NO.	T081-871
ISSUED:	MAY 10, 2012
REVISED:	NOV. 1, 2012

HOSHIZAKI
DRAWER TYPE UNDERCOUNTER REFRIGERATOR/FREEZER

MODEL RTL-DDAC series
FTL-DDAC series

SERVICE MANUAL

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I. GENERAL INFORMATION

1. SAFETY INSTRUCTIONS

The following instructions contain important safety precautions and should be strictly observed. The terms used here are defined as follows:

WARNING: There is a possibility of death or serious injury to the service person and a third party or the user due to improper service operations or defects in serviced products.

CAUTION: There is a possibility of injury to the service person and a third party or the user or damage to their property* due to improper service operations or defects in serviced products.

* The term “damage to their property” here refers to extensive damage to household effects, houses and pets.

WARNING

1. Always ask the user to keep children away from the work area. They may be injured by tools or disassembled products.

2. When there is no need to energize the unit during disassembly or cleaning, be sure to unplug the unit or disconnect the main power supply before servicing the unit to prevent electric shocks.

3. If the unit must be energized for inspection of the electric circuit, use rubber gloves to avoid contact with any live parts resulting in electric shocks.

4. Keep the following in mind when servicing the refrigeration circuit:

   (1) Be sure to recover the refrigerant. Do not discharge it into the atmosphere. It will affect the environment.

   (2) Check for any flames in the vicinity, and ensure good ventilation.

   (3) If the refrigerant should leak in servicing, immediately put out any fire used in the vicinity.

   (4) When unbrazing the refrigeration circuit connections, check that the circuit is completely evacuated. The refrigerant may produce a poisonous gas when coming in contact with an open flame.

   (5) Do not braze in an enclosed room to prevent carbon monoxide poisoning.

   (6) In case of a refrigerant leak, locate and repair the leaking part completely before recharging the refrigerant and checking for further leaks. If the leaking part cannot

be located, be sure to check again for further leaks after recharging the refrigerant. Leaked refrigerant may produce a poisonous gas when coming in contact with an open flame of a gas cooking stove or a fan heater.

(7) Before servicing, check the surface temperature of the refrigeration circuit to prevent a burn.

5. Keep the following in mind when making electrical connections:

(1) Check for proper earth connections, and repair if necessary to prevent electric shocks.

(2) Always use service parts intended for the applicable model for replacement of defective parts. Use proper tools to secure the wiring. Otherwise abnormal operation or trouble may occur and cause electric leaks or fire.

(3) Check for proper part installations, wiring conditions and soldered or solderless terminal connections to avoid fire, heat or electric shocks.

(4) Be sure to replace damaged or deteriorated power cords and lead wires to prevent fire, heat or electric shocks.

(5) Cut-off lead wires must be bound using closed end connectors or the like, with their closed ends up to avoid entrance of moisture that could lead to electric leaks or fire.

(6) After servicing, always use a megohmmeter (500V DC) to check for the insulation resistance of at least 1 megohm between the live part (attachment plug) and the dead metal part (earth terminal).

(7) Do not service the electrical parts with wet hands to prevent electric shocks.

(8) The capacitors used for the compressor and other components may be under high voltage and should be discharged properly before servicing.

CAUTION

1. After servicing, follow the instructions below:

(1) Always check the unit for proper operation before finishing services.

(2) Be sure to reassemble the parts completely. Loose assembly of such parts as control box cover may cause entrance of vermins resulting in a short circuit between terminals and possible ignition.

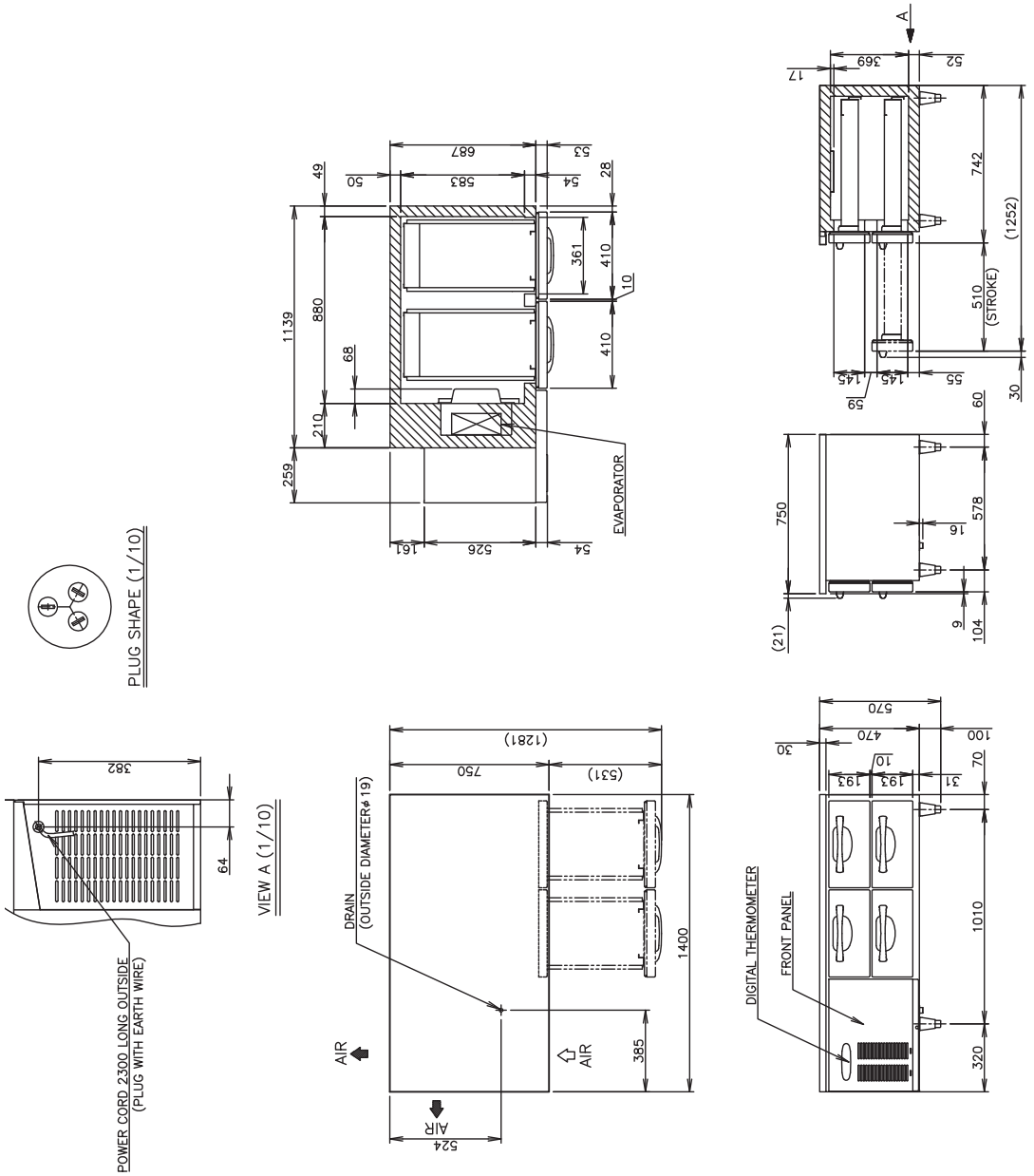
2. DIMENSIONS/SPECIFICATIONS

[a] RTL-140DDAC

ITEM	Hoshizaki Drawer Type Undercounter Refrigerator
MODEL	RTL-140DDAC
POWER SUPPLY	1 Phase 220-240V 50Hz Capacity: 0.5kVA(2.27A)
AMPERAGE	Rated: 1.6A
ELECTRIC CONSUMPTION	Motor: 225W(Power Factor: 68%) Heater: 174W Refrigeration: 248W Defrost: 174W
HEAT REJECTION	450W
POWER CORD	2.3m (Plug with Earth Wire)
EFFECTIVE CAPACITY	176L
OUTSIDE DIMENSIONS	1400mm(W)×750mm(D)×570mm(H) (560-600)mm
INSIDE DIMENSIONS	880mm(W)×583mm(D)×369mm(H)
EXTERIOR	Precoated Steel, Galvanized Steel (Rear/Bottom) Stainless Steel (Door,Front Panel)
INTERIOR	Precoated Steel, Stainless Steel(Door)
INSULATION	Polyurethane Foam
INSULATION FOAM BLOWING AGENT	Cyclopentane
REFRIGERATION SYSTEM	Forced Air Circulation
DEFROST SYSTEM	Heater
COMPRESSOR	Hermetic 280W (cooling capacity)
CONDENSER	Fin and Tube type, Air-cooled
EVAPORATOR	Fin and Tube Type
REFRIGERANT	R134a
TEMPERATURE CONTROL	Microprocessor (Digital Temp Indication) Adjustable from -6 to 12℃
DEFROST CONTROL	Microprocessor
ELECTRIC CIRCUIT PROTECTION	Fuse, Earth Wire
REFRIGERANT CIRCUIT PROTECTION	Motor Protector
LEG	Plastic Adjustable 90 to 130mm
WEIGHT	93kg (Gross Approx. 102kg)
PACKAGE	Carton 1465mm(W)×830mm(D)×560mm(H)
ACCESSORIES	Drain Hosex1,Elbowx1,Cable strapx2
OPERATING CONDITIONS	Ambient Temperature:5-38℃ Voltage Range:Rated Voltage±6%

■ We reserve the right to make changes in specifications and design without prior notice.

1. Install the product properly in accordance with the instructions on location, electrical connections stated in the instruction manual provided. Allow 10mm extra space at the installation site to meet any installation requirements(additional spacing is also required for proper air flow and pipe connections).
2. The heat rejection is based on the reached pulldown temperature at ambient temperature of 38℃ and power supply of 220V 50Hz. The amperage and electric consumption are based on measurements at ambient temperature of 38℃ and power supply of 220V 50Hz.
3. Product code: T081

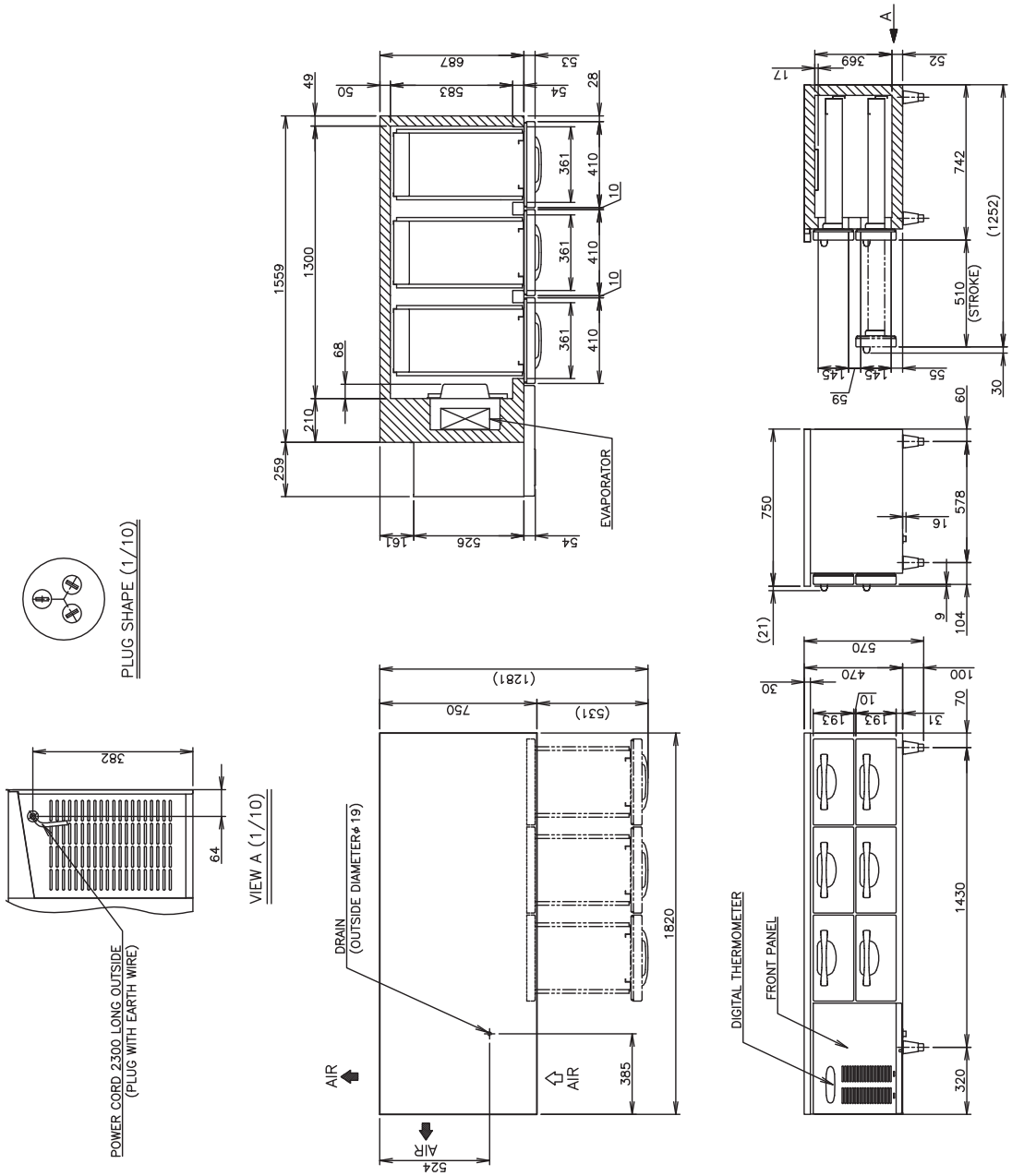


[b] RTL-182DDAC

ITEM	Hoshizaki Drawer Type Undercounter Refrigerator
MODEL	RTL-182DDAC
POWER SUPPLY	1 Phase 220-240V 50Hz Capacity: 0.5kVA(2.27A)
AMPERAGE	Rated: 1.6A
ELECTRIC CONSUMPTION	Motor: 225W(Power Factor: 68%) Heater: 183W Refrigeration: 257W Defrost: 183W
HEAT REJECTION	450W
POWER CORD	2.3m (Plug with Earth Wire)
EFFECTIVE CAPACITY	267L
OUTSIDE DIMENSIONS	1820mm(W)×750mm(D)×570mm(H) (560-600)mm
INSIDE DIMENSIONS	1300mm(W)×583mm(D)×369mm(H)
EXTERIOR	Precoated Steel, Galvanized Steel (Rear/Bottom) Stainless Steel (Door,Front Panel)
INTERIOR	Precoated Steel, Stainless Steel(Door)
INSULATION	Polyurethane Foam
INSULATION FOAM BLOWING AGENT	Cyclopentane
REFRIGERATION SYSTEM	Forced Air Circulation
DEFROST SYSTEM	Heater
COMPRESSOR	Hermetic 280W (cooling capacity)
CONDENSER	Fin and Tube type, Air-cooled
EVAPORATOR	Fin and Tube Type
REFRIGERANT	R134a
TEMPERATURE CONTROL	Microprocessor (Digital Temp Indication) Adjustable from -6 to 12℃
DEFROST CONTROL	Microprocessor
ELECTRIC CIRCUIT PROTECTION	Fuse, Earth Wire
REFRIGERANT CIRCUIT PROTECTION	Motor Protector
LEG	Plastic Adjustable 90 to 130mm
WEIGHT	118kg (Gross Approx. 130kg)
PACKAGE	Carton 1885mm(W)×830mm(D)×560mm(H)
ACCESSORIES	Drain Hosex1,Elbowx1,Cable strapx2
OPERATING CONDITIONS	Ambient Temperature:5-38℃ Voltage Range:Rated Voltage±6%

*We reserve the right to make changes in specifications and design without prior notice.

1. Install the product properly in accordance with the instructions on location, electrical connections stated in the instruction manual provided. Allow 10mm extra space at the installation site to meet any installation requirements(additional spacing is also required for proper air flow and pipe connections).
2. The heat rejection is based on the reached pulldown temperature at ambient temperature of 38℃ and power supply of 220V 50Hz. The amperage and electric consumption are based on measurements at ambient temperature of 38℃ and power supply of 220V 50Hz.
3. Product code: T082

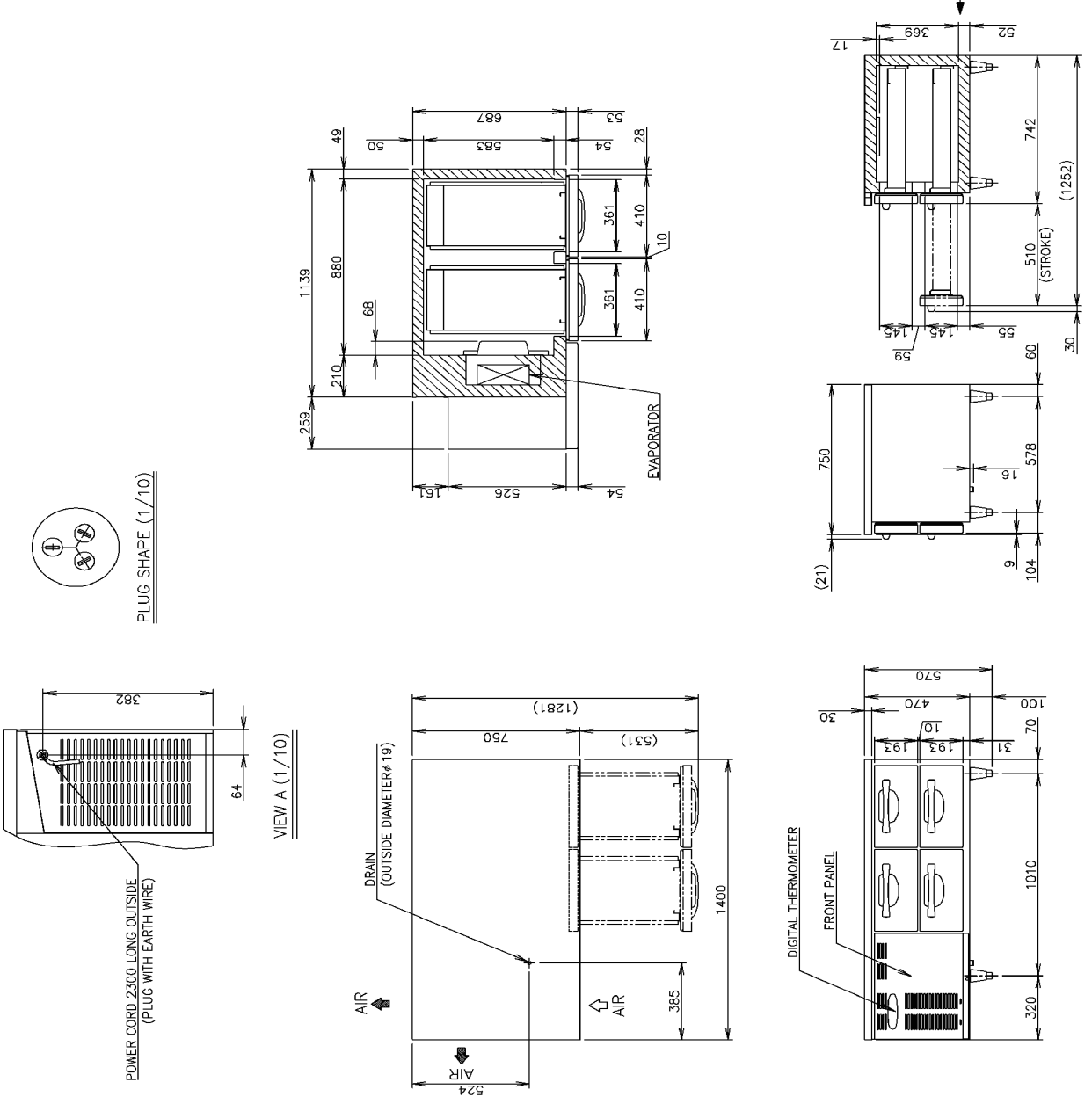


[c] FTL-140DDAC

ITEM	Hoshizaki Drawer Type Undercounter Freezer
MODEL	FTL-140DDAC
POWER SUPPLY	1 Phase 220-240V 50Hz Capacity: 0.95kVA(4.3A)
AMPERAGE	Rated : 2.6A
ELECTRIC CONSUMPTION	Motor: 360W(Power Factor: 74%) Heater: 347W Refrigeration: 390W Defrost: 347W
HEAT REJECTION	650W
POWER CORD	2.3m (Plug with Earth Wire)
EFFECTIVE CAPACITY	176L
OUTSIDE DIMENSIONS	1400mm(W)×750mm(D)×570mm(560-600)mm(H)
INSIDE DIMENSIONS	880mm(W)×583mm(D)×369mm(H)
EXTERIOR	Precoated Steel, Galvanized Steel (Rear/Bottom) Stainless Steel (Door,Front Panel)
INTERIOR	Precoated Steel, Stainless Steel(Door)
INSULATION	Polyurethane Foam
INSULATION FOAM BLOWING AGENT	Cyclopentane
REFRIGERATION SYSTEM	Forced Air Circulation
DEFROST SYSTEM	Heater
COMPRESSOR	Hermetic 410W (cooling capacity)
CONDENSER	Fin and Tube type, Air-cooled
EVAPORATOR	Fin and Tube Type
REFRIGERANT	R404A/160g
TEMPERATURE CONTROL	Microprocessor (Digital temp indication) Adjustable from -23 to -7℃
DEFROST CONTROL	Microprocessor
ELECTRIC CIRCUIT PROTECTION	Fuse, Earth Wire
REFRIGERANT CIRCUIT PROTECTION	Motor Protector
LEG	Plastic Adjustable 90-130mm
WEIGHT	99kg (Gross Approx. 108kg)
PACKAGE	Carton 1465mm(W)×830mm(D)×560mm(H)
ACCESSORIES	Drain Hosex1,Elbowx1,Cable strapx2
OPERATING CONDITIONS	Ambient Temperature:5-38℃ Voltage Range:Rated Voltage±6%

※We reserve the right to make changes in specifications and design without prior notice.

1. Install the product properly in accordance with the instructions on location, electrical connections stated in the instruction manual provided. Allow 10mm extra space at the installation site to meet any installation requirements(additional spacing is also required for proper air flow and pipe connections).
2. The heat rejection is based on the reached pulldown temperature at ambient temperature of 38℃ and power supply of 220V 50Hz. The amperage and electric consumption are based on measurements at ambient temperature of 38℃ and power supply of 220V 50Hz.
3. Product code: T083

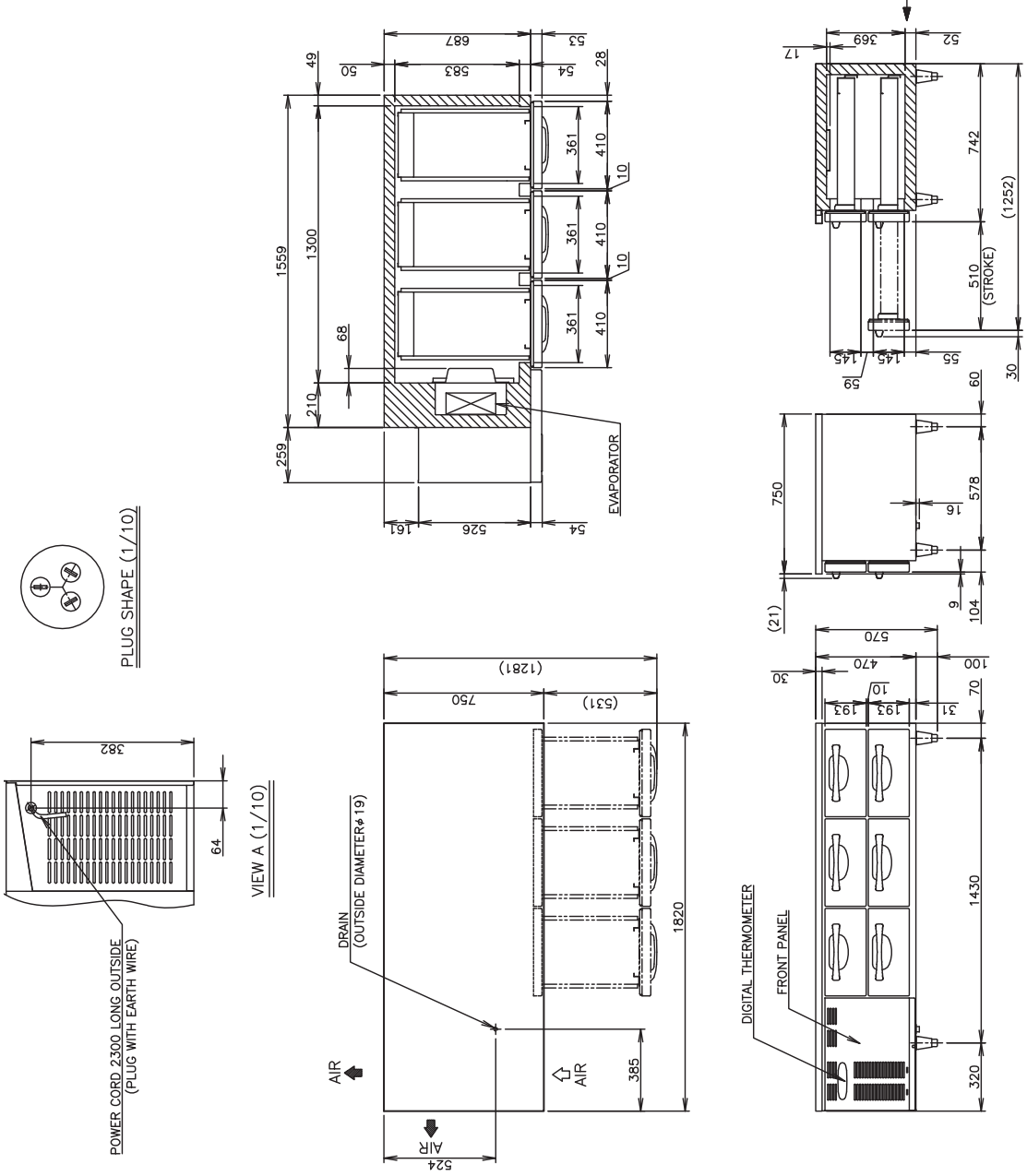


[d] FTL-182DDAC

ITEM	Hoshizaki Drawer Type Undercounter Freezer
MODEL	FTL-182DDAC
POWER SUPPLY	1 Phase 220-240V 50Hz Capacity: 0.79kVA(3.6A)
AMPERAGE	Rated : 2.1A
ELECTRIC CONSUMPTION	Motor : 360W(Power Factor : 86%) Heater : 360W Refrigeration : 418W Defrost : 360W
HEAT REJECTION	650W
POWER CORD	2.3m (Plug with Earth Wire)
EFFECTIVE CAPACITY	267L
OUTSIDE DIMENSIONS	1820mm(W)×750mm(D)×570mm(H) (560-600)mm
INSIDE DIMENSIONS	1300mm(W)×583mm(D)×369mm(H)
EXTERIOR	Precoated Steel, Galvanized Steel (Rear/Bottom) Stainless Steel (Door,Front Panel)
INTERIOR	Precoated Steel, Stainless Steel(Door)
INSULATION	Polyurethane Foam
INSULATION FOAM BLOWING AGENT	Cyclopentane
REFRIGERATION SYSTEM	Forced Air Circulation
DEFROST SYSTEM	Heater
COMPRESSOR	Hermetic 480W (cooling capacity)
CONDENSER	Fin and Tube type, Air-cooled
EVAPORATOR	Fin and Tube Type
REFRIGERANT	R404A
TEMPERATURE CONTROL	Microprocessor (Digital Temp Indication) Adjustable from -23 to -7℃
DEFROST CONTROL	Microprocessor
ELECTRIC CIRCUIT PROTECTION	Fuse, Earth Wire
REFRIGERANT CIRCUIT PROTECTION	Motor Protector
LEG	Plastic Adjustable 90 to 130mm
WEIGHT	124kg (Gross Approx. 136kg)
PACKAGE	Carton 1885mm(W)×830mm(D)×560mm(H)
ACCESSORIES	Drain Hosex1,Elbowx1,Cable strapx2
OPERATING CONDITIONS	Ambient Temperature:5-38℃ Voltage Range:Rated Voltage±6%

■ We reserve the right to make changes in specifications and design without prior notice.

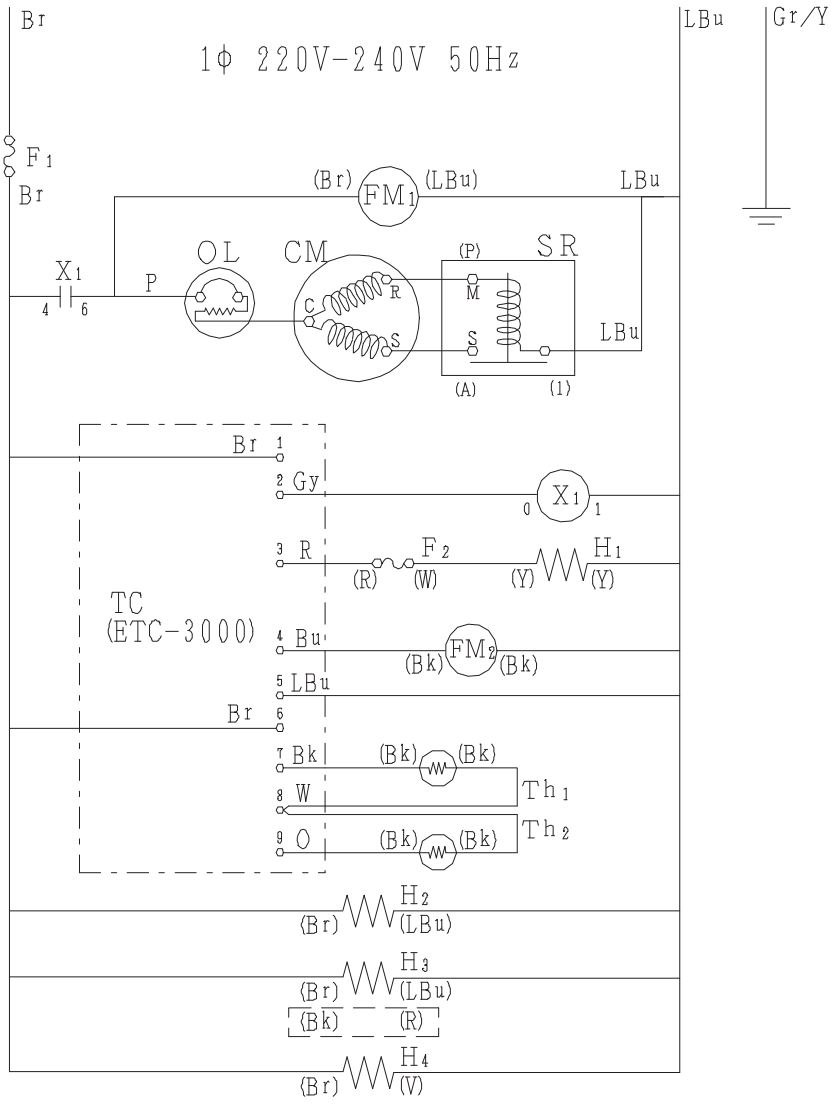
1. Install the product properly in accordance with the instructions on location, electrical connections stated in the instruction manual provided. Allow 10mm extra space at the installation site to meet any installation requirements(additional spacing is also required for proper air flow and pipe connections).
2. The heat rejection is based on the reached pulldown temperature at ambient temperature of 38℃ and power supply of 220V 50Hz. The amperage and electric consumption are based on measurements at ambient temperature of 38℃ and power supply of 220V 50Hz.
3. Product code: T084



II. TECHNICAL INFORMATION

1. WIRING DIAGRAM

[a] RTL SERIES



CODE	NAME
F_1	FUSE 10A
F_2	THERMAL FUSE CUT OFF:94℃
TC	TEMPERATURE CONTROLLER
CM	COMPRESSOR
SR	START RELAY
OL	OVER LOAD PROTECTOR
X_1	POWER RELAY
FM_1	FAN MOTOR (CONDENSER)
FM_2	FAN MOTOR (INTERIOR)
Th_1	THERMISTOR (INTERIOR)
Th_2	THERMISTOR (DEFROST)
H_1	DEFROST HEATER
H_2	CORD HEATER (OUTER FRAME)
$H_{3,4}$	CORD HEATER (CENTER FRAME)

*WIRE COLOR

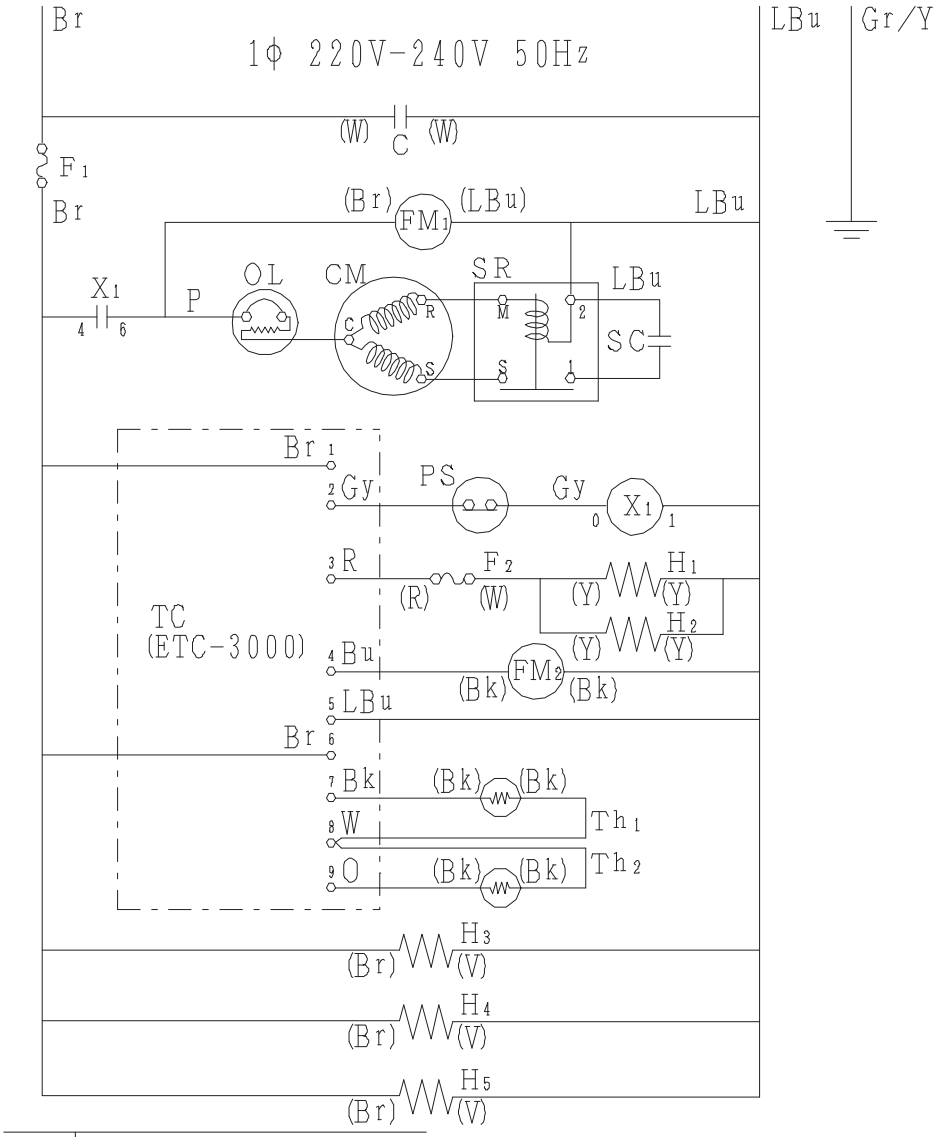
PRIMARY SECONDARY (THIN)

:FOR RTL-182DDAC

WIRE COLOR CODE	
Br	BROWN
LBu	LIGHT BLUE
W	WHITE
P	PINK
R	RED
Bk	BLACK
O	ORANGE
Gy	GRAY
Gr	GREEN
Y	YELLOW
Bu	BLUE
V	VIOLET

3S3940L01A

[b] FTL-140DDAC



CODE	NAME
F_1	FUSE 10A
F_2	THERMAL FUSE CUT OFF:94℃
TC	TEMPERATURE CONTROLLER
CM	COMPRESSOR
SR	START RELAY
SC	START CAPACITOR
RC	RUN CAPACITOR
OL	OVER LOAD PROTECTOR
X_1	POWER RELAY
FM_1	FAN MOTOR (CONDENSER)
FM_2	FAN MOTOR (INTERIOR)
Th_1	THERMISTOR (INTERIOR)
Th_2	THERMISTOR (DEFROST)
$H_{1,2}$	DEFROST HEATER
H_3	CORD HEATER (OUTER FRAME)
$H_{4,5}$	CORD HEATER (CENTER FRAME)
PS	PRESSURE SWITCH
C	CAPACITOR

*WIRE COLOR

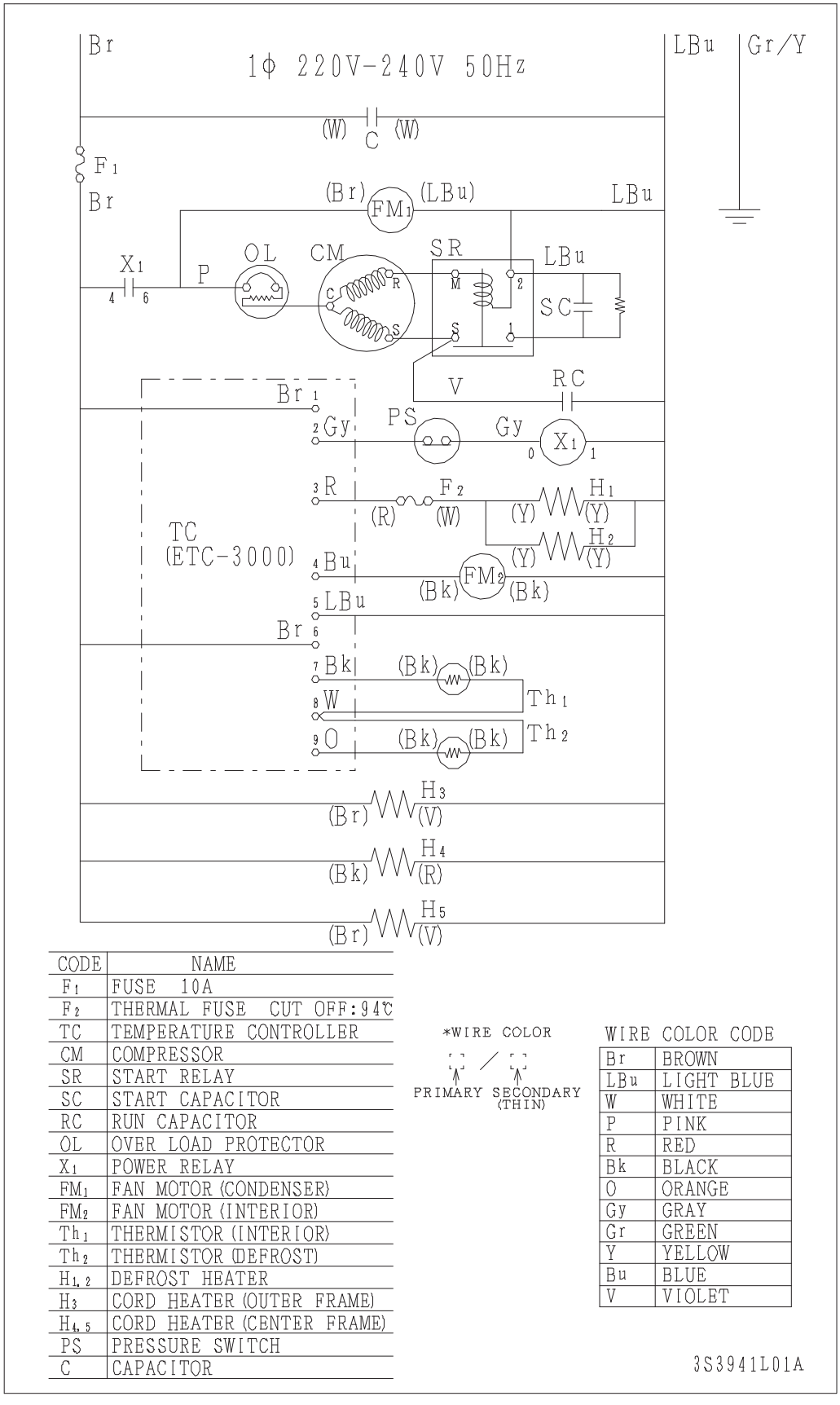
PRIMARY SECONDARY (THIN)

WIRE COLOR CODE

Br	BROWN
LBu	LIGHT BLUE
W	WHITE
P	PINK
R	RED
Bk	BLACK
O	ORANGE
Gy	GRAY
Gr	GREEN
Y	YELLOW
Bu	BLUE
V	VIOLET

3S4068L01A

[c] FTL-182DDAC



CODE	NAME
F_1	FUSE 10A
F_2	THERMAL FUSE CUT OFF:94℃
TC	TEMPERATURE CONTROLLER
CM	COMPRESSOR
SR	START RELAY
SC	START CAPACITOR
RC	RUN CAPACITOR
OL	OVER LOAD PROTECTOR
X_1	POWER RELAY
FM_1	FAN MOTOR (CONDENSER)
FM_2	FAN MOTOR (INTERIOR)
Th_1	THERMISTOR (INTERIOR)
Th_2	THERMISTOR (DEFROST)
$H_{1,2}$	DEFROST HEATER
H_3	CORD HEATER (OUTER FRAME)
$H_{4,5}$	CORD HEATER (CENTER FRAME)
PS	PRESSURE SWITCH
C	CAPACITOR

*WIRE COLOR

[ ] / [ ]

PRIMARY SECONDARY (THIN)

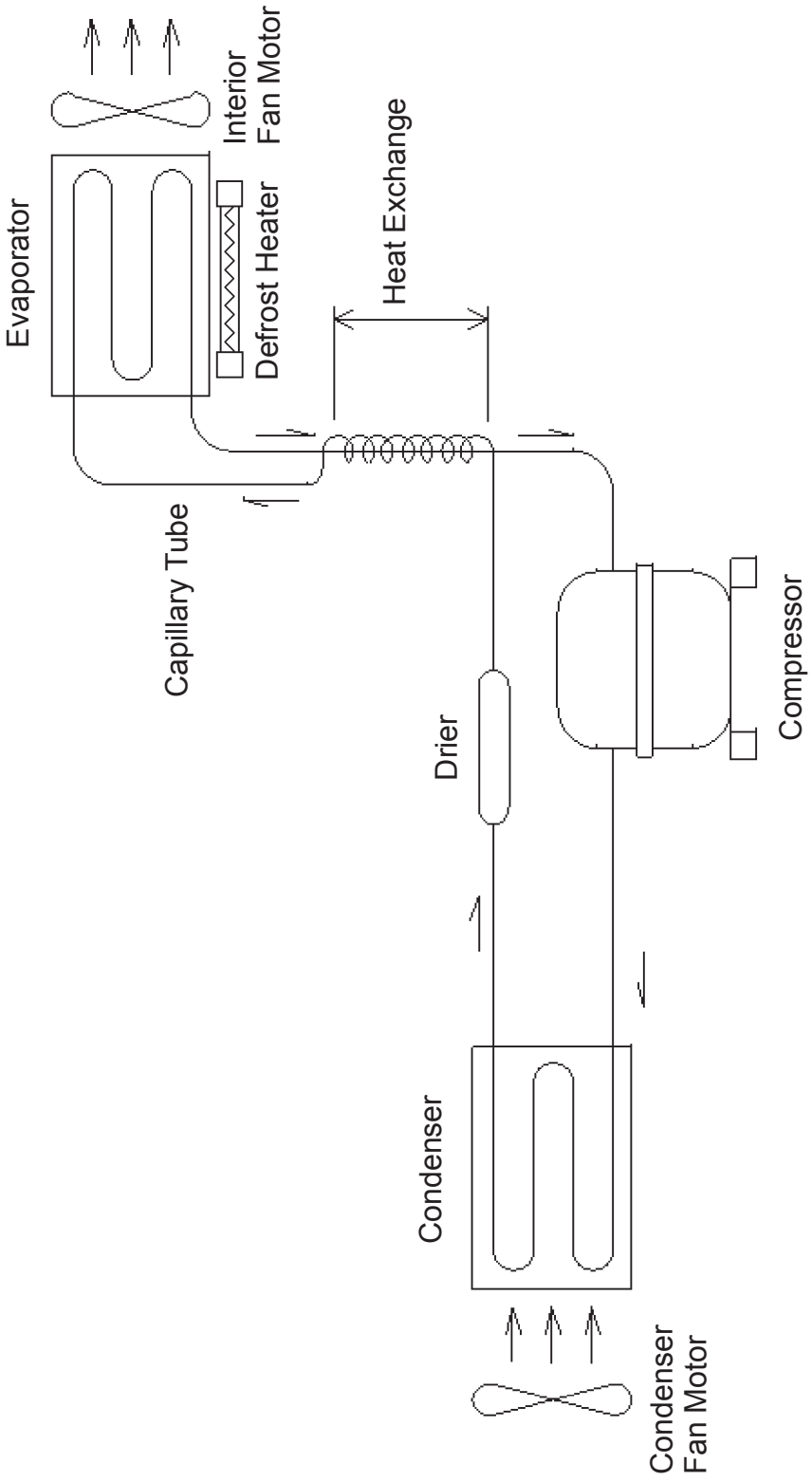
WIRE COLOR CODE

Br	BROWN
LBu	LIGHT BLUE
W	WHITE
P	PINK
R	RED
Bk	BLACK
O	ORANGE
Gy	GRAY
Gr	GREEN
Y	YELLOW
Bu	BLUE
V	VIOLET

3S3941L01A

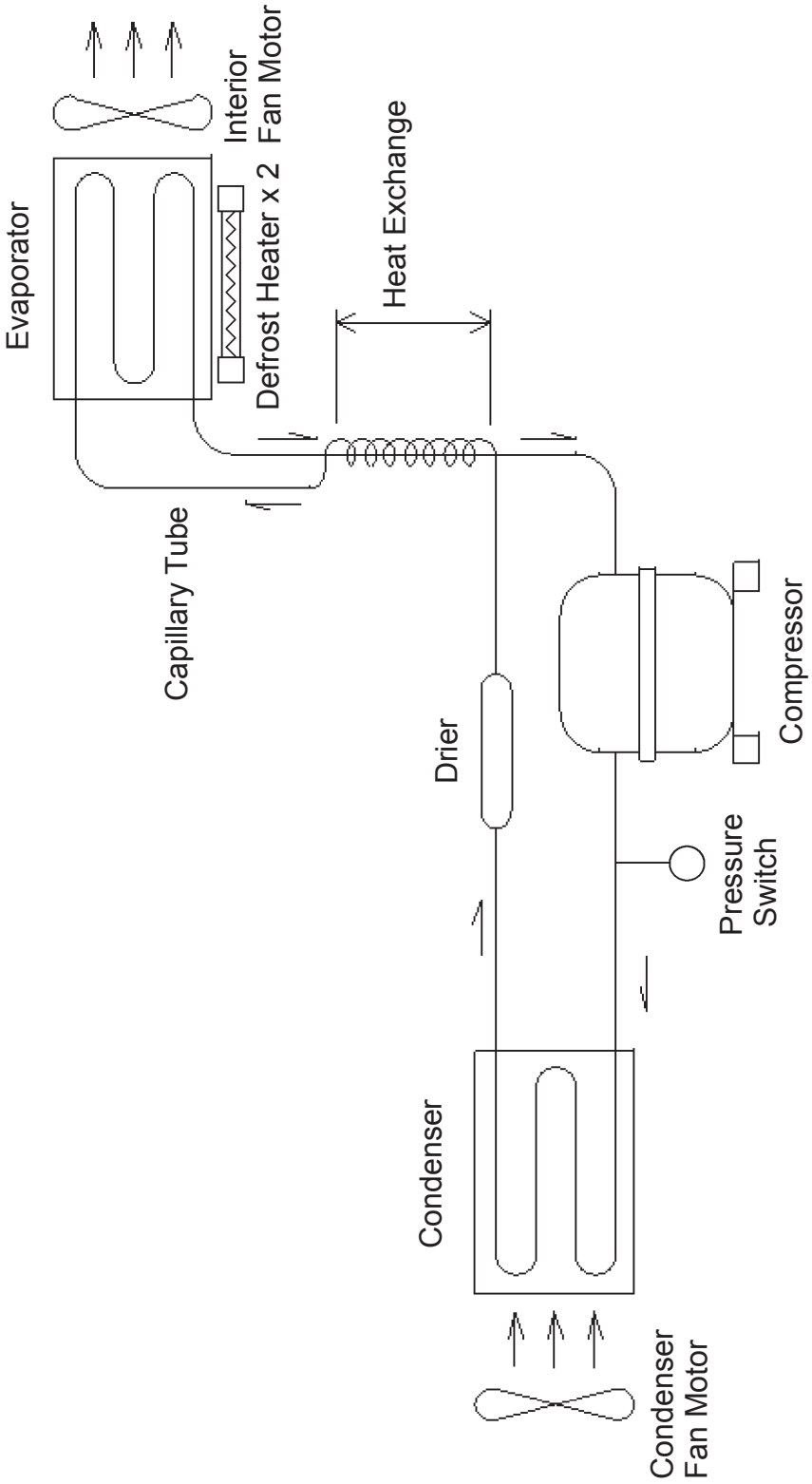
2. REFRIGERATION CIRCUIT

[a] RTL SERIES



Refrigerant: HFC-134a

[b] FTL SERIES

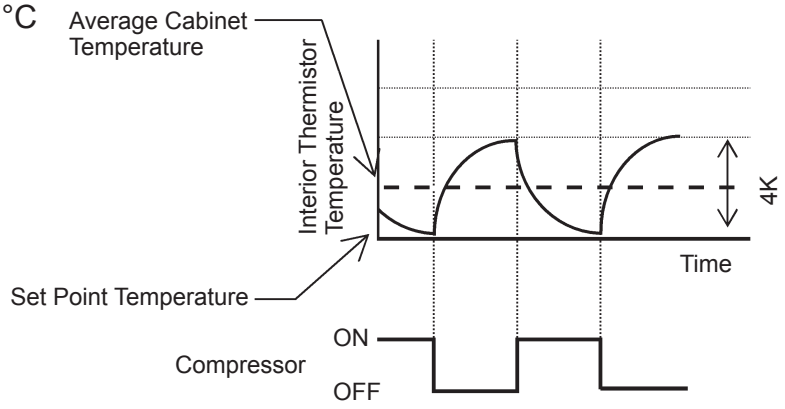


Refrigerant: HFC-404A

3. ELECTRONIC CONTROLS

[a] SET POINT TEMPERATURE (compressor OFF temperature)

Heater defrost (RTL series): -6 to +12°C
Heater defrost (FTL sereis): -23 to -7°C



[b] CABINET TEMPERATURE DIFFERENTIAL

4 K (from “set point temp” to “set point temp + 4 K”)

The compressor stops when the cabinet temperature reaches down to the set point temperature, and starts when the cabinet temperature rises to the set point temperature + 4°C. Accordingly, the average cabinet temperature will be around the set point temperature + 2°C.

[c] DEFROST CYCLE

The unit automatically defrosts the evaporator 6 hours after the refrigeration starts. The defrost indicator light on the operation panel comes on when the defrost cycle starts.

[d] DEFROST TERMINATION TEMPERATURE

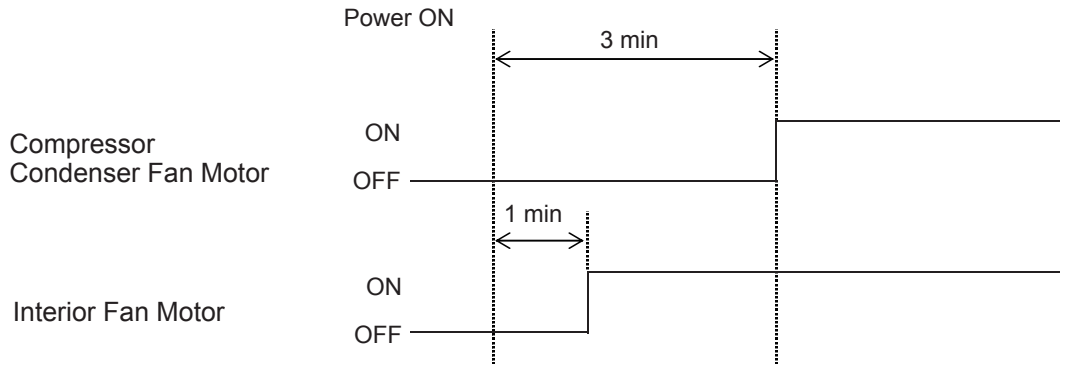
Heater defrost (RTL series): +5°C
Heater defrost (FTL sereis): +20°C

[e] TEMPERATURE DISPLAY

During a defrost cycle, the screen indicates “dF”.

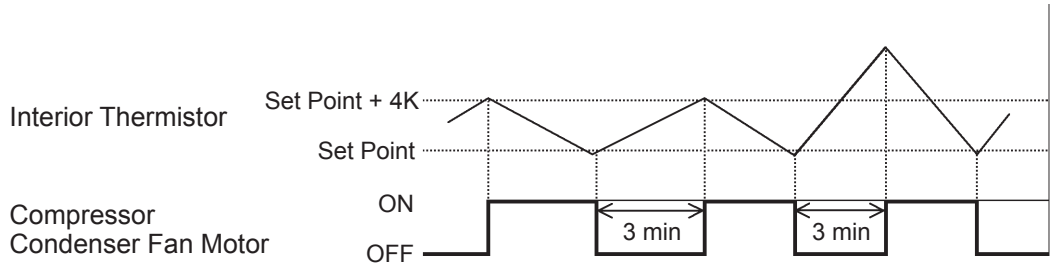
[f] COMPRESSOR SOFT START

1) Startup



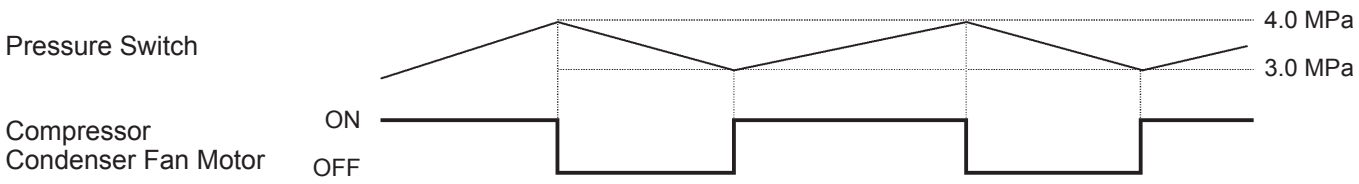
When the power supply is turned on, the screen shows the cabinet temperature and the interior fan motor starts up with a 1 minute delay. The compressor and condenser fan motor start up with a 3 minute delay.
This delay is intended to minimize the difference between the high-side and low-side pressures and to reduce the load on the compressor so that it can start easily in case of a short (especially instantaneous) power failure.

2) Normal Control



When the compressor turns off during normal control, it has a mandatory 3 minute delay before startup. For example, if the compressor turns off by its thermistor and the door is opened immediately after (causing the cabinet temperature to immediately exceed the restart temperature), the compressor will still not start until 3 minutes have passed since its shutdown.

[g] HIGH PRESSURE SWITCH



[h] CHECKING SET POINT TEMPERATURE

Note: See “5. CONTROLLER” for the operation panel key locations.

Press and hold the set key on the operation panel for 3 seconds to display “SEt” on the screen. Press the set key again to display the set point temperature on the screen. After 10 seconds, the screen displays the cabinet temperature again.

[i] MANUAL DEFROST

To start the manual defrost cycle, press the defrost key for 3 seconds. The defrost indicator light on the operation panel comes on when the defrost cycle starts.

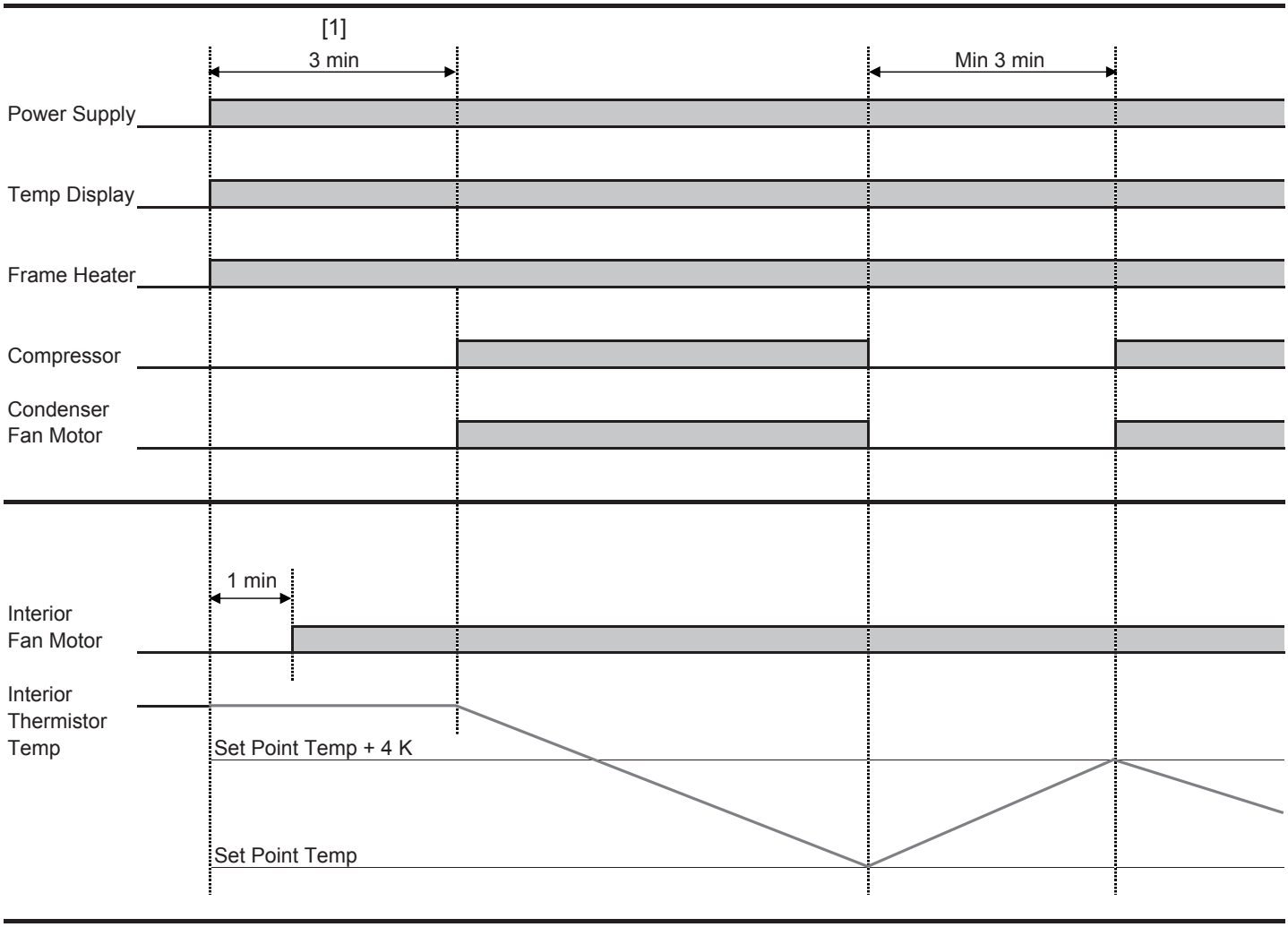
[j] ERROR CODES

Code	Possible Cause	Operation and Remedy
HHH	Cabinet sensor (interior thermistor) error	Compressor cycles on for 45 minutes and off for 15 minutes. Check cabinet temperature. See “III. 1. ERROR CODES” for further details.
LLL		
HHH * With [6] down key pressed	Cabinet sensor (defrost thermistor) error	Forcibly finishes defrost cycle at the end of defrost time. See “III. 1. ERROR CODES” for further details.
LLL * With [6] down key pressed		

* The code “dF” is not an error code but indicates the unit is in defrost cycle.
* When the defrost thermistor is defective, error code will not be displayed without [6] down key being pressed. See “II. 5. CONTROLLER” for operation panel detail.

4. TIMING CHART

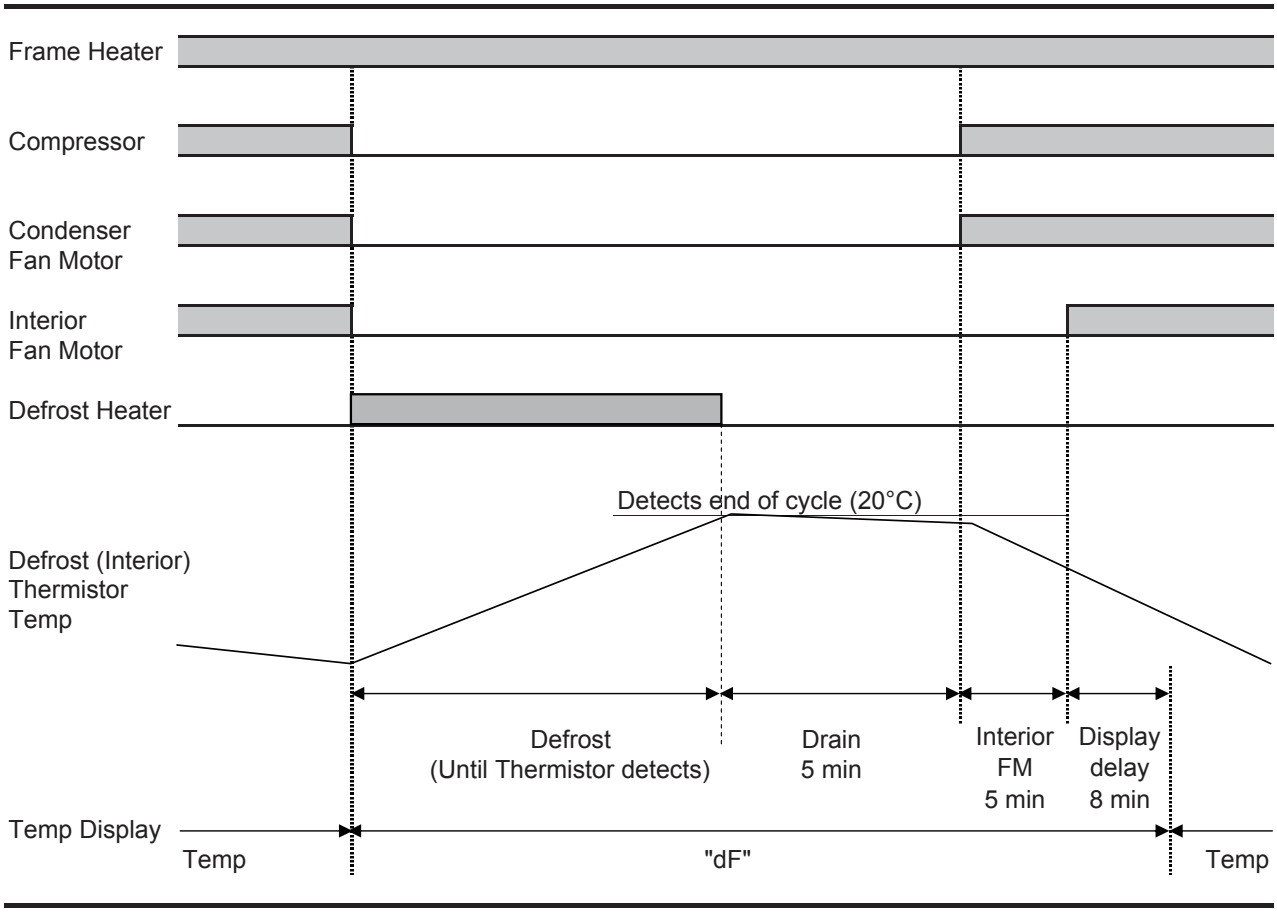
[a] STARTUP - CONTROL



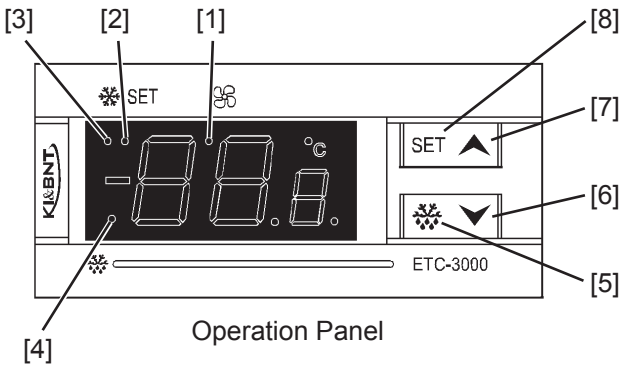
[1] Standby at Startup

Only temperature indication is available for 3 min (not a sign of failure).

[b] DEFROST


Frame Heater
Compressor
Condenser Fan Motor
Interior Fan Motor
Defrost Heater
Detects end of cycle (20°C)
Defrost (Interior) Thermistor Temp
Defrost (Until Thermistor detects)
Drain 5 min
Interior FM 5 min
Display delay 8 min
Temp Display
Temp
"dF"
Temp

5. CONTROLLER



Operation Panel

[1] Fan Indicator Light
[2] Set Indicator Light
[3] Refrigeration Indicator Light
[4] Defrost Indicator Light
[5] Defrost Key
[6] Down Key
[7] Up Key
[8] Set Key

Indicator Lights

Indicator Light	Symbol	Status	Meaning
Refrigeration	❄	On	Compressor running
		Off	Compressor stopped
		Flash	Compressor delayed
		Quick flash	Manual refrigeration
Defrost	❄	On	Defrosting
		Off	Defrost stopped
		Flash	Defrost drain
		Quick flash	Manual defrost
Fan		On	Fan running
		Off	Fan stopped
		Flash	Fan delayed
Set	SET	On	Setting mode
		Off	Normal mode
Celsius	C	On	Celsius display under normal mode
		Off	Fahrenheit display under normal mode

Key Functions and Setting Modes

Key Operation	Function 1 (Normal Mode)	Function 2 (User Setting Mode)	Function 3 (Administrator Setting Mode)
Set		Enter parameter setting	Save parameter and return to setting interface
Set (3 sec)	Enter user setting	Exit setting	Exit setting
Set + Down (10 sec)	Enter administrator setting		
Down		Check menu item	Calibrate parameter
Down (3 sec)		Fast forward menu item	Quickly calibrate parameter
Up	Upload copy key	Check menu item	Calibrate parameter
Up (3 sec) *See Note	Start/stop forced refrigeration	Fast rewind menu item	Quickly calibrate parameter
Defrost (3 sec)	Start/stop manual defrost		
Up + Down (10 sec)	Lock key operation		

Note: Do not use “Up (3 sec)” in normal mode because defrost cycle may not start.
If “Up (3 sec)” key operation starts forced refrigeration, defrost cycle will not start until temperature reaches set point. During forced refrigeration, [3] refrigeration indication light will flash quickly. Forced refrigeration can be cancelled by “Up (3 sec)” key operation. After cancellation, defrost cycle will automatically start.

Parameters

Menu	Item	Range	Default RTL series	Default FTL series	Remark
User	SEt	RTL: -6 to 12 (*) FTL: -23 to -7	1 (*)	-20	Temp parameter setting *<US> setup is set to <12> in advance.
	HY	1 to 25°C	4	4	Return difference setting
	MdF	0 to 255 min	60	60	Defrost time
	IdF	0 to 120 hrs	6	6	Defrost cycle
Administrator	LS	-45.5°C to SEt	-6	-23	Min temp setting
	US	SEt to 99.9°C	12	-7	Max temp setting
	ot	-10 to +10°C	140: +0.0 182: +0.0	140: +0.5 182: +1.5	Room temp calibration 140: 140DDAC, 182: 182DDAC
	oE	-10 to +10°C	0	0	Defrost temp calibration
	AC	0 to 50 min	4	4	Compressor delay time
	CON	0 to 255 min	45	45	Interior thermistor error compressor ON time
	CoF	0 to 255 min	15	15	Interior thermistor error compressor OFF time
	CF	°C: Celsius °F: Fahrenheit	°C	°C	Temp measurement unit
	tdF	EL: 0 (Electric heating) HtG: 1 (Thermal)	EL	EL	Defrost type
	dtE	-45.5 to +49.9°C	20	20	Defrost termination temp
	dFd	Rt: 0 (Normal display of room temp) It: 1 (Defrost start temp) SEt: 2 (Display set point) dEF: 3 (Display dF)	dEF	dEF	Display delay after defrosting
	dAd	0 to 255 min	18	18	Display delay time after defrosting
	Fdt	0 to 255 min	5	5	Draining time after defrost
	dPo	y:0 (Immediately) n:1 (Later)	n	n	Defrost cycle at initial startup
	dAF	0 to 24 hrs	0	0	Defrost delay after forced refrigeration
	FnC	C-N: Start/stop with compressor, OFF when defrosting O-N: Continuous, OFF when defrosting C-Y: Start/stop with compressor, ON when defrosting O-Y: Continuous, ON when defrosting	O-N	O-N	Fan operation mode
	Fnd	0 to 255 min	10	10	Fan delay after defrosting
	FCt	0 to 50°C	50	50	Forced startup by difference between room temp and evaporator temp
	ALU	ALL to 99.9°C	110	110	Upper alarm temp limit
	ALL	-45.5°C to ALU	-45.5	-45.5	Lower alarm temp limit
	Ald	0 to 255 min	15	15	Temp alarm delay
	dAo	0 to 24	1	1	Temp alarm delay after energized
	Cot	0 to 255 min	0	0	Thermistor error delay
	FSt	-45.5 to 49.9	40	40	Fan stop temp

Operations

1. Compressor functions:

A. Under electric heating defrost mode:

Start condition: Compressor relay closes when both a) and b) or both a) and c) are met.
a) Compressor delay time exceeds the set delay time.
b) Forced refrigeration starts when the room temperature is higher than the set point temperature.
c) Under non-defrost mode, the room temperature is higher than the set point temperature + return difference.

Stop condition: Compressor relay opens when any of the following conditions is met.
a) Room temperature is lower than the set point temperature.
b) At the start of defrost cycle.
c) Forced refrigeration stops.

B. Under thermal defrost mode:

Start condition: Compressor relay closes when both a) and b), both a) and c) or both a) and d) are met.
a) Compressor delay time exceeds the set delay time.
b) Under non-defrost mode, the room temperature is higher than the set point temperature + return difference.
c) Forced refrigeration starts when the room temperature is higher than the set point temperature.
d) In defrost cycle.

Stop condition: Compressor relay opens when any of the following conditions is met.
a) Room temperature is lower than the set point temperature.
b) At the end of defrost cycle.
c) Forced refrigeration stops, and defrost cycle does not start immediately.

2. Defrost functions:

Defrost relay closes when the following conditions are met.
a) Defrost delay time meets the set delay time.
b) Defrost thermistor temperature is lower than the defrost termination temperature.
c) Defrost cycle ends or manual defrost starts.

Defrost relay opens when any of the following conditions is met.
a) Defrost time runs out.
b) Defrost thermistor temperature is higher than the defrost termination temperature.

3. Fan functions:

Fan relay closes when any of the following conditions is met.

a) Defrost temperature is higher than the fan stop temperature; Difference between room temperature and evaporator temperature is more than the set difference.
b) Operation mode “0”; Compressor starts; Defrost thermistor temperature is lower than the fan stop temperature; Fan delay time after defrost exceeds the set value.
c) Operation mode “1”; Under non-defrost mode, the defrost temperature is lower than the fan stop temperature; Fan delay time after defrost exceeds the set value.
d) Operation mode “2”; When the compressor is running or during defrost cycle, the defrost temperature is lower than the fan stop temperature; Fan delay time after defrost exceeds the set value.
e) Operation mode “3”; Defrost temperature is lower than the fan stop temperature.

Fan relay opens when the following conditions are met.

a) Defrost temperature is higher than the fan stop temperature; Difference between room temperature and evaporator temperature is less than the set difference.
b) Operation mode “0”; Compressor stops or defrost starts.
c) Operation mode “1”; Defrost starts.
d) Operation mode “2”; Compressor stops.

4. Alarm functions:

LED flashes and displays alarm information when the room temperature exceeds the upper or lower alarm temperature limit and the set alarm delay time runs out.
LED displays “HHH” when the room temperature exceeds the upper limit of measured temperature or the thermistor short-circuits and runs out of the thermistor error delay time.
LED displays “LLL” when the room temperature is lower than the lower limit of measured temperature or the thermistor short-circuits and runs out of the thermistor error delay time.

5. Copy key operations:

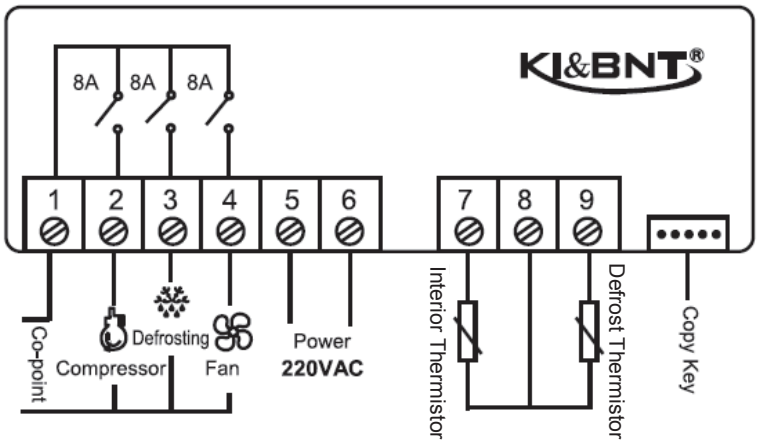
Under the controller power-on mode, plug in the copy key and press the up key to display “UPL”. At this time, press the set key to upload the parameters to the copy key. LED displays normal temperature after uploading. Then, turn off the controller and unplug the copy key. LED flashes and displays “err” if there is any error while uploading.
Under the controller power-off mode, plug in the copy key and turn on the controller. At this time, the controller automatically detects the copy key and downloads the parameters. LED displays “DOW” while downloading and “End” after downloading. Then, turn off the controller and unplug the copy key. Restart the controller. LED flashes and displays “err” if there is any parameter error or controller model error.

6. Key lock functions:

Under normal mode, press and hold the up and down keys at the same time for 10 seconds to turn on/off the key lock. At this time, LED displays the key lock on/off mode. Release the up and down keys. LED displays normal temperature. All the parameters can be checked but cannot be modified.

Wiring Diagram

ETC-3000



III. SERVICE DIAGNOSIS

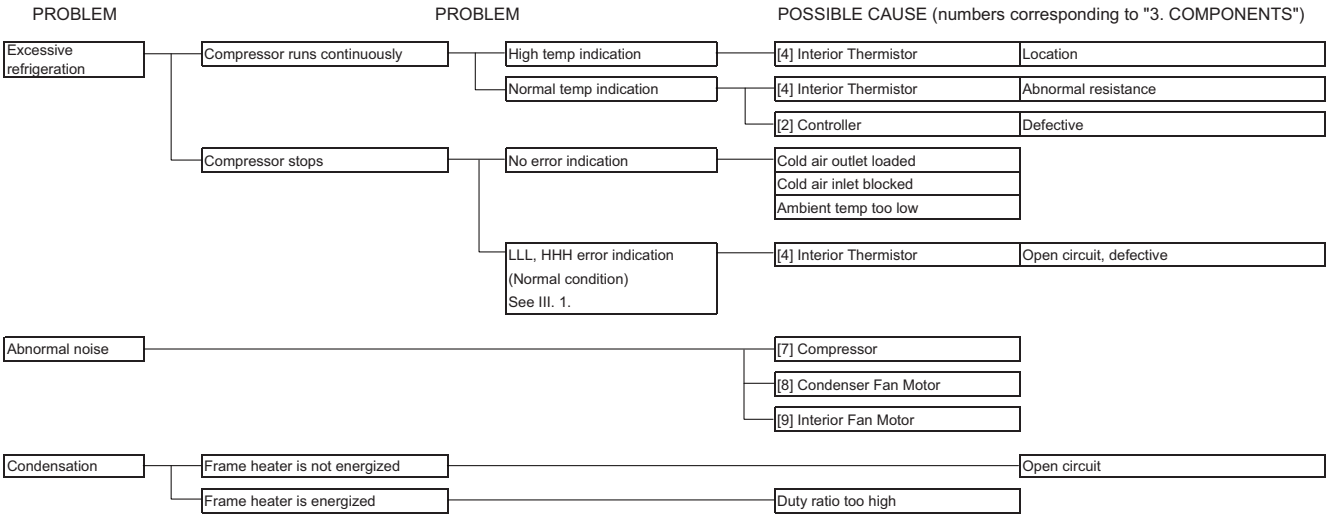
1. ERROR CODES

Display	Error	Description	Possible Cause	Reset
HHH	Interior thermistor defective	Repeats starting and stopping operation at certain interval.	• Interior thermistor circuit shorted, dusty connector	• Automatically resets after cause is removed
LLL		Repeats starting and stopping operation at certain interval.	• Interior thermistor circuit open, connector unplugged	• Automatically resets after cause is removed
HHH * With [6] down key pressed	Defrost thermistor defective	Forcibly finishes defrost cycle at the end of defrost time and starts normal operation.	• Defrost Thermistor circuit shorted, dusty terminal	• Automatically resets after cause is removed
LLL * With [6] down key pressed		Forcibly finishes defrost cycle at the end of defrost time and starts normal operation.	• Defrost Thermistor circuit open, connector unplugged	• Automatically resets after cause is removed

* When the defrost thermistor is defective, error code will not be displayed without [6] down key being pressed. See “II. 5. CONTROLLER” for operation panel detail.

2. FLOWCHART

PROBLEM	PROBLEM		POSSIBLE CAUSE (numbers corresponding to "3. COMPONENTS")	
No refrigeration	Compressor will not start	No temp indication	[1] Fuse	Blown Out
			[2] Controller	Open circuit, connector unplugged
		No error indication	[4] Interior Thermistor	Abnormal resistance, bad contact
			[6] Pressure Switch	Defective
			[3] Relay	Output
			[7] Compressor	Winding open, electrical part defective
	Compressor starts and stops immediately	No error indication	Ambient temp too high	
			Condensing capacity insufficient	Heat source, ventilation
			[15] Air Filter	Clogged
			[8] Condenser Fan Motor	Locked, open circuit
			[6] Pressure Switch	Defective
			[3] Relay	Output
			[4] Interior Thermistor	Location
			[7] Compressor	Locked, etc
	Compressor runs with no refrigeration	LLL, HHH error indication (Down Key pressed) See II. 5. [b] and III. 1.	[5] Defrost Thermistor	Open circuit, short circuit
			[11] Thermal Fuse	Blown out
		LLL, HHH error indication (No button operation) See III. 1.	[4] Interior Thermistor	Open circuit, short circuit
		Refrigeration Indicator Light flashes quickly every 0.5 second (No button operation) See II. 5. [b].	[2] Controller	Hold down Up Key for 3 seconds to cancel forced refrigeration. After cancellation, defrost cycle starts automatically.
		No error indication	Ambient temp too high	
			Condensing capacity insufficient	Heat source, ventilation
			[15] Air Filter	Clogged
			Internal load too large	
			Door gap	
			[4] Interior Thermistor	Location
			[9] Interior Fan Motor	Open circuit, defective
			[2] Controller	Defective
			[13] Refrigeration Circuit	Capillary, drier
			[14] Refrigerant Leak	
			[8] Condenser Fan Motor	Locked, open circuit
			[7] Compressor	Defective
			[10] Defrost Heater	Open circuit, defective
Poor refrigeration	Slow refrigeration	Set point is reached	Interior overloaded	
		Set point is not reached	See "Compressor runs with no refrigeration" above	
	Normal temp indication with poor refrigeration		Interior overloaded	
			Heat load inside	
			[9] Interior Fan Motor	Open circuit, defective
			[2] Controller	Defective
			[4] Interior Thermistor	Abnormal resistance, bad contact, location
		Frosted evaporator	Defrost cycle setting readjusted	Too long
			[5] Defrost Thermistor	Abnormal resistance
			[10] Defrost Heater	Open circuit, defective
			[11] Thermal Fuse	Blown out
	High cabinet temperature after defrost	LLL, HHH error indication (Down Key pressed) See II. 5. [b] and III. 1.	[5] Defrost Thermistor	Open circuit, short circuit
		No error indication	[5] Defrost Thermistor	Location


PROBLEM
PROBLEM
POSSIBLE CAUSE (numbers corresponding to "3. COMPONENTS")
Excessive refrigeration
Compressor runs continuously
High temp indication
[4] Interior Thermistor
Location
Normal temp indication
[4] Interior Thermistor
Abnormal resistance
[2] Controller
Defective
Compressor stops
No error indication
Cold air outlet loaded
Cold air inlet blocked
Ambient temp too low
LLL, HHH error indication
(Normal condition)
See III. 1.
[4] Interior Thermistor
Open circuit, defective
Abnormal noise
[7] Compressor
[8] Condenser Fan Motor
[9] Interior Fan Motor
Condensation
Frame heater is not energized
Open circuit
Frame heater is energized
Duty ratio too high

3. COMPONENTS

CHART NO.	COMPONENT	CHECK	REMEDY
[1]	Fuse	Blown out	Replace
[2]	Controller	Open circuit	Correct or replace
		Input/output (interior fan motor) See wiring label	Replace
		Connector disconnected	Correct
		Connector dusty/dirty	Remove
		7 segment display partially/totally off	Replace
		Electronic parts defective/burnt out	
[3]	Relay	Fast-on terminal/pin disconnected	Correct
		Connector dusty/dirty	Remove
		Open circuit	Correct
		Output to each load Check with wiring diagram/timing chart	Replace
		Abnormal noise	
[4]	Interior Thermistor	Location (holder in front of evaporator) Disconnected, replaced with defrost thermistor, etc	Correct
		Incorrect temp indication	Immerse in ice water to check resistance (25 - 30k) Replace if necessary
		Short circuit (temp displayed as "HHH")	Clean/dry connector Replace
		Open circuit (temp displayed as "LLL")	Replace
[5]	Defrost Thermistor	Location (plug in from evaporator back) Disconnected, replaced with interior thermistor, etc	Correct
		Abnormal resistance	Immerse in ice water to check resistance (25 - 30k) Replace if necessary
		Short circuit (temp displayed as "HHH")	Clean/dry connector Replace
		Open circuit (temp displayed as "LLL")	Replace
[6]	Pressure Switch	Open circuit	Replace
[7]	Compressor	Resistance between terminals (at 25°C) Compressor Winding resistance (Ω) Start Run AZ0411Y 26.85 11.10 AE2416ZK 24.27 5.71 AE2420ZK-SR 17.70 6.10	Replace
		Abnormal noise	
		Insufficient compression (discharge temp too low)	Replace if no gas leaks
		Compressor electrical part defective - Run/start capacitor ruptured/deformed - Capacitor defective Check resistance between terminals Gradually reduces: No problem 0 from start: Defective - Starter defective Loose terminal, no conductivity, damaged - Overload relay defective Loose terminal, no conductivity, damaged	Replace
[8]	Condenser Fan Motor	Open circuit	Correct
		Locked (not rotating with voltage)	Replace
		Abnormal noise	
		Burning smell	
[9]	Interior Fan Motor	Open circuit	Correct
		Locked (not rotating with voltage)	Replace
		Abnormal noise	
		Burning smell	
[10]	Defrost Heater	Open circuit	Correct
		Conductivity	
		Insulation resistance 1MΩ or more at 500V	Replace
[11]	Thermal Fuse	Conductivity	Replace
		Contact welding of relay	Replace relay
[12]	Supply Voltage	Check for ±6% of rated voltage	Increase power supply capacity Plug into a separate power receptacle
[13]	Refrigeration Circuit Clogged	Discharge pressure: High Suction pressure: Low (vacuum)	Replace capillary (Replace drier at same time)
[14]	Refrigerant Leak	Discharge pressure: Low Suction pressure: Low	Locate leakage and replace (Replace drier at same time)
		Compressor discharge pipe will not heat up	
		Compressor suction pipe will not cool down	Note: Low-side leak requires drying after welding
		Check with leak detector	
[15]	Air Filter Air-Cooled Condenser	Clogged Dirty fins	Clean

4. CONTROLLER

[a] SERVICING CONTROLLER

1) When receiving a service call, ask the user to turn off the power supply and turn it back on after 30 seconds, while watching the unit. This will reset the controller, and in some cases normal operation will resume.

2) Keep the following in mind when servicing the controller:

* Check that the unit has been earthed properly. If not, the controller will not work properly.

* To get static free, always touch the cabinet (earth) before servicing. Electrostatic discharge will cause severe damage to the controller.

* The controller and thermistor can be replaced separately.

* Do not drop the controller on the floor.

* The thermistor and pressure switch leads have a thin coating and are potentially breakable. Do not tension the leads.

* The connectors must not be subjected to tension to prevent disconnection or breakage. After servicing the controller, check for disconnected connectors.

* The thermistor is provided with single-wire leads. Do not bend or stretch them.

* Do not pinch or weigh down the thermistor and thermistor leads. The coatings may be broken, resulting in a short circuit.

[b] CHECKING THERMISTOR

1) Remove the thermistor from the controller.

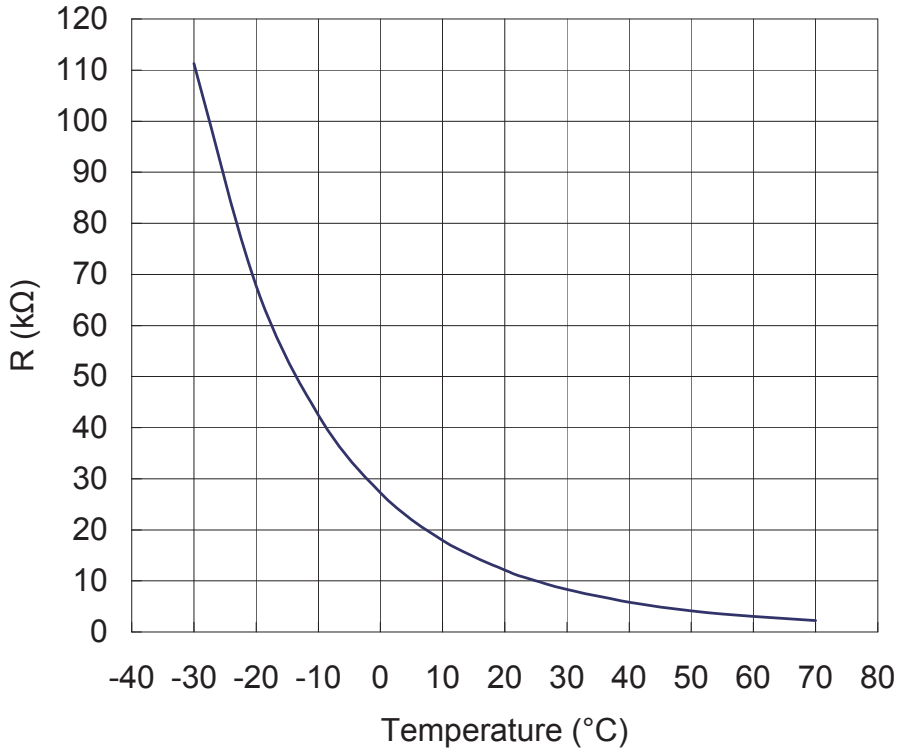
2) Put ice and water in a glass or other container to make 0°C water. Immerse the thermistor bulb in the water for 5 minutes (at the center of the container).

3) Use the Ω range of the tester to measure the resistance between the thermistors.

4) If the measured resistance is not within 25 - 30 kΩ (standard 27 kΩ), replace the thermistor (see the T-R curve below).

T-R Curve (Interior/Defrost Thermistor)

The graph shows reference values only and may differ from actual values.



IV. REMOVAL AND REPLACEMENT OF COMPONENTS

WARNING

Always unplug the unit or turn off the main power supply before replacing components.

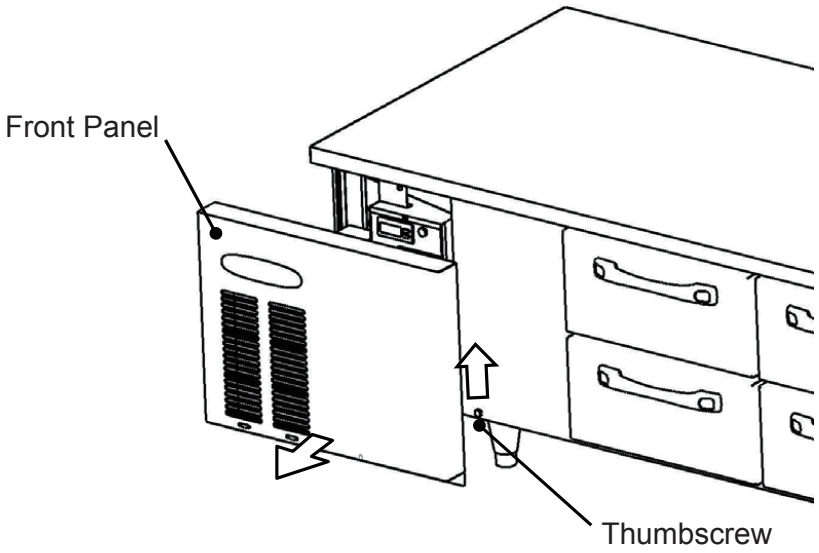
1. REFRIGERATION CIRCUIT

[a] REFRIGERANT

Refrigerant R134a and R404a used for this unit is not flammable or poisonous itself. It also provides remarkably lower pressure than ammonia or similar substances at the same condensing temperatures.

[b] REFRIGERATION UNIT

1) Remove the thumbscrew at the bottom of the front panel, and take off the front panel.



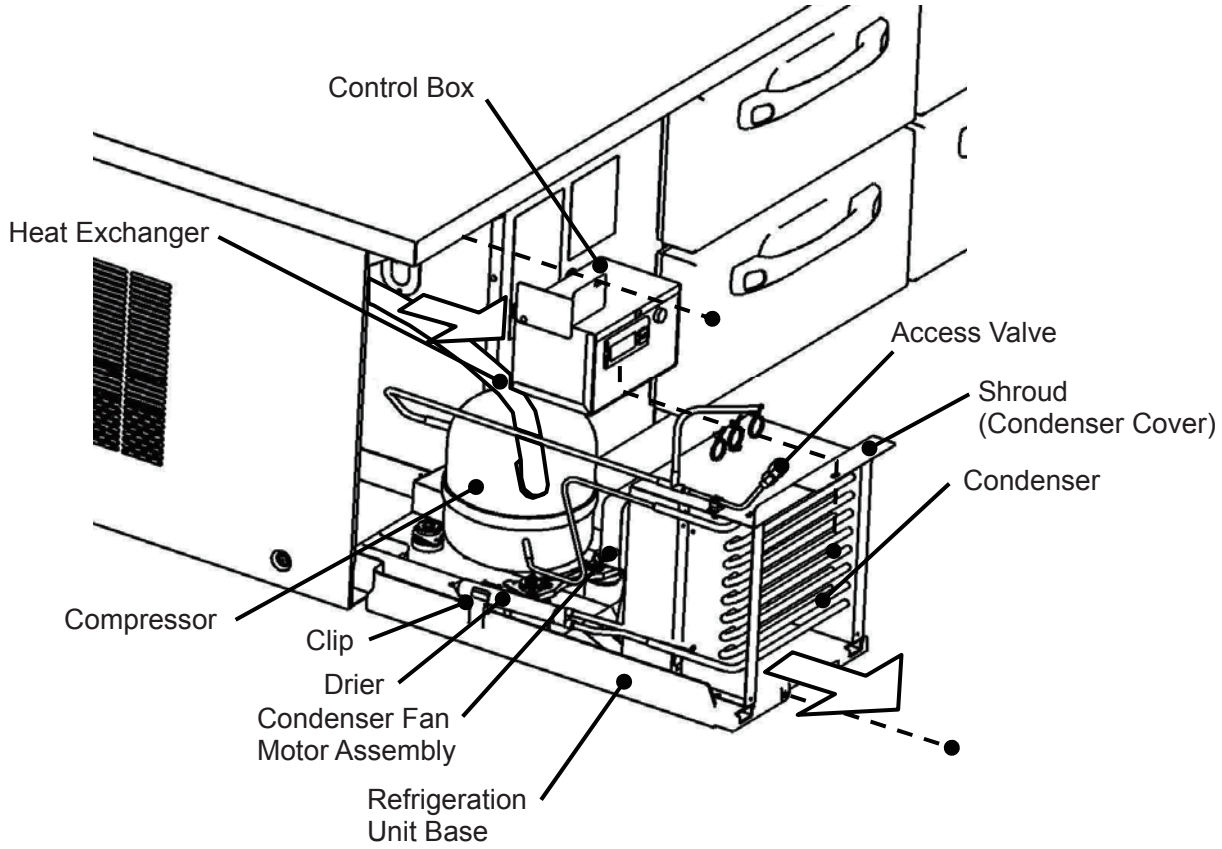
2) Remove the screw at the top and bottom of control box, and take off the control box.

3) Remove the hexagon head bolt securing the refrigeration unit to the base. Pull out the refrigeration unit.

Note: 1. When pulling out or pushing in the refrigeration unit, do not overload the piping to prevent gas leaks from the joints.

2. Keep wiring away from the fan motor and discharge pipe.

3. Do not catch wiring when pulling out or pushing in the refrigeration unit.



[c] COMPRESSOR

1) Pull out the refrigeration unit according to steps 1) through 3) of “[b] REFRIGERATION UNIT”.

2) Remove the terminal cover enclosing the compressor electrical parts.

3) Remove the overload relay and start relay.

4) Recover the refrigerant from the access valve, and store it in a proper container, if required by an applicable law.

5) Disconnect the discharge and suction pipes using brazing equipment.

6) Remove the bolts securing the compressor.

7) To replace the removed parts, reverse the above removal procedure.

Note: 1. To recharge the refrigerant, install a stop valve in the access line.

2. Evacuation time must be at least 1 hour.

3. To prevent oxidation, braze the pipes with nitrogen gas flowing.

4. Check for gas leaks, remove flux and oxide film, and apply anti-corrosion treatment.

5. While brazing, use a wet towel to protect the plastic parts and electrical parts from burner flame.

[d] CONDENSER

1) Pull out the refrigeration unit according to steps 1) through 3) of “[b] REFRIGERATION UNIT”.

2) Remove the screws securing the shroud to the condenser, and disconnect the shroud.

3) Disconnect the condenser from the refrigeration circuit using brazing equipment. Use a wet towel to protect any flammable materials from burner flame.

4) To replace the removed parts, reverse the above removal procedure.

Note: See Notes 1 - 5 for “[c] COMPRESSOR”.

[e] DRIER

1) Pull out the refrigeration unit according to steps 1) through 3) of “[b] REFRIGERATION UNIT”.

2) Remove the drier from the clip.

3) Disconnect the drier from the refrigeration circuit using brazing equipment. Use a wet towel to protect any flammable materials from burner flame.

4) To replace the removed parts, reverse the above removal procedure.

Note: 1. See Notes 1 - 5 for “[c] COMPRESSOR”.

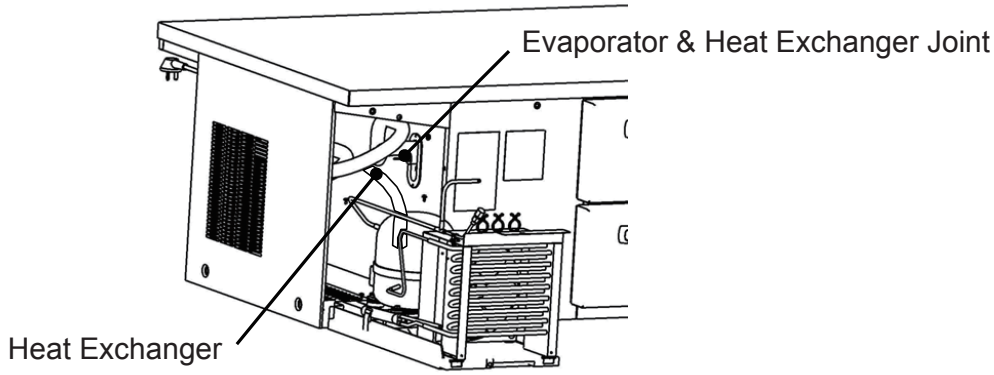
2. After brazing, wait for the drier to cool down before securing it to the clip.

[f] EVAPORATOR

1) Pull out the refrigeration unit according to steps 1) through 3) of “[b] REFRIGERATION UNIT”.

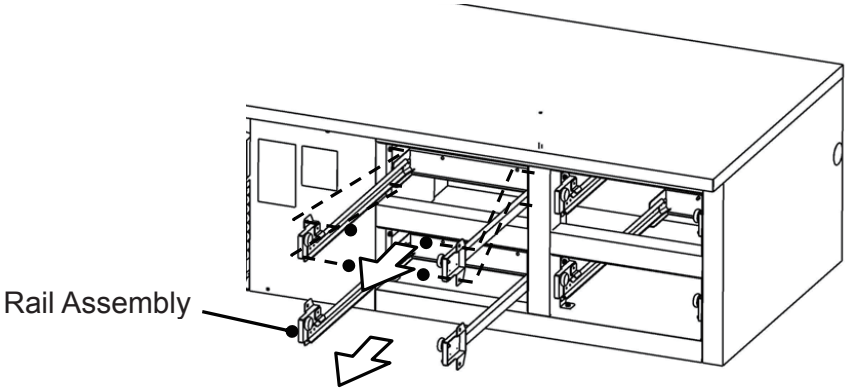
2) Recover the refrigerant from the access valve, and store it in a proper container, if required by an applicable law.

3) Disconnect the evaporator from the heat exchanger (first from the suction pipe and then from the capillary tube) using brazing equipment. Use a wet towel to protect any flammable materials from burner flame.



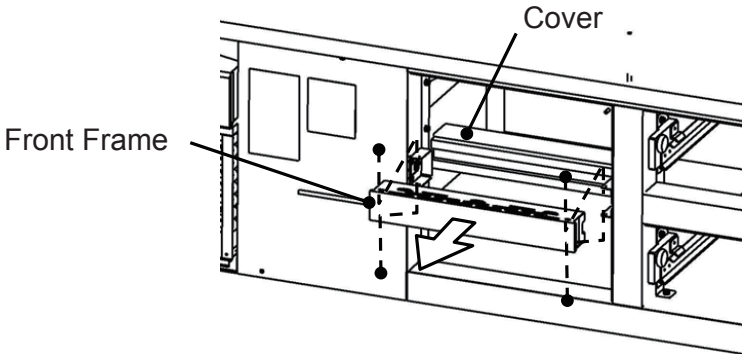
4) Take off the drawer door.

5) Remove the four mounting screws, and take off the drawer rail.



6) Remove the plastic cover from behind the front frame.

7) Remove the four mounting screws, and take off the front frame.



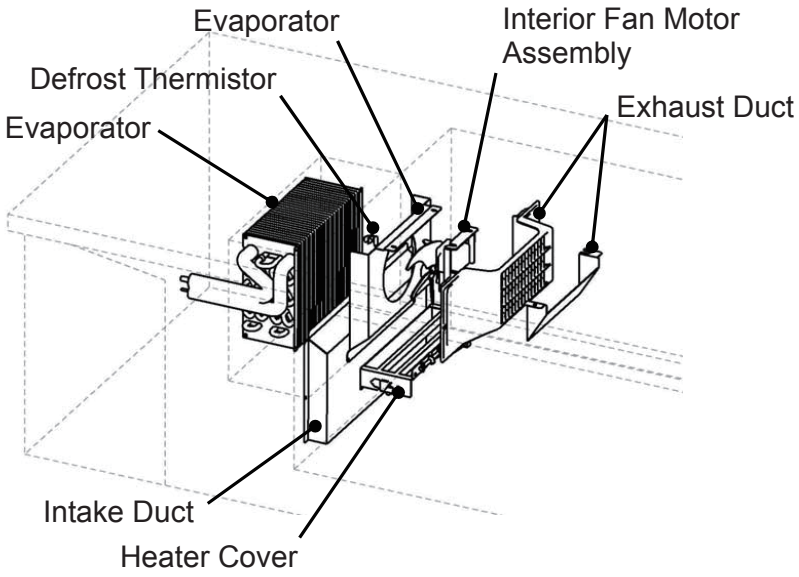
8) Remove the intake and exhaust ducts from inside the cabinet.

9) Remove the interior fan motor assembly.

10) Remove the evaporator cover (and the heater cover).

11) Remove the defrost thermistor from the evaporator.

12) To replace the removed parts, reverse the above removal procedure.



Note: 1. See Notes 1 - 5 for “[c] COMPRESSOR”.

2. Be sure to replace the defrost thermistor in its correct position.

3. After servicing, use putty to seal the pipe through-hole in the cabinet.

4. When disconnecting the evaporator from the heat exchanger, use a wet towel to protect the wires from burner flame.

2. ELECTRICAL PARTS

[a] CONDENSER FAN MOTOR

1) Pull out the condenser and condenser fan motor assembly according to steps 1) through 3) of “1. [b] REFRIGERATION UNIT”.

2) Disconnect the condenser fan motor leads.

3) Remove the screws securing the condenser fan motor to the bracket, and take off the condenser fan motor.

4) To replace the removed parts, reverse the above removal procedure.

[b] INTERIOR FAN MOTOR

1) Remove the control box according to steps 1) through 2) of “1. [b] REFRIGERATION UNIT”.

2) Disconnect the interior fan motor leads.

3) Remove the front frame according to “1. [f] EVAPORATOR”.

4) Remove the intake and exhaust ducts from inside the cabinet.

5) Remove the insulations in the wire through-hole from inside and outside the cabinet.

6) Remove the interior fan motor assembly.

7) Remove the screws securing the interior fan motor to the bracket, and take off the interior fan motor.

8) To replace the removed parts, reverse the above removal procedure.

Note: 1. After servicing, insert new insulations into the wire through-hole from inside and outside the cabinet. Do not reuse the removed insulations.

2. Be sure to install the interior fan motor in the proper direction as shown above.

[c] DEFROST HEATER, THERMAL FUSE

1) Remove the control box according to steps 1) through 2) of “1. [b] REFRIGERATION UNIT”.

2) Disconnect the defrost heater or thermal fuse leads.

3) Remove the front frame according to “1. [f] EVAPORATOR”.

4) Remove the intake duct and exhaust duct from inside the cabinet.

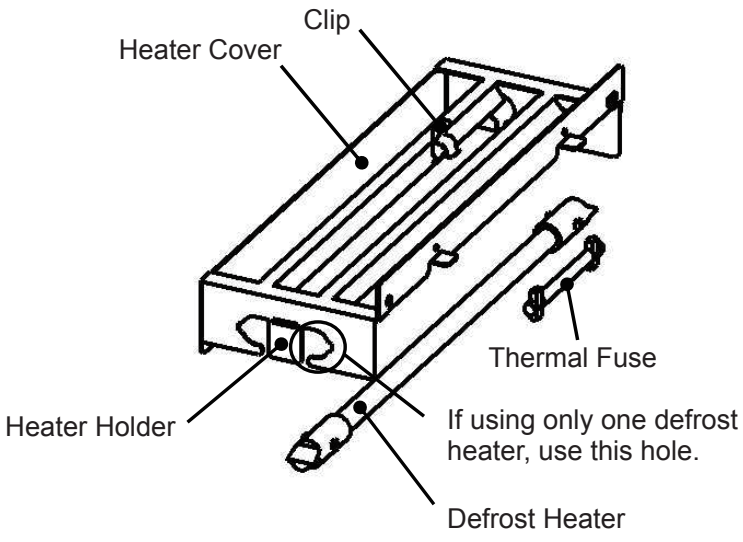
5) Remove the insulations in the wire through-hole from inside and outside the cabinet.

6) Remove the defrost heater and thermal fuse with the heater cover from the evaporator.

7) Bend the heater holder on the heater cover to remove the defrost heater from the heater cover. Take off the clip to remove the thermal fuse.

8) Pull the leads out of the wire through-hole to remove the defrost heater or thermal fuse.

9) To replace the removed parts, reverse the above removal procedure.



Note: 1. After servicing, insert new insulations into the wire through-hole from inside and outside the cabinet. Do not reuse the removed insulations.

2. If using two defrost heaters, mark the end of the heater leads to prevent miswiring.

3. If using only one defrost heater, install the heater in the hole on the cabinet side of the heater cover.

[d] INTERIOR THERMISTOR, DEFROST THERMISTOR

1) Remove the control box according to steps 1) through 2) of “1. [b] REFRIGERATION UNIT”.

2) Disconnect the interior thermistor or defrost thermistor leads.

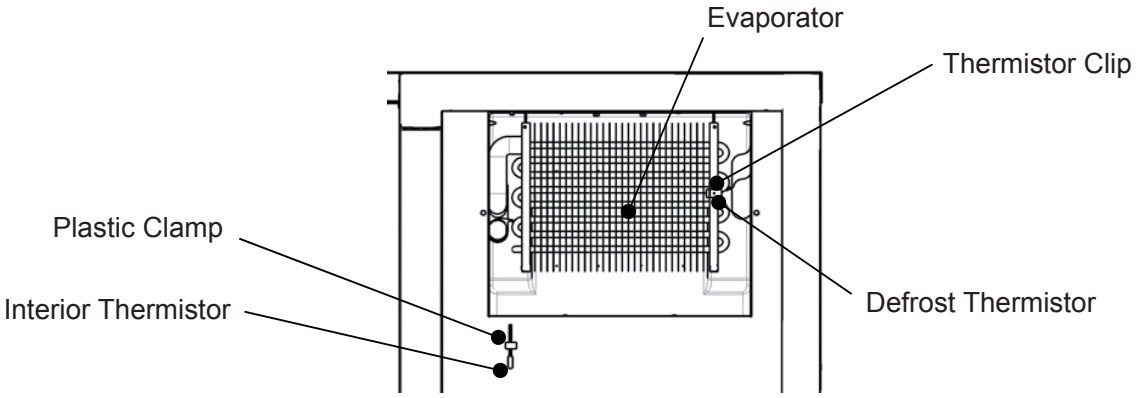
3) Remove the front frame according to “1. [f] EVAPORATOR”.

4) Remove the intake duct and exhaust duct from inside the cabinet.

5) Remove the insulations in the wire through-hole from inside and outside the cabinet.

6) Open the plastic clamp to remove the interior thermistor. Pull the thermistor clip off the evaporator to remove the defrost thermistor.

7) To replace the removed parts, reverse the above removal procedure.

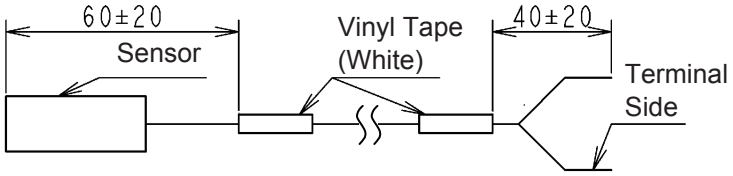


Note: 1. After servicing, insert new insulations into the wire through-hole from inside and outside the cabinet. Do not reuse the removed insulations.

2. Be careful not to contact the interior thermistor bulb on the cabinet interior wall.

3. Route the defrost thermistor leads through the U-channel at the evaporator top out of the evaporator reed pipe side.

4. If the defrost thermistor color is not white, wind white vinyl tape around the thermistor as shown below for indication.



[e] CONTROLLER

1) Remove the front panel.

2) Unscrew the top and bottom of the control box to remove the control box.

3) Push the stoppers at both sides of the controller, and slide the stoppers to remove the controller.

4) Use a precision flat head screwdriver to loosen the screws and disconnect the wiring from the controller.

5) To replace the removed parts, reverse the above procedure.

[f] FUSE

1) Remove the front panel.

2) Apply a flat head screwdriver to the slot on the fuse holder, and turn it counterclockwise.

3) Remove the fuse from the fuse holder.

4) To replace the removed parts, reverse the above procedure.

3. DOOR GASKET

[a] REMOVAL

1) Take off the drawer door.

2) Detach the door gasket from the door liner.

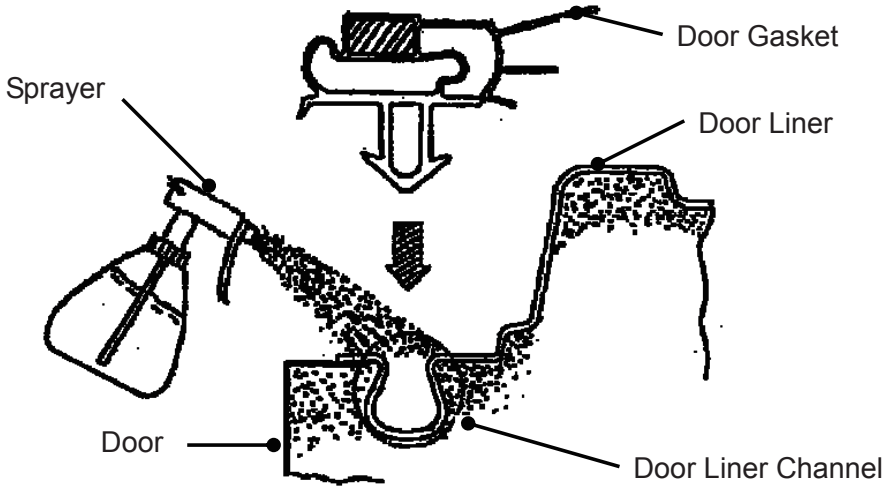
[b] REPLACEMENT

1) Spray water on the drawer liner channel with a sprayer.

2) Fit the four corners of the door gasket into those of the door liner channel.

3) Push in each part of the door gasket from both sides.

Note: After fitting the door gasket, check every part for tightness and security.



Replacement of the door or door gasket may cause a gap between the cabinet and the gasket. To correct this gap, slightly heat the gasket with a drier. To avoid melting the gasket:

1) Keep the drier at least 100 mm away from the gasket.

2) Move the drier up and down to heat the entire gap.

Note: If the drier is too close or heats a particular part intensively, the gasket may melt.