NO.	F048-796
ISSUED:	MAR. 1, 2010
REVISED:	MAY 14, 2010

HOSHIZAKI
MODULAR ICE MAKER

MODEL FM-481AGE-HC
FM-481AGE-HCN
FM-300AFE-HC
FM-300AFE-HCN

SERVICE MANUAL

⚠ WARNING

This machine contains flammable refrigerant. Do not attempt to break into the refrigerant circuit unless qualified, competent and authorised to do so.

If any component of the refrigeration circuit requires removal or replacement, please contact the manufacturer:

HOSHIZAKI EUROPE LIMITED
Telford 70 Stafford Park 7, Telford, Shropshire TF3 3BQ UK
Tel: +44 (0)1952-291777
Fax: +44 (0)1952-292777

CONTENTS

PAGE

I. SPECIFICATIONS

1. FEATURES

[a] LOW VOLTAGE

When the supply voltage is too low or surrounding high-current equipment starts up, the voltage in the icemaker may drop temporarily. In this case, the Compressor will fail to start, or the Gear Motor will lock during the icemaking operation. The locked Gear Motor may apply the maximum torque to the icemaking mechanism and damage its parts. To avoid this trouble, the icemaker will be shut down when the voltage drops. The icemaker will restart automatically when the proper voltage is restored.

[b] OVERLOAD PROTECTION

The auger type icemaker employs the Gear Motor generating a large torque to scrape ice forming inside the Evaporator. To produce nugget ice, the Extruding Head also requires a large torque to compress ice. Some use conditions may overload the icemaking mechanism. The icemaker will detect overload by reduction in Gear Motor rotation speed and partly bypass the refrigerant flow in the refrigeration circuit. This will temporarily reduce the ice production to avoid the overload condition.

[c] OVERLOAD ERROR

When the above protection fails to evade the overload condition and the Gear Motor has a high current and a low rotation speed, the icemaker will shut down for protection. The icemaking mechanism will have extensive damage, if this condition is repeated ten times. In this case, the icemaker will display an error code to notify the user of the excessive load on the icemaking mechanism and the need of its replacement.

[d] USER RESET

When a protector trips to shut down the icemaker, an error code will be displayed. If it is a resettable error, the user can restart the icemaker by pressing the Reset Button accessible from the Window Panel and continue the icemaking operation until a service person arrives. Some errors are non-resettable or repetitive and require troubleshooting by qualified personnel.

[e] ERROR CODES AND RECORDS

When the icemaker shuts down with an error, the Display Window will show an error code “E_”. A maximum of eight most recent records are memorized and can be checked at the time of service or inspection.

[f] OTHER INFORMATION

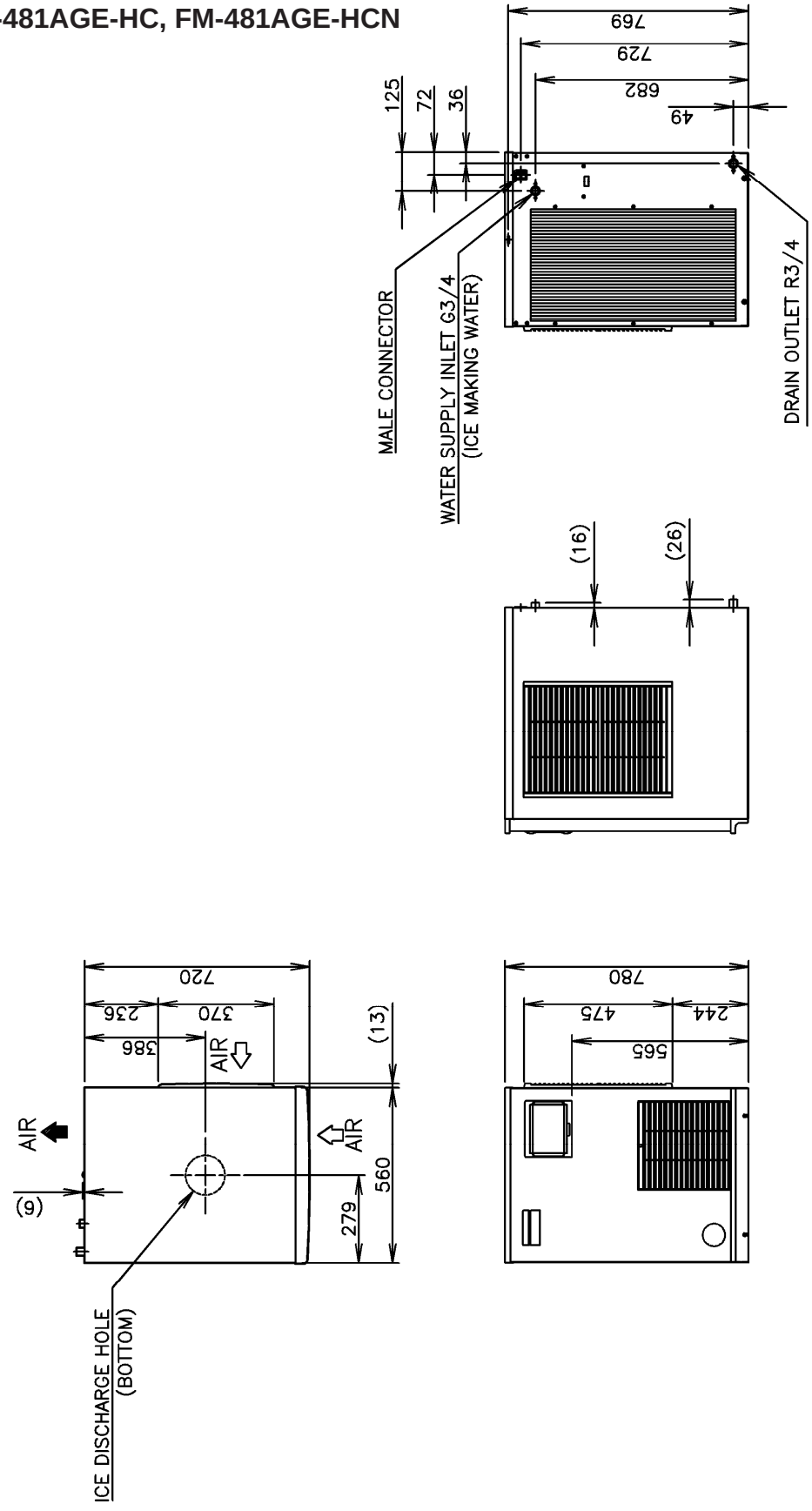
Other information is also available from the Controller Board. See “III. 7. OPERATION BOARD” for details.

[g] CHANGE OF ICE TYPE

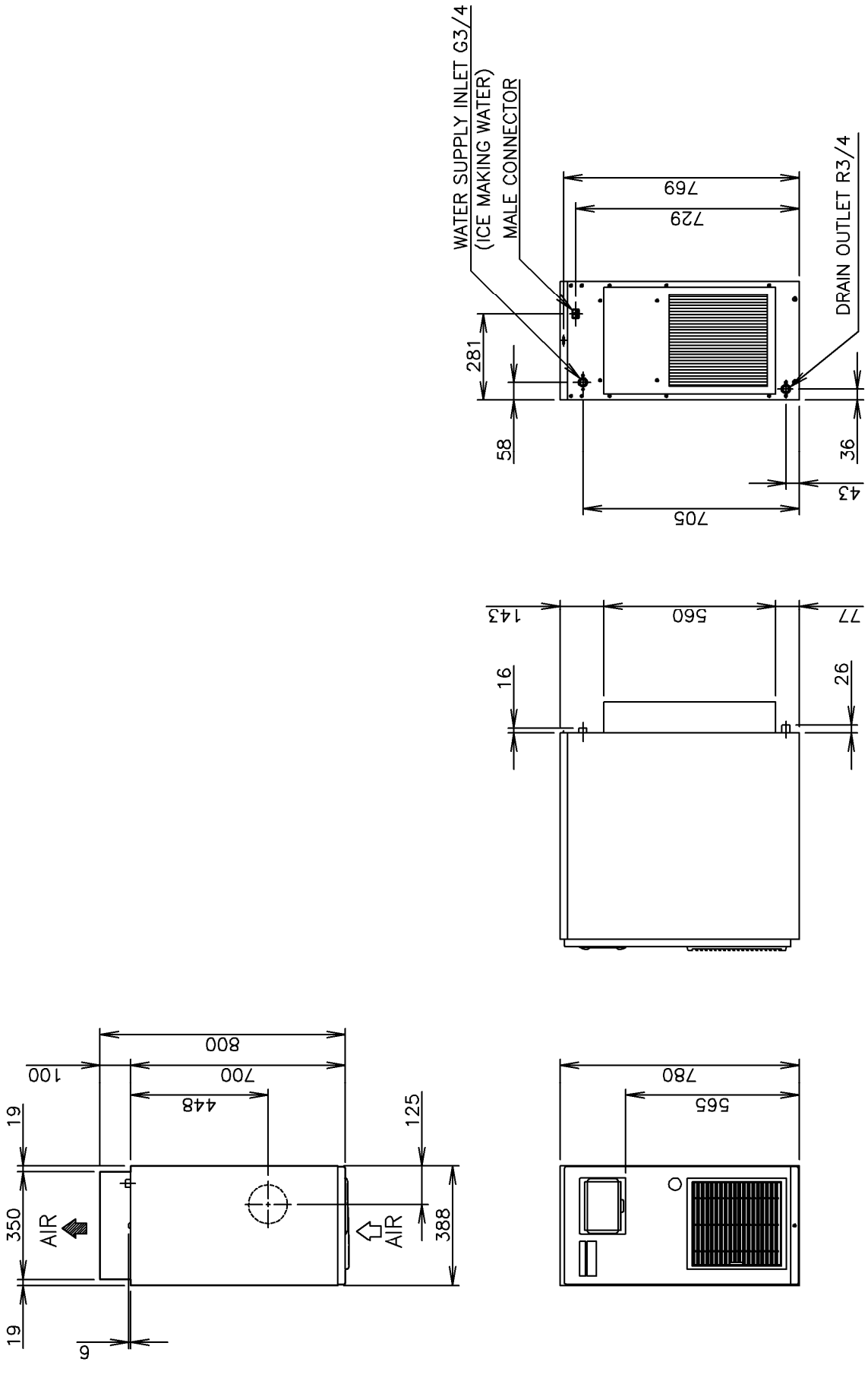
With the older models, changes between flake ice and nugget ice were available by replacing the Extruding Head and Cutter. With the new models, not only the Extruding Head and Cutter but also the refrigeration circuit is different between the flake ice model and nugget ice model. To ensure the proper capacity and prevent a trouble with excessive ice production, do not replace the Extruding Head and Cutter to change the ice type.

2. DIMENSIONS/CONNECTIONS

[a] FM-481AGE-HC, FM-481AGE-HCN



[b] FM-300AFE-HC, FM-300AFE-HCN



3. SPECIFICATIONS

[a] FM-481AGE-HC

ITEM	HOSHIZAKI FLAKE ICE MAKER
MODEL	FM-481AGE-HC
POWER SUPPLY	1 Phase 230V 50Hz Capacity: 2.2kVA (9.5A)
AMPERAGE	9.3A Starting: 22A
ELECTRIC CONSUMPTION	1665W (Power Factor: 77%)
POWER CORD	2m (UK PLUG)
ICE PRODUCTION PER 24h	Approx.450kg (Ambient Temp. 10° C, Water Temp. 10° C) Approx.400kg (Ambient Temp. 21° C, Water Temp. 15° C) Approx.350kg (Ambient Temp. 32° C, Water Temp. 21° C)
SHAPE OF ICE	Flake
MAX. STORAGE CAPACITY	Not Applicable
WATER CONSUMPTION PER 24h	Approx.0.450m³(Ambient Temp. 10° C, Water Temp. 10° C) Approx.0.400m³(Ambient Temp. 21° C, Water Temp. 15° C) Approx.0.350m³(Ambient Temp. 32° C, Water Temp. 21° C)
OUTSIDE DIMENSIONS	560(W) x 720(D) x 780mm(H)
HEAT REJECTION	3100W(Ambient temp.32℃,Water temp.21℃)
CABINET	Stainless Steel, Galvanized Steel (Rear)
ICE MAKING SYSTEM	Thin ice forming inside Cylinder (Flake Ice)
WATER SUPPLY SYSTEM	Direct Connection to Water Main, Inlet: G1/2 (Rear)
DRAIN SYSTEM	Outlet: R3/4 (Rear)
COMPRESSOR	Hermetic, Model: SC18CNX.2 x 2, Output 600W x 2
CONDENSER	Spiral Tube Type, Air-cooled (Fan Motor Output 30W x 2)
EVAPORATOR	Tube coiled around Cylinder (Solder Plated)
REFRIGERANT	R290, 78g x 2
BIN CONTROL	Actuator and Reed Switch (Time delay controlled)
ICEMAKING WATER CONTROL	Float Switch and Solenoid Valve
ELECTRICAL CIRCUIT PROTECTION	Circuit Breaker, 3A Fuse (Control Circuit), Earth Wire, 5A Fuse (Microprocessor)
REFRIGERANT CIRCUIT PROTECTION	Compressor Internal Thermostat (Auto-reset), Pressure Switch (Auto-reset)
MECHANISM PROTECTION	Micro Switch (Manual-reset)
INTERLOCK	Shutdown by Microprocessor (Manual-reset)
WEIGHT	Net: 105kg(Gross: 126kg)
PACKAGE	Carton 671(W)×820(D)×910mm(H)
ACCESSORIES	Mounting Bracket,Installation Kit
OPERATING CONDITIONS	Ambient Temp.: 5 – 40° C, Water Supply Temp.: 5-35℃ Water Supply Pressure: 0.05-0.8MPa,Voltage Range: Rated Voltage± 10%

[b] FM-481AGE-HCN

ITEM	HOSHIZAKI FLAKE ICE MAKER
MODEL	FM-481AGE-HCN
POWER SUPPLY	1 Phase 230V 50Hz Capacity: 2.2kVA (9.5A)
AMPERAGE	9.6A Starting: 22A
ELECTRIC CONSUMPTION	1730W (Power Factor: 78%)
POWER CORD	2m (UK PLUG)
ICE PRODUCTION PER 24h	Approx.380kg (Ambient Temp. 10° C, Water Temp. 10° C) Approx.330kg (Ambient Temp. 21° C, Water Temp. 15° C) Approx.280kg (Ambient Temp. 32° C, Water Temp. 21° C)
SHAPE OF ICE	Nugget
MAX. STORAGE CAPACITY	Not Applicable
WATER CONSUMPTION PER 24h	Approx.0.380m³ (Ambient Temp. 10° C, Water Temp. 10° C) Approx.0.330m³ (Ambient Temp. 21° C, Water Temp. 15° C) Approx.0.280m³ (Ambient Temp. 32° C, Water Temp. 21° C)
OUTSIDE DIMENSIONS	560(W) x 720(D) x 780mm(H)
HEAT REJECTION	3100W(Ambient temp.32℃,Water temp.21℃)
CABINET	Stainless Steel, Galvanized Steel (Rear)
ICE MAKING SYSTEM	Thin ice forming inside Cylinder (Nugget Ice)
WATER SUPPLY SYSTEM	Direct Connection to Water Main, Inlet: G1/2 (Rear)
DRAIN SYSTEM	Outlet: R3/4 (Rear)
COMPRESSOR	Hermetic, Model: SC18CNX.2 x 2, Output 600W x 2
CONDENSER	Spiral Tube Type, Air-cooled (Fan Motor Output 30W x 2)
EVAPORATOR	Tube coiled around Cylinder (Solder Plated)
REFRIGERANT	R290, 78g x 2
BIN CONTROL	Actuator and Reed Switch (Time delay controlled)
ICEMAKING WATER CONTROL	Float Switch and Solenoid Valve
ELECTRICAL CIRCUIT PROTECTION	Circuit Breaker, 3A Fuse (Control Circuit), Earth Wire, 5A Fuse (Microprocessor)
REFRIGERANT CIRCUIT PROTECTION	Compressor Internal Thermostat (Auto-reset), Pressure Switch (Auto-reset)
MECHANISM PROTECTION	Micro Switch (Manual-reset)
INTERLOCK	Shutdown by Microprocessor (Manual-reset)
WEIGHT	Net: 105kg(Gross: 126kg)
PACKAGE	Carton 671(W)×820(D)×910mm(H)
ACCESSORIES	Mounting Bracket,Installation Kit
OPERATING CONDITIONS	Ambient Temp.: 5 – 40° C, Water Supply Temp.: 5-35℃ Water Supply Pressure: 0.05-0.8MPa,Voltage Range: Rated Voltage±10%

[c] FM-300AFE-HC

ITEM	HOSHIZAKI FLAKE ICE MAKER
MODEL	FM-300AFE-HC
POWER SUPPLY	1 Phase 230V 50Hz Capacity: 1.46kVA (6.4A)
AMPERAGE	4.9A Starting: 15A
ELECTRIC CONSUMPTION	895W (Power Factor: 79%)
POWER CORD	2m (UK PLUG)
ICE PRODUCTION PER 24h	Approx.300kg (Ambient Temp. 10℃, Water Temp. 10℃) Approx.250kg (Ambient Temp. 21℃, Water Temp. 15℃) Approx.205kg (Ambient Temp. 32℃, Water Temp. 21℃)
SHAPE OF ICE	Flake
MAX. STORAGE CAPACITY	Not Applicable
WATER CONSUMPTION PER 24h	Approx.0.300m³ (Ambient Temp. 10℃, Water Temp. 10℃) Approx.0.250m³ (Ambient Temp. 21℃, Water Temp. 15℃) Approx.0.205m³ (Ambient Temp. 32℃, Water Temp. 21℃)
OUTSIDE DIMENSIONS	388(W) x 800(D) x 780mm(H)
HEAT REJECTION	1840W(Ambient temp.32℃, Water temp.21℃)
CABINET	Stainless Steel, Galvanized Steel (Rear)
ICE MAKING SYSTEM	Thin ice forming inside Cylinder (Flake Ice)
WATER SUPPLY SYSTEM	Direct Connection to Water Main, Inlet: G3/4 (Rear)
DRAIN SYSTEM	Outlet: R3/4 (Rear)
COMPRESSOR	Hermetic
CONDENSER	Spiral Tube Type, Air-cooled
EVAPORATOR	Tube coiled around Cylinder (Solder Plated)
REFRIGERANT	R290
BIN CONTROL	Actuator and Reed Switch (Time delay controlled)
ICEMAKING WATER CONTROL	Float Switch and Solenoid Valve
ELECTRICAL CIRCUIT PROTECTION	Circuit Breaker, 3A Fuse (Control Circuit), Earth Wire, 5A Fuse (Microprocessor)
REFRIGERANT CIRCUIT PROTECTION	Compressor Internal Thermostat (Auto-reset), Pressure Switch (Auto-reset)
MECHANISM PROTECTION	Micro Switch (Manual-reset)
INTERLOCK	Shutdown by Microprocessor (Manual-reset)
WEIGHT	Net: 76kg(Gross: 85kg)
PACKAGE	Carton 500(W)×970(D)×965mm(H)
ACCESSORIES	Installation Kit
OPERATING CONDITIONS	Ambient Temp.: 5 – 40℃, Water Supply Temp.: 5-35℃ Water Supply Pressure: 0.05-0.8MPa,Voltage Range: Rated Voltage±10%

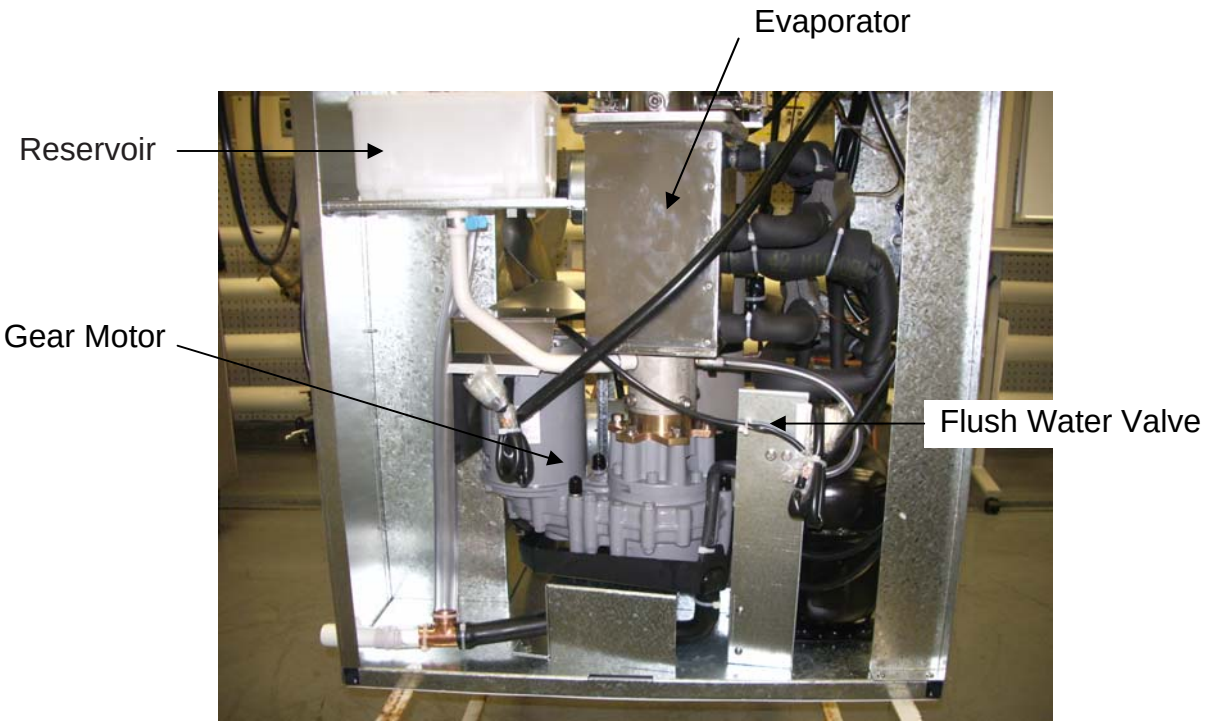
[d] FM-300AFE-HCN

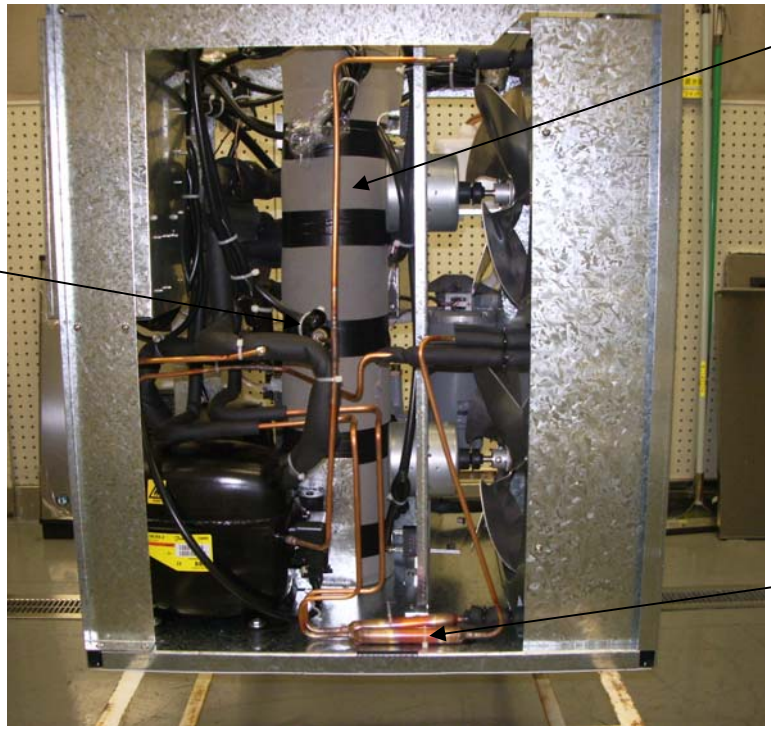
ITEM	HOSHIZAKI FLAKE ICE MAKER
MODEL	FM-300AFE-HCN
POWER SUPPLY	1 Phase 230V 50Hz Capacity: 1.46kVA (6.4A)
AMPERAGE	5.1A Starting: 15A
ELECTRIC CONSUMPTION	955W (Power Factor: 81%)
POWER CORD	2m (UK PLUG)
ICE PRODUCTION PER 24h	Approx.250kg (Ambient Temp. 10℃, Water Temp. 10℃) Approx.210kg (Ambient Temp. 21℃, Water Temp. 15℃) Approx.175kg (Ambient Temp. 32℃, Water Temp. 21℃)
SHAPE OF ICE	Nugget
MAX. STORAGE CAPACITY	Not Applicable
WATER CONSUMPTION PER 24h	Approx.0.250m³ (Ambient Temp. 10℃, Water Temp. 10℃) Approx.0.210m³ (Ambient Temp. 21℃, Water Temp. 15℃) Approx.0.175m³ (Ambient Temp. 32℃, Water Temp. 21℃)
OUTSIDE DIMENSIONS	388(W) x 800(D) x 780mm(H)
HEAT REJECTION	1840W(Ambient temp.32℃, Water temp.21℃)
CABINET	Stainless Steel, Galvanized Steel (Rear)
ICE MAKING SYSTEM	Thin ice forming inside Cylinder (Nugget Ice)
WATER SUPPLY SYSTEM	Direct Connection to Water Main, Inlet: G3/4 (Rear)
DRAIN SYSTEM	Outlet: R3/4 (Rear)
COMPRESSOR	Hermetic
CONDENSER	Spiral Tube Type, Air-cooled
EVAPORATOR	Tube coiled around Cylinder (Solder Plated)
REFRIGERANT	R290
BIN CONTROL	Actuator and Reed Switch (Time delay controlled)
ICEMAKING WATER CONTROL	Float Switch and Solenoid Valve
ELECTRICAL CIRCUIT PROTECTION	Circuit Breaker, 3A Fuse (Control Circuit), Earth Wire, 5A Fuse (Microprocessor)
REFRIGERANT CIRCUIT PROTECTION	Compressor Internal Thermostat (Auto-reset), Pressure Switch (Auto-reset)
MECHANISM PROTECTION	Micro Switch (Manual-reset)
INTERLOCK	Shutdown by Microprocessor (Manual-reset)
WEIGHT	Net: 76kg(Gross: 85kg)
PACKAGE	Carton 500(W)×970(D)×965mm(H)
ACCESSORIES	Installation Kit
OPERATING CONDITIONS	Ambient Temp.: 5 – 40℃, Water Supply Temp.: 5-35℃ Water Supply Pressure: 0.05-0.8MPa, Voltage Range: Rated Voltage±10%

4. CONSTRUCTION

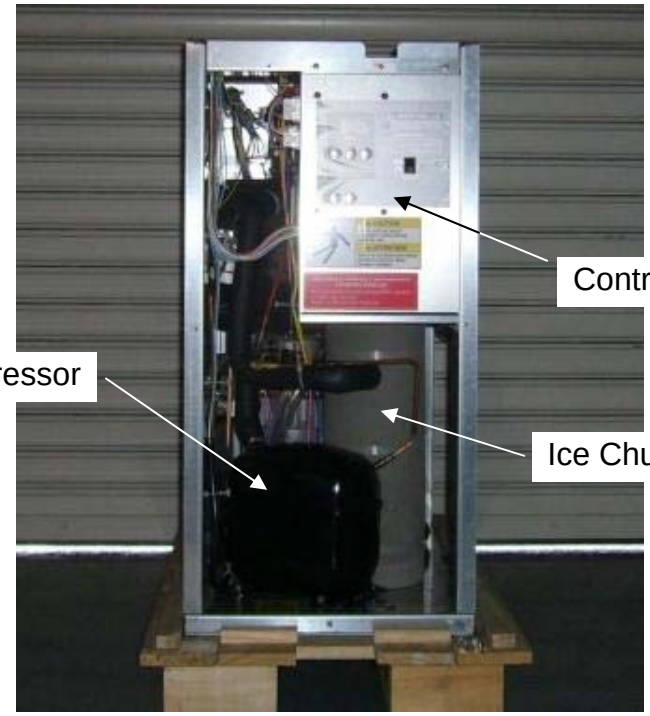
Modular flaker models FM-481AGE-HC, FM-481AGE-HCN, FM-300AFE-HC and FM-300AFE-HCN include Water Supply, Evaporator, Compressor, Condenser and Control Assemblies. As the unit is not equipped with an Ice Storage Bin, this must be purchased separately as optional extra.

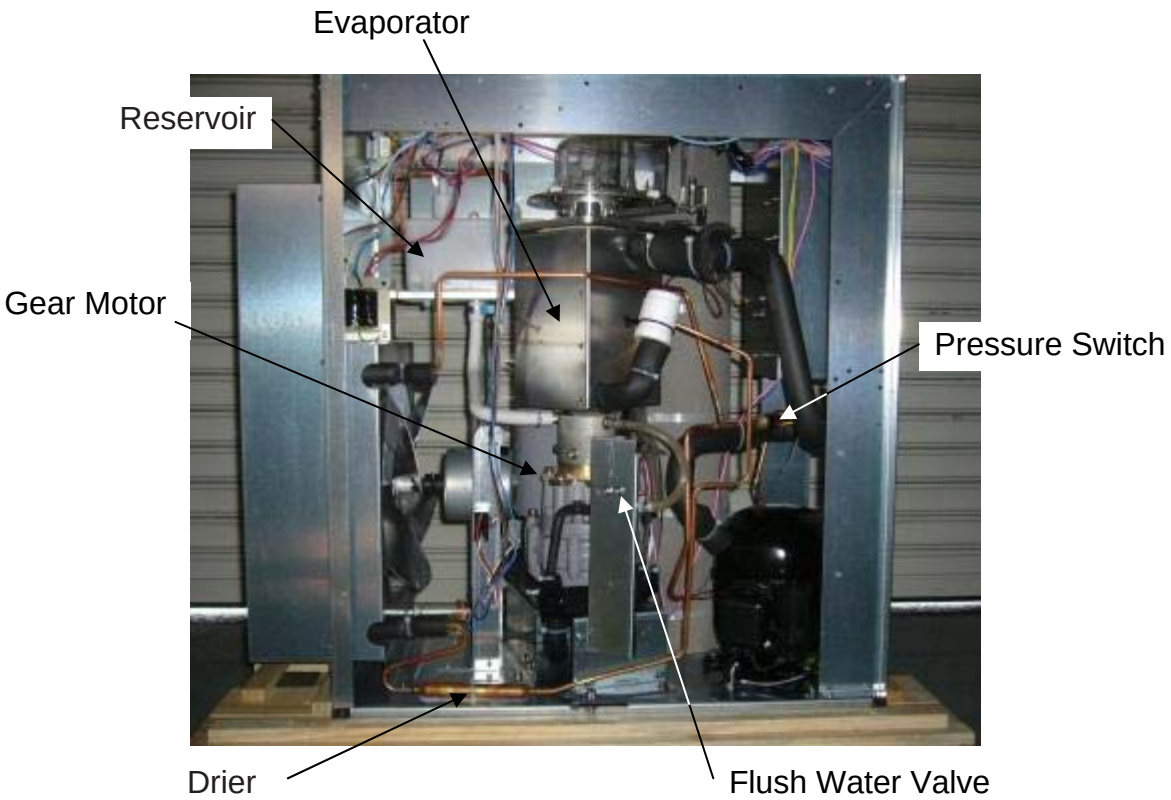
[a] FM-481AGE-HC, FM-481AGE-HCN




Ice Chute
Pressure Switch
Drier

[b] FM-300AFE-HC, FM-300AFE-HCN





II. MAINTENANCE AND CLEANING INSTRUCTIONS

IMPORTANT

1. This icemaker must be maintained individually, referring to the instruction manual and labels provided with the icemaker.

2. To have the optimum performance of this icemaker, the following consumable parts need periodical inspection, maintenance and replacement:

   Extruding Head (Top Bearing)
   Housing (Lower Bearing)
   Mechanical Seal

   These parts should be inspected at least once a year or every 10,000 hours of operation. Their service life ultimately depends on water quality and environment, therefore more frequent inspection and maintenance may be required.

1. EXTRUDING HEAD, HOUSING BEARING, AUGER BEARING

These parts should be replaced if a diametrical gap of more than 0.5 mm is found when at least three spots are checked by changing the direction of the Auger on each Bearing.
It depends on the water quality and conditions, but normally the Bearings should be checked for wear after a total of 8,000 - 10,000 hour operation from installation date.

Note: The clearance between the Auger blades and the Evaporator interior is 0.4 - 0.5 mm. If the Bearings and rotating parts are worn out to create a larger clearance, the Evaporator interior may be damaged. (The diameters differ by 0.8 - 1.0 mm.)
If the Auger surfaces against which the Bearings contact are no longer smooth or show any burrs or abrasions during the above inspection, replace the auger.

2. MECHANICAL SEAL

The Mechanical Seal prevents water leaks from between the Auger and the Housing Bearing and gradually wears out to reduce its watertightness. Check the amount of water leakage from the Drain Pipe located at the side of the Gear Case to determine the necessity of replacement.

Total operation time	Water leakage
3,000 hours	0.1 mL/h
10,000 hours	0.5 mL/h

Note: The water leakage will exceed the above amount with scale/dirt build up or damage on the mating surface. Replace the Mechanical Seal when the water leakage exceeds 0.5 mL/h.

3. GEAR MOTOR

After the following hours of operation, check the Gear Motor for excessive noise caused by increased torque or deterioration of mechanical parts.

Bearing, Gear and other mechanical parts:	10,000 hours
Oil seal:	5 years

Note: When the output shaft oil seal is exposed to a large amount of water at one time, water may enter the Gear Case. Always drain the water circuit before removing the Auger for service.

4. CONDENSER

Check the Condenser once a year, and clean if required by using a brush or vacuum cleaner. More frequent cleaning may be required depending on the location of the icemaker.

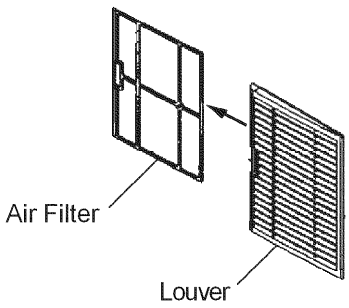
5. AIR FILTER

Plastic mesh Air Filters remove dirt or dust from the air, and keep the Condenser from getting clogged. If the Filters get clogged, the icemaker's performance will be reduced. Remove and clean the Air Filters at least twice per month:

1) Slide the Air Filter off the Louver.

2) Clean the Air Filter by using a vacuum cleaner. When severely clogged, use warm water and a neutral cleaner to wash the Air Filter.

3) Rinse and dry the Air Filter thoroughly, and place it in position.



6. WATER VALVE

1) Disconnect the power source.

2) Close the water supply tap.

3) Disconnect the Inlet Hose from the Water Valve.

4) Remove the Mesh Filter from the Water Valve.

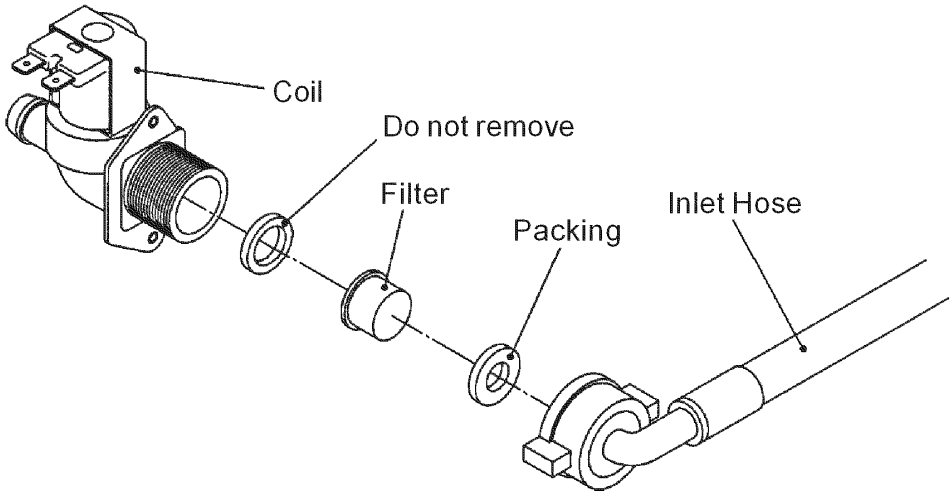
5) Clean the Mesh using a brush.

6) Replace the Mesh and Inlet Hose in their correct positions.

7) Open the water supply tap.

8) Connect the power source.

9) Check for leaks.



7. CLEANING OF WATER SYSTEM

WARNING

1. HOSHIZAKI recommends cleaning this unit at least twice a year. More frequent cleaning, however, may be required in some existing water conditions.
2. Do not touch the Operation Switch with damp hands.
3. Always wear rubber gloves, eye protectors, apron, etc. for safe handling of the cleaner and sanitiser.
4. Use the cleaners and sanitisers recommended by Hoshizaki. Contact your local Hoshizaki office for further details. (The instructions below give an example of those recommended cleaners and sanitisers.)
5. Never mix cleaning and sanitising solutions in an attempt to shorten cleaning time.
6. Wipe off any splashed or spilt cleaner/sanitiser immediately.
7. Do not use any ammonia type cleaners on any part of the icemaker.

<STEP 1>

Dilute the solutions with water as follows:

Cleaning solution: “Nickel-Safe Ice Machine Cleaner” by The Rectorseal Corporation or similar. Prepare approximately 3 L of solution as directed on the container.

Sanitising solution: 30 mL of 5.25% sodium hypochlorite with 7.6 L of water or the Hoshizaki recommended sanitiser as directed on the container.

IMPORTANT

For safety and maximum effectiveness, use the solutions immediately after dilution.

<STEP 2>

Use the cleaning solution to remove lime deposits in the water system.

1) Open the Plastic Access Flap on the Front Panel.

2) Press the Stop Button to activate the flush cycle (approx. 10 minutes).

3) Remove all ice from the Storage Bin to avoid contamination by the cleaner.

4) Unplug the icemaker. Remove the Top and Front Panels.

5) Remove the Cover of the Reservoir. Remove any loose debris or scale.

6) Carefully fill the Reservoir with the solution to the overflow point. If necessary, use a small brush to clean the inside of the Reservoir.

7) Refit the Reservoir Cover.

8) Check that the Operation Switch is in the “RUN” position.

9) Loose fit the Front and Top Panels.

10) Allow the icemaker to stand for about 10 minutes, then plug in the icemaker to make ice with the solution.

11) With the water supply tap open, allow the machine to continue icemaking for a further 20 minutes. Open the Access Flap and press the Stop Button.

12) Allow time for the Gear Motor to stop and the water system to drain.

13) Unplug the icemaker.

14) Refit the Top and Front Panels. Plug in the icemaker.

15) Allow the icemaker to make ice for approximately 10 minutes.

16) Pour warm water into the Storage Bin to melt any ice down the drain.

Note: 1. If the machine has heavy deposits of scale, repeat the complete cleaning procedure.

2. Do not increase the proportion of cleaning solution to shorten cleaning times, as this may lock the Auger when completing item 10).

<STEP 3>

Note: Sanitising should always be completed after cleaning or alternately as an individual procedure if conditions exist to make it necessary.

Use 2.8 litres of the sanitising solution to sanitise the icemaker.

17) Follow items 1) to 16) to complete sanitisation of the water system.

8. PERIODICAL CLEANING

1) Machine and Bin Exterior

Wipe the exterior at least once per week with a clean, soft cloth. Use a damp cloth containing a neutral cleaner to wipe off grease or dirt.

2) Storage Bin Interior Cleaning/Sanitisation (as required)

1) Open the Storage Bin Door, and remove all ice.

2) Wash the Bin Liner, Ice Deflector and Door inner surface with a neutral non-abrasive cleaner. Rinse thoroughly with a clean cloth and fresh water.

3) Mix 5 litres of water with 18 mL of 5.25% sodium hypochlorite solution in a suitable container or the recommended Hoshizaki sanitiser as directed.

4) Soak a clean sponge or cloth with the solution and wipe all the surfaces of the Bin Liner, Ice Deflector and Door inner surface.

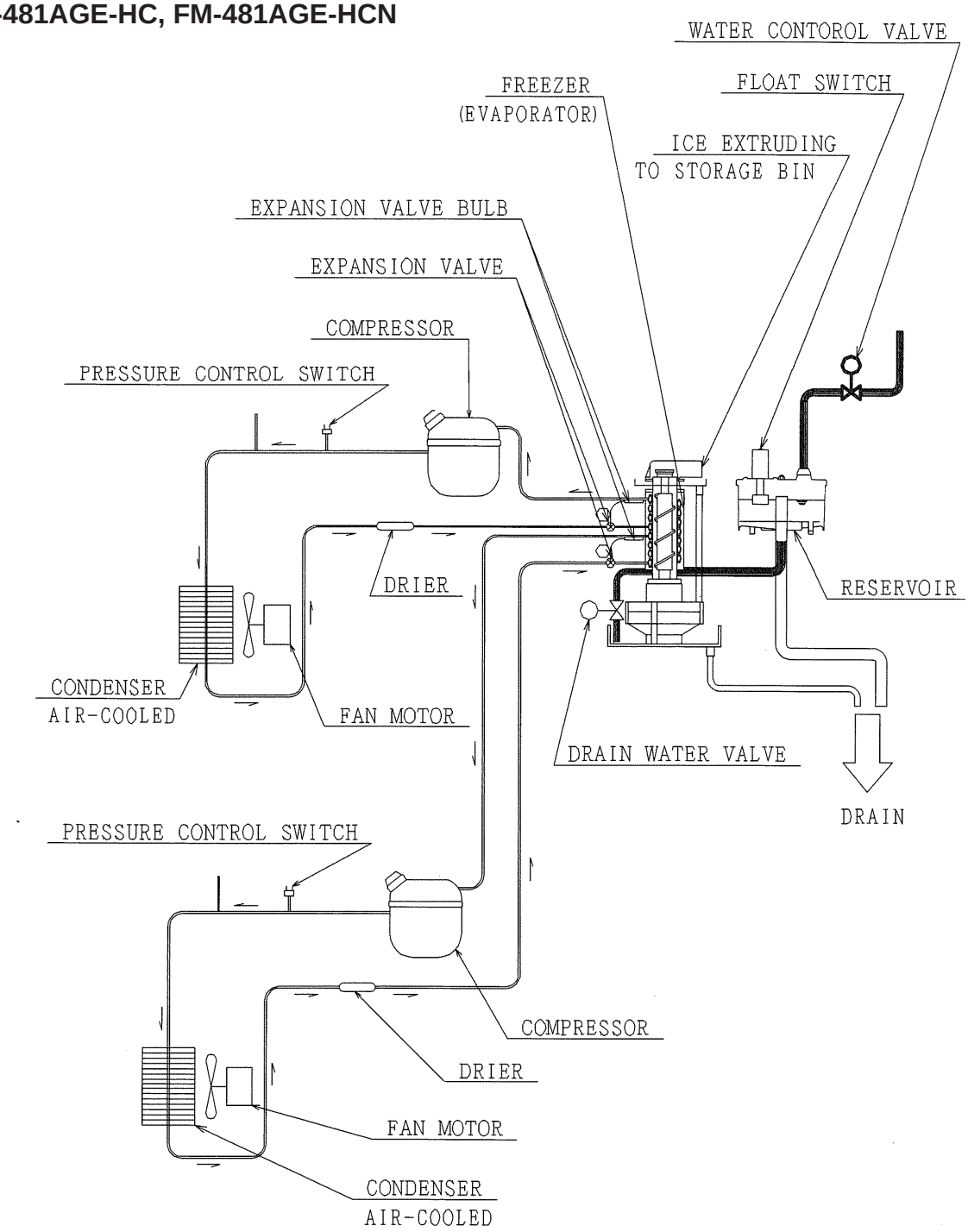
5) Rinse thoroughly with fresh water and a clean cloth to wipe off the solution. Close the Bin Door.

Note: Some solutions may cause damage to the Bin liner surfaces or corrosion on the metal parts. Always rinse the sanitiser unless directed otherwise by Hoshizaki guidelines.

III. TECHNICAL INFORMATION

1. WATER CIRCUIT AND REFRIGERANT CIRCUIT

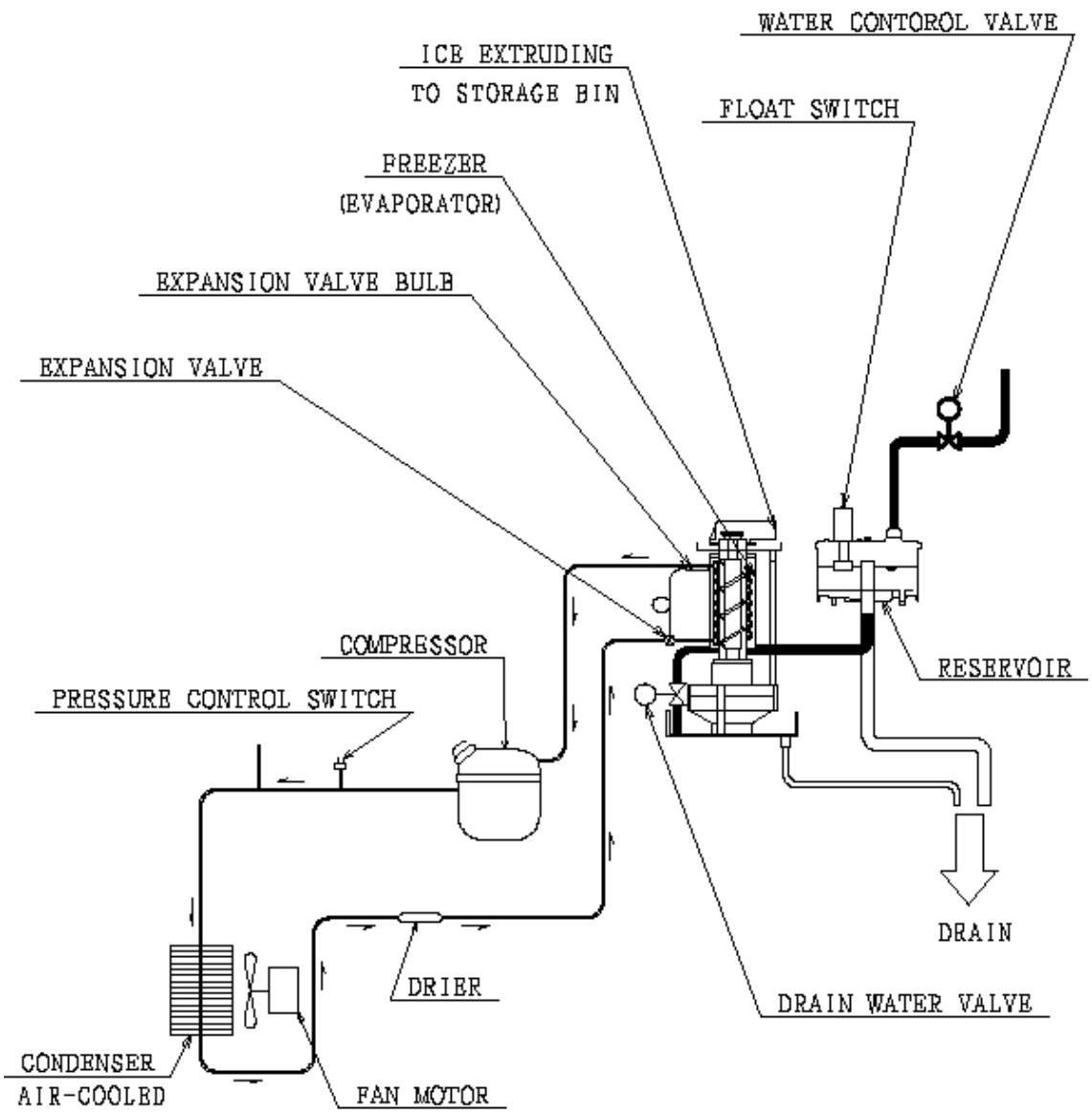
[a] FM-481AGE-HC, FM-481AGE-HCN



Pressure Switch

Cut-out	22.6 ± 1.5/0 bar
Cut-in	15.7 ± 1.5 bar

[b] FM-300AFE-HC, FM-300AFE-HCN



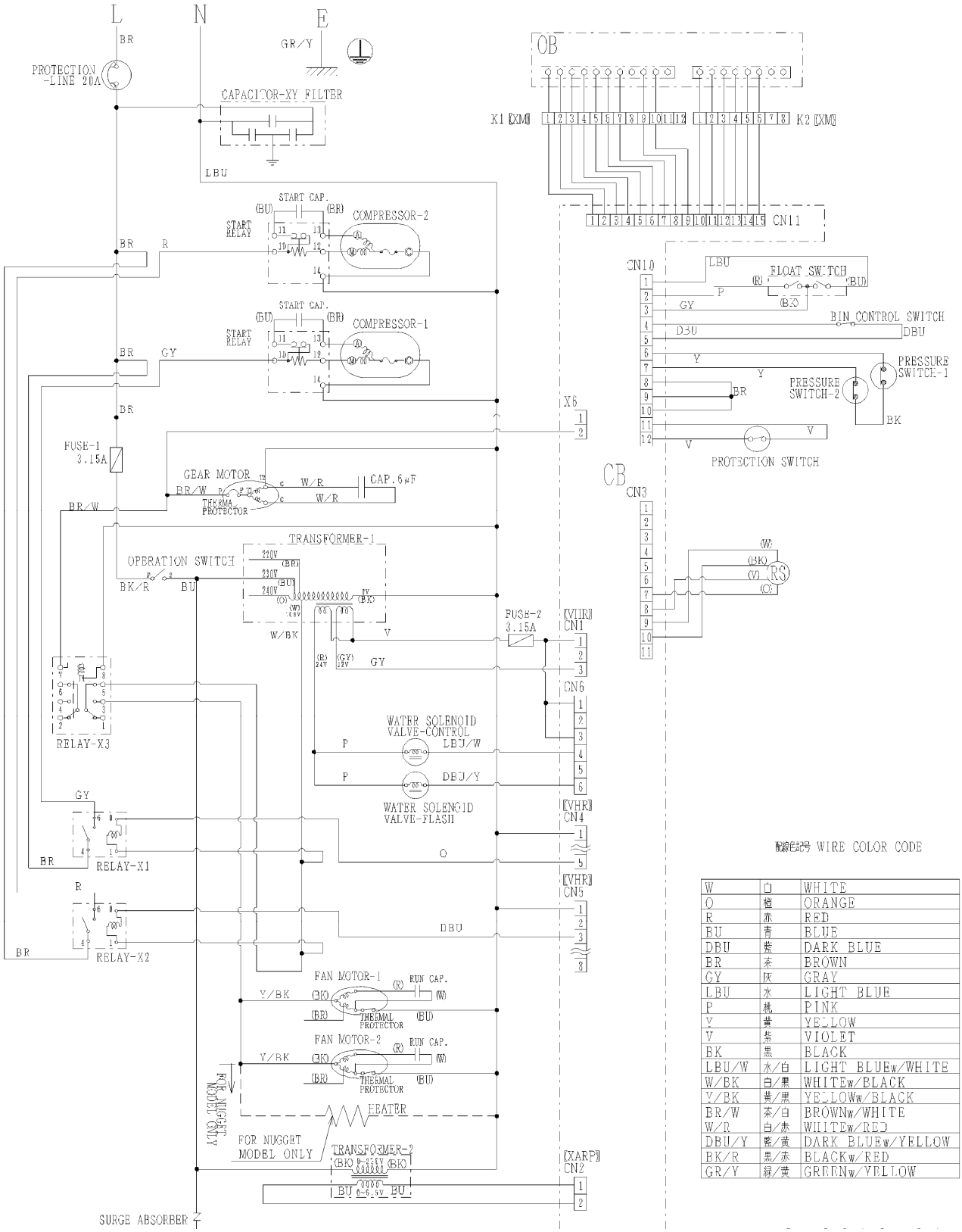
Pressure Switch

Cut-out	22.6 ± 1.5/0 bar
Cut-in	15.7 ± 1.5 bar

2. WIRING DIAGRAM

[a] WIRING DIAGRAM

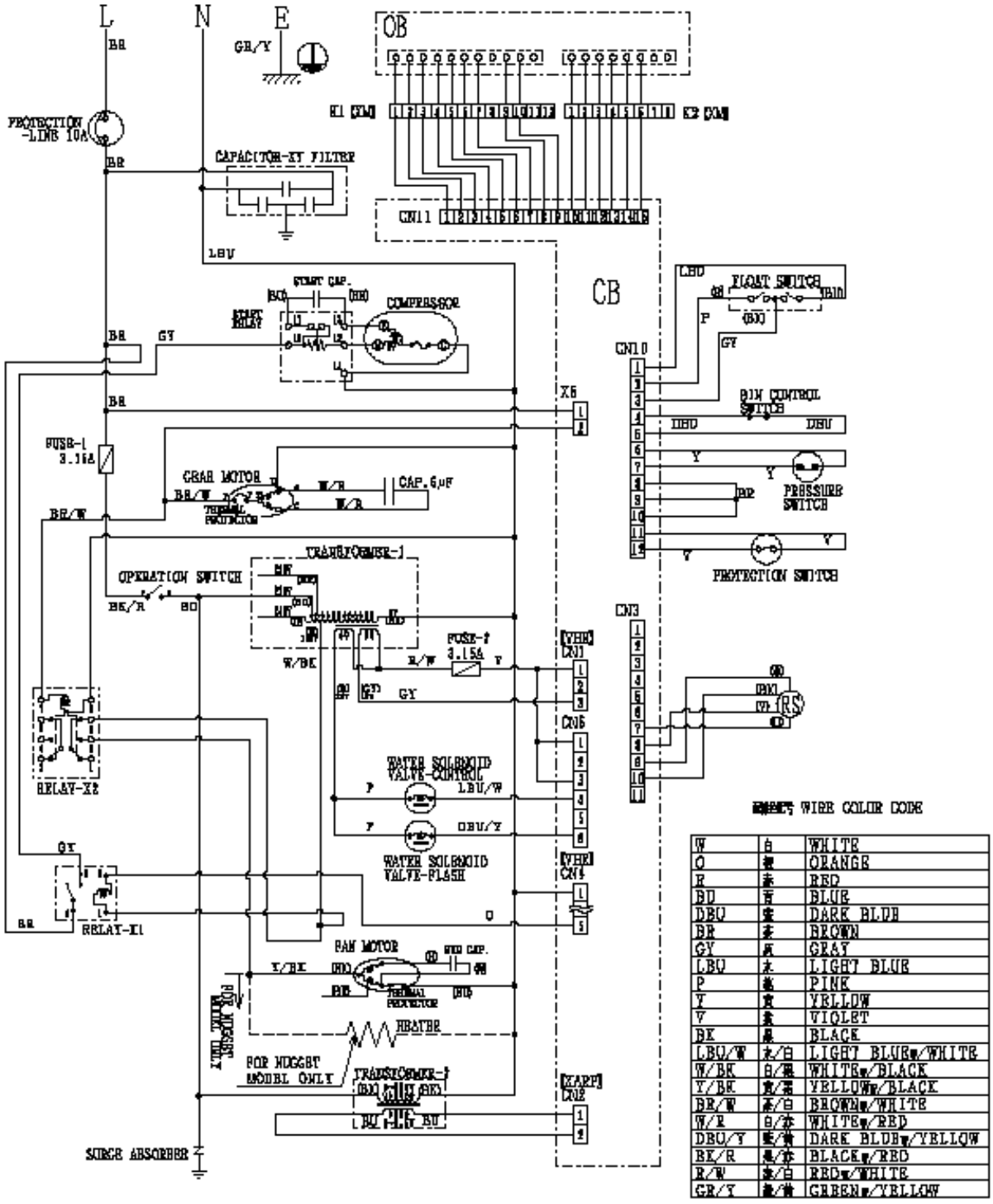
FM-481AGE-HC, FM-481AGE-HCN



配線記号 WIRE COLOR CODE

W	白	WHITE
O	橙	ORANGE
R	赤	RED
BU	青	BLUE
DBU	藍	DARK BLUE
BR	茶	BROWN
GY	灰	GRAY
LBU	水	LIGHT BLUE
P	桃	PINK
Y	黄	YELLOW
V	紫	VIOLET
BK	黒	BLACK
LBU/W	水/白	LIGHT BLUEw/WHITE
W/BK	白/黒	WHITEw/BLACK
Y/BK	黄/黒	YELLOWw/BLACK
BR/W	茶/白	BROWNw/WHITE
W/R	白/赤	WHITEw/RED
DBU/Y	藍/黄	DARK BLUEw/YELLOW
BK/R	黒/赤	BLACKw/RED
GR/Y	緑/黄	GREENw/YELLOW

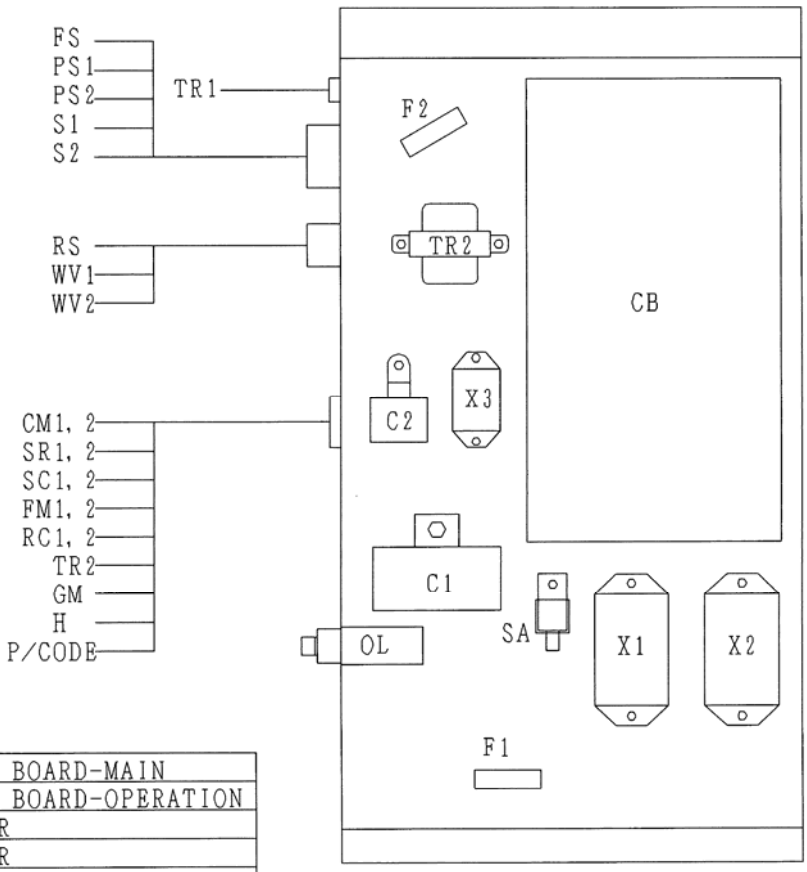
FM-300AFE-HC, FM-300AFE-HCN



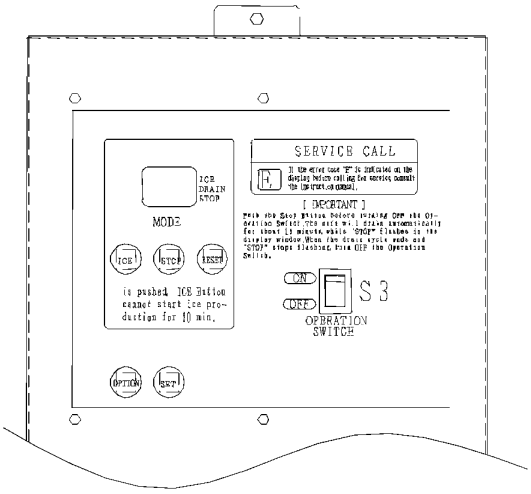
W	白	WHITE
O	橙	ORANGE
R	赤	RED
BU	青	BLUE
DBU	紺	DARK BLUE
BR	茶	BROWN
GY	灰	GRAY
LBU	水	LIGHT BLUE
P	桃	PINK
Y	黄	YELLOW
V	紫	VIOLET
BK	黒	BLACK
LBU/W	水/白	LIGHT BLUE/WHITE
W/BK	白/黒	WHITE/BLACK
Y/BK	黄/黒	YELLOW/BLACK
BR/W	茶/白	BROWN/WHITE
W/R	白/赤	WHITE/RED
DBU/Y	紺/黄	DARK BLUE/YELLOW
BK/R	黒/赤	BLACK/RED
R/W	赤/白	RED/WHITE
GR/Y	緑/黄	GREEN/YELLOW

[b] CONTROL BOX LAYOUT

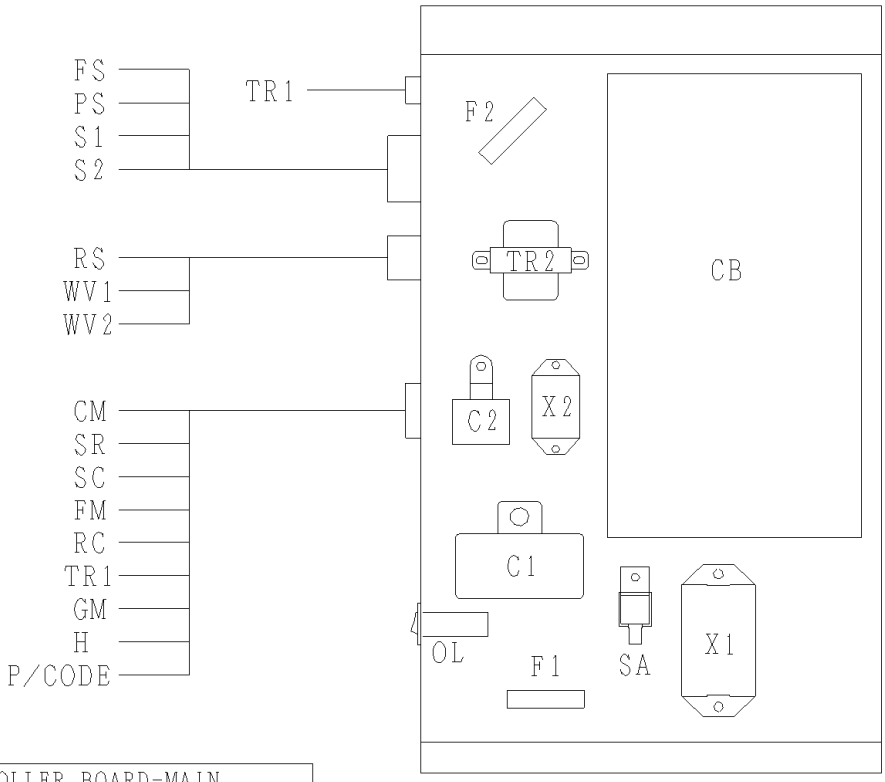
FM-481AGE-HC, FM-481AGE-HCN



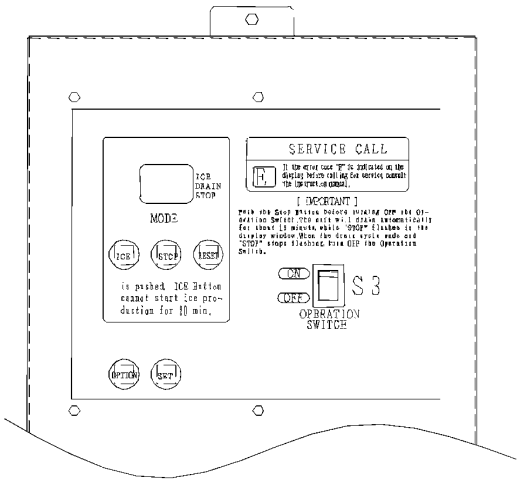
CB	CONTROLLER BOARD-MAIN
OB	CONTROLLER BOARD-OPERATION
TR1	TRANSFORMER
TR2	TRANSFORMER
C1	CAPACITOR (GM)
C2	CAPACITOR-XY FILTER
CM1, 2	COMPRESSOR
SR1, 2	START RELAY
SC1, 2	START CAPACITOR
GM	GEAR MOTOR
TPO	THERMAL PROTECTOR (GM)
FM1, 2	FAN MOTOR
RC1, 2	RUN CAPACITOR (FM)
X1, 2, 3	POWER RELAY
S1	BIN CONTOROL SWITCH
S2	PROTECTION SWITCH
S3	OPERATION SWITCH
WV1	CONTROL WATER VALVE
WV2	FLUSH WATER VALVE
FS	FLOAT SWITCH
PS1, 2	PRESSURE SWITCH
RS	ROTATION SENSOR
OL	PROTECTOR 20A
SA	SURGE ABSOBER
F1, 2	FUSE
H	HEATER
P/CODE	POWER SUPPLY CODE



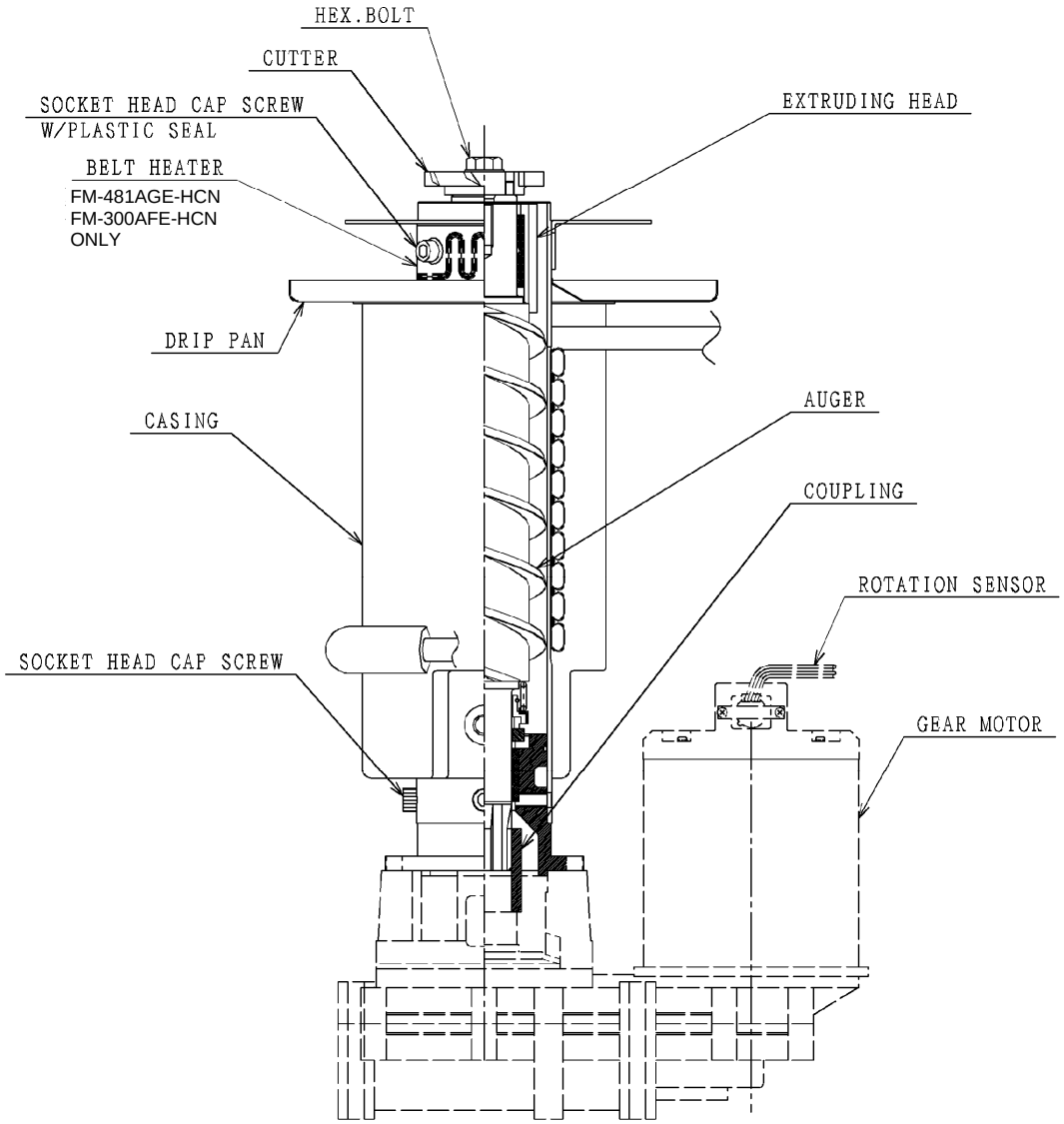
FM-300AFE-HC, FM-300AFE-HCN



CB	CONTROLLER BOARD-MAIN
OB	CONTROLLER BOARD-OPERATION
TR_1	TRANSFORMER
TR_2	TRANSFORMER
C_1	CAPACITOR (GM)
C_2	CAPACITOR-XY FILTER
CM	COMPRESSOR
SR	START RELAY
SC	START CAPACITOR
GM	GEAR MOTOR
TPO	THERMAL PROTECTOR (GM)
FM	FAN MOTOR
RC	RUN CAPACITOR (FM)
$X_{1,2}$	POWER RELAY
S_1	BIN CONTROL SWITCH
S_2	PROTECTION SWITCH
S_3	OPERATION SWITCH
WV_1	CONTROL WATER VALVE
WV_2	FLUSH WATER VALVE
FS	FLOAT SWITCH
PS	PRESSURE SWITCH
RS	ROTATION SENSOR
OL	PROTECTOR 10A
SA	SURGE ABSOBER
$F_{1,2}$	FUSE
H	HEATER



3. ICEMAKING MECHANISM



[a] EVAPORATOR (CASING)

The Evaporator consists of a stainless steel icemaking cylinder coiled with a refrigeration pipe and wrapped together with a polyurethane foam insulation material. Water coming from the inlet into the Evaporator will be frozen into ice. The Ice Spout is located on top of the Evaporator. The Deicing Heater (Belt Heater) around the top of the cylinder functions to reduce the load on the Gear Motor (FM-481AGE-HCN, FM-300AFE-HCN only). See “5. REFRIGERATION CIRCUIT” for further details.

[b] AUGER

The stainless steel Auger is supported by the upper and lower Bearings of the Evaporator and slowly rotated by the Gear Motor, while scraping off the ice forming on the inner wall of the Cylinder and pushing up to the Ice Spout.

[c] EXTRUDING HEAD (BEARING)

The stainless steel Extruding Head is provided with a press-fit plastic Bearing inside and fixed on top of the Evaporator. The Extruding Head functions as the Auger Bearing and compresses the sherbet ice carried up by the Auger into a column shape with the path resistance.

[d] HOUSING

The cast bronze Housing is provided with a press-fit plastic Bearing inside and fixed on the bottom of the Evaporator for connection with the Gear Motor.

[e] MECHANICAL SEAL

The Mechanical Seal on the lower Auger Bearing prevents icemaking water leaks into the Evaporator. The mating surfaces are made of ceramic and carbon.

[f] COUPLING (SPLINE JOINT)

The Auger bottom and Gear Motor output shaft are splined and connected with the Spline Joint.

[g] GEAR MOTOR

The Gear Motor consists of a 1 phase 240V drive motor integrated with a decelerator and provided with a built-in auto-reset Thermal Protector. When the Thermal Protector trips, the Controller Board will stop the Gear Motor. The Protector can be reset by the Reset Button on the Operation Board. The Thermal Protector trips when the Gear Motor mechanism is overloaded or when excessively high or low voltage is applied on the Gear Motor. The electrical capacity must be increased if a large current flows through the surrounding equipment.

[h] BELT HEATER - FM-481AGE-HCN, FM-300AFE-HCN ONLY

The Belt Heater is provided to reduce the load of ice passing the Extruding Head during a freeze cycle and to prevent vapor lock during a flush cycle.

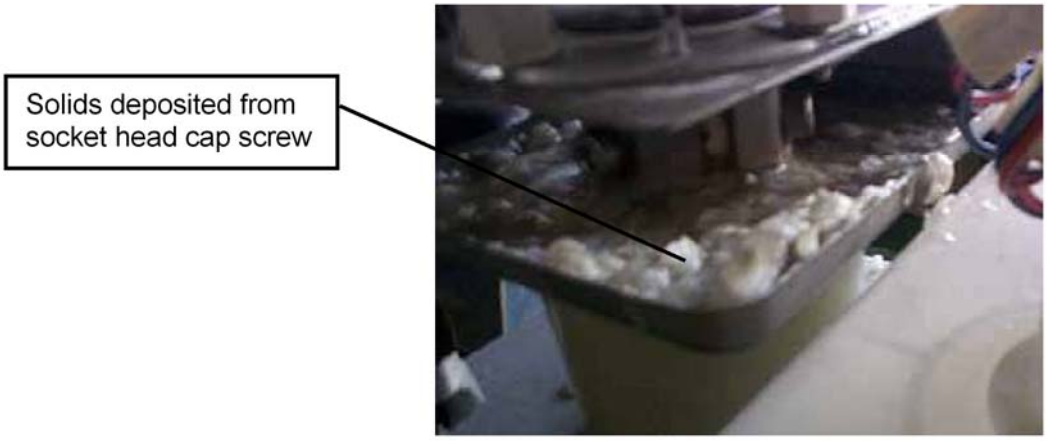
[i] REMOVABLE FLANGE

The Flange used to be welded on the Evaporator to fix the Spout. But sometimes the Extruding Head applies excessive load on the Evaporator to compress ice, resulting in breaking the welded joints. To avoid the load, the Flange has been changed to a separate part to be secured together with the Extruding Head by using a socket head cap screw.

[j] SOCKET HEAD CAP SCREW

Sometimes the icemaking operation may produce white solids on the Drip Pan. They are deposits of silica and calcium contents in the icemaking water leaking from the socket head

cap screw. The screw is provided with retaining and sealing functions, which may be reduced by the load and vibration during a freeze cycle. Do not reuse a removed socket head cap screw.



4. WATER CIRCUIT

[a] RESERVOIR (WATER TANK)

The Reservoir made of plastic maintains the water level necessary for ice production.

[b] FLOAT SWITCH

The Reservoir is provided with a plastic Float Switch to detect the water level. The floats move up and down along with the water level and send ON/OFF signals to open/close the Water Valve in order to maintain the proper water level.
If the proper water level cannot be resumed within a specific time after the Float Switch sends an OFF signal, the icemaker will detect a low water condition and shut down. The icemaker will automatically restart icemaking operation when the proper water level is resumed.
If the Float Switch trips at the upper float level on startup and trips at the lower float level (request for water supply) before the Compressor starts, the icemaker will display “E0” for a water leak error and shut down.
If the Float Switch trips at the upper float level and does not trip at the lower float level, the icemaker will display “E1” for a low ice production error and shut down.
If the Float Switch trips at both upper (fill) and lower (empty) float levels, the icemaker will display “E2” for a switch contact error and shut down.
See “9. ERROR CODES” for details.

[c] CONTROL WATER VALVE

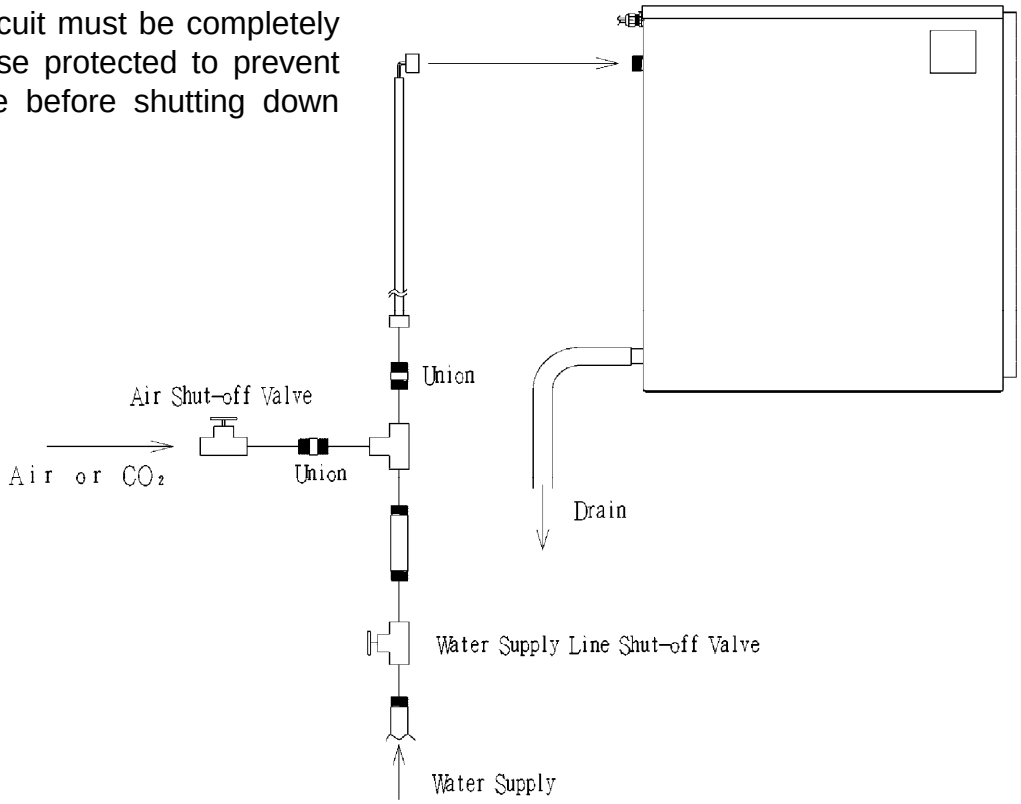
The Control Water Valve located above the Reservoir will open to supply water to the Reservoir when the coil is energized. Despite the water pressure varying from 0.5 bar to 8 bar at the water supply inlet, the built-in flow controller maintains almost the same water flow (24V AC).

[d] FLUSH WATER VALVE

When the Flush Timer operates or the Stop Button is pressed to shut down the icemaker, the Flush Water Valve will be energized to open and flush out the Evaporator Casing and Reservoir (21.7V DC).

[e] DRAINING ICEMAKER IN SUBFREEZING CONDITIONS

In winter, the water circuit must be completely drained out or otherwise protected to prevent freeze-up and damage before shutting down the icemaker at night.



1) Close the Water Supply Line Shut-off Valve to stop water supply.
2) Open the Air Shut-off Valve.
3) Press the Stop Button, and drain the Float Tank and Evaporator Casing.
4) Turn off the icemaker.

Before restarting the icemaker:
1. Close the Air Shut-off Valve.
2. Open the Water Supply Line Shut-off Valve.

5. REFRIGERATION CIRCUIT

⚠ WARNING

This machine contains flammable refrigerant. Do not attempt to break into the refrigerant circuit unless qualified, competent and authorised to do so.

[a] APPLICABLE PARTS

Refrigerant (R290)
Compressor
Evaporator Casing
Air-cooled Condenser
Air-cooled Condenser Fan Motor
Drier
Thermal Expansion Valve (with MOP)

[b] SERVICE INSTRUCTIONS

Always restore the original bindings after servicing the refrigeration circuit. Otherwise, vibration may cause overstress and damage to the circuit, resulting in refrigerant leak.

After replacing the Evaporator or Auger, run the icemaker for 30 minutes to produce ice, check for impurities, and discard.

[c] REFRIGERANT

The HFC-free refrigerant is flammable and sealed in the refrigeration system. Although the refrigerant does not leak out under normal usage, take utmost care when handling this icemaker so as not to cause any damages to the system. In the case of accidental damage to the refrigeration system causing refrigerant leak, do not create a source of ignition in the area. Do not operate electrical switches or plugs in the area, do not use naked flame. Immediately ventilate the area by opening doors and/or windows.

[d] COMPRESSOR

The Compressor absorbs the low-pressure refrigerant gas vaporized in the Evaporator (to reduce the pressure inside the Evaporator), compresses the refrigerant into high-temperature high-pressure gas, and sends it out to the Condenser.
The hermetic-type Compressor is efficient in refrigeration, and the refrigeration circuit is designed to endure long hours of operation. The Compressor is mounted on vibration damping rubber to prevent transmission of vibration. In case of accidental overload, the Case Thermostat or Overload Relay will shut down the Compressor. The Reset Button must be pressed to reset the Overload Relay.

[e] EVAPORATOR CASING

The Evaporator Casing is a thin and rigid stainless steel pipe tightly coiled around with a copper tube and solder finished. The refrigerant flows through a very narrow path in the Expansion Valve with a sudden drop of pressure and evaporates by absorbing heat of vaporization from the Evaporator Casing. The water supplied inside the Evaporator Casing is deprived of heat and forms ice film which will be scraped and moved up by the Auger.

[f] CONDENSER

The Condenser refrigerates and liquefies the high-temperature high-pressure refrigerant gas discharged from the Compressor into high-pressure liquid refrigerant. The Condenser is air-cooled.
A dirty Condenser will significantly reduce the refrigeration efficiency and performance, and will also shorten the service life of the components (especially refrigeration circuit). The frequency of cleaning depends on the installation conditions.

a) Air-cooled Condenser (Spiral tube type)

A copper tube is attached on a spiral aluminum plate with high heat conductivity to promote heat radiation, and a Fan Motor is also provided for forced air cooling.
Use a vacuum cleaner or brush to remove dirt and dust between the spiral fins. Be careful not to bend the fins.

[g] CONDENSER COOLING FAN MOTOR

The Fan Motor cools the Air-cooled Condenser and sends air to condense refrigerant gas inside the Condenser.

[h] DRIER

The Drier uses desiccants (molecular sieves + activated alumina) to absorb moisture in the refrigeration circuit. The built-in filter also corrects foreign matter in the refrigeration circuit to prevent troubles with valves clogged with dirt or moisture.

[i] THERMOSTATIC EXPANSION VALVE

The Expansion Valve throttles high-pressure liquid refrigerant into low-temperature low-pressure state by adiabatic expansion and maintains the proper amount of refrigerant supply depending on the Evaporator load. The Thermostatic Expansion Valve controls the valve position to regulate the superheat (difference between evaporating temperature and suction gas temperature). No superheat control is available from outside.
To check the Expansion Valve for proper operation, remove the Bulb while the Compressor is running. If the suction pressure rises, the Expansion Valve is working normally.

> Note: Do not leave the Bulb removed for a long time while the Compressor is running. The Compressor may fail due to liquid return.

6. ELECTRIC CIRCUIT

CAUTION
Reassemble all the components as they were after servicing the unit according to a service call.

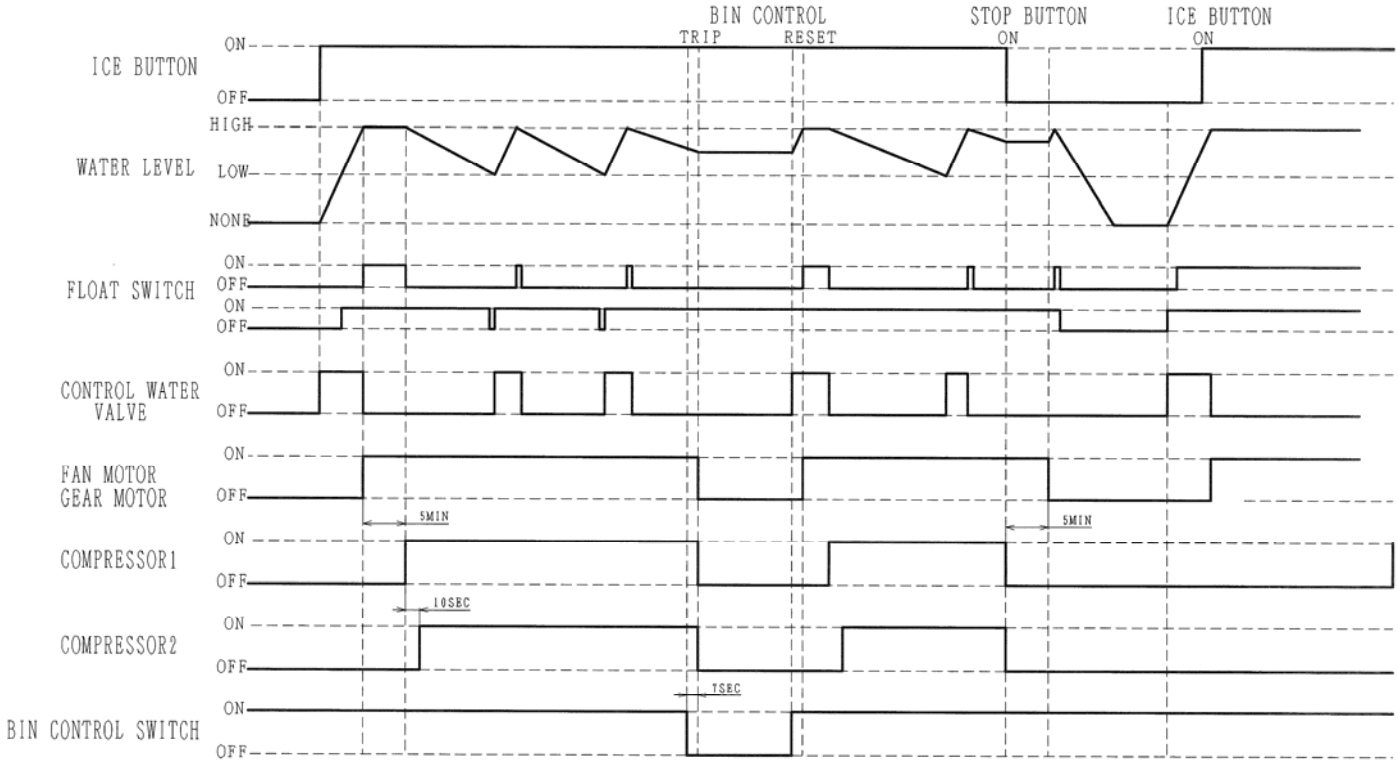
[a] BASIC OPERATION

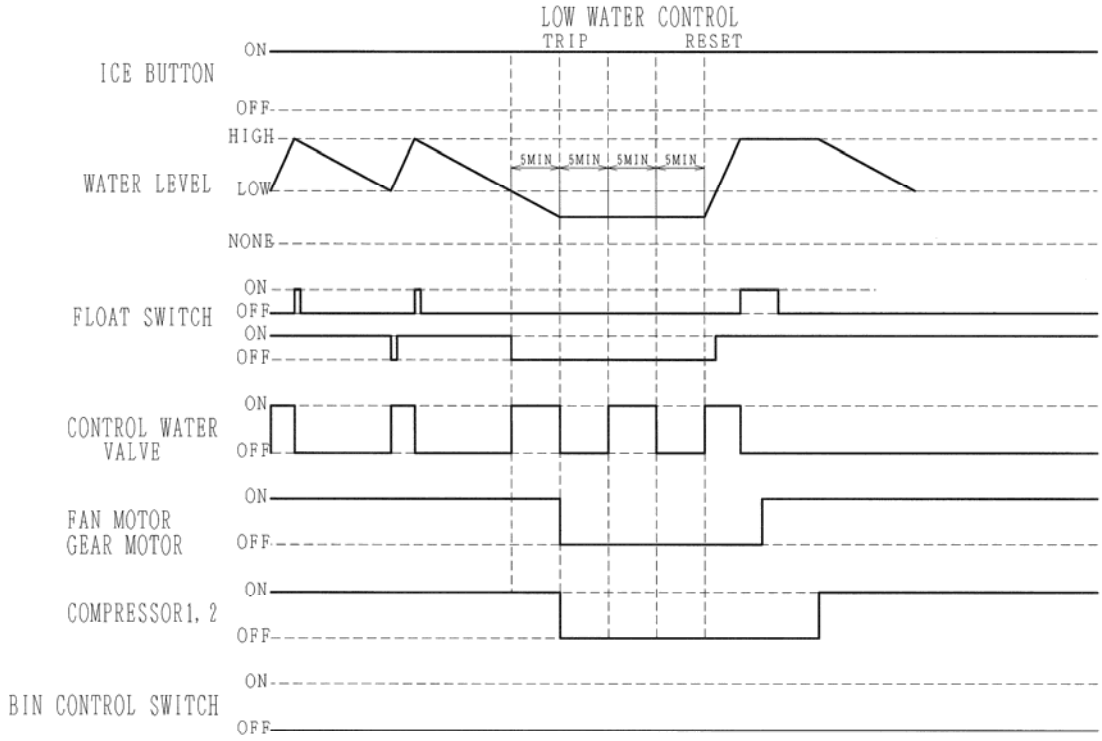
The icemaker starts water supply when the Operation Switch is turned ON. On completion of water supply, the Gear Motor starts immediately. After 5 minutes the Compressor starts to begin icemaking operation.

In normal operation, the icemaker shuts down when the Storage Bin fills up to trip the Bin Control Switch or the Stop Button is pressed. When the Compressor operates for 6 hours in total and continuously for more than 10 minutes, the icemaker supplies water until the Reservoir fills up and starts a drain cycle. After 10 minutes the icemaker automatically starts water supply and resumes icemaking operation.

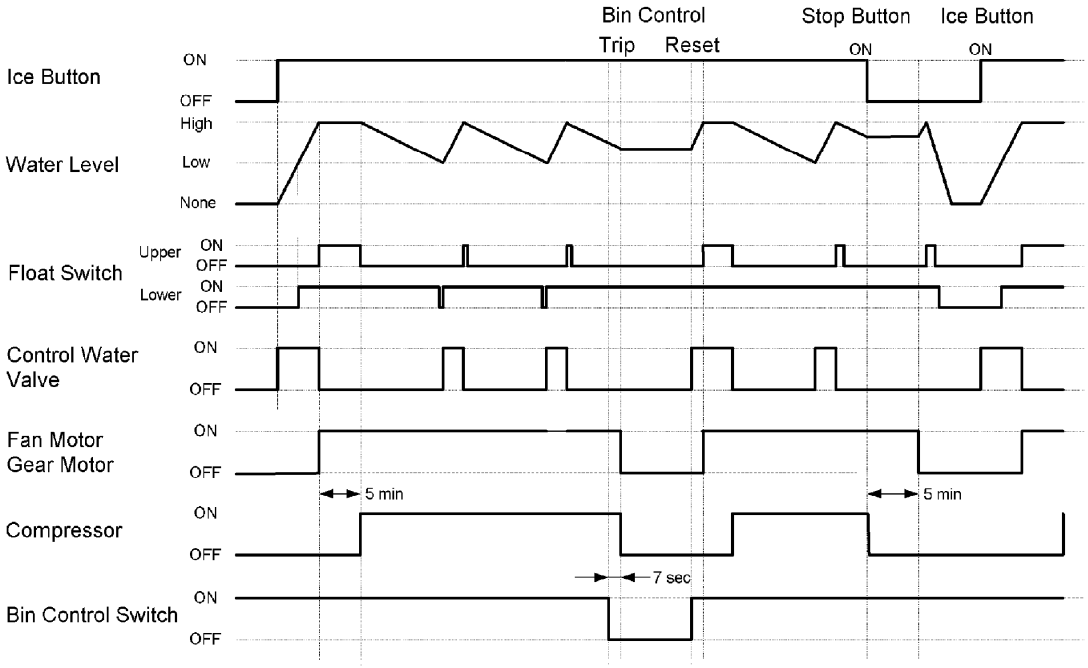
[b] TIMING CHART

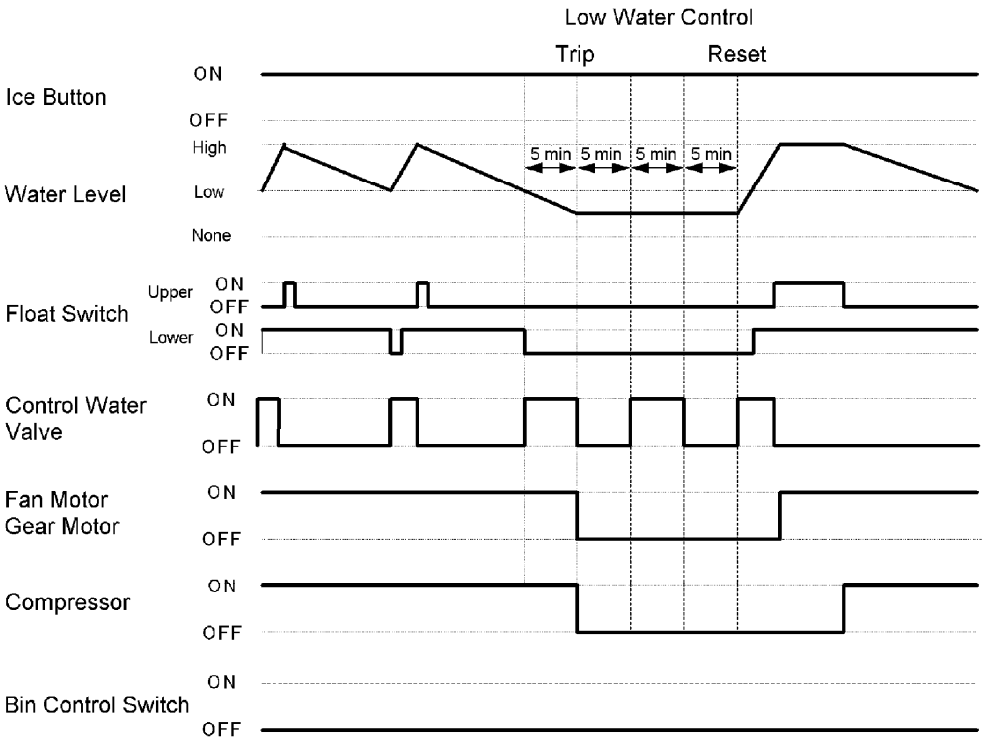
FM-481AGE-HC, FM-481AGE-HCN





FM-300AFE-HC, FM-300AFE-HCN

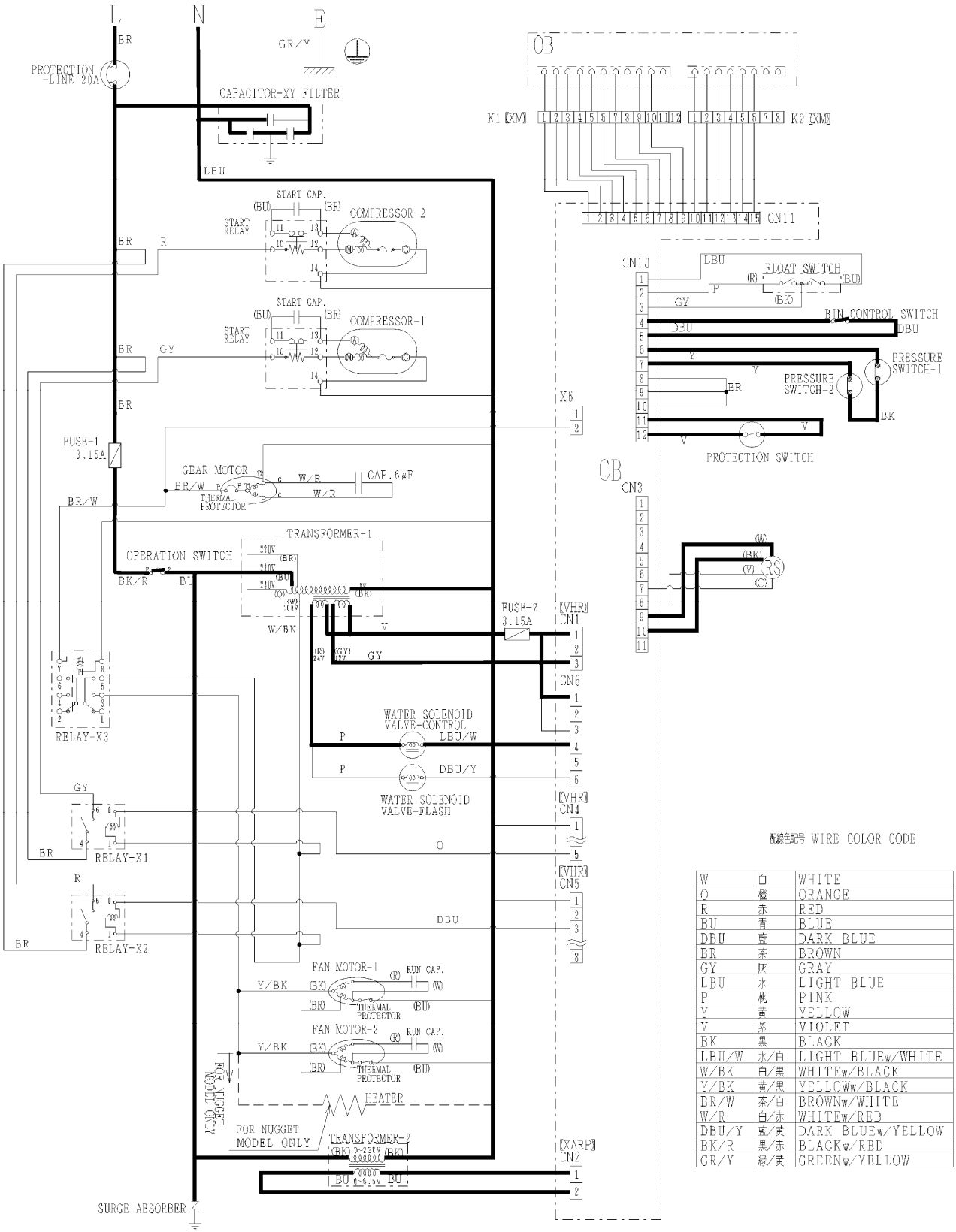



Low Water Control
Trip
Reset
Ice Button
ON
OFF
Water Level
High
Low
None
5 min
5 min
5 min
5 min
Float Switch
Upper
ON
OFF
Lower
ON
OFF
Control Water Valve
ON
OFF
Fan Motor Gear Motor
ON
OFF
Compressor
ON
OFF
Bin Control Switch
ON
OFF

[c] SEQUENCE

FM-481AGE-HC, FM-481AGE-HCN

(1) Startup - Water Supply

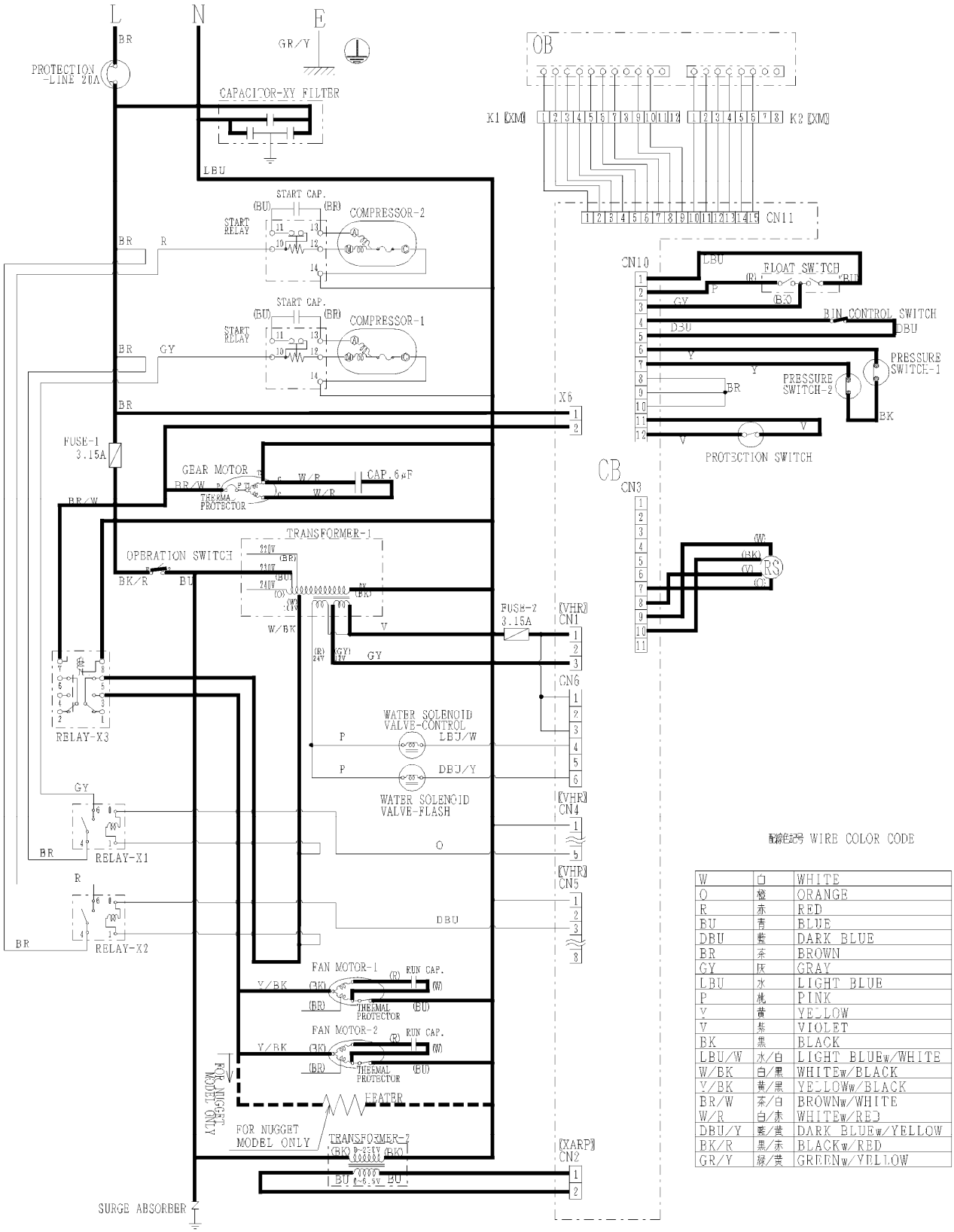


線記号 WIRE COLOR CODE

W	白	WHITE
O	橙	ORANGE
R	赤	RED
BU	青	BLUE
DBU	藍	DARK BLUE
BR	茶	BROWN
GY	灰	GRAY
LBU	水	LIGHT BLUE
P	桃	PINK
Y	黄	YELLOW
V	紫	VIOLET
BK	黒	BLACK
LBU/W	水/白	LIGHT BLUEw/WHITE
W/BK	白/黒	WHITEw/BLACK
Y/BK	黄/黒	YELLOWw/BLACK
BR/W	茶/白	BROWNw/WHITE
W/R	白/赤	WHITEw/RED
DBU/Y	藍/黄	DARK BLUEw/YELLOW
BK/R	黒/赤	BLACKw/RED
GR/Y	緑/黄	GREENw/YELLOW

FM-481AGE-HC, FM-481AGE-HCN

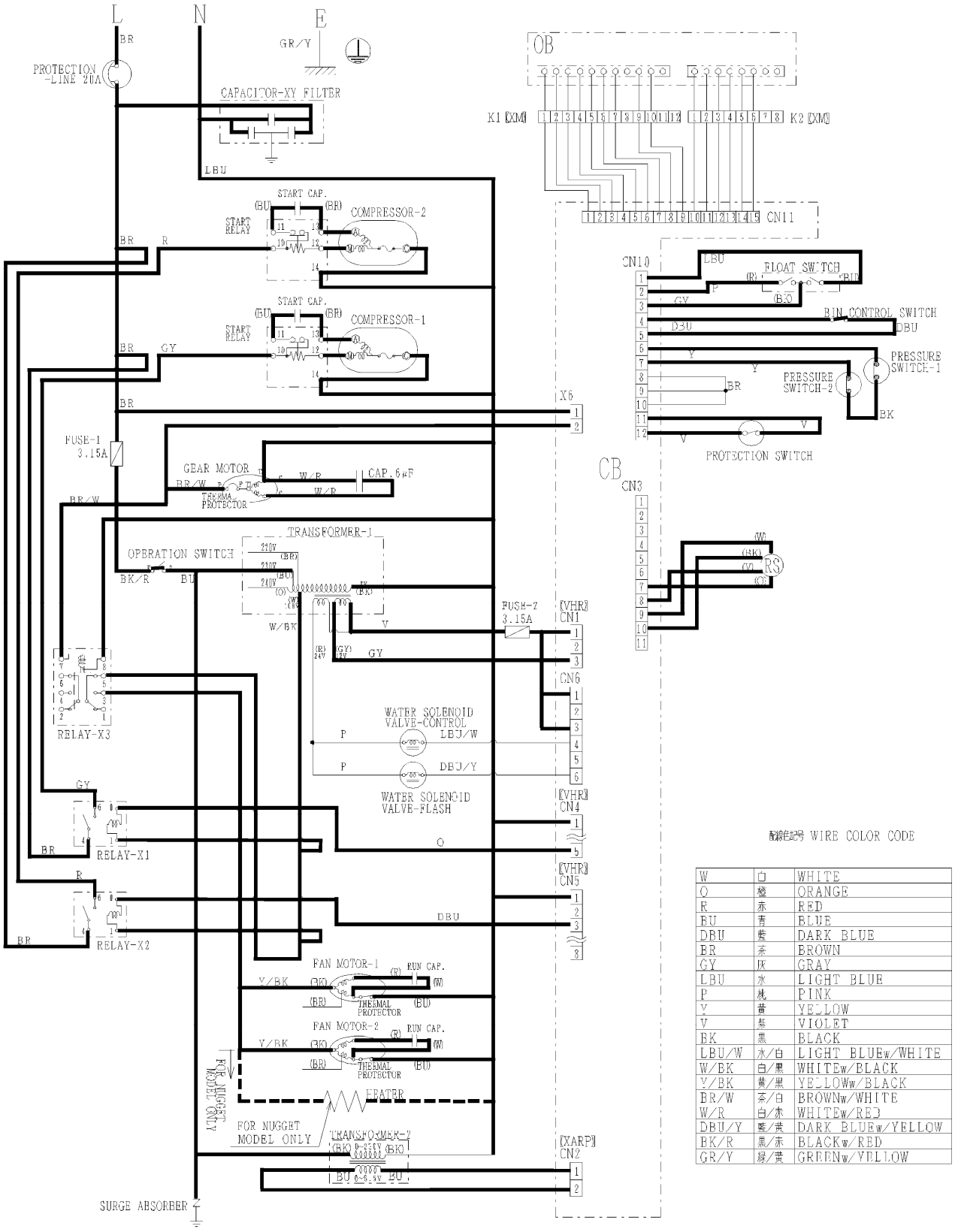
(2) Startup - After completion of water supply, Gear Motor and Fan Motor start (5 min).



配線記号 WIRE COLOR CODE

W	白	WHITE
O	橙	ORANGE
R	赤	RED
BU	青	BLUE
DBU	藍	DARK BLUE
BR	茶	BROWN
GY	灰	GRAY
LBU	水	LIGHT BLUE
P	桃	PINK
Y	黄	YELLOW
V	紫	VIOLET
BK	黒	BLACK
LBU/W	水/白	LIGHT BLUEw/WHITE
W/BK	白/黒	WHITEw/BLACK
Y/BK	黄/黒	YELLOWw/BLACK
BR/W	茶/白	BROWNw/WHITE
W/R	白/赤	WHITEw/RED
DBU/Y	藍/黄	DARK BLUEw/YELLOW
BK/R	黒/赤	BLACKw/RED
GR/Y	緑/黄	GREENw/YELLOW

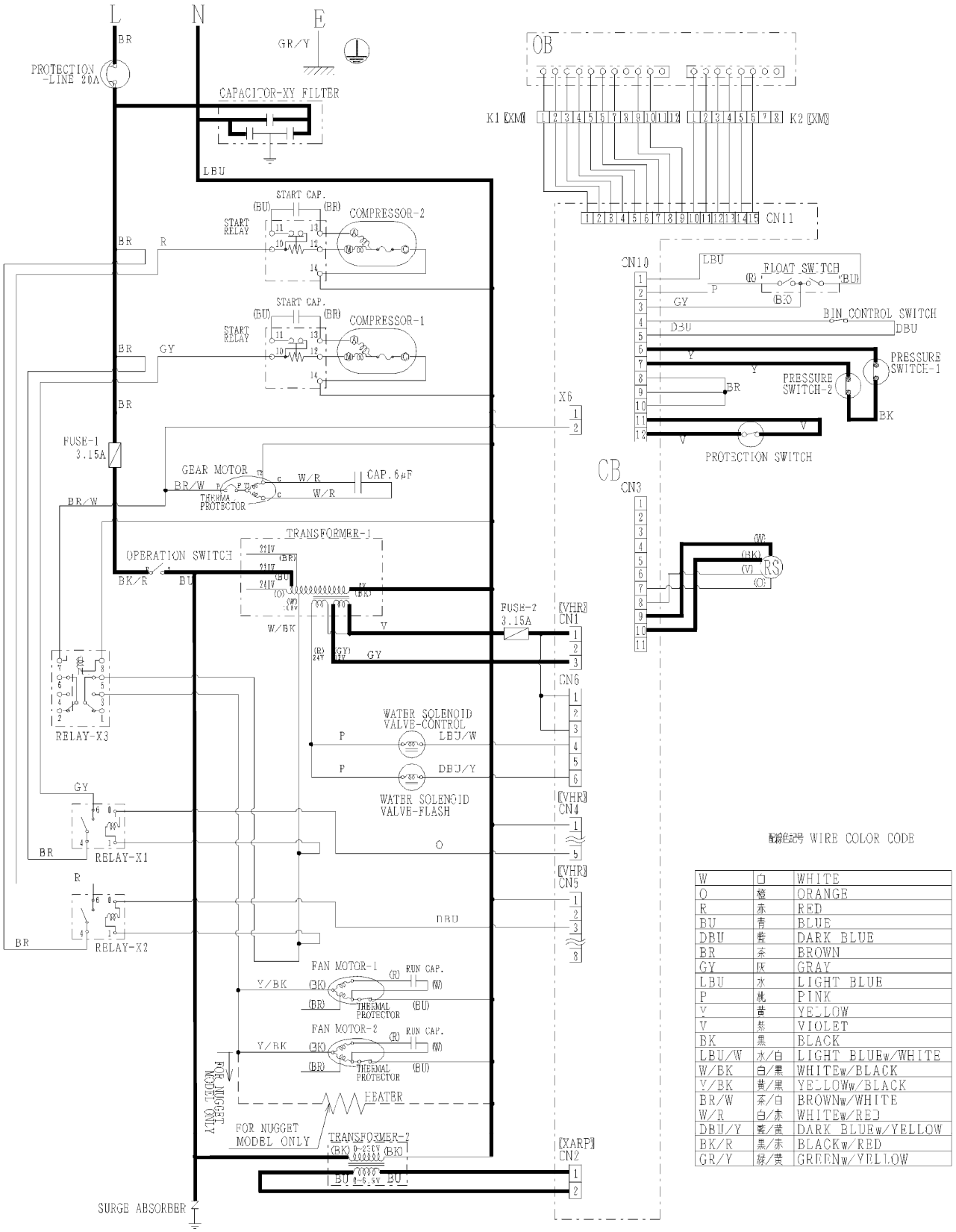
(3) Startup - Ice production starts



配線記号 WIRE COLOR CODE

W	白	WHITE
O	橙	ORANGE
R	赤	RED
BU	青	BLUE
DBU	藍	DARK BLUE
BR	茶	BROWN
GY	灰	GRAY
LBU	水	LIGHT BLUE
P	桃	PINK
Y	黄	YELLOW
V	紫	VIOLET
BK	黒	BLACK
LBU/W	水/白	LIGHT BLUEw/WHITE
W/BK	白/黒	WHITEw/BLACK
Y/BK	黄/黒	YELLOWw/BLACK
BR/W	茶/白	BROWNw/WHITE
W/R	白/赤	WHITEw/RED
DBU/Y	藍/黄	DARK BLUEw/YELLOW
BK/R	黒/赤	BLACKw/RED
GR/Y	緑/黄	GREENw/YELLOW

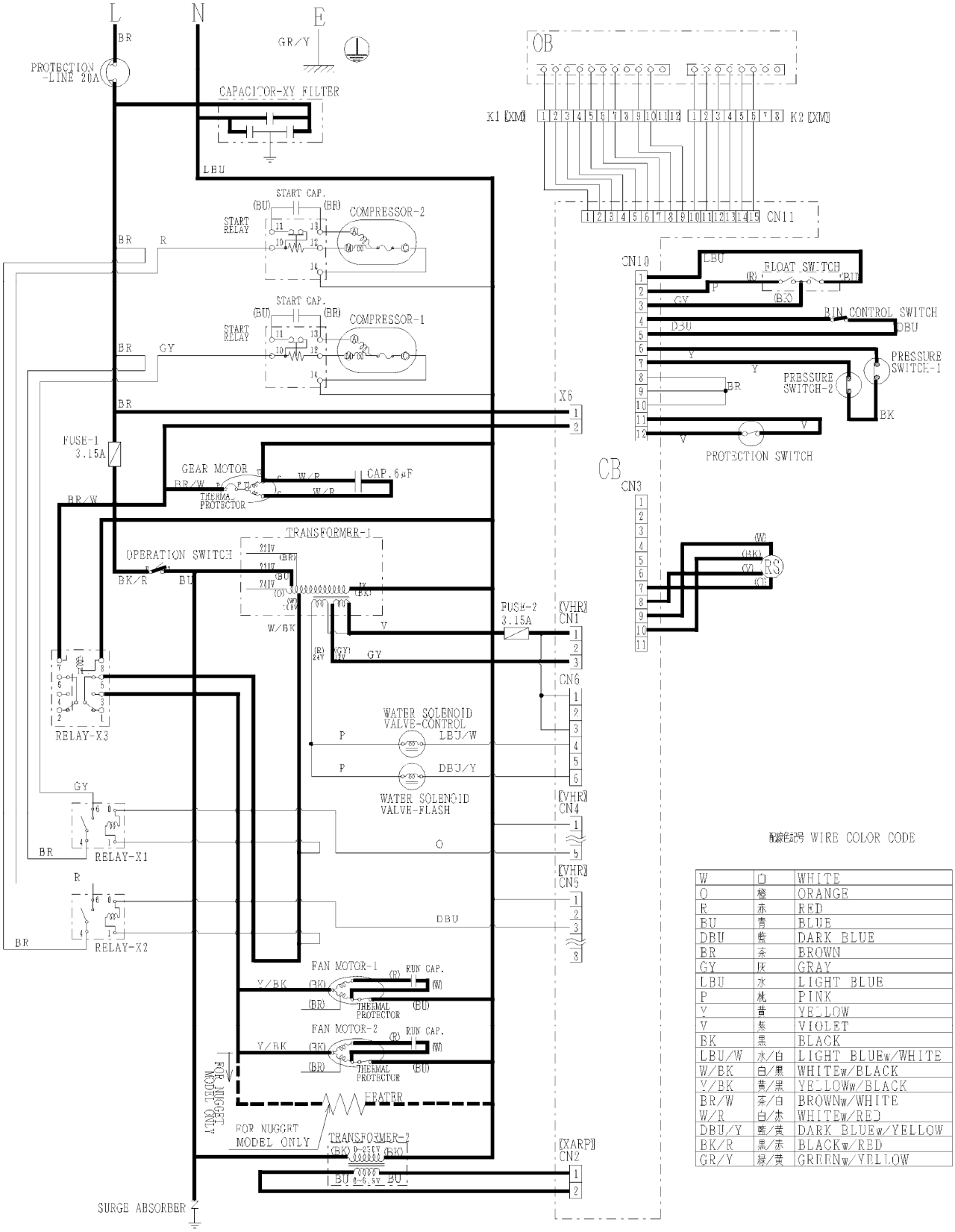
(4) Normal Operation - Bin Control



配線記号 WIRE COLOR CODE

W	白	WHITE
O	橙	ORANGE
R	赤	RED
BU	青	BLUE
DBU	藍	DARK BLUE
BR	茶	BROWN
GY	灰	GRAY
LBU	水	LIGHT BLUE
P	桃	PINK
Y	黄	YELLOW
V	紫	VIOLET
BK	黒	BLACK
LBU/W	水/白	LIGHT BLUEw/WHITE
W/BK	白/黒	WHITEw/BLACK
Y/BK	黄/黒	YELLOWw/BLACK
BR/W	茶/白	BROWNw/WHITE
W/R	白/赤	WHITEw/RED
DBU/Y	藍/黄	DARK BLUEw/YELLOW
BK/R	黒/赤	BLACKw/RED
GR/Y	緑/黄	GREENw/YELLOW

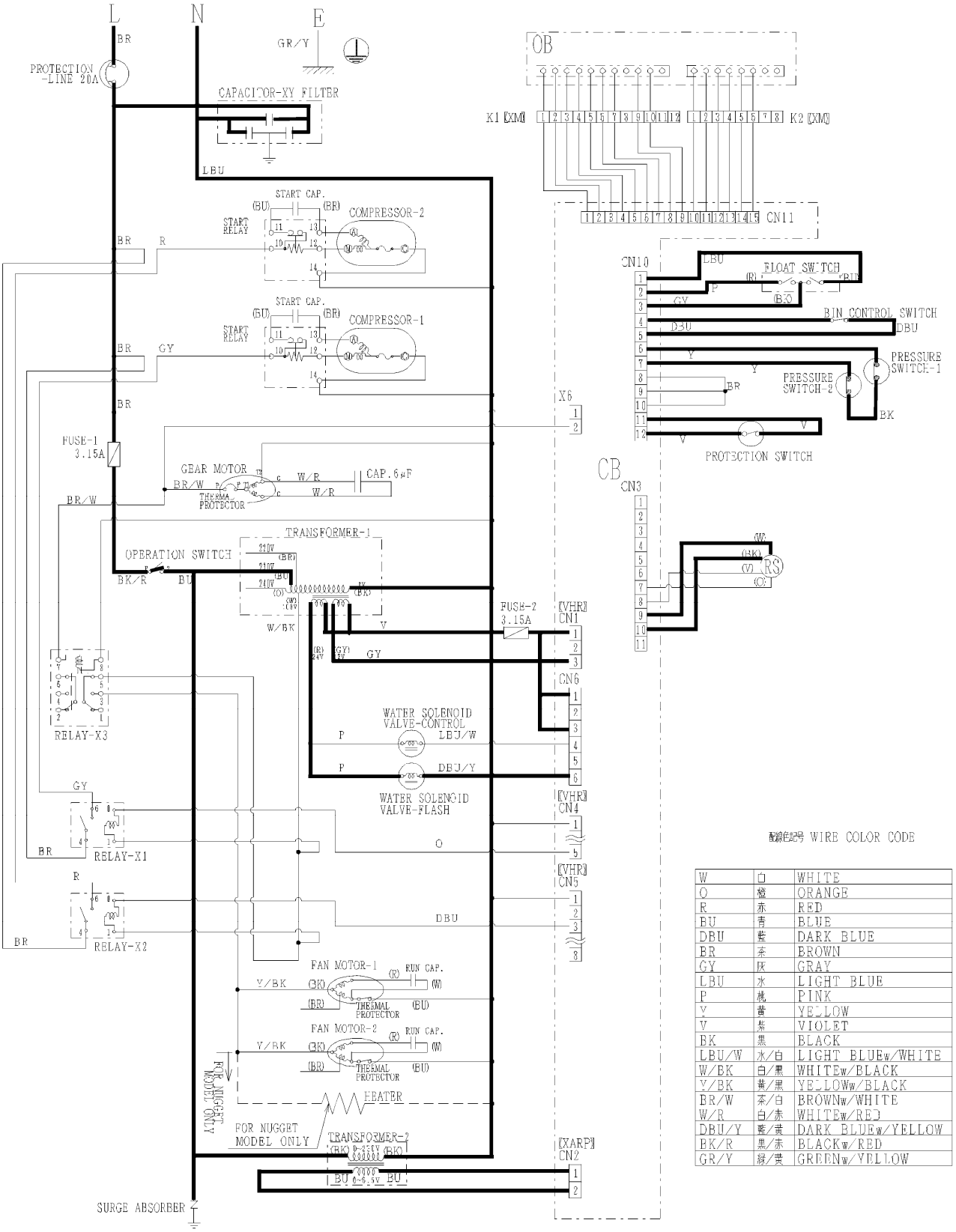
(5) Shutdown - Compressor stops (5 min)



配線記号 WIRE COLOR CODE

W	白	WHITE
O	橙	ORANGE
R	赤	RED
BU	青	BLUE
DBU	藍	DARK BLUE
BR	茶	BROWN
GY	灰	GRAY
LBU	水	LIGHT BLUE
P	桃	PINK
Y	黄	YELLOW
V	紫	VIOLET
BK	黒	BLACK
LBU/W	水/白	LIGHT BLUEw/WHITE
W/BK	白/黒	WHITEw/BLACK
Y/BK	黄/黒	YELLOWw/BLACK
BR/W	茶/白	BROWNw/WHITE
W/R	白/赤	WHITEw/RED
DBU/Y	藍/黄	DARK BLUEw/YELLOW
BK/R	黒/赤	BLACKw/RED
GR/Y	緑/黄	GREENw/YELLOW

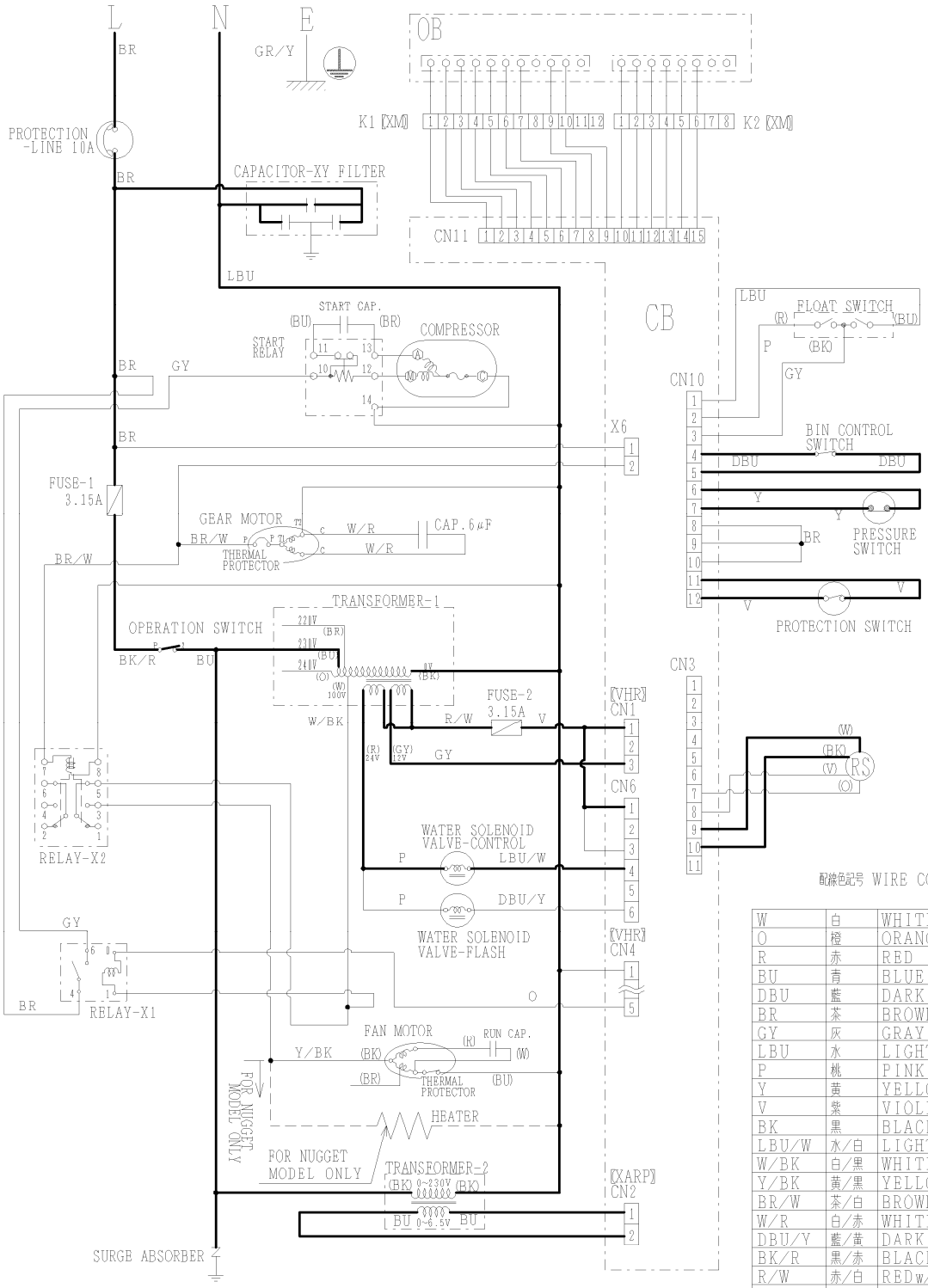
(6) Shutdown - Drain



記号	WIRE COLOR CODE	
W	白	WHITE
O	橙	ORANGE
R	赤	RED
BU	青	BLUE
DBU	紺	DARK BLUE
BR	茶	BROWN
GY	灰	GRAY
LBU	水	LIGHT BLUE
P	桃	PINK
Y	黄	YELLOW
V	紫	VIOLET
BK	黒	BLACK
LBU/W	水/白	LIGHT BLUEw/WHITE
W/BK	白/黒	WHITEw/BLACK
Y/BK	黄/黒	YELLOWw/BLACK
BR/W	茶/白	BROWNw/WHITE
W/R	白/赤	WHITEw/RED
DBU/Y	紺/黄	DARK BLUEw/YELLOW
BK/R	黒/赤	BLACKw/RED
GR/Y	緑/黄	GREENw/YELLOW

FM-300AFE-HC, FM-300AFE-HCN

(1) Startup - Water Supply

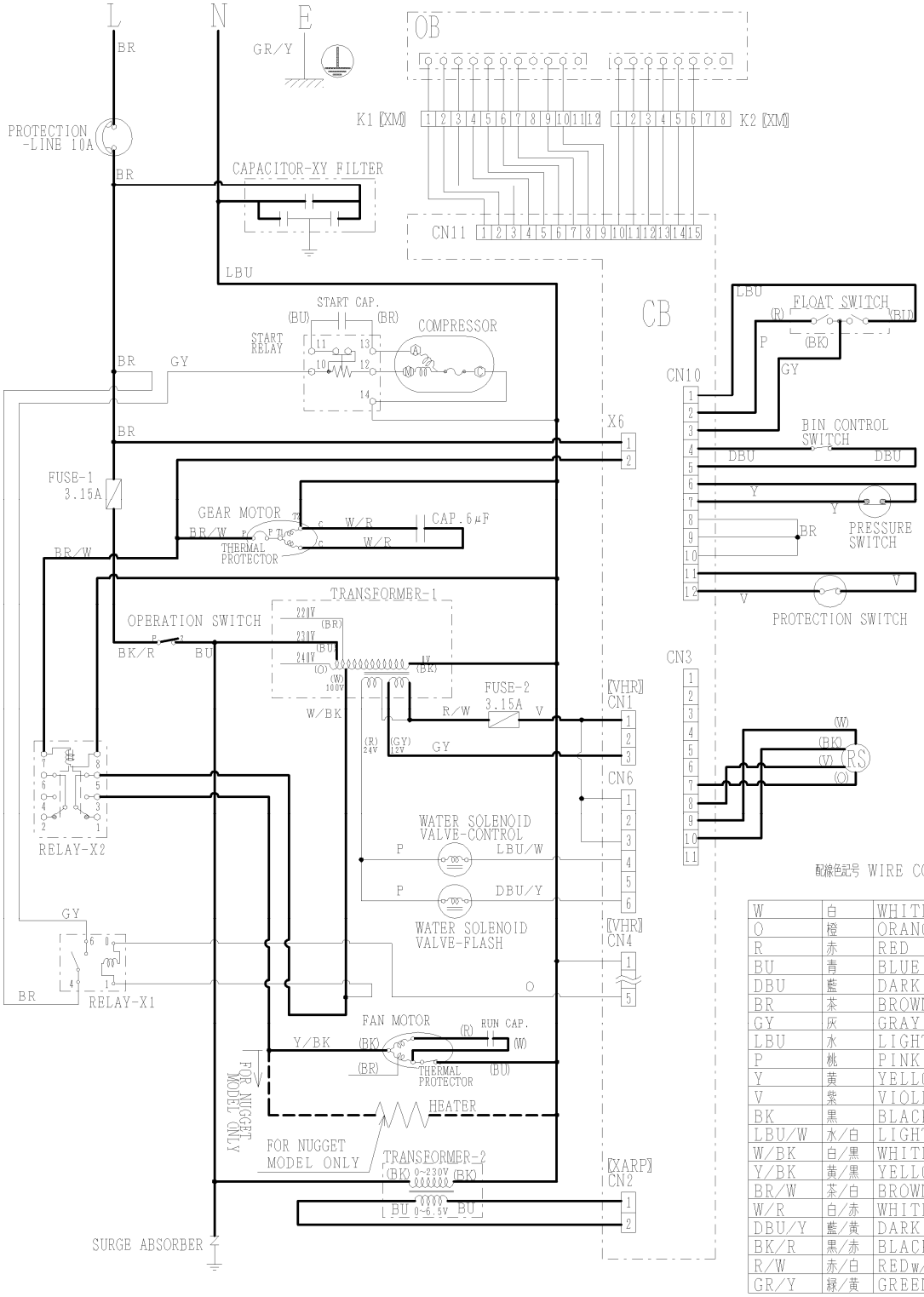


配線色記号 WIRE COLOR CODE

W	白	WHITE
O	橙	ORANGE
R	赤	RED
BU	青	BLUE
DBU	藍	DARK BLUE
BR	茶	BROWN
GY	灰	GRAY
LBU	水	LIGHT BLUE
P	桃	PINK
Y	黄	YELLOW
V	紫	VIOLET
BK	黒	BLACK
LBU/W	水/白	LIGHT BLUEw/WHITE
W/BK	白/黒	WHITEw/BLACK
Y/BK	黄/黒	YELLOWw/BLACK
BR/W	茶/白	BROWNw/WHITE
W/R	白/赤	WHITEw/RED
DBU/Y	藍/黄	DARK BLUEw/YELLOW
BK/R	黒/赤	BLACKw/RED
R/W	赤/白	REDw/WHITE
GR/Y	緑/黄	GREENw/YELLOW

FM-300AFE-HC, FM-300AFE-HCN

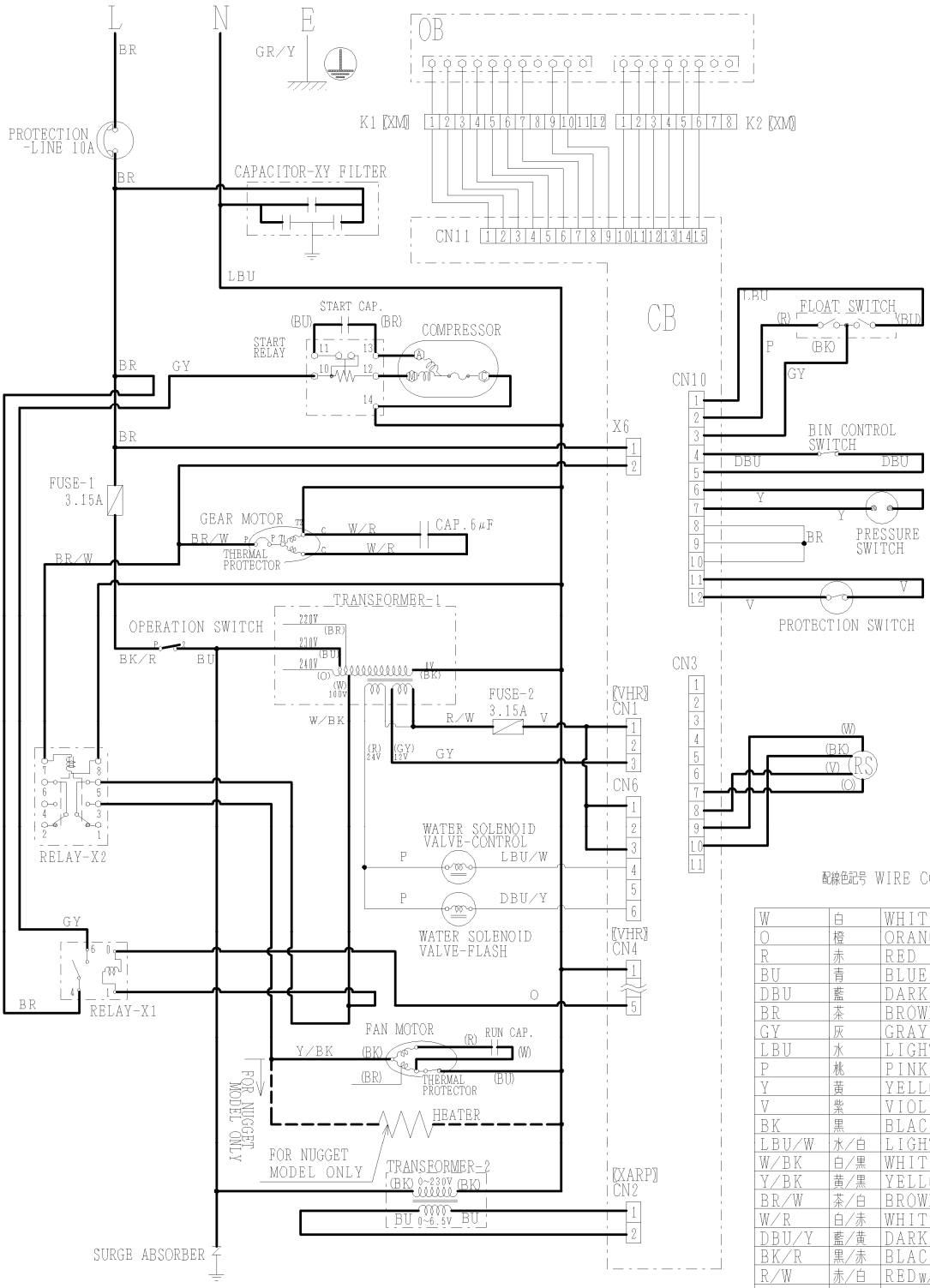
(2) Startup - After completion of water supply, Gear Motor and Fan Motor start (5 min).



配線色記号 WIRE COLOR CODE

W	白	WHITE
O	橙	ORANGE
R	赤	RED
BU	青	BLUE
DBU	藍	DARK BLUE
BR	茶	BROWN
GY	灰	GRAY
LBU	水	LIGHT BLUE
P	桃	PINK
Y	黄	YELLOW
V	紫	VIOLET
BK	黒	BLACK
LBU/W	水/白	LIGHT BLUEw/WHITE
W/BK	白/黒	WHITEw/BLACK
Y/BK	黄/黒	YELLOWw/BLACK
BR/W	茶/白	BROWNw/WHITE
W/R	白/赤	WHITEw/RED
DBU/Y	藍/黄	DARK BLUEw/YELLOW
BK/R	黒/赤	BLACKw/RED
R/W	赤/白	REDw/WHITE
GR/Y	緑/黄	GREENw/YELLOW

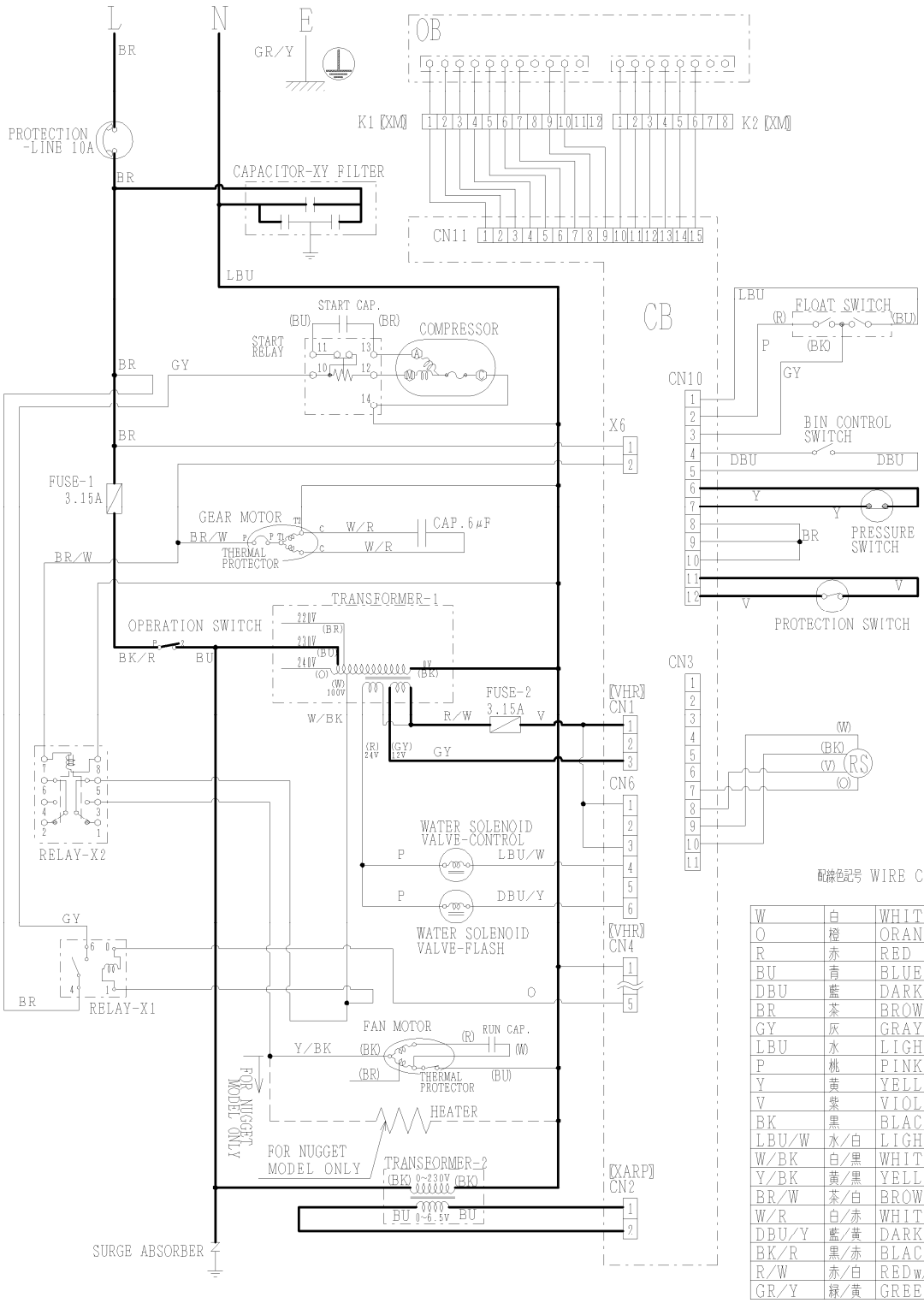
(3) Startup - Ice production starts



配線色記号 WIRE COLOR CODE

W	白	WHITE
O	橙	ORANGE
R	赤	RED
BU	青	BLUE
DBU	藍	DARK BLUE
BR	茶	BROWN
GY	灰	GRAY
LBU	水	LIGHT BLUE
P	桃	PINK
Y	黄	YELLOW
V	紫	VIOLET
BK	黒	BLACK
LBU/W	水/白	LIGHT BLUEw/WHITE
W/BK	白/黒	WHITEw/BLACK
Y/BK	黄/黒	YELLOWw/BLACK
BR/W	茶/白	BROWNw/WHITE
W/R	白/赤	WHITEw/RED
DBU/Y	藍/黄	DARK BLUEw/YELLOW
BK/R	黒/赤	BLACKw/RED
R/W	赤/白	REDw/WHITE
GR/Y	緑/黄	GREENw/YELLOW

(4) Normal Operation - Bin Control

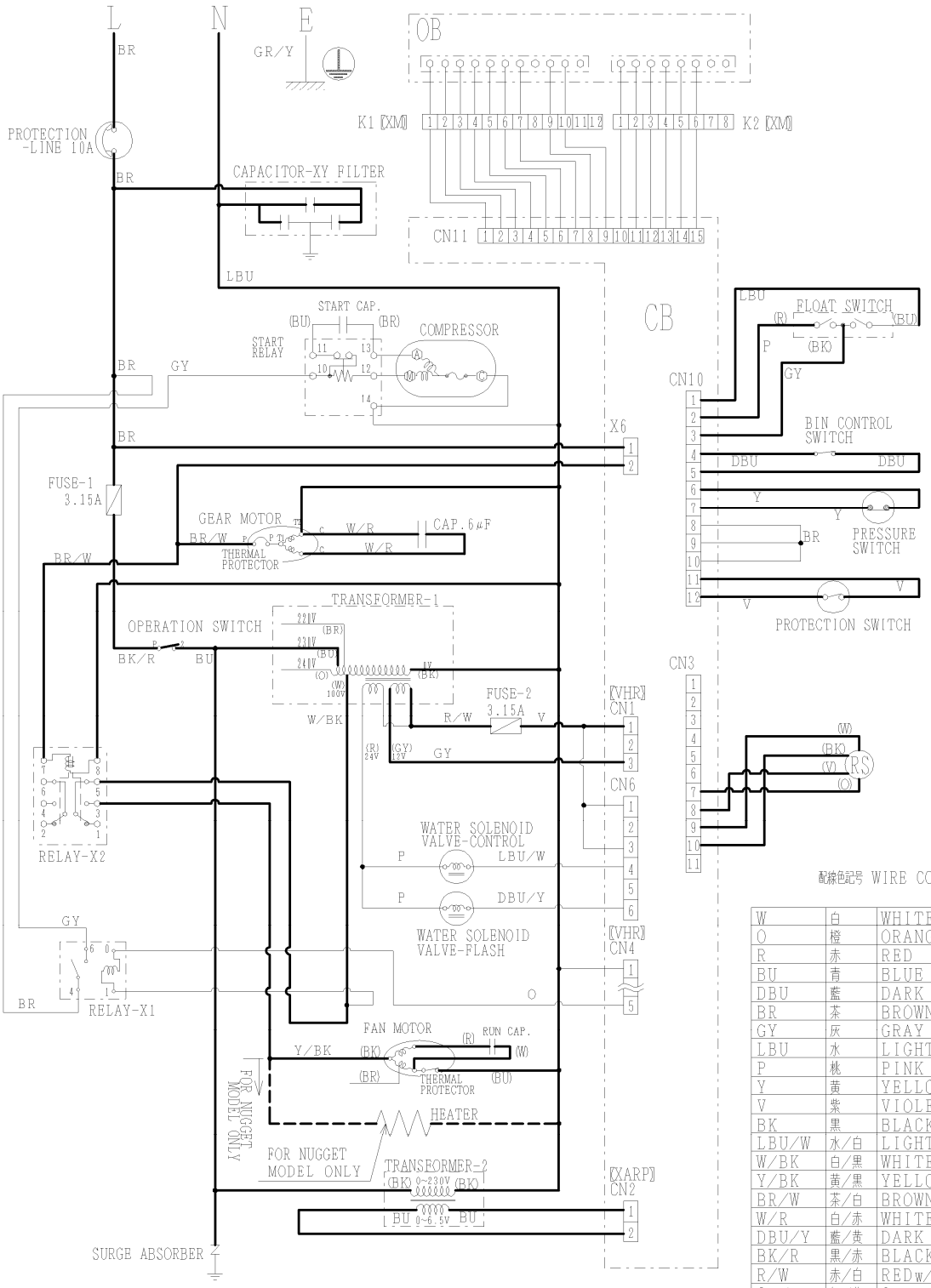


配線色記号 WIRE COLOR CODE

W	白	WHITE
O	橙	ORANGE
R	赤	RED
BU	青	BLUE
DBU	藍	DARK BLUE
BR	茶	BROWN
GY	灰	GRAY
LBU	水	LIGHT BLUE
P	桃	PINK
Y	黄	YELLOW
V	紫	VIOLET
BK	黒	BLACK
LBU/W	水/白	LIGHT BLUEw/WHITE
W/BK	白/黒	WHITEw/BLACK
Y/BK	黄/黒	YELLOWw/BLACK
BR/W	茶/白	BROWNw/WHITE
W/R	白/赤	WHITEw/RED
DBU/Y	藍/黄	DARK BLUEw/YELLOW
BK/R	黒/赤	BLACKw/RED
R/W	赤/白	REDw/WHITE
GR/Y	緑/黄	GREENw/YELLOW

FM-300AFE-HC, FM-300AFE-HCN

(5) Shutdown - Compressor stops (5 min)

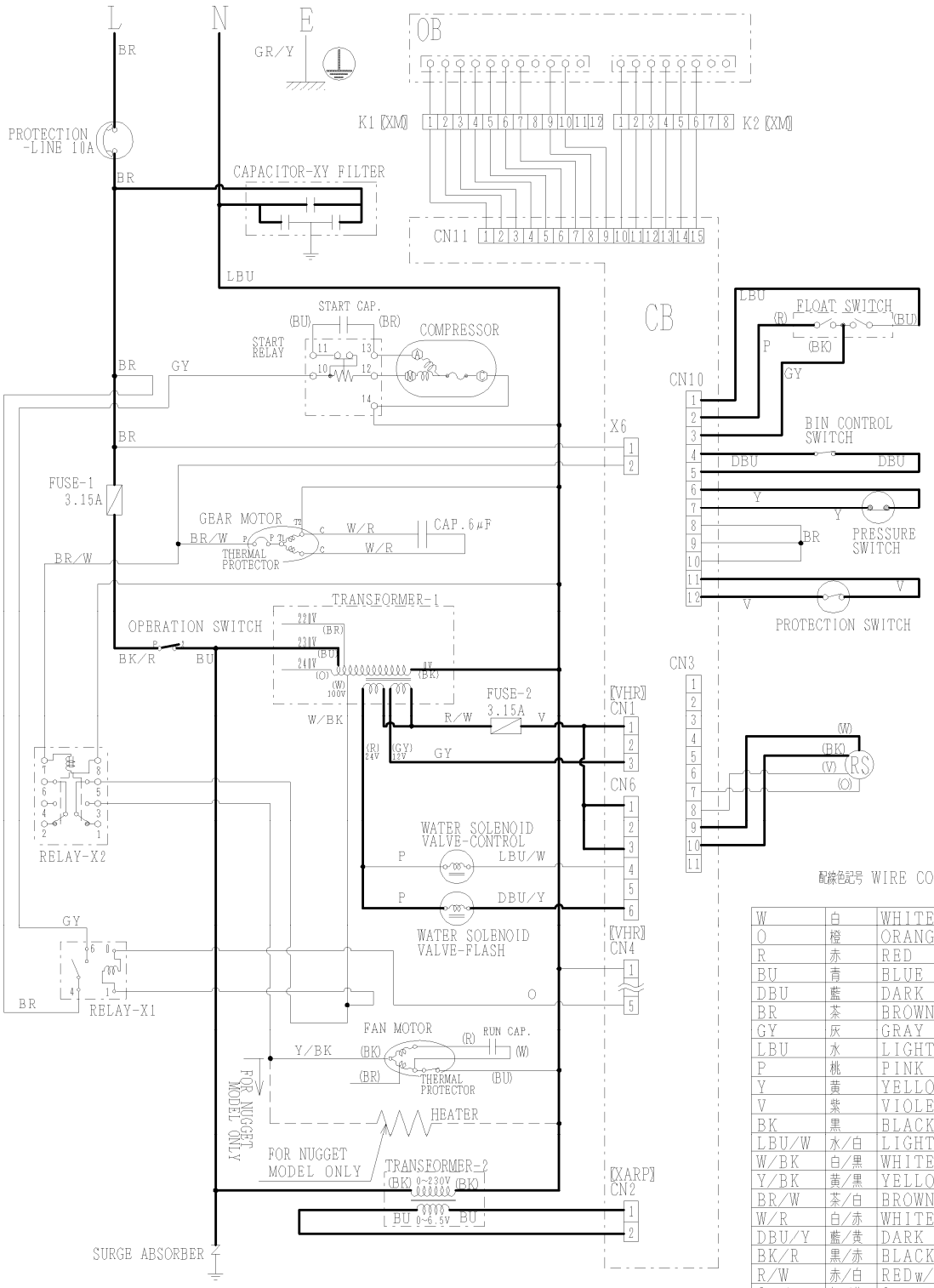


配線色記号 WIRE COLOR CODE

W	白	WHITE
O	橙	ORANGE
R	赤	RED
BU	青	BLUE
DBU	藍	DARK BLUE
BR	茶	BROWN
GY	灰	GRAY
LBU	水	LIGHT BLUE
P	桃	PINK
Y	黄	YELLOW
V	紫	VIOLET
BK	黒	BLACK
LBU/W	水/白	LIGHT BLUEw/WHITE
W/BK	白/黒	WHITEw/BLACK
Y/BK	黄/黒	YELLOWw/BLACK
BR/W	茶/白	BROWNw/WHITE
W/R	白/赤	WHITEw/RED
DBU/Y	藍/黄	DARK BLUEw/YELLOW
BK/R	黒/赤	BLACKw/RED
R/W	赤/白	REDw/WHITE
GR/Y	緑/黄	GREENw/YELLOW

FM-300AFE-HC, FM-300AFE-HCN

(6) Shutdown - Drain



配線色記号 WIRE COLOR CODE

W	白	WHITE
O	橙	ORANGE
R	赤	RED
BU	青	BLUE
DBU	藍	DARK BLUE
BR	茶	BROWN
GY	灰	GRAY
LBU	水	LIGHT BLUE
P	桃	PINK
Y	黄	YELLOW
V	紫	VIOLET
BK	黒	BLACK
LBU/W	水/白	LIGHT BLUEw/WHITE
W/BK	白/黒	WHITEw/BLACK
Y/BK	黄/黒	YELLOWw/BLACK
BR/W	茶/白	BROWNw/WHITE
W/R	白/赤	WHITEw/RED
DBU/Y	藍/黄	DARK BLUEw/YELLOW
BK/R	黒/赤	BLACKw/RED
R/W	赤/白	REDw/WHITE
GR/Y	緑/黄	GREENw/YELLOW

[d] OPERATION BOARD

The Operation Board is provided for operation of the icemaker. See “7. OPERATION BOARD” for details.

[e] CONTROLLER BOARD

The icemaker is controlled by the Controller Board based on the following logic:

1) Low Voltage Standby

In a low voltage condition, the Compressor and Gear Motor may fail to start or rotate properly due to insufficient torque. This could result in a twisted Evaporator. The icemaker will stop icemaking operation until the proper voltage is restored.

2) Ice Production Control

In a low ambient or water temperature condition, the ice production capacity will increase. Then, the Gear Motor will have a larger torque to scrape off ice, which will overload the entire icemaking mechanism.

3) Error Code Indication

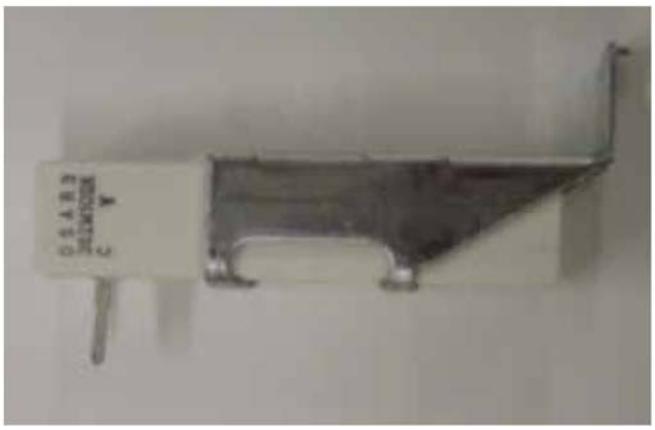
When the icemaker shuts down with a trouble, an error code will be displayed immediately to notify the user. To facilitate servicing, ask the user for the applicable error code, and prepare for the trouble in advance.

4) Flush Timer

The previous models were equipped with a Flush Timer that periodically flushes the water circuit to prevent water deposits from entering the Bearing and accelerating its wear. The latest models have the Controller Board provided with this function of the Flush Timer.
During the flush cycle, the Display Window on the Operation Board will illuminate “DRAIN”. As the auger type icemaker continuously produces ice, the content of substances included in the icemaking water inside the Evaporator Casing is three to five times as high as that in the supplied water. As a result, substances such as calcium, magnesium, and silica contained in water will attach and deposit inside the Evaporator Casing to reduce the ice production capacity or accelerate wear on the moving parts.

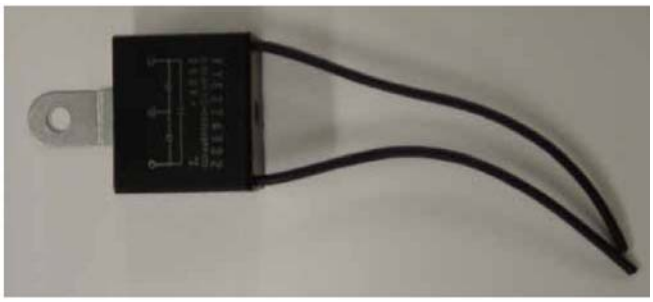
[f] SURGE ABSORBER

The Surge Absorber is provided to protect the Controller Board from lightning.



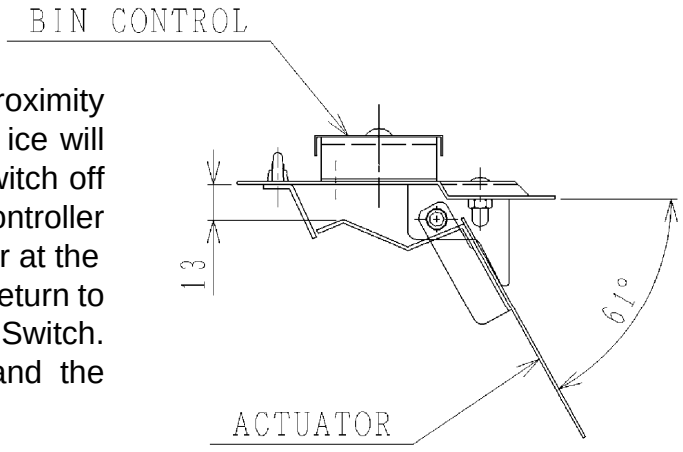
[g] CAPACITOR - XY FILTER

The Capacitor - XY Filter is provided to prevent the Controller Board from signal errors caused by internal and external noises.

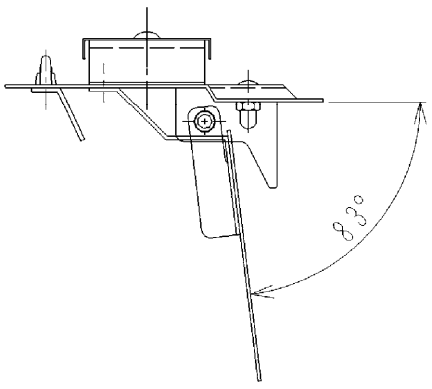


[h] BIN CONTROL SWITCH

The Bin Control Switch is composed of a Proximity Switch and Actuator. When the Chute fills up, ice will push up the Actuator on top of the Chute to switch off the Proximity Switch. After 7 seconds, the Controller Board will stop the Gear Motor and Compressor at the same time. When ice is used, the Actuator will return to the original position to switch on the Proximity Switch. The Gear Motor will restart in 7 seconds, and the Compressor in 5 minutes.



When the Bin Control Switch seems to have malfunctioned, check the dimensions of the Actuator as well as the operation of the Proximity Switch. Also, if the Chute Switch or the Gear Motor Circuit Protector has operated for some unidentified reason, be sure to check the Actuator for proper dimensions.



1) Remove the Bin Control Switch from the Chute.

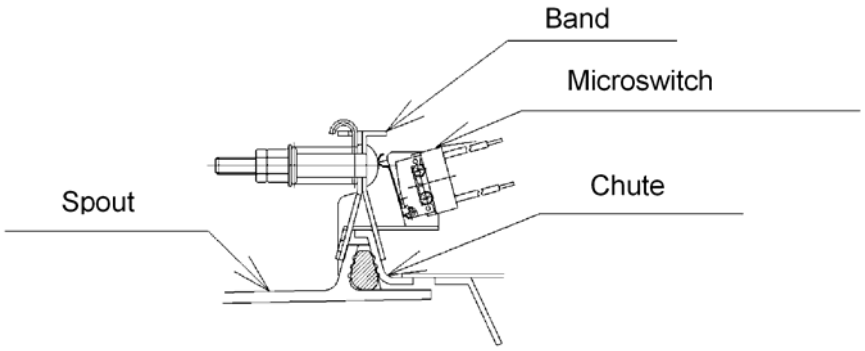
2) Move the Actuator to the maximum operation angle as shown below (top). Check that the Actuator is about 13 mm away from the Barrier. If not, replace the whole Bin Control Switch assembly.

[i] CHUTE SWITCH

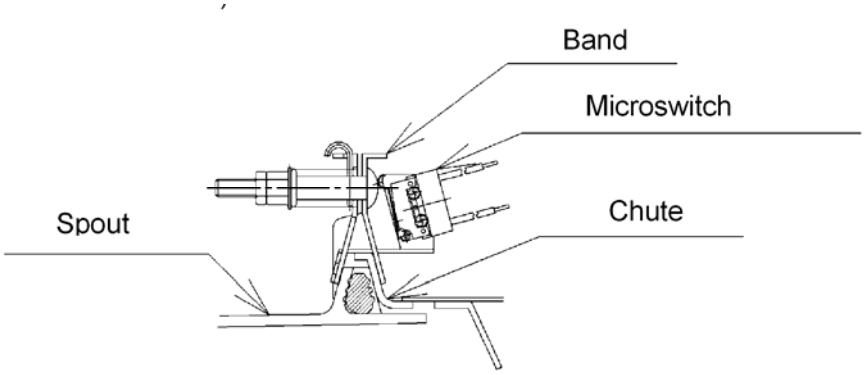
The Chute Switch consists of a microswitch and a band securing the Spout and Chute. When the Bin Control Switch breaks down, the band opens and presses the button on the microswitch (contacts open) to stop the icemaker (error code: EL).

To restart the icemaker, remove ice from the Spout and Chute, and move the Operation Switch to the “STOP” position, then to the “RUN” position.

Normal Condition



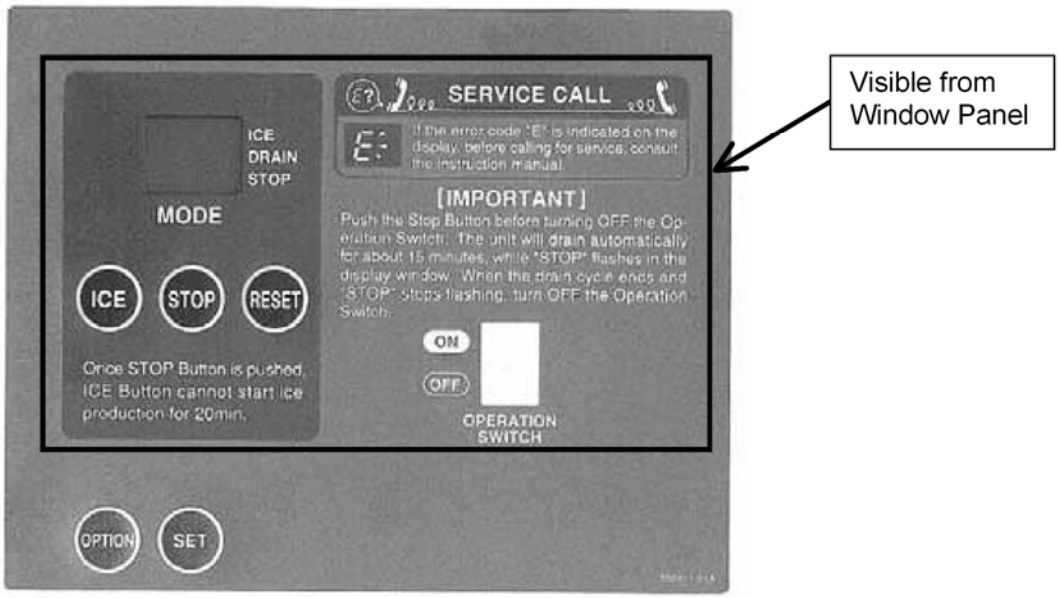
Abnormal Condition
(Band moves and presses microswitch)



[j] DEICING HEATER (BELT HEATER) - FM-481AGE-HCN, FM-300AFE-HCN ONLY

The Deicing Heater is provided to reduce the load of ice passing the Extruding Head and prevent vapor lock. If the Extruding Head is clogged with ice, a creaking sound will be heard, or the Evaporator Cylinder will expand to break the soldered joint between the Cylinder and Copper Tube, where condensate may enter and freeze to crush the Copper Tube. In the previous models, the Flange was welded to secure the Spout, which may cause cracked welded joints.

7. OPERATION BOARD



[a] USER OPERATION (accessible from the Window Panel)

ICE = When pressed in the STOP mode, the unit will be supplied with water and start icemaking operation.
STOP = When pressed in the ICE mode, the unit will stop icemaking operation and drain.
RESET = When pressed during shutdown with an error code displayed, the unit may restart icemaking operation. Unless the cause of the error is removed, the unit may stop again with the error code returned.
OPERATION SWITCH = Power supply for the icemaker. Turn it OFF to shut down the unit for a long time.

[b] SERVICE OPERATION (Remove the Front Panel for access to the Option and Set Buttons)

> **CAUTION**
> Removal of the Front Panel will expose moving and hot parts. It is allowed for qualified service personnel only.

1) Setting Model No.

> The Model Setting No. must be set to “34” at the time of replacement of the Controller Board. Improper setting may result in failure or inoperability.

Keep pressing the Set Button, and turn ON the Operation Switch.
Release the Set Button when the Display Window shows “01”.
Press the Ice Button to increase the number, or press the Stop Button to decrease the number until it reaches “34”.

Press the Set Button again to complete the setting and start icemaking operation in the ICE mode.

2) Displaying Model Setting No.

Keep pressing the Option Button in the ICE or STOP mode.
The Display Window will show the compressor operating hours ([b] - 3).
Press and release the Ice Button.
The Display Window will show the freeze cycle time ([b] - 9).
When "– –" appears, press and release the Ice Button.
The Display Window will show the active Model Setting No.
Release the Option Button to return to the original mode.

3) Displaying Compressor Operating Hours

Keep pressing the Option Button in the ICE or STOP mode.
The Display Window will show the compressor operating hours.
"00" indicates the operating hours less than 1,000 hours.
"01" indicates not less than 1,000 hours but less than 2,000 hours.
¦
"25" indicates not less than 25,000 hours but less than 26,000 hours.

4) Resetting Compressor Operating Hours

Do not use this command unless necessary.

With the Operation Switch in the OFF position, keep pressing the Ice + Stop + Option Buttons together, and turn ON the Operation Switch.
Release the Buttons when the Display Window shows the ICE mode.
The Compressor will start 15 seconds after completion of water supply.
The compressor operating hours has been reset.

5) Displaying Error Record

Keep pressing the Option Button in the ICE or STOP mode.
The Display Window will show the compressor operating hours ([b] - 3).
Press and release the Stop Button to display the error record.
A maximum of eight most recent errors will be displayed in reverse order of occurrence, including those not informed to the user.
"– –" shows the end of the error record.
Release the Option Button to return to the original mode.

6) Displaying Ongoing Error

Keep pressing the Option Button in the ICE or STOP mode.
The Display Window will show the compressor operating hours ([b] - 3).
Press and release the Stop Button to display the error record ([b] - 5).
The most recent errors will be displayed in reverse order of occurrence.
When "– –" appears, press and release the Stop Button.
The Display Window will show the ongoing error.
Release the Option Button to return to the original mode.

7) Resetting Error Record

> Before resetting the errors, record them on the Inspection Record attached to the Front Panel.

With the Operation Switch in the OFF position, keep pressing the Stop + Option Buttons together, and turn ON the Operation Switch.
Release the Buttons when the Display Window shows the ICE mode.
The error record has been reset. Do NOT use this command unless necessary.

8) Displaying Gear Motor Errors

Keep pressing the Option Button in the ICE or STOP mode.
The Display Window will show the compressor operating hours ([b] - 3).
Press and release the Stop Button to display the error record ([b] - 5).
The most recent errors will be displayed in reverse order of occurrence.
When "– –" appears, press and release the Stop Button ([b] - 6).
Press and release the Stop Button to indicate numerals and/or letters six times.
When "– –" appears, release the Option Button to return to the original mode.

The numerals and/or letters are indicated in hexadecimal notation.
The numerals 0 - 9 are used as 0 - 9, A as 10, b as 11, C as 12, d as 13, E as 14, and F as 15.
In other words, they need conversion to decimal notation by calculating "1st numeral or letter x 16 + 2nd numeral or letter".
The converted number presents the frequency of occurrence.

(Example)

Seven Segment Display	Frequency of Occurrence in Decimal Notation
00	0 x 16 + 0 = 0 time
08	0 x 16 + 8 = 8 times
10	1 x 16 + 0 = 16 times
36	3 x 16 + 6 = 54 times
A1	10 x 16 + 1 = 161 times
C0	12 x 16 + 0 = 192 times
FF	15 x 16 + 15 = 255 times

The numerals and/or letters will appear in the following order:

1	GM locking detected by current + GM hunting detected by current + (Low GM rotation speed + High GM current + Voltage above low voltage sensor reset level)
2	GM locking detected by current
3	GM hunting detected by current
4	Low GM rotation speed + High GM current + Voltage above low voltage sensor reset level
5	Abnormal low voltage
6	Freeze up

9) Displaying Freeze Cycle Time

The five most recent freeze cycles are memorized and will be deleted by turning OFF the Operation Switch.

Keep pressing the Option Button in the ICE or STOP mode.
The Display Window will show the compressor operating hours ([b] - 3).
Press and release the Ice Button to display the freeze cycle time (max. five cycles).
Release the Option Button to return to the original mode.

The freeze cycle time is displayed with two digits each for minutes [o - E] + [0 - 9] and seconds [0 - 5] + [0 - 9].

Minutes
[o] + [0 - 9] = 0 - 9 min
[A] + [0 - 9] = 10 - 19 min
[b] + [0 - 9] = 20 - 29 min
[C] + [0 - 9] = 30 - 39 min
[d] + [0 - 9] = 40 - 49 min
[E] + [0 - 9] = 50 - 59 min

Seconds
[0 - 5] + [0 - 9]

(Example)
[o] + [9] [4] + [8] = 9 minutes 48 seconds
[b] + [7] [3] + [6] = 27 minutes 36 seconds

An approximate ice production capacity can be calculated from the freeze cycle time:
Flake Ice production capacity (kg/d) = 66,000 / cycle time (sec)
Nugget Ice production capacity (kg/d) = 65,000 / cycle time (sec)

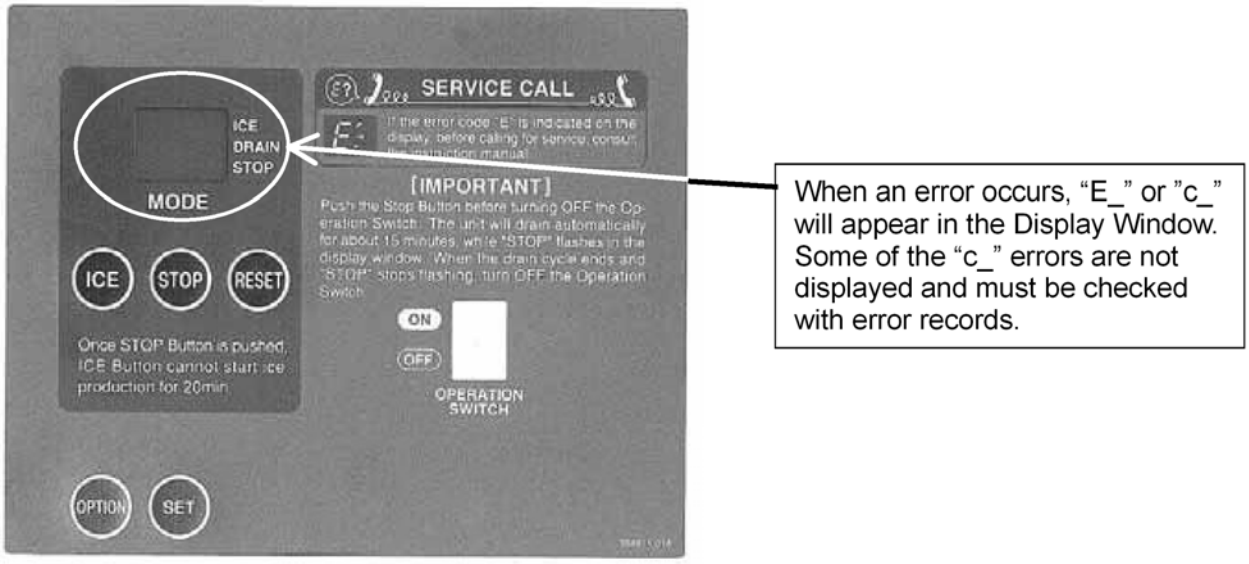
This is just an approximate ice production capacity. The capacity depends on ambient temperature, water temperature, voltage, and frequency. To determine an accurate capacity, use a container to receive ice produced for 10 minutes, measure its weight, and convert it into daily production. Take three measurements, and calculate their average.

10) Reducing Compressor Startup Time

With the Operation Switch in the OFF position, keep pressing the Option Button, and turn ON the Operation Switch.
Release the Option Button when the Display Window shows the ICE mode.
The Compressor will start up about 30 seconds after completion of water supply.

8. PROTECTORS

[a] INDICATION



When an operational error occurs, “E_” will appear and blink in the Display Window on the Operation Board, and the icemaker will stop. When a service call is received, ask the user to check which error code is in the Display Window. Then, see the error code table in “9. ERROR CODES” to locate the cause.

[b] PROTECTORS

1) Compressor

Internal Inherent Motor Protector
Senses a temperature rise of the Compressor, and internally shuts off the circuit. Automatically resets when the temperature goes down. If the Compressor takes a long time to restart, the Ice Production Timer may shut down the unit with “E1” in the Display Window. In this case, press the Reset Button.

2) Gear Motor

Rotation Sensor
Counts the motor rotation time in every cycle. Controls to reduce the load by flowing hot

gas when the rotation slows down. Shuts down the icemaker when the rotation slows down further.

Thermal Protector
Provided on the motor coil. Operates when the motor temperature rises. The protector is auto-reset, but the controller shuts down the icemaker. Press the Reset Button to restart.

The above protectors indicate “E3”, “Ed” or “EE”. When “Ed” or “EE” appears ten times, “EJ” will be displayed. The Evaporator has been frequently overloaded. This could result in an excessively worn Gear or a broken screw on the Housing.

3) Fan Motor

The auto-reset Fuse attached to the motor coil will operate when the motor temperature rises. For the air-cooled models, the High Pressure Switch will turn on and off the icemaker. “E4” may appear in the Display Window.

4) Overcurrent Protector

Trips to shut down the icemaker in case of over current conditions. Manual-reset.

5) Chute Switch

If the Bin Control Switch fails to operate, the Spout and Chute will be clogged with ice and disconnected to spill ice. The Chute Switch is installed to prevent this trouble. “EL” will appear in the Display Window when the Chute Switch operates.

6) Low Water

In case of low water or clogged water supply circuit, the icemaker will shut down unless the Float Switch trips at the upper float level within 5 minutes after tripping at the lower float level. The Water Valve will open and close every 5 minutes until the Float Switch trips at the upper float level. The record of low water is indicated by the code “c1” when the Option and Stop Buttons are pressed in servicing.

7) Ice Production Timer

Detects reduction in ice production capacity unless the Float Switch trips at the lower float level within 30 minutes for the first freeze cycle and 15 minutes for the second and subsequent cycles after tripping at the upper float level. “E1” will appear in the Display Window.

8) Water Leak

Detects a water leak if the water level goes down with the Compressor out of operation after the first water supply cycle (i.e. no ice production). “E0” will appear in the Display Window.

9) Float Switch

The Float Switch or connector may have a bad contact if the Float Switch trips at the upper float level but not at the lower float level with the Flush Water Valve closed. “E2” will appear in the Display Window.

10) High Pressure Switch

Operates at a high condensing pressure when the icemaker has a clogged Air Filter or a dirty Condenser. “E4” will appear in the Display Window when the Pressure Switch trips five times within an hour.

11) Voltage

If the supply voltage is too low, the Compressor may fail to start properly, or the Gear Motor may lock to cause freeze-up inside the Evaporator. To prevent these troubles, the icemaker will shut down and wait until the proper voltage is restored. “EF” will appear in the Display Window.

9. ERROR CODES

Interlock Errors

Code	Error	Condition	Operation	Reset	Check/Repair
E0	Icemaking Water Leak	Following initial water supply, Float Switch trips at lower float level after Gear Motor starts and before Compressor starts.	Whole unit stops.	Press Reset Button.	Water leak, Flush Water Valve not closing, Float Switch
E1	Low Ice Production	Icemaking cycle takes too long.	Whole unit stops.	Press Reset Button.	Gas leak, Control Water Valve not closing, Vapor lock, Freeze up, Float Switch
E2	Float Switch Error	With Flush Water Valve OFF, Float Switch trips at both upper and lower float levels for 2 seconds.	Whole unit stops.	Press Reset Button.	Float Switch
E3	Gear Motor Error or Gear Motor Sensor Circuit Open	Gear Motor is ON with Rotation Sensor or Current Sensor circuit open. Gear Motor Relay is ON with Gear Motor protective circuit detector OFF.	Whole unit stops.	Press Reset Button.	Rotation Sensor, Current Sensor Gear Motor protective circuit (TPO, Overload, etc.)
E4	Abnormal High Side Pressure	c2 error occurs 5 times in 1 hour of Compressor operation.	E4 blinks.	N/A	Fan Motor, Cooling water circuit, Refrigeration circuit, Condenser clogged, Water supply, Installation conditions
E5	Gear Motor Drive Element Error	Gear Motor is OFF on Controller Board while Rotation Sensor signals Gear Motor rotation or current flows.	Whole unit stops.	Press Reset Button.	Miswiring, Gear Motor Magnet Switch or Relay Replace Controller Board.
E8	Discharge Pipe Temperature Error	Discharge Pipe Thermostat is OFF.	Whole unit stops.	Press Reset Button.	Gas leak, Compressor Cooling Fan failure
EA	Water Temperature Thermistor Circuit Open	Water Temperature Thermistor circuit is open.	EA blinks.	N/A	Water Temperature Thermistor
Eb	Condenser Center Thermistor Circuit Open	Condenser Center Thermistor circuit is open.	Eb blinks.	N/A	Condenser Center Thermistor
EC	Resistor Circuit Open	Resistor circuit is open.	Whole unit stops.	Press Reset Button.	Resistor
Ed	Abnormal Gear Motor Current	Current Sensor detects locked or hunting Gear Motor.	Whole unit stops.	Press Reset Button.	Gear Motor locked, hunting or overloaded
EE	Gear Motor Rotation Error	Rotation Sensor detects reversing. Rotation rate reduces with current higher than setting and voltage exceeding low voltage reset setting.	Whole unit stops.	Press Reset Button.	Gear Motor locked, hunting, reversing or overloaded

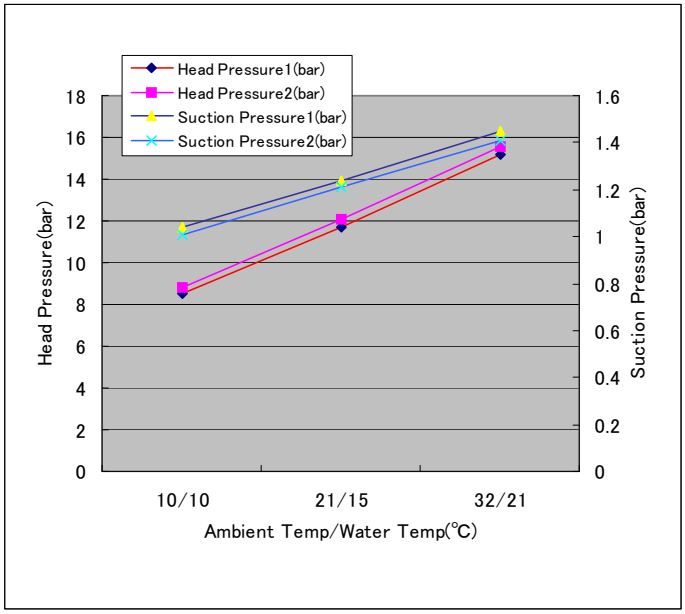
Code	Error	Condition	Operation	Reset	Check/Repair
EF	Frequent Voltage Error	c3 error occurs 3 times in 24 hours.	Whole unit stops.	Press Reset Button.	Supply voltage
EJ	Gear Motor Failure Precaution	Ed and EE occur 10 times in total.	EJ blinks.	N/A	Replace Evaporator and Gear Motor.
EL	Bin Control Switch Error	Bin Control Protective Switch trips.	Whole unit stops.	Press Reset Button.	Bin Control Switch
En	Low Voltage Sensing Transformer Circuit Open	Low Voltage Sensing Transformer circuit is open.	Whole unit stops.	Press Reset Button.	Low Voltage Sensing Transformer
EP	Controller Board Model Setting Error	No model setting. Unacceptable supply frequency.	Whole unit stops.	Press Reset Button.	Model setting, Supply frequency
EU	Controller Board Error	Controller Board IC fails.	Whole unit stops.	Press Reset Button.	Replace Controller Board.
None	Electric Leak Short Circuit	Electric leak or overcurrent.	Whole unit stops.	Press Reset Button. Replace Fuse.	Electric leak, Fuse

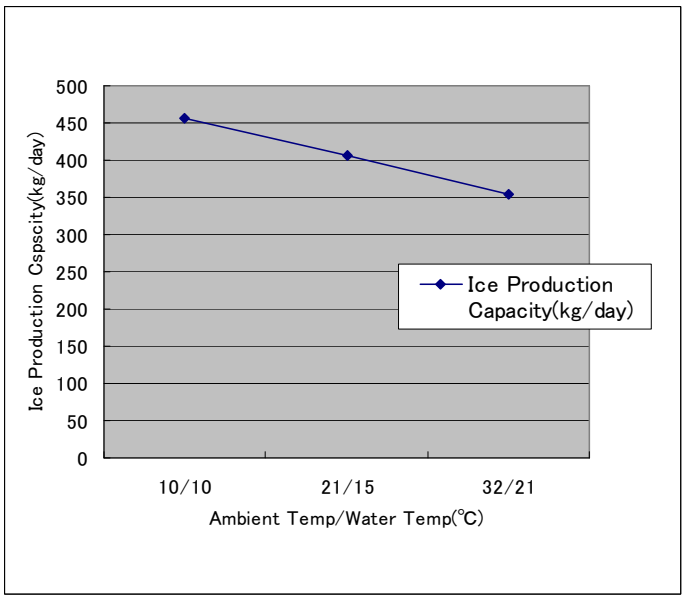
Non-Interlock Errors

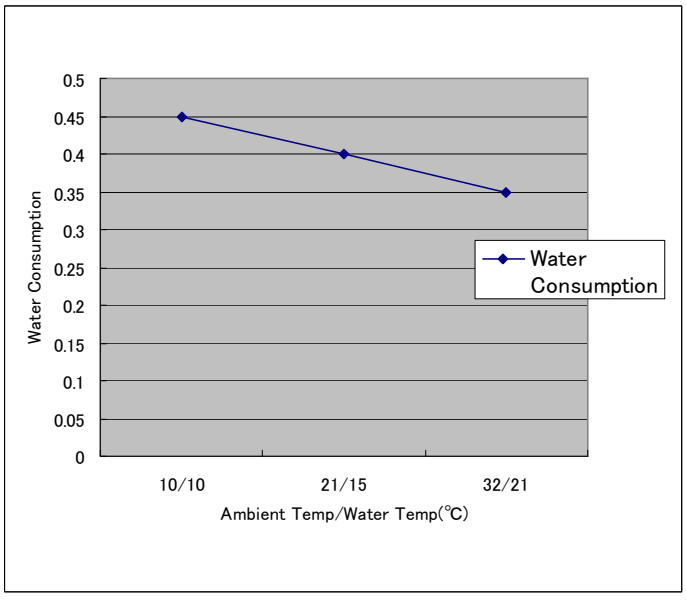
Code	Error	Condition	Operation	Reset	Check/Repair
CM Time "— —"	Microcomputer Read/Write Error	Microcomputer fails to read/write properly.	Memory circuit not available.	Replace Controller Board.	Error records and compressor operating hours not available on display
c1	Low Water	Water supply continues for more than 90 seconds, or Float Switch trips at lower float level and does not reset for more than 60 seconds after water supply.	Whole unit stops until Reservoir fills up. Only Control Water Valve operates intermittently for 5 minutes.	Automatically resets after Reservoir fills up.	Water supply interruption, Control Water Valve not opening, Flush Water Valve not closing, Float Switch, Water leak
c2	Abnormal High Side Pressure	Pressure Switch stays OFF for 5 seconds.	Whole unit stops.	Automatically resets after Pressure Switch turns ON.	Condenser clogged, Cooling water circuit, Refrigeration circuit
c3	Abnormal Low Voltage	Voltage stays below setting for more than 1 second with Compressor ON and Control Water Valve OFF.	c3 blinks.	Automatically resets after voltage stays above reset setting for 2 minutes.	Supply voltage
c4	Drain Error	Float Switch trips at upper float level in 10 minutes after Flush Water Valve turns ON.	Indication only.	N/A	Flush Water Valve not opening, Control Water Valve not closing
c5	Gear Motor Error	Rotation rate reduces.	Whole unit stops except Control Water Valve.	Automatically resets after 2 minutes.	Gear Motor overloaded

10. PERFORMANCE DATA

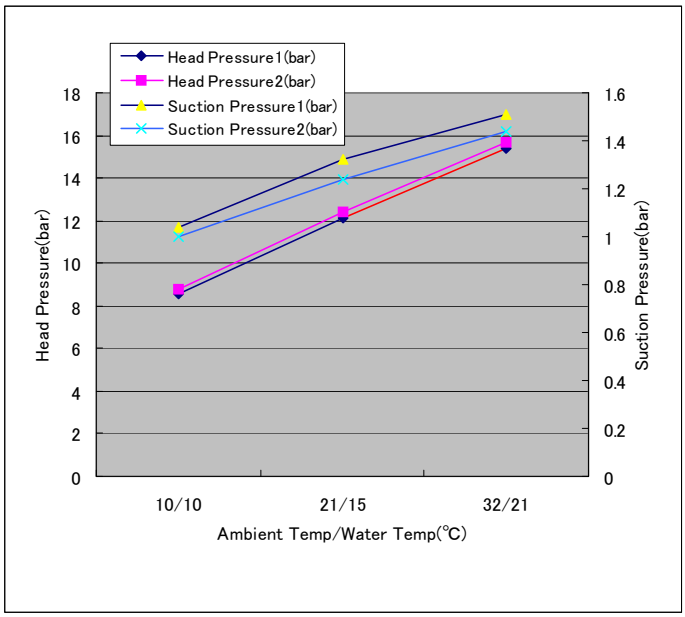
[a] FM-481AGE-HC

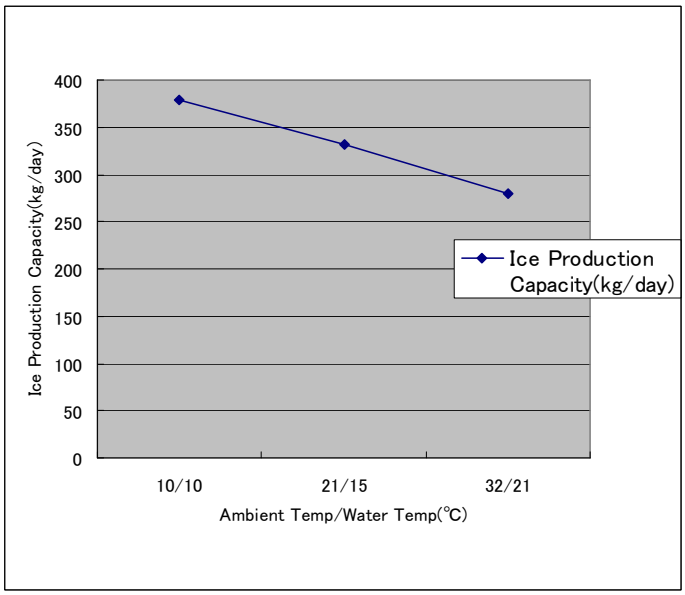


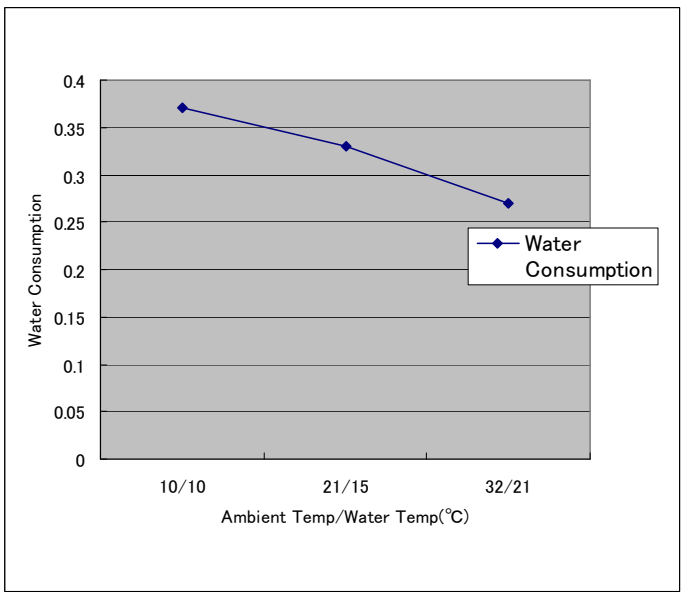




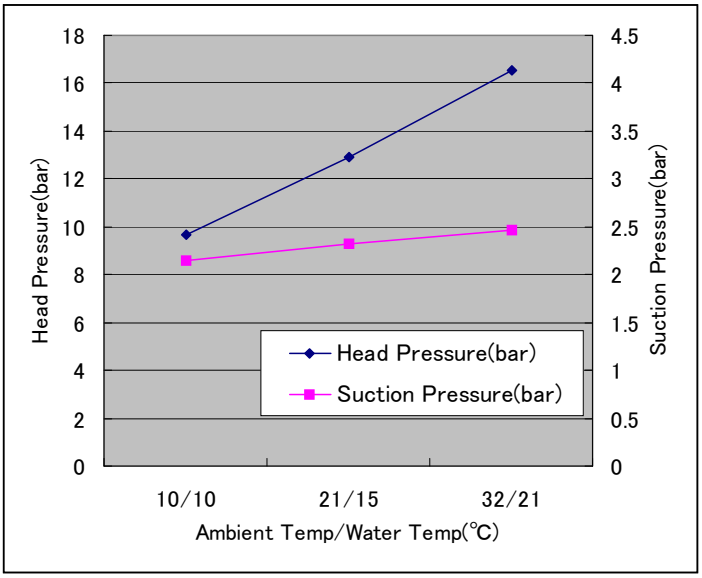
[b] FM-481AGE-HCN

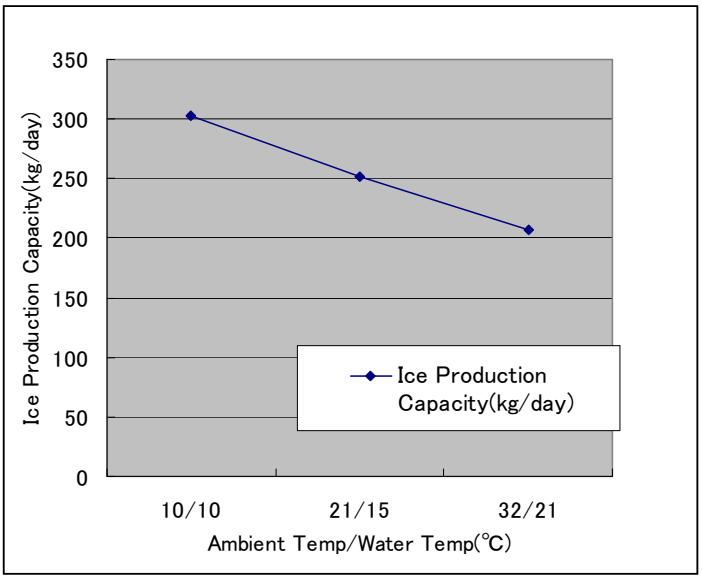


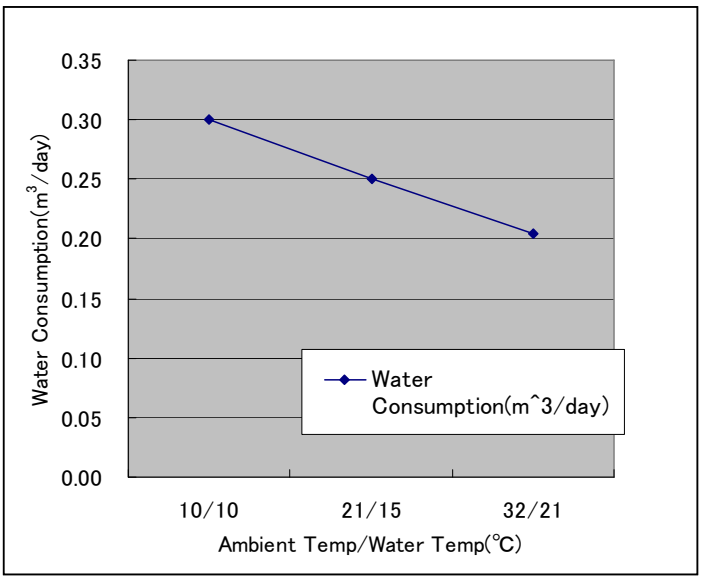




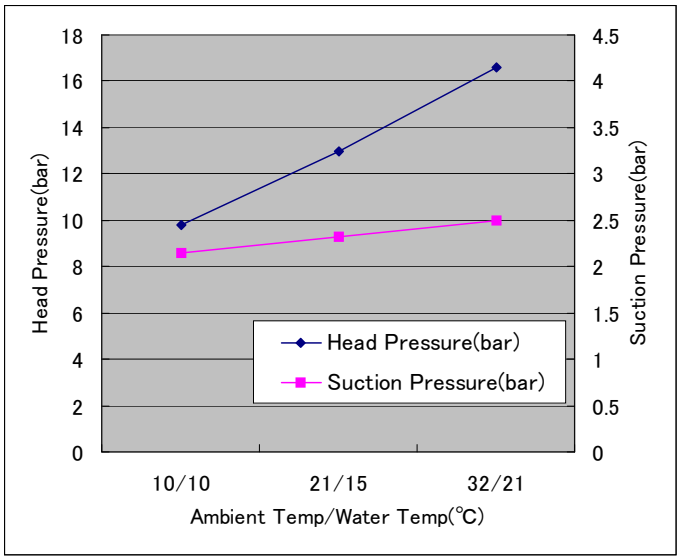
[c] FM-300AFE-HC

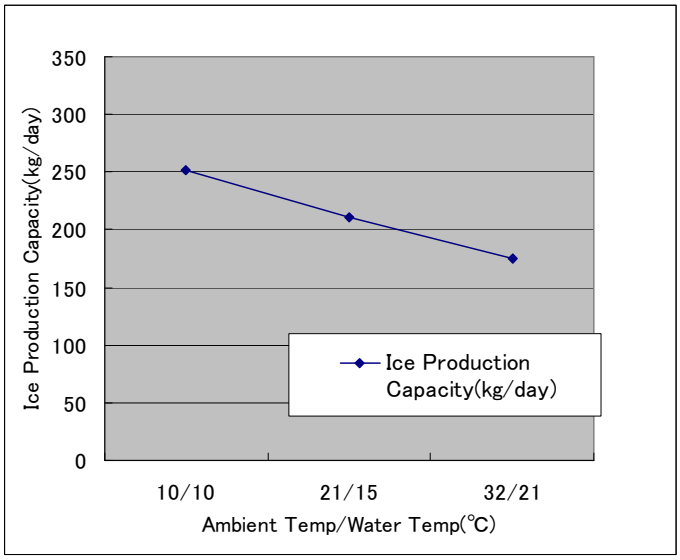


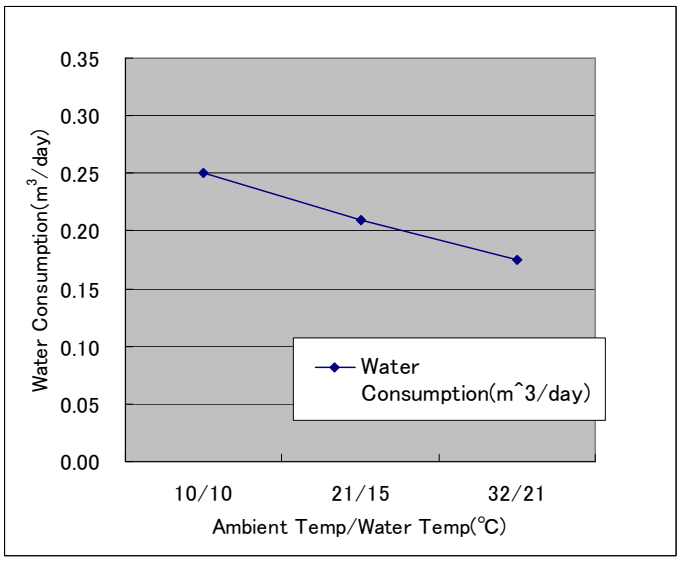




[d] FM-300AFE-HCN







IV. SERVICE DIAGNOSIS

Display error record by operating the Operation Board (See “III. 7. [b] 5) Displaying Error Record”). Check for a possible cause and service the unit.

1. NO ICE PRODUCTION

PROBLEM	POSSIBLE CAUSE		REMEDY
[1] The icemaker will not start.	a) Power Supply	1. OFF position.	1. Move to ON position.
		2. Loose connections.	2. Tighten.
		3. Bad contacts.	3. Check for continuity and replace.
		4. Blown fuse.	4. Replace.
		5. Voltage too low.	5. Get recommended voltage.
	b) Fuse (Controller Board)	1. Blown out. No indication on Operation Board.	1. Find out the cause of short circuit (ex. Control Water Valve, Flush Water Valve), resolve it, and replace Controller Board.
	c) Transformer Receptacle	1. Disconnected.	1. Connect.
	d) Operation Switch	1. OFF position.	1. Move to ON position.
		2. Bad contacts.	2. Check for continuity and replace.
	e) Transformer	1. Coil winding opened.	1. Replace.
	f) Water Valve	1. Coil winding opened.	1. Replace.
	g) Water Supply Tap	1. Closed.	1. Open.
		2. Water failure.	2. Wait till water is supplied.
	h) Plug and Receptacle (Control Box)	1. Disconnected.	1. Connect.
		2. Terminal out of Plug or Receptacle.	2. Insert Terminal back in position.
	i) Chute Switch	1. Tripped.	1. See “III. 6. [i] CHUTE SWITCH”.
	j) Overload Protector	1. Tripped.	2. Reset.
	k) Model Setting No.	1. Incorrect.	2. Set correct No. See “III. 7. [b] 1) Setting Model No.”
[2] Water does not stop, and the icemaker will not start.	a) Water Control Relay (Controller Board)	1. Contacts fused.	1. Replace Controller Board.
		2. Coil winding opened.	2. Replace Controller Board.
	b) Float Switch	1. Bad contacts.	1. Check for continuity and replace.
		2. Float does not move freely.	2. Clean or replace.
	c) Flush Water Valve	1. Valve seat clogged and water leaking.	1. Clean or replace.
	d) Hoses	1. Disconnected.	1. Connect.
	e) Mechanical Seal	1. Water leaks.	1. Replace.
	f) Reservoir	1. Cracked.	1. Replace.

PROBLEM	POSSIBLE CAUSE		REMEDY
[3] Water has been supplied, but the icemaker will not start.	a) Bin Control	1. Bad contacts.	1. Check for continuity and replace.
		2. Activator does not move freely.	2. Clean Axle and its corresponding holes or replace Bin Control. See “III. 6. [h] BIN CONTROL SWITCH”.
	b) Gear Motor Protector (Thermal Breaker)	1. Tripped.	1. Find out the cause, resolve it, and press Reset Button on Motor Protector.
	c) Controller Board	1. Broken.	1. Replace.
	d) Pressure Switch	1. Dirty Condenser fins.	1. Clean.
		2. Ambient temperature too warm.	2. Check for recommended temperature.
		3. Fan not rotating.	3. See 3 - [1] - a).
		4. Condenser water pressure too low or off.	4. Check and get recommended pressure.
		5. Water Regulating Valve clogged	5. Clean.
		6. Refrigerant overcharged.	6. Recharge.
		7. Refrigerant line or components plugged	7. Clean and replace Drier.
		8. Bad contacts.	8. Check for continuity and replace.
		9. Loose connections.	9. Tighten.
[4] Gear Motor starts, but Compressor will not start or operates intermittently.	a) X1 and X2 Relays	1. Bad contacts.	1. Check for continuity and replace Controller Board.
		2. Coil winding opened.	2. Replace Controller Board.
	b) Compressor	1. Loose connections.	1. Tighten.
		2. Motor winding opened or earthed.	2. Replace.
		3. Motor Protector tripped.	3. Find out the cause of overheat or over current.
	c) Power Supply	1. Circuit Ampacity too low.	1. Install a larger-sized conductor.
	d) Controller Board	1. Broken.	1. Replace
[5] Gear Motor and Compressor start, but no ice is produced.	a) Refrigerant Line	1. Gas leaks.	1. Check for leaks with a leak detector. Reweld leak, replace Drier and charge with refrigerant. The amount of refrigerant is marked on Nameplate or Label
		2. Refrigerant line clogged.	2. Replace the clogged component.

2. LOW ICE PRODUCTION

PROBLEM	POSSIBLE CAUSE		REMEDY
[1] Low ice production.	a) Refrigerant Line	1. Gas leaks.	1. See 1 - [5] - a).
		2. Refrigerant line clogged.	2. Replace the clogged component.
		3. Overcharged.	3. Recharge.
	b) High-side Pressure Too High	1. Dirty Air Filter or Condenser.	1. Clean.
		2. Ambient or condenser water temperature too warm.	2. Check for recommended temperature.
		3. Condenser water pressure too low or off.	3. Check and get recommended pressure.
		4. Fan rotating too slow.	4. See 3 - [1] - a).
		5. Water Regulating Valve clogged.	5. Clean.
	c) Expansion Valve (not adjustable)	1. Low-side pressure exceeding the limit.	1. Replace.
	d) Evaporator	1. Evaporator pipe crushed.	1. Replace.

3. OTHERS

PROBLEM	POSSIBLE CAUSE		REMEDY
[1] Abnormal noise	a) Fan Motor (Condenser Unit)	1. Bearing worn out.	1. Replace.
		2. Fan blade deformed.	2. Replace fan blade.
		3. Fan blade does not move freely.	3. Replace.
	b) Compressor	1. Bearings worn out, or cylinder valve broken.	1. Replace.
		2. Mounting pad out of position.	2. Reinstall.
	c) Refrigerant Lines	1. Rub or touch lines or other surfaces.	1. Replace.
	d) Gear Motor (Ice Making)	1. Bearing or Gear wear/damage.	1. Replace.
	e) Evaporator	1. Low-side pressure too low.	1. See if Expansion Valve Bulb is mounted properly, and replace the valve if necessary.
		2. Scale on inside wall of Freezing Cylinder.	2. Remove Auger. Use a solution of lime removing cleaner to clean periodically. If water is found to surpass the following levels, install a conditioner. Hardness 50 ppm Silica 30 ppm
	f) Heater	1. Broken.	1. Replace.
	g) CPR (Condenser Unit)	1. Internal leaks.	1. Replace.

PROBLEM	POSSIBLE CAUSE		REMEDY
[2] Overflow from Reservoir (Water does not stop.)	a) Water Supply	1. Water pressure too high.	1. Install a Pressure Reducing Valve.
	b) Water Valve	1. Diaphragm does not close.	1. Clean or replace.
	c) Float Switch	1. Bad contacts.	1. Check for continuity and replace.
[3] Gear Motor Protector operates frequently.	a) Power Supply Voltage	1. Too high or too low.	1. Connect the unit to a power supply of proper voltage.
	b) Evaporator Assy	1. Bearings or Auger worn out.	1. Replace Bearing or Auger.

V. REMOVAL AND REPLACEMENT OF COMPONENTS

⚠ WARNING

This machine contains flammable refrigerant. Do not attempt to break into the refrigerant circuit unless qualified, competent and authorised to do so.

If any component of the refrigeration circuit requires removal or replacement, please contact the manufacturer:

HOSHIZAKI EUROPE LIMITED
Telford 70 Stafford Park 7, Telford, Shropshire TF3 3BQ UK
Tel: +44 (0)1952-291777
Fax: +44 (0)1952-292777