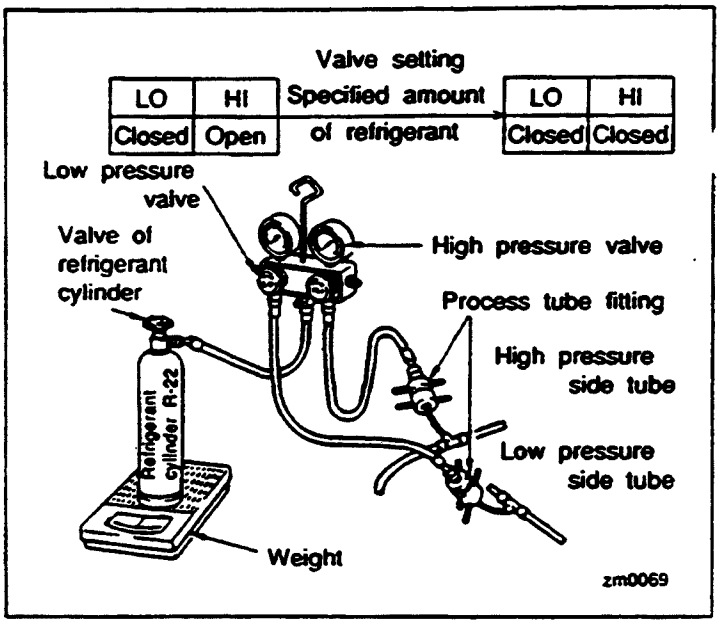
3) Place the refrigerant cylinder on a scale. (weighting capacity: 70 lbs; graduated in 0.2 oz.)

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, looking at the graduations of the scale.

[Specified Charging Amount of Refrigerant]

Model Charging	Charging Amount of Refrigerant
50HU	1.59 lbs. $^{+0.7}_{-0}$ oz. $\left(720\ ^{+20}_{-0}\ g\right)$



Charging with Refrigerant

If the system cannot be charged with the specified amount of refrigerant under this condition, follow the steps below:

1. Close the high-pressure valve of manifold.
2. Run the system.
3. Slowly open the low-pressure valve while looking at the scale reading.
4. When the scale reads the specified amount, immediately close the low pressure valve.
5. Bring the system to a stop.

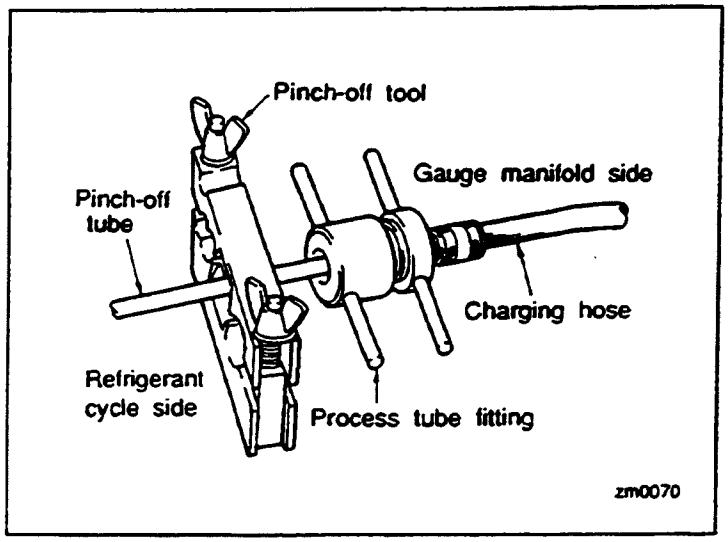
CAUTION:

The charging amount of refrigerant, has a great effect on the cooling capacity.
Charge to the specified amount, always looking at the scale graduations.

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

5-4-2. Removal of Gauge Manifold

1) Pinch off the pinch-off tube with a pinch-off tool.
2) Remove the gauge manifold charging hose and the process tube fitting. Crush the end of the pinch-off tube, with the pinchi off tool still in position
3) Braze the end of the pinch-off tube.
4) Remove the pinch off tool and make sure that gas leakage is not observed at the pinched off portion and the brazed end.



Removal of Gauge Manifold

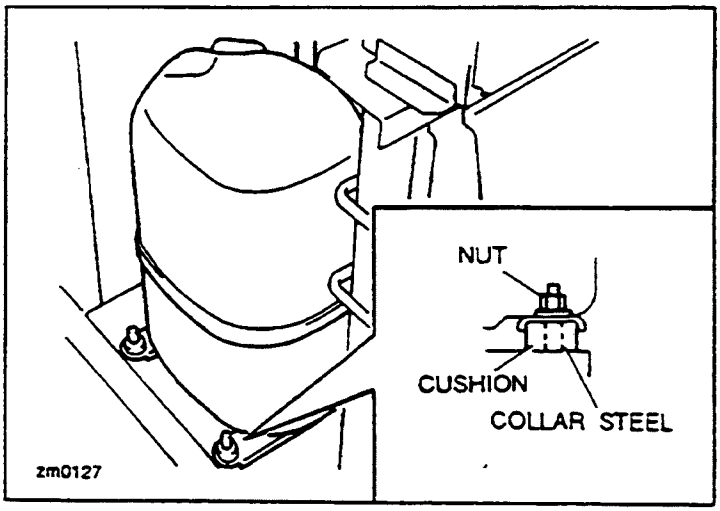
6. REASSEMBLY

Reassemble the unit in the reverse order of removal.

Described below are the parts that need special care in reassembling the unit. Perform wiring with reference to the wiring diagram.

1) Compressor Mounting

Mount the compressor on the frame, using cushion, collar steel, and nut.



Compressor Mounting

2) Blower Assembly Mounting

1. Mounting of blower fans.

Note: 1) After reassembling, the gap between evaporator fan and casing should be 0.06 inches (1. 5mm) or more.

2) After reassembling, the gap between condenser fan and exhaust duct should be 0.2 inches (5 mm) or more

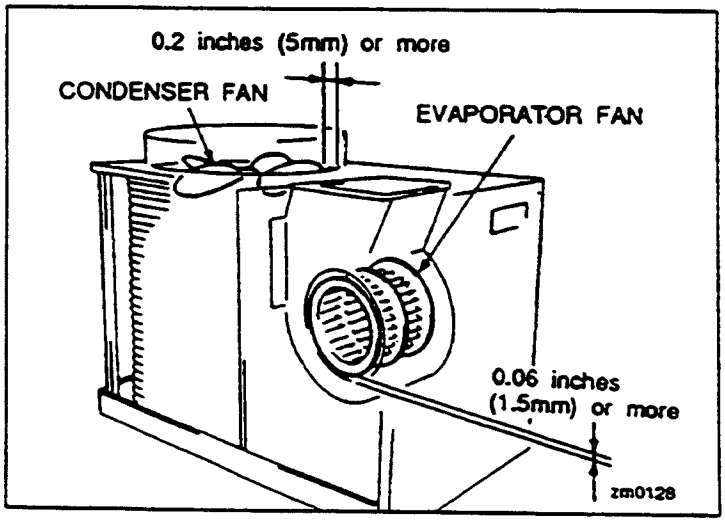
3) Wiring Notice

Fix the wires with clamps so that they do not come into contact with the edges of structure, etc.

Set the wires with clamps at the same positions they were before removal.

4) Perform Test

Perform the inspection of cooling capacity in 2-3., and check for abnormal noise or vibration.



Blower Assembly Mounting

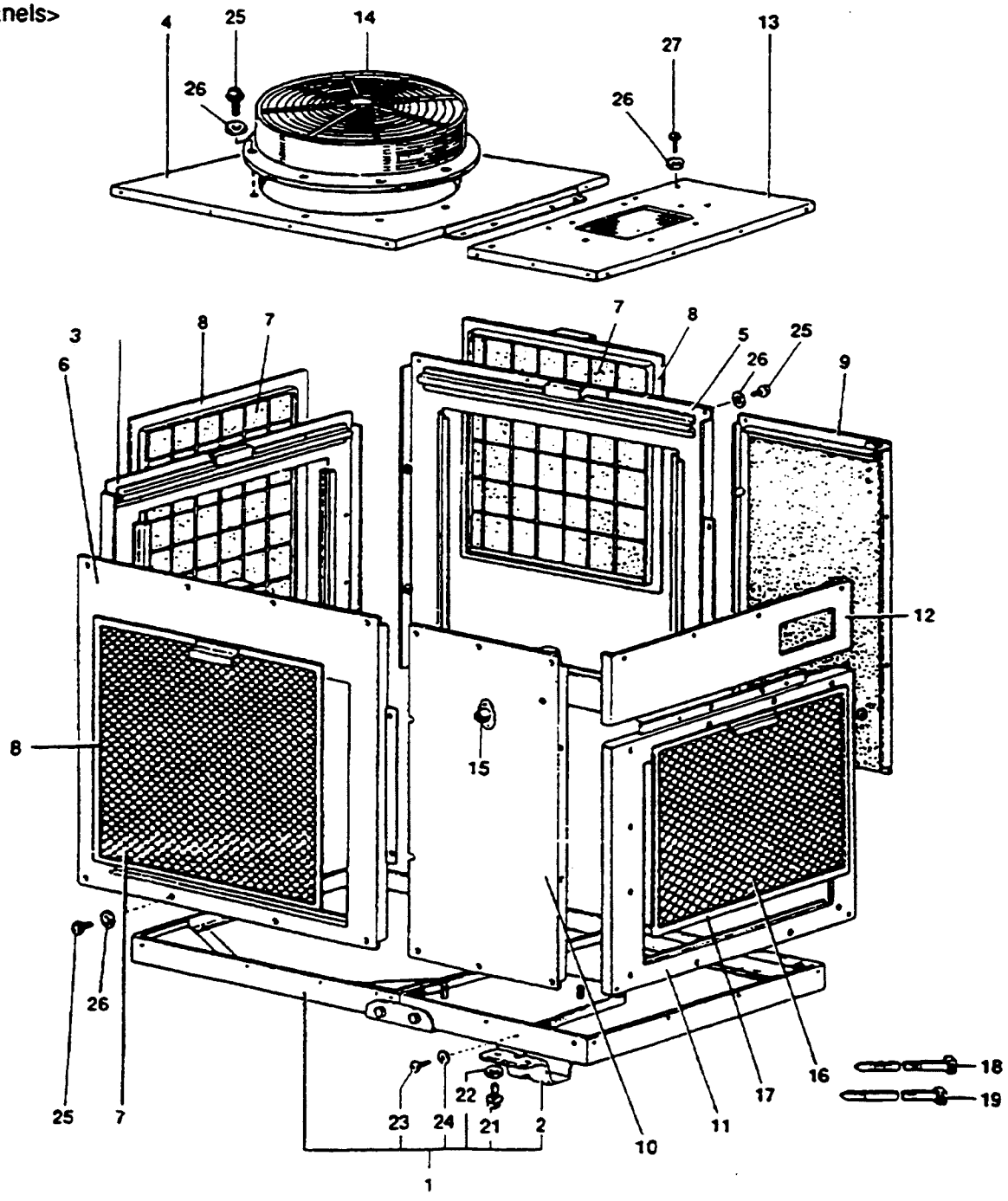
7. SERVICE PARTS LIST

The service parts of the SPOT COOL are supplied as shown below.

The standard parts of the unit, which are standardized by ISO (International Standardization Organization), are bolts, nuts and screws.

The specifications of these standard parts are included in this parts list over page.

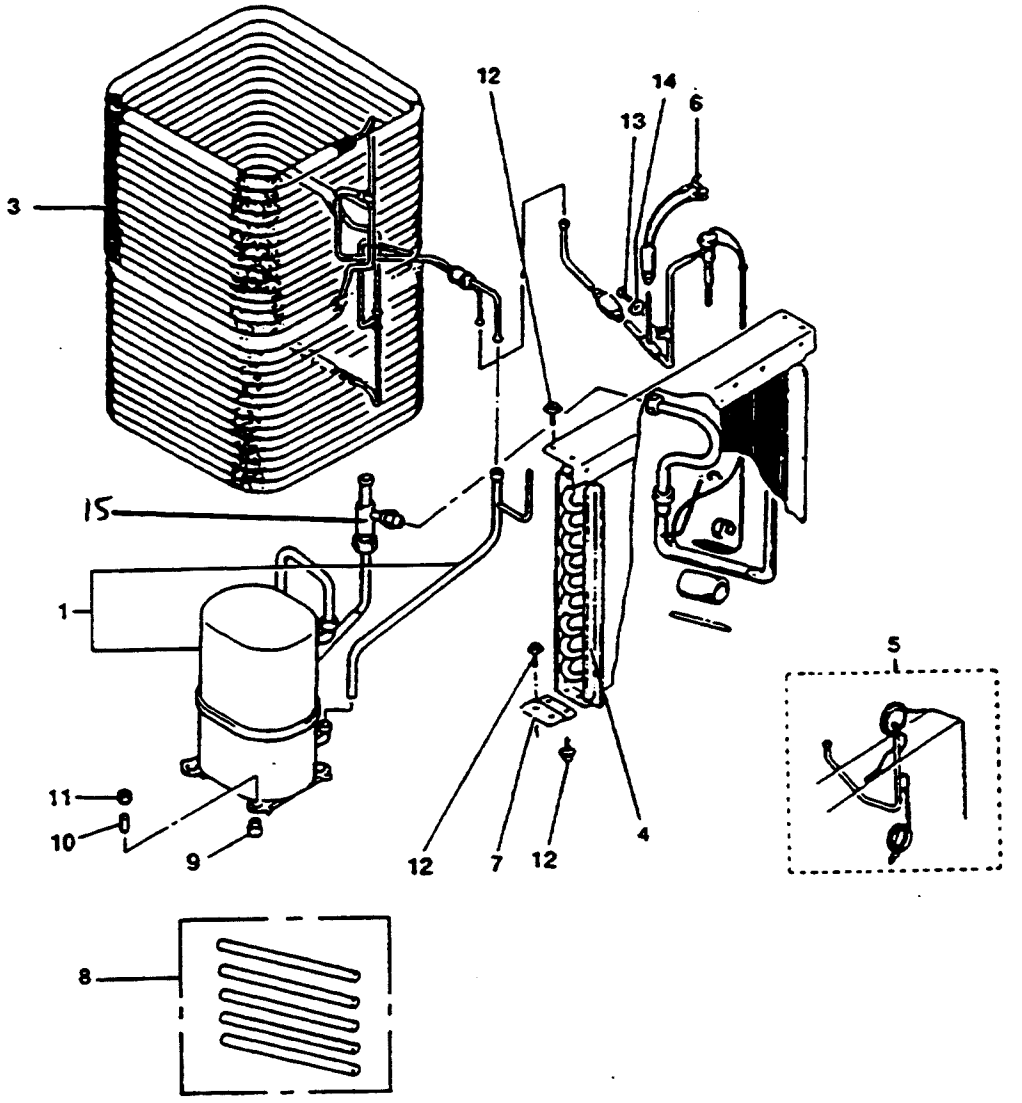
<Outer panels>



SERVICE PARTS

ILL. NO.	NOMENCLATURE	PART NO.	QTY.	REMARKS
	Unit assy, 50HU	484100-1040	1	
1	Frame, base	484300-0870	1	Include 2, 21~24
2	Leg	484921-0040	4	
3	Panel, rear	484410-0391	1	
4	Panel, condenser, upper	484420-0091	1	
5	Panel, condenser, right	484410-0371	1	
6	Panel, condenser, left	484410-0381	1	
7	Filter, condenser	484401-0140	3	
8	Frame, condenser filter	484300-0210	3	
9	Panel, right	484410-2870	1	
10	Panel, left	484410-2880	1	Include 15
11	Panel, evaporator	484410-0420	1	
12	Panel, front	484410-2900	1	
13	Panel, evaporator, upper	484420-0170	1	
14	Grille, exhaust	484370-0030	1	
15	Conduit	479748-0020	1	
16	Filter, evaporator	484401-0150	1	
17	Frame, evaporator filter	484300-0220	1	
18	Clip, middle	481951-0020	5	Length 150
19	Clip, short	480841-0010	16	Length 100
20	Filter set	484409-0060	1	7&16
21	Bolt, w/Washer	91470-10207	16	M10, ℓ 20
22	Washer, toothed	949016-1030	16	M10
23	Screw	90051-06160	1	M6, ℓ16
24	Washer, plate	90201-06400	1	
25	Screw, w/Washer	91370-06147	69	M6, ℓ14
26	Washer, toothed	949016-0120	81	M6
27	Screw, w/Washer	91370-06357	12	M6, ℓ35

<Refrigerant system>

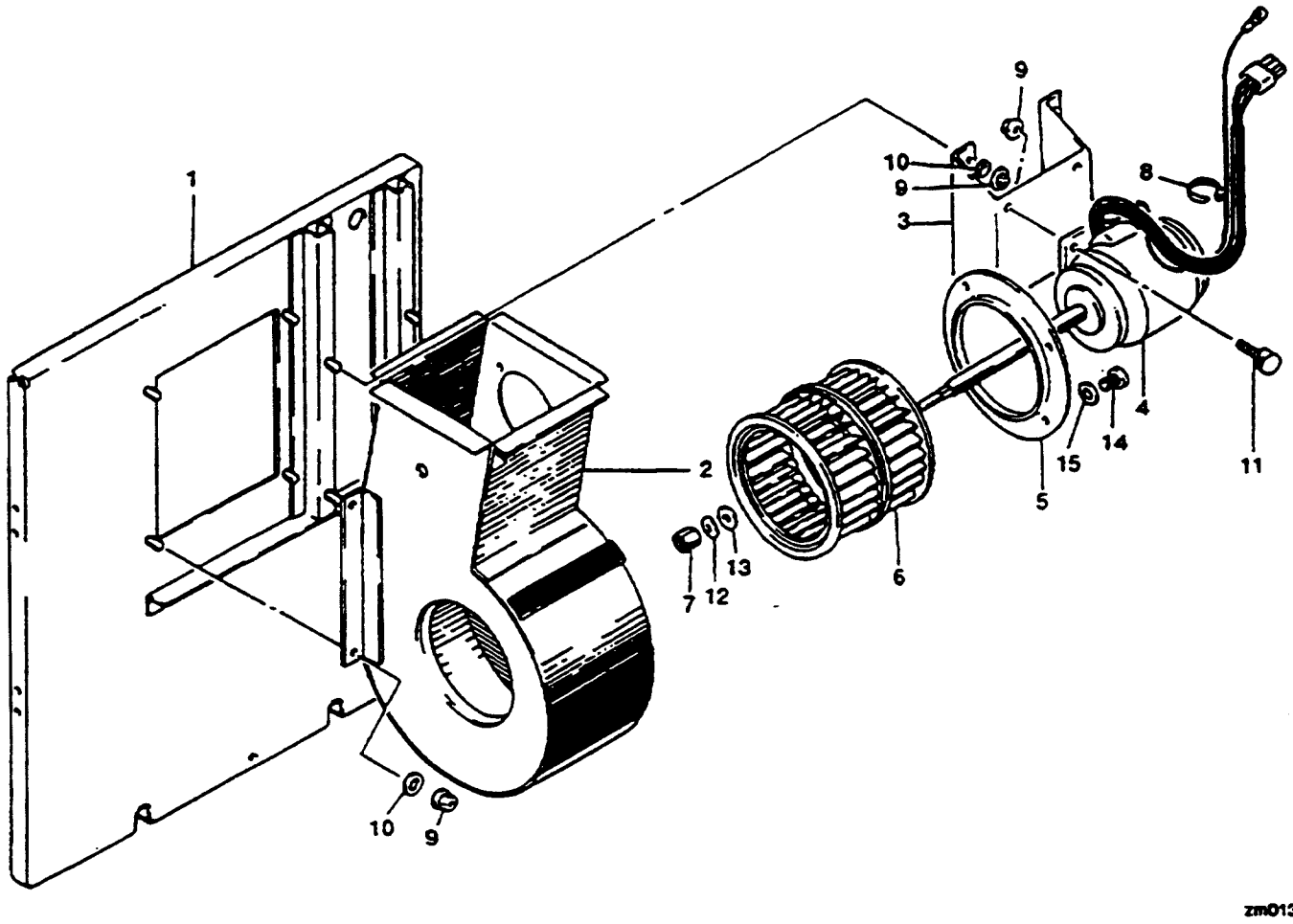


SERVICE PARTS

ILL. NO.	NOMENCLATURE	PART NO.	QTY.	REMARKS
1	Compressor assy	484650-0930	1	
2	Pressure regulator	484782-0050	1	
3	Core assy, condenser	484600-0560	1	
4	Core assy, evaporator	484600-0650	1	Include 6
5	Pipe assy, capillary	484640-0150	1	
6	High pressure switch	484660-0270	1	
7	Bracket	484321-0400	2	
*8	Pipe, charging	484800-0440	1	
9	Cushion	484904-0170	4	
10	Collar	484915-0230	4	
11	Nut, hex.	949056-2500	4	M8, Hex. size 12
12	Screw, w/Washer	91370-06147	6	M6, ℓ14
13	Screw	91051-04100	1	M4, ℓ10
14	Washer, plate	90201-04300	1	
15	Value (SPR)	484782-0050	1	

*Pipe charging is supplied with 5 pipes per one package.

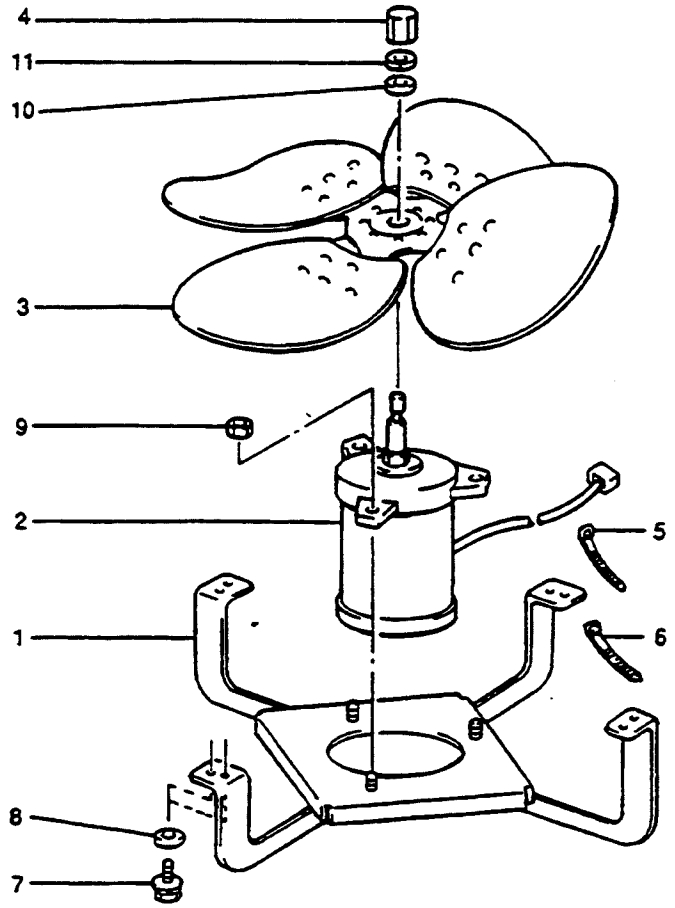
<Blower assy. for evaporator>



SERVICE PARTS

ILL. NO.	NOMENCLATURE	PART NO.	QTY.	REMARKS
1	Frame	484300-0880	1	
2	Casing, fan	484260-0011	1	
3	Bracket, motor	484330-0400	1	
4	Motor	484211-0850	1	
5	Ring	484381-0200	1	
6	Fan	484221-0151	1	Include set bolt
7	Nut, special	481216-0020	1	Hex. size 19
8	Clip,short	480841-0010	1	Length 100
9	Nut, flange	92150-08081	12	Hex. size 12, M8
10	Washer, toothed	949016-0320	8	M8
11	Bolt, hex.	90120-08251	4	M8, ℓ25, Hex. size 12
12	Washer, Spring	949017-1270	1	T1.2
13	Washer, plate	90200-13001	1	M13
14	Screw	949006-3250	4	M4, ℓ10
15	Washer, toothed	949016-0230	4	M4

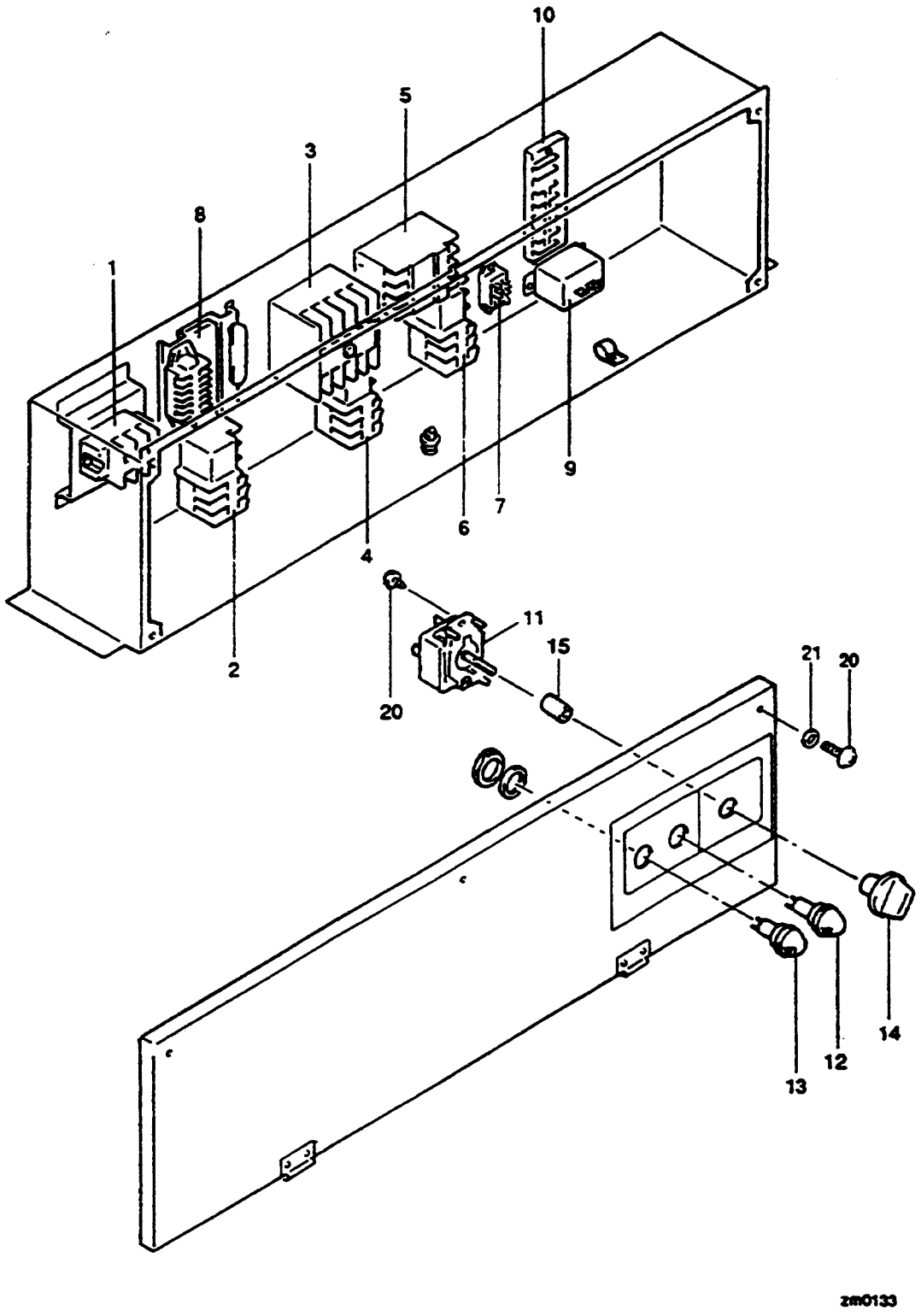
<Blower assy. for condenser>



SERVICE PARTS

ILL. NO.	NOMENCLATURE	PART NO.	QTY.	REMARKS
1	Bracket, motor	484330-0390	1	
2	Motor	484211-0840	1	
3	Fan	484221-0080	1	
4	Nut, special	481216-0020	1	Hex. size 19
5	Clip, short	480841-0010	1	Length 100
6	Clip, middle	481951-0020	3	Length 150
7	Screw, w/Washer	91370-06147	8	M6, ℓ14
8	Washer, toothed	949016-0120	8	M6
9	Nut, flange	92150-08081	3	M8, Hex. size 12
10	Washer, plate	949011-4010	1	
11	Washer, spring	949017-1270	1	

<Control unit>



SERVICE PARTS

ILL. NO.	NOMENCLATURE	PART NO.	QTY.	REMARKS
	Control box assy	484500-1080	1	Include all parts
1	Terminal block	484503-0260	1	
2	Overcurrent reley, compressor	484505-0300	1	
3	Reley, compressor	484531-0180	1	
4	Overcurrent reley, condenser fan motor	484505-0280	1	
5	Reley, fan motor	484531-0350	1	
6	Overcurrent reley, evaprator fan motor	484505-0270	1	
7	Reley, auxiliary	484531-0170	1	
8	Transformer	480819-0070	1	
9	Thermostat	484504-0020	1	
10	Terminal block	484503-0051	1	
11	Control switch	484560-0490	1	
12	Red lamp	484933-0120	1	
13	Clear lamp	484933-0110	1	
14	Knob, control switch	484923-0150	1	
15	Clip	484917-0131	1	
16	Cap, insulating	484922-0140	1	
17	Washer, plate	90201-04300	4	
18	Nut, hex.	91161-04320	2	M4
19	Screw, crossrecess pan	91051-04100	2	M4, ℓ10
20	Screw, w/Washer	91370-04087	5	M4, ℓ8
21	Washer, toothed	949016-0230	3	M4
22	Washer, plate	90200-04001	8	
23	Screw	949006-3250	4	M4, ℓ10
24	Screw	949006-3280	14	M4, ℓ18
25	Bolt, w/Washer	949047-0220	2	M4, ℓ8 Hex, size 7
26	Screw, flange	92100-03081	2	M3, ℓ8

NIPPONDENSO CO.,LTD.

OVERSEAS SERVICE DEPARTMENT

Kariya, Aichi, Japan

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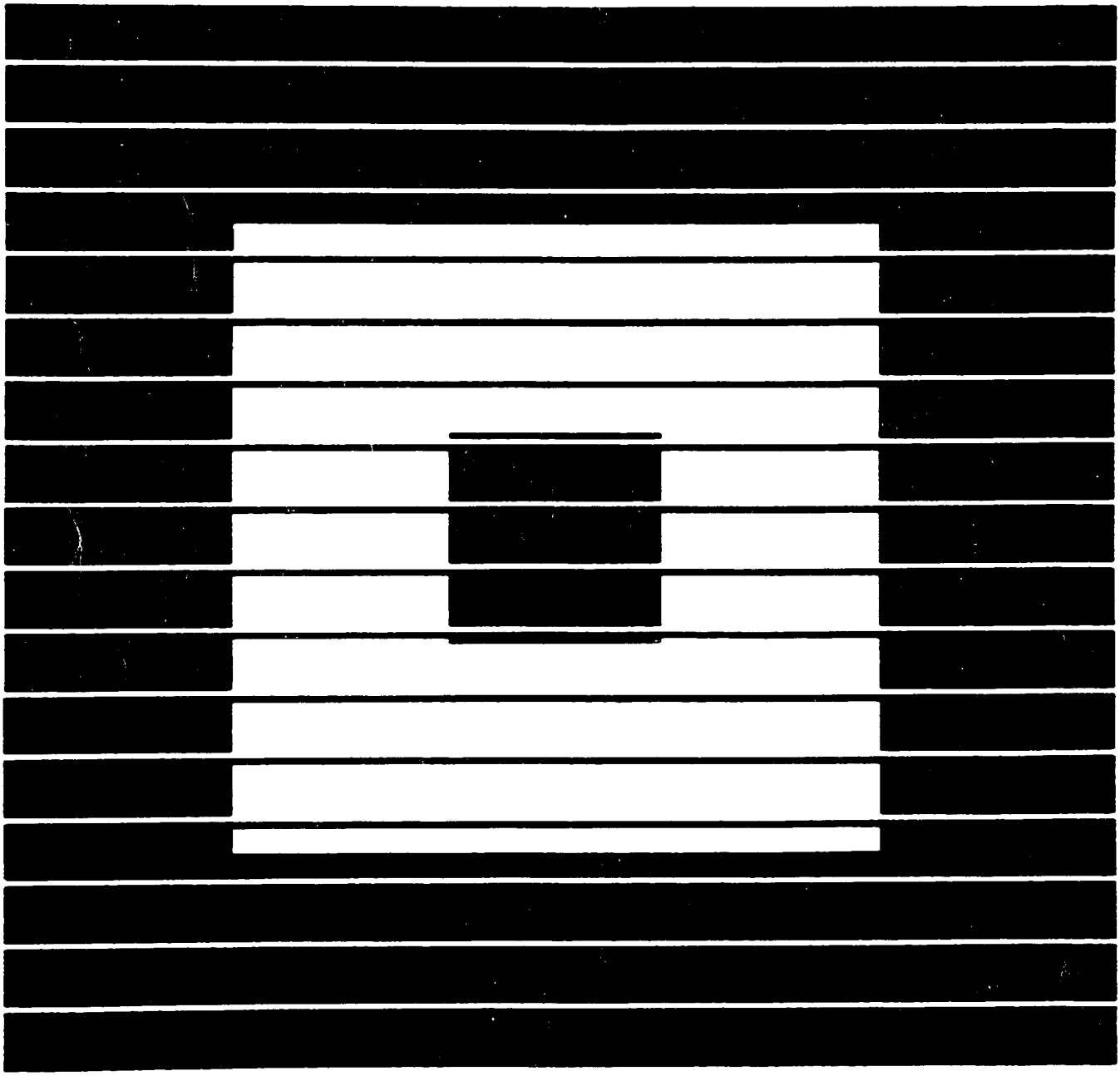

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9301-H-150