MHI

INSTRUCTION MANUAL

使用説明書

Manual No.: '97-RC-I-359-A

Supersedes: Nothing

Note: Data subject to change and shall be updated as required.

MITSUBISHI TRANSPORT REFRIGERATION UNIT

三菱牌運輸用致冷機組

CPE14-2BAⅢES

(Delivered since March '98)

三菱重工業株式會社

MITSUBISHI HEAVY INDUSTRIES, LTD.

PART 1

ENGLISH EDITION

This instruction manual covers model:

CPE14-2BAⅢES (Delivered since Mar., '98)

Differences of specification for operation by models are as follows.

Item \ Model		CPE14-2BAⅢES (Delivered since Mar,'98)	CPE14-2BAⅢES (Delivered since June,'97)	CPE14-2BAⅢES (Delivered since Jan.,'97)	CPE14-2BAⅢES (Delivered since July,'96)	CPE14-2BAⅢES (Delivered until June,'96 from Dec.,'95)
1	Air differential pressure transducer	Not provided				Provided
2	Controller • Display (height)	25 mm			25 mm (Since Oct.,'96)	15 mm
	• NVRAM (EEPROM) Refer to page 98	Provided			Provided (Since Oct.,'96)	Not provided
3	Controller software • Container No. setting • Calendar setting	Provided		Not Provided		
	• Trip data storage period	1 year	90 days			
	• Temperature display function in chill mode Refer to page 53	Set point temp. ↓ Supply air temp. ↓ Return air temp.	Set point temp. ↔ Supply air temp.			
4	Heater access panel construction	Screw mounting			Screw & hinge mounting	
–	Instruction manual No.	'97·RC-I·359-A	'97·RC-I·359	'97·RC-I·354	'96·RC-I·345	'96·RC-I·331
–	Parts List No.	CPE9603C3				

For further information refer to ...

Parts List .....CPE 9603C3

Unit Description

1. The Refrigeration Unit (Hereinafter called "Reefer Unit") is all-electric, one-piece, self contained refrigeration unit.
2. The Reefer Unit is used for 40 ft. and 45 ft. ISO refrigerated container designed for international transportation by sea and by road and rail on land.
3. The Reefer Unit is of slim (445mm, 17.5" deep) picture frame type housing the machinery and the bulkhead which afford the maximum cargo space in the container.
4. The Reefer Unit is electrically driven and cooling (including capacity control), heating and defrosting operations are made automatically by means of electronic thermostats which control the inside temperature of the container within a specified range.
5. The Reefer Unit requires 400 to 500V × 60Hz, 360 to 460V × 50 Hz, AC 3 phase power. The Reefer Unit is furnished with power plug and power cable stowed in the cable storage compartment in the condenser section.
6. The Reefer Unit features include an air exchange system; hermetic scroll compressor; a hot gas modulating capacity control system; MMCCIIIA (Mitsubishi Micro-computerized Recorder Controller) with failsafe and selfdiagnostic functions; an adjustable 3, 6, 9, 12 hour and automatic program defrost timer of MMCCIIIA; automatic PTI (MAX. PTI, MIN. PTI) function of MMCCIIIA; data control function of MMCCIIIA; recording function of MMCCIIIA.
7. All electrical equipments are protected from wind, rain and waves under severe marine conditions.
8 All components are treated to resist corrosion from sea water under severe marine conditions.
9 The Reefer Unit is designed to operate under the atmospheric temperature conditions of –30°C to 50°C (–22°F ~ +122°F).
10. The Reefer Unit is equipped with the USDA receptacles for connecting of cold treatment temperature sensors.
11. The Reefer Unit is designed, tested and marked in accordance with Rules for Certification of Container Refrigeration machinery of AMERICAN BUREAU OF SHIPPING.
12. All materials and components are in accordance with Japanese Industrial Standards or equal.
13. The Reefer Unit is designed to comply with the regulation issued by the Customs Authority in Japan in accordance with the Customs Conventions on Containers (CCC) when fitted to the coutainer.
14. The electrical wiring and electrical equipments are in line with the S.A.A. (STANDARD ASSOCIATION OF AUSTRALIA).
15. The Reefer Unit is designed to comply with requirements for approval of refrigerated containers for flower bulb transport issued by the ATO AGROTECHNOLOGY (former SPRENGER INSTITUTE).

TABLE OF CONTENTS

Safety precautions

■ Read through this "Safety precautions" section for safe operation.

■ The cautionary items described here are important for safety. Be sure to observe them.

• Indication and meaning are as follows.

⚠WARNING	Incorrect handling may cause death, serious injuries or other danger.
⚠CAUTION	Incorrect handling may cause danger in certain situation.

• The meaning of symbols used in main part of this manual is as follows.

⃠	Never do this.	❗	Be sure to follow the instruction.
⏚	Be sure to connect the grounding conductor.	✋⃠	Do not touch.

• After the reading through this, store it in a place where whoever operates the refrigeration unit can read it.

• When giving or lending the refrigeration unit, please hand over this operation manual with the unit so that the new user can know the correct usage of the unit.

▮ Precautions for installation or transportation

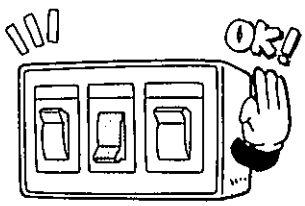
⚠WARNING

When the refrigeration unit is removed from the container, fix it on the special stand and store it.

Without the special stand, the refrigeration unit may fall, possibly causing injuries.

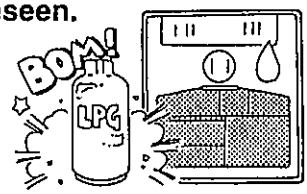
⚠CAUTION

Install a leakage breaker in the external power supply equipment.



Without a leakage breaker, there is danger of electric shock.

Avoid installing the refrigeration unit at a site where leakage of flammable gases is foreseen.



Flammable gases may cause a fire if they leak and accumulate near the unit.

Be sure to use power receptacle which has grounding pin.

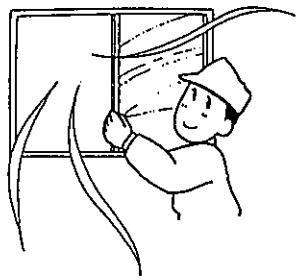
An improperly grounded power receptacle may cause electric shock.

▮ Precautions for operation or repair

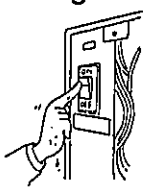
⚠WARNING

Ventilate the work area.

Leaking refrigerant could cause an oxygen shortage: the refrigerant gas is heavy and settles in the lower part of the room, possibly causing suffocation if a large volume were to leak.When handling the refrigerant or operating the refrigeration unit in a closed area such as in a container or ship's hold, take sufficient care as to ventilation.

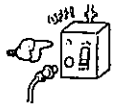


Do not operate the refrigeration unit with wet hands or gloves.



If the floor is wet, you will be given an electric shock.

When trouble has occurred, turn the ON-OFF switch of the unit off, turn the external power switch off and disconnect the power plug.

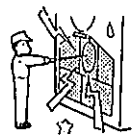


Continuation of operation with trouble present may cause electric shock, fire or damage.

Do not smoke or weld in an environment where refrigerant is handled.

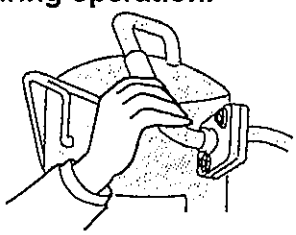
The fluorocarbon refrigerant produce poisonous gases in an area where an open flame or any kind is burning.

Do not insert your fingers or a rod into the air outlet or intake port.



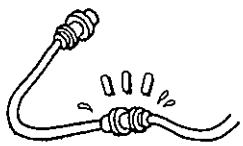
The fan rotating inside the port may cause injuries.

Do not touch heater, piping or compressor during operation.



You may be burned.

Do not connect the power cable in the middle and do not use as an extension cable. As Well, do not share the power cable with other electrical equipment.



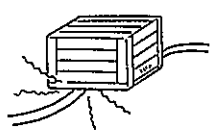
Electric shock, heat generation or fire may be caused.

⚠WARNING

Check the power plug is free from dust. Insert the plug fully to the root of pins and firmly tighten it.

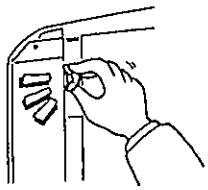
Dust as well as poor connections can cause electric shock or fire.

Do not break or process the power cable.



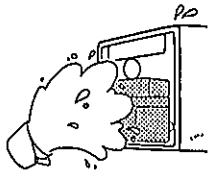
Electric shock or fire may be caused. The power cable may be damaged if something heavy is placed on it or it is heated or pulled.

Firmly tighten the screws of the control box cover.



Electric shock, fire or damage may be caused by water penetration.

Do not splash water on electrical components such as the controller.



Electric shock, fire or damage may be caused.

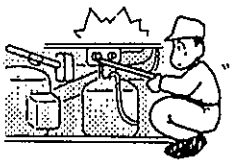
Make sure that nobody is in the container before starting the operation of the refrigerating unit.

Being locked in the container accidently may cause death from the cold.

Do not put volatile or inflammable matter in the container.

There is a danger of explosion.

Do not push the pin in the check joint using a bar or the like.



The refrigerant is sometimes released through the pipe and it can cause frostbite.

Pay attention to your posture when moving heavy equipment such as the power transformer, the compressor and the evaporator fan motor, for repairs.

compressor	Approx. 50kg
Evaporator fan & motor	Approx. 15kg

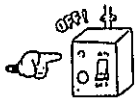
Back pain may result and you may drop the equipment on your feet.

Do not look into the sight glass during operation when the panel in front of the glass is removed.

The sight glass may shatter and its flying fragments may hurt you.

⚠CAUTION

When cleaning, inspecting, disassembling or assembling the unit, turn the ON-OFF switch of the unit, circuit protectors, circuit breaker, and the external power switch OFF, and also disconnect the power plug.

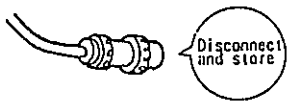


Electric shock may be caused or you may be injured by rotating objects.

When cleaning, inspecting, disassembling or assembling the unit, use appropriate tools.

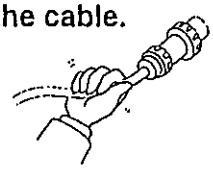
Use of an inappropriate tool may cause injuries or breakage of parts.

When leaving the unit unused for an extended period of time, disconnect the power plug from the receptacle for reasons of safety, and keep the cable in the cable tray of the refrigeration unit.



Dust accumulation may cause heat generation or fire.

When disconnecting the power plug, do not pull at the cable.

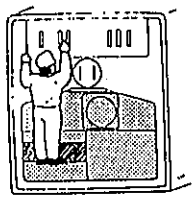


Hold the plug surely and disconnect the plug from the receptacle. If the cable is pulled to disconnect the plug, the element wires may be broken, causing heat generation and fire.

When working at a height, i.e.installing or removing the inspection hatch or inspecting the evaporator fan, use a stepladder or a footstool to ensure safety.

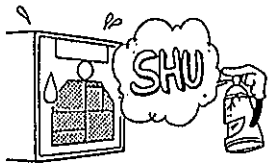
You may fall and be injured.

Do not sit on or hang from the control panel, inspection hatch, piping or the other parts.



You may fall and be injured.

Do not use inflammable spray or place inflammable matter near the refrigeration unit.



Sparks generated at the switch may start a fire.

When the refrigeration unit is installed at a site where someone other than the unit operators may touch the unit, post a sign "DO NOT TOUCH" or erect a protective fence around the unit.

Incorrect usage may cause injuries.

⚠CAUTION

When handling the refrigerant, wear protective goggles and the like to protect your skin from the refrigerant.

The liquefied refrigerant rapidly evaporates in the air. If it makes contact with your skin, it may cause frostbite.

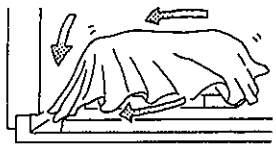
Pay attention to the power cable etc. around your feet when working around the refrigerating unit for operation or maintenance. Furthermore, caution is necessary so as not to hit your head on the control box cover.

Carelessness may cause an unexpected accident

While making repairs, pay attention to the edges of sheet metal such as the condenser coil fin, the evaporator coil fin and the panel.

The sharp edges may cut you.

When packing loads using a vinyl sheet or the like, fix the ends of the sheet tightly so as to avoid sucking the sheet into the inlet of the refrigerating unit.



If the air duct is clogged with foreign matter such as a vinyl sheet, it may cause insufficient refrigerating performance or overloading the fan.

Cover a load which is easily damaged by moisture tightly with a vinyl sheet or the like.

A small amount of water may flow out or condensation may occur in the container due to deterioration of the insulation of the evaporator panel and the like after using the unit for many years.

1. OPERATION

1.1 Power Source

Designed for use with 40ft. and 45ft. refrigerated container, this unit accepts 400V class power source.

1.2 Operation

1.2.1 Start sequence

(1) Make sure that the UNIT on-off switch is in the "OFF" position.
(2) Fit a new recording chart.
(3) Set the recording pen ready for recording.
(4) Switch on the circuit breaker.
(5) Adjust the ventilator according to instructions.
(6) Connect the power plug.
(7) Switch on the external power switch.
(8) Switch the UNIT on-off switch to the "ON" position.
(9) Set the controller at the desired temperature.
(10) Set the defrost timer (automatic/fixed).

Then cooling, stopping, defrosting and heating are controlled automatically.

1.2.2 Details of starting procedure

(1) Make sure that the UNIT on-off switch is in the "OFF" position.

See to it that the UNIT on-off switch attached to the left side of the control box is turned to the "OFF" side (lower side).

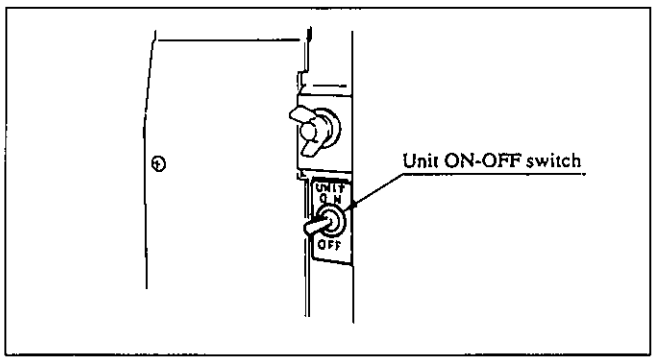


Fig. 1 Operation switch

(2) Insert recording chart.

Caution: Don't move the stylus by hand.

(a) Loosen the screw fastening the cover to open the control box (see Fig.2).

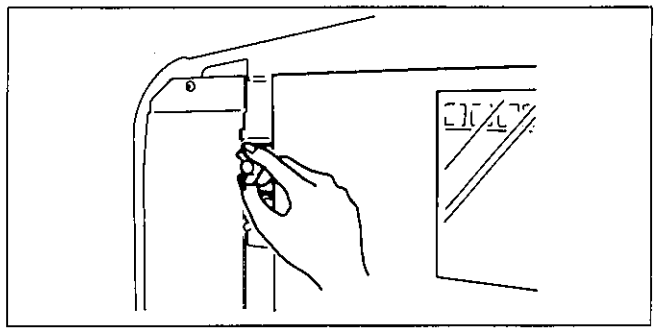


Fig. 2 Cover of control box

(b) Swing out the stylus (the recording pen) by pushing the ⇧ & ⇩ key pads at the same time 3 seconds or more.

In case of the power off, push [MODE] key pad before pushing ⇧ & ⇩ key pads for recording chart replacement.

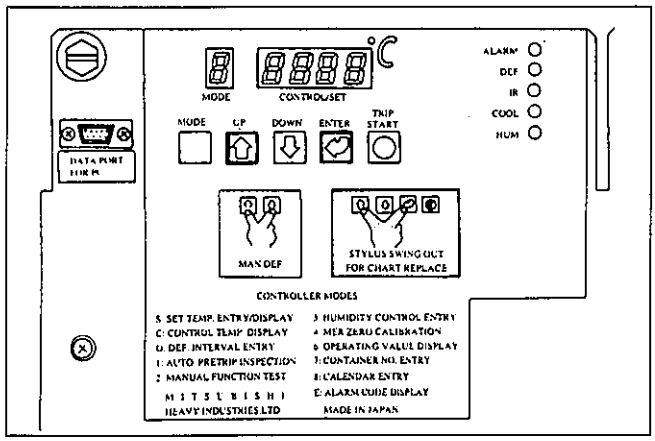


Fig. 3 Stylus swing out

(c) Unscrew the chart holder and remove the recording chart.

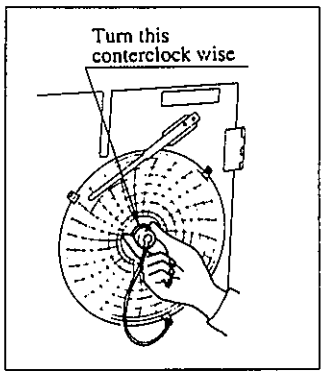


Fig. 4 Recording chart holder

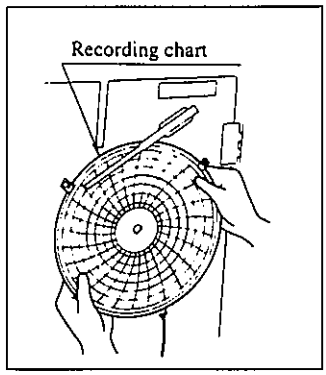


Fig. 5 Removing recording chart

(d) Place a new recording chart in the chart holder, ensuring that recording will start at the correct date and hour.

Ensure that the chart is properly inserted and fastened, otherwise inaccurate recording will result.

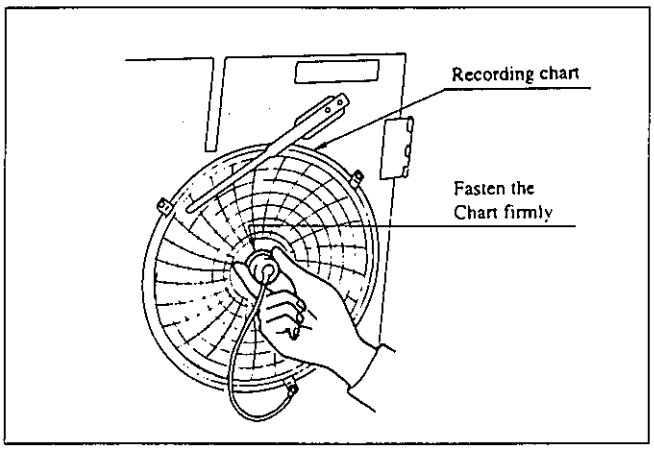


Fig. 6 Setting of recording chart

Note:

Stylus swing out will return to the appropriate position automatically.

Swing out time:

Power source ON: 5min*

*By pushing [MODE] key, it will return instantlly.

(3) Switch on the circuit breaker.

Check circuit protector (CP1) for ON position.

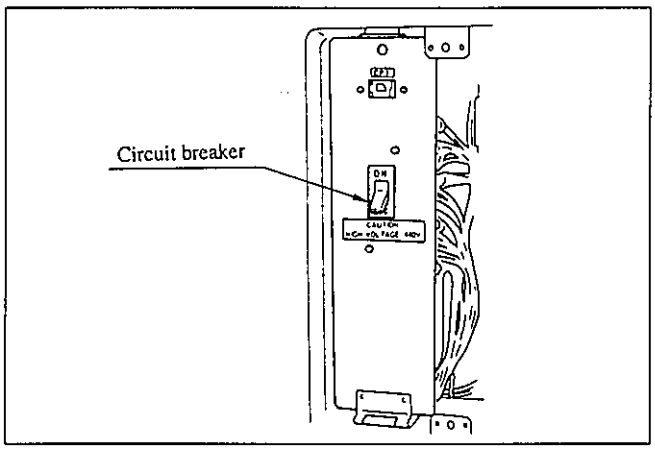


Fig. 7 Circuit breaker

NOTE: (1) Check to be sure connectors are securely connected when the controller cover opened.

(2) **When closing the cover of the control box, be sure to tighten the screws firmly as loose or one sided tightening of the screws may allow water penetration and thereby cause malfunction or breakdown of control equipment.**

(4) Ventilator opening and closing

(a) Open the ventilator for CHILL cargo transportation with fresh air intake. (Depend on Ship Owner)

(b) Close the ventilator for FROZEN cargo transportation. If opened, the unit ices up causing excessive defrosting and results in shortage of cooling capacity.

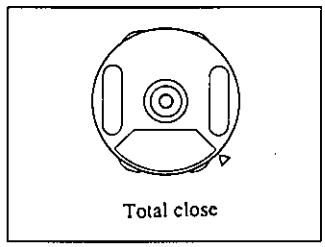


Fig. 8A Ventilator (Closed)

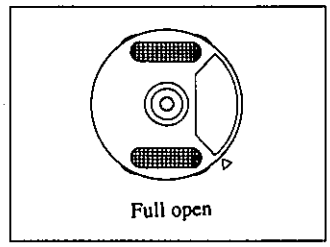


Fig. 8B Ventilator (Opened)

(5) Connect the power plug securely in outlet.

(6) Turn external power supply switch on.

(7) Switch the UNIT on-off switch to "ON" (upper position).

(a) The system will automatically check itself for the initial self-diagnostic items during "power on" status for ten (10) seconds before the unit starts. (See chapter 12.12).

(b) When no abnormalities, such as causing the unit to stop, have occurred, the unit will automatically start.

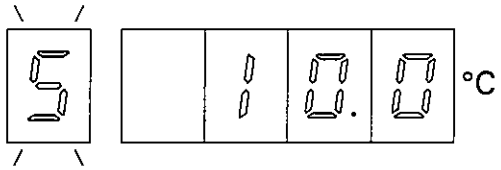
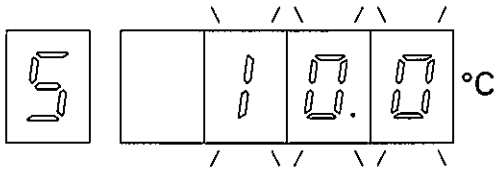
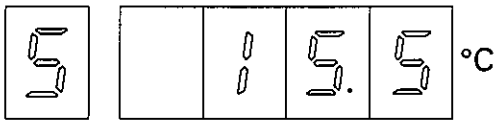
* During this period, the self-diagnostic items for the "run" status are also checked. (See chapter 12.12).

(c) If any abnormality occurs

If the alarm LED lamp is blinking, check the unit following the display on the controller.

(8) Setting the temperature

The temperature can be set on the MMCCⅢA Control Panel by manipulating four different keys; MODE [M], UP [⇧], DOWN [⇩] and ENTER [↵]

Operation Flow	Key Operation	Display	Remarks
Temp. setting & display	[MODE] key through normal display 		 blinks every 0.5 sec. • The temp. last set is displayed. • "-----" before being set.
Temp. setting & change	[ENTER] key [UP] or [DOWN] key		 blinks every 0.5 sec. • Using the [UP] or [DOWN] key, sets the temp. to between –30.0°C and +25.0°C.
Temp. setting entry	[ENTER] Key		

Note: (1) If 30 sec. pass without any key operation, the display automatically returns to its normal display.

(2) In the temp. setting mode, pressing the [MODE] key will immediately cause the display to return to its normal display.

(Note) For the operation of the MMCCⅢA Controller, refer to the Instruction Sheet which can be found in the control box chart pocket. Also, refer to the operating procedures and displays (See chapter 12.11.1 ~ 12.11.13) or general flows (See chapter 12.11.19) described in this manual.

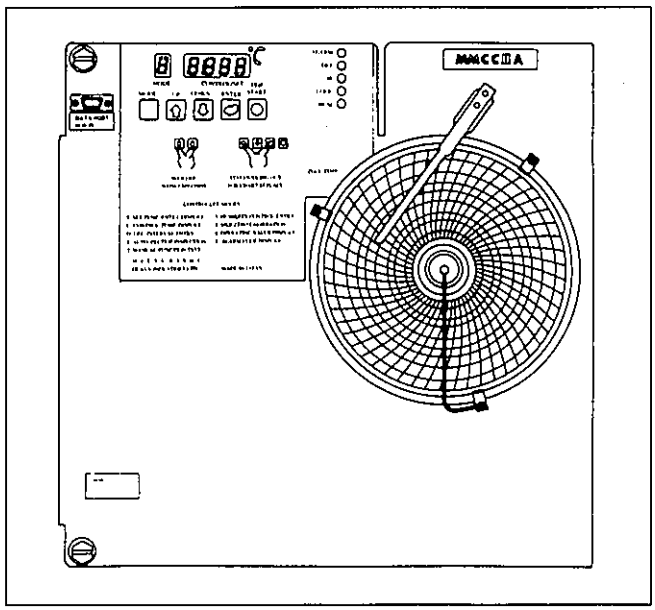
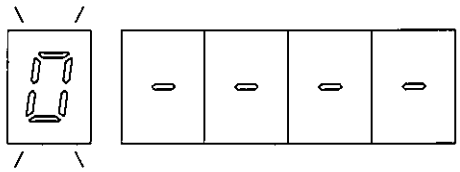
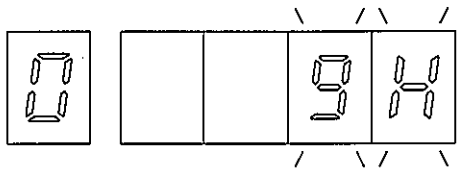
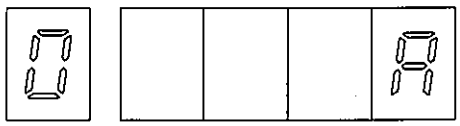


Fig. 9 Controller Panel

(9) Setting the defrost timer

The defrost timer can also be set by key manipulation.

Operation Flow	Key Operation	Display	Remarks
Defrost timer setting & display	[MODE] key through normal display 		
Defrost timer setting change	[ENTER] key [UP] or [DOWN] key		• The timer last set is displayed. • "-----" before being set. • The [Up] or [Down] key will cause the timer setting to be A ↔ 3H ↔ 6H ↔ 9H ↔ 12H. • "A" represents "automatic".
Defrost timer setting entry	[ENTER] Key		

Note: (1) If 30 sec. pass without any key operation, the display automatically returns to its normal display.

1.2.3 Stop procedures

(1) Turn the unit switch off and the compressor immediately stops.

(2) If power plug is disconnected from power source, cable should always be stowed in the cable tray.

(3) Remove recording chart.

To remove the recording chart open the cover of the control box. Then push the ⇧ & ⇩ key pads at the same time 3 seconds or more to swing out the stylus, and unscrew chart holder and remove chart. Remember of fit chart holder again and shut cover of control box. (See Fig. 3)

(4) Shut the control box cover securely.

1.2.4 Manual defrost

Defrost performed automatically. But when manual defrost is required, push the ⇧ & ⇩ key pads at the same time 3 seconds or more. (See Fig. 10)

When the evaporator outlet temperature sensor detects the temperature below 10°C (50°F), the unit initiates manual defrost operation.

Ice is then removed and the unit returns to cooling operation automatically.

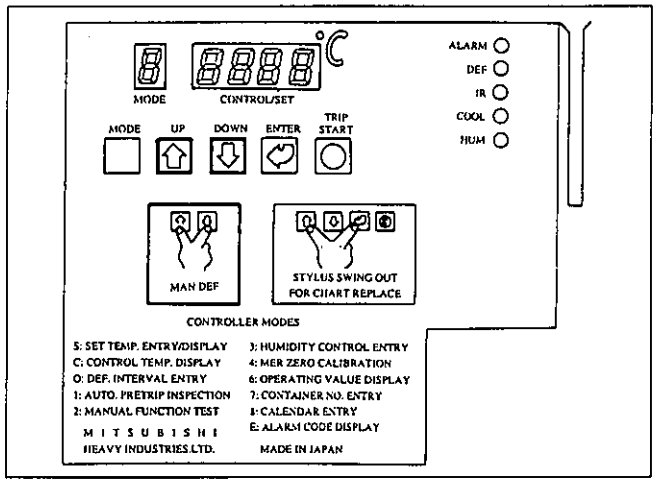
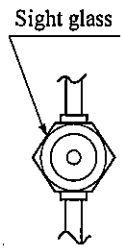
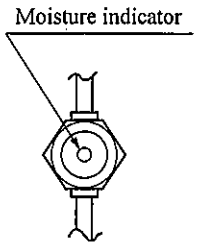


Fig. 10 Manual defrost key pads

2. INSPECTION DURING OPERATION

The controller checks the contents of operation, which is designated in Self-diagnosis function. Should any abnormality occur, the alarm LED will light up. If it is not able to maintain normal operation, the controller will terminate the unit run or perform fail-safe and backup operations.

Time	Check Point	Method
Immediately after starting	1. Abnormal display by the initial automatic self-diagnoses (10 sec). 2. Abnormal noise from compressor, fan etc. 3. Abnormal vibration of respective parts.	Auditory check Feeling, visual inspection
10 – 15 minutes later	1. Shortage of the refrigerant.  **Fig. 11 Sight Glass** 2. Moisture inclusion in the refrigerant circuit.  **Fig. 12 Moisture indicator** 3. Normal indicating of digital display and normal recording of silver needle of the temperature recorder.	Visual inspection. Sight glass must be clear. Visual inspection. Dry without moisture ..... green Moisture inclusion ..... yellow
15 minutes later (Any time afterward)	1. Checking of operating conditions following the various information on the controller display and in the temperature recording chart.	Visual check

3. STRUCTURE

3.1 Outside Drawing

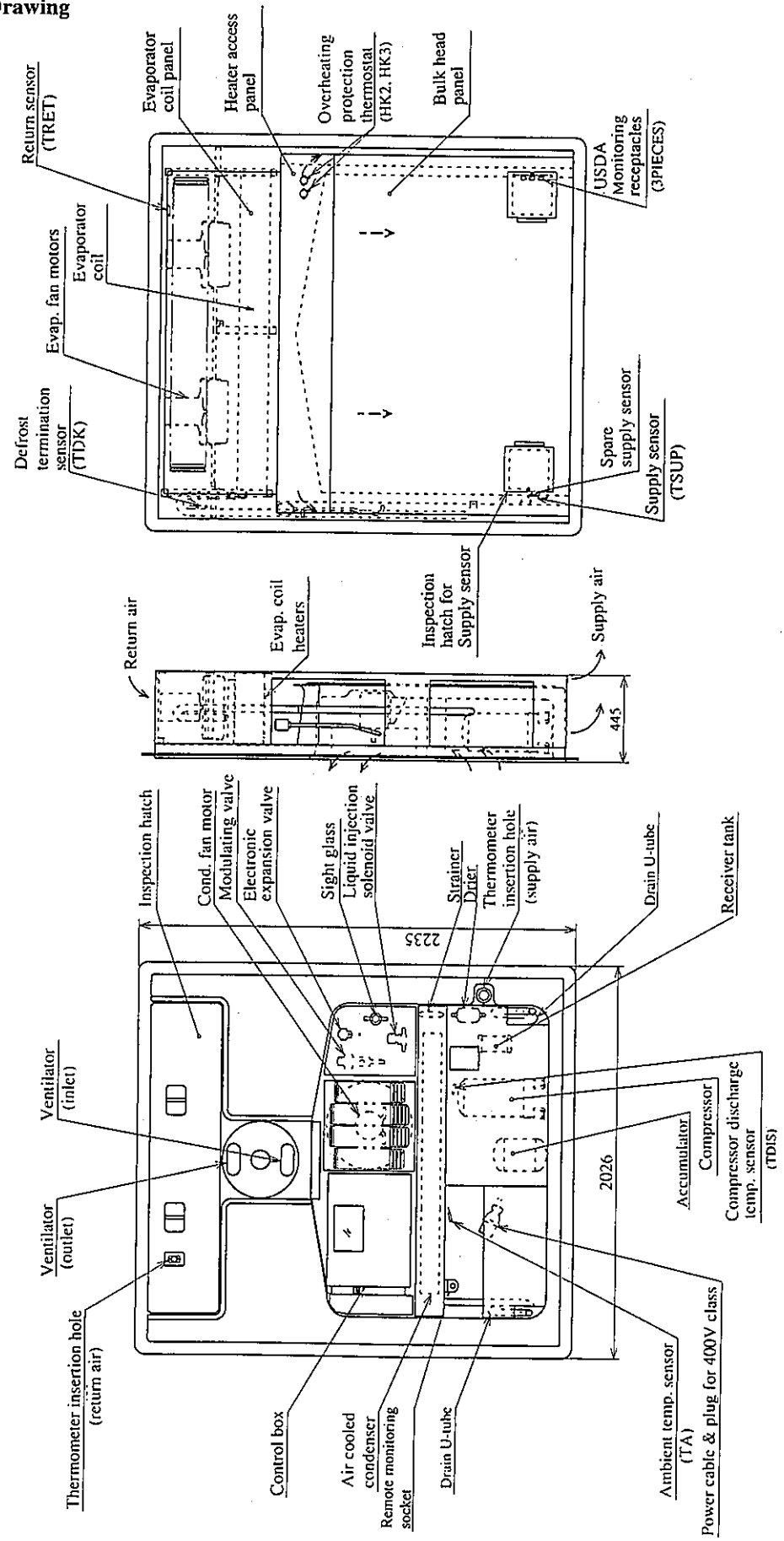


Fig. 13 Outside drawing

3.2 Refrigerant System

3.2.1 Refrigeration cycle

After being compressed in the compressor the high temperature and high pressure gaseous refrigerant flows into the air-cooled condenser where it is cooled and liquefied by exchanging heat with the ambient air.

Then liquefied refrigerant goes through the receiver tank for storing refrigerant, and it enters the drier wherein included moisture is separated. It then goes through the strainer where foreign particles are removed. The liquid refrigerant is throttled by the electronic expansion valve and the pressure is reduced evaporating pressure.

The refrigerant is vaporized passing through the evaporator coil, thereby absorbing heat from the air inside the container and lowering its temperature. The refrigerant is completely vaporized in the evaporator coil and is "superheated" when it leaves the evaporator.

The temperature and pressure sensors installed on the evaporator outlet pipe detects the extent of outlet gas superheating. Following the information obtained thereby, the electronic expansion valve controls the opening of the valve (PID), always maintaining at an optimum level the amount of refrigerant flowing into the evaporator. Vapourized refrigerant returns to the compressor through the accumulator for preventing the compressor from liquid compression.

3.2.2 Capacity control

In capacity control operation the modulating valve diverts the hot gas into the evaporator.

The valve operation and thereby amount of hot gas passing through the modulating valve, is controlled continuously by the MMCCIIIA controller.

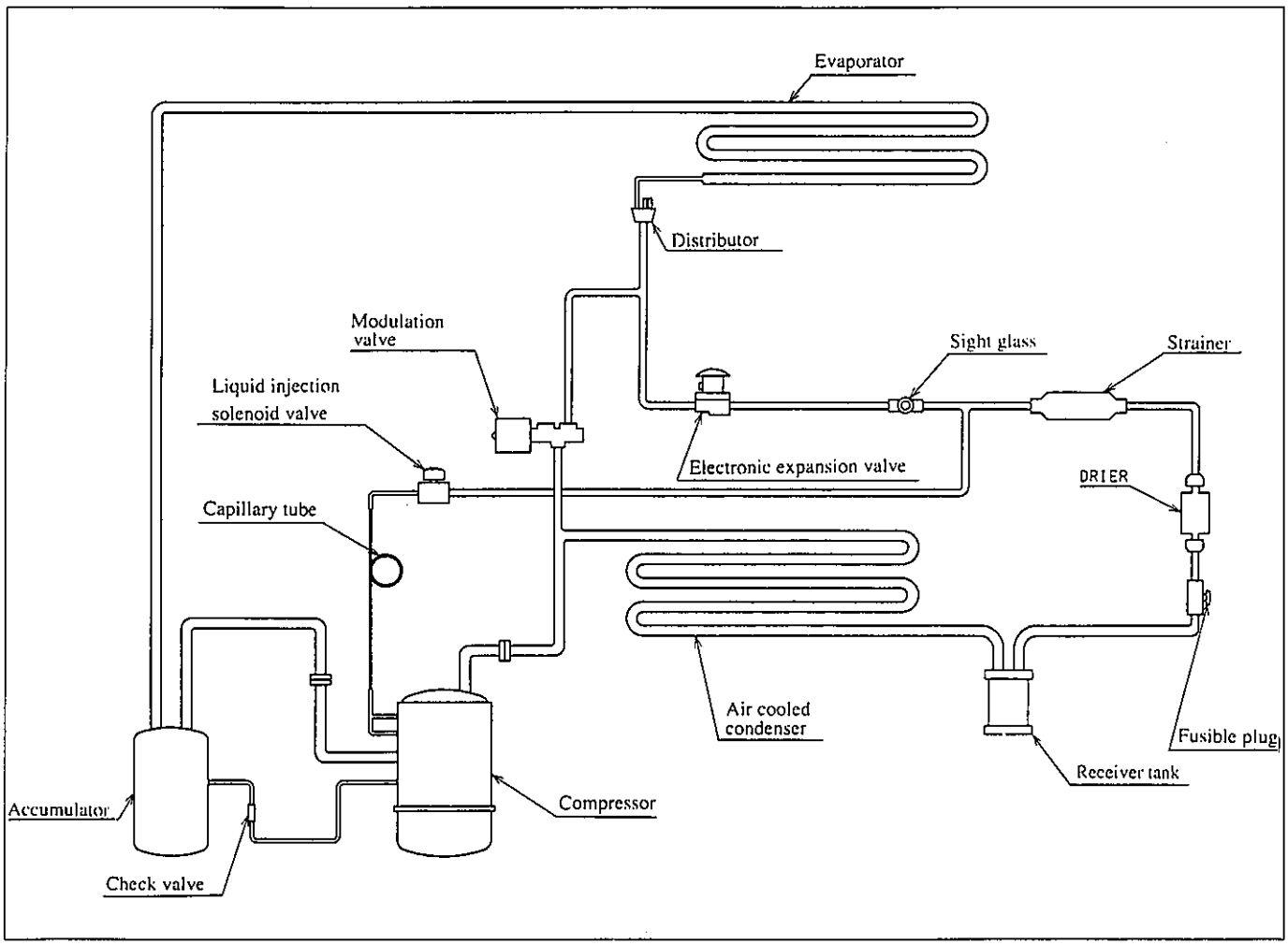


Fig. 14 Refrigerant system diagram

4. FUNCTIONAL PARTS

To enable automatic operation, the refrigeration unit includes a number of functional parts.

4.1 Micro-Computerized Recorder Controller (MMCCIIIA)

Please refer to chapter 12.

4.2 High Pressure and Low Pressure Sensors (HPT, LPT)

These sensors detect levels of high pressure and low pressure respectively. The following protection and control mechanisms have been built into the electronic circuit.

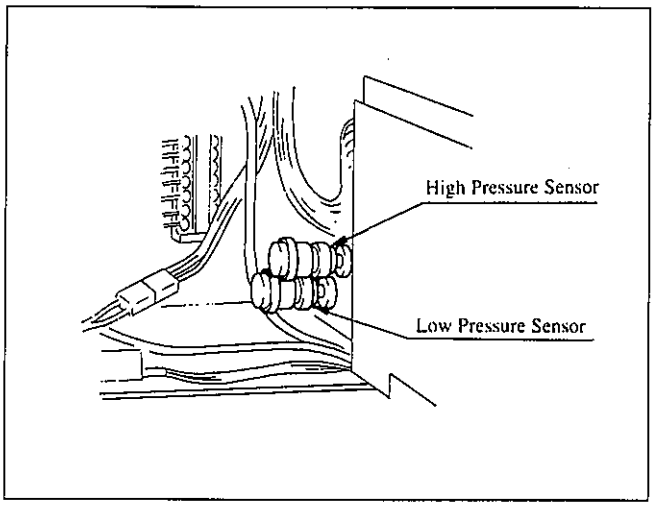


Fig. 15 High-low pressure sensor

(1) Protection for abnormal high pressure (HP) and low pressure (LP)

If the HP exceeds the preset pressure due to condenser fan failure, etc. or if the LP drops below the preset pressure due to leakage of, or clogged refrigerant, such an event will be judged as an abnormal HP or LP, and the compressor will be stopped.

(2) Others

In addition to the above, they are used to detect pressures for controlling of the superheat of the evaporator by the electronic expansion valve, etc..

4.3 High Pressure Switch (HP)

To prevent abnormal high-pressure from occurring, a backup high-pressure switch has been built into the unit. If activated this switch will cause to stop the compressor.

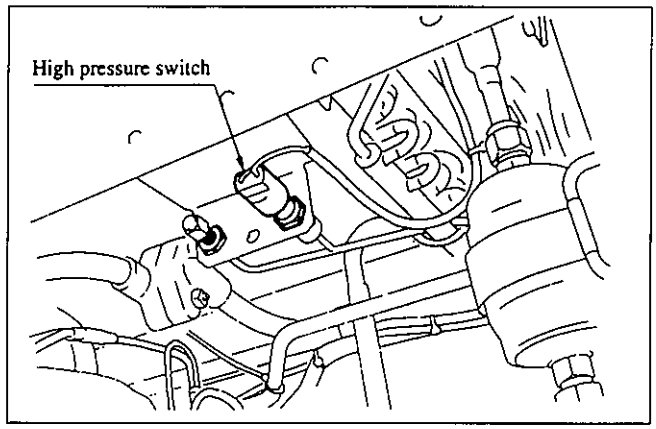


Fig. 16 High pressure switch

4.4 Air Temperature Sensors (TRET, TSUP)

Return air sensors and supply air sensors are fitted in the air ducts leading to and from the container and are used to control and record temperature. See chapter 14 of this manual for details.

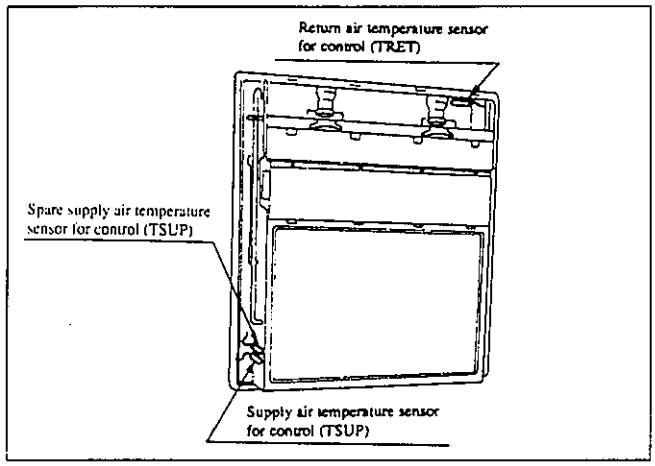


Fig. 17 Air temperature sensors

4.5 Ambient Temperature Sensor (TA)

Indicated in the figure, this sensor is used to judge any abnormal event, such as in automatic PTI.

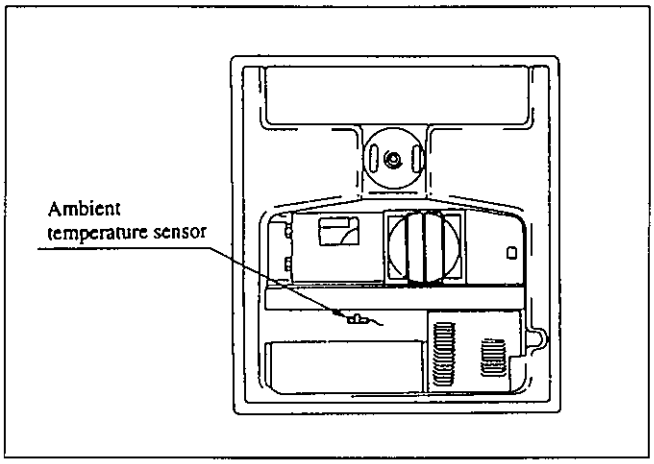


Fig. 18 Ambient temperature sensor

4.6 Evaporator Coil Outlet Sensor (TDK)

This sensor is used to detect gas temperature at the evaporator outlet and to control superheat due to electronic expansion, and to sense defrost termination and conditions which defrost requires.

Termination of defrost and detection of frosting condition

Setting : ON: 10°C, OFF: 15°C

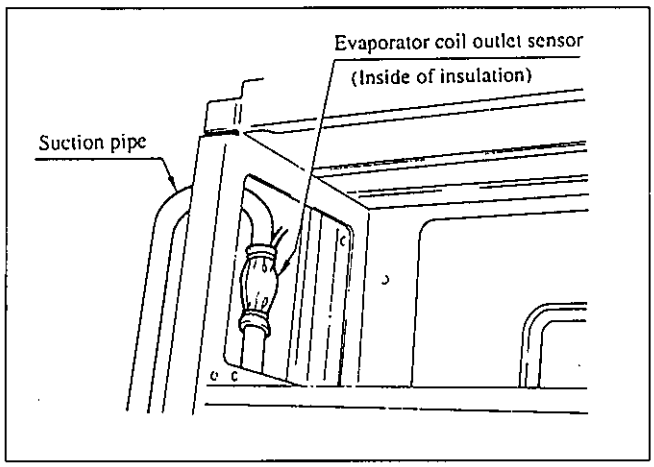


Fig. 19 Evaporator coil outlet sensor

4.7 Overheating Protection Thermostat (HK2, HK3)

This thermostat is used to detect overheating of the heaters in heating or defrost operation. Any abnormality will cause it to stop energizing the heaters.

OFF : 66°C (150°F)

ON : 52°C (125°F)

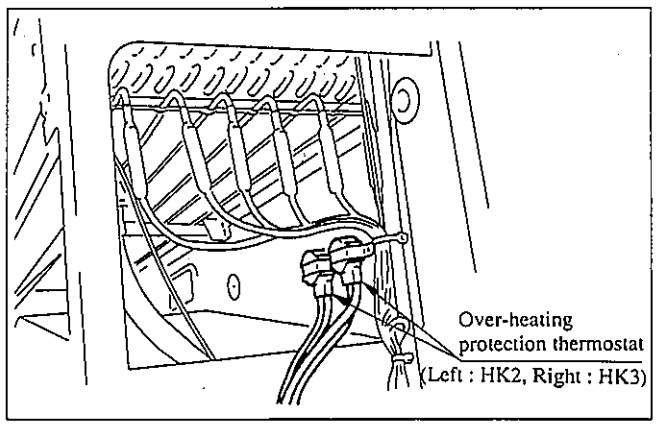


Fig. 20 Overheating protection thermostat

4.8 Strainer

The strainer filters any foreign mixtures in the refrigerant circuit.

The position is in the liquid refrigerant piping between the drier and the sight glass.

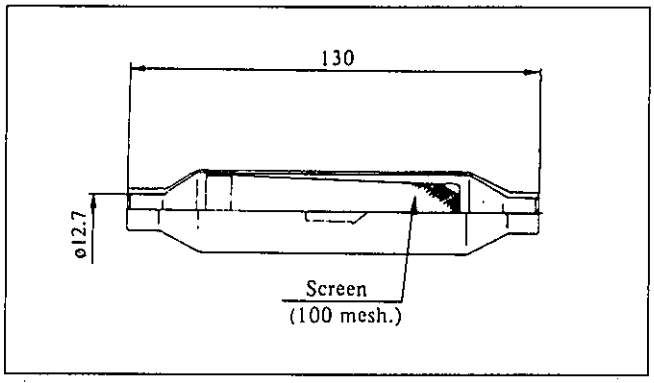


Fig. 21 Strainer

4.9 Modulating Valve (MV)

The modulating valve is placed in the discharge line to provide capacity control. This valve is controlled by the MMCCIIIA controller for stepless modulation of the hot gas bypass.

The MMCCIIIA controller allows the following items to be checked:

MV manual test opening check: MODE 7 segment LED

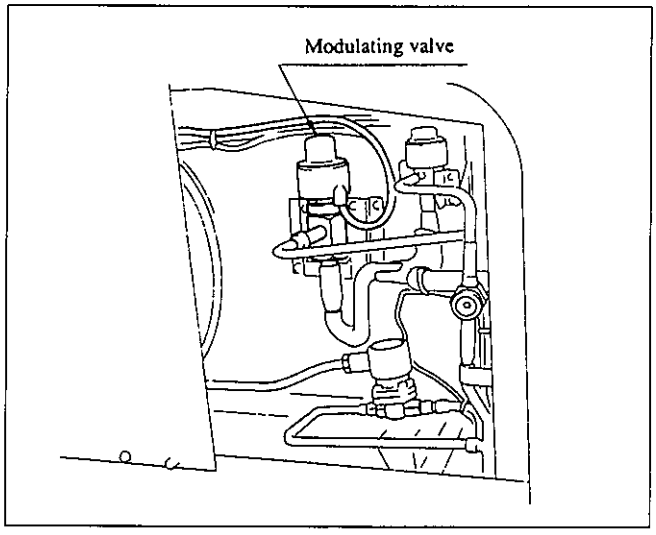


Fig. 22 Modulating valve

4.10 Liquid injection solenoid valve (S5)

This valve is placed in the liquid line to provide the liquid injection control for protecting the compressor against overheating.

- Open when energized
- Closed when de-energized

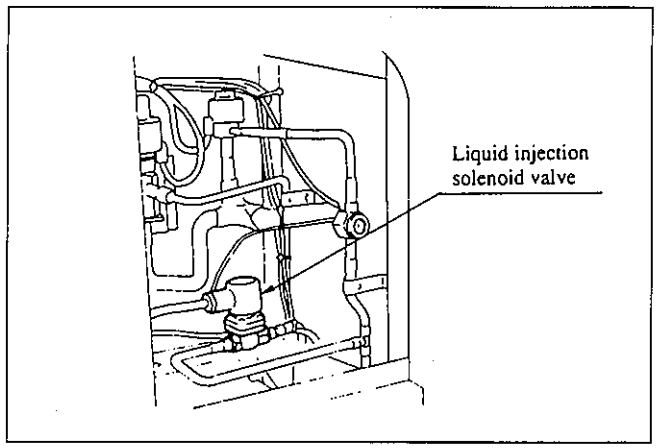


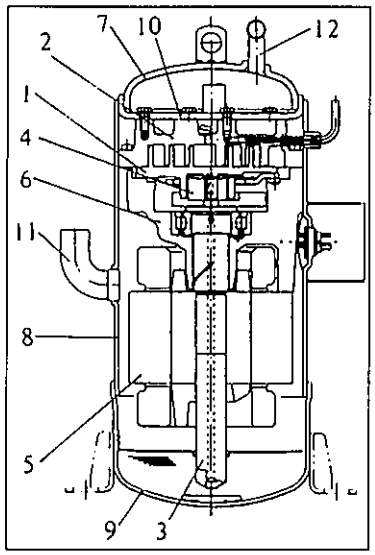
Fig. 23 Liquid injection solenoid valve

4.11 Compressor

Compressor is of hermetic scroll type with built-in electric motor. Compressor can not rotate in either direction so that phase reversal switch is needed.

Power: 3 Phase 440V AC

Output: 5.5 kW × 1



No	Name
1.	Orbit scroll
2.	Fixed scroll
3.	Crankshaft
4.	Drive bearing
5.	Motor
6.	Motor case
7.	Upper housing
8.	Body
9.	Lower housing
10.	Discharge cover
11.	Suction pipe
12.	Discharge pipe

Fig. 24 Cross section of compressor

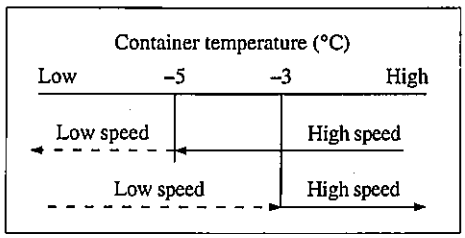
4.12 Condenser fan motor and Evaporator fan motor

The fan motors are of weather and corrosion proof type. Condenser fan motor is single speed and evaporator fan motors are two speed.

They are 3 phase, so that phase reversal is needed. Each motor is provided with an overload protector of self-recovery type to avoid overheating.

- Condenser fan motor:
  3 phase, 4 Pole, 440V/60Hz
  and 380, 415V/50Hz
  780W (input) × 1
- Evaporator fan motor:
  3 phase, 2/4 Pole, 440V/60Hz
  and 380, 415V/50Hz
  1200W/190W (input) × 2

Evaporator fan motor speed is controlled by the MMCCIIIA controller depending on the container temperature.



4.13 Condenser and Evaporator Fans

Condenser fan: 440mm Dia.
four blades propeller type.

Evaporator fan: 320mm Dia.
four blades propeller type.

4.14 Heaters

⚠ **Warning** **Do not touch the heater and the area around it because of its high temperature while the power is turned on.**
Your hands may be burned.

Mounted under the evaporator coil, and energized in heating or defrosting operation.

Evaporator coil : 900W × 6

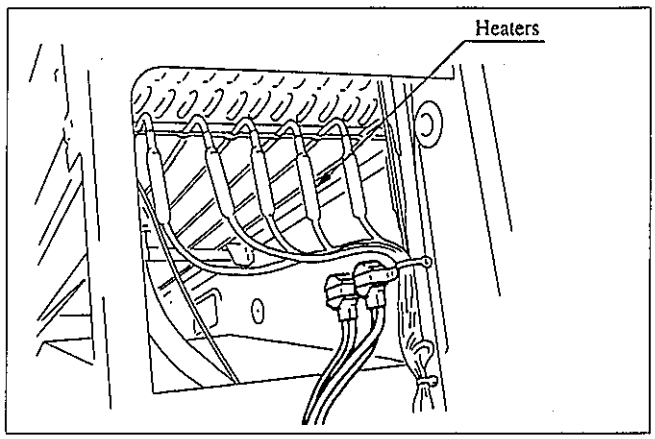


Fig. 25 Heaters

4.15 Electronic Expansion Valve (EEV)

With its aperture being controlled by the MMCCIIIA controller, the electronic expansion valve serves a number of uses, such as cooling capacity control, power consumption control, high pressure control, refrigerant circuit shut off, etc..

The MMCCIIIA controller allows the following items to be checked:

	MODE	7 segment LED
EEV manual test opening check:	2	- - 0 9

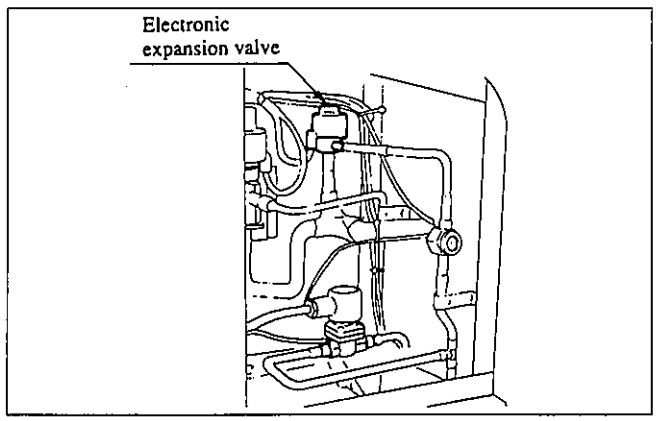


Fig. 26 Electronic expansion valve

4.16 Current Sensor (CT_1, CTM)

Used to detect abnormalities, such as in the main circuit, control circuit and compressor circuit, possible burnout, or short circuit in components.

These have been installed in the control box.

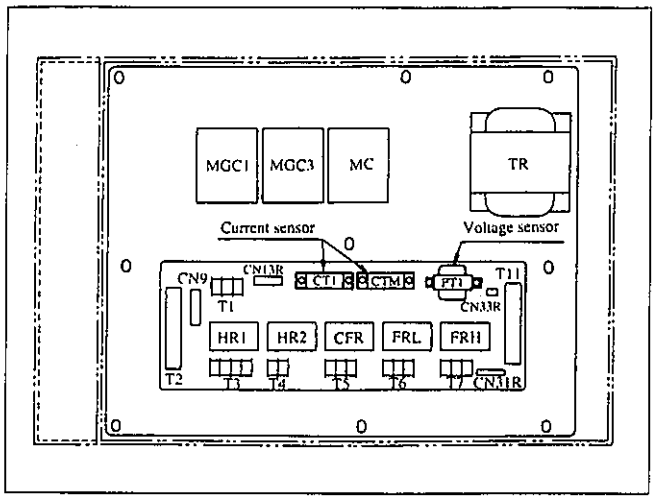


Fig. 27 Current sensor, voltage sensor

4.17 Voltage Sensor (PT1)

Installed in the control box for detection of abnormalities in power supply voltage.
(See Fig. 27)

4.18 Battery unit (rechargeable)

MMCCIIIA can operate by battery unit after power source OFF. Also the battery is useful for setting of control temperature, back-up of a memory storing the various operation data and temperature recording for 3 days.

If the voltage of the battery becomes low during battery operation, the alarm LED will light up. Then set to Existing alarm information display mode by the MODE key and make sure of "alarm code: 997". When the 7 segment LED displays "alarm code: 997", charge the battery from AC power source.

Soon after charging, when the 7 segment LED displays "alarm code: 997", change the battery to new one.

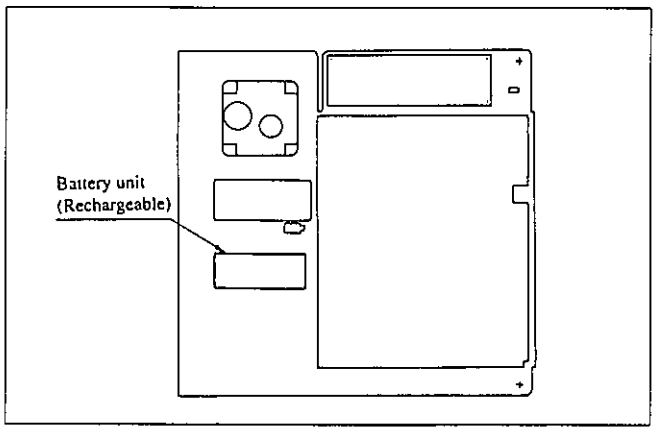


Fig. 28 Battery unit (Backside of MMCCIIIA)

4.19 Remote monitoring socket

Remote monitoring socket with weather proof cap is provided for remote display and monitoring of operation status; COOL, DEFROST and IN RANGE.

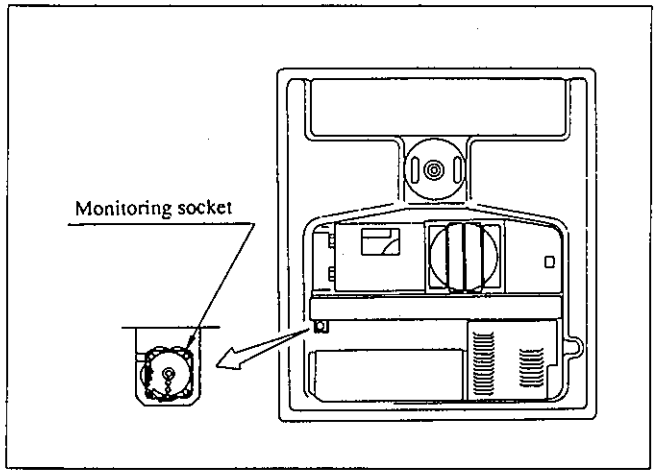


Fig. 29 Remote monitoring socket

4.20 USDA Receptacles

3 USDA sensor receptacles with weatherproof cap are provided in the bulkhead for connecting of cold treatment temperature sensors. (See Fig. 13)

Before starting cold treatment operation, should adjust the offset data of three cold treatment temperature sensors, following the instruction which is shown at main menu screen of Hand-held computor.

4.21 Functions of Control Equipment

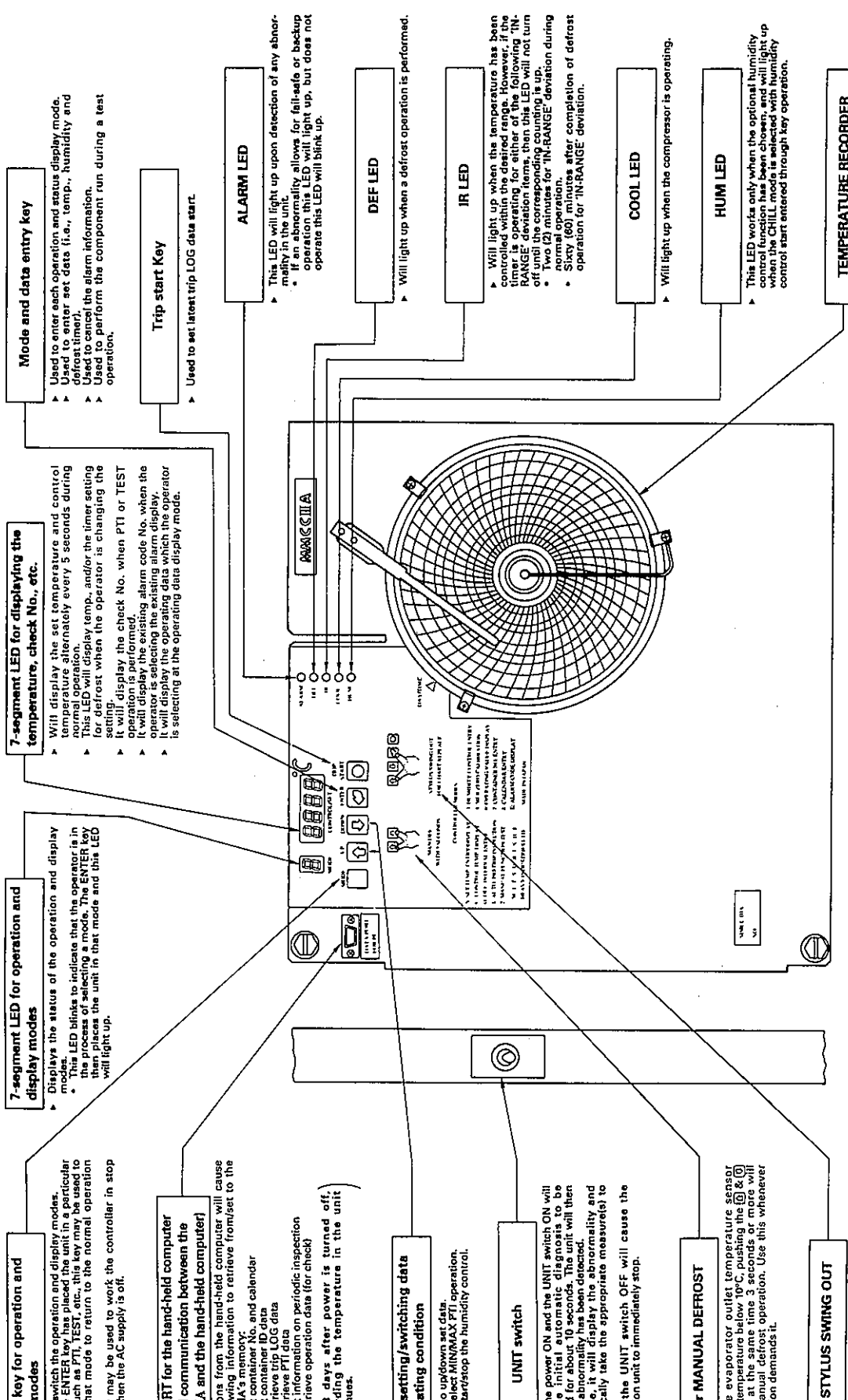
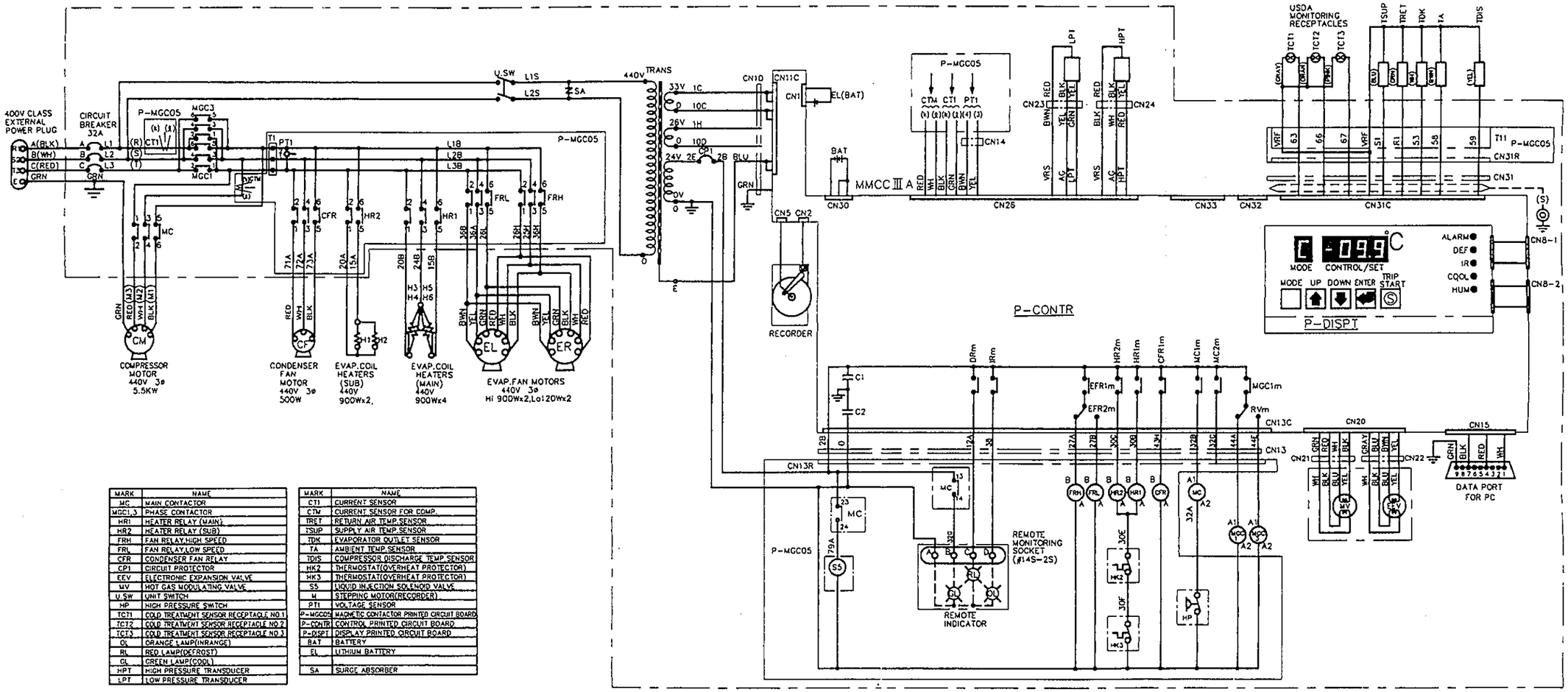


Fig. 30 Control equipment

5. ELECTRIC WIRING

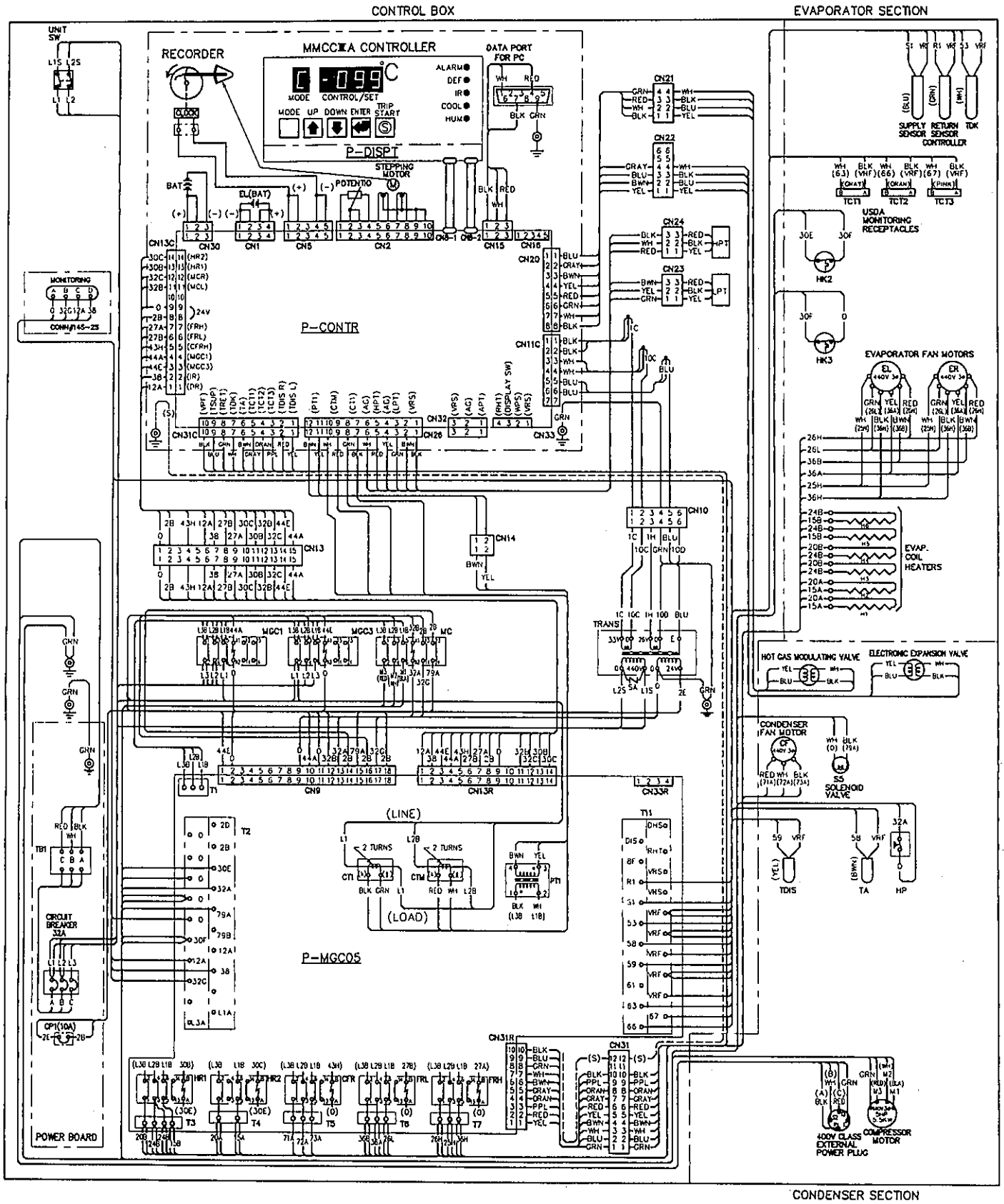
5.1 Sequence diagram



MARK	NAME
MC	MAIN CONTACTOR
MGC1,3	PHASE CONTACTOR
HR1	HEATER RELAY (MAIN)
HR2	HEATER RELAY (SUB)
FRH	FAN RELAY,HIGH SPEED
FRL	FAN RELAY,LOW SPEED
CFR	CONDENSER FAN RELAY
CP1	CIRCUIT PROTECTOR
EEV	ELECTRONIC EXPANSION VALVE
MV	HOT GAS MODULATING VALVE
U.SW	UNIT SWITCH
HP	HIGH PRESSURE SWITCH
TCT1	COLD TREATMENT SENSOR RECEPTACLE NO.1
TCT2	COLD TREATMENT SENSOR RECEPTACLE NO.2
TCT3	COLD TREATMENT SENSOR RECEPTACLE NO.3
OL	ORANGE LAMP(INRANGE)
RL	RED LAMP(DEFROST)
GL	GREEN LAMP(COOL)
HPT	HIGH PRESSURE TRANSDUCER
LPT	LOW PRESSURE TRANSDUCER

MARK	NAME
CT1	CURRENT SENSOR
CTM	CURRENT SENSOR FOR COMP.
TRET	RETURN AIR TEMP.SENSOR
TSUP	SUPPLY AIR TEMP.SENSOR
TDK	EVAPORATOR OUTLET SENSOR
TA	AMBIENT TEMP.SENSOR
TDIS	COMPRESSOR DISCHARGE TEMP.SENSOR
HK2	THERMOSTAT(OVERHEAT PROTECTOR)
HK3	THERMOSTAT(OVERHEAT PROTECTOR)
SS	LIQUID INJECTION SOLENOID VALVE
M	STEPPING MOTOR(RECORDER)
PT1	VOLTAGE SENSOR
P-MGC05	MAGNETIC CONTACTOR PRINTED CIRCUIT BOARD
P-CONTR	CONTROL PRINTED CIRCUIT BOARD
P-DISPT	DISPLAY PRINTED CIRCUIT BOARD
BAT	BATTERY
EL	LITHIUM BATTERY
SA	SURGE ABSORBER

5.2 Wiring diagram

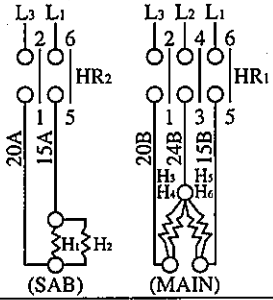


6. SETTING OF FUNCTIONAL PARTS

Item			Unit	Setting Value	
Fusible plug			°C (°F)	Fused at	95 (203)
Thermal protector. condenser/evaporator fan motor			°C (°F)	OFF	140 (284)
				ON	92 (197.6)
HP (Back up high pressure switch)			kPa <kgf/cm²> (lb/in²G)	Cut out	3630 <37 ± 1> (526 ± 14)
				Cut in	2550 <26 ± 1.5> (370 ± 21)
HK2, HK3 (overheating protection thermostat)			°C (°F)	Open	66 ± 3.0 (150 ± 5)
				Close	52 ± 4.5 (125 ± 8)
Electronic Controller	HPT	Abnormality protection	kPa <kgf/cm²> (lb/in²G)	Cut out	3430 <35.0> (498)
				Cut in	2550 <26> (370)
	LPT	Abnormality protection	kPa <kgf/cm²> (lb/in²G)	Cut out	0 <0> (0)
				Cut in	60 <0.6> (8.5)
	TDIS (Compressor discharge gas temp. protection)		°C (°F)	open	125 (257)
	CTM (Compressor motor overcurrent protection)		A	stop	25
	TDK (Defrost termination)		°C (°F)	ON	10 (50)
				OFF	15 (59)
	Defrost timer (To be set to the mode display '⏱')		Auto (A)	3ᴴ↔6ᴴ↔9ᴴ↔12ᴴ	
			Fixed	3ᴴ, 6ᴴ, 9ᴴ, 12ᴴ	
			Caution (1) Compulsory three (3) hours for the first time immediately after start-up. (2) The timer is active for two (2) hours immediately after the power has been turned off.		

※ Conversion factors to SI units:
1kgf/cm² = 9.80665 × 10kPa
1kgf·cm = 9.80665 × 10⁻²N·m

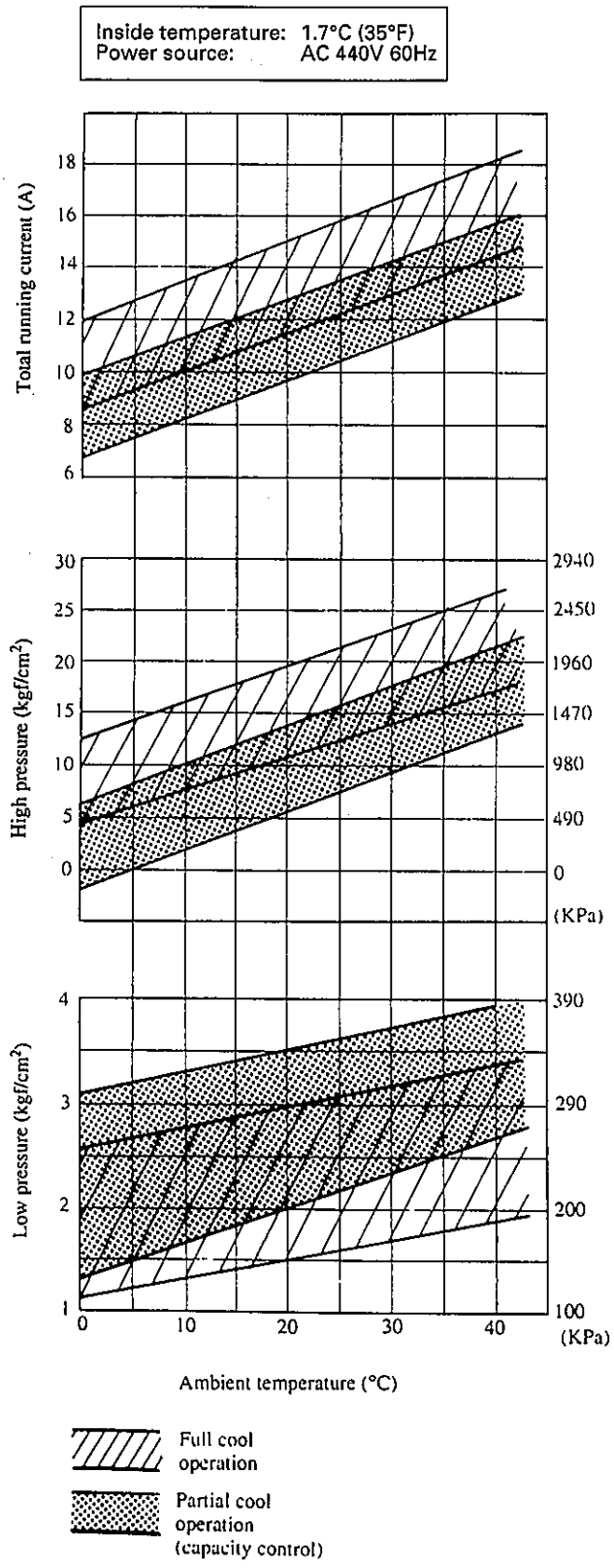
7. REFERENCE DATA

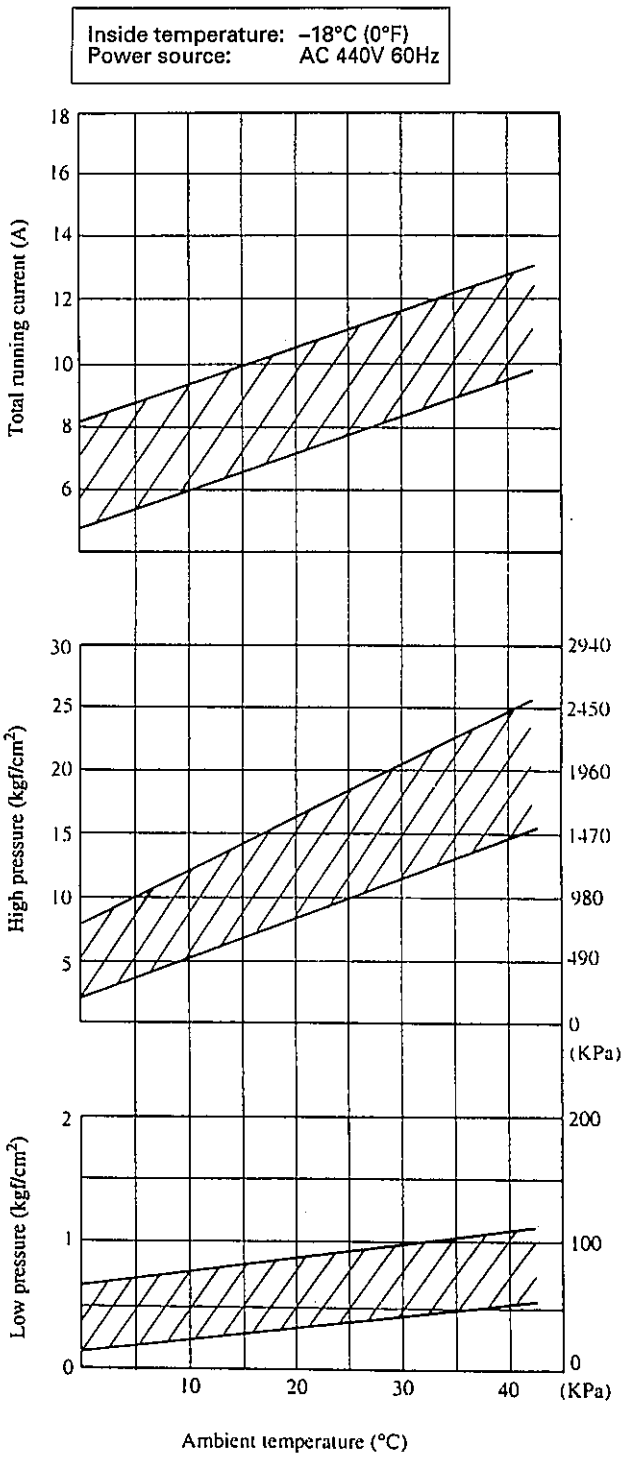
No.	Item		Unit	Data			
1	Compressor	Starting current	A	75			
		Running current		9.0			
2	Condenser fan. running current		A	1.2			※1
3	Evaporator fan. running current		A	Low (26L)	0.9		※1, ※2
				High (26H)	3.5		※1, ※2
4			A	HR1	L1 (15B)	3.7	※1
					L2 (24B)	7.4	※1
					L3 (20B)	3.7	※1
				HR2	L1 (15A)	3.7	※1
					L3 (20A)	3.7	※1
5	Insulation resistance	Other than heater	MΩ	above 1.0			
		Heater		above 0.3			
6	Clearance of fan and shroud	Condenser	mm	6.0~7.25			
		Evaporator		4.0~5.25			
7	Tightening torque of bolts	compressor fixing bolt	N·m <kgf·cm> (ft·lb)	31.4~36.3 <320~370> (22~27)			
		fan motor fixing bolt		14.7~17.6 <150~180> (11~13)			
		Unit mounting bolt		147~157 <1500~1600> (108~116)			

※1 Ambient temperature 38°C, inside temperature 1.7°C, power source 440V, 60Hz.
※2 Two evaporator fan motors' running current.

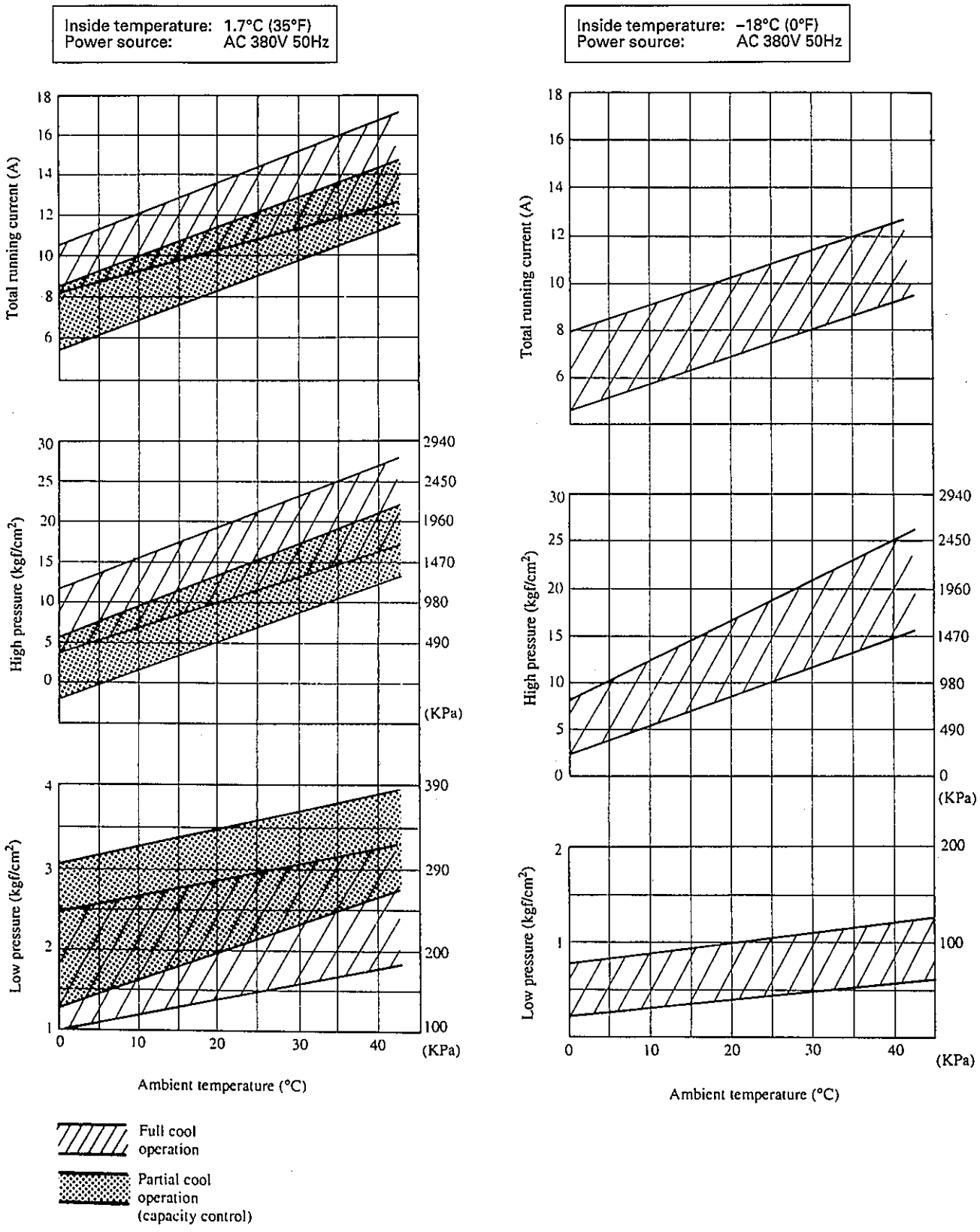
8. TABLE OF OPERATING CURRENT AND PRESSURE

8.1 60Hz Operation





8.2 50Hz Operation



9. INSPECTION BEFORE LOADING (PTI)

Selecting the PTI mode on the MMCCIIIA controller will cause the Unit to automatically perform MIN.PTI functions, which primarily check the components, and MAX.PTI functions, which check all functions including operating conditions.

Note: The following table lists the inspection items recommended by the manufacturer; these may differ from those instructed by the relevant shipping company.

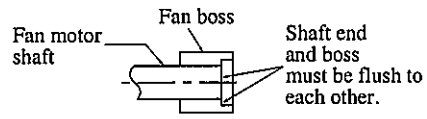
9.1 MIN. PTI and MAX. PTI functions

Refer to chapter 12.6.3 for functional details and chapter 12.11.19 for operational procedures and displays.

9.2 Visual Inspection

⚠**Warning** **Make inspection after turning off the unit ON-OFF switch, circuit protector, circuit breaker and the equipment power and disconnecting the power plug.**

If the inspection is made with the power on, injuries due to rotating matter, electric shock, fire or other trouble may be caused.

No.	Check Point		Tool Gauge	Inspection Method	Criterion for judgement	Counter-measure
1	Damage of container	(a) Inside wall, outside wall and frame		Visual inspection	Bending, breakage etc.	Repair or replace
		(b) Door latch, door seal and door hinge			Bending, breakage, twist of sealing agent	
		(c) Ventilator cover			Breakage	Replace
2	Damage of unit	(a) Frame		Visual inspection	Bending, crank	Repair or replace
		(b) Panel and cover			Bending, breakage	
		(c) Cable and plug			Breakage, damage to cable	Replace
3	Clogging of drip pan	Outlet of drip pan		Visual check of inspection opening	Deposited obstacles	Remove with hand or brush
	Clogging of drain hose	Inside of hose		Visual or with a metal rod		Remove foreign substance by water pressure or any other appropriate means.
4	Fan motor, fan and fixing bolts of evaporator and condenser	(a) Clearance between fan and orifice		Visual inspection or with a thickness gauge	Fan shaft must be in the center of the orifice. If deviated, the allowable clearance shows below. Condenser fan : 6.0~7.25 mm Evaporator fan : 4.0~5.25 mm	Adjust orifice mounting position
		(b) Fan mounting position		Visual and by hand		
		(c) Fan shaft bearing		Turn shaft by hand	No smooth rotation Unusual noise	Repair or replace
		(d) Fan motor fixing bolt		Visual inspection or hammering with a test hammer	Tightening torque: 14.7 ~ 17.6 N·m <150 ~ 180 kgf·cm> (11 ~ 13 ft-lb)	Retighten
5	Compressor fixing bolt			Visual inspection or hitting with a test hammer	Tightening torque: 31.4 ~ 36.3 N·m <320 ~ 370 kgf·cm> (22 ~ 27 ft-lb)	Retighten
6	Sealing condition	Sealing agent of control box and receptacle		Visual inspection	Twisted sealing agent and incomplete coating of silicon sealer	Replace sealing agent or coat with silicon sealer
7	Fixing bolt of unit to container	Tightness of bolt		Visual inspection or hitting with a test hammer	Torque: 147 ~ 157 N·m <1500 ~ 1600 kgf·cm> (108 ~ 116 ft-lb)	Retighten (Apply an anti-seize compound to the threads)

9.3 Inspection for Leakage

⚠Warning **Do not bring detectors or your hands to the rotating matter.**

Injuries, breakage of the refrigeration unit or other trouble may be caused.

⚠Warning **Do not touch the compressor or hot or cold part of pipes.**

Your hands may be burned.

No.	Check Point		Tool Gauge	Inspection Method	Criterion for judgement	Counter-measure
1	Gas and oil leakage from refrigerant system	(a) Points to check for gas leakage: welded parts, joints, functional parts, and fixing screws.	Halide torch or Electronic leak detector	Visual inspection	Green halide torch for trouble, blue for normal	Repair or replace.
		(b) Points to check for oil leakage: flare fittings of piping.			Oozing out of oil, crack on flare piping, and loosening of flare. Pay attention, in particular, to refrigerant charge in case of oil leakage.	Retighten fittings or replace.

9.4 Inspection of Electrical System

⚠Warning **Make inspection after turning off the unit ON-OFF switch, circuit protector, circuit breaker and the equipment power and disconnecting the power plug.**

If the inspection is made with the power on, injuries due to rotating matter, electric shock, fire or other trouble may be caused.

No.	Check Point		Tool Gauge	Inspection Method	Criterion for judgement	Counter-measure
1	Loosening and corrosion of terminals	Inside of control box and terminal box		Visual inspection or with a screw driver	Loosening, missing and salt corrosion of terminal	Re-tighten, replace.
2	Faulty contact of connectors	Connectors of recorder controller		Check if securely connected		• Connect securely. • Spray contact cleaner THREE BOND #2501S.
3	Burning out of magnetic contactor and loosening of fixing bolt	(a) Burning out or corrosion of contact point and coil		Visual inspection or with a screw driver	Burning out or salt corrosion of contact point and coil	Replace.
		(b) Loosening of magnetic contactor fixing bolt			Loosening or missing of fixing bolt	Retighten.
4	Insulation resistance	Power line, compressor motor heater, evaporator fan motor and condenser fan motor • Do not apply the 500V power of the meggar to the secondary side of the transformer in the control box to prevent damage of the electronic controller. • Before checking, switch the UNIT on-off switch to "OFF" position.	Meggar DC 500V	Place manually contactors to ON position and check insulation.	1 MΩ and above between the power plug terminal and the body (except the heater). The heater is allowable if 0.3 MΩ and above.	Replace.

9.5 Inspection During Operation

⚠ **Warning** **Do not touch the electrical system with the power on.**

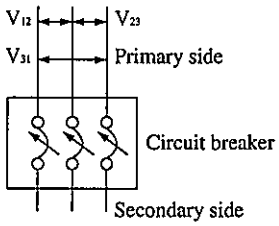
Electric shock, injuries or other trouble may be caused.

⚠ **Warning** **Do not touch the rotating matter.**

Injuries, breakage of the refrigeration unit or other trouble may be caused.

⚠ **Warning** **Do not touch the compressor or hot or cold part of pipes.**

You may be burned.

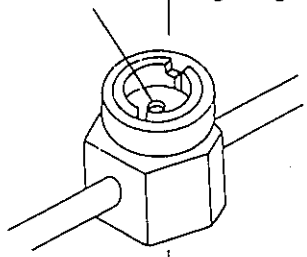
No.	Check Point		Tool Gauge	Inspection Method	Criterion for judgement	Counter-measure
1	Power supply voltage and phase	Measurement of line voltage ⚠ **Warning** **(Refer to Note (1).)**	MMCC IIIA or Voltage sensor, Voltage meter	Measure between following points 	Within the rated voltage ± 10%	Repair power supply equipment.
		Phase check ⚠ **Warning** **(Refer to Note (1).)**	Phase checker	Check phase at comp-terminal box		Change wiring of R, S and T
2	Abnormal noise and vibration of equipment	Compressor, fan motor, piping, capillary tube, panel, etc.		Visual inspection, auditory check	Abnormal noise and vibration	Repair or replace.
3	Compressor current draw	Normal value ⚠ **Warning** **(Refer to Note (1).)**	MMCC IIIA or Am-meter	Measure when inside temperature is about 1.7°C (35°F)	Check current against data. (See chapter 7)	Repair fault
4	Refrigerant charge	Charge amount	MMCC IIIA	MAX.PTI or Sight glass ⚠ **Warning** **(Refer to Note (2).)** Judge the appropriate amount of refrigerant based on the overall condition of the suction pressure, discharge pressure, ambient temperature, etc...	Sight glass must be clear The sight glass of liquid line must be free from any excessive frothing.	Charge or purge.

Note (1) ⚠ **Warning** **Turn the power off (that is, turn off the unit ON-OFF switch, circuit protector, circuit breaker and the equipment power, and disconnect the power plug) before connecting any measuring instrument.**

If the measuring instrument is connected with the power on, electric shock, injuries or other trouble may be caused.

Note (2) ⚠ **Warning** **Do not look into the sight glass during operation when the panel in front of the glass is removed.**

The sight glass may shatter and its flying fragments may hurt you.

No.	Check Point		Tool Gauge	Inspection Method	Criterion for judgement	Counter-measure
5	Moisture indicator	Color of moisture indicator		Visual inspection	Green: normal Yellow: abnormal 	Replace drier, purge and charge refrigerant.
6	Operating pressure	Suction pressure, discharge pressure ⚠**Warning** **(Refer to Note (3).)**	MMCC IIIA Pressure sensor Gauge mani-fold	Connect gauge manifold to service valves.	Check pressures against table. (See chapter 8)	Purge and charge refrigerant
7	High/low pressure sensors	Pressure deviation between hand-held computer indication value and gauge manifold. ⚠**Warning** **(Refer to Note (3).)**	MMCC IIIA Pressure sensor and Gauge mani-fold	Compare and check the hand-held computer indication value and gauge manifold during stable operation.	Deviation High pressure 1 kg/cm² Low pressure 0.2 kg/cm² In the above case, recheck the gauge manifold.	Recheck the gauge manifold, and if any deviation is found, adjust or replace.
8	Temperature recorder	Deviation between temperature recording paper scale and needle	MMCC IIIA	Calibrate 0°C in the mode No. [4] of MMCCIIIA, and check the needle position.	If the deviation is ±0.5° or more, press [⇧] or [⇩] key to bring needle to near 0°C scale. (Don't forget to press [↵] key.)	If the deviation exceeds the adjusting range, replace MMCCIIIA.
9	Heater	Measurement of heater current ⚠**Warning** **(Refer to Note (4).)**	Am meter MMCC IIIA Current sensor	Measure the heater current by the manual defrost operation.	Check current against data (See chapter 7)	
10	Pull down test	Inside temperature	MMCC IIIA	MAX. PTI	Make sure that the inside temp. goes down to –18°C (0°F)	Check the cause that prevents cooling.

Note (3) ⚠Warning **Turn the power off (that is, turn off the unit ON-OFF switch, circuit protector, circuit breaker and the equipment power, and disconnect the power plug) before installing or removing the gauge manifold.**

If the gauge manifold is installed or removed with the power on, electric shock, injuries or other trouble may be caused.

Note (4) ⚠Warning **Turn the power off (that is, turn off the unit ON-OFF switch, circuit protector, circuit breaker and the equipment power, and disconnect the power plug) before installing or removing the measuring instrument.**

If the measuring instrument is installed or removed with the power on, electric shock, injuries or other trouble may be caused.

9.6 Final Inspection

⚠Warning **Do not touch the electrical system with the power on.**

Electric shock, injuries or other trouble may be caused.

No.	Check Point	Tool Gauge	Inspection Method	Criterion for judgement	Counter-measure
1	Spraying of rustproof lubricant to terminal or contact in the control box. ⚠Warning (Refer to Note (5).)		Spray the lubricant when motion of magnetic contactor is not smooth.		For the rust-proof lubricant, use THREE BOND #1804. NOTE: Do not use silicon grease or spray including freon gas.
2	Set a new recording chart		Remove the recording chart used for operational inspection and set a new recording chart		
3	Fill in the history card		Note on the history card such items as parts replaced, additional charging of refrigerant, purging, spraying of rust prevention, if made. Also note the deviation of the automatic temperature recorder on the history card at every inspection		

Note (5) ⚠Warning • **Do not spray with the power on.**

• **Turn off the unit ON-OFF switch, circuit protector, circuit breaker and equipment power and disconnect the power plug before spraying.**

If lubricant is sprayed with the power on, injuries, electric shock, fire or other trouble may be caused.

10. PERIODIC SERVICE GUIDE

⚠ **Warning** **Do not touch the electrical system with the power on.**

If you touch the electrical system with the power on, electric shock, injuries or other trouble may be caused.

⚠ **Warning** **Do not touch the compressor or hot or cold part of pipes.**

You may be burned.

Period	Parts	Maintenance
(1) Inspection during power "OFF"		
⚠ **Warning** **Turn off the unit ON-OFF switch, circuit protector, circuit breaker and equipment power and disconnect the power plug before making inspection.** If inspection is made with the power on, electric shock, injuries due to rotating matter, breakage of the refrigeration unit or other trouble may be caused.		
Every 2 years	Recorder controller	• Check the following with regard to the controller. Check P-CONTR board for voltage of lithium battery and change the battery if it is less than DC3V. Change the battery once in every four or five years. Note: Turn unit switch "ON" to change lithium battery and change it while AC power is "ON". ⚠ **Warning (Refer to Note (1).)**
	Electrical contact of main contactor	Replace contacts
	Evaporator coils	• Clean with steam within a short time. • Be careful not to expose thermistor sensors to a temperature of 80°C (176°F) and above, since the allowable temperature limit of the sensor is approximately 80°C (176°F).
	Air cooled condenser coils	Clean with cold water to avoid refrigerant pressure rise.
	Drier	Replace
	Copper pipes	Polish and coat with rust preventive material.
	Outer surfaces, especially those of compressor.	Inspect for rust or corrosion. Remove rust and paint with rust preventive paint.
	Refrigerant	Charge or purge if necessary.
	Control box cover	Check the fitting or the cover to the control box if necessary.
Every 4 years	Electrical contacts of fan relays	Inspect contacts for pitting or corrosion and replace tips if necessary.
	Sight glass (Moisture indicator)	Replace if surface rusted.
	Harness and control box	• Replace if insulation is cracked or aged. • Repair seals.
	Entire unit	• Sweep and clean inside. • Repaint unit surface.
	Control box cover	Check and change the cover gasket if necessary.
After initial 15 years	Compressor	Replace

Note (1) ⚠ **Warning** **Do not touch other electrical systems.**

If you touch the other electrical system with the power on, electric shock, injuries or other trouble may be caused.

Period	Parts	Maintenance
(2) Inspection during operation		
⚠ **Warning** **Turn off the unit ON-OFF switch, circuit protector, circuit breaker and equipment power and disconnect the power plug before installing or removing the thermometer or measuring instruments to the electric circuit, or the gauge manifold to the check joints.** If the measuring instruments are installed or removed with the power on, electric shock, injuries due to rotating matter, breakage of the refrigeration unit or other trouble may be caused. ⚠ **Warning** **Do not touch the rotating matter.** Injuries, breakage of the refrigeration unit or other trouble may be caused.		
Every 2 years	Recorder controller	• Check temperature control operation and recording function and repair or replace as necessary.
	Condenser and evaporator fan	• Check fan rotation. • Check that two evaporator fan motors running current (Hi) is below 6.0 amps and the condenser fan motor running current is below 3.6 amps.
	High-low pressure sensor	Check the actual value measured with a gauge manifold.
	Current sensor	Check the actual value measured with an ammeter.
	Voltage sensor	Check the actual value measured with a voltmeter.
	High-pressure switch	Check the working pressure.
	Overheating protection thermostat	Check the working temperature.

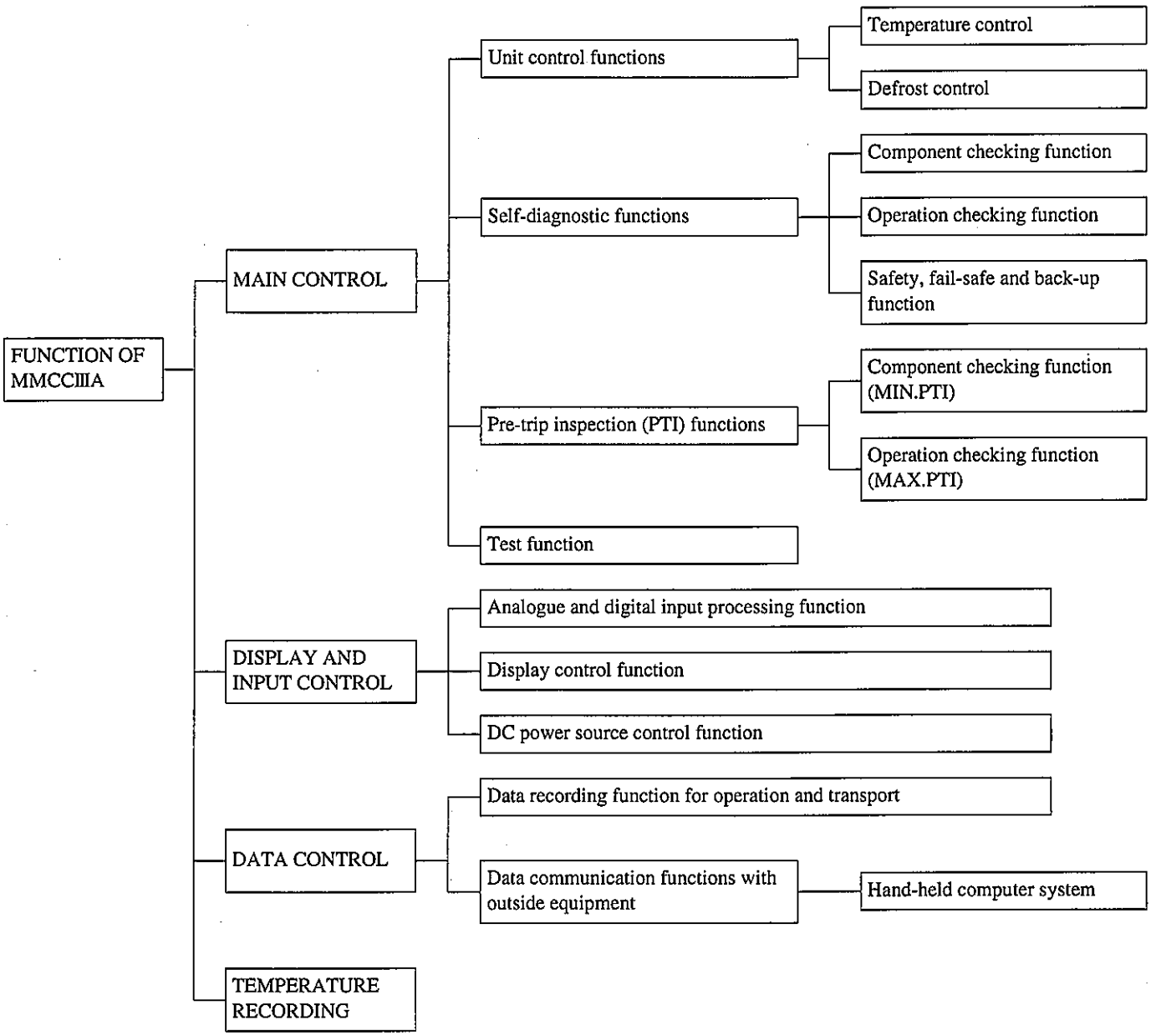
11. SPECIFICATIONS

Item		Unit	CPE14-2BAⅢES
Power Source			400 to 500V × 60Hz, 360 to 460V × 50Hz, AC3 phase
Outside Dimensions (H × W × D)		mm (in.)	2235 (88) × 2026 (79.75) × 445 (17.5)
Weight (max.)		kg (lb)	460 (1010)
Compressor	Model		Hermetic scroll, RS2527ESH
	Output	kW	5.5
	Operating current (Full load)	A	9.0 (starting current 75), at power source of 440V × 60Hz × 3ø
	Revolution	rpm	3450 (440V × 60Hz × 3ø)
	Lubrication oil	ℓ (gal)	BARREL FREEZE 32 SAM 1.8 (0.48)
Air-cooled condenser			Forced air circulation, plate fin and tube type, with ø 440, 4-blades fan (propeller) 780W (input) × 1 (direct coupled with motor)
Evaporator			Forced air circulation, plate fin and tube type, with ø 320, 4-blades fan (propeller) 1200W/190W (input) × 2 (direct coupled with motor)
Refrigerant		kg (lb)	R22 5.0 (11.0)
Expansion valve			Electronic expansion valve
Temperature control and recorder			Micro-computerized recorder controller (MMCCⅢA)
Defrost			• Initiated by electronic timer or air differential pressure transducer • Terminated by electronic thermostat or timer Coil heater: 900W × 6
Ventilation volume		m³/h	max. 180 (at 380V × 50Hz)
Over-load protector	Compressor motor		Over-current actuation type
	Condenser fan motor		Thermal actuation type (Auto-reset)
	Evaporator fan motor		Thermal actuation type (Auto-reset)
Fusible plug		°C (°F)	95 (203)
High-low pressure protection		kPa <kgf/cm²> (ℓb/in²-G)	High-pressure side Cut out 3430 <35> (498) Cut in 2550 <26> (370) Low-pressure side Cut out 0 <0> (0) Cut in 60 <0.6> (8.5)
Compressor overtheat (Discharge gas temperature)		°C (°F)	Cut out 125 (257)
Power source circuit breaker		A	32

12. MITSUBISHI MICRO-COMPUTERIZED RECORDER CONTROLLER (MMCCIIIA)

12.1 Features

Mitsubishi Micro-Computerized Recorder Controller (MMCCIIIA) is a high-precision, multi-functional recorder controller developed for use with refrigerated cargo containers and has every function required for them, such as various control functions, display, data control, and temperature recording function, for refrigeration unit.



12.2 General construction of MMCCIIIA system

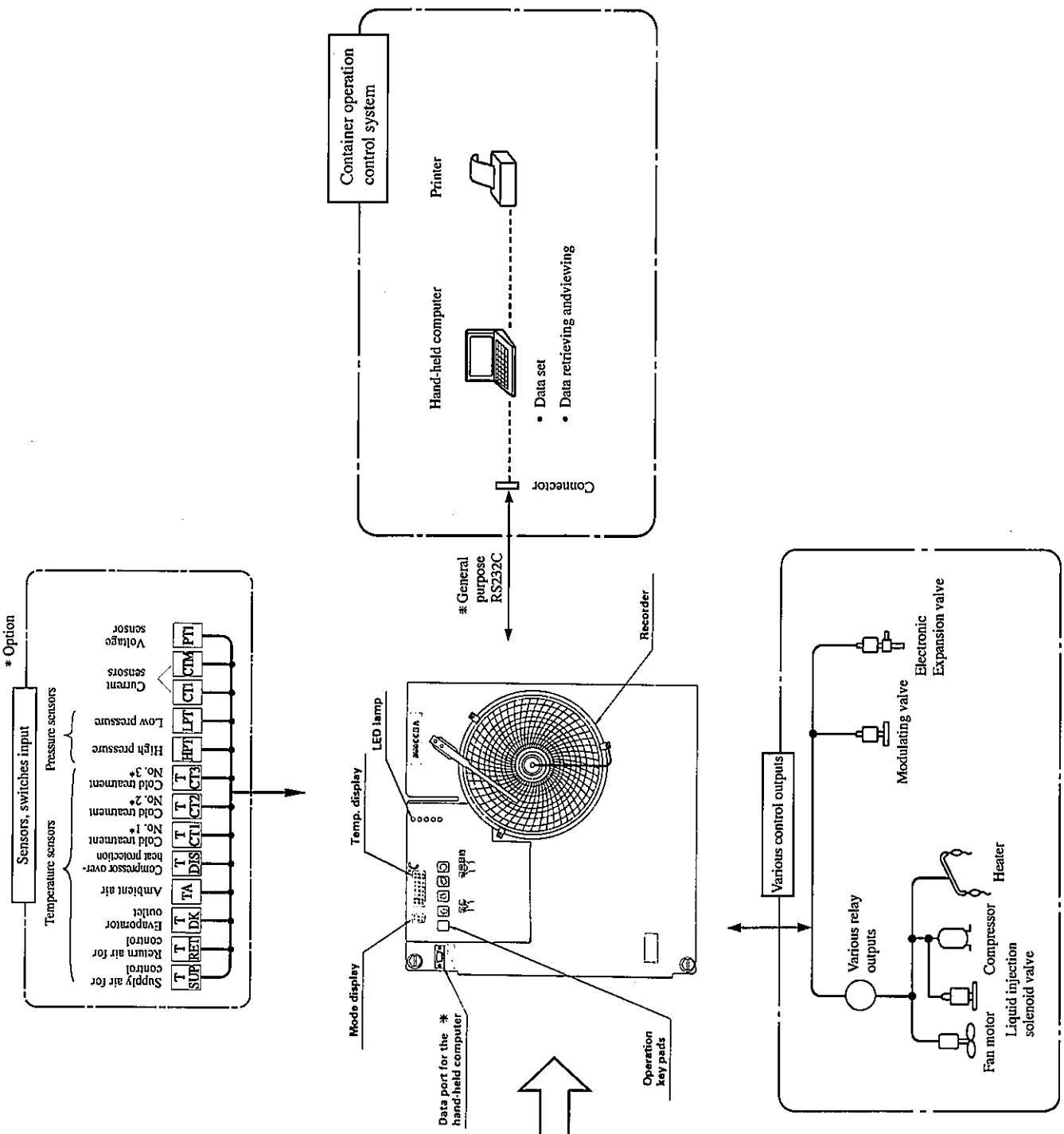


Fig. 31

12.3 Specifications

12.3.1 Input and output devices

	ITEM	DEVICE
	Manual switch	• Unit switch
INPUT	Operation switch	 Key pad MODE UP DOWN ENTER TRIP START
	Temperature sensor	• Supply air temperature sensor for control (TSUP) and the spare. • Return air temperature sensor for control (TRET) • Evaporator outlet temperature sensor (TDK) • Ambient temperature sensor (TA) • Compressor discharge temperature sensor (TDIS) • Cold treatment temperature sensor No. 1 (TCT1) <option> • Cold treatment temperature sensor No. 2 (TCT2) <option> • Cold treatment temperature sensor No. 3 (TCT3) <option>
	Pressure sensor	• High pressure sensor (HPT) • Low pressure sensor (LPT)
	Current sensor	• Current sensor × 2 (CT1, CTM)
	Voltage sensor	• Voltage sensor × 1 (PT1)
OUTPUT	Unit control	• Miniature relay outputs (Main contactor × 2, Evaporator fan Hi and Lo, Heater main and sub, Condenser fan × 1, Phase reversal × 2, Monitoring × 2) • Modulating valve driving voltage output • Electronic expansion valve driving voltage output
	Display	• Operation mode and condition: LED × 4 • Alarm: LED × 1 • Temperature/Code display: 7-segment LED • MODE: 7-segment LED
	Temperature record	• Temperature recorder
	Monitoring & Communication	• Socket for remote monitoring • Data port for the hand-held computer
Data control		• Hand-held computer

12.3.2 Technical data

(1) Power supply

Main power

(Primary) : 380/415V 50Hz, 440V 60Hz AC

(Controller transformer input voltage)

(Secondary) : 33V 50/60Hz AC

(For relay circuit, electronic circuit, electronic expansion valve, modulating valve and pressure sensor.)

24V 50/60Hz AC (For relay)

(Voltage tolerance ± 10%, frequency tolerance ± 5%)

(2) Ambient operating temperature range : –30 to +65°C

(3) Ambient operating humidity : RH 90% and below

(4) Temperature setting range : –30 to +25°C (0.1°C Step)

(5) Set point temperature for changeover operating modes

CHILL mode : –5°C and above

FROZEN mode : below –5°C

(6) Temperature control accuracy

CHILL mode : ±0.2°C

(7) Temperature recording range : –30°C ~ +25°C

(8) Temperature recording accuracy

0°C : ±0.2°C

+10°C ~ –20°C : ±0.6°C

+25°C ~ +10°C, –20°C ~ –30°C : ±1.2°C

(9) Temperature record hysteresis : ±0.3°C

(10) Evaporator fans delay time in starting

At initial start of cooling operation : 20 seconds

After defrosting operation : 4 minutes

12.4 Outline draw

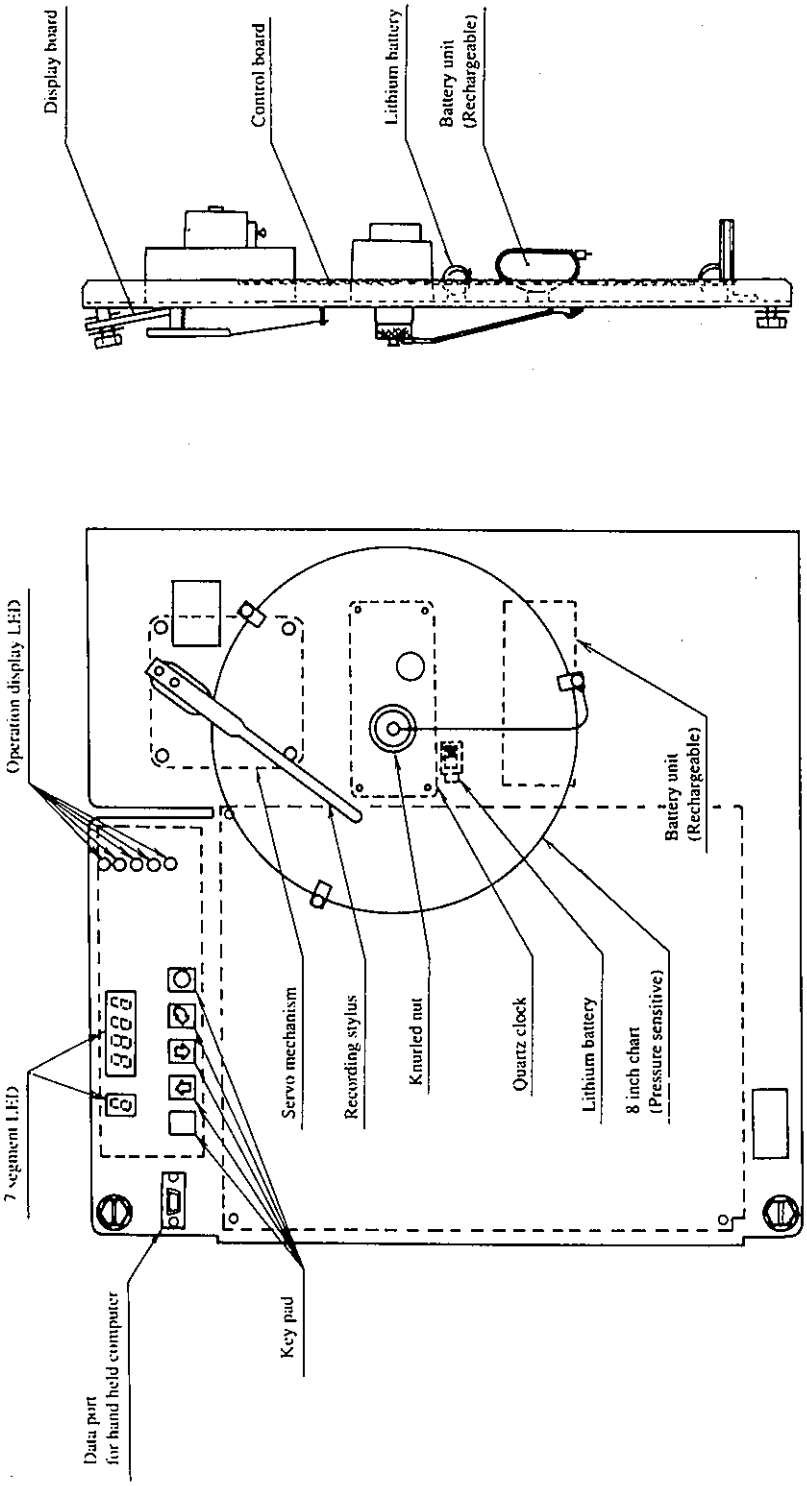


Fig. 32

12.5 Input/output diagram

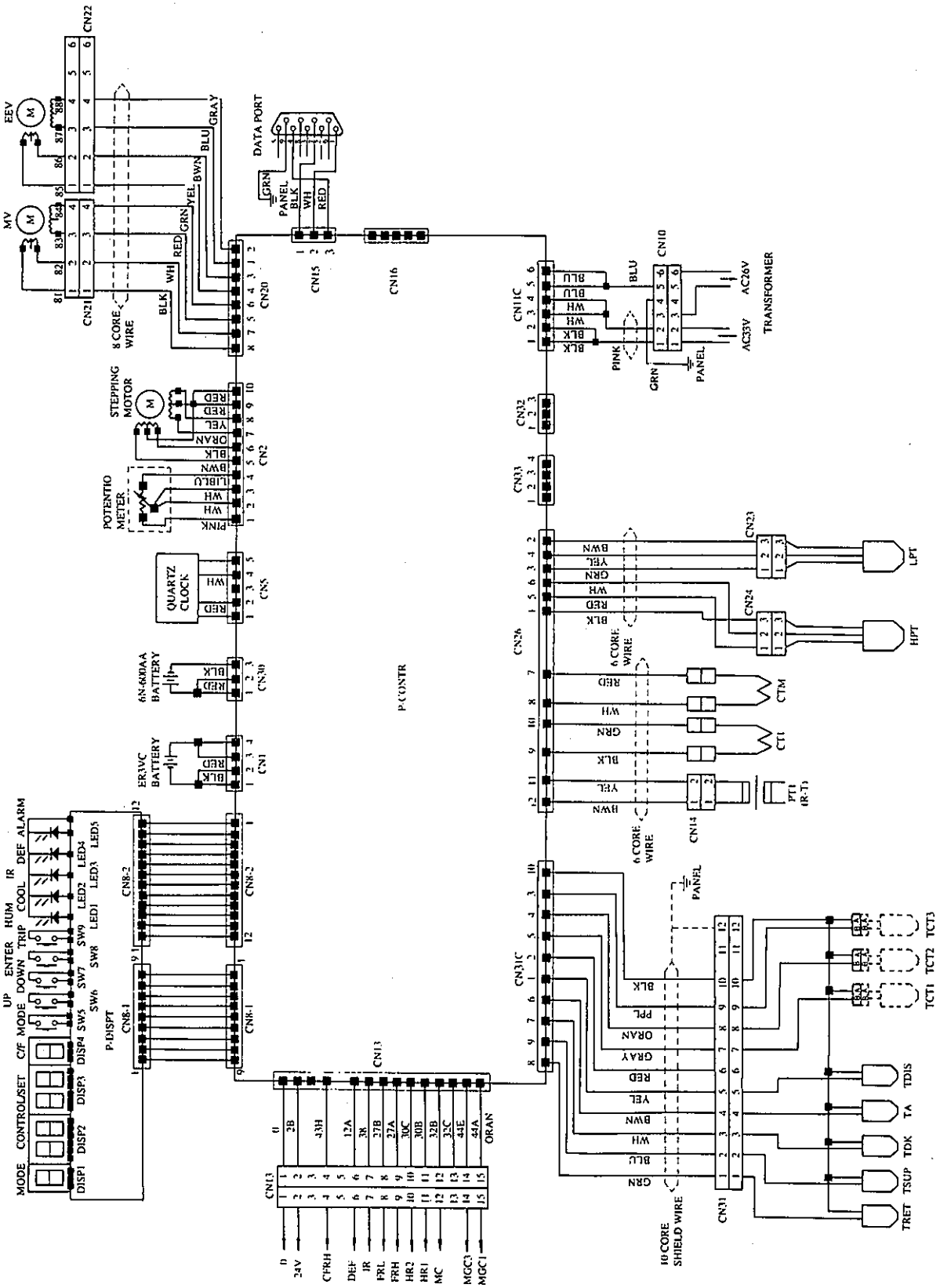


Fig. 33

12.6 Main control

12.6.1 Unit control functions

(1) Starting and stopping

MMCCIIIA checks the micro-computer system, various inputs, power phase sequence, single phase and voltage-frequency when the power supply is turned on, and indicates an alarm condition and takes appropriate actions automatically if there are any irregularities. The Reefer Unit starts with the unit switch put into the "ON" position and begins the temperature control.

The Reefer Unit stops with the unit switch put into the "OFF" position.

(2) Temperature control

The set point temperature is adjustable by four function keys and hand-held computer with automatic changeover between "CHILL" and "FROZEN" modes at –5°C.

MMCCIIIA controls the temperature by transferring the operation step in predetermined order according to the deviation of the existing temperature from the set point temperature. Each operation step is maintained till the each operation becomes stable and thereafter transferred to the next step, if the existing temperature goes out of the each temperature range.

(a) CHILL mode – Set point temperature: –5°C and above

In CHILL mode operation the Reefer Unit controls the supply air temperature at the set point temperature by involving five operation steps, those five operation steps are, (0) full cool, (1) capacity control employing hot gas modulating valve, (2) capacity control plus low heat, (3) low heat, and (4) high heat. Heatings are provided by the electric resistance heater.

The controller fixes the initial operation step on whether full cool or low heat at the start of operation. The Reefer Unit takes full cool when the supply air temperature is above the set point and takes low heat when the supply air temperature is below the set point. When the Reefer Unit starts operation from full cool, it will transfer to the next lower step of capacity control, when the supply air temperature reaches the set point temperature (i.e. the lower limit temperature of the full cool operation range).

When the Reefer Unit starts operation from low heat, the unit will go into the next lower step of high heat, when the supply air temperature reaches temperature of 2.0°C lower than the set point temperature that is the lower limit of the low heat operation step, and when the supply air temperature reaches temperature of 1.5°C higher than the set point temperature that is the upper limit of the low heat operation, the operation moves to the next upper step of capacity control + low heat.

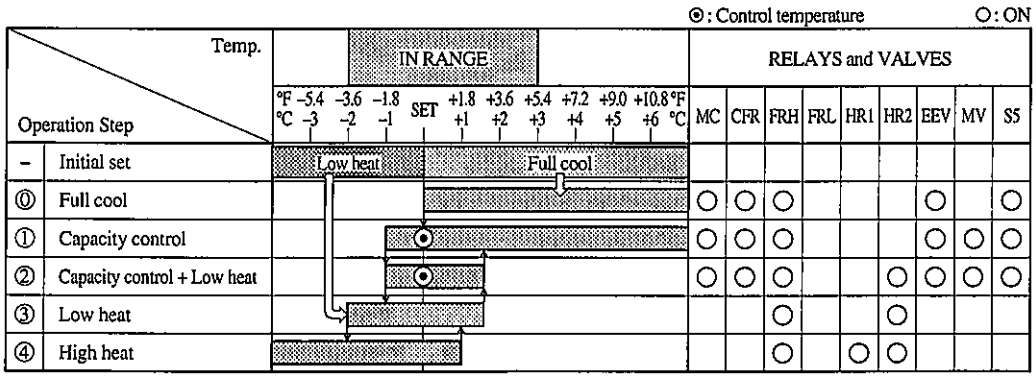
Thereafter the Reefer Unit will transfer to the next step when the deviation of the supply air temperature from the set point temperature goes out of the particular operation step range.

The transfer between capacity control and capacity control plus low heat is also effected by the control condition of the modulating valve or the electronic expansion valve and the particular superheat level at evaporator outlet or the temperature deviation.

When the electronic expansion valve's control condition is maintained at condition over the certain level for 10 minutes, the capacity control operation is changed to capacity control + low heat operation, on the other hand, when the electronic expansion valve's control condition is maintained at condition under the certain conditions for 10 minutes, capacity control + low heat operation is changed to capacity control operation.

Also in either cases, when a state, where temperature deviation value exceeds the specified range, is maintained for more than 20 minutes, operation transfer between the two steps is conducted.

Normal-Supply air temperature continuous control



Note: Details of temperature control method

(1) Upon start-up of normal operation (i.e., upon turning the unit supply power on, "TEST or PTI → switching to normal operation", or after defrosting), the operating steps will initially be set.

(2) If the control temperature exceeds the temperature range set for each operating step, the operation is transferred by one step.

(3) The transition from capacity control to "capacity control + low heat" may also result according to the opening of the modulating valve, set super heat, and temperature deviation condition.

(a) "Capacity control → capacity control + low heat" transition requirements

1) A condition "set super heat > preset value (including modulating valve opening > preset value)" and "temperature deviation < preset value" has continued for ten (10) minutes.

2) A condition "temperature deviation < preset value" has continued for twenty (20) minutes.

(b) "Capacity control + low heat → capacity control" transition requirements

1) A condition "set super heat < preset value (including modulating valve opening < preset value" and "temperature deviation > preset value" has continued for ten (10) minutes.

2) A condition "temperature deviation > preset value" has continued for twenty (20) minutes.

(4) "Capacity control + low heat → low heat" will be performed when a condition "temperature deviation < preset value" and "modulating valve opening > preset value" is satisfied.

(5) Under the step transition condition from the initial operation step immediately after completion of defrost operation, the operation will be transferred to the operation step immediately before defrost operation is initiated. That is, the operation may skip as in ⓪ → ② or ③ → ①.

(6) In the case where the unit supply power has been OFF for less than two (2) hours and then normal operation has been initiated, following the step transition condition from the initial operation step will cause the operation to transfer to the step which was active immediately before the unit supply power was turned OFF. That is, the operation may skip as in ⓪ → ② or ③ → ①.

(b) FROZEN mode - Set point temperature: below –5°C

In FROZEN mode operation the Reefer Unit controls the container inside temperature by the higher temperature out of the return and supply air temperature.

There are three operation steps involved, which are (0) full cool, (1) low circulation (fan operation) and (2) low heat, that are used to keep the set point temperature. The controller fixes the initial operation step on the full cool operation when the higher temperature out of the return and supply air temperature, is of higher value than the set point temperature.

On the other hand, when the higher temperature out of the return and supply air temperature is of lower value than the set point temperature, the initial operation step is set to low circulation.

Thereafter, when the temperature deviation from the set point temperature goes out of each operation step range, the transfer to the next step is conducted.

Normal-Supply/Return higher air temperature ON/OFF control

O : ON

Operation Step \ Temp.		IN RANGE										RELAYS and VALVES								
		°F –10.8	–9.0	–7.2	–5.4	–3.6	–1.8	SET	+1.8	+3.6	+5.4 °F	MC	CFR	FRH	FRL	HR1	HR2	EEV	MV	S5
		°C –6	–5	–4	–3	–2	–1		+1	+2	+3 °C									
–	Initial set	Low circulation						Full cool												
⓪	Full cool											○	○	○	○			○		○
①	Low circulation														○					
②	Low heat													○			○			

Note: Details of temperature control method

(1) Upon the start of normal operation (i.e., upon turning the unit supply power on, "TEST or PTI → switching to normal operation", or after defrosting), the operating steps will initially be set.

(2) If the control temperature exceeds the temperature range set for each operating step, the operation is transferred by one step.

(3) Evaporator fan control

Evaporator fans will rotate at all times except at the time of defrosting when the Reefer Unit is being run.

The details of the fan operation control are as follows:

(a) At initial start of cooling operation

Evaporator fans are delayed in starting by 20 seconds according to the operating conditions at initial start of cooling operation. This delayed starting is not used in the thermo-operation and heating operation.

(b) In CHILL mode operation

Evaporator fans always rotate at high speed.

(c) In FROZEN mode operation

The evaporator fan motor switches from high speed operation to low speed operation when the higher temperature out of the supply and return air temperature drops and reaches –5°C. The low speed operation switches to high speed operation when the higher air temperature out of the return and supply air temperature rises and reaches –3°C.

(d) After defrosting

Evaporator fans are delayed in starting for 4 minutes when cooling operation is required after the defrosting operation.

(4) Condenser fan control

The condenser fans always rotates during cooling operation.

(5) Electronic expansion valve control

MMCCIIIA has a number of refrigerant control functions, such as cooling capacity control, power consumption control and high pressure control, all of which are executed through the adjustment of the opening of the electronic expansion valve.

(a) Cooling capacity control

MMCCIIIA adjusts to a superheat level which is the most suitable for a given set of operating conditions by performing PID action control of opening of electronic expansion valve, therefore a cooling capacity matched with a heat load realizes the least required power.

The optimum adjustment of cooling capacity improves stability of return air temperature in chill mode.

(b) Power consumption control

MMCCIIIA controls opening of the electronic expansion valve so that power consumption will not exceed the specified value, which may occur when power consumption is increased (at pull-down, etc), and thus prevents an overload to a ship's generating capacity.

(c) High pressure control

If high pressure is abnormally increased because of high ambient temperature, etc., the unit may be stopped and cargo damage may result.

To prevent such problems, MMCCIIIA controls the opening of the electronic expansion valve so that high pressure will not exceed the specified level and operation is continued.

(6) Defrosting

To eliminate unnecessary defrosting operation, the defrosting is initiated either automatically or manually only when Reefer Unit is on the frost condition that the temperature on the evaporator outlet sensor (TDK) is below 10°C.

Defrosting is terminated when the temperature on TDK sensor rises and reaches 15°C or when 60 minutes have passed since the start of defrosting.

(a) Automatic defrosting

1) Initiation

Defrosting is initiated only when the frosting conditions for the evaporator exist, by the program timer (3↔6↔9↔12 hours) which is automatically set based on the time required for defrosting or the four position manually adjustable defrost timer (intervals at 3,6,9 or 12 hours). However, the first defrosting operation is initiated after 3 hours have passed since the start of operation regardless of the adjustable timer or the program timer setting.

Defrost initiation timer starts to count when the frosting condition appears, and adds up the hour of the frosting condition.

2) Defrosting

When the Reefer Unit is in cooling operation, the defrosting is effected after the compressor has stopped, and in case of fan or air circulation operation, the defrosting is effected after the evaporator fan motors have turned off.

All evaporator coil heaters are used in the defrosting operation.

3) Termination

Defrosting is terminated when the temperature on the evaporator outlet sensor (TDK) reaches 15°C or when the 60 minutes work period of the electronic timer is up, and then controller will start the temperature control from the initial operation step.

(b) Manual defrost

Defrosting is initiated manually at any time by pushing the specified key pads when the frosting conditions for the evaporator exit. The other sequence is just the same as above automatic defrosting.

12.6.2 Self-diagnostic Functions

(1) Component check function

When the unit switch is turned on, MMCCIIIA initiates a check of components as shown in "Power ON" item in chapter 12.12. If any irregularities should occur, the alarm LED will light, and at the same time, the alarm code could be displayed using 7-segment LED.

If normal operation cannot be conducted, proper action will be taken to start the unit operation with the aid of back-up function, or the unit will be forcibly stopped.

(2) Check function during operation

MMCCIIIA continuously checks operating conditions, as shown in "Operating" item in chapter 12.12 during unit running. If any irregularities should occur, the alarm LED will light, and at the same time, the alarm code could be displayed using 7-segment LED.

If normal operation cannot be continued, proper action will be taken to keep the unit running with aid of back-up function, or the unit will be forcibly stopped.

(3) Safety functions

(a) High refrigerant pressure protection

If the high refrigerant pressure reaches the abnormally high level, the controller will directly shut off the compressor.

After 3 minutes, when the high pressure drops to the normal level, the operation re-starts automatically, only 3 times.

(b) Low refrigerant pressure protection

If the low refrigerant pressure reaches the abnormally low level, the controller will directly shut off the compressor and condenser fan.

After 3 minutes, when the low pressure rises the normal level, the operation re-starts automatically, only 3 times.

(c) Compressor overheating protection

If the temperature on the compressor discharge piping reaches the abnormally high level, the controller will directly shut off the compressor and the condenser fan.

(d) Compressor motor overcurrent protection

If the running current of the motor keeps for a few seconds more than the abnormally level, the controller will directly shut off the compressor and the condenser fan.

(e) Compressor motor reversal protection

The controller checks the power phase sequence before the compressor runs, and takes appropriate action so that the compressor motor rotates in proper direction all the time.

(f) Defrosting termination protection

If 60 minutes have passed since the starting of defrosting, the defrosting will be terminated by the electronic timer for forced termination.

(g) Control temperature abnormal

If the control temperature goes out of the specified range for more than 2 hours during "IN RANGE" operation after the start of operation or the termination of defrosting, the controller will judge it as an alarm condition, and at this time, alarm code will be indicated using 7-segment LED.

(4) Fail-safe and back-up functions

Following fail-safe and back-up functions are provided for prevention of cargo damages and alarm modes are indicated on the failure.

(a) Supply and return air temperature sensors failure

1) If either the return or supply air temperature sensor should fail.

If either one of the air temperature sensors should fail, the controller will automatically switch to "Fail-safe temperature control" using the other working temperature sensor. This fail-safe function provides the temperature control which is very close to the normal temperature control. The details of fail-safe temperature control is shown below.

Fail-safe Temperature Control

– CHILL MODE –

Fail safe-Return air temperature control (Supply air sensor failure)

⊙: Control temperature ○: ON

Operation Step		Temp. / IN RANGE	RELAYS and VALVES								
		°F –5.4 –3.6 –1.8 SET +1.8 +3.6 +5.4 +7.2 +9.0 +10.8 °F °C –3 –2 –1 +1 +2 +3 +4 +5 +6 °C	MC	CFR	FRH	FRL	HR1	HR2	EEV	MV	S5
–	Initial set	Low heat / Full cool									
⓪	Full cool		○	○	○				○		○
①	Capacity control		○	○	○				○	○	○
②	Capacity control + Low heat		○	○	○			○	○	○	○
③	Low heat				○			○			
④	High heat				○		○	○			

– FROZEN MODE –

Fail safe-Return air temperature control (Supply air sensor failure)

○: ON

Operation Step		Temp. / IN RANGE	RELAYS and VALVES								
		°F –10.8 –9.0 –7.2 –5.4 –3.6 –1.8 SET +1.8 +3.6 +5.4 °F °C –6 –5 –4 –3 –2 –1 +1 +2 +3 °C	MC	CFR	FRH	FRL	HR1	HR2	EEV	MV	S5
–	Initial set	Low circulation / Full cool									
⓪	Full cool		○	○	○	○			○		○
①	Low circulation					○					
②	Low heat				○			○			

Fail safe-Supply air temperature control (Return air sensor failure)

O : ON

Operation Step		Temp.	IN RANGE											RELAYS and VALVES								
		°F	-16.2	-14.4	-12.6	-10.8	-9.0	-7.2	-5.4	-3.6	-1.8	SET	+1.8	+3.6	+5.4	°F								
		°C	-9	-8	-7	-6	-5	-4	-3	-2	-1		+1	+2	+3	°C	MC	CFR	FRH	FRL	HR1	HR2	EEV	MV	S5
-	Initial set						Low circulation								Full cool										
⓪	Full cool																○	○	○	○			○		○
①	Low circulation																			○					
②	Low heat																		○			○			

2) If both air temperature sensors should fail

When both air temperature sensors should go out of order, actions will be taken according to the operating modes.

i) In CHILL mode (set point temperature: –5°C and above).....

Reefer unit will operate at low fan speed operation and defrosting operation will not be performed.

ii) In FROZEN mode (set point temperature: below –5°C).....

Reefer unit will be forcibly kept in full cooling operation and defrosting will be possible.

(b) Evaporator outlet sensor (TDK) failure

If the evaporator outlet sensor (TDK) should fail, defrosting will be terminated by the 60 minutes electronic timer for forced termination.

The judgement of the frost condition is done by the supply air temperature sensor (TSUP) in place of TDK sensor and defrosting can be initiated when the temperature on the supply air temperature sensor is below 10°C.

Defrosting can be terminated when the temperature on the return air temperature sensor (TRET) is more than 30°C.

(c) High refrigerant pressure sensor failure

If the high refrigerant pressure sensor should fail, the high pressure control function and the safety function are nullified and the condenser fan is turned on to maintain normal operation when the ambient temperature is below 50°C. If the ambient temperature is above 50°C, the operation is stopped to prevent the possibility of damage to the Reefer Unit.

(d) Low refrigerant pressure sensor failure

If the low refrigerant pressure sensor should fail, the evaporator superheat control will not function. In this case the electronic expansion valve opening is adjusted to a preset level according to the set point temperature to maintain operation.

(e) CPU communications failure

In case of CPU communications failure, the data obtained before the failure occurred are used to operate the system.

If CPU communications should already fail at the time of "Power ON", the unit will not start.

(f) Current sensor failure (CT1, CTM)

If the current sensor (CT1) should fail, the controller stops detecting the current and the unit normally continues to operate.

If the current sensor for compressor (CTM) should fail, the controller stops detecting the current and the unit normally continues to operate.

12.6.3 Pre-Trip Inspection (PTI) functions

MMCCIIIA can perform both MIN. and MAX. Pre-Trip Inspection by selecting PTI mode with mode select keys. MIN. PTI checks mainly components, and MAX. PTI checks every function including running condition.

(1) MIN. PTI function

This function will check the operation following the "PTI" check No.1 ~ 15 (See chapter 12.11.7).

Should any abnormality be found the PTI will terminate.

(2) MAX. PTI function

This function will check the operation following the "PTI" check No.1 ~ 19 (See chapter 12.11.7).

Should any abnormality be found the PTI will terminate.

The standard MAX. PTI routine is shown below.

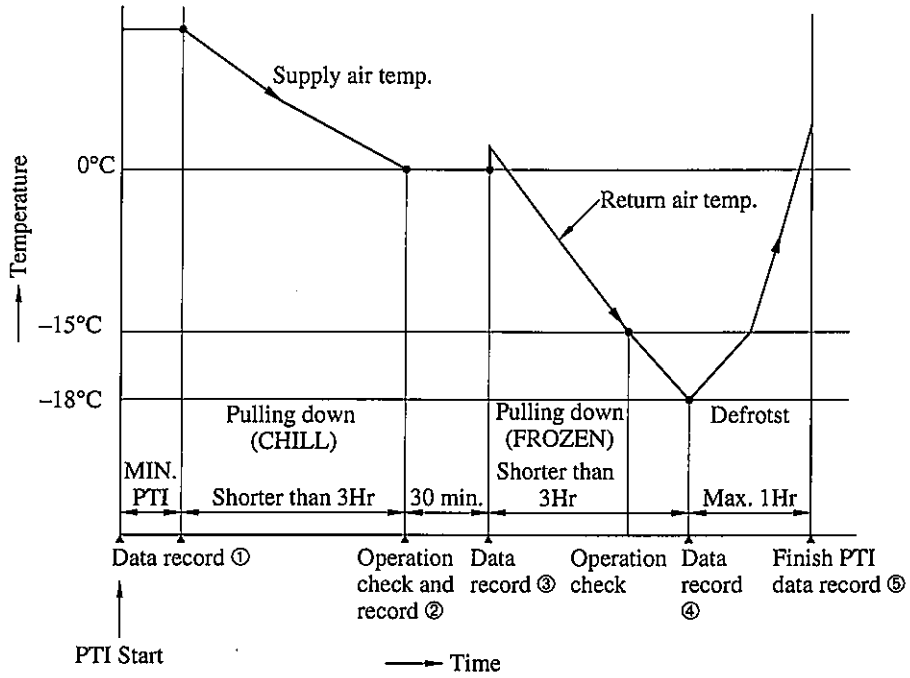


Fig. 34

12.6.4 Test functions

MMCCIIIA can manually check functions of the following components by selecting test mode with mode selection key. (For details see chapter 12.11.8)

(1) Display
(2) Compressor
(3) Condenser fan & motor
(4) Evaporator fan & motor (High speed)
(5) Evaporator fan & motor (Low speed)
(6) Heater
(7) Electronic expansion valve
(8) Modulating valve
(9) Temperature recorder
(10) Phase reversal relay
(11) Joint inspection with the classification society (HPT, LPT)

12.7 Display and input control

12.7.1 Analogue and digital input processing function

MMCCIIIA takes various input data such as temperature, pressure, voltage, current, switch, operation key input into the main control unit, and manages these data.

12.7.2 Display control function

MMCCIIIA display mode, set point temperature, container inside temperature and various data using 7-segment LED.

12.7.3 DC power source control function

MMCCIIIA can operate by a built-in battery at power outage.

Also the battery is useful for back-up of a memory storing the various operating data and temperature recording for 3 days.

12.8 Data control

Data recording function for operation and transport

MMCCIIIA records various operation and transport data, utilizing a memory capacity 128 kbyte.

(1) Factory-set data (Input)

These are the data set by the factory before delivery.

(a) Container No. (Ex: MHIU1234567)

(b) Calender (Ex: JAN-30-98-10:30)

(2) ID data (Input)

These are the data set by operator before voyage.

(a) Set point temperature	(Ex: +00.0°C)	(f) Ship name	(Ex: MHI-MARU)
(b) Ventilator position	(Ex: 180CMH)	(g) Loading point	(Ex: TOKYO)
(c) Product	(Ex: BEEF)	(h) Discharging point	(Ex: NAGOYA)
(d) Loading date	(Ex: JAN-30-98)	(i) Operator	(Ex: M. MITSUBISHI)
(e) Voyage No.	(Ex: 10)	(j) Comment	(Ex: less than 70 words)

(3) PTI data (Output)

These are the data when MIN.PTI and MAX.PTI are complete or interrupted, and can be easily produced by using the hand-held computer and a printer.

(a) MIN.PTI data

The results of PTI check No. 1 ~ 15 (chapter 12.11.7) will be MIN.PTI data.

(b) MAX.PTI data

The results of PTI check No. 1 ~ 19 (chapter 12.11.7) will be MAX.PTI data.

(4) Operating data

(a) Trip data

These are the data recorded every one hour interval during normal operation.

1) Data and time (Ex: "30-11" indicates 11 o'clock of 30th)

2) Operation mode (Ex: C2)

3) Supply air temp. (Ex: +00.0)

4) Return air temp. (Ex: +01.0)

(b) Trip data at power outage

This data is recorded every one hour while the unit is isolated from the power source.

(c) Event data

These are the data recorded when the following conditions have occurred.

1) Power supply is turned to ON or OFF.
2) Defrost is turned to ON or OFF.
3) Set point temp. is changed.
4) ID data is changed or set.
5) Trip start set
6) MER calibration set
7) Three days passed after unit switch was turned to OFF.
8) Alarm is developed or released.
9) Battery alarm is developed or released.

In relation to above data, following data are recorded at any time.

1) Date and time of occurrence (Ex: APR-30-11:30)
2) Event code (Ex: B1)
3) Set point temperature (Ex: +10.0)
4) Supply and return air temperature (Ex: +10.0, +11.0)

(d) Alarm data

These are the recorded data at the occurrence of alarm.

1) Date and time of occurrence (Ex: APR-30-11:30)
2) Alarm code (Ex: 0107)
3) Alarm information (Ex: SRAM Failure)
4) Operation mode (Ex: C1)
5) Supply air temperature (Ex: +00.0)
6) Return air temperature (Ex: +01.0)
7) Ambient temperature (Ex: +30.0)
8) High refrigerant pressure (Ex: 1250)
9) Low refrigerant pressure (Ex: 200)
10) Current (CT1) (Ex: 15.0)
11) Voltage (PT1) (Ex: 440)

12.9 Temperature recorder

MMCCIIIA records automatically the supply air temperature at the set point above –5°C in CHILL mode and the higher temperature out of the return and supply air temperature at the set point below –5°C in FROZEN mode.

The chart is driven by a clockwork (quartz type clock).

The recorder is suitable for use with the Partlow chart PSD 217C (Rev. A) 31 day or equivalent made of pressure sensitive paper within the range of –25°C to +25°C.

Adjustment of re-zeroing can be easily done by the use of the test mode regardless of the actual container inside temperature.

NOTE (1) See the Fig. 32 for the outline draw.

(2) See the MER. mode ↳ (12.11.9) about the MER zero calibration.

12.10 Data communication function with outside equipment

Data communication port for hand held computer.

All data are transferred between the MMCCIIIA controller and hand-held computer through the serial communication port. Writing of calender, container number and ID data, and displaying, retrieving of various operating data can be done. Refer to the separate hand-held computer manual for details.

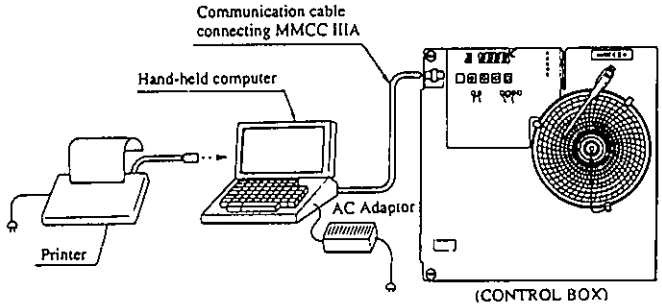


Fig. 35 Hand-held computer system

12.11 MMCCIIIA Operation and displays

12.11.1 Key panel

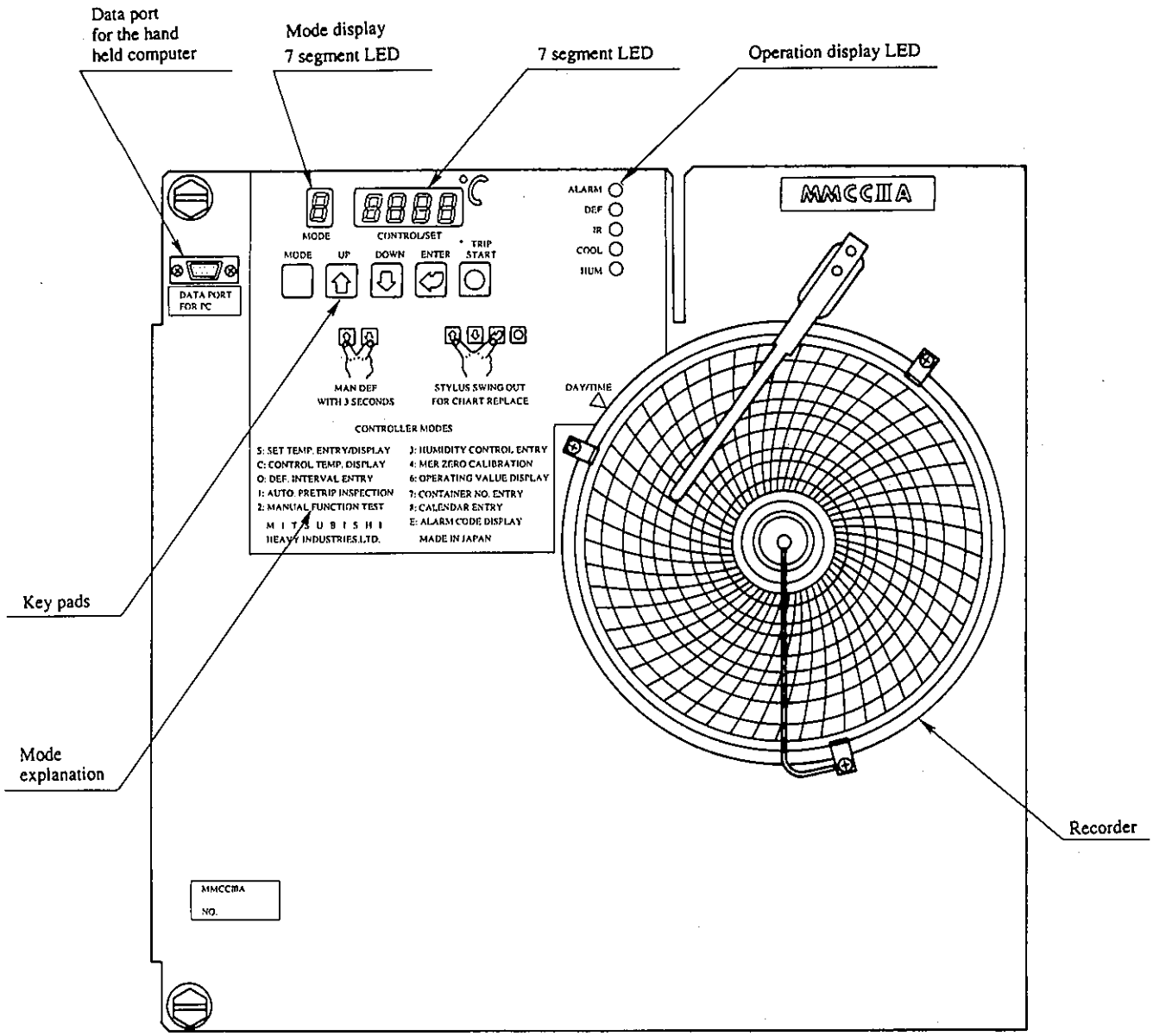


Fig. 36

12.11.2 Key operation and functions

(1) MODE key

(a) The MODE key can be accessed when AC power has been turned on and the initial diagnosis has been completed. It is used to select any one of the following nine (11) different modes.

Mode	Use	Description
	Set or display temperature	To change or enter the set temperature
	Display control temperature	To fix the 7-seg LED to display the control temperature
	Set or display defrost timer	To set or enter manual automatic switch for the defrost timer
	Automatic PTI run	To select and operate the MIN.PTI or MAX.PTI function.
	Manual test run	To manually operate and display up to 11 items of I/O status of a component
	Humidity control start/stop and humidity set & start	To enter the humidity control start/stop, to change or enter the set humidity. (for option only)
	MER 0°C calibration	0°C calibration To change or enter temperature
	Display operating data	To display up to 24 items (at this unit) of operating data, such as temperature, pressure, current draw, voltage, etc..
	Container No. setting	To set container No.
	Calendar setting	To set calendar
	Display existing alarm information	To display up to 10 items of existing alarm code.

(b) The MODE key has also a cancellation function: When the operator (from normal operation) has selected a mode and entered the PTI or TEST run, he can return to normal operation and display using this key.

(c) The MODE key is used to start the controller when the AC power supply is off; After it has started, this key is also used to select any particular mode from S, C, 0, 3, 4, 6, 7, 8, E when it is driven by the built-in battery.
Modes 1, 2 are not available for Unit operation, Mode 3 is not available for option and thus will be skipped.

(2) [⇧] (UP) key

(a) Used to increment the set data.

(b) Used to select and start the MIN.PTI.

(c) Used to start the humidity control (i.e., to enter the set humidity change display).

(3) [⇩] (DOWN) key

(a) Used to decrement the set data.

(b) Used to select and start the MAX.PTI.

(c) Used to stop the humidity control.

However, [⇧] & [⇩] keys together 3 seconds or more will cause to initiate manual defrost operation.

(4) [↵] (ENTER) key

(a) Used to change the each mode.

(b) Used to enter the set data.

(c) Used to run the component for test operation.

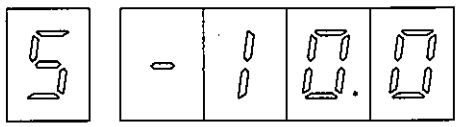
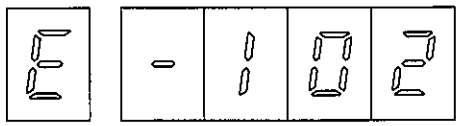
However, (i) this key will cancel the run when the Classification Society test mode has been used.

(ii) [↵] & [⇩] keys together will cause the evaporator fan Hi/Lo function to run continuously.

(iii) [↵] & [⇧] keys together 3 seconds or more will cause to swing out the stylus of temperature recorder.

12.11.3 Initial diagnostic display and normal display

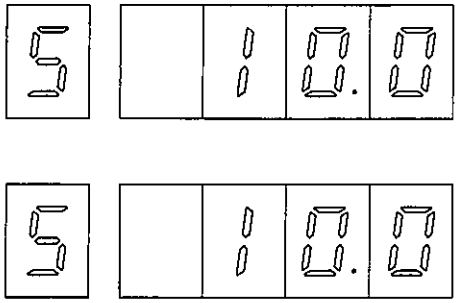
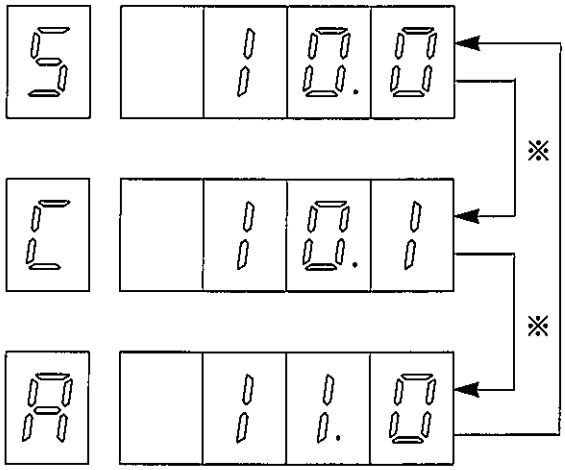
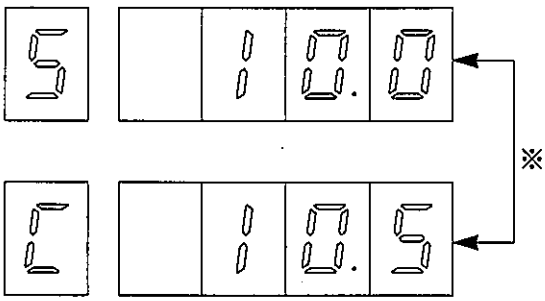
(1) Initial diagnostic display

Operation Flow	Key Manipulation	Display	Remarks
UNIT switch is ON			• Display the mode and set temperature.
Serious error occurred			• Continuous display

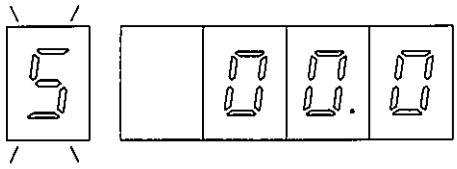
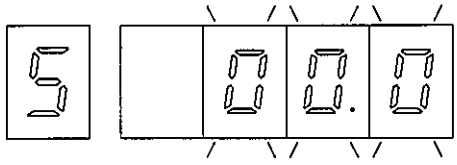
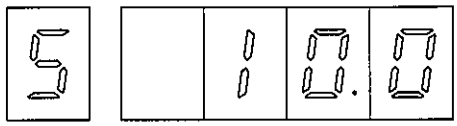
Note: (1) The alarm LED lamp is blinking every 0.5 seconds. The DEF, IR, COOL and HUM LEDs will turn off.

(2) The initial automatic diagnosis will be performed for 10 seconds.

(2) Normal Display

Operation Flow	Key Manipulation	Display	Remarks
Ope. start Failed			• Keys are available when the unit has started operation. • Alarm LED lamp Automatic return: Yes ☀ / No ◑ ☀ light ◑ blink (every 0.5 seconds)
In Chill mode		 ※ ※ ※	Set point temperature Supply air temperature Return air temperature (※: every 5 seconds)
In Frozen mode		 ※	Set point temperature *Control air temperature (※: every 5 seconds) *: The higher temperature out of the return and supply air temperature

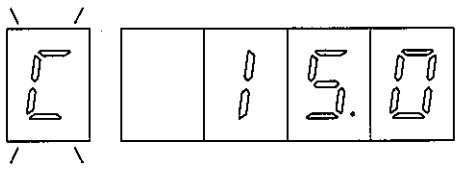
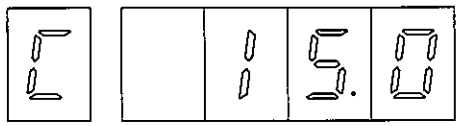
12.11.4 Temperature set and display mode

Operation Flow	Key Manipulation	Display	Remarks
Temp. set and display	[MODE] key		If the temperature has already been set, it will appear on the display.
Temp. set change	[ENTER] key ([UP] or [DOWN] key)		• Each push of the ⇧ or ⇩ key will increment or decrement the displayed temp. by 0.1°C. • Pressing and holding the key for one second or more will cause the displayed temp. to increase or decrease by 1°C per second.
Temp. set entry	[ENTER] key		The set temperature should fall between –30°C and +25°C.

Note: (1) The display will automatically return to the normal display if no key is manipulated for 30 seconds.

(2) In the temp. set and display mode, by pressing the MODE key the display will immediately return to the normal display.

12.11.5 Control Temperature display mode

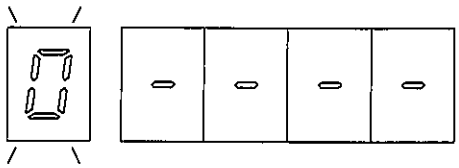
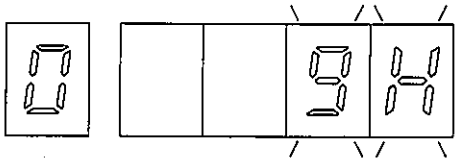
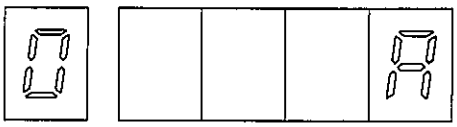
Operation Flow	Key Manipulation	Display	Remarks
Control temp. display	[MODE] key		
	[ENTER] key		

Note: (1) The blinking "C" display will automatically return to the normal display if no key is manipulated for 30 seconds.

(2) The "C" display must be canceled by using the MODE key in order to return to the normal display.

12.11.6 Defrost timer set and display mode

With the Unit, the defrost timer can be used either in automatic or fixed (3H, 6H, 9H or 12H) mode in order to avoid performing unnecessary defrosting. If the automatic mode has been selected, the system will compare the last defrost time with the current one and automatically set the optimum defrost time interval (timer).

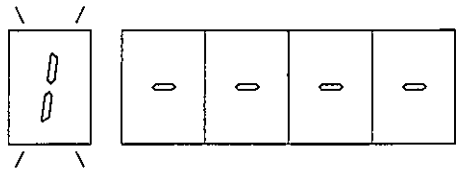
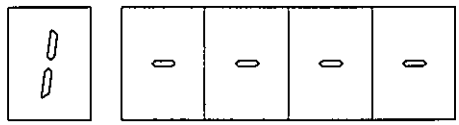
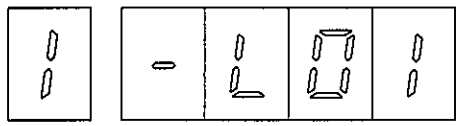
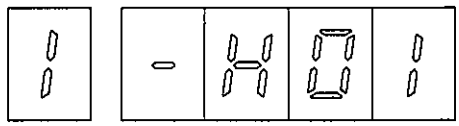
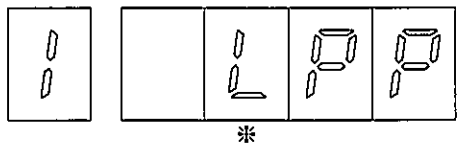
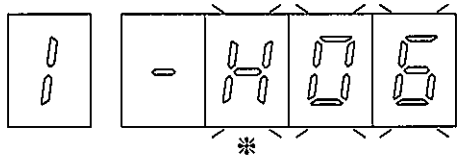
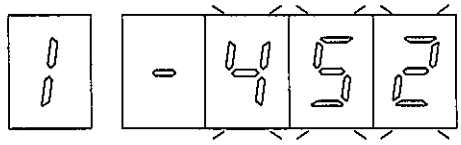
Operation Flow	Key Manipulation	Display	Remarks
Set the defrost timer	[MODE] key		
"Change the defrost timer"	[ENTER] key [UP] or [DOWN] key		• The timer last set is displayed. • "----" before being set. The ⇧ or ⇩ keys are used to set to 12H ↔ 9H ↔ 6H ↔ 3H ↔ A (auto).
"Entry the defrost timer"	[ENTER] key		

Note: (1) These screens will automatically return to the normal display if no key is manipulated for 30 seconds.

(2) Selecting "A" will cause the built-in program to automatically change amount 12H ↔ 9H ↔ 6H ↔ 3H.

12.11.7 Automatic PTI mode

This mode automatically diagnoses the operation of the controller and the refrigeration unit. This operation will be performed when the PTI mode is indicated on the control panel. Automatic PTI will primarily check the components. The MIN.PTI will be performed. The MAX.PTI consists of a MIN.PTI check and an operation check. The key operation and displays are as follows:

Operation Flow	Key Manipulation	Display	Remarks
Automatic PTI	[MODE] key		
PTI is selected	[ENTER] key		
MIN.PTI	[UP] key		MIN. PTI displays No.1 ~ 15
MAX.PTI	[DOWN] key		MAX. PTI displays No.1 ~ 19
PTI normally ended		 ※	※: "L" (MIN.PTI) or "H" (MAX.PTI) displayed.
PTI abnormally ended		 ※	• PTI run is called off • See Note (4)
			

Note:
(1) The 'Automatic PTI' and 'PTI Selection' displays will automatically return to the normal display if no key is manipulated for 30 seconds.
(2) The 'PTI Abnormal End' display should be switched to the normal display by using the MODE key.
(3) The check specifications are detailed on next pages.
(4) If the PTI is abnormally ended, the check No. and the alarm code are displayed each 5 seconds on the LED for No. display alternately.

PTI Check Specification

Check No.	Check Period	Check Item	Target Operation
1	12 sec.	CT1 & CTM check (Current sensor for main circuit) CT1: <#350> CTM: <#356> / CT1: <#351> CTM: <#357>	1) With the full load turned off, check whether the current through CT1 and CTM goes below the specified value. 2) Check the possible increments of CT1and CTM with MGC1 or MGC3:ON, FRH:ON, CFR:ON and MC:ON. 3) Check the possible decrements of CT1 and CTM with all of the items listed in 2) turned off.
2	5 sec.	Check for possible breakage or shortcircuit in the compressor motor. <#412> <#411>	Check the possible increments of CTM with MGC1 or MGC3 turned on and MC turned on. After checking the MC is turned off.
4	20 sec.	Check for possible breakage or shortcircuit in the condenser fan motor (Hi). <#422> <#421>	Check the possible increments of CT1 with CFR turn on and MGC1 or MGC3 turned on. After checking the relay is turned off.
6	120 sec.	Check for possible breakage or shortcircuit in the evaporator fan motor (Hi). <#452> <#451>	Check the possible increments of CT1 with FRH turn on and MGC1 or MGC3 tured on. After checking the relay is turned off.
7	120 sec.	Check for possible breakage or shortcircuit in the evaporator fan motor (Lo). <#462> <#461>	Check the possible increments of CT1 with FRL turn on and MGC1 or MGC3 turned on. After checking the relay is turned off.
8	10 sec.	Check for possible breakage or shortcircuit in the evaporator heater (Hi). <#472> <#471>	Check the possible increments of CT1 with HR1, HR2 turn on and MGC1 or MGC3 turned on. After checking the relay is turned off.
9	10 sec.	Check for possible breakage or shortcircuit in the evaporator heater (Lo). <#482> <#481>	Check with HR2 turn on and MGC1 or MGC 3 turned off. After checking the relay is turned off.
10	5 sec. (Max. 305 sec.)	Gap between HPT/LPT (High pressure/Low pressure sensor) <#332>	With MV/EEV fully opened, check the difference between LPT and HPT.
11	Max. 180 sec.	MV closing check <#205>	Check if the low pressure goes below the specified value within the specified time period, with MC:ON, CFR:ON, MV/EEV:fully closed.
12	10 sec.	MV opening check <#492>	Immediately after No. 11 check has been performed, check the possible increments of low pressure with the MV fully opened.
13	Max. 180 sec.	EEV closing check <#205>	See check No. 11.
14	10 sec.	EEV opening check <#491>	Immediately after No. 13 check has been performed, check the possible increments of low pressure with the EEV fully opened.

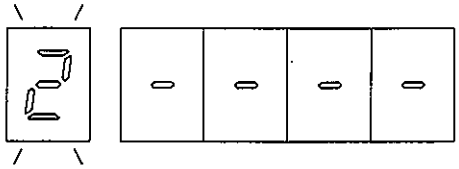
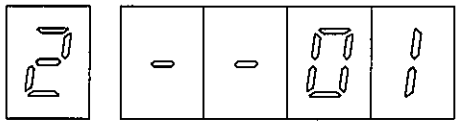
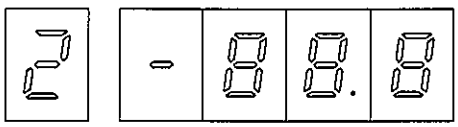
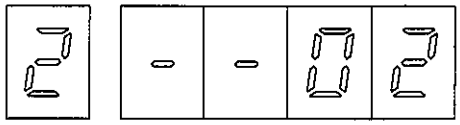
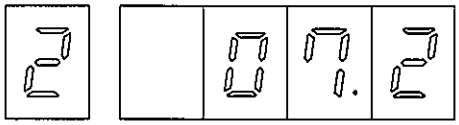
Note: (1) Check No. 3 and No. 5 will be skipped on this unit.

Check No.	Check Period	Check Item	Target Operation
15	Max. 90 sec.	MER (Motor & potentio) <#601>	After order the 0°C run recording, check the potentiometer value.
16	5 min.	Mixed with air <#904>	After MV/EEV fully closed with running the compressor, check high pressure and ambient temperature with CFR:ON. Any portion outside the ambient temperature range of 5~38°C will be skipped.
17	Max. 3.5H (depending on pulldown time)	Run at 0°C (to start from initial pump down) <#900> <#901> <902> <#903> <#314> <#317>	1) With full cool, ambient temperature from 5~38°C, and condenser fan operating, check the amount of refrigerant when the temperature inside the container has reached 0°C. 2) Check the pull-down duration to reach 0°C (within three hours). 3) Immediately after the full cool and evaporator fan have started, check the relationship between the supply air temp. (TSUP) and the return air temp. ((TRET) inside the container. 4) Under the same conditions as in 3), check the relationship between the evaporator exit temp. (TDK) and the return air temp. (TRET). 5) Perform a continuous run at 0°C for 30 minutes.
18	Max. 3.0H	Run at –18°C <#900> <#901> <#903> <#314> <#317>	1) With full cool, ambient temperature from 5~38°C, and condenser fan operating, check the amount of refrigerant when the control temperature has reached –15°C. 2) Check the pull-down duration for the control temperature of 0°C to reach –18°C (within three hours). 3) Check with the same condition as 3) and 4) stipulated for 0°C run.
19	Max. 60 min. (approx.)	Defrost operation	Check each state upon defrost initiation/termination and long-time defrost.

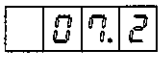
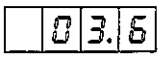
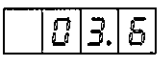
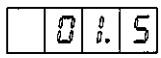
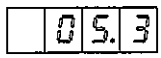
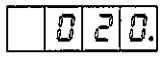
Note: (1) Check No. 1 to 15 should be performed during MIN.PTI; No. 1 to 19 should be performed during MAX.PTI.

12.11.8 Manual test mode

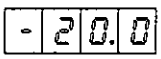
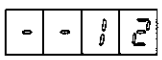
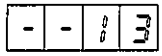
This mode manually causes each component to operate and its I/O status to appear on the display. This test function will be activated when the operator has specified the TEST mode on the control panel, and it then will sequentially display the results of output and load tests and input test.

Operation Flow	Key Manipulation	Display	Remarks
Test function	[MODE] key		
Test display initial function	[ENTER] key		
No.1 is displayed	[ENTER] key		
No.2~13 are displayed	[UP] key or [DOWN] key		 --02 up to --13 [UP] or [DOWN] key
Data on No.2 is displayed	[ENTER] key		Displays data only when [ENTER] key is pressed and held.

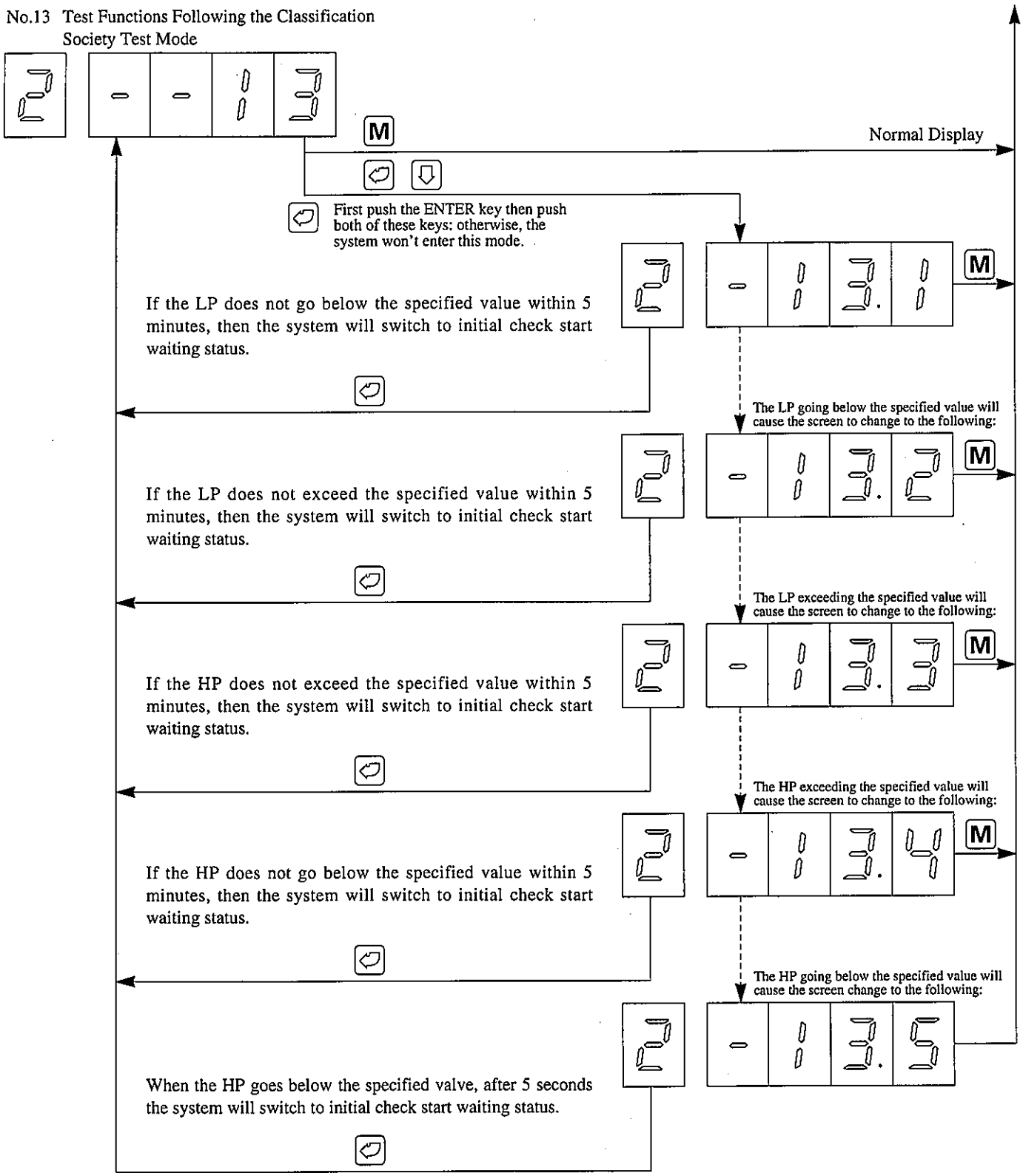
Note: (1) The typical display and controller output status are shown on next pages.

No.	Test Item	Controller output status to ENTER key
01	Display	1. Mode display LED: 2 2. Temp. display LED:  (With output on) 3. All LED lamps are lit. (COOL, DEF, IR, ALARM, HUM) 4. IRm, DRm: ON
02	Compressor	1. Mode display LED: 2 2. Temp. display LED:  (A) (Running current draw, CTM) 3. LED lamp: COOL is lit 4. MGC1m: ON MCLm: ON EEV: 20% open
04	Condensor fan & motor	1. Mode display LED: 2 2. Temp. display LED:  (A) (Running current draw, CT1) 3. LED lamp: OFF 4. MGC1m: ON CFR1m: ON
06	Evaporator fan (Hi) & motor	1. Mode display LED: 2 2. Temp. display LED:  (A) (Running current draw, CT1) 3. LED lamp: OFF 4. MGC1m: ON EFR1m: ON
07	Evaporator fan (Lo) & motor	1. Mode display LED: 2 2. Temp. display LED:  (A) (Running current draw, CT1) 3. LED lamp: OFF 4. MGC1m: ON EFR1m, EFR2m: ON
08	Heater	1. Mode display LED: 2 2. Temp. display LED:  (A) (Running current draw, CT1) 3. LED lamp: OFF 4. MGC1m: ON HR1m, HR2m: ON
09	Electronic expansion valve (EEV)	1. Mode display LED: 2 2. Temp. display LED:  (%) (Valve openning) 3. LED lamp: OFF 4. Repeats fully opened ↔ fully closed. (at max. speed) (1) The test will stop when the operator has released the ENTER key, with the opening instruction at the time of release stored in the system. (2) When the system shifts to test item No.9, the valve will operate at 10% increments from the last aperture. However, if the last aperture is 10 ~ 90% then it will increase or decrease in the same direction as in the last.

Note: (1) Test No. 3 and 5 will be skipped on this unit.

No.	Test Item	Controller output status to ENTER key
10	Modulating valve	1. Mode display LED: 2 2. Temp. display LED:  (%) (Valve opening) 3. LED lamp: OFF 4. Repeats fully opened ↔ fully closed. (at max. speed) (1) The test will stop when the operator has released the ENTER key with the opening instruction at the time of release stored in the system. (2) When the system shifts to test item No.10, the valve will operate at 10% increments from the last aperture. However, if the last aperture is 10 ~ 90% then it will increase or decrease in the same direction as in the last.
11	Temperature recorder	1. Mode display LED: 2 2. Temp. display LED:  (°C) (Temperature command) 3. LED lamp: OFF 4. →+20°C→ 0°C→ –20°C Repeat this sequence. 0°C ← (1) Compulsory operation stop for ten seconds after the prescribed temperature is reached. (2) In the present test, after switching to item No.10 or No.12, the temperature must be increased or decreased depending on previous instructions. However, the initial value immediately after the present test is initiated must be +20°C.
12	Phase reversal relay	1. Mode display LED: 2 2. Temp. display LED:  (Test No.) 3. LED lamp: OFF 4. RVm: ON (However, this will turn off after 3 seconds in case of correct phase.) 5. MGC1m: ON
13	Classification society test	1. Mode display LED: 2 2. Temp. display LED:  (Test No.) 3. LED lamp: OFF

No.13 Test Functions Following the Classification Society Test Mode



Note:

Control output status when the ENTER key has been pushed

1. Mode display LED: 2
2. Temp. display LED: - - 13
3. LED lamp: OFF

(1) LPT-OFF check (Operation with the compressor turned on and with the condenser fan)
MGC1m: ON, MCm: ON, CFR1m: ON
EEV/MV fully closed.

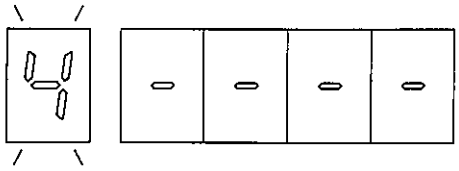
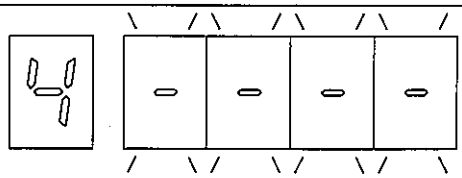
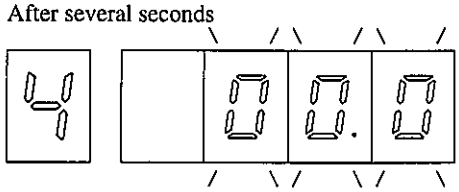
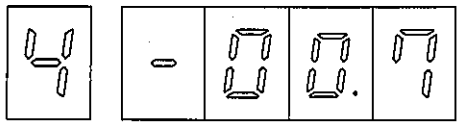
(2) LPT-ON check EEV 65% opened

(3) HPT-OFF check (with compressor turned on, condenser fan stopped and evaporator fan set to Hi)
EEV: 65% opened, MCm: ON, EFR1m: ON, EFR2m: OFF

(4) HPT-ON check EEV fully closed.

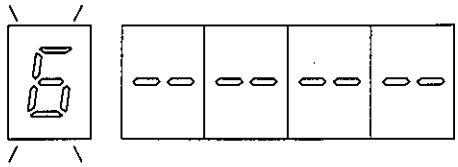
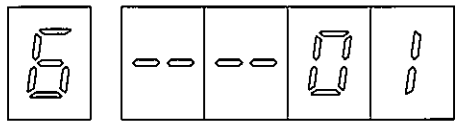
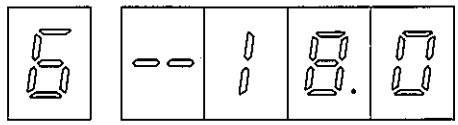
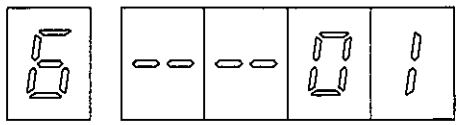
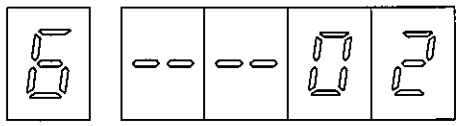
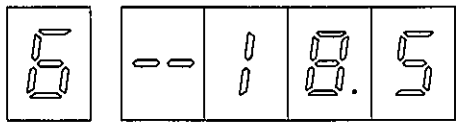
12.11.9 MER ZERO CAL. mode

This mode can easily do adjust of re-zeroing regardless of actual container inside temperature.

Operation Flow	Key Manipulation	Display	Remarks
MER ZERO CAL.	[MODE] key		Note (1)
ZERO SET	[ENTER] key		
		After several seconds 	Note (1)
	[UP] key or [DOWN] key		Each push of the ⇧ or ⇩ key will increase or decrease the displayed temp by 0.1°C
New Shift temp.	[ENTER] key		Note (1)

Note: (1) This display will automatically return to the normal display if no key is manipulated for 30 seconds.

12.11.10 Operating data display mode

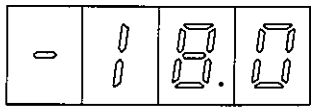
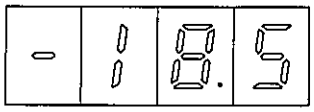
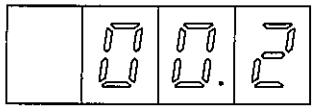
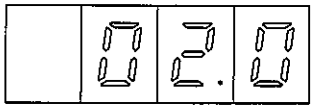
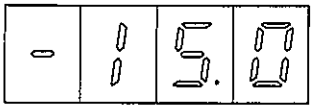
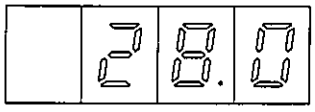
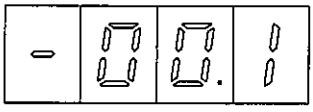
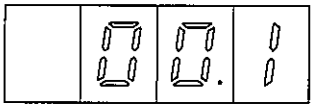
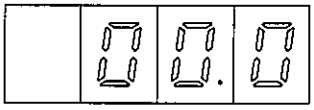
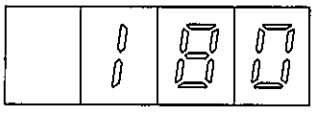
Operation Flow	Key Manipulation	Display	Remarks
Operating data display	[MODE] key		
	[ENTER] key		
Data on No. 1 is displayed	[ENTER] key		Displays data only when [ENTER] key is pressed and held.
	Free from [ENTER] key		
No. 2 ~ 28 are displayed	[UP] key or [DOWN] key		 -- 02 up to -- 28 [UP] key or [DOWN] key
No. 2 ~ 28 Data on the items are displayed	[ENTER] key		Displays data only when [ENTER] key is pressed and held.

Note: (1) This display will automatically return to the normal display without regard to AC power or battery operation, if no key is manipulated for 30 seconds.

(2) In this mode, by pressing the [MODE] key the display will immediately return to the normal display.

(3) Each operating data display is shown on the following pages.

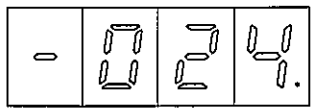
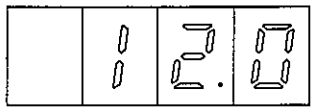
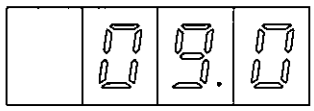
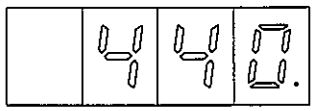
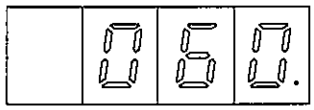
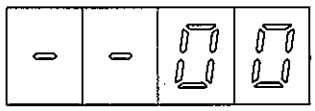
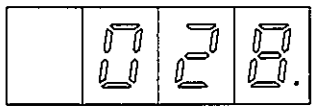
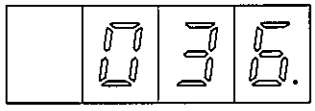
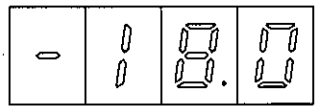
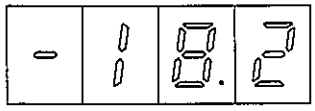
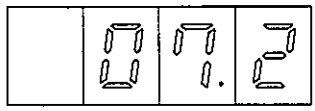
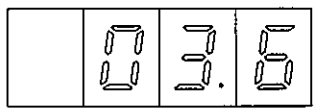
<Operating Data Display (1)>

No.	Item	Display	Remarks
01	Set point temperature	 (°C)	
02	Control temperature	 (°C)	
03	Supply air temperature	 (°C)	
04	Return air temperature	 (°C)	
07	Evaporator coil outlet sensor (TDK)	 (°C)	
08	Ambient temperature sensor (TA)	 (°C)	
09	Cold treatment temperature sensor No. 1 (TCT1) USDA	 (°C)	• Option
10	Cold treatment temperature sensor No. 2 (TCT2) USDA	 (°C)	• Option
11	Cold treatment temperature sensor No. 3 (TCT3) USDA	 (°C)	• Option
13	High refrigerant pressure	 (× 10 kPa)	• See Note (1)

Note: (1) No. 13 ~ 21 items will be skipped at AC power source [OFF].

But the other No. items will be displayed without regard to AC power source [ON]/[OFF].

<Operating Data Display (2)>

No.	Item	Display	Remarks
14	Low refrigerant pressure	 (kPa)	• See Note (1)
15	Unit running current (CT1)	 (A)	• See Note (1)
16	Compressor running current (CTM)	 (A)	• See Note (1)
17	Power Source Voltage	 (V)	• See Note (1)
18	Power Source Frequency	 (Hz)	• See Note (1)
19	Operation mode * 1: Chill mode 2: Frozen mode ** Operation step 0, 1, 2, 3, 4		• See Note (1)
20	Electronic expansion valve opening	 (%)	• See Note (1)
21	Modulating valve opening	 (%)	• See Note (1)
22	MER setting temperature	 (°C)	
23	MER recording temperature (Feedback temperature)	 (°C)	
24	Ni-Cd battery (rechargeable) voltage	 (V)	
25	Lithium battery voltage	 (V)	

<Operating Data Display (3)>

No.	Item	Display	Remarks
26	Compressor running time	0014 × 100 (H)	
28	Evaporator fan motor running time	158 × 100 (H)	

Note: (2) No. 5, 6, 9, 10, 11, 12, 27 are optional items, so these displays are skipped on this unit.

(3) When each sensor is abnormal, the display shows as follows.

- When it exceeds upper limit: 999
- When it is below lower limit: -999
- When it is over range: ----

12.11.11 Container No. setting mode

<An example of container No.>

EMCU 5167032
☆ ※

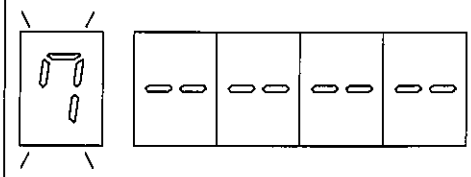
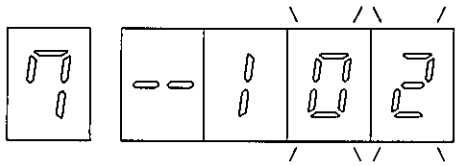
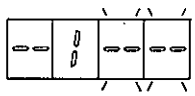
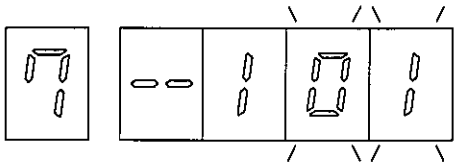
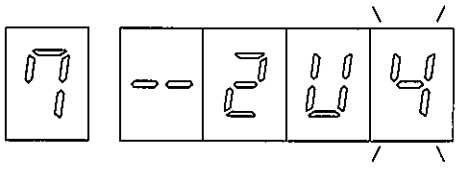
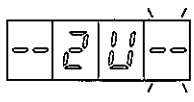
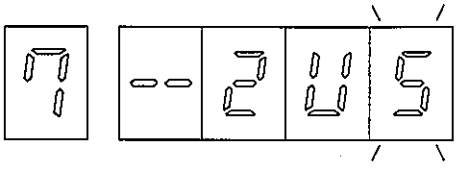
☆: • Setting No. for the alphabetical part (☆) is as follows.

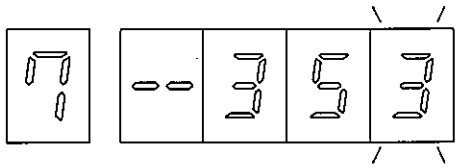
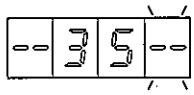
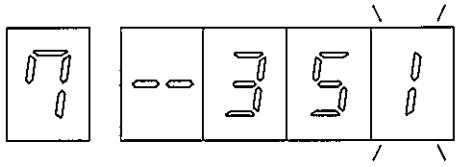
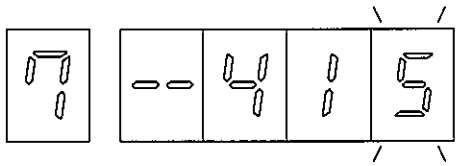
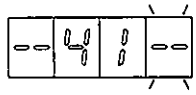
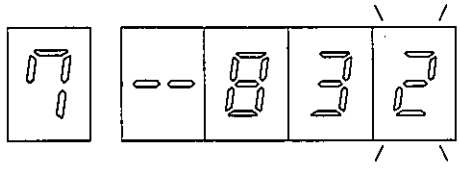
Alphabetical part	Setting No.
EMCU	01
UGMU	02
E I S U	03
\	\
----------	99

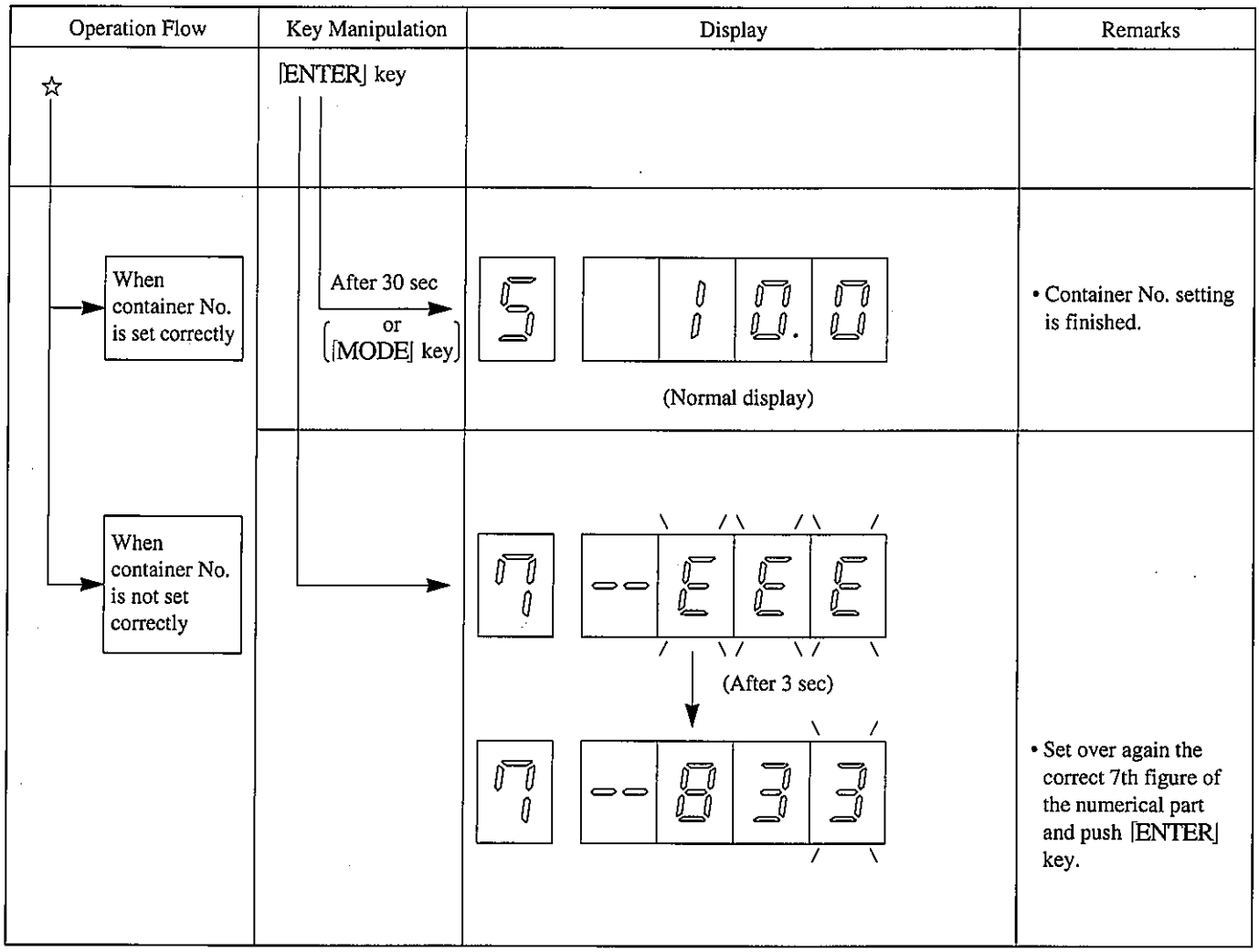
• Set the setting No. as shown in Step No.1 of the following operation flow.

※: • Set seven figures of the numerical part (※) as shown in Step No.2 8 of the following operation flow.

Step No.	Container No.	Example: EMCU5167032
1	Alphabetical part	EMCU
2	1st figure of numerical part	5
3	2nd figure of numerical part	1
4	3rd figure of numerical part	6
5	4th figure of numerical part	7
6	5th figure of numerical part	0
7	6th figure of numerical part	3
8	7th figure of numerical part	2

Operation Flow	Key Manipulation	Display	Remarks
Container No. setting display	[MODE] key (When mode "6" LED blinks, push [MODE] key.)		• This container No. setting operation is available even during the battery operation.
Step No.1 Alphabetical part setting	[ENTER] key		• The former set. No. (e. g. "02") for the alphabetical part of container No. blinks every 0.5sec. • When a former set. No. does not exist, the display shows as follows. 
	[UP] key or [DOWN] key		• Setting of the set. No. for the alphabetical part of container No.
	[ENTER] key		• When the set. No. for the alphabetical part is set by [ENTER] key, "U"and the next step No. "2" light continiously, and the former set 1st figure (e. g. "4") of the numerical part blinks every 0.5sec. • When a former set 1st figure does not exist, the display shows as follows. 
Step No.2 1st figure setting of numerical part ※(To next page)	[UP] key or [DOWN] key		• Setting of the 1st figure of the numerical part.

Operation Flow	Key Manipulation	Display	Remarks
※	[ENTER] key		• When the 1st figure of the numerical part is set by [ENTER] key, "5" and the next step No. "3" light continuously, and the former set 2nd figure (e. g. "3") blinks every 0.5sec. • When a former set 2nd figure does not exist, the display shows as follows. 
Step No.3 2nd figure setting of mumerical part	[UP] key or [DOWN] key		• Setting of the 2nd figure of the numerical part.
	[ENTER] key		• When the 2nd figure of the numerical part is set by [ENTER] key, "1" and the next step No. "4" light continiously, and the former set 3rd figure (e. g. "5") of numerical part blinks every 0.5sec. • When a former set 3rd figure of the numerical part does not exist, the display shows as follows. 
Step No.8 7th figure setting of numerical part ☆ (To next page)	[UP] key or [DOWN] key		• Setting of the 7th figure of the numerical part.



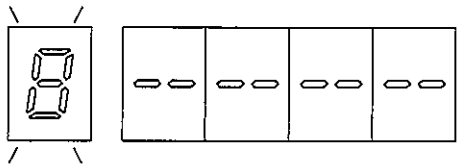
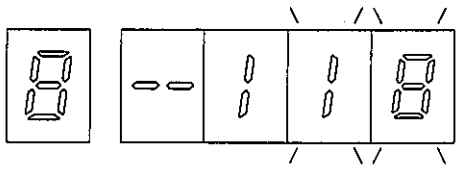
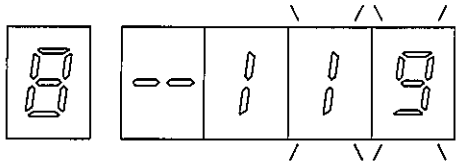
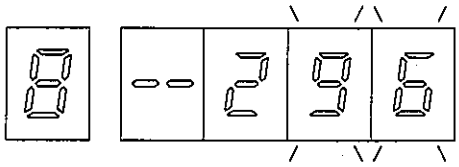
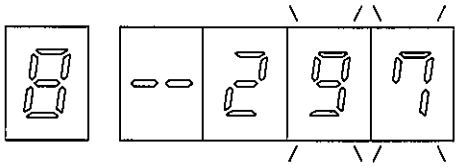
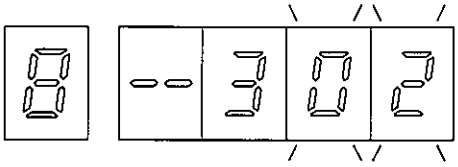
Note: (1) During container No. setting operation, when no key is manipulated for 30 sec and when [MODE] key is pushed, the display will seturn to the normal display. Then operate ever again from the first operation of container No. setting.

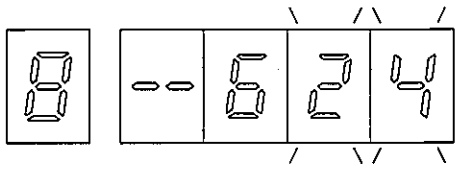
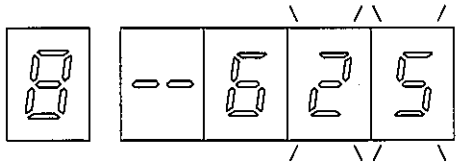
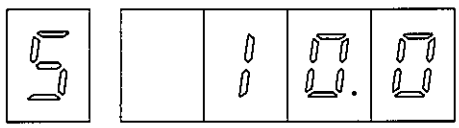
12.11.12 Calendar setting mode

<An example of Calendar>

13th March, 1997, 16:30

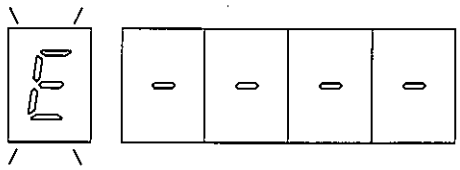
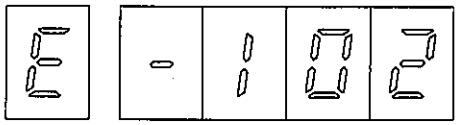
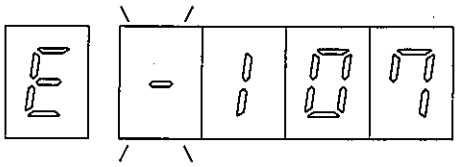
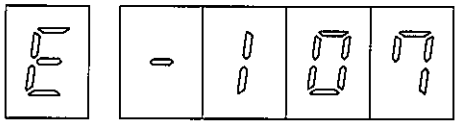
Step No.	Time	Example:13th March, 1997, 16:30
1	1st figure of year	1
	2nd figure of year	9
2	3rd figure of year	9
	4th figure of year	7
3	1st figure of month	0
	2nd figure of month	3
4	1st figure of day	1
	2nd figure of day	3
5	1st figure of time (hour)	1
	2nd figure of time (hour)	6
6	3rd figure of time (minute)	3
	4th figure of time (minute)	0

Operation Flow	Key Manipulation	Display	Remarks
Calendar setting display	[MODE] key (When mode "7" LED blinks, push [MODE] key.)		• This calender setting operation is available even during the battery operation.
Step No.1	[ENTER] key		• By [ENTER] key manipulation, Step No."1" lights continiously and the former set number (e.g. "18") for Step No.1 blinks every 0.5sec.
	[UP] key or [DOWN] key		• Setting of the number "19" for Step No.1. • The displayed blinking number increases or decreases only one every one pushing of [UP] or [DOWN] key. By pushing [UP] or [DOWN] key for more than 1 sec., the displayed blinking number increases or decreases by 10 per second.
Step No.2	[ENTER] key		• When the number "19" for Step No.1 is set by [ENTER] key, the next step No."2" lights continiously and the former set number (e. g. "96") blinks every 0.5sec.
	[UP] key or [DOWN] key		• Setting of the number "97" for Step No.2.
Step No.3	[ENTER] key		• When the number "97" for Step No.2 is set by [ENTER] key, the next step No."3" lights continiously and the former set No. (e. g. "02") blinks every 0.5sec.
※(To next page)			

Operation Flow	Key Manipulation	Display	Remarks
※			
Step No.6	[ENTER] key		
	[UP] key or [DOWN] key		
	[ENTER] key		
	After 30 sec or [MODE] key	 (Normal display)	• Calendar setting is finished.

Note: (1) During calendar setting operation, when no key is manipulated for 30 sec and when [MODE] key is pushed, the display will return to the normal display. Then operate over again from the first operation of calendar setting.

12.11.13 Existing alarm information display mode

Operation Flow	Key Manipulation	Display	Remarks
Alarm occurred	[MODE] key		
Alarm information is displayed (Existing alarm is displayed)	[ENTER] key		• Max. 10 items of alarm code No. are displayed in order from low alarm code No..
	[UP] key or [DOWN] key		• When the displayed alarm code No. is not the highest No..
			• When the displayed alarm code No. is the highest No..

Note: (1) This display will automatically return to the normal display if no key is manipulated for 30 seconds.

(2) If no alarm exists, this alarm information display mode will be skipped.

12.11.14 Trip start function key

This key is used to mark the starting point to retrieve LOG data.

(1) Accommodating the trip start key switch

(a) In cases where the controller is active (i.e., power is ON or the system is battery driven), if the trip key switch is pushed (for more than three seconds), the system keeps in mind that this is the start of the voyage. However, this key can not be accepted if initial checking is performed while power is on.

(b) If the trip start key is accepted, this LED has priority over other LEDs, thus displaying "[5 5 5]" for three seconds.

It then returns to the original display.

(2) Transferring the LOG data

If the system accepts a LAST LOG retrieval instruction from hand-held computer, the system transfers data memorized between the time of the trip start and retrieval.

However, if ID data is set after the trip function has started, this transmission is performed on data memorized between the time of the ID data set and retrieval. Note that overwriting will erase the trip start memory.

12.11.15 Others

(1) In cases where 1H pulse from calendar IC is entered while the power supply is off under the controller is inactive, the controller activates, and it is operated by battery for several seconds. During this time, the system performs the 1H LOG and 1H recording functions, but all of the LEDs and 7-seg LED turn off.

(2) While the system is battery driven, the LED and 7-seg LED turn on for 30 seconds after hand-held computer operation has been completed.

12.11.16 LED lamp information

 light  blink ○ off

	ALARM		DEF	IR	COOL
Initial automatic diagnosis is underway	○		○	○	○
Error has been detected by the initial diagnosis	 (Returnable)	 (Not returnable)	○	○	○
Normal display immediately after the initial diagnosis has been completed	 (Returnable)	 (Not returnable)	○	○	○
MIN.PTI selected	 (Failed)		○	○	 (Comp. ON)
MAX.PTI selected	 (Failed)		 (Defrosting)	 (IN RANGE)	 (Comp. ON)
Outline	• The LED will blink up when any error is detected, but if it can return to normal status the LED will light.		• The defrosting (DRm 'ON') will cause the LED to light up, and its completion will turn it off.	• Two minutes delay when control temp. goes out of range. • Sixty minute delay when defrosting has been completed. • The LED will be forcibly turned off when one of the following errors has occurred. #310 ~ 313 #315, 316 #330 #331 • Compulsory stop after automatic re-start, when one of the following errors has occurred. #201 } #202 } * (see chapter 12.12)	• The LED will light up when the compressor MCm has been turned on.

* The operation re-starts automatically, only 3 times.

12.11.17 Dip SW

Dip switches are located on the rear surface of the control board (P-CONTR).

These switches are used to select the operational model types (including those optional) as listed below.

They have been set before shipment.

Name of SW	SW No.	Description	Setting
S W	1	Model type select (CPE52/CPE14)	OFF (CPE14)
	2	MER Chart type (Chart 7, 9/6)	ON (Chart 6)
	3	Defrosting yes/no	OFF (Yes)
	4	Humidity yes/no	↑ (No)
	5	Not used	———
	6	Factory clear yes/no Note (1)	OFF (No)
	7	Cold treatment yes/no Note (2)	↑ (No)
	8	APT yes/no	OFF (No)

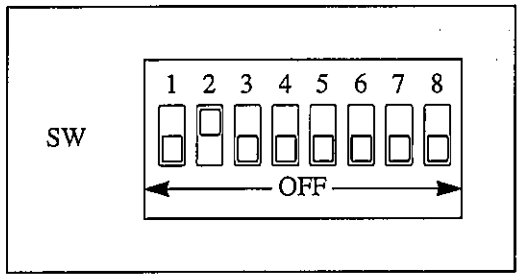


Fig.37 Dip SW

Note: (1) (a) **When this dip switch for Factory Cear has been turned ON, every time the unit ON-OFF switch is turned ON, all of the data that has been stored in the controller are cleared, and at the same time the set point temperature of the container inside is set to "0°C" automatically.**

(b) Do not carry out Factory Cleare except the following cases.

① When the controller is replaced.

② When the controller hangs up by some cause.

(c) About how to carry out Factory Cleare, refer to the controller technical manual ('95 • RC-I • 422A).

(2) When selecting the function of Cold Treatment, set this switch "ON" position.

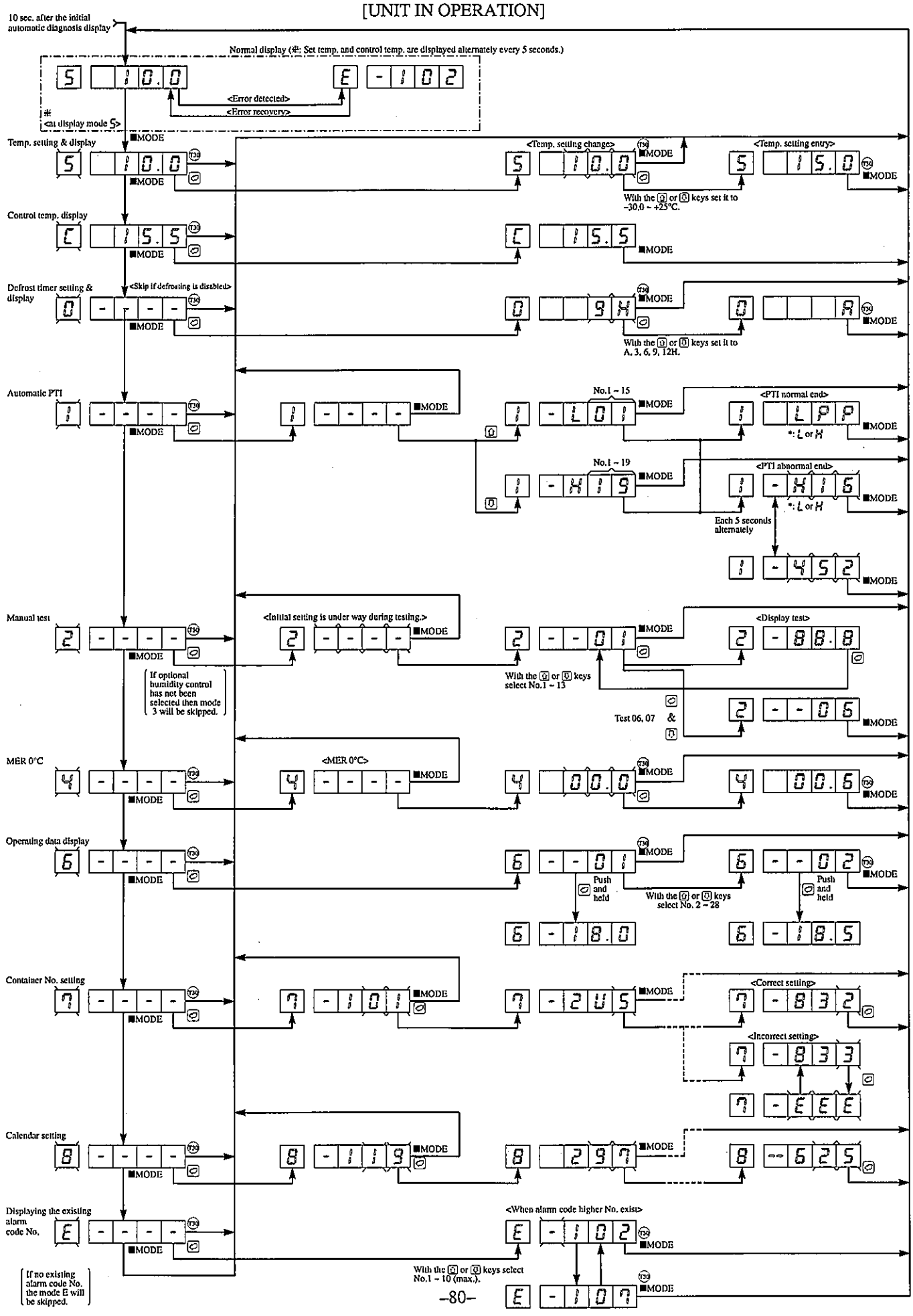
12.11.18 Operating Modes

○: ON

Operating function	Operation mode	CHILL						FROZEN			
	Set point	–5°C and above						Below –5°C			
	Controlled temperature	Supply air temp.						Supply/Return higher air temp.			
	Step No.	⓪	①	②	③	④		⓪	①	②	
	Operation step	Full cool	Capa-city control	Capacity control + Low heat	Low heat	High heat	Defrost	Full cool	Low circula-tion	Low heat	Defrost
Compressor		○	○	○				○			
Condenser fan		○	○	○				○			
Evaporator fan	Hi	○	○	○	○	○		○		○	
	Lo								○	○	
Heater	Sub (H1, H2)			○	○	○	○			○	○
	Main (H3~H6)					○	○				○
Electronic expansion valve (EEV)		○	○	○				○			
Modulating valve (MV)			○	○							
Liquid injection Solenoid valve (S5)		○	○	○				○			
Main contactor MC		○	○	○				○			
Heater relay	Main (HR_1)					○	○				○
	Sub (HR_2)			○	○	○	○			○	○
Fan relay	Hi (FRH)	○	○	○	○	○		○		○	
	Lo (FRL)								○	○	
Contactor	MGC_1	○	○	○	○	○	○	○	○	○	○
	MGC_3										
Controller miniature relay output	(MCL_m)	○	○	○				○			
	($CFR1_m$)	○	○	○				○			
	($CFR2_m$)										
	($EFR1_m$)	○	○	○	○	○		○	○	○	
	($EFR2_m$)								○	○	
	($HR1_m$)					○	○				○
	($HR2_m$)			○	○	○	○			○	○
	($MGC1_m$)	○	○	○	○	○	○	○	○	○	○
	($MGC3_m$:RV_m) ※1										
	(IR_m)										
	(DR_m)										

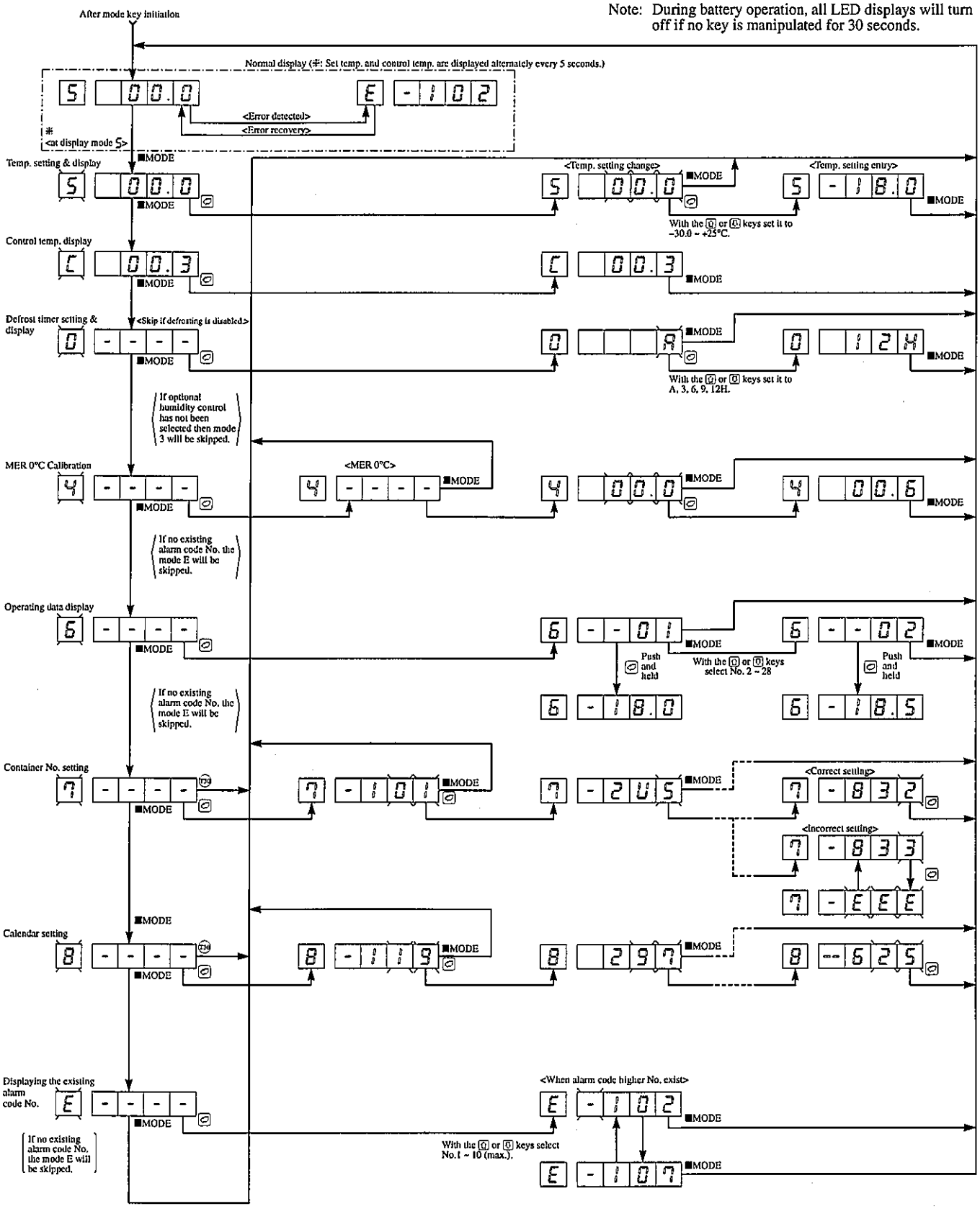
※1 For positive phase; RVm: OFF, MGC1m: ON, MGC3m: OFF.
For negative phase; RVm: ON, MGC1m: OFF, MGC3m: ON.

12.11.19 Operation and Display Manual



[DURING BATTERY OPERATION]

Note: During battery operation, all LED displays will turn off if no key is manipulated for 30 seconds.



12.12 Self-diagnosis item

◑ : ALARM LED is blinking ○ : Light out
● : ALARM LED is lit

Alarm code	Self-diagnosis item and failure	Check timing			Measure			Indication
		Power supply ON	Opera-tion	PTI	Power supply ON	Operation	PTI	ALARM LED
#102	A/D reversal failure	○	○	–	Only display	Only display	–	●
		–	–	○	–	–	PTI Interruption	◑
#105	EEPROM failure (Refer to page 97)	○	–	–	Only display	–	–	●
#107	SRAM failure	○	–	–	Stop	–	–	◑
#108	Phase pulse failure	○	–	–	Stop	–	–	◑
		–	○	–	–	Only display	–	●
		–	–	○	–	–	PTI Interruption	◑
#200	Control temperature failure	–	○	–	–	Only display	–	●
#201	High refrigerant pressure failure	○	○	–	Stop	Compressor stop Condenser fan run EEV/MV fully closed Evaporator fan (Lo) ※1	–	◑ or ●
		–	–	◎	–	–	PTI Interruption	◑
#202	Low refrigerant pressure failure	–	○	–	–	Compressor & condenser fan stop EEV/MV fully closed Evaporator fan (Lo) ※1	–	◑ or ●
		–	–	◎	–	–	PTI Interruption	◑
#205	Modulating valve or Electronic expansion valve Closing failure	–	–	○	–	–	PTI Interruption	◑

※1. The operation re-starts automatically, only 3 times.

○ : MIN-PTI
◎ : MAX-PTI only

Alarm code	Self-diagnosis item and failure	Check timing			Measure			Indication
		Power supply ON	Opera-tion	PTI	Power supply ON	Operation	PTI	ALARM LED
#206	Forced termination of defrosting	–	○	–	–	Forced termination of defrosting	–	●
		–	–	◎	–	–	PTI Interruption	◑
#207	Single phase	○	○	–	Stop	Compressor stop Condenser fan stop EEV/MV fully closed Evaporator fan stop	–	◑
		–	–	○	–	–	PTI Interruption	◑
#208	Power source frequency failure	○	○	–	Only display	Only display	–	●
		–	–	○	–	–	PTI Interruption	◑
#209	Power source voltage failure	○	○	–	Only display	Only display	–	●
		–	–	○	–	–	PTI Interruption	◑
#300	Operation key switch failure (MODE KEY)	○	–	–	Stop	–	–	◑
#301	Operation key switch failure (UP KEY)	○	–	–	Stop	–	–	◑
#302	Operation key switch failure (DOWN KEY)	○	–	–	Stop	–	–	◑
#303	Operation key switch failure (ENTER KEY)	○	–	–	Stop	–	–	◑
#307	Trip start switch failure	○	–	–	Nullify	–	–	●

Alarm code	Self-diagnosis item and failure	Check timing			Measure			Indication
		Power supply ON	Opera-tion	PTI	Power supply ON	Operation	PTI	ALARM LED
#310	Disconnection of supply air temperature sensor for control	○	○	–	Only display	Fail-safe and back-up	–	●
		–	–	○	–	–	PTI Interruption	◑
#311	Short circuit of supply air temperature sensor for control	○	○	–	Only display	Fail-safe and back-up	–	●
		–	–	○	–	–	PTI Interruption	◑
#312	Disconnection of return air temperature sensor for control	○	○	–	Only display	Fail-safe and back-up	–	●
		–	–	○	–	–	PTI Interruption	◑
#313	Short circuit of return air temperature sensor for control	○	○	–	Only display	Fail-safe and back-up	–	●
		–	–	○	–	–	PTI Interruption	◑
#314	Temperature discrepancy failure of supply or return air temp. sensor for control	–	○	–	–	Compressor stop Condenser fan stop EEV/MV fully closed Evaporator fan (Lo)	–	◑
		–	–	◎	–	–	PTI Interruption	◑
#315	Disconnection of evaporator outlet sensor	○	○	–	Only display	Fail-safe and back-up	–	●
		–	–	○	–	–	PTI Interruption	◑
#316	Short circuit of evaporator outlet sensor	○	○	–	Only display	Fail-safe and back-up	–	●

Alarm code	Self-diagnosis item and failure	Check timing			Measure			Indication
		Power supply ON	Opera-tion	PTI	Power supply ON	Operation	PTI	ALARM LED
#316	Short circuit of evaporator outlet sensor	–	–	○	–	–	PTI Interruption	◑
#317	Temperature discrepancy failure of evaporator outlet sensor	–	–	◎	–	–	PTI Interruption	◑
#320	Disconnection of ambient temperature sensor	○	○	–	Only display	Nullify	–	●
		–	–	○	–	–	PTI Interruption	◑
#321	Short circuit of ambient temperature sensor	○	○	–	Only display	Nullify	–	●
		–	–	○	–	–	PTI Interruption	◑
#322	Disconnection of cold treatment temperature sensor No.1	○	○	–	Only display	Only display	–	●
		–	–	○	–	–	PTI Interruption	◑
#323	Short circuit of cold treatment temperature sensor No.1	○	○	–	Only display	Only display	–	●
		–	–	○	–	–	PTI Interruption	◑
#324	Disconnection of cold treatment temperature sensor No.2	○	○	–	Only display	Only display	–	●
		–	–	○	–	–	PTI Interruption	◑
#325	Short circuit of cold treatment temperature sensor No.2	○	○	–	Only display	Only display	–	●

Alarm code	Self-diagnosis item and failure	Check timing			Measure			Indication
		Power supply ON	Opera-tion	PTI	Power supply ON	Operation	PTI	ALARM LED
#325	Short circuit of cold treatment temperature sensor No.2	–	–	○	–	–	PTI Interruption	◑
#326	Disconnection of cold tratment temperature sensor No.3	○	○	–	Only display	Only display	–	●
		–	–	○	–	–	PTI Interruption	◑
#327	Short circuit of cold treatment temperature sensor No.3	○	○	–	Only display	Only display	–	●
		–	–	○	–	–	PTI Interruption	◑
#330	High refrigerant pressure sensor failure	○	–	–	Stop	–	–	◑
		–	○	–	–	Fail-safe and back-up	–	●
		–	–	○	–	–	PTI Interruption	◑
#331	Low refrigerant pressure sensor failure	○	–	–	Stop	–	–	◑
		–	○	–	–	Fail-safe and back-up	–	●
		–	–	○	–	–	PTI Interruption	◑
#332	Detected pressure discrepancy failure of high or low refrigerant pressure sensor	–	–	○	–	–	PTI Interruption	◑
#337	Disconnection of compressor discharge gas temperature sensor failure (TDIS)	○	○	–	Only display	Only display	–	●

Alarm code	Self-diagnosis item and failure	Check timing			Measure			Indication
		Power supply ON	Opera-tion	PTI	Power supply ON	Operation	PTI	ALARM LED
#337	Disconnection of compressor discharge gas temperature sensor failure (TDIS)	–	–	○	–	–	PTI Interruption	◑
#338	Short circuit failure of compressor discharge gas sensor failure (TDIS)	○	○	–	Only display	Only display	–	●
		–	–	○	–	–	PTI Interruption	◑
#340	Voltage sensor failure (PT1)	○	○	–	Only display	Only display	–	●
		–	–	○	–	–	PTI Interruption	◑
#350	Current sensor detection failure (CT1, Hi)	○	○	–	Only display	Fail-safe and back-up	–	●
		–	–	○	–	–	PTI Interruption	◑
#351	Current sensor detection failure (CT1, Lo)	○	○	–	Only display	Fail-safe and back-up	–	●
		–	–	○	–	–	PTI Interruption	◑
#356	Current sensor detection failure (CTM, Hi)	○	○	–	Only display	Only display	–	●
		–	–	○	–	–	PTI Interruption	◑
#357	Current sensor detection failure (CTM, Lo)	○	○	–	Only display	Only display	–	●
		–	–	○	–	–	PTI Interruption	◑

Alarm code	Self-diagnosis item and failure	Check timing			Measure			Indication
		Power supply ON	Opera-tion	PTI	Power supply ON	Operation	PTI	ALARM LED
#411	Lock or short circuit of compressor motor (CM)	–	○	–	–	Compressor & condenser fan stop EEV/MV fully closed Evaporator fan stop	–	◑ or ●
		–	–	○	–	–	PTI Interruption	◑
#412	Disconnection of compressor motor (CM)	–	○	–	–	Only display	–	●
		–	–	○	–	–	PTI Interruption	◑
#413	Overheating failure of compressor (CM)	○	○	–	Nullify	Compressor & condenser fan stop EEV/MV fully closed Evaporator fan (Lo)	–	◑ or ●
		–	–	○	–	–	PTI Interruption	◑
#421	Lock or short circuit of condenser fan motor (Hi)	–	–	○	–	–	PTI Interruption	◑
#422	Disconnection or internal thermostat actuation of condenser fan motor (Hi)	–	–	○	–	–	PTI Interruption	◑
#451	Lock or short circuit of evaporator fan motor (Hi)	–	–	○	–	–	PTI Interruption	◑
#452	Disconnection or internal thermostat actuation of evaporator fan motor (Hi)	–	–	○	–	–	PTI Interruption	◑
#461	Lock or short circuit of evaporator fan motor (Lo)	–	–	○	–	–	PTI Interruption	◑
#462	Disconnection or internal thermostat actuation of evaporator fan motor (Lo)	–	–	○	–	–	PTI Interruption	◑
#471	Short circuit of evaporator coil heater (All heaters)	–	○	–	–	All heaters off	–	●

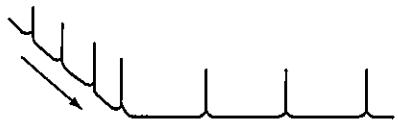
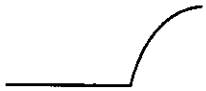
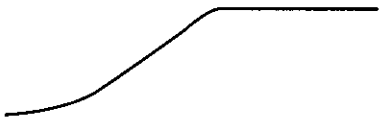
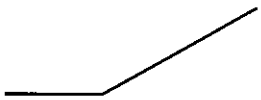
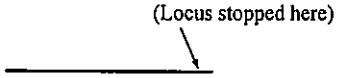
Alarm code	Self-diagnosis item and failure	Check timing			Measure			Indication
		Power supply ON	Opera-tion	PTI	Power supply ON	Operation	PTI	ALARM LED
#471	Short circuit of evaporator coil heater (All heaters)	–	–	○	–	–	PTI Interruption	◑
#472	Disconnection of evaporator coil heater (All heaters)	–	○	–	–	Only display	–	●
		–	–	○	–	–	PTI Interruption	◑
#481	Short circuit of evaporator coil heater (Low)	–	○	–	–	All heaters off	–	●
		–	–	○	–	–	PTI Interruption	◑
#482	Disconnection of evaporator coil heater (Low)	–	○	–	–	Only display	–	●
		–	–	○	–	–	PTI Interruption	◑
#491	Electronic expansion valve failure	–	–	○	–	–	PTI Interruption	◑
#492	Modulating valve failure	–	○	–	–	Compressor & condenser fans stop EEV-MV fully closed Evaporator fan (Lo)	–	◑
		–	–	○	–	–	PTI Interruption	◑
#550	Weak lithium battery	○	○	–	Only display	Only display	–	●
		–	–	○	–	–	PTI Interruption	◑
#601	Servo motor or Potentiometer failure of recorder	○	○	–	Only display	Only display	–	●

Alarm code	Self-diagnosis item and failure	Check timing			Measure			Indication
		Power supply ON	Opera-tion	PTI	Power supply ON	Operation	PTI	ALARM LED
#601	Servo motor or Potentiometer failure of recorder	–	–	○	–	–	PTI Interruption	◑
#900	High refrigerant pressure failure (Too high) (Over-charge of refrigerant)	–	–	◎	–	–	PTI Interruption	◑
#901	High refrigerant pressure failure (Too low) (Insufficient refrigerant)	–	–	◎	–	–	PTI Interruption	◑
#902	Low refrigerant pressure failure	–	–	◎	–	–	PTI Interruption	◑
#903	Pulling down failure (Too long pulling down time)	–	–	◎	–	–	PTI Interruption	◑
#904	Mixing of air in refrigerant circuit	–	–	◎	–	–	PTI Interruption	◑
#997	※2 Battery alarm	–	○	–	–	Only display	–	●
		–	–	○	–	–	PTI Interruption	◑
		At battery operation			Recording only (AI BAT)			○
#998	Mode change	PTI operation canceled			Recording only (PTI CANCELED #998 BY MODE CHANGE)			○
#999	Power OFF	PTI operation canceled			Recording only (PTI CANCELED #999 BY POWER OFF)			○

※2 LED, 7-Segment LED will switch off.

13. TROUBLE SHOOTING

13.1 Trouble Shooting by Recording Chart (Typical Examples)

No.	Locus	Trouble
1		Normal
2		Insufficient refrigerant or clogging in expansion valve (Slow curve of temperature drop)
3		Unit turned off by unit protecting device. (Only the evaporator fans are operated.)
4		Evaporator fans not operating due to lock or disconnection. (On recorder, over-cooling results and unit short cycles on LPT cutout.)
5		Both the supply and the return air temperature sensors defective in FROZEN mode. (Unit operates continuously)
6		Both the supply and the return air temperature sensors defective in CHILL mode. (Compressor does not run and unit runs low fan operation.)
7		Frosted evaporator coil (defrosting is not being carriedout.)
8		Clock for driving recording chart and the stepping motor for recording pen stop (at three days after unit power supply "OFF" or at the battery-alarm).

13.2 Trouble Shooting on Actual Unit

Shown below are typical instances. Diagnosis needs all conditions to be taken into consideration, as problems may often be the result of two or more causes, not just by single cause. A single cause may sometimes bring about two or more problems.

For MMCCIIIA controller related circuits, check according to 'Existing alarm information' (chapter 12.11.10), and 'Manual test' (chapter 12.11.8).

Trouble	Cause
(1) Diagnosis by pressure gauge 1) High side pressure is abnormally high and low side pressure is slightly high.	• Over-charge of refrigerant. • Mixing of air in refrigerant system. • Condenser fan is not running. (lock, disconnection, etc.) • Dirty or restricted condenser.
2) High side pressure is normal but low side pressure is abnormally low.	• Insufficient refrigerant. • Ice clogging in Electronic expansion valve. (Remedy) Gas leak test, Replace drier. • Clogging of drier. (Remedy) – – Replace drier. • Evaporator fan is not running. (Locking, Disconnection)
(2) Trouble in refrigerant circuit 3) Though the compressor turns, cooling is ineffective. (Excessive frost on suction pipe)	• Abnormal frosting • Disconnection of heater circuit. See (5).
4) Compressor repeats start-stop operation. Stops soon after starting Box temperature is too high	• See 1), 2) • The HPT and/or LPT has a problem or failed.
5) Compressor runs too long in "frozen" mode operation.	• Insufficient refrigerant. • Electrical circuit of MC is defective (sticking of contacts, – short-circuit.) • Ineffective compression. • Excessive frost on evaporator. • Defective container insulation.
6) Frosting on drier outlet.	• Clogging of foreign substance. (Compressor can be operated, but short cycles)

Trouble	Cause
7) Malfunction of electronic expansion valve	• Over-supply of refrigerant: · Electronic expansion valve is not closed due to clogging. · Failure of evaporator outlet temperature sensor or pressure sensor. • Non-supply of refrigerant: · Electronic expansion valve is defective. · Failure of temperature sensor set at outlet of evaporator. · Failure of pressure sensor.
8) Condenser top is cold. (High side pressure is low)	• Insufficient refrigerant. • Ineffective compression.
(3) Trouble in electrical circuit. 9) Tripping of circuit breaker.	• Short circuit due to broken power cable. • Defective insulation of heater circuit. • Over-current due to lock or short-circuit of components. • Over-load due to low voltage.
10) Tripping of circuit protector.	• Short circuit of control and electronic circuits.
11) Relay, contactor fail to function.	• Tripping of circuit protector. • Disconnection of circuit. • Transformer for controller is defective. • Malcontact of unit switch. • MMCCIIIA controller is defective.
○ Main contactor (MC) fails to function.	• MC or connection wiring has a problem. • MMCCIIIA controller is defective.
○ Heater relay (HR) fails to function.	• HR and/or connected circuit trouble. • MMCCIIIA controller is defective.
12) Though relay and contactor function are normal, but not powered on.	• Disconnection of circuit due to cut or disconnected lead wire. • Malcontact of contact points. • Disconnection of heater – Measure the current with a clamp meter.
13) No signal is given at monitoring socket.	• Miniature relays (DR), (IR) and (MCm) are defective. • MMCCIIIA controller is defective. • Disconnection of monitoring socket.
(4) Temperature control. 14) Inside temperature drops too low.	• LPT sensor is defective. • Electronic expansion valve is not closed due to clogging. • MMCCIIIA controller is defective.
(5) Trouble in defrost system. 15) Though the heater is powered, defrosting is not normal (heater current is normal.)	• Poor contact between heaters and evaporator coil due to disengaged heater clamp. • TDK sensor is defective.

Trouble	Cause
16) Both manual and auto defrost are not performed (DEF indicator lamp does not function.)	• Evaporator is not in frosted condition (above 10°C) ..... Normal. • TDK sensor is defective. • MMCCIIIA controller is defective.
17) Auto-defrost is not performed.	• TDK sensor is defective. • MMCCIIIA controller is defective.
18) Frequent auto-defrost.	• MMCCIIIA controller is defective.
(6) 19) Recording chart does not turn.	• Loosening of chart holder nut. • Failure of clock.
(7) Others 20) Compressor fails to run and hums.	• Single phase operation due to disconnection or burning of compressor circuit. • Seizure of scroll, etc.
21) Abnormal temperature, vibration.	• Compressor liquid slugging. • Mounting loose.

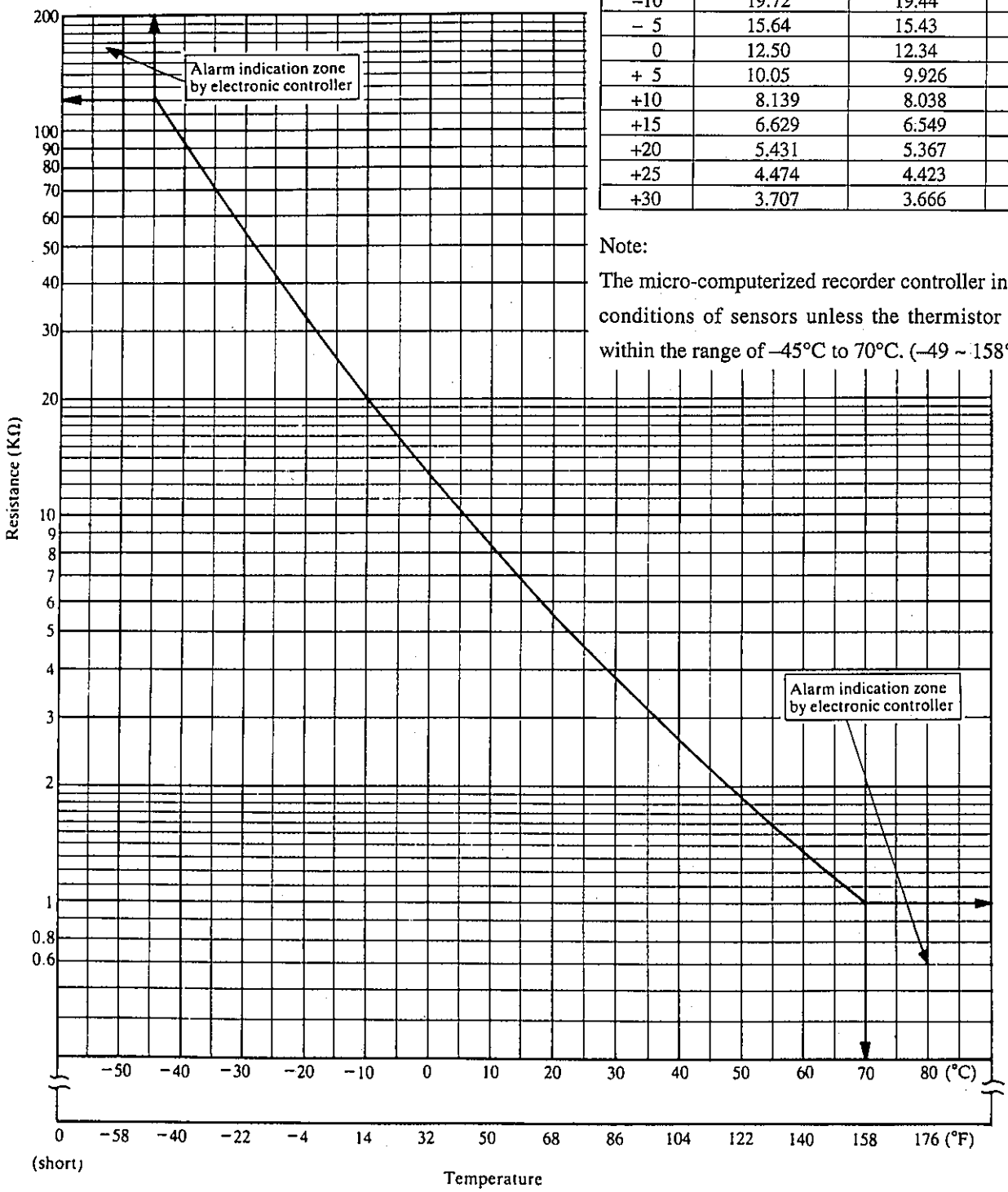
14. THERMISTOR SENSOR TEMPERATURE-RESISTANCE CURVE

(1) Supply air sensor, Return air sensor, Ambient air sensor, Evaporator coil outlet sensor (TSUP, TRET, TA, TDK)

Temp. °C	Standard resistance k ohme	Permissible resistance	
		Min.	Max.
–30	53.65	52.80	54.50
–25	41.27	40.64	41.91
–20	32.01	31.54	32.49
–15	25.03	24.67	25.39
–10	19.72	19.44	19.99
– 5	15.64	15.43	15.86
0	12.50	12.34	12.66
+ 5	10.05	9.926	10.18
+10	8.139	8.038	8.239
+15	6.629	6.549	6.708
+20	5.431	5.367	5.494
+25	4.474	4.423	4.525
+30	3.707	3.666	3.748

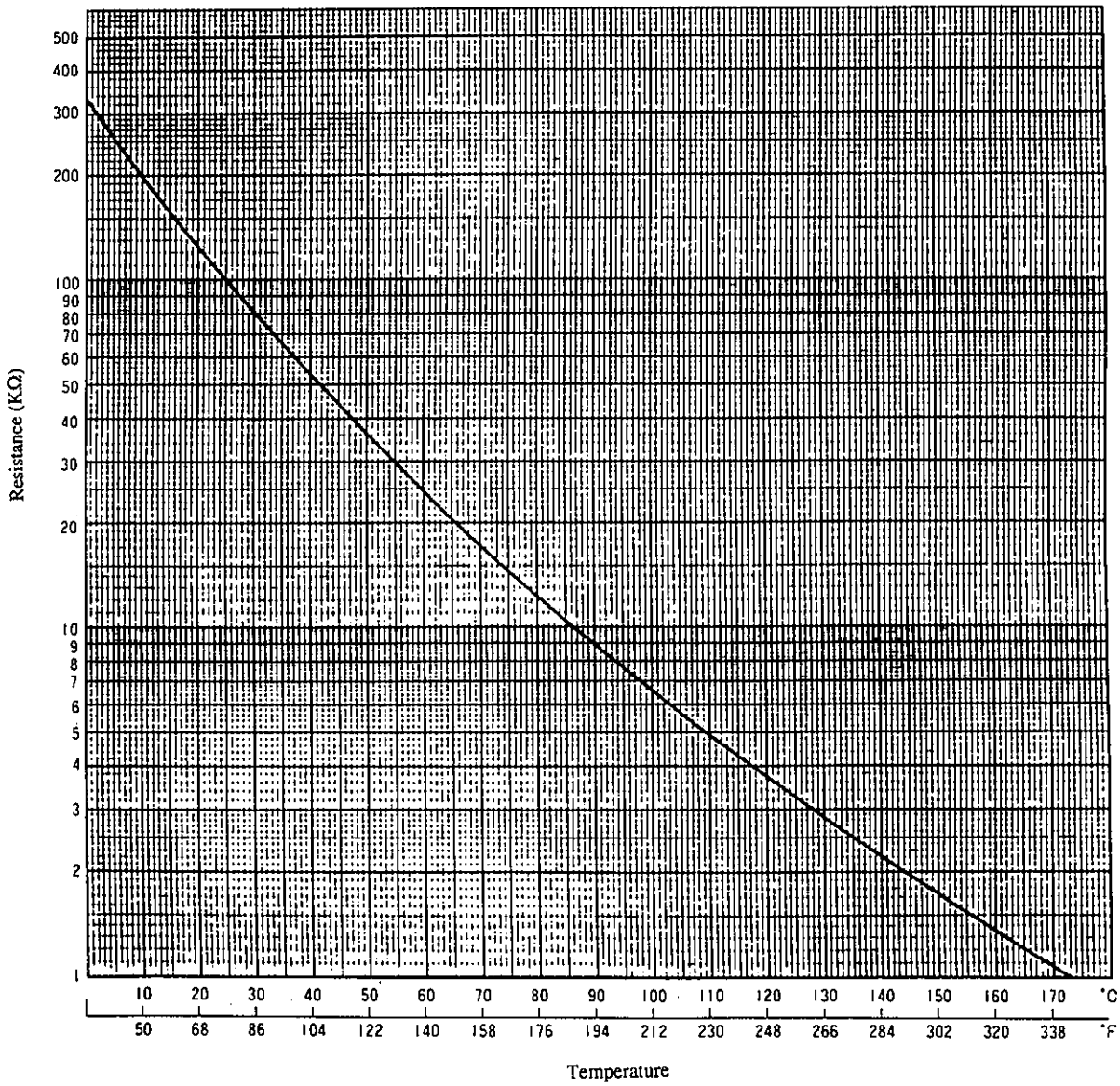
Note:

The micro-computerized recorder controller indicates alarm conditions of sensors unless the thermistor resistance is within the range of –45°C to 70°C. (–49 ~ 158°F)



(2) Discharge temperature sensor (TDIS)

Temp. °C	Standard resistance k ohme	Tolerance		Temp. °C	Standard resistance k ohme	Tolerance	
		Min.	Max.			Min.	Max.
0	329.90	314.70	345.70	80	12.43	12.26	12.59
10	201.50	193.30	210.10	90	9.00	8.91	9.09
20	126.50	121.90	131.20	100	6.62	6.54	6.71
30	81.46	78.87	84.13	110	4.94	4.86	5.02
40	53.70	52.22	55.22	120	3.73	3.66	3.80
50	36.17	35.32	37.05	130	2.85	2.79	2.92
60	24.87	24.37	25.38	140	2.21	2.16	2.26
70	17.43	17.14	17.72	150	1.74	1.69	1.78



15. PRESSURE CONVERSION TABLE

kPa	PSIG	kgf/cm^2	mmHg
1	0.1450	0.0102	7.5001
6.8966	1	0.0703	51.71
98.0665	14.22	1	735.6
0.1333	0.0193	0.0013	1

PSIG (inHgVAC.)	kPa	kgf/cm^2 (mmHgVAC.)
(29.5)	–100	(750.1)
(22.1)	–75	(562.5)
(14.8)	–50	(375.0)
(7.4)	–25	(187.5)
0	0	0
3.6	25	0.3
7.3	50	0.5
10.9	75	0.8
14.5	100	1.0
18.1	125	1.3
21.8	150	1.5
25.4	175	1.8
29.0	200	2.0
32.6	225	2.3
36.3	250	2.5
39.9	275	2.8
43.5	300	3.1
47.1	325	3.3
50.8	350	3.6
54.4	375	3.8
58.0	400	4.1
61.6	425	4.3
65.3	450	4.6
68.9	475	4.8
72.5	500	5.1
76.1	525	5.4
79.8	550	5.6
83.4	575	5.9
87.0	600	6.1
90.6	625	6.4
94.3	650	6.6
97.9	675	6.9
101.5	700	7.1
105.1	725	7.4
108.8	750	7.6
112.4	775	7.9
116.0	800	8.2
119.6	825	8.4
123.3	850	8.7
126.9	875	8.9
130.5	900	9.2
134.1	925	9.4
137.8	950	9.7
141.4	975	9.9
145.0	1000	10.2
148.6	1025	10.5
152.3	1050	10.7
155.9	1075	11.0
159.5	1100	11.2

PSIG	kPa	kgf/cm^2
163.1	1125	11.5
166.8	1150	11.7
170.4	1175	12.0
174.0	1200	12.2
177.6	1225	12.5
181.3	1250	12.7
184.9	1275	13.0
188.5	1300	13.3
192.1	1325	13.5
195.8	1350	13.8
199.4	1375	14.0
203.0	1400	14.3
206.6	1425	14.5
210.3	1450	14.8
213.9	1475	15.0
217.5	1500	15.3
221.1	1525	15.6
224.8	1550	15.8
228.4	1575	16.1
232.0	1600	16.3
235.6	1625	16.6
239.3	1650	16.8
242.9	1675	17.1
246.5	1700	17.3
250.1	1725	17.6
253.8	1750	17.8
257.4	1775	18.1
261.0	1800	18.4
264.6	1825	18.6
268.3	1850	18.9
271.9	1875	19.1
275.5	1900	19.4
279.1	1925	19.6
282.8	1950	19.9
286.4	1975	20.1
290.0	2000	20.4
293.6	2025	20.6
279.3	2050	20.9
300.9	2075	21.2
304.5	2100	21.4
308.1	2125	21.7
311.8	2150	21.9
315.4	2175	22.2
319.0	2200	22.4
322.6	2225	22.7
326.3	2250	22.9
329.9	2275	23.2
333.5	2300	23.5
337.1	2325	23.7

PSIG	kPa	kgf/cm^2
340.8	2350	24.0
344.4	2375	24.2
348.0	2400	24.5
351.6	2425	24.7
355.3	2450	25.0
358.9	2475	25.2
362.5	2500	25.5
366.1	2525	25.7
369.8	2550	26.0
373.4	2575	26.3
377.0	2600	26.5
380.6	2625	26.8
384.3	2650	27.0
387.9	2675	27.3
391.5	2700	27.5
395.1	2725	27.8
398.8	2750	28.0
402.4	2775	28.3
406.0	2800	28.6
409.6	2825	28.8
413.3	2850	29.1
416.9	2875	29.3
420.5	2900	29.6
424.1	2925	29.8
427.8	2950	30.1
431.4	2975	30.3
435.0	3000	30.6
438.6	3025	30.8
442.3	3050	31.1
445.9	3075	31.4
449.5	3100	31.6
453.1	3125	31.9
456.8	3150	32.1
460.4	3175	32.4
464.0	3200	32.6
467.6	3225	32.9
471.3	3250	33.1
474.9	3275	33.4
478.5	3300	33.7
482.1	3325	33.9
485.8	3350	34.2
489.4	3375	34.4
493.0	3400	34.7
496.6	3425	34.9
500.3	3450	35.2
503.9	3475	35.4
507.5	3500	35.7
511.1	3525	35.9
514.8	3550	36.2

16. REFRIGERANT (R22) VAPOR PRESSURE TABLE

temperature (°C)	saturation pressure		temperature (°C)	saturation pressure		temperature (°C)	saturation pressure		temperature (°C)	saturation pressure		temperature (°C)	saturation pressure	
	cmHg VAC.	kPa		kgf/cm²	kPa		kgf/cm²	kPa		kgf/cm²	kPa		kgf/cm²	kPa
−70	60.6	−81	−42	4.3 (cmHg VAC.)	−6	−14	2.11	207	14	6.84	671	42	15.55	1525
−68	58.6	−78	−40	0.04	4	−12	2.34	229	16	7.31	717	44	16.36	1604
−66	56.4	−75	−38	0.15	15	−10	2.60	255	18	7.80	765	46	17.20	1687
−64	53.7	−72	−36	0.26	25	−8	2.86	280	20	8.32	816	48	18.07	1772
−62	50.9	−68	−34	0.38	37	−6	3.14	308	22	8.86	869	50	18.97	1860
−60	47.9	−64	−32	0.51	50	−4	3.43	336	24	9.42	924	52	19.90	1952
−58	44.5	−59	−30	0.65	64	−2	3.74	367	26	10.00	981	54	20.85	2045
−56	40.8	−54	−28	0.79	77	0	4.07	399	28	10.60	1040	56	21.85	2143
−54	36.7	−49	−26	0.95	93	2	4.41	432	30	11.23	1101	58	22.87	2243
−52	32.4	−43	−24	1.11	109	4	4.79	470	32	11.89	1166	60	23.94	2348
−50	27.4	−37	−22	1.29	127	6	5.15	505	34	12.57	1233	–	–	–
−48	22.3	−30	−20	1.48	145	8	5.54	543	36	13.27	1301	65	26.50	2599
−46	16.6	−22	−18	1.63	160	10	5.96	584	38	13.99	1372	–	–	–
−44	10.5	−12	−16	1.89	185	12	6.39	627	40	14.76	1447	70	29.52	2895

○ ○

Cautions for replacement of EEPROM (IC45)

- The EEPROM is installed on the main PWB assembly (PCB-C) that is situated on the back of the controller (MMCCIIIA).
- When you must retain the data of operating time, container No. and setting temperature, replace the EEPROM as the following procedure.

(1) Replace the broken controller (control assembly or main PWB assembly) with the new one.

(2) Disconnect the connector CN30 for the rechargeable battery of the broken controller and remove the EEPROM from the broken controller.

(3) Perform "Factory Clear" of the new controller as follows:

① Set DIPSW1-⑥ to ON, and then turn the unit ON-OFF switch ON.

*If the sequence of operation is inverted, "Factory Clear" will not be done.

② When Initial Diagnosis has finished, set DIPSW1-⑥ to OFF and turn the unit ON-OFF switch OFF.

(4) Disconnect CN30 of the new controller and remove the EEPROM of the new controller. And then install the EEPROM of the broken controller to the new controller.

(5) Connect CN30 of the new controller.

(6) Turn the unit ON-OFF switch ON.(The new controller starts to read the data of the previous EEPROM)

PART 2

中文版

本使用說明書適用的機型:

CPE14-2BAⅢES(1998年3月以後交貨)

各型號的主要不同規格如下所示。

<table>
<tr><th colspan="2">項目 ＼ 型號</th><th>CPE14-2BAⅢES
(1998年3月後交貨)</th><th>CPE14-2BAⅢES
(1997年6月後交貨)</th><th>CPE14-2BAⅢES
(1997年1月後交貨)</th><th>CPE14-2BAⅢES
(1996年7月後交貨)</th><th>CPE14-2BAⅢES
(1995年12月~96年6月交貨)</th></tr>
<tr><td>1</td><td>空氣壓差傳感器</td><td colspan="4">不裝備</td><td>裝備</td></tr>
<tr><td rowspan="2">2</td><td>控制器
• 顯示器(高度)</td><td colspan="3">25 mm</td><td>25 mm(1996年10月起)</td><td>15 mm</td></tr>
<tr><td>NVRAM(EEPROM)
(參照第94頁)</td><td colspan="3">裝備</td><td>裝備(1996年10月起)</td><td>不裝備</td></tr>
<tr><td rowspan="3">3</td><td>控制器軟體
• 集裝箱號設定
• 日歷設定</td><td colspan="2">裝備</td><td colspan="3">不裝備</td></tr>
<tr><td>• 航運資料
周期存儲</td><td>1年</td><td colspan="4">90天</td></tr>
<tr><td>• 在chill(冷藏)
方式下的溫
度顯示功能
(參照第52頁)</td><td>設定點溫度
↓
供氣溫度
↓
回氣溫度</td><td colspan="4">設定點溫度←→供氣溫度</td></tr>
<tr><td>4</td><td>加熱器檢修口面板結構</td><td colspan="3">螺釘安裝</td><td colspan="2">螺釘和鉸鏈安裝</td></tr>
<tr><td>—</td><td>使用說明書No.</td><td>'97·RC-I·359-A</td><td>'97·RC-I·359</td><td>'97·RC-I·354</td><td>'96·RC-I·345</td><td>'96·RC-I·331</td></tr>
<tr><td>—</td><td>零部件手冊</td><td colspan="5">CPE9603C3</td></tr>
</table>

更詳細的資料請參閱……

零部件手冊: CPE9603C3

機組簡介

1. 本致冷機組(以下簡稱致冷機)是全部電氣化的整體式獨立致冷機組。
2. 本致冷機適用於海運、公路運輸和鐵路運輸中使用的40英尺和45英尺ISO致冷集裝箱。
3. 本致冷機被設計成狹長(445mm，17.5″深)的框架結構，全部機器收藏在此框架上，可以用隔板隔開，因此在集裝箱內佔有最小的空間。
4. 本致冷機用電力驅動，致冷(包括容量控制)、加熱和除霜運轉全部用電子恒溫器進行自動控制，其能夠在規定的範圍內控制集裝箱內部的溫度。
5. 本致冷機所需的電源爲400～500V×60Hz、360～460V×50Hz、三相交流電。本機由收藏在集裝箱內貯藏室中的電源插頭和電源線供電。
6. 本致冷機具有下列特點：換氣系統；封閉式渦流壓縮機；高溫氣體調節容量控制系統；具有失效一保護和故障自動診斷功能的MMCC ⅢA(三菱微型電腦記錄控制器)；MMCC ⅢA的3、6、9、12小時可調和自動程式除霜定時器；MMCC ⅢA的自動PTI(MAX. PTI、MIN. PTI)功能；MMCC ⅢA的數據控制功能；MMCC ⅢA的記錄功能。
7. 在海運中，全部電氣設備都具有防風、防雨和抗浪能力。
8. 全部零部件都經防腐蝕處理，以防在嚴酷的海上使用條件下受海水腐蝕。
9. 本致冷機能在－30～50℃(－22℉～＋122℉)的外圍溫度條件下使用。
10. 本致冷機裝有能在寒冷天候使用的壓力控制開關和用於連接冷藏處理溫度傳感器的USDA插座。
11. 本致冷機根據美國標準局的貨物櫃致冷機的規則設計、進行試驗和標認。
12. 全部材料和零部件符合日本工業標準(JIS)或同等標準的要求。
13. 本致冷機是完全按照日本海關管理機構頒佈的規則進行設計的，符合海關貨物櫃條款(CCC)的實際尺寸規定。
14. 電氣配線和電氣設備符合SCC和SECV條例中S.A.A(澳大利亞標準協會)的規定要求。
15. 本致冷機設計完全符合ATO AGROTECHNOLOGY(原來的SPRENGER INSTITUTE)所頒佈的花卉運輸用冷藏集裝箱的規定要求。

目錄

安全注意事項

■請通讀本"安全注意"事項以確保安全操作。

■這部份說明的安全注意事項對於確保安全都是極爲重要的，務必嚴格遵守。

• 標記和意義如下。

⚠警告	不正確的操作可能會引起死亡、嚴重事故或其他的危險。
⚠注意	不正確的操作可能會引起某種情況的危險。

• 用於本手册中主要部份的符號之意義如下。

	嚴禁…。		務必遵照使用說明。
	務必連接接地導體。		切勿觸碰。

• 在通讀本手册後，應將其保存在當無論誰操作致冷機組時都能拿到它的地方。

• 當把本致冷機組贈送或借給他人時，請隨同機組移交本使用說明書，使新的用戶能夠知道如何正確地使用機器。

■安裝或運輸的注意事項

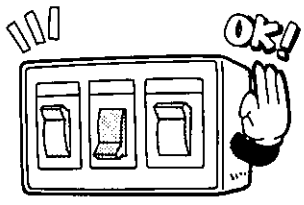
⚠警告

當從集裝箱內拆出致冷機組時，要將它固定在專用的支架上加以保管。

不使用專用支架，致冷機組會掉下，可能會引起工傷事故。

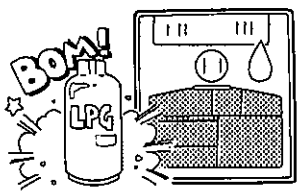
⚠注意

在外部電源設備內安裝漏電斷路器。



不裝漏電斷路器會產生電擊的危險。

切勿把致冷機組安裝在預計會滲漏可燃氣體的場所。



如果可燃氣體漏出並聚積在機器的附近，將會引起火災。

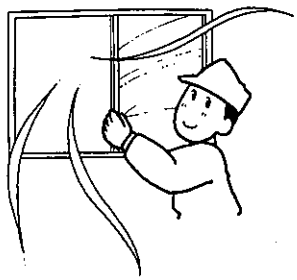
務必使用有接地腳的電源插座。

接地不正確的電源插座可能會引起電擊。

■操作或修理的注意事項

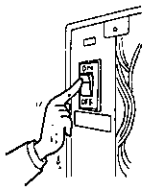
⚠ 警告

確保作業場所通風良好。



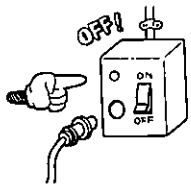
漏出的致冷劑會導致缺氧：氣態致冷劑比重大而聚積在房間的下部，如果大量的致冷劑漏出則可能會引起窒息。
在密閉的場所，例如在集裝箱或船艙內處理致冷劑或操作致冷機組時，務必注意通風良好。

切勿用濕手或戴著濕手套來操作致冷機組。



如果地板潮濕，你將會受到電擊的危險。

發生故障時，應關斷ON-OFF開關來停止機器，關斷外部電源開關並拔出電源插座。

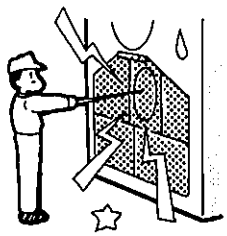


在故障狀態下繼續運轉機器可能會引起電擊、火災或機器損壞。

切勿在處理致冷劑的場所附近吸煙或進行銲接作業。

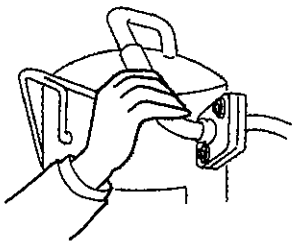
碳氟化合物致冷劑在有明火或任何燃燒火焰的地方會產生有毒氣體。

切勿將你的手指或棒插入出氣口或進氣口。



內部旋轉的風扇會導致工傷事故。

在機器運轉中切勿觸碰管道或壓縮機。



你可能會燙傷。

切勿在中間連接電源電纜，切勿使用加接延長電纜。此外，切勿與其他電氣設備共用電源電纜。

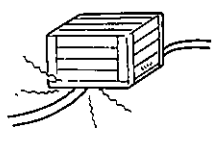
可能會引起電擊、發熱或火災。

⚠ 警告

檢查電源插頭應無塵埃，將插頭完全插入插脚的底部，然後牢牢緊固它。

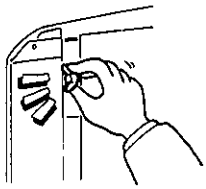
塵埃除了造成接觸不良外，還可能會引起電擊和火災。

嚴防電源電纜斷裂或被切斷。



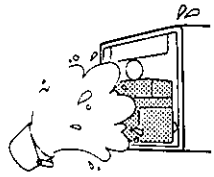
可能會引起電擊或火災。如果重物壓在電源電纜上面，或電源電纜受熱或被拉則會導致電纜損壞。

擰緊控制箱蓋的螺釘。



進水會引起電擊、火災或損壞。

切勿在電氣元件，例如控制器上灑水。



可能會引起電擊、火災或損壞。

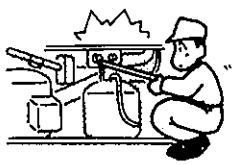
在開始運轉致冷機組時，請確認集裝箱內應無任何人。

如果有人被關在集裝箱內而運轉機器，則可能會將他凍死。

切勿將易揮發性或易燃性物品放在集裝箱內。

有引起爆炸的危險。

切勿用棒或類似的東西推壓檢查接頭的銷子。



配管中的致冷劑可能會噴出而引起周圍人的傷害。

在修理中，要移動電源變壓器、壓縮機、蒸發器風扇馬達等重物時，務請充分注意要以正確的姿勢來移動它們。

壓縮機	約50kg
蒸發器風扇和馬達	約15kg

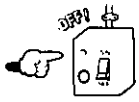
移動不當，往往會造成重物掉落而導致腰部及脚部受損傷。

在運轉中，如觀察窗前的面板已被拆除，請不要通過觀察窗進行窺視。

万一觀察窗的玻璃破裂，碎玻璃飛出有引起傷害的可能。

⚠注意

在清潔、檢查、分解或重新裝配機器時，要關斷機器的ON-OFF開關、電路保護器、斷路器和外部電源開關，還應拔下電源插頭。

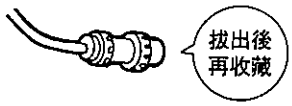


可能會引起電擊，或可能因旋轉件旋轉而引起工傷事故。

在清潔、檢查、分解或重新裝配機器時，應使用合適的工具。

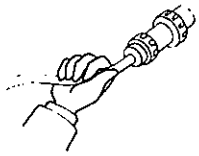
使用不合適的工具可能會引起工傷事故或零部件損壞。

當長時間不使用機器時，應從電源插座拔出電源插頭以確保安全，將電源電纜收藏在致冷機組的電纜盤內。



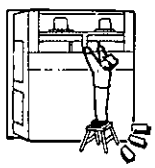
塵埃聚積可能會引起發熱或火災。

當拔出電源插頭時應握住插頭拔出。



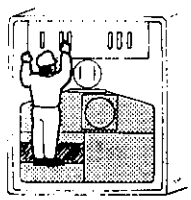
緊緊的握住插頭從插座將其拔出。
如果拉電纜來拔出插頭，可能會拉斷芯線而引起發熱或火災。

當在高處作業，即安裝或拆卸檢查口，或者檢查蒸發器風扇時，應使用梯子或踏腳架以確保安全。



如不當心可能會掉下而受傷害。

切勿坐在或站在控制板、檢查口、管道或其他零部件上。



如不當心可能會掉下而受傷害。

切勿在致冷機組附近使用易燃噴霧劑或易燃物品。

否則，開關處會發生火花而引起火災。

當致冷機組被安裝在除了操作者以外的人也可能會觸碰到機器的場所時，應做上"切勿觸碰"的標誌或在機器四周設置防護柵。

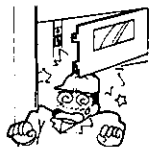
非操作者隨意擺弄機器可能會引起工傷事故。

⚠ 注意

在處理致冷劑時請戴護目鏡和類似的保護用品以防止你的皮膚接觸到致冷劑。

液態致冷劑在空氣中蒸發極快，如果它接觸到你的皮膚則會凍傷皮膚。

爲了運轉或保養致冷機組而要在致冷機組周圍進行作業時，請注意脚下的電源電纜等。此外，請注意不要讓自己的頭等撞碰到控制箱的蓋。

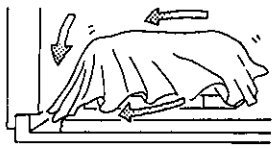


如不小心則有可能造成傷害。

在修理中，要觸碰冷凝器盤管的散熱片、蒸發器盤管的散熱片及面板等時，請注意這些部份的邊緣，仔細操作。

尖銳的邊緣有引起傷害的可能。

用乙烯樹脂紙等包裝貨物時，請將紙端牢靠固定住，不要讓乙烯樹脂紙等被致冷機組的吸入口吸入。



如風道被乙烯樹脂紙等異物阻塞，則會引起致冷能力不足及風扇超負荷運轉等故障。

在裝載極度嫌水的貨物時，請用乙烯樹脂紙等將貨物完全封住。

致冷機組經多年使用後，蒸發器板的絕緣性等會逐漸變差；因此，存在從內部流出少量的水或產生結露的可能。

1. 操作方法

1.1 電源

用於40英尺和45英尺的致冷集裝箱時，本機組可使用400V級的電源。

1.2 操作方法

1.2.1 啟動順序

(1) 一定要確認UNT ON-OFF雙位開關位於"OFF"位置。
(2) 裝入新的記錄圖。
(3) 裝上準備記錄的記錄筆。
(4) 接通斷路器。
(5) 按照規定調節通風口的開度。
(6) 連接電源插頭。
(7) 接通外部電源開關。
(8) 把機組的UNIT ON-OFF開關置於"ON"位置。
(9) 於控制器上設定所需的溫度。
(10) 設定除霜定時器(自動/選定)。

經過上述的操作後，本機組將自動地進行致冷、停止、除霜和加熱控制運轉。

1.2.2 啟動步驟詳細說明

(1) 一定要確認機組的UNIT ON-OFF開關位於"OFF"位置。
確認裝在控制箱左側的UNIT ON-OFF開關應位於"OFF"側(向下位置)。

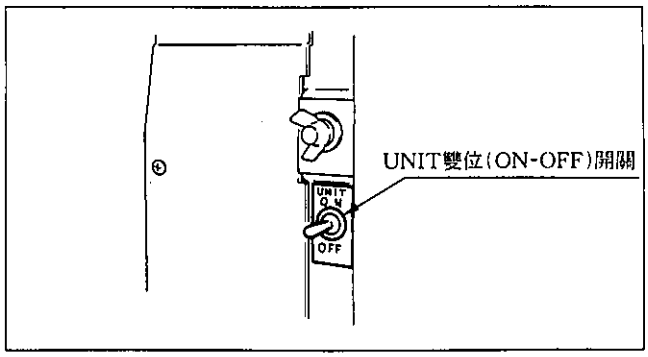


圖1 操作開關

(2) 插入記錄圖

注意：不要用手移動記錄針。

(a) 擰鬆前操縱板的螺釘，打開控制箱(見圖2)。

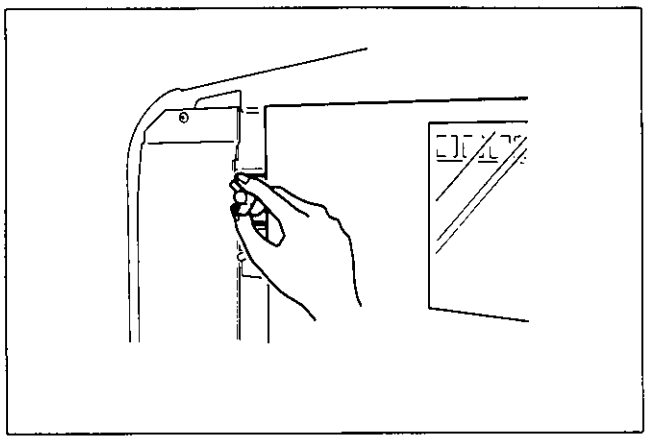


圖2 控制箱的前操縱板

(b) 同時按下⌂和⌀鍵3秒以上，使記錄針(記錄筆)擺出。
要更換記錄圖時，在電源斷開的情況下，先按下「MODE」鍵，然後按下⌂和⌀鍵。

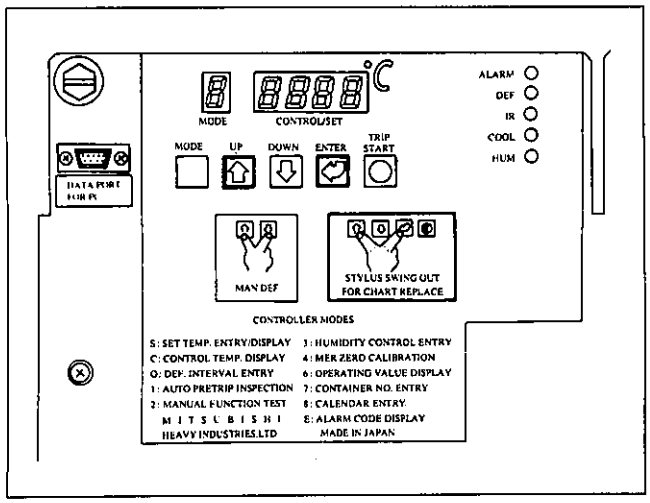


圖3 記錄針擺出

(c) 擰鬆記錄圖固定器，拆下記錄圖。

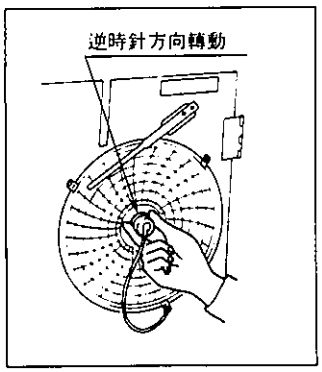


圖4 記錄圖固定器

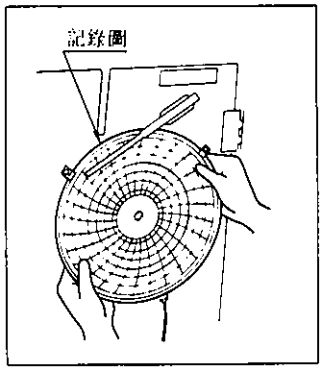


圖5 拆下記錄圖

(d) 把新的記錄圖裝入圖夾，以確認紀錄圖在正確的日期和時間開始記錄。
一定要正確地裝入記錄圖並固緊，否則會造成記錄不正確。

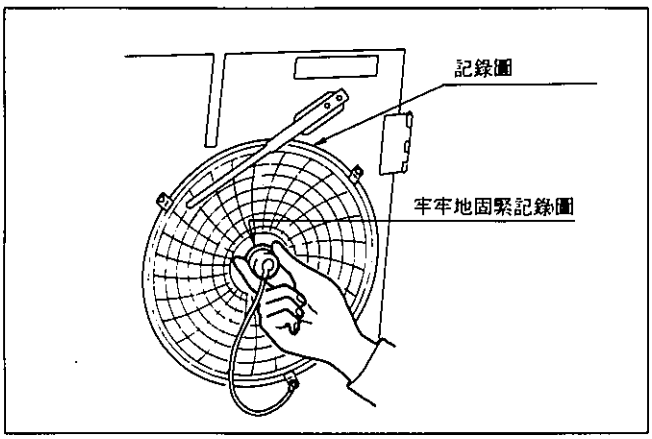


圖6 記錄筆的安裝

備註：

記錄針擺出將自動返回到相應的位置。

擺出時間：

電源ON：5分鐘*

*按下[MODE]鍵，它將立即返回。

(3) 接通斷路器。

檢查電路保護器(CP1)在ON位置。

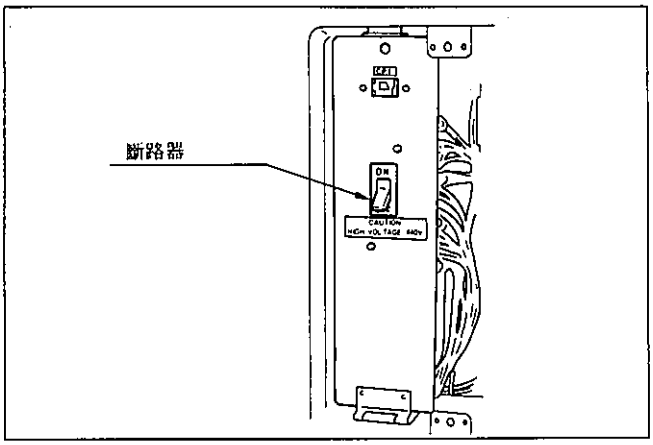


圖7 斷路器

備註：(1) 爲確保可靠起見，請檢查在開啓控制器面板時連接器是否已牢固地連接好。

(2) 關上控制箱的前操縱板後，一定要牢固地擰緊各螺釘，如果沒有擰緊或單側擰緊，則可能會滲水，從而導致控制裝置功能失常或損壞。

(4) 通風口的打開和關閉

(a) 在運輸需要吸入新鮮空氣的CHILL(冷藏)物品時打開通風口(根據船主要求)。

(b) 在運輸FROZEN(冷凍)物品時關閉通風口。如果通風口被打開，則本機組將結冰而形成嚴重結霜，導致致冷能力下降。

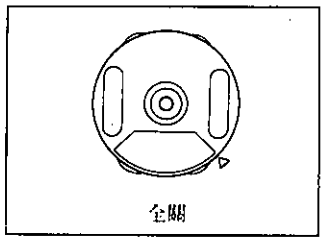


圖8A 通風口(關閉狀態)

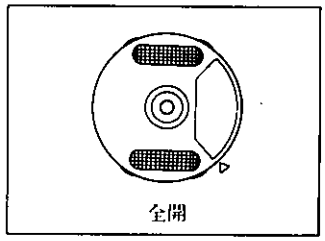


圖8B 通風口(打開狀態)

(5) 把電源插頭牢靠地插入電源插座。

(6) 接通外部電源開關。

(7) 把UNIT ON-OFF開關置於"ON"位置(向上位置)。

(a) 在電源接通(ON)的狀態下，在機組啟動前的10秒鐘內本系統將自動地對初始自動診斷項目進行檢查(見表12.12)。

(b) 當沒有出現引起機組停機之類的不正常時，機組將自動啓動運轉。

* 在此期間，"運轉"狀態下的自動診斷項目也偵檢中(見表12.12)。

(c) 如果有任何不正常現象發生時
如果發光二極管(LED)警報燈閃亮，則應根據控制器上的顯示內容進行檢查。

(8) 設定溫度

按撳四個不同的鍵： MODE (方式鍵)、UP (增大鍵) DOWN (減小鍵)和 ENTER (輸入鍵)可以在MMCC ⅢA的控制盤上設定溫度的高低。

操作流程	鍵操作	畫面顯示	備註
溫度設定和顯示	"MODE"鍵 從正常顯示狀況下 S	S 100 °C	S 每隔0.5秒閃亮一次 • 顯示出最後設定的溫度。 • 在設定之前爲"……"。
溫度的設定和變更	"ENTER"鍵 "UP"或"DOWN"鍵	S 100 °C	每隔0.5秒閃亮一次 • 用 ⇧ 或 ⇩ 鍵設定溫度。設定範圍爲－30～＋25℃之間。
輸入設定溫度	"ENTER"鍵	S 15.5 °C	

備註：(1) 如果在30秒內不按撳任何鍵，則畫面將自動地返回到正常顯示狀態。

(2) 在溫度設定方式之中，如按撳MODE鍵，則就立即返回到正常顯示狀態。

（備註） 有關MMCC ⅢA控制器的操作方法，請參照其說明書，此說明書裝在控制箱的圖表袋中。
此外，還請參照操作順序和顯示內容(見表12.11.1～12.11.13)或本說明書中所敍述的綜合流程圖(見12.11.19節) 。

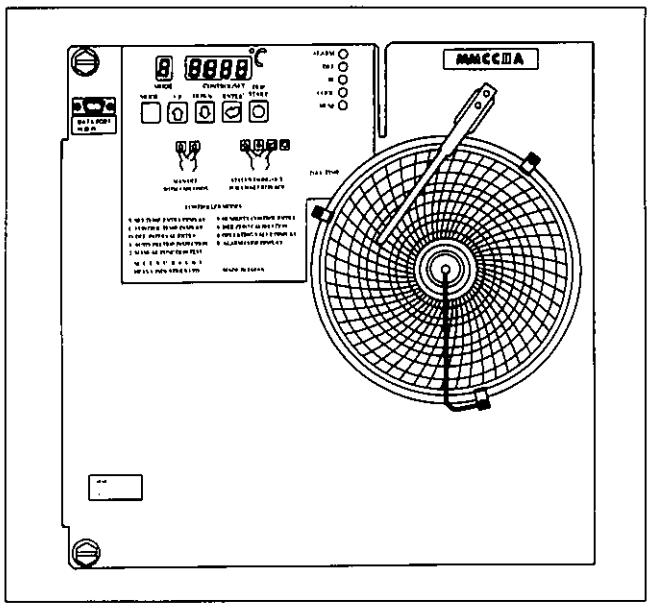
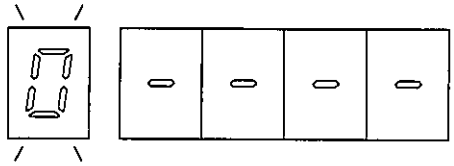
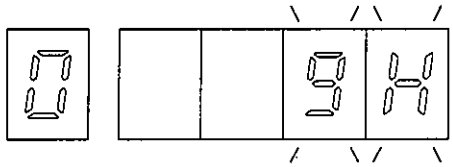
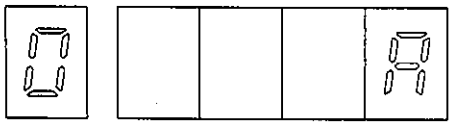


圖 9 控制器面板

(9) 設定除霜定時器

除霜定時器也能以操作鍵來設定。

操作流程	鍵操作	畫面顯示	備註
除霜定時器的設定和顯示	"MODE"鍵 從正常顯示狀況下至 		
除霜定時器設定變更	"ENTER"鍵 "UP"或"DOWN"鍵		• 顯示出定時器的最後設定內容。 • 在設定之前為"……"。 • 按揿"UP."或"DOWN"鍵，定時器的設定時間將按下列次序循環變化：A↔3H↔6H↔9H↔12H。 • "A"表示"自動除霜"。
輸入除霜定時器的設定內容	"ENTER"鍵		

備註：(1) 如果在30秒內不按揿任何鍵，則畫面將自動地返回到正常顯示狀態。

1.2.3 停機操作順序

(1) 關掉本機組的開關，壓縮機將立即停止。

(2) 如果電源線脫開電源，則電源線應始終收藏在電源線盤內。

(3) 取下記錄圖。

要取下記錄圖時請打開控制箱蓋。然後同時按下 ⇧ 和 ↵ 鍵 3 秒以上使記錄針擺出，撐鬆記錄圖固定器將它取下。切記務必再次固緊記錄圖固定器並關上控制箱蓋(見圖 3)。

(4) 關緊控制箱門。

1.2.4 手動除霜

自動進行除霜，但當需要進行手動除霜時，請同時按下 ⇧ 和 ⇧ 鍵3秒以上(見圖10)。

當蒸發器出口溫度傳感器檢測到溫度低於10℃(50°F)時，機組開始手動除霜運轉。

結凍被解除後本機組將自動返回到致冷運轉狀態。

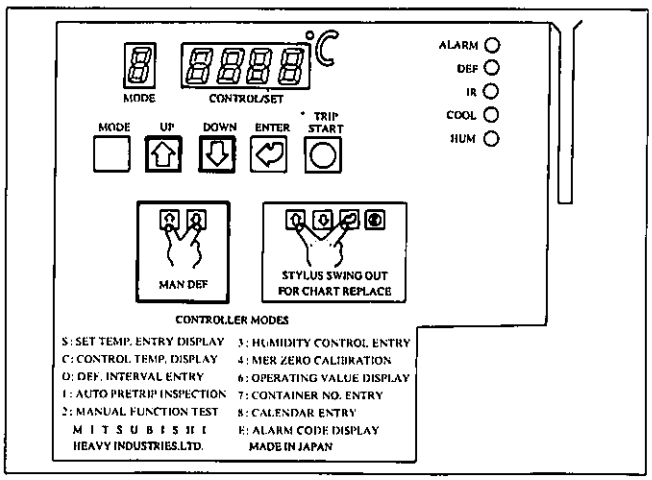
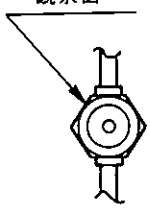
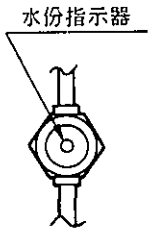


圖10 手動除霜鍵

2. 運轉中的檢查

自動診斷功能之設計，使控制器能偵檢運轉中之各種情況。如果出現故障，LED警報燈就點亮。如果因故障機組不能保持正常運轉，則控制器將中止本機組運轉或進行失效—保護和儲備運轉。

時間	檢查部位	方法
在啓動後立即出現故障	1. 在控制器初始自動診斷中(10秒鐘之內)有無報警信號。 2. 壓縮機、風扇等發出不正常的噪聲。 3. 個別零部件出現異常振動。	視覺 耳聽檢查 感覺、目測檢查
啓動後10-15分鐘	1. 致冷劑不足。 觀察窗  圖11 觀察窗 2. 致冷回路中含水份。 水份指示器  圖12 水份指示器 3. 數字顯示的指示正常，溫度記錄器銀針的記錄正常。	目測檢查 觀察窗玻璃應清清。 目測檢查 無水份……綠色 含有水份……黃色
15分鐘之後(之後無論什麼時候)	1. 根據控制器顯示屏上顯示出的各種不同資料和溫度記錄圖檢查運轉狀況。	目測檢查

3. 構造

3.1 外形圖

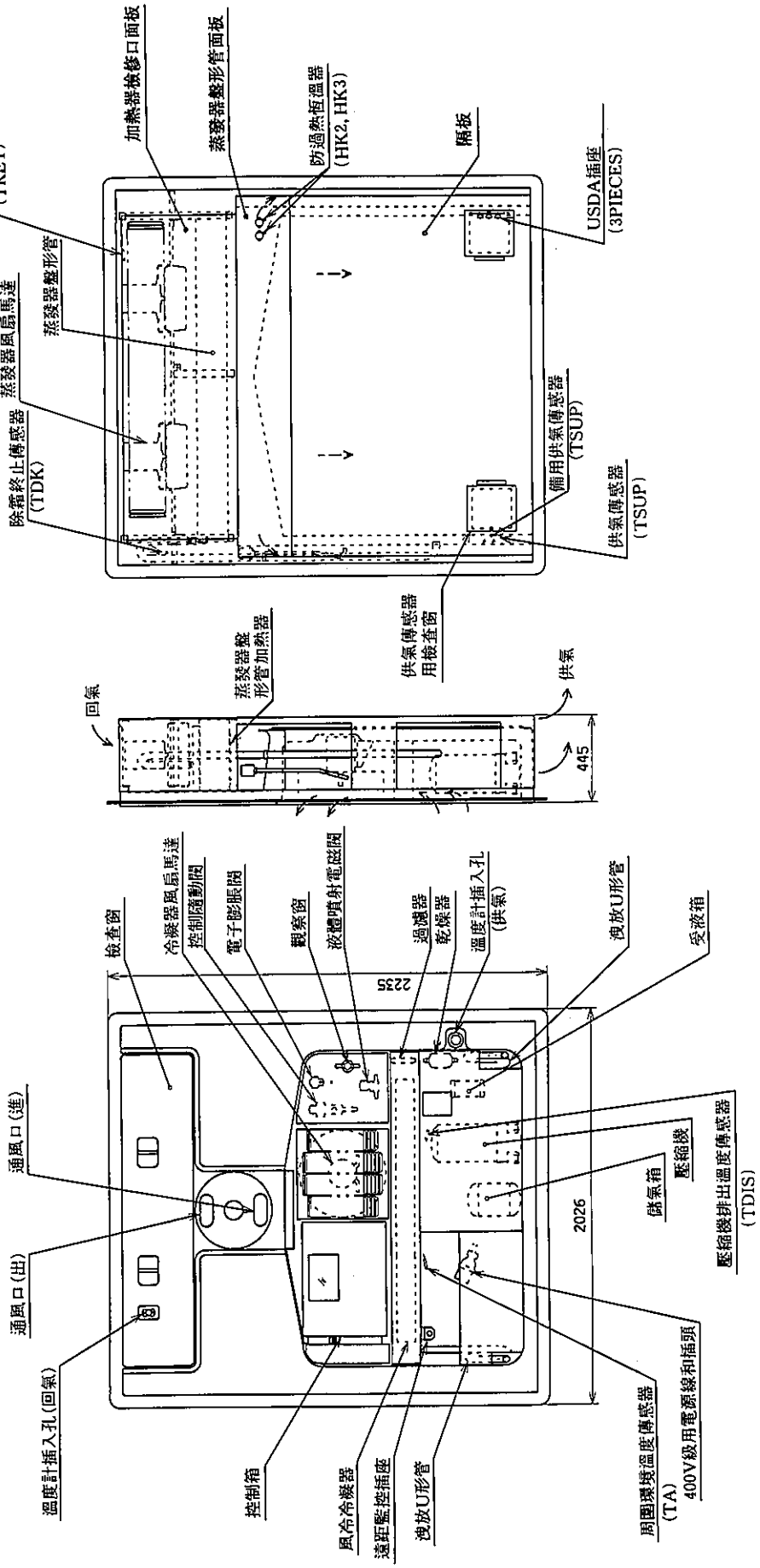


圖13 外形圖

3.2 致冷系統

3.2.1 致冷循環

在壓縮機內被壓縮後的高溫、高壓氣化致冷劑流入氣冷冷凝器，在冷凝器中與外界空氣進行熱交換而被冷卻和液化。在水冷運轉時，致冷劑被冷卻並在水冷冷凝器被液化。

被液化的致冷劑通過儲備致冷劑的受液箱進入乾燥器，在乾燥器內分離出致冷劑內含有的水份。然後，致冷劑通過過濾器將其的雜質過濾掉。液態致冷劑流過電子膨脹閥時被節流，壓力下降到蒸發壓力大小。

致冷劑流過蒸發器盤形管時被蒸發，同時吸收集裝箱內的熱量使其溫度下降。致冷劑在蒸發器盤形管內被完全蒸發，當它離開蒸發器時已呈"過熱"狀態。

安裝在出口管上的溫度和壓力傳感器檢測出口氣體的過熱程度。根據所檢測到的訊息，電子膨脹閥(PID)控制閥的開度，以此始終保持最適量的致冷劑流入蒸發器。被蒸發的致冷劑流過儲氣箱返回到壓縮機，以防止壓縮機進行液體壓縮。

3.2.2 容量控制

於容量控制動作時，控制隨動閥把高溫壓縮氣體轉送給蒸發器。

MMCC ⅢA控制器不斷地控制該閥的動作和流過控制隨動閥的高溫氣體量。

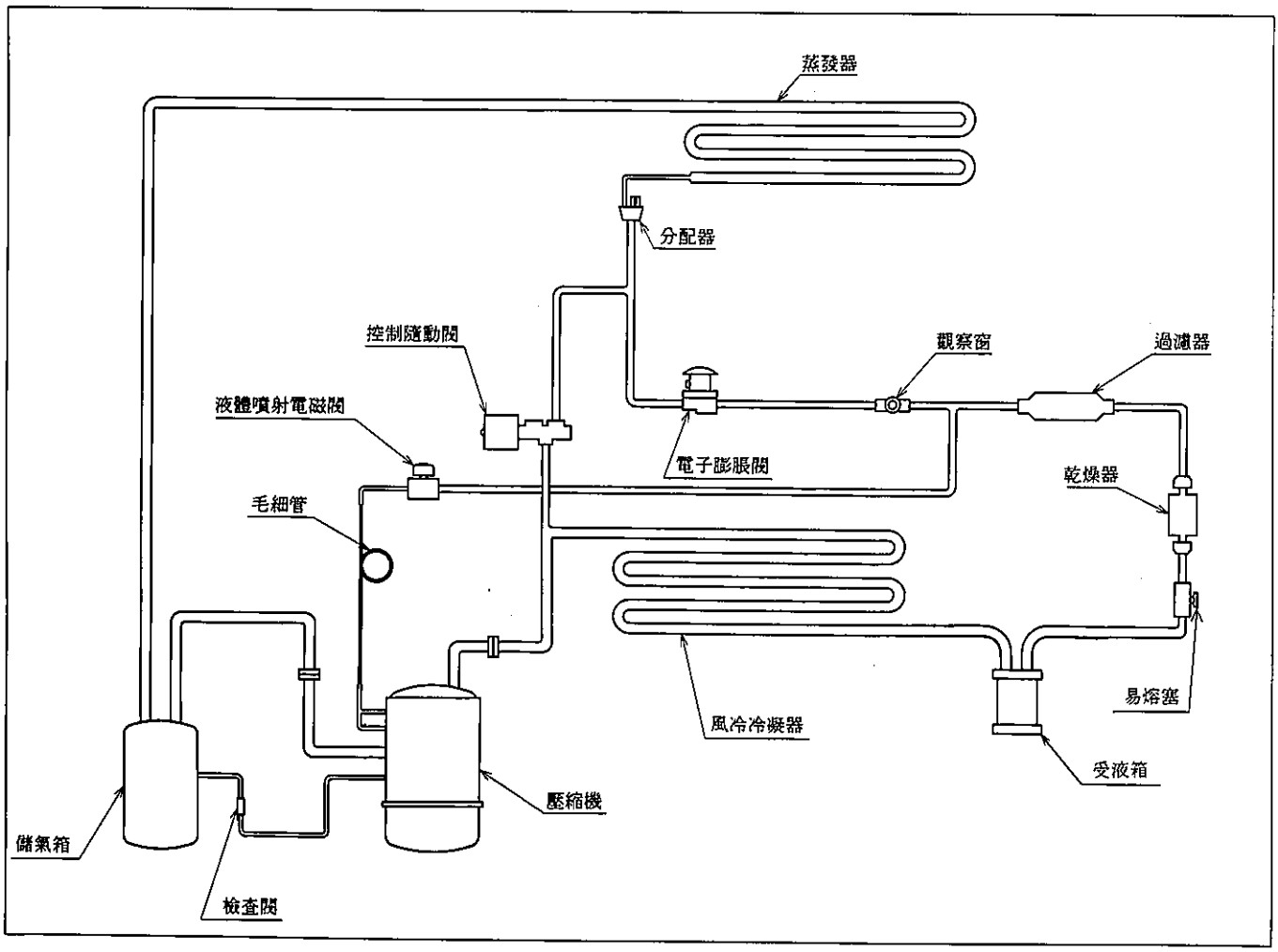


圖14 致冷系統圖

4. 功能部件

爲了能進行自動運轉，本致冷機備有許多功能部件。

4.1 微型電腦記錄控制器(MMCC ⅢA)

請參閱第12章。

4.2 高壓和低壓傳感器(HPT、LPT)

這兩種傳感器分別檢測高壓和低壓壓力。裝在電子回路內的保護和控制機構如下所述：

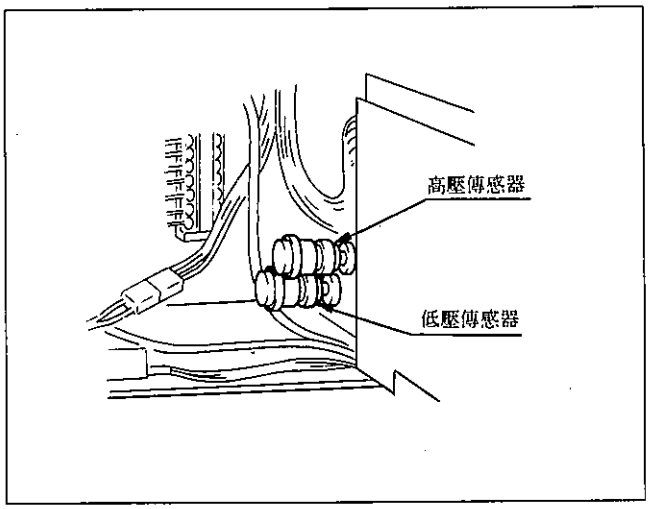


圖15 高一低壓傳感器

(1) 異常高壓(HP)和低壓(LP)保護

如果因冷凝器風扇故障等而使HP超過預先設定的壓力；或者因致冷劑滲漏、堵塞而使LP下降到低於預先設定的壓力，則這種狀態就被判斷爲異常高壓(HP)或異常低壓(LP)，此時壓縮機將停止運轉。

(2) 其他

除上述外，這兩種傳感器還被用於檢測由電子膨脹閥所控制的蒸發器過熱度等。

4.3 高壓開關(HP)

爲防止出現異常高壓，本機組內還裝有後備高壓開關。如果這個開關起作用，將會引起壓縮機停止。

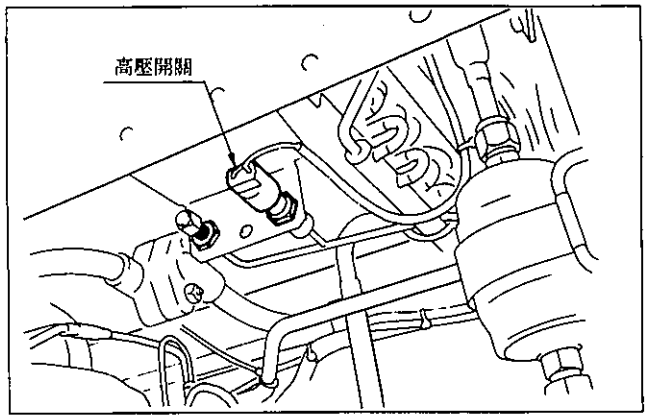


圖16 高壓開關

4.4 空氣溫度傳感器(TRET、TSUP)

回氣傳感器和供氣傳感器被裝在引入集裝箱和從集裝箱引出的空氣管道上，用於控制和記錄溫度。詳細內容請參閱本說明書的第14章。

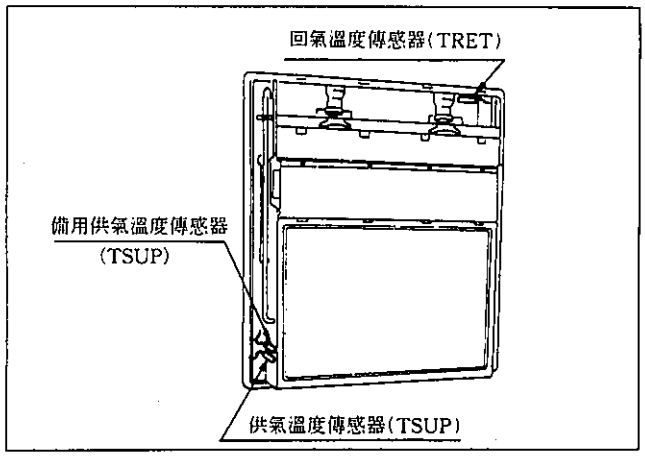


圖17 空氣溫度傳感器

4.5 周圍環境溫度傳感器(TA)

如上圖所示，這個傳感器被用於判斷各種異常現象，諸如於自動PTI時。

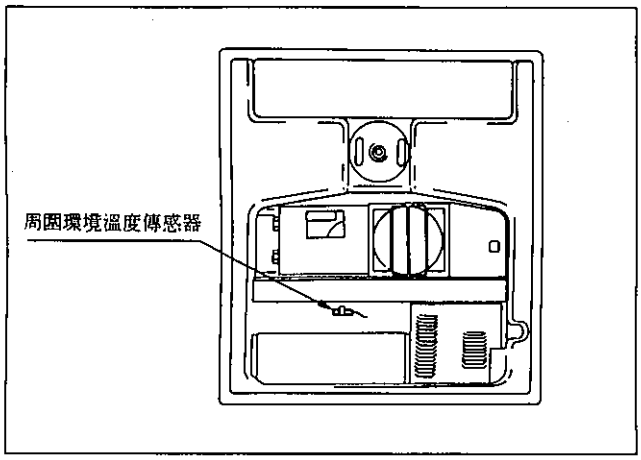


圖18 周圍環境溫度傳感器

4.6 蒸發器盤形管出口傳感器(TDK)

這個傳感器被用於檢測蒸發器出口的氣體溫度，控制因電子膨脹閥而來的過熱度，並檢測除霜終止和除霜所需的情況。

除霜終止和除霜情況的檢測

設定：ON：10℃　OFF：15℃

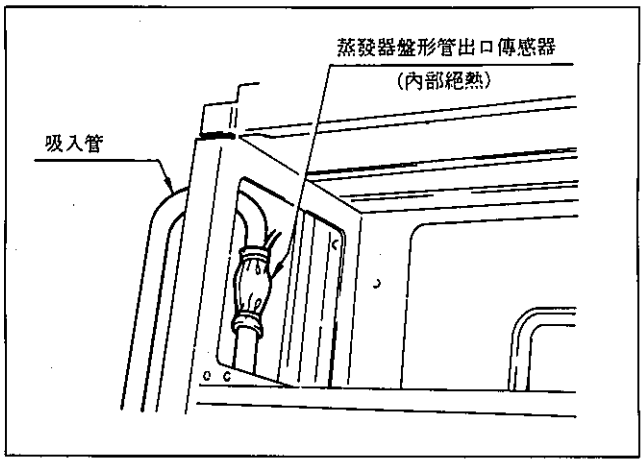


圖19　蒸發器出口傳感器

4.7 防過熱恒溫器(HK2、HK3)

本恒溫器用於在加熱或除霜運轉中檢測加熱器的過熱狀況。

這個恆溫器是作爲4.8項的後備恆溫器而被設計的。當出現異常現象時它將停止加熱器供電。

OFF：66℃(150℉)

ON：52℃(125℉)

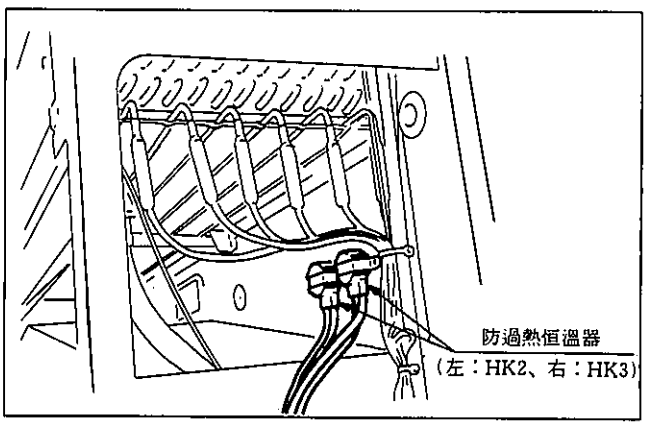


圖20　防過熱恆溫器

4.8 濾器

這個濾器用於濾掉致冷回路中的各種雜質。

它被裝在乾燥器和電子膨脹閥之間的液態致冷劑管道上。

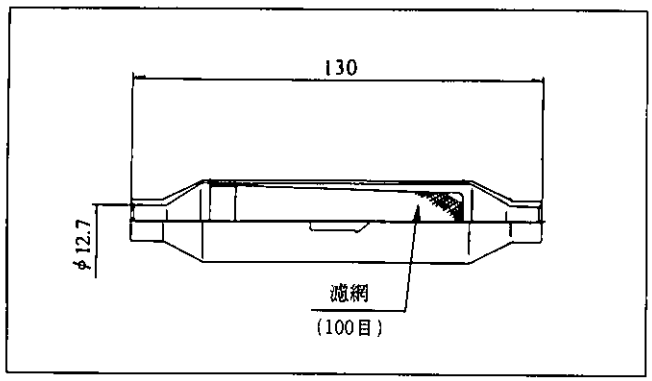


圖21　濾器

4.9 控制隨動閥(MV)

這個控制隨動閥被裝在壓縮機的排出管路上，用於進行容量控制。這個閥由MMCC ⅢA控制器控制，用於高溫氣體旁通流量的無級調節。

MMCC ⅢA控制器能提供下列檢查項目：

MV手動測試　MODE　7段發光二極管(LED)

開度檢查：　2　- - 10

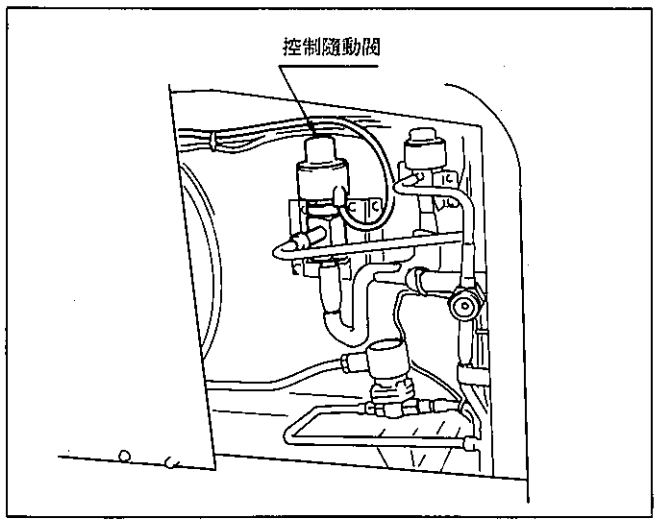


圖22　控制隨動閥

4.10 液體噴射電磁閥(S5)

這個閥裝在液體管路上，用於進行液體噴射控制，防止壓縮機過熱。

- 被激磁時打開
- 被切斷時關閉

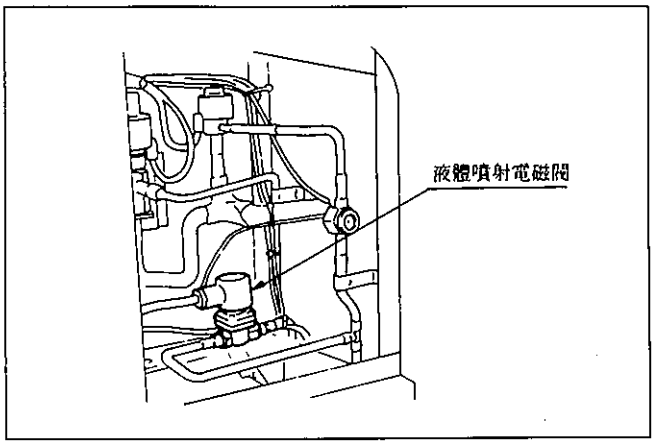


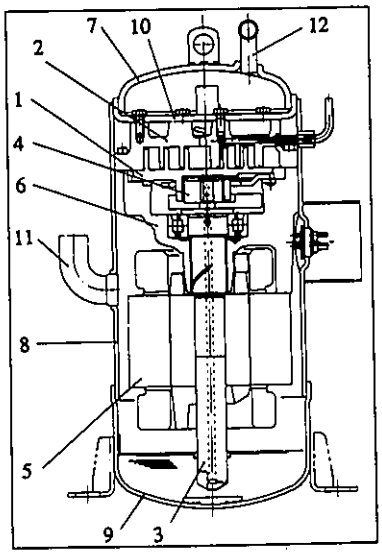
圖23 液體噴射電磁閥

4.11 壓縮機

壓縮機爲封閉式渦流型結構，內裝電馬達。壓縮機不能在兩個方向都旋轉，因此必須備有相位轉換開關。

電源：3相、440V、交流

功率：5.5kW×1



序號	名稱
1.	旋轉葉輪
2.	固定葉輪
3.	曲軸
4.	驅動軸承
5.	馬達
6.	馬達罩殼
7.	上殼體
8.	殼體
9.	下殼體
10.	排出口蓋
11.	吸入管
12.	排出管

圖24 壓縮機的橫剖視圖

4.12 冷凝器風扇馬達和蒸發器風扇馬達

所有風扇馬達都是全天候和防腐型。冷凝器風扇馬達爲單速結構；蒸發器風扇馬達爲雙速結構。

有3個相，因此需要反相。

各馬達都有裝備有自動恢復式的過載保護器，以防止馬達過熱。

- 冷凝器風扇馬達：

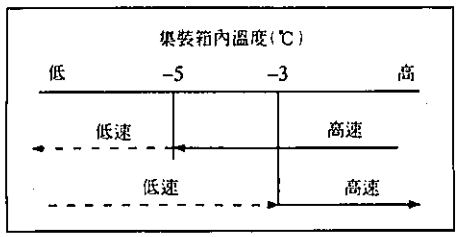
  3 相、 4 極、 440V/60Hz 和 380、415V/50Hz

  780W(輸入)×1
- 蒸發器風扇馬達：

  3 相、 2/4 極、 440V/60Hz 和 380、415V/50Hz

  1200W/190W(輸入)×2

  蒸發器風扇馬達的轉速由MMCC ⅢA控制器根據集裝箱內溫度進行控制。



4.13 冷凝器和蒸發器風扇

- 冷凝器風扇：直徑440毫米，四葉片螺旋槳式。
- 蒸發器風扇：直徑320毫米，四葉片螺旋槳式。

4.14 加熱器

⚠警告　**請勿觸碰加熱器及其周圍部分，因爲在電源接通時它的溫度相當高。**
如觸碰它，您的手可能會被燒傷。

安裝在蒸發器盤形管的下面，在加熱或除霜時被接通。
蒸發器盤形管加熱器：900W× 6

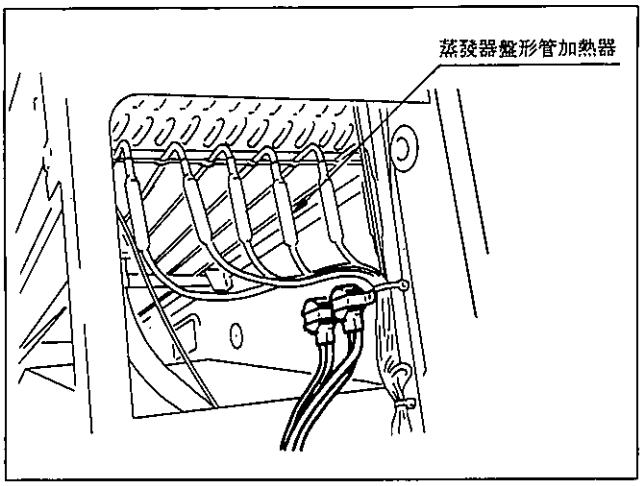


圖25　加熱器

4.15 電子膨脹閥(EEV)

由MMCC ⅢA控制器控制它的開度，電子膨脹閥有許多用途，例如致冷能力控制、電力消耗控制、高壓控制、致冷回路切斷等。
MMCC ⅢA控制器能提供下列檢查項目：

MODE　7段發光二極管(LED)
EEV手動測試
開度檢查：　2　-09

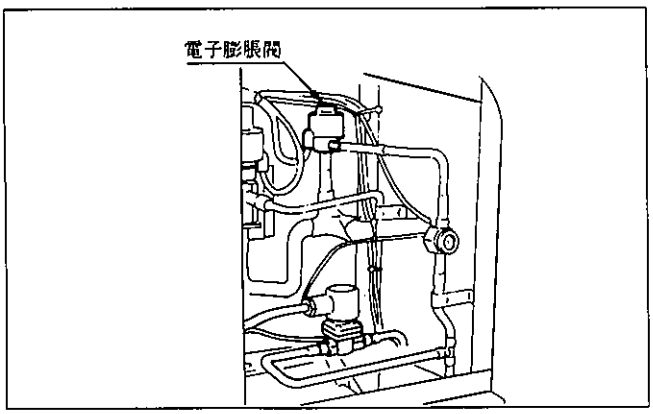


圖26　電子膨脹閥

4.16 電流傳感器(CT1、CTM)

用於檢測各種異常現象，例如主電路、控制電路和壓縮機電路中可能出現的燒斷或元件短路等。
這些傳感器被裝在控制箱內。

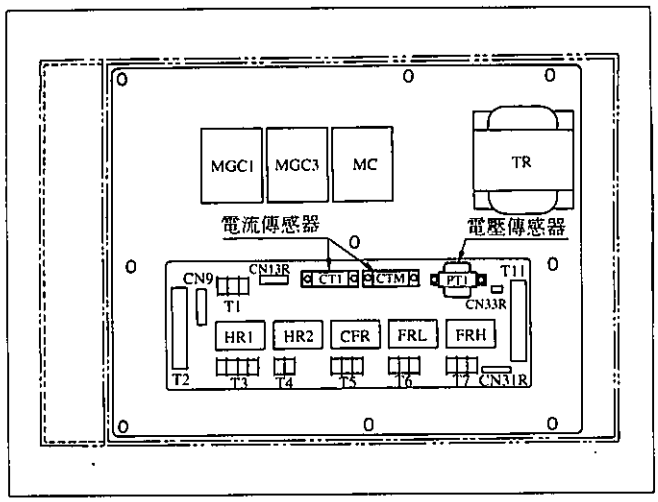


圖27　電流傳感器、電壓傳感器(控制箱的內部)

4.17 電壓傳感器(PT1)

被裝在控制箱內，用於檢測電源電壓的異常。(見圖27)

4.18 蓄電池組(能重新充電)

在關掉電源後，MMCC ⅢA能以蓄電池組供電進行工作。另外，此蓄電池還用於設定控制溫度、支撐記憶裝置記憶各種運轉數據和三天的溫度記錄。
如果在蓄電池供電運轉中蓄電池的電壓下降，警報LED將會點亮。此時請用MODE鍵觀看當前警報訊息顯示並確認"警報代碼：997"。
當 7 段LED顯示出"警報代碼：997"時，請用交流電源對蓄電池充電。
充電後若 7 段LED又立即顯示出"警報代碼：997"則應更換新電池。

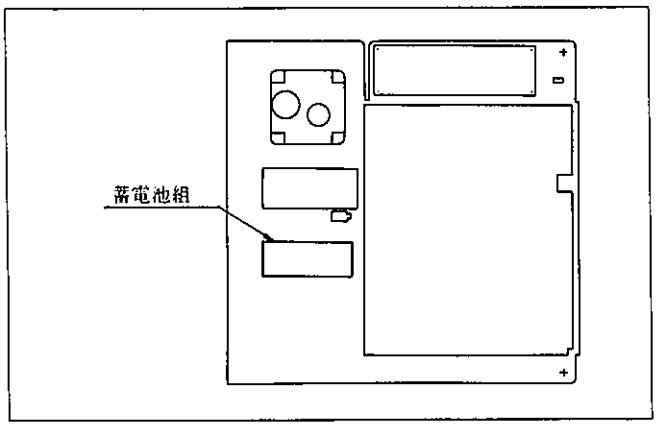


圖28　蓄電池組(MMCC ⅢA的後側)

4.19 遠距監控插座

帶防風雨蓋的遠距監控插座能用來連接遠距顯示器，監控運轉狀態：致冷、除霜和範圍內運轉。

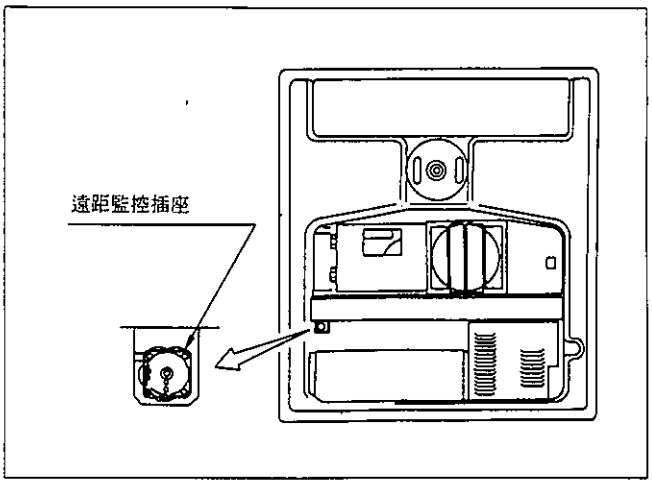
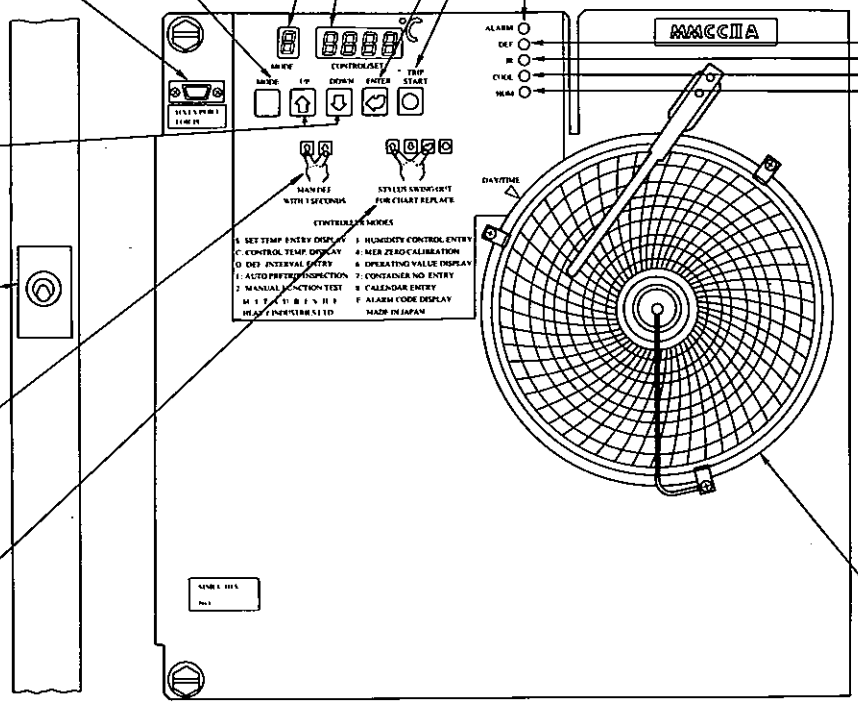


圖29 遠距監控插座

4.20 USDA插座

裝在隔板上帶防風雨蓋的三個USDA傳感器插座用於連接冷藏處理溫度傳感器(見圖13)。在開始冷藏處理運轉前，應按照攜帶式電腦的主菜單畫面的說明來調整三個冷藏處理溫度傳感器的補償數據。



用於運轉和各種顯示方式的選擇鍵

- 用於轉換運轉和顯示方式。
- 在ENTER鍵被按下機組進入特定方式，例如PTI、TEST等之後，用這個鍵可取消該方式並返回到正常的運轉顯示狀態。
- 在關掉交流電源時的停機狀態下，用這個鍵可以使控制器工作。

攜帶式電腦的數據端口(在MMCC ⅢA和攜帶式電腦之間進行串行通訊)

- 用携帶式電腦的指令能從MMCC ⅢA的記憶裝置中讀取/向MMCC ⅢA的記憶裝置寫入下列訊息：
  - 設定集裝箱號碼和日曆。
  - 設定集裝箱的ID(識別)數據。
  - 讀取航行LOG數據。
  - 讀取PTI數據。
  - 設定有關定期檢查的訊息。
  - 讀取運轉數據(用於檢查)。

  (電源被關斷後的三天內，繼續記錄機組的溫度。)

設定/轉換數據和運轉狀態用操作鍵

- 用於增大/減小設定數據。
- 用於選擇MIN/MAX PTI(最小/最大PTI)運轉。
- 用於啓動/停止溫度控制。

UNIT開關

- 接通電源開關和UNIT開關後將進行10秒鐘左右的初始自動診斷。如果沒有檢測到異常現象則機組啓動運轉。否則，將顯示出異常訊息並自動地採取適當的措施排除故障。
- 關掉UNIT開關則致冷機組就立即停止運轉。

手動除霜鍵

- 當蒸發器出口溫度傳感器檢測到溫度低於10℃時，同時按下 ▽ 和 ▽ 鍵3秒以上機組將開始手動除霜運轉。任何時候需要除霜時都能使用這個鍵。

記錄針擡出鍵

- 在取下和設定記錄圖時，同時按下 △ 和 ▽ 鍵則記錄針將擡出。

遠距監控插座

- 用於遠距顯示和監控的插座。有三種型式的輸出——能提供致冷、除霜和範圍內運轉的遠距監控。

用於運轉和顯示方式的7段LED(發光二極管)

- 顯示出運轉狀態和顯示方式。
  - 這個LED閃亮表示操作者正在選擇某一方式的過程中。然後按下ENTER鍵使機組進入那個方式，這個LED將點亮。

用於顯示溫度、檢查號碼等的7段LED

- 在正常運轉中每隔5秒鐘交替地顯示出設定溫度和控制溫度。
- 當操作者變更設定數據時，這個LED將顯示出溫度和(或)除霜定時器的設定狀態。
- 在進行PTI或TEST運轉時，它將顯示出檢查號碼。
- 當操作者正在選擇當前警報訊息顯示時，它將顯示出當前警報代碼號。
- 將顯示操作者在運轉數據顯示方式下選擇的運轉數據。

方式和數據輸入鍵

- 用於輸入各種運轉和狀態顯示方式。
- 用於輸入設定數據(例如溫度、濕度和除霜定時器)。
- 用於取消警報訊息。
- 用於在試驗運轉中進行部件試運轉。

航行開始鍵

- 用於設定最新的航行LOG數據開始。

ALARM(警報)LED

- 當檢測到本機組有異常時這個LED就點亮。
  - 如果異常現象允許失效—保護功能或監視功能起作用繼續運轉，則這個LED將點亮；但如果機組不繼續運轉則這個LED就閃亮。

DEF(除霜)LED

- 在進行除霜運轉時將點亮。

IR(範圍內)

- 當被控制的溫度在所需的範圍內時這個LED點亮。但是，如果定時器由於下列兩個"IN-RANGE(範圍內)"偏離項目中的一個，那麼這個LED就不想被直至到計時時間一致爲止。
  - 在正常運轉中"IN-RANGE"偏離2分鐘。
  - 在完成除霜運轉後"IN-RANGE"偏離60分鐘。

COOL(致冷)LED

- 壓縮機在運轉時將點亮。

HUM(濕度)LED

- 僅當選用了運轉的濕度控制功能時這個LED才有效。用鍵輸入了濕度控制開始信號後在選擇CHILL方式時它將點亮。

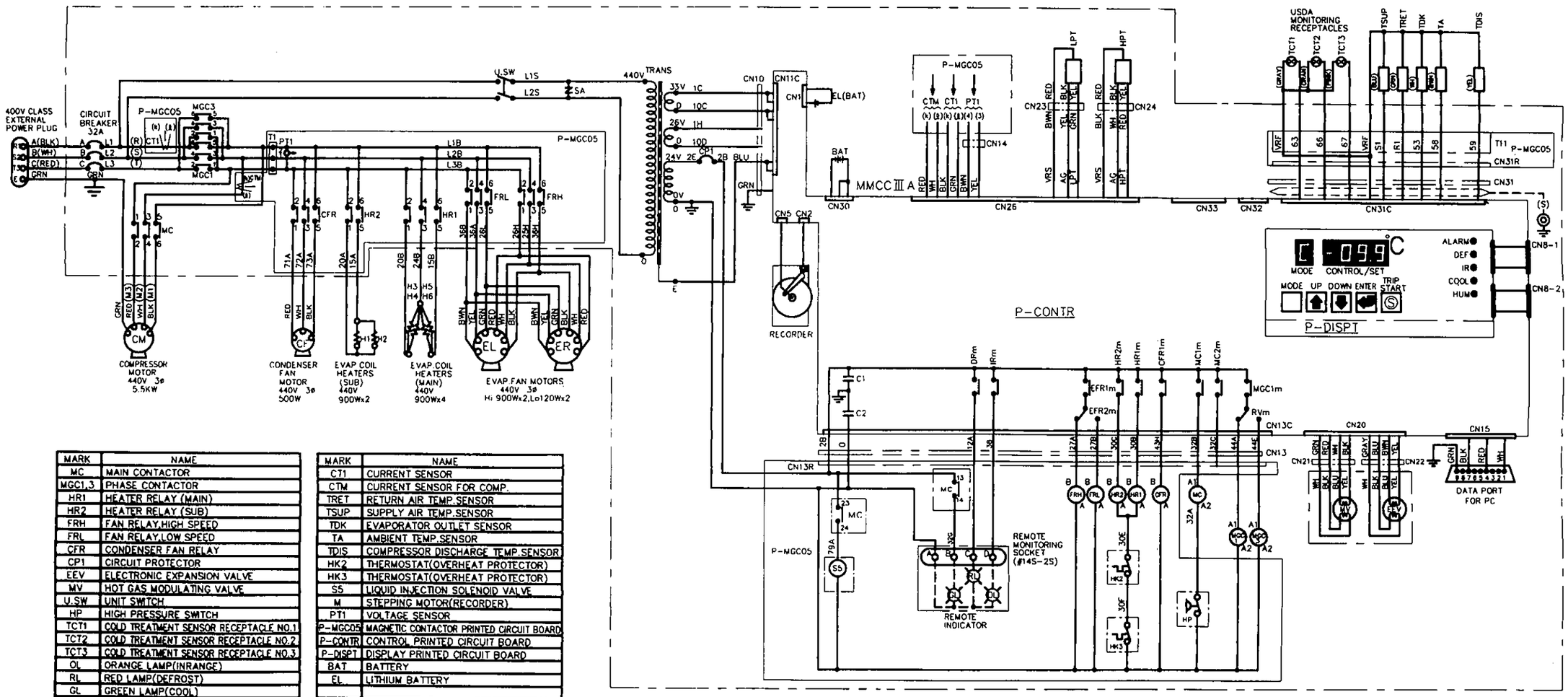
溫度記錄器

- CHILL(冷藏)方式下的供氣溫度或FROZEN(冷凍)方式下更高的回氣溫度和供氣溫度將被記錄在這個記錄圖上。
- 電源被切斷後的三天內，繼續記錄機組的溫度。

圖30 控制裝置

5. 電氣配線

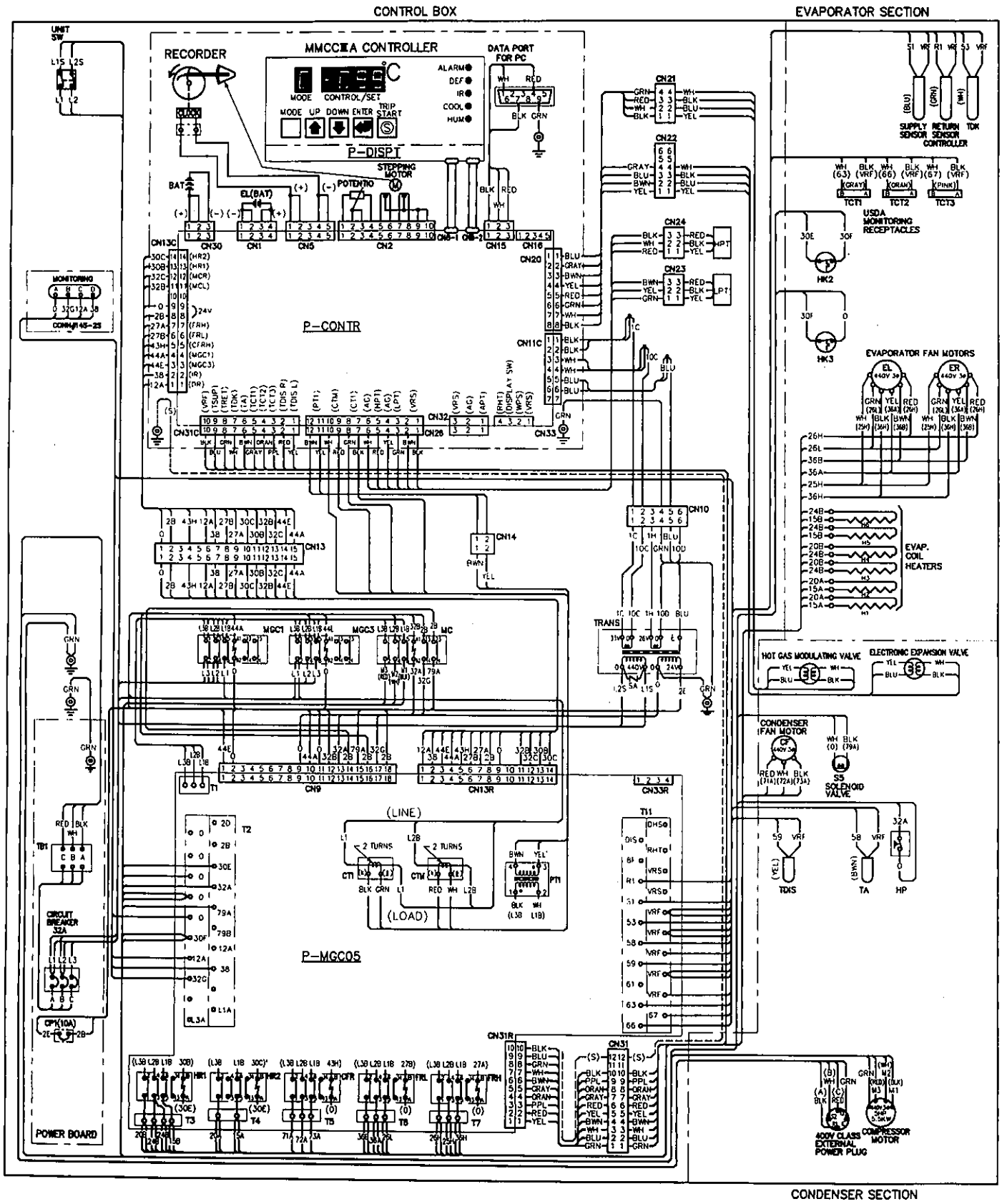
5.1 順序圖



MARK	NAME
MC	MAIN CONTACTOR
MGC1,3	PHASE CONTACTOR
HR1	HEATER RELAY (MAIN)
HR2	HEATER RELAY (SUB)
FRH	FAN RELAY,HIGH SPEED
FRL	FAN RELAY,LOW SPEED
CFR	CONDENSER FAN RELAY
CP1	CIRCUIT PROTECTOR
EEV	ELECTRONIC EXPANSION VALVE
MV	HOT GAS MODULATING VALVE
U.SW	UNIT SWITCH
HP	HIGH PRESSURE SWITCH
TCT1	COLD TREATMENT SENSOR RECEPTACLE NO.1
TCT2	COLD TREATMENT SENSOR RECEPTACLE NO.2
TCT3	COLD TREATMENT SENSOR RECEPTACLE NO.3
OL	ORANGE LAMP(INRANGE)
RL	RED LAMP(DEFROST)
GL	GREEN LAMP(COOL)
HPT	HIGH PRESSURE TRANSDUCER
LPT	LOW PRESSURE TRANSDUCER

MARK	NAME
CT1	CURRENT SENSOR
CTM	CURRENT SENSOR FOR COMP.
TRET	RETURN AIR TEMP.SENSOR
TSUP	SUPPLY AIR TEMP.SENSOR
TDK	EVAPORATOR OUTLET SENSOR
TA	AMBIENT TEMP.SENSOR
TDIS	COMPRESSOR DISCHARGE TEMP.SENSOR
HK2	THERMOSTAT(OVERHEAT PROTECTOR)
HK3	THERMOSTAT(OVERHEAT PROTECTOR)
S5	LIQUID INJECTION SOLENOID VALVE
M	STEPPING MOTOR(RECORDER)
PT1	VOLTAGE SENSOR
P-MGC05	MAGNETIC CONTACTOR PRINTED CIRCUIT BOARD
P-CONTR	CONTROL PRINTED CIRCUIT BOARD
P-DISPT	DISPLAY PRINTED CIRCUIT BOARD
BAT	BATTERY
EL	LITHIUM BATTERY
SA	SURGE ABSORBER

5.2 配線圖


CONTROL BOX
EVAPORATOR SECTION
CONDENSER SECTION
RECORDER
MMCCIEA CONTROLLER
DATA PORT FOR PC
P-DISPI
P-CONTR
P-MGC05
STEPPING MOTOR
POTENTIO
BAT
EL(BAT)
TRIP START
ALARM
DEF
IR
COOL
HUM
MODE
CONTROL/SET
UP
DOWN
ENTER
UNIT SW
MONITORING
CN1
CN2
CN5
CN15
CN16
CN20
CN21
CN22
CN23
CN24
CN30
CN31C
CN32
CN33
CN11C
CN10
CN13
CN14
CN9
CN13R
CN33R
CN31
CN31R
TRANS
MGC1
MGC3
MC
T1
T2
T3
T4
T5
T6
T7
TB1
CIRCUIT BREAKER 32A
CPK(10A)
POWER BOARD
(LINE)
(LOAD)
2 TURNS
CT1
CT2
PT1
SUPPLY SENSOR
RETURN SENSOR
TDK
CONTROLLER
USDA MONITORING RECEPTACLES
TCT1
TCT2
TCT3
HK2
HK3
EVAPORATOR FAN MOTORS
EL
ER
EVAP. COIL HEATERS
HOT GAS MODULATING VALVE
ELECTRONIC EXPANSION VALVE
CONDENSER FAN MOTOR
CF
S5 SOLENOID VALVE
TDKS
TA
HP
460V CLASS EXTERNAL POWER PLUG
COMPRESSOR MOTOR
CM

6. 功能部件的設定

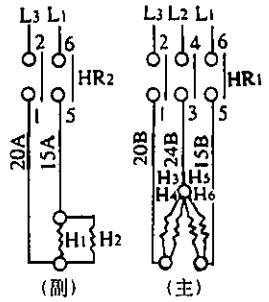
項目			單位	設定值	
易熔塞			℃ (℉)	被熔化	95 (203)
溫度保護器，冷凝器/蒸發器風扇馬達			℃ (℉)	OFF	140 (284)
				ON	92 (197.6)
HP(後備高壓開關)			kPa <kgf/cm²> (lb/in²G)	切斷	3630 < 37 ± 1 > (526 ± 14)
				接通	2550 < 26 ± 1.5 > (370 ± 21)
HK_2 (防過熱恒溫器)			℃ (℉)	打開	66 ± 3.0 (150 ± 5)
				關閉	52 ± 4.5 (125 ± 8)
電子控制器	HPT	異常保護	kPa <kgf/cm²> (lb/in²G)	切斷	3430 < 35.0 > (498)
				接通	2550 < 26 > (370)
	LPT	異常保護	kPa <kgf/cm²> (lb/in²G)	切斷	0 < 0 > (0)
				接通	60 < 0.6 > (8.5)
	TDIS (壓縮機排出氣體溫度保護)		℃ (℉)	打開	125 (257)
	CTM(壓縮機馬達過電流保護)		A	停止	25
	TDK (除霜終止)		℃ (℉)	ON	10 (50)
				OFF	15 (59)
	除霜定時器 (被設定到該方式時顯示出"0")		自動(A)	3ᴴ ◄► 6ᴴ ◄► 9ᴴ ◄► 12ᴴ	
			固定	3ᴴ, 6ᴴ, 9ᴴ, 12ᴴ	
			注意 (1) 啟動後3小時立即強迫進行第一次除霜。 (2) 在電源被關掉後該定時器立即動作2小時。		

＊ 變換至SI(國際單位制)單位:

1 kgf/cm² = 9.80665 × 10 kPa

1 kgf·cm = 9.80665 × 10^{-2} N·m

7. 參考數據

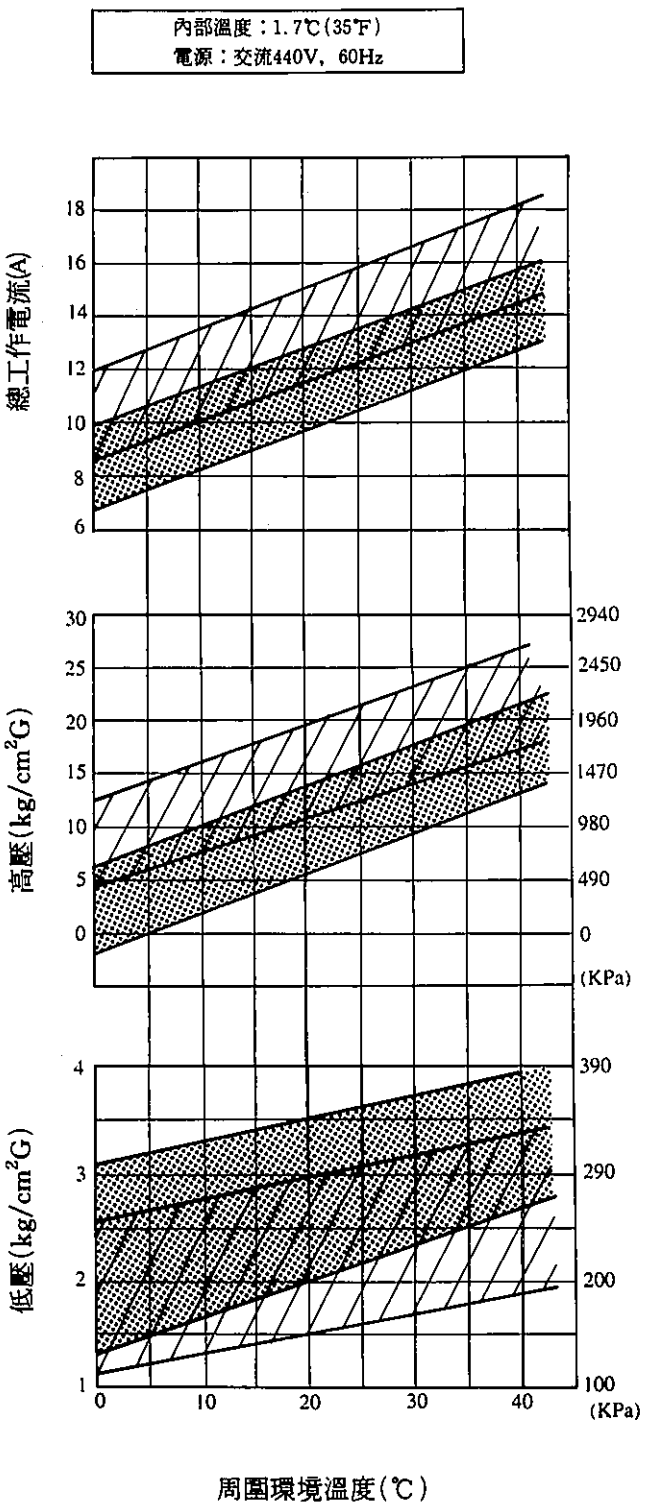
號碼	項目		單位	數據		
1	壓縮機	啟動電流	A	57.5		
		工作電流		7.7		
2	冷凝器風扇工作電流		A	1.2		＊1.
3	蒸發器風扇工作電流		A	低速(26L)	0.9	＊1, ＊2
				高速(26H)	3.5	＊1, ＊2
4			A	HR_1	L_1 (15B) 3.7	＊1
					L_2 (24B) 7.4	＊1
					L_3 (20B) 3.7	＊1
				HR_2	L_1 (15A) 3.7	＊1
					L_3 (20A) 3.7	＊1
5	絕緣阻抗	加熱器除外	MΩ	大於 1.0		
		加熱器		大於 0.3		
6	風扇和罩殼之間的間隙	冷凝器	mm	6.0 ~ 7.25		
		蒸發器		4.0 ~ 5.25		
7	各螺栓的擰緊力矩	壓縮機固定螺栓	N·m <kgf·cm> (ft·lb)	31.4 ~ 36.3 < 320 ~ 370 > (22 ~ 27)		
		風扇馬達固定螺栓		14.7 ~ 17.6 < 150 ~ 180 > (11 ~ 13)		
		機組安裝螺栓		147 ~ 157 < 1500 ~ 1600 > (108 ~ 116)		

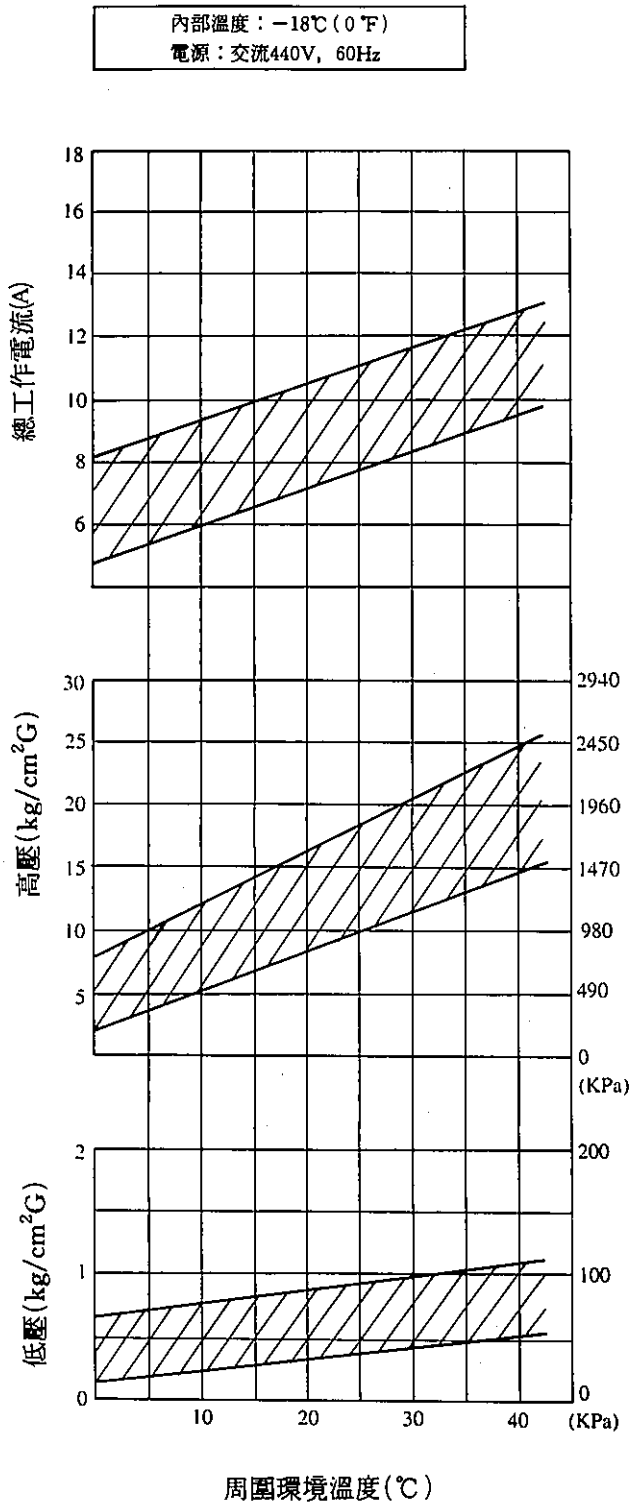
＊1 外圍溫度38℃; 內部溫度1.7℃; 電源440V, 60Hz

＊2 二台蒸發器風扇馬達的工作電流.

8. 運轉電流和壓力的特性圖

8.1 60Hz電源

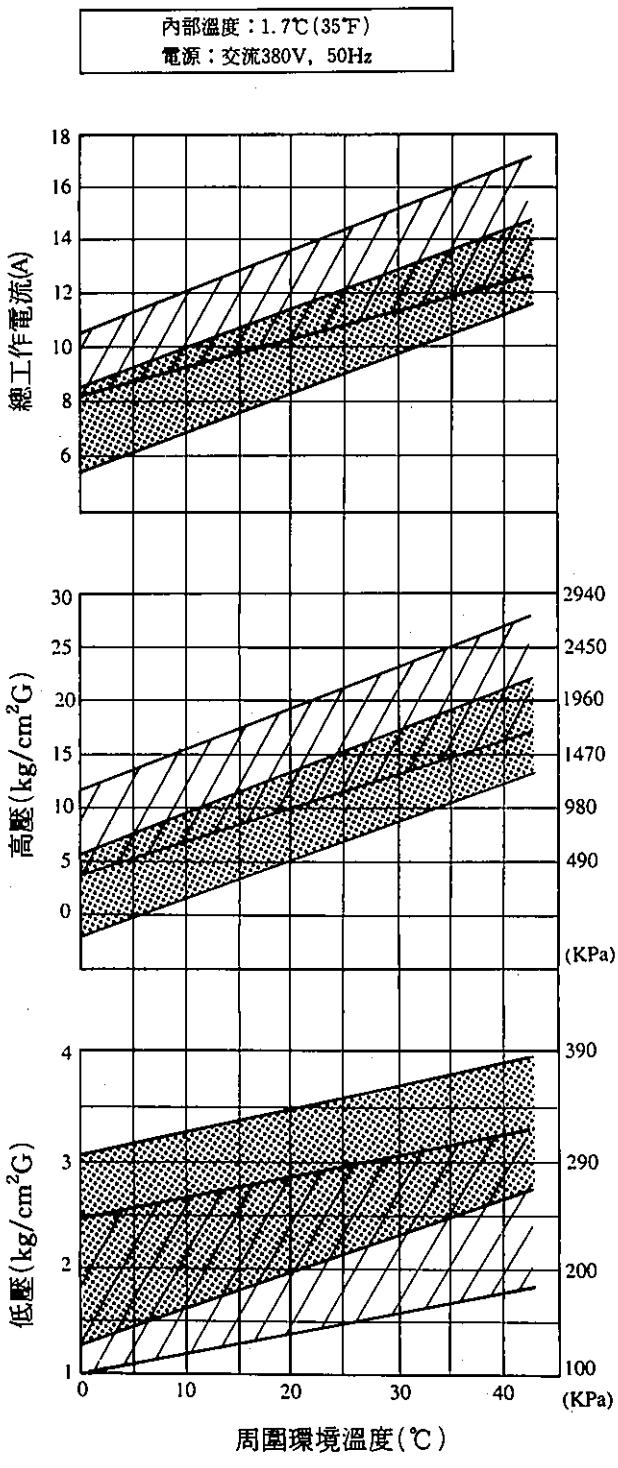


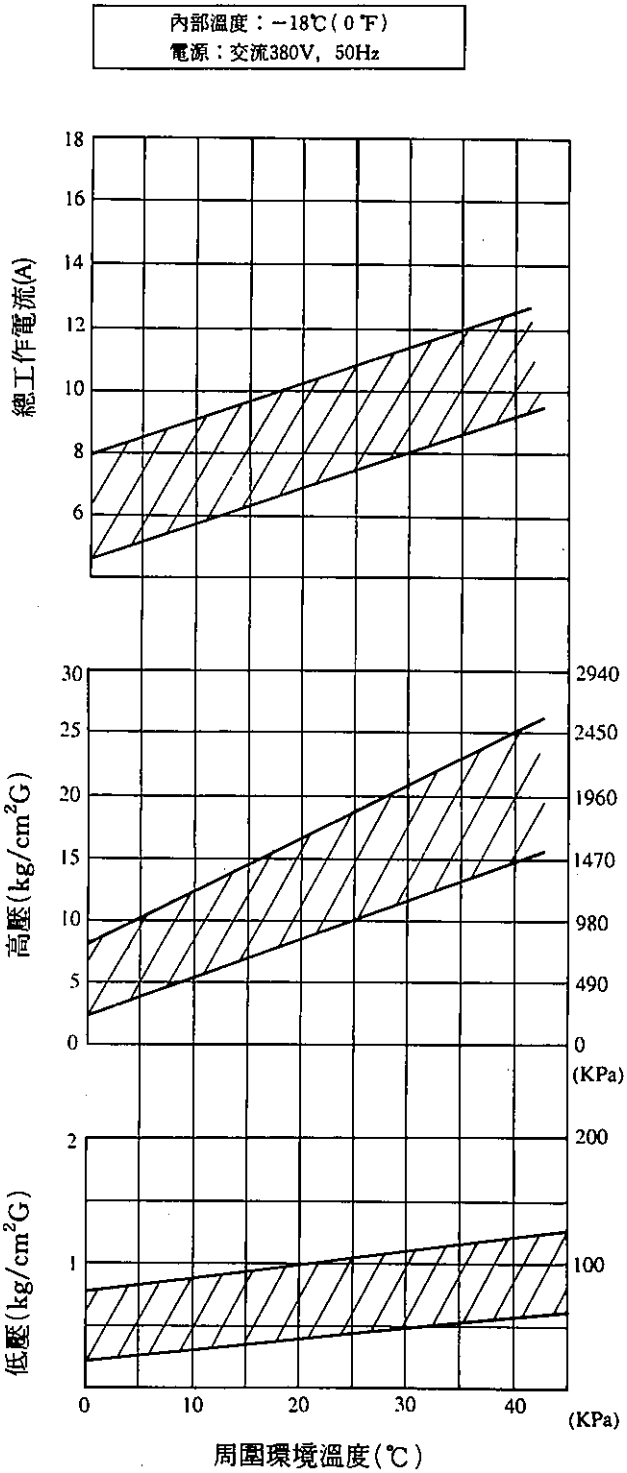


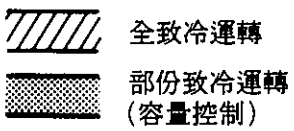
全致冷運轉

部份致冷運轉
(容量控制)

8.2 50Hz電源


內部溫度：1.7℃(35℉)
電源：交流380V，50Hz
總工作電流(A)
高壓(kg/cm²G)
低壓(kg/cm²G)
(KPa)
周圍環境溫度(℃)


內部溫度：－18℃(0℉)
電源：交流380V，50Hz
總工作電流(A)
高壓(kg/cm²G)
低壓(kg/cm²G)
(KPa)
周圍環境溫度(℃)


全致冷運轉
部份致冷運轉
(容量控制)

9. 裝貨前的檢查(PTI)

在MMCC IIIA控制器上選擇PTI方式，則本機組將自動地執行MIN. PTI功能。這個功能將首先檢查各個部件；然後執行MAX. PTI功能，這個功能將檢查包括運轉條件在內的全部功能。

備註：下表列出的是由製造廠推薦的檢查項目；這些項目可能與有關海運公司所說明的項目有所不同。

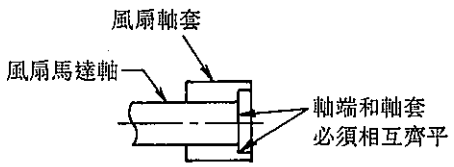
9.1 MIN. PTI和MAX. PTI功能

有關這兩個功能的詳細內容請參照12.6.3節所述；有關功能的執行步驟和顯示內容請參照12.11.19節所述。

9.2 目測檢查

⚠警告 務必在關斷機組的ON－OFF開關、電路保護器、斷路器和設備電源並拔出電源插頭後再進行檢查。

如果在電源接通的狀態下進行檢查，則可能會引起因旋轉體而受傷害、電擊、火災或其他事故。

號碼	檢查部位		工具量具	檢查方法	評定標準	解決措施
1	集裝箱的損傷狀況	(a) 內壁、外壁和框架		目測檢查	彎曲、斷裂等	修理或更換
		(b) 門銷、門密封和門鉸鏈			密封條的彎曲、斷裂和撓曲	
		(c) 通風口蓋			斷裂	更換
2	機組的損傷狀況	(a) 機架		目測檢查	彎曲、破裂	修理或更換
		(b) 面板和罩蓋			彎曲、斷裂	
		(c) 電纜和插頭			電纜斷裂、損傷	更換
3	盛水盤的阻塞狀況	盛水盤出口		打開目測檢查	金屬絲網上沉澱物堵塞	用手或刷子清除阻塞物
	洩放軟管的阻塞狀況	軟管內部		目測或用金屬棒		用壓力水或其他適當的方法沖洗掉雜質
4	蒸發器和冷凝器的風扇馬達、風扇和固定螺栓	(a) 風扇和孔板之間的間隙		目測檢查或用測隙規	風扇軸必須位於孔板的中心。如有偏差則允許有下列間隙。 冷凝器風扇: 6.0～7.25mm 蒸發器風扇: 4.0～5.25mm	調整孔板安裝位置
		(b) 風扇安裝位置		目測和用手檢查		
		(c) 風扇軸的軸承		用手轉動軸	轉動不平穩、異常噪聲	修理或更換
		(d) 風扇馬達固定螺栓		目測檢查或用測試錘子敲打	擰緊力矩: 14.7～17.6N·m <150～180kgf·cm> (11～13ft-lb)	重新擰緊
5	壓縮機固定螺栓			目測檢查或用測試錘子敲打	擰緊力矩: 31.4～36.3N·m <320～370kgf·cm> (22～27ft-lb)	重新擰緊
6	密封狀況	控制箱、面板和容器的密封條		目測檢查	密封條扭曲和老化以及矽密封膠塗敷不足	更換密封條或塗敷矽密封膠
7	機組跟集裝箱的連接螺栓	螺栓的鬆緊		目測檢查或用測試錘子敲打	力矩 147～157N·m <1500～1600kgf·cm> (108～116ft-lb)	重新擰緊 (螺紋部分塗防粘劑)

9.3 滲漏檢查

⚠警告 切勿將檢測工具或你的手放到旋轉體上。
否則，可能會引起傷害、致冷機組損壞或其他事故。

⚠警告 切勿觸碰壓縮機或管道的冷熱部份。
否則，可能會燙傷你的手。

號碼	檢查部位		工具量具	檢查方法	評定標準	解決措施
1	致冷系統漏氣和漏油	(a)漏氣檢查部位：焊接部份、接頭、功能部件和固定螺釘。	鹵化物噴燈或電子滲漏檢測器	目測檢查	有滲漏爲綠色火焰，正常爲藍色火焰	修理或更換
		(b)漏油檢查部位：擴口式管接頭、開關、管子。			擴口管處破裂，有油滲出和擴口鬆動。在存在滲漏油的情況下更換致冷劑時要特別小心。	重新擰緊各接頭或更換。

9.4 電氣系統的檢查

⚠警告 務必在關斷機組的ON-OFF開關、電路保護器、斷路器和設備電源並插出電源插頭後再進行檢查。
如果在電源接通的狀態下進行檢查，則可能會引起因旋轉體而受傷害、電擊、火災或其他事故。

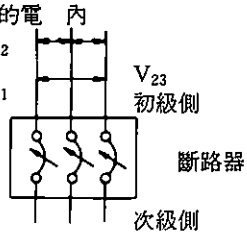
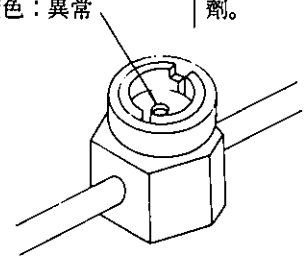
號碼	檢查部位		工具量具	檢查方法	評定標準	解決措施
1	各接線端子的鬆動和腐蝕	控制箱和端子盒的內部		目測檢查或用螺絲起子	端子鬆動、脫落和腐蝕	重新固緊、更換
2	連接器接觸不良	記錄控制器的連接器		檢查連接是否牢靠		• 牢靠的連接。 • 噴觸點清潔液 THREE BOND #2501S。
3	電磁接觸器燒壞和固定螺栓鬆動	(a)觸點和線圈燒壞或腐蝕		目測檢查或用螺絲起子	觸點和線圈燒壞或腐蝕	更換
		(b)電磁接觸器固定螺栓鬆動			固定螺栓鬆動或脫落	重新擰緊
4	絕緣阻抗	電源線路、壓縮機馬達、加熱器、蒸發器風扇馬達和冷凝器風扇馬達 • 爲了防止電子控制器壞，不可對控制箱內變壓器的次級側加兆歐表的500V電壓。 • 在檢查之前，把UNIT ON-OF開關置於OFF位置。	兆歐表直流500V	用手把觸點置於ON位置後檢查絕緣狀況。	電源插頭端子和殼體(除加熱器)之間應在1MΩ和1MΩ以上。加熱器允許0.3MΩ和0.3MΩ以上。	更換

9.5 運轉中的檢查

⚠警告　在電源接通的狀態下切勿觸碰電氣系統。
否則，可能會引起電擊、傷害或其他事故。

⚠警告　切勿觸碰旋轉體
否則，可能會引起傷害、致冷機組損壞或其他事故。

⚠警告　切勿觸碰壓縮機或管道的冷熱部分。
否則，可能會燙傷你的手。

號碼	檢查部位		工具量具	檢查方法	評定標準	解決措施
1	電源電壓和相位	測量線路電壓 ⚠警告 (參照備註(1)。) 檢查相位 ⚠警告 (參照備註(1)。)	MMCC ⅢA 或電壓傳感器、電壓表 相位測試儀	測量下列各點之間的電壓 V_{12} V_{23} V_{31}  檢查組合端子盒的相位	在額定電壓的±10之內	修理電源設備。 改變R.S.和T的接線
2	設備的異常噪聲和振動	壓縮機、風扇馬達、管道、毛細管和面版等。		目測檢查、聽聲檢查	異常噪聲和振動	修理或更換
3	壓縮機耗電	正常值 ⚠警告 (參照備註(1)。)	MMCC ⅢA 或電流表	在內部溫度約爲1.7℃(35℉)時進行測量	測量電流與規定數據對照 (見第7章)	修理
4	致冷劑充注狀況	充注量	MMCC ⅢA	MAX. PTI或觀察窗。 ⚠警告 (參照備註(2)。) 根據吸入壓力、排出壓力和環境溫度等綜合條件來判斷致冷劑的量是否適當。	觀察窗應清潔 液體管路的觀察窗應無過多的泡沫。	充注或排出。
5	水份指示器	水份指示器的顏色		目測檢查	綠色：正常 黃色：異常 	更換乾燥器、排出和充注致冷劑。

備註(1)　⚠警告　在連接任何測量儀器之前應先關斷電源(即關斷機組的ON-OFF關開、電路保護器、斷路器和設備電源並拔出電源插頭)。

如果在電源接通的狀態下連接測量儀器，則可能會引起電擊、傷害或其他事故。

備註(2)　⚠警告　在運轉中，如觀察窗前的面板已被拆除，請不要通過觀察窗進行窺視。

萬一觀察窗的玻璃破裂，碎玻璃飛出有引起傷害的可能。

號碼	檢查部位		工具量具	檢查方法	評定標準	解決措施
6	工作壓力	吸入壓力、排出壓力 ⚠警告 (參照備註(3)。)	MMCC ⅢA、壓力傳感器和壓力測量裝置	把壓力測量裝置接到輔助閥上。	測量壓力與特性圖對照(見第8章)	排出和充注致冷劑。
7	高/低壓傳感器	携帶式電腦指示值與管道壓力測試裝置間的壓力偏差。 ⚠警告 (參照備註(3)。)	MMCC ⅢA 壓力傳感器和管道壓力測試裝置	在穩定運轉中比較和檢查携帶式電腦指示值與管道壓力測試裝置間的偏差。	偏差 高壓 1kg/cm² 低壓 0.2kg/cm² 在上述狀況下再檢查管道壓力測試裝置。	再檢查管道壓力測試裝置，如果發現有偏差應予調整或更換。
8	溫度記錄器	溫度記錄器指針與刻度間的偏差	MMCC ⅢA	在 MMCC ⅢA的④方式下設定0℃並檢查指針位置。	如果偏差爲±0.5°或更大，則應按下⊡或⊟鍵使指針指到0℃刻度附近。(不要忘記按下⊡鍵。)	如果偏差超過調節範圍，更換MMCCⅢA。
9	加熱器	測量加熱器電流 ⚠警告 (參照備註(4)。)	安培計、MMCC ⅢA、電流傳感器	進行手動除霜運轉，測量加熱器的電流。	測量電流與規定數據對照(見第7章)	
10	下拉試驗	內部溫度	MMCC ⅢA	MAX PTI	一定要使內部溫度下降到－18℃(0°F)	檢查阻礙致冷的原因。

備註(3) ⚠警告 在安裝或拆卸管道壓力測試裝置之前應先關斷電源(即關斷機組的ON-OFF開關、電路保護器、斷路器和設備電源並拔出電源插頭)。

如果在電源接通的狀態下安裝或拆卸管道壓力測試裝置，則可能會引起電擊、傷害或其他事故。

備註(4) ⚠警告 在安裝或拆卸測量儀器之前應先關斷電源(即關斷機組的ON-OFF開關、電路保護器、斷路器和設備電源並拔出電源插頭)。

如果在電源接通的狀態下安裝或拆卸測量儀器，則可能會引起電擊、傷害或其他事故。

9.6 最終檢查

⚠警告 在電源接通的狀態下切勿觸碰電氣系統。

否則，可能會引起電擊、傷害或其他事故。

號碼	檢查部位	工具量具	檢查方法	評定標準	解決措施
1	對控制箱內的端子或觸點噴防銹潤滑劑 ⚠警告 (參照備註(5)。)		當電磁接觸器動作不靈活時噴潤滑劑。		防銹潤滑劑採用 THREE BOND #1804。 備註：不要使用矽潤滑脂或含有氟立昂氣的噴劑。
2	安裝新的記錄圖		拆下用於進行運轉檢查的記錄圖，並裝上新的記錄圖。		
3	填寫檢查記錄卡		在檢查記錄卡上填寫零部件的更換、致冷劑添加、排出、防銹劑的噴射等內容。此外，還要在檢查記錄卡上填寫每次檢查時的自動溫度記錄器之偏差。		

備註(5) ⚠警告 • 切勿在電源接通的狀態下噴射。

• 在噴射之前應先關斷機組的ON-OFF開關、電路保護器、斷路器和設備電源並拔出電源插頭。

如果在電源接通的狀態下噴射潤滑劑，則可能會引起電擊、傷害或其他事故。

10. 定期保養指南

⚠警告　在電源接通的狀態下切勿觸碰電氣系統。

如果在電源接通的狀態下觸碰電氣系統，則可能會引起電擊、傷害或其他事故。

⚠警告　切勿觸碰壓縮機或管道的冷熱部份。

否則，可能會燙傷你的手。

保養周期	零部件	保養內容
(1) 在電源"OFF"的狀態下檢查		
⚠警告　在進行檢查之前應先關斷機組的ON-OFF開關、電路保護器、斷路器和設備電源並拔出電源插頭。 如果在電源接通的狀態下進行檢查，則可能會引起因旋轉體而受傷害、致冷機組損壞或其他事故。		
每隔二年	記錄控制器	• 有關控制器方面檢查下列各項。 檢查P-CONTR板以測量出鋰電池的電壓，如電壓低於DC 3V則應更換電池。每隔四年或五年應更換一次電池。 備註：在更換鋰電池時要把機組開關和AC電源開關置於"ON"位置。 **⚠警告**　(參照備註(1)。)
	主接觸器的電觸點	更換觸點
	蒸發器盤形管	• 以蒸汽做短時間清洗。 • 應小心不要使熱敏傳感器受熱到80℃(176℉)或更高的溫度，該傳感器的允許極限傳感溫度約爲80℃(176℉)。
	冷凝器盤形管	用冷水清洗以防止致冷劑壓力昇高。
	乾燥器	更換
	紫銅管	擦塗防銹材料。
	各外部表面，特別是壓縮機的外表面。	檢查有無銹迹或腐蝕現象。清除銹迹並塗防銹漆。
	致冷劑	視需要充注或排出致冷劑。
	控制箱蓋	視需要檢查控制箱蓋的配合狀況。
每隔四年	風扇繼電器的電觸點	檢查各觸點有無凹坑和腐蝕，如有必要應更換觸頭。
	觀察窗(水份指示器)	如表面生銹則應更換。
	配線和控制箱	• 如絕緣層破裂或老化則應更換。 • 修理密封條。
	整個機組	• 清掃和清洗內部。 • 重新油漆機組表面。
	控制箱蓋	視需要檢查和更換蓋墊片。
最初的15年後	壓縮機	更換

備註(1) **⚠警告　切勿觸碰其他電氣系統。**

如果在電源接通的狀態下去觸碰其他電氣系統，則可能會引起電擊、傷害或其他事故。

保養周期	零部件	保養內容
(2) 在運轉中檢查		
⚠警告 **在將溫度計或測量儀器裝到電路或者從電路將其拆下之前；以及將管道壓力測試裝置裝到檢查接頭或從檢查接頭將其拆下之前應先關斷機組的ON-OFF開關、電路保護器、斷路器和設備電源並拔出電源插頭。** 如果在電源接通的狀態下安裝和拆卸測量儀器，則可能會引起電擊、因旋轉體而受傷害、致冷機組損壞或其他事故。 ⚠警告 **切勿觸碰旋轉體。** 否則，可能會引起傷害、致冷機組損壞或其他事故。		
每隔二年	記錄控制器	• 檢查溫度控制動作和記錄功能，視需要進行修理或更換。
	冷凝器和蒸發器風扇	• 檢查風扇轉動狀態。 • 檢查兩個蒸發器風扇馬達的工作電流(Hi)應低於6.0A，冷凝器風扇馬達的工作電流應低於3.6A。
	高—低壓力傳感器	檢查用壓力測量裝置測量出的實際壓力值。
	電流傳感器	檢查用安培表測量出的實際電流值。
	電壓傳感器	檢查用伏特表測量出的實際電壓值。
	高壓開關	檢查作動壓力。
	過熱保護恆溫器	檢查作動溫度。

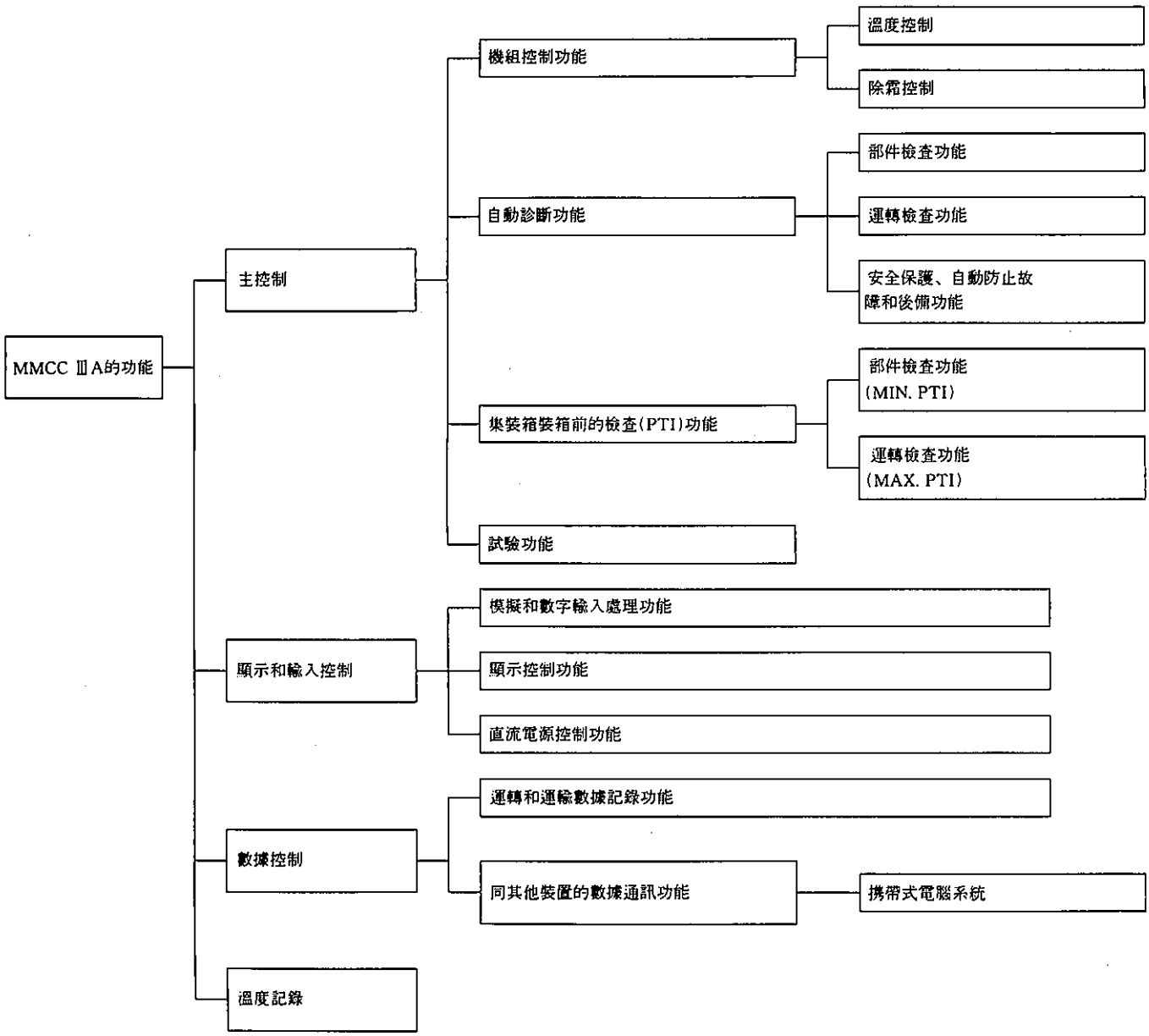
11. 規格

項目		單位	CPE14-2BAⅢES
電源			400～500V×60Hz、360～460V×50Hz；交流3相
外形尺寸(H×W×D)		mm(in.)	2235(88)×2026(79.75)×445(17.5)
重量(最大)		kg(lb)	460(1010)
壓縮機	型式		封閉式渦流型，RS2527ESH
	輸出功率	kW	5.5
	工作電流	A	9.0(啟動電流75)，在440V×60Hz×3相電源時
	轉速	rpm	3450(440V×60Hz×3相)
	潤滑油	ℓ(gal)	BARREL FREEZE 32SAM 1.8(0.48)
風冷冷凝器			強制空氣循環，散熱鰭片式，φ440，4葉片風扇(螺旋槳式)，780W(輸入)×1(同馬達直接連接)
蒸發器			強制空氣循環，散熱鰭片式，φ320，4葉片風扇(螺旋槳式)，120W/190W(輸入)×2(同馬達直接連接)
致冷劑		kg(lb)	R22 5.0(11.0)
膨脹閥			電子膨脹閥
溫度控制和記錄器			微型電腦記錄控制器(MMCC ⅢA)
除霜			• 由電子定時器或空氣壓差傳感器開始 • 由電子恒溫器終止 盤形管加熱器900W×6
通風量		m^3/h	最大180(50Hz)
過載保護	壓縮機馬達		過電流促動式
	冷凝器風扇馬達		熱促動式(自動復位)
	蒸發器風扇馬達		熱促動式(自動復位)
易熔塞		℃(°F)	95(203)
高—低壓保護		kpa 〈kgf/cm^2〉 (lb/in^2G)	高壓側 切斷3430〈35〉(498) 接通2550〈26〉(370) 低壓側 切斷0〈0〉(0) 接通60〈0.6〉(8.5)
壓縮機過熱(排出口氣體溫度)		℃(°F)	切斷125(257)
電源斷路器		A	32

12. 三菱微型電腦記錄控制器(MMCC ⅢA)

12.1 特點

三菱微型電腦記錄控制器(MMCC ⅢA)是爲冷藏貨物集裝箱而開發的極其精密、多功能記錄控制器。這種控制器具有這類集裝箱所要求的各種功能，例如用於致冷機組的各種控制功能、顯示、數據控制和溫度記錄功能等。



12.2 MMCC Ⅲ A系統的整體結構

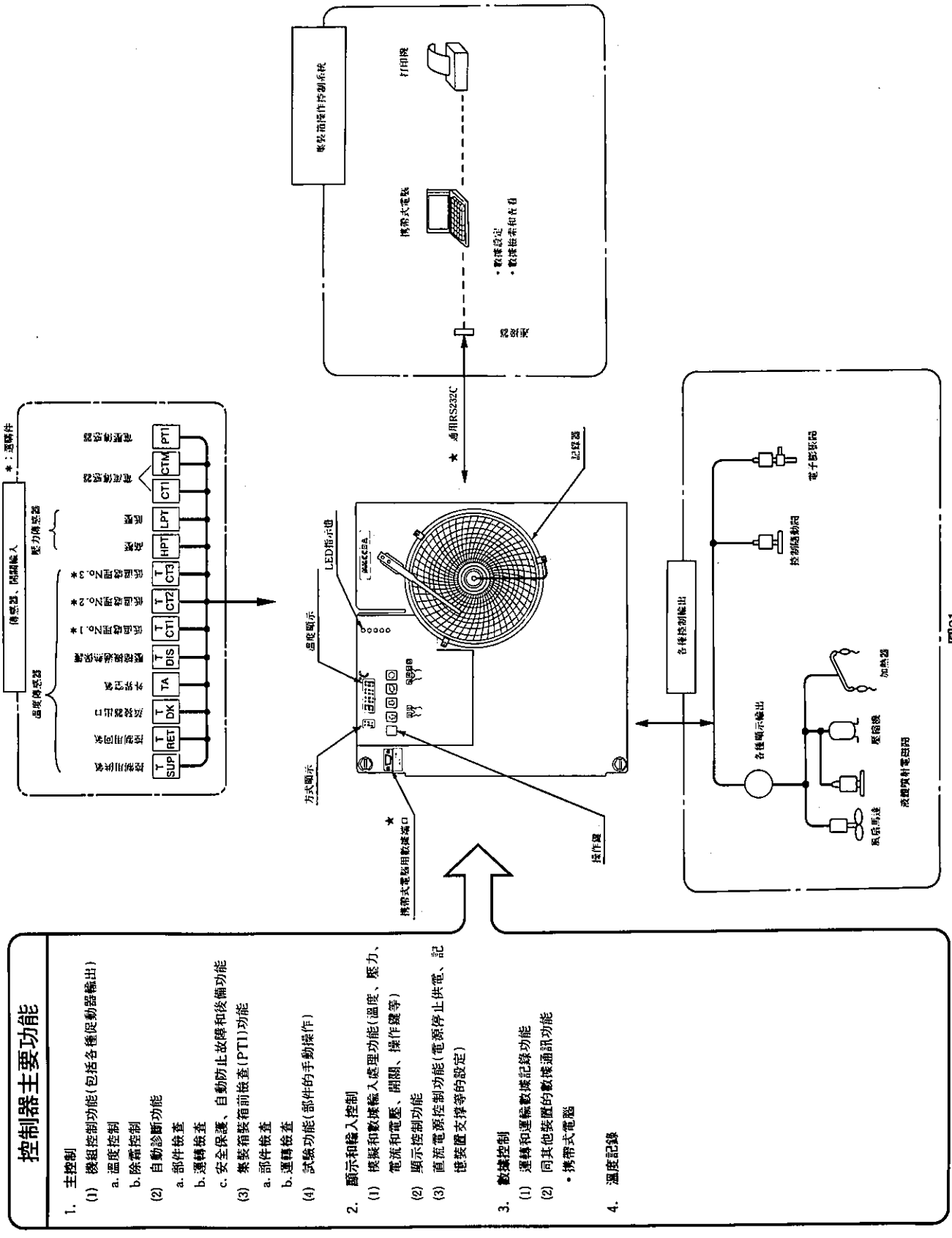


圖31

12.3 規格

12.3.1 輸入和輸出裝置

	項目	裝置
輸入	手動開關	• 機組開關
	操作開關	 Key pad MODE UP DOWN ENTER TRIP START
	溫度傳感器	• 控制用供氣溫度傳感器(TSUP)和備件 • 控制用回氣溫度傳感器(TRET) • 蒸發器出口溫度傳感器(TDK) • 外圍溫度傳感器(TA) • 壓縮機排出溫度傳感器(TDIS) • 低溫處理溫度傳感器NO. 1(TCT1)〈選購件〉 • 低溫處理溫度傳感器NO. 2(TCT2)〈選購件〉 • 低溫處理溫度傳感器NO. 3(TCT3)〈選購件〉
	壓力傳感器	• 高壓傳感器(HPT) • 低壓傳感器(LPT)
	電流傳感器	• 電流傳感器× 2 (CT1、CTM)
	電壓傳感器	• 電壓傳感器× 1 (PT1)
輸出	機組控制	• 小型繼電器輸出 (主接觸器×2、蒸發器風扇高速和低速、加熱器主和副、 冷凝器風扇× 1 、反相×2、監控×2) • 控制隨動閥驅動電壓輸出 • 電子膨脹閥驅動電壓輸出
	顯示	• 運轉方式和條件：LED×4 • 警報：LED×1 • 溫度/代碼：7段LED • 方式：7段LED
	溫度記錄	• 溫度記錄器
	監控和數據	• 用於携帶式電腦的數據通訊插座 • 遠距監控插座
數據控制		• 携帶式電腦

12.3.2 技術數據

(1) 電源

主電源

(初級)： 380/415V，50Hz；440V，60Hz，交流

(控制器變壓器輸入電壓)

(次級)： 33V，50/60Hz，交流(用於繼電器電路、電子電路、電子膨脹閥、控制隨動閥和壓力傳感器)

24V，50/60Hz，交流(用於繼電器)

(電壓允差±10%，頻率允差±5%)

(2) 使用外圍濕度 ： RH90%或以下

(3) 使用環境溫度範圍 ： －30℃～＋65℃

(4) 溫度設定範圍 ： －30℃～＋25℃ (0.1℃一檔)

(5) 轉換運轉方式的設定點溫度

CHILL(冷藏)方式 ： －5℃或－5℃以上

FROZEN(冷凍)方式 ： 低於－5℃

(6) 溫度控制精度

CHILL方式 ： ±0.2℃

(7) 溫度記錄範圍 ： －30℃～＋25℃

(8) 溫度記錄精度

0℃ ： ±0.2℃

－20℃～＋10℃ ： ±0.6℃

＋10℃～＋25℃、－30℃～－20℃：±1.2℃

(9) 溫度記錄滯後：±0.3℃

(10) 蒸發器風扇啟動延遲時間

在致冷運轉初始啟動時：20秒鐘

在除霜運轉後 ： 4分鐘

12.4 外形圖

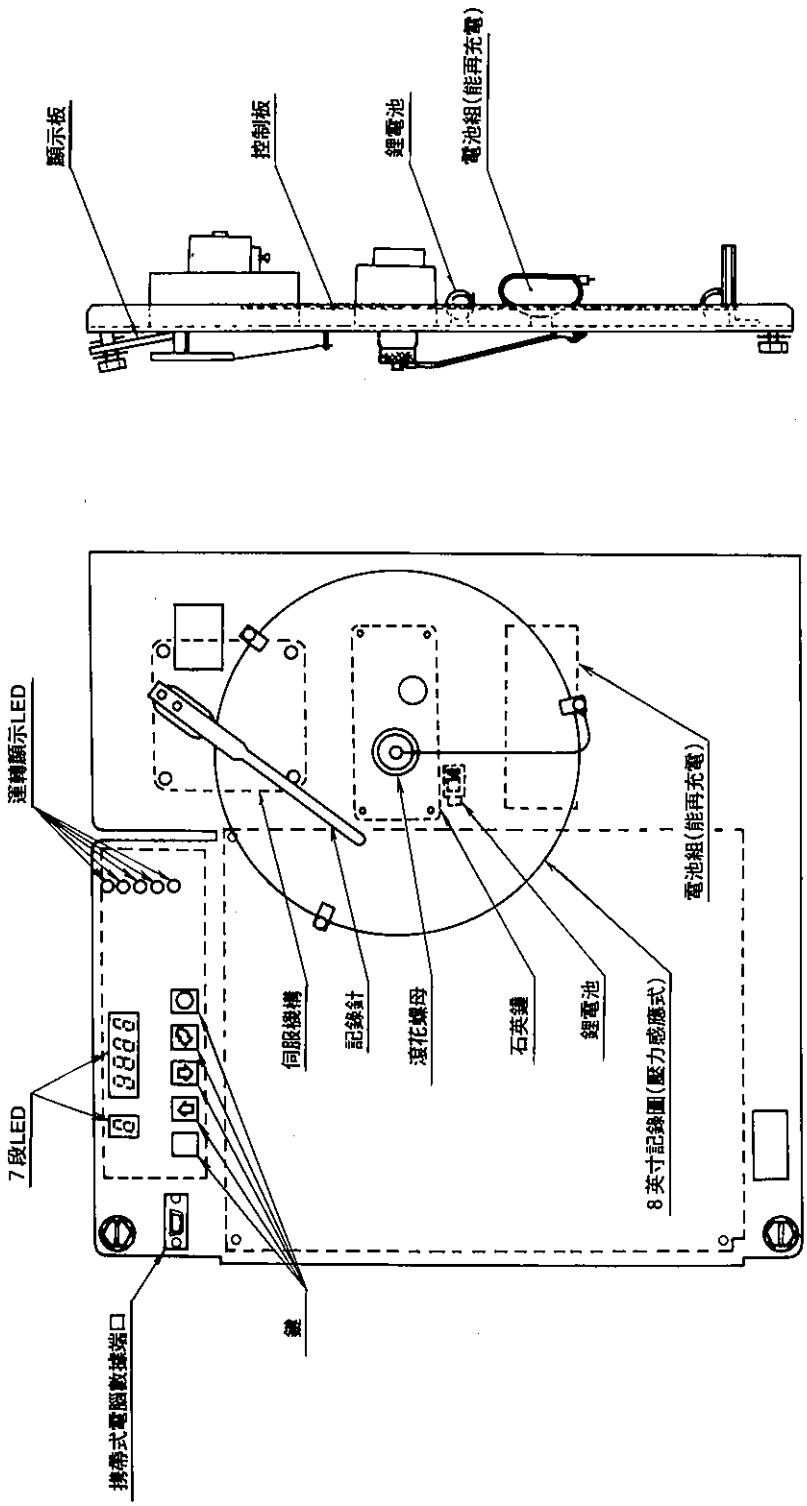

顯示板
控制板
鋰電池
電池組(能再充電)
運轉顯示LED
7段LED
伺服機構
記錄針
滾花螺母
石英鐘
鋰電池
電池組(能再充電)
8英寸記錄圖(壓力感應式)
鍵
攜帶式電腦數據端口

圖32

12.5 輸入/輸出圖

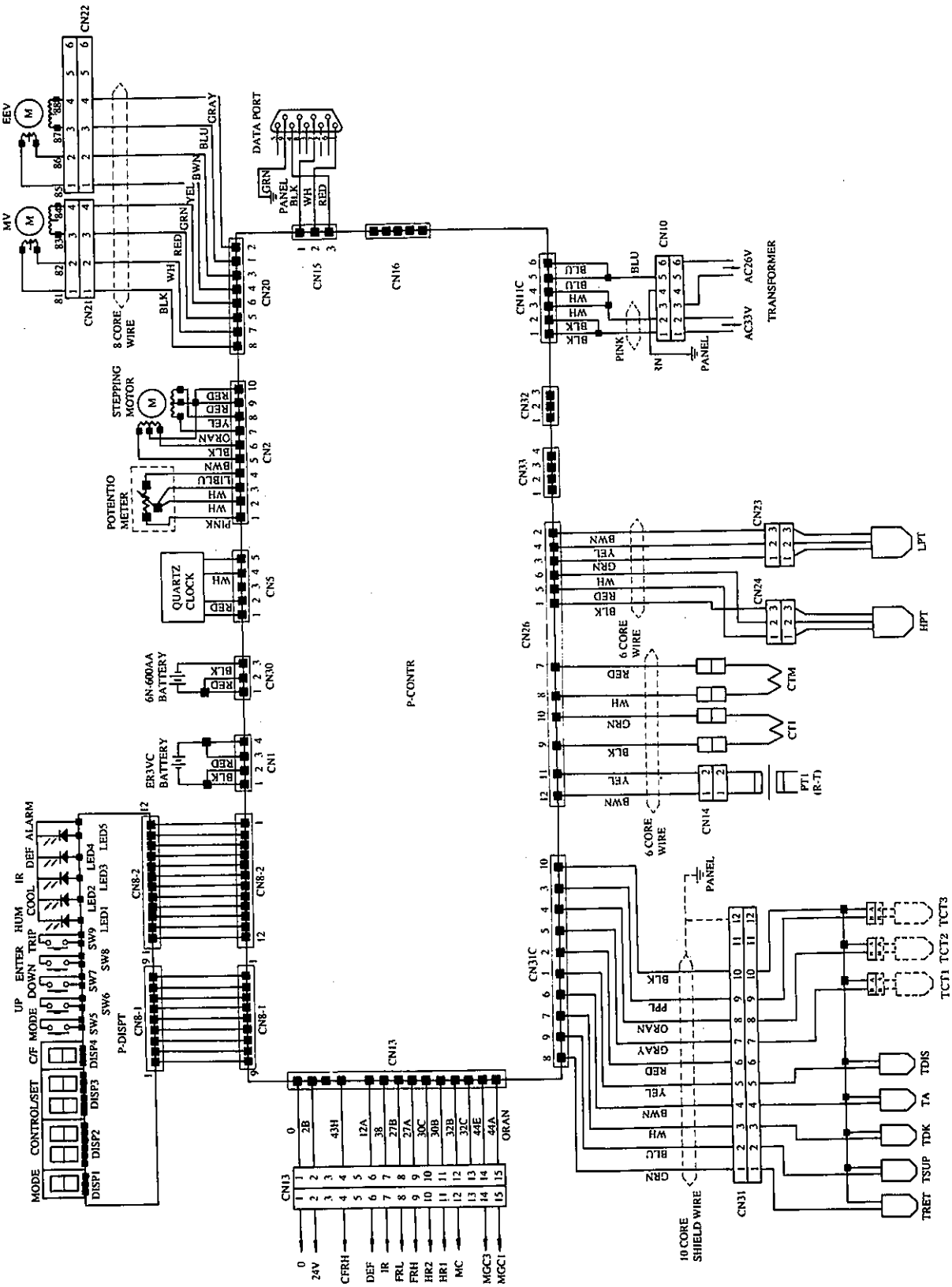


圖33

12.6 主控制

12.6.1 機組控制功能

(1) 啟動和停機

當電源接通時，MMCC ⅢA檢查微型電腦系統、各種輸入、電源相序、單相和電壓—頻率，如果發現有異常現象則指示出警報狀態並自動地採取適當的措施。把機組開關放到"ON"位置則致冷機組啟動並開始溫度控制。

把機組開關置於"OFF"位置時則致冷機組就停止運轉。

(2) 溫度控制

利用四個功能鍵、携帶式電腦，藉助"CHILL"和"FROZEN"方式之間以－5℃爲界的自動轉換可以調節設定點的溫度。

MMCC ⅢA根據實際溫度與設定點溫度之差並依預設順序，轉換運轉檔來控制溫度。每個運轉檔一直被保持到其變成穩定爲止，然後轉換到下一檔，否則實際溫度將偏離各溫度範圍。

(a) 在CHILL(冷藏)方式——設定點溫度：－5℃及其以上

在CHILL(冷藏)方式下運轉時含有五個運轉檔，本致冷機組將控制各檔設定點的供氣溫度。這五個運轉檔分別是，(0)全致冷運轉；(1)使用高溫氣體控制隨動閥的容量控制運轉；(2)容量控制＋低熱運轉；(3)低熱運轉和(4)高熱運轉。加熱能量由電阻絲加熱器提供。在運轉開始時，控制器把初始運轉檔固定在全致冷或低熱運轉狀態。當供氣溫度高於設定點溫度時，本致冷機組將進行全致冷運轉；而當供氣溫度低於設定點溫度時進行低熱運轉。在本致冷機組從全致冷檔開始運轉的情況下，當供氣溫度達到設定溫度(即全致冷運轉範圍的下限溫度)時，它將轉換到下一檔的容量控制檔進行運轉。

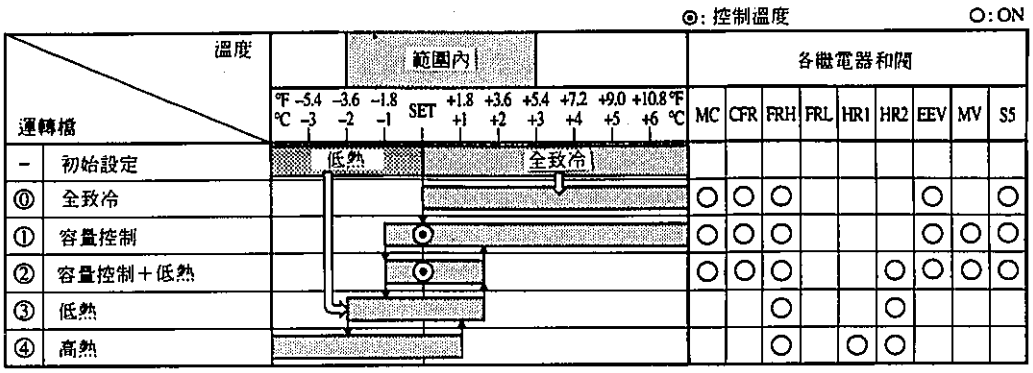
在本致冷機組從低熱檔開始運轉的情況下，當供氣溫度達到低於設定點溫度2℃時，機組將進入下一檔的高熱檔進行運轉，因爲這個溫度是低熱運轉檔的下限溫度；而當供氣溫度達到高於設定點溫度1.5℃時，機組將轉換到上一檔的容量控制＋低熱檔進行運轉，因爲這個溫度是低熱運轉檔的上限溫度。

其後，當供氣溫度偏離特定運轉檔範圍的設定點溫度時，本致冷機組將轉換到下一個運轉檔。

容量控制跟容量控制＋低熱運轉檔之間的轉換，依靠控制隨動閥或電子膨脹閥的控制條件以及蒸發器出口的過熱度或溫度偏差也有效。當電子膨脹閥的控制條件被保持在某一確定值以上達10分鐘時，容量控制運轉將被轉換到容量控制＋低熱運轉；另一方面，當電子膨脹閥的控制條件被保持在某一確定值以下達10分鐘時，容量控制＋低熱運轉將被轉換到容量控制運轉。

當某一狀態下，溫度偏差值超出規定範圍並被保持20分鐘以上時，則上述兩種情況都將進行兩個檔之間的運轉轉換。

正常供氣溫度的持續控制



備註：溫度控制方法的詳細說明

(1) 在正常運轉啟動時(即接通機組電源，TEST或PTI→轉換到正常運轉時，或在除霜之後)，運轉檔一開始即被設定。

(2) 如果控制溫度超出爲各運轉檔所設定的溫度範圍，則就轉換一檔進行運轉。

(3) 根據控制隨動閥的開度、設定過熱度和溫度偏差狀況也可能會從容量控制轉換到容量控制＋低熱運轉。

(a) 容量控制→容量控制＋低熱的轉換必要條件

1) 狀況"設定過熱度＞預先設定值(包括控制隨動閥的開度＞預先設定值)"和"溫度偏差＜預先設定值"被持續10分鐘時。

2) 狀況"溫度偏差＜預先設定值"被持續20分鐘時。

(b) 容量控制＋低熱→容量控制的轉換必要條件

1) 狀況"設定過熱度＜預先設定值(包括控制隨動閥的開度＜預先設定值)"和"溫度偏差＞預先設定值"被持續10分鐘時。

2) 狀況"溫度偏差＞預先設定值"被持續20分鐘時。

(4) 當狀況"溫度偏差＜預先設定值"和"控制隨動閥開度＞預先設定值"成立時，則將進行"容量控制＋低熱→低熱運轉"的轉換。

(5) 在除霜運轉結束後立即進入初始運轉檔，但當檔位轉換條件成立時，運轉就立即被轉換到除霜運轉開始前的運轉檔。即可以跳過該運轉檔，如⓪→②或③→①。

(6) 在機組電源被關掉時間不到2小時，然後又開始正常運轉的情況下，根據檔位轉換條件，將立即從初始運轉檔轉換到機組電源被關掉前的運轉檔。即可以跳過該運轉檔，如⓪→②或③→①。

(b) "FROZEN(冷凍)"方式——設定點溫度：低於－5℃

在冷凍方式下運轉時，本致冷機利用回氣和供氣溫度兩者中較高溫度來控制集裝箱的內部溫度。含有三個運轉檔：即(0)全致冷、(1)低循環(風扇工作)和(2)低熱運轉，以此保持設定點的溫度。當回氣和供氣溫度兩者中較高溫度高於設定點溫度時，控制器使初始運轉檔保持在全致冷運轉狀態。

另一方面，當回氣和供氣溫度兩者中較高溫度低於設定點溫度時，初始運轉檔就被設定在低循環運轉狀態。其後，當偏離設定點的溫度超出各運轉檔的範圍時，則就被轉換到下一檔進行運轉。

正常—供氣/回氣較高溫度ON/OFF控制

O:ON

運轉檔 \ 溫度		範圍內									各繼電器相閉								
		°F −10.8	−9.0	−7.2	−5.4	−3.6	−1.8	SET	+1.8	+3.6	+5.4 °F	MC	CFR	FRH	FRL	HR1	HR2	EEV	MV	S5
		°C −6	−5	−4	−3	−2	−1		+1	+2	+3 °C									
−	初始設定	小循環							全致冷											
⓪	全致冷											○	○	○	○			○		○
①	低循環														○					
②	低熱													○			○			

備註：溫度控制方法的詳細說明

(1) 在正常運轉啟動時(即接通機組電源，TEST或PTI→轉換到正常運轉時，或在除霜後)，運轉檔一開始即被設定。

(2) 如果控制溫度超出各運轉檔的設定溫度範圍，即轉換一檔進行運轉。

(3) 蒸發器風扇控制

在本致冷機組運轉中，除了除霜時之外蒸發器風扇將始終旋轉。

本風扇運轉控制的詳細說明如下：

(a) 在致冷運轉的初始啟動時

根據致冷運轉初始啟動時的運轉條件，蒸發器風扇延遲20秒左右啟動。這個延遲啟動不用於熱運轉和加熱運轉。

(b) 在CHILL(冷藏)方式下運轉時

蒸發器風扇始終在高速下旋轉。

(c) 在FROZEN(冷凍)方式下運轉時

當供氣和回氣溫度兩者中較高溫度下降並達到－5℃時，蒸發器風扇馬達將從高速轉換到低速運轉；而當回氣和供氣溫度兩者中較高溫度昇高並達到－3℃時，則從低速轉換到高速運轉。

(d) 除霜後

當在除霜後需要進行致冷運轉時，蒸發器風扇將延遲4分鐘啟動。

(4) 冷凝器風扇控制

在致冷運轉中冷凝器風扇始終轉動。

(5) **電子膨脹閥控制**

MMCC ⅢA備有許多致冷劑控制功能，例如致冷能力控制、耗電控制和高壓控制，所有這些控制是通過調節電子膨脹閥的開度而實現的。

(a) 致冷能力控制

MMCC ⅢA調節到某一過熱程度，這個過熱程度必須適用於由PID動作進行電子膨脹開度控制所給定的開度條件，因此致冷能力與所需要的最小電力下的熱負荷相一致。

在冷藏方式下，把致冷能力調節到最佳狀態能改善回氣溫度的穩定性。

(b) 耗電控制

當耗電增加時(在下拉運轉等時)，MMCC ⅢA能控制電子膨脹閥的開度使耗電不超過規定值，這樣可以防止船舶的發電容量過載。

(c) 高壓控制

如果由於周圍環境溫度高等原因而使高壓異常昇高，則本機組會停止運轉，從而導致貨物損壞。爲防止出現這樣的問題，MMCC ⅢA控制電子膨脹閥的開度以防止高壓超過規定範圍，保持機組繼續運轉。

(6) 除霜

爲了排除不必要的除霜運轉，僅當致令機組滿足除霜條件，即蒸發器出口傳感器(TDK)檢測到的溫度低於10℃時才開始自動或手動除霜。

當TDK傳感器上的溫度昇高並達到15℃或除霜時間從開始起達60分鐘時，除霜被終止。

(a) 自動除霜

1) 初始狀況

僅當蒸發器上結有霜的情況下才開始除霜，利用預約定時器(3-6-9-12小時)可根據所需的除霜時間自動進行除霜；或利用四位置手動可調除霜定時器(可調間隔爲3、6、9或12小時)進行除霜。但是，第一次除霜開始時間與可調除霜定時器或程式定時器的設定無關，自運轉開始起經過三小時後便開始第一次除霜。

當滿足除霜條件時，除霜開始定時器便開始計時，累加除霜狀況的小時數。

2) 除霜

當本致冷機組處於致冷運轉中時，在壓縮機被停止後執行除霜；而當處於風扇或空氣循環運轉的情況下，在蒸發器風扇馬達停止後執行除霜。

全部蒸發器盤形管的加熱器和洩放軟管的加熱器都被用於除霜作業。

3) 終止

當蒸發器出口傳感器(TDK)上的溫度昇到15℃時，或者當電子定時器已達60分鐘時，除霜被終止。之後，控制器將從初始運轉檔開始溫度控制。

(b) 手動除霜

當蒸發器上結霜時若按下規定的鍵則隨時可開始手動除霜。其他動作順序與上述自動除霜完全相同。

12.6.2 自動診斷功能

(1) 部件檢查功能

在機組開關被置於ON位置後，MMCC ⅢA便按照12.12節表中"電源接通"一項所示開始檢查各部件。如果有任何異常現象出現，警報LED將點亮。與此同時 7 段LED顯示出警報代碼。

如果不能進行正常運轉，將依輔助的後備功能採取適當的措施使機組啟動運轉，或機組被强制停止。

(2) 運轉中的檢查功能

MMCC ⅢA按照12.12節表中"運轉"一項所示不斷地檢查運轉狀態。如果有任何異常現象出現，警報LED將點亮。與此同時 7 段LED顯示出警報代碼。

如果正常運轉不能繼續下去，將依輔助的儲備功能採取適當的措施以保持機組運轉，或機組被强制停止。

(3) 安全保護功能

(a) 致冷劑高壓保護

如果致冷劑高壓異常昇高，則控制器將直接切斷壓縮機。

過 3 分鐘後，當高壓降到正常大小時便自動地重新開始運轉，此功能僅執行 3 次。

(b) 致冷劑低壓保護

如果致冷劑低壓降到異常低，則控制器將直接切斷壓縮機和冷凝器風扇。

3 分鐘後當低壓上昇到正常範圍內時便自動地重新開始運轉，僅三次。

(c) 壓縮機過熱保護

如果壓縮機排出管的溫度異常昇高，則控制器將直接切斷壓縮機和冷凝器風扇。

(d) 壓縮機馬達過電流保護

如果馬達的工作電流持續數秒鐘大於正常範圍，則控制器將直接切斷壓縮機和冷凝器風扇。

(e) 壓縮機馬達反轉保護

在壓縮機運轉前控制器檢查電源的相序，並以適當的動作使壓縮機馬達始終保持正確的旋轉方向。

(f) 除霜終止保護

如果從除霜開始起經過60分鐘後除霜尚未完成，則除霜將被電子定時器强制終止。

(g) 控制溫度不正常

在運轉開始或除霜終止後的"IN RANGE"(範圍內)運轉中，如果控制濕度偏離規定範圍的時間超過 2 小時，則控制器將判斷它爲警報狀態，與此同時 7 段LED顯示出警報代碼。

(4) 失效—保護和儲備功能

下列失效—保護和儲備功能用於防止貨物變壞和故障時的警報方式指示。

(a) 供氣和回氣溫度傳感器故障

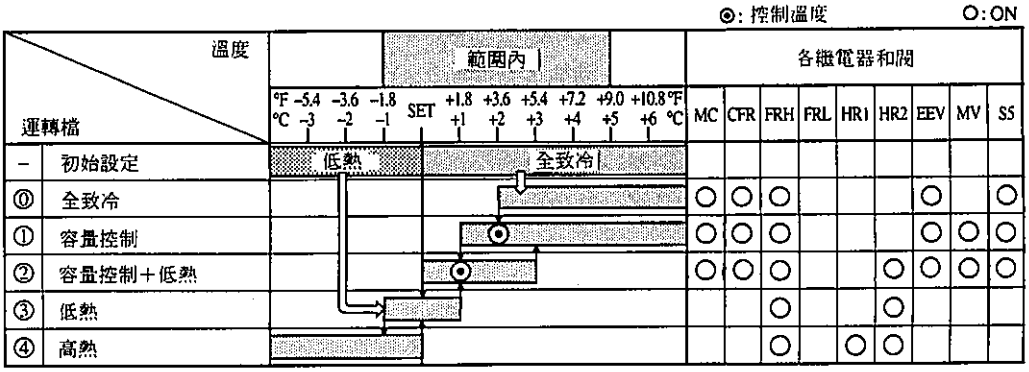
1) 如果回氣或供氣溫度傳感器中之一有故障

如果空氣溫度傳感器中之一有故障，則控制器將自動轉換到使用其他運作中之溫度傳感器的"失效－保護溫度控制"狀態。這個失效－保護功能所維持的溫度控制非常接近正常的溫度控制。失效－保護的溫度控制之詳細原理如下圖所示。

失效—保護溫度控制

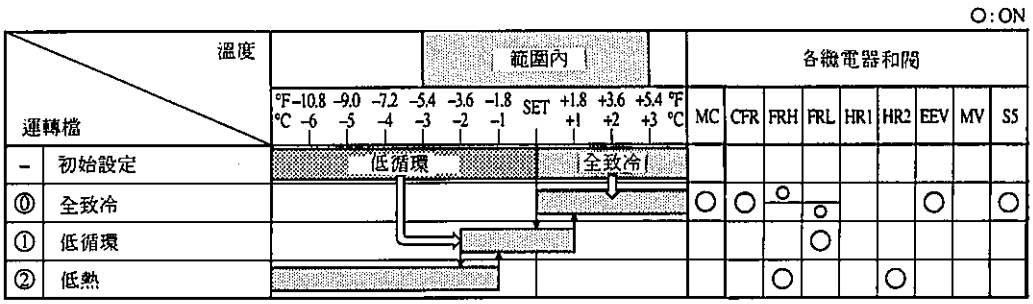
—冷藏方式—

失效—保護—回氣溫度控制(供氣傳感器故障)

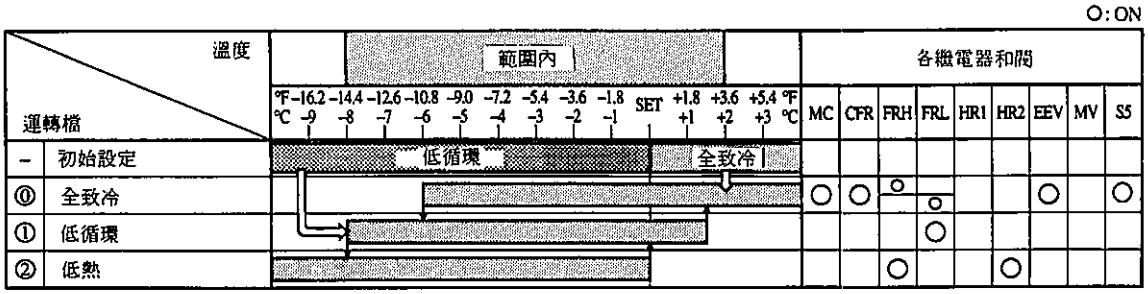


—冷凍方式—

供氣傳感器故障—回氣溫度控制



回氣傳感器故障—供氣溫度控制



2) 如果兩個空氣溫度傳感器都出故障

當兩個空氣溫度傳感器都出故障時，防止故障動作將取決於運轉方式。

ⅰ) 冷藏方式下(設定點溫度：－5℃或更高)……

致冷機組將在低的風扇速度下運轉，不進行除霜運轉。

ⅱ) 冷凍方式下(設定點溫度：低於－5℃)……

致冷機組將被强制保持在全致冷檔運轉，除霜仍可進行。

(b) 蒸發器出口傳感器(TDK)

如果蒸發器出口傳感器(TDK)有故障，則除霜將由60分鐘電子定時器强制終止。

除霜條件的判斷將由裝在TDK傳感器內的供氣溫度傳感器(TSUP)進行，當供氣溫度傳感器上的溫度低於10℃時就能開始除霜。

當回氣溫度傳感器(TRET)上的溫度大於30℃時除霜能被終止。

(c) 致冷劑高壓傳感器故障

如果致冷劑高壓傳感器出現故障，則高壓控制功能和安全保護功能變爲無效，當周圍環境溫度低於50℃時，全部冷凝器風扇接通保持正常運轉。如果周圍環境溫度高於50℃，則運轉停止以防止發生損傷致冷機組的可能性。

(d) 致冷劑低壓傳感器

如果致冷劑低壓傳感器出現故障，則蒸發器的過熱控制就不起作用。在此情況下，電子膨脹閥的開度將根據設定點溫度被調節到預先設定的大小，以此保持運轉。

(e) CPU(中央處理機)通訊故障

在CPU通訊故障的情況下，在故障發生前所獲得的數據被用於操作系統工作。

如果在"電源接通"時CPU通訊已存在故障，則機組將不啟動。

(f) 電流傳感器故障(CT1、CTM)

如果電流傳感器(CT1)有故障，控制器便停止檢測電流而機組仍繼續正常運轉。

如果壓縮機用的電流傳感器(CTM)有故障，控制器便停止檢測電流而機組仍繼續正常運轉。

12.6.3 集裝箱航前檢查(PTI)功能

用方式選擇鍵選擇PTI方式則MMCC ⅢA便能進行MIN.和MAX.兩種航前檢查：MIN.—PTI主要用於檢查各部件，MAX.—PTI用於檢查包括運轉狀況在內的各功能。

(1) MIN.—PTI功能

這個功能將根據"PTI"檢查號碼NO. 1～15(見12.11.7節)檢查運轉狀況，如果發現任何異常現象則PTI將終止動作。

(2) MAX.—PTI功能

這個功能將根據"PTI"檢查號碼NO. 1～19(見12.11.7節)檢查運轉狀況，如果發現任何異常現象則PTI將終止動作。

標準Max.—PTI程序如下圖所示。

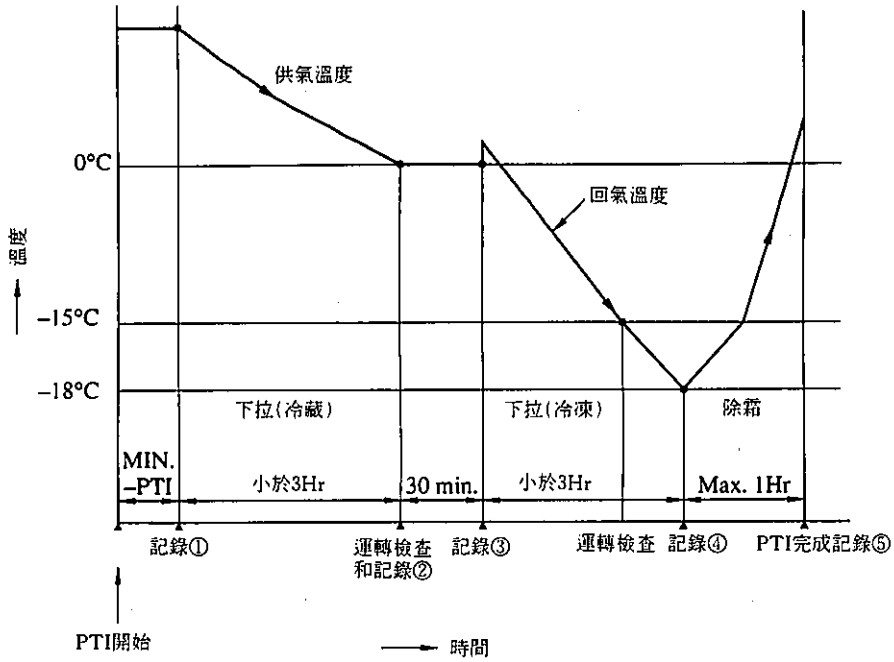


圖34

12.6.4 試驗功能

用方式選擇鍵選擇試驗方式則MMCC ⅢA便能手動操作檢查下列各部件的功能。(詳細請見12.11.8節)

(1) 顯示器
(2) 壓縮機
(3) 冷凝器風扇和馬達
(4) 蒸發器風扇和馬達(高速)
(5) 蒸發器風扇和馬達(低速)
(6) 加熱器
(7) 電子膨脹閥
(8) 控制隨動閥
(9) 溫度記錄器
(10) 反相繼電器
(11) 船級社共同檢查(HPT, LPT)

12.7 顯示和輸入控制

12.7.1 類比擬和數位輸入處理功能

MMCC ⅢA處理各種輸入數據，例如溫度、壓力、電壓、電流及開關、操作鍵輸入主控制器的數據等，並管理這些數據。

12.7.2 顯示控制功能

MMCC ⅢA利用7段LED(發光二極管)顯示出運轉方式、設定點溫度、集裝箱內部溫度、各種數據。

12.7.3 直流電源控制功能

在停電時，MMCC ⅢA能依助內置電池繼續工作。

此電池還支撐記憶裝置工作，可使存在記憶裝置內的各種操作數據和溫度記錄保存3天。

12.8 數據控制

運轉和運輸資料記錄功能

MMCC IIIA備有128K byte容量的記憶裝置，能夠記錄各種運轉和運輸資料。

(1) 工廠設定資料(輸入)

這是在機器出廠前由廠家設定的資料。

(a) 集裝箱號碼(例如: MHIU 1234567)

(b) 日曆 (例如: JAN-30-98-10: 30〈1998年1月30日10: 30〉)

(2) ID(識別)資料(輸入)

航行開始前由操作者設定的各種數據。

(a) 設定點溫度(例如: +00.0℃)

(b) 通風口位置(例如: 180CMH〔米³/小時〕

(c) 物品 (例如: ORANGE)

(d) 裝貨日期 (例如: JAN-30-98)

(e) 航次 (例如: 10)

(f) 船名 (例如: MHI-MARU)

(g) 裝貨港口 (例如: TOKYO〈東京〉)

(h) 卸貨港口 (例如: NAGOYA〈名古屋〉)

(i) 操作者(例如: M. MITSUBISHI〈三菱君〉)

(j) 加註 (例如: 少於70個字)

(3) PTI資料(輸出)

當MIN. PTI和MAX. PTI執行完成或中斷時的各種數據，用携帶式電腦和打印機能方便地獲得這類數據。

(a) MAX. PTI資料

PTI檢查號碼1～15(12.11.7節)的檢查結果為MIN.PTI資料。

(b) MAX. PTI資料

PTI檢查號碼1～19(12.11.7節)的檢查結果為MAX. PTI資料。

(4) 運轉和運輸資料

(a) 航行資料

這是在正常運轉中每隔1小時記錄的各種數據。

1) 日期和小時(例如: 30-11表示30日11時)

2) 運轉方式(例如: C2)

3) 供氣溫度(例如: +00.0)

4) 回氣溫度(例如: +01.0)

(b) 停電時的運輸數據

當機組斷電時每隔1小時記錄一次此數據。

(c) 特殊時機的資料

這是在下列狀況下記錄的資料。

1) 電源被接通或關斷。

2) 除霜被接通或關斷。

3) 設定點溫度被改變。

4) 改變或設定ID數據。

5) 航行開始設定

6) MER(Mitsubishi Electronic Recorder)校準設定

7) 機組被關掉後經過三天時

8) 警報發出或解除

9) 電池警報發出或解除

除了上述資料外，還隨時記錄下列資料。

1) 事故發生的日期和時間(例如: APR-30-11：30〈4月30日11：30〉)

2) 事件代碼 (例如: B1)

3) 設定點溫度 (例如: +10.0)

4) 供氣和回氣溫度 (例如: +10.0、+11.0)

(d) 警報資料

在發出警報時記錄這類資料。

1) 發出警報的日期和時間(例如：APR-30-11：30 〈4月30日11：30〉)
2) 警報代碼 (例如：0107)
3) 警報訊息 (例如：SRAM故障)
4) 運轉方式 (例如：C1)
5) 供氣溫度 (例如：+00.0)
6) 回氣溫度 (例如：+01.0)
7) 外圍溫度 (例如：+30.0)
8) 高的致冷劑壓力 (例如：1250)
9) 低的致冷劑壓力 (例如：200)
10) 電流(CT1) (例如：15.0)
11) 電壓(PT1) (例如：440)

12.9 溫度記錄器

在CHILL(冷藏)方式下，MMCC ⅢA自動記錄設定點高於−5℃時供氣溫度；在FROZEN(冷凍)方式下，自動記錄設定點低於−5℃時的回氣和供氣中之較高溫度。

記錄圖由時鐘機構傳動(石英晶體式鐘)。

MMCC ⅢA適宜使用PSD 217C (Rev. A)31天Partlow記錄圖，或者相當的−25℃+25℃範圍內的壓力感應記錄紙。

利用試驗方式能方便地進行零位調整，而與集裝箱內部的實際溫度無關。

備註(1) 外形圖請見圖32。

(2) 有關MER零位校準請見MER.方式 ↳ (12.11.9)。

12.10 同外部設備的資料通訊

携帶式電腦用數據通訊端口。

通過串行通訊端口在MMCC ⅢA和携帶式電腦之間能進行全部資料的傳送，包括日曆、集裝箱號碼和ID資料，還能顯示和檢索各種運轉資料。有關詳細內容請參閱携帶式電腦的說明書。

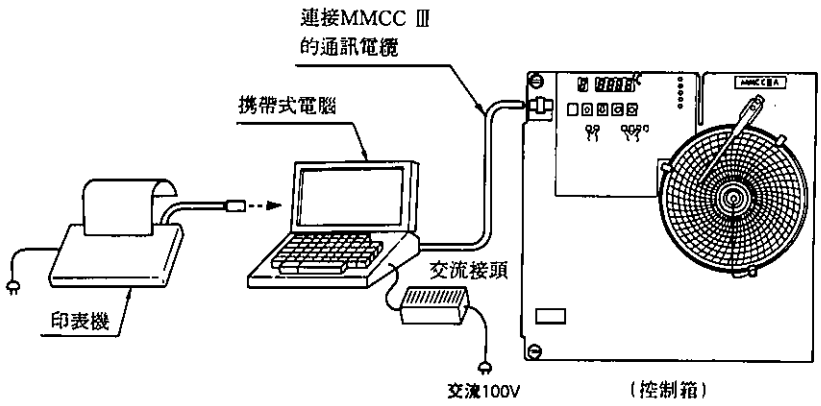


圖35 携帶式電腦系統

12.11 MMCC ⅢA的操作和顯示

12.11.1 鍵盤

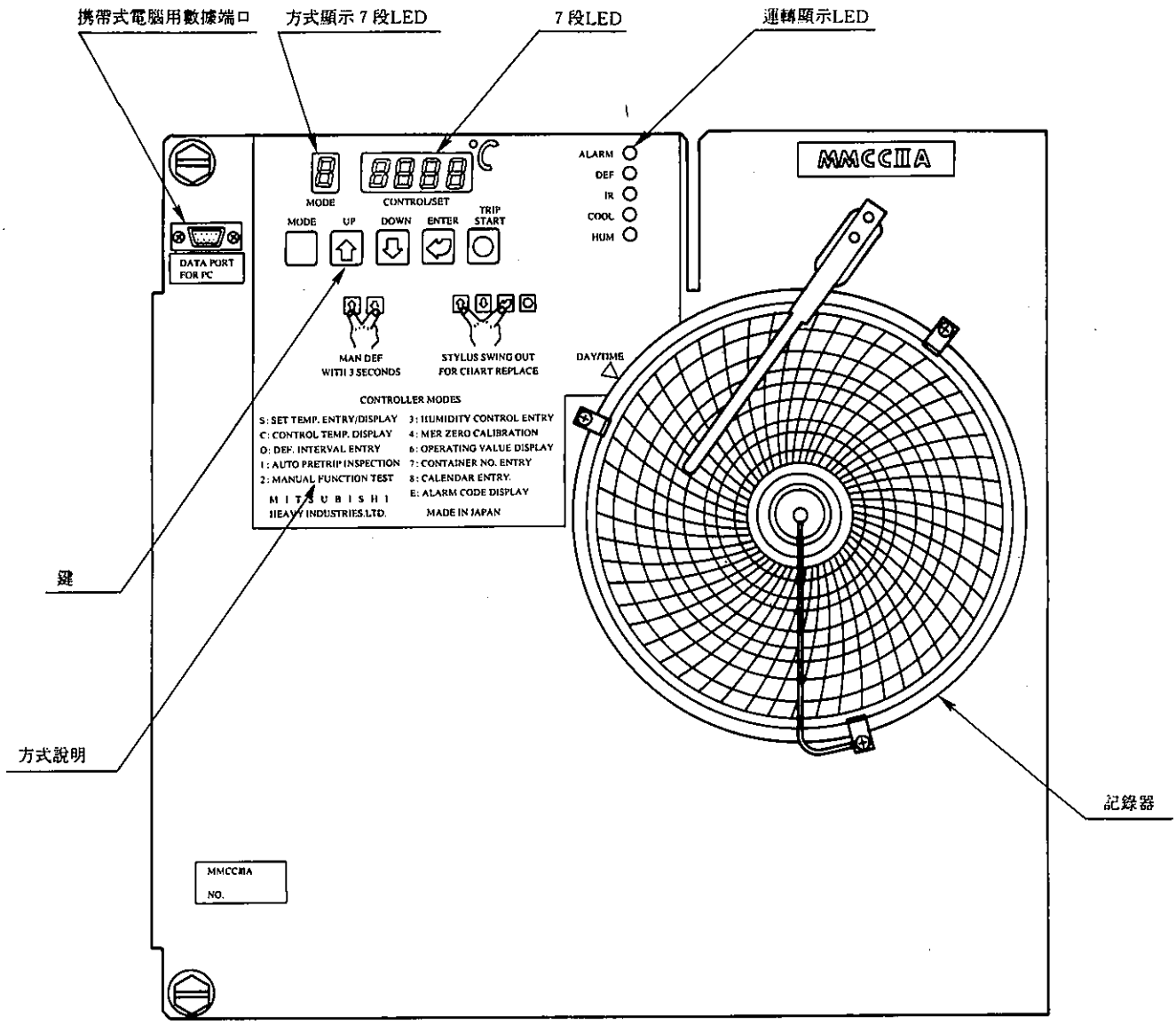


圖36

12.11.2 鍵操作和功能

(1) MODE(方式)鍵

(a) 當交流電源被接通後就能使用MODE鍵，並完成初始診斷。使用MODE鍵可以從下表所列出的11種不同的方式中選擇任意一種方式。

方式	用途	說明
	設定或顯示溫度	變更或輸入設定溫度。
	顯示控制溫度	使7段LED顯示出控制溫度。
	設定或顯示除霜定時器	設定或輸入用於除霜定時器的手動自動開關。
	自動PTI運轉	選擇和操作MIN. PTI或MAX. PTI功能。
	手動試驗運轉	進行手動操作運轉，最多可顯示部件的12個I/O狀態。
	濕度控制開始/停止及濕度設定和開始	輸入濕度控制開始/停止，改變或輸入設定的濕度。(選購件)
	MER 0℃校準	0℃校準，改變或輸入溫度。
	顯示運轉數據	最多可顯示22項本機組的運轉數據，例如溫度、電流消耗、電壓等。
	集裝箱號設定	設定集裝箱號。
	日歷設定	設定日歷。
	顯示當前的警報訊息	最多可顯示10個當前的警報代碼。

(b) 本MODE鍵也具有取消功能：當操作者(從正常運轉的情況下)選擇了一個方式並進入了PTI或TEST運轉時，他能用這個鍵返回到正常運轉和顯示狀態。

(c) 當交流電源被關斷後，MODE鍵可用於啟動控制器；而當控制器被啟動後由內藏的電池供電工作時，這個鍵還被用於從S、C、0、3、4、6、7、8、E中選擇特定的方式。

方式1、2不是供機組運轉使用的，方式3是供選購的，因此這些方式將被跳過。

(2) ⏫ (UP)鍵

(a) 用於加大設定數據。

(b) 用於選擇和啟動MIN. PTI。

(c) 用於開始濕度控制(即輸入設定的濕度改變畫面)。

(3) ⏬ (DOWN)鍵

(a) 用於減小設定數據。

(b) 用於選擇和啟動MAX. PTI。

(c) 用於停止濕度控制。

但是，同時按下 ⏫ 和 ⏬ 鍵3秒以上將會開始手動除霜運轉。

(4) ⏎ (ENTER)鍵

(a) 用於改變各方式。

(b) 用於輸入設定數據。

(c) 用於操作部件進行試驗運轉。

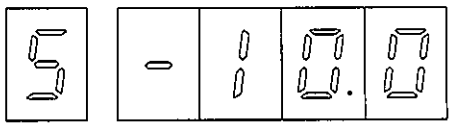
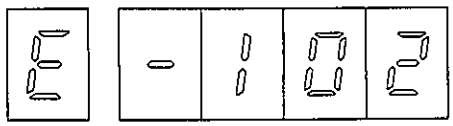
但是(i)當使用船級社的試驗方式時這個鍵將不予使用。

(ii) ⏎ 和 ⏬ 鍵將同時使蒸發器風扇Hi/Lo功能連續生效。

(iii) 同時按下 ⏎ 和 ⏫ 鍵3秒以上將會使溫度記錄器的記錄針擺出。

12.11.3 初始診斷顯示和正常顯示

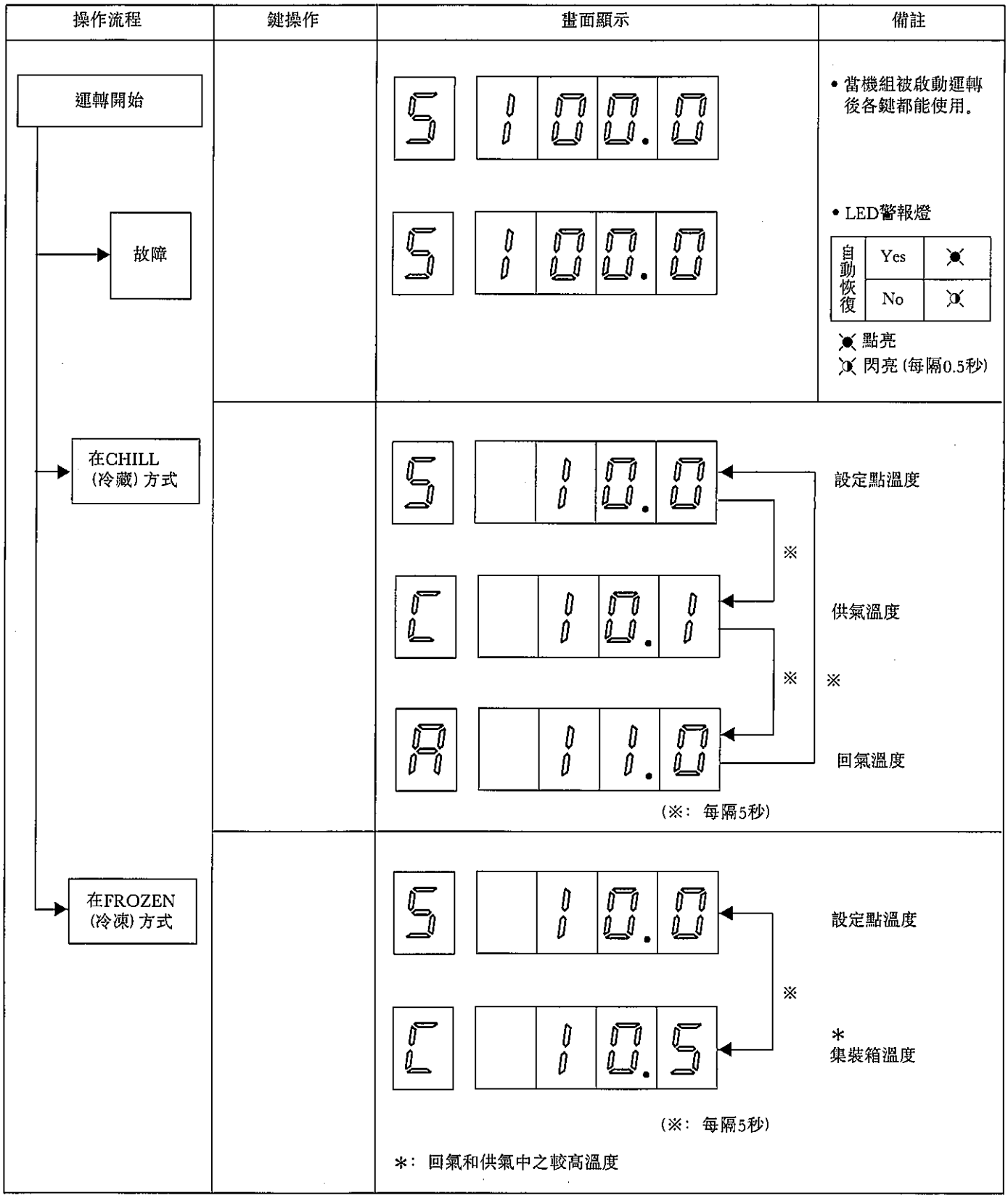
(1) 初始診斷顯示

操作流程	鍵操作	顯示	備註
UNIT開關接通			• 顯示出方式和設定溫度。
出現嚴重錯誤			• 繼續顯示

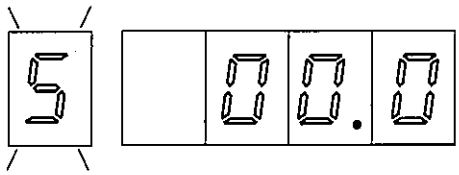
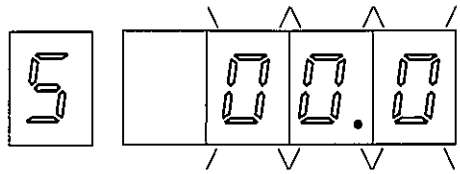
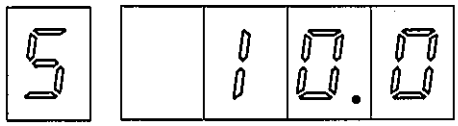
備註：(1) LED警報燈每0.5秒閃亮一次。DEF、IR、COOL和HUM LED將熄滅。

(2) 初始自動診斷將被進行10秒鐘。

(2) 正常顯示


操作流程
鍵操作
畫面顯示
備註
運轉開始
故障
在CHILL
(冷藏) 方式
在FROZEN
(冷凍) 方式
S 100.0
S 100.0
• 當機組被啟動運轉後各鍵都能使用。
• LED警報燈
自動恢復
Yes
No
點亮
閃亮 (每隔0.5秒)
S 10.0
C 10.1
A 11.0
※
※
※
設定點溫度
供氣溫度
回氣溫度
(※: 每隔5秒)
S 10.0
C 10.5
※
設定點溫度
*
集裝箱溫度
(※: 每隔5秒)
*: 回氣和供氣中之較高溫度

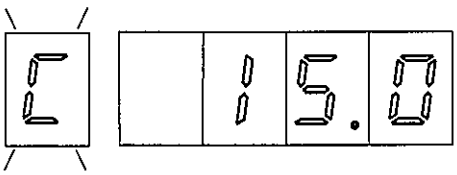
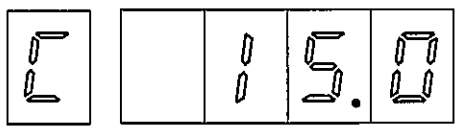
12.11.4 溫度設定和顯示方式

操作流程	鍵操作	畫面顯示	備註
溫度設定和顯示	"MODE"鍵		如果溫度已被設定好，則在畫面上就顯示出此溫度。
改變溫度設定	"ENTER"鍵 "UP"或"DOWN"鍵		每按撳一下 ⏫ 或 ⏬ 鍵則所顯示的溫度將昇高或降低0.1℃。 • 按着一個鍵保持不放達一秒鐘或更長時間，則所顯示出的溫度將昇高或降低1℃。
設定溫度輸入	"ENTER"鍵		設定溫度的可變範圍為－30～＋25℃。

備註：(1) 如果在30秒內不操作任何鍵，則畫面將自動地返回到正常顯示狀態。

(2) 在溫度設定和顯示方式下按下MODE鍵，顯示將立即返回到正常顯示狀態。

12.11.5 控制溫度顯示方式

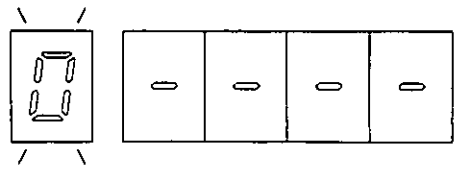
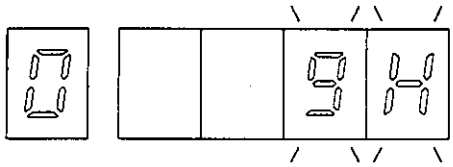
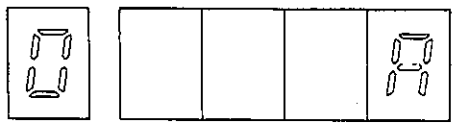
操作流程	鍵操作	畫面顯示	備註
控制溫度顯示	"MODE"鍵		
	"ENTER"鍵		

備註：(1) 在 C 閃亮中，如果在30秒內不操作任何鍵，則畫面將自動地返回到正常顯示狀態。

(2) 為了返回到正常顯示狀態，必須用MODE鍵清除"C"。

12.11.6 除霜定時器設定和顯示方式

本機組的除霜定時器可用於自動或固定(3H、6H、9H或12H)方式進行除霜，以此防止不必要的除霜。如果選定自動方式，則本系統就把最後一次的除霜時間跟當前的一次進行比較並自動地設定最佳的除霜時間間隔(定時器)。

操作流程	鍵操作	畫面顯示	備註
設定除霜定時器	"MODE"鍵		
"變更除霜定時器"	"ENTER"鍵 "UP"或"DOWN"鍵		如果定時器已被設定好，則在畫面上將顯示出定時器時間間隔。 ⏫或⏬鍵被用於設定12H↔9H↔6H↔3H ↔A(自動)的除霜時間。
"輸入除霜定時器"	"ENTER"鍵		

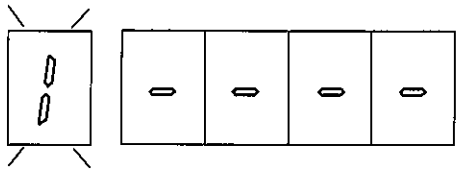
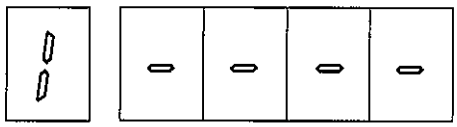
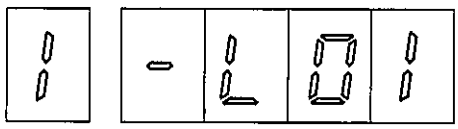
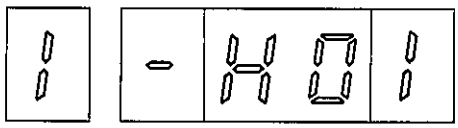
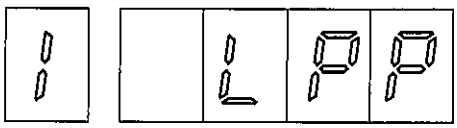
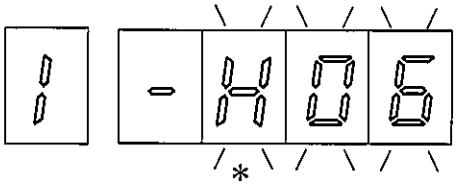
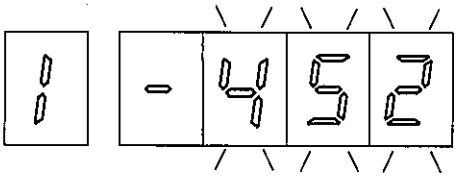
備註：(1) 如果在30秒內不操作任何鍵，則上述畫面將自動地返回到正常顯示狀態。

(2) 如選定"🚗"，則內藏的程式會自動地改變除霜時間，即12H↔9H↔6H↔3H。

12.11.7 自動PTI方式

本方式用於自動地診斷控制器和致冷機組的工作狀態。當PTI方式被指示在操縱板上時便進行此診斷動作。

本方式首先檢查各部件，即執行MIN. PTI。MAX. PTI包括MIN. PTI檢查和運轉檢查。自動診斷中的鍵操作和顯示如下表所示。

操作流程	鍵操作	畫面顯示	備註
自動PTI	"MODE"鍵		
選定PTI	"ENTER" 鍵		
MIN. PTI	"UP"鍵		MIN. PTI 顯示1～15號。
MAX. PTI	"DOWN"鍵		MAX. PTI 顯示1～19號。
PTI正常結束		 *	*：顯示出"L" (MIN. PTI) 或"H" (MAX. PTI)。
PTI不正常結束		 * 	• PTI運轉被取消 • 見備註(4)

備註：(1) 如果在30秒內不操作任何鍵，則"自動PTI"和"PTI選擇"畫面將自動返回到正常顯示狀態。

(2) 使用MODE鍵能把"PTI不正常結束"畫面轉換到正常顯示狀態。

(3) 檢查規範詳見後面頁上所述。

(4) 如PTI為不正常結束，LED上每隔 5 秒鐘交替地以號碼顯示出檢查號和警報代碼。

PTI 檢查規範

檢查號	檢查周期	檢查項目	目標動作
1	12秒	CT1和CTM的檢查 (主電路用電流傳感器) CT1：〈#350〉 CTM：〈#356〉 CT1：〈#351〉 CTM：〈#357〉	1) 在全部負被切斷的狀態下，檢查通過CT1和CTM的電流是否低於規定值。 2) 在MGC1或MGC3：ON、FRH：ON、CFR：ON和MC：ON的狀態下檢查CT1和CTM可能的增量。 3) 在2)中全部項目被關斷的狀態下檢查CT1和CTM可能的減量。
2	5秒	檢查壓縮機馬達是否可能斷路或短路。〈#412〉〈#411〉	在MGC1或MGC3接通及MC接通的狀態下檢查CTM可能的增量。 在檢查後MC被切斷。
4	20秒	檢查冷凝器風扇馬達(Hi)是否可能斷路或短路。〈#422〉〈#421〉	在CFR接通及MGC1或MGC3接通的狀態下檢查CT1可能的增量。 檢查後繼電器被切斷。
6	120秒	檢查蒸發器風扇馬達(Hi)是否可能斷路或短路。〈#452〉〈#451〉	在FRH接通及MGC1或MGC3接通的狀態下檢查CT1可能的增量。 檢查後繼電器被切斷。
7	120秒	檢查蒸發器風扇馬達(Lo)是否可能斷路或短路。〈#462〉〈#461〉	在FRL接通及MGC1或MGC3接通的狀態下檢查CT1可能的增量。 檢查後繼電器被切斷。
8	10秒	檢查蒸發加熱器(Hi)是否可能斷路或短路。〈#472〉〈#471〉	在HR1、HR2接通及MGC1或MGC3接通的狀態下檢查CT1可能的增量。 檢查後繼電器被切斷。
9	10秒	檢查蒸發加熱器(Lo)是否可能斷路或短路。〈#482〉〈#481〉	在HR2接通及MGC1或MGC3關斷的狀態下檢查。 檢查後繼電器被切斷。
10	5秒 (最長305秒)	HPT/LPT間的差值 (高壓/低壓傳感器)〈#332〉	在MV/EEV完全打開的狀態下檢查LPT和HPT間的差值。
11	最長180秒	MV關閉檢查〈#205〉	在MC：ON、CFR：ON、MV/EEV：全閉的狀態下檢查在規定的時間間隔內低壓是否低於規定值。
12	10秒	MV開啟檢查〈#492〉	在上述檢查號11的檢查完成後，立即檢查MV全開狀態下的低壓可能的增量。
13	最長180秒	EEV關閉檢查〈#205〉	見檢查號11。
14	10秒	EEV開啟檢查〈#491〉	在上述檢查號13的檢查完成後，立即檢查EEV全開狀態下的低壓可能的增量。
15	最長90秒	MER(馬達和電位計)〈#601〉	在處理0℃運轉記錄後檢查電位計值。
16	5分	混有空氣〈#904〉	在壓縮機運轉的狀態下MV/EEV完全關閉後，在CFR：ON的狀態下檢查高壓和外圍溫度。 外圍溫度5～38℃的任何部份將被跳過。

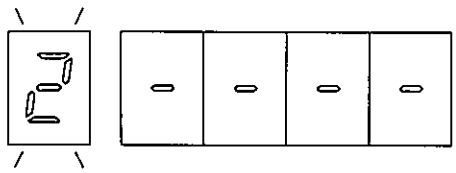
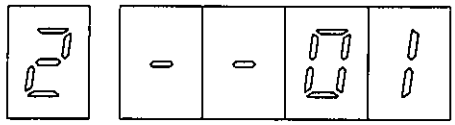
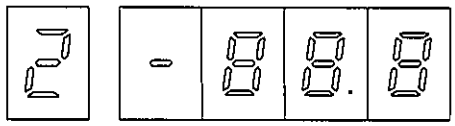
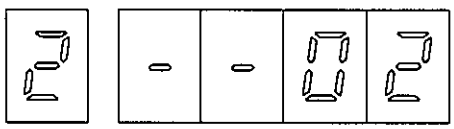
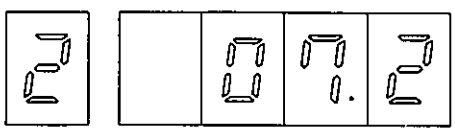
備註：(1) 在本機組中檢查號3和5將被跳過。

檢查號	檢查周期	檢查項目	目標動作
17	最長3.5小時 (取決於下拉時間)	〈#900〉 〈#901〉 〈#902〉 〈#903〉 在0℃下運轉 (從開始降壓起動) 〈#314〉 〈#317〉	1) 在全致冷、外圍溫度5～38℃和冷凝器風扇工作的狀態下，檢查集裝箱內部溫度達到0℃時的致冷劑量。 2) 檢查達到0℃的下拉時間(3小時內)。 3) 在全致冷和蒸發器風扇啓動後立即檢查集裝箱內部供氣溫度(TSUP)和回氣溫度(TRET)之間的關係。 4) 在上述3)相同的條件下檢查蒸發器出口溫度(TDK)和回氣溫度(TRET)之間的關係。 5) 在0℃下連續運轉30分鐘。
18	最長3小時	〈#900〉 〈#901〉 在－18℃下運轉 〈#903〉 〈#314〉 〈#317〉	1) 在全致冷、外圍溫度5～38℃和冷凝器風扇工作的狀態下，檢查當控制溫度達到－15℃時的致冷劑量。 2) 檢查控制溫度從0℃下降到－18℃的下拉時間(3小時內)。 3) 在3)和4)相同的條件下檢查是否能保證0℃運轉。
19	最長60分鐘 (大約)	除霜運轉	檢查除霜開始/終止和長時間除霜的各狀態。

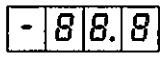
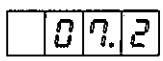
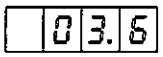
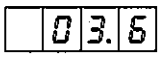
備註：(1) 在MIN. PTI中將進行檢查號1～15；在MAX. PTI中將進行檢查號1～19。

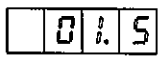
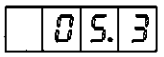
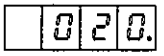
12.11.8 手動試驗方式

本方式是以手動操作各部件動作，其I/O狀態顯示在畫面上。當操作者指定了操縱板上的TEST方式後本試驗功能將生效，然後便將依次地顯示出輸出、負荷試驗和輸入試驗的結果。

操作流程	鍵操作	顯示	備註
試驗功能	"MODE"鍵		
試驗顯示初始功能	"ENTER"鍵		
顯示出號碼 1	"ENTER"鍵		
顯示出號碼 2～13	"UP"鍵 或 "DOWN"鍵		--02  直到 --13 "UP"或"DOWN"鍵
顯示出號碼 2 上的資料	"ENTER"鍵		當按下並保持按下"ENTER"鍵時，僅顯示出資料。

備註：(1) 典型顯示畫面和控制器輸出狀態如下頁所示。

號碼	試驗項目	控制器輸出狀態 至ENTER鍵
01	顯示	1. 方式顯示 LED：2 2. 溫度顯示 LED：  （在輸出接通的狀態下） 3. 全部LED指示燈點亮 （COOL、DEF、IR、 ALARM、HUM） 4. IRm、DRm：ON
02	壓縮機	1. 方式顯示 LED：2 2. 溫度顯示 LED：  (A) （工作電流消耗，CTM） 3. LED指示燈：COOL點亮 4. MGC1m：ON MCLm：ON EEV：20% 開度
04	冷凝器風扇和 馬達	1. 方式顯示 LED：2 2. 溫度顯示 LED：  (A) （工作電流消耗，CT1） 3. LED指示燈：OFF 4. MGC1m：ON CFR1m：ON
06	蒸發器風扇(Hi) 和馬達	1. 方式顯示 LED：2 2. 溫度顯示 LED：  (A) （工作電流消耗，CT1） 3. LED指示燈：OFF 4. MGC1m：ON EFR1m：ON

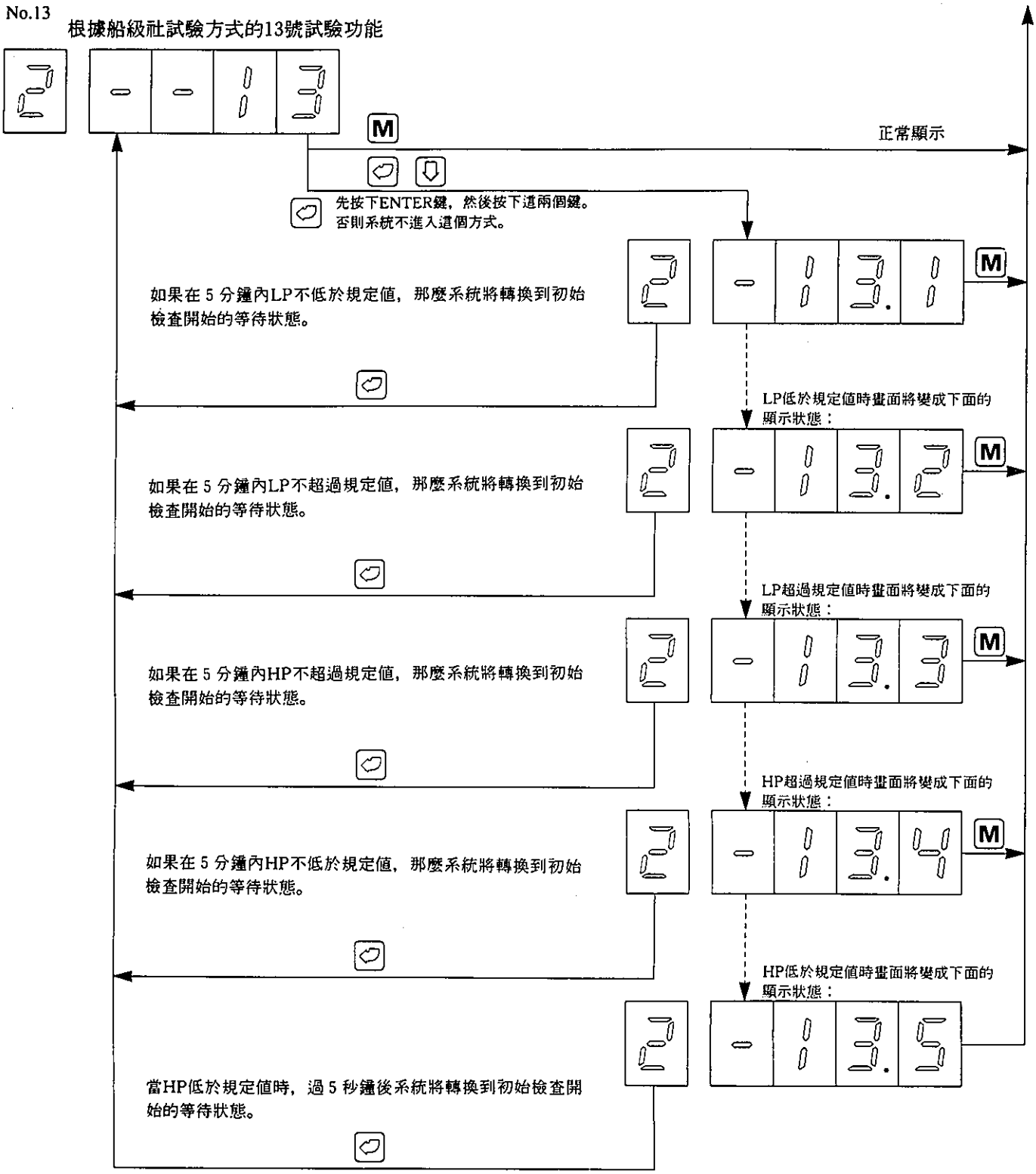
號碼	試驗項目	控制器輸出狀態 至ENTER鍵
07	蒸發器風扇(Lo) 和馬達	1. 方式顯示 LED：2 2. 溫度顯示 LED：  (A) （工作電流消耗，CT1） 3. LED指示燈：OFF 4. MGC1m：ON EFR1m、EFR2m：ON
08	加熱器	1. 方式顯示 LED：2 2. 溫度顯示 LED：  (A) （工作電流消耗，CT1） 3. LED指示燈：OFF 4. MGC1m：ON HR1m、HR2m：ON
09	電子膨脹閥 (EEV)	1. 方式顯示 LED：2 2. 溫度顯示 LED：  (%) （閥打開） 3. LED指示燈：OFF 4. 反覆地全開↔全閉(在最大速度下) (1) 在記憶在系統內的釋放時間下，操作者釋放了帶有開度指令的ENTER鍵時，試驗將停止。 (2) 當系統轉換到9號試驗項目時，該閥將從原來的開度起動作，開度增大10%。 但是，如果原來的開度爲10～90%，那麼它將以原來的相同方向增加或減小開度。

備註：(1) 在本機組中試驗號 3 和 5 將被跳過。

號碼	試驗項目	控制器輸出狀態 至ENTER鍵
10	控制隨動閥	1. 方式顯示 LED：2 2. 溫度顯示 LED： 060. (%) （閥打開） 3. LED指示燈：OFF 4. 反覆地全開↔全閉(在最大速度下) (1) 在記憶在系統內的釋放時間下，操作者釋放了帶有開度指令的ENTER鍵時，試驗將停止。 (2) 當系統轉換到10號試驗項目時，該閥將從原來的開度起動作，開度增大10%。 但是，如果原來的開度爲10～90%，那麼它將以原來的相同方向增加或減小開度。
11	溫度記錄器	1. 方式顯示 LED：2 2. 溫度顯示 LED： -20.0 (℃) （溫度指令） 3. LED指示燈：OFF 4. → +20℃→ 0 ℃→ −20℃ 反覆循環。 0 ℃← (1) 在達到規定的溫度後强制停止運轉10秒鐘。 (2) 在當前的試驗中，在轉換到項目10或12後，溫度將一定根據早先的指令昇高或降低。但是，在當前的試驗被開始後，初始值立即成爲＋20℃
12	反相繼電器	1. 方式顯示 LED：2 2. 溫度顯示 LED： --12 （試驗號） 3. LED指示燈：OFF 4. RVm：ON (但是，在校正相位過 3 秒鐘後，它將OFF。) 5. MGC1m：ON
13	船級社試驗	1. 方式顯示 LED：2 2. 溫度顯示 LED： --13 （試驗號） 3. LED指示燈：OFF

No.13

根據船級社試驗方式的13號試驗功能



備註：

ENTER鍵被按下時的控制輸出狀態。

1. 方式顯示LED：
2. 溫度顯示LED：
3. LED指示燈：OFF

(1) LPT-OFF檢查(在壓縮機接通和冷凝器風扇工作的狀態下進行)
MGC1m: ON、MCm: ON、CFR1m: ON
EEV/MV全閉。

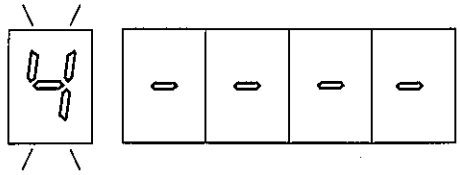
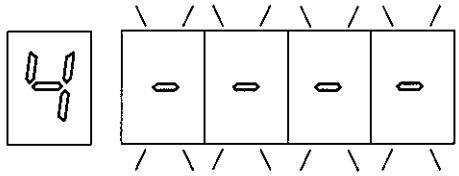
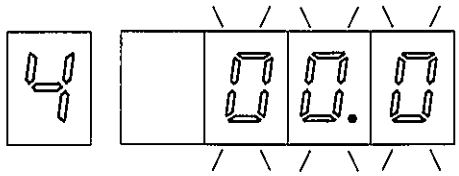
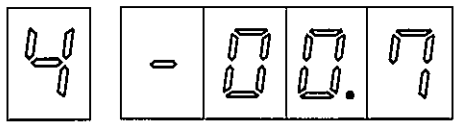
(2) EEV 65%開度時的LPT-ON檢查。

(3) HPT-OFF檢查(在壓縮機接通、冷凝器風扇停止和蒸發器風扇設定在Hi的狀態下進行)
EEV: 65% 開度、MCm: ON、EFR1m: ON、EFR2m: OFF

(4) EEV全閉時的HPT-ON檢查。

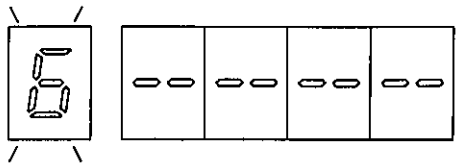
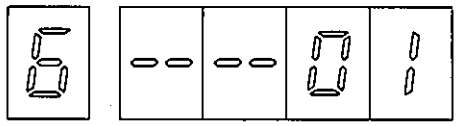
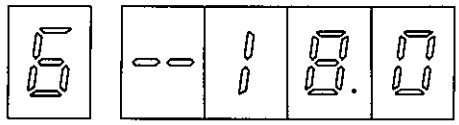
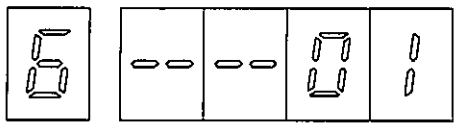
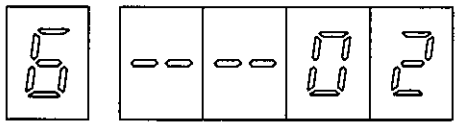
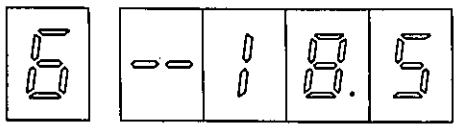
12.11.9 MER零位校準方式

這個方式能容易地進行重調零的調節，而與集裝箱內部的實際溫度無關。

操作流程	鍵操作	畫面顯示	備註
MER零位校準	"MODE"鍵		備註 (1)
調零	"ENTER"鍵		
		隔數秒鐘後	備註 (1)
	"UP"鍵 或 "DOWN"鍵		每按一次 ⌂ 或 ⌂ 鍵顯示溫度將昇高或降低0.1℃
新的指示溫度	"ENTER"鍵		備註 (1)

備註: (1) 如果在30秒內不操作任何鍵則這個畫面將自動返回到正常顯示狀態。

12.11.10 運轉資料顯示方式

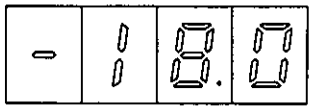
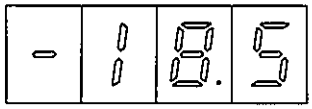
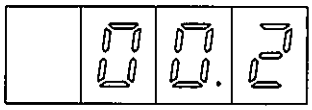
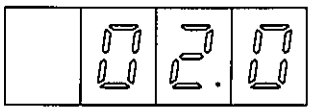
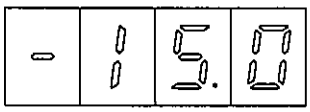
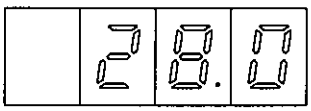
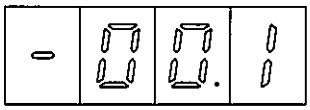
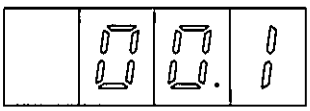
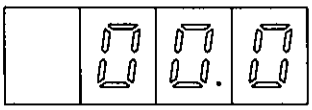
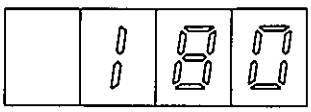
操作流程	鍵操作	顯示	備註
運轉資料顯示	"MODE"鍵		
	"ENTER"鍵		
顯示出號碼 1上的資料	"ENTER"鍵		當按下並保持按下 "ENTER"鍵時, 僅顯示出資料。
	放開"ENTER"鍵		
顯示出號碼 2～28	"UP"鍵 或 "DOWN"鍵		 －－02 直到 －－28 "UP"鍵 或 "DOWN"鍵
號碼2～28 顯示出各項目 的資料	"ENTER"鍵		當按下並保持按下 "ENTER"鍵時, 僅顯示出資料。

備註：(1) 如果在30秒內不操作任何鍵，則這個畫面將與交流電源或是蓄電池運轉無關，自動返回到正常顯示狀態。

(2) 在這個方式下按下"MODE"鍵，顯示將立即返回到正常顯示狀態。

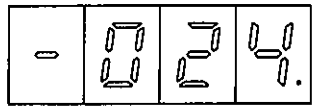
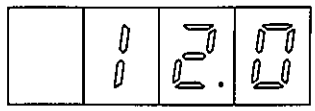
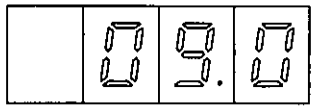
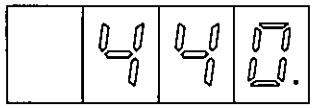
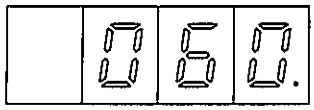
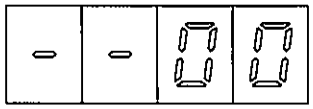
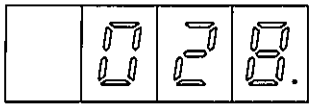
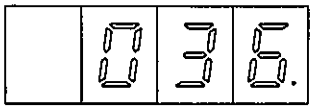
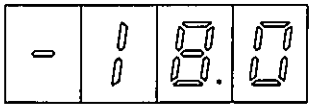
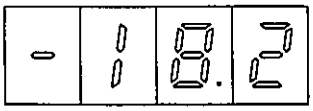
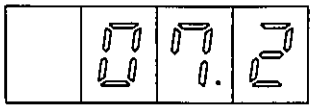
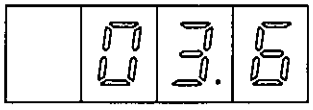
(3) 每一個運轉資料顯示如後面頁上所示。

〈 運轉資料顯示(1) 〉

號碼	項目	顯示	備註
01	設定點溫度	 (°C)	
02	控制溫度	 (°C)	
03	供氣溫度	 (°C)	
04	回氣溫度	 (°C)	
07	蒸發器盤形管出口傳感器(TDK)	 (°C)	
08	周圍環境溫度傳感器(TA)	 (°C)	
09	冷藏處理溫度傳感器 1號(TCT 1) USDA	 (°C)	• 選購件
10	冷藏處理溫度傳感器 2號(TCT 2) USDA	 (°C)	• 選購件
11	冷藏處理溫度傳感器 1號(TCT 3) USDA	 (°C)	• 選購件
13	高致冷劑壓力	 (× 10 kPa)	• 見備註(1)

備註：(1) 在交流電源斷開時，號碼13～21將被跳過。
但是，其他號碼的項目則與交流電源的接通/斷開無關仍被顯示出。

〈運轉資料顯示(2)〉

號碼	項目	顯示	備註
14	低致冷劑壓力	 (kPa)	• 見備註(1)
15	機組工作電流(CT 1)	 (A)	• 見備註(1)
16	壓縮機工作電流(CTM)	 (A)	• 見備註(1)
17	電源電壓	 (V)	• 見備註(1)
18	電源頻率	 (Hz)	• 見備註(1)
19	運轉方式 * 1：冷藏方式 2：冷凍方式 ** 運轉步驟0、1、2、3、4		• 見備註(1)
20	電子膨脹閥開度	 (%)	• 見備註(1)
21	控制隨動閥開度	 (%)	• 見備註(1)
22	MER設定溫度	 (°C)	
23	MER記錄溫度(反饋溫度)	 (°C)	
24	鎳鎘電池(可再充電)電壓	 (V)	
25	鋰電池電壓	 (V)	

〈 運轉資料顯示(3) 〉

號碼	項目	顯示	備註
26	壓縮機 工作時間	014 ×100 (H)	
28	蒸發器風扇馬達工作時間	158 ×100 (H)	

備註：(2) 號碼5、6、9、10、11、12、27爲選購項目，因此這些項目的顯示本機組中將被跳過。

(3) 當各傳感器不正常時，顯示如下所示。

- 超出上限時： 999
- 低於下限時： -99
- 超出範圍時： ----

12.11.11 集裝箱號設定方式

〈集裝箱號設定的例子〉

EMCU 5167032
☆ ※

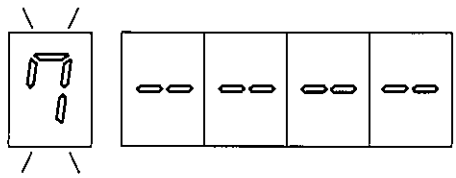
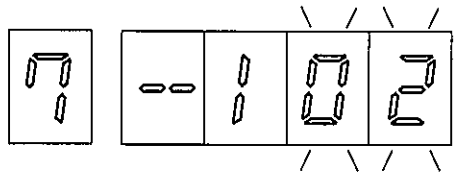
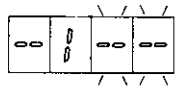
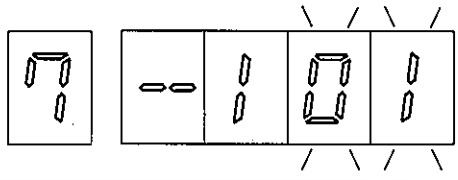
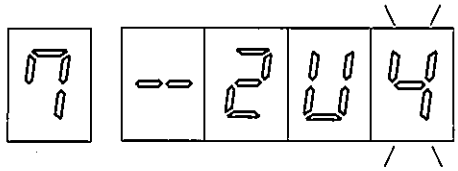
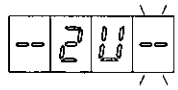
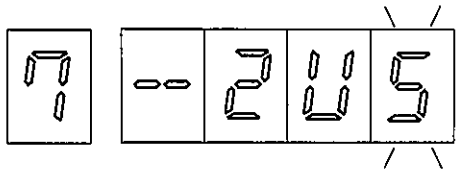
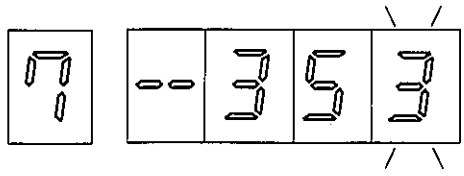
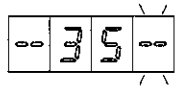
☆：• 對於羅馬字部份（☆）的設定號如下所述。

羅馬字部份	設定號
EMCU	01
UGMU	02
EISU	03
〃	〃
----	99

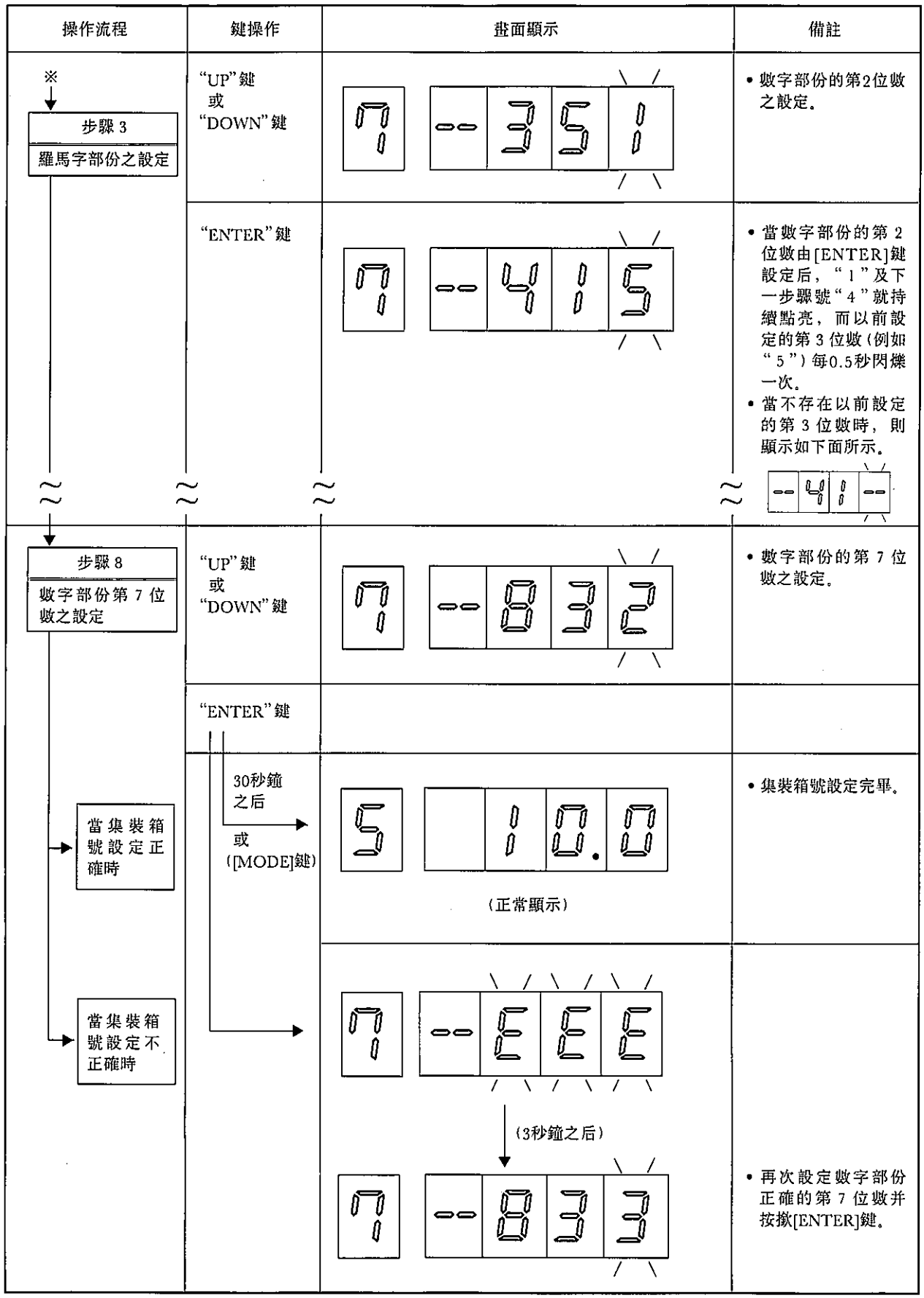
• 設定表中下述操作中步驟 1 所示的設定號。

※：設定表中下述操作中步驟2-8所示的數字部份（※）之 7 位數。

步驟	集裝箱號	例子：EMCU5167032
1	羅馬字部份	EMCU
2	數字部份的第 1 位數	5
3	數字部份的第 2 位數	1
4	數字部份的第 3 位數	6
5	數字部份的第 4 位數	7
6	數字部份的第 5 位數	0
7	數字部份的第 6 位數	3
8	數字部份的第 7 位數	2

操作流程	鍵操作	畫面顯示	備註
集裝箱號 設定顯示	"MODE"鍵 (當方式"6"LED 閃爍時請按揿 "MODE"鍵。)		• 這個集裝箱號設定操作即使在電池供電運轉期間也可進行。
步驟 1 羅馬字部份之設定	"ENTER"鍵		• 集裝箱號中羅馬字部份的以前的設定號(例如"02")每0.5秒閃爍一次。 • 當不存在以前的設定號時，則顯示如下面所示。 
	"UP"鍵 或 "DOWN"鍵		• 集裝箱號碼中羅馬字部份的設定號之設定。
	"ENTER"鍵		• 當羅馬字部份的設定號由[ENTER]鍵設定后，"U"及下一步驟號"2"就持續點亮。而數字部份的以前設定的第1位數(例如"4")每0.5秒閃爍一次。 • 當不存在以前設定的第1位數時，則顯示如下面所示。 
步驟 2 數字部份第1位數之設定	UP"鍵 或 "DOWN"鍵		• 數字部份的第1位數之設定。
	"ENTER"鍵		• 當數字部份的第1位數由[ENTER]鍵設定后，"5"及下一步驟號"3"就持續點亮，而以前設定的第2位數(例如"3")每0.5秒閃爍一次。 • 當不存在以前設定的第2位數時，則顯示如下面所示。 

※(接下頁)



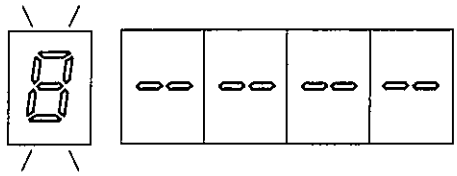
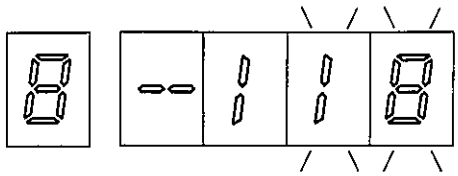
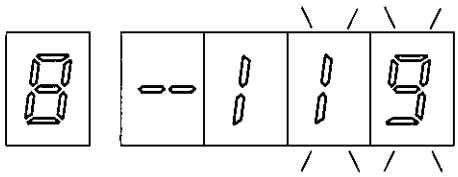
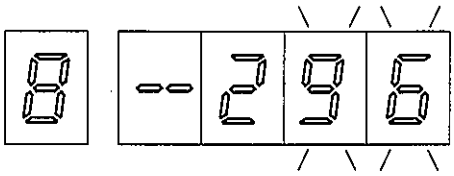
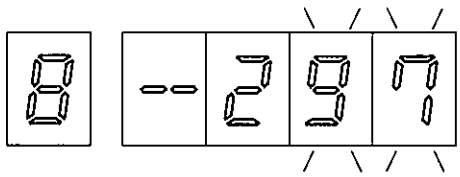
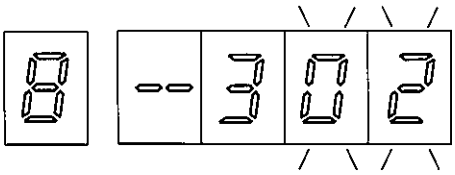
備註：(1) 在集裝箱號設定操作中，如在30秒鐘內不進行鍵操作或不按揿[MODE]鍵，則畫面顯示將返回到正顯示狀態。其后，應重新從集裝箱號設定的第1步起進行操作。

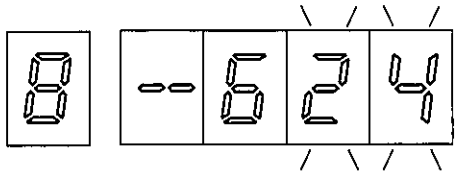
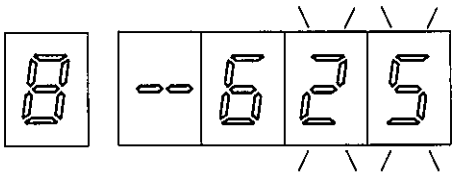
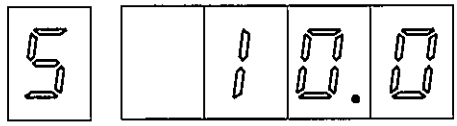
12.11.12 日歷設定方式

〈日歷設定的例子〉

1997年 3 月13日16：30

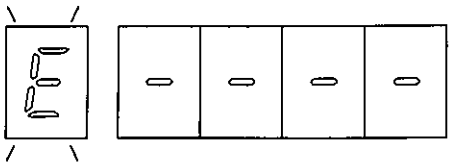
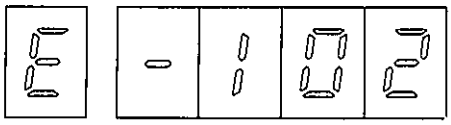
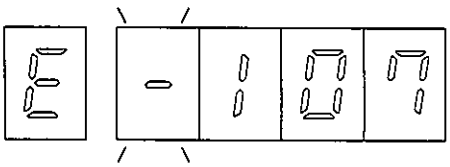
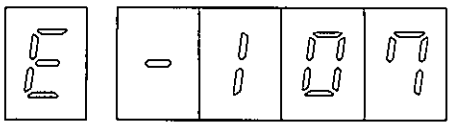
步驟	時間	例子：1997年3月13日16：30
1	年份的第 1 位數	1
	年份的第 2 位數	9
2	年份的第 3 位數	9
	年份的第 4 位數	7
3	月份的第 1 位數	0
	月份的第 2 位數	3
4	日數的第 1 位數	1
	日數的第 2 位數	3
5	時間的第 1 位數 (小時)	1
	時間的第 2 位數 (小時)	6
6	時間的第 3 位數 (分鐘)	3
	時間的第 4 位數 (分鐘)	0

操作流程	鍵操作	畫面顯示	備註
日歷設定顯示	"MODE"鍵 (當方式"7"LED閃爍時請按揿"MODE"鍵。)		• 這個日歷設定操作即使在電池供電運轉期間也可進行。
步驟 1	"ENTER"鍵		• 通過[ENTER]鍵操作，步驟號"1"持續點亮，步驟1中以前設定的數字(例如"18")每0.5秒閃爍一次。
	"UP"鍵 或 "DOWN"鍵		• 設定步驟1中的數字"19"。 • 每按揿一下[UP]或[DOWN]鍵則顯示的閃爍中之數字將增大或減小1。如按著[UP]或[DOWN]鍵達1秒鐘以上，則顯示的閃爍中之數字將每秒增大或減小10。
步驟 2	"ENTER"鍵		• 當步驟1中的數字"19"由[ENTER]鍵設定后，下一步驟號"2"就持續點亮，而以前設定的數字(例如"96")每0.5秒閃爍一次..
	UP"鍵 或 "DOWN"鍵		• 設定步驟2中的數字"97"。
步驟 3	"ENTER"鍵		• 當步驟2中的數字"97"由[ENTER]鍵設定后，下一步驟號"3"就持續點亮，而以前設定的數字(例如"02")每0.5秒閃爍一次。
※(接下頁)			

操作流程	鍵操作	畫面顯示	備註
※ ↓ 步驟 6	"ENTER"鍵		
	"UP"鍵 或 "DOWN"鍵		
	"ENTER"鍵		
	30秒鐘 之后 或 ([MODE]鍵)	 (正常顯示)	• 日歷設定完畢。

備註: (1) 在日歷設定操作中，如在30秒鐘內不進行鍵操作或不按撳[MODE]鍵，則畫面顯示將返回到正常顯示狀態。其后，應重新從日歷設定的第 1 步起進行操作。

12.11.13 當前警報訊息顯示方式

操作流程	鍵操作	畫面顯示	備註
發生警報	"MODE"鍵		
顯示出警報訊息 (顯示出當前警報訊息)	"ENTER"鍵		• 最多可從低位的警報代碼號起依次顯示出10個警報代碼號。
	"UP"鍵 或 "DOWN"鍵		• 當顯示出的警報代碼號不是最高位號碼時。
			• 當顯示出的警報代碼號是最高位號碼時。

備註：(1) 如果在30秒內不操作任何鍵，則畫面顯示將返回到正常顯示狀態。

(2) 如果無警報存在，此警報訊息顯示方式將被跳過。

12.11.14 航行開始功能鍵

這個鍵用於檢索LOG數據的開始點。

(1) 調節航行開始鍵開關

(a) 在控制器處於工作狀態(即電源接通或系統由電池供電)的情況下，如果按下該航行鍵開關(3秒鐘以上)，則系統記憶這是航行的開始。但是，如果在電源接通的時候正在進行初始檢查，則這個鍵不起作用。

(b) 如果航行開始鍵被接受，此LED將優先於其他LED而顯示出“ 5 5 5 ”達 3 秒。然後返回到原始顯示狀態。

(2) 傳送LOG數據

如果系統接受來自携帶式電腦的LAST LOG檢索指令，則系統就傳送航行開始和檢索的時間中間所記憶的數據。

但是，如果ID數據被設定在航行功能開始之後，則就傳送ID數據設定和檢索的時間中間所記憶的數據。要注意重寫將會擦清航行開始記憶裝置。

12.11.15 其他

(1) 在控制器不工作的情況下，在電源被關斷的同時由日曆IC發出的1H脈衝被輸入，而使控制器動作並在電池供電下工作若干秒。在此時間中系統執行1H LOG和1H記錄功能，全部LED和 7 段LED都關斷。

(2) 當系統由電池供電工作時，在携帶式電腦操作完成後LED、7 段LED點亮30秒鐘。

12.11.16 LED燈訊息

●點亮 ◑閃亮 ○熄滅

	ALARM(警報)		DEF(除霜)	IR(範圍內)	COOL(致冷)
進行初始自動診斷中	○		○	○	○
在初始診斷中檢測出錯誤	● (可復原的)	◑ (不可復原的)	○	○	○
在初始診斷完成後立即成爲正常顯示	● (可恢復正常)	◑ (不可恢復正常)	○	○	○
MIN. PTI選定	◑ (有故障)		○	○	● (壓縮機接通)
MIN. PTI選定	◑ (有故障)		● (除霜)	● (範圍內)	● (壓縮機接通)
概要	• 當有錯誤被檢測到時LED將閃爍，但是如其能返回到正常狀態則LED將點亮。		• 除霜時(DRm"ON")此LED將點亮，除霜結束後熄滅。	• 當控制溫度超出範圍時延遲2分鐘。 • 當除霜結束時延遲60分鐘。 • 當出現下列中任一錯誤時此LED將被强制關斷。 ＃310～313 ＃315～316 ＃330 ＃331 • 當出現下列中任一錯誤時，在自動重新啟動後强制停止。 ＃201 ＊ ＃202 (見12.12節)	• 當壓縮機MCm被接通時LED將點亮。

＊ 自動地重新啟動運轉僅三次。

12.11.17 微型開關

微型開關被裝在控制盤(P-CONTR)的背面。

這些開關用於選擇下表中列出的操作類型。型式(包括選購件)。

在裝貨前這些開關已被設定好。

(a) 可選用的微型開關

開關名稱	開關號	説明	設定
開關	1	型選擇(CPE52/CPE14)	OFF(CPE14)
	2	MER記錄紙型式(記錄紙9/6)	ON(記錄紙6)
	3	除霜 是/否	OFF(是)
	4	濕度	↑(否)
	5	未使用	——
	6	製造廠清除 是/否 備注(1)	OFF(否)
	7	冷藏處理 是/否 備注(2)	↑(否)
	8	APT	OFF(否)

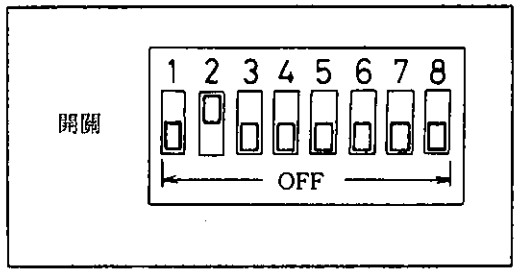


圖37 微型開關

備註: (1) (a) 如這個微型開關為了進行工廠清零而被轉到ON，則當每次機器的ON-OFF開關被轉到ON時，存儲在控制器內的全部資料就被清除。與此同時，集裝箱內部的設定點溫度將被自動設定在"0 ℃"。

(b) 除了下述情況外，請勿進行工廠清零操作。

① 控制器被更換時。

② 由於某些原因使控制器中止工作時。

(c) 關於如何進行工廠清零操作，請參照控制器技術手冊(95 • RC-I • 422A)。

(2) 當選擇冷藏處理功能時，請把這個開關設定在"ON"位置。

12.11.18 運轉方式

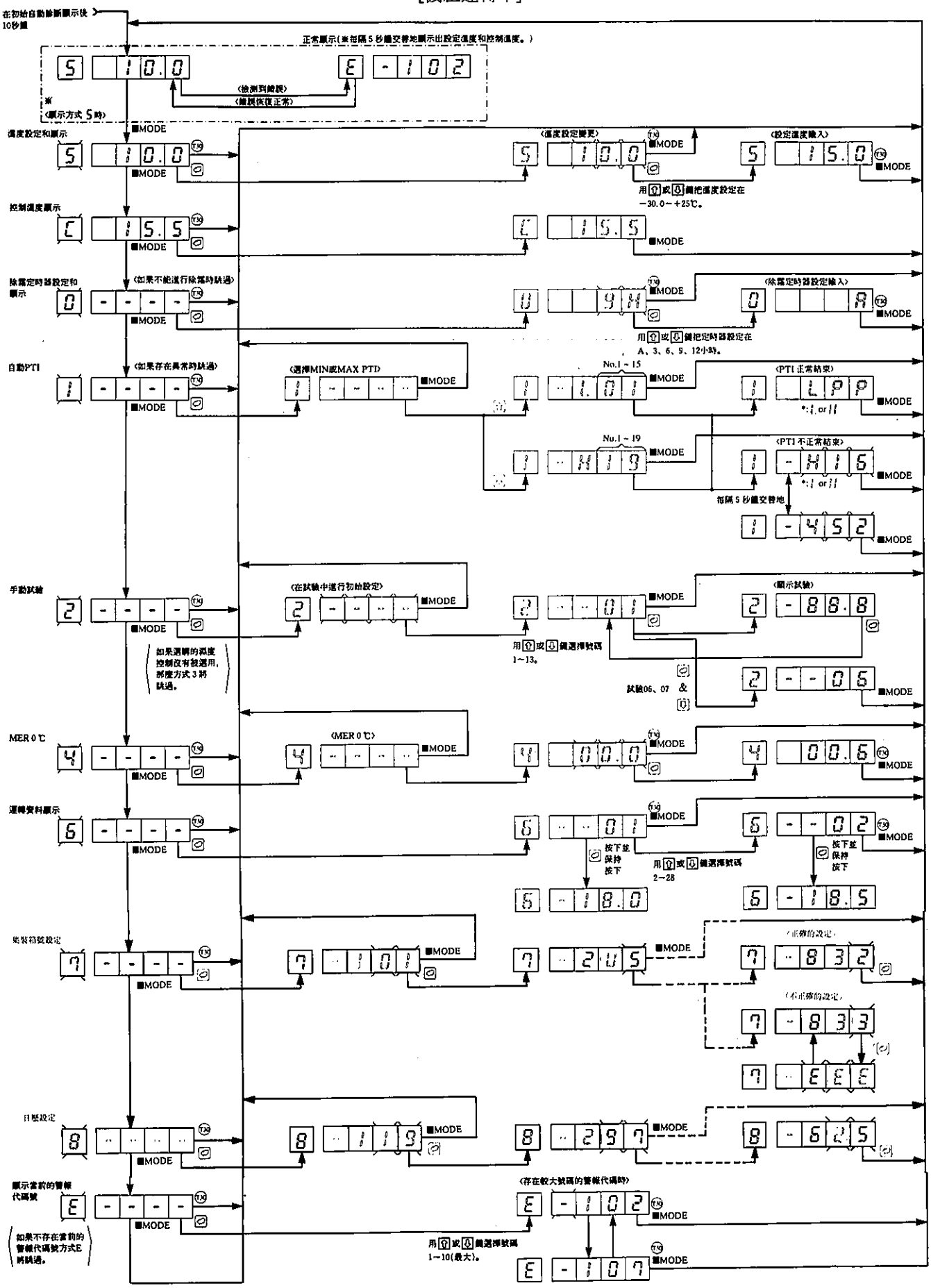
○：ON

運轉方式	運轉功能	CHILL(冷藏)						FROZEN(冷凍)			
	設定點	－5℃和以上						低於－5℃			
	控制的溫度	供氣溫度						供回氣較高的空氣溫度			
	運轉檔號碼	⓪	①	②	③	④		⓪	①	②	
	運轉檔	全制冷	容量控制	容量控制＋低熱	低熱	高熱	除霜	全制冷	低循環	低熱	除霜
壓縮機		○	○	○				○			
冷凝器風扇		○	○	○				○			
蒸發器風扇	高速	○	○	○	○	○		○		○	
	低速								○	○		
加熱器	副(H1、H2)			○	○	○	○			○	○
	主(H3～H6)					○	○				○
電子膨脹閥(EEV)		○	○	○				○			
控制隨動閥(MV)			○	○							
液體噴射電磁閥 (S5)		○	○	○				○			
主接觸器	(MC)	○	○	○				○			
加熱器繼電器	主(HR_1)					○	○				○
	副(HR_2)			○	○	○	○			○	○
風扇繼電器	高速(FRH)	○	○	○	○	○		○		○	
	低速(FRL)								○	○		
接觸器	MGC_1	○	○	○	○	○	○	○	○	○	○
	MGC_3										
控制器小型繼電器輸出	(MCL_m)	○	○	○				○			
	($CFR1_m$)	○	○	○				○			
	($CFR2_m$)										
	($EFR1_m$)	○	○	○	○	○		○	○	○	
	($EFR2_m$)								○	○	
	($HR1_m$)					○	○				○
	($HR2_m$)			○	○	○	○			○	○
	($MGC1_m$)	○	○	○	○	○	○	○	○	○	○
	($MGC3_m$：RV_m) ※1										
	(IR_m)										
	(DR_m)										

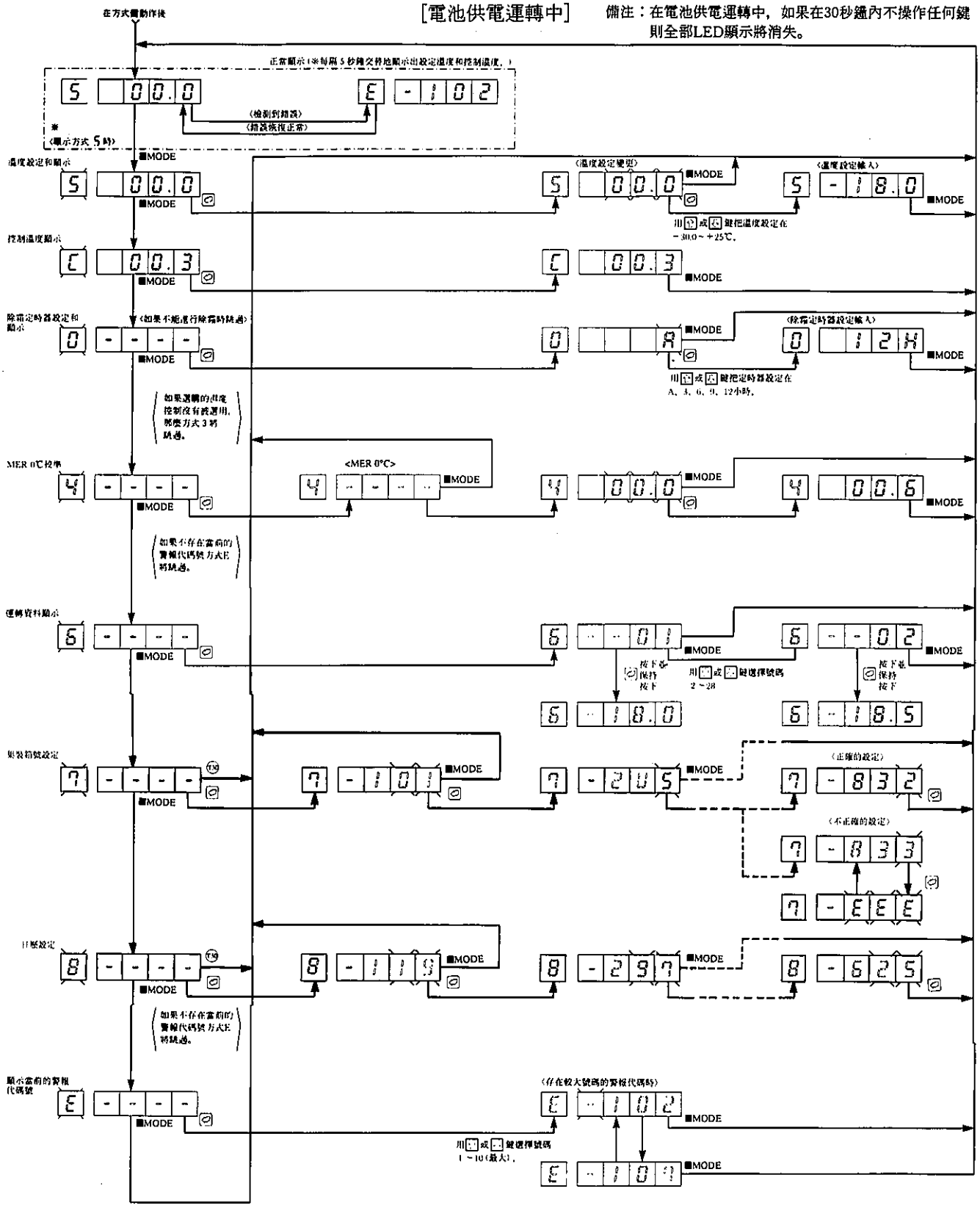
※1 對於正相；RVm：OFF，MGC1m：ON，MGC3m：OFF。
對於負相；RVm：ON，MGC1m：OFF，MGC3m：ON。

12.11.19 運轉和顯示流程說明

[機組運轉中]



[電池供電運轉中]　備注：在電池供電運轉中，如果在30秒鐘內不操作任何鍵則全部LED顯示將消失。



12.12 自動診斷項目

 ：警報LED閃亮　○：熄滅

 ：警報LED點亮

警報代碼	自動診斷項目和故障	檢查時間			措施			顯示
		電源ON	運轉	PTI	電源ON	運轉	PTI	警報LED
#102	A/D變換故障	○	○	－	僅顯示	僅顯示	－	
		－	－	○	－	－	PTI中斷	
#105	EEPROM故障 （參照第93頁）	○	－	－	僅顯示	－	－	
#107	SRAM故障	○	－	－	停止	－	－	
#108	相位脈衝故障	○	－	－	停止	－	－	
		－	○	－	－	僅顯示	－	
		－	－	○	－	－	PTI中斷	
#200	控制溫度故障	－	○	－	－	僅顯示	－	
#201	致冷劑高壓故障	○	○	－	停止	壓縮機停止、冷凝器風扇運轉、EEV/MV全閉、蒸發器風扇（低速）※1	－	 或
		－	－	◎	－	－	PTI中斷	
#202	致冷劑低壓故障	－	○	－	－	壓縮機和冷凝器風扇停止、EEV/MV全閉、蒸發器風扇（低速）※1	－	 或 
		－	－	◎	－	－	PTI中斷	
#205	電子膨脹閥或控制隨動閥關閉故障	－	－	○	－	－	PTI中斷	

※1. 自動重新啟動運轉僅三次。

○: MIN-PTI
◎: 僅MAX-PTI

警報代碼	自動診斷項目和故障	檢查時間			措施			顯示
		電源ON	運轉	PTI	電源ON	運轉	PTI	警報LED
#206	強制終止除霜	–	○	–	–	強制終止除霜	–	●
		–	–	◎	–	–	PTI中斷	◑
#207	單相	○	○	–	停止	壓縮機和冷凝器風扇停止、EEV/MV全閉、蒸發器風扇停止	–	◑
		–	–	○	–	–	PTI中斷	◑
#208	電源頻率故障	○	○	–	僅顯示	僅顯示	–	●
		–	–	○	–	–	PTI中斷	◑
#209	電源電壓故障	○	○	–	僅顯示	僅顯示	–	●
		–	–	○	–	–	PTI中斷	◑
#300	運轉鍵開關故障(MODE鍵)	○	–	–	停止	–	–	◑
#301	運轉鍵開關故障(UP鍵)	○	–	–	停止	–	–	◑
#302	運轉鍵開關故障(DOWN鍵)	○	–	–	停止	–	–	◑
#303	運轉鍵開關故障(ENTER鍵)	○	–	–	停止	–	–	◑
#307	航行開始開關故障	○	–	–	無效	–	–	●
#310	用於控制的供氣溫度傳感器斷開	○	○	–	僅顯示	失效－保護和儲備	–	●
		–	–	○	–	–	PTI中斷	◑

警報代碼	自動診斷項目和故障	檢查時間			措施			顯示
		電源ON	運轉	PTI	電源ON	運轉	PTI	警報LED
#311	用於控制的供氣溫度傳感器短路	○	○	—	僅顯示	失效－保護和儲備	—	✱
		—	—	○	—	—	PTI中斷	☼
#312	用於控制的回氣溫度傳感器斷開	○	○	—	僅顯示	失效－保護和儲備	—	✱
		—	—	○	—	—	PTI中斷	☼
#313	用於控制的回氣溫度傳感器短路	○	○	—	僅顯示	失效－保護和儲備	—	✱
		—	—	○	—	—	PTI中斷	☼
#314	用於控制的供氣或回氣溫度傳感器溫度誤差大	—	○	—	—	壓縮機和冷凝器風扇停止、EEV/MV全閉、蒸發器風扇(低速)	—	☼
		—	—	◎	—	—	PTI中斷	☼
#315	蒸發器出口傳感器斷開	○	○	—	僅顯示	失效－保護和儲備	—	✱
		—	—	○	—	—	PTI中斷	☼
#316	蒸發器出口傳感器短路	○	○	—	僅顯示	失效－保護和儲備	—	✱
		—	—	○	—	—	PTI中斷	☼
#317	蒸發器出口傳感器溫度誤差大	—	—	◎	—	—	PTI中斷	☼
#320	外圍溫度傳感器斷開	○	○	—	僅顯示	無效	—	✱
		—	—	○	—	—	PTI中斷	☼

警報代碼	自動診斷項目和故障	檢查時間			措施			顯示
		電源ON	運轉	PTI	電源ON	運轉	PTI	警報LED
#321	外圍溫度傳感器短路	○	○	—	僅顯示	顯示	—	●
		—	—	○	—	—	PTI中斷	◑
#322	低溫處理溫度傳感器斷開No. 1	○	○	—	僅顯示	顯示	—	●
		—	—	○	—	—	PTI中斷	◑
#323	低溫處理溫度傳感器短路No. 1	○	○	—	僅顯示	顯示	—	●
		—	—	○	—	—	PTI中斷	◑
#324	低溫處理溫度傳感器斷開No. 2	○	○	—	僅顯示	顯示	—	●
		—	—	○	—	—	PTI中斷	◑
#325	低溫處理溫度傳感器短路No. 2	○	○	—	僅顯示	顯示	—	●
		—	—	○	—	—	PTI中斷	◑
#326	低溫處理溫度傳感器斷開No. 3	○	○	—	僅顯示	顯示	—	●
		—	—	○	—	—	PTI中斷	◑
#327	低溫處理溫度傳感器短路No. 3	○	○	—	僅顯示	顯示	—	●
		—	—	○	—	—	PTI中斷	◑

警報代碼	自動診斷項目和故障	檢查時間			措施			顯示
		電源ON	運轉	PTI	電源ON	運轉	PTI	警報LED
#330	致冷劑高壓傳感器故障	○	–	–	停止	–	–	◑
		–	○	–	–	失效－保護和儲備	–	●
		–	–	○	–	–	PTI中斷	◑
#331	致冷劑低壓傳感器故障	○	–	–	停止	–	–	◑
		–	○	–	–	失效－保護和儲備	–	●
		–	–	○	–	–	PTI中斷	◑
#332	致冷劑高壓或低壓傳感器檢測的壓力差大	–	–	○	–	–	PTI中斷	◑
#337	壓縮機排出氣體溫度傳感器斷開 (TDIS)	○	○	–	僅顯示	僅顯示	–	●
		–	–	○	–	–	PTI中斷	◑
#338	壓縮機排出氣體溫度傳感器短路 (TDIS)	○	○	–	僅顯示	僅顯示	–	●
		–	–	○	–	–	PTI中斷	◑
#340	電壓傳感器故障 (PT1)	○	○	–	僅顯示	僅顯示	–	●
		–	–	○	–	–	PTI中斷	◑
#350	電流傳感器檢測故障 (CT1，Hi)	○	○	–	僅顯示	失效－保護和儲備	–	●
		–	–	○	–	–	PTI中斷	◑

警報代碼	自動診斷項目和故障	檢查時間			措施			顯示
		電源 ON	運轉	PTI	電源 ON	運轉	PTI	警報 LED
#351	電流傳感器檢測故障 (CT1，Lo)	○	○	–	僅顯示	失效－保護和儲備	–	✱
		–	–	○	–	–	PTI中斷	◑
#356	電流傳感器檢測故障 (CTM，Hi)	○	○	–	僅顯示	僅顯示	–	✱
		–	–	○	–	–	PTI中斷	◑
#357	電流傳感器檢測故障 (CTM，Lo)	○	○	–	僅顯示	僅顯示	–	✱
		–	–	○	–	–	PTI中斷	◑
#411	壓縮機馬達卡住或短路 (CM)	–	○	–	–	壓縮機和冷凝器風扇停止、EEV/MV全閉、蒸發器風扇停止	–	◑ 或 ✱
		–	–	○	–	–	PTI中斷	◑
#412	壓縮機馬達斷開 (CM)	–	○	–	–	僅顯示	–	✱
		–	–	○	–	–	PTI中斷	◑
#413	壓縮機過熱故障 (CM)	○	○	–	無效	壓縮機和冷凝器風扇停止、EEV/MV全閉、蒸發器風扇(低速)	–	◑ 或 ✱
		–	–	○	–	–	PTI中斷	◑
#421	冷凝器風扇馬達卡住或短路 (Hi)	–	–	○	–	–	PTI中斷	◑
#422	冷凝器風扇馬達斷開或內部恒溫器動作 (Hi)	–	–	○	–	–	PTI中斷	◑
#451	蒸發器風扇馬達卡住或短路 (Hi)	–	–	○	–	–	PTI中斷	◑

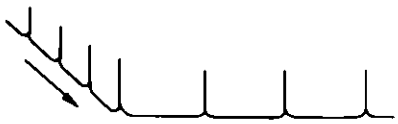
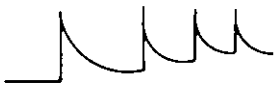
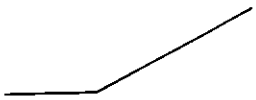
警報代碼	自動診斷項目和故障	檢查時間			措施			顯示
		電源 ON	運轉	PTI	電源 ON	運轉	PTI	警報 LED
#452	蒸發器風扇馬達斷開或內部恒溫器動作 (Hi)	–	–	○	–	–	PTI中斷	☼
#461	冷凝器風扇馬達卡住或短路 (Lo)	–	–	○	–	–	PTI中斷	☼
#462	冷凝器風扇馬達斷開或內部恒溫器動作 (Lo)	–	–	○	–	–	PTI中斷	☼
#471	蒸發器盤形管加熱器短路 (全部加熱器)	–	○	–	–	全部加熱器切斷	–	●
		–	–	○	–	–	PTI中斷	☼
#472	蒸發器盤形管加熱器斷開 (全部加熱器)	–	○	–	–	僅顯示	–	●
		–	–	○	–	–	PTI中斷	☼
#481	蒸發器盤形管加熱器短路 (低)	–	○	–	–	全部加熱器切斷	–	●
		–	–	○	–	–	PTI中斷	☼
#482	蒸發器盤形管加熱器斷開 (低)	–	○	–	–	僅顯示	–	●
		–	–	○	–	–	PTI中斷	☼
#491	電子膨脹閥故障	–	–	○	–	–	PTI中斷	☼
#492	控制隨動閥故障	–	○	–	–	壓縮機和冷凝器風扇停止、EEV/MV全閉、蒸發器風扇 (低速)	–	☼
		–	–	○	–	–	PTI中斷	☼

警報代碼	自動診斷項目和故障	檢查時間			措施			顯示
		電源ON	運轉	PTI	電源ON	運轉	PTI	警報LED
#550	鋰電池電不足	○	○	—	僅顯示	僅顯示	—	●
		—	—	○	—	—	PTI中斷	◑
#601	記錄器用的伺服馬達或電位計故障	○	○	—	僅顯示	僅顯示	—	●
		—	—	○	—	—	PTI中斷	◑
#900	致冷劑高壓故障(壓力太高)(致冷劑充注過多)	—	—	◎	—	—	PTI中斷	◑
#901	致冷劑高壓故障(壓力太低)(致冷劑不足)	—	—	◎	—	—	PTI中斷	◑
#902	致冷劑低壓故障	—	—	◎	—	—	PTI中斷	◑
#903	下拉故障(下拉時間太長)	—	—	◎	—	—	PTI中斷	◑
#904	致冷回路內混有空氣	—	—	◎	—	—	PTI中斷	◑
#997	※2 電池警報	—	○	—	—	僅顯示	—	●
		—	—	○	—	—	PTI中斷	◑
		在電池供電時			僅記錄(AI BAT)			○
#998	方式轉換	在PTI運轉中被取消			僅記錄(PTI CANCELED #998 BY MODE CHANGE)			○
#999	電源切斷	在PTI運轉中電源被切斷			僅記錄(PTI CANCELED #999 BY POWER OFF)			○

※2. LED、7段LED被切斷。

13. 故障偵測

13.1 根據記錄圖偵測故障(典型例子)

號碼	曲線圖	故障
1		正常
2		致冷劑不足或膨脹閥阻塞(溫度下降曲線平緩)。
3		機組被機組保護裝置關斷(這時僅蒸發器風扇運轉)。
4		蒸發器風扇因卡住或斷開而不運轉(記錄器記錄出過冷的溫度和機組因LPT切斷而進行短時間反覆)。
5		在FROZEN(冷凍)方式下供氣和回氣空氣溫度傳感器都失效(機組繼續運 轉)。
6		在CHILL(冷藏)方式下供氣和回氣空氣溫度傳感器都失效(壓縮機不運轉，機組以低速運轉風扇)。
7		蒸發器盤形管結霜(不進行除霜)。
8	(曲線在此中斷) 	記錄紙驅動用時鐘和記錄筆停止動作 (機組電源關斷三天後或出現電池報警時)。

13.2 在實際機組上的故障偵測

下表所示是典型例子。診斷時必須考慮所有條件，因爲有許多故障往往是由於兩個或更多的原因所引起的，而不是由一個單純的原因所造成的。另外，有時一個原因也可能會引起兩個或更多的故障。

對於MMCC Ⅲ A控制器的有關電路，請按照"當前的警報訊息"(12.11.11節)和"手動試驗"(12.11.8節)進行檢查。

故障	原因
(1) 用壓力表檢查診斷 1) 高壓側壓力異常昇高和低壓側壓力稍高。	• 致冷劑充注太多。 • 致冷系統內混有空氣。 • 冷凝器風扇不運轉(卡住、斷開等原因)。 • 冷凝器污髒或阻塞。
2) 高壓側壓力正常，但低壓側異常降低。	• 致冷劑不足。 • 電子膨脹閥內結冰阻塞。 (處理方法)——漏氣試驗、更換乾燥器。 • 乾燥器阻塞。(處理方法)——更換乾燥器。 • 蒸發器風扇不運轉。(卡住、斷開)
(2) 致冷循環故障 3) 雖然壓縮機運轉，但致冷效率低。 (吸入管上結霜過多)	• 除霜不正常。 • 加熱器電路斷開。見(5)
4) 壓縮機反覆啟動——停止。 啟動後立即停止 櫃內溫度太高	• 見1)、2)。 • HPT和(或)LPT有問題或損壞。
5) 在"冷凍"方式下壓縮運轉時間太長。	• 致冷劑不足。 • MC的電子回路有故障。(觸點卡住、一短路) • 壓縮效率差。 • 蒸發器結霜過多。 • 集裝箱絕熱不好。
6) 乾燥器出口有霜。	• 外部雜質阻塞。 (壓縮機反覆運轉及停止)
7) 電子膨脹閥功能不正常。	• 致冷劑供給過多： · 電子膨脹閥因阻塞而不關閉。 · 溫度傳感器或壓力傳感器故障。 • 不供給致冷劑。 · 電子膨脹閥故障。 · 蒸發器出口處的溫度傳感器故障。 · 壓力傳感器故障。
8) 冷凝器頂部冷。 (高壓側壓力偏低)	• 致冷劑不足。 • 壓縮效率差。

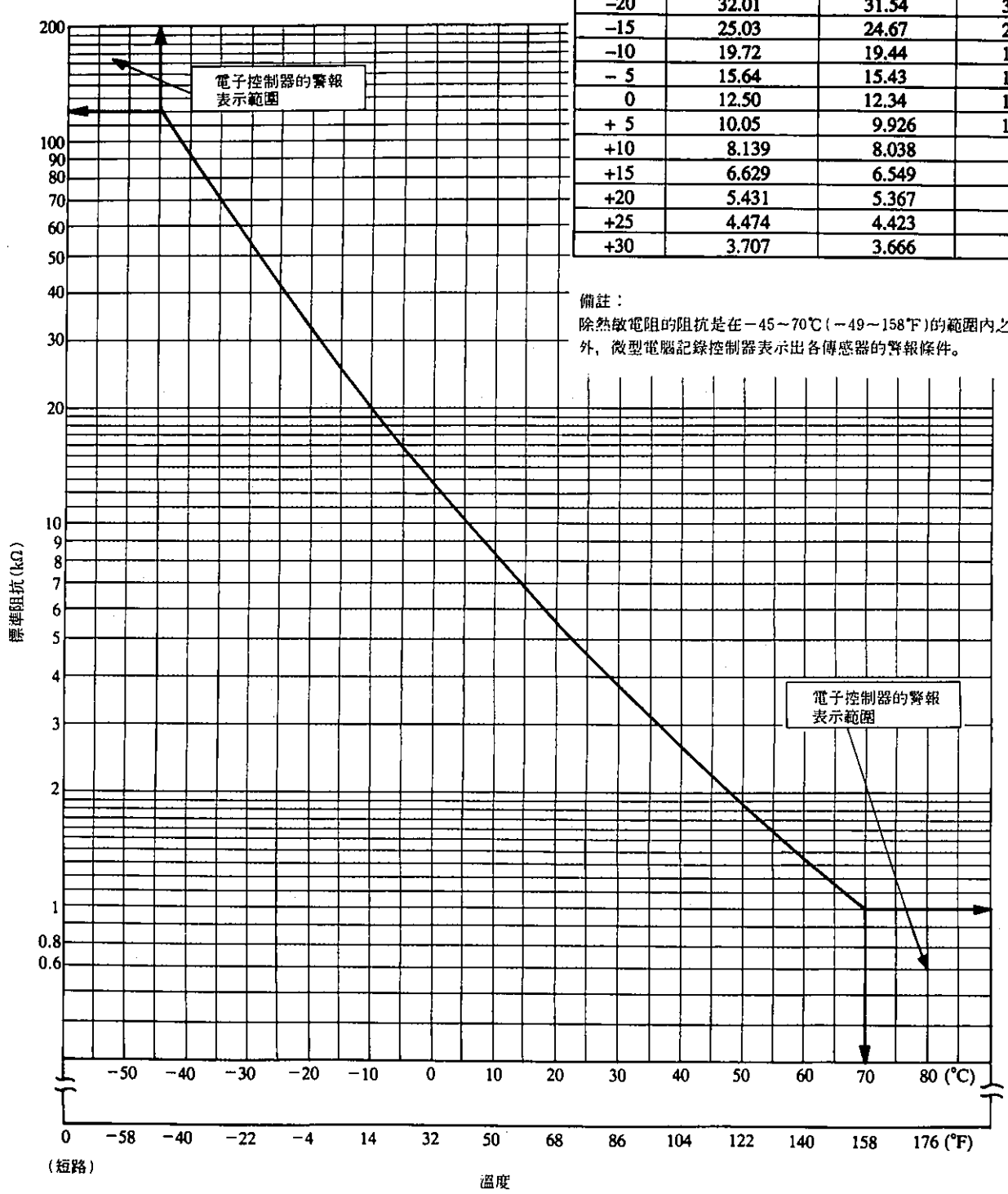
故障	原因
(3) 電子回路故障 9) 斷路器斷開。	• 因電源線斷而短路。 • 加熱器電路絕緣差。 • 由於元件鎖定或短路而過電流。 • 由於電壓低而過載。
10) 電流保護器斷開。	• 控制和電子回路短路。
11) 繼電器、接觸器功能故障。	• 電流保護器斷開。 • 電路斷開。 • 控制器用的變壓器故障。 • 機組開關接觸不良。 • MMCCⅢA控制器故障。
○ 主接觸器(MC)功能故障。	• MC或連接配線有問題。 • MMCCⅢA控制器故障。
○ 加熱器(HR)功能故障。	• HR和(或)連接的電路故障。 • MMCCⅢA控制器故障。
12) 雖然繼電器和接觸器功能正常，但不接通電源。	• 由於導線折斷或脫線而電路開路。 • 觸點不接觸。 • 加熱器斷路——用夾式電流表測量。
13) 監控插座無信號輸出。	• 微型繼電器(DR)、(IR)和(MCm)故障。 • MMCCⅢA控制器故障。 • 監控插座脫開。
(4) 溫度控制 14) 內部溫度降得太低。	• LPT傳感器故障。 • 電子膨脹閥由於阻塞而不關閉。 • MMCCⅢA控制器故障。
(5) 除霜系統故障 15) 雖然加熱器獲得電能但除霜不正常(加熱器電流正常)。	• 加熱器和蒸發器盤形管之間由於加熱器夾緊器脫開而接觸不良。 • TDK傳感器故障。
16) 手動和自動除霜都不能進行(DEF指示燈不起作用)。	• 蒸發器沒有達到結霜條件(高於10℃)……正常。 • TDK傳感器故障。 • MMCCⅢA控制器故障。
17) 不進行自動除霜。	• TDK傳感器故障。 • MMCCⅢA控制器故障。
18) 頻繁地自動除霜。	• MMCCⅢA控制器故障。
(6) 19) 記錄圖不移動。	• 記錄圖支座螺母鬆動。 • 時鐘故障。
(7) 其他 20) 壓縮機不運轉和有嗡嗡聲。	• 由於斷線或壓縮機電路燒壞而單相工作。 • 渦桿卡住。
21) 異常溫度和振動。	• 壓縮機液阻。 • 固定座鬆動。

14. 熱敏傳感器溫度阻抗曲線

(1) 供氣傳感器、回路傳感器、周圍環境溫度傳感器、蒸發器盤形管出口傳感器(TSUP, TRET, TA, TDK)

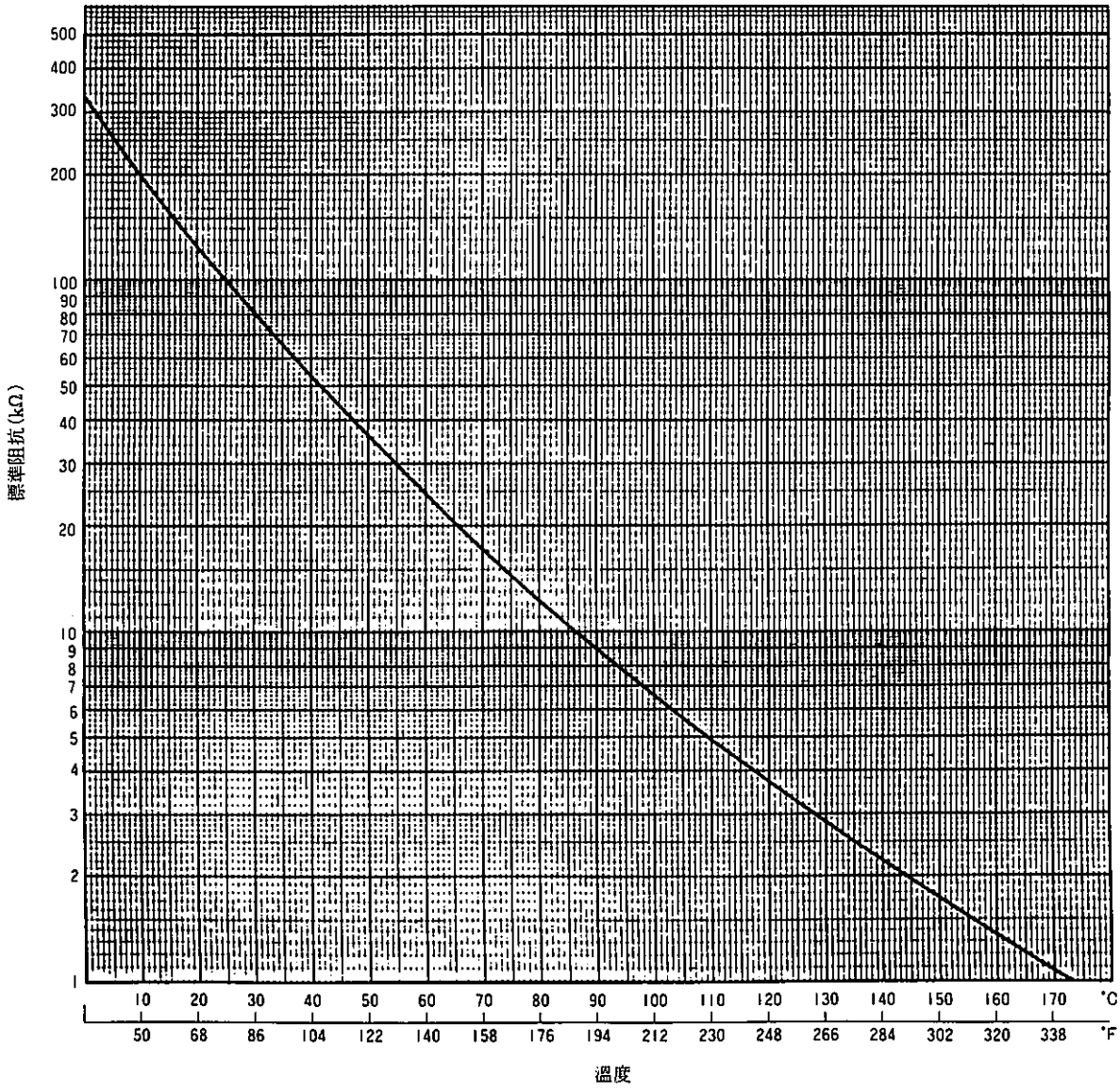
溫度℃	標準阻抗kΩ	允許阻抗	
		最小	最大
-30	53.65	52.80	54.50
-25	41.27	40.64	41.91
-20	32.01	31.54	32.49
-15	25.03	24.67	25.39
-10	19.72	19.44	19.99
- 5	15.64	15.43	15.86
0	12.50	12.34	12.66
+ 5	10.05	9.926	10.18
+10	8.139	8.038	8.239
+15	6.629	6.549	6.708
+20	5.431	5.367	5.494
+25	4.474	4.423	4.525
+30	3.707	3.666	3.748

備註：
除熱敏電阻的阻抗是在－45～70℃(－49～158℉)的範圍內之外，微型電腦記錄控制器表示出各傳感器的警報條件。



(2) 壓縮機排出氣體溫度傳感器(TDIS)

溫度	標準阻抗	容許值		溫度	標準阻抗	容許值	
℃	kΩ	最小	最大	℃	kΩ	最小	最大
0	329.90	314.70	345.70	80	12.43	12.26	12.59
10	201.50	193.30	210.10	90	9.00	8.91	9.09
20	126.5	121.90	131.20	100	6.62	6.54	6.71
30	81.46	78.87	84.13	110	4.94	4.86	5.02
40	53.70	52.22	55.22	120	3.73	3.66	3.80
50	36.17	35.32	37.05	130	2.85	2.97	2.92
60	24.87	24.37	25.38	140	2.21	2.16	2.26
70	17.43	17.14	17.72	150	1.74	1.69	1.78



15. 壓力換算表

kPa	PSIG	kgf/cm²	mmHg
1	0.1450	0.0102	7.5001
6.8966	1	0.0703	51.71
98.0665	14.22	1	735.6
0.1333	0.0193	0.0013	1

PSIG (inHgVAC.)	kPa	kgf/cm² (mmHgVAC.)
(29.5)	–100	(750.1)
(22.1)	–75	(562.5)
(14.8)	–50	(375.0)
(7.4)	–25	(187.5)
0	0	0
3.6	25	0.3
7.3	50	0.5
10.9	75	0.8
14.5	100	1.0
18.1	125	1.3
21.8	150	1.5
25.4	175	1.8
29.0	200	2.0
32.6	225	2.3
36.3	250	2.5
39.9	275	2.8
43.5	300	3.1
47.1	325	3.3
50.8	350	3.6
54.4	375	3.8
58.0	400	4.1
61.6	425	4.3
65.3	450	4.6
68.9	475	4.8
72.5	500	5.1
76.1	525	5.4
79.8	550	5.6
83.4	575	5.9
87.0	600	6.1
90.6	625	6.4
94.3	650	6.6
97.9	675	6.9
101.5	700	7.1
105.1	725	7.4
108.8	750	7.6
112.4	775	7.9
116.0	800	8.2
119.6	825	8.4
123.3	850	8.7
126.9	875	8.9
130.5	900	9.2
134.1	925	9.4
137.8	950	9.7
141.4	975	9.9
145.0	1000	10.2
148.6	1025	10.5
152.3	1050	10.7
155.9	1075	11.0
159.5	1100	11.2

PSIG	kPa	kgf/cm²
163.1	1125	11.5
166.8	1150	11.7
170.4	1175	12.0
174.0	1200	12.2
177.6	1225	12.5
181.3	1250	12.7
184.9	1275	13.0
188.5	1300	13.3
192.1	1325	13.5
195.8	1350	13.8
199.4	1375	14.0
203.0	1400	14.3
206.6	1425	14.5
210.3	1450	14.8
213.9	1475	15.0
217.5	1500	15.3
221.1	1525	15.6
224.8	1550	15.8
228.4	1575	16.1
232.0	1600	16.3
235.6	1625	16.6
239.3	1650	16.8
242.9	1675	17.1
246.5	1700	17.3
250.1	1725	17.6
253.8	1750	17.8
257.4	1775	18.1
261.0	1800	18.4
264.6	1825	18.6
268.3	1850	18.9
271.9	1875	19.1
275.5	1900	19.4
279.1	1925	19.6
282.8	1950	19.9
286.4	1975	20.1
290.0	2000	20.4
293.6	2025	20.6
279.3	2050	20.9
300.9	2075	21.2
304.5	2100	21.4
308.1	2125	21.7
311.8	2150	21.9
315.4	2175	22.2
319.0	2200	22.4
322.6	2225	22.7
326.3	2250	22.9
329.9	2275	23.2
333.5	2300	23.5
337.1	2325	23.7

PSIG	kPa	kgf/cm²
340.8	2350	24.0
344.4	2375	24.2
348.0	2400	24.5
351.6	2425	24.7
355.3	2450	25.0
358.9	2475	25.2
362.5	2500	25.5
366.1	2525	25.7
369.8	2550	26.0
373.4	2575	26.3
377.0	2600	26.5
380.6	2625	26.8
384.3	2650	27.0
387.9	2675	27.3
391.5	2700	27.5
395.1	2725	27.8
398.8	2750	28.0
402.4	2775	28.3
406.0	2800	28.6
409.6	2825	28.8
413.3	2850	29.1
416.9	2875	29.3
420.5	2900	29.6
424.1	2925	29.8
427.8	2950	30.1
431.4	2975	30.3
435.0	3000	30.6
438.6	3025	30.8
442.3	3050	31.1
445.9	3075	31.4
449.5	3100	31.6
453.1	3125	31.9
456.8	3150	32.1
460.4	3175	32.4
464.0	3200	32.6
467.6	3225	32.9
471.3	3250	33.1
474.9	3275	33.4
478.5	3300	33.7
482.1	3325	33.9
485.8	3350	34.2
489.4	3375	34.4
493.0	3400	34.7
496.6	3425	34.9
500.3	3450	35.2
503.9	3475	35.4
507.5	3500	35.7
511.1	3525	35.9
514.8	3550	36.2

16. 致冷劑(R22)汽化壓力表

溫度℃	飽和壓力		溫度℃	飽和壓力		溫度℃	飽和壓力		溫度℃	飽和壓力		溫度℃	飽和壓力	
	cmHg VAC.	kPa		kgf/cm²	kPa		kgf/cm²	kPa		kgf/cm²	kPa		kgf/cm²	kPa
-70	60.6	-81	-42	4.3 (cmHg VAC.)	-6	-14	2.11	207	14	6.84	671	42	15.55	1525
-68	58.6	-78	-40	0.04	4	-12	2.34	229	16	7.31	717	44	16.36	1604
-66	56.4	-75	-38	0.15	15	-10	2.60	255	18	7.80	765	46	17.20	1687
-64	53.7	-72	-36	0.26	25	-8	2.86	280	20	8.32	816	48	18.07	1772
-62	50.9	-68	-34	0.38	37	-6	3.14	308	22	8.86	869	50	18.97	1860
-60	47.9	-64	-32	0.51	50	-4	3.43	336	24	9.42	924	52	19.90	1952
-58	44.5	-59	-30	0.65	64	-2	3.74	367	26	10.00	981	54	20.85	2045
-56	40.8	-54	-28	0.79	77	0	4.07	399	28	10.60	1040	56	21.85	2143
-54	36.7	-49	-26	0.95	93	2	4.41	432	30	11.23	1101	58	22.87	2243
-52	32.4	-43	-24	1.11	109	4	4.79	470	32	11.89	1166	60	23.94	2348
-50	27.4	-37	-22	1.29	127	6	5.15	505	34	12.57	1233	–	–	–
-48	22.3	-30	-20	1.48	145	8	5.54	543	36	13.27	1301	65	26.50	2599
-46	16.6	-22	-18	1.63	160	10	5.96	584	38	13.99	1372	–	–	–
-44	10.5	-12	-16	1.89	185	12	6.39	627	40	14.76	1447	70	29.52	2895

關於交換EEPROM(IC45)的注意事項

- EEPROM安裝在位於控制器(MMCCIIIA)后面的主印刷電路板總成(PCB-C)上。
- 當你必須保持運轉時間、集裝箱編號及設定溫度等數據時，請按下述方法來交換EEROM。

(1) 用一個新的控制器來更換已斷路的控制器(主印刷電路板總成上的控制裝置)。

(2) 脫開已斷路控制器的可充電電池用連接器CN30，然后從已斷路控制器上拆下EEPROM。

(3) 按下述進行新控制器的"工廠清零"：

1 將微型開關1-6置於ON，然后將機器ON-OFF開關置於ON位置。

＊如果操作順序被顛倒，則"工廠清零"將不進行。

2 當初始診斷完成后，請將微型開關1-6置於OFF，然后將機器ON-OFF開關置於OFF。

(4) 脫開新控制器的CN30，拆下新控制器的EEPROM。

然后將已斷路控制器的EEPROM裝到新控制器上。

(5) 連接新控制器的CN30。

(6) 將機器的ON-OFF開關置於ON位置。(新控制器開始讀EEPROM提供的數據。)