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FILE No. A10-1703

AIR TO WATER HEAT PUMP

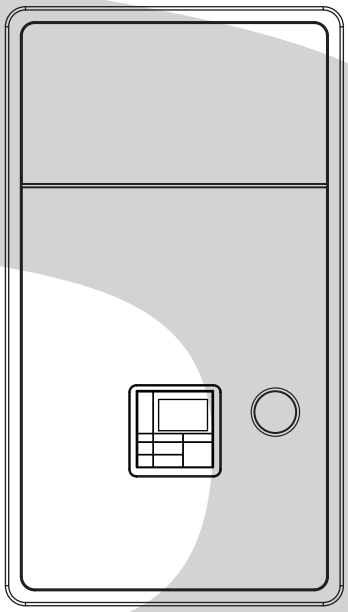
Service Manual

HFC
R410A

Model name:

Hydro unit

HWS-455XWHM3-E(TR)



Combination Outdoor Unit
HWS-455H-E (TR)

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1 Safety precautions

The unit and this service guide list very important safety precautions.
Understand the following details (indications and symbols) before reading the body text, and follow the instructions.

[About indication]

Indication	Meaning of Indication
⚠ DANGER	**Indicates that a wrong operation may cause a service engineer and the third persons around to get fatal or serious injuries.**
⚠ WARNING	**Indicates that a wrong operation may cause a service engineer and the third persons around to get fatal or serious injuries, or that unit defective after the operation may cause a user to have a similar serious accident.**
⚠ CAUTION	**Indicates that a wrong operation may cause a service engineer and the third persons around to get injuries or may cause property damage*, or that unit defective after the operation may cause a user to have a similar accident.**

* Property damage indicates extended damage to property, furniture, livestock, or pets.

[About symbols]

Symbols	Meaning of Symbols
⃠	**Indicates a forbidden action.** **Specific forbidden actions are described in text near the symbol.**
●	**Indicates a forcible (must do) action.** **Specific forcible actions are described in text near the symbol.**
△	**Indicates a caution (including danger and warning).** **Specific cautions are described in picture or text inside or near the symbol.**

⚠ DANGER

<Turn off the power breaker>

Turn off the power breaker before removing the front panel and cabinet.
- Failure to do so may cause a high voltage electric shock, leading to death or injury.
- During an operation, the second side circuit of high pressure transmission(*) are applied with a high voltage of 230 V or higher.
- Touching the circuit even with an electrical insulator, let alone a bare hand or body, causes an electric shock.

∗: For details, see the schematic.

<Discharge between terminals>

When the front panel and cabinet are removed, make short-circuit current to discharge between high pressure capacitor terminals.
- Failure to do so may cause a high voltage electric shock, leading to death or injury.
- After the power is turned off, the high pressure capacitor is still charged with high voltage.

<Forbidden>

Do not turn on the power breaker after removing the front panel cabinet.
- Failure to do so may cause a high voltage electric shock, leading to death or injury.

⚠ WARNING

<Check earth ground>

Before starting failure diagnosis or repair, check that the earth wire (∗) is connected to the unit ground terminal.
- An unconnected earth wire could cause an electric shock if electric leakage occurs.
- If the earth ground is not properly connected, ask an electrical worker for rework of the ground connection.

∗: Earth wire of class D grounding

⚠ WARNING

<No modification>

Do not modify the unit.

- Do not disassemble or modify the parts also.
- A fire, an electric shock, or an injury may occur.

<Use specified parts>

Use the specified parts (∗) when replacing them.

- Using parts other than specified ones may cause a fire or an electric shock.

∗: For details, see the parts price list.

<Keep children away from unit>

Keep any person (including children) other than service engineers away from a failure diagnosis or repairing place.

- A tool or disassembled parts may cause an injury.
- Advise the customer to keep the third persons (including children) away from the unit.

<Insulation treatment>

After connecting a cut lead with a crimp contact, discharge by facing the closed side upward.

- Connect lead wires with crimping terminals and turn the closed end upwards to avoid exposure to water.

<Watch out for fire>

Observe the following instructions when repairing the refrigerant cycle.

(1) Watch out for surrounding fire. Always put out the fire of stove burner or other devices before starting the repair.
Should the fire fail to be put out, the oil mixed with refrigerant gas could catch fire.

(2) Do no use a welder in a closed room.
A room with no ventilation may cause carbon monoxide poisoning.

(3) Keep away flammable materials.
The materials may catch the fire of a welder.

<Use refrigerant carefully>

Check the refrigerant name to use the tools and members appropriate for the refrigerant.

- A product using the refrigerant R410A has the refrigerant name prominently displayed on its outdoor unit. In addition, the diameter of the service port is changed from that of the conventional R22 to prevent incorrect filling.

Never use refrigerant other than R410A for Air to Water Heat Pump using R410A. Also, never use R410A for Air to Water Heat Pump using other refrigerant (such as R22).

- A mixture of R410A with different ones excessively raises the pressure in the refrigerant cycle, leading to an injury due to burst.

Do not make additional charge of the refrigerant.

- An additional charge when refrigerant gas leaks changes the refrigerant composition in the refrigerant cycle, causing the characteristics change of the Air to Water Heat Pump or excessive high pressure in the refrigerant cycle with more than the specified amount of refrigerant charged. This may cause burst or an injury. If the refrigerant gas leaks, perform refrigerant recovery or other operation to make the Air to Water Heat Pump contain no refrigerant, and then perform vacuuming. After that, refill the unit with the defined amount of liquid refrigerant. Never charge refrigerant exceeding the amount specified.

When the refrigerant cycle is refilled with refrigerant, do not enter air or refrigerants other than the specified refrigerant, R410A.

- A mixture of R410A with air or an inappropriate substance causes excessive high pressure inside the refrigerant cycle, leading to an injury due to burst.

Check that there is no refrigerant gas leak after the installation is completed.

- If it catches fire of a fan heater, a space heater, or a stove, poisonous gases may be produced.

<Be careful with wiring>

After a repair is completed, be sure to reassemble the parts and put the wiring back to its original state. In addition, be careful with the internal wiring not to be caught in a cabinet or panel.

- A defective assembly or wiring may cause a disaster at a customer site due to electrical leakage or a fire.

<Check for water leak>

After the repair of a water pathway is completed, check that there is no water leak.

- In using the product, water leak may cause a fire at a customer site due to electrical leakage or an electric shock.

⚠ WARNING

<Check insulation>

After the work is completed, check with an insulating-resistance tester (500V) that the insulation resistance between the live and dead-metal parts is 2 MΩ or higher.

- A low insulation resistance may cause a disaster at a customer site due to electrical leakage or an electric shock.

<Ventilate>

Ventilate if refrigerant gas leaks during service work.

- Should refrigerant gas catch fire, poisonous gases may be produced. A closed room full of leaking refrigerant results in the absence of oxygen; it is dangerous. Make sure to ventilate.

<Caution: electric shock>

When checking a circuit while energized if necessary, use rubber gloves not to contact the live part.

- Contact with the live part may cause an electric shock.
- The unit contains high-voltage circuits. Contact with a part in the control board with your bare hand may cause an electric shock. Take enough care to check circuits.

<Turn off the power breaker>

Because the electrical components are energized with high voltage, always turn off the power breaker before starting to work.

- Failure to do so may cause an electric shock.

<Always do>

Should refrigerant gas leak, find where the gas leaks and properly repair it.

- To stop the repair work because the leakage location cannot be identified, perform refrigerant recovery and close the service valve. Failure to do so may cause the refrigerant gas to leak in a room. Although refrigerant gas alone is harmless, if it catches fire of a fan heater, a space heater, or a stove, poisonous gases may be produced.

When installing the unit or re-installing it after relocation, follow the installation guide for proper operation.

- A defective installation may cause a refrigerant cycle defective, a water leak, an electric shock, or a fire.

<Check after repair>

After a repair is completed, check for any abnormality.

- Failure to do so may cause a fire, an electric shock, or an injury.
- Turn off the power breaker to perform check.

After a repair is completed (and the front panel and cabinet are placed), make a test run to check for any abnormality such as smoke or abnormal sound.

- Failure to do so may cause a fire or an electric shock. Place the front panel and cabinet before making a test run.

<Check after re-installation>

Check that the following are properly performed after re-installation.

(1) The earth wire is properly connected.
(2) The installation is stable without any tilt or wobbles.
Failure to check them may cause a fire, an electric shock, or an injury.

⚠ CAUTION

<Wear gloves>

Wear gloves (∗) when performing repair.

- Failure to do so may cause an injury when accidentally contacting the parts.

∗: Thick gloves such as cotton work gloves

<Cooling check>

Perform service work when the unit becomes cool enough after the operation.

- High temperature of compressor piping or other equipment after a cooling or heating operation may cause burn.

<Tighten with torque wrench>

Tighten a flare nut with a torque wrench in the specified method.

- A flare nut tightened too much might crack after a long period, causing refrigerant leak.

2 New refrigerant (R410A)

This Air to Water Heat Pump adopts a new refrigerant HFC (R410A) to prevent destruction of the ozone layer. The working pressure of R410A refrigerant is 1.6 times higher than that of the conventional refrigerant R22.The refrigerant oil is also changed for the new refrigeration. Therefore, during installation or service work, be sure that water, dust, former refrigerant, or refrigeration machine oil does not enter the refrigerant cycle of the new type refrigerant Air to Water Heat Pump. A wrong installation or service operation may cause a serious accident. Read carefully the following instructions to use the tools or members for R410A for safety work.

2-1. Safety during installation and service

- Use only the refrigerant R410A for Air to Water Heat Pump using R410A.
  A mixture of R410A with different ones excessively raises the pressure in a refrigerant cycle, leading to an injury due to burst.
- Check the refrigerant name to use the tools and members appropriate for the refrigerant.
  A product using the refrigerant R410A has the refrigerant name prominently displayed on its outdoor unit. In addition, the diameter of the service port is changed from that of the conventional R22 to prevent incorrect filling.
- Ventilate if refrigerant gas leaks during service work.
  Should refrigerant gas catch fire, poisonous gases may be produced. A closed room full of leaking refrigerant results in the absence of oxygen; it is dangerous. Make sure to ventilate.
- When the refrigerant cycle is refilled with refrigerant, do not mix air or refrigerants other than the specified refrigerant, R410A.
  A mixture of R410A with air or an inappropriate substance causes excessive high pressure inside the refrigerant cycle, leading to an injury due to burst.
- Check that no refrigerant gas leaks after the installation is completed.
  Should a refrigerant gas leak in a room and catch fire, poisonous gases may be produced.
- When installing the unit that contains large amount of refrigerant such as Air to Water Heat Pump, take measures to prevent the refrigerant from exceeding the threshold concentration in case it leaks.
  Should leaking refrigerant exceed the threshold concentration could cause an accident due to oxygen deficient.
- When installing the unit or re-installing it after relocation, follow the installation guide for proper operation.
  A defective installation may cause a refrigerant cycle defective, a water leak, an electric shock, or a fire.
- Do not modify the product. Do not disassemble or modify the parts also.
  A fire, an electric shock, or an injury may occur.

2-2. Installing refrigerant pipe

2-2-1. Steel pipe and joint

For refrigerant piping, steel pipe and joints are mainly used. Select those comply with JIS (Japanese Industrial Standards) for a service work. Also, use such clean piping materials that less impurities attach to the inside of pipe and joints.

Copper pipe

Use copper pipe of the “copper and copper alloy seamless pipe” type with attach oil quantity of 40 mg / 10 m or less. Do not use pipe that is cracked, distorted, or discoloured (especially inside).The expansion valve or capillary may get clogged with impurities.
Considering that Air to Water Heat Pump using R410A is higher in pressure than those using the conventional R22, be sure to select the material that comply with the standard.
Table 2-1 shows the thickness of copper pipe used for R410A.
Never use commercially available thin-walled copper pipe of 0.8 mm thick or less.

Table 2-1 Wall thickness of copper pipe

		Wall thickness (mm)
Nominal diameter	**Outer diameter**	**R410A**
1/4	6.35	0.80
1/2	12.7	0.80

Joints

For the joint of copper pipe, flared joint and socket joint are used. Remove impurities from a joint before using it.

- **Flared joint**
  A flared joint cannot be used for the copper pipe whose outer diameter is 20 mm or larger. A socket joint can be used instead in that case.
  Table 2-2-3 and 2-2-4 show the dimensions of flare pipe, the end of flared joint, and flare nuts.
- **Socket joint**
  A socket joint is used to connect the thick-walled pipe of mainly 20 mm or larger in diameter.
  Table 2-2 shows the wall thickness of socket joints.

Table 2-2 The minimum wall thickness of socket joints

Nominal diameter	Reference of outer diameter of copper pipe connected (mm)	Minimum joint wall thickness (mm)
1/4	6.35	0.50
1/2	12.7	0.70

2-2-2. Processing of piping materials

When installing refrigerant pipe, prevent water or dust from entering the pipe, and do not use oil other than lubricant used for Air to Water Heat Pump. Make sure that no refrigerant leak occurs.
If piping needs lubrication, use lubricating oil whose water content is removed.
After the oil is put in, be sure to seal the container with air proof cover or other covers.

Flare and precautions

1) **Cut a pipe.**
   Cut slowly with a pipe cutter so that the pipe is not distorted.
2) **Remove burr and flaw.**
   A burr or flaw in a flare part may cause refrigerant leak. Remove carefully all the burrs, and clean up the cut ends before installation.
3) **Insert a flare nut.**
4) **Flare**
   Check that the clasps and copper pipe are clean. Flare correctly using the clasp. Use a flare tool for R410A or the conventional one. Flare processing dimension varies depending on the flare tool type. When using the conventional flare tool, use a gauge for size adjustment to secure the A dimension.

Figure 2-2-1
Flare dimension

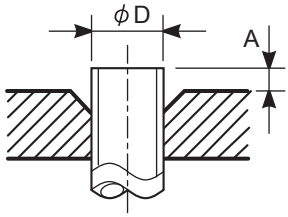


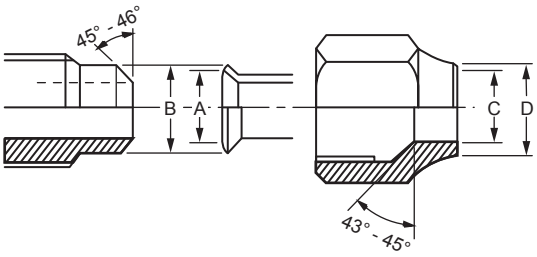
Table 2-2-3 Flare processing related dimension for R410A

Nominal diameter	Outer diameter (mm)	Wall thickness (mm)	A (mm)		
			Flare tool for R410A clutch type	Conventional flare tool	
				Clutch type	Butterfly-nut type
1/4	6.35	0.8	0 to 0.5	1.0 to 1.5	1.5 to 2.0
1/2	12.7	0.8	0 to 0.5	1.0 to 1.5	2.0 to 2.5

Table 2-2-4 Dimension of flare for R410A and flare nut

Nominal diameter	Outer diameter (mm)	Wall thickness (mm)	Dimension (mm)				Flare nut width (mm)
			A	B	C	D	
1/4	6.35	0.8	9.1	9.2	6.5	13	17
1/2	12.7	0.8	16.0	16.6	12.9	23	26

Figure 2-2-2 Relationship between flare nut and flare surface



Flare connecting procedure and precautions

1) Make sure that the flare and connecting portions do not have any flaw and dust.
2) Correctly align the flared surface and the connecting axis.
3) Tighten the flare with designated torque by means of a torque wrench. The tightening torque for R410A is the same as that for the conventional R22. If the torque is weak, gas leakage may occur. If it is too strong, the flare nut may crack and may be made non-removable. When choosing the tightening toque, comply with values designated by products. Table 2-2-5 shows reference values.

NOTE

When applying oil to the flare surface, be sure to use oil designated by the product. Using any other oil deteriorates the lubricating oil, possibly causing the compressor to burn out.

Table 2-2-5 Tightening torque of flare for R410A (Reference values)

Nominal diameter	Outer diameter (mm)	Tightening torque N•m (kgf•m)
1/4	6.35	14 to 18 (1.4 to 1.8)
1/2	12.7	50 to 62 (5.0 to 6.2)

2-3. Tools

2-3-1. Necessary tools

In Air to Water Heat Pump using R410A, the service port diameter of packed valve of the outdoor unit is changed to prevent mixing of other refrigerant. To reinforce the pressure resistance, flare dimensions and opposite side dimensions of flare nut (For Ø 12.7 copper pipe) of the refrigerant piping are lengthened.

Because the refrigerating machine oil is changed, mixing of oil may generate sludge, clog capillary, or cause other problems. Accordingly, the tools to be used include:

- tools dedicated for R410A (Those that cannot be used for the conventional refrigerant, R22)
- tools dedicated for R410A, but can be also used for the conventional refrigerant, R22
- tools that can be used for the conventional refrigerant, R22.
  The following table shows the tools dedicated for R410A and their interchangeability.

Tools dedicated for R410A (The following tools must be for R410A)

Tools whose specifications are changed for R410A and their interchangeability

No.	Tool to be used	Usage	R410A Air to Water Hear Pump installation		Conventional refrigerant Air to Water Heat Pump installation
			For R410A Existence of new equipment	Conventional equipment can be used	New equipment can be used with conventional refrigerant
1	Flare tool	Pipe flaring	Yes	*(Note 1)	Yes
2	Copper pipe gauge for adjusting projection margin	Flaring by conventional flare tool	Yes	*(Note 1)	*(Note 1)
3	Torque wrench (For Ø15.9)	Connection of flare nut	Yes	No	No
4	Gauge manifold	Evacuating, refrigerant charge, run check, etc.	Yes	No	No
5	Charge hose				
6	Vacuum pump adapter	Vacuum evacuating	Yes	No	Yes
7	Electrical balance for refrigerant charging	Refrigerant charge	Yes	No	Yes
8	Refrigerant cylinder	Refrigerant charge	Yes	No	No
9	Leakage detector	Gas leakage check	Yes	No	Yes
10	Charging cylinder	Refrigerant charge	*(Note 2)	No	No

* **(Note 1)** Flaring for R410A by using the conventional flare tool requires projection margin adjustment. This adjustment requires copper pipe gauge or other instrument.

* **(Note 2)** A charging cylinder for R410A is currently under development.

General tools (Conventional tools are available)

In addition to the above dedicated tools, the following equipment also available for R22 is necessary as the general tools.

1. Vacuum pump
   Use this by attaching vacuum pump adapter.
2. Torque wrench (For Ø6.35)
3. Pipe cutter
4. Reamer
5. Pipe bender
6. Level vial
7. Screwdriver (+, –)
8. Spanner or Monkey wrench
9. Hole core drill (Ø65)
10. Hexagon wrench
    (Opposite side 4 mm)
11. Tape measure
12. Metal saw

Also prepare the following equipment for other work methods or run check.

1. Clamp meter
2. Thermometer
3. Insulation resistance meter
4. Electroscope

2-4. Recharging of refrigerant

Recharge, if necessary, the specified amount of new refrigerant according to the following procedure.

Recover the refrigerant, and check that no refrigerant remains in the refrigerant cycle.

↓

Connect the charge hose to packed valve service port on the outdoor unit's gas side.

↓

Connect the charge hose to the vacuum pump adapter.

↓

Open fully both packed valves on the liquid and gas sides.

↓

Open fully the handle of gauge manifold Lo, turn on the vacuum pump, and then perform vacuum evacuating.

↓

When the compound gauge's pointer indicates -0.1 MPa (-76 cmHg), close fully the handle Lo and turn off the vacuum pump.

↓

Let the equipment stay as it is for one to two minutes and check that the compound gauge pointer does not return.

↓

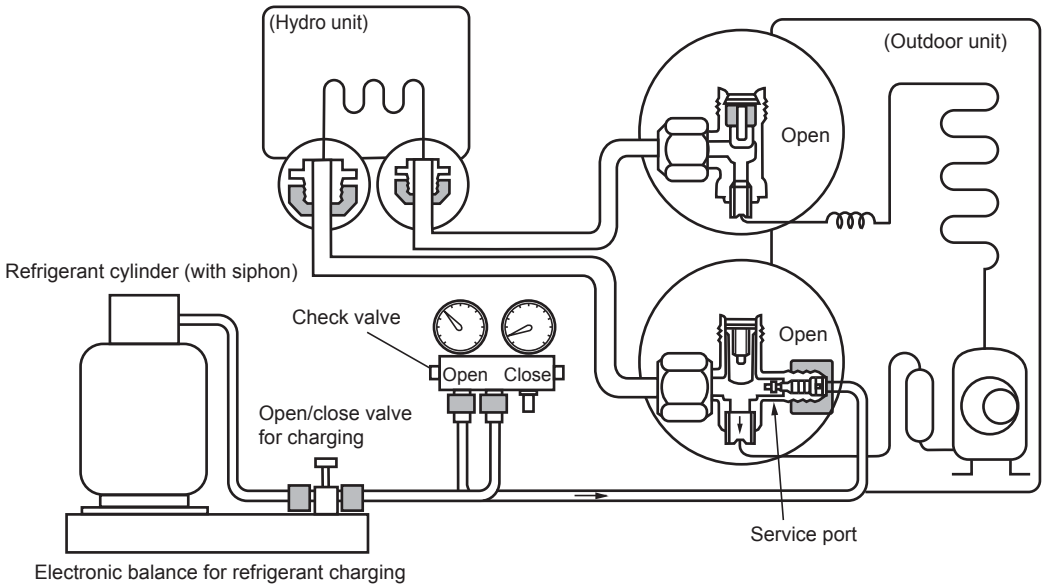
Place the refrigerant cylinder to the electronic balance, connect the connecting hose to the cylinder and the connecting port of the electronic balance, and then charge liquid refrigerant.

(For refrigerant charging, see the figure below)

NOTE

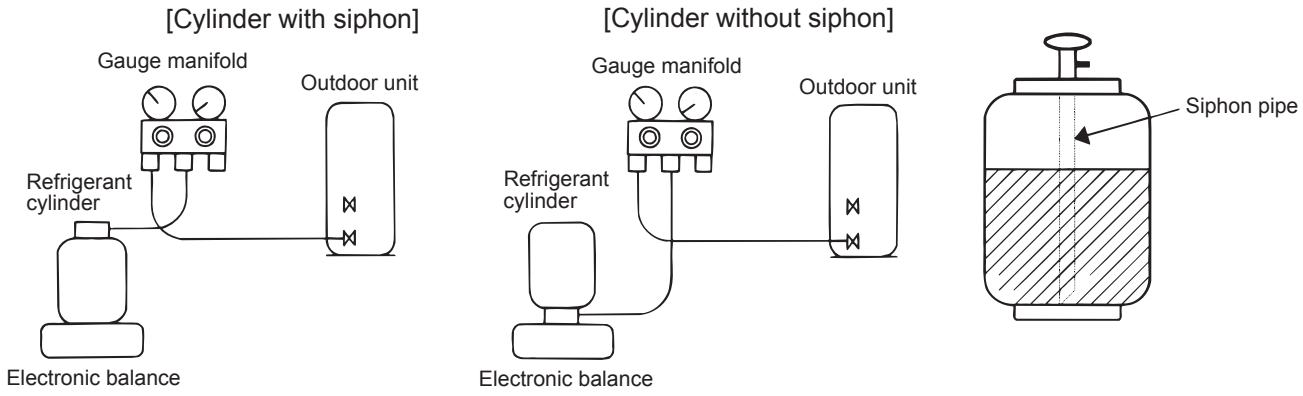
- Never charge refrigerant exceeding the specified amount.
- If the specified amount of refrigerant cannot be charged, charge it a little at a time while running refrigerant recovery (pump down).
- Do not make additional charging.
  An additional charge when refrigerant leaks changes the refrigerant composition in the refrigerant cycle, causing the characteristics change of the Air to Water Heat Pump or excessive high pressure in the refrigerant cycle with more than the specified amount of refrigerant charged. This may cause burst or an injury.

Fig. 2-4-1 Configuration of refrigerant charging



NOTE

- Make sure that the setting is appropriate so that liquid can be charged.
- A cylinder with siphon enables liquid to be charged without the cylinder turned upside down.



NOTE

- Because R410A is HFC mixed refrigerant, charging with gas changes the charged refrigerant composition, causing the equipment characteristics to change.

2-5. Brazing of pipes

2-5-1. Materials of brazing

Silver brazing metal

Silver brazing metal is an alloy mainly composed of silver and copper.
It uses iron, copper, or copper alloy, and is relatively expensive though it excels in soldering.

Phosphor bronze brazing metal

Phosphor bronze brazing metal is generally used to join copper or copper alloy.

Low temperature brazing metal

Low temperature brazing metal is generally called solder, and is an alloy of tin and lead. Do not use it for refrigerant piping because its adhesive capacity is low.

NOTE

- Phosphor bronze brazing metal tends to react with sulfur, producing a fragile compound water solution. This may cause gas leakage. Therefore, use other type of brazing metal at a hot spring resort or similar place, and coat the surface with coatings.
- To braze the pipe again while performing service work, use the same type of brazing metal.

2-5-2. Flux

Why flux is necessary

- Removing all the oxide film and any foreign matter on the metal surface assists the flow of brazing metal.
- Flux prevents the metal surface from being oxidized in the course of brazing.
- Reducing the brazing metal's surface tension enables the brazing metal to adhere for better metal processing.

Characteristics of flux

- The activation temperature of flux matches the brazing temperature.
- A wide effective temperature range makes flux hard to carbonize.
- It is easy to remove slag after brazing.
- The corrosive action to the treated metal and brazing metal is minimum.
- The good performance of flux gives no harm to a human body.
  Since flux works in a complicated manner as described above, select an appropriate type of flux according to metal treatment type, brazing metal and brazing method, or other conditions.

Type of flux

- Non-corrosive flux
  It is generally a compound of borax and boric acid. It is effective when brazing temperature is higher than 800 °C.
- Active solvent
  Most of this type of flux is generally used for silver brazing.
  It features the increase of oxide film while moving the capability to the borax-boric acid compound to add compounds such as potassium fluoride, potassium chloride, or sodium fluoride.

Piping materials for brazing and brazing metal / flux

Piping material	Brazing metal to be used	Flux to be used
Copper - Copper	Phosphor copper	Do not use
Copper - Iron	Silver	Paste flux
Iron - Iron	Silver	Vapour flux

NOTE

- Do not enter flux into the refrigerant cycle.
- If chlorine contained in the flux remains within the pipe, the lubricating oil deteriorates. Because of this, use a flux that does not contain chlorine.
- When adding water to the flux, use water that does not contains chlorine. (e.g. distilled water or ion-exchange water)
- Remove the flux after brazing.

2-5-3. Brazing

Brazing must be performed by a person qualified and experienced with theoretical knowledge since the operation requires sophisticated techniques.
Perform brazing while flowing dry nitrogen gas (N2) to prevent oxide film from forming during brazing application to the inside of the pipe.

NOTE

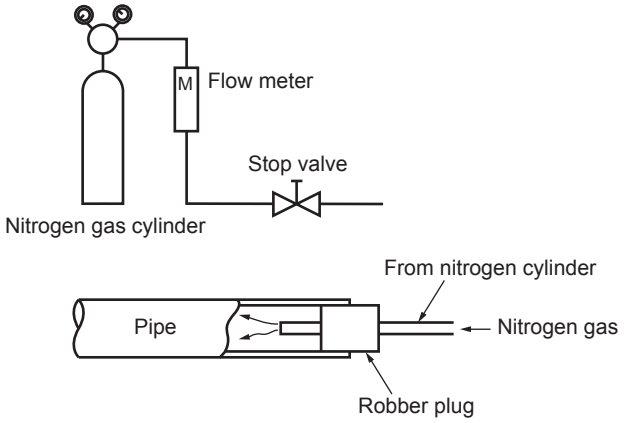
- Never use gas other than nitrogen gas.

Brazing method to prevent oxidation

1) Attach a reducing valve and a flow meter to the nitrogen cylinder.
2) Use a copper pipe to direct the piping material, and attach the flow meter to the balance.
3) Apply a mark to the clearance between the piping material and the copper pipe filled with nitrogen to prevent the back flow of the nitrogen gas.
4) If the nitrogen gas flows out, be sure to keep open the piping end.

5) Use the reducing valve to adjust the nitrogen gas flow speed to 0.05 m^3/hour or 0.02 MPa (0.2 kgf/cm^2).
6) After the steps above, keep the nitrogen gas flowing until the pipe cools down to a certain extent. (Temperature where the pipe is cool enough to be touched by hands)
7) Remove the flux completely after brazing.

Fig 2-5-1
Prevention of oxidation during brazing



3 Specifications

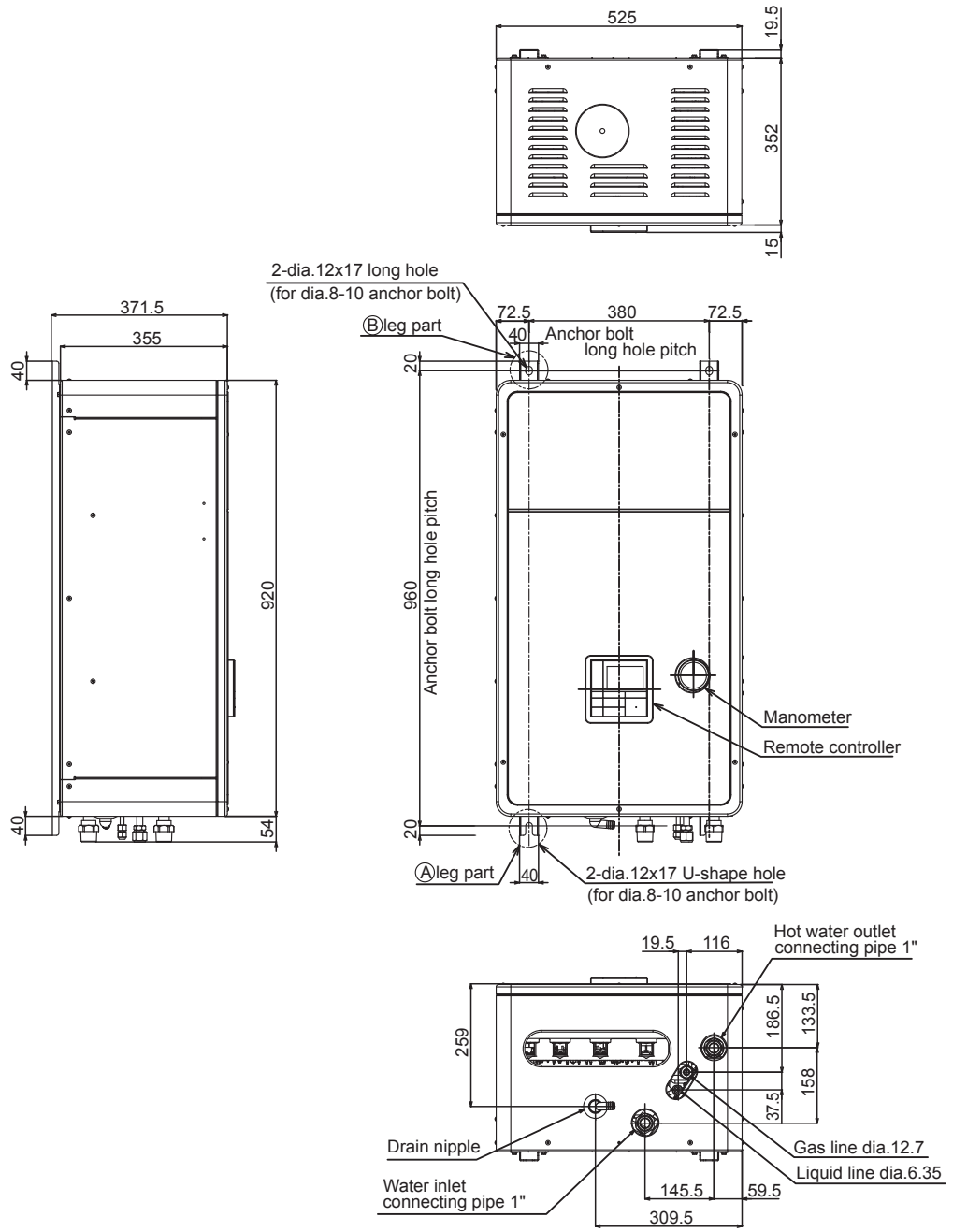
Unit name	Hydro unit		HWS-455XWHM3-E	
	Outdoor unit		HWS-455H-E	
Heating capacity *1 (kW)			4.5	
Cooling capacity *2 (kW)			4.5	
Variable range of compressor frequency			10 - 80 Hz	
Power source			Single phase 50 Hz 220-230 V	
Operation mode			Heating	Cooling
Electric characteristic *1 *2	Hydro unit	Current (A)	0.44	0.44
		Power (kW)	0.06	0.06
		Power factor (%)	59.3	59.3
	Outdoor unit	Current (A)	4.56	6.76
		Power (kW)	0.86	1.40
		Power factor (%)	82	90
	Total	Running current (A)	5.00	7.20
Operating noise sound power level	Hydro unit (dB (A))		41	
	Outdoor unit (dB (A))		65	
Coefficient of performance *1 *2			4.90	3.08
Hydro unit	Outer dimension	Height (mm)	925	
		Width (mm)	525	
		Depth (mm)	355	
	Net weight (kg)		47	
	Color		Silky shade (Munsell 1Y8.5/0.5)	
	Remote controller Outer dimension *3	Height (mm)	120	
		Width (mm)	120	
		Depth (mm)	20	
	Circulation pump	Motor output (W)	125 (MAX)	
		Flow rate (L/min)	12.9	12.9
		Type	Non-self-suction centrifugal pump	
	Heat exchanger		Plate-type heat exchange	
Outdoor unit	Outer dimension	Height (mm)	630	
		Width (mm)	800	
		Depth (mm)	300	
	Net weight (kg)		42	
	Color		Silky shade (Munsell 1Y8.5/0.5)	
	Compressor	Motor output (W)	1100	
		Type	Twin rotary type with DC-inverter variable speed control	
		Model	DA150A1T-21F	
	Fan motor	Standard air capacity (m^3/min)	40	
		Motor output (W)	43	
Refrigerant piping	Connection method		Flare connection	
	Hydro unit	Liquid	Ø6.35	
		Gas	Ø12.7	
	Outdoor unit	Liquid	Ø6.35	
		Gas	Ø12.7	
	Maximum length (m)		15	
	Maximum chargeless length (m)		15	
	Maximum height difference (m)		±10	
	Minimum length (m)		5	
Refrigerant	Refrigerant name		R410A	
	Charge amount (kg)		1.15	
Water piping	Pipe diameter		R1	
	Maximum length (m)		None (Need the flow rate 10ℓ/min or more)	
	Maximum height difference (m)		±7	
	Maximum working water pressure (kPa) *4		300	
Operating temperature range	Hydro unit (°C) *5 (Cooling / Heating / Hot water)		5-32 / 5-32 / 5-32	
	Outdoor unit (°C) (Cooling / Heating / Hot water)		10-43 / -20-25 / -20-43	
Operating humidity range	Hydro unit (%)		15-85	
	Outdoor unit (%)		15-100	
Wiring connection	Power wiring		3 wires: including earth wire (Outdoor unit)	
	Connecting line		4 wires: including earth wire	

*1 Heating performance measurement conditions: outside air temperature 7 °C, water supply temperature 30 °C, outlet temperature 35 °C, refrigerant piping length 7.5 m (no height difference).
*2 Cooling performance measurement conditions: outside air temperature 35 °C, water supply temperature 12 °C, outlet temperature 7 °C, refrigerant piping length 7.5 m (no height difference).
*3 • The remote controller should be shipped with the hydro unit.
• Use two 1.5-meter wires to connect the hydro unit with the remote controller.
*4 Check the water piping for leakage under the maximum operating pressure.
*5 Do not leave the hydro unit at 5 °C or below.

4 Outside drawing

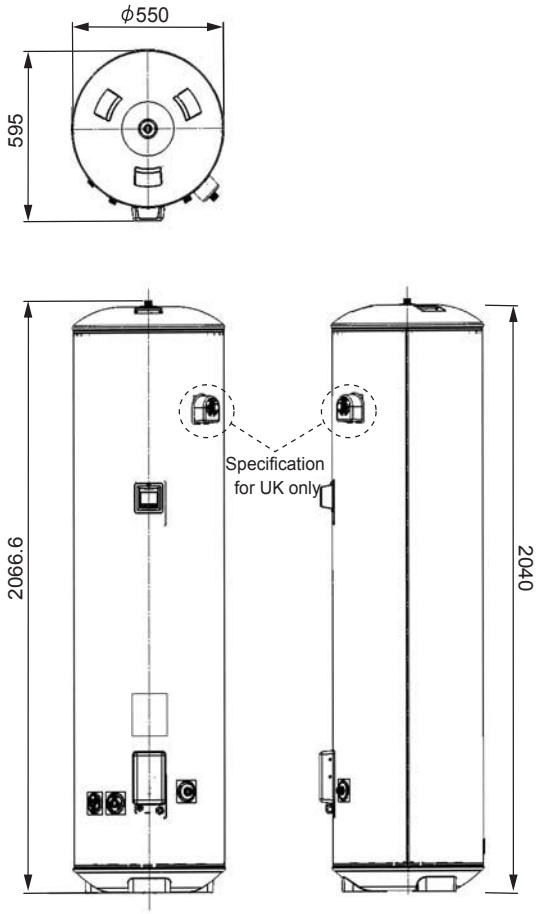
4-1. Hydro unit

HWS-455XWHM3-E

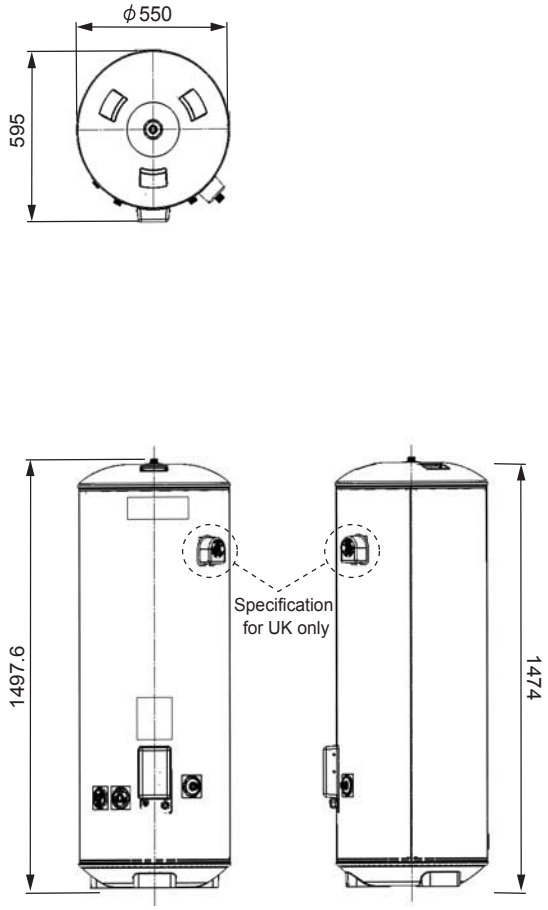


4-2. Hot water cylinder

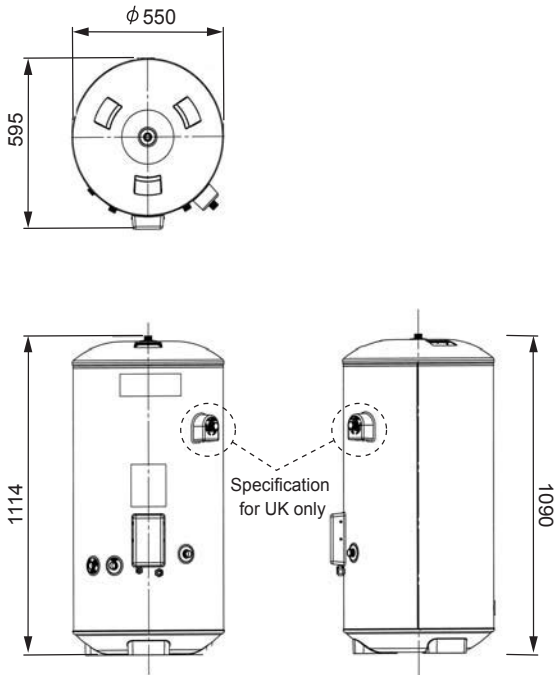
HWS-3001CSHM3-E(-UK)



HWS-2101CSHM3-E(-UK)

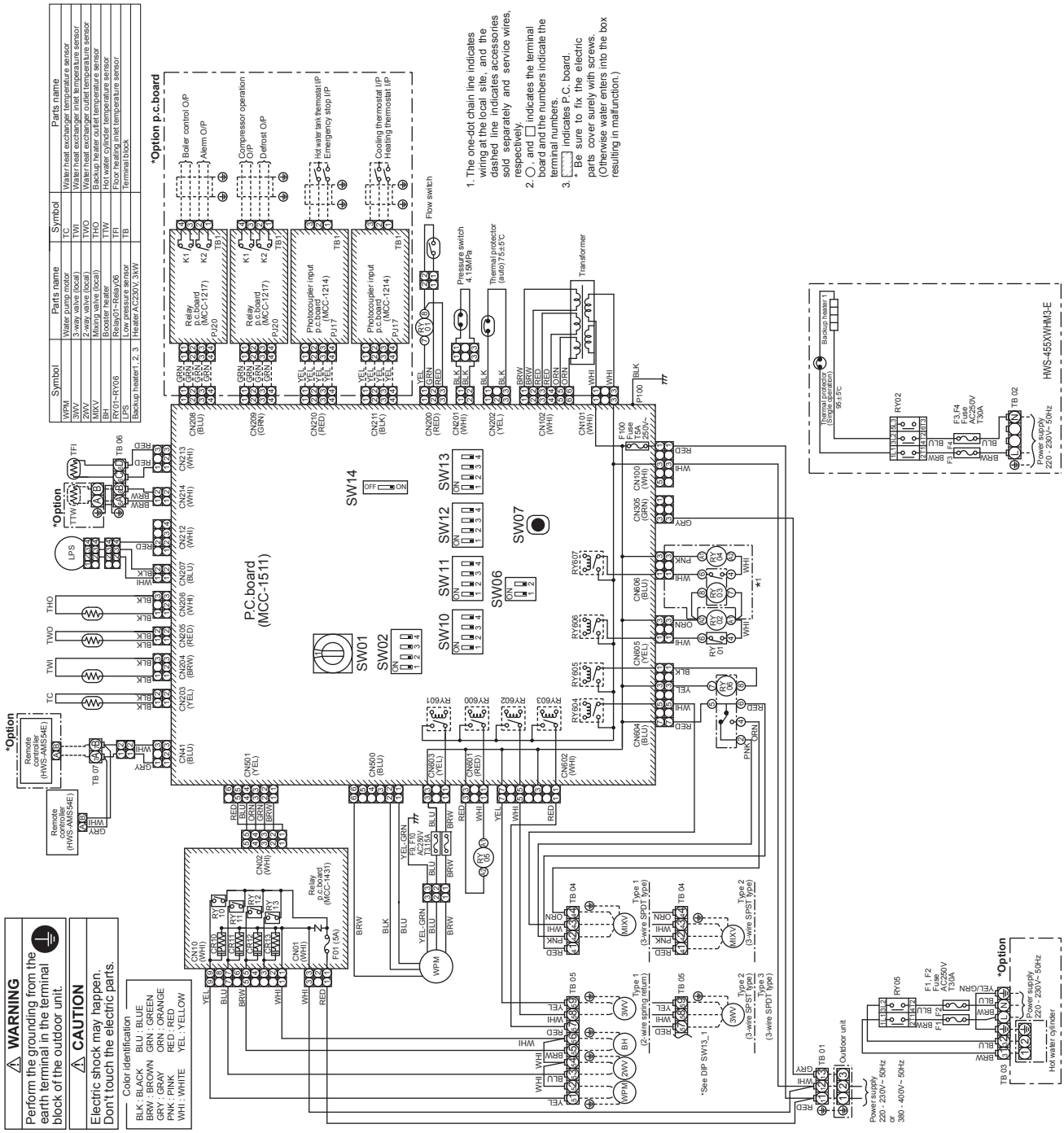


HWS-1501CSHM3-E(-UK)

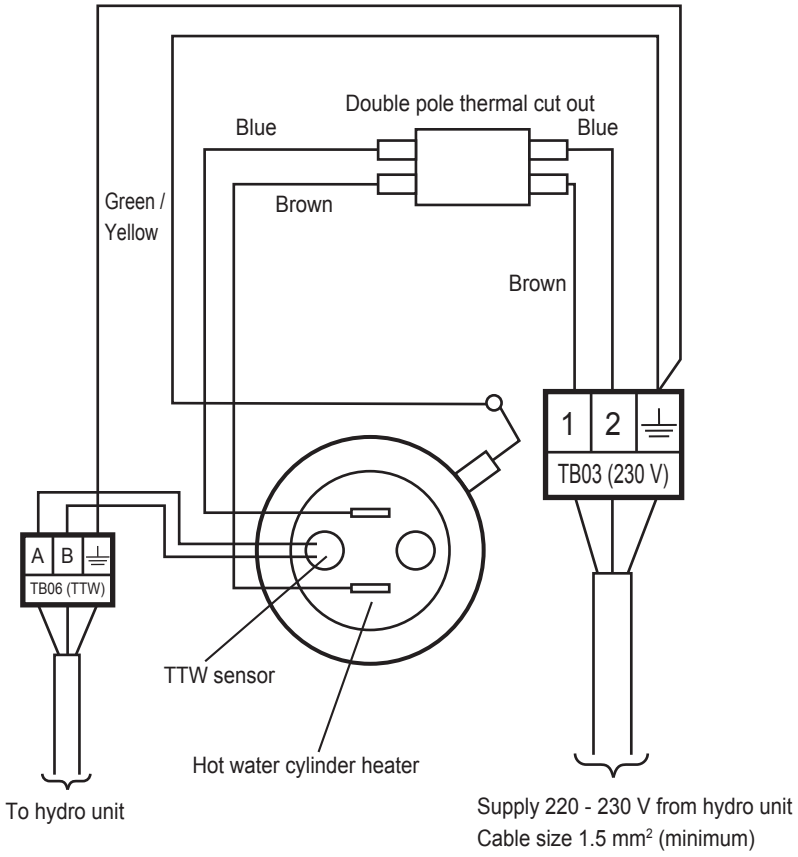


5 Wiring diagram

5-1. Hydro unit



5-2. Hot water cylinder unit



6 Key electric component rating

6-1. Hydro unit

HWS-455XWHM3-E

No.	Component name	Type name	Rating
1	Circulation pump	UPM 2K 25-60 130	AC230 V 0.40 A (MAX)
2	Backup heater 3 kW	SA3-23652B	AC230 V 3 kW
3	Water heat exchange temperature sensor (TC sensor)	–	10 kΩ (25 °C)
4	Water inlet temperature sensor (TWI sensor)	–	10 kΩ (25 °C)
5	Water outlet temperature sensor (TWO sensor)	–	10 kΩ (25 °C)
6	Heater outlet water temperature sensor (THO sensor)	–	10 kΩ (25 °C)
7	Floor inlet temperature sensor (TFI sensor)	–	10 kΩ (25 °C)
8	Pressure switch	–	Operating pressure 4.15 MPa +0 -0.3 MPa
9	Low pressure sensor	–	Operating pressure 0.20 MPa
10	Bimetal thermostat (auto)	–	Operating temperature 75±3 °C DC12 V / 0.2 A
11	Bimetal thermostat (single operation)	–	Operating temperature 95±5 °C AC250 V / 16 A
12	Flow switch	–	Operating flowing quantity 10 ℓ/min
13	Output board OP*	TCB-PCIN3E	AC230 V 0.5 A, DC24 V 1 A
14	Input board OP*	TCB-PCM03E	Contact input
15	Remote controller (Main)	HWS-AMS54E	
16	Remote controller (Sub) OP*	HWS-AMS54E	
17	Water 3-way valve terminal	–	AC230 V 0.1 A 2Wire, 3Wire SPST, SPDT type mountable
18	Water 2-way valve terminal	–	AC230 V 0.1 A 2Wire type mountable
19	Mixing valve terminal	–	AC230 V 0.1 A 3Wire SPST, SPDT type mountable
20	Circulation pump terminal	–	AC230 V 1.0 A
21	Booster heater terminal	–	AC230 V 1.0 A
22	Fuse	–	AC250 V 30 A

* : OP ···· Optional accessory

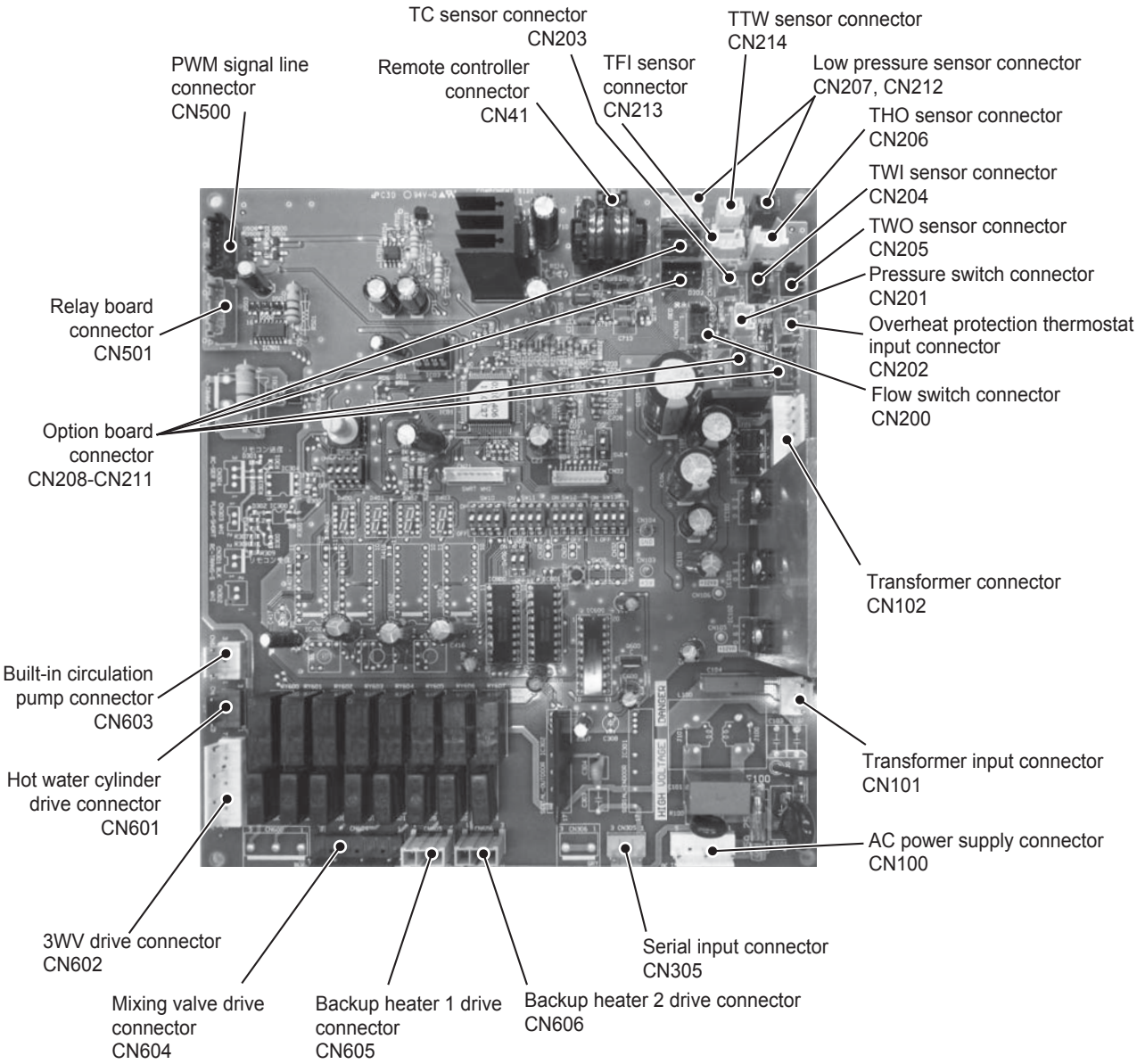
6-2. Hot water cylinder unit

No.	Component name	Model name			Type name	Rating
		1501 CSH M3-E (-UK)	2101 CSH M3-E (-UK)	3001 CSH M3-E (-UK)		
1	Hot water cylinder heater	O	O	O	–	AC230 V 2.7 kW
2	Hot water cylinder temperature sensor (TTW sensor)	O	O	O	–	10 kΩ (25 °C)
3	Thermal cut-out	O	O	O	–	Operating temperature Manual reset 82 °C (+3K/-2K)

O ····· Applied

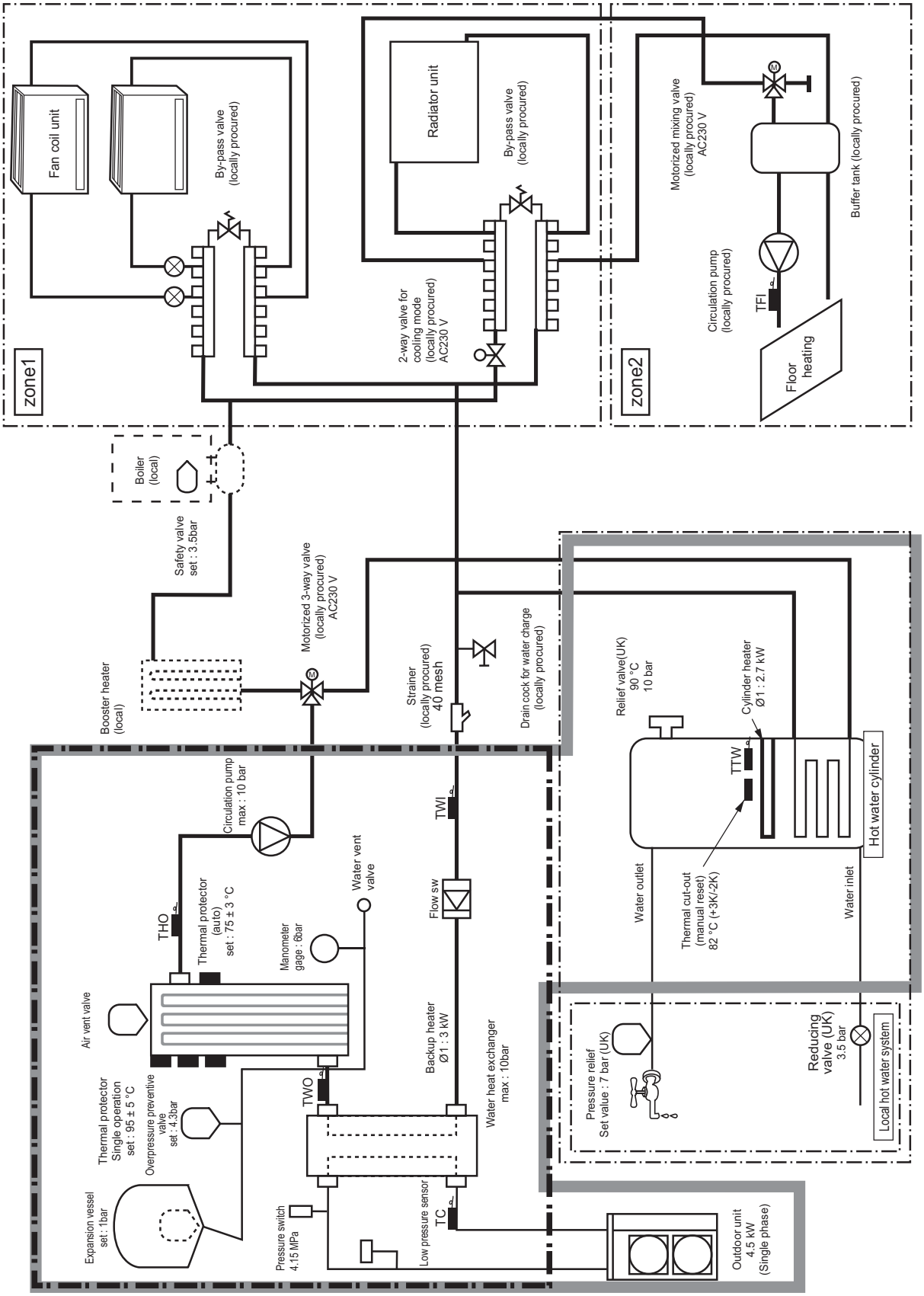
6-3. Water heat exchange control board

HWS-455XWHM3-E

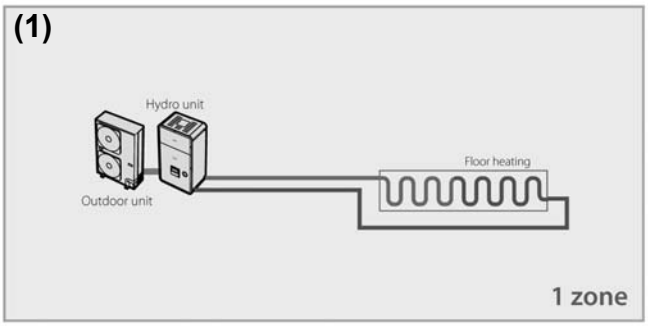


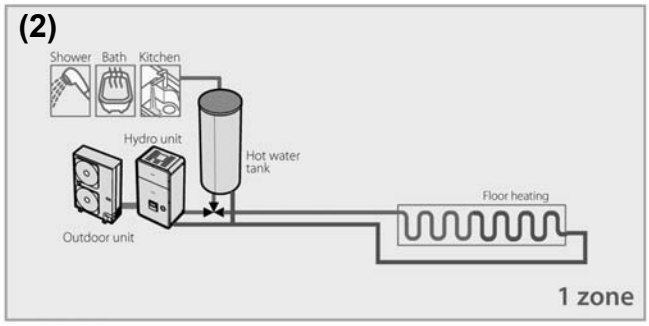
7 Refrigeration cycle / Water system diagram

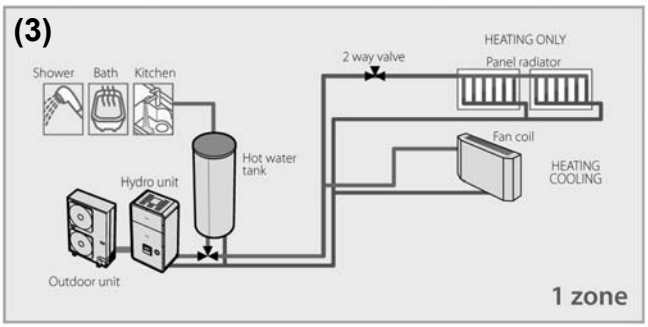
7-1. Water system diagram

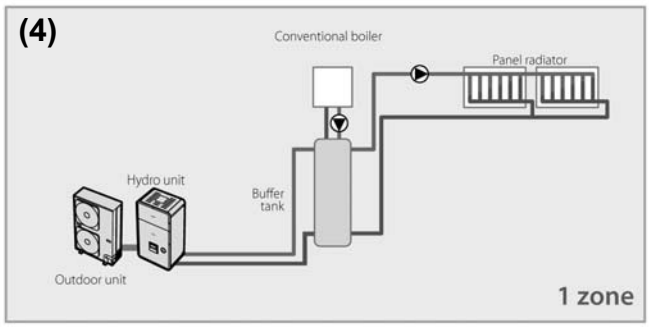


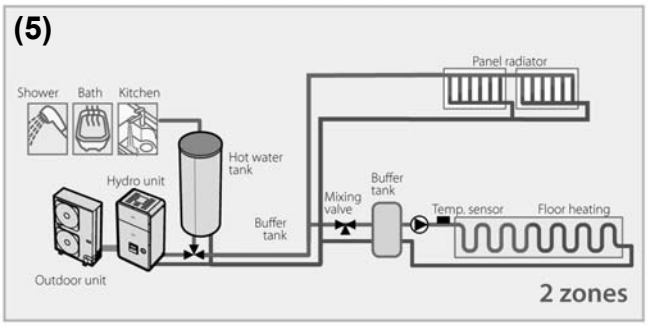
Installation example of water circuit

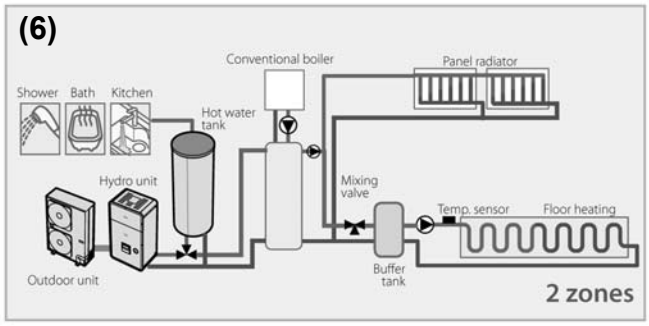








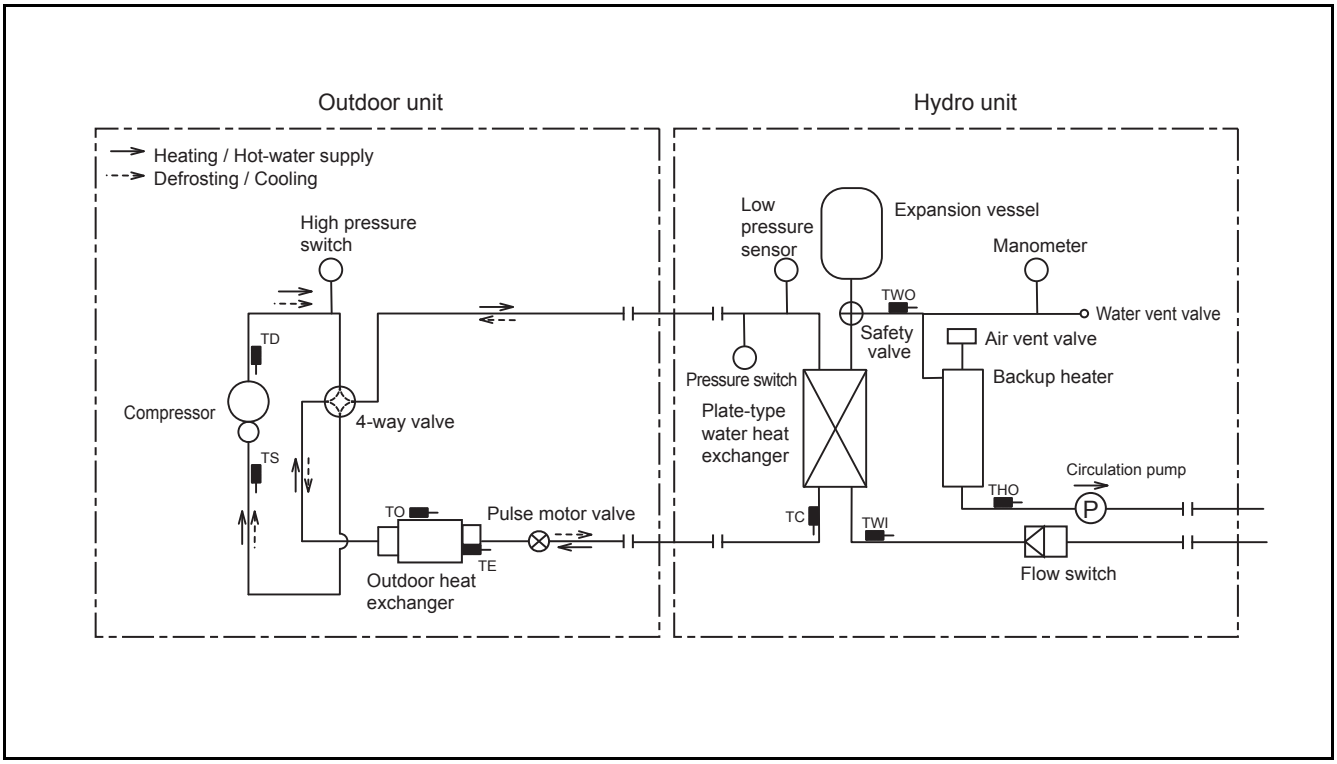




The water flowing for a system without buffer tank ((1), (2), (3), (5)) requires10 ℓ/min or more. This water flowing requires 5 or more branches of Floor heating or Radiator etc.
Less than 5 branches may cause a flow deficiency. In this case, please provide a buffer tank and secondary pumps as shown in (4).
Please check how to install the boiler (See page 35)

7-2. Refrigeration cycle system diagram

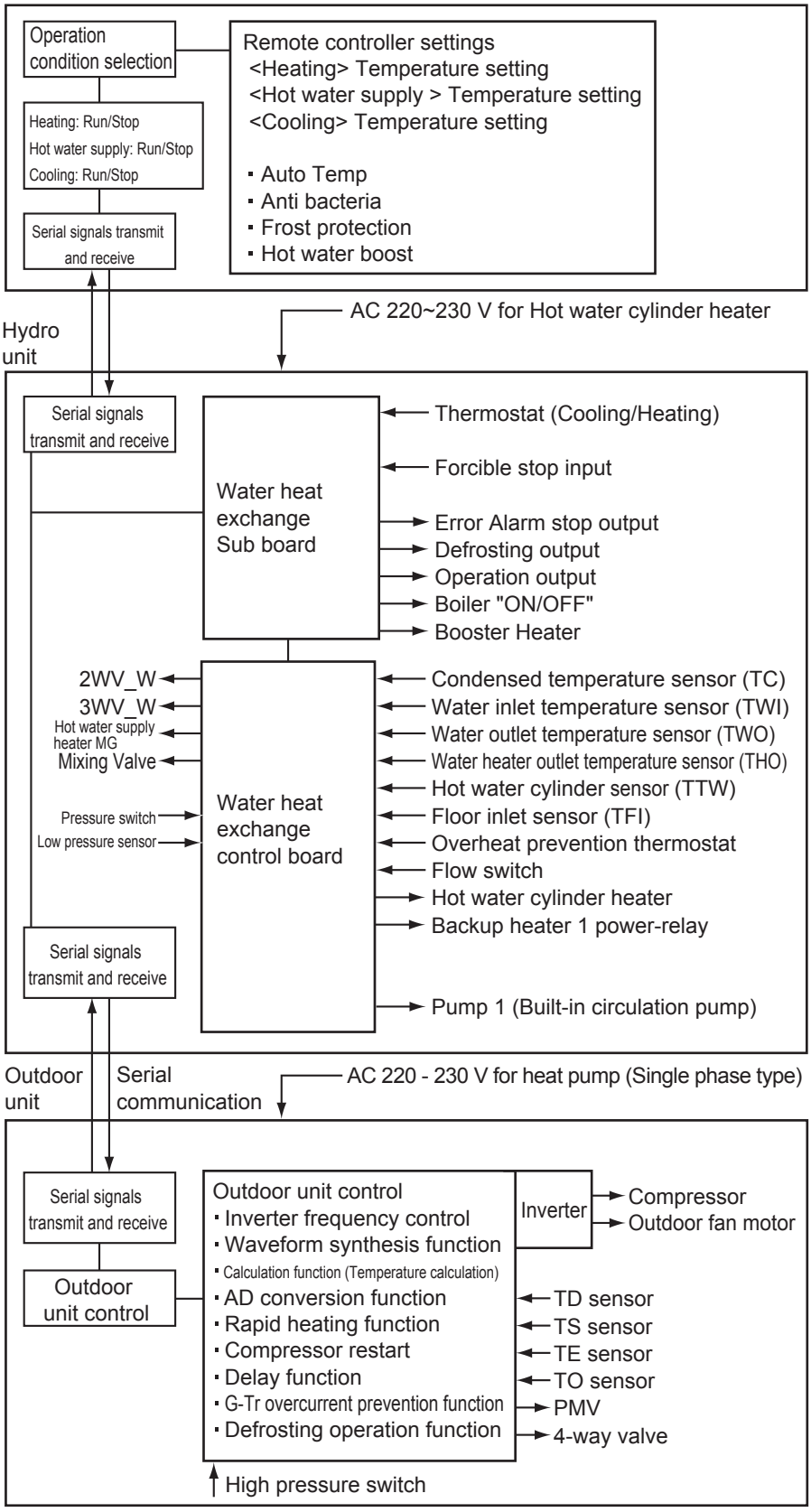
HWS-455XWHM3-E / HWS-455H3-E

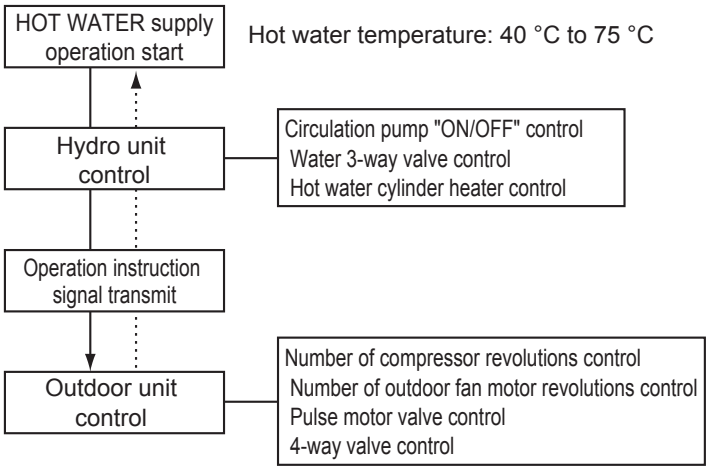
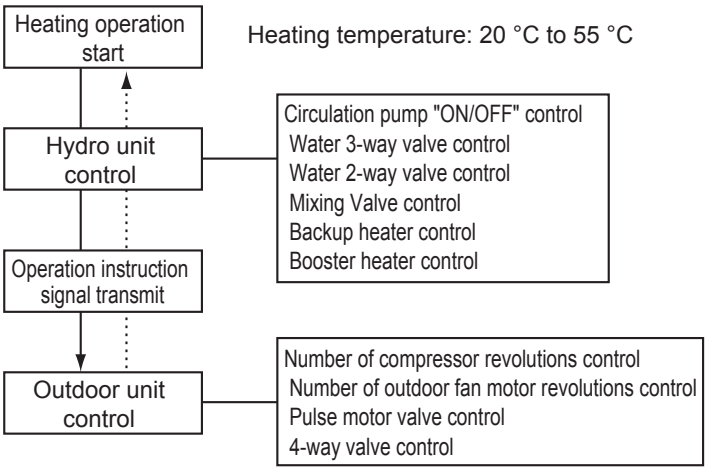


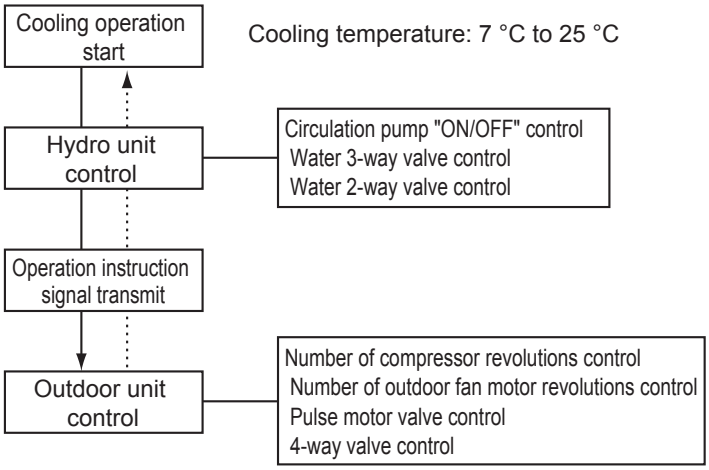
8 Operational description

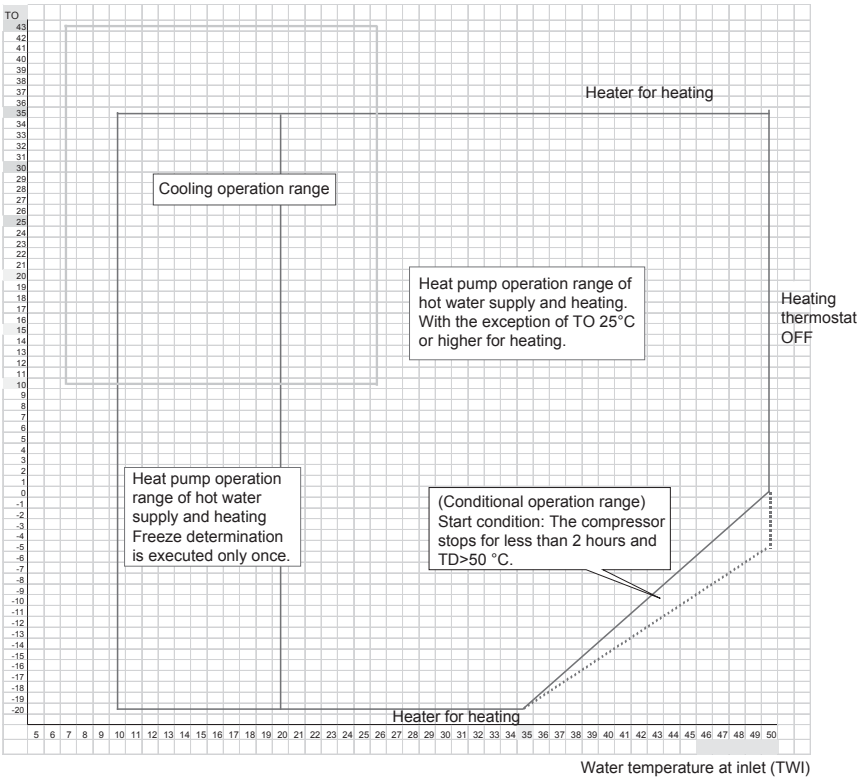
This chapter describes the working circuit and control of Air to Water Heat Pump about the following operations.

	Item	Page
8-1	**8-1. Basic Operation** 1) Operation control 2) Hot water supply operation 3) Heating operation 4) Cooling operation	27 to 29
8-2	**8-2. Operation Mode and Control Method** 1) Heat pump operation range of hot water supply, heating and cooling 2) Hot water supply operation 3) Heating operation 4) Cooling operation 5) Simultaneous operations of "hot water supply" and "heating" 6) Simultaneous operations of "hot water supply" and "cooling" 7) Boiler control 8) Hot water boost operation 9) Anti bacteria operation 10) Night setback operation 11) Frost protection operation 12) Auto operation 13) Night time low-noise operation	30 to 41
8-3	**8-3. Hydro Unit Control** 1) Capacity control (compressor, high-temperature release, low-temperature release) 2) Heater control 3) Circulation pump control 4) Control by the flow switch 5) Mixing Valve control (2-temperature heating control) 6) Room temperature control 7) Room temperature control with the thermostat 8) Hot water cylinder thermostat control 9) Control of force stop and restart 10) Control of limit of heat pump operation 11)Output signal control 1 12)Output signal control 2 13) Q-H characteristics of hydro unit 14) Automatic restart control 15) Piping freeze prevention control 16) High return water protect control	41 to 58

Item	Operation flow and applicable data, etc.	Operation description
8-1. Basic Operation	1) Operation control Remote controller  	1. Purpose The operations of the hydro unit and the outdoor unit are controlled according to user-defined operation condition settings. 2. Details The operation controls include those shown on the left. 3. Operations 1) An operation condition is selected with the remote controller. 2) Setting the remote controller button to "ON" transmits a signal to the hydro unit. 3) The hydro unit controller controls the operations shown on the left while also controlling the water 2-way valve, water 3-way valve, circulation pump, mixing valve, hot water cylinder heater, and backup heater. 4) The hydro unit controller transmits an operation instruction to the outdoor unit, and uses serial signals to transmit and receive control statuses. 5) The outdoor unit control unit performs the operation controls shown on the left while also controlling the compressor, outdoor fan motor, pulse motor valve, and 4-way valve.

Item	Operation flow and applicable data, etc.	Operation description
8-1. Basic Operation	2) Hot water supply operation  	Hot water supply operation 1. Purpose Hot water supply 2. Details This section performs hot water supply operation according to heating conditions specified for the steps on the left. 3. Operations 1) By pressing the [F2] button on the remote controller, the hydro unit controller starts to transmit a hot water supply operation signal to the outdoor unit. 2) The hydro unit performs the operation controls shown on the left while also controlling the circulation pump, hot water cylinder heater "3WV". 3) The outdoor unit controls the compressor, outdoor fan motor, electric expansion valve, and 4-way valve based on the operation signals transmitted by the hydro unit.
	3) Heating operation  	Heating operation 1. Purpose Heating 2. Details This section performs heating operation according to heating conditions specified for the steps on the left. 3. Operations 1) By pressing the [F1] button on the remote controller, the hydro unit controller starts to transmit a heating operation signal to the outdoor unit. 2) The hydro unit performs the operation controls shown on the left while also controlling the circulation pump, backup booster heater "ON/OFF", water 2-way valve, and water 3-way valve. 3) The outdoor unit controls the compressor, outdoor fan motor, electric expansion valve, and 4-way valve based on the operation signals transmitted by the hydro unit.

Item	Operation flow and applicable data, etc.	Operation description
8-1. Basic Operation	4) Cooling operation  	1. Purpose Cooling 2. Details This section performs cooling operation according to cooling conditions specified for the steps on the left. 3. Operations 1) By pressing the [F1] button twice on the remote controller, the hydro unit controller starts to transmit a cooling operation signal to the outdoor unit. 2) The hydro unit controller performs the operation controls shown on the left while also controlling the circulation pump, water 2-way valve, and water 3-way valve. 3) The outdoor unit controls the compressor, outdoor fan motor, pulse motor valve, and 4-way valve based on the operation signals transmitted by the hydro unit.

Item	Operation flow and applicable data, etc.
8-2. Operation Mode and Control Method	1) Heat pump operation range of hot water supply, heating and cooling The heat pump operation range of hot water supply, heating and cooling is shown on the figures below. 1) HWS-455XWHM3-E 

Item	Operation flow and applicable data, etc.

8-2. Operation Mode and Control Method

The following shows the operation modes and controlled objects.

Operation mode / Controlled object	Cooling only	Heating only	Hot water supply only	Heating and Hot water both operate				Cooling and Hot water both operate			
				Heat pump select for heating		Heat pump select for hot water supply		Heat pump select for cooling		Heat pump select for hot water supply	
				Heating side	Hot water supply side	Heating side	Hot water supply side	Cooling side	Hot water supply side	Cooling side	Hot water supply side
Heat pump	O	O	O	O	×	×	O	O	×	×	O
Backup heater	×	O	×	O	×	×	×	×	×	×	×
Hot water cylinder heater	×	×	O	×	O	×	O	×	O	×	O

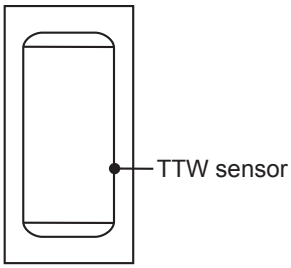
O Possible
× Not possible

2) Hot water supply operation

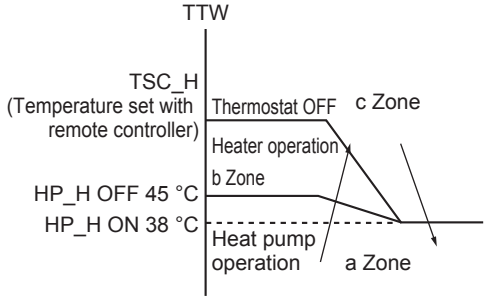
1) Operation start condition
When the [F2] remote controller button is pressed and the following operation start condition is met, the operation starts.
- TTW < 38 °C is detected.

2) Operation mode determination
An operation mode is determined according to the temperature of TTW sensor.
- Heat pump operation selection *1 *2
- When TTW < 38 °C (a zone in the right figure) is met, the heat pump operation is selected.
- Heater operation selection
  When 45 °C ≤ TTW < TSC_H (b zone in the right figure) is met, the heater operation is selected.
- Thermostat status "OFF" selection
  When TTW ≥ TSC_H is met, the thermostat status "OFF" is selected.

3) Operation stop
The operation stops in the following cases.
- The remote controller gives a stop instruction.
- TTW ≥ TSC_H is met.



(Hot water cylinder unit)



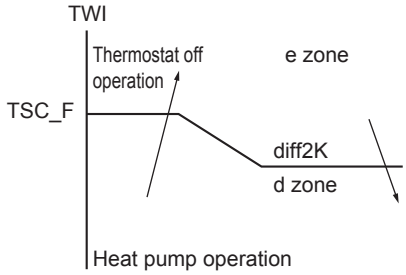
TSC_H is hot water temperature set with remote controller

*1: When the outside temperature is -20 °C or below, the heater operation is selected even if the TTW temperature falls into "a zone".
*2: When "Hot water supply" and "Heating" are simultaneously in operation, the heater operation may be selected depending on the outside air temperature.

Related FC

FC No.	Setting item	Default	Setting available range
1E	Upper limit of hot water supply temperature	75 °C	60-80 °C
1F	Lower limit of hot water supply temperature	40 °C	40-60 °C
20	Heat pump start temperature	38 °C	20-45 °C
21	Heat pump end temperature	45 °C	40-50 °C
24	Outside air correction start temperature for hot water supply*3	0 °C	-20-10 °C
25	Outside air correction temperature for hot water supply*3	3 degree	0 -15 degree

*3:When the outside temperature is 0 °C or below, the boil-up temperature will be higher that setting temperature in hot water supply mode.

Item	Operation flow and applicable data, etc.
8-2. Operation Mode and Control Method	3) Heating operation <Operation only for ZONE1> • This operation is enabled when DP_SW12_2 ZONE1 is set to "OFF" (default). • The remote controller displays [ZONE 1] settings, and only the set temperature of [ZONE 1] can be changed. <Operation for ZONE1 and ZONE2 (2 temperatures control)> • This operation is enabled when DP_SW12_2 ZONE1 is set to "OFF" (default) and DP_SW12_3 ZONE2 to "ON". • The remote controller displays [ZONE 1] [ZONE 2] settings, and the set temperatures of [ZONE 1] [ZONE 2] can be changed. • To set temperatures for [ZONE 1] and [ZONE 2], use SELECT [ ] to switch between [ZONE 1] and [ZONE 2]. • For 2 zone temperatures control, the flow adjustment of MIXING VALVE controls the water temperature of [ZONE 2]. For details, see the description on MIXING VALVE control in 8-3-5. 1) Operation start condition Pressing the [F1] button of remote controller starts a heating operation. *1 *2 2) Operation mode selection An operation mode is determined according to the temperature of TWI sensor. • Heat pump operation selection *1 *2 When TWI < TSC_F (d zone in the right figure) is met, the heat pump operation is selected. • Thermostat status "OFF" When TWI ≥ TSC_F (e zone in the right figure) is met, the thermostat status "OFF" is selected. 3) Operation stop condition When the following condition is met, the heating operation stops. • The remote controller gives a stop instruction. *1: When the outside temperature is -20 °C or below, the heater operation is selected even if the TWI temperature falls into "d zone". *2: When "Hot water supply" and "Heating" are simultaneously in operation, the heater operation may be selected depending on the outside air temperature.  TSC_F is a heating temperature set with remote controller Related FC

FC No.	Setting item	Default	Setting available range
1A	Upper limit of heating (Zone1) limited temperature	55	37-55 °C
1B	Lower limit of heating (Zone1) limited temperature	20	20-37 °C
1C	Upper limit of heating (Zone2) limited temperature	55	37-55 °C
1D	Lower limit of heating (Zone2) limited temperature	20	20-37 °C

Item	Operation flow and applicable data, etc.

8-2. Operation Mode and Control Method

4) Cooling operation

Pressing the [F1] button twice, starts a cooling operation.

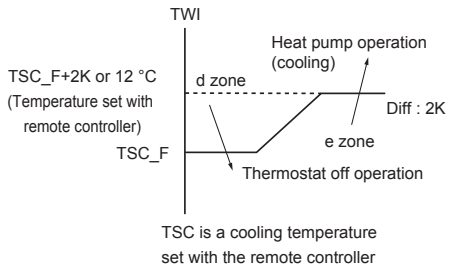
1) Operation start condition

Pressing the [F1] button twice, starts a cooling operation.

2) Operation mode selection

An operation mode is determined according to the temperature of TWI sensor.

- Heat pump operation selection *1
  When TWI ≥ TSC_F (d zone in the right figure) is met, the heat pump operation is selected.
- Thermostat status "OFF"
  When TWI < TSC_F (e zone in the right figure) is met, the thermostat status "OFF" is selected.



3) Operation stop condition

When either of the following conditions is met, the cooling operation stops.

- The remote controller gives a stop instruction.
- The operation is switched to heating.

*1: When the outside temperature is 10 °C or below, cooling does not start even if the TWI temperature falls into "d zone".

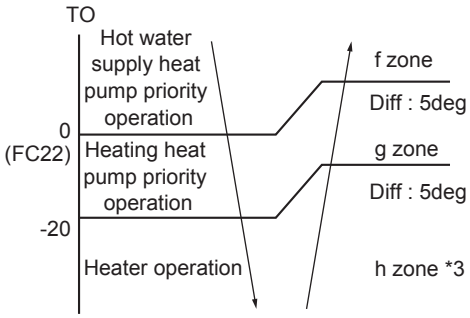
Related FC

FC No.	Setting item	Default	Setting available range
02	Cooling mode availability	0	0: Permitted
18	Upper limit of cooling setting temperature	25	18-30 °C
19	Lower limit of cooling setting temperature	7	7-20 °C

5) Simultaneous operations of "hot water supply" and "heating"

At the time of "Hot water supply" and "Heating" simultaneous operation, the operation mode is select as follows depending on the outside air temperature.

- f zone Operation with hot water supply priority
  A heat pump operation is performed in the hot water supply side, and a heating operation in the heating side.
  The heat pump maintains a supply of hot water for up to 30 minutes during a simultaneous operation.
- g zone Operation with heating priority
  A heat pump operation is performed in the heating side, and a cylinder heater operation in the hot water supply side.



Operation mode by zone

Zone	Hot water supply side	Heating side
f	Heat pump *2	Stop *2
g	Heater	Heat pump
h	Heater *3	Heater *3

*2: Note that after a heat pump operation for "Hot water supply" is selected in f zone, when the operation moves to a heater operation for "hot water" and then 5 minutes has passed (Hot water supply operation in b zone), the operation mode changes as follows.

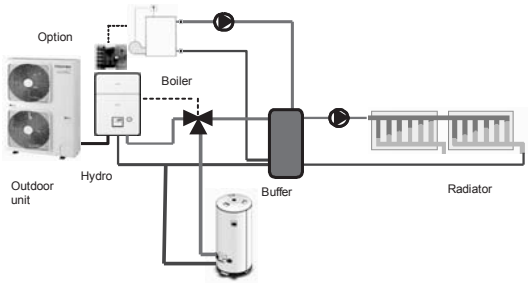
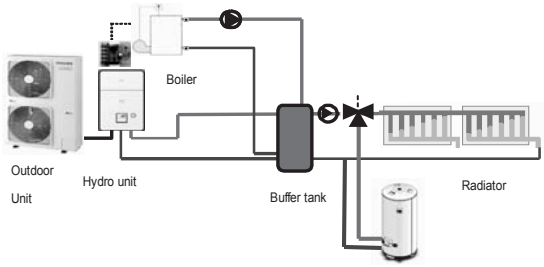
Zone	Hot water supply side	Heating side
f'	Heater	Heat pump

When TTW ≥ 45 °C (FC: 21) is met, the operation ends f' zone and returns to f zone.

*3: If the h-zone operation starts while external temperature is higher than -20 °C, the h-zone operation continues for 60 minutes.

<table>
<tr><th>Item</th><th>Operation flow and applicable data, etc.</th></tr>
<tr><td></td><td>Related FC
<table>
<tr><th>FC No.</th><th>Setting item</th><th>Default</th><th>Setting available range</th></tr>
<tr><td>22</td><td>Priority mode switch temperature</td><td>0 °C</td><td>-20-20 °C</td></tr>
</table>
* Note: When user selects “hot water supply” and “ZONE1,2”, and Heat pump selects hot water supply mode, the Maximum operating time of heat pump is 30 min.</td></tr>
<tr><td>8-2.
Operation Mode and Control Method</td><td>6) Simultaneous operations of "hot water supply" and "cooling"
For simultaneous operations of "hot water supply" and "cooling", basically cooling runs by a heat pump operation, and hot water supply by a heater operation.
<table>
<tr><th></th><th>Hot water supply side</th><th>Cooling side</th></tr>
<tr><td>Normal</td><td>Heater *</td><td>Heat pump *</td></tr>
</table>
* By setting FC_0F to “1”, heat pump operation for “hot water supply” is permitted. Under the setting, the heat pump runs for the hot water supply side when TTW is less than 38 °C.
<table>
<tr><th></th><th>Hot water supply side</th><th>Cooling side</th></tr>
<tr><td>TTW<38 °C</td><td>Heat pump</td><td>stop</td></tr>
</table>
The operation mode returns to normal when TTW become 45 °C or more (FC: variable).

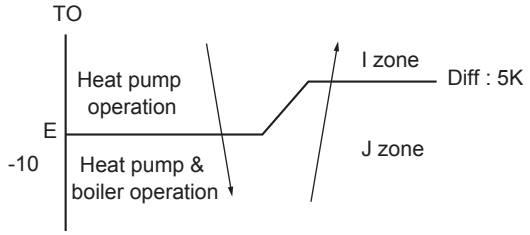
Related FC
<table>
<tr><th>FC No.</th><th>Setting item</th><th>Default</th><th>Setting available range</th></tr>
<tr><td>0F</td><td>Heat pump operation for hot water supply permitted / not permitted</td><td>0: Not permit</td><td>1:Permitted (Heat pump may run for hot water supply.)</td></tr>
</table></td></tr>
</table>

Item	Operation flow and applicable data, etc.
8-2. Operation Mode and Control Method	7) Boiler control The boiler assists the hot water supply operation and heating operation according to the boiler's position. 7-1) Boiler setting • TCB-PCIN3E optional PC board is required. Connect its connection cable to CN208 port on the PC board of the hydro unit. • Setting DPSW on the hydro unit: DP_SW13_2="ON/OFF" switches "Using boiler / Not using boiler (Default)". Set the switch to "ON" when using the boiler. • The temperature switching the boiler and heat pump: FC_23=-10 °C (Default) See the next item. The boiler output becomes effective when the outside air temperature is -10 °C or less. • Boiler position setting: DP_SW02_1="ON/OFF" must be switched in accordance with the boiler position from the 3-way valve; before the 3-way valve / after the 3-way valve and in the heating side (Default). When the switch is set to "ON", the boiler runs in the hot water supply operations or heating operation. The action of the 3-way valve depends on heat pump's action and the boiler follows their action. When the switch is set to "OFF", the boiler runs in heating operation. Also, the boiler runs when the heat pump is running for hot water supply while heating and supplying hot water simultaneously. • Priority setting between the boiler and hydro unit: FC_3E="0/1" switches the running priority; hydro unit (Default) / boiler. When FC_3E is set to "0" (Default), the hydro unit has priority, the boiler stops as temperature reaches the hydro unit's temperature setting. When FC_3E is set to "1", the boiler continues to run even after temperature reaches the hydro unit's temperature setting. (The setting of FC_3E is effective during the HP+Boiler operation.) • Coordination setting of the boiler and heat pump: when FC_5B="0", the boiler and heat pump runs simultaneously. When FC_5B="1", only the boiler runs, pump ON. (However, if the external air temperature becomes the boiler-HP switching temperature or more within 60 minutes) When FC_5B="2", the heater runs. (the heater may run instead for up to 60 minutes.) When FC_5B="3", only the boiler runs. (Pump OFF:Default) * :DP_SW10_3 should be "OFF (Default)" <Installation example> DP_SW02_1="OFF"(The boiler is placed after the 3-way valve and in the heating side.)  * Boiler & HP switching temp setting FC23= -10 ** Boiler control / functionality setting FC5B= 0 (HP+Boiler) *** Hot water & cooling priority setting (FC_0F="1" hot water priority is necessary.) TO<=-10* / -10*<TO HEATING: Boiler + HP*** / HP HOT WATER: HP / HP HEATING & HOT WATER: Boiler for heating HP for hot water or heating / HP COOLING: – / HP (TO≥10) COOLING & HOT WATER: HP for cooling Heater for hot water*** / HP for cooling Heater for hot water*** DP_SW02_1="ON"(The boiler is placed before the 3-way valve.)  * Boiler & HP switching temp setting FC23= -10 ** Boiler control / functionality setting FC5B= 0 (HP+Boiler) *** Hot water & cooling priority setting (FC_0F="1" hot water priority is necessary) TO<=-10* / -10*<TO HEATING: Boiler + HP** / HP HOT WATER: Boiler + HP** / HP HEATING & HOT WATER: Boiler + HP** / HP COOLING: – / HP (TO≥10) COOLING & HOT WATER: HP for cooling Heater for hot water*** / HP for cooling Heater for hot water***

Item	Operation flow and applicable data, etc.
8-2. Operation Mode and Control Method	

7-2) Boiler-output control

- I zone: heat pump operation
  Normally the heat pump operation is executed in the zone.
- J zone: heat pump operation and boiler operation *1
  In the zone, the heat pump + boiler operation (*2) is executed and the heater operation is executed in the hot-water-supply side.



*2:Operation mode is not changed with the outside temperature when an external signal to control the limit of heat pump limit operation (see 8-3-10) is input.

7-3) Boiler output limit control

The boiler power output is limited depending on the settings of boiler position (DPSW02_1) and FC62.

Boiler position (DPSW02_1)	FC62 (Activate/deactivate A02 error detection)	Temperature range in which the boiler signal is output (Detected temperature of TWI, TWO or THO)
OFF (After 3-way valve, heating side)	0	TWI or TWO or THO<58 °C
	1	TWI or TWO or THO<58 °C
ON (Before 3-way valve)	0	TWI or TWO or THO<70 °C
	1	No limit *1

7-4) A02 error detection while the boiler is running

A02 error detection is deactivated depending on the settings of FC62 and whether the boiler is installed or not (DPSW13_2).

Boiler is installed or not (DPSW13_2)	FC62 (Activate/deactivate A02 error detection)	Temperature recognized as A02 error (Detected temperature of TWI, TWO or THO)
OFF (Not installed)	0	TWI or TWO or THO≥70 °C (Beep)
	1	TWI or TWO or THO≥70 °C (Beep)
ON (Installed)	0	TWI or TWO or THO≥70 °C (Beep)
	1	No error detection *1 (No beep)

*1 If a user runs the boiler under the condition that no limit has been set, and hot water from the boiler has damaged parts inside of the hydro unit, the user is fully responsible for the damage.

7-5)2 zone temperature control while the boiler is running

2 zone temperature control by boiler with P1 OFF is required DPSW10_3 OFF

Boiler is installed (DPSW13_2)	ZONE2 operation is using (DPSW12_3)	P2 synchronize with P1 (DPSW10_3)	FC5B Coordination of the boiler and heat pump	2 zone temperature control P1 / P2 / Mixing Valve control
ON (Installed)	ON (Using)	OFF (No synchronize, Always ON)	0 (Boiler and heat pump)	ON / ON / ON
			1 (Boiler only)	
			2 (Heater only)	
			3 (Boiler only(P1 OFF))	OFF / ON / ON
		ON (Synchronize)	0 (Boiler and heat pump)	ON / ON / ON
			1 (Boiler only)	
			2 (Heater only)	
			3 (Boiler only(P1 OFF))	OFF / OFF / OFF

Item	Operation flow and applicable data, etc.
8-2. Operation Mode and Control Method	

Related FC

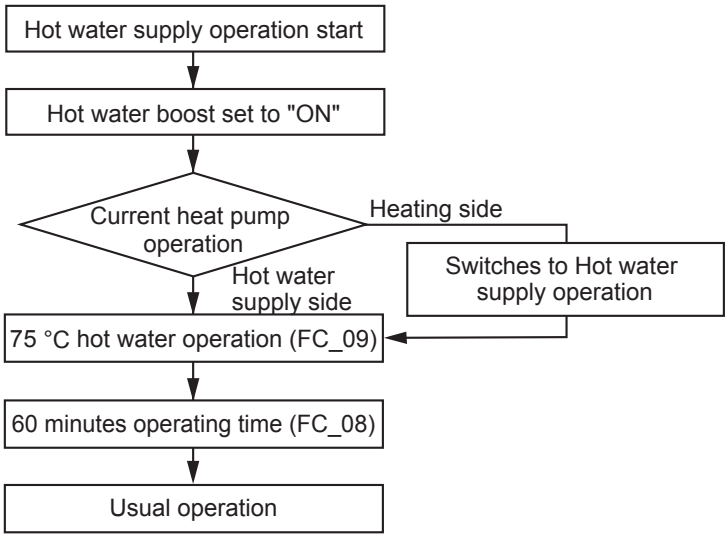
FC No.	Setting item	Default	Variable range
23	Boiler-heat pump switching temperature	-10 °C	-20-20 °C
3E	Control priority between the hydro unit and boiler (Control valid for operating heat pump mode)	0: Hydro unit control	Independent temperature control for the hydro unit and boiler
5B	Coordination of the boiler and heat pump	3: Boiler only (Pump OFF)	0: Boiler and Heat pump 1: Boiler only 2: Heater only
62	Activate/deactivate A02 error detection	0: Activate	1: Deactivate

8) Hot water boost operation

A Hot water boost operation heats the water quickly to the set temperature TSC_H = 75 °C (FC_09).

1) How to operate

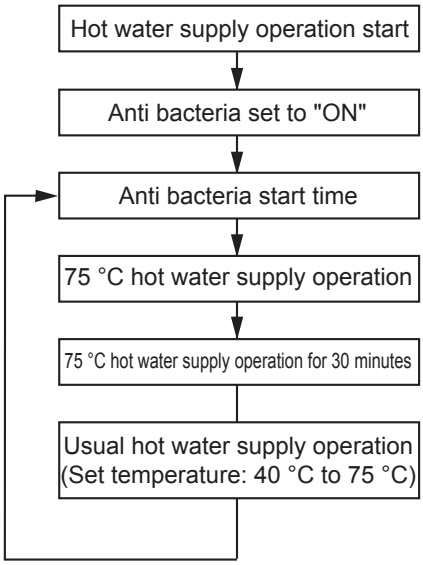
- When setting Hot water boost "ON" after pressing the remote controller [F2] button, a heat pump operation in progress in the heating side switches to in the hot water side, and continues the operation regardless of the hot water supply start condition, TTW < 38 °C. In addition, the hot water cylinder is immediately energized to start a Hot water supply operation under TSC_H = 75 °C.
- A Hot water boost operation returns to the usual operation after 60 minutes passed **or** reached 75 °C.
- <u>The remote controller display during a Hot water boost operation is the same as the set temperature display of a usual Hot water supply operation.</u>
- The usual set temperature change is used for changing the set temperature during a Hot water boost operation. Change the BOOST set temperature with FC_09, if necessary.



Related FC

FC No.	Setting item	Default	Setting available range
09	Hot water boost set temperature	75 °C	40-80 °C
08	Hot water boost operation time	60 min	30-180 min Every 10 min

Item	Operation flow and applicable data, etc.
8-2. Operation Mode and Control Method	9) Anti bacteria operation An Anti bacteria operation regularly performs a Hot water supply operation with the set temperature TSC_H = 75 °C (can be set with FC_0A). 1) How to operate • Pressing the [F2] button and then the remote controller setting Anti bacteria "ON" changes the setting to TSC_H = 75 °C at the set cycle and time (both can be set with the remote controller FC) to start Anti bacteria operation. • The first Anti bacteria operation starts when set Anti bacteria "ON" and starting time come. • When the set temperature 75 °C is reached after the Anti bacteria operation started, the set temperature remains another 30 minutes (can be set with FC_0B). • The priority zone determined by the outside temperature selects an operation, Hot water heat pump or hot water supply heater. • The hot water heat pump operation, when selected, ignores the hot water supply start condition (TTW < 38 °C) and forcibly performs a hot water operation. • During Anti bacteria operation (Forcible hot water operation at 75 °C), the hot water set temperature display is not changed. If it is changed from the remote controller, the normal hot water set temperature will be changed.



⚠ Caution

- During a 75 °C hot water supply operation with Anti bacteria, the remote controller does not display 75 °C.
- Be careful not to burn yourself; Output water may be hotter than that displayed on the remote controller.

Related FC

FC No.	Setting item	Default	Setting available range
0A	Anti bacteria set temperature	75 °C	65-80 °C
0B	Anti bacteria holding time	30 min	0 - 60 min
Remote controller OC	Anti bacteria start time	22:00	0:00-22:00
Remote controller OD	Anti bacteria operation cycle	7 days	Every day to 10 days

Item	Operation flow and applicable data, etc.
8-2. Operation Mode and Control Method	

10) Night setback operation

A Night setback operation performs heating at 5K lower and cooling at 5K higher temperatures against the remote controller set temperature from the setting start time (22:00) to the end time (6:00) every day.

Note) • Set the remote controller time before starting a Night setback operation.
• The set time can be changed with remote controller FC. (See page 98)

Related FC

FC No.	Setting item	Default	Setting available range
Remote controller OE	Night setback start Time setting	22:00	0:00-23:00
Remote controller OF	Night setback end Time setting	6:00	0:00-23:00
26	Night setback setting Temperature width	5 degree	3 -20 degree
58	Night setback setting activate	0. Zone 1 & 2	1. Zone 1 only

11) Frost protection operation

A Frost protection operation performs heating at the set temperature RSC_F = 15 °C (FC).

1) How to operate
- Pressing the remote controller [F1] button and then setting Frost protection "ON" starts a heating operation at the set temperature of 15 °C.
- Setting Frost protection "OFF" cancels the Frost protection operation.
- The remote controller displays "F" as the temperature during Frost protection.
- A set temperature change during a Frost protection operation cancels the operation.

2) Automatic stop of Frost protection operation
- The operation period of Frost protection can be set at FC 12 and 13 on the remote controller.
  Longest period available: 20 days and 23 hours
- By entering the operation period (day and hour) at FC 12 and 13 on the remote controller and setting Frost protection "ON", the operation period is set and the Frost protection operation will automatically be finished after the period has passed.
- The operation period setting (day and hour) is stored in the memory.

Related FC

FC No.	Setting item	Default	Setting available range
3A	Frost protection Yes / No	1: Yes	0: No
3B	Frost protection Set temperature	15 °C	10-20 °C
12 (Remote controller)	FROST running period (days)	0	0-20 days
13 (Remote controller)	FROST running period (hours)	0	0-23hours

Item	Operation flow and applicable data, etc.
8-2. Operation Mode and Control Method	

12) Auto operation

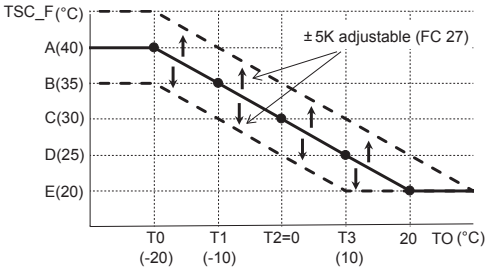
An Auto operation sets the water temperature TSC_F depending on the outside air temperature TO.

1) How to operate

- Pressing the remote controller [F1] button and then setting Auto mode "ON" starts Auto operation for heating.
- During an Auto operation, setting Auto mode "OFF" returns to the usual manual set heating operation.
- The remote controller displays "A" as the temperature during an Auto operation.
  (When 2-temperature control is enabled, the remote controller displays "A".)
- Long-pressing the [F1] button in menu display activates the Auto-Curve FC change mode, enabling the set Auto-Curve water temperature to be shifted by ±5K range (FC_27). When using the auto curve shift function please note the maximum and minimum water temperature at 60 °C and 20 °C respectively.
- Even if the temperature setting is changed during an Auto operation, the operation continues.
- An Auto operation works with a heating operation only, not with a cooling or a hot water supply operation.

<ZONE1>

- An operation starts at the set temperature of straight -line approximation for the following: water temperature A °C with the outside temperature T0 °C, B °C with T1 °C, C °C with T2 °C, D °C with T3 °C, and E °C with 20 °C.



Related FC

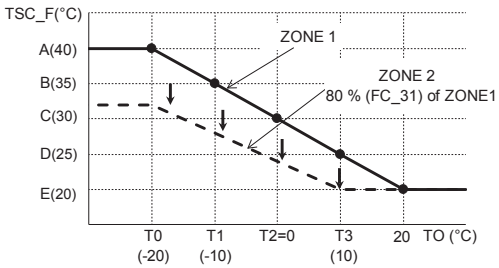
FC No.	Setting item	Default	range
2C	Setting temperature A at T0	40	20~55 °C
2D	Setting temperature B at T1	35	20~55 °C
2E	Setting temperature C at T2 (= 0 °C)	30	20~55 °C
2F	Setting temperature D at T3	25	20~55 °C
30	Setting temperature E at 20 °C	20	20~55 °C
A1	Outside temperature T0	-20	-30~-20 °C
29	Outside temperature T1	-10	-15~0 °C
2B	Outside temperature T3	10	0~15 °C
27	Set temperature shift with heating set to auto	0	-5 to 5K

<ZONE2>

- Set temperature of the ZONE2 can be selected from two methods (FC_A2). One is a percentage of ZONE1, the other is a fixed value.

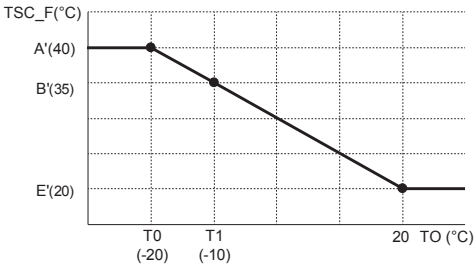
FC_A2 = "0" : Percentage method that is set by FC_31.
FC_A2 = "1" : Fixed value method that is set by FC_A3, A4 and A5.
However, it is automatically controlled the set temperature of ZONE1 to be the ZONE2 or more.

FC_A2=0 Percentage method



Auto-Curve in ZONE2 shows 80% (FC) of that of ZONE1, the water temperature setting does not fall below 20 °C.

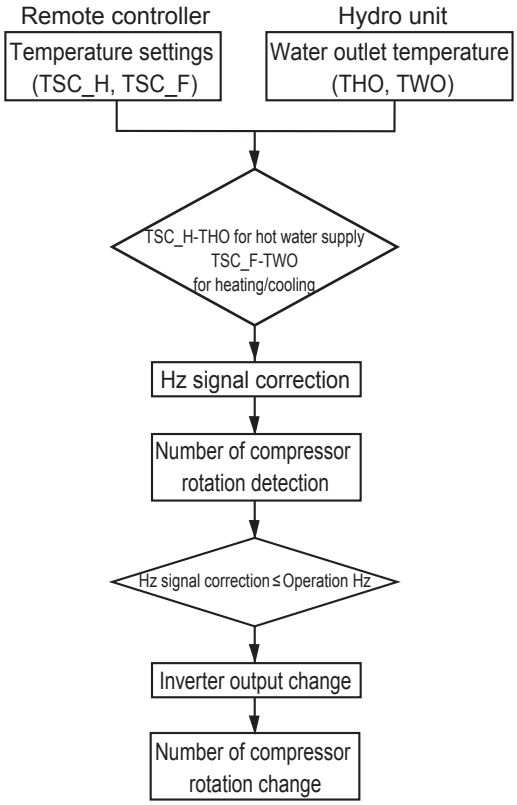
FC_A2=1 Fixed value method



The ZONE2 set temperature A' °C with the outside temperature T0 °C, B' °C with T1 °C, E' °C with 20 °C.

Related FC

FC No.	Setting item	Default	range
A2	The choice of how to set ZONE2	0	0 or 1
A3	Setting temperature A' at T0	40	20~55 °C
A4	Setting temperature B' at T1	35	20~55 °C
A5	Setting temperature E' at 20 °C	20	20~55 °C
31	Auto-Curve ratio of ZONE2	80	0~100%

Item	Operation flow and applicable data, etc.
8-2. Operation Mode and Control Method	13) Night time low-noise operation A night time low-noise operation reduces operation frequency and the number of outdoor fan rotations for a certain period during night time as noise control for urban operation. Maximum operation frequency 60.6 Hz (Hot water supply/Heating) Maximum fan tap 50.4 Hz (Cooling) 750 rpm The night time low-noise operation is enabled / disabled by changing the remote controller FC_09. **<How to set> - Refer to “11. Night time Low-noise Setting” on page 115.** Select "Silent mode" in menu display, and set to "ON".
8-3. Hydro Unit Control	1) Capacity control (compressor, high-temperature release, low-temperature release) This unit controls the compressor frequency and heater output so that the water outlet temperature matches the remote controller set temperature. 1-1) Compressor control • Calculates the different between the remote controller set temperature (TSC_H, TSC_F) and the water outlet temperature (Hot water supply: THO, Heating: TWO). • Sets the Hz signal correction amount that determines the number of compressor rotations by the temperature difference. • Detects the number of compressor rotations. • Compares the Hz signal correction amount and the current operation Hz, and changes the compressor output according to the difference. * The control details are the same for hot water supply, heating, and cooling.  Compressor frequency changeable range 9 Hz to 80 Hz

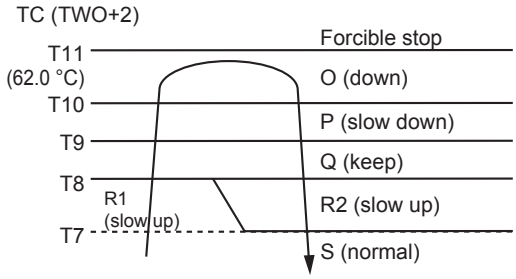
Item	Operation flow and applicable data, etc.
8-3. Hydro Unit Control	

1-2) High temperature release control

A heat pump operation is performed as shown in the table below according to the TC sensor detecting temperature.

- For the detected temperature, TC (= TWO + 2 degree) of a heat pump operation is used. The values of T7 through T10 varies depending on TWI. (See the table below)
- If the compressor frequency instruction from the hydro unit is less then 10 Hz, the compressor stops.
- TC > 62 °C causes the compressor to stop abnormally. When the compressor restarts 140 seconds after the stop and TC > 62 °C is not detected for 20 minutes, the abnormal stop counter is cleared. 10 times of compressor abnormal stop stops the operation of heat pump, and fault code A11 is displayed on the remote controller.

* If the heat pump operation is switched to other operation, the abnormality detection counter is reset to 0.



Zone	Control operation
R1	Increase compressor frequency by 0.8 Hz every 60 sec.
R2	Increase compressor frequency by 0.4 Hz every 60 sec.
O	Decrease compressor frequency by 4.5 Hz every 10 sec.
P	Decrease compressor frequency by 2.4 Hz every 10 sec.
Q	Keep compressor frequency.

TC=TWO+2degree (°C)

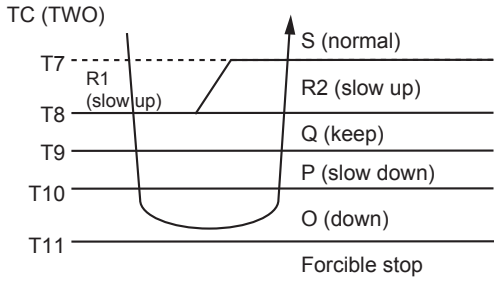
TWI	T7	T8	T9	T10	T11
TWI<30	57.0	59.0	60.0	61.0	62.0
30 ≤ TWI<35	57.0	59.0	60.0	61.0	62.0
35 ≤ TWI<40	56.5	58.5	59.5	60.5	62.0
40 ≤ TWI<45	56.5	58.5	59.5	60.5	62.0
45 ≤ TWI<50	56.0	58.0	59.0	60.0	62.0
50 ≤ TWI	56.0	58.0	59.0	60.0	62.0

1-3) Low temperature release control

A heat pump operation is performed as shown in the table below according to the TC sensor detecting temperature.

- For the detected temperature, TC = TWO of a heat pump operation is used. The values of T7 through T10 varies depending on TWI. (See the table below)
- If the compressor frequency instruction from the hydro unit is less then 10 Hz, the compressor stops.
- TC < 3 °C causes the compressor to stop abnormally. When the compressor restarts when 140 seconds has passed after the stop and TC < 3 °C is not detected for 20 minutes, the abnormal stop counter is cleared. 10 times of compressor abnormal stop stops the operation of heat pump, and fault code A11 is displayed on the remote controller.

* If the heat pump operation is switched to other operation, the abnormality detection counter is reset to 0.

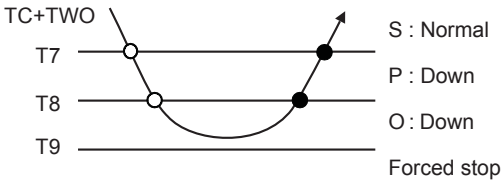


Zone	Control operation
R1	Increase compressor frequency by 0.8 Hz every 60 sec.
R2	Increase compressor frequency by 0.4 Hz every 60 sec.
O	Decrease compressor frequency by 4.5 Hz every 10 sec.
P	Decrease compressor frequency by 2.4 Hz every 10 sec.
Q	Keep compressor frequency.

TC=TWO (°C)

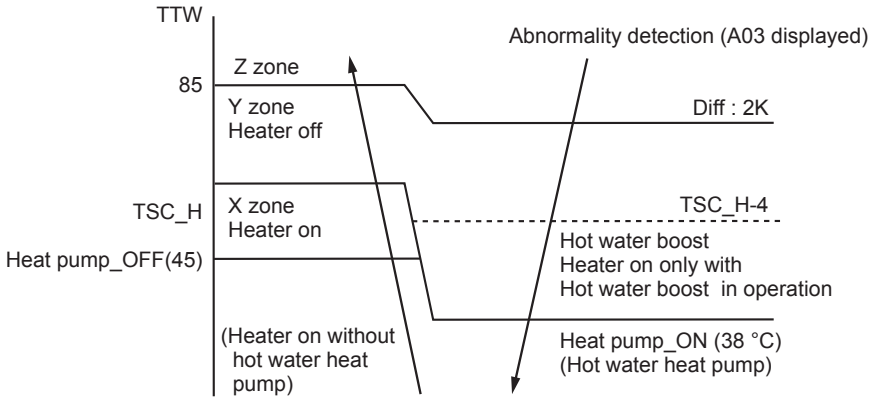
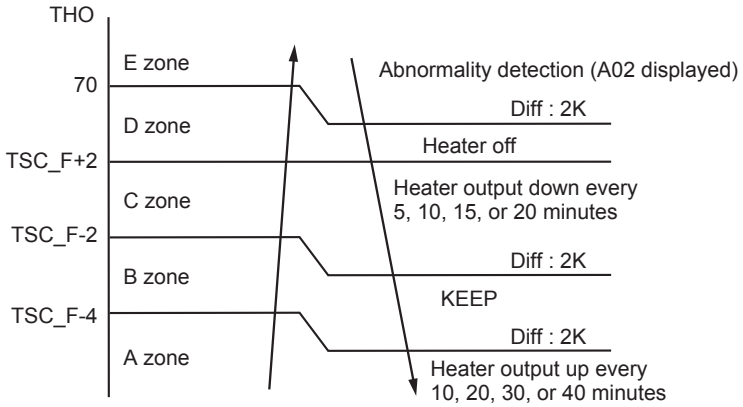
TWI	T7	T8	T9	T10	T11
TWI<10	8.0	6.0	4.0	3.0	2.5
10 ≤ TWI<15	8.5	6.5	4.5	3.4	2.5
15 ≤ TWI<20	9.0	7.0	5.0	4.0	2.5
20 ≤ TWI	9.5	7.5	5.5	4.5	2.5

Item	Operation flow and applicable data, etc.
8-3. Hydro Unit Control	1-4) Freeze release control (TC+TWO release control) For freeze prevention, the compressor is controlled during cooling operation as shown in the table below according to the calculated values of TC and TWO. • If TC + TWO falls below -15 for a total of 10 times, the compressor stops abnormally and fault code A10 is displayed on the remote controller. • When cooling operation has lasted normally for 10 minutes, the abnormality detection counter is reset to 0.



	T7	T8	T9
TC+TWO	6.0	4.0	-15

Zone	Control operation
S (normal)	Normal cooling operation
P (slowdown)	Decrease compressor frequency by approx. 2.0 Hz every 10 sec.
O (down)	Decrease compressor frequency by approx. 4.0 Hz every 10 sec.
(Forced stop)	Stop the compressor.

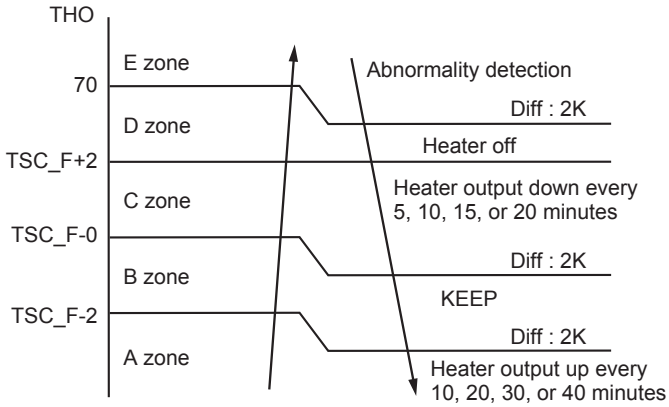
Item	Operation flow and applicable data, etc.
8-3. Hydro Unit Control	2) Heater control 2-1) Hot water supply operation During a hot water heat pump operation, the unit energizes the hot water cylinder heater (2.7 kW) when all the following conditions are met. Note that when the hot water supply set temperature (TSC_F) is reached, the unit stops energizing the heater. • When 30 minutes has passed after the hot water heat pump operation started. • The water inlet temperature (TWI) reaches 50 °C. • The hot water cylinder sensor reaches the HP_OFF temperature (45 °C-FC). • The HP_ON temperature (38 °C-FC) is reached without the hot water HP status. • Hot water boost operation is in progress. 
	2-2) Heating operation 1) Heater control at the time of heat pump operation • Object to be controlled: Backup heater The backup heater control starts when 13 minutes has passed after the heating heat pump operation started and select the ZONE (A-D). The backup heater control increases, decreases, or maintains the number of heaters every 10 minutes (FC) depending on the difference between the heating set temperature (TSC_F) and the heater outlet temperature (THO). When the heating set temperature (TSC_F) is reached, the hydro stops energizing the backup heater.  Status / Heater ON/OFF Heater 1 / Backup-heater 1 3 kW = ON Heater 2 / Backup-heater 2 9 kW = ON HWS-455XWHM3-E model has the backup heater 1 of 3 kW only. • Restriction of backup heater energization during heating mode (For energy saving) When outdoor temperature is higher than the reference valve, the backup heater is forcibly off during heating mode. Related FC FC No. / Setting item / Default / Setting available range B8 / Forcibly heater off at TO ≥ A °C / no restriction / -5 ~ 20 °C

Item	Operation flow and applicable data, etc.
8-3. Hydro Unit Control	

2) Control at the time of heating heater operation

- Controlled Object: Backup heater, Booster heater

The backup heater control starts when 13 minutes has passed after the heating heat pump operation started. The backup heater control increases, decreases, or maintains the number of heaters every 10 minutes (FC) depending on the difference between the heating set temperature (TSC_F) and the heater outlet temperature (THO). Note that when the heating set temperature (TSC_F) is reached, the unit stops energizing the heater.



Status	Heater ON/OFF
Heater 1	Backup heater 3 kW = ON
Heater 2	Heater 1 + Booster heater

The single-phase model of 3 kW has the backup heater 1 only.
Booster heater operation come only output signal. (Booster heater activate under heater only mode)

Related FC

FC No.	Setting item	Default	Setting available range
20	Hot water supply heat pump start temperature	38 °C	20-45 °C
21	Hot water supply heat pump stop temperature	45 °C	40-50 °C
33	Heater control of down time	1:10 min	0:5 min 2:15 min 3:20 min
34	Heater control of up time	0:10 min	1:20 min 2:30 min 3: 40 min

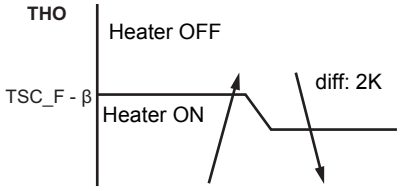
2-3) Heater control at the time of defrosting

- Object to be controlled: Backup heater

When a defrosting operation starts during the heating heat pump operation, the unit energizes a backup heater (3 kW) according to the heater outlet temperature sensor (THO) and the set temperature (TSC_F) as shown in Figure.

1) When the heater outlet temperature sensor (THO) drops to the temperature of 2 °C below the TSC_F-β, the backup heater is energized.
β can be changed for energy saving.

Defrosting ends according to the usual heater control.



Status	Heater ON/OFF
Heater 1	Backup heater 3 kW = ON

Related FC

FC No.	Setting item	Default	Setting available range
B9	β : 0 = 0K, ..., 4 = 40K Recommendation : β = 2 (20K)	0K	0K - 40K

2-4) Forcible heater energization

To prevent freeze, the unit energizes or stops energizing a backup heater (3 kW) regardless of the unit status, not operated or in operation.

- Object to be controlled: Backup heater

1) Energization start condition: TWO < 4 or TWI < 4 or THO < 4
2) Energization stop condition: TWO ≥ 5 and TWI ≥ 5 and THO ≥ 5

Defrosting ends according to the usual heater control.

Item	Operation flow and applicable data, etc.
8-3. Hydro Unit Control	2-5) No heater operation According to the DP_SW11 setting, the unit switches the energize / not energize for the hot water cylinder, backup heater, and booster. For details, see 10-1. (Caution) All heater should be added to this Air to water system. The system has been designed to operate with all electrical heaters energized.

Item	Operation flow and applicable data, etc.
8-3. Hydro Unit Control	

3) Circulation pump control

One circulation pump (external circulation pump P2) can be connected to the unit in addition to the built-in circulation pump P1.

You can change the settings of the built-in circulation pump P1 and the external circulation pump P2 using DP_SW10-1, 2, and 3 in the hydro unit.

Item	Operation	Initial value	DPSW
Circulation pump DPSW10	01: Built-in circulation pump P1's action during hot water supply operation: HP operation only / Always energized	OFF: HP operation only	SW10-1
	02: Built-in circulation pump P1's action during heating operation: Always energized / Turned off when TO sensor detect over than 20 °C.	OFF: Always energized	SW10-2
	03: External circulation pump P2's action: Non-synchronous / Synchronous with the built-in circulation pump P1	OFF: Non-synchronous*2	SW10-3
	04: Built-in circulation pump P1 ON/OFF cycling (During long periods of system off)	OFF: None	SW10-4

If the external circulation pump P2 is set to Non-synchronous, the pump P2 is always energized.

3-1) Controlling the built-in circulation pump P1

Pump type: DC motor, rated voltage 220-230 V, 6 speed (changed manually)

The pump operation starts under the condition below:

- When the [F2] or [F1] button is pressed.

The pump operation stops under the condition below:

- When the [F2] or [F1] button is pressed.
  (Operation will stop fully in about 1 minute.)

FC_code A0	Pump flow rate
0 (Default)	100%
1	90%
2	80%
3	70%
4	60%
5	50%

The pump operation stops/restarts under the conditions shown below.

- When changing operation modes, the pump stops for 30 seconds.

Boiler is installed or not (DPSW13_2)	Boiler position (DPSW02_1)	P1 pump control Stop/restart temperatures (TWI or TWO or THO)
OFF (Not installed)	OFF (After 3-way valve, heating side)	70 °C / 68 °C
	ON (Before 3-way valve)	70 °C / 68 °C
ON (Installed)	OFF (After 3-way valve, heating side)	70 °C / 68 °C
	ON (Before 3-way valve)	58 °C / 55 °C

3-2) Controlling the built-in circulation pump P1 during the hot water supply operation

You can change the action of the built-in circulation pump P1 during the hot water supply operation using DP_SW10-1.

- DP_SW10-1 OFF (Default): The pump stops as the HP for hot water supply stops.
- DP_SW10-1 ON: The pump is always energized.

3-3) Controlling the built-in circulation pump P1 during the heating operation

You can change the action of the built-in circulation pump P1 during the heating operation using DP_SW10-2.

- DP_SW10-2 OFF (Default): The pump is always energized.
- DP_SW10-2 ON : The pump stops when To ≥ 20 °C. (Practically the HP for heating is turned off.)

3-4) Synchronized external circulation pump P2

Pump type: DC motor, rated voltage 220-230 V, connectable directly up to 200W rated power output.

You can select whether the pump P2 is synchronized with the pump P1 using DP_SW10-3. The pump P2 is always energized if the pump P2 is not synchronized.

- DP_SW10-3 OFF (Default): Non-synchronous

NOTE:

2 zone temperature control by boiler with P1 OFF is required DP_SW10-3 OFF

3-5) Controlling the external circulation pump P2

You can change the action of the external circulation pump P2 during cooling operation by setting FC64.

- FC64="00"(Default): The pump is always energized.
- FC64="01" : The pump is always stopped.

Item	Operation flow and applicable data, etc.
8-3. Hydro Unit Control	3-6) Controlling the built-in circulation pump P1 during cooling operation controlled with the room temperature thermostat or room temperature remote controller. You can change the action of the built-in circulation pump P1 by setting FC65. • FC65=”00”(Default): The pump is always energized. • FC65=”01” : The pump is stopped when the thermostat is turned off. 3-7) Interval operation of the pump P1 during thermostat off operation (For energy saving) The pump of the hydro unit performs intermittent operation according to the outdoor temperature during thermostat off (compressor off) operation. **NOTE:** When boiler is installed (DPSW13_2 : ON), do NOT set intermittent operation or do NOT set the valve of A (FC_BA) lower than the Boiler-heat pump switching temperature (FC_23). A, lower limit of To during the heating operation, must be higher than the Boiler-heat pump switching temperature. Because when To is lower than the Boiler-heat pump switching temperature, the boiler output is ON state. But if the pump stops due to the intermittent operation, the boiler output is also turned OFF. Related FC

FC No.	Setting item	Default	Setting value
5A	Control of the pump P1 during the hot water supply operation	0: synchronized with HP	1: Always energized Equal to DPSW10-1
64	Control of the pump P2 during in cooling operation	0: Always ON	1: Always stopped
65	Control of the pump P1 while using the room temperature control or room temperature thermostat	0: Always ON	1: Stopped when the thermostat is OFF
9E	Turn off the P1 when TO sensor detect over than this temperature	0: 20 °C	10~30 °C
6E	Pump P1 restart diff TO sensor temperature, when turn off the P1 by to sensor detection.	2: 2K	1~5K
BA	intermittent operation at TO ≥ A °C (heating)	0: continuous operation	-5 ~ 20 °C
BB	intermittent operation at TO < B °C (cooling)	0: continuous operation	25 ~ 35 °C

Item	Operation flow and applicable data, etc.
8-3. Hydro Unit Control	

4) Control by the flow switch

Whether water flows or not is judged with the ON/OFF of the flow switch.

Model	Determined that water flows when:	Determined that water does not flow when:
HWS-455XWHM3-E	10L or more water flows per minute	Water less than 10L flows per minute

Without water-flow determination from the flow switch after the hot water supply operation, heating operation, or cooling operation, The HP, backup heater and booster heater are not energized. Similarly, The “A01” error indication flashes if the flow switch judged that water does not flow.

The specification of the flow switch is the same in 804**-E1 and 1404**-E1. The flow setting differs due to the specification of piping in the hydro unit.

5) Mixing Valve control (2-temperature heating control)

To set different radiator unit supply temperatures or floor heating supply temperatures, the unit performs Mixing Valve control.

When Mixing Valve "Yes" is selected, the unit controls Mixing Valve every 4 minutes (FC) based on the difference TSC_ΔT between the Zone2 set temperature and TFI (floor inlet water temperature sensor) temperature as follows:

TSC_ΔT	2 ≤ TSC_ΔT	-2 ≤ TSC_ΔT < 2	-2 > TSC_ΔT
Control value	+ 1 step (Open)	± 0 step	- 1 step (Close)

Initial value	Driving range	1 step	Control cycle
6	0-12	3 WV move 7.5 degrees	4 min (FC)

To enable 2 zone temperature control switch DP_SW12-3 to ON.

NOTE:

The mixing valve will automatically be reset if 24 hours pass with the valve fully closed.

2 zone temperature control by boiler with P1 OFF is required DP_SW10-3 OFF.

Related FC

FC No.	Setting item	Default	Setting available range
0C	Mixing Valve operation time	60	30 - 240 sec
59	Mixing Valve control time	4	1 - 30 min

6) Room temperature control

You can install a sub remote controller (separately purchased) in a room to control room temperature.

6-1) Installing the sub remote controller

- Wiring with the main unit (See the figure on the right) : After detaching the front panel, connect the sub remote controller to the right terminal on the main remote controller, which is connected with the hydro unit. (No polarity)
- Place to install (inside a room): At the height of 100 cm-150 cm on a wall Opposite to the radiator or fan coil installed
  No assignment when floor heating is used on the room.

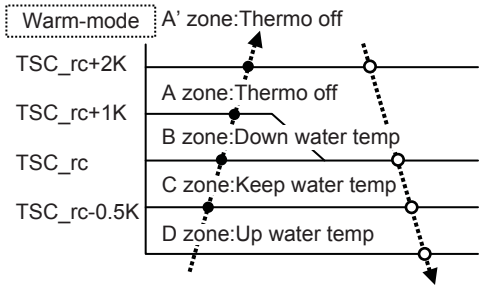
6-2) Room temperature control settings

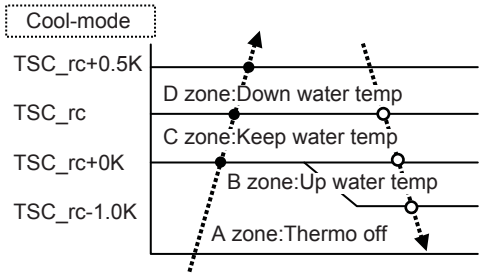
- Function code setting:FC_40=“1”
- Setting of the remote controller Temperature control “ON”.
  (Setting → Initial setting → Temperature control)

Item	Operation flow and applicable data, etc.
8-3. Hydro Unit Control	

6-3) Control method

- The water temperature setting at starting operation is 40 °C (FC_9D) at heating and 20 °C (FC_96) at cooling. If the temperature setting calculated by Auto curve at starting operation is used instead of the fixed temperature 40 °C (FC_9D), FC_B5 should be set to “1”.
- The target water outlet temperature is adjusted by 1deg every 30 minutes based on the TSC_rc, the temperature setting on the remote controller, and the room temperature (temperature indicated on the remote controller: T_rc). The adjustable range of water temperature is set with FC18-1B.
- <u>The temperature set on the remote controller and actual room temperature may differ depending on the place of the remote controller or room space. In that case, adjust temperature detection using FC02 (for heating) and FC03 (for cooling) on the remote controller.</u>





<u>How to shift up/down the temperature by remote controller FC02, 03</u>

- Ambient temperature (remote controller) is higher than room temperature: example. 1deg
  Change remote controller FC02, 03 = “-1K” to “-2K”
- Ambient temperature (remote controller) is lower than room temperature: example. 1deg
  Change remote controller FC02, 03 = “-1K” to “0”

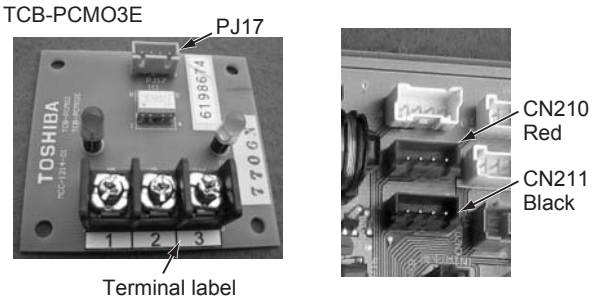
T_rc	Correction control	
	Heating	Cooling
D zone	Setting is corrected upward Water temperature setting is up by 1deg every 30 minutes.	Setting is corrected upward Water temperature setting is down by 1deg every 30 minutes.
C zone	No correction	No correction
B zone	Setting is corrected downward. Water temperature setting is down by 1deg every 30 minutes.	Setting is corrected downward. Water temperature setting is down by 1deg every 30 minutes.
A zone	Thermo off. But if inlet water detect less 25 °C, then heat pump restart.	Thermo off
A’ zone	Setting is corrected downward. Water temperature setting is down by 1deg every 39 minutes.	
	Thermo off	

Related FC

FC No.	Setting item	Default	Variable range
18	Upper limit of cooling temperature setting	25	18-25 °C
19	Lower limit of cooling temperature setting	7	7-18 °C
1A	Upper limit of heating temperature setting (Zone 1)	55	37-55 °C
1B	Lower limit of heating temperature setting (Zone 1)	20	20-37 °C
40	Room temperature control	0	0:Not permitted 1:Permitted
96	Initial water temperature setting when controlling cooling by the room temperature remote controller and room temperature thermostat	20	10-25 °C
9D	Initial water temperature setting when controlling heating by the room temperature remote controller and room temperature thermostat	40	20-55 °C
02 (Remote controller)	Room temperature correction (at heating)	-1	-10K - +10K, 1K step
03 (Remote controller)	Room temperature correction (at cooling)	-1	-10K - +10K, 1K step
B2	Heat pump restart water condition in A zone.	25	20-37 °C
B5	Choose of the initial setting temperature. Either use the temperature set in FC_9D, or use the temperature calculated by Auto curve. This applies heating operation only.	0	0 : Use the temperature set in FC_9D 1 : Use the temperature calculated by Auto curve

Item	Operation flow and applicable data, etc.
8-3. Hydro Unit Control	7) Room temperature control with the thermostat You can install a commercially available thermostat to control room temperature. 7-1) Installing the room temperature thermostat • TCB-PCM03E optional PC board is required. Connect its connection cable to CN211 port on the PC board of the hydro unit. • Wiring to the main unit: connect the optional PC board TCB-PCM03E to the hydro unit after detaching the front panel. Thermostat for heating : Connect TCB-PCM03E between the terminals (1) and (3). Thermostat for cooling : Connect TCB-PCM03E between the terminals (2) and (3). • Place to install (inside a room): At the height of 120 cm-180 cm on a wall Opposite to the radiator or fan coil installed No assignment when floor heating is used on the room.

7-2) Room temperature thermostat control setting
- Setting of DPSW on the hydro unit
  :DP_SW02_4="ON" (Default "OFF")



7-3)Heating thermostat operation

When the heating thermostat does not reach the assigned temperature (the circuit between (1) and (3) is closed), heating starts under the setting that water temperature for heating is 40 °C (FC_9D). If the heating thermostat has not reached the assigned temperature 30 minutes after heating had started, the water temperature setting is turned up 1 degree, and the same action will be repeated every 30 minutes until the thermostat reaches the assigned temperature. The backup heater and booster heater are controlled in the same way as in the normal HP operation.

When the heating thermostat reaches the assigned temperature (the circuit between (1) and (3) is open), the heat pump shifts to the "thermostat off" operation. During the operation, the water temperature setting is turned down by 1 degree every 30 minutes. The backup heater and booster heater are tuned off as the heat pump shifts to the "thermostat off" operation.

7-4)Cooling thermostat operation

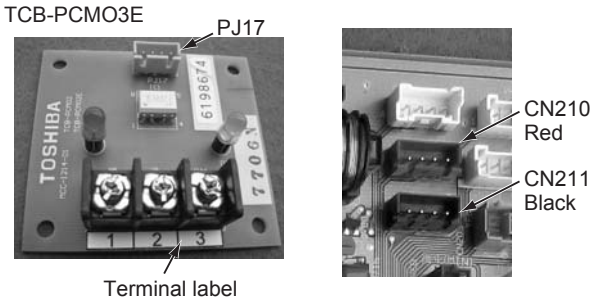
When the cooling thermostat does not reach the assigned temperature (the circuit between (2) and (3) is open), cooling starts under the setting that water temperature fro cooling is 20 °C (FC_96). If the cooling thermostat has not reached the assigned temperature 30 minutes after cooling had started, the water temperature setting is turned down 1 degree, and the same action will be repeated every 30 minutes until the thermostat reaches the assigned temperature.

When the cooling thermostat reaches the assigned temperature (the circuit between (2) and (3) is closed), operation shifts to the "thermostat off" operation. During the operation, the water temperature setting is turned up by 1 degree every 30 minutes.

Room thermostat	Correction control	Heating operation	Cooling operation
CLOSE	Setting is corrected upward	Thermo on The water temperature setting is turned up by 1 degree every 30 minutes.	Thermo off The water temperature setting is turned up by 1 degree every 30 minutes.
OPEN	Setting is corrected downward.	Thermo off The water temperature setting is turned down by 1 degree every 30 minutes.	Thermo on The water temperature setting is turned down by 1 degree every 30 minutes.

Related FC

FC No.	Setting item	Default	Variable range
9D	Initial water temperature setting when controlling heating by the room temperature remote controller and room temperature thermostat.	40	20-55 °C
96	Initial water temperature setting when controlling cooling by the room temperature remote controller and room temperature thermostat.	20	10-25 °C
B5	Choose of the initial setting temperature. Either use the temperature set in FC_9D, or use the temperature calculated by Auto curve. This applies heating operation only.	0	0 : Use the temperature set in FC_9D 1 : Use the temperature calculated by Auto curve

Item	Operation flow and applicable data, etc.
8-3. Hydro Unit Control	8) Hot water cylinder thermostat control Hot water can be supplied using an existing hot-water cylinder with a thermostat. 8-1) Installing the hot-water cylinder thermostat • Optional board : TCB-PCM03E optional PC board is required. Connect its connection cable to CN210 port on the PC board of the hydro unit. • Wiring with the main unit : After detaching the front panel, install TCB-PCM03E optional PC board in the hydro unit. Hot-water cylinder heating thermostat : Connect this thermostat between (1) and (2) on TCB-PCM03E. • Place to install the thermostat (hot-water cylinder) : At a height of 30 to 50 cm from the base. • Hot-water heater : A hot-water heater is required. (Without a hot-water heater, the hydro unit will not work.) 8-2) Setting the hot-water cylinder thermostat Setting of DPSW on the hydro unit : DP_SW02_3 = “ON” (Default “OFF”)  8-3) Hot-water thermostat operation (hot-water supply operation only) If hot water is used when the hot-water thermostat is at the assigned temperature (the circuit between (1) and (2) is open), the hot-water heat pump starts with the hot-water thermostat closed. After 30 minutes, the hot-water cylinder heater turns on, but the hot-water heat pump continues running until the hot-water cylinder thermostat becomes open. It should be noted, however, that the hot-water heat pump might stop if the water input temperature becomes high. 8-4) Hot-water thermostat operation (hot-water supply + heating operation) If hot water is used when the hot-water thermostat is at the assigned temperature (the circuit between (1) and (2) is open), the hot-water heat pump starts with the hot-water thermostat closed. In 30 minutes, the hot-water heat pump stops. After that, only the hot-water cylinder heater is used to raise water temperature. The heat pump switches to heating operation. Unless the hot-water cylinder thermostat temperature rises, the hot-water heat pump will never take over. 8-5) Hot-water thermostat operation (hot-water supply + cooling operation) For automatic switching to hot-water supply plus cooling operation, FC-0F is required. If hot water is used when the hot-water thermostat is at the assigned temperature (the circuit between (1) and (2) is open), the hot-water heat pump starts with the hot-water thermostat closed. In 30 minutes, the hot-water heat pump stops. After that, only the hot-water cylinder heater is used to raise water temperature. The heat pump switches to cooling operation. Unless the hot-water cylinder thermostat temperature rises, the hot-water heat pump will never take over. Related FC

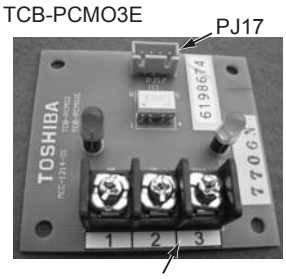
FC No.	Setting item	Default	Setting value
0F	Hot water HP allowance while cooling + hot water supply	0:Not allow	1:Allow

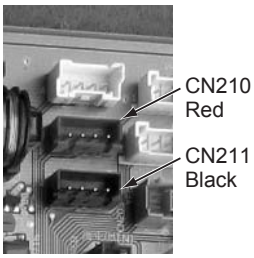
Item	Operation flow and applicable data, etc.
8-3. Hydro Unit Control	

9) Control of force stop and restart

The unit can be stopped and restarted with external input. By setting FC52, FC61 and FCB6, you can set an operation mode to run/stop or can run/stop the unit in the mode assigned on the remote controller.

- TCB-PCM03E optional PC board is required. Connect its connection cable to CN210 port on the PC board of the hydro unit.





9-1)Setting the control method

Select a control method by setting FC52.

- FC52=”0”:Stops ESTIA as the circuit between the terminals (1) and (3) is closed. (Default)
- FC52=”1”:Stops ESTIA as the circuit between the terminals (1) and (3) is opened.
- FC52=”2”: Starts ESTIA as the circuit between the terminals (1) and (3) is closed.
  Stops ESTIA as the circuit between the terminals (1) and (3) is closed.
- FC52=”3”:Starts/Stops ESTIA as the circuit between the terminals (1) and (3) is received closed plus.

9-2)Setting the object to control

Select an operation mode by setting FC61.

- FC61=”0”:Hot water supply and heating (Default)
- FC61=”1”:Follows the setting on the remote controller (If the hot water supply operation, heating operation, or hot water supply + heating operation is started manually after the unit was stopped with an external input, the new status is reflected to the setting on the remote controller.)
- FC61=”2”:Hot water supply only
- FC61=”3”:Heating only

It is possible to control each of the heating and hot water supply with the following settings:

- FCB6=“1” (Default “0”) and FC61=“3” and DP_SW02_3=“OFF” (Default “OFF”)
  The terminals (1) and (3) is the heating control.
  The terminals (2) and (3) is the hot water supply control.
  Both of control method is selected by FC52.

9-3)Cautions

The circuit between the external input terminals (1) and (3) is also used to control the limit of heat pump operation. You cannot use the forced stop control when the circuit is configured to control the limit of heat pump operation. (See page 55)

9-4)Setting example

- When you want to turn on/off the unit with static external input reflecting the operation setting on the remote controller (hot water supply, heating, or hot water supply and heating).
  FC52=”2”, FC61=”1”

○ RC on condition
× RC off condition

	FC61=1 & FC52=2				
		Operation pattern			
Operation status 1	Heating	○	○	×	×
	Hot water	○	×	○	×
	↓ open signal input				
Operation status 2	Heating	×	×	×	×
	Hot water	×	×	×	×
	↓ close signal input				
Operation status 3	Heating	○	○	×	×
	Hot water	○	×	○	×
	↓ open signal input				
Operation status 4	Heating	×	×	×	×
	Hot water	×	×	×	×

Manually ON/OFF change by remote controller

close signal input

Item	Operation flow and applicable data, etc.
8-3. Hydro Unit Control	

Basic operation logic

There are 4 operation combination pattern for Heating & Hot water
When open signal is input, the operation status change to the next status.
For example, if current operation status is heating ON and hot water OFF, then next status to be heating OFF & hot water OFF when pulse is input Hydro unit memorize the status of the operation pattern before changing OFF status by close signal.
If pulse is input at operation status 2, the operation pattern in the status 3 is same pattern in the status 1.

Manually ON/OFF

If customer change operation pattern manually by remote controller, change then operation pattern will not be same as the basic logic.

1. If customer stop operation (Heating off and hot water off) by the controller, then both heating& hot water are <u>not to be ON with close or open signal</u>.
2. If the unit is stopped (Heating off and hot water off) by open signal, operation pattern will be referred to the pattern before the unit OFF by close signal.

- When you want to turn on/off with the pulse input reflecting the operation setting on the remote controller (hot water supply, heating, or hot water supply and heating).
  FC52=”3”, FC61=”1”

○ RC on condition
× RC off condition

	FC61=1 & FC52=3				
		Operation pattern			
Operation status 1	Heating	○	○	×	×
	Hot water	○	×	○	×
↓ Pulse input					
Operation status 2	Heating	×	×	×	○
	Hot water	×	×	×	○
↓ Pulse input					
Operation status 3	Heating	○	○	×	×
	Hot water	○	×	○	×
↓ Pulse input					
Operation status 4	Heating	×	×	×	○
	Hot water	×	×	×	○

Manually ON/OFF change by remote controller

Pulse input

There are 4 operation combination pattern for Heating & Hot water
When pulse signal is input, the operation status change to the next status.
For example, if current operation status is heating ON and hot water OFF, then next status to be heating OFF & hot water OFF when pulse is input Hydro unit memorize the status of the operation pattern before changing OFF status by pulse signal.
If pulse is input at operation status 2, the operation pattern in the status 3 is same pattern in the status 1.

If customer change operation pattern manually by remote controller, then operation pattern will not be same as the basic logic.

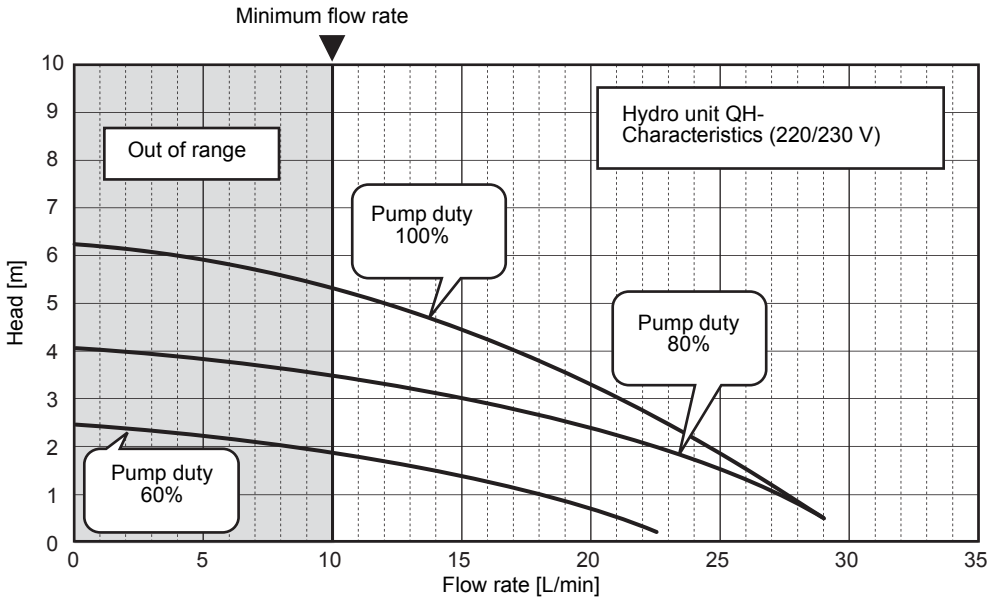
1. If customer stop operation (Heating off and hot water off) by the controller, then both heating& hot water <u>to be ON with pulse input</u>.
2. If the unit is stopped (Heating off and hot water off) by pulse input, operation pattern will be referred to the pattern before the unit OFF by pulse.

Related FC

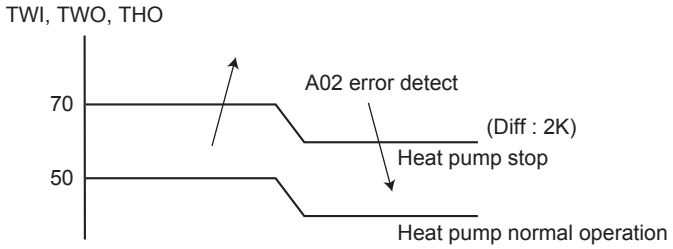
FC No.	Setting item	Default	Setting value
52	Control method	0	See page 97
61	Object to control	0	See page 97

Item	Operation flow and applicable data, etc.
8-3. Hydro Unit Control	10) Control of limit of heat pump operation When the peak period of electric power charge is set due to the contract or other conditions, you can limit heat pump operation and give priority to boiler operation using an external input signal. (This control functions only during the period the signal is input.) • TCB-PCM03E optional board is required. Connect its connection cable to CN210 port on the PC board of the hydro unit. TCB-PCMO3E PJ17 Terminal label CN210 Red CN211 Black 10-1)Setting the control method Select an operation mode by setting FC61. • FC61=”4”:Hot water cylinder heater = OFF, backup heater = OFF (Built-in circulation pump is ON.) • FC61=”5”:Hot water cylinder heater = OFF, backup heater = OFF, heat pump = OFF, Built-in circulation pump is stopped. 10-2)Control summary When the TEMPO signal is input (the circuit is closed), the boiler signal is output regardless the outside temperature and devices are turned off following the setting on FC61. 1. Basic operation: heating operation using the boiler 2. Switching to hot water supply: the water circuit is switched to the hot water supply side as the unit detect that TTW is less than 38 °C. 3. Switching to heating: the water circuit is switched to the heating side as the unit detect that TTW is 45 °C or more, or 30 minutes has passed since operation started. Heating operation continues at least 30 minutes. 4. The LED on the PC board lights up when the input signal is ON.
	11)Output signal control 1 (TCB-PCIN3E optional PC board is required. Connect its connection cable to the CN208 terminal on the PC board in the hydro unit.) • The circuit between the terminals (1) and (2) gets closed as an error detection signal is output. • The circuit between the terminals (3) and (4) gets closed as a boiler signal is output. The LED on the PC board lights up when the signals are output. 12)Output signal control 2 (TCB-PCIN3E optional PC board is required. Connect its connection cable to the CN209 terminal on the PC board in the hydro unit.) < FC67=”0”: Default > • The circuit between the terminals (1) and (2) is closed during defrosting. • The circuit between the terminal (3) and (4) is closed while the compressor is running. < FC67=”1” > • The circuit between the terminals (1) and (2) gets closed as an error is detected. • The circuit between the terminals (3) and (4) is closed during operation (when the remote controller is ON) The LED on the PC board lights up when the signals are output. TCB-PCIN3E PJ20 Terminal label CN208 Blue CN209 Green Related FC

FC No.	Setting item	Default	Setting value
67	Changing the condition of optional output (For the optional PC board connected to CN209)	0: 1-2 During defrosting 2-4 While compressor is running.	1: 1-2 As error is detected 2-4 During operation

Item	Operation flow and applicable data, etc.
8-3. Hydro Unit Control	13) Q-H characteristics of hydro unit The following shows the Q-H characteristics. 13-1)HWS-455XWHM3-E Hydraulic heat exchanger (4.5 kW) QH characteristics 

Item	Operation flow and applicable data, etc.
8-3. Hydro Unit Control	14) Automatic restart control The unit records operation information before a power outage and retrieves the information after the power is restored to restart automatically the operation with the information. 14-1)Operation during remote controller • The operation status before a power outage automatically restarts after the power is restored. (The merit functions are also enabled) • Approximately 6 hours or more after a power outage The operation status before a power outage automatically restarts after the power is restored. But the merit functions (Night setback, Anti bacteria) are disabled. The remote controller time displays "00:00". (The merit functions are disabled) 14-2)Operation during forcible automatic operation A forcible automatic operation is performed when the power is restored after a power outage. 14-3) Operation during defrosting operation When the power is restored after a power outage, the usual operation restarts. Note: The operation details recorded before a power outage Operation mode: Hot water supply, Heating, Cooling, Hot water supply + Heating, Hot water supply + Cooling Set temperature: Hot water set temperature, Heating set temperature, Cooling set temperature Merit function: Hot water supply operation (Anti bacteria) Heating operation (Night setback)
	15) Piping freeze prevention control This control operates when the power is on regardless the remote controller setting ON or OFF. To prevent frost bursting of the water piping for hot water supply and heating, the unit flows water with the circulation pump when the temperature sensor value falls below a certain temperature. 15-1)Piping freeze prevention control 1 1) Start condition: TWO < 4 °C or THWI < 4 °C or THO < 4 °C 2) End condition: TWO ≥ 5 °C and TWI ≥ 5 °C and THO ≥ 5 °C 3)-1 How to operate (circulation pump) • When the circulation pump is not in operation, if the sensor detects the freeze prevention control start temperature, the unit operate the circulation pump. • During a freeze prevention operation, a heat pump operation does not start. • When neither Hot water supply nor heating/cooling is in operation, if the end condition is not met when 3 minutes has passed after an operation starts, the unit performs the operation in 3)-2 to prevent freeze. 3)-2 How to operate (circulation pump + backup heater) • When neither Hot water supply nor heating/cooling is in operation, if the end condition is not met when 3 minutes has passed after an operation starts. • End condition: TWO ≥ 5 °C and TWI ≥ 5 °C and THO ≥ 5 °C • Heating with the set temperature 55 °C operates. 3)-3 Abnormal stop • If a freeze prevention operation continues for 30 minutes and does not meet the end condition, the operation stops as abnormal stop. (Remote controller check code: A05) 15-2)Piping freeze prevention control 2 TC and TWO activates freeze prevention regardless of a heat pump operation mode. 1) Determination condition: TWO>20 °C. 2*TC+TWO<-12 °C is continuously detected for 180 seconds or longer. Or TWO ≤ 20 °C. TC+TWO<4 °C is continuously detected for 180 seconds or longer. 2) Determination cancellation conditions • The stop or operation mode is changed by the remote controller • The mode is defrosting at the time of determination At the next time of defrosting, the start condition is not met. • The mode is other than defrosting at the time of determination After cooling, heating, hot water heat pump restarts, the start condition is not met for 10 minutes. 3) Error display • If freeze determination cancellation condition is not met, A04 error is displayed. 15-3)Piping freeze prevention control 3 This control applies only when defrosting is in operation. 1) Determination condition: During defrosting, TWI ≤ 15 °C is continuously detected for 30 seconds or longer (After the stop, the unit restarts.) 2) Determination cancellation condition • At the next time of defrosting, the start condition is not met. 3) Error display • If freeze determination cancellation condition is not met, A04 error is displayed.

<table>
<tr><th>Item</th><th>Operation flow and applicable data, etc.</th></tr>
<tr><td rowspan="2">8-3.
Hydro Unit Control</td><td>15-4)Piping freeze prevention control 4
When the value of Ps sensor is low, freeze prevention is activated regardless of a heat pump operation mode.
1) Determination condition: Low pressure sensor detects PS < 0.2 MPa and 90 seconds passes (defrosting and cooling) (During a defrosting operation for cooling and heating, or hot water supply)
Low pressure sensor detects PS < 0.2 MPa and 10 minutes passes (heating and hot water supply operation)
2) Determination cancellation condition
• After a restart, the start condition is not met for 180 minutes.
• At the next time of defrosting, the start condition is not met. (Defrosting operation for heating or hot water supply)
3) Error display
• If freeze determination cancellation condition is not met, A08 error is displayed.</td></tr>
<tr><td>16) High return water protect control
The hydro unit protects against high return water which made by separate boiler system.
 

When A02 error appeared, the built-in circulation pump will stop.

Related FC
<table>
<tr><th>FC No.</th><th>Setting item</th><th>Default</th><th>Setting available range</th></tr>
<tr><td>62</td><td>Activate/deactivate A02 error detection</td><td>0: Activate</td><td>1: Deactivate</td></tr>
</table>
This FC62 function is valid when DP_SW13-2 is ON. (See 10.1-1. Setting switch names and positions)</td></tr>
</table>

9 Method of defect diagnosis

In order to diagnose the defective part of the heat pump system, first understand the symptom of the defect.
(1) Check the operation status. (It does not move, or it moves but stops, etc.)
(2) Flashing display on the display part of the hydro unit.
(3) Check the “check code” by the remote controller.

Please refer to the following procedure of defect diagnosis for the identification.

No.	Procedure of defect diagnosis		Remark
9-1	Matters to be confirmed first	9-1-1. Check the power supply voltage 9-1-2. Check for any miswiring of the connection cables between the hydro unit and the outdoor unit 9-1-3. About the installation of the temperature sensor	Check the power supply for the heat pump hot water heater, the crossover between the hydro unit and the outdoor unit, and the installation of temperature sensors.
9-2	Non-defective operation (program operation)		Non-defective program operations for the protection of the heat pump unit.
9-3	Outline of the determination diagram	9-3-1. Procedure of defect diagnosis 9-3-2. How to determine from the check code on the remote controller 9-3-3. How to cancel a check code on the remote controller 9-3-4. How to diagnose by error code	With reference to the "check code", roughly identify the defect from the defect diagnosis for the heat pump hot water heater and determine the defective part from individual symptoms.
9-4	Diagnosis flow chart for each error code	9-4-1. Hydro unit failure detection 9-4-2. Temperature sensor, temperature-resistance characteristic table	
9-5	Operation check by PC board	9-5-1. Operation check mode	The operation check mode allows to determine good or not by checking the operation of the 4-way valve, 2-way valve and pulse motor valve.
9-6	Brief method for checking the key components	9-6-1. Hydro unit	How to determine the presence of any defect particularly in functional parts.

9-1. Matters to be confirmed first

9-1-1. Check the power supply voltage

Check that the power supply voltage is AC220-230 V± 10% (signal phase type). If the power supply voltage is not in this range, it may not operate normally.

9-1-2. Check for any miswiring of the connection cables between the hydro unit and the outdoor unit

The hydro unit and the outdoor unit are connected with three connection cables. Make sure the interconnecting connections between the hydro unit and the outdoor unit terminal blocks are connected to the correct terminal numbers. If not connected correctly, the heat pump system does not operate. However, a miswiring would not cause damage to the equipment.

9-1-3. About the installation of the temperature sensor

If each sensor is removed due to the replacement of the water heat exchange or inverter board, or the replacement of the refrigeration cycle parts, make sure to put the sensor back to the position where it was before.

- Each sensor position has a marking. Make sure to put it back to the exact position.
- Make sure to install it with a sensor holder so that the temperature sensing part of the sensor and the straight part of the copper piping are attached with each other tightly.
- If the installation of the sensor is incomplete or the installed position is wrong, it will not perform a normal control operation and may cause a defect such as a malfunction of the equipment or an occurrence of an abnormal sound, etc.

9-2. Non-defective operation (program operation) … No fault code display appears.

In order to control the heat pump unit, there are the following operations as the built-in program operations in the microcomputer. If a claim occurs about the operation, please confirm whether it falls under any of the contents in the following table.
If it does, please understand that the symptom is not a defect of the equipment, and it is an operation necessary for the control and maintenance of the heat pump unit.

Table 9-2-1 Non-defective operation

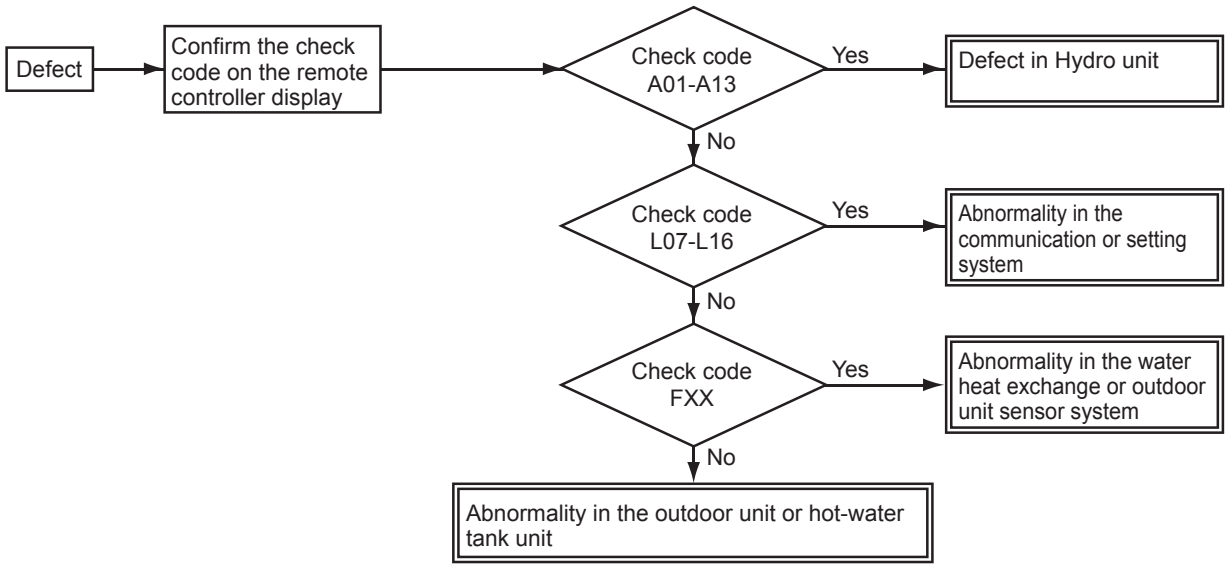
No.	Operation of the heat pump system	Explanation
1	The compressor sometimes does not operate even within the range of compressor “ON”.	The compressor does not operate during the operation of the compressor reboot timer (3 min). Even after the power activation, the compressor reboot timer continues to be active.
2	During the hot water supply or heating operation, without reaching the set temperature, the compressor operation frequency stays at a frequency of less than the maximum Hz or lowers down.	It may be caused by the high temperature release control (release protection control by the temperature of the water heat exchanger) or the current release control.
3	The “Stop” operation on the remote controller will not stop the circulation pump. (The same for hot water supply, heating and cooling)	In order to deal with the temperature increase in the heat exchanger after stopping, the operation continues for 1 min after the compressor is stopped.
4	“ON” on the remote controller will not operate the compressor. (It will not operate even after the reboot delay timer elapsed)	When the outdoor temperature (TO sensor detection temperature) is -20 °C or lower, the heat pump will not operate in order to protect the compressor, and the heater will operate instead.
5	When the power is turned on, it starts operation without operating the remote controller.	• The auto restart operation may be working. • The antifreeze operation may be working. • If the TWI, TWO or THO sensor detects a temperature below 4 °C, the operation changes from circulation pump --->> circulation pump + heater.)

9-3. Outline of the determination diagram

The first determination of whether a defective part is in the hydro unit or the outdoor unit can be performed by the following method.

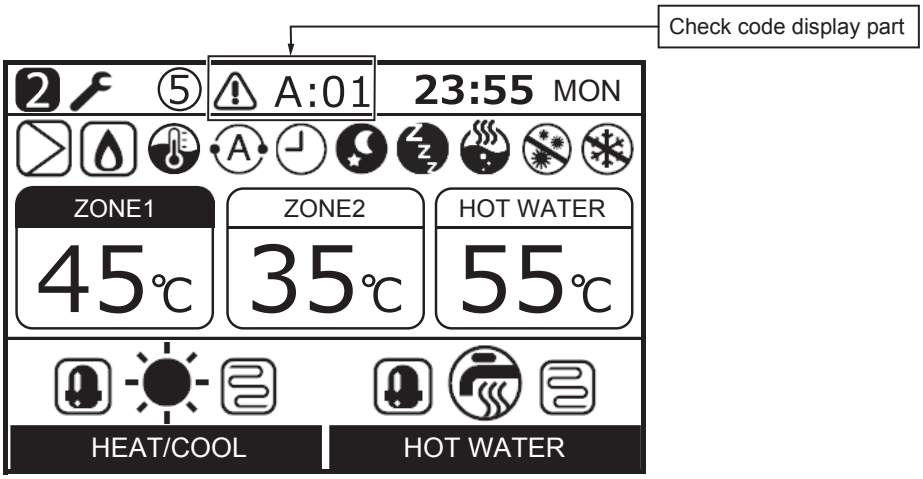
9-3-1. Procedure of defect diagnosis

In the case of a defect, please apply the following procedure in order to find the defective part.



9-3-2. How to determine from the check code on the remote controller

If the defect is limited by the check code displayed on the remote controller, please repair the defect based on the table on the next page.
The check codes are separated into two groups: software and hardware errors.
Since a hardware error cannot be cancelled without a part replacement etc., please perform a repair.
If its abnormality is determined, the abnormality is noticed by indicating the check code on the remote controller check code display part while sounding off a buzzer.



9-3-3. How to cancel a check code on the remote controller

Press [F1] or [F2] button (on the operation side) to clear the check code.

Although the above procedure cancels the check code, the hardware error will be displayed again until the hardware repair is completed.

9-3-4. How to diagnose by error code

Defect mode detected by the water heat exchange

O ... Possible
× .... Not possible

Check code	Diagnostic functional operation			Determination and action	Number of abnormalities for confirmation	Detailed item
	Operational cause	Backup operation	Automatic reset			
A01	**Pump or flowing quantity error** 1) Detected by TC sensor TC≥63 °C is detected in the heating or hot water supply heat pump operation (except for defrosting).	Heating × Hot water O	×	1. Almost no or little water flow. • Not enough vent air • Dirt clogging in the water piping system. • The water piping is too long. • Installation of buffer tank and secondary pump	4	70
	2) Detected by flow switch abnormality When no signal of the flow switch is showing 2 min after the built-in circulation pump operation started.				8	70
	3) Detection of chattering abnormality in the flow switch input Chattering detection: Detects input changes (OFF⇔ON) 4 times within 10 seconds during operation.				8	70
	4) Disconnection of the flow switch connector When the stopped built-in circulation pump starts its operation, the flow switch status is detecting "water flow".			1. Disconnection of the flow switch connector. 2. Defect of the flow switch.	2	70
A02	**Temperature increase error** (heating) When one of the TWI, TWO and THO sensors exceeds 70 °C.	Heating × Hot water O	O	1. Check the water inlet, water outlet and heater outlet (TWI, TWO, THO) sensors. 2. Defect of the backup heater (defect automatic reset thermostat).	1	71
A03	**Temperature increase error** (hot water supply) When the TTW sensor exceeds 85 °C.	Heating O Hot water ×	O	1. Check the hot water cylinder sensor (TTW). 2. Check the hot water cylinder thermal cut-out.	1	72
A04	**Antifreeze operation (1)** 1)TWO>20 °C condition: 2×TC+TWO≤-12 °C is detected. 2)TWO≤20 °C condition: TC+TWO≤4 °C is detected. 3)TWI≤10 °C is detected during defrosting.	O	×	1. Almost no or little water flow. • Dirt clogging in the water piping system. • The water piping is too long, or too short. 2. Check the heater power circuit. • Power supply voltage, breaker, power supply connection 3. Set the presence of the backup heater. 4. Check the water inlet, water outlet and heat exchange (TWI, TWO, TC) sensors and Flow Switch.	Heating8 Hot water8 Cooling4	73
A05	**Piping antifreeze operation** Activating the heater under the condition of TWO<4orTWI<4orTHO<4 does not achieve TWO,TWI,THO≥5 °C after 30 min elapsed.	O	O	1. Check the heater power circuit. • Power supply voltage, breaker, power supply connection 2. Check the water inlet, water outlet and heater outlet sensors (TWI, TWO, THO). 3. Disconnection of the backup heater.	1	74

Check code	Diagnostic functional operation			Determination and action	Number of abnormalities for confirmation	Detailed item
	Operational cause	Backup operation	Automatic reset			
A07	**Pressure switch operation** The pressure switch operates for 300 sec continuously during the heat pump operation.	O	×	1. Almost no or little water flow. 2. Defect of the flow switch. 3. On-load operation under the above conditions. 4. Defect in the pressure switch.	1	75
A08	**Low pressure sensor operation error** The low pressure sensor detected 0.2 MPa or less.	O	×	1. Almost no or little water flow. 2. Defect of the flow switch. 3. On-load cooling or prolonged defrosting (a lot of frost formation) under the above conditions. 4. Defect in the low pressure sensor. 5. Check the refrigeration cycle (gas leak).	8	76
A09	**Overheat protection operation** When the thermostat of the backup heater activates during the operation of the heat pump or backup heater. When the thermostat operation is activated while it has been stopped.	Heating × Hot water O	×	1. No water (heating without water) or no water flow. 2. Defect of the flow switch.	2	77
				3. Defect of the backup heater (poor automatic reset thermostat).	1	
A10	**Antifreeze operation (2)** When TC-TWO<-15K detected in cooling mode.	O	×	1. Almost few water flow. 2. Defect of the flow switch. 3. Low refrigerant.	10	78
A11	**Operation of the release protection** When the TWO release counts to 10.	Heating Cooling × Hot water O	×	1. Almost no water flow. 2. Defect of the flow switch. 3. Check the water outlet temperature sensor (TWO).	10	79
A12	**Heating, hot water heater** The antifreeze control is detected under the condition of TWI<15 °C while TWI≥15 °C, TTW≥20 °C is not detected after the heater backup.	O	O	1. Activated by a large load of heating or hot water supply. 2. Check the heater power circuit (backup or hot water cylinder heater). • Power supply voltage, breaker, power supply connection	1	80
A13	**Pump error**	Heating × Hot water O	×	1. Pump has stopped by a certain cause. • Low supply voltage. • High humidity around the electric box of the pump. • Dew condensation to the electric board of the pump. • Once turn off the power supply to the system and turn on again and operate the system. 2. Check the Flow switch in the Hydro unit.	2	81
E03	**Regular communication error between hydro unit and remote controller** When there is no regular communication from the remote controller for 3 min, or when no remote controller is equipped.	×	O	1. Check remote controller connection. 2. Defect in the remote controller.	1	—

Check code	Diagnostic functional operation			Determination and action	Number of abnormalities for confirmation	Detailed item
	Operational cause	Backup operation	Automatic reset			
E04	**Regular communication error between hydro unit and outdoor unit** The serial signal cannot be received from outdoor.	O	O	1. Check the serial circuit. • Miswiring of the crossover between the water heat exchanger and the outdoor unit	1	82
E08	**Duplicate address of Hydro unit, or Duplicate master Hydro unit during Group control**	×	O	1. Set the address No. of the Rotary switch "SW01" correctly for each Hydro unit.	1	—
E18	**Regular communication error between master Hydro unit and slave Hydro unit during Group control**	×	O	1. Check the Hydro unit connection. • Miswiring of the master and slave Hydro unit.	1	—
F03	**TC sensor error** Open or short circuit in the heat exchange temperature sensor.	O	O	1. Check the resistance value and connection of the heat exchange temperature sensor (TC).	1	82
F10	**TWI sensor error** Open or short circuit in the water inlet temperature sensor.	O	O	1. Check the resistance value and connection of the water inlet temperature sensor (TWI).	1	84
F11	**TWO sensor error** Open or short circuit in the water outlet temperature sensor.	Heating × Hot water O	O	1. Check the resistance value and connection of the water outlet temperature sensor (TWO).	1	84

Check code	Diagnostic functional operation			Determination and action	Number of abnormalities for confirmation	Detailed item
	Operational cause	Backup operation	Automatic reset			
F14	**TTW sensor error** Open or short circuit in the hot water cylinder sensor.	Heating × Hot water O	O	1. Check the resistance value and connection of the hot water cylinder sensor (TTW).	1	85
F17	**TFI sensor error** Open or short circuit in the floor temperature sensor. (Only when zone 2 is used)	Heating × Hot water O	O	1. Check the resistance value and connection of the floor-inlet temperature sensor (TFI).	1	85
F18	**THO sensor error** Open or short circuit in the heater outlet temperature sensor.	Heating × Hot water O	O	1. Check the resistance value and connection of the heater outlet temperature sensor (THO).	1	85
F19	**Detection of THO disconnection error** When TWO–THO>15K is detected and 30 sec elapsed.	Heating × Hot water O	×	1. Check for any disconnection of the heater outlet temperature sensor (THO). 2. Defect of the flow switch.	1	86
F20	**TFI sensor error** When TWO–TFI>40K is detected and TFI<TWI–5K is detected 60 sec.	Heating × Hot water O	×	1. Check the connection of the floor-inlet temperature sensor (TFI).	1	87
F23	**Low pressure sensor error** When PS<0.07 MPa is detected for 90 sec or more. (cooling, defrosting) When PS<0.07 MPa is detected for 10 min or more. (hot water supply, heating)	O	O	1. Check the connection (body or connection wiring) of the low pressure sensor. 2. Check the resistance value of the low pressure sensor. 3. Check the refrigeration cycle (gas leak).	1	88
F29	**EEROM error** Inconsistency is detected once without verify ACK after writing to EEPROM.	×	×	1. Replace the water heat exchange control board.	1	88
F30	**Extended IC error** When the extended IC is abnormal.	×	×	1. Replace the water heat exchange control board.	1	88
L02	**Combination error** Model name of the hydro unit is different.	×	×	1. Check the model name of the hydro unit. 2. Check DP_SW13_4 is set to "OFF".	1	—
L07	**Communication error** Individual hydro units have a group line.	×	×	1. Replace the water heat exchange control board.	1	88
L09	**Communication error** The capability code for the hydro unit has not been set.	×	×	1. Check the setting of the FC01 capability specifications.	1	89
L16	**Setting error** When ZONE1 has not been set, while ZONE2 has been set.	×	×	1. Check the body DP-SW12_2,3.	1	89
P31	**Slave Hydro unit error which occurs when error occurs in master Hydro unit**	×	O	1. Check the remote controller connection. 2. Defect in the remote controller. 3. Set the address No. of the Rotary switch "SW01" correctly for each Hydro unit.	1	—

HWS-455XWHM3-E = 0012

Defect mode detected by the Outdoor Unit

Check code	Diagnostic functional operation			Determination and action	Number of abnormalities for confirmation	Detailed item
	Operational cause	Backup operation	Automatic reset			
F04	**TD sensor error** Open or short circuit in the discharge temperature sensor.	O	×	1. Check the resistance value and connection of the discharge sensor (TD).	4	83
F06	**TE sensor error** Open or short circuit in the heat exchange temperature sensor.	O	×	1. Check the resistance value and connection of the heat exchange temperature sensor (TE).	4	83
F07	**TL sensor error** Open or short circuit in the heat exchange temperature sensor.	O	×	1. Check the resistance value and connection of the heat exchange temperature sensor (TL).	4	—
F08	**TO sensor error** Open or short circuit in the outdoor temperature sensor.	O	×	1. Check the resistance value and connection of the outdoor temperature sensor (TO).	4	84
F12	**TS sensor error** Open or short circuit in the suction temperature sensor.	O	×	1. Check the resistance value and connection of the suction temperature sensor (TS).	4	—
F13	**TH sensor error** Open or short circuit in the heat-sink temperature sensor.	O	×	1. Check the resistance value and connection of the heat-sink temperature sensor (TH).	8	—
F15	**TE, TS sensors error** TE, TS sensor connections are opposite.	O	×	1. Check for any wrong installation of the heat exchange temperature sensor (TE) and the suction temperature sensor (TS).	4	—
F31	**EEPROM error**	O	×		1	—
H01	**Compressor breakdown** 1 When the operation frequency lowers due to the current release 40 sec or later after the compressor activation and it stops by underrunning the minimum frequency. 2 When the operation frequency lowers due to the current limit control and it stops by underrunning the minimum frequency. 3 When an excess current is detected 0.8 sec or later after the compressor activation.	O	×	1. Check the power supply voltage (AC220-230 V±10%: single phase type). (AC380-400 V±10%: 3 phase type). 2. Over-loaded condition of the refrigeration cycle. 3. Check that the service valve is fully open.	8	—
H02	**Compressor lock** 1 When the input current is more than zero 20 sec or later after the compressor activation and the activation has not been completed.	O	×	1. Defect of compressor (lock) – Replace the compressor. 2. Defect of compressor wiring (open phase).	8	—
H03	**Defect in the current detection circuit**	O	×	1. Replace the outdoor inverter control board.	8	—

Check code	Diagnostic functional operation			Determination and action	Number of abnormalities for confirmation	Detailed item
	Operational cause	Backup operation	Automatic reset			
H04	**Operation of case thermostat** When the case thermostat exceeds 125 °C.	O	×	1. Check the refrigeration cycle (gas leak). 2. Check the case thermostat and connector. 3. Check that the service valve is fully open. 4. Defect of the pulse motor valve. 5. Check for kinked piping.	10	—
L10	**Unset service PC board jumper** Jumpers J800-J803 have not been cut.	O	×	1. Cut J800-J803.	1	—
L15	**Combination error** Model name of the outdoor unit is different.	×	×	1. Check the model name of the outdoor unit.	1	—
L29	**The communication between the outdoor PC board MUCs error** No communication signal between IPDU and CDB.	O	×	1. Replace the outdoor control board.	1	—
P03	**The outlet temperature error** When the discharge temperature sensor (TD) exceeds 111 °C.	O	×	1. Check the refrigeration cycle (gas leak). 2. Defect of the pulse motor valve. 3. Check the resistance value of the discharge temperature sensor (TD).	4	—
P04	**The high pressure switch error**	O	×		10	—
P05	**The power supply voltage error** When the power supply voltage is extremely high or low.	O	×	1. Check the power supply voltage. (AC220-230 V±10%: single phase type). (AC380-400 V±10%: 3 phase type).	8	—
P07	**Overheating of heat-sink error** When the heat-sink exceeds 105 °C.	O	×	1. Check the thread fastening and heat-sink grease between the outdoor control board and the heat-sink. 2. Check the heat-sink fan duct. 3. Check the resistance value of the heat-sink temperature sensor (TH).	4	—
P15	**Detection of gas leak** When the discharge temperature sensor (TD) exceeds 106 °C for consecutive 10 min. When the suction temperature sensor (TS) exceeds 60 °C for cooling or 40 °C for heating for 10 consecutive min.	O	×	1. Check the refrigeration cycle (gas leak). 2. Check that the service valve is fully open. 3. Defect of the pulse motor valve. 4. Check for kinked piping. 5. Check the resistance value of the discharge temperature sensor (TD) and the suction temperature sensor (TS).	8	—
P19	**The 4-way valve inversion error** When the heat exchange temperature sensor (TE) exceeds 30 °C or the suction temperature sensor (TS) exceeds 50 °C during the heat pump operation.	O	×	1. Check the operation of the 4-way valve unit or the coil characteristics. 2. Defect of the pulse motor valve. 3. Check the resistance value of the heat exchange temperature sensor (TE) and the suction temperature sensor (TS).	4	—

Check code	Diagnostic functional operation			Determination and action	Number of abnormalities for confirmation	Detailed item
	Operational cause	Backup operation	Automatic reset			
P20	**High pressure protection operation** When an abnormal stop occurs due to the high pressure release control. When the heat exchange temperature sensor (TL) detects 63 °C during the cooling operation. When the water outlet sensor (TWO) detects 60 °C during the heating or hot water supply operation.	O	×	1. Check that the service valve is fully open. 2. Defect of the pulse motor valve. 3. Check the outdoor fan system (including clogging). 4. Over-filling of refrigerant. 5. Check the resistance value of the heat exchange temperature sensor (TL) and the water outlet temperature sensor (TWO).	10	—
P22	**Outdoor fan system error** When a DC fan rotor position detection NG, element short circuit, loss of synchronization, or abnormal motor current occurs.	O	×	1. Check the lock status of the motor fan. 2. Check the connection of the fan motor cable connector. 3. Check the power supply voltage. (AC220~230 V±10%: single phase type) (AC380~400 V±10%: 3 phase type)	8	—
P26	**Short circuit of the compressor driver element error** When an abnormal short circuit of IGBT is detected.	O	×	1. P26 abnormality occurs when operating with the compressor wiring disconnected … Check the control board. 2. No abnormality occurs when operating with the compressor wiring disconnected … Compressor rare short.	8	—
P29	**Compressor rotor position error** The rotor position in the compressor cannot be detected.	O	×	1. Even if the connection lead wire of the compressor is disconnected, it stops due to an abnormality in the position detection … Replace the inverter control board. 2. Check the wire wound resistor of the compressor. Short circuit … Replace the compressor.	8	—

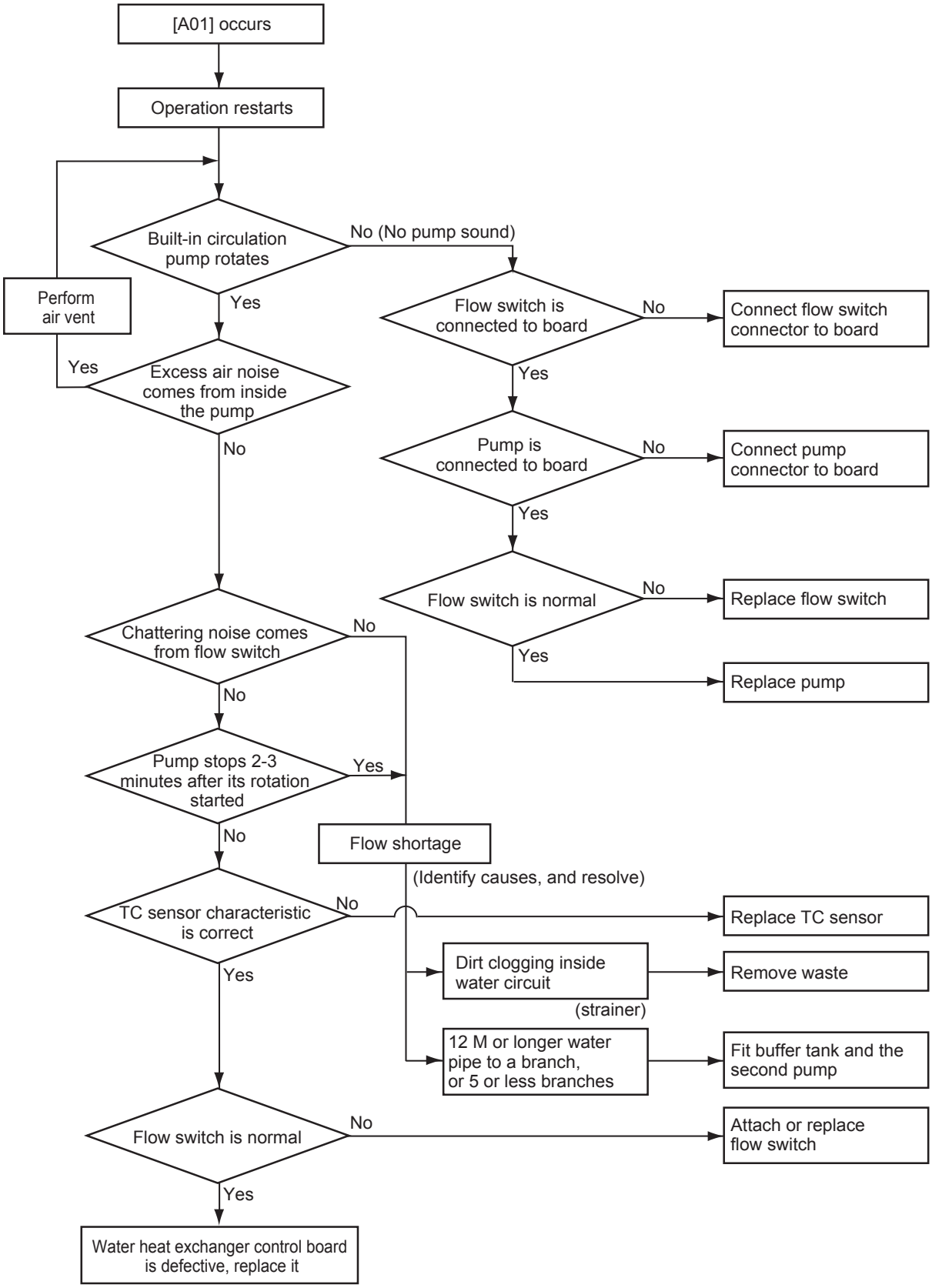
Defect mode detected by the remote controller

Check code	Diagnostic functional operation			Determination and action
	Operational cause	Status of air-conditioning	Condition	
Not displaying at all (cannot operate by the remote controller)	**No communication between hydro unit an remote controller** • The remote controller wiring is not connected correctly. • The hydro unit has not been turned on.	Stop	–	Defect in the remote controller power supply 1. Check the remote controller wiring. 2. Check the remote controller. 3. Check the hydro unit power supply wiring. 4. Check the water heat exchange control board.
E01	**No communication between hydro unit and remote controller** • Disconnection of the crossover between the remote controller and the base unit of the indoor unit (detected on the remote controller side).	Stop (Automatic reset)	Displayed when the abnormality is detected.	Defect in the reception of the remote controller 1. Check the remote controller crossover. 2. Check the remote controller. 3. Check the hydro power supply wiring. 4. Check the water heat exchanger board.
E02	**Defect in the signal transmission to the hydro unit.** (Detected on the remote controller side)	Stop (Automatic reset)	Displayed when the abnormality is detected.	Defect in the transmission of the remote controller 1. Check the transmitter circuit inside the remote controller. … Replace the remote controller.
E09	**Several remote controller base units** (Detected on the remote controller side)	Stop (The handset continues)	Displayed when the abnormality is detected.	1.2 Check several base units with the remote controller … The base unit is only one, and others are handsets.

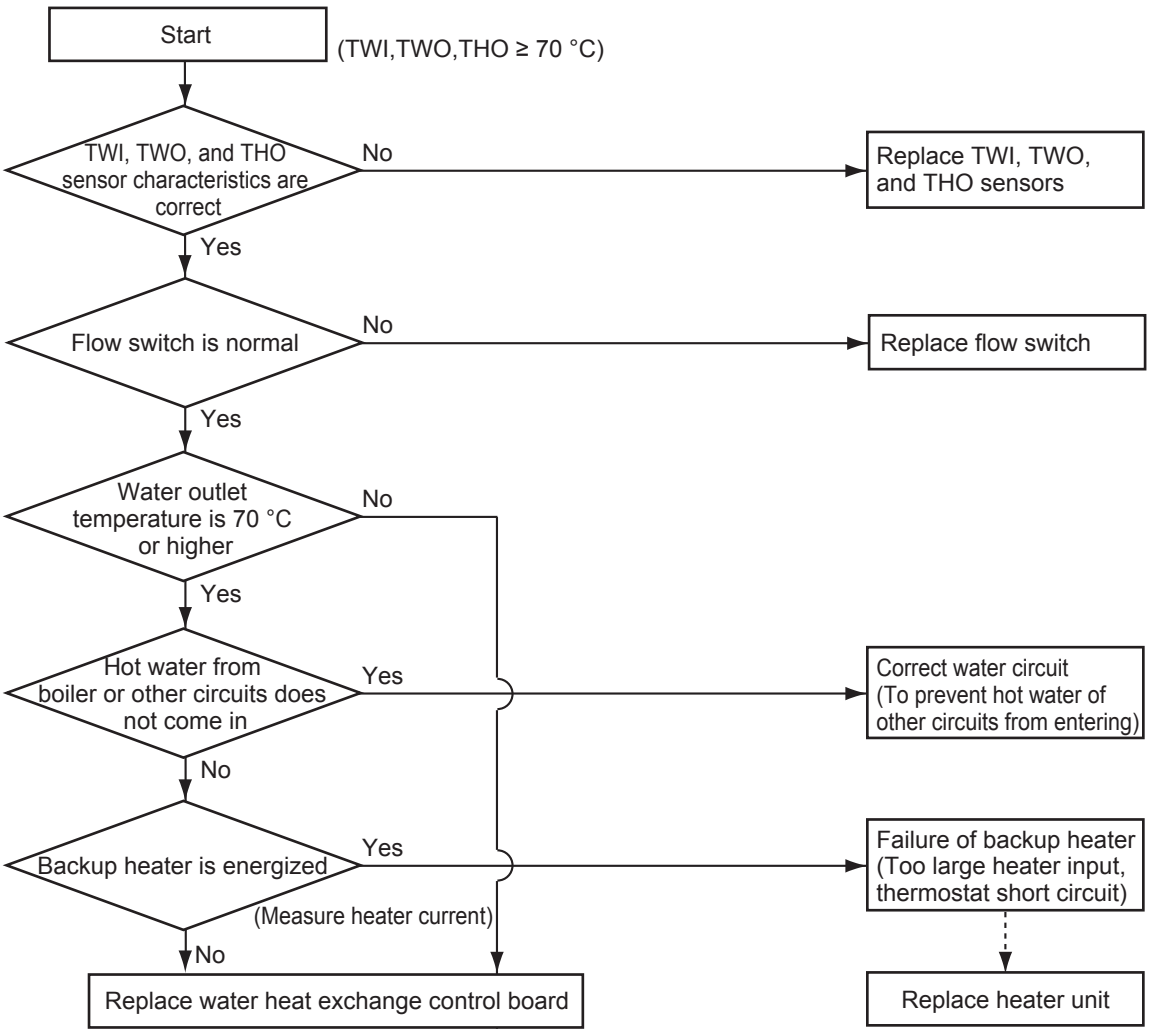
9-4. Diagnosis flow chart for each error code

9-4-1. Hydro unit failure detection

[A01] Error Pump flow determination

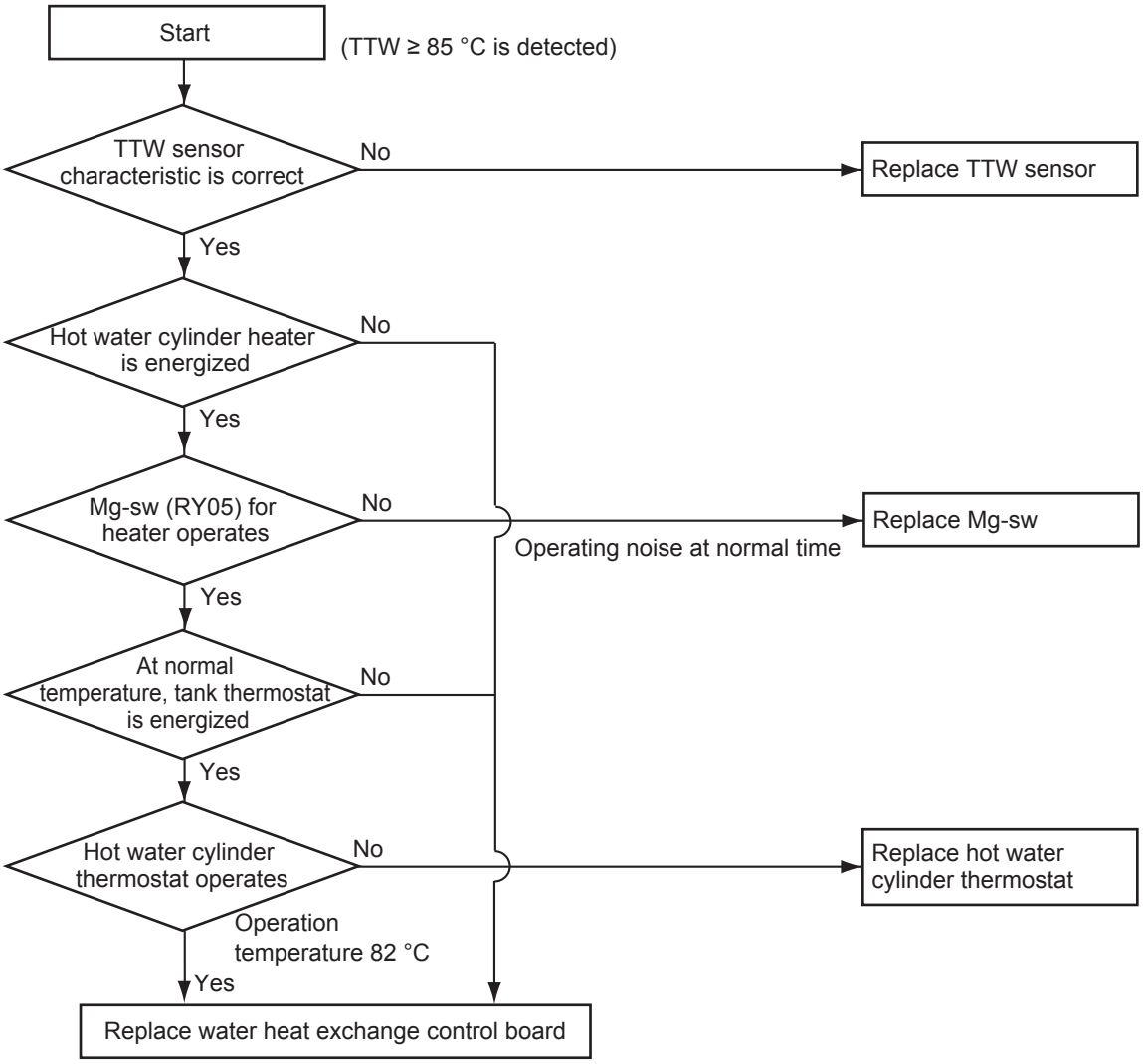


[A02] Error Temperature rise and error short circuit



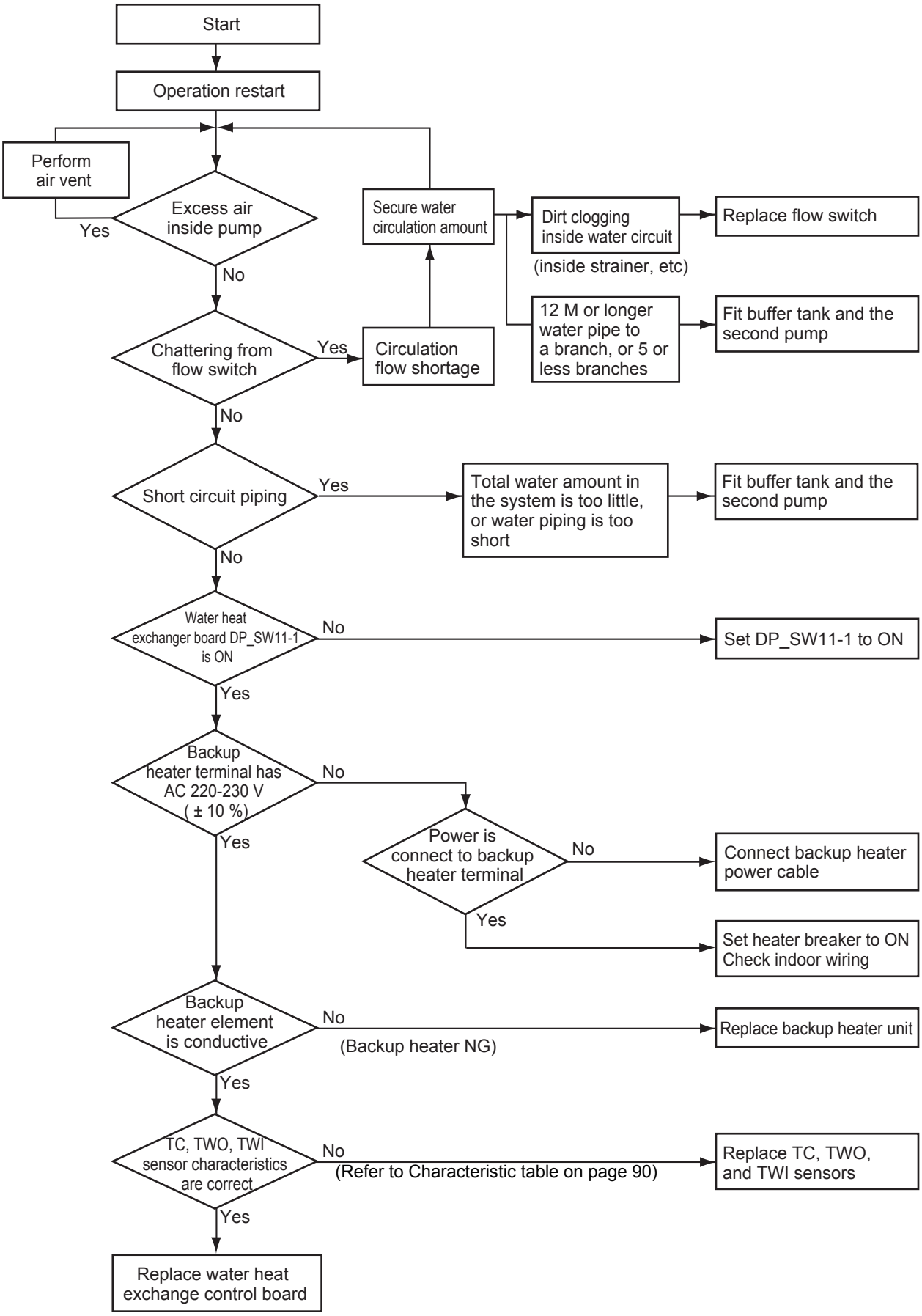
- If Boiler setting is ON (DPSW13-2 is ON) and FC62 is “1”, the A02 error is not detected.

[A03] Error Temperature rise and error short circuit

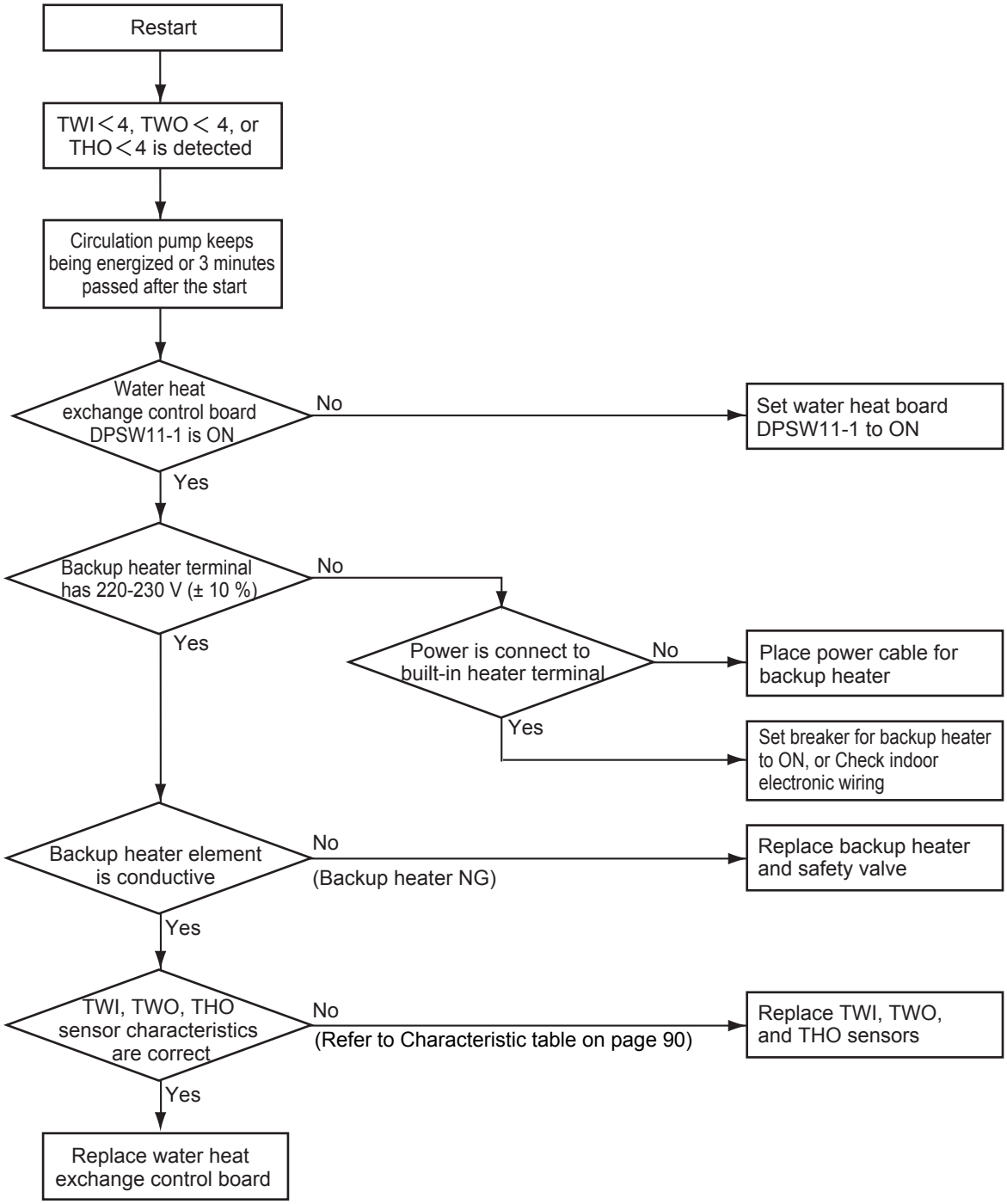


[A04] Error Freeze prevention control

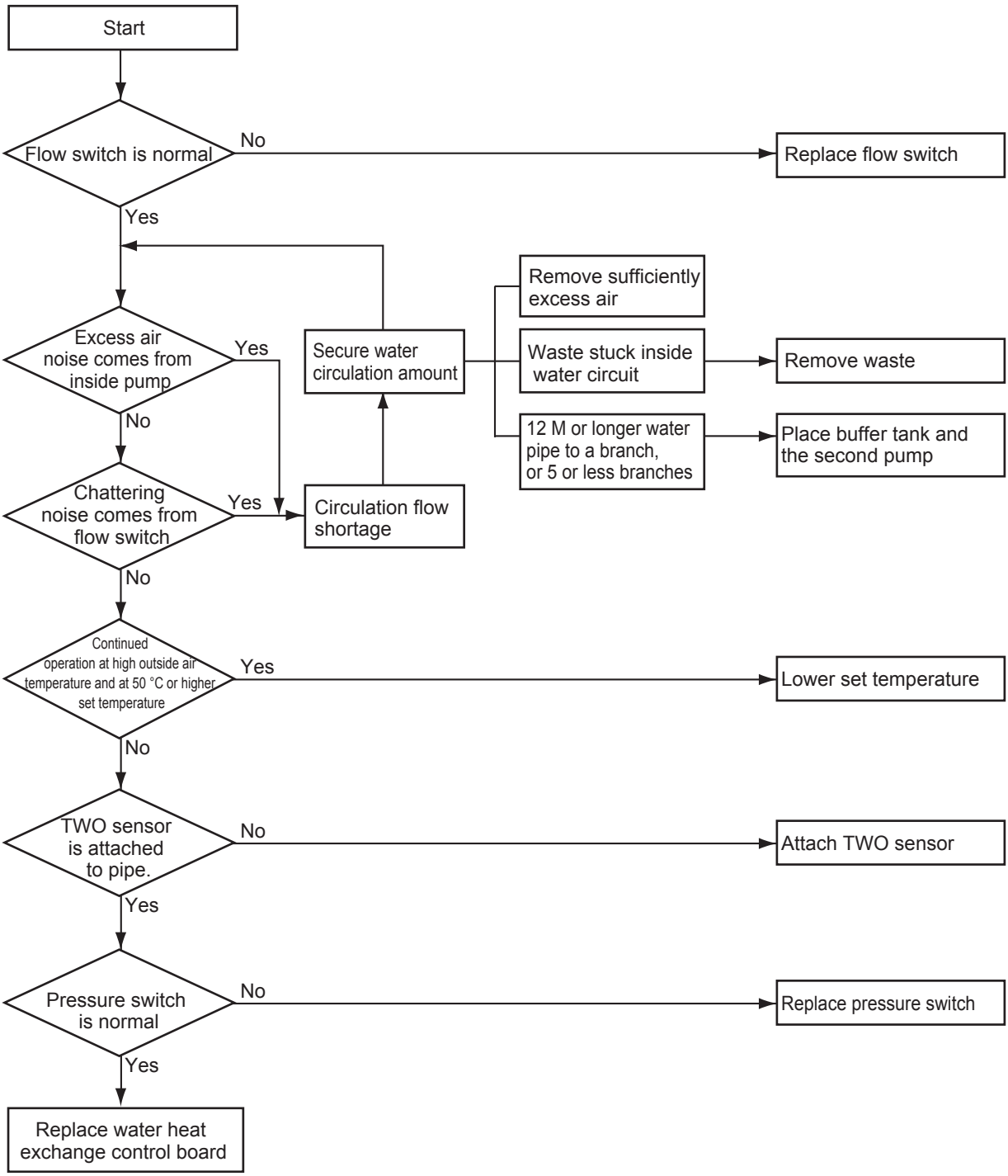
When the outside temperature and inlet water temperature is low (approx. 20 °C or lower) and the room load is large (operation frequency ≥ rating), the freeze prevention control may be activated.



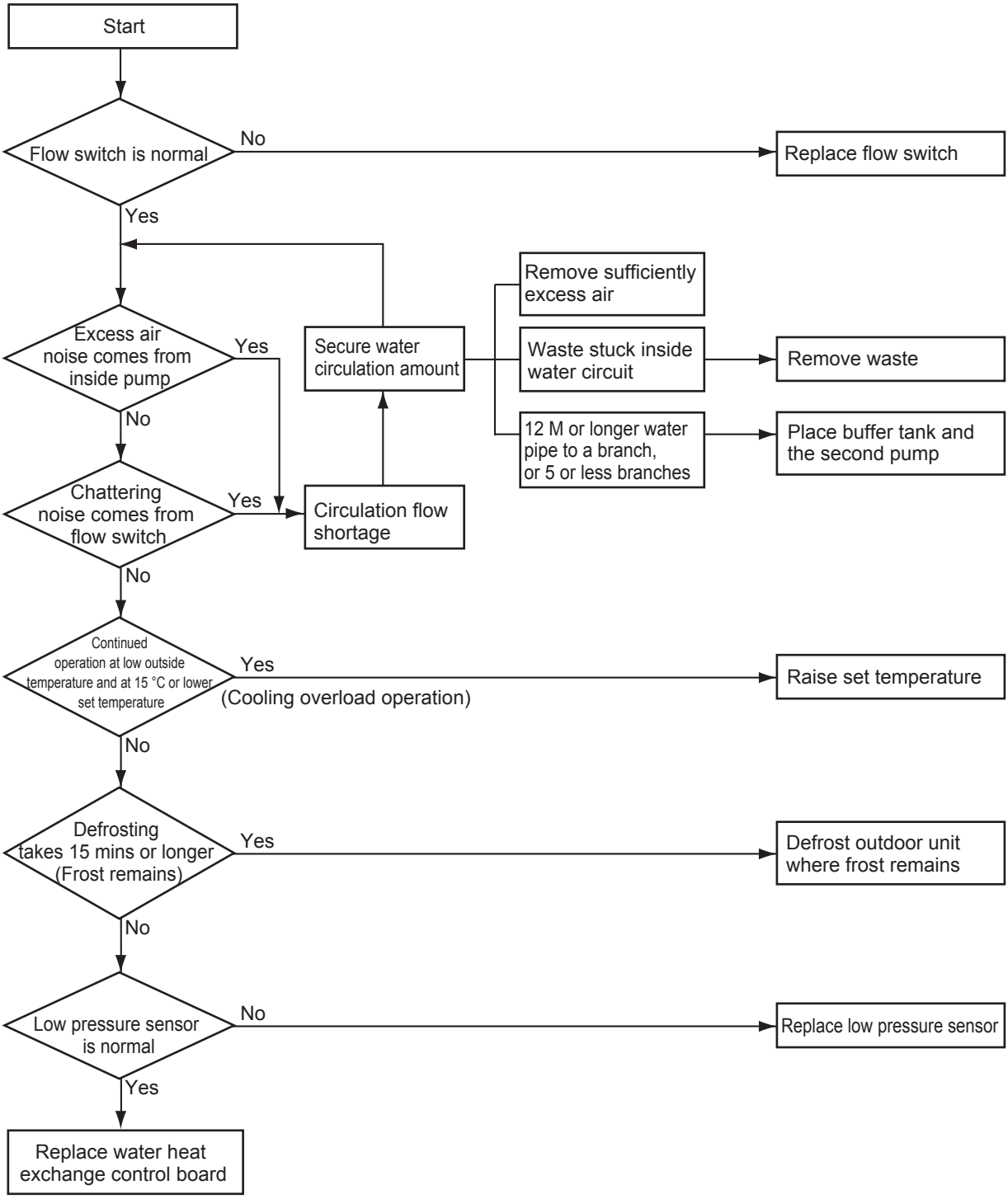
[A05] Error Piping freeze prevention control



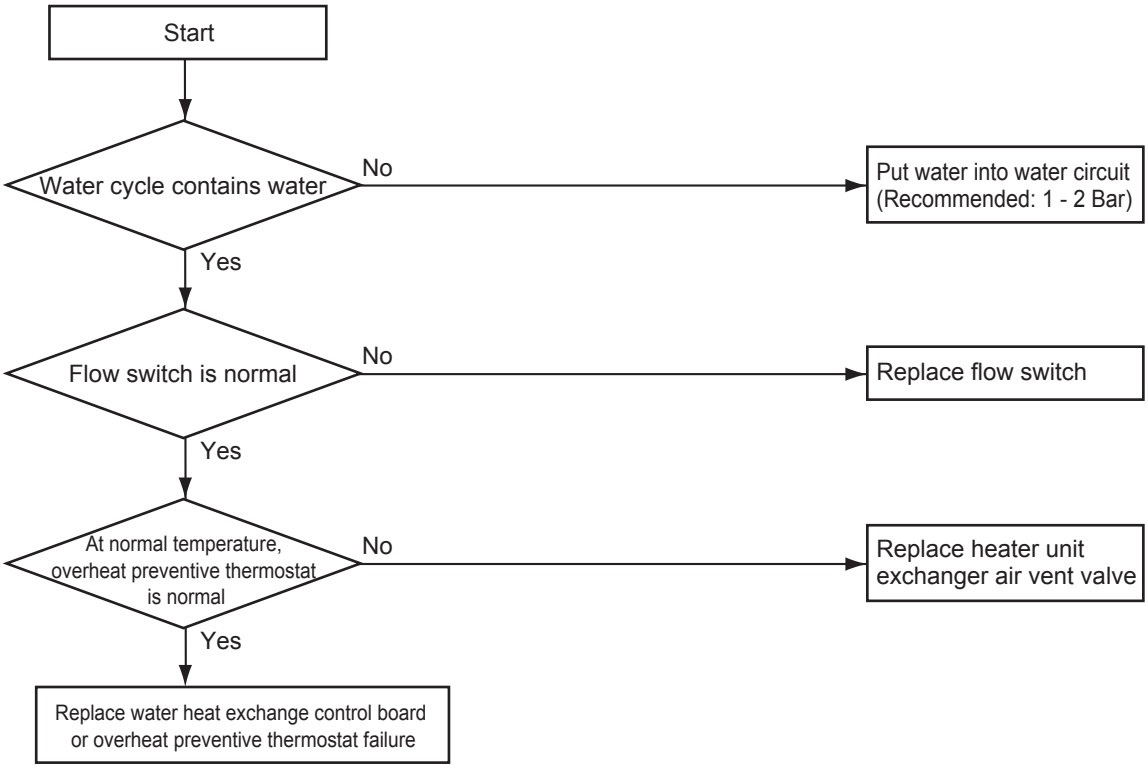
[A07] Error Pressure switch operation (Hot water supply / Heating operation)



[A08] Error Low pressure sensor lowering operation failure (Cooling / Defrosting operation)

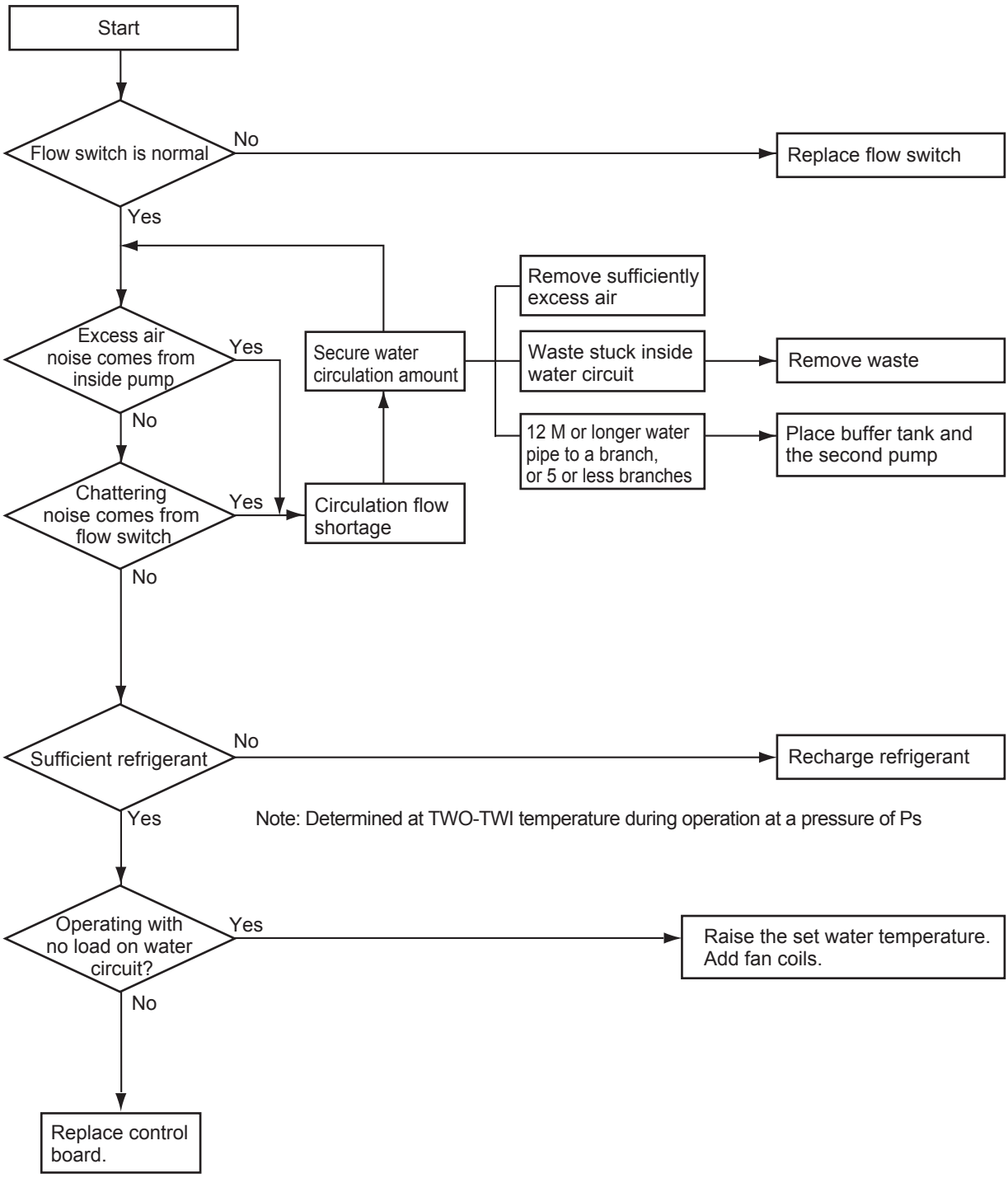


[A09] Error Overheat prevention thermostat failure (Hot water supply / Heating operation)

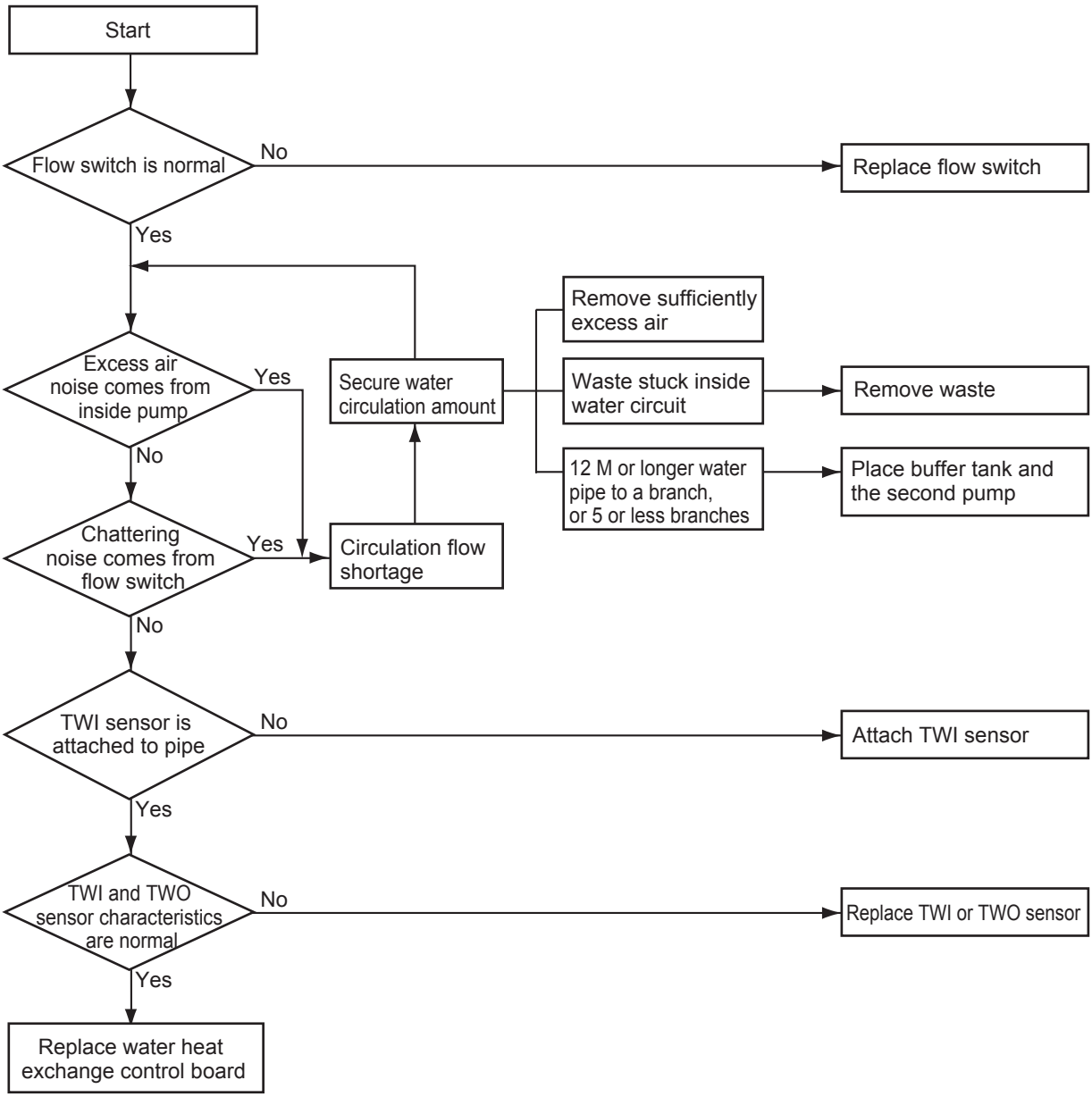


*Replace water heat exchange control board or overheat preventive thermostat failure: After the control board is replaced, if the same operation repeats, the overheat preventive thermostat is determined as defective (does not operate at 75 °C).

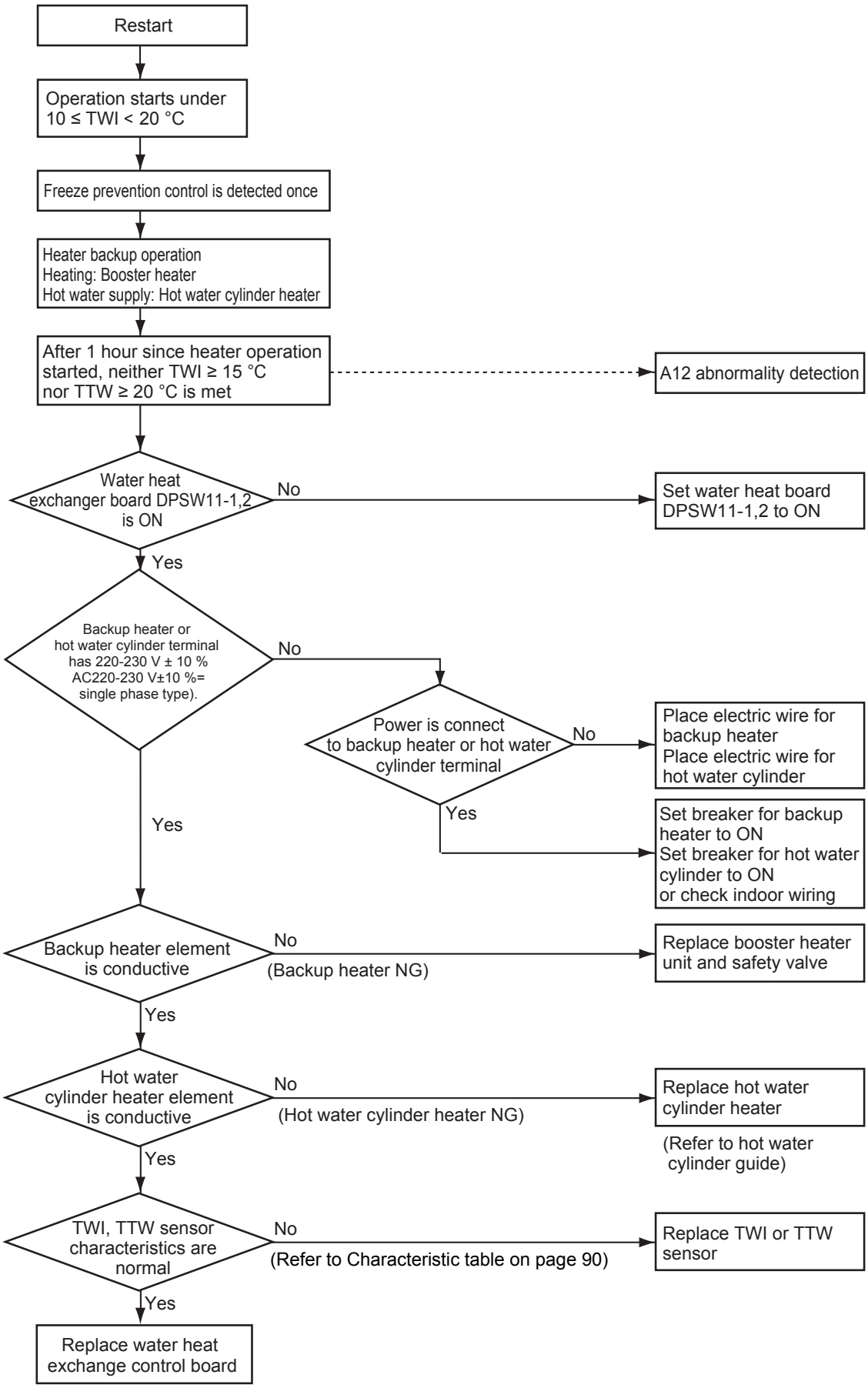
[A10] Error Freeze prevention control (2) (Cooling only)



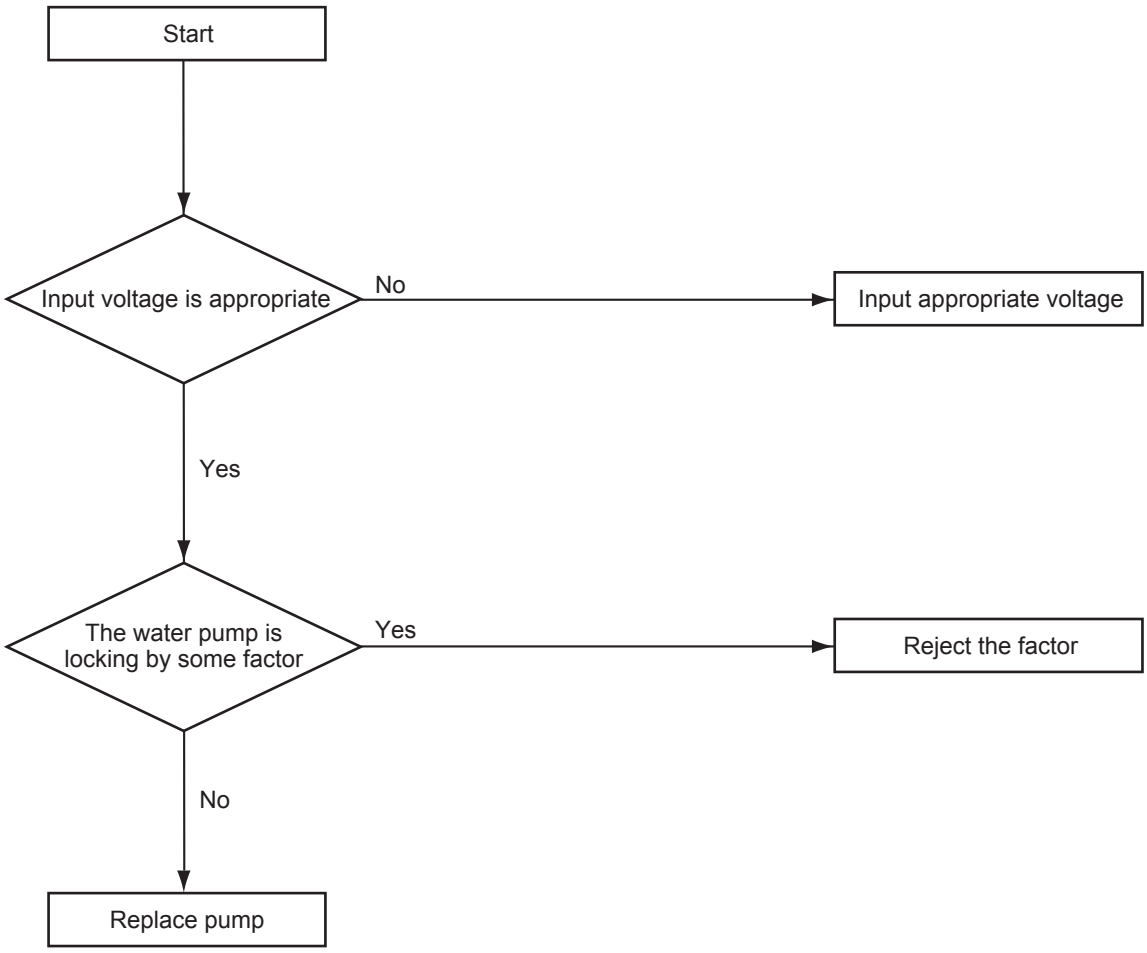
[A11] Error Release protection operation



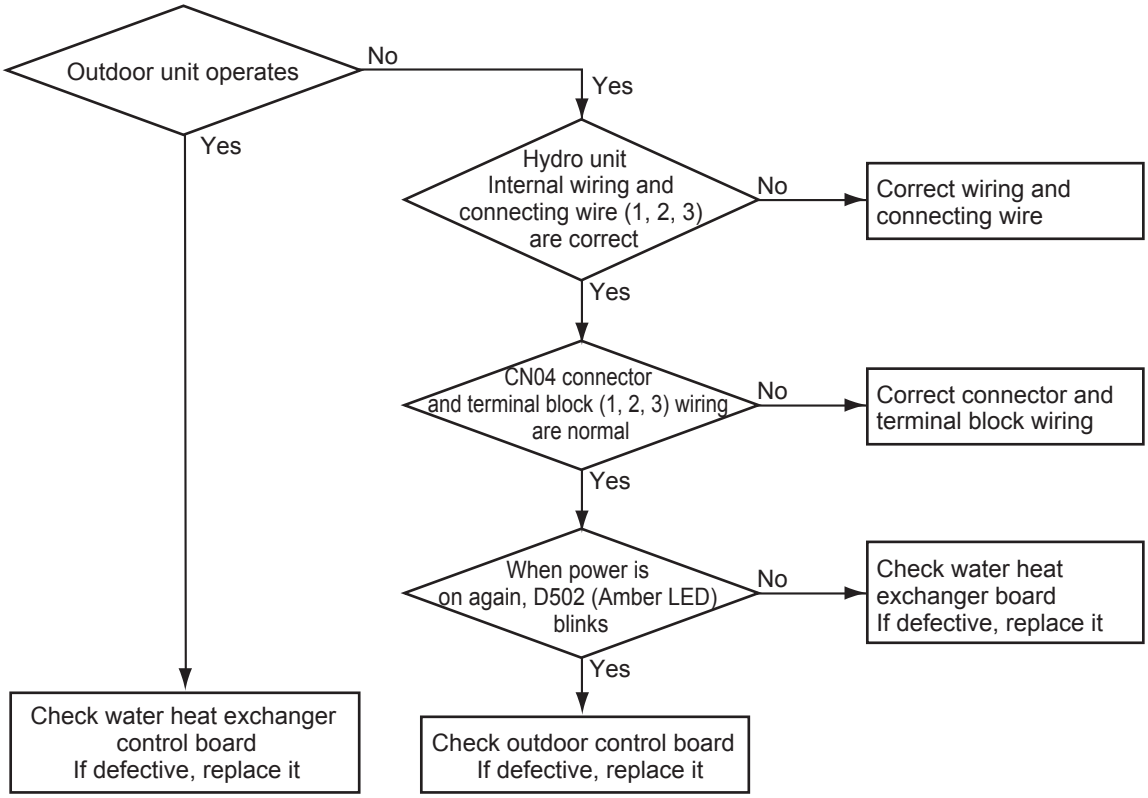
[A12] Error Heating or Hot water supply heater failure



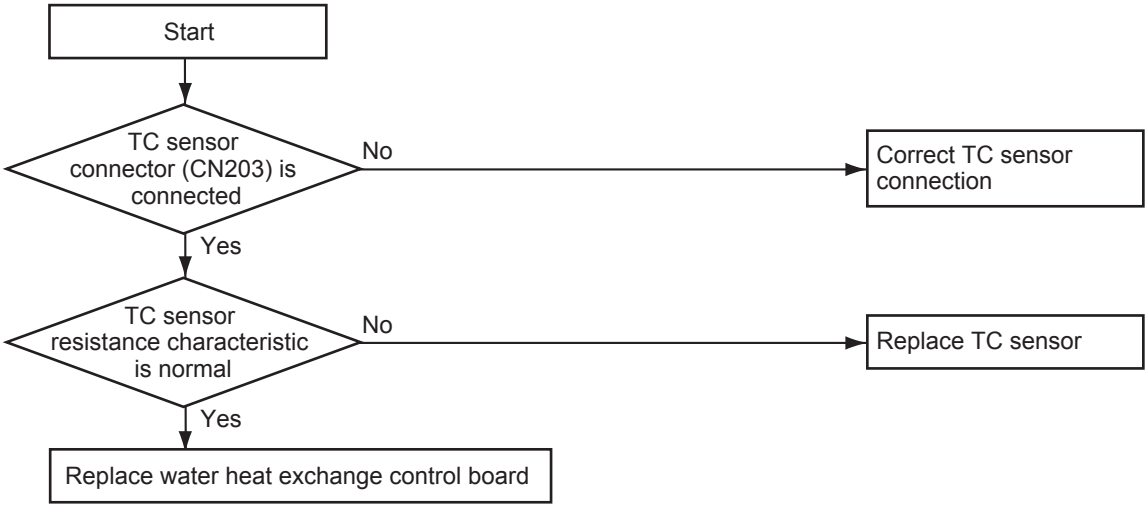
[A13] Pump error



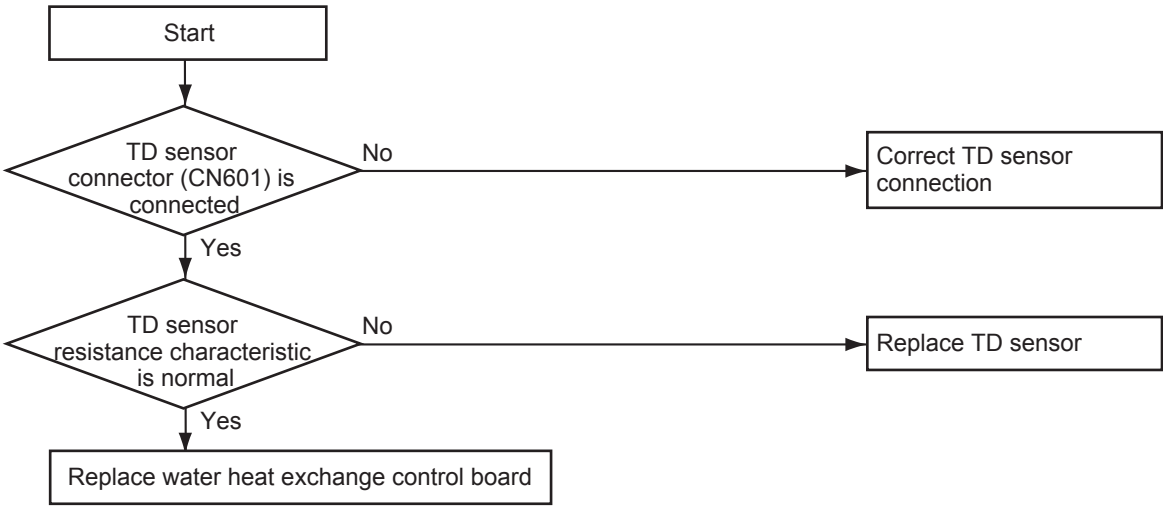
[E04] Error



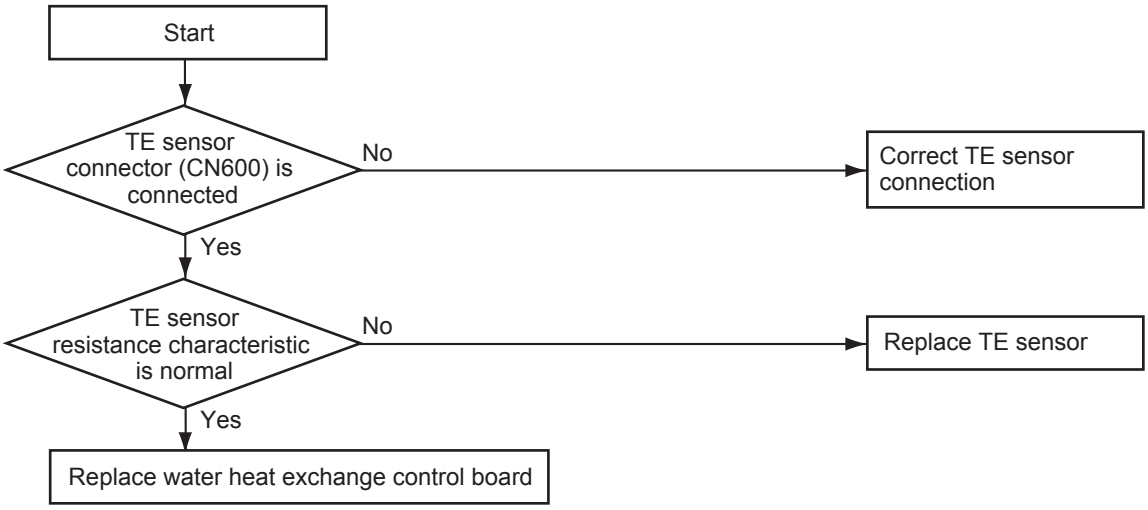
[F03] Error TC sensor failure



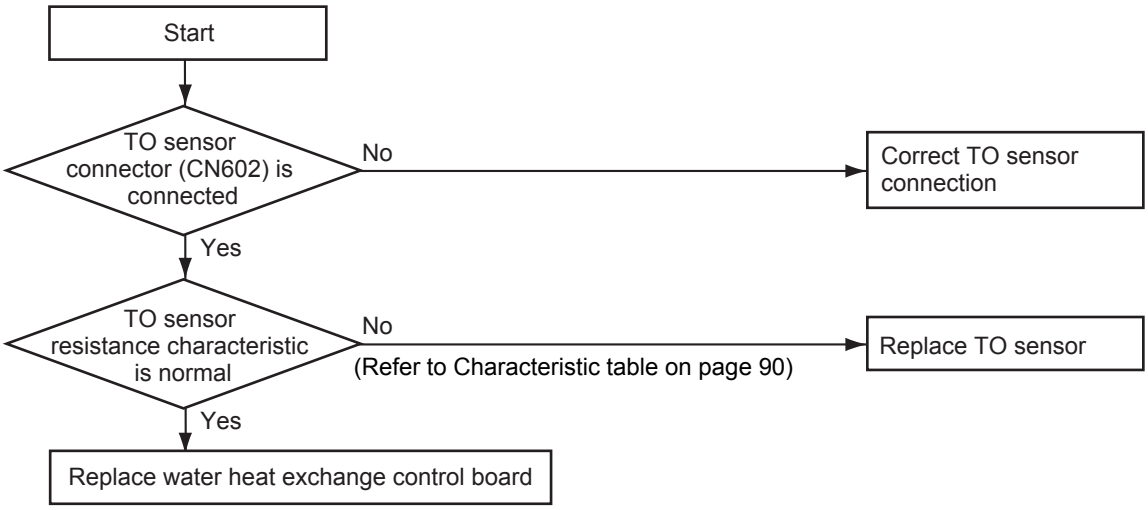
[F04] Error TD sensor failure



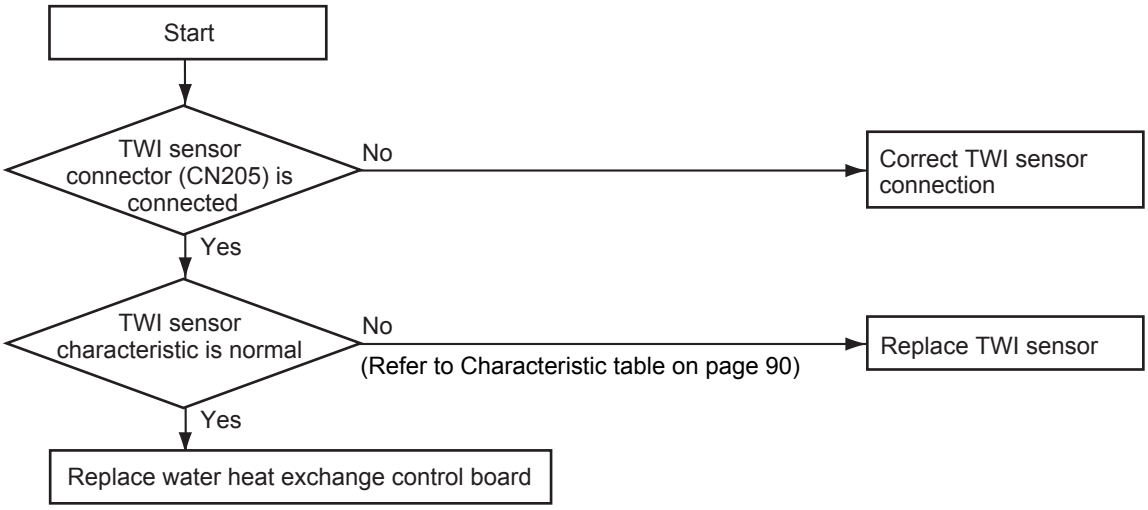
[F06] Error TE sensor failure



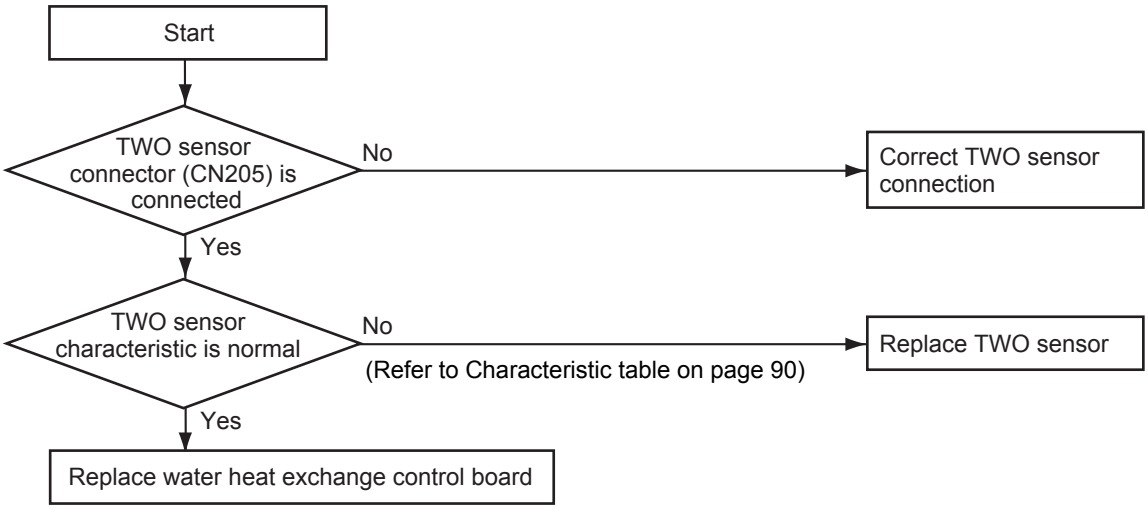
[F08] Error TO sensor failure



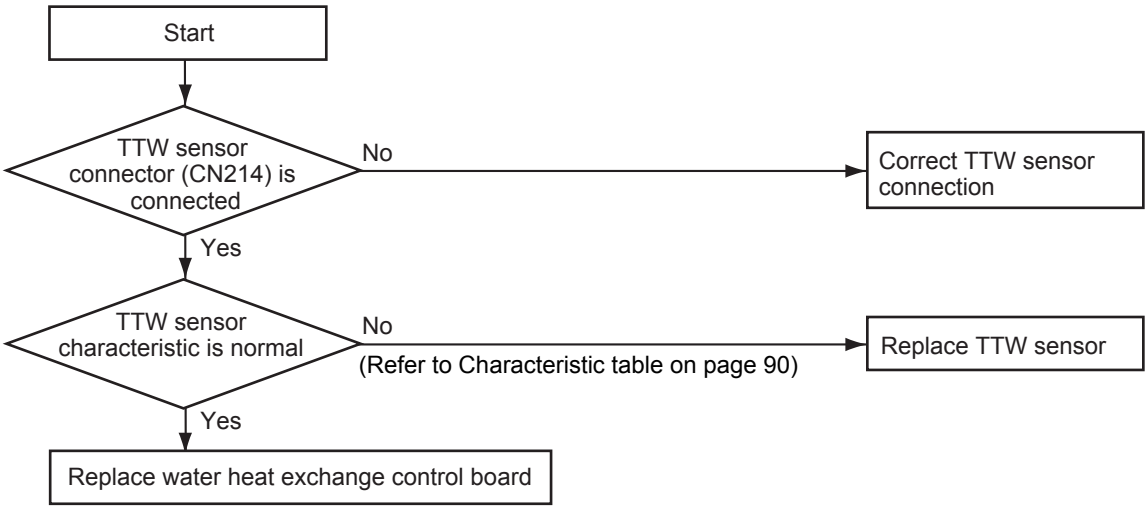
[F10] Error TWI sensor failure



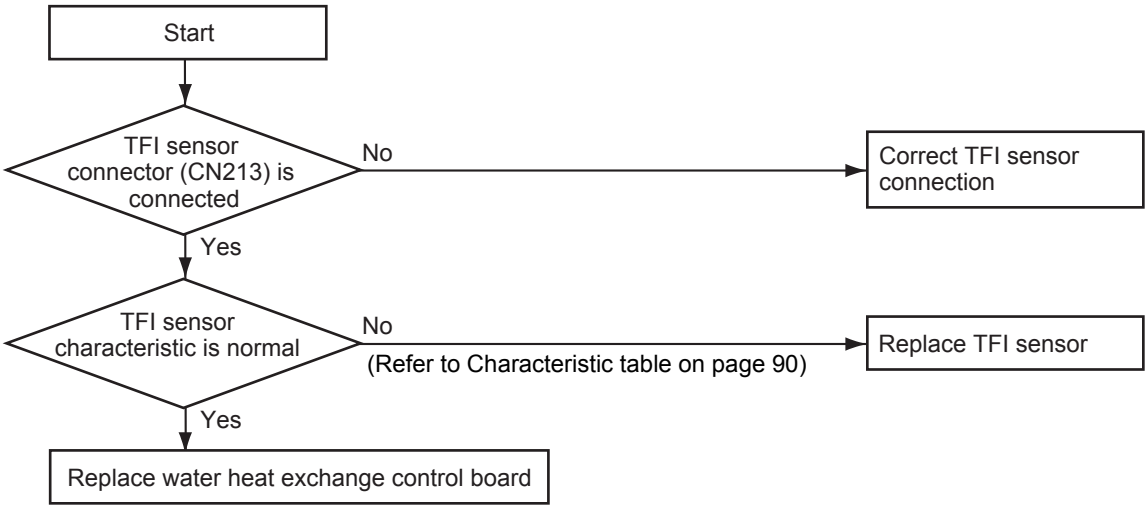
[F11] Error TWO sensor failure



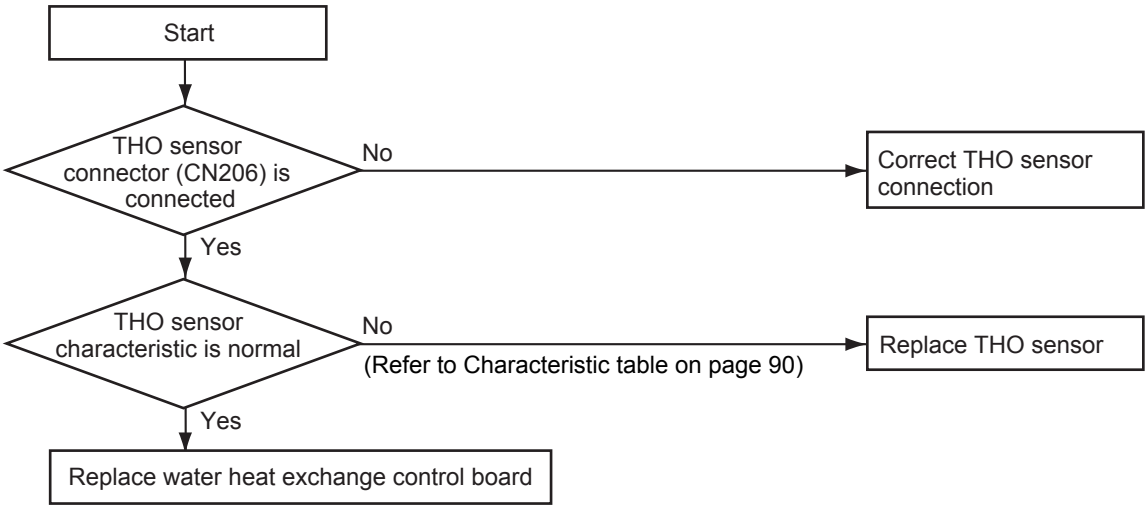
[F14] Error TTW sensor failure



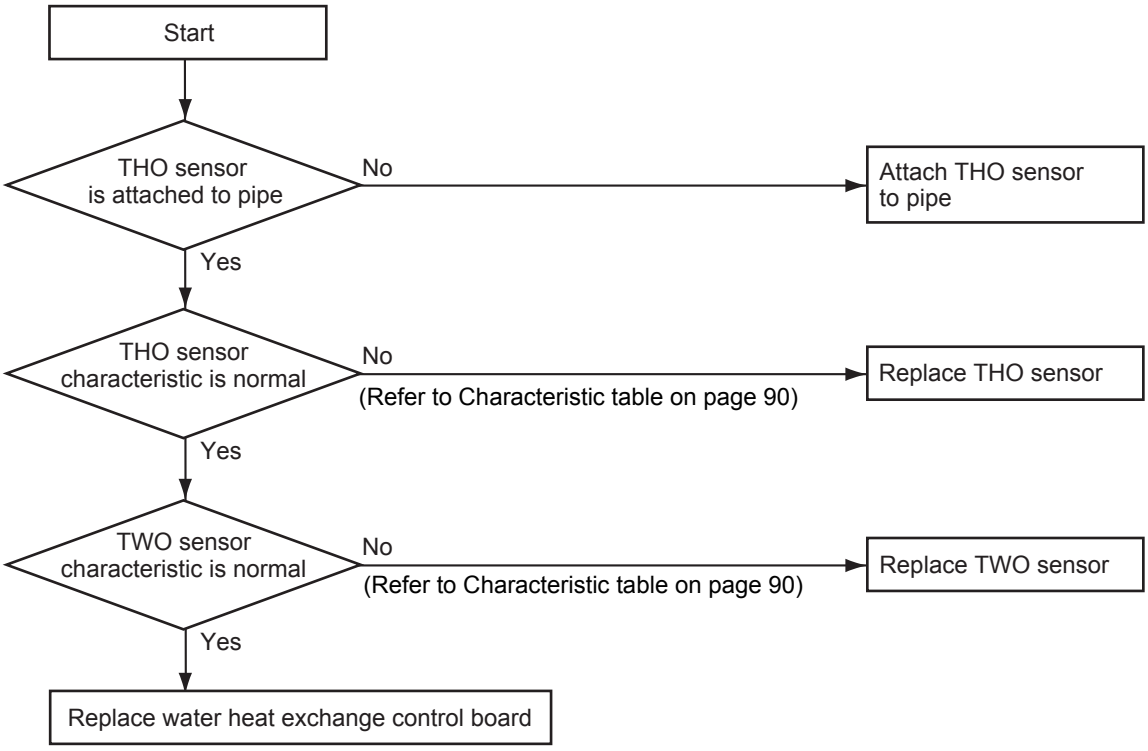
[F17] Error TFI sensor failure



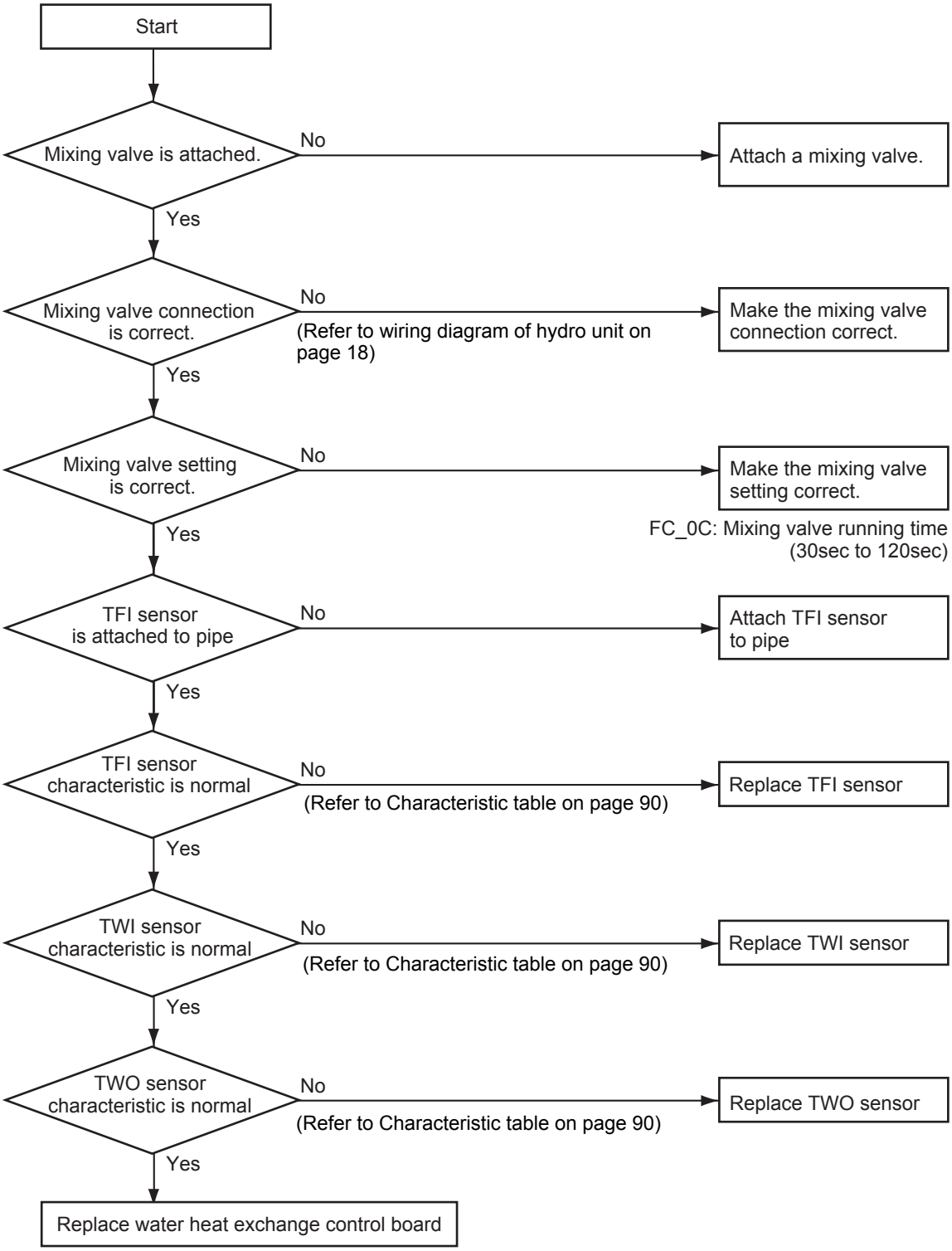
[F18] Error THO sensor failure



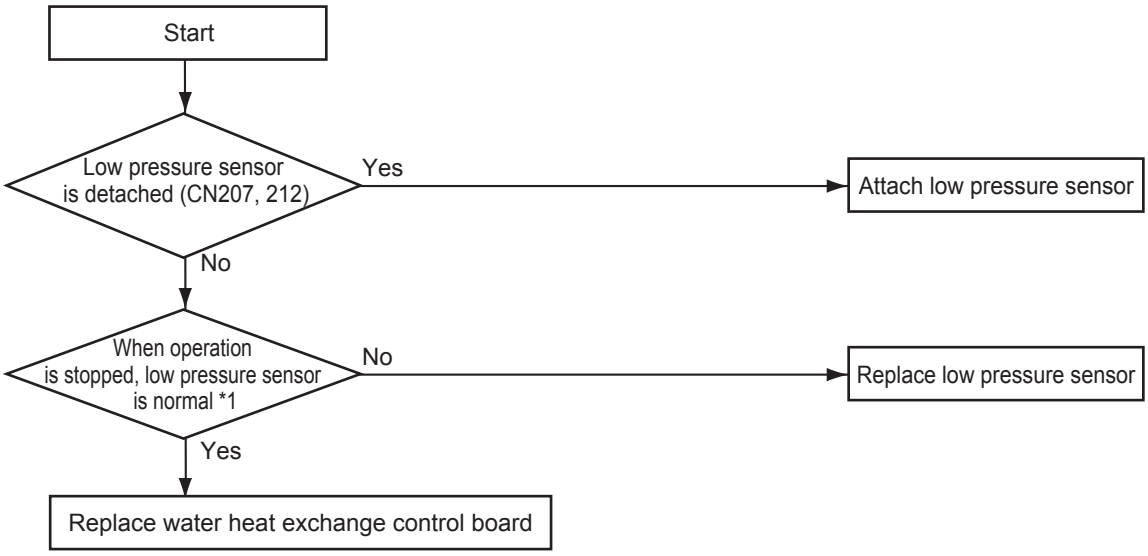
[F19] Error THO sensor detach failure



[F20] Error TFI detach failure



[F23] Error Low pressure sensor detach failure

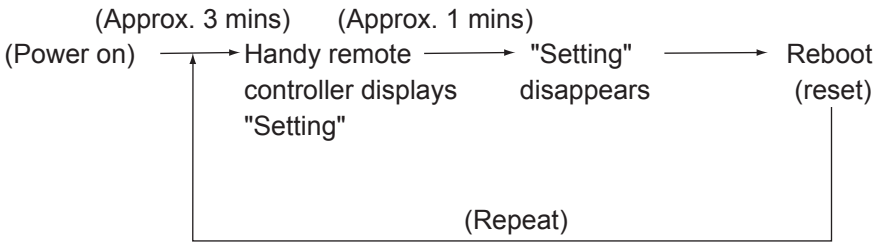


*1 How to determine: When operation is stopped

[F29] Error EEPROM failure

A failure is detected in the IC10 non-volatile memory on the water heat exchanger board during a hot water supply unit operation. Replace the service board.

* If the unit does not have EEPROM inserted when the power is turned on, or if EEPROM data read or write is unavailable, automatic address mode repeats. In this case, the intensive control unit displays [97 Abnormal].



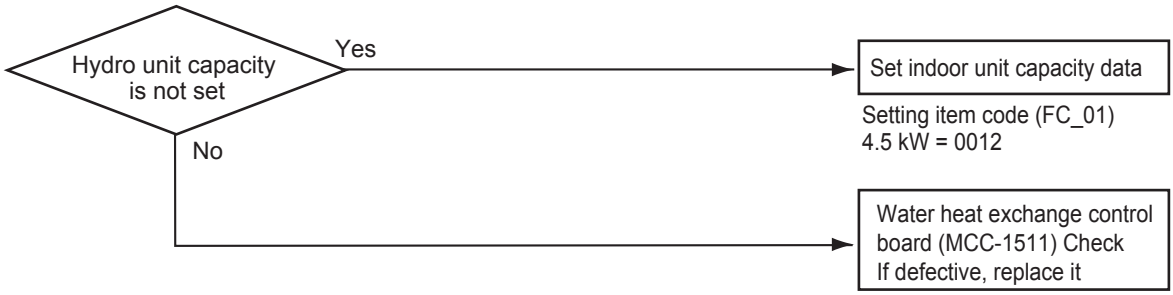
[F30] Error Enhanced IC failure

Enhanced IC on water heat exchanger control board is abnormal.
Replace the water heat exchanger control board to a service board.

[L07] Error

At the time of power on, detecting the above failure automatically activates the automatic address setting mode.
(Check code is not output)
Note that if the above failure is detected in the automatic address setting mode, a check code may be output.

[L09] Error



[L16] Error

In DP_SW12-2, 3 of main unit water heat exchanger, if ZONE1 is not set and ZONE2 is set, [L16] displays abnormality.
Set correctly DP_SW12-2, 3.

9-4-2. Temperature sensor, temperature-resistance characteristic table

TC, TWI, TWO, TFI, TTW, TE, TS, TO sensors

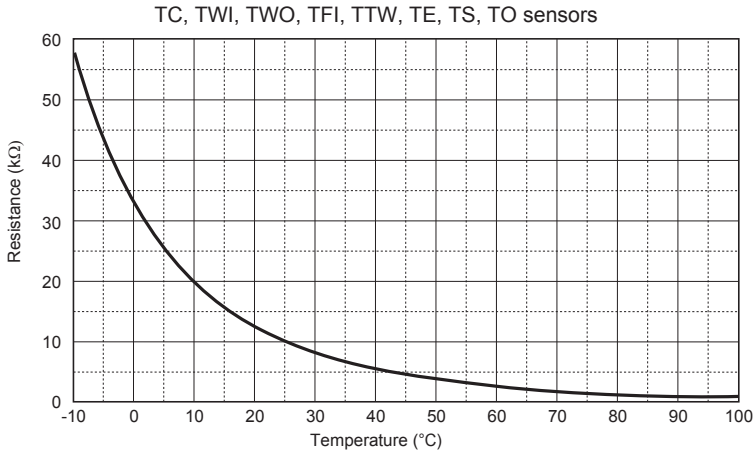
Typical value

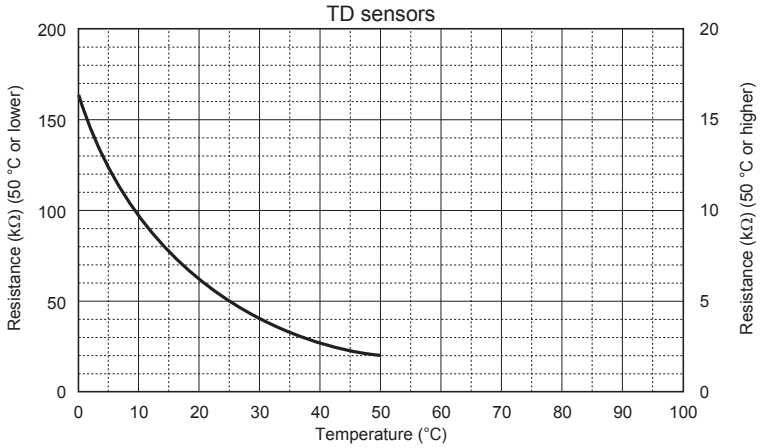
Temperature (°C)	Resistance value (kΩ)		
	(Minimum)	(Standard)	(Maximum)
-10	55.42	55.73	60.04
0	32.33	33.80	35.30
10	19.63	20.35	21.09
20	12.23	12.59	12.95
25	9.75	10.00	10.25
30	7.764	7.990	8.218
40	5.013	5.192	5.375
50	3.312	3.451	3.594
60	2.236	2.343	2.454
70	1.540	1.623	1.709
80	1.082	1.146	1.213
90	0.7740	0.8237	0.8761
100	0.5634	0.6023	0.6434

TD sensors

Typical value

Temperature (°C)	Resistance value (kΩ)		
	(Minimum)	(Standard)	(Maximum)
0	150.5	161.3	172.7
10	92.76	99.05	105.6
20	58.61	62.36	66.26
25	47.01	49.93	52.97
30	37.93	40.22	42.59
40	25.12	26.55	28.03
50	17.00	17.92	18.86
60	11.74	12.34	12.95
70	8.269	8.668	9.074
80	5.925	6.195	6.470
90	4.321	4.507	4.696
100	3.205	3.336	3.468





* Since the TH sensor (outdoor unit heat-sink temperature sensor) is built in the outdoor control board, the resistance value cannot be measured.

9-5. Operation check by PC board switch

9-5-1. Operation check mode

This mode allows to check the operations of the water 2-way valve, water 3-way valve, mixing valve, and circulation pump. This operation is valid when the hydro unit and the outdoor unit are turned on the power.

Operation check mode

(1) Preparation

1) Turn all of the remote controllers "OFF" for the hot water supply and heating.
2) Turn off the hydro unit and the outdoor unit.
3) Remove the front panel of the hydro unit.
4) Set SW06_2 "ON".

(2) Operation check

1) Turn on the hydro unit and the outdoor unit.
2) Rotate switch DIP SW01 to position "1" and press tactile switch SW07 for 5 sec. or longer.
3) Rotating the rotary SW01 allows to check each operation.
4) Set the DIP SW06_2 "OFF" to finish.

Rotary switch	Check contents		Remark
1	None		
2	2WV_W	Alive for approx. 2 sec, not alive for 3 sec	
3	3WV_W		
4	Mixing valve	Alive for 30 sec in the forward direction Alive for 30 sec in the reverse direction	
5	Built-in circulation pump	Alive / not alive for 20 sec	
6	External circulation pump 1	Alive / not alive for 20 sec	
7	(External circulation pump 2)	Alive / not alive for 20 sec	Reserved
8	Water heat exchange backup heater	Repeat heater 1, heater 2, and OFF every 20 sec	The built-in circulation pump operates.
9	Hot water cylinder heater	Alive / not alive for 10 sec	
10	Backup heater	Alive / not alive for 10 sec	The built-in circulation pump and external circulation pump operate.
11	Check the alarm output.	Output for 10 sec / no output for 10 sec	
12	Check the boiler output.	Output for 10 sec / no output for 10 sec	
13	Check the defrost output.	Output for 10 sec / no output for 10 sec	
14	Check the operation output.	Output for 10 sec / no output for 10 sec	
15	None		
16	Built-in circulation pump continuous operation	Continuously alive	Do not operate the circulation pump alive continuously without any water in hydro unit.

9-6. Brief method for checking the key components

9-6-1. Hydro unit

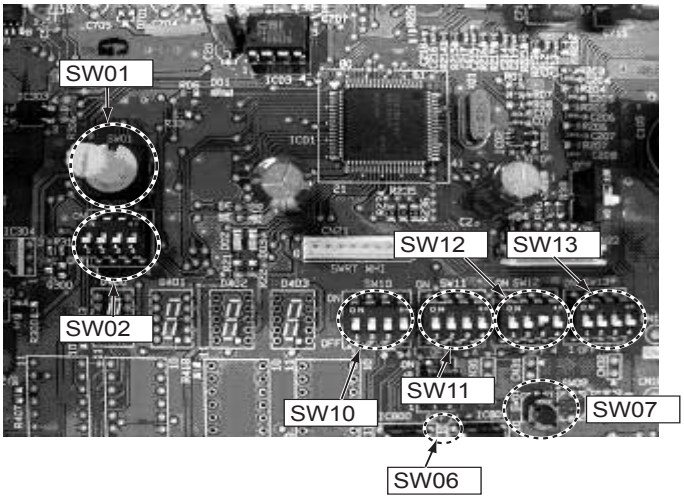
<table>
<tr><th>No.</th><th>Component name</th><th>Check procedure</th></tr>
<tr><td>1</td><td>Water heat exchange temperature (TC) sensor
Water inlet temperature (TWI) sensor
Water outlet temperature (TWO) sensor
Hot water cylinder temperature (TTW) sensor
Floor inlet temperature (TFI) sensor</td><td>Remove the connector and measure the resistance value with a tester. (Normal temperature)
<table>
<tr><th>Sensor \ Temperature</th><th>0 °C</th><th>10 °C</th><th>20 °C</th><th>30 °C</th></tr>
<tr><td>Water heat exchange temperature (TC) sensor</td><td rowspan="5">33.8 kΩ</td><td rowspan="5">20.35 kΩ</td><td rowspan="5">12.59 kΩ</td><td rowspan="5">7.99 kΩ</td></tr>
<tr><td>Water inlet temperature (TWI) sensor</td></tr>
<tr><td>Water outlet (TWO) sensor</td></tr>
<tr><td>Hot water cylinder temperature (TTW) sensor</td></tr>
<tr><td>Floor inlet temperature (TFI) sensor</td></tr>
</table></td></tr>
</table>

10 Hydro unit and outdoor unit settings

Hydro unit

1. Hydro unit Setting

1-1. Setting switch names and positions



1-2. SW02 (System switching 1)

SW02	Switching details	Factory default		Remarks
02_1	Boiler install position After 3WV heating side / Before 3WV	After 3WV, heating	OFF	Before 3 WV
02_2	–	–	OFF	
02_3	External cylinder thermostat connected.	No	OFF	
02_4	External room thermostat connected.	No	OFF	

1-3. SW10 (Pump switching)

SW10	Switching details	Factory default		Remarks
10_1	Pump P1 operation during hot water mode OFF = P1 ON during heat pump activate ON = P1 Continuous run	Heat-pump activate	OFF	
10_2	Pump P1 operation during room heating. P1 pump stop or not using outside air temperature. OFF = Continuous run ON = Pump P1 stop when TO>20 ^{o}C (Available to change the temperature setting by FC 9E)	Continuous run	OFF	
10_3	Synchronization of Pump P1 and P2.	Non-synchronous	OFF	
10_4	Pump P1 ON/OFF cycling (During long periods of system OFF)	No	OFF	

1-4. SW11 (Heater Yes/No switching)

SW11	Switching details	Factory default		Remarks
11_1	Hydro unit backup heater Energized Yes/No	Energized	OFF	
11_2	Hot water cylinder heater Energized Yes/No	Energized	OFF	
11_3	External booster heater output Enabled Yes/No	Enabled	OFF	
11_4	–	–	OFF	

1-5. SW12 (System switching 2)

SW12	Switching details	Factory default		Remarks
12_1	Hot water supply is using	Yes	OFF	
12_2	ZONE1 operation is using	Yes	OFF	
12_3	ZONE2 operation is using	No	OFF	
12_4	–	–	OFF	

1-6. SW13 (System switching 3)

SW13	Switching details	Factory default		Remarks
13_1	3WV SPST/SPSD Specification switching	SPST	OFF	
13_2	Boiler output enabled	No	OFF	
13_3	Auto Restart of power outage after system power failure.	Yes	OFF	
13_4	–	–	OFF	

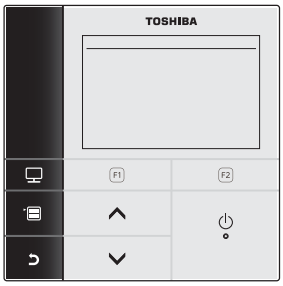
2. Function Code Setting

- Hydro unit function code setting is available only for the header remote controller.
- Set function codes for various operation modes with the remote controller.

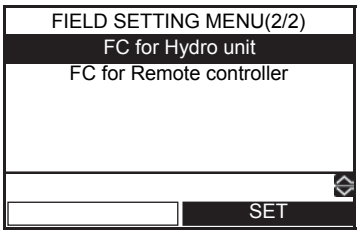
2-1. How to set hydro unit function code

<Procedure> Perform the following when no operation is in progress.

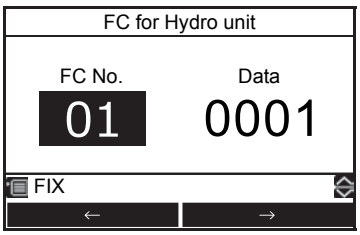
1 **Press the [▤] button and the [∨] button at same time for 4 seconds or longer on the top screen to display the "FIELD SETTING MENU".**



2 **Press the [∧] / [∨] button to select "FC for Hydro unit" on the FIELD SETTING screen, then press the [F2] button.**



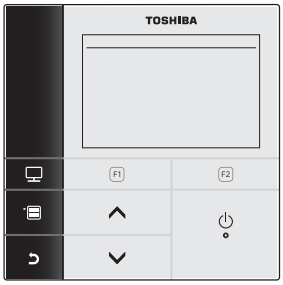
3 **Press the [F1] / [F2] button to select FC number or Data, then press the [∧] / [∨] button to set the value.**



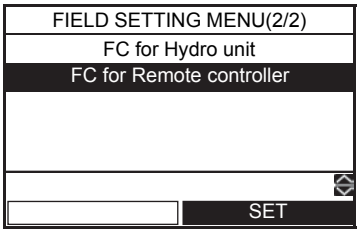
4 **Press the [▤] button. The set value is registered.**

2-2. How to set remote controller function code
<Procedure> Perform the following when no operation is in progress.

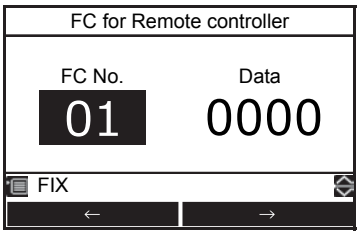
1 **Press the [ ] button and the [ ] button at same time for 4 seconds or longer on the top screen to display the "FIELD SETTING MENU".**



2 **Press the [ ] / [ ] button to select "FC for Remote controller" on the FIELD SETTING screen, then press the [F2] button.**



3 **Press the [F1] / [F2] button to select FC number or Data, then press the [ ] / [ ] button to set the value.**



4 **Press the [ ] button. The set value is registered.**

Function code table

FC	Item	Details			Factory default
01	Water heat exchanger capacity *1	0012: 455XWHM3-E			
02	Cooling/Non-cooling switching	0000: Cooling		0001: Not cooling	0000: Cooling
08	Hot water boost operation time (operating time)	0003: 30 min	-	0018: 180 min	0006: 60 min
09	Hot water boost set temperature	0040: 40 °C	-	0080: 80 °C	0075: 75 °C
0A	Anti bacteria set temperature	0065: 65 °C	-	0080: 80 °C	0075: 75 °C
0B	Anti bacteria holding time	0000: 0 min	-	0060: 60 min	0030: 30 min
0C	Mixing valve drive time	0003: 30 sec	-	0024: 240 sec	0006: 60 sec
0F	Hot water HP allowance while cooling + hot water supply	0000: Not allow	-	0001: Allow	0000: Not allow
18	Upper limit of cooling set temperature	0018: 18 °C	-	0030: 30 °C	0025: 25 °C
19	Lower limit of cooling set temperature	0007: 7 °C	-	0018: 20 °C	0007: 7 °C
1A	Upper limit of heating (ZONE1) set temperature	0037: 37 °C	-	0055: 55 °C	0055: 55 °C
1B	Lower limit of heating (ZONE1) set temperature	0020: 20 °C	-	0037: 37 °C	0020: 20 °C
1C	Upper limit of heating (ZONE2) set temperature	0037: 37 °C	-	0055: 55 °C	0055: 55 °C
1D	Lower limit of heating (ZONE2) set temperature	0020: 20 °C	-	0037: 37 °C	0020: 20 °C
1E	Upper limit of hot water set temperature	0060: 60 °C	-	0080: 80 °C	0075: 75 °C
1F	Lower limit of hot water set temperature	0040: 40 °C	-	0060: 60 °C	0040: 40 °C
20	Hot water HP start temperature	0020: 20 °C	-	0045: 45 °C	0038: 38 °C
21	Hot water HP stop temperature	0040: 40 °C	-	0050: 50 °C	0045: 45 °C
22	Priority mode Hot water supply/Heating switching temperature	-0020: -20 °C	-	0020: 20 °C	0000: 0 °C
23	Boiler output enable switching temperature	-0020: -20 °C	-	0020: 20 °C	-0010: -10 °C
24	Outside air temperature for hot water temperature compensation start	-0020: -20 °C	-	0010: 10 °C	0000: 0 °C
25	Hot water temperature compensation value	0000: 0K	-	0015: 15K	0003: 3K
26	Night setback change temperature range	0003: 3K	-	0020: 20K	0005: 5K
27	Set temperature shift with heating Auto	-0005: -5K	-	0005: 5K	0000: 0K
29	Outside air temperature T1 temperature	-0015: -15 °C	-	0000: 0 °C	-0010: -10 °C
2B	Outside air temperature T3 temperature	0000: 0 °C	-	0015: 15 °C	0010: 10 °C
2C	Set temperature A with outside air temperature of T0	0020: 20 °C	-	0055: 55 °C	0040: 40 °C
2D	Set temperature B with outside air temperature of T1	0020: 20 °C	-	0055: 55 °C	0035: 35 °C
2E	Set temperature C with outside air temperature of 0 °C	0020: 20 °C	-	0055: 55 °C	0030: 30 °C
2F	Set temperature D with outside air temperature of T3	0020: 20 °C	-	0055: 55 °C	0025: 25 °C
30	Set temperature E with outside air temperature of 20 °C	0020: 20 °C	-	0055: 55 °C	0020: 20 °C
31	Zone2 ratio with Zone1 as Auto	0000: 0%	-	0100: 100%	0080: 80%
33	Hydro unit backup heater down time	0000: 5 min 0002: 15 min		0001: 10 min 0003: 20 min	0001: 10 min
34	Hydro unit backup heater up time	0000: 10 min 0002: 30 min		0001: 20 min 0003: 40 min	0000: 10 min
3A	Frost protection function Invalid/Valid	0000: Invalid		0001: Valid	0001: Invalid
3B	Frost protection set temperature	0008: 10 °C	-	0020: 20 °C	0015: 15 °C
3C	2-way valve operation (logical reverse) control	0000: Energized during cooling 0001: Not energised during cooling			0000: Activate during cooling
3E	Heating HP/Boiler priority switching when using boiler	0000: Priority on HP		0001: Priority on boiler	0000: Priority on HP
40	Activate/deactivate room temperature control	0000: Deactivate		0001: Activate	0000: Deactivate

*1 FC_01 is needed for PCB replacement or function code reset procedure has been completed.
*2 System restart with remote controller.
*3 Restart in the mode when stopping.
*4 In addition, it is enable only when switch 2-3 is set to “OFF” and FC61 is set to “3”.

FC	Item	Details	Factory default
52	External input contact logic (must be used in with FC61)	0000: CLOSE to stop system *2 0001: OPEN to stop system *2 0002: OPEN to stop system, CLOSE to restart system (Statics input) 0003: CLOSE to stop system, CLOSE again to restart system (plus input)	0000:CLOSE to stop
54	Logic of 3-way valve's action when powered (Single return only)	0000: Not reversed (Hot water mode when powered) 0001: Reversed (Heating when powered)	0000: Not reversed (Hot water mode when powered)
58	Night setback is activated	0000: Zone 1 & 2 0001: Zone 1 only	0000: Zone1 & 2
59	Interval of Mixing Valve control	0001: 1 minute - 0030: 30 minutes	0004: 4 minutes
5A	P1 setting while in hot water supply mode	0000: While running HP only 0001: P1 continues running	0000: While running HP only
5B	Boiler running setting	0000: Boiler and HP 0001: Boiler only with pump running 0002: Heater 0003: Boiler only (Pump stopping)	0003: Boiler only
61	Changing the target of stopping/starting by external signal or changing the TEMPO setting	0000: Hot water supply and heating 0001: Keeping initial status *3 0002: Hot water supply only 0003: Heating only 0004: TEMPO1 (Not activate the heaters) 0005: TEMPO2 (Not activate the heaters, inlet pump, heat pump)	0000: Hot water supply and heating
62	Activate/deactivate A02 error detection	0000: Activate 0001: Deactivate	0000: Activate
64	Continuously run or stop the P2 pump while cooling	0000: Continuously run P2 0001: Stop P2	0000: Continuous running
65	P1 pump setting when the thermostat is deactivated in the room temperature remote controller and room temperature thermostat settings	0000: Continuously run P1 0001: Stop P1 when the thermostat is OFF	0000: Continuous running
67	Changing the condition of optional output (For the optional PC board connected to CN209)	0000: 1-3 During defrosting 2-3 While compressor is running. 0001: 1-3 As error is detected 2-3 During operation	0000: 1-3 During defrosting 2-3 While compressor is running.
6E	To diff temperature, when pump P1 stop at to 20 °C	0001: 1K 0005: 5K	0002: 2K
73	Hot water tank heater start time of heat-pump while operating	0000: 30 min passed 0003: 120 min passed	0000: 30 min passed
92	Upper room temperature limit when cooling	0000: 0 °C - 0055: 55 °C	0029: 29 °C
93	Lower room temperature limit when cooling	0000: 0 °C - 0055: 55 °C	0018: 18 °C
94	Upper room temperature limit when heating	0000: 0 °C - 0055: 55 °C	0029: 29 °C
95	Lower room temperature limit when heating	0000: 0 °C - 0055: 55 °C	0018: 18 °C
96	Initial water temperature setting when controlling cooling by the room temperature remote controller and room temperature thermostat	0005: 5 °C - 0030: 30 °C	0020: 20 °C
9D	Initial water temperature setting when controlling heating by the room temperature remote controller and room temperature thermostat	0020: 20 °C - 0055: 55 °C	0040: 40 °C
9E	TO temperature setting to stop the P1 pump during the middle period heating	0010: 10 °C - 0030: 30 °C	0020: 20 °C
A0	P1 pump speed control changes the percentage duty of the PWM control	0000: 100% 0005: 50%	0000: 100%
A1	Outside air temperature T0 temperature	-0030: -30 °C - -0020: -20 °C	-0020: -20 °C
A2	Zone2 temperature setting method	0000: Percentage (FC31) 0001: Fixed value (FCA3~ A5)	0000: Percentage
A3	Set temperature A' with outside temperature of T0	0020: 20 °C - 0055: 55 °C	0040: 40 °C
A4	Set temperature B' with outside temperature of T1	0020: 20 °C - 0055: 55 °C	0035: 35 °C
A5	Set temperature E' with outside temperature of 20 °C	0020: 20 °C - 0055: 55 °C	0020: 20 °C

*1 FC_01 is needed for PCB replacement or function code reset procedure has been completed.
*2 System restart with remote controller.
*3 Restart in the mode when stopping.
*4 In addition, it is enable only when switch 2-3 is set to "OFF" and FC61 is set to "3".

FC	Item	Details	Factory default
B2	HP restart water temperature in A zone. (Valid only room temp control using 2nd remote controller)	0020: 20 °C 0037: 37 °C	0025: 25 °C
B5	Initial water temperature setting method when controlling heating by the room temperature remote controller and room temperature thermostat	0000: The fixed temperature by FC9D 0001: The calculated temperature by Auto curve	0000: The fixed
B6	Changing the target of stopping / starting by external signal (CN210 - terminal 2 and 3)	0000: none (Local hot water tank thermostat) 0001: Hot water supply control *4	0000: none
B8	Forcibly heater off at T0 ≥ A °C	0000: no restriction, 0001: 20 °C 0002: 15 °C, ⋯, 0006: -5 °C	0000: no restriction
B9	Backup heater energization temperature during defrosting.	Correction coefficient B 0000: 0K, ⋯, 0004: 40K	0000: 0K
BA	Intermittent operation at T0 ≥ A °C (heating mode)	0000: continuous operation 0001: 20 °C, ⋯, 0006: -5 °C	0000: continuous operation
BB	Intermittent operation at T0 < B °C (cooling mode)	0000: continuous operation 0001: 35 °C, ⋯, 0003: 25 °C	0000: continuous operation
BC	Pump off time during thermostat off operation	0000: 5 min, ⋯, 0005: 30 min	0001: 10 min

*1 FC_01 is needed for PCB replacement or function code reset procedure has been completed.
*2 System restart with remote controller.
*3 Restart in the mode when stopping.
*4 In addition, it is enable only when switch 2-3 is set to “OFF” and FC61 is set to “3”.

Remote controller function code table

FC	Item	Details	Fist shipment
02	Temperature correction by the room temperature sensor (heating)	-10K~+10K: By 1K steps	-1: -1K correction
03	Temperature correction by the room temperature sensor (cooling)	-10K~+10K: By 1K steps	-1: -1K correction
09	Night time low-noise mode	0: Invalid 1: Valid	0: Invalid
0A	Night time low-noise start time	0 - 23 (0:00 to 23:00)	22: 22:00
0B	Night time low-noise end time	0 - 23 (0:00 to 23:00)	06: 06:00
0C	Anti bacteria start time	0 - 23 (0:00 to 23:00)	22: 22:00
0D	Anti bacteria start cycle	1 - 10 (Every day to 10-day cycle)	07: 7-day cycle
0E	Starting time of Night setback	0 - 23 (0:00 to 23:00)	22: 22:00
0F	Ending time of Night setback	0 - 23 (0:00 to 23:00)	06: 06:00
11	Remote controller Alarm Tone.	0: Alarm Tone OFF 1: Alarm Tone ON	1: Alarm Tone ON
12	Frost running period (days)	(0 days – 20 days)	00: No setting
13	Frost running period (hours)	(0 hours – 23 hours)	00: No setting
14	Start and End temperature	20 - 55 (20 °C - 55 °C)	00: No setting
15	Max temperature	20 - 55 (20 °C - 55 °C)	00: No setting
16	Continuation days for every step up to Max temperature	1 - 7 (1 day - 7 days)	00: No setting
17	Temperature difference for every step up to Max temperature	1 - 10 (1 K - 10 K)	00: No setting
18	Continuation days for every step down to End temperature	1 - 7 (1 day - 7 days)	00: No setting
19	Temperature difference for every step down to End temperature	1 - 10 (1 K - 10 K)	00: No setting
1A	Continuation days in Max temperature	1 - 30 (1 day - 30 days)	00: No setting

*14~1A: for floor drying function

2-3. How to reset hydro function code

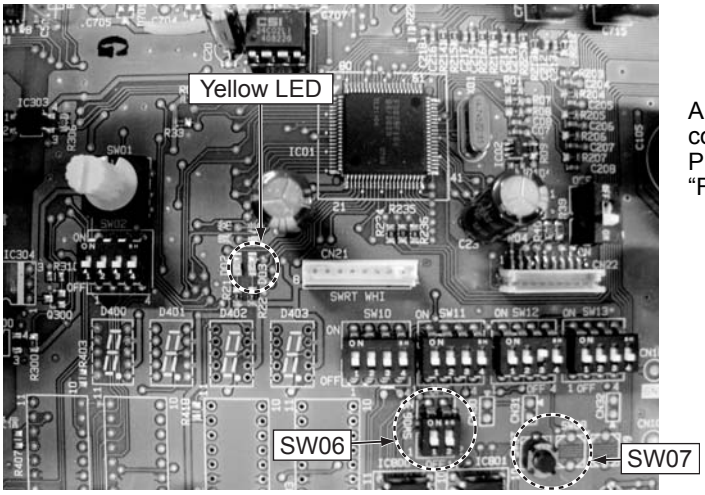
If the hydro unit PCB has been replaced, it is necessary to change the FC 01 (capacity setting)

(1) Preparation

1) Turn all off the Hot water supply operation and Heating/Cooling operation.
2) Turn off the power supply of the hydro unit and the outdoor unit.
3) Remove the front panel of the hydro unit and cover to the hydro unit electrical box.
4) Set SW06_1 and _2 "ON".

(2) Procedure

1) Turn on the power supply of the hydro unit and the outdoor unit.
   - The small yellow LED located near the MCU should be flashing slowly.
2) Press tactile switch SW07 until the yellow LED turns off.
   - When the tactile switch SW07 has been press for 5 sec, flashing becomes quickly. And when the switch will be pressed further 5 sec, the yellow LED will turn off.
     When the SW07 is released, the yellow LED start to flash quickly again.
3) Turn off the power supply of the hydro unit and the outdoor unit.
4) Set SW06_1 and _2 to "OFF".
5) Replace the electrical box cover and front panel on the hydro unit.



And you can reset hydro function code on remote controller.
Press the [∧] [∨] [↩] long time in "FC for Hydro unit" display, and select "YES".

2-4. How to reset remote controller function code

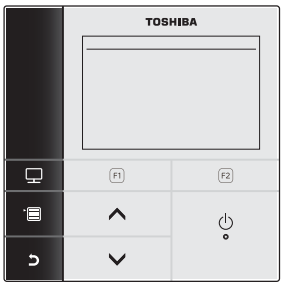
You can reset remote controller function code on remote controller.
Press the [∧] [∨] [↩] long time in "FC for remote controller" display, and select "YES".

3. Test run

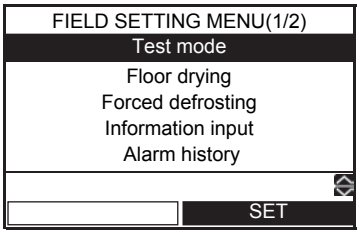
- Even if the outside air temperature or water temperature is outside the setting value range, Heating, Cooling and Hot water supply operation become possible.
- Since the protection setting is disabled in the TEST mode, do not continue a test run longer than 10 minutes.

<Procedure>

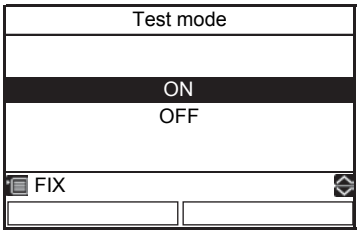
1 **Press the [ ] button and the [ ] button at same time for 4 seconds or longer on the top screen to display the "FIELD SETTING MENU".**



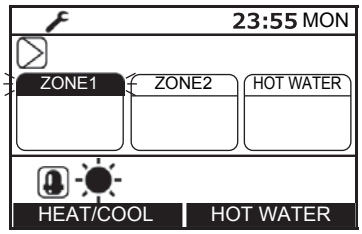
2 **Press the [ ] / [ ] button to select "Test mode" on the FIELD SETTING MENU screen, then press the [F2] button.**



3 **Press the [ ] button to select ON, then press the [ ] button. The mark appears on the top screen.**



4 **Start the heating or cooling or Hot water operation on the top screen, then the selected mode mark is blinking during Test mode.**



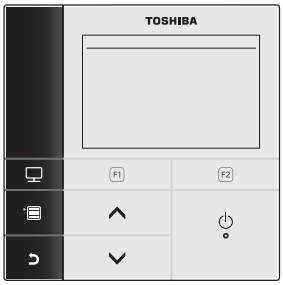
- The pump is activated in 30 seconds. If air is not released completely, the flow rate switch is activated to stop operation. Release air again according to the piping procedure. Little air entrainment is discharged from the purge valve.
- Check that the hydraulic pressure has become the predetermined pressure 0.1 to 0.2 MPa (1 to 2 bar). If the hydraulic pressure is insufficient, replenish water.
- Heating operation starts. Check that the hydro unit starts heating.
- Press the [F1] button to select the Cooling operation, in a few second, the operation starts.
- Check that the hydro unit starts cooling and that the floor heating system is not cooled.
- Press the [F1] button to stop the operation.
- Press the [F2] button to start the Hot water supply operation.
- Check that there is no air entrainment.
- Check that hot water is present at the connection port of the hot water cylinder.
- Press the [F2] button or [ON/OFF] button to stop the operation.

4. Auto Curve Setting

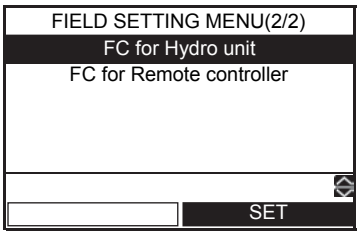
- This function is available only for the header remote controller.
- Set function codes for various operation modes with the remote controller.

<Procedure> Perform the following when no operation is in progress.

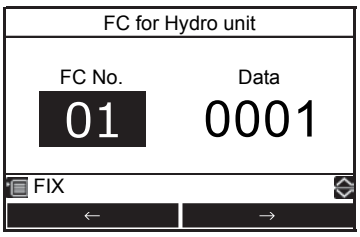
1 **Press the [ ] button and the [ ] button at same time for 4 seconds or longer on the top screen to display the "FIELD SETTING MENU".**



2 **Press the [ ] / [ ] button to select "FC for Hydro unit" on the FIELD SETTING screen, then press the [F2] button.**



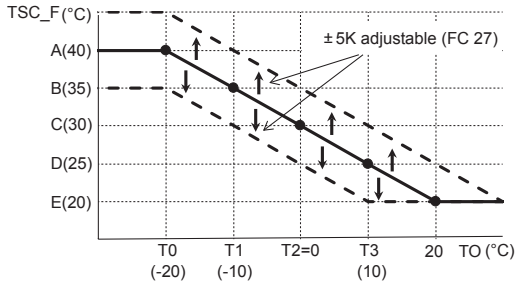
3 **Press the [F1] / [F2] button to select FC number or Data, then press the [ ] / [ ] button to set the value.**



4 **Press the [ ] button. The set value is registered.**

<ZONE1>

- An operation starts at the set temperature of straight -line approximation for the following: water temperature A °C with the outside temperature T0 °C, B °C with T1 °C, C °C with T2 °C, D °C with T3 °C, and E °C with 20 °C.



Related FC

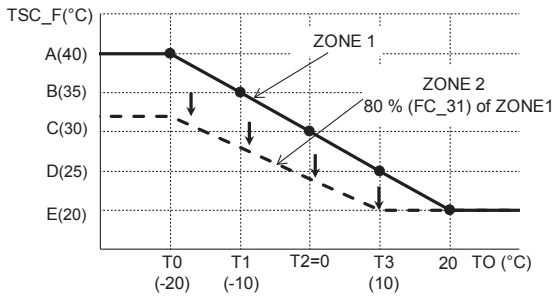
FC No.	Setting item	Default	range
2C	Setting temperature A at T0	40	20~55 °C
2D	Setting temperature B at T1	35	20~55 °C
2E	Setting temperature C at T2(= 0 °C)	30	20~55 °C
2F	Setting temperature D at T3	25	20~55 °C
30	Setting temperature E at 20 °C	20	20~55 °C
A1	Outside temperature T0	-20	-30~-20 °C
29	Outside temperature T1	-10	-15~0 °C
2B	Outside temperature T3	10	0~15 °C
27	Set temperature shift with heating set to auto	0	-5 to 5K

<ZONE2>

- Set temperature of the ZONE2 can be selected from two methods (FC_A2). One is a percentage of ZONE1, the other is a fixed value.

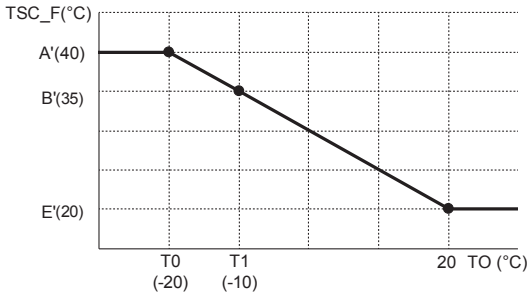
FC_A2 = "0" : Percentage method that is set by FC_31.
FC_A2 = "1" : Fixed value method that is set by FC_A3, A4 and A5.
However, it is automatically controlled the set temperature of ZONE1 to be the ZONE2 or more.

FC_A2=0 Percentage method



Auto-Curve in ZONE2 shows 80% (FC) of that of ZONE1, the water temperature setting does not fall below 20 °C.

FC_A2=1 Fixed value method



The ZONE2 set temperature A' °C with the outside temperature T0 °C, B' °C with T1 °C, E' °C with 20 °C.

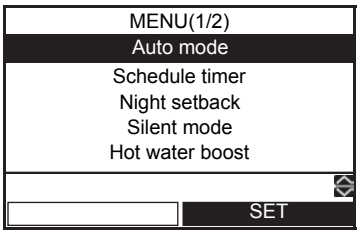
Related FC

FC No.	Setting item	Default	range
A2	The choice of how to set ZONE2	0	0 or 1
A3	Setting temperature A' at T0	40	20~55 °C
A4	Setting temperature B' at T1	35	20~55 °C
A5	Setting temperature E' at 20 °C	20	20~55 °C
31	Auto-Curve ratio of ZONE2	80	0~100%

Auto-Curve temperature shift

- This function is available only for the header remote controller.
- The set temperature can be shifted in the range of ±5K of the current setting.

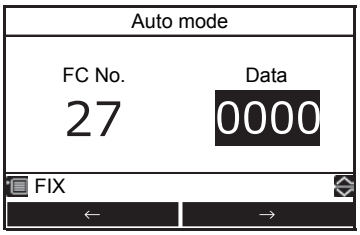
1 **Press the [∧] / [∨] button to select "Auto mode" on the MENU screen.**



2 **Press the [F1] button for 4 seconds or longer to enter the setting mode. The function code setting screen appears.**
FC No. 27: Shifted temperature (Range: -5 ~ +5, Default: 0)

3 **Press the [F2] button to select Data value, then press the [∧] / [∨] button to adjust the temperature between -5K to +5 K.**

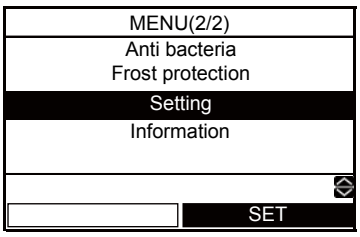
4 **Press the [▤] button. The set temperature is registered.**



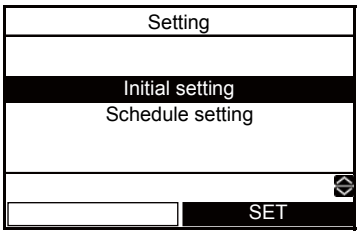
5. Clock Setting

- Setting for the clock (date, month, year, time)

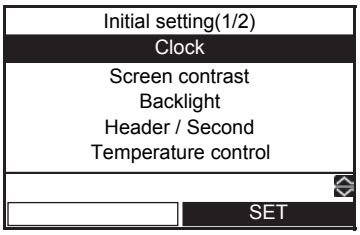
1 **Press the [∧] / [∨] button to select “Setting” on the MENU screen, then press the [F2] button.**



2 **Press the [∧] / [∨] button to select “Initial setting” on the Setting screen, then press the [F2] button.**



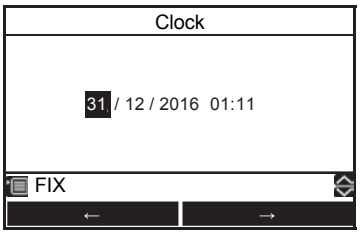
3 **Press the [∧] / [∨] button to select “Clock” on the Initial setting screen, then press the [F2] button.**



4 **Press the [F1] / [F2] button to select the date, month, year, and, time.**

5 **Press the [∧] / [∨] button to set the value, then press the [▤] button.**

- The clock display appears on the top screen.
- The clock display blinks if the clock setting has been reset due to power failure or other cause.



6. Scheduled Operation Setting

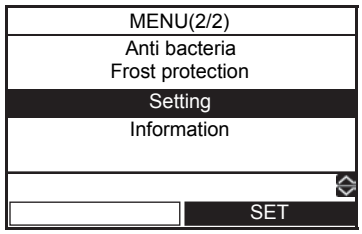
6-1. How to set scheduled operation

- This function is available only for the header remote controller.
- Schedule setting makes the following modes to be flexibly set: hot water supply, heating, cooling, hot water supply and heating, hot water supply and cooling, and stop, and set temperature.
- Set the unit clock and the schedule condition setting before schedule timer setting.

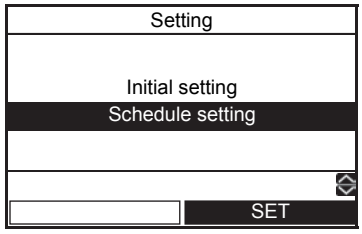
<Preparation>

Set the remote controller time at first.

1 **Press the [∧] / [∨] button to select "Setting" on the MENU screen, then press the [F2] button.**



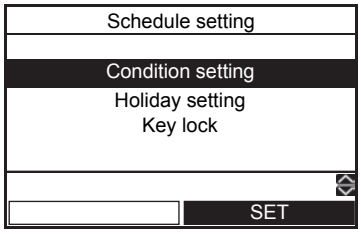
2 **Press the [∧] / [∨] button to select "Schedule setting" on the setting screen, then press the [F2] button.**



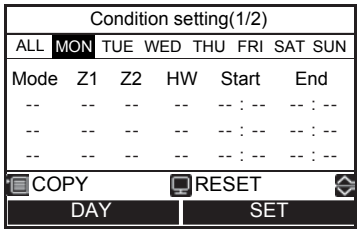
Condition setting

- Up to 6 different running patterns per day can be programmed.

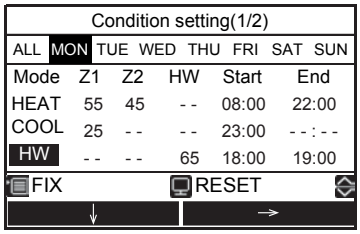
1 **Press the [∧] / [∨] button to select "Condition setting" on the Schedule setting screen, then press the [F2] button.**



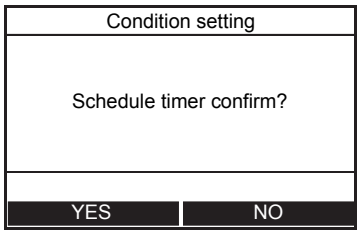
2 **Press the [F1] button to select the day, then press the [F2] button to input running pattern.**



3 **Press [F1] / [F2] button to select the change item, then press the [∧] / [∨] button.**



4 **Press the [ ] button.**



5 **Press the [F1] button to Fix.**

Mode :Operation mode (HEAT, COOL, HW (Hot water))
Z1 :ZONE1 setting temperature
Z2 :ZONE2 setting temperature
HW :Hot water supply operation setting temperature
Start :Operation start time (0:00 ~ 23:59)
End :Operation end time (0:00 ~ 24:00, -- : --)

- “-- : --” means the operation continues.

If End time is set earlier than Start time, an error is displayed.

To set up ranging over a day

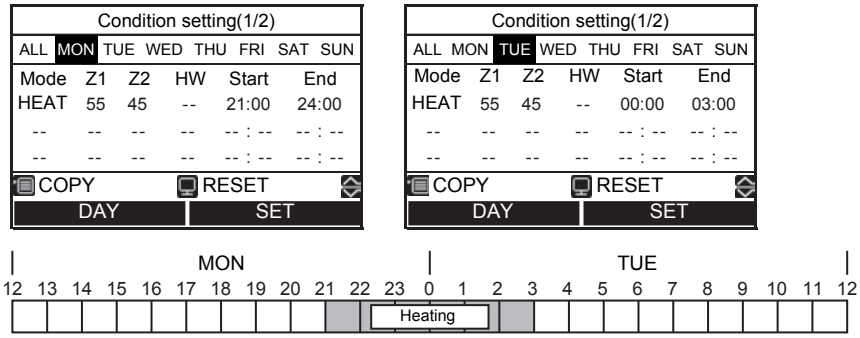
There are two methods.

①If “24:00” is set to “END” and “00:00” is set to “START” next day, the previous operation status will be continued. And set the time you want to stop to “END”.

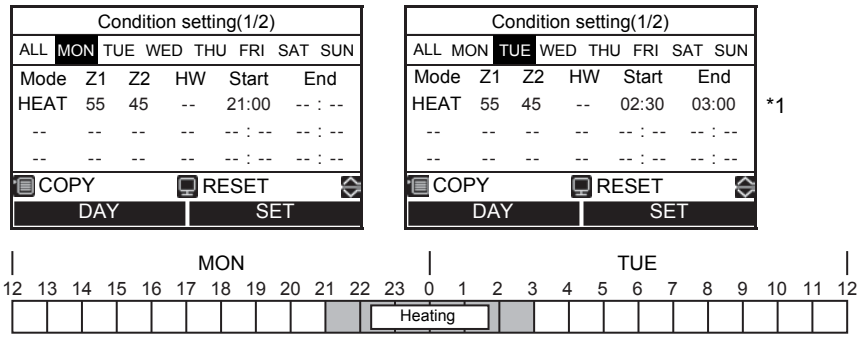
②If “--” is set to “END”, the previous operation status will be continued next day. And set the time you want to stop to “END”. Any “START” time is sufficient if it is earlier than “END” time.

In the case of heating operation from 21:00 of Monday night to 3:00 of Tuesday morning.

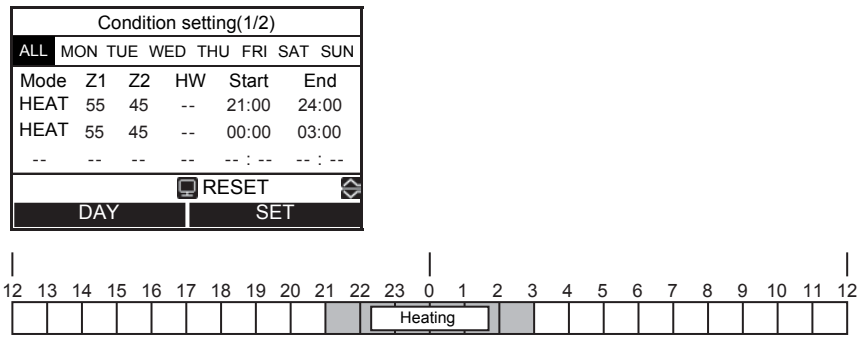
Example of set up (1)



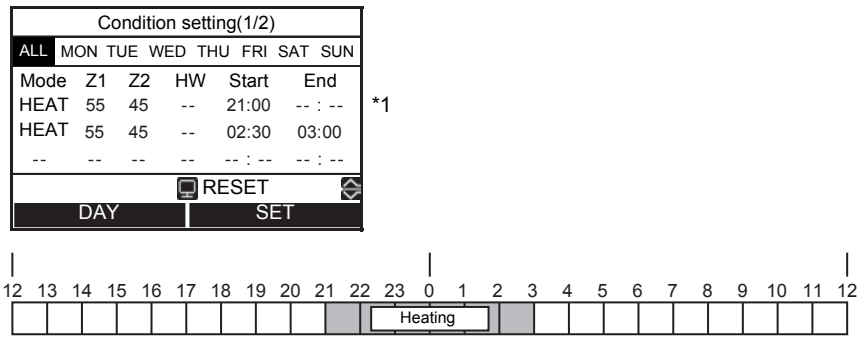
Example of set up (2)



Example of set up (3) (ALL DAY)



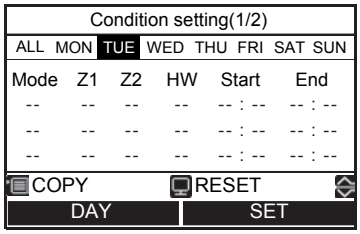
Example of set up (4) (ALL DAY)



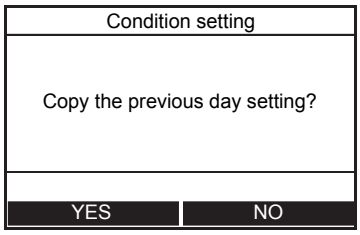
*1: “START” time is permissible 00:00 ~ 02:59 in this example.

To copy the settings of the previous day

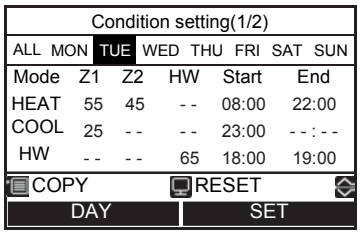
1 **Press the [F1] button to select the day, then press the [▤] button to copy the settings of the previous day.**



2 **Press the [F1] button, then the contents of the setting is displayed.**



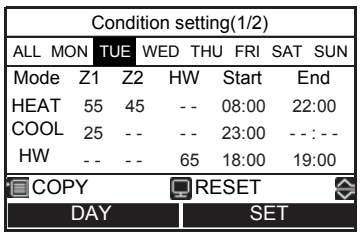
↓



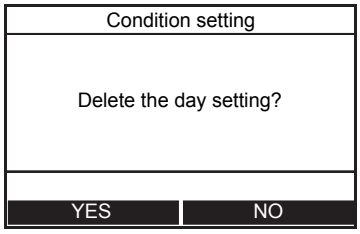
- If the [▤] button is pressed in the state where “MON” is selected, the contents of the setting of “SUN” is copied.

To reset the settings for each day.

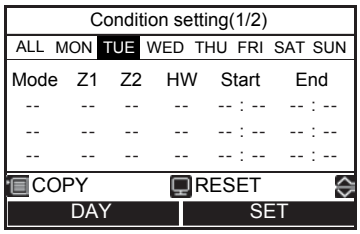
1 **Press the [F1] button to select the day, then press the [▭] button to reset the settings of the day.**



2 **Press the [F1] button, then the contents of the setting is cleared.**



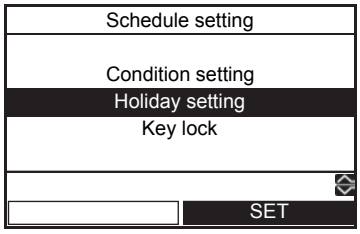
↓



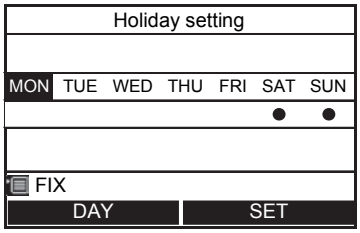
Holiday setting

- Set the days of the week when the schedule timer not used.

1 **Press the [∧] / [∨] button to select "Holiday setting" on the Schedule setting screen, then press the [F2] button.**



2 **Press the [F1] button to select the day, then press the [F2] button to set.**
●: Schedule timer is not used.



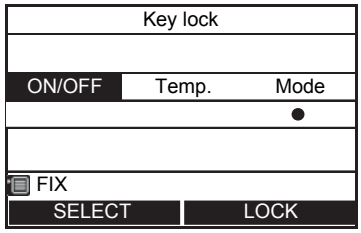
3 **Press the [▤] button to Fix.**

Key lock

- Select whether to LOCK / UNLOCK [ON/OFF], [Temperature], [mode] during schedule timer.

1 **Press the [∧] / [∨] button to select "Key lock" on the Schedule setting screen, then press the [F2] button.**

2 **Press the [F1] button to select object, then press the [F2] button to select LOCK or UNLOCK.**
●: LOCK

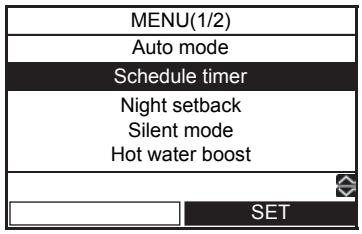


3 **Press the [▤] button to Fix.**

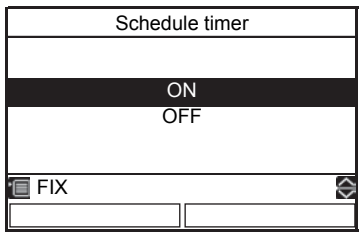
- When "LOCK" is selected, the key cannot be used during Key lock and schedule timer.
- The factory default is "UNLOCK".

To enable the Schedule timer function

1 **Press the [∧] / [∨] button to select "Schedule timer" on the MENU screen, then press the [F2] button.**



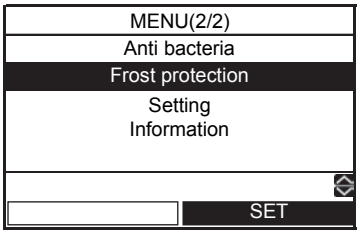
2 **Press the [∧] button to select "ON" on the Schedule timer screen, then press the [▤] button. The ◷ mark appears on the top screen.**



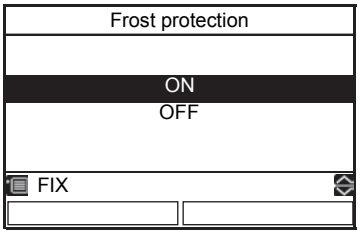
7. Frost protection Setting

- This function performs operation with the minimum capacity (target water temperature:15°C) to prevent pipes from freezing in case the unit is not used for a long period due to absence.
- Cancel schedule timer to start Frost protection operation. When Frost protection is operated with schedule timer on, it may stop during its operation.
- The minimum capacity can be changed, ask the installation company to make the required changes to the settings.
- This function takes precedence over the Night setback operation that is set separately.
- Start the heating operation before making the setting.
  It may not be able to go to the setting screen immediately after start. In that case, select “Frost protection” again after tens of seconds.

1 Press the [∧] / [∨] button to select “Frost protection” on the MENU screen, then press the [F2] button.

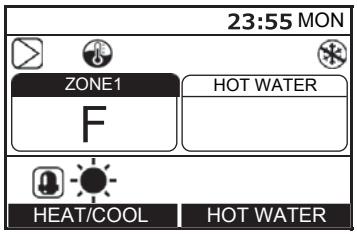


2 Press the [∧] button to select “ON” on the Frost protection screen, then press the [▤] button.



3 The temperature indication change to “F” and ❄ mark appears on the top screen.

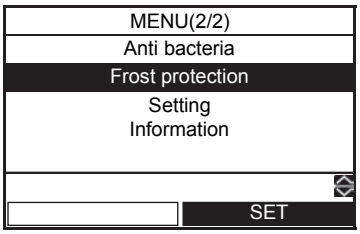
- When the set period has passed, the Frost protection operation ends automatically.



<How to set Frost protection operation end time>

- This function is available only for the header remote controller.

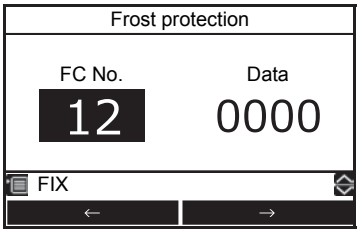
1 **Press the [∧] / [∨] button to select "Frost protection" on the MENU screen.**



2 **Press the [F1] button for 4 seconds or longer to enter the setting mode. The function code setting screen appears.**
FC No. 12: End days (Range: 0~20, Default: 0)
13: End times (Range: 0~23, Default: 0)
ex)
Code No. 12: 05
13: 13 = 5 days 13 hours

3 **Press the [F1] / [F2] button to select FC number or Data, then press the [∧] / [∨] button to set the value.**

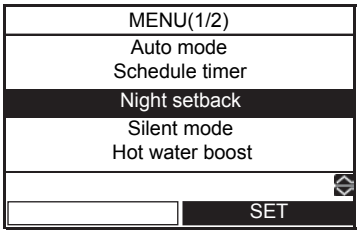
4 **Press the [▤] button. The set value is registered.**



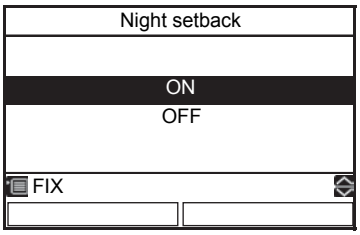
8. NIGHT Operation Setting

- This function is used for energy saving during specified time zone (sleeping hours, etc.).
- For night time hours (sleeping hours, etc.), this function shifts the set temperature of heating or cooling by 5K.

1 **Press the [∧] / [∨] button to select an "Night setback" on the MENU screen, then press the [F2] button.**



2 **Press the [∧] button to select "ON" on the Night setback screen, then press the [▤] button.**

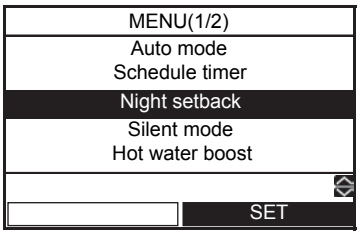


3 **Start the heating or cooling operation, then the ⏲ mark appears on the top screen.**

<How to set NIGHT operation start and end time>

- This function is available only for the header remote controller.

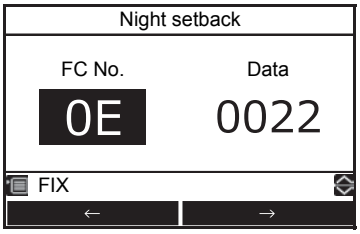
1 **Press the [∧] / [∨] button to select an "Night setback" on the MENU screen.**



2 **Press the [F1] button for 4 seconds or longer to enter the setting mode. The function code setting screen appears.**
FC No. 0E: Start time (Range: 0~23, Default: 22)
0F: End time (Range: 0~23, Default: 06)

3 **Press the [F1] / [F2] button to select FC number or Data, then press the [∧] / [∨] button to set the value.**
The same value cannot be set to 0E and 0F.

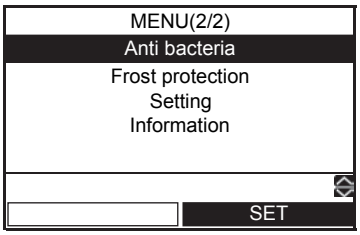
4 **Press the [▤] button. The set time is registered.**



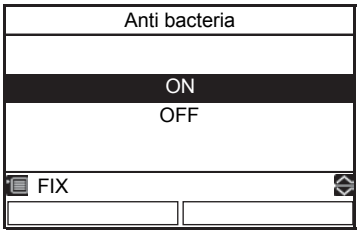
9. Anti bacteria Setting

- This setting regularly raises the hot water cylinder temperature to prevent bacteria from growing.
- The Anti bacteria operation is performed to maintain the temperature (75°C) for the period (30 minutes) when the preset start time (22:00) comes according to the preset cycle (7 days).
- The maintain temperature and the period can be changed, ask the installation company to make the required changes to the settings.

1 **Press the [∧] / [∨] button to select "Anti bacteria" on the MENU screen, then press the [F2] button.**



2 **Press the [∧] button to select "ON" on the Anti bacteria screen, then press the [▤] button.**



3 **Start the hot water operation, then the ⊛ mark appears on the top screen.**

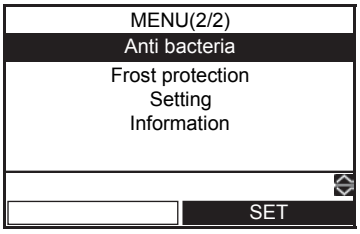
<How to set Anti bacteria temperature and holding time>

In FC_0A or 0B, the set temperature and holding time can be changed.
FC_0A: Set temperature change range 70 to 80 °C (75 °C: default)
FC_0B: Holding time change range 0 to 60 minutes (30 minutes: default)

<How to set Anti bacteria start time and cycle>

- This function is available only for the header remote controller.

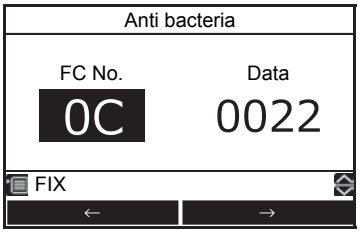
1 **Press the [∧] / [∨] button to select "Anti bacteria" on the MENU screen.**



2 **Press the [F1] button for 4 seconds or longer to enter the setting mode. The function code setting screen appears.**
FC No. 0C: Start time (Range: 0~23, Default: 22)
0D: cycle (Range: 0~10, Default: 07)

3 **Press the [F1] / [F2] button to select FC number or Data, then press the [∧] / [∨] button to set the value.**

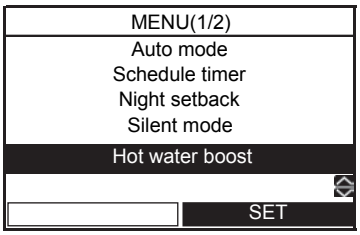
4 **Press the [▤] button. The set value is registered.**



10. Hot water boost Setting

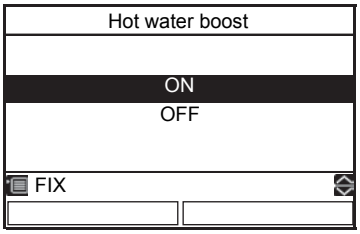
- This function is used when temporarily giving priority to the hot water supply operation. The hot water supply operation is performed in preference to other operations with a target of the preset time (60 minutes) or the preset temperature (75°C). Use this function when hot water is not used for a long time or before using a large amount of hot water.
- The preset time and temperature settings can be changed to values with in a range of 30 to 180 minutes and 40 to 80°C. Ask the installation company to make the required changes to the settings.
- Start the hot water operation before making the setting.
  It may not be able to go to the setting screen immediately after start. In that case, select “Hot water boost” again after tens of seconds.

1 Press the [∧] / [∨] button to select “Hot water boost” on the MENU screen, then press the [F2] button.



2 Press the [∧] button to select “ON” on the Hot water boost screen, then press the [▤] button. The ♨ mark appears on the top screen.

- When the set time period has passed or the water temperature has reached the set temperature, the Hot water boost operation ends automatically.



Hot water boost operation with the heat pump and heater ends when the water temperature reaches 75 °C; however, the normal hot water supply operation automatically starts after 60 minutes even if the temperature is not as high as 75 °C.

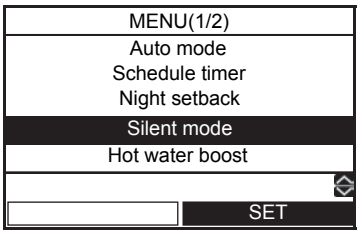
<How to set Hot water boost operation time and temperature>

In FC_08 or 09, the operation time and set temperature can be changed.
FC_08: Operation time change range 30 to 120 minutes (60 minutes: default)
FC_09: Set temperature change range 40 to 80 °C (75 °C: default)

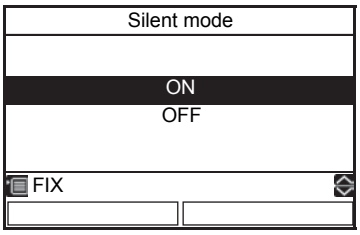
11. Night time Low-noise Setting

- This function is available only for the header remote controller.
- This setting is used to reduce noise output, from the outdoor unit, during night time for neighbours. Night time low-noise operates with lower operation frequency and fan tap than normal operation only for the set time period.

1 **Press the [∧] / [∨] button to select "Silent mode" on the MENU screen, then press the [F2] button.**



2 **Press the [∧] button to select "ON" on the Silent mode screen, then press the [▤] button.**

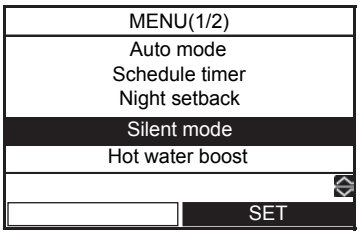


3 **Start the heating, cooling or hot water operation. The ⏲ mark appears on the top screen during the set-up time zone.**

<How to enable, set start time and end time of night time low-noise>

- This function is available only for the header remote controller.

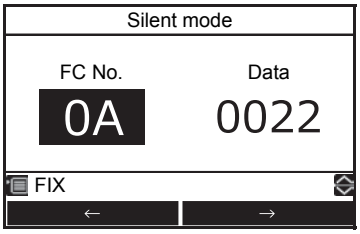
1 **Press the [∧] / [∨] button to select "Silent mode" on the MENU screen.**



2 **Press the [F1] button for 4 seconds or longer to enter the setting mode. The function code setting screen appears.**
FC No. 0A: Start time (Range: 0~23, Default: 22)
0B: End time (Range: 0~23, Default: 06)

3 **Press the [F1] / [F2] button to select FC number or Data, then press the [∧] / [∨] button to set the value.**
The same value cannot be set to 0A and 0B.

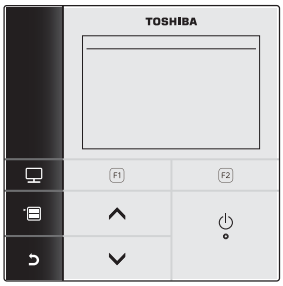
4 **Press the [▤] button. The set time is registered.**



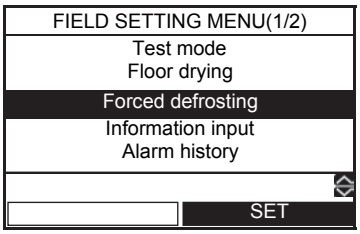
12. Forced Defrosting Setting

- This function is available only for the header remote controller.
- This function can active the forced defrosting mode for the outdoor unit.

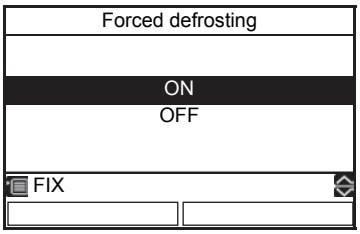
1 **Press the [ ] button and the [ ] button at same time for 4 seconds or longer on the top screen to display the "FIELD SETTING MENU".**



2 **Press the [ ] / [ ] button to select "Forced defrosting" on the FIELD SETTING screen, then press the [F2] button.**



3 **Press the [ ] button to select ON, then press the [ ] button.**



4 **Start the heating operation on the top screen.**

(Operation)

- Press the F1 button.
- Set the operation to the heating mode.
- After a while, forced defrosting signals are transmitted to the outdoor unit, and the unit starts defrosting. (Forced defrosting lasts for up to 10 minutes.)
- After the defrosting, the heating operation starts.
- To perform defrosting again, start with ***1*** above. (Performing the forced defrosting once cancels the forced defrosting setting above described.)

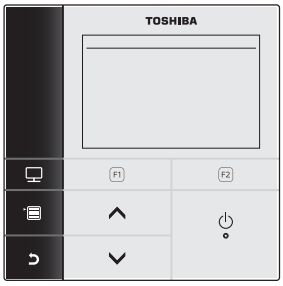
13. Display Function of Set Temperature and Other Settings

- The sensor sensing temperature is displayed on the remote controller.
- This function allows you to make sure whether the sensor is installed properly.

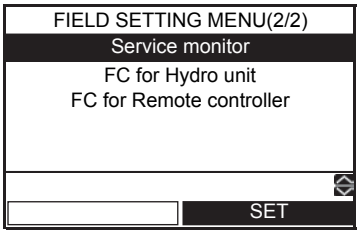
■ Sensor temperature display calling

<Procedure>

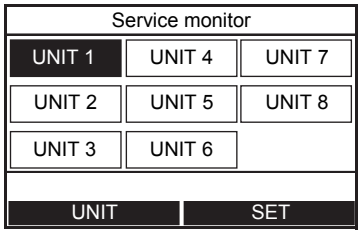
1 **Press the [▤] button and the [∨] button at same time for 4 seconds or longer on the top screen to display the "FIELD SETTING MENU".**

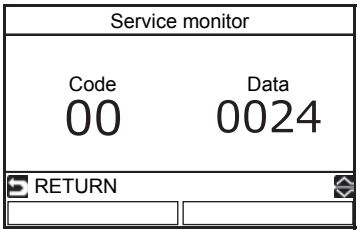


2 **Press the [∧] / [∨] button to select "Service monitor" on the FIELD SETTING MENU screen, then press the [F2] button.**



3 **Press the [F1] button to select the unit, then press the [F2] button to display the status.**





	Item code	Data name	Unit
Hydro unit data	00	Control temperature (Hot water cylinder)	°C
	01	Control temperature (Zone1)	°C
	02	Control temperature (Zone2)	°C
	03	Remote controller sensor temperature	°C
	04	Condensed temperature (TC)	°C
	06	Water inlet temperature (TWI)	°C
	07	Water outlet temperature (TWO)	°C
	08	Water heater outlet temperature (THO)	°C
	09	Floor inlet temperature (TFI)	°C
	0A	Hot water cylinder temperature (TTW)	°C
	0B	Mixing valve position	step
	0	Low pressure (Ps) × 1/10	kPa
	0F	Hydro soft Ver.	–

	Item code	Data name	Unit
Outdoor unit data	60	Heat exchange temperature (TE)	°C
	61	Outside air temperature (TO)	°C
	62	Discharge temperature (TD)	°C
	63	Suction temperature (TS)	°C
	65	Heat sink temperature (THS)	°C
	6A	Current × 10	A
	6D	Heat exchanger coil temperature (TL)	°C
	70	Compressor operation Hz	Hz
	72	Number of revolutions of outdoor fan (lower or 1 fan model)	rpm
	73	Number of revolutions of outdoor fan (upper)	rpm
	74	Outdoor PMV position × 1/10	pls

	Item code	Data name	Unit
Service data	F0	Micro computer energized accumulation time × 1/100	h
	F1	Hot water compressor ON accumulation time × 1/100	h
	F2	Cooling compressor ON accumulation time × 1/100	h
	F3	Heating compressor ON accumulation time × 1/100	h
	F4	Built-in circulation pump operation accumulation time × 1/100	h
	F5	Hot water cylinder heater operation accumulation time × 1/100	h
	F6	Backup heater operation accumulation time × 1/100	h
	F7	Booster heater operation accumulation time × 1/100	h

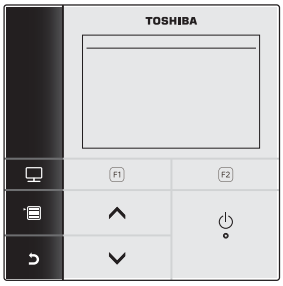
- Some sensors (temperature / pressure) or fan are not displayed, because not connected.

14. Failure History Calling Function

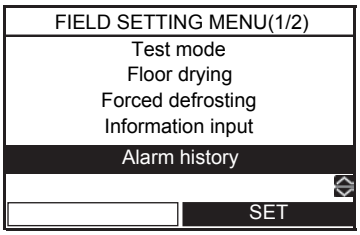
- List of latest 10 alarm data: error information of error code, date and time is displayed.

<Procedure>

1 **Press the [ ] button and the [ ] button at same time for 4 seconds or longer on the top screen to display the "FIELD SETTING MENU".**

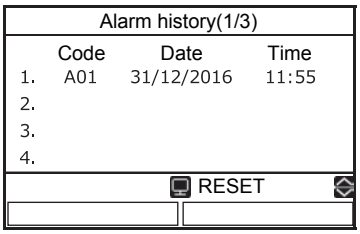


2 **Press the [ ] / [ ] button to select "Alarm history" on the FIELD SETTING MENU screen, then press the [F2] button.**

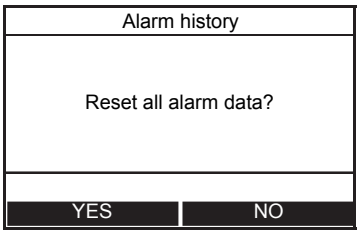


To reset the alarm history

1 **Press the [ ] button to reset the alarm history.**



2 **Press the [F1] button, then all alarm data is cleared.**



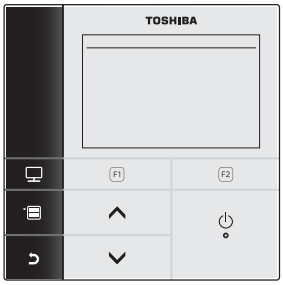
NOTE

If the current failure is the same as the one occurred last time before deleted, the history may not record the current failure.

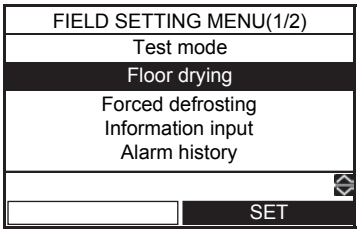
15. Floor drying

- This function is available only for the header remote controller.
- This function is used for drying concrete etc.
- Service personnel must operate the unit after setting the related function code.
- Operation is not started unless All the related function codes are set.
- Refer to the following for the settings of the related items. Please setup on the responsibility for an installer. An unsuitable setup may cause a crack of concrete etc.
- When the operation starts, the unit operates as follows.

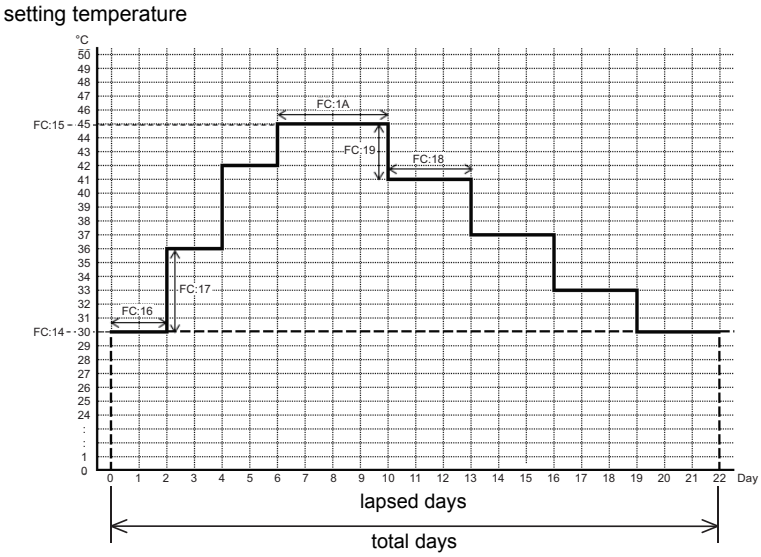
1 **Press the [ ] button and the [ ] button at same time for 4 seconds or longer on the top screen to display the "FIELD SETTING MENU".**



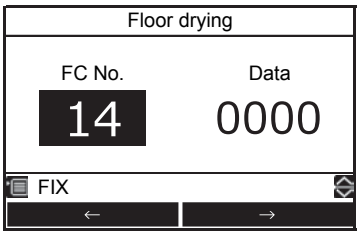
2 **Press the [ ] / [ ] button to select "Floor drying" on the FIELD SETTING MENU, then press the [F1] button for 4 seconds or longer.**



FC:14 setting start and End temperature [20-55°C]
FC:15 setting Max temperature [20-55°C]
FC:16 continuation days for every step up to Max temperature [1-7 days]
FC:17 temperature difference for every step up to Max temperature [1-10 K]
FC:18 continuation days for every step down to End temperature [1-7 days]
FC:19 temperature difference for every step down to End temperature [1-10 K]
FC:1A Continuation days in Max temperature [1-30 days]



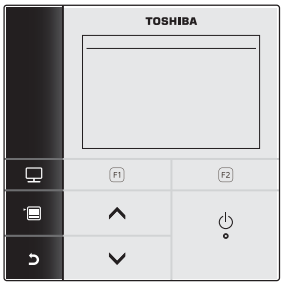
3 **Press the [F1] / [F2] button to select FC number or Data, then press the [ ] / [ ] button to set the value.**



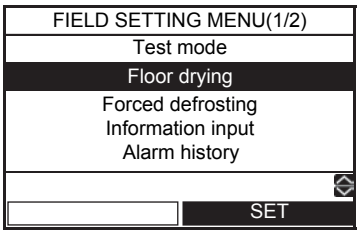
4 **Press the [ ] button. The set value is registered.**

To start the operation

1 **Press the [ ] button and the [ ] button at same time for 4 seconds or longer on the top screen to display the "FIELD SETTING MENU".**

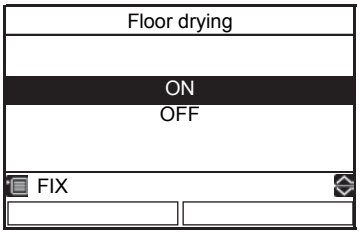


2 **Press the [ ] / [ ] button to select "Floor drying" on the FIELD SETTING MENU, then press the [F2] button.**



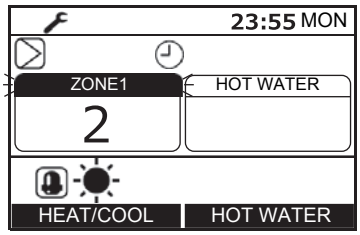
3 **Press the [ ] button to select the ON, then press the [ ] button.**

- Check the total days for Floor drying operation, then press [F1] button. The mark and mark appears on the Top screen.



4 **Start the heating operation on the top screen.**

- Then ZONE1 mark blinks during Floor drying operation and lapsed days are displayed.



- If some abnormalities occur during Floor drying operation, the System stops and Alarm history screen is displayed.
- After heating operation is stopped by operating the remote controller during Floor drying operation, if heating operation is again started within 30 minutes, Floor drying operation is started from the time of stopping.

11 How to exchange main parts

⚠ WARNING

<Turn off the power breaker>
Because the electrical components are energized with high voltage, always turn off the power breaker before starting to work.

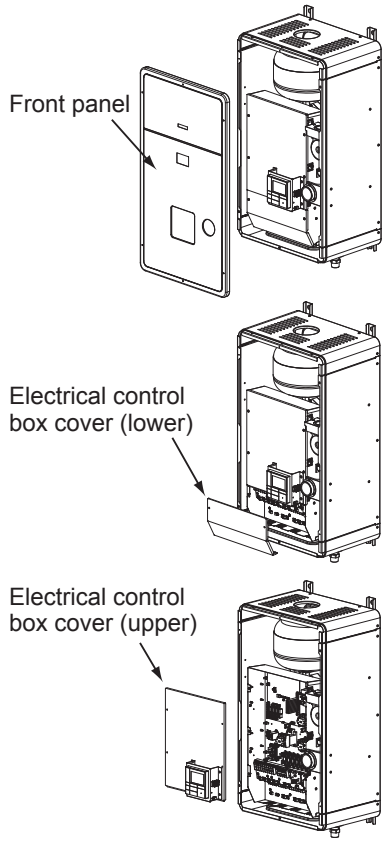
<Check>
Ensure that no water pressure is present when replacing the water circuit (circulation pump, heater unit, flow switch, etc). After a repair is complete, perform a test run (after attaching the front panel, upper and lower cabinets, and side cabinet) and check that no abnormality including smoke or abnormal noise occurs. Failure to do so may cause a fire or an electric shock. Place the cabinets before making a test run.

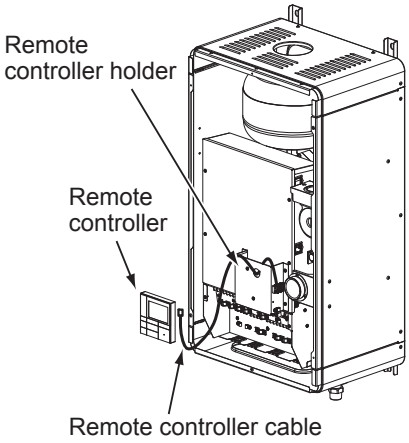
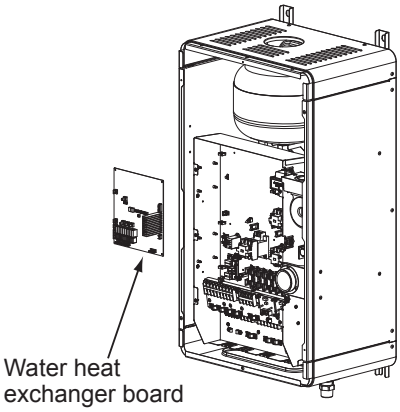
<Watch out for fire>
Observe the following instructions when repairing the refrigerant cycle.
(1) Watch out for surrounding fire. Always put out the fire of stove burner or other devices before starting the repair.
Should the fire fail to be put out, the oil mixed with refrigerant gas could catch fire.
(2) Do not use a welder in a closed room.
A room with no ventilation may cause carbon monoxide poisoning.
(3) Keep away flammable materials.
The materials may catch the fire of a welder.

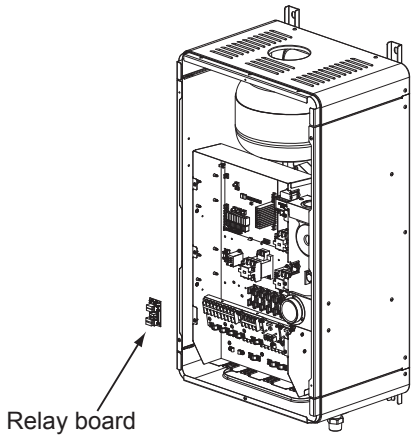
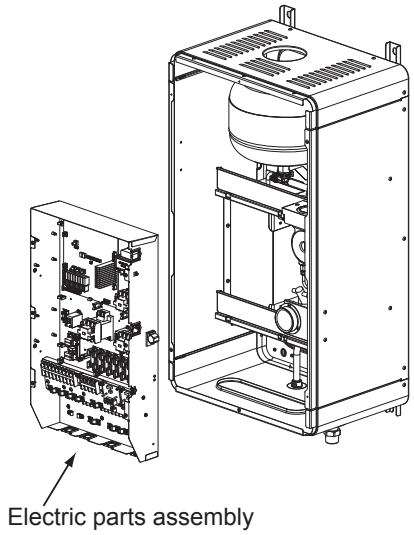
⚠ CAUTION

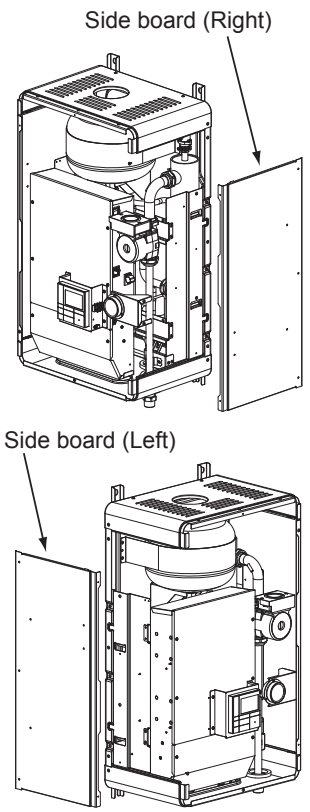
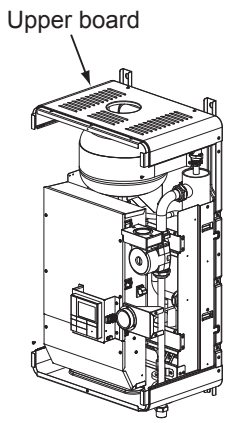
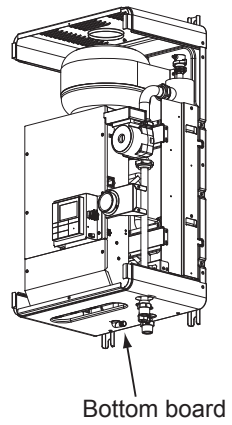
<Wear gloves>
Wear gloves (∗) when performing repair.
Failure to do so may cause an injury when accidentally contacting the parts.
∗: Thick gloves such as cotton work gloves

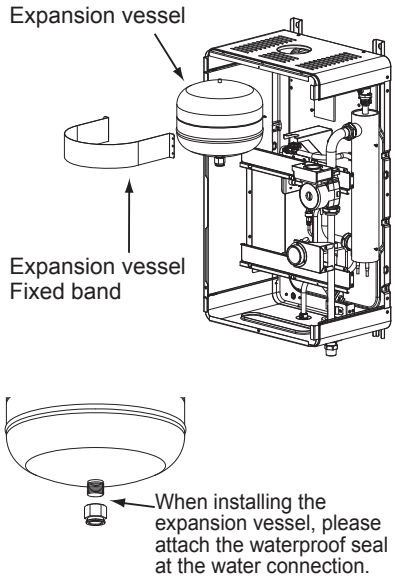
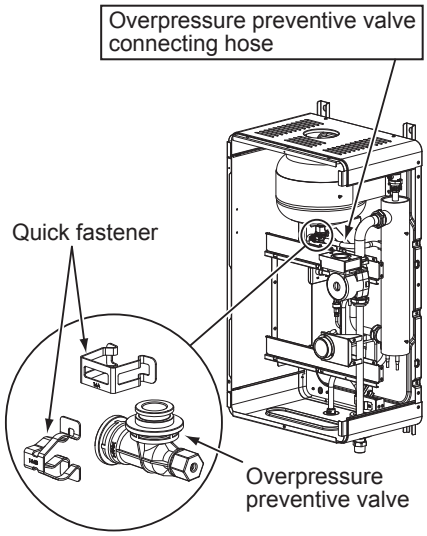
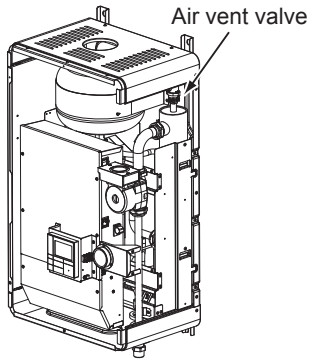
1. Hydro Unit

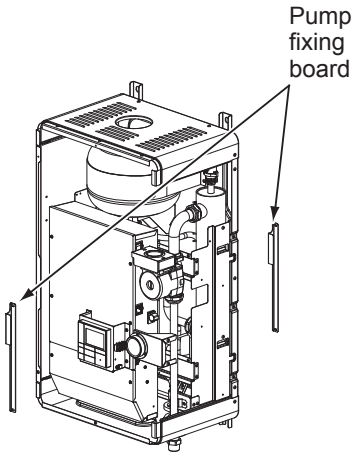
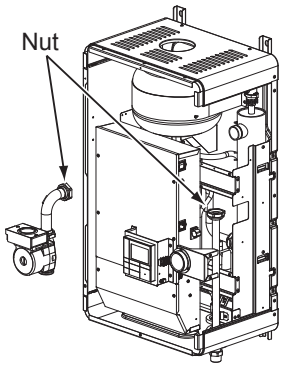
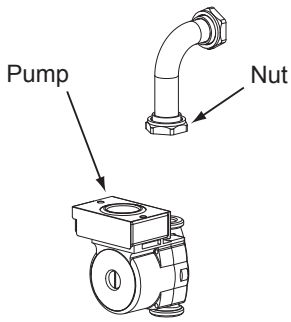
No.	Exchange parts name	Work procedure	Remarks
1	Common procedure	Wear gloves when performing the work. Failure to do so may cause an injury when accidentally contacting the parts.	
	Front panel	1. How to remove 1) Stop the hydro unit operation, and turn off the power breaker. 2) Remove the front panel. (ST1T Ø4 × 10, 6 screws) 3) After unscrew the screws, remove the front panel by pulling it toward you.	
	Electrical control box cover (lower)	4) Remove the electrical control box cover (lower). (ST2T Ø4 × 8, 2 screws) 5) Disconnect the power source cable and outdoor unit connecting cable from the terminal block.	
	Electrical control box cover (upper)	6) Remove the electrical control box cover (upper). (ST2T Ø4 × 8, 4 screws) 7) Disconnect the remote controller connecting cable from the CN41 connector of the water heat exchange board. 2. How to attach 1) Connect the remote controller connecting cable to the water heat exchange board. 2) Attach the electrical control box cover (upper). 3) Connect the power source cable and outdoor unit connecting cable to the terminal block, and fix with the cord clamp. 4) Attach the electrical control box cover (lower). 5) Attach the front panel.	

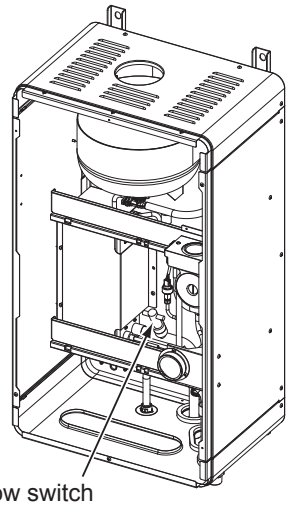
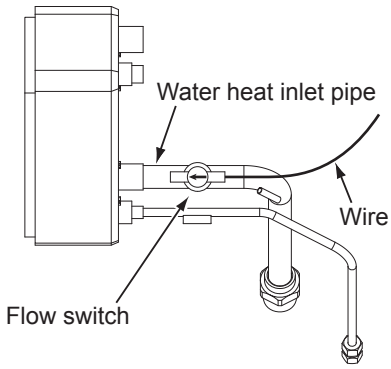
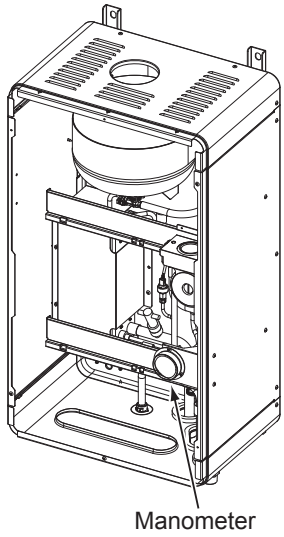
No.	Exchange parts name	Work procedure	Remarks
2	Remote controller	1.How to remove 1) Perform the step 1-1. 2) Remove the remote controller from the holder using a flat-blade screwdriver. (Release the stopper.) 3) Disconnect the remote controller cable from the terminal block on the back side of the remote controller. 2.How to attach 1) Attach it in the reverse order of the removal.	
3	Water heat exchanger board MCC-1511	1. How to remove 1) Perform the step 1-1. 2) Disconnect the connectors and lead cables connected to other parts from the water heat exchanger board. 1. Connector CN100: TB 01 3P Connector (5P: White) CN101: Trans (3P: White) CN102: Trans (6P: White) CN200: Flow switch (3P: Red) CN201: Pressure switch (2P: White) CN202: Bimetal thermostat (3P: Yellow) CN203: TC sensor (2P: Yellow) CN204: TWI sensor (3P: Brown) CN205: TWO sensor (2P: Red) CN206: THO sensor (3P: White) CN207: Low pressure sensor (2P: Blue) CN212: Low pressure sensor (4P: White) CN213: TB 06 4P Terminal block (3P: White) CN214: TB 06 4P Terminal block (2P: White) CN305: TB 01 3P Terminal block (3P: Green) CN500: PWM control line (6P: Blue) CN501: Relay board (6P: Yellow) CN601: Relay 05 (3P: Red) CN602: TB 04 6P Terminal block (7P: White) CN603: Pump (3P: Yellow) CN604: Relay 06, TB 04 4P Terminal block (7P: Blue) CN605: Relay 01, Relay 02 (3P: Yellow) CN606: Relay 03, Relay 04 (3P: Blue) 2. Round-shape terminal 100: Ground (ST2T Ø4 × 8, 1 wire) **NOTE** When removing the connector, release the safety lock of the housing. 3) Release the 6 stoppers of the water heat exchanger board to remove the board.	

No.	Exchange parts name	Work procedure	Remarks
4	Relay board MCC-1431	1. How to remove 1) Perform the step 1-1. 2) Disconnect the connectors and lead cables connected to other parts from the relay board. 1. Connector CN01: TB 01 3P Terminal block (3P: White) CN02: Water heat exchanger board (5P: White) CN10: TB 05 9P Terminal block (9P: White) **NOTE** When removing the connector, release the safety lock of the housing. 3) Release the 3 stoppers of the relay board to remove the board.	
5	Electric parts assembly	1. How to remove 1) Perform the step 1-1. 2) Disconnect the connectors and lead cables connected to other parts from the water heat exchanger board. 1. Connector CN200: Flow switch (3P: Red) CN201: Pressure switch (2P: White) CN202: Bimetal thermostat (3P: Yellow) CN203: TC sensor (2P: Yellow) CN204: TWI sensor (3P: Brown) CN205: TWO sensor (2P: Red) CN206 THO sensor (3P: White) CN207: Low pressure sensor (2P: Blue) CN212: Low pressure sensor (4P: White) CN603: Pump (3P: Yellow) Disconnect the heater power source cable (For backup heater and hot water cylinder heater) from the MgSW. **NOTE** When removing the connector, release the safety lock of the housing. 3) Remove the fixed screws. (ST2T Ø4 × 8, 2 screws) 4) Remove the electric parts assembly by pulling it toward you while pulling it upward because the assembly back side has a hook holding structure.	

No.	Exchange parts name	Work procedure	Remarks
6	Side board	1. Side board (Right) 1) Perform the step 1-1-1), 2), 3). 2) Remove the fixed screws of the side board (Right). (ST1T Ø4 × 10, 5 screws) 3) Remove the fixed screws of the side board (Right) and the manometer fixing board. (ST1T Ø4 × 10, 2 screws) 2. Side board (Left) 1) Remove the fixed screws of the side board (Left). (ST1T Ø4 × 10, 5 screws)	
7	Upper board	1) Perform the step 1-1-1), 2), 3) and step 6. 2) Remove the fixed screws of the upper board. (ST1T Ø4 × 10, 4 screws)	
8	Bottom board	1) Perform the step 1-1-1), 2), 3) and step 6. 2) Remove the fixed screws of the bottom board. (ST1T Ø4 × 10, 4 screws) Removal is required if water and refrigerant piping are connected.	

No.	Exchange parts name	Work procedure	Remarks
9	Expansion vessel	To replace a water circuit part, first close the water supply source valve and the valve of water pipe connected to the hydro unit. 1) Perform the step 1-1, step 5, step 6-1 2) Remove the fixed band of the expansion vessel. (ST1T Ø4 × 8, 4 screws) 3) Remove the expansion vessel connection. When installing the expansion vessel, please attach the waterproof seal at the water connection. After the expansion vessel replacement repair, open the water supply source valve and water piping valve to pass water through the hydro unit, and check that the expansion vessel connection has no water leakage.	
10	Overpressure preventive valve	To replace a water circuit part, first close the water supply source valve and the valve of water pipe connected to the hydro unit. 1) Perform the step 1-1, step 5, step 6-1 2) Remove the quick fastener. 3) Remove the Overpressure preventive valve. The Overpressure preventive valve connection uses an O ring for water seal. Be careful not to scratch the O ring; otherwise, water leakage may occur. After the Overpressure preventive valve replacement repair, open the water supply source valve and water piping valve to pass water through the hydro unit, and check that the relief valve connection has no water leakage.	
11	Air vent valve	To replace a water circuit part, first close the water supply source valve and the valve of water pipe connected to the hydro unit. 1) Perform the step 1-1-1), 2), 3), step 6-1. 2) Remove the air vent valve. The Air vent valve connection uses an O ring for water seal. Be careful not to scratch the O ring; otherwise, water leakage may occur. After the air vent valve replacement repair, open the water supply source valve and water piping valve to pass water through the hydro unit, and check that the air vent valve connection has no water leakage.	

No.	Exchange parts name	Work procedure	Remarks
12	Pump	To replace a water circuit part, first close the water supply source valve and the valve of water pipe connected to the hydro unit. 1. How to remove 1) Perform the step 1-1-1), 2), 3), step 6-1. 2) Remove the 2 nuts of the heater connection and the lower side of the pump. (Water pipe wrench is necessary.) 3) Remove the pump fixing board. (ST2T Ø4 × 8, 4 screws) 4) Remove the nut of the upper part of the pump. 2. How to attach The pump connection uses a liquid packing for water seal. When replacing the pump, use a packing which was slathered with the liquid gasket. Part code: 37595721 Service parts: Packing 1) Attach a new pump in the reverse order of the removal. After the pump replacement repair, open the water supply source valve and water piping valve to pass water through the hydro unit, and check that the pump connection has no water leakage.	  

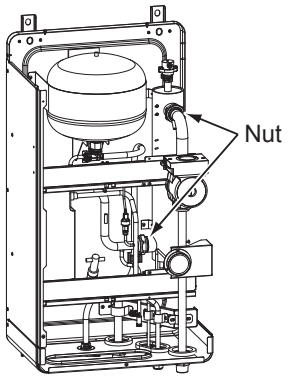
No.	Exchange parts name	Work procedure	Remarks
13	Flow switch	To replace a water circuit part, first close the water supply source valve and the valve of water pipe connected to the hydro unit. 1. How to remove 1) Perform the step 1-1 and step 5. 2) Remove the flow switch. The flow switch connection uses an O ring for water seal. Be careful not to scratch the O ring; otherwise, water leakage may occur. 2. How to attach 1) Attach a new flow switch in the reverse order of the removal. **NOTE** As shown on the right, place a flow sensor parallel to the water heat exchanger inlet pipe so that the wire is place on the right side from the front view. After the flow switch replacement repair, open the water supply source valve and water piping valve to pass water through the hydro unit, and check that the flow switch connection has no water leakage.	 
14	Manometer	To replace a water circuit part, first close the water supply source valve and the valve of water pipe connected to the hydro unit. 1. How to remove 1) Perform the step 1-1 and step 5 and 6. 2) Remove the manometer. After the manometer replacement repair, open the water supply source valve and water piping valve to pass water through the hydro unit, and check that the manometer connection has no water leakage.	

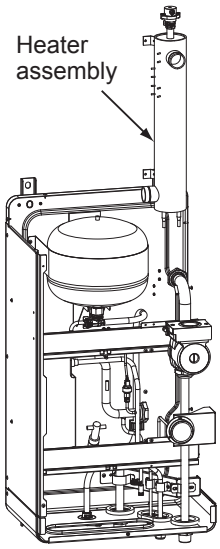
<table>
<tr><th>No.</th><th>Exchange parts name</th><th>Work procedure</th><th>Remarks</th></tr>
<tr><td>15</td><td>Heater assembly</td><td>
To replace a water circuit part, first close the water supply source valve and the valve of water pipe connected to the hydro unit.

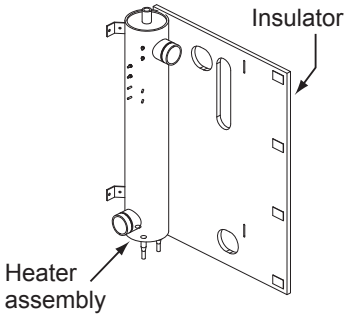
1. How to remove
1) Perform the step 1-1, step 5, 6, 7, and 11.
2) Remove the nut of the heater connection.
3) Remove the 2 fixed screws of the heater.
4) Pull the heater out upward.
5) Remove the insulator from the heater.

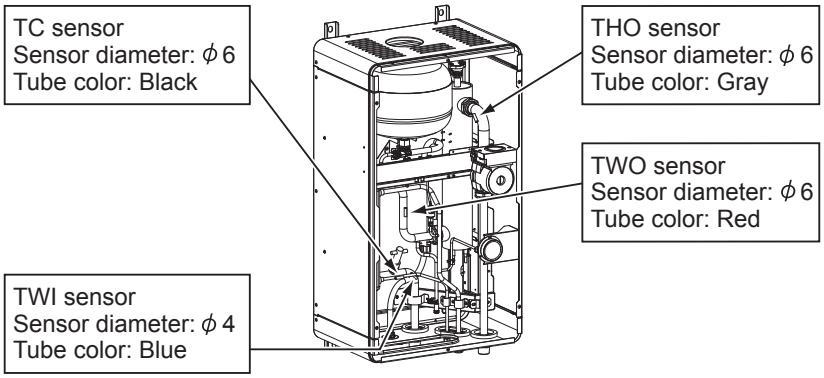
2. How to attach

The heater connection uses a liquid packing for water seal. When replacing the heater, use a packing which was slathered with the liquid gasket.
<table><tr><th>Part code</th><th>Service parts</th></tr><tr><td>37595721</td><td>Packing</td></tr></table>
1) Attach a new heater in the reverse order of the removal.

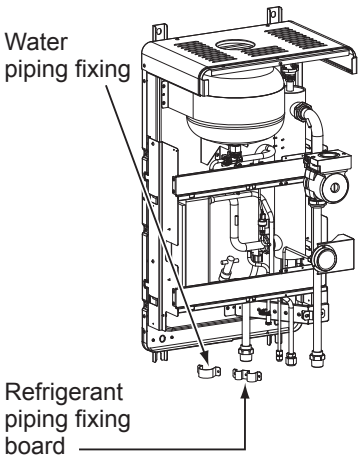
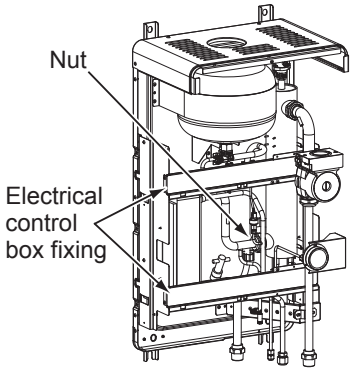
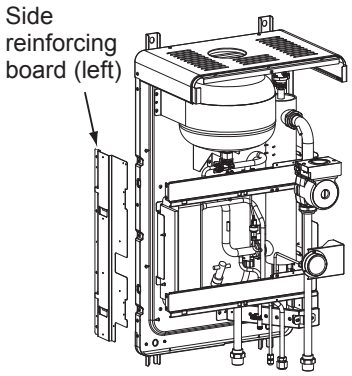
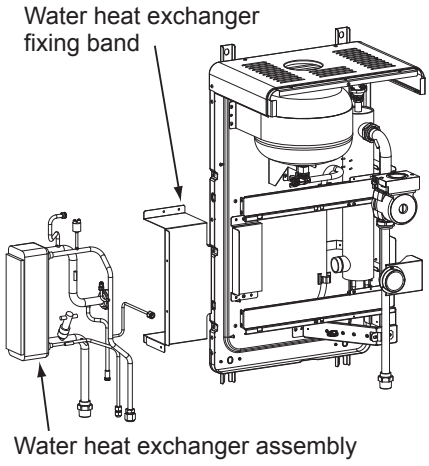
After the heater assembly replacement repair, open the water supply source valve and water piping valve to pass water through the hydro unit, and check that the heater connection has no water leakage.
</td><td>






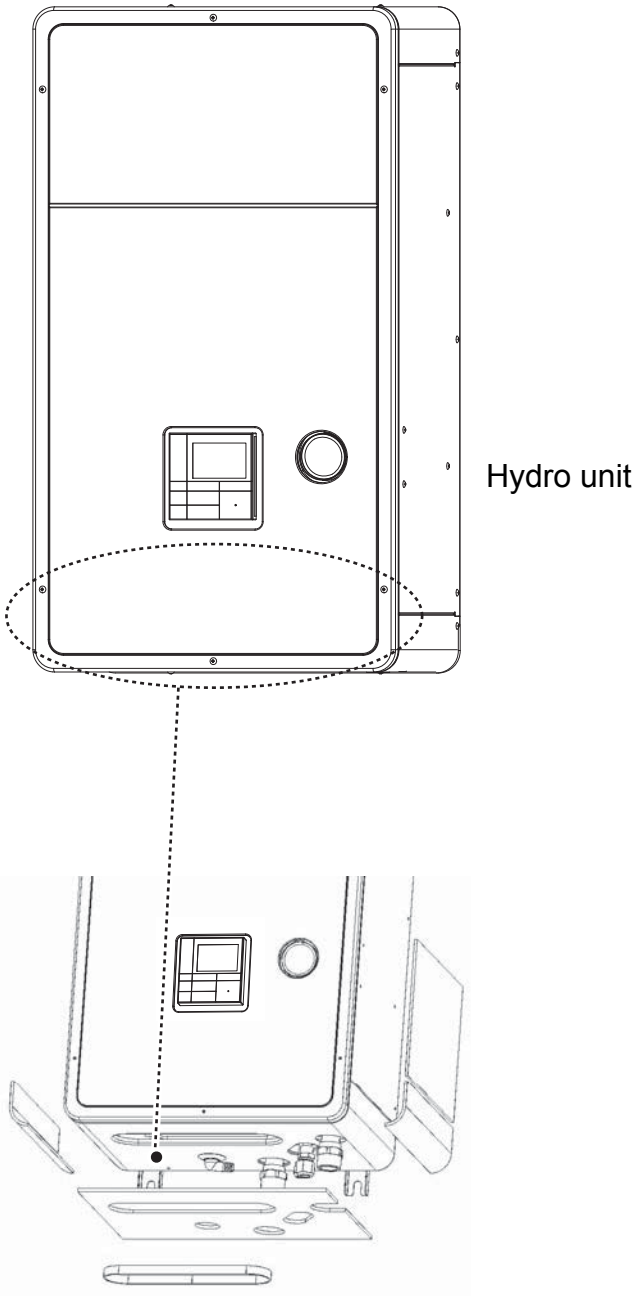
</td></tr>
<tr><td>16</td><td>TC sensor
TWI sensor
TWO sensor
THO sensor</td><td colspan="2">
1. How to remove
1) Perform the step 1-1 and step 5.
2) Take the sensor out.


</td></tr>
</table>

No.	Exchange parts name	Work procedure	Remarks
17	Water heat exchanger assembly	• Close the water piping source valve and the valve of water pipe connected to the hydro unit, and then remove the refrigerant and water piping. • Perform refrigerant recovery with the outdoor unit. • Disconnect all the power source cable, outdoor unit connection cable, and cylinder connection cable. 1. How to remove 1) Perform the step 1-1, step 5, 6, and 8. 2) Remove the water pipe fixing board. (ST2T Ø4 × 8, 2 screws) 3) Remove the refrigerant piping fixing board. (ST2T Ø4 × 8, 3 screws) 4) Remove the nut of the heater connection. 5) Remove the fixed screws of the electrical control box fixing board. (ST2T Ø4 × 8, 4 screws) 6) Remove the side reinforcing board (left). (ST2T Ø4 × 8, 6 screws) 3 for inside, 3 for outside 7) Remove the water heat exchanger fixing band. (ST2T Ø4 × 8, 6 screws) 8) Remove the water heat exchanger assembly. The heater connection uses a packing for water seal. Be careful not to scratch the packing; otherwise, water leakage may occur. 2. How to attach 1) Attach a new water heat exchanger assembly in the reverse order of the removal. 2) Restore all piping and wiring as in the original state, and check that there is no water or refrigerant leakage. • After the water heat exchanger assembly replacement repair, open the water supply source valve and water piping source valve to pass water through the hydro unit, and check that the connection has no water leakage. • After connecting the refrigerant pipe, check that the connection has no refrigerant leakage.	   

12 For cooling installation

If user install the Hydro unit to place humidity location or high humidity region, also user use cooling mode, please attach moisture- proof parts which parts are contained in Hydro unit.



• Stick the optional insulator for cooling to the bottom of the Hydro Unit.

13 Periodic inspection items

For a long-term safe operation of this equipment, perform periodic inspection and parts replacement.

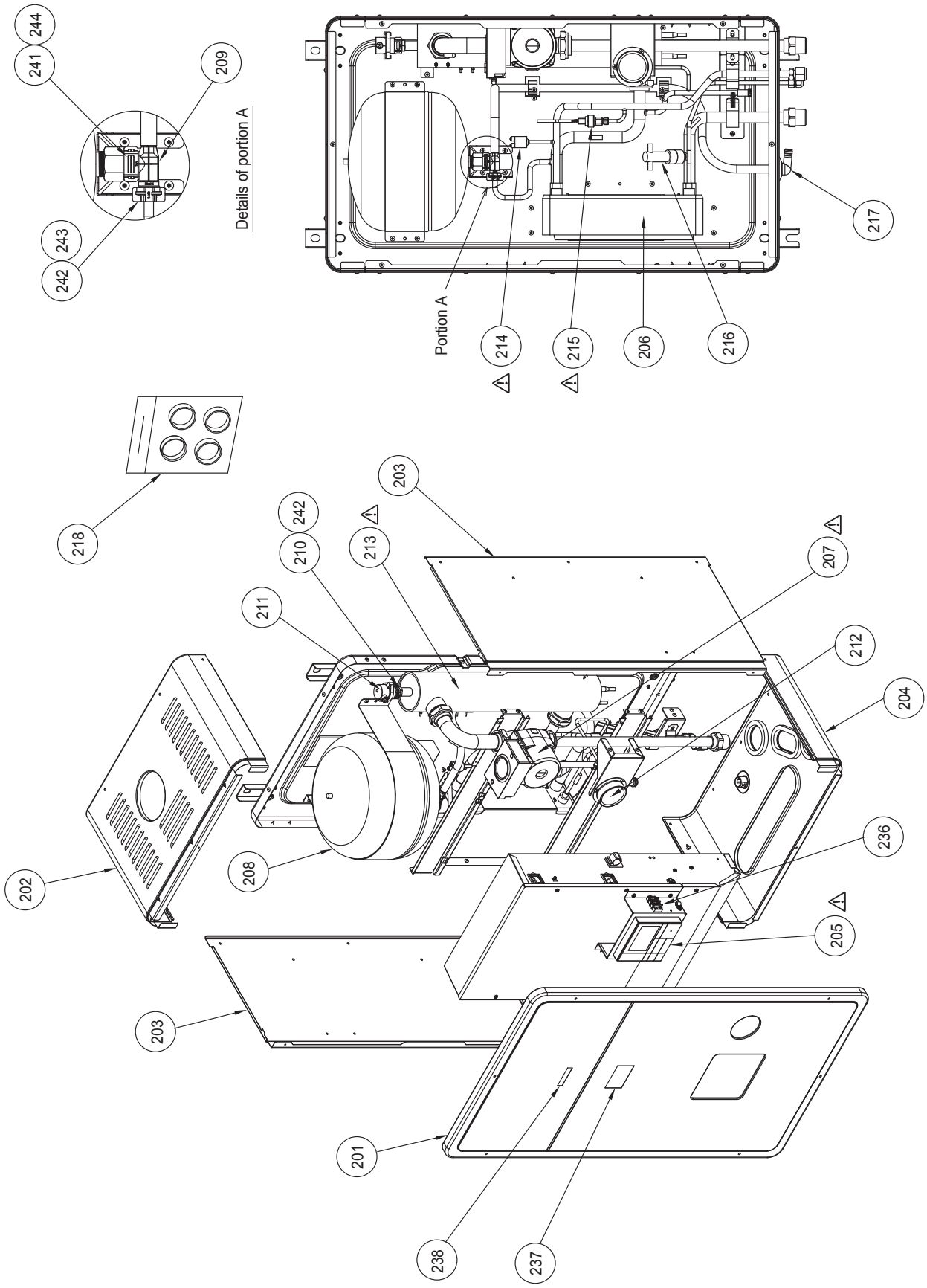
<Inspection items>

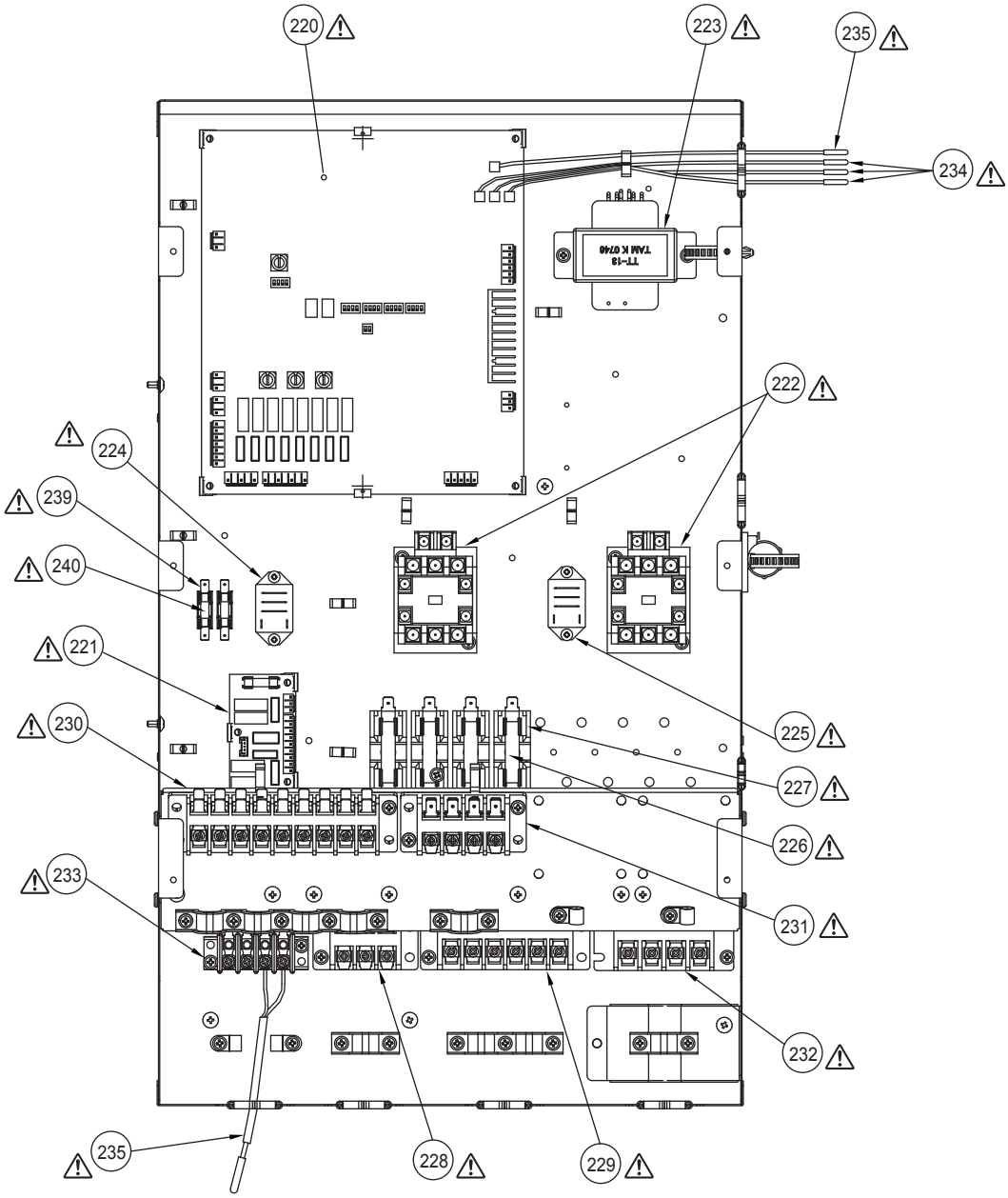
Hydro unit	Frequency	Periodic inspection details
1. Insulation measurement (Power source circuit / Heater circuit)	Annually	Insulation measurement with a mega tester
2. Power source measurement (No-load voltage)	Annually	Electronic voltage measurement: 220-230 V ±10%
3. Operation check	Annually	Hot water supply / Heating / *-Cooling operation check with remote controller
4. Refrigerant leakage / Water leakage inspection	Annually	Visual inspection and check with a leak tester: No leakage must be found
5. Water heat exchanger inspection (Internal dirt and clogging)	Annually	Checking for water dirtiness in a closed cycle, Cleaning
6. Inlet / Outlet water temperature measurement	Annually	Temperature measurement: Temperature measurement during an operation
7. Circulation pump inspection	Annually	No leakage or abnormal noise must be found (Replacement every 10 years: Charged)
8. Air vent valve inspection	Annually	Water leakage, Air vent
9. Expansion vessel	Annually	Visual check for charge pressure abnormality, water leakage, or corrosion
10. Heater assembly	Annually	Check for appearance damage, deformation, or loose terminal
11. Flow switch	Annually	Operation check while running
12. Manometer	Annually	Water leakage, water pressure check
13. Safety valve	Annually	Water leakage, Appearance check, Drainage check
14. Water heat exchanger control board, Terminal block	Annually	Check for loose connector and connecting terminal

Hot water cylinder (HWS-150CSHM3-E(-UK), 210CSHM3-E(-UK), 300CSHM3-E(-UK))	Frequency	Periodic inspection details
1. Insulation measurement (Power source circuit)	Annually	Insulation measurement with a mega tester
2. Power source measurement (No-load voltage)	Annually	Electronic voltage measurement: 220-230 V ±10%
3. Water leakage inspection	Annually	Visual inspection for leakage: No leakage must be found
4. Terminal block	Annually	Check for loose connector and connecting terminal
5. Heater assembly	Annually	Check for appearance damage, deformation, or loose terminal
6. Temperature, Pressure relief valve (Specification for UK only)	Annually	Drainage check

14 Part exploded view, part list

Hydro Unit

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Safety ⚠	Location No.	Part No.	Description	Number of pieces per unit
				HWS-455XWHM3-E
	201	37500840	CABINET, FRONT	1
	202	37500800	PLATE, UP	1
	203	37500801	PLATE, SIDE	2
	204	37500835	PLATE, DN, ASSY	1
⚠	205	37566711	REMOTE CONTROLLER	1
	206	37546884	PIPE ASSY, WATER HEAT EXCHANGER	1
⚠	207	37541739	PUMP, WATER, ASSY	1
	208	37542710	VESSEL, EXPANTION	1
	209	37547773	VALVE ASSY, OVERPRESSURE PREVENTIVE	1
	210	37519776	FASTENER, QUICK	1
	211	37547769	VALVE, AIR VENT	1
	212	37543706	METER, PRESSURE	1
⚠	213	37545713	HEATER ASSY	1
⚠	214	43151273	SWITCH, PRESSURE	1
⚠	215	37551736	SENSOR, LOW PRESSURE	1
	216	37551740	SWITCH, FLOW	1
	217	43F32441	NIPPLE, DRAIN	1
	218	37595721	PACKING, ASSY	1
⚠	220	3026V072	PC BOARD ASSY	1
⚠	221	4316V338	PC BOARD ASSY	1
⚠	222	43152401	CONTACTOR, MAGNETIC	2
⚠	223	43158187	TRANSFORMER	1
⚠	224	43154156	RELAY, LY1F	1
⚠	225	43054107	RELAY, LY1F	1
⚠	226	43160297	FUSE	4
⚠	227	43060059	FUSE, HOLDER	4
⚠	228	43160565	TERMINAL BLOCK, 3P, 20A	1
⚠	229	43160566	TERMINAL BLOCK, 6P, 20A	1
⚠	230	4306A130	TERMINAL BLOCK, 9P, 20A	1
⚠	231	43160576	TERMINAL BLOCK, 4P, 20A	1
⚠	232	43160579	TERMINAL	1
⚠	233	43160561	TERMINAL, 4P	1
⚠	234	43050425	SENSOR ASSY, SERVICE	3
⚠	235	43150320	SENSOR ASSY, SERVICE	2
⚠	236	43160568	TERMINAL, 2P	1
	237	37517875	MARK, ESTIA	1
	238	37517876	MARK, TOSHIBA FOR ESTIA	1
⚠	239	43160571	FUSE, HOLDER, 15A, 250V	2
⚠	240	43F6A156	FUSE(ET), 3.15A, AC250V	2
	241	3025Q006	RING, O	1
	242	3025Q013	RING, O	2
	243	3025S012	FASTENER,QUICK	1
	244	3025S013	FASTENER,QUICK	1

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